



# Converse Consultants

*Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services*

**GEOTECHNICAL STUDY REPORT**  
**Proposed Fill Placement at the West Parcel**  
Mount San Antonio College  
Walnut, California

Converse Project No. 13-31-339-01

December 19, 2014

Prepared For:

Mount San Antonio College  
Facilities Planning & Management  
1100 North Grand Avenue, Building No. 23  
Walnut, California 91789

Prepared By:

Converse Consultants  
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# Converse Consultants

*Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services*

December 19, 2014

Ms. Mikaela (Mika) Klein, AIA, LEED AP  
Facilities Planner  
Mt. San Antonio College  
Facilities Planning & Management  
1100 North Grand Avenue, Building 23  
Walnut, California 91789

Subject: **GEOTECHNICAL STUDY REPORT**  
**Proposed Fill Placement for the West Parcel**  
Mount San Antonio College  
Walnut, California  
Converse Project No. 13-31-339-01

Dear Ms. Klein:

Converse Consultants (Converse) has prepared this geotechnical study report to present the findings, conclusions and recommendations of our geotechnical investigation for the proposed placement of fill to create a large pad area at elevation 761 feet within the west parcel on the campus of Mt. San Antonio College, in Walnut, California. The purpose of this study was to explore and evaluate the soil, bedrock and groundwater conditions beneath the project area of the proposed west parcel, with the ultimate objective of creating large buildable pads for possible solar arrays. It should be advised that this report is not intended for DSA and CGS review submittal and not for design of future structures. Our services were performed in accordance with our proposal dated December 6, 2013.

Based on our field exploration, laboratory testing, geologic evaluation, and geotechnical analysis, the site is suitable from a geotechnical standpoint for the site grading and earthwork proposed projects, provided our conclusions and recommendations are implemented during construction.

We appreciate the opportunity to be of continued service to Mt. San Antonio College. If you should have any questions, please do not hesitate to contact us at (626) 930-1200.

Sincerely,

**CONVERSE CONSULTANTS**

William H. Chu, P.E., G.E.  
Senior Vice President/Principal Engineer

Dist: 5/Addressee  
MM/MBS/SKS/WHC/jjl

### PROFESSIONAL CERTIFICATION

This report has been prepared for Mount San Antonio College for the Proposed Fill Placement at the West Parcel by the staff of Converse under the professional supervision of the individuals whose seals and signatures appear hereon.

The findings, recommendations, specifications or professional opinions contained in this report were prepared in accordance with generally-accepted professional engineering and engineering geologic principles and practice in this area of Southern California. There is no warranty, either expressed or implied.



Mohammad-Saad Malim, E.I.T.  
Staff Engineer



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Vice President/Principal Engineer



## EXECUTIVE SUMMARY

The following is a summary of our geotechnical investigation, conclusions and recommendations, as presented in the body of this report. Please refer to the appropriate sections of the report for complete conclusions and recommendations. In the event of a conflict between this summary and the report, or an omission in the summary, the report shall prevail.

- The proposed developments for the West Parcel consists of the removal of approximately the top 55 feet of the hillside, canyon cleanouts and placement of fill in the areas between the hillsides to create a large pad area at elevation 761 feet to be used for proposed solar arrays. Fill soils from proposed development areas on campus (hilltop removal on west side of track stadium, parking structure excavation, etc.) are planned be imported and used to raise the West Parcel to create a building pad for the future solar arrays.
- Our subsurface exploration consisted of drilling, logging and sampling twenty-one (21) hollow-stem auger borings from May 5 to May 9, 2014 extending between depths of approximately 10 to 51.5 feet below the existing ground surface (bgs), and one (1) bucket auger boring (BH-13) on May 19, 2014 to a depth of 31 feet (bgs).
- The earth materials encountered during our investigation consist of existing fill soils in the northernmost portion of the project site at the Christmas Tree Lot, natural alluvial and colluvial soils, and sedimentary bedrock of the Sycamore Formation.
- Undocumented fill was encountered during exploration of the West Parcel site, to a depth of five (5) feet in Boring BH-3 in the area of the Christmas Tree lot. Deeper fill may occur elsewhere on the site. The fill at the site consists of primarily silty sand with some gravels.
- The project site is not located within a currently designated State of California Earthquake Fault Zone (formerly Alquist-Priolo Special Studies Zones) for surface fault rupture.
- The sites are partially located within potential liquefaction zones per the State of California Seismic Hazard Zones Map for the San Dimas Quadrangle. Based on our liquefaction potential analyses, the project sites are not susceptible to liquefaction and seismically-induced settlement is considered to be negligible.
- Localized zones of groundwater were encountered during subsurface exploration, ranging in depths at approximately 16 feet bgs in boring BH-15 to 44 feet bgs in Boring BH-14. Localized perched groundwater seepage should be anticipated during excavation in these locations.



- Based on our field exploration, laboratory testing, and analyses of subsurface conditions at the site, remedial grading, including cut-and-fill operations, is required to prepare the planned fill pads for support of the future developments.
- The fill slope on the east side of the site along Grand Avenue will include a maximum proposed fill height of approximately 80 feet. Existing slopes within the project area will be completely removed or reduced to a 2:1 (H:V) gradient during the proposed grading operations placed over underlying hard sandstone pebble conglomerate bedrock. In the absence of significantly steep slopes, the potential for seismically-induced landslides to affect the proposed site is considered to be very low.
- The earth materials at the site consisting of soil should be excavatable with conventional heavy-duty earth moving and trenching equipment. Earth materials consisting of conglomerate bedrock will be considerably harder to excavate. The on-site materials contain about 5 to 30 percent gravel up to 3 inches in maximum dimension. Larger gravels, cobbles and possible boulders may exist at the site. Earthwork should be performed with suitable equipment for gravelly materials.

Results of our investigation indicate that the site is suitable from a geotechnical standpoint for the proposed development, provided that the recommendations contained in this report are incorporated into the design and construction of the project.



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## 1.0 INTRODUCTION

This report contains the findings and recommendations of our geotechnical study performed at the site of the proposed *Fill Placement at West Parcel Project*, located west of Grand Avenue on the campus of Mount San Antonio College, in the City of Walnut, California, as shown on Drawing No. 1, *Site Location Map*.

The purpose of this investigation was to explore and evaluate the soil, bedrock, and groundwater conditions of the existing West Parcel hillside site with soil borings to further determine the excavatability, rippability, and grading considerations for removal of approximately the top 55 feet of the hillside and placement of fill in the canyon areas between the hillsides to create a large pad area at elevation 761 feet to be used for future solar arrays. Conditions of particular concern include the depth of groundwater, the liquefaction potential of natural soils and the stability of the proposed fill slope on the east side along Grand Avenue with a maximum proposed fill height of approximately 80 feet.

We have used proposed preliminary site plans provided to us by your office, titled "Grand Avenue Parcel Earthwork, Exhibit D-5" dated 11/04/13 and a revised drawing annotated by Necomb/Anderson/McCormick dated 01/07/14 as references for this project. The site plan is included in this report as Drawing No. 2, *Site Plan and Approximate Locations of Borings*. Plans for the proposed future buildings and structures were not available or reviewed in the preparation of this geotechnical study. When such plans are made available, additional geotechnical studies, reviews and recommendations may be warranted.

This report is written for the project described herein and is intended for use solely by Mount San Antonio College and its design team. This report is not intended for submittal to the Department of the State Architect (DSA) or the California Geological Survey (CGS). It should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.

## 2.0 SITE AND PROJECT DESCRIPTION

### 2.1 Site Description

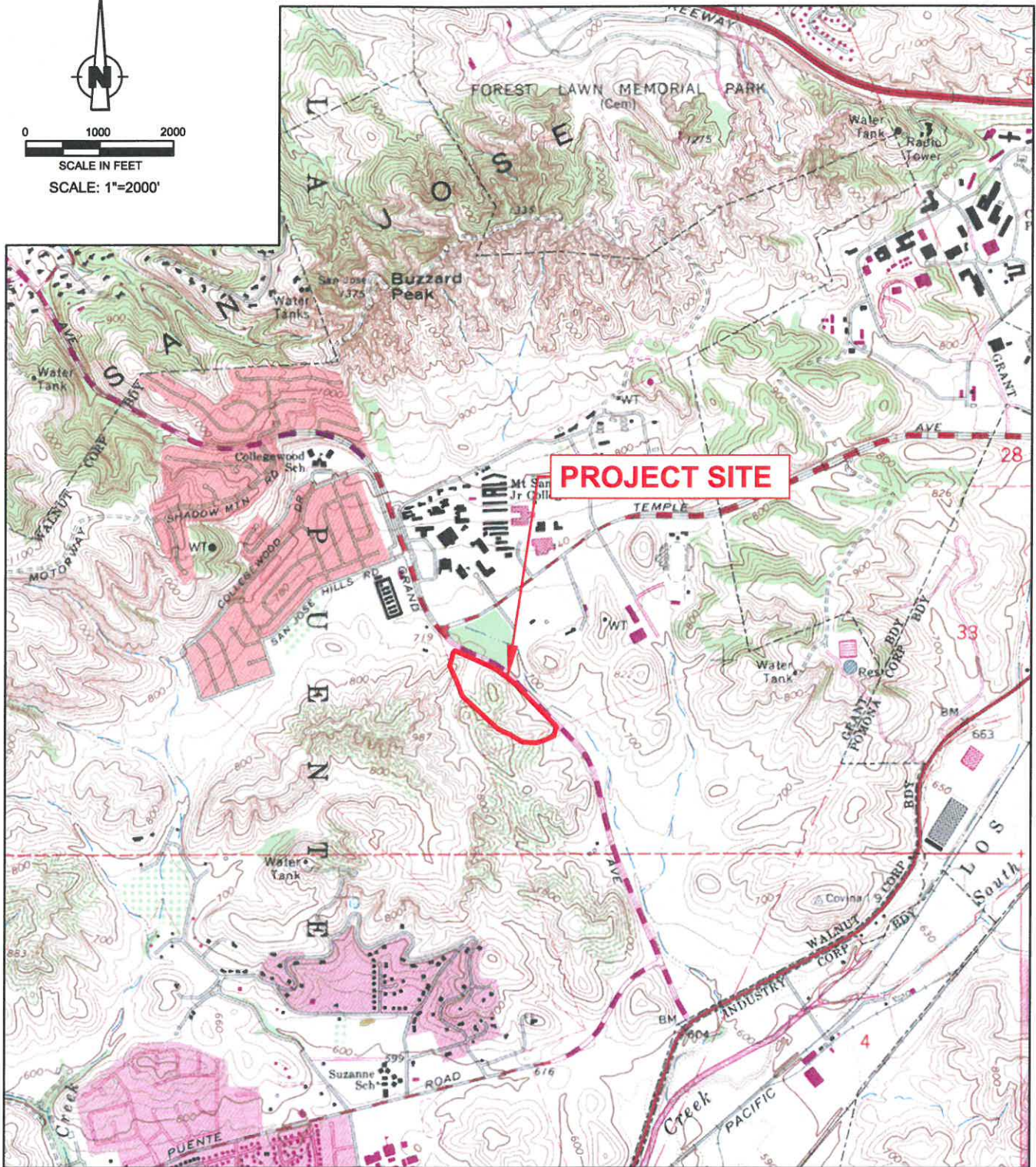
The project site for the proposed West Parcel is primarily located within a natural drainage area and includes four gentle bedrock hilltops located at the southwest portion of the campus as shown on Drawing No. 2, *Site Plan and Approximate Locations of Borings*. The West Parcel is located southwest of Amar Road/Temple Avenue and Grand Avenue. The site dimensions are approximately 1100 feet east-west by 1900 feet







0 1000 2000  
SCALE IN FEET  
SCALE: 1"=2000'



REFERENCE: USGS MAP  
SAN DIMAS QUADRANGLE 1966 PHOTO REVISED 1981

## SITE LOCATION MAP

MT. SAN ANTONIO COLLEGE  
WEST PARCEL  
WALNUT, CALIFORNIA

Project No.  
13-31-339-01



**Converse Consultants**

Drawing No.

1

north-south. The site is bordered by Amar Road to the north, Grand Avenue to the east, and single family residential housing tracts to the west and south. The top of the hilltop in the central portion of the site is at an elevation of approximately 815 feet relative to mean-sea-level (MSL) and rises about 105 feet above the road along Grand Avenue. The site coordinates are: North latitude: 34.0398 degrees, West longitude: 117.8452 degrees.

The geographic coordinates provided herein were centered on the subject sites and were used to calculate the earthquake ground motions. Review of the Engineering Geology and Seismology for Public Schools and Hospitals in California, dated August 9, 2005 (page 35) indicates that accuracy to within a few hundred meters of these coordinates is sufficient for the computation of the earthquake ground motion of the project site.

Historical and modern aerial imagery for the project site were reviewed from Google Earth (2013) and the website [www.HistoricAerials.com](http://www.HistoricAerials.com) (2009). The aerial imagery shows hillside ridges with intervening canyons that drained eastward through the project site toward Grand Avenue, located along the southwestern property boundary. A roadway that eventually became Grand Avenue cut through the northern portion of the site (in what is known as the Christmas Tree Lot) as early as 1948. Besides this, the project site was generally undisturbed until 1980, when grading of the slope along the eastern portion of the site was conducted during the widening of Grand Avenue. Sometime after this time, the hilltops along the western portion of the site were flattened to an elevation of approximately 795 feet MSL and 815 feet MSL for the hilltop on the north and central portion of the site respectively, possibly as a result of grading operations for the housing tract west of the site. Currently, the site has been used for cattle grazing lands.

## **2.2 Project Description**

The proposed developments for the West Parcel consists of the removal of approximately the top 55 feet of the hillside and placement of fill in the areas between the hillsides to create a large pad area at elevation 761 feet to be used for proposed solar arrays. Fill soils from proposed development areas on campus (proposed hilltop removal on west side of track stadium, parking structure excavation, etc.) are planned be imported and used to raise the West Parcel to create a building pad for future solar arrays. The structural information for the future development is unknown at this time.

The planned fill pad at the project site is expected to be up to approximately 60 feet in thickness above the existing grade. The slopes along the western portion of the proposed fill pad are planned to be placed in a 2:1 (H:V) step-like fashion as depicted in Drawing No. 2, *Site Plan and Approximate Locations of Borings*.



### **3.0 SCOPE OF WORK**

Our scope of work consists of the tasks described in the following subsections.

#### **3.1 *Site Reconnaissance***

A site reconnaissance was conducted on April 02, 2014, during which the surface conditions were noted and the locations of the borings were determined. The borings were located using existing boundary features as a guide and should be considered accurate only to the degree implied by the method used. Underground Service Alert (USA) of Southern California was notified of our proposed drilling locations at least 48 hours prior to initiation of the subsurface field work.

#### **3.2 *Subsurface Exploration and Access Road Grading***

Our subsurface exploration consisted of drilling, logging and sampling twenty-one (21) hollow-stem auger borings from May 5 to May 9, 2014 extending between depths of approximately 10 to 51.5 feet below the existing ground surface (bgs), and one (1) bucket auger boring on May 19, 2014 with downhole observations to a depth of 31 feet (bgs). The borings were advanced using a truck-mounted drill rig with an 8-inch-diameter hollow-stem auger and 24-inch bucket auger drilled within or adjacent to the accessible areas of the planned pad locations.

The grading of a temporary dirt access road was required to provide drill rig access to the proposed boring locations on top of the bedrock hilltop just south of the Christmas Tree Lot and across the hillside to the southern portion of the site. The access road was cut into the sides of the hill, gradually working its way up the slope to the top of the hill. Converse had a representative onsite to observe the access road grading, which was done using a track-mounted dozer (John Deere 650J dozer with sideboard). The access road will be removed during hillside grading.

Subsurface conditions encountered in the borings were continuously logged and classified in the field by visual/manual examination by a Converse engineer and geologist in accordance with the Unified Soil Classification System (USCS). California Modified Sampler ("ring samples"), Standard Penetration Test (SPT) samples, and bulk soil samples were obtained from the borings and were delivered to the laboratory for testing. The bucket auger boring location (BH-13) was utilized for downhole logging. A geologist downhole logged the boring to identify bedrock materials and bedding structure. The bore holes were backfilled with soil cuttings following the completion of drilling.



The approximate locations of the exploratory borings are shown in Drawing No. 2, *Site Plan and Approximate Locations of Borings*. A description of the field exploration and sampling program are presented in Appendix A, *Field Exploration*.

### **3.3 Laboratory Testing**

Representative samples of the site soils were tested in the laboratory to aid in the classification and to evaluate relevant engineering properties. The tests performed included:

- *In Situ* Moisture Contents and Dry Densities (ASTM Standard D2216)
- Grain Size Distribution (ASTM Standard C136)
- Maximum Dry Density and Optimum-Moisture Content Relationship (ASTM Standard D1557)
- Direct Shear (ASTM Standard D3080)
- Consolidation (ASTM Standard D2435)
- Expansion Index (ASTM Standard D4829)

A detailed description of the laboratory test methods and test results are presented in Appendix B, *Laboratory Testing Program*.

### **3.4 Analyses and Report**

Data obtained from the exploratory fieldwork and laboratory-testing program were analyzed and evaluated. This report was prepared to provide the findings, conclusions and recommendations developed during our investigation and evaluation.

### **3.5 Locating High-Pressure Gas Line**

As requested, Converse retained a subcontractor to detect the existing high pressure gas line along the eastern property boundary by using ground penetration radar devices. The location of the referenced high-pressure gas line has been delineated with approximate depths of the line as shown on Drawing No. 2, *Site Plan and Approximate Locations of Borings*.

## **4.0 GEOLOGIC CONDITIONS**

### **4.1 Regional Geology**

The proposed project sites are located in the San Jose Hills along the western edge of the Pomona Valley within the Transverse Ranges geomorphic province of California near the northern terminus of the Peninsular Ranges Province.



The Pomona Valley is situated at the junction of two major convergent fault systems: 1) the northwest-trending, high-angle strike-slip faults of the San Andreas Fault System projecting from the northern terminus of the Peninsular Ranges Province, and 2) east-trending, low-angle reverse or reverse-oblique faults bounding the southern margin of the Transverse Ranges. Faults in the first group include the Palos Verdes, Newport-Inglewood, Whittier-Elsinore, and San Jacinto fault zones. Faults in the second group include the Malibu-Santa Monica, Hollywood, Raymond, Sierra Madre, and Cucamonga fault zones.

The *Geologic Map of the San Dimas and Ontario Quadrangles* prepared by Thomas W. Dibblee, Jr. (DF-91, dated July, 2002) was reviewed during this study. The map shows the location of Mount San Antonio College campus within an alluvial basin surrounded by hillsides consisting of sedimentary bedrock of the Monterey (Puente) and Sycamore Canyon Formations. No faults are shown running through or projecting toward the project sites. The location of the proposed West Parcel is mapped as underlain by the Sycamore Canyon Formation (Tscs). The Sycamore Canyon Formation consists of light gray sandstone and includes some conglomerate consisting of plutonic-derived cobbles and boulders in a light gray sandstone matrix. A portion of the map by Thomas W. Dibblee has been reproduced and is shown as Drawing No. 3, *Regional Geologic Map*.

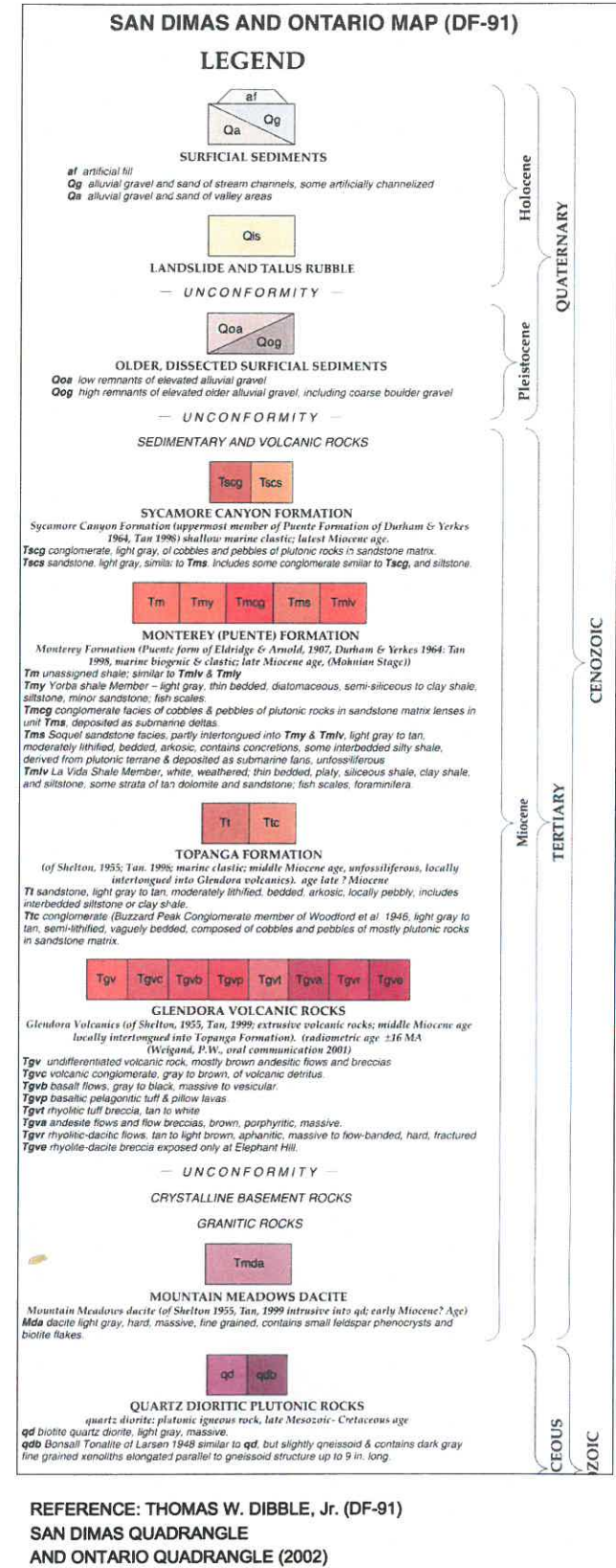
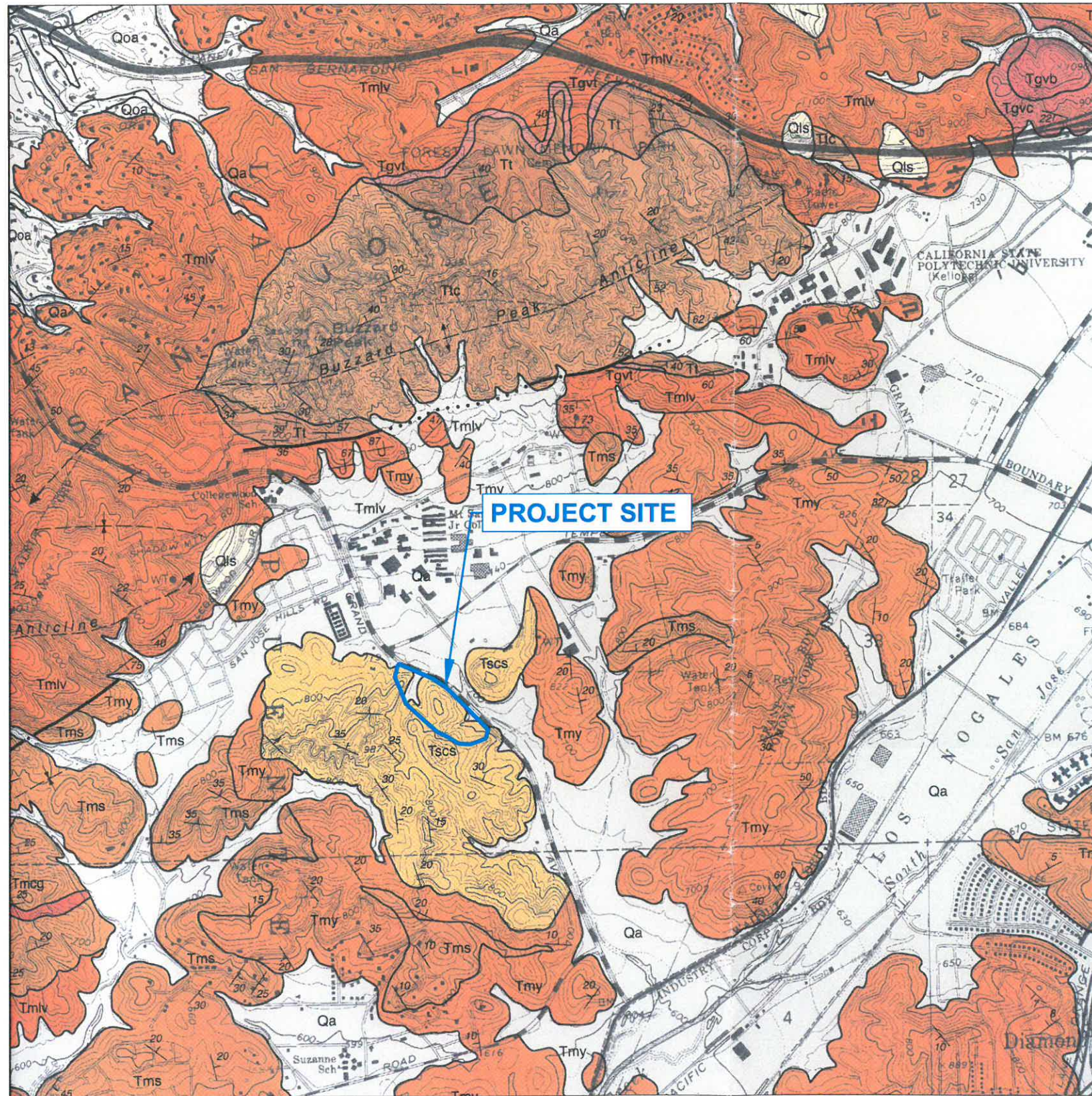
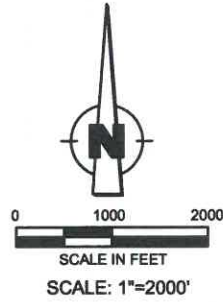
Durham and Yerkes (1964) attribute the Sycamore Canyon Formation to the upper member of the Monterey (Puente) Formation. For the purposes of this report, the bedrock underlying both project sites will be considered as belonging to the Puente Formation.

#### **4.2 Subsurface Profile of Subject Site**

The earth materials encountered during our study consist of existing fill soils in the northernmost portion of the project site at the Christmas Tree Lot, natural alluvial and colluvial soils, and sedimentary bedrock of the Sycamore Formation. Existing soil and bedrock materials exhibited moisture contents ranging from as low as 3% up to 55% during the field exploration, while the optimum moisture contents for purposes of compaction range from 9.2% to 16.8%. Thorough moisture conditioning and mixing of soils should be performed to meet the requirements of acceptable fill materials prior to placing as engineered fill.

For the proposed West Parcel, much of the site exposes natural materials at the surface, generally consisting of colluvial soil over bedrock on the hilltop and alluvial soils over bedrock on the gentle swales below. The surficial geologic conditions and locations of borings performed for Site A are shown on Drawing No. 2, *Site Plan and Approximate Locations of Borings*.





## REGIONAL GEOLOGIC MAP



MT. SAN ANTONIO COLLEGE  
WEST PARCEL  
WALNUT, CALIFORNIA

Project No. Drawing No.  
13-31-339-01 **3**

### Fill Soils

Undocumented fill was encountered during exploration of the West Parcel site, to a depth of five (5) feet in Boring BH-3 in the area of the Christmas Tree lot. Deeper fill may occur elsewhere on the site. The fill at the site consists of primarily silty sand with some gravels.

### Alluvium

Alluvial soil was encountered overlying the bedrock at the project site varying in thickness from approximately five (5) feet in Boring BH-7, BH-16, and BH-17 to twenty (20) feet in Boring BH-3. The alluvial soil encountered in the borings consists primarily of mixtures of silty sand and gravelly sand with variable amounts of clay, gravel, and cobbles. The soils also include occasional fragments of weathered bedrock. We expect that cobbles are larger in size than the largest observed, approximately three (3) inches in the maximum dimension, in the hollow-stem-auger soil cuttings. Based on our previous experience and knowledge of the area, and materials encountered during subsurface exploration, cobbles greater than eight (8) inches and occasional boulders may also be buried below the site (Converse 2007). The full thickness of the alluvial soils in the northern portion of the site near the gate and well (Borings BH-1 and BH-2) was not determined, as the full thickness and bottom of the alluvium was not penetrated in the borings.

### Colluvium

Residual colluvial soil overlies the bedrock knolls throughout the subject site and was encountered to depths of two (2) feet in Borings BH-5 and BH-6 to five (5) feet in Boring BH-4. The colluvium consists of silty sand with variable amounts of clay, gravel, and cobbles.

### Sandstone and Pebble Conglomerate Bedrock of the Sycamore Canyon Formation (Tscg)

The majority of the proposed West Parcel site is underlain by hard, cemented sandstone pebble conglomerate bedrock. The harder conglomerate bedrock consists of gravel and cobble-sized rocks in a cemented sand matrix. The conglomerate is massive and may contain boulder-sized hard rock material. The conglomerate bedrock materials were observed to be very hard during the exploration and will be more difficult to excavate during construction.

For additional information on the subsurface conditions, see the Logs of Boring data in Appendix A, *Field Exploration*.

Subsurface geologic conditions beneath the subject site are depicted on *Geologic Cross-Sections A-A', B-B', C-C' and D-D'* for the site as shown on Drawing No. 4. The geologic



cross-sections show the proposed developments (building pads for solar arrays) and the interpreted extent and limits of the different earth materials encountered during our study.

Downhole geologic observations were performed by an engineering geologist in Boring BH-13. A limited access 24-inch diameter bucket auger was used to drill the boring to a depth of thirty-one (31) feet. Boring BH-13 encountered moderately hard to hard conglomerate bedrock that required coring bits to drill the boring to a depth of thirty-one (31) feet. Bedding attitudes ranged from north 10 to 30 degrees east with bedding dips of 8 to 25 degrees northwest. These bedding attitudes will produce neutral to favorable orientations with respect to proposed cut slopes.

#### **4.3 Groundwater**

The West Parcel site is situated within the Puente Basin portion of the larger San Gabriel Valley Groundwater Basin. Localized zones of groundwater were encountered during subsurface exploration, ranging in depths at approximately 16 feet bgs in boring BH-15 to 44 feet bgs in Boring BH-14.

Higher groundwater levels at the south eastern portion of the site are likely attributed to the existing drainage channel, which still transmits water along its historical drainage axis towards Grand Avenue to the existing Snow Creek stream channel located east of Grand Avenue. It appears the groundwater encountered during the current exploration is localized within the axes of historical drainages and is not likely to be encountered in areas away from the drainage channels. Canyon bottom subdrain devices should be installed along the bottom axes of the drainage channels during grading operations, as described herein, to transmit the subsurface water to approved outlet locations.

It should be noted that wet weather periods may produce groundwater seepage in the bedrock fractures and along less permeable layers from infiltration of rainfall. Surface flow and runoff and should be anticipated during grading and construction. In general, groundwater levels fluctuate with the seasons. Groundwater conditions below any given site vary depending on numerous factors including seasonal rainfall, local irrigation, and groundwater pumping.

#### **4.4 Subsurface Variations**

Based on results of the subsurface exploration and our experience with the subject area, some variations in the continuity and nature of subsurface conditions within the project site are anticipated. Because of the uncertainties involved in the nature and depositional characteristics of the earth material at the site, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond the boring locations. If, during construction, subsurface conditions different from those presented in this report are encountered, this office should be notified immediately so that recommendations can be modified, if necessary.





## 5.0 FAULTING AND SEISMIC HAZARDS

The project site is not located within a currently designated State of California Earthquake Fault Zone (formerly Alquist-Priolo Special Studies Zones) for surface fault rupture. The Alquist-Priolo Earthquake Fault Zoning Act requires the California Geological Survey to zone “active faults” within the State of California. An “active fault” has exhibited surface displacement with Holocene time (within the last 11,000 years) hence constituting a potential hazard to structures that may be located across it. Public school structures are required to be set-back at least 50 feet from an active fault. The active fault set-back distance is measured perpendicular from the dip of the fault plane.

### 5.1 Seismic Characteristics of Nearby Faults

No surface faults are known to project through or towards the site. The closest known faults to the project site with mappable surface expressions are the San Jose Fault (3.9 kilometers to the north) and Chino-Central Avenue (Elsinore) Fault (8.2 kilometers to the east/ southeast). The concealed Puente Hills Blind Thrust Fault (Coyote Hills segment) along with other regional faults was included as active fault sources for the probabilistic seismic hazard analysis for the site. The approximate locations of these local active faults with respect to the project site are tabulated on Table No. 1, *Summary of Regional Faults*, and are shown on Drawing No. 5, *Southern California Regional Fault Map*.

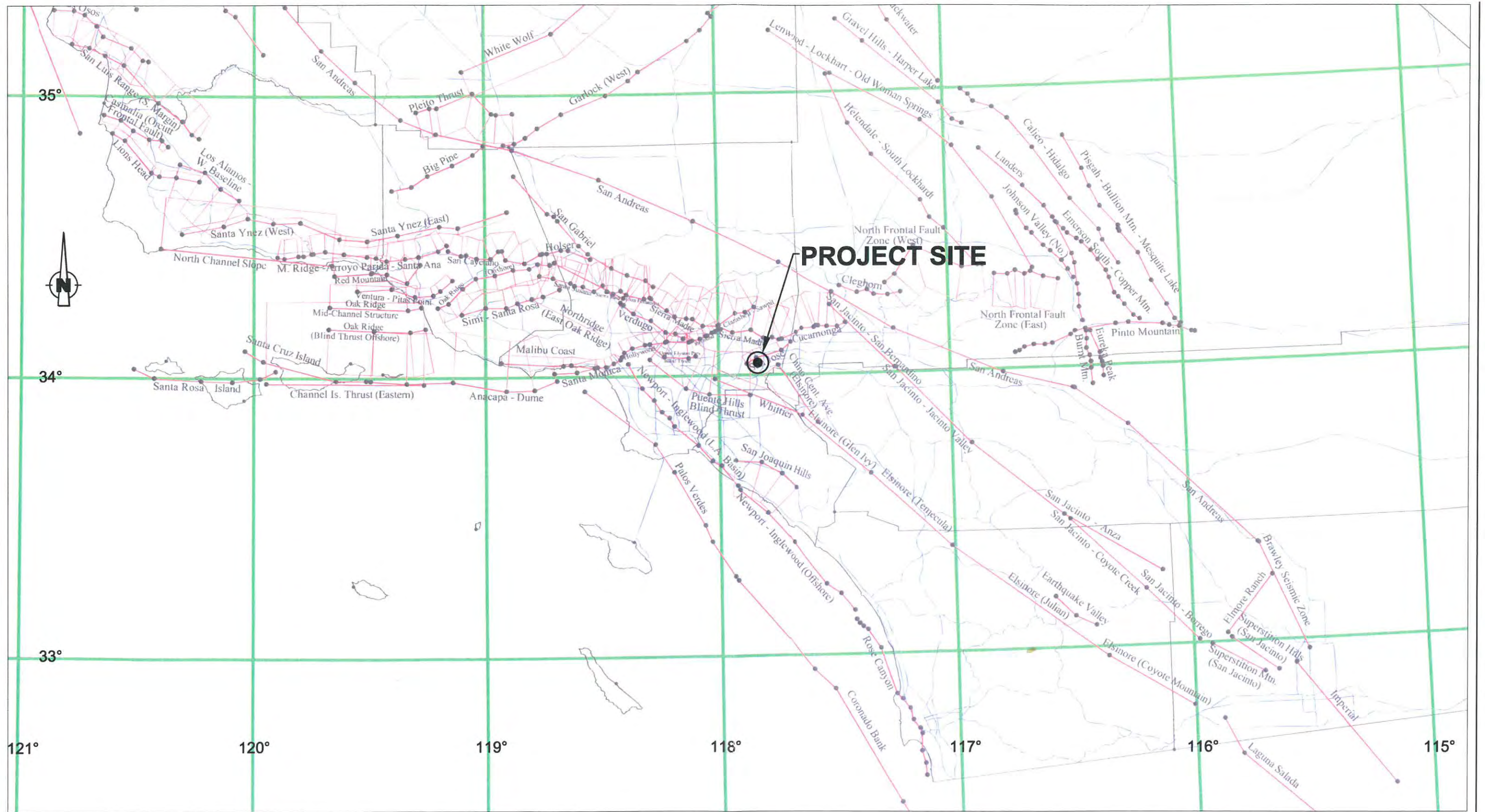
The Pomona Valley Basin is bounded to the north by the San Jose Fault and to the southwest by the Chino-Central Avenue faults. These two fault systems do not exhibit evidence of surface movement within Holocene time and are not considered active based on current geologic information. The San Jose and Chino-Central Avenue faults are considered Late Quaternary, having exhibited displacement and movement within the past 130,000 years.

#### San Jose Fault



The San Jose Fault lies along the southern flank of the northeast trending San Jose Hills. The fault trends northeast and dips to the north. The mapped trace of the San Jose Fault is located approximately 3.9 kilometer north of the project.

Geotechnical investigations performed on the campus of California State Polytechnic University at Pomona (Geocon, 2001) indicated that the San Jose is an active reverse-separation fault. Because of the lack of success in previous fault trench excavations, Geocon based its conclusions on a series of closely spaced boreholes along several traverses across a subtle topographic bench on the campus. They discovered two shallowly to moderately north-dipping thrust faults with the most recent displacement





REFERENCE: PORTION OF CGS 2002 CALIFORNIA FAULT MODEL  
 MODIFIED FOR USE WITH FRISKSP AND EQFAULT  
 BY THOMAS F. BLAKE, AUGUST 2004

-  FAULT SOURCES
-  BLIND THRUST FAULT,  
POLYGONS INDICATE RUPTURE  
PLANES AND DIP DIRECTION

## SOUTHERN CALIFORNIA REGIONAL FAULT MAP



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 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No.  
 13-31339-01

Drawing No.  
**5**

being about 1 meter and occurred since 3500 yrs. B.P. on the basis of radiocarbon dating of faulted alluvium. These findings would show this segment of the fault is active, but is a reverse separation fault south of the San Jose Hills (Yeats, 2004).

### Chino-Central Avenue Faults

The Chino and Central Avenue faults trend northwest along the southwest portion of the Chino Basin. The fault ties along the northeast edge of the Puente Hills. The Chino and Central Avenue faults are considered part of the Elsinore fault which is one of the major right-lateral, strike-slip faults of the Peninsular Ranges geomorphic province. The Elsinore fault splits near Prado Dam into the Chino-Central Avenue and Whittier faults. The Chino-Central Avenue faults are two separate fault strands that strike northwest. The Chino fault dips southwest and is at least 18 km in length. The Central Avenue fault is about 8 km in length and concealed by younger alluvial deposits.

As is the case for most areas of Southern California, ground-shaking resulting from earthquakes associated with nearby and more distant faults may occur at the project site. During the life of the project, seismic activity associated with active faults can be expected to generate moderate to strong ground shaking at the site.

Table No. 1, *Summary of Regional Faults*, summarizes selected data of known faults capable of seismic activity within 50 kilometers of the site. The data presented below was calculated using EQFAULT Version 3.0 with updated fault data from “The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al., 2003)”, Appendix A, and other published geologic data.

**Table No. 1, Summary of Regional Faults**

Fault Name and Section	Approximate * Distance to Site (kilometers)	Max. Moment Magnitude (Mmax)	Slip Rate (mm/yr)
San Jose*	3.9	6.4	0.50
Chino-Central Ave. (Elsinore)	8.2	6.7	1.00
Whittier	12.6	6.8	2.50
Sierra Madre*	13.5	7.2	2.00
Puente Hills Blind Thrust**	14.1	7.3	0.70
Cucamonga*	15.1	6.9	5.00
Elysian Park Blind Thrust*	17.1	6.7	1.50
Raymond	21.6	6.5	1.50
Clamshell-Sawpit	23.6	6.5	0.50
Elsinore-Glen Ivy	28.2	6.8	5.00
Verdugo*	30.1	6.9	0.50
Compton Thrust	31.4	6.8	1.50
Hollywood	37.6	6.4	1.00



Fault Name and Section	Approximate * Distance to Site (kilometers)	Max. Moment Magnitude (Mmax)	Slip Rate (mm/yr)
San Jacinto – San Bernardino	38.0	6.7	12.00
San Andreas – 1857 Rupture*	39.5	7.4	30.00
San Andreas – Mojave*	39.5	7.4	30.00
Newport-Inglewood (L.A. Basin)*	39.7	7.1	1.00
San Andreas – San Bernardino*	41.1	7.5	24.00
San Andreas – Southern*	41.1	7.2	25.00
Cleghorn*	45.7	6.7	2.00

\*Review of published geologic data and mapping including Appendix A of the 2002 California Fault Parameters Report (Cao et al., 2003). Distance from the site to nearest subsurface projection, per Shaw et al., 2002.

## 5.2 Seismic History

An analysis of the seismic history of the site was conducted using the computer program EQSEARCH, (Blake, 2000, updated 2010), and attenuation relationships proposed by Bozorgnia, et al. (1999) for soft rock conditions. The Southern California Earthquake Catalog with the Southern California Earthquake Center was also utilized (SCEC, 2013).

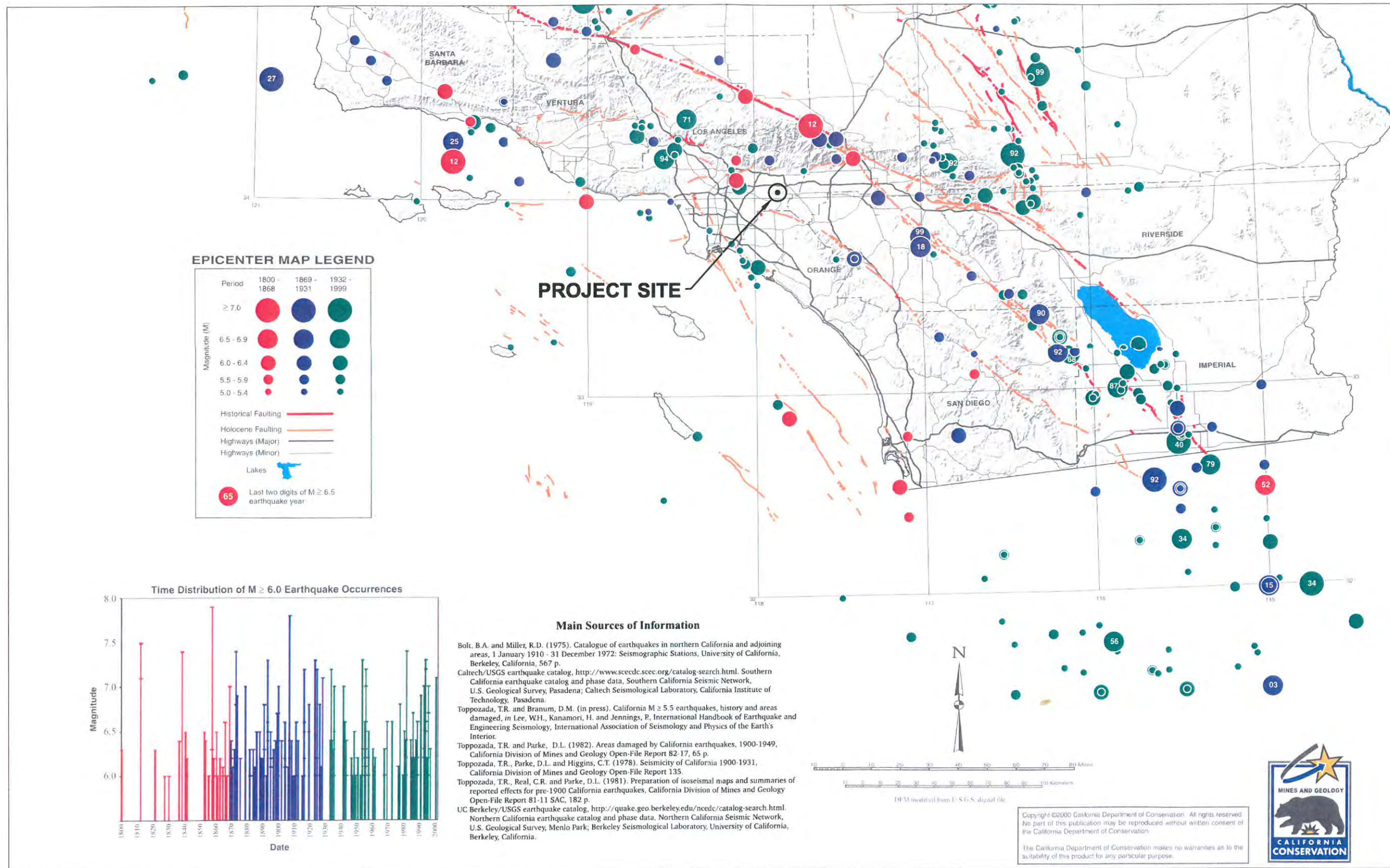
Based on the analysis of seismic history, the number of earthquakes with a moment magnitude of 5.0 or greater occurring within a distance of 100 kilometers was 81 since the year 1800. Based on the analysis, the largest earthquake-induced ground acceleration affecting the site since the year 1800 is a 7.0 magnitude earthquake in 1858 with a calculated ground acceleration of 0.18g at the site.

Review of recent seismological and geophysical publications indicates that the seismic hazard for the Pomona Basin is high. The Pomona Basin is bounded by active regional faults on all sides and underlain by alluvial sediments and buried thrust faults. The seismic hazard for the heavily populated Pomona Basin was illustrated by the 1971 San Fernando, 1987 Whittier Narrows, 1991 Sierra Madre and 1994 Northridge earthquakes. The epicenters for these earthquakes are shown on Drawing No. 6, *Epicenters Map of Southern California Earthquakes (1800-1999)*.

## 5.3 Seismic Hazards

In addition to direct effects on structures, strong ground shaking from earthquakes can also produce other side effects that include surface fault rupture, soil liquefaction, lateral spreading, seismically-induced settlement, ground lurching, landsliding, earthquake-induced flooding, seiches, and tsunamis. Drawing No. 7, *Seismic Hazard Zones Map*, has been prepared to show the mapped location of potential liquefaction and earthquake-induced landslide areas near the project site. The State of California





REFERENCE: PORTION OF EPICENTERS AND AREAS DAMAGED BY M≥5 CALIFORNIA EARTHQUAKES, 1800-1999 CALIFORNIA DEPARTMENT OF CONSERVATION, MAP SHEET 49 DATED 2000.

**EPICENTER MAP OF SOUTHERN CALIFORNIA EARTHQUAKES (1800-1999)**

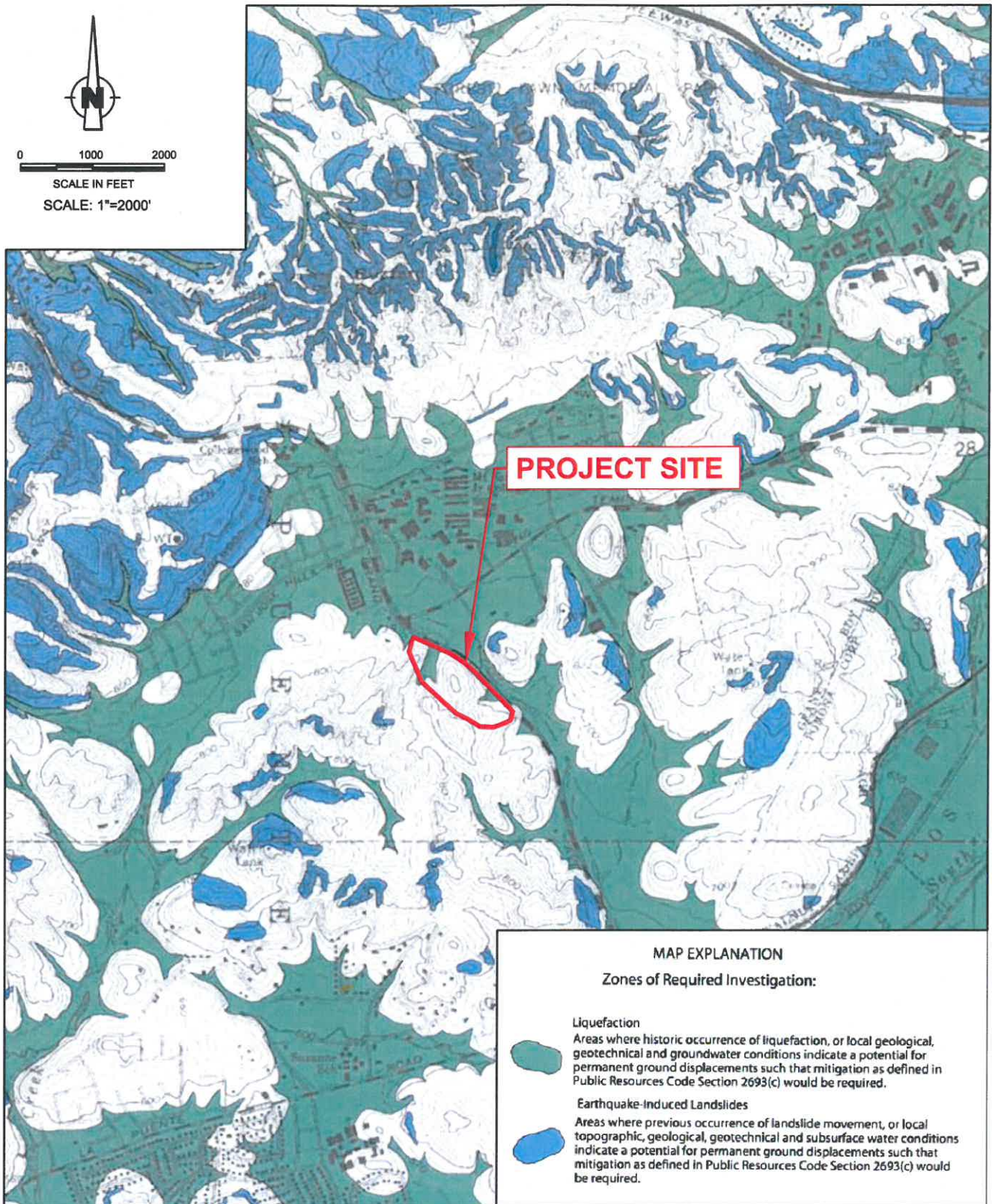


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0 1000 2000

SCALE IN FEET  
SCALE: 1"=2000'



REFERENCE: SAN DIMAS QUADRANGLE 1999  
SEISMIC HAZARD ZONES STATE OF CALIFORNIA

## SEISMIC HAZARD ZONES MAP



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MT. SAN ANTONIO COLLEGE  
WEST PARCEL  
WALNUT, CALIFORNIA

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7

Seismic Hazard Zone Map for the San Dimas Quadrangle (March 25, 1999) shows the project site is located within an area of potential liquefaction and portions of the site indicate areas of potential seismically-induced landsliding.

Results of a site-specific evaluation for each type of possible seismic hazard are explained below:

### 5.3.1 Surface Fault Rupture

The site is not located within a currently designated State of California Earthquake Fault Zone. Based on a review of existing geologic information, no known active fault zone crosses or projects toward the site. The potential for surface rupture resulting from the movement of the nearby major faults is considered remote.

### 5.3.2 Liquefaction and Seismically-Induced Settlement

Liquefaction is the sudden decrease in the strength of cohesionless soils due to dynamic or cyclic shaking. Saturated soils behave temporarily as a viscous fluid (liquefaction) and, consequently, lose their capacity to support the structures founded on them. The potential for liquefaction decreases with increasing clay and gravel content, but increases as the ground acceleration and duration of shaking increase. Liquefaction potential has been found to be the greatest where the groundwater level and loose sands occur within 50 feet of the ground surface.

The site is partially located within potential liquefaction zones per the State of California Seismic Hazard Zones Map for the San Dimas Quadrangle. Drawing No. 7, *Seismic Hazard Zones Map*, has been prepared to show the mapped locations of potential liquefaction in relation to the project sites. Groundwater was encountered at 19 feet in BH-1 and BH-2 in the northern portion of the site and at 44 feet and 16 feet respectively in BH-14, BH-15.

The liquefaction potential and seismic settlement analyses were performed utilizing SPT data obtained from boring BH-15 for the upper 50 feet of soil. The detailed results of the liquefaction analysis and a summary of the methods used are presented in Appendix C, *Liquefaction/Seismic Settlement Analysis*. Based on our liquefaction potential analyses, and the firm bedrock materials encountered during the exploration, the project site is not susceptible to liquefaction and seismically-induced settlement is anticipated to be negligible.

### 5.3.3 Lateral Spreading

Seismically induced lateral spreading involves primarily lateral movement of saturated earth materials due to ground shaking. It differs from the slope failure in that complete ground failure involving large movement does not occur due to the



relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the project sites consists of bedrock knolls overlain by relatively-dry and dense colluvial soils and gentle swales below. Under these circumstances, the potential for lateral spreading at the subject site is considered negligible.

#### 5.3.4 Seismically-Induced Slope Instability

Seismically-induced landslides and other slope failures are common occurrences during or soon after earthquakes. Slopes within the project area will be completely removed or reduced to a 2:1 (H:V) gradient during the proposed grading operations. Slopes with a gradient steeper than 2:1 (H:V) would be over underlying hard, cemented sandstone pebble conglomerate bedrock. In the absence of significantly steep slopes, the potential for seismically-induced landslides to affect the proposed site is considered to be very low.

#### 5.3.5 Earthquake-Induced Flooding

Review of the Flood Insurance Rate Map (FIRM), Panel 1725 of 2350, from the FEMA Map Service Center Viewer, indicates that the site is in an area designated as Zone D, "Areas in which flood hazards are undetermined, but possible." Due to the absence of groundwater at shallow depths, distance of the subject site from large bodies of water and regional flood control structures, the potential for flooding at the subject site is considered remote.

#### 5.3.6 Tsunami and Seiches

Tsunamis are seismic sea waves generated by fault displacement or major ground movement. Based on the location of the site from the ocean (over 20 kilometers), tsunamis do not pose a hazard. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on site location away from lakes and reservoirs, seiches do not pose a hazard.

#### 5.3.7 Volcanic Eruption Hazard

There are no known volcanoes near the site. According to Jennings (1994), the nearest potential hazards from future volcanic eruptions is the Amboy Crater-Lavic Lake area located in the Mojave Desert more than 120 miles east/northeast of the site. Volcanic eruption hazards are not present.





## 6.0 SEISMIC ANALYSIS

### 6.1 CBC Seismic Design Parameters

Seismic parameters based on the 2013 California Building Code are calculated using the United States Geological Survey *U.S. Seismic Design Maps* website application and the site coordinates (34.0398 degrees North Latitude, 117.8452 degrees West Longitude). These coordinates are in reference to the central portion of the project area. Review of the California Geologic Survey (CGS) publication Engineering Geology and Seismology for Public Schools, Colleges and Hospitals in California, dated August 9, 2005 (page 32) indicates that accuracy to within a few hundred meters of these coordinates is sufficient for the computation of the earthquake ground motion of the project site. Therefore, these coordinates are considered representative of the entire site. The seismic parameters are presented below.

**Table No. 2, CBC Seismic Design Parameters**

Seismic Parameters	2013 CBC
Site Class	D
Mapped Short period (0.2-sec) Spectral Response Acceleration, $S_s$	2.177 g
Mapped 1-second Spectral Response Acceleration, $S_1$	0.776 g
Site Coefficient (from Table 1613.5.3(1)), $F_a$	1.0
Site Coefficient (from Table 1613.5.3(2)), $F_v$	1.5
MCE 0.2-sec period Spectral Response Acceleration, $S_{MS}$	2.177 g
MCE 1-second period Spectral Response Acceleration, $S_{M1}$	1.163 g
Design Spectral Response Acceleration for short period, $S_{DS}$	1.451 g
Design Spectral Response Acceleration for 1-second period, $S_{D1}$	0.776 g
Seismic Design Category	E

### 6.2 Site-Specific Ground Motion Response Spectrum

The subject site is partially located in a Seismic Hazard Zone. Based on 2013 CBC Section 1616A.1.3, a site-specific ground motion analysis is required. A site-specific response spectrum was developed for the project for a Maximum Considered Earthquake (MCE), defined as a horizontal peak ground acceleration that has a 2 percent probability of being exceeded in 50 years (return period of approximately 2,475 years).

In accordance with ASCE 7-10, Section 21.2 and Code Application Notice (CAN 2-1802A.6.2) the site-specific response spectra can be taken as the lesser of the probabilistic maximum rotated component of MCE ground motion and the 84<sup>th</sup> percentile of deterministic maximum rotated component of MCE ground motion response spectra. The design response spectra can be taken as 2/3 of site-specific MCE response



spectra, but should not be lower than 80 percent of CBC general response spectra. The risk coefficient  $C_R$  has been incorporated at each spectral response period for which the acceleration was computed in accordance with ASCE 7-10, Section 21.2.1.1.

The 2013 CBC mapped acceleration parameters are provided in the following table. These parameters were determined using the United States Geological Survey *U.S. Seismic Design Maps* website application, and in accordance with ASCE 7-10 Sections 11.4, 11.6, 11.8 and 21.2.

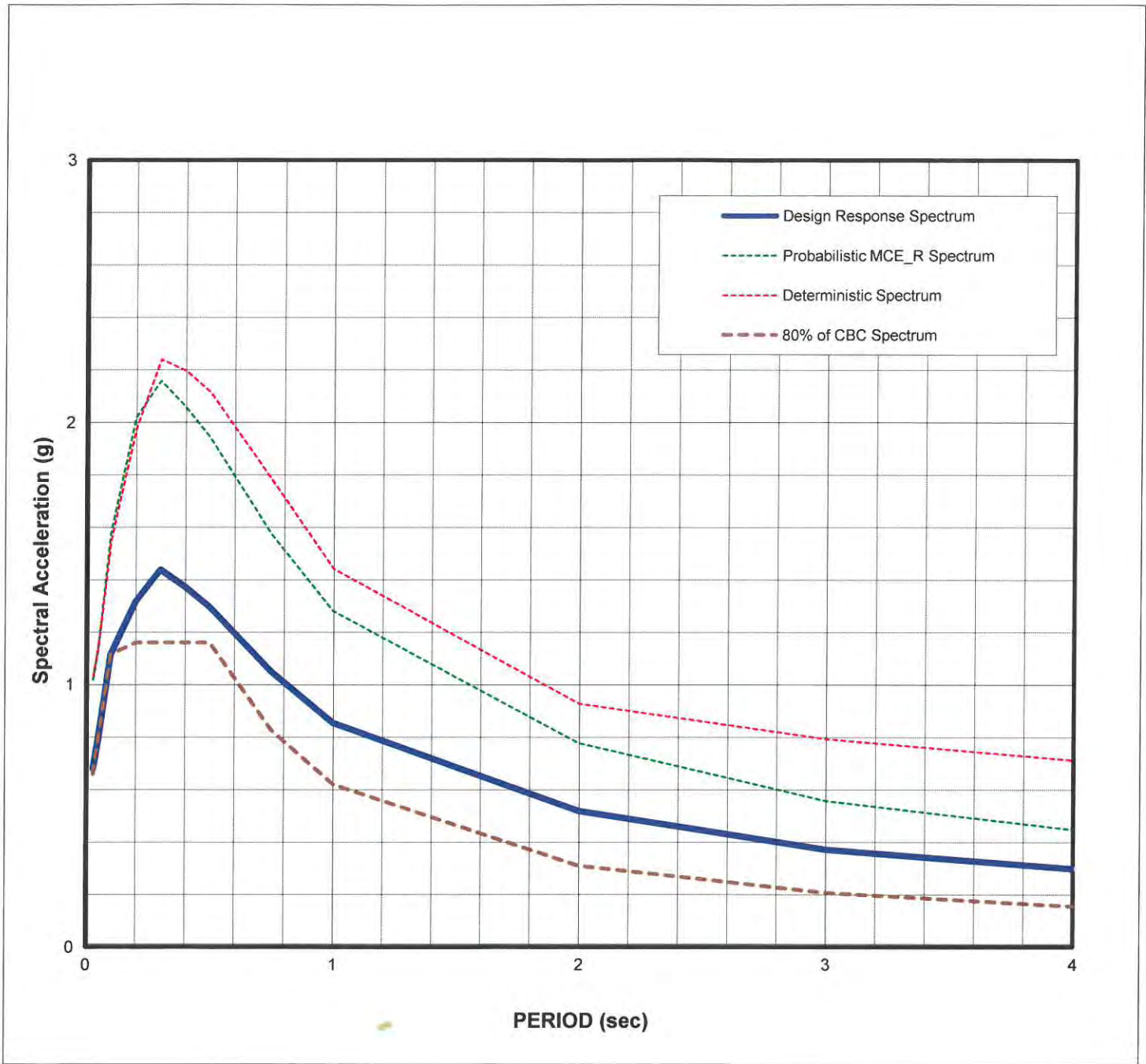
**Table No. 3, 2013 CBC Mapped Acceleration Parameters**

Site Class	D	Seismic Design Category	E
$S_s$	2.177	$C_{RS}$	1.007
$S_1$	0.776	$C_{R1}$	1.019
$F_a$	1	$0.08 F_v/F_a$	0.120
$F_v$	1.5	$0.4 F_v/F_a$	0.600
$S_{MS}$	2.177	$T_0$	0.107
$S_{M1}$	1.164	$T_s$	0.535
$S_{DS}$	1.451	$T_L$	8
$S_{D1}$	0.776		

A Site-Specific response analysis, using faults within 100 kilometers of the site, was developed using the computer program EZ-FRISK by Risk Engineering (v. 7.51) and the 2008 USGS Fault Model database. Attenuation relationships proposed by Boore and Atkinson (2008), Campbell and Bozorgnia (2008), Chiou and Youngs (2008) were used in the analysis. These attenuation relationships are based on Next Generation Attenuation (NGA) project model. Maximum rotated components were determined using Huang (2008) method. An average shear wave velocity at upper 30 meters of soil profile ( $V_{s30}$ ) of 270 meters per second, depth to bedrock of with a shear wave velocity 1,000 meters per second at 50 meters below grade, and depth of bedrock where the shear wave velocity is 2,500 meters per second at 3,000 meters below grade were selected for EZ-Frisk Analysis.

Applicable response spectra data are presented in the table below and on Drawing No. 8, *Site-Specific Design Response Spectrum*. These curves correspond to response values obtained from above attenuation relations for horizontal elastic single-degree-of-freedom systems with equivalent viscous damping of 5 percent of critical damping.





Note: Calculated using EZFRISK program Risk Engineering, version 7.51 and USGS 2008 fault model database.

**SITE SPECIFIC DESIGN RESPONSE SPECTRUM**

Mt. SAC West Parcel

Project Number:

Mt. San Antonio College, Walnut

13-31-339-01

For : Mt. San Antonio College



**Converse Consultants**

Drawing No.

8

**Table No. 4, Site-Specific Response Spectrum Data**

Period (sec)	2% in 50yr Probabilistic Spectral Acceleration (g)	Risk Coefficient $C_R$	Probabilistic $MCE_R$ Spectral Acceleration (g)	84th Percentile Deterministic MCE Response Spectra, (g)	Deterministic CBC Lower Level, (g)	Site Specific $MCE_R$ Spectral Acceleration (g)	80% CBC Design Response Spectrum	Site Specific Design Spectral Acceleration (g)
0.03	1.013	1.007	1.020	1.032	0.825	1.020	0.660	<b>0.680</b>
0.05	1.130	1.007	1.138	1.146	0.975	1.138	0.790	<b>0.790</b>
0.10	1.567	1.007	1.578	1.550	1.350	1.550	1.116	<b>1.116</b>
0.20	2.005	1.007	2.019	1.976	1.500	1.976	1.161	<b>1.317</b>
0.30	2.140	1.009	2.158	2.240	1.500	2.158	1.161	<b>1.439</b>
0.40	2.039	1.010	2.059	2.197	1.500	2.059	1.161	<b>1.373</b>
0.50	1.922	1.012	1.944	2.116	1.500	1.944	1.161	<b>1.296</b>
0.75	1.551	1.015	1.575	1.782	1.200	1.575	0.828	<b>1.050</b>
1.00	1.258	1.019	1.282	1.442	0.900	1.282	0.621	<b>0.855</b>
2.00	0.764	1.019	0.779	0.929	0.450	0.779	0.310	<b>0.519</b>
3.00	0.548	1.019	0.559	0.794	0.300	0.559	0.207	<b>0.372</b>
4.00	0.440	1.019	0.448	0.714	0.225	0.448	0.155	<b>0.299</b>

Vertical acceleration at the site may be calculated using the ASCE 7-10, Section 12.4.

The site-specific design response parameters are provided in the following table. These parameters were determined from Design Response Spectra presented in table above, and following guidelines of ASCE Section 21.4.

**Table No. 5, Site-Specific Seismic Design Parameters**

	Design Parameters (5% Damping)	Lower Limit, 80% of CBC Design Spectra
Site-Specific 0.2-second period Spectral Response Acceleration, $S_{MS}$	1.976	1.742
Site-Specific 1-second period Spectral Response Acceleration, $S_{M1}$	1.558	0.931
Site-Specific Design Spectral Response Acceleration for short period $S_{DS}$	1.317	1.161
Site-Specific Design Spectral Response Acceleration for 1-second period, $S_{D1}$	1.039	0.621



## 7.0 GEOTECHNICAL EVALUATIONS AND CONCLUSIONS

Based on the results of our background review, subsurface exploration, laboratory testing, geotechnical analyses, and understanding of the planned grading development, it is our opinion that the proposed project is feasible from a geotechnical standpoint, provided the following conclusions and recommendations are incorporated into the project plans, specifications, and are followed during site construction.

The following is a summary of the major geologic and geotechnical factors to be considered for the planned project:

- The site is located partially within a mapped Seismic Hazard Zone for liquefaction. Based on our liquefaction potential analyses, and the firm bedrock materials encountered during the exploration, the project site is not susceptible to liquefaction and seismically-induced settlement is anticipated to be negligible.
- Localized zones of groundwater were encountered during subsurface exploration, ranging in depths at approximately 16 feet bgs in boring BH-15 to 44 feet bgs in Boring BH-14. Localized perched groundwater seepage should be anticipated during excavation in these locations.
- For the West Parcel site, the axes of historical drainage channels should be installed with canyon bottom subdrains to collect any direct subsurface drainage to an approved outlet location.
- Undocumented fill soils up to 5 feet were encountered in boring BH-3 at the northern portion of the site in the Christmas Tree Lot. The fill at the site consists of primarily silty sand with some gravels. Undocumented fill should be excavated and recompacted.
- Based on the proposed plan, cut-and-fill grading operations are required to achieve the planned finished grades.
- The surficial site soils and earth materials generated from excavations of bedrock at both sites exhibit a low expansive potential. These materials should be mitigated if they are to be used for any future structural support.
- On-site silty, clayey soils and siltstone with an expansion index exceeding 20 should not be re-used for compaction within 5 feet below the planned fill pad finish grade or for retaining wall backfill. Soils containing organic materials should not be used as structural fill. The extent of removal should be determined by the geotechnical representative based on soil observation during grading. Based on borings BH-1 and BH-20, the top 5 feet of existing grade exhibits an expansion index greater than 20.
- The planned fill pad at the site is expected to be up to approximately 60 feet in thickness above the existing grade. Long term consolidation ground settlement for



the planned compacted fill pads is expected to be less than 1.5 inches with differential settlement of 0.5 inch over a 30-foot span.

- The earth materials at the site consisting of soil should be excavatable with conventional heavy-duty earth moving and trenching equipment. Earth materials consisting of conglomerate bedrock will be considerably harder to excavate. The on-site materials contain about 5 to 30 percent gravel up to 3 inches in maximum dimension. Larger gravels, cobbles and possible boulders may exist at the site. Earthwork should be performed with suitable equipments for gravelly materials.
- Removals up to approximately 55 feet deep are anticipated.
- The fill slope on the east side of the site along Grand Avenue will include a maximum proposed fill height of approximately 80 feet. Existing slopes within the project area will be completely removed or reduced to a 2:1 (H:V) gradient during the proposed grading operations placed over underlying hard sandstone pebble conglomerate bedrock. In the absence of significantly steep slopes, the potential for seismically-induced landslides to affect the proposed site is considered to be very low.
- Slopes along the western portion of the proposed fill pad are planned to be placed in a 2:1 (H:V) step-like fashion as depicted in Drawing No. 2, *Site Plan and Approximate Locations of Borings*.

## **8.0 EARTHWORK AND SITE GRADING RECOMMENDATIONS**

### **8.1 General Evaluation**

Based on our field exploration, laboratory testing, and analyses of subsurface conditions at the site, remedial grading including cut-and-fill operations is required to prepare the planned fill pads for support of the future developments. To reduce differential settlement, variations in the soil type, degree of compaction, and thickness of the compacted fill, the thickness of compacted fill placed underneath the footings should be kept uniform.

Site grading recommendations provided below are based on our experience with similar projects in the area and our evaluation of this study. Site preparation might involve removal of any existing structures with their foundations and other existing underground manmade structures and utilities.

### **8.2 Over-Excavation/Removal**

The existing undocumented fill materials in their present condition are not considered suitable for supporting the planned additional fill. All undocumented fill should be removed, moisture-conditioned if necessary, and replaced as compacted fill. The actual depth of over-excavation from the existing ground surface will depend on existing depth



of fill placed during site grading. During our explorations in the proposed area, undocumented fill soils up to five (5) feet in thickness below the existing ground surface were encountered in boring BH-3 at the northern portion of the site in the Christmas Tree Lot. The depth of existing fill could be deeper elsewhere onsite.

Unsuitable natural surface soils and alluvium shall be removed, moisture conditioned to near optimum moisture levels, mixed and recompacted as compacted fill to project specifications. Clay top soils that are disturbed and loosened by seasonal cycles of wetting and drying producing desiccation cracks and voids shall be removed and recompacted. Estimated depth of clay top soil removal is approximately three (3) feet. Loose, disturbed or unsuitable alluvial soils encountered in the drainage canyons shall be removed to firm natural soils and/or bedrock and then replaced as compacted fill. Loose and unsuitable alluvial soils shall be cleaned out of the canyon bottoms prior to the placement of compacted fills and canyon bottom subdrains.

Due to the proposed approximately 55 foot removal of bedrock off of the top of hill, the rebound of the cut subgrade of bedrock is expected after the cut is first made. Elastic rebound due to removal of overburden typically occurs for cuts of greater than 50 feet in thickness. The amount of rebound will vary across the site and may result in an uneven ground surface. Therefore, we recommend the hilltop removal portions of the site (cut areas) be over-excavated at least two (2) feet and replaced with a properly compacted fill. This will aid in reducing unevenness in the subgrade below the planned pavement and/or future structures.

Keyways with a minimum width of 25 feet and a minimum embedment depth of 5 feet should be excavated and constructed along the toe of the compacted fill slope for the site. Backdrains should be installed at the bottom of slope with a minimum one percent gradient to outlet pipe. A backdrain consisting of 4-inch diameter perforated PVC pipe (Schedule 40 or equivalent) with perforations down and ends capped encased with 1-cubic-foot  $\frac{3}{4}$ -inch gravel per linear foot wrapped with filter fabrics should be installed along the bench. Backdrains should be installed every 15 feet vertically. A Minimum 1 percent gradient to solid outlet pipes is recommended. The outlet pipes should be a minimum of 4-inch diameter PVC pipe (Schedule 40 or equivalent) and be installed every 50 feet horizontal spacing, or minimum two outlets.

All excavations on slopes steeper than a gradient of 10:1 (horizontal: vertical) shall be benched into competent soils or bedrock. Typically the benching should be 2 to 3 feet in height and minimum 3 feet in width.

To minimize the potential of differential settlement, we recommend that over-excavation be kept uniform. The excavation to remove undocumented fill and unsuitable soils should be extended to a minimum of five (5) feet laterally beyond the fill pad limits, where space is available. The actual depth of removal should be determined based on observations and tests made during grading.



The exposed bottom of the over-excavation area should be scarified at least 6 inches; moisture conditioned as needed to near-optimum moisture content, and compacted to 90 percent relative compaction. Over-excavation should not undermine adjacent off-site improvements. Remedial grading should not extend within a projected 1:1 (horizontal to vertical) plane projected down from the outer edge of adjacent off-site improvements.

Existing soil and bedrock materials exhibited moisture contents ranging from as low as 3% up to 55% during the field exploration, while the optimum moisture contents for purposes of compaction range from 9.2% to 16.8%. The grading contractor will need to take efforts to process the soils with thorough moisture conditioning and mixing of soils to meet the requirements of acceptable fill materials prior to placing as engineered fill as stated in the earthwork specifications.

If soft, yielding soil conditions are encountered at the excavation bottom, the following options can be considered:

- a. Over-excavate until reach firm bottom
- b. Over-excavate additional 18 inches deep, and then place at least 18-inch-thick compacted base material (CAB or equivalent) to bridge the soft bottom. Base should be compacted to 95% relative compaction.
- c. Over-excavate additional 18 inches deep, and then place a layer of geofabric (i.e. Marifi HP570, X600 or equivalent), place 18-inch-thick compacted base material (CAB or equivalent) to bridge the soft bottom. Base should be compacted to 95% relative compaction. An additional layer of geofabric may be needed on top of base depending on the actual site conditions.

Site grading may result in transition lines with cut and/or fill conditions. This transition line would require special grading considerations. Detailed site grading recommendations are provided in the following sections.

### **8.3 Canyon Bottom Subdrains**

Canyon bottom subdrain systems should be constructed of a minimum 6-inch diameter, Schedule 80 PVC pipe with glued manufactured pipe fitting and caps. The subdrain pipes should be located in the bottoms of the canyons. The drain pipes should be sloped at a minimum 2% gradient to provide gravity flow to the approved outlet location. Perforated pipes shall be laid with perforations down. Schedule 80 PVC perforated pipe may have to be custom fabricated.

Surface drain systems should not be connected to the subdrain system. Introduction of surface water in the subdrain system could recharge water into the compacted fill soils. Surface and subsurface drainage systems should be kept separate.





A State of California Department of Transportation (Caltrans) Class 2 Permeable Material is recommended for the permeable drain material. The percentage composition by weight of permeable material in place shall conform to the following gradings:

**Table No. 6, Caltrans Class 2 Permeable Material Grading**

CALTRANS CLASS 2 PERMEABLE MATERIAL	
Sieve Size	Percentage Passing
1"	100
¾"	90 - 100
3/8"	40 - 100
No. 4	25 - 40
No.8	18 - 33
No. 30	5 - 15
No. 50	0 - 7
No. 200	0 - 3

Note: Class 2 permeable material shall have a Sand Equivalent value of not less than 75.

#### **8.4 Structural Fill**

All engineered fill should be placed on competent, scarified and compacted bottom as evaluated by the geotechnical engineer and in accordance with the specifications presented in this section. Generally, excavated site soils, free of deleterious materials and rock particles larger than three (3) inches in the largest dimension, should be suitable for placement as compacted fill. Any proposed import fill should be evaluated and approved by Converse prior to import to the site. Import fill material should have an expansion index less than 20.

Excavated conglomerate bedrock, which consists of sand, gravel, and cobbles may be considered as base material below proposed hardscape, such as the propose access road.

Prior to compaction, fill materials should be thoroughly mixed and moisture conditioned when necessary, within two (2) percent of the optimum moisture for granular soils and at approximately three (3) percent above the optimum moisture for fine-grained soils. Fill soils shall be evenly spread in maximum 8-inch lifts, watered or dried as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

Fills exceeding five (5) feet in height shall not be placed on native slopes that are steeper than 5:1 horizontal:vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than five (5) feet, the fill shall be keyed and



benched into competent materials. A 2:1 (horizontal to vertical) or flatter slope gradient for the planned new fill pad is recommended. All new fill should be compacted to at least 90 percent of the maximum dry density for the upper 10 feet of fill and 95 percent of the maximum dry density for fill placed 10 feet below proposed finished grade in accordance with the ASTM Standard D1557 test method. Appropriate means and methods of placement will be required to achieve these compaction requirements.

Though we expect most of the bedrock materials to break down to less than 3-inch size materials by the standard grading process, following are recommendations with regards to hard cobble and boulder size clasts that may be encountered in the bedrock materials that do not break down without considerable effort.

Structural fills placed in the top ten (10) feet of the finished graded pads and 2:1 (H:V) fill slopes shall contain sedimentary bedrock particles no larger than three (3) inches in size throughout and be mixed evenly throughout the fill soil matrix.

Deeper structural fills placed below the top ten (10) feet of the graded pad and slope surfaces can contain rock particle sizes from three (3) to twelve (12) inch size provided the following conditions are adhered to during grading:

- The rock materials shall not be nested, stacked or piled on top of each other during placement.
- Rock materials shall be evenly placed and dispersed in controlled lifts and layers throughout the compacted fill soils.
- Granular fine grained soils shall be placed and compacted on all sides of the rock to eliminate void spaces.
- Buried rock materials shall be proof-rolled with loaded heavy rubber tire grading equipment (scrapers, loaders and compactors) to provide the required compaction.
- Compaction and moisture conditioning of the structural fill soils containing rocks shall meet all earthwork specifications for structural fill placement.
- Placement of rock within the structural fill soils shall be performed under the full-time observation and testing of the Geotechnical Soil Consultant.

Placement of natural rock materials larger than twelve (12) inches and less than twenty four (24) inches in deeper structural fills shall require special observation and testing during fill placement. Placement of this rock size in the structural fills shall require prior approval by the Geotechnical Soils Consultant on a case by case basis. The contractor shall demonstrate that rocks of this size cannot be broken down and downsized by conventional grading methods.



Natural oversize rock materials that are resistant and durable can be used as natural rock armor for surface drain outlets, drainage aprons and drainage channels. Rocks should be placed in a controlled, tightly spaced pattern with compacted fill or concrete placed between the rocks to eliminate void spaces. The remaining oversize rocks, if any, could then be placed in specific areas selected by the Geotechnical Soils Consultants and documented on the as-built grading plans. The oversize rock shall be placed in accordance with the same criteria as the three (3) to twelve (12) inch size rock materials in controlled layers and with soil placed and compacted on all sides of the rock to eliminate void spaces.

Rock sizes could be increased from 3-inch to 6-inch size maximum in the top 10 feet if significant quantities of hard rocks were to be encountered. However, we do not anticipate this. The rock materials would have to be spread out in the fills in single layers with no nesting, stacking, or voids and then completely buried by fill soils as stated earlier. Additional re-grading of future building pad or structure areas (i.e., footing, slab and utility trench areas) may be required if rocks larger than 3-inch size are used in the top 10-feet of compacted fills.

If the campus decides to allow up to 6-inch size rocks be used within top 10 feet of fills, it should be reminded that earthwork may need to be redone for future buildings or structures and removal of large size rocks may result in requiring imported soils at that time. Temporary shoring may also be required for excavation deeper than 5 feet or sloping excavation is not feasible in future construction activities.

### **8.5 Excavatability and Rippability**

Based on our field exploration, most of the earth materials at the site should be excavatable and rippable with conventional heavy-duty earth moving equipment in good working condition. However areas of harder, cemented and resistant bedrock units and layers (pebble conglomerates, sandstone layers, siliceous layers, etc.) are anticipated to be encountered during excavation and grading. These areas may require the use of larger heavy-duty dozers, excavators, track-mounted hydraulic breakers and/or single shank rippers to loosen, rip, cross-rip, downsize, crush, breakdown, mix and process the excavated sedimentary bedrock materials into soil size materials suitable for use as structural fill. Every effort shall be made during excavation, transport and grading to reduce the size of the bedrock materials to particle sizes less than three (3) inches in size to be adequately placed as structural fill.

The earth materials generated from the removal of the existing bedrock knoll will contain larger gravels, cobbles and possible boulders. Those materials require screening and/or processing into smaller particles prior to be used for compaction as specified in the section under structural fill.



## **8.6 Expansive Soil**

Based on our laboratory testing results, the on-site silty, clayey earth materials are considered to be expansive. On-site silty, clayey soils and siltstone with an expansion index exceeding 20 should not be re-used for compaction within 5 feet below the planned fill pad finish grade or for retaining wall backfill. Soils containing organic materials should not be used as structural fill. The extent of removal should be determined by the geotechnical representative based on soil observation during grading. Based on borings BH-1 and BH-20, the top 5 feet of existing grade exhibits an expansion index greater than 20.

There are several alternative mitigation measures that can be utilized to improve expansive soils at the site. Some mitigation measures include:

- Placement of 2 feet thick of non-expansive soil below finished subgrade.
- Pre-saturation of on-site compacted subgrade soils to at approximate three (3) percent above optimum moisture content.
- Lime treat the upper two (2) feet of the subgrade soils.

The on-site soil materials will be mixed during the grading and the expansion potential might change. Therefore, the expansion potential of site soils should be verified after the grading.

## **8.7 Shrinkage and Bulking**

The shrinkage and/or bulking would depend on, among other factors, the depth of cut and/or fill, and the grading method and equipment utilized. For preliminary estimation, bulking and shrinkage factors for various units of earth material at the site may be taken as presented below:

- The approximate shrinkage factor for the upper ten (10) feet of alluvial soils is estimated to range from ten (10) to twenty (20) percent.
- The approximate bulking factor for the fill materials generated from the removal of bedrock hilltop is estimated to range from two (2) to five (5) percent, depending on final compaction achieved for the fill materials.

Although these values are only approximate, they represent our best estimates of the factors to be used to calculate lost volume that may occur during grading. If more accurate shrinkage and bulking factors are needed, it is recommended that field-testing using the actual equipment and grading techniques be conducted.



## **8.8 Subgrade Preparation**

Final subgrade soils for structures and roads should be uniform and non-yielding. To obtain a uniform subgrade, soils should be well mixed and uniformly compacted. The subgrade soils should be non-expansive and well-drained. The near-surface site soils should be free draining. We recommend that at least the upper two (2) inches of subgrade soils underneath the slab-on-grade should be comprised of well-drained granular soils such as sands, gravel or crushed aggregate satisfying the following criteria:

- Maximum size  $\leq 1.5$  inches
- Percent passing U.S. #200 sieve  $\leq 12$  percent
- Sand equivalent  $\geq 30$

The subgrade soils should be moisture conditioned before placing concrete.

## **9.0 PRELIMINARY DESIGN RECOMMENDATIONS**

The future development plans on the graded pads presented in this report were not available at this time. However, for planning purposes, we assume the future development will consist of multiple arrays of solar panels without subterranean basement to provide the preliminary design recommendations. Our recommendations provided in this section are based on the assumptions that in preparing the site, the earthwork and site grading recommendations provided in this report will be followed. It should be advised that the design recommendations presented herein are considered preliminary for planning purpose only. Any future development at these project sites shall be further reviewed and provided with project-specific geotechnical recommendations.

### **9.1 Shallow Foundations**

#### **9.1.1 Vertical Capacity**

We recommend continuous and square footings be founded at least 18 inches below lowest adjacent final grade on compacted fill on bedrock. A minimum footing width of 24 inches is recommended for square footings and 12 inches for continuous footings. The allowable bearing value for footings with above minimum sizes is 2,000 psf for compacted fill and 2,500 psf for bedrock. The net allowable bearing pressure can be increase by 350 psf for each additional foot of excavation depth and by 250 psf for each additional foot of excavation width up to a maximum value of 4,500 psf.

The net allowable bearing values indicated above are for the dead loads and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity.



### 9.1.2 Lateral Capacity

Resistance to lateral loads can be provided by friction acting at the base of the foundation and by passive earth pressure. A coefficient of friction of 0.35 may be assumed with normal dead load forces. An allowable passive earth pressure of 300 psf per foot of depth up to a maximum of 3,000 psf may be used for footings poured against properly compacted fill or undisturbed stiff natural soils. The values of coefficient of friction and allowable passive earth pressure include a factor of safety of 1.5.

### 9.1.3 Settlement

The static settlement of structures supported on continuous and/or spread footings founded on compacted fill will depend on the actual footing dimensions and the imposed vertical loads. Most of the footing settlement at the project site is expected to occur immediately after the application of the load. Based on the maximum allowable net bearing pressures presented above, static settlement is anticipated to be less than 1.0 inch. Differential settlement is expected to be up to one-half of the total settlement over a 30 foot span.

### 9.1.4 Dynamic Increases

Bearing values indicated above are for total dead load and frequently applied live loads. The above vertical bearing may be increased by 33% for short durations of loading which will include the effect of wind or seismic forces. The allowable passive pressure may be increased by 33% for lateral loading due to wind or seismic forces.

## 9.2 ***Pier Foundations***

As an alternative to conventional shallow foundations, the planned solar arrays can be supported on piers (caissons) provided the following recommendations incorporated into design and construction. The piers can be connected to a grade beam system determined by the project structural engineer to control the deflections of structure under the design tolerance.

### 9.2.1 Vertical Capacity

Piers should be at least 24-inch in diameter extending at least 8 feet below adjacent final grade on compacted fill or bedrock. Piers can be designed for an allowable skin friction of 250 psf against the perimeter of pier for a minimum embedment of 8 feet below the adjacent grade. The upper two (2) feet of soil skin friction should be neglected in pier capacity calculations.

If end bearing capacity is to be considered for design, the bottom of pier should be cleaned out with appropriate equipment. The allowable end bearing capacity can be



designed for 3,500 psf. However, the diameter of pier may be increased and temporary casing may be required to facilitate cleanout.

### 9.2.2 Lateral Capacity

Resistance to lateral loads can be provided by friction acting at the base of the foundation and by passive earth pressure. A coefficient of friction of 0.35 may be assumed with normal dead load forces. An allowable passive earth pressure of 300 psf per foot of depth up to a maximum of 3,000 psf may be used for foundations poured against compacted fill or bedrock. The values of coefficient of friction and allowable passive earth pressure include a factor of safety of 1.5. For ground surface restrained by concrete slab, the passive resistance may be calculated from the ground surface. For unrestrained ground condition, the passive resistance of the upper one (1) feet earth material should be neglected in design.

### 9.2.3 Settlement

The static settlement of structures supported on piers founded on native alluvium will depend on the actual footing dimensions and the imposed vertical loads. Most of the footing settlement at the project site is expected to occur immediately after the application of the load. Based on the maximum allowable net bearing pressures presented above, static settlement is anticipated to be less than 0.5 inch.

### 9.2.4 Dynamic Increases

Bearing values indicated above are for total dead load and frequently applied live loads. The above vertical bearing may be increased by 33% for short durations of loading which will include the effect of wind or seismic forces. The allowable passive pressure may be increased by 33% for lateral loading due to wind or seismic forces.

## 9.3 *Modulus of Subgrade Reaction*

For the subject project, design of the structures supported on compacted fill subgrade prepared in accordance with the recommendations provided in this report may be based on a soil modulus of subgrade reaction of ( $k_s$ ) of 150 pounds per square inch per inch.

## 9.4 *Lateral Earth Pressure*

Though not anticipated, following are recommendations for retaining walls up to 6 feet in height. The earth pressure behind any buried wall depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressure. The following fluid pressures are recommended for vertical walls with no hydrostatic pressure, no surcharge, and level backfill.



**Table No. 7, Lateral Earth Pressures for Retaining Wall Design**

Wall Type	Equivalent Fluid Pressure (pcf)
	Level Backfill
Cantilever Wall (Active pressure)	30 (Triangular Distribution)
Restrained Wall (At-rest pressure)	50 (Triangular Distribution)

The recommended lateral pressures assume that the walls are fully back-drained to prevent build-up of hydrostatic pressure. Adequate drainage could be provided by means of permeable drainage materials wrapped in filter fabric installed behind the walls. The drainage system should consist of perforated pipe surrounded by free draining, uniformly graded, ¾ -inch washed, crushed aggregate, and wrapped in filter fabric such as Mirafi 140N or equivalent, and should extend to about 2 feet below the finished grade. The filter fabric should overlap approximately 12 inches or more at the joints. The subdrain pipe should consist of perforated, four-inch diameter, rigid ABS (SDR-35) or PVC A-2000, or equivalent, with perforations placed down. Alternatively, a prefabricated drainage composite system such as the Miradrain G100N or equivalent can be used. The subdrain should be connected to surface drain or sump pump.

In addition, walls with inclined backfill should be designed for an additional equivalent fluid pressure of one (1) pound per cubic foot for every two (2) degrees of slope inclination. Walls subjected to surcharge loads located within a distance equal to the height of the wall should be designed for an additional uniform lateral pressure equal to one-third or one-half the anticipated surcharge load for unrestrained or restrained walls, respectively. These values are applicable for backfill placed between the wall stem and an imaginary plane rising 45 degrees from below the edge (heel) of the wall footings.

### **9.5 Flexible Pavement**

The flexible pavement structural section design recommendations were performed in accordance with the method contained in the *CALTRANS Highway Design Manual*, Chapter 630 without the factor of safety. No specific traffic study was performed to determine the Traffic Index (TI) for the proposed project, therefore a wide range of TI values were evaluated.

Due to various earth materials encountered at the site, flexible pavement structural section recommendations are prepared for both subgrade soils. We recommend that the project structural engineer consider the traffic loading conditions at various locations and select the appropriate pavement sections from the following table:





**Table No. 8, Flexible Pavement Structural Sections**

Design R-value	Design TI	Asphalt Concrete (AC) Over Aggregate Base (AB) Structural Sections		Full AC Structural Section
		AC (inches)	AB (inches)	AC (inches)
44	4	2	2.5	3
	5	3	3	4.5
	6	4	3.5	5.5
	7	4	6	7
	8	5	6.5	8
	9	6	7	9

Base material shall conform to requirements for Crushed Miscellaneous Base (CMB) or equivalent and should be placed in accordance with the requirements of the Standard Specifications for Public Works Construction (SSPWC, latest Edition).

Asphaltic materials should conform to Section 203-1, "Paving Asphalt," of the Standard Specifications for Public Works Construction (SSPWC, latest Edition) and should be placed in accordance with Section 302-5, "Asphalt Concrete Pavement," of the SSPWC, 2012 edition.

Positive drainage should be provided away from all pavement areas to prevent seepage of surface and/or subsurface water into the pavement base and/or subgrade.

**9.6 Rigid Pavement**

Rigid pavement design recommendations were provided in accordance with the Portland Cement Association's (PCA) Southwest Region Publication P-14, *Portland Cement Concrete Pavement (PCCP) for Light, Medium, and Heavy Traffic*. We recommend that the project structural engineer consider the loading conditions at various locations and select the appropriate pavement sections from the following table:

**Table No. 9, Rigid Pavement Structural Sections**

Design R-Value	Design Traffic Index (TI)	PCCP Pavement Section (inches)
44	4.5	5.75
	5.0	6.00
	6.0	6.25
	7.0	6.75
	8.0	7.00
	9.0	7.25

The pavement sections presented in the table are based on a minimum 28-day Modulus of Rupture (M-R) of 550 psi and a compressive strength of 3,000 psi. The third point method of testing beams should be used to evaluate modulus of rupture. The concrete mix design should contain a minimum cement content of 5.5 sacks per cubic yard

**9.7 Site Drainage**

Adequate positive drainage should be provided away from the structures to prevent ponding and to reduce percolation of water into structural backfill. We recommend that the any landscape area immediately adjacent to the foundation shall be designed sloped away from the structures with a minimum 5% slope gradient for at least 10 feet measured perpendicular to the face structure. Impervious surfaces within 10 feet of the foundation shall be sloped a minimum of 2 percent away from the structure per 2013 CBC.

Planters and landscaped areas adjacent to the any building perimeter should be designed to minimize water infiltration into the subgrade soils. Lower level walkways and open patio areas may require special drainage provisions and sump pumps to provide suitable drainage.

**10.0 CONSTRUCTION RECOMMENDATIONS**

**10.1 Temporary Excavations**

Based on the materials encountered in the exploratory borings, sloped temporary excavations may be constructed according to the slope ratios presented in the following table:

**Table No. 10, Slope Ratios for Temporary Excavation**

Maximum Depth of Cut (feet)	Maximum Slope Ratio* (horizontal: vertical)
0 - 5	vertical
5 - 15	1:1
15+	1.5:1

\*Slope ratio assumed to be uniform from top to toe of slope.

Any loose utility trench backfill or other fill encountered in excavations will be less stable than the native soils. Temporary cuts encountering loose fill or loose dry sand should be constructed at a flatter gradient than presented in the table above. Surfaces exposed in slope excavations should be kept moist but not saturated to minimize raveling and sloughing during construction. Adequate provisions should be made to protect the slopes



from erosion during periods of rainfall. Surcharge loads, including construction, should not be placed within five (5) feet of the unsupported excavation edge.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1987 and current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by the project's geotechnical consultant. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

## **10.2 Geotechnical Services during Construction**

This report has been prepared to aid in the foundation plans and specifications, and to assist the architect, civil and structural engineers in the design of the proposed structures. It is recommended that this office be provided an opportunity to review final design drawings and specifications to verify that the recommendations of this report have been properly implemented.

Recommendations presented herein are based upon the assumption that adequate earthwork monitoring will be provided by Converse. Footing excavations should be observed by Converse prior to placement of steel and concrete so that footings are founded on satisfactory materials and excavations are free of loose and disturbed materials. Trench backfill should be placed and compacted with observation and field density testing provided by this office.

During construction, the geotechnical engineer and/or their authorized representatives should be present at the site to provide a source of advice to the client regarding the geotechnical aspects of the project and to observe and test the earthwork performed. Their presence should not be construed as an acceptance of responsibility for the performance of the completed work, since it is the sole responsibility of the contractor performing the work to ensure that it complies with all applicable plans, specifications, ordinances, etc.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any recommended actions presented herein to be unsafe.



## 11.0 CLOSURE

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice. We make no other warranty, either expressed or implied. Our conclusions and recommendations are based on the results of the field and laboratory investigations, combined with an interpolation and extrapolation of soil conditions between and beyond boring locations. If conditions encountered during construction appear to be different from those shown by the borings, this office should be notified.

The preliminary design recommendations given in this report are based on the assumption that the earthwork and site grading recommendations contained in this report are implemented. It should be advised that the design recommendations presented herein are considered preliminary for planning purpose only. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the final site grading and actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.



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## **APPENDIX A**

### **FIELD EXPLORATION FOR PROPOSED FILL PLACEMENT AT WEST PARCEL**



## APPENDIX A

### FIELD EXPLORATION FOR PROPOSED FILL PLACEMENT AT WEST PARCEL

Our field investigation included a site reconnaissance of the site and a subsurface exploration program consisting of drilling soil borings. During the site reconnaissance on April 2, 2014, the surface conditions were noted and the locations of the borings were determined. The borings were located using existing boundary features as a guide and should be considered accurate only to the degree implied by the method used.

#### Exploratory Borings

Twenty-one (21) hollow-stem auger borings were drilled from May 5 to May 9, 2014 extending between depths of approximately 10 to 51.5 feet below the existing ground surface (bgs), and one (1) bucket auger boring (BH-13) on May 19, 2014 to a depth of 31 feet (bgs). The borings were drilled using a truck-mounted drill rig equipped with an 8-inch diameter hollow-stem auger for soil sampling. The bucket auger boring location was utilized for downhole logging for detailed classification of bedrock properties. Soils were logged by our engineer/geologist and classified in the field by visual examination in accordance with the Unified Soil Classification System. The field descriptions have been modified where appropriate to reflect the laboratory test results.

Ring samples of the subsurface materials were obtained at frequent intervals in the exploratory borings using a drive sampler (2.4-inches inside diameter and 3.0-inches outside diameter) lined with sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches, using an automatic hammer. Samples were retained in brass rings (2.4-inches inside diameter and 1.0-inch in height). The central portion of the sample was retained and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Blow counts for each sample interval are presented on the logs of borings. Bulk samples of typical soil types were also obtained.

Standard Penetration Tests (SPT) were also performed using a standard (1.4-inches inside diameter and 2.0-inches outside diameter) split-barrel sampler. The mechanically driven hammer for the SPT sampler was 140 pounds, falling 30 inches for each blow. The recorded blow counts for every six inches for a total of 1.5 feet of sampler penetration are shown on the Logs of Borings in the "BLOWS" column. The standard penetration test was performed in accordance with the ASTM Standard D1586 test method. The soil retrieved from the spoon sampler was carefully sealed in waterproof plastic containers for shipment to the laboratory.

It should be noted that the exact depths at which material changes occur cannot always be established accurately. Changes in material conditions that occur between driven samples are indicated in the logs at the top of the next drive sample. A key to soil



symbols and terms is presented as Drawing No. A1, *Soil Classification Chart*. The logs of the exploratory boring are presented in Drawing Nos. *A2 through A23, Log of Borings*.



# SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

## BORING LOG SYMBOLS

### SAMPLE TYPE

- STANDARD PENETRATION TEST**  
Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method
- DRIVE SAMPLE** 2.42" I.D. sampler.
- DRIVE SAMPLE** No recovery
- BULK SAMPLE**
- GROUNDWATER WHILE DRILLING**
- GROUNDWATER AFTER DRILLING**

### LABORATORY TESTING ABBREVIATIONS

#### TEST TYPE

(Results shown in Appendix B)

#### CLASSIFICATION

Plasticity pi  
Grain Size Analysis ma  
Passing No. 200 Sieve wa  
Sand Equivalent se  
Expansion Index ei  
Compaction Curve max  
Hydrometer h

#### STRENGTH

Pocket Penetrometer p  
Direct Shear ds  
Direct Shear (single point) ds\*  
Unconfined Compression uc  
Triaxial Compression tx  
Vane Shear vs  
  
Consolidation c  
Collapse Test ccl  
Resistance (R) Value r  
Chemical Analysis ca  
Electrical Resistivity er

## UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS



**Converse Consultants**

Project Name  
**MT. SAN ANTONIO COLLEGE  
WEST PARCEL  
WALNUT, CALIFORNIA**

Project No. Drawing No.  
**13-31-339-01 A-1**

# Log of Boring No. BH- 1

Dates Drilled: 5/6/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 734      Depth to Water (ft): 19.25

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, with gravels up to 1.5" in maximum dimension, brown.						ei
5		-with cobbles			16/19/14	8	99	c
10		-with clay	X		5/5/6			
15		<b>GRAVELLY SAND (SP):</b> medium to coarse-grained, some silt, brown.			14/12/15	26	103	
20			X		12/9/12			
		End of boring at 21.5 feet. Groundwater encountered at 19.25 feet. Borehole backfilled with soil cuttings on 5-6-14.						



**Converse Consultants**

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No.    Drawing No.  
 13-31-339-01    A-2

# Log of Boring No. BH- 2

Dates Drilled: 5/6/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 734      Depth to Water (ft): 15.5

Depth (ft)	Graphic Log	<b>SUMMARY OF SUBSURFACE CONDITIONS</b> This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, with gravels up to 1.5" in maximum dimension, dark brown.  -brown			15/14/13	9	98	
10		<b>GRAVELLY SAND (SP):</b> medium to coarse-grained, gravels up to 2" in maximum dimension, trace silts, few cobbles, brown.			11/13/15	13	105	
15					17/15/12			
20		-with cobbles			50(3")	16	107	
		End of boring at 21.5 feet. Groundwater encountered at 15.5 feet. Borehole backfilled with soil cuttings on 5-6-14.						



**Converse Consultants**

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No.    Drawing No.  
 13-31-339-01    A-3

# Log of Boring No. BH- 3

Dates Drilled: 5/5/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 729      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, brown.			15/39/49	8	126	max
10					25/33/37	10	126	
15					7/10/13			
20		<b>BEDROCK - SYCAMORE CANYON FORMATION (Tscs):</b> <b>SILTSTONE AND SANDSTONE:</b> weathered, thinly bedded, near vertical bedding, grayish brown.			11/13/18	14	117	
25					6/10/12			
30					9/11/12			
		End of boring at 31.5 feet. No groundwater encountered during drilling. Borehole backfilled with soil cuttings on 5-5-14						



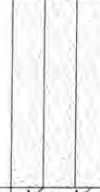


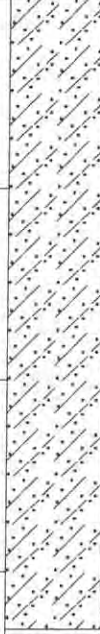


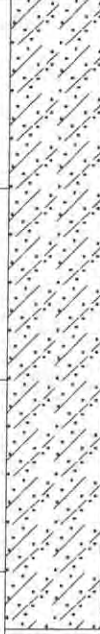


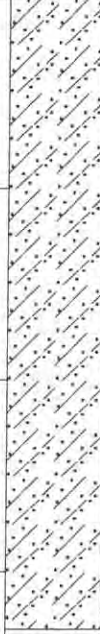


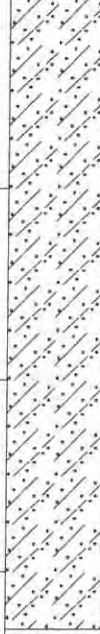


**Converse Consultants**

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 A-4

# Log of Boring No. BH- 4

Dates Drilled: 5/5/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 737      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>COLLUVIUM (Qc):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, brown.						
5		<b>BEDROCK - SYCAMORE CANYON FORMATION (Tscs):</b> <b>SILTSTONE, SANDSTONE:</b> weathered, no apparent bedding, orangish brown.			17/50(6")	7	125	
10					12/17/32			
15					31/45/50(5")	9	127	
20					10/16/29			
		End of boring at 21.5 feet. No groundwater encountered. Borehole backfilled with soil cuttings on 5-5-14.						



**Converse Consultants**

Project Name  
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 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No.    Drawing No.  
 13-31-339-01    A-5



# Log of Boring No. BH- 5

Dates Drilled: 5/8/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 792      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS <small>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.</small>	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>COLLUVIUM (Qc):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, with gravels up to 3" in maximum dimension and cobbles up to 12" in maximum dimension, yellowish brown.  <b>BEDROCK - SYCAMORE CANYON FORMATION (Tscg):</b> <b>CONGLOMERATE WITH SANDSTONE:</b> gravels and cobbles up to 3" in maximum dimension, weathered massive, orangish brown.	X		50(4")	4	108	ma (fc=19.9%)
10			X		50(5")			
15			X		50(5")	3	117	
20			X		50(4")			
25		<b>BEDROCK - SYCAMORE CANYON FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> severely weathered, no apparent bedding, with gravels up to 3" in maximum dimension, orangish brown.	X		50(4")	5	131	
30			X		50(2")			



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Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 A-6a

# Log of Boring No. BH- 5

Dates Drilled: 5/8/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 792      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<p><b>BEDROCK - SYCAMORE CANYON FORMATION (Tscs):</b>  <b>SANDSTONE, SILTSTONE:</b> severely weathered, no apparent bedding, with gravels up to 3" in maximum dimension, orangish brown.</p> <p>End of boring at 37 feet due to refusal from hard bedrock including cobbles and possible boulders.                      No groundwater encountered during drilling.                      Borehole backfilled with soil cuttings on 5-8-14.</p>			50(3")	5	129	



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 WALNUT, CALIFORNIA

Project No.    Drawing No.  
 13-31-339-01    A-6b

# Log of Boring No. BH- 6

Dates Drilled: 5/5/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 793      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<p><b>COLLUVIUM (Qc):</b>  <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, with gravels and cobbles up to 3" in maximum dimension, orangish brown.</p> <p><b>BEDROCK - SYCAMORE CANYON FORMATION (Tscq):</b>  <b>CONGLOMERATE WITH SANDSTONE:</b> gravels and cobbles up to 3" in maximum dimension, weathered massive, orangish brown.</p>	X	X	50(5")	5	113	
10			X	X	41/50(6")	6	111	
15			X	X	50(3")			
20			X	X	50(3")	5	111	
25			X	X	50(5")			
30			X	X	50(2")	6	122	



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 WALNUT, CALIFORNIA

Project No. 13-31-339-01      Drawing No. A-7a

# Log of Boring No. BH- 6

Dates Drilled: 5/5/2014 Logged by: MM Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 793 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	<p style="text-align: center;"><b>SUMMARY OF SUBSURFACE CONDITIONS</b></p> <p>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.</p>	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
40		<p><b>BEDROCK - SYCAMORE CANYON FORMATION (Tscs):</b>  <b>SANDSTONE, SILTSTONE:</b> with gravels up to 3" in maximum dimension, no apparent bedding, orangish brown.</p>	X		50(6")			
45			█		50(2")	4	116	
50			X		33/50(2")			
			X		50(2")			
		<p>End of boring at 51.5 feet.                      No groundwater encountered.                      Borehole backfilled with soil cuttings on 5-5-14.</p>						



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Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 A-7b

# Log of Boring No. BH- 7

Dates Drilled: 5/6/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 744.5      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, brown.			10/11/14	8	103	r
10		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, no apparent bedding, with gravels up to 2.5" in maximum dimension, few cobbles, orangish brown.			13/33/50(4")	6	115	
15					27/48/50(5")			
20					50(5")	8	112	
		End of boring at 21.5 feet. No groundwater encountered. Borehole backfilled with soil cuttings on 5-5-14.						



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Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
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Project No.    Drawing No.  
 13-31-339-01    A-8

# Log of Boring No. BH- 8

Dates Drilled: 5/6/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 745.5      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<b>COLLUVIUM (Qc):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 2.5" in maximum dimension, brown.		[Cross-hatched pattern]				
5	[Diagonal line pattern]	<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, no apparent bedding, with gravels up to 2.5" in maximum dimension and few cobbles, orangish brown and brown.	[Solid black]		36/41/50(4")	9	114	c
10			[Solid black]		50(6")	6	114	
15			[X pattern]		50(6")			
20			[X pattern]		50(4")			
		End of boring at 21.5 feet. No groundwater encountered. Borehole backfilled with soil cuttings on 5-5-14.						



**Converse Consultants**

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No.    Drawing No.  
 13-31-339-01    A-9

# Log of Boring No. BH- 9

Dates Drilled: 5/6/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 739      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<b>COLLUVIUM (Qc):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 2.5" in maximum dimension, brown.		[Cross-hatched pattern]				max, ds
5	[Diagonal lines pattern]	<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SILTSTONE, SANDSTONE:</b> weathered, no apparent bedding, few gravels up to 1" in maximum dimension, orange.  -olive brown	[Solid black]		29/50(4")	16	99	
10			[Solid black]		33/50(5")	5	107	
15		<b>BEDROCK - PUENTE FORMATION (Tscg):</b> <b>CONGLOMERATE WITH SANDSTONE:</b> severely weathered, no apparent bedding, gravels and cobbles up to 3" in maximum dimension, massive, olive brown, orangish brown.	[X pattern]		13/10/18			
20			[Solid black]		50(4")	16	103	
25			[X pattern]		50(4")			
		End of boring at 26 feet due to refusal from hard bedrock including cobbles and possible boulders. No groundwater encountered. Borehole backfilled with soil cuttings on 5-6-14.						













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Project No.      Drawing No.  
 13-31-339-01      A-10

# Log of Boring No. BH-10

Dates Drilled: 5/6/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 757.5      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, brown.			50(6")	6	112	ma (fc=44%)
10		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> with gravels up to 2.5" in maximum dimension, weathered, no apparent bedding, orangish brown, grayish brown.			50(6")	6	122	
15		-with cobbles			50(6")			
20					50(2")	12	120	
		End of boring at 21.5 feet. No groundwater encountered. Borehole backfilled with soil cuttings on 5-5-14.						



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Project No.    Drawing No.  
 13-31-339-01    A-11



# Log of Boring No. BH-11

Dates Drilled: 5/8/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 785      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<b>COLLUVIUM (Qc):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 2" in maximum dimension, light brown.						
5		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> severely weathered, no apparent bedding, orangish brown, grayish brown.			50(4")	13	95	
10		-with cobbles			35/45/50			
15					50(5")	4	107	
20					13/19/38			
25					50(4")	5	114	
		End of boring at 27 feet due to refusal from hard bedrock including cobbles and possible boulders. No groundwater encountered. Borehole backfilled with soil cuttings on 5-5-14.						



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Project No.      Drawing No.  
 13-31-339-01      A-12

# Log of Boring No. BH-12

Dates Drilled: 5/8/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 776.5      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM) WITH CLAY AND GRAVELS:</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, brown			35/42/50	6	125	
10						14/30/47	9	109
15		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> with gravels up to 2" in maximum dimension, severely weathered, no apparent bedding, orangish brown, brown.			18/20/27			
20						10/12/19	23	93
		End of boring at 21.5 feet. No groundwater encountered. Borehole backfilled with soil cuttings on 5-5-14.						



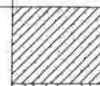








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Project No.    Drawing No.  
 13-31-339-01    A-13

# Log of Boring No. BH-13

Dates Drilled: 5/19/2014      Logged by: MBS/MM      Checked By: WHC  
 Equipment: 24" BUCKET AUGER      Driving Weight and Drop: 800 lbs / 30 in  
 Ground Surface Elevation (ft): 786      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<b>SILTY SAND (SM) WITH CLAY AND GRAVELS</b> topsoil with round gravels 30%-40%, organics, roots, gray to blackish gray						
5		<b>BEDROCK - PUENTE FORMATION (Tscg): CONGLOMERATE</b> clayey sand with gravels, cobbles and boulders, clay binder, mottled, oxidized rust, weathered, yellowish brown -bedding 5.5, N24E, 22NW,  -increased rock, gravels and cobbles-subrounded to rounded (30-40% rock), olive gray to yellowish brown color			20(6") 24(6")	30	99	
10					15(6") 36(6")	28	94	
15		-clayey sandstone, matrix with gravels and cobbles, rocks subrounded to rounded, hard stream rocks, some boulder size rocks -bedding 16.5, N30E, 25W,			17(6") 40(6")	36	91	
20		-increased drilling resistance, gravels and cobbles, cemented conglomerate, weathered, gray to yellowish brown  bedding 23.5, N10E, 8NW,			50(6")			
25		-cemented hard, sandstone matrix with gravels and cobbles, olive gray			47(6") 50(5")	6	125	max,ds
30					60(6") 20(2")	6	100	
		End of boring at 31 feet due to refusal from hard bedrock. No groundwater encountered. Borehole backfilled with soil cuttings on 5-19-14.						



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Project No. 13-31-339-01      Drawing No. A-14

# Log of Boring No. BH-14

Dates Drilled: 5/8/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 719.5      Depth to Water (ft): 44

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<b>COLLUVIUM (Qc):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 2" in maximum dimension, light brown.		[Cross-hatched pattern]				
5	[Diagonal line pattern]	<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered bedding, nearly horizontal bedding, orangish brown, brown	[Solid black bar]		26/50(6")	5	112	
10			[X pattern]		18/18/19			
15			[Solid black bar]		50(5")	8	102	
20			[X pattern]		15/17/30			
25			[Solid black bar]		50(6")	33	90	
30			[X pattern]		16/17/23			



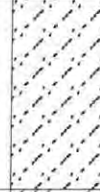


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Project No.      Drawing No.  
13-31-339-01      A-15a

# Log of Boring No. BH-14

Dates Drilled: 5/8/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 719.5      Depth to Water (ft): 44

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
40		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered bedding, nearly horizontal bedding, orangish brown, brown	■		14/26/31	11	116	
45		<b>CLAYSTONE, SILTSTONE:</b> severely weathered, laminated bedding, near horizontal bedding, grayish brown, olive brown	X		5/9/14			
46.5		End of boring at 46.5 feet. Groundwater encountered at 44 feet. Borehole backfilled with soil cuttings on 5-8-14.	■		50(6")	37	85	



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Project No. 13-31-339-01      Drawing No. A-15b

# Log of Boring No. BH-15

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 706      Depth to Water (ft): 16

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, brown.  -few clays, dark brown			10/18/24	20	105	c
10					19/36/30	16	117	
15		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SILTSTONE, SANDSTONE:</b> near vertical bedding, few caliche, orange brown, olive brown  -thinly bedded at 45°			3/4/7			
20					10/15/19	31	89	c
25					5/7/9			
30		<b>SANDSTONE:</b> with gravels up to 2.5" in maximum dimension, light brown			22/41/32			



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Project No.      Drawing No.  
 13-31-339-01      A-16a

# Log of Boring No. BH-15

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 706      Depth to Water (ft): 16

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
		<b>SANDSTONE:</b> with gravels up to 2.5" in maximum dimension, light brown	■		50(6")	16	121	
40	[diagonal hatching]	<b>SANDSTONE, SILTSTONE:</b> moderately weathered, nearly 40° bedding, gray, orangish brown	X		16/25/23			
45	[diagonal hatching]		X		15/28/31			
		End of boring at 46.5 feet. Groundwater encountered at 16 feet. Borehole backfilled with soil cuttings on 5-8-14.						



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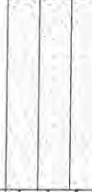







Project No.      Drawing No.  
 13-31-339-01      A-16b

# Log of Boring No. BH-16

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 706      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS <small>This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.</small>	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, light brown.						
10		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> severely weathered, no apparent bedding, with gravels up to 1.5" in maximum dimension, dark orangish brown.			26/40/50(4")	10	124	
		End of boring at 11.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings on 5-7-14			50(6")			



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# Log of Boring No. BH-17

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 695.5      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, light brown.						
5		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SILTSTONE, SANDSTONE:</b> with gravels up to 1.5" in maximum dimension, slightly weathered, no bedding, yellowish brown			50(5")	10	100	
10					50(3")	30	99	
		End of boring at 11.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings on 5-7-14						



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Project No. 13-31-339-01      Drawing No. A-18

# Log of Boring No. BH-18

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 691      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5	[Vertical lines]	<b>ALLUVIUM (Qa):</b> <b>SANDY SILT (ML):</b> fine to medium-grained, some clay, few gravels up to 1" in maximum dimension, brown.  -with cobbles	[Solid black]	[Cross-hatch]	21/50(5")	55	67	ma
10	[Diagonal lines]	<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, laminated, near horizontal bedding, olive brown, orangish brown.	[Solid black]		22/29/50(3")	30	99	
		End of boring at 11.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings on 5-7-14						



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Project No.      Drawing No.  
 13-31-339-01      A-19

# Log of Boring No. BH-19

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 694      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1" in maximum dimension, brown.			19/29/33	12	122	c
10		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, laminated, near horizontal bedding, orangish brown, olive brown.			19/31/50(5")	42	78	
		End of boring at 11.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings on 5-7-14						



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Project No.      Drawing No.  
 13-31-339-01      A-20

# Log of Boring No. BH-20

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 689      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.25" in maximum dimension, brown.  -with cobbles			18/37/32	15	104	ei
10		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, laminated, near horizontal bedding, orangish brown, olive brown			15/21/28	13	117	
		End of boring at 11.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings on 5-7-14						



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Project No.      Drawing No.  
 13-31-339-01      A-21

# Log of Boring No. BH-21

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC  
 Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in  
 Ground Surface Elevation (ft): 686      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1.5" in maximum dimension, brown.  -with cobbles	█		50(2")	17	97	max
10		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, laminated, nearly horizontal bedding, orangish brown, olive brown	█		31/50(3")	24	95	
		End of boring at 11.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings on 5-7-14						



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Project No. 13-31-339-01      Drawing No. A-22

# Log of Boring No. BH-22

Dates Drilled: 5/7/2014      Logged by: MM      Checked By: WHC

Equipment: 8" HOLLOW STEM AUGER      Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 693      Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES		BLOWS/FT	MOISTURE (%)	DRY UNIT WT. (pcf)	TEST
			DRIVE	BULK				
5		<b>ALLUVIUM (Qa):</b> <b>SILTY SAND (SM):</b> fine to medium-grained, some clay, few gravels up to 1" in maximum dimension, brown.			13/17/22	14	114	
10		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, laminated, near vertical horizontal bedding, orangish brown, olive brown.			14/20/26	31	87	
15		<b>BEDROCK - PUENTE FORMATION (Tscs):</b> <b>SANDSTONE, SILTSTONE:</b> weathered, laminated, near vertical horizontal bedding, orangish brown, olive brown.			15/21/28	34	84	
		End of boring at 16.5 feet. Groundwater not encountered. Borehole backfilled with soil cuttings on 5-7-14						



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Project No. 13-31-339-01      Drawing No. A-23

**APPENDIX B**

**LABORATORY TESTING PROGRAM  
FOR PROPOSED FILL PLACEMENT AT WEST PARCEL**



## APPENDIX B

### LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. The amount and selection of tests were based on the geotechnical requirements of the project. Test results are presented herein and on the Logs of Borings in Appendix A, *Field Exploration for Proposed Fill Placement at West Parcel*. The following is a summary of the laboratory tests conducted for this project.

#### **Moisture Content and Dry Density**

Results of moisture content and dry density tests, performed on relatively undisturbed ring samples were used to aid in the classification of the soils and to provide quantitative measure of the *in situ* dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, *Field Exploration for Proposed Fill Placement at West Parcel*.

#### **Grain-Size Analysis**

To assist in classification of soils, mechanical grain-size analyses were performed on Three (3) selected samples. Tests were performed in general accordance with the ASTM Standard C136 test method. Grain-size curves are shown in Drawing No. B1, *Grain Size Distribution Results*.

#### **Maximum Dry Density Test**

Four (4) laboratory maximum dry density-moisture content relationship tests were performed on one representative bulk sample. The tests were conducted in accordance with ASTM Standard D1557 laboratory procedure. The test results are presented on Drawing No. B2, *Moisture-Density Relationship Results*.

#### **Direct Shear**

Direct shear tests were performed on two (2) relatively undisturbed samples at soaked moisture conditions. For each test, three samples contained in brass sampler rings were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The samples were then sheared at a constant strain rate of 0.01 inch/minute. Shear deformation was recorded until a maximum of about 0.50-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear





strength parameters. For test data, including sample density and moisture content, see Drawing Nos. B3a through B3b, *Direct Shear Test Results*, and in the following table:

**Table No. B-1, Direct Shear Test Results**

Boring No.	Depth (feet)	Soil Classification	Peak Strength Parameters	
			Friction Angle (degrees)	Cohesion (psf)
BH-9	0-5	Silty Sand (SM)	32	150
BH-13	25-30	Sedimentary Bedrock-Conglomerate	29	300

**Consolidation Test**

Consolidation tests were performed on four (4) selected samples. Data obtained from this test performed on a relatively undisturbed soil sample was used to evaluate the settlement characteristics of the foundation soils under load. Preparation for this test involved trimming the sample and placing the one-inch high brass ring into the test apparatus, which contained porous stones, both top and bottom, to accommodate drainage during testing. Normal axial loads were applied to one end of the sample through the porous stones, and the resulting deflections were recorded at various time periods. The load was increased after the sample reached a reasonable state of equilibrium. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. The sample was tested at field and submerged conditions. The test results, including sample density and moisture content, are presented in Drawings Nos. B4a through B4d, *Consolidation Test Results*.

**Expansion Index Test**

Two (2) representative bulk samples were tested to evaluate the expansion potential of material encountered at the site. The test was conducted in accordance with ASTM D4829 Standard. Test results are presented in the following table:

**Table No. B-3, Expansion Index Test Result**

Boring No.	Depth (feet)	Soil Description	Expansion Index	Expansion Potential
BH-1	0-5	Silty Sand (SM)	21	Low
BH-20	0-5	Silty Sand (SM)	23	Low



### **R-value Test**

One (1) representative bulk soil sample was tested for resistance value (R-value) in accordance with State of California Standard Method 301-G. This test is designed to provide a relative measure of soil strength for use in pavement design. The test results are shown in the following table:

**Table No. B-4, R-value Test Result**

<b>Boring No.</b>	<b>Depth (feet)</b>	<b>Soil Classification</b>	<b>Measured R-value</b>
BH-7	0-5	Silty Sand (SM)	44

### **Sample Storage**

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period of time.

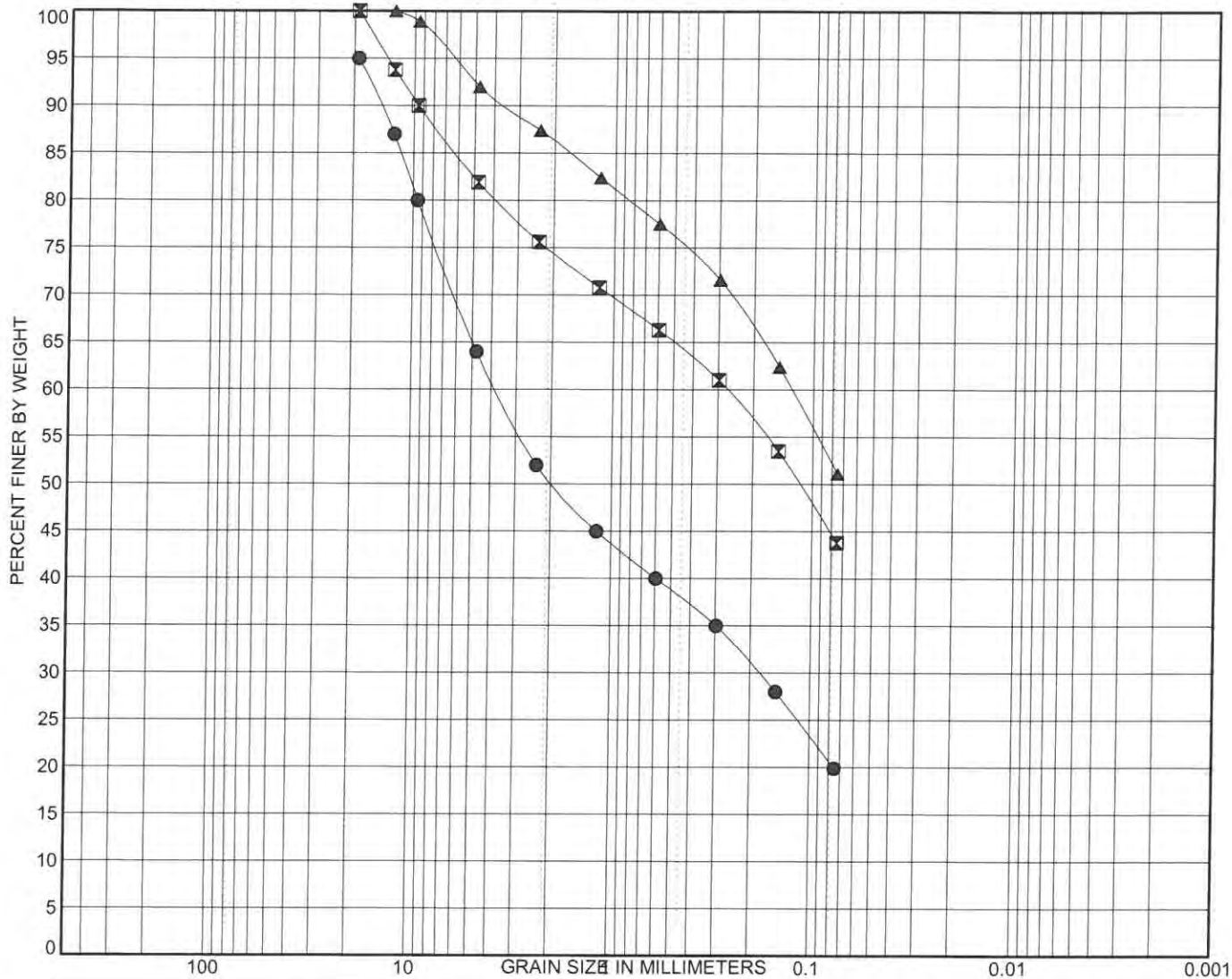


U.S. SIEVE OPENING IN INCHES

U.S. SIEVE NUMBERS

HYDROMETER

6 4 3 2 1.5 1 3/4 1/2 3/8 3 4 6 8 10 14 16 20 30 40 50 60 100 140 200



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth (ft)	Description				LL	PL	PI	Cc	Cu
● BH-5	0-5	SILTY SAND (SM)								
☒ BH-10	0-5	SILTY SAND (SM)								
▲ BH-18	0-5	SANDY SILT (ML)								
Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
● BH-5	0-5	19	3.762	0.181		31.0	44.1	19.9		
☒ BH-10	0-5	19	0.271			18.1	38.1	43.8		
▲ BH-18	0-5	12.5	0.129			8.0	40.9	51.1		

### GRAIN SIZE DISTRIBUTION RESULTS

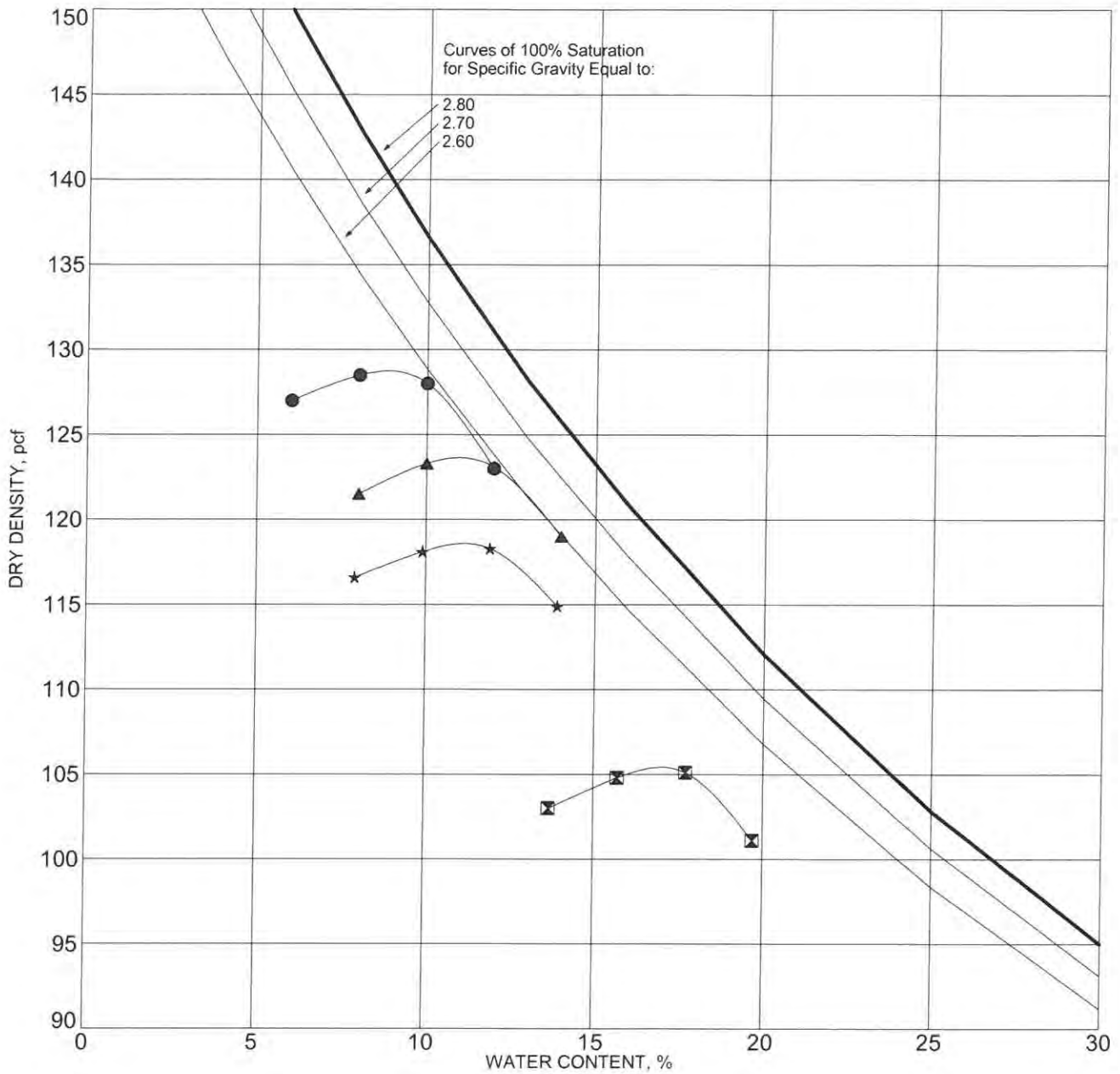


Converse Consultants

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No.  
 13-31-339-01

Drawing No.  
 B-1



SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	BH- 3	0-5	SILTY SAND (SM)	D1557 Method B	9.2	128.5
⊠	BH- 9	0-5	SILTY SAND (SM)	D1557 Method A	16.8	106
▲	BH-13	0	SILTY SAND (SM) WITH CLAY AND GRAVELS	D1557 Method C	11.2	124
★	BH-21	0-5	SILTY SAND (SM)	D1557 Method A	11	119

NOTE:

## MOISTURE-DENSITY RELATIONSHIP RESULTS

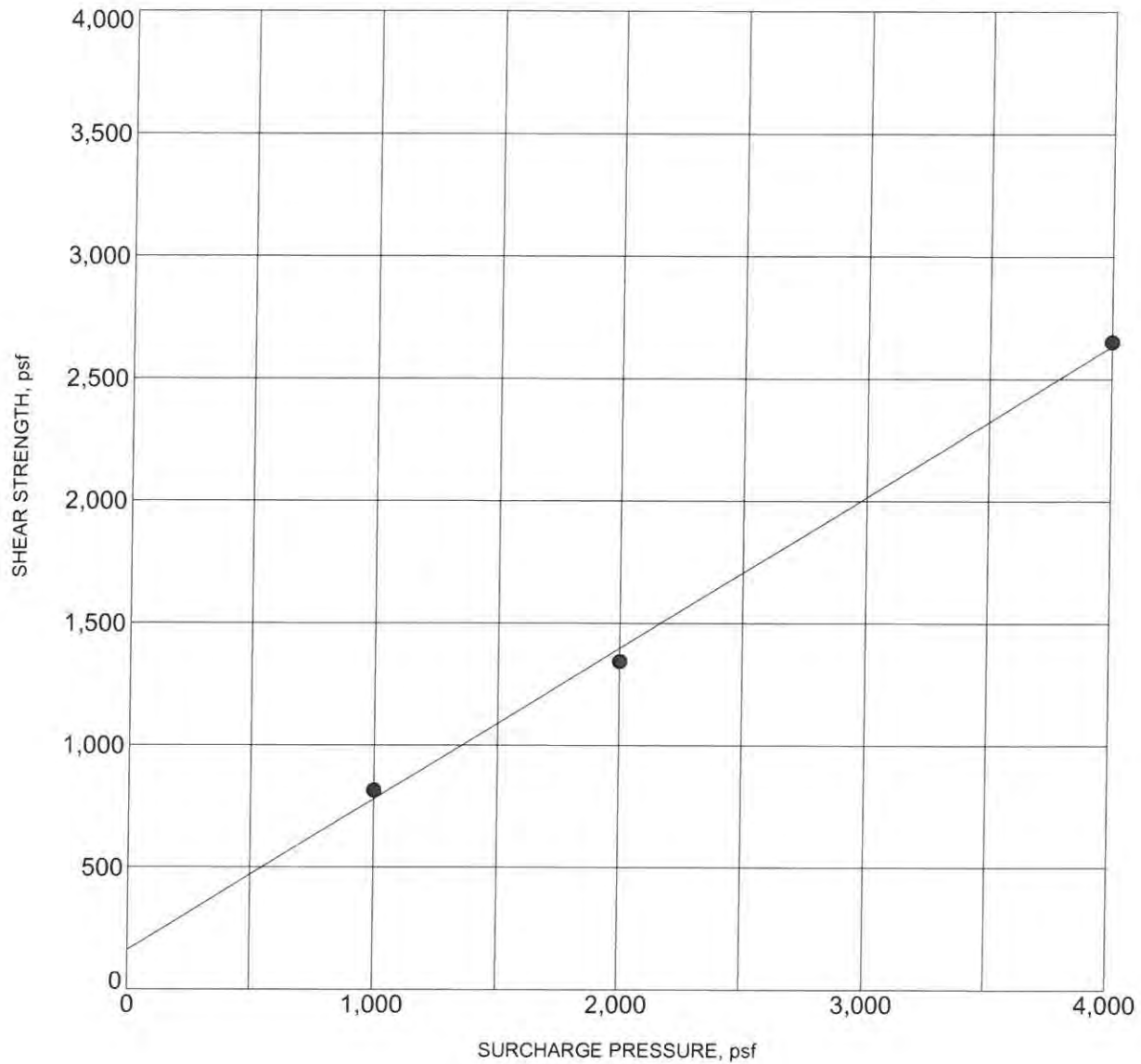


Converse Consultants

Project Name  
MT. SAN ANTONIO COLLEGE  
WEST PARCEL  
WALNUT, CALIFORNIA

Project No.  
13-31-339-01

Drawing No.  
B-2



BORING NO.	: BH- 9	DEPTH (ft)	: 0-5
DESCRIPTION	: SILTY SAND (SM)		
COHESION (psf)	: 150	FRICTION ANGLE (degrees):	32
MOISTURE CONTENT (%)	: 18.0	DRY DENSITY (pcf)	: 94.5

NOTE: Ultimate Strength.

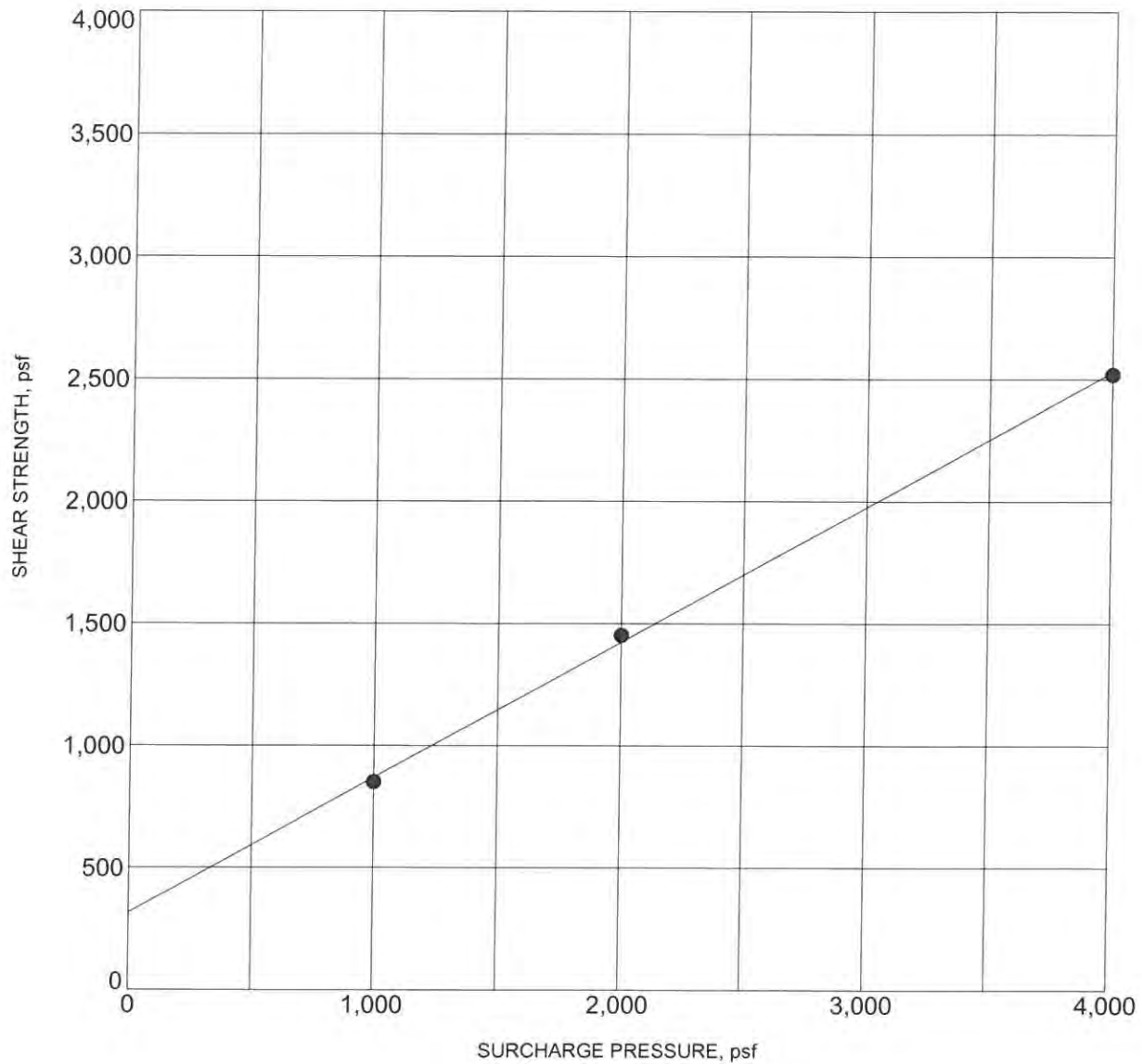
## DIRECT SHEAR TEST RESULTS



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Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 B-3a



BORING NO. :	<b>BH-13</b>	DEPTH (ft) :	<b>25-30</b>
DESCRIPTION :	<b>SEDIMENTARY BEDROCK - CONGLOMERATE</b>		
COHESION (psf) :	<b>300</b>	FRICTION ANGLE (degrees):	<b>29</b>
MOISTURE CONTENT (%) :	<b>13.3</b>	DRY DENSITY (pcf) :	<b>109.6</b>

NOTE: Ultimate Strength.

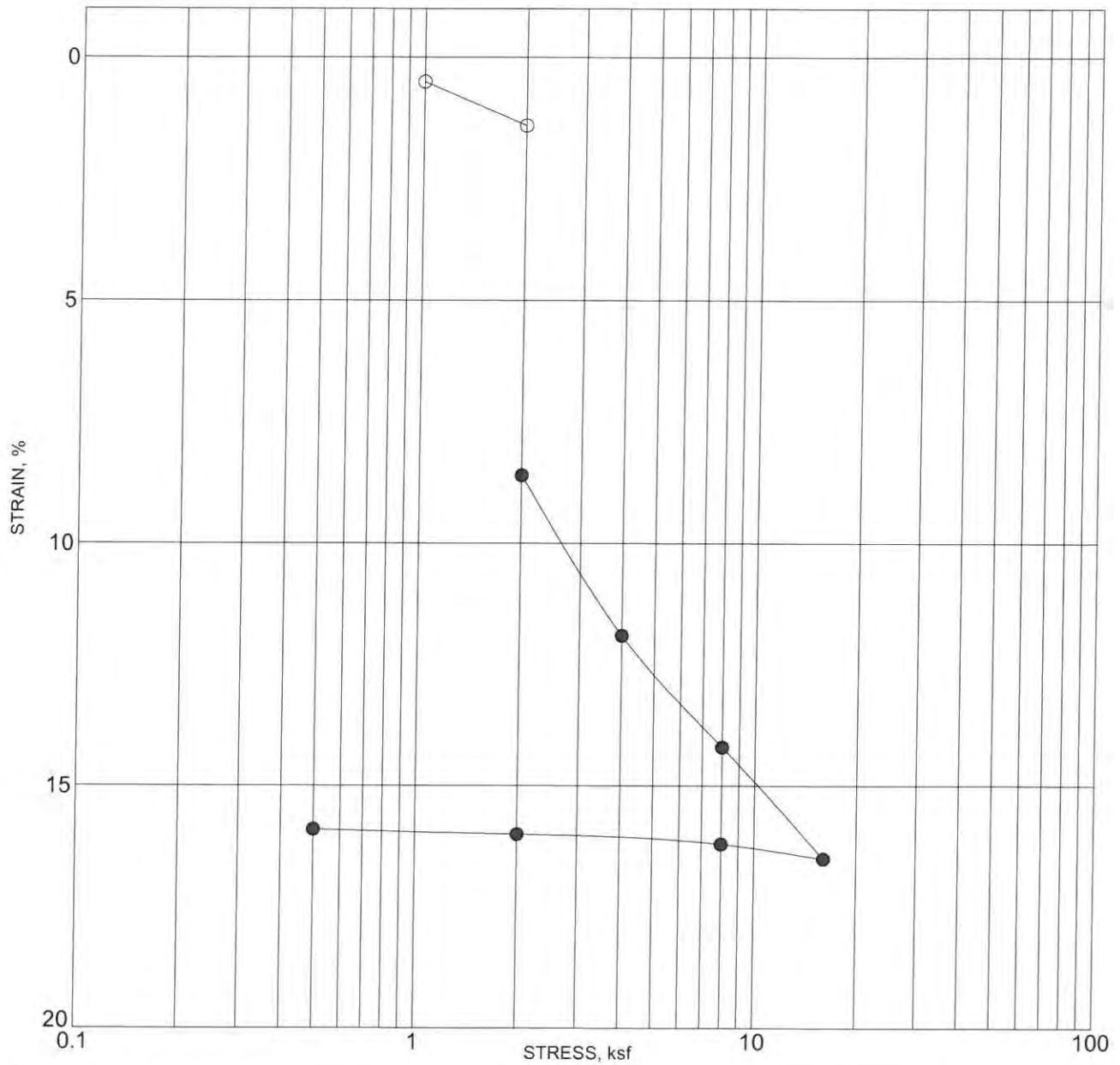
## DIRECT SHEAR TEST RESULTS



**Converse Consultants**

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 B-3b



BORING NO. :		BH- 1		DEPTH (ft) :		5	
DESCRIPTION :		SILTY SAND (SM)					
MOISTURE CONTENT (%)		DRY DENSITY (pcf)		PERCENT SATURATION		VOID RATIO	
INITIAL	8.1	99.1					
FINAL	13.6	114.9					

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

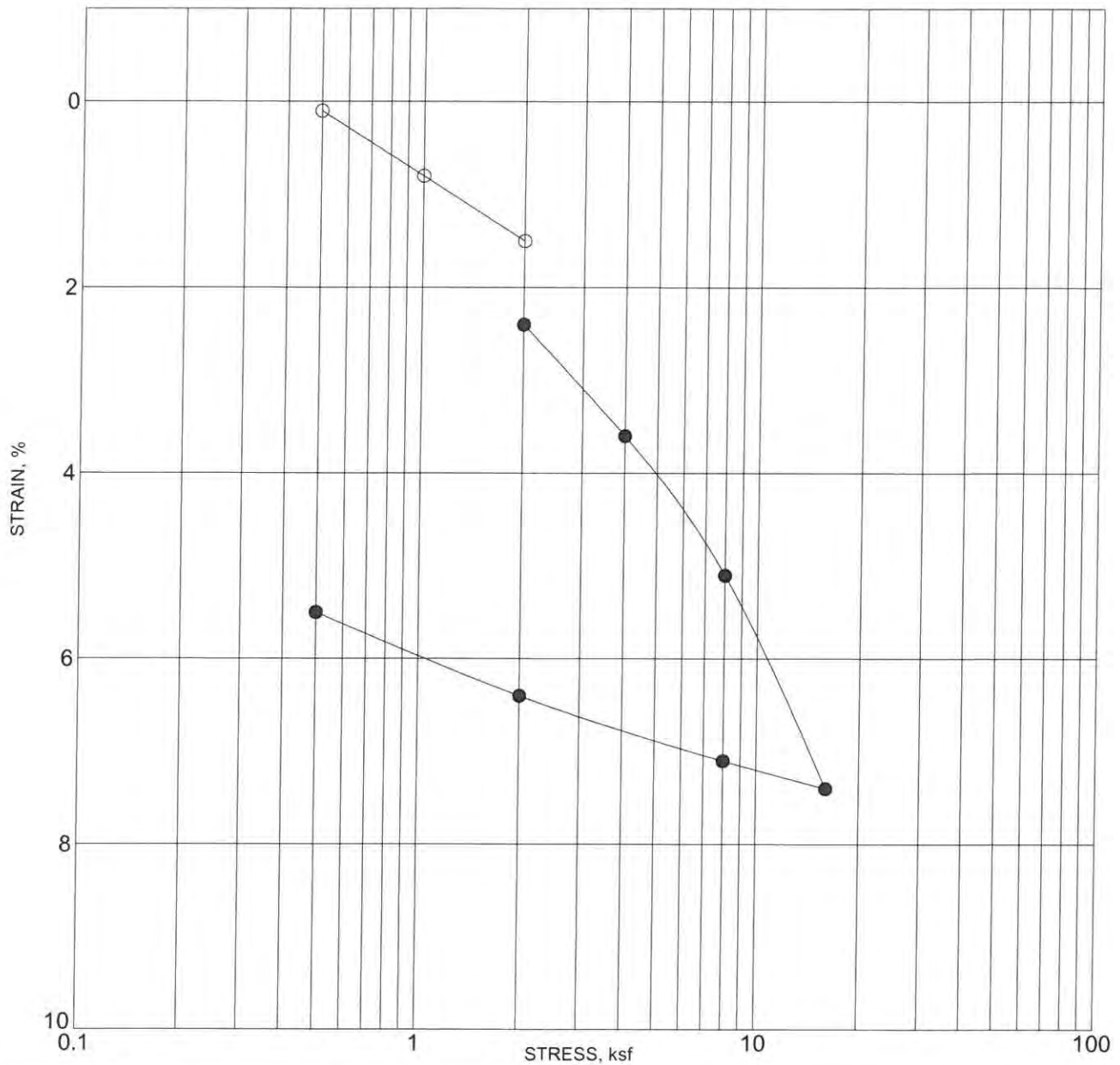
### CONSOLIDATION TEST RESULTS



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 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 B-4a



BORING NO. : <b>BH- 8</b>		DEPTH (ft) : <b>5</b>	
DESCRIPTION : <b>SANDSTONE - SILTSTONE</b>			
MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL <b>8.9</b>	<b>113.9</b>		
FINAL <b>15.8</b>	<b>120.2</b>		

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

### CONSOLIDATION TEST RESULTS

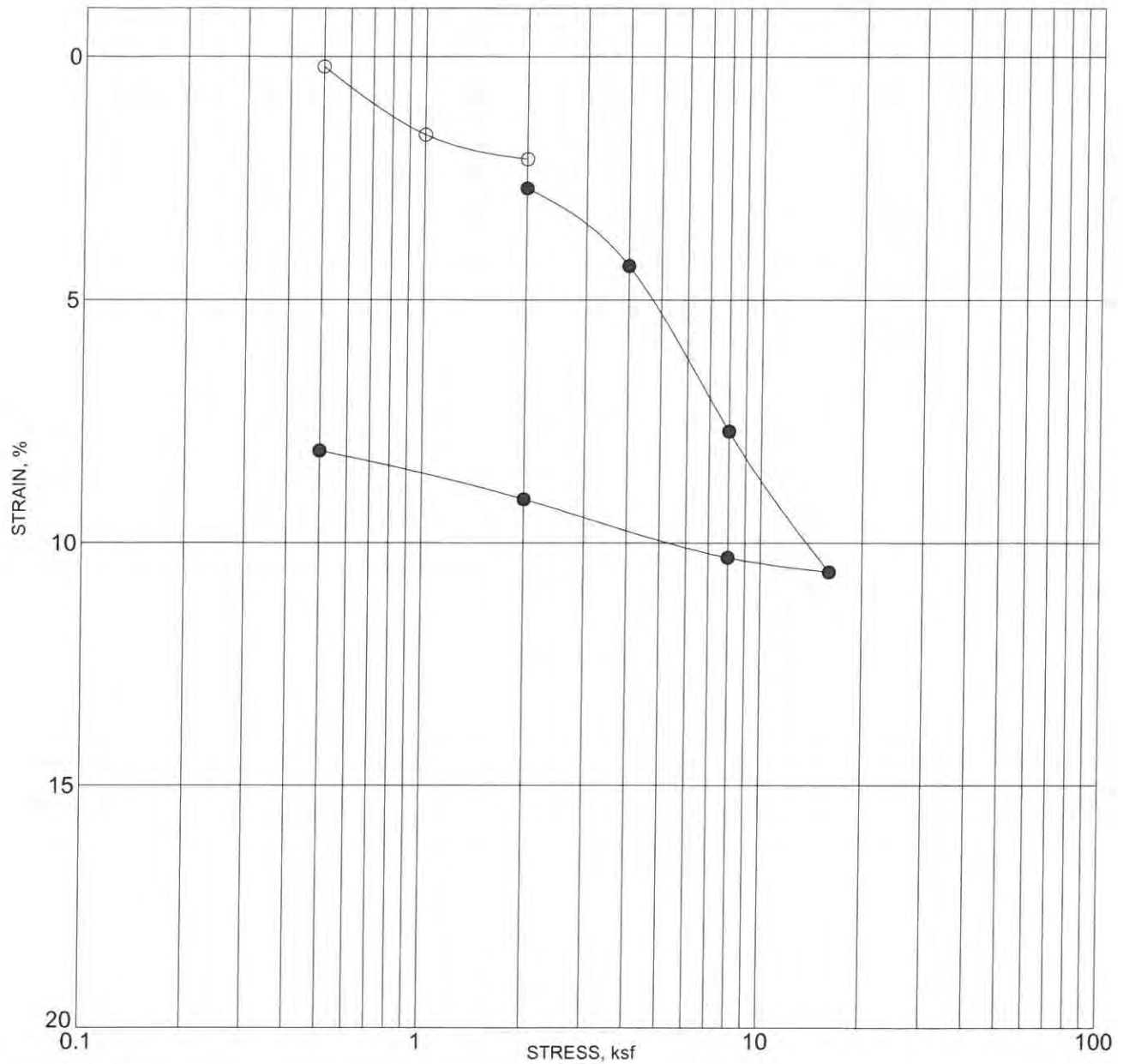


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 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 B-4b





BORING NO. :		BH-15		DEPTH (ft) :		5	
DESCRIPTION :		SILTY SAND (SM)					
MOISTURE CONTENT (%)		DRY DENSITY (pcf)		PERCENT SATURATION		VOID RATIO	
INITIAL	19.5	105					
FINAL	19.8	110.2					

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

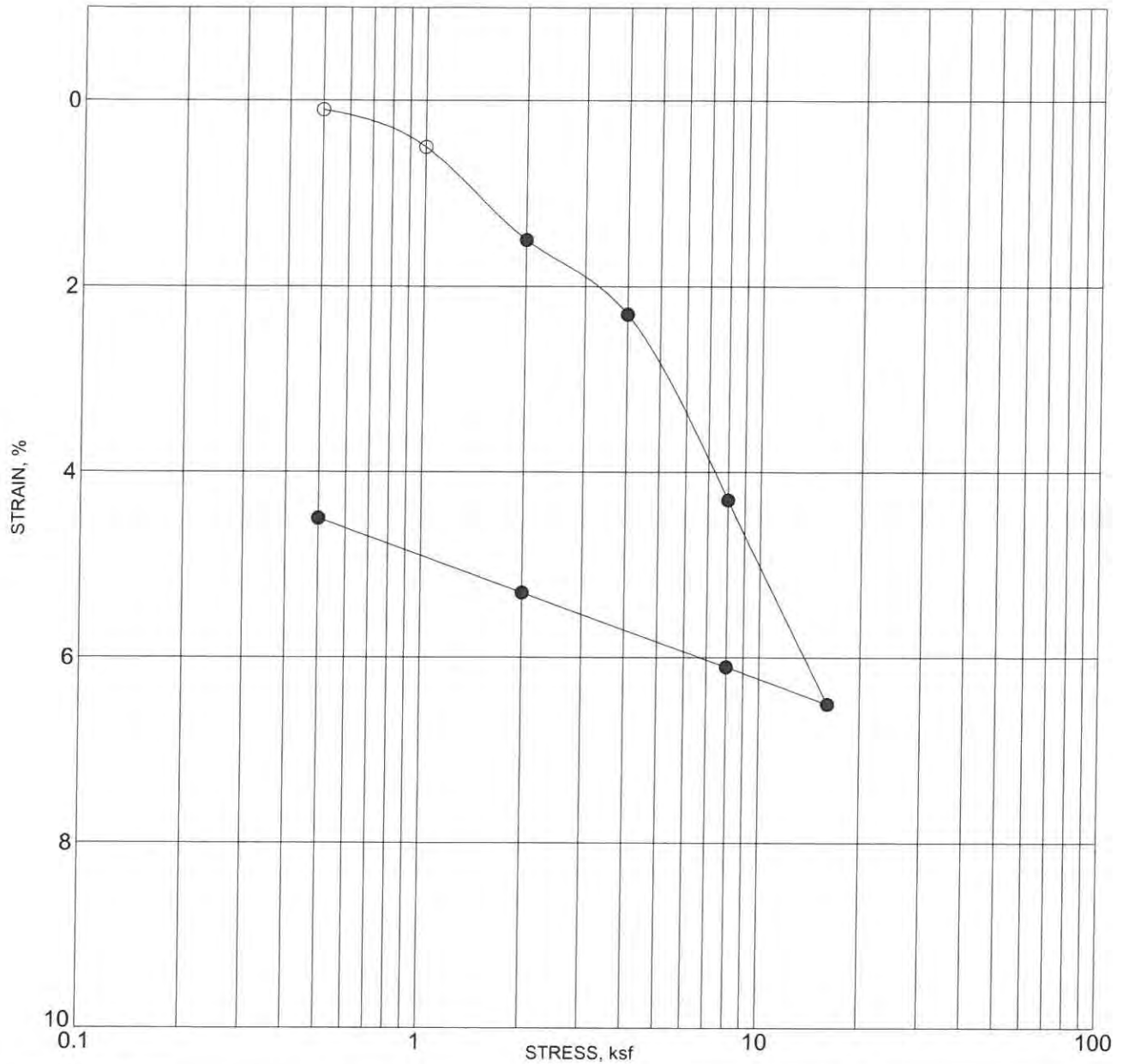
## CONSOLIDATION TEST RESULTS



Converse Consultants

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 B-4c



BORING NO. : <b>BH-15</b>		DEPTH (ft) : <b>20</b>	
DESCRIPTION : <b>SILTY SAND (SM)</b>			
MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL <b>30.9</b>	<b>89</b>		
FINAL <b>30.5</b>	<b>93</b>		

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

### CONSOLIDATION TEST RESULTS



**Converse Consultants**

Project Name  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Project No. Drawing No.  
 13-31-339-01 B-4d

## **APPENDIX C**

### **LIQUEFACTION/SEISMIC SETTLEMENT ANALYSIS**



## APPENDIX C

### LIQUEFACTION/SEISMIC SETTLEMENT ANALYSIS

Liquefaction is defined as the phenomenon where a soil mass exhibits a substantial reduction in its shear strength. This strength reduction is due to the development of excess pore pressure in a soil mass caused by earthquake induced ground motions. Saturated soils behave temporarily as a viscous fluid (liquefaction) and, consequently, lose their capacity to support the structures founded on them. The potential for liquefaction decreases with increasing clay and gravel content, but increases as the ground acceleration and duration of shaking increase. Liquefaction potential has been found to be the greatest where the groundwater level and loose sands occur within 50 feet of the ground surface.

Our liquefaction analyses are based on the *Special Publication 117A: Guidelines for Evaluating and Mitigating Seismic Hazards in California (9/2008)*, *Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California (3/1999)*, and *2013 California Building Code*.

The subsurface data obtained from exploratory boring was used to evaluate the liquefaction/seismic settlement potential of the area. The Logs of Borings are presented in Appendix A, *Field Exploration*. The liquefaction potential and seismic settlement analyses were performed utilizing SPT data obtained from boring BH-15 for the upper 46.5 feet of soils, using *LiquefyPro*, Version 5.8d, 2009, by Civil Tech Software. The following seismic parameters are used for liquefaction potential analyses.

**Table No. D-1, Seismic Parameters Used in Liquefaction Analysis**

Groundwater Depth* (feet)	Earthquake Magnitude** Mw	Peak Ground Acceleration*** (g)
16	6.69	0.77

\* Based on Groundwater encountered during field exploration.

\*\* Based on USGS 2008 NSHMP PSHA Interactive Deaggregation web site.

\*\* Based on  $PGA_M$  per section 21.5 of ASCE 7-10.

The results of our liquefaction analyses indicate the project site is not susceptible to liquefaction as presented in the attached calculations. The estimated seismic settlement is approximately 0.10 inches with differential settlement of approximately 0.05 inches.

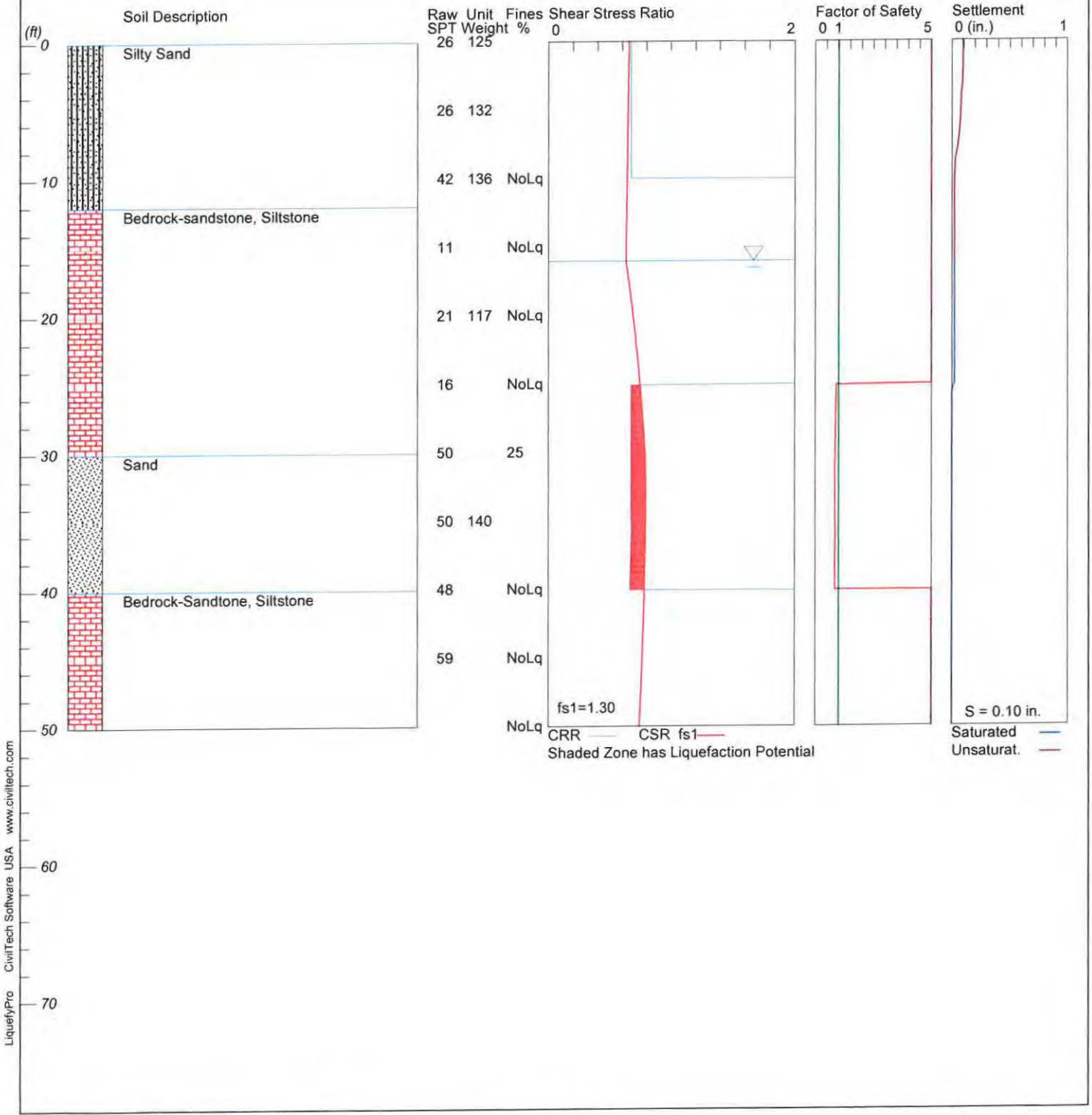


# LIQUEFACTION ANALYSIS

## MT. SAN ANTONIO COLLEGE

Hole No.=BH-15    Water Depth=16 ft    Surface Elev.=706

Magnitude=6.69  
Acceleration=0.77g



LiquefyPro CivilTech Software USA www.civiltech.com

\*\*\*\*\*

LIQUEFACTION ANALYSIS SUMMARY  
 Copyright by CivilTech Software  
 www.civiltech.com

\*\*\*\*\*

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Input File Name: E:\Liquefy5\13-31-339-01-BH-15.liq  
 Title: MT. SAN ANTONIO COLLEGE  
 Subtitle: 13-31-339-01

Surface Elev.=706  
 Hole No.=BH-15  
 Depth of Hole= 50.00 ft  
 Water Table during Earthquake= 16.00 ft  
 Water Table during In-Situ Testing= 16.00 ft  
 Max. Acceleration= 0.77 g  
 Earthquake Magnitude= 6.69

Input Data:

Surface Elev.=706  
 Hole No.=BH-15  
 Depth of Hole=50.00 ft  
 Water Table during Earthquake= 16.00 ft  
 Water Table during In-Situ Testing= 16.00 ft  
 Max. Acceleration=0.77 g  
 Earthquake Magnitude=6.69  
 No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
  2. Settlement Analysis Method: Tokimatsu/Seed
  3. Fines Correction for Liquefaction: Stark/Olson et al.\*
  4. Fine Correction for Settlement: During Liquefaction\*
  5. Settlement Calculation in: All zones\*
  6. Hammer Energy Ratio, Ce = 1.3
  7. Borehole Diameter, Cb= 1.15
  8. Sampling Method, Cs= 1.12
  9. User request factor of safety (apply to CSR) , User= 1.3  
 Plot one CSR curve (fs1=User)
  10. Use Curve Smoothing: Yes\*
- \* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	26.00	125.00	0.00
5.00	26.00	132.00	0.00
10.00	42.00	136.00	NoLiq
15.00	11.00	136.00	NoLiq
20.00	21.00	117.00	NoLiq
25.00	16.00	117.00	NoLiq
30.00	50.00	117.00	25.00
35.00	50.00	140.00	25.00
40.00	48.00	140.00	NoLiq
45.00	59.00	140.00	NoLiq
50.00	59.00	140.00	NoLiq

Output Results:

Settlement of Saturated Sands=0.02 in.  
 Settlement of Unsaturated Sands=0.08 in.  
 Total Settlement of Saturated and Unsaturated Sands=0.10 in.  
 Differential Settlement=0.049 to 0.065 in.

Depth CRRm CSRfs F.S. S\_sat. S\_dry S\_all







Liquefy.sum						
6.60	0.67	0.64	5.00	0.02	0.04	0.07
6.65	0.67	0.64	5.00	0.02	0.04	0.07
6.70	0.67	0.64	5.00	0.02	0.04	0.07
6.75	0.67	0.64	5.00	0.02	0.04	0.07
6.80	0.67	0.64	5.00	0.02	0.04	0.07
6.85	0.67	0.64	5.00	0.02	0.04	0.06
6.90	0.67	0.64	5.00	0.02	0.04	0.06
6.95	0.67	0.64	5.00	0.02	0.04	0.06
7.00	0.67	0.64	5.00	0.02	0.04	0.06
7.05	0.67	0.64	5.00	0.02	0.04	0.06
7.10	0.67	0.64	5.00	0.02	0.04	0.06
7.15	0.67	0.64	5.00	0.02	0.04	0.06
7.20	0.67	0.64	5.00	0.02	0.04	0.06
7.25	0.67	0.64	5.00	0.02	0.04	0.06
7.30	0.67	0.64	5.00	0.02	0.04	0.06
7.35	0.67	0.64	5.00	0.02	0.04	0.06
7.40	0.67	0.64	5.00	0.02	0.03	0.06
7.45	0.67	0.64	5.00	0.02	0.03	0.06
7.50	0.67	0.64	5.00	0.02	0.03	0.06
7.55	0.67	0.64	5.00	0.02	0.03	0.06
7.60	0.67	0.64	5.00	0.02	0.03	0.05
7.65	0.67	0.64	5.00	0.02	0.03	0.05
7.70	0.67	0.64	5.00	0.02	0.03	0.05
7.75	0.67	0.64	5.00	0.02	0.03	0.05
7.80	0.67	0.64	5.00	0.02	0.03	0.05
7.85	0.67	0.64	5.00	0.02	0.03	0.05
7.90	0.67	0.64	5.00	0.02	0.03	0.05
7.95	0.67	0.64	5.00	0.02	0.02	0.05
8.00	0.67	0.64	5.00	0.02	0.02	0.05
8.05	0.67	0.64	5.00	0.02	0.02	0.05
8.10	0.67	0.64	5.00	0.02	0.02	0.04
8.15	0.67	0.64	5.00	0.02	0.02	0.04
8.20	0.67	0.64	5.00	0.02	0.02	0.04
8.25	0.67	0.64	5.00	0.02	0.02	0.04
8.30	0.67	0.64	5.00	0.02	0.02	0.04
8.35	0.67	0.64	5.00	0.02	0.02	0.04
8.40	0.67	0.64	5.00	0.02	0.01	0.04
8.45	0.67	0.64	5.00	0.02	0.01	0.04
8.50	0.67	0.64	5.00	0.02	0.01	0.04
8.55	0.67	0.64	5.00	0.02	0.01	0.03
8.60	0.67	0.64	5.00	0.02	0.01	0.03
8.65	0.67	0.64	5.00	0.02	0.01	0.03
8.70	0.67	0.64	5.00	0.02	0.01	0.03
8.75	0.67	0.64	5.00	0.02	0.01	0.03
8.80	0.67	0.64	5.00	0.02	0.01	0.03
8.85	0.67	0.64	5.00	0.02	0.01	0.03
8.90	0.67	0.64	5.00	0.02	0.01	0.03
8.95	0.67	0.64	5.00	0.02	0.01	0.03
9.00	0.67	0.64	5.00	0.02	0.01	0.03
9.05	0.67	0.64	5.00	0.02	0.01	0.03
9.10	0.67	0.64	5.00	0.02	0.01	0.03
9.15	0.67	0.64	5.00	0.02	0.01	0.03
9.20	0.67	0.64	5.00	0.02	0.01	0.03
9.25	0.67	0.64	5.00	0.02	0.00	0.03
9.30	0.67	0.64	5.00	0.02	0.00	0.03
9.35	0.67	0.64	5.00	0.02	0.00	0.03
9.40	0.67	0.64	5.00	0.02	0.00	0.03
9.45	0.67	0.64	5.00	0.02	0.00	0.03
9.50	0.67	0.64	5.00	0.02	0.00	0.03
9.55	0.67	0.64	5.00	0.02	0.00	0.03
9.60	0.67	0.64	5.00	0.02	0.00	0.03
9.65	0.67	0.64	5.00	0.02	0.00	0.03
9.70	0.67	0.64	5.00	0.02	0.00	0.02
9.75	0.67	0.64	5.00	0.02	0.00	0.02
9.80	0.67	0.64	5.00	0.02	0.00	0.02
9.85	0.67	0.64	5.00	0.02	0.00	0.02
9.90	0.67	0.64	5.00	0.02	0.00	0.02









Liquefy.sum

23.35	2.00	0.73	5.00	0.02	0.00	0.02
23.40	2.00	0.73	5.00	0.02	0.00	0.02
23.45	2.00	0.73	5.00	0.02	0.00	0.02
23.50	2.00	0.73	5.00	0.02	0.00	0.02
23.55	2.00	0.73	5.00	0.02	0.00	0.02
23.60	2.00	0.73	5.00	0.02	0.00	0.02
23.65	2.00	0.73	5.00	0.02	0.00	0.02
23.70	2.00	0.73	5.00	0.02	0.00	0.02
23.75	2.00	0.73	5.00	0.02	0.00	0.02
23.80	2.00	0.73	5.00	0.02	0.00	0.02
23.85	2.00	0.73	5.00	0.02	0.00	0.02
23.90	2.00	0.73	5.00	0.02	0.00	0.02
23.95	2.00	0.73	5.00	0.02	0.00	0.02
24.00	2.00	0.73	5.00	0.02	0.00	0.02
24.05	2.00	0.73	5.00	0.02	0.00	0.02
24.10	2.00	0.73	5.00	0.02	0.00	0.02
24.15	2.00	0.73	5.00	0.02	0.00	0.02
24.20	2.00	0.73	5.00	0.02	0.00	0.02
24.25	2.00	0.74	5.00	0.02	0.00	0.02
24.30	2.00	0.74	5.00	0.02	0.00	0.02
24.35	2.00	0.74	5.00	0.02	0.00	0.02
24.40	2.00	0.74	5.00	0.02	0.00	0.02
24.45	2.00	0.74	5.00	0.02	0.00	0.02
24.50	2.00	0.74	5.00	0.02	0.00	0.02
24.55	2.00	0.74	5.00	0.02	0.00	0.02
24.60	2.00	0.74	5.00	0.02	0.00	0.02
24.65	2.00	0.74	5.00	0.02	0.00	0.02
24.70	2.00	0.74	5.00	0.02	0.00	0.02
24.75	2.00	0.74	5.00	0.02	0.00	0.02
24.80	2.00	0.74	5.00	0.02	0.00	0.02
24.85	2.00	0.74	5.00	0.02	0.00	0.02
24.90	2.00	0.74	5.00	0.02	0.00	0.02
24.95	2.00	0.74	5.00	0.02	0.00	0.02
25.00	2.00	0.74	5.00	0.02	0.00	0.02
25.05	0.67	0.74	0.90*	0.02	0.00	0.02
25.10	0.67	0.74	0.90*	0.02	0.00	0.02
25.15	0.67	0.74	0.90*	0.02	0.00	0.02
25.20	0.67	0.74	0.90*	0.02	0.00	0.02
25.25	0.67	0.75	0.90*	0.01	0.00	0.01
25.30	0.67	0.75	0.90*	0.01	0.00	0.01
25.35	0.67	0.75	0.90*	0.01	0.00	0.01
25.40	0.67	0.75	0.90*	0.01	0.00	0.01
25.45	0.67	0.75	0.90*	0.01	0.00	0.01
25.50	0.67	0.75	0.90*	0.00	0.00	0.00
25.55	0.67	0.75	0.90*	0.00	0.00	0.00
25.60	0.67	0.75	0.89*	0.00	0.00	0.00
25.65	0.67	0.75	0.89*	0.00	0.00	0.00
25.70	0.67	0.75	0.89*	0.00	0.00	0.00
25.75	0.67	0.75	0.89*	0.00	0.00	0.00
25.80	0.67	0.75	0.89*	0.00	0.00	0.00
25.85	0.67	0.75	0.89*	0.00	0.00	0.00
25.90	0.67	0.75	0.89*	0.00	0.00	0.00
25.95	0.67	0.75	0.89*	0.00	0.00	0.00
26.00	0.67	0.75	0.89*	0.00	0.00	0.00
26.05	0.67	0.75	0.89*	0.00	0.00	0.00
26.10	0.67	0.75	0.89*	0.00	0.00	0.00
26.15	0.67	0.75	0.89*	0.00	0.00	0.00
26.20	0.67	0.75	0.89*	0.00	0.00	0.00
26.25	0.67	0.75	0.89*	0.00	0.00	0.00
26.30	0.67	0.76	0.89*	0.00	0.00	0.00
26.35	0.67	0.76	0.89*	0.00	0.00	0.00
26.40	0.67	0.76	0.89*	0.00	0.00	0.00
26.45	0.67	0.76	0.89*	0.00	0.00	0.00
26.50	0.67	0.76	0.88*	0.00	0.00	0.00
26.55	0.67	0.76	0.88*	0.00	0.00	0.00
26.60	0.67	0.76	0.88*	0.00	0.00	0.00
26.65	0.67	0.76	0.88*	0.00	0.00	0.00















Liquefy.sum						
46.80	2.00	0.75	5.00	0.00	0.00	0.00
46.85	2.00	0.75	5.00	0.00	0.00	0.00
46.90	2.00	0.75	5.00	0.00	0.00	0.00
46.95	2.00	0.75	5.00	0.00	0.00	0.00
47.00	2.00	0.75	5.00	0.00	0.00	0.00
47.05	2.00	0.75	5.00	0.00	0.00	0.00
47.10	2.00	0.75	5.00	0.00	0.00	0.00
47.15	2.00	0.75	5.00	0.00	0.00	0.00
47.20	2.00	0.75	5.00	0.00	0.00	0.00
47.25	2.00	0.75	5.00	0.00	0.00	0.00
47.30	2.00	0.75	5.00	0.00	0.00	0.00
47.35	2.00	0.75	5.00	0.00	0.00	0.00
47.40	2.00	0.75	5.00	0.00	0.00	0.00
47.45	2.00	0.75	5.00	0.00	0.00	0.00
47.50	2.00	0.75	5.00	0.00	0.00	0.00
47.55	2.00	0.75	5.00	0.00	0.00	0.00
47.60	2.00	0.75	5.00	0.00	0.00	0.00
47.65	2.00	0.75	5.00	0.00	0.00	0.00
47.70	2.00	0.75	5.00	0.00	0.00	0.00
47.75	2.00	0.75	5.00	0.00	0.00	0.00
47.80	2.00	0.75	5.00	0.00	0.00	0.00
47.85	2.00	0.75	5.00	0.00	0.00	0.00
47.90	2.00	0.75	5.00	0.00	0.00	0.00
47.95	2.00	0.75	5.00	0.00	0.00	0.00
48.00	2.00	0.75	5.00	0.00	0.00	0.00
48.05	2.00	0.75	5.00	0.00	0.00	0.00
48.10	2.00	0.75	5.00	0.00	0.00	0.00
48.15	2.00	0.75	5.00	0.00	0.00	0.00
48.20	2.00	0.75	5.00	0.00	0.00	0.00
48.25	2.00	0.75	5.00	0.00	0.00	0.00
48.30	2.00	0.75	5.00	0.00	0.00	0.00
48.35	2.00	0.75	5.00	0.00	0.00	0.00
48.40	2.00	0.75	5.00	0.00	0.00	0.00
48.45	2.00	0.75	5.00	0.00	0.00	0.00
48.50	2.00	0.75	5.00	0.00	0.00	0.00
48.55	2.00	0.75	5.00	0.00	0.00	0.00
48.60	2.00	0.75	5.00	0.00	0.00	0.00
48.65	2.00	0.75	5.00	0.00	0.00	0.00
48.70	2.00	0.75	5.00	0.00	0.00	0.00
48.75	2.00	0.75	5.00	0.00	0.00	0.00
48.80	2.00	0.74	5.00	0.00	0.00	0.00
48.85	2.00	0.74	5.00	0.00	0.00	0.00
48.90	2.00	0.74	5.00	0.00	0.00	0.00
48.95	2.00	0.74	5.00	0.00	0.00	0.00
49.00	2.00	0.74	5.00	0.00	0.00	0.00
49.05	2.00	0.74	5.00	0.00	0.00	0.00
49.10	2.00	0.74	5.00	0.00	0.00	0.00
49.15	2.00	0.74	5.00	0.00	0.00	0.00
49.20	2.00	0.74	5.00	0.00	0.00	0.00
49.25	2.00	0.74	5.00	0.00	0.00	0.00
49.30	2.00	0.74	5.00	0.00	0.00	0.00
49.35	2.00	0.74	5.00	0.00	0.00	0.00
49.40	2.00	0.74	5.00	0.00	0.00	0.00
49.45	2.00	0.74	5.00	0.00	0.00	0.00
49.50	2.00	0.74	5.00	0.00	0.00	0.00
49.55	2.00	0.74	5.00	0.00	0.00	0.00
49.60	2.00	0.74	5.00	0.00	0.00	0.00
49.65	2.00	0.74	5.00	0.00	0.00	0.00
49.70	2.00	0.74	5.00	0.00	0.00	0.00
49.75	2.00	0.74	5.00	0.00	0.00	0.00
49.80	2.00	0.74	5.00	0.00	0.00	0.00
49.85	2.00	0.74	5.00	0.00	0.00	0.00
49.90	2.00	0.74	5.00	0.00	0.00	0.00
49.95	2.00	0.74	5.00	0.00	0.00	0.00
50.00	2.00	0.74	5.00	0.00	0.00	0.00

\* F.S.<1, Liquefaction Potential Zone

Liquefy.sum

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft<sup>2</sup>)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

**APPENDIX D**  
**EARTHWORK SPECIFICATIONS**



## APPENDIX D

### EARTHWORK SPECIFICATIONS

#### **D1.1 Scope of Work**

The work includes all labor, supplies and construction equipment required to construct the building pads in a good, workmanlike manner, as shown on the drawings and herein specified. The major items of work covered in this section include the following:

- ◆ Site Inspection
- ◆ Authority of Geotechnical Engineer
- ◆ Site Clearing
- ◆ Excavations
- ◆ Preparation of Fill Areas
- ◆ Placement and Compaction of Fill
- ◆ Observation and Testing

#### **D1.2 Site Inspection**

1. The Contractor shall carefully examine the site and make all inspections necessary, in order to determine the full extent of the work required to make the completed work conform to the drawings and specifications. The Contractor shall satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.
2. This *Geoseismic/Geotechnical Study Report* by Converse Consultants may be used as a reference to the surface and subsurface conditions on this project. The information presented in this report is intended for use in design and is subject to confirmation of the conditions encountered during construction. The exploration logs and related information depict subsurface conditions only at the particular time and location designated on the boring logs. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations. In addition, the passage of time may result in a change in subsurface conditions at the exploration locations. Any review of this information shall not relieve the





Contractor from performing such independent investigation and evaluation to satisfy himself as to the nature of the surface and subsurface conditions to be encountered and the procedures to be used in performing his work.

### **D1.3 Authority of the Geotechnical Engineer**

1. The Geotechnical Engineer will observe the placement of compacted fill and will take sufficient tests to evaluate the uniformity and degree of compaction of filled ground.
2. As the Owner's representative, the Geotechnical Engineer will (a) have the authority to cause the removal and replacement of loose, soft, disturbed and other unsatisfactory soils and uncontrolled fill; (b) have the authority to approve the preparation of native ground to receive fill material; and (c) have the authority to approve or reject soils proposed for use in building areas.
3. The Civil Engineer and/or Owner will decide all questions regarding (a) the interpretation of the drawings and specifications, (b) the acceptable fulfillment of the contract on the part of the Contractor and (c) the matters of compensation.

### **D1.4 Site Clearing**

1. Clearing and grubbing shall consist of the removal from building areas to be graded of all existing structures, pavement, utilities, and vegetation.
2. Organic and inorganic materials resulting from the clearing and grubbing operations shall be hauled away from the areas to be graded.

### **D1.5 Excavations**

1. Based on observations made during our field explorations, the surficial soils can be excavated with conventional earthwork equipment.

### **D1.6 Preparation of Fill Areas**

1. All organic material, organic soils, incompetent alluvium, undocumented fill soils and debris should be removed from the proposed building areas.
2. In order to provide a relative uniform bearing material below shallow foundations, over-excavation and re-compaction of below the foundations and slab-on-grade are recommended. We recommend a minimum 2 feet of onsite soils below the bottom of foundations should be removed, moisture-conditioned if necessary, and replaced as compacted fill. At least the six (6) inches of soil at bottom of over-excavation, cut and transition areas should be scarified and compacted. All



undocumented fill should be removed and replaced with compacted fill. The excavation to remove unsuitable soils should be extended to five (5) feet beyond the building limits and appendages where space is available. All loose, soft or disturbed earth materials should be removed from the bottom of excavations before placing structural fill. The actual depth of removal should be determined based on observations made during grading. After the required removals have been made, the exposed native earth materials shall be excavated to provide a zone of structural fill for the support of footings, slabs-on-grade, and exterior flatwork. The fill thickness under structures should not vary.

3. The subgrade in all areas to receive fill shall be scarified to a minimum depth of six (6) inches, the soil moisture adjusted within three (3) percent of the optimum moisture for granular soils and at above approximately three (3) percent of the optimum moisture for fine-grained soils, and then compacted to at least 90 percent for the upper 10 feet and 95 percent for fill placed 10 feet below proposed finished grade, of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. Scarification may be terminated on moderately hard to hard, cemented earth materials with the approval of the Geotechnical Engineer.
4. Compacted fill may be placed on native soils that have been properly scarified and recompacted as discussed above.
5. All areas to receive compacted fill will be observed and approved by the Geotechnical Engineer before the placement of fill.

#### **D1.7 Placement and Compaction of Fill**

1. Compacted fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and driveways will be considered structural fill. Structural fill may consist of approved on-site soils or imported fill that meets the criteria indicated below.
2. Fill consisting of selected on-site earth materials or imported soils approved by the Geotechnical Engineer shall be placed in layers on approved earth materials. Soils used as compacted structural fill shall have the following characteristics:
  - a. All fill soil particles shall not exceed three (3) inches in nominal size, and shall be free of organic matter and miscellaneous inorganic debris and inert rubble.
3. Imported fill materials shall have an Expansion Index (EI) less than 20. All imported fill should be compacted to at least 90 and 95 percent of the laboratory maximum dry density (ASTM Standard D1557) at about three (3) percent above



optimum moisture for fine grained soils, and within three (3) percent of optimum for granular soils.

4. Fill soils shall be evenly spread in maximum 6-inch to 8-inch lifts, watered or dried as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.
5. All fill placed at the site shall be compacted to at least 90 or 95 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. The on-site soils shall be moisture conditioned within three (3) percent of the optimum moisture for granular soils and at above approximately three (3) percent of the optimum moisture for fine-grained soils. At least the upper 12 inches of subgrade soils underneath the concrete apron, pavement and parking areas should be compacted to a minimum of 95 percent relative compaction.
6. Fill exceeding five (5) feet in height shall not be placed on native slopes that are steeper than 5:1 horizontal: vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than five (5) feet, the fill shall be benched into competent materials. The height and width of the benches shall be at least two (2) feet.
7. Representative samples of materials being used, as compacted fill will be analyzed in the laboratory by the Geotechnical Engineer to obtain information on their physical properties. Maximum laboratory density of each soil type used in the compacted fill will be determined by the ASTM Standard D1557 compaction method.
8. Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations shall not resume until the Geotechnical Engineer approves the moisture and density conditions of the previously placed fill.
9. It shall be the Grading Contractor's obligation to take all measures deemed necessary during grading to provide erosion control devices in order to protect slope areas and adjacent properties from storm damage and flood hazard originating on this project. It shall be the contractor's responsibility to maintain slopes in their as-graded form until all slopes are in satisfactory compliance with job specifications, all berms have been properly constructed, and all associated drainage devices meet the requirements of the Civil Engineer.



## **D1.8 Trench Backfill**

The following specifications are recommended to provide a basis for quality control during the placement of trench backfill.

1. Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement.
2. Trench backfill shall be compacted to a minimum relative compaction of 90 percent as per ASTM Standard D1557 test method.
3. Rocks larger than one (1) inch should not be placed within 12 inches of the top of the pipeline or within the upper 12 inches of pavement or structure subgrade. No more than 30 percent of the backfill volume shall be larger than 3/4-inch in largest dimension diameter and rocks shall be well mixed with finer soil.
4. The pipe design engineer should select bedding material for the pipe. Bedding materials generally should have a Sand Equivalent (SE) greater than or equal to 30, as determined by the ASTM Standard D2419 test method.
5. Trench backfill shall be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers, or mechanical tampers, to achieve the density specified herein. The backfill materials shall be brought to within three (3) percent of optimum moisture content for granular soils and fine-grained soils, then placed in horizontal layers. The thickness of uncompacted layers should not exceed eight (8) inches. Each layer shall be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.
6. The contractor shall select the equipment and processes to be used to achieve the specified density without damage to adjacent ground and completed work.
7. The field density of the compacted soil shall be measured by the ASTM Standard D1556 or ASTM Standard D2922 test methods or equivalent.
8. Observation and field tests should be performed by Converse during construction to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compactive effort shall be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.
9. It should be the responsibility of the Contractor to maintain safe conditions during cut and/or fill operations.
10. Trench backfill shall not be placed, spread or rolled during unfavorable weather

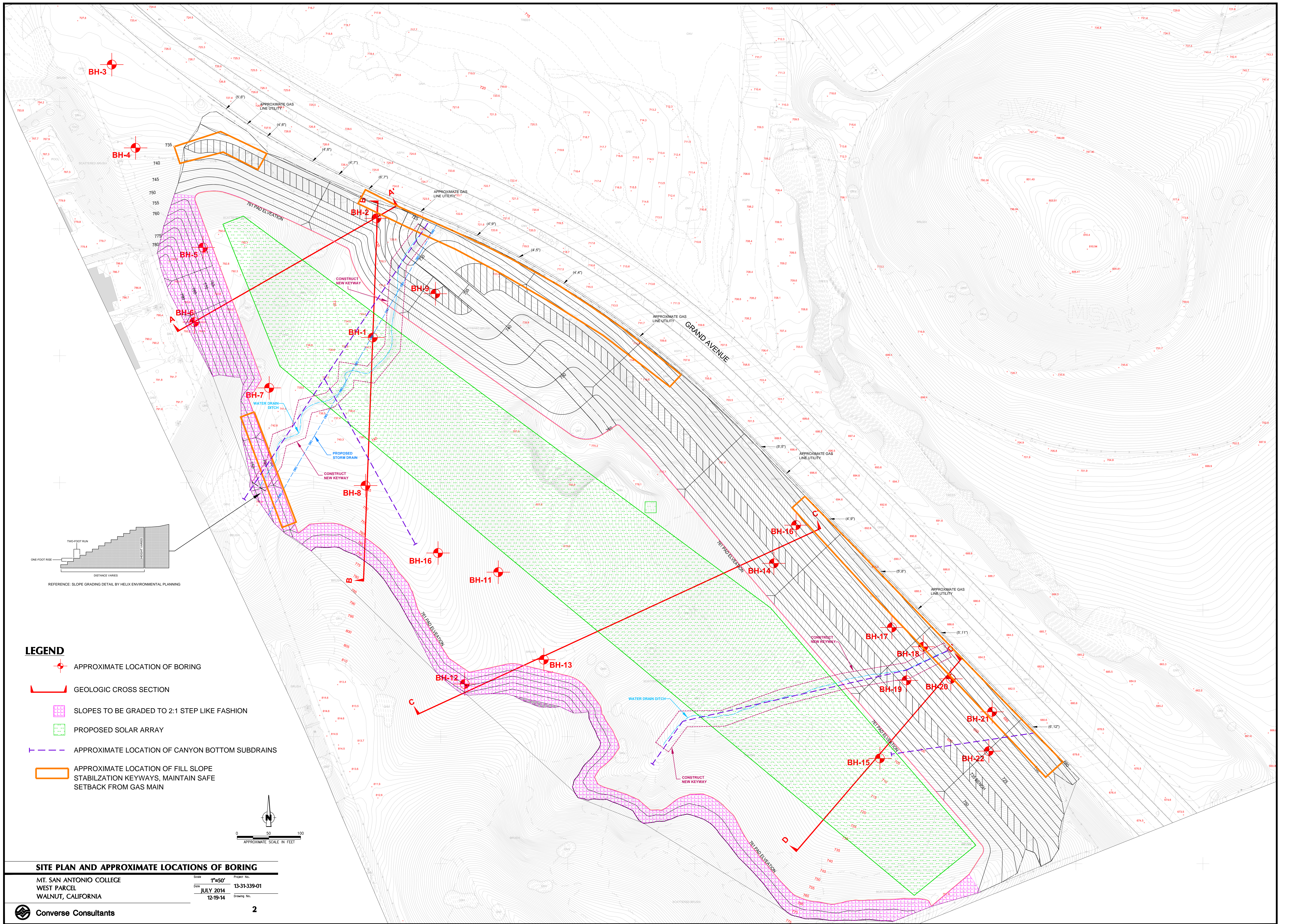


conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are as previously specified.

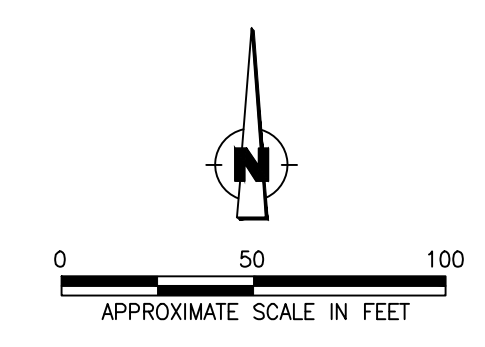
### **D1.9 Observation and Testing**

1. During the progress of grading, the Geotechnical Engineer will provide observation of the fill placement operations.
2. Field density tests will be made during grading to provide an opinion on the degree of compaction being obtained by the contractor. Where compaction of less than specified herein is indicated, additional compactive effort with adjustment of the moisture content shall be made as necessary, until the required degree of compaction is obtained.
3. A sufficient number of field density tests will be performed to provide an opinion to the degree of compaction achieved. In general, density tests will be performed on each one-foot lift of fill, but not less than one for each 500 cubic yards of fill placed.





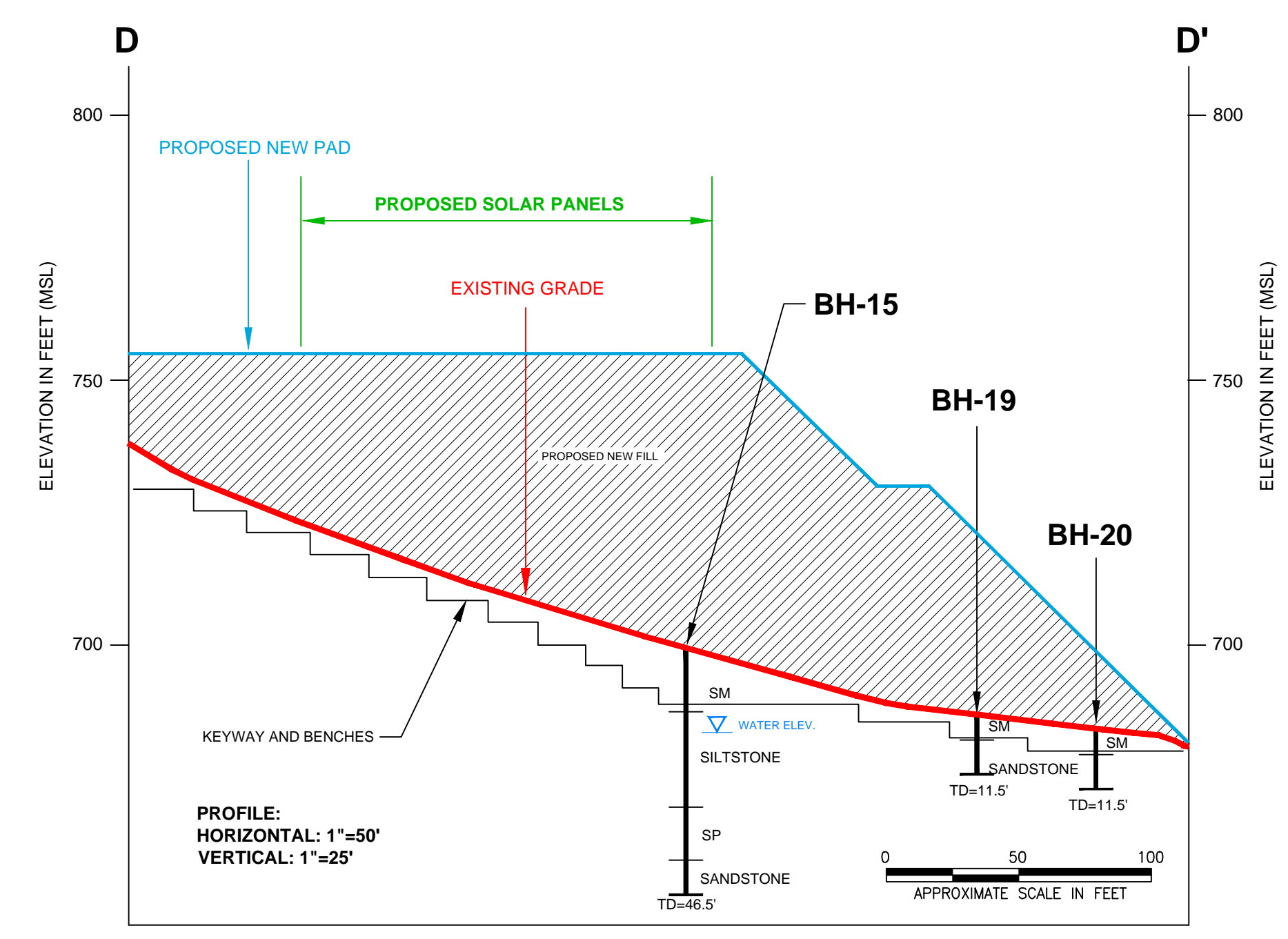
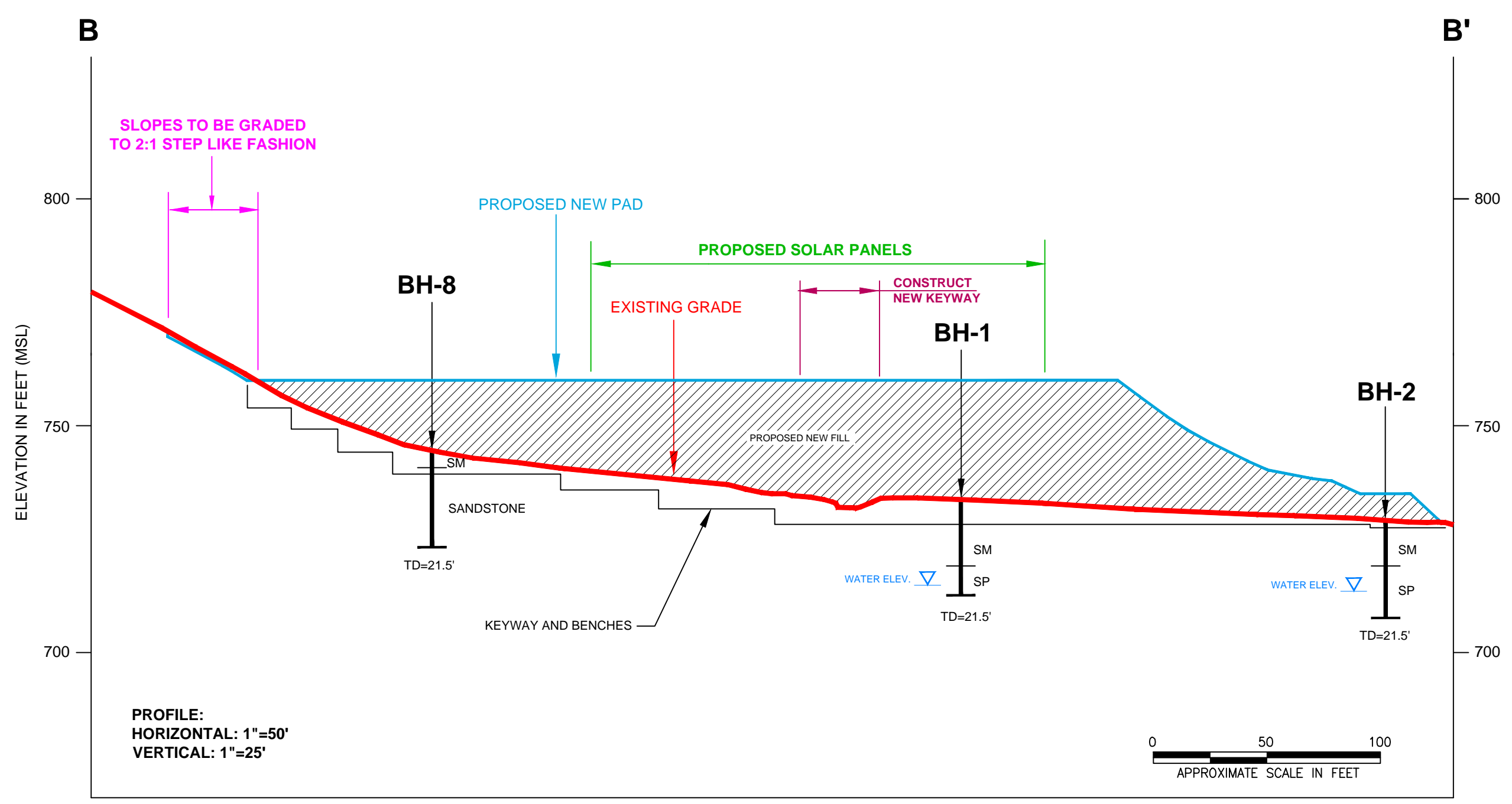
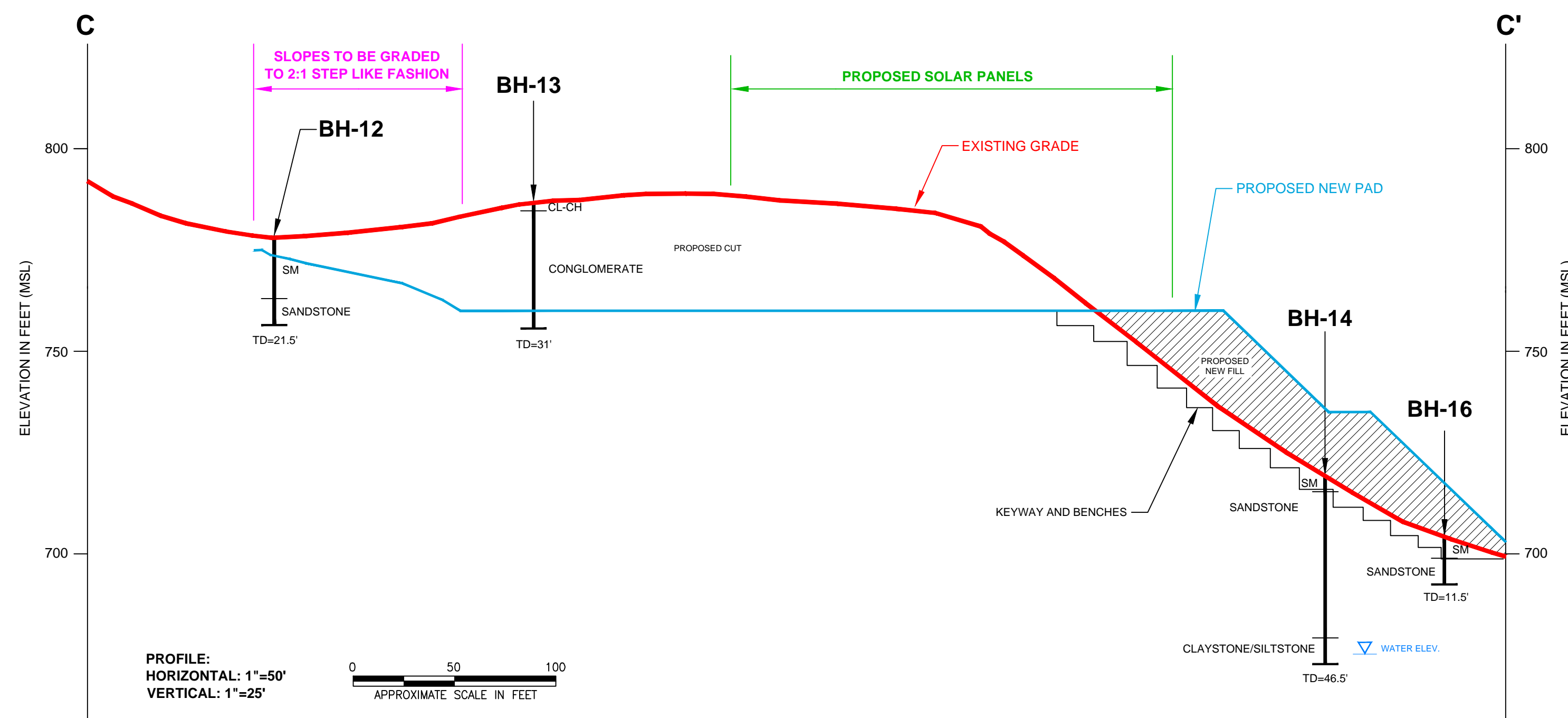
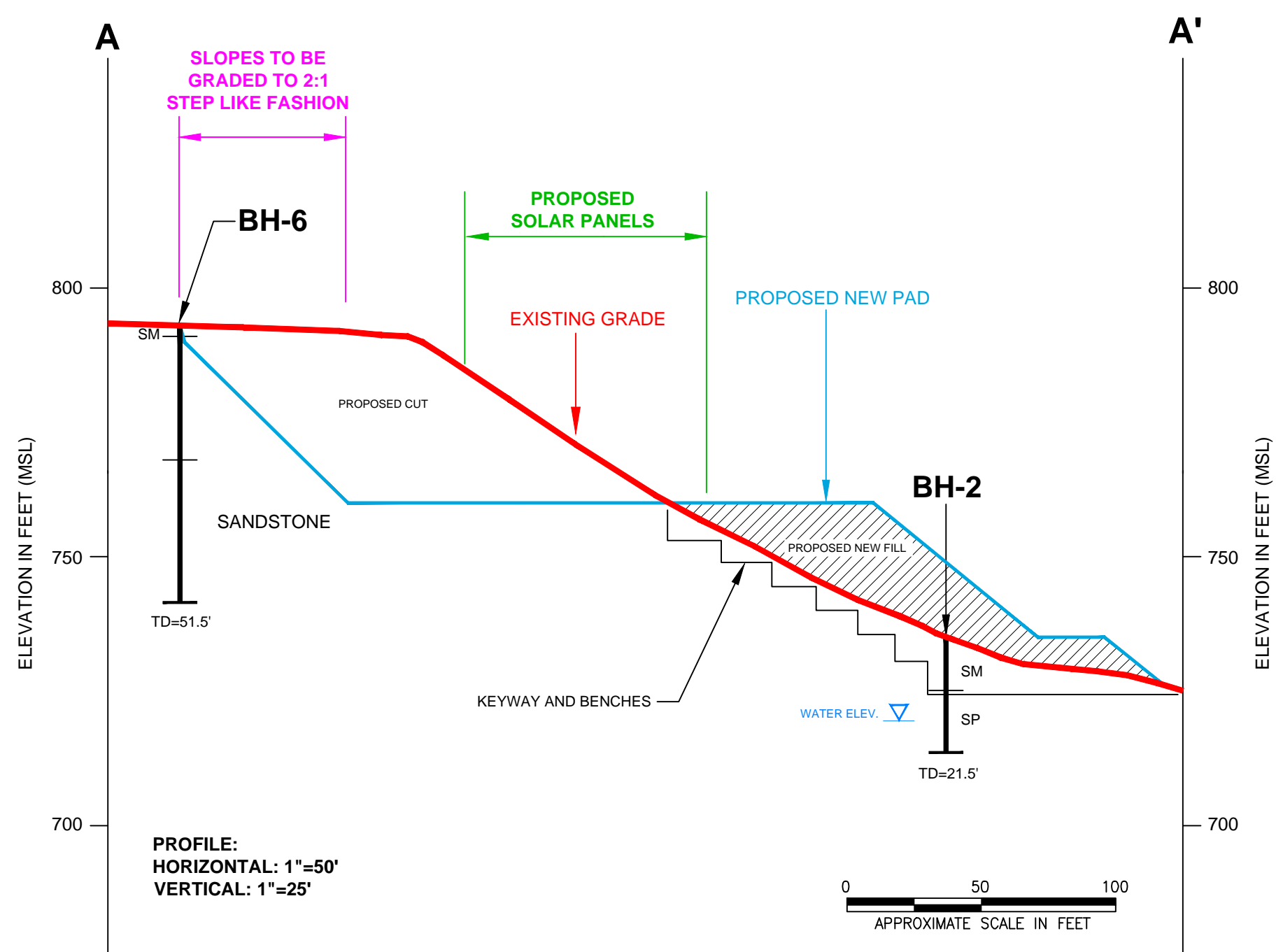
- LEGEND**
- APPROXIMATE LOCATION OF BORING
  - GEOLOGIC CROSS SECTION
  - SLOPES TO BE GRADED TO 2:1 STEP LIKE FASHION
  - PROPOSED SOLAR ARRAY
  - APPROXIMATE LOCATION OF CANYON BOTTOM SUBDRAINS
  - APPROXIMATE LOCATION OF FILL SLOPE STABILIZATION KEYWAYS. MAINTAIN SAFE SETBACK FROM GAS MAIN



**SITE PLAN AND APPROXIMATE LOCATIONS OF BORING**  
 MT. SAN ANTONIO COLLEGE  
 WEST PARCEL  
 WALNUT, CALIFORNIA

Scale: 1"=50'  
 Date: JULY 2014  
 12-19-14

Project No.: 13-31-339-01  
 Drawing No.:



**CROSS SECTION A-A', B-B', C-C', D-D'**

MT. SAN ANTONIO COLLEGE  
WEST PARCEL  
WALNUT, CALIFORNIA

Project No. 13-31-339-01  
Date JULY 2014  
Drawing No.

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