

# Geotechnical Engineering Report

**Proposed Development**  
**425 W Mission Avenue**  
**Escondido, San Diego County, California**

December 14, 2016  
Terracon Project No. 60165245

**Prepared for:**  
NLA Acquisitions LLC  
Franklin, Tennessee

**Prepared by:**  
Terracon Consultants, Inc.  
Tustin, California

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December 14, 2016



NLA Acquisitions LLC  
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Attn: Mr. Chad Williams  
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**Re: Geotechnical Engineering Report  
Proposed Development  
425 W Mission Avenue  
Escondido, San Diego County, California  
Terracon Project No. 60165245**

Dear Mr. Williams:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. These services were performed in general accordance with our Task Order, dated November 11, 2016, issued under Master Service Agreement.

This geotechnical engineering report presents the results of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, pavements and infiltration systems for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,  
Terracon Consultants, Inc.



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## **EXECUTIVE SUMMARY**

A geotechnical exploration has been performed for the proposed project to be located at 425 W. Mission Avenue, Escondido, California. Terracon's geotechnical scope of work included the advancement of nine (9) test borings to approximate depths ranging between 5 and 40¼ feet below the ground surface (bgs). Three (3) of these borings were utilized for percolation testing.

Based on the information obtained from our subsurface exploration, the site is suitable for development of the proposed project provided the recommendations included within this report are implemented during the design and construction phases of the project. The following geotechnical considerations were identified:

- The subsurface materials generally consisted of predominantly interbedded layers of loose to medium dense silty sand and clayey sand, and stiff to very stiff lean clay with variable amount of sand to the depth of about 20 feet bgs. Below these interbedded layers, dense to very dense sand with variable amount of silt are encountered to the maximum depth explored at 40¼ feet. Borings B-2 and B-6 encountered auger refusals at the depth of about 30 and 40 feet bgs, respectively.
- Groundwater was encountered between 12 and 18 feet bgs.
- Liquefaction potential analysis was performed from a depth of 0 to 40¼ feet bgs. The seismically induced total and differential settlement of saturated soils was found to be less than ½ inch and ¼ inch, respectively.
- Due to the low bearing capacity of the near surface materials, and anticipated expansion potential and hydro-collapse potential of the near surface materials, the upper soils should be overexcavated for the entire building footprints of each building to a minimum depth of 3½ feet below the bottom of footings or 5 feet below the existing ground, whichever is larger.
- Light (automobile) parking areas – 3" AC over 7" AB or 5" PCC over 4" AB; On-site driveways and delivery areas – 3" AC over 9" AB or 6" PCC over 4" AB. All pavements should be supported on a minimum of 10 inches of scarified, moisture conditioned, and compacted materials.
- The 2013 California Building Code (CBC) seismic site classification for this site is D.
- Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during construction.

This geotechnical executive summary should be used in conjunction with the entire report for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled General Comments should be read for an understanding of the report limitations.

**GEOTECHNICAL ENGINEERING REPORT  
 PROPOSED DEVELOPMENT  
 425 W MISSION AVENUE  
 ESCONDIDO, CALIFORNIA  
 Terracon Project No. 60165245  
 December 14, 2016**

**1.0 INTRODUCTION**

This report presents the results of our geotechnical engineering services performed for the proposed structure to be located at 425 W Mission Avenue, Escondido, California. The Site Location Plan (Exhibit A-1) is included in Appendix A of this report. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- earthwork
- seismic considerations
- floor slab design and construction
- groundwater conditions
- foundation design and construction
- pavement design and construction
- infiltration systems

Our geotechnical engineering scope of work for this project included the advancement of nine (9) test borings to approximate depths ranging between 5 and 40¼ feet bgs. Three (3) of these borings were used for percolation testing.

Logs of the borings along with a Boring Location Diagram (Exhibit A-2) are included in Appendix A of this report. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included in Appendix B of this report. Descriptions of the field exploration and laboratory testing are included in their respective appendices.

**2.0 PROJECT INFORMATION**

**2.1 Project Description**

ITEM	DESCRIPTION
<b>Site layout</b>	Refer to the Boring Location Diagram (Exhibit A-2 in Appendix A).
<b>Structures</b>	The site will be developed with a new shopping center with multiple buildings. Approximate footprint of the proposed buildings are: Stanton Optical = 3,500 SF Habit Restaurant = 2,900 SF Restaurant/Retail = 5,200 SF Car Wash = 4,000 SF
<b>Finished floor elevation</b>	Within one foot of existing grade (assumed).

ITEM	DESCRIPTION
<b>Maximum loads (assumed)</b>	Columns: 40 to 120 kips Walls: 1 to 2 klf Slabs: 150 psf max
<b>Grading</b>	Minimal cut/fill – assumed to be less than one foot.
<b>Traffic loading</b>	Assumed Design Traffic Index (TI's): Automobile Parking Areas: 4.5 On-site Driveways and Delivery Areas: 5.5

## 2.2 Site Location and Description

Item	Description
<b>Location</b>	This project is located at 425 W Mission Avenue, Escondido, CA.
<b>Existing site features</b>	The site currently consists of an existing lodge comprised of multiple single story buildings, a swimming pool, and associated parking.
<b>Surrounding developments</b>	North: W Mission Avenue South: Vacant lot at W Washington Avenue East: Shopping Complex West: Centre City Parkway
<b>Current ground cover</b>	Asphalt and concrete pavements, a swimming pool, trees and plants
<b>Existing topography</b>	Relatively level project site

## 3.0 SUBSURFACE CONDITIONS

### 3.1 Site Geology

The site is situated within the Southern Peninsular Ranges Geomorphic Province in Southern California. Geologic structures within this Province trend mostly northwest, in contrast to the prevailing east-west trend in the neighboring Transverse Ranges Geomorphic Province to the north. The Peninsular Range Province extends into lower California, and is bounded by the Colorado Desert to the east, the Pacific Ocean to the west and the San Gabriel and San Bernardino mountains to the north.<sup>1,2</sup> Surficial geologic units mapped at the site consists of Pleistocene nonmarine deposits of Quaternary age<sup>3</sup>.

<sup>1</sup> Harden, D. R., "California Geology, Second Edition," Pearson Prentice Hall, 2004.

<sup>2</sup> Norris, R. M. and Webb, R. W., "Geology of California, Second Edition," John Wiley & Sons, Inc., 1990.

<sup>3</sup> Division of Mines and Geology, "Geologic Map of California, Olaf P. Jenkins Edition, Santa Ana Sheet", Compilation by Thomas H. Rogers, 1965, Second Printing 1973.

### **3.2 Typical Subsurface Profile**

Specific conditions encountered at the boring locations are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for the borings can be found on the boring logs included in Appendix A.

Based on the results of the borings, subsurface conditions encountered on the project site can be generalized as predominantly interbedded layers of loose to medium dense silty sand and clayey sand, and stiff to very stiff lean clay with variable amount of sand to the depth of about 20 feet bgs. Below these interbedded layers, dense to very dense sand with variable amount of silt are encountered to the maximum depth explored at 40¼ feet.

Borings B-2 and B-6 encountered auger refusals at the depth of about 30 and 40 feet bgs, respectively.

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B and on the boring logs. Atterberg limit test results indicate that the near surface clayey materials exhibit low to medium plasticity. Expansion Index tests were performed on the near surface clayey soils and indicate these materials have Expansion Index ranging between 7 and 34. Consolidation/swell tests indicate that clayey sand and lean clay with sand materials encountered at approximate depths of 2½ and 5 feet have no collapse potential when saturated under normal footing loads of 2,000 psf. However, sandy lean clay materials encountered in Boring B-5 at a depth of 2½ feet have moderate collapse potential when saturated under normal footing loads of 2,000 psf. Direct shear tests were performed on sandy materials encountered at approximate depths of 2½ and 7½ feet and indicated ultimate friction angles ranging between 30 and 39 degrees with corresponding cohesions ranging between 30 and 336 psf.

### **3.3 Groundwater**

Groundwater was encountered between depths of 12 and 18 feet bgs except in Boring B-5. In Boring B-5, groundwater was not encountered to the maximum depth explored at 20 feet. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations.

In clayey soils with low permeability, the accurate determination of groundwater level may not be possible without long term observation. Long term observation after drilling could not be performed as borings were backfilled immediately upon completion due to safety concerns. Groundwater levels can best be determined by implementation of a groundwater monitoring plan. Such a plan would include installation of groundwater monitoring wells, and periodic measurement of groundwater levels over a sufficient period of time.

Based on ground water data recorded from a monitoring wells located just east of the project site located at a distance of about 700 feet, the highest historical groundwater measurement was approximately 3 feet bgs.<sup>4</sup>

### 3.4 Seismic Considerations

#### 3.4.1 Seismic Site Classification Parameters

DESCRIPTION	VALUE
2013 California Building Code Site Classification (CBC) <sup>1</sup>	D
Site Latitude	N 33.1281°
Site Longitude	W 117.0909°
S <sub>s</sub> Spectral Acceleration for a Short Period	1.030g
S <sub>1</sub> Spectral Acceleration for a 1-Second Period	0.399g
F <sub>a</sub> Site Coefficient for a Short Period	1.088
F <sub>v</sub> Site Coefficient for a 1-Second Period	1.601

<sup>1</sup> Note: The 2013 California Building Code (CBC) requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the required 100 foot soil profile determination. Borings were extended to a maximum depth of 40¼ feet, and this seismic site class definition considers that similar or denser soils continue below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

#### 3.4.2 Faulting and Estimated Ground Motions

The site is located in Southern California, which is a seismically active area. The type and magnitude of seismic hazards affecting the site are dependent on the distance to causative faults, the intensity, and the magnitude of the seismic event. Based on calculations using the USGS Earthquake Hazard Program 2008 interactive deaggregations, the Elsinore Fault is considered to have the most significant effect at the site from a design standpoint. The Elsinore Fault is located approximately between 24.9 and 26.0 kilometers from the site.

Based on the USGS Design Maps Summary Report, using the American Society of Civil Engineers (ASCE 7-10) standard, the peak ground acceleration (PGA<sub>M</sub>) at the project site is expected to be 0.43g. Based on the USGS 2008 interactive deaggregations, the project site has a mean magnitude of 6.55. Furthermore, the site is not located within an Alquist-Priolo Earthquake Fault Zone based on our review of the State Fault Hazard Maps.<sup>5</sup>

<sup>4</sup> Data collected from Well No MW-10 located just east of the project site at Pacific Petroleum (T06019794859), 750 N Escondido Blvd, Escondido, California (<http://geotracker.waterboards.ca.gov>).

<sup>5</sup> California Department of Conservation Division of Mines and Geology (CDMG), "Digital Images of Official Maps of Alquist-Priolo Earthquake Fault Zones of California, Southern Region", CDMG Compact Disc 2000-003, 2000.

### **3.4.3 Liquefaction Potential**

Liquefaction is a mode of ground failure that results from the generation of high pore water pressures during earthquake ground shaking, causing loss of shear strength. Liquefaction is typically a hazard where loose sandy soils exist below groundwater. The County of San Diego has designated certain areas within the county as potential liquefaction hazard zones. These are areas considered at a risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table.

The project site is located within a liquefaction hazard zone as designated by the County of San Diego maps. Based on the materials encountered at the project site, subsurface materials generally consisted of predominantly interbedded layers of loose to medium dense silty sand and clayey sand, and stiff to very stiff lean clay with variable amount of sand to the depth of about 20 feet bgs. Below these interbedded layers, dense to very dense sand with variable amount of silt are encountered to the maximum depth explored at 40¼ feet. Groundwater was encountered between depths of 12 and 18 feet bgs. Historical high groundwater in the project vicinity is approximately 3 feet bgs.

Liquefaction analysis for the site was performed in general accordance with the DMG Special Publication 117. The liquefaction study utilized the software “LiquefyPro” by CivilTech Software. This analysis was based on the soils data from Boring B-2 and B-6. Peak Ground Acceleration (PGA) was of 0.43g was used. Calculations utilized historical groundwater depths. Settlement analysis used the Tokimatsu, M-correction method. Fines were corrected for liquefaction using Modified Stark and Olsen. Liquefaction potential analysis was calculated from a depth of 0 to 40¼ feet bgs. Liquefaction potential analysis is attached in Appendix D of this report.

Based on the subsurface conditions presented in Boring B-2 and analytical results, liquefiable saturated sands are encountered below the historical high groundwater depth. Based on the calculation results, seismically-induced settlement of saturated sands are expected to be less than ½ inch. Differential seismically-induced settlement of saturated sands are expected to be less than ¼ inch.

### **3.5 Percolation Test Results**

Three (3) in-situ percolation tests (falling head borehole permeability) were performed to approximate depths of 5 to 10 bgs. A 2-inch thick layer of gravel was placed in the bottom of each boring after the borings were drilled to investigate the soil profile. A 3-inch diameter perforated pipe was installed on top of the gravel layer in each boring. Gravel was used to backfill between the perforated pipes and the boring sidewall. The borings were then filled with water for a pre-soak period. Testing began after the entire amount of water added to the borings had infiltrated into the ground. At the beginning of each test, the pipes were refilled with water and readings were taken at standardized time intervals. Percolation rates are provided in the following table:

<b>TEST RESULTS</b>				
<b>Test Location (depth, feet bgs)</b>	<b>Soil Classification</b>	<b>Slowest Measured Percolation Rate (in/hr)</b>	<b>Correlated Infiltration Rate* (in/hr)</b>	<b>Water Head (in)</b>
B-7 (0 to 5 ft)	Sandy Silty Clay	5.5	0.17	47
B-8 (0 to 5 ft)	Sandy Silty Clay	6.5	0.20	48
B-9 (5 to 10 ft)	Silty Sand	8.4	0.30	40

\*If the proposed infiltration systems will mainly rely on vertical downward seepage, the correlated infiltration rates should be used. The correlated infiltration rates were calculated using the Porche Method.

The field test results are not intended to be design rates. They represent the result of our tests, at the depths and locations indicated, as described above. The design rate should be determined by the designer by applying an appropriate factor of safety. The designer should take into consideration the variability of the native soils when selecting appropriate design rates. With time, the bottoms of infiltration systems tend to plug with organics, sediments, and other debris. Long term maintenance will likely be required to remove these deleterious materials to help reduce decreases in actual percolation rates.

The percolation test was performed with clear water, whereas the storm water will likely not be clear, but may contain organics, fines, and grease/oil. The presence of these deleterious materials will tend to decrease the rate that water percolates from the infiltration systems. Design of the storm water infiltration systems should account for the presence of these materials and should incorporate structures/devices to remove these deleterious materials.

Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different than measured in the field due to variations in fines and gravel content. The design elevation and size of the proposed infiltration system should account for this expected variability in infiltration rates. We recommend that the proposed infiltration systems reach the sandy soil layers underlying the upper clayey soils.

Infiltration testing should be performed after construction of the infiltration system to verify the design infiltration rates. It should be noted that siltation and vegetation growth along with other factors may affect the infiltration rates of the infiltration areas. The actual infiltration rate may vary from the values reported here. Infiltration systems should be located at least 10 feet from any existing or proposed foundation system.

### **3.6 Corrosion Potential**

Results of soluble sulfate testing indicate that ASTM Type I/II Portland cement may be used for all concrete on and below grade. Foundation concrete may be designed for low sulfate exposure in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

Laboratory test results indicate the on-site soils have a pH of 8.16 and 8.55, minimum resistivities of 931 and 1,358 ohm-centimeters, water soluble sulfate contents of 0.01% and 0.02%, Red-Ox potentials of +637 and +650 mV, negligible sulfides, and chloride contents of 75 and 228 parts per million (ppm) as shown on the attached Results of Corrosivity Analysis sheet. These values should be used to evaluate corrosive potential of the on-site soils to underground ferrous metals.

Refer to the Results of Corrosivity Analysis sheet in Appendix B for the complete results of the corrosivity testing conducted in conjunction with this geotechnical exploration.

## **4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION**

### **4.1 Geotechnical Considerations**

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided the recommendations included within this report are implemented. Based on the geotechnical engineering analyses, subsurface exploration, and laboratory test results, we recommend supporting the proposed building on a spread footing foundation system.

Due to the low bearing capacity of the near surface materials, and anticipated expansion potential and hydro-collapse potential of the near surface materials, the upper soils should be overexcavated for the entire building footprints of each building to a minimum depth of 3½ feet below the bottom of footings or 5 feet below the existing ground, whichever is larger. The on-site sandy soils could be used as engineered fill provided the material meets the low-volume change material specifications presented in Section 4.2.3. The on-site clayey soils should not be used as engineered fill beneath structures due to its expansive potential.

expansive soils are present on this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion; however, even if these procedures are followed, some movement and at least minor cracking in the structure should be anticipated. The severity of cracking and other cosmetic damage such as uneven floor slabs will probably increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and cosmetic distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

Potentially compressible soils, which show significant tendency for hydro-compaction when elevated in moisture content, will require particular attention in the design and construction. Hydro-compactive soils, sometimes referred to as collapsible soils, are capable of supporting typical building loads at natural moisture contents, these same materials however, undergo

volume decrease, including settlement and consolidation, when subjected to increases in moisture content under constant load.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing (which are presented in Appendices A and B), engineering analyses, and our current understanding of the proposed project.

## **4.2 Earthwork**

The following presents recommendations for site preparation, excavation, subgrade preparation and placement of reinforced engineered fills on the project. The recommendations presented for the design and construction of earth supported elements including, foundations, slabs, and pavements, are contingent upon following the recommendations outlined in this section. All grading for the proposed building should incorporate the limits of the proposed construction plus a lateral distance of 3 feet beyond the perimeter of the proposed building.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

### **4.2.1 Site Preparation**

Strip and remove existing pavement, demolition debris, and other deleterious materials from proposed building and pavement areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

Demolition of the existing buildings and a swimming pool should include complete removal of all foundation systems and remaining underground utilities within the proposed construction area. This should include removal of any loose backfill found adjacent to existing foundations and swimming pool. All materials derived from the demolition of existing structures, swimming pool and pavements should be removed from the site and not be allowed for use as on-site fill.

The swimming pool is located near the southern end of the project limit. It is our understanding that the swimming pool will be demolished and two buildings will be constructed on north and south side of the existing outline of swimming pool. After the demolition of the swimming pool, the excavation should be backfilled and compacted per the compaction requirements in Section 4.2.4. If the excavation for the demolition of swimming pool is found to be within 5 feet of the proposed buildings, then the excavation walls at the proposed building side should be benched or sloped with a slope that is no steeper than a 1H:1V. Engineered fill at depths below 5 feet of existing grades should be backfilled to a minimum of 95% per ASTM D-1557.

Evidence of underground facilities such as septic tanks, cesspools, and basements, was not observed during the site reconnaissance, however such features could be encountered during construction. If fill materials, underground facilities, and/or utilities lines are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

#### **4.2.2 Subgrade Preparation**

Due to the low bearing capacity of the near surface materials, and anticipated expansion potential and hydro-collapse potential of the near surface materials, the entire proposed building footprints of each building should bear on reinforced engineered fill comprised of low volume change soils extending to a minimum depth of 3½ feet below the bottom of the foundation or 5.0 feet below existing grade, whichever greater.

The over-excavation bottom, once properly cleared, should be scarified to a minimum depth of 10 inches, moisture conditioned, and compacted per the compaction requirements in Section 4.2.4.

Subgrade soils beneath exterior slabs, and pavements may be scarified, moisture conditioned, and compacted to a minimum depth of 10 inches. The moisture content and compaction of subgrade soils should be maintained until slab or pavement construction.

#### **4.2.3 Fill Materials and Placement**

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than three inches in size. Pea gravel or other similar non-cementitious, poorly-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

The on-site near surface clayey soils are not considered suitable for use as engineered fill beneath the structures due to its expansion potential. The on-site sandy soils are considered suitable for use as engineered fill, provided these on-site sandy soils conform to the low volume change specifications provided in this section for imported or onsite engineered fill materials.

Imported or on-site sandy soils may only be used as engineered fill materials in the following areas:

- foundation support
- interior slab areas
- foundation backfill

Imported or on-site soils (including clayey soils) may be used in the following areas:

- general site grading
- exterior slab areas
- pavement areas

Imported soils or on-site sandy soils should conform to low volume change materials as indicated in the following specifications:

<u>Gradation</u>	<u>Percent Finer by Weight (ASTM C 136)</u>
3" .....	100
No. 4 Sieve .....	50 to 100
No. 200 Sieve .....	10 to 40
■ Liquid Limit .....	30 (max)
■ Plasticity Index .....	15 (max)
■ Maximum expansive index* .....	20 (max)

\*ASTM D 4829

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed ten inches loose thickness.

#### 4.2.4 Compaction Requirements

Recommended compaction and moisture content criteria for engineered fill materials are as follows:

Material Type and Location	Per the Modified Proctor Test (ASTM D 1557)		
	Minimum Compaction Requirement	Range of Moisture Contents for Compaction Above Optimum	
		Minimum	Maximum
Approved on-site sandy soils or imported materials:			
Beneath foundations:	90%	-1%	+4%
Beneath slabs:	90%	-1%	+4%
On-site soils (including clayey soils) or imported materials:			
Utility trenches*:	90%	-1%	+4%
Beneath pavements:	95%	-1%	+4%
Bottom of excavation to receive fill:	90%	-1%	+4%
Miscellaneous backfill:	90%	-1%	+4%
Aggregate base (beneath pavements):	95%	-2%	+2%

\* Upper 12 inches should compacted to 95% within pavement and structural areas

#### **4.2.5 Grading and Drainage**

Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at least 10 feet from perimeter walls.

Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration. We recommend a minimum horizontal setback distance of 10 feet from the perimeter of any building and the high-water elevation of the nearest storm-water retention basin.

Roof drainage should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems and landscaped irrigation should not be installed within 5 feet of foundation walls.

#### **4.2.6 Exterior Slab Design and Construction**

Exterior slabs-on-grade, exterior architectural features, and utilities founded on, or in backfill may experience some movement due to the volume change of the backfill. To reduce the potential for damage caused by movement, we recommend:

- exterior slabs should be supported directly on subgrade fill with no, or very low expansion potential;
- strict moisture-density control during placement of subgrade fills;
- maintain proper subgrade moisture until placement of slabs;
- placement of effective control joints on relatively close centers and isolation joints between slabs and other structural elements;
- provision for adequate drainage in areas adjoining the slabs;
- using of designs which allow vertical movement between the exterior slabs and adjoining structural elements.

#### **4.2.7 Utility Trenches**

It is anticipated that the on-site soils will provide suitable support for underground utilities and piping that may be installed. Any soft and/or unsuitable material encountered at the bottom of excavations should be removed and be replaced with an adequate bedding material. A non-expansive granular material with a sand equivalent greater than 30 is recommended for bedding and shading of utilities, unless otherwise allowed by the utility manufacturer.

On-site materials are considered suitable for backfill of utility and pipe trenches from one foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances. Trench backfill should be mechanically placed and compacted as

discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

#### **4.2.8 Construction Considerations**

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. On-site clay soils may pump or become unworkable at high water contents. The workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. Workability may be improved by scarifying and drying. Lightweight excavation equipment may be required to reduce subgrade pumping. Should unstable subgrade conditions develop stabilization measures will need to be employed.

At the time of our study, moisture contents of the surface and near-surface native soils ranged from about 5 to 20 percent. Based on these moisture contents, some moisture conditioning may be needed for the project. The soils may need to be dried by aeration during dry weather conditions, or an additive, such as lime, cement, or kiln dust, may be needed to stabilize the soil. If the construction schedule does not allow for drying by aeration, clay soils may be stabilized using triaxial geogrid and coarse aggregate materials.

It is our understanding that the existing swimming pool will be demolished and two buildings will be constructed on north and south side of the existing outline of swimming pool. After the demolition of the swimming pool, the excavation should be backfilled and compacted per the compaction requirements in Section 4.2.4. If the excavation for the demolition of swimming pool is found to be within 5 feet of the proposed buildings, then the excavation walls at the proposed building side should be benched or sloped with a slope that is no steeper than a 1H:1V. Engineered fill at depths below 5 feet of existing grades should be backfilled to a minimum of 95% per ASTM D-1557.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proof-rolling, placement and compaction of controlled compacted fills, backfilling of excavations to the completed subgrade.

We recommend that the earthwork portion of this project be completed during extended periods of dry weather if possible. If earthwork is completed during the wet season (typically November through April) it may be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork operations may require additional mitigation measures beyond that which would be expected during the drier summer and fall months. This could include diversion of surface runoff around exposed soils and draining of ponded water on the site. Once subgrades are established, it may be necessary to protect the exposed subgrade soils from construction traffic.

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

### 4.3 Foundations

DESCRIPTION	RECOMMENDATION
<b>Foundation Type</b>	Conventional Shallow Spread Footings
<b>Bearing Material</b>	Engineered fill comprised of low volume change soils extending to a minimum depth of 3½ feet below the bottom of the proposed foundations or 5 feet below the existing grade, whichever is larger.
<b>Allowable Bearing Pressure</b>	2,500 psf
<b>Minimum Dimensions</b>	Walls: 18 inches; Columns: 24 inches
<b>Minimum Embedment Depth Below Finished Grade</b>	18 inches
<b>Total Estimated Settlement</b>	1 inch
<b>Estimated Differential Settlement</b>	½ inch across 40 feet

Footings should be proportioned to reduce differential foundation movement. Proportioning on the basis of equal total settlement is recommended; however, proportioning to relative constant dead-load pressure will reduce differential settlement between adjacent footings. Additional foundation movements could occur if water, from any source, saturates the foundation soils; therefore, proper drainage should be provided during construction and in the final design.

Finished grade is defined as the lowest adjacent grade within five feet of the foundation for perimeter (or exterior) footings. The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

Foundations should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of control joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

#### 4.4 Floor Slab

DESCRIPTION	RECOMMENDATION
Interior floor system	Slab-on-grade concrete
Floor slab support	Engineered fill comprised of low volume change soils extending to a minimum depth of 3½ feet below the bottom of the proposed foundations or 5 feet below the existing grade, whichever is larger.
Subbase	Minimum 4-inches of Aggregate Base
Modulus of subgrade reaction	200 pounds per square inch per inch (psi/in) (The modulus was obtained based on estimates obtained from NAVFAC 7.1 design charts). This value is for a small loaded area (1 Sq. ft or less) such as for forklift wheel loads or point loads and should be adjusted for larger loaded areas.

In areas of exposed concrete, control joints should be saw cut into the slab after concrete placement in accordance with ACI Design Manual, Section 302.1R-37 8.3.12 (tooled control joints are not recommended). Additionally, dowels should be placed at the location of proposed construction joints. To control the width of cracking (should it occur) continuous slab reinforcement should be considered in exposed concrete slabs.

The use of a vapor retarder or barrier should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

#### 4.5 Lateral Earth Pressures

For engineered fill comprised of on-site materials above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are:

ITEM	VALUE <sup>1</sup>
Active Case	37 psf/ft
Passive Case	390 psf/ft

ITEM	VALUE <sup>1</sup>
At-Rest Case	56 psf/ft
Coefficient of friction	0.40

<sup>1</sup>Note: The values are based on onsite materials used as backfill.

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design.

Fill against foundation and retaining walls should be compacted to densities specified in the Earthwork section of this report. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors.

## 4.6 Pavements

### 4.6.1 Design Recommendations

An estimated design R-Value was used to calculate the asphalt concrete pavement thickness sections and the portland cement concrete pavement sections. R-value testing should be completed prior to pavement construction to verify the design R-value.

Assuming the pavement subgrades will be prepared as recommended within this report, the following pavement sections should be considered minimums for this project for the traffic indices assumed in the table below. As more specific traffic information becomes available, we should be contacted to reevaluate the pavement calculations.

	Recommended Pavement Section Thickness (inches)*	
	Light (Automobile) Parking Assumed Traffic Index (TI) = 4.5	On-site Driveways and Delivery Areas Assumed TI = 5.5
<u>Section I</u> Portland Cement Concrete (600 psi Flexural Strength)	5.0-inches PCC over 4-inches Class II Aggregate Base	6.0-inches PCC over 4-inches Class II Aggregate Base
<u>Section II</u> Asphaltic Concrete	3-inches AC over 7-inches Class II Aggregate Base	3-inches AC over 9-inches Class II Aggregate Base

\* All materials should meet the CALTRANS Standard Specifications for Highway Construction.

Subsequent to clearing, grubbing, and removal of topsoil, subgrade soils beneath all pavements should be scarified, moisture conditioned, and compacted to a minimum depth of 10 inches. These pavement sections are considered minimal sections based upon the expected traffic and the existing subgrade conditions. However, they are expected to function with periodic maintenance and overlays if good drainage is provided and maintained.

All materials should meet the CALTRANS Standard Specifications for Highway Construction. Aggregate base materials should meet the gradation and quality requirement of Class 2 Aggregate Base ( $\frac{3}{4}$  inch maximum) in Caltrans Standard Specifications, latest edition, Sections 25 through 29.

All concrete for rigid pavements should have a minimum flexural strength of 600 psi (4,250 psi Compressive Strength), and be placed with a maximum slump of four inches. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Preventative maintenance should be planned and provided for through an on-going pavement management program in order to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment.

Preventative maintenance consists of both localized maintenance (e.g. crack sealing and patching) and global maintenance (e.g. surface sealing). Preventative maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements.

#### **4.6.2 Construction Considerations**

Materials and construction of pavements for the project should be in accordance with the requirements and specifications of the State of California Department of Transportation, or other approved local governing specifications.

Base course or pavement materials should not be placed when the surface is wet. Surface drainage should be provided away from the edge of paved areas to minimize lateral moisture transmission into the subgrade.

## **5.0 GENERAL COMMENTS**

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be

## **Geotechnical Engineering Report**

Proposed Development ■ Escondido, California

December 14, 2016 ■ Terracon Project No. 60165245

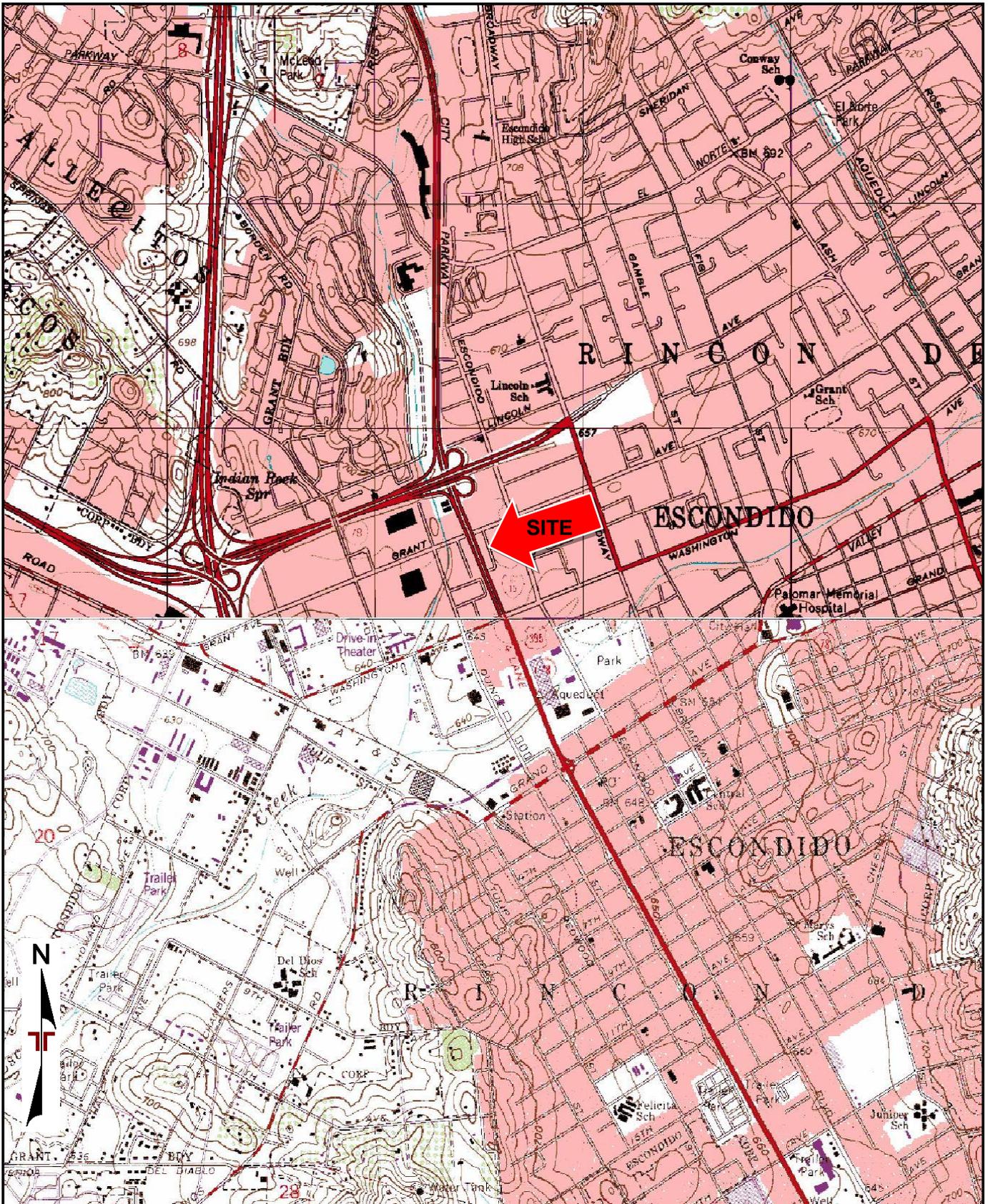


immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

**APPENDIX A**  
**FIELD EXPLORATION**



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY  
 QUADRANGLES INCLUDE: VALLEY CENTER, CA (1/1/1996) and ESCONDIDO, CA (1/1/1996).

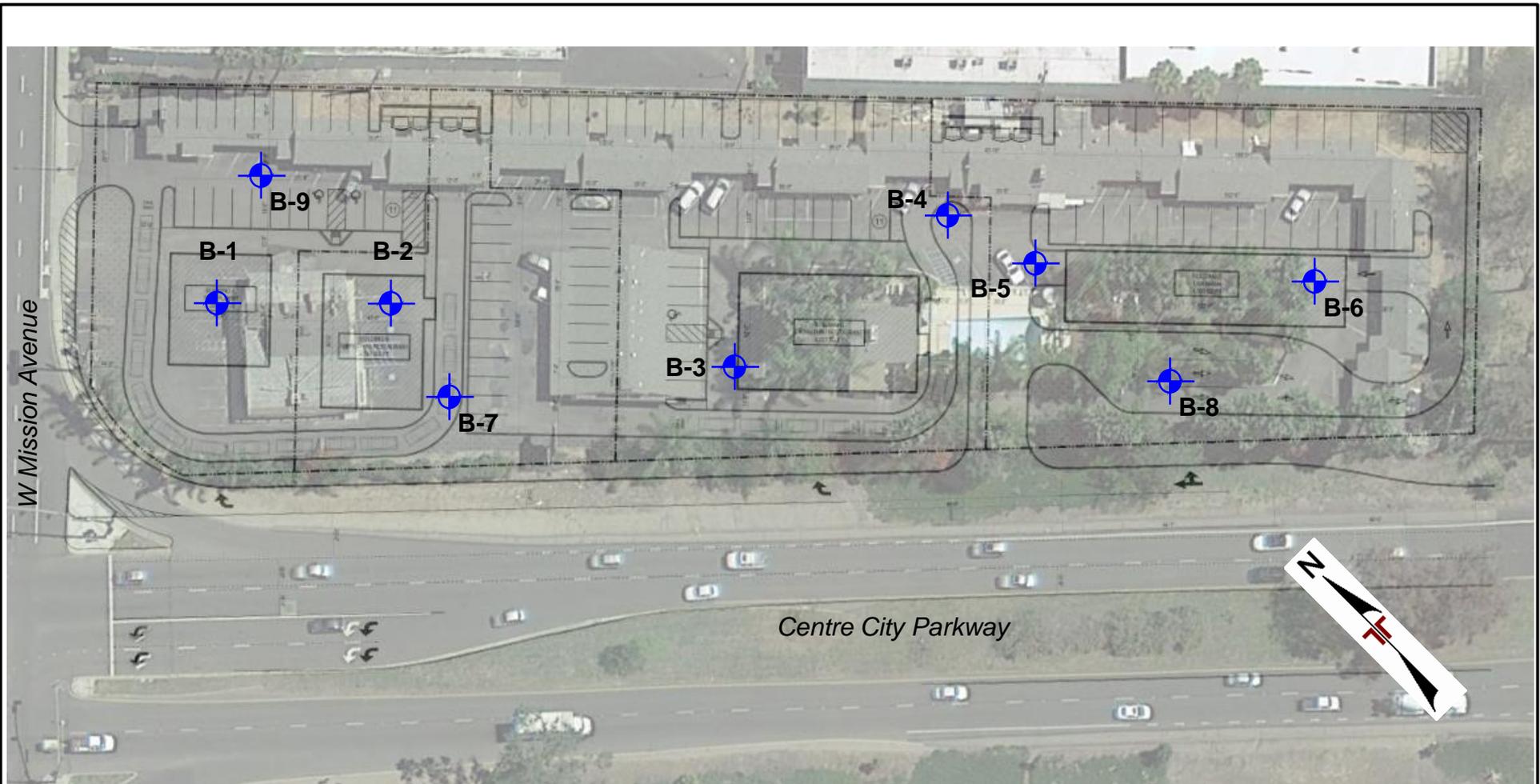
Project Manager:	SP
Drawn by:	SP
Checked by:	FH
Approved by:	FH
Project No.	60165245
Scale:	1"=2,000'
File Name:	A-1
Date:	12/9/2016



1421 Edinger Ave  
 Tustin, CA 92780-6287

<b>SITE LOCATION</b>
Proposed Development 425 W. Mission Avenue Escondido, CA

Exhibit
A-1



**LEGEND**

 **B-1** BORING APPROXIMATE LOCATION

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	SP	Project No.	60165245
Drawn by:	GA	Scale:	1 in ~ 70 ft.
Checked by:	SP	File Name:	A-2
Approved by:	Fh	Date:	12/13/2016

**Terracon**  
Consulting Engineers & Scientists

2817 McGaw Avenue Irvine, CA 92614  
PH. (949) 261-0051 FAX. (949) 261-6110

<b>BORING LOCATION DIAGRAM</b>
<b>Proposed Development</b> 425 W. Mission Avenue Escondido, California

Exhibit
<b>A-2</b>

## **Field Exploration Description**

A total of nine (9) test borings were drilled at the site on November 22 and 23, 2016. The borings were drilled to approximate depth ranging between 5 and 40¼ feet bgs at the approximate locations shown on the attached Boring Location Diagram, Exhibit A-2. Test borings were advanced with a truck-mounted B-61 drill rig utilizing 6-inch diameter hollow-stem augers. Three (3) of those borings were utilized for percolation testing.

Borings B-2 and B-6 encountered auger refusals at the depth of about 30 and 40 feet bgs, respectively.

The borings were located in the field by using the proposed site plan, an aerial photograph of the site, GPS handheld device and measuring from reference features. The accuracy of boring locations should only be assumed to the level implied by the method used.

Continuous lithologic logs of the borings were recorded by the field engineer during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon or ring-barrel samplers. Bulk samples of subsurface materials were also obtained. Groundwater conditions were evaluated in the borings at the time of site exploration.

Penetration resistance measurements were obtained by driving the split-spoon and ring-barrel samplers into the subsurface materials with a 140-pound automatic hammer falling 30 inches. The penetration resistance value is a useful index in estimating the consistency or relative density of materials encountered.

An automatic hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

# BORING LOG NO. B-1

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1283° Longitude: -117.091°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)				
0.3	<b>ASPHALT CONCRETE</b> , 4" thickness												
2.5	<b>CLAYEY SAND (SC)</b> , reddish-brown to dark brown					18						27-13-14	49
5	<b>SILTY SAND (SM)</b> , reddish-brown, loose			X	3-3-5				20	97	NP	43	
10	medium dense			X	7-17-26				15	118		44	
15				X	8-9-15				16	113			
20	<b>SANDY SILT (ML)</b> , grayish-brown, stiff			X	12-5-5 N=10								
25				X	7-9-14				22	105			
30	<b>SANDY SILT (ML)</b> , orange to gray, medium dense			X	4-6-8 N=14								
35	<b>SANDY SILT (ML)</b> , reddish-brown, stiff		▽	X									
40	<b>Boring Terminated at 20 Feet</b>												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**

▽ Groundwater encountered at 18 ft after drilling



Boring Started: 11/22/2016

Boring Completed: 11/22/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-2

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1281° Longitude: -117.0909°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)				
DEPTH													
	0.3 <b>ASPHALT CONCRETE</b> , 4" thickness <b>SANDY LEAN CLAY (CL)</b> , brown											23-14-9	54
	2.5 <b>CLAYEY SAND (SC)</b> , brown to reddish-brown, medium dense			X	5-8-13				15	109			
	5 <b>CLAYEY SAND (SC)</b> , brown to reddish-brown, medium dense			X	4-5-6 N=11								
	7.5 <b>SILTY CLAYEY SAND (SC-SM)</b> , brown, loose			X	3-5-6				14	112			
	10.0 <b>SANDY LEAN CLAY (CL)</b> , grayish-brown, stiff			X	3-4-5 N=9								
	15 <b>SANDY LEAN CLAY (CL)</b> , grayish-brown, stiff		▽	X	5-5-7 N=12								51
	20 <b>SANDY LEAN CLAY (CL)</b> , grayish-brown, stiff  very stiff			X	6-9-11 N=20								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

See Appendix C for explanation of symbols and abbreviations.

**WATER LEVEL OBSERVATIONS**

▽ Groundwater encountered at 14 ft after drilling



Boring Started: 11/23/2016

Boring Completed: 11/23/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-5

# BORING LOG NO. B-2

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1281° Longitude: -117.0909°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)				
24.0	<b>SANDY LEAN CLAY (CL)</b> , grayish-brown, very stiff <i>(continued)</i>												
30.3	<b>SILTY SAND (SM)</b> , trace clay, greenish-brown very dense	25		X	44-50/3"								
30.3	<b>Auger Refusal at 30.3 Feet</b>	30		X	50/3"								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**

Groundwater encountered at 14 ft after drilling



Boring Started: 11/23/2016

Boring Completed: 11/23/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-3

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1277° Longitude: -117.0908°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)			LL-PL-PI		
0.3	<b>ASPHALT CONCRETE</b> , 3" thickness													
0.8	<b>FILL - POORLY GRADED SAND (SP)</b> , 6" thickness					34						29-13-16	67	
2.5	<b>SANDY LEAN CLAY (CL)</b> , reddish-brown, micaceous													
	<b>LEAN CLAY WITH SAND (CL)</b> , dark brown, medium stiff			X	2-2-6				16	95		27-17-10	74	
	stiff	5		X	3-5-6				29	86				
	reddish-brown			X	4-5-6 N=11									
				X	5-7-10				21	105				
			▽											
15.0	<b>SILTY CLAYEY SAND (SC-SM)</b> , gray, medium dense			X	5-3-7 N=10							26-21-5	35	
				X	10-22-29				18	103				
	<b>Boring Terminated at 20 Feet</b>	20												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**

▽ Groundwater encountered at 13 ft  
30 min after drilling



Boring Started: 11/22/2016

Boring Completed: 11/22/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-4

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1275° Longitude: -117.0905°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)			LL-PL-PI		
DEPTH														
0.3	<b>ASPHALT CONCRETE</b> , 3" thickness													
0.5	<b>FILL - POORLY GRADED SAND (SP)</b> , reddish-brown, 3" thickness <b>SANDY LEAN CLAY (CL)</b> , reddish-brown											25-12-13	53	
2.5	<b>CLAYEY SAND (SC)</b> , reddish-brown, loose				2-2-6				13	112				
	medium dense	5			8-13-19				12	112	23-15-8	49		
					7-11-12 N=23									
10.0	<b>SANDY LEAN CLAY (CL)</b> , brown to reddish-brown, very stiff		▽		4-7-14				21	107				
15.0	<b>LEAN CLAY WITH SAND (CL)</b> , grayish-brown, very stiff				3-5-15 N=20									
	hard				11-17-50				8	118				
20.0	<b>Boring Terminated at 20 Feet</b>													

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**

▽ Groundwater encountered at 12 ft,  
20 min after drilling



Boring Started: 11/22/2016

Boring Completed: 11/22/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-5

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1274° Longitude: -117.0905°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)				
DEPTH													
0.3	<b>ASPHALT CONCRETE</b> , 3" thickness												
0.4	<b>FILL - POORLY GRADED SAND (SP)</b> , 2" thickness <b>SANDY LEAN CLAY (CL)</b> , reddish-brown to dark brown stiff, encountered roots and organic contents					7					21-13-8	54	
				X	5-7-11				5	98			
	5			X	5-11-35				13	110			
	reddish-brown, stiff			X	6-6-7 N=13								
	10			X	5-9-13				28	93		71	
	stiff			X	3-4-6 N=10								
	15			X	16-15-12				19	103			
	gray to tan, very stiff			X									
20.0	<b>Boring Terminated at 20 Feet</b>	20											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**  
*Groundwater not encountered*



Boring Started: 11/22/2016

Boring Completed: 11/22/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-6

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1271° Longitude: -117.0904°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)				
0.3	<b>ASPHALT CONCRETE</b> , 4" thickness												
0.6	<b>FILL - POORLY GRADED SAND (SP)</b> , 3" thickness <b>SANDY SILTY CLAY (CL-ML)</b> , reddish-brown											50	
	very stiff			X	8-11-24				7	116			
	hard	5		X	27-50/6"				8	110			
10.0	<b>CLAYEY SAND (SC)</b> , brown to reddish-brown, medium dense			X	5-7-10 N=17						26-17-9	31	
15.0	<b>SILTY SAND (SM)</b> , trace clay, grayish-brown, medium dense		▽	X	10-10-18 N=28							13	
20.0	<b>CLAYEY SAND (SC)</b> , trace gravel, brown to tan, very dense			X	6-13-44 N=57								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**

▽ Groundwater encountered at 15 ft after drilling



Boring Started: 11/23/2016

Boring Completed: 11/23/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-6

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1271° Longitude: -117.0904°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS		PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)			LL-PL-PI	PERCENT FINES	
	<b>CLAYEY SAND (SC)</b> , trace gravel, brown to tan, very dense <i>(continued)</i>	25.0												
	<b>POORLY GRADED SAND WITH SILT (SP-SM)</b> , gray to black, very dense, micaceous	30.0		X	33-50/4"									
	<b>SILTY SAND (SM)</b> , trace clay, gray, very dense	35.0		X	50/5"									
		40.3		X	50/3"									
<b>Boring Terminated at 40.3 Feet</b>														

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**

Groundwater encountered at 15 ft after drilling



Boring Started: 11/23/2016

Boring Completed: 11/23/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-7

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.128° Longitude: -117.091°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)			LL-PL-PI	
DEPTH													
	0.3 <b>ASPHALT CONCRETE</b> , 4" thickness <b>SANDY SILTY CLAY (CL-ML)</b> , reddish-brown											20-16-4	52
	5.0 <b>Boring Terminated at 5 Feet</b>	5											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**

*Groundwater not encountered*



Boring Started: 11/22/2016

Boring Completed: 11/22/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-8

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1272° Longitude: -117.0906°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)			LL-PL-PI	
DEPTH													
	0.3 <b>ASPHALT CONCRETE</b> , 4" thickness <b>SANDY SILTY CLAY (CL-ML)</b> , reddish-brown												51
	5.0 <b>Boring Terminated at 5 Feet</b>	5											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).  
See Appendix C for explanation of symbols and abbreviations.

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

**WATER LEVEL OBSERVATIONS**  
*Groundwater not encountered*



Boring Started: 11/22/2016

Boring Completed: 11/22/2016

Drill Rig: B-61

Driller: Cal Pac

Project No.: 60165245

Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

# BORING LOG NO. B-9

**PROJECT:** Proposed Development

**CLIENT:** NLA Acquisitions LLC  
Franklin, TN

**SITE:** 425 W Mission Avenue  
Escondido, CA

GRAPHIC LOG	LOCATION See Exhibit A-2 Latitude: 33.1283° Longitude: -117.0908°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	EXPANSION INDEX	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
							TEST TYPE	COMPRESSIVE STRENGTH (psf)	STRAIN (%)				
DEPTH													
0.3	<b>ASPHALT CONCRETE</b> , 4" thickness												
5.0	<b>SANDY SILTY CLAY (CL-ML)</b> , reddish-brown	5											
10.0	<b>SILTY SAND (SM)</b> , reddish-brown	10											
	<b>Boring Terminated at 10 Feet</b>												

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic SPT Hammer

Advancement Method:  
Hollow Stem Auger

See Exhibit A-3 for description of field procedures.  
See Appendix B for description of laboratory procedures and additional data (if any).

Notes:

Abandonment Method:  
Boring backfilled with soil cuttings upon completion and capped with asphalt patch.

See Appendix C for explanation of symbols and abbreviations.

<b>WATER LEVEL OBSERVATIONS</b>
<i>Groundwater not encountered</i>



Boring Started: 11/22/2016	Boring Completed: 11/22/2016
Drill Rig: B-61	Driller: Cal Pac
Project No.: 60165245	Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL\_60165245 BORING LOGS.GPJ TERRACON2015.GDT 12/13/16

**APPENDIX B**  
**LABORATORY TESTING**

## Geotechnical Engineering Report

Proposed Development ■ Escondido, California

December 14, 2016 ■ Terracon Project No. 60165245



### Laboratory Testing

Samples retrieved during the field exploration were taken to the laboratory for further observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System (USCS) described in Appendix C. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials.

Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

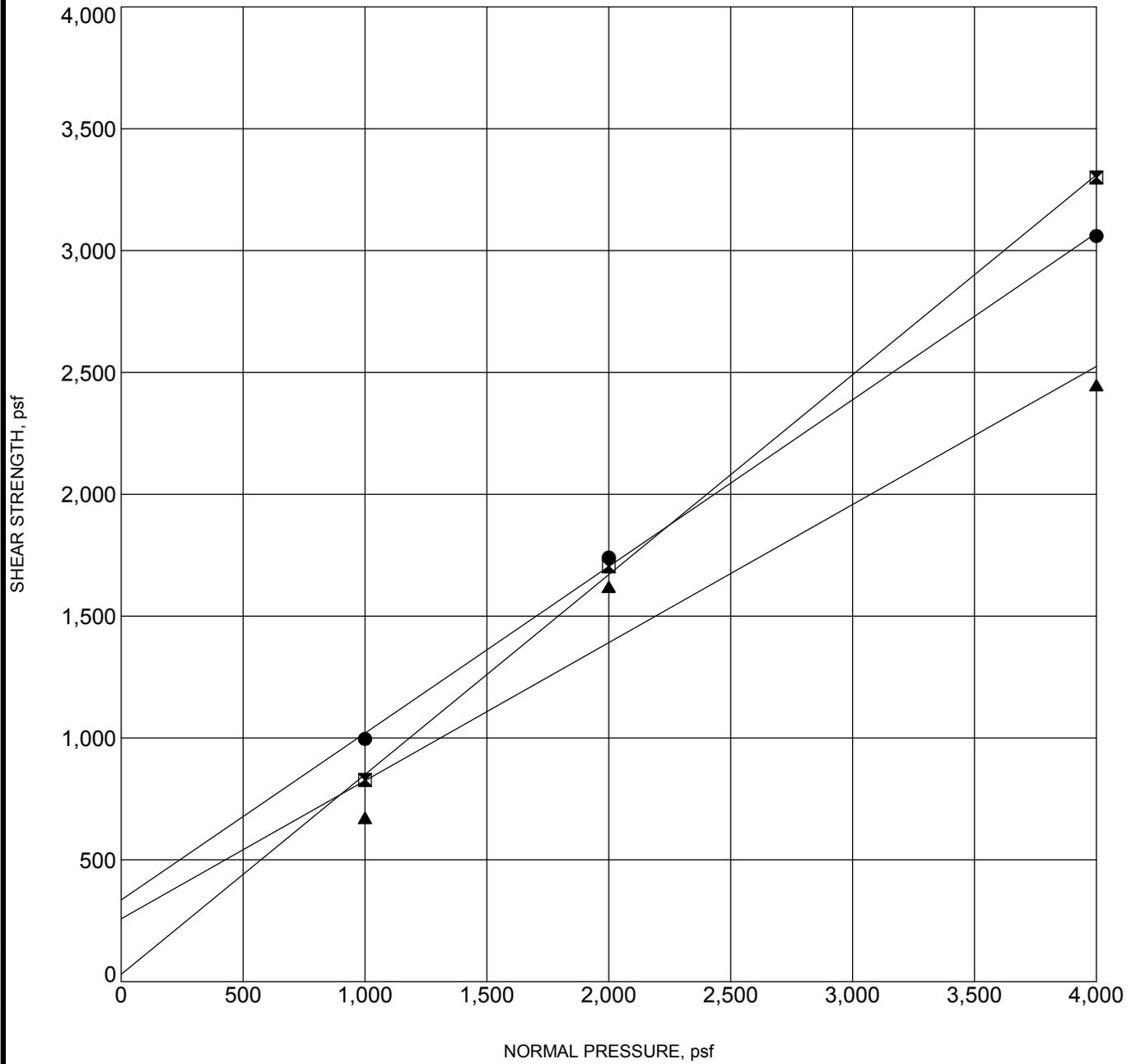
Selected soil samples obtained from the site were tested for the following engineering properties:

- ASTM D7263 Dry Density
- CT422 Chloride Content
- CT643 pH
- ASTM C136 Percent Passing #200 Sieve
- ASTM D4546 Collapse/Swell Potential
- ASTM D2216 Moisture Content
- CT417 Soluble Sulfates
- CT643 Minimum Resistivity
- ASTM D4318 Atterberg Limits
- ASTM D3080 Direct Shear

Procedural standards noted above are for reference to methodology in general. In some cases variations to methods are applied as a result of local practice or professional judgment.



## DIRECT SHEAR TEST ASTM D3080



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %	c, psf	$\phi^\circ$
● B-2      7.5ft	<b>SILTY CLAYEY SAND</b>	<b>112</b>	<b>14</b>	<b>336</b>	<b>34</b>
■ B-4      2.5ft	<b>CLAYEY SAND</b>	<b>112</b>	<b>13</b>	<b>30</b>	<b>39</b>
▲ B-6      2.5ft	<b>SILTY SAND</b>	<b>116</b>	<b>7</b>	<b>258</b>	<b>30</b>

PROJECT: Proposed Development

SITE: 425 W Mission Avenue  
Escondido, CA



PROJECT NUMBER: 60165245

CLIENT: NLA Acquisitions LLC  
Franklin, TN

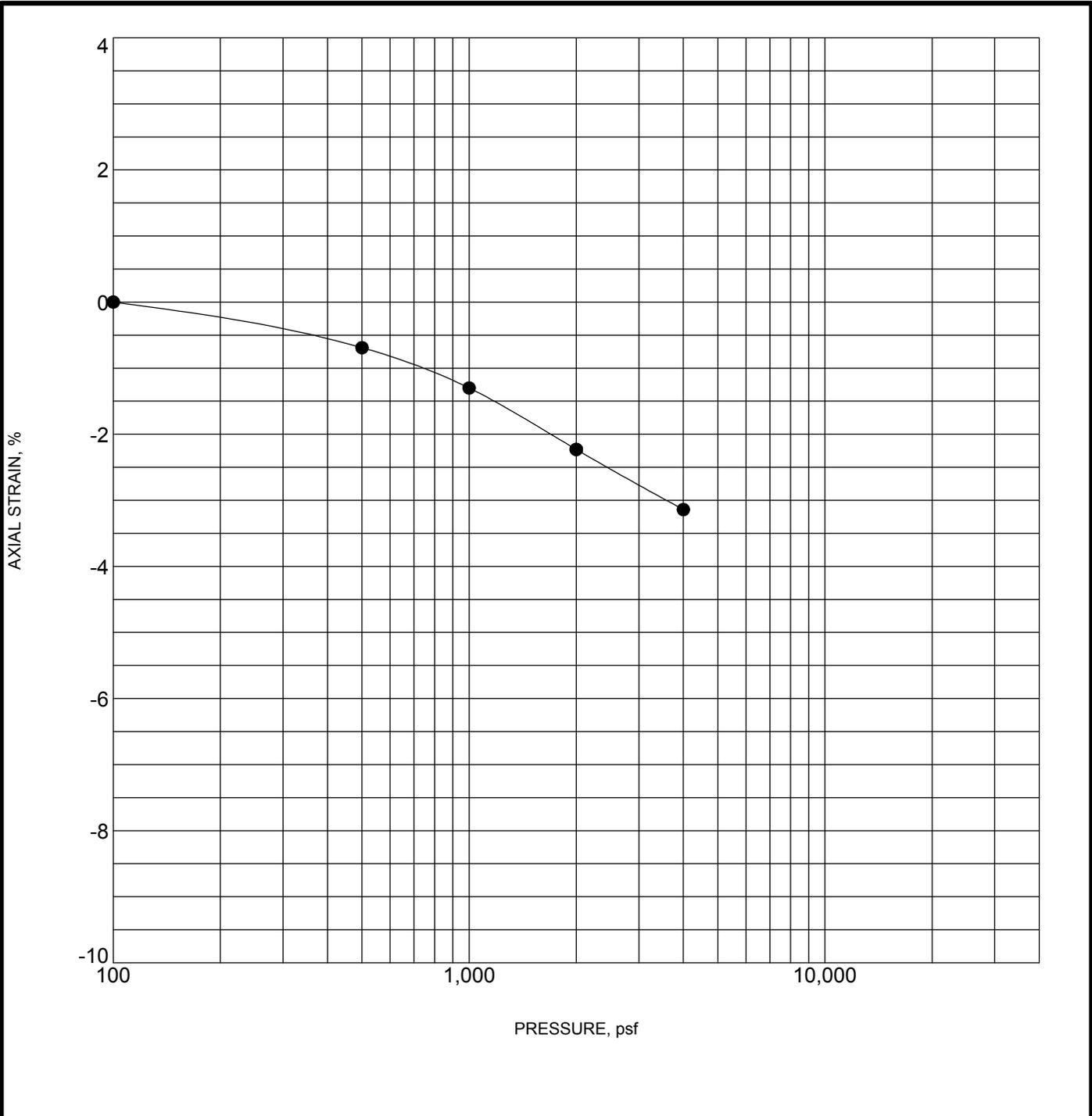
EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_DIRECT\_SHEAR\_60165245 BORING LOGS.GPJ TERRACON2012.GDT 12/13/16

# SWELL CONSOLIDATION TEST

ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS\_60165245 BORING LOGS.GPJ TERRACON\_DATA\TEMPLATE.GDT\_12/13/16



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-2      2.5 ft	CLAYEY SAND	109	15

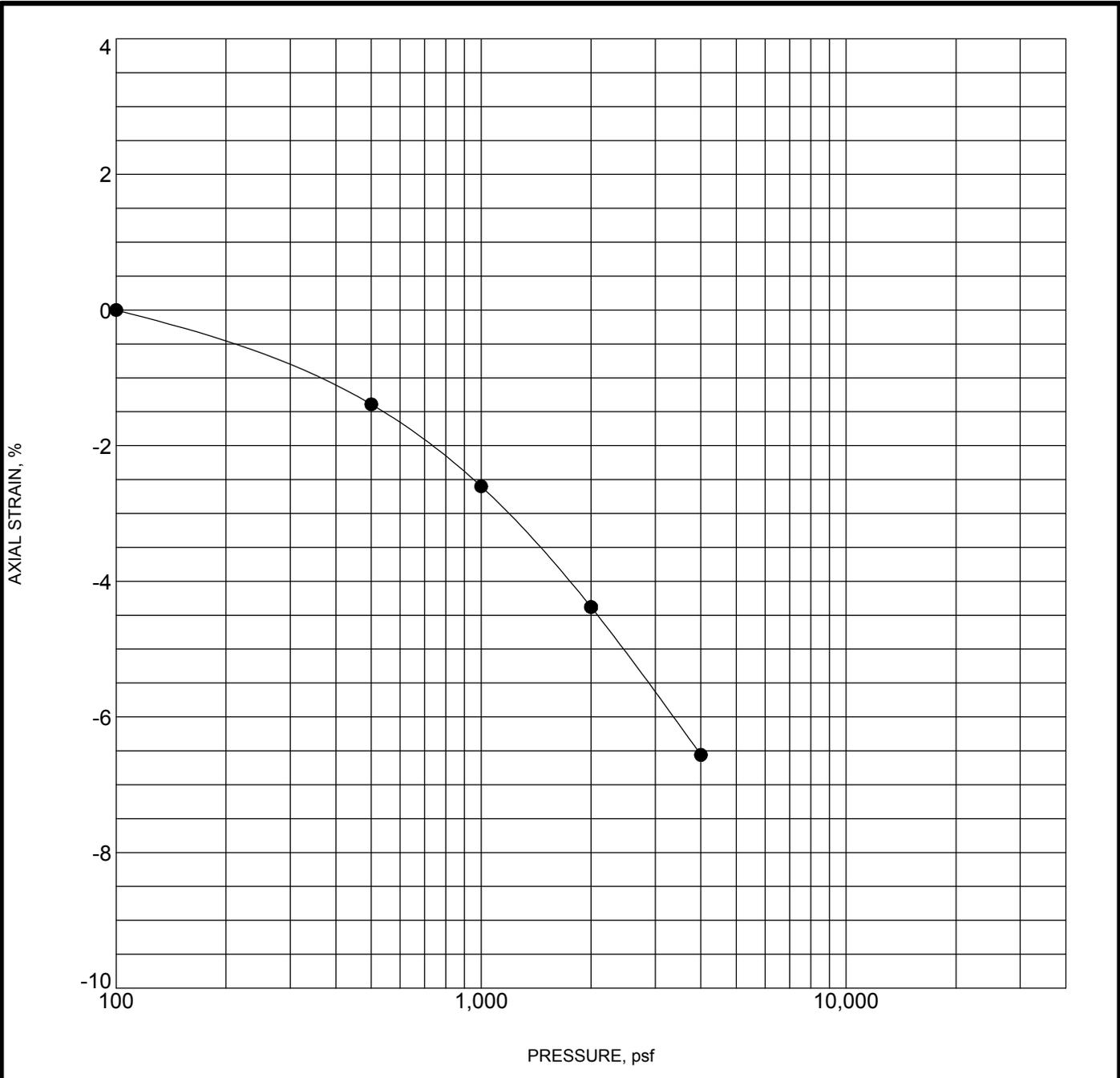
NOTES: Water added at 2000 psf

PROJECT: Proposed Development	<p style="margin: 0;">1421 Edinger Ave Tustin, CA</p>	PROJECT NUMBER: 60165245
SITE: 425 W Mission Avenue Escondido, CA		CLIENT: NLA Acquisitions LLC Franklin, TN
		EXHIBIT: B-4

# SWELL CONSOLIDATION TEST

ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS 60165245 BORING LOGS.GPJ TERRACON\_DATA\TEMPLATE.GDT 12/13/16



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-3      5.0 ft	LEAN CLAY WITH SAND	86	29

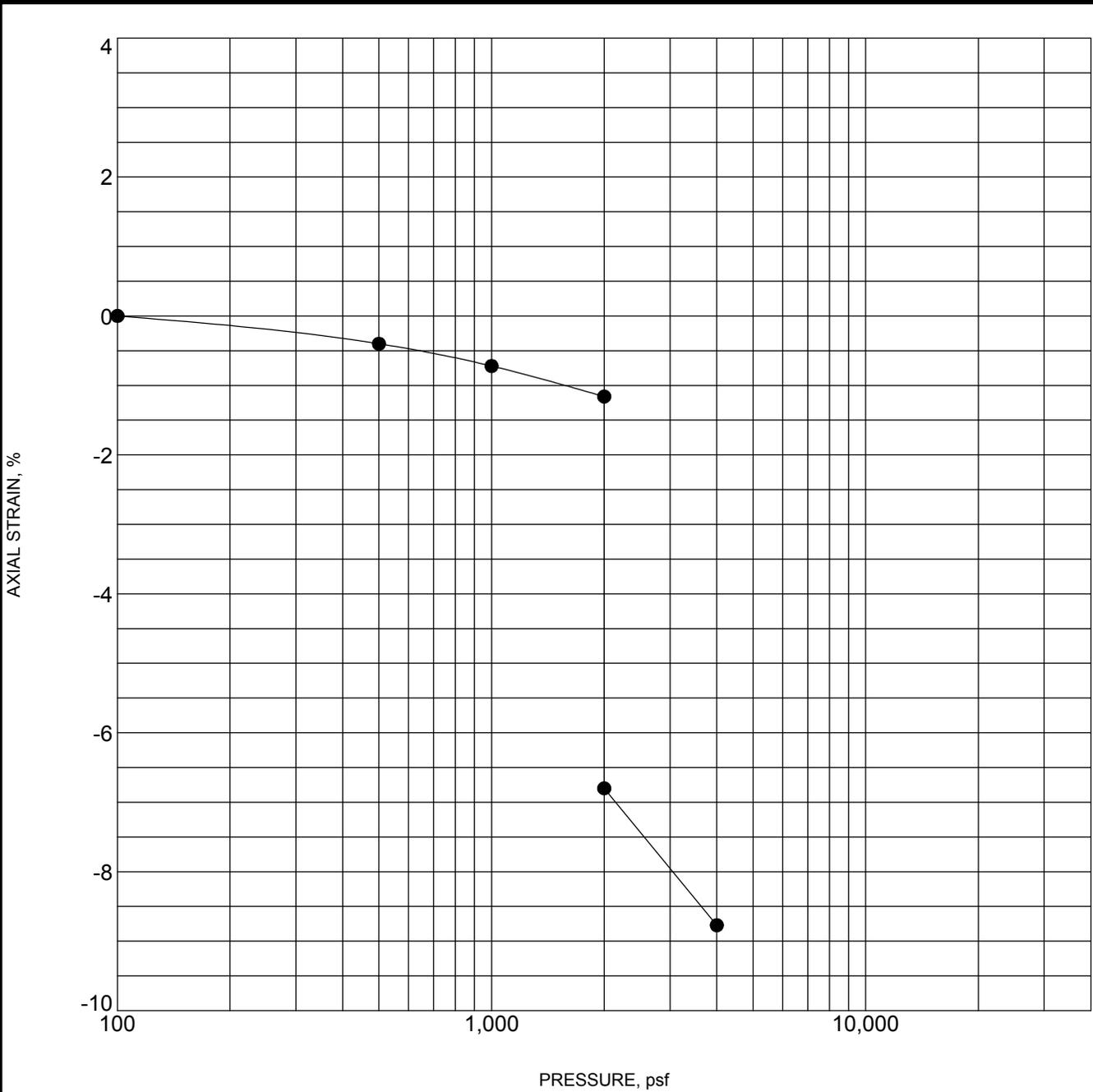
NOTES: Water added at 2000 psf

PROJECT: Proposed Development	<p style="margin: 0;">1421 Edinger Ave Tustin, CA</p>	PROJECT NUMBER: 60165245
SITE: 425 W Mission Avenue Escondido, CA		CLIENT: NLA Acquisitions LLC Franklin, TN
		EXHIBIT: B-5

# SWELL CONSOLIDATION TEST

ASTM D4546

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC\_CONSOL\_STRAIN-USCS\_60165245 BORING LOGS.GPJ TERRACON\_DATA\TEMPLATE.GDT\_12/14/16



Specimen Identification	Classification	$\gamma_d$ , pcf	WC, %
● B-5      2.5 ft	SANDY LEAN CLAY	98	5

NOTES: Water added at 2000 psf

PROJECT: Proposed Development	<p style="margin: 0;">1421 Edinger Ave Tustin, CA</p>	PROJECT NUMBER: 60165245
SITE: 425 W Mission Avenue Escondido, CA		CLIENT: NLA Acquisitions LLC Franklin, TN
		EXHIBIT: B-6

# CHEMICAL LABORATORY TEST REPORT

Project Number: 60165245

Service Date: 12/12/16

Report Date: 12/12/16

Task:

# Terracon

750 Pilot Road, Suite F  
Las Vegas, Nevada 89119  
(702) 597-9393

---

**Client****Project**

NLA: Proposed Development - Escondido

**Sample Submitted By:** Terracon (60)**Date Received:** 12/7/2016**Lab No.:** 16-1085

## *Results of Corrosion Analysis*

<i>Sample Number</i>		
<i>Sample Location</i>	B-2	B-4
<i>Sample Depth (ft.)</i>	0.0	0.0
pH Analysis, AWWA 4500 H	8.55	8.16
Water Soluble Sulfate (SO <sub>4</sub> ), AWWA 4500 E (percent %)	0.02	0.01
Sulfides, AWWA 4500-S D, (mg/kg)	Nil	Nil
Red-Ox, AWWA 2580, (mV)	+650	+637
Total Salts, AWWA 2510, (mg/kg)	1820	560
Chlorides, AWWA 4500 Cl B, (mg/kg)	288	75
Resistivity, ASTM G-57, (ohm-cm)	931	1358

---

**Analyzed By:**

Kurt D. Ergun  
Chemist

The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

**EXHIBIT B-7**

**APPENDIX C**  
**SUPPORTING DOCUMENTS**

# GENERAL NOTES

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

<b>SAMPLING</b>				<b>WATER LEVEL</b>		Water Initially Encountered	<b>FIELD TESTS</b>	(HP) Hand Penetrometer
						Water Level After a Specified Period of Time		(T) Torvane
						Water Level After a Specified Period of Time		(b/f) Standard Penetration Test (blows per foot)
	Auger	Shelby Tube	Split Spoon					(OVA) Organic Vapor Analyzer
	Rock Core	Macro Core	Modified California Ring Sampler		Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.			(WOH) Weight of Hammer
	Grab Sample	No Recovery	Modified Dames & Moore Ring Sampler					

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

## LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

<b>STRENGTH TERMS</b>	<b>RELATIVE DENSITY OF COARSE-GRAINED SOILS</b> (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels and sands.			<b>CONSISTENCY OF FINE-GRAINED SOILS</b> (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance Includes silts and clays.			
	Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-Value Blows/Ft.	Ring Sampler Blows/Ft.
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3	
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4	
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9	
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18	
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42	
			Hard	> 8,000	> 30	> 42	

## RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

## GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

## RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

## PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

# UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification			
				Group Symbol	Group Name <sup>B</sup>		
<b>Coarse Grained Soils:</b> More than 50% retained on No. 200 sieve	<b>Gravels:</b> More than 50% of coarse fraction retained on No. 4 sieve	<b>Clean Gravels:</b> Less than 5% fines <sup>C</sup>	$Cu \geq 4$ and $1 \leq Cc \leq 3$ <sup>E</sup>	GW	Well-graded gravel <sup>F</sup>		
			$Cu < 4$ and/or $1 > Cc > 3$ <sup>E</sup>	GP	Poorly graded gravel <sup>F</sup>		
		<b>Gravels with Fines:</b> More than 12% fines <sup>C</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>F,G,H</sup>		
			Fines classify as CL or CH	GC	Clayey gravel <sup>F,G,H</sup>		
	<b>Sands:</b> 50% or more of coarse fraction passes No. 4 sieve	<b>Clean Sands:</b> Less than 5% fines <sup>D</sup>	$Cu \geq 6$ and $1 \leq Cc \leq 3$ <sup>E</sup>	SW	Well-graded sand <sup>I</sup>		
			$Cu < 6$ and/or $1 > Cc > 3$ <sup>E</sup>	SP	Poorly graded sand <sup>I</sup>		
		<b>Sands with Fines:</b> More than 12% fines <sup>D</sup>	Fines classify as ML or MH	SM	Silty sand <sup>G,H,I</sup>		
			Fines classify as CL or CH	SC	Clayey sand <sup>G,H,I</sup>		
<b>Fine-Grained Soils:</b> 50% or more passes the No. 200 sieve	<b>Silts and Clays:</b> Liquid limit less than 50	<b>Inorganic:</b>	$PI > 7$ and plots on or above "A" line <sup>J</sup>	CL	Lean clay <sup>K,L,M</sup>		
			$PI < 4$ or plots below "A" line <sup>J</sup>	ML	Silt <sup>K,L,M</sup>		
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OL	Organic clay <sup>K,L,M,N</sup>	
			Liquid limit - not dried		OH	Organic silt <sup>K,L,M,O</sup>	
	<b>Silts and Clays:</b> Liquid limit 50 or more	<b>Inorganic:</b>	PI plots on or above "A" line	CH	Fat clay <sup>K,L,M</sup>		
			PI plots below "A" line	MH	Elastic Silt <sup>K,L,M</sup>		
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OH	Organic clay <sup>K,L,M,P</sup>	
			Liquid limit - not dried		OH	Organic silt <sup>K,L,M,Q</sup>	
			Primarily organic matter, dark in color, and organic odor		PT	Peat	
			Highly organic soils:				

<sup>A</sup> Based on the material passing the 3-inch (75-mm) sieve

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup> Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

<sup>D</sup> Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>F</sup> If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup> If fines are organic, add "with organic fines" to group name.

<sup>I</sup> If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>K</sup> If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>L</sup> If soil contains  $\geq 30\%$  plus No. 200 predominantly sand, add "sandy" to group name.

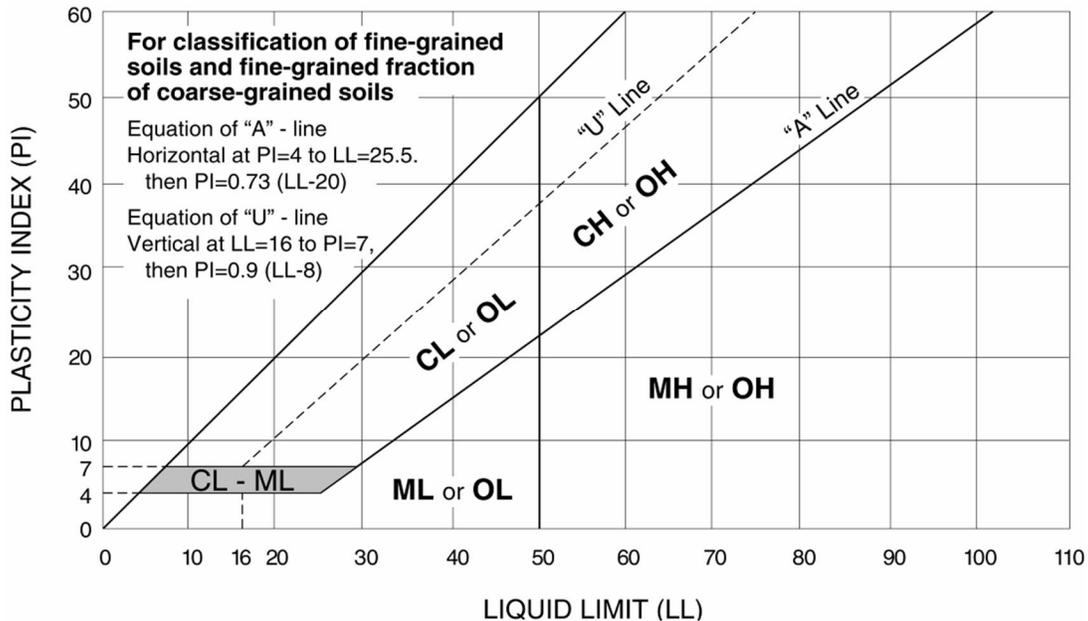
<sup>M</sup> If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup>  $PI \geq 4$  and plots on or above "A" line.

<sup>O</sup>  $PI < 4$  or plots below "A" line.

<sup>P</sup> PI plots on or above "A" line.

<sup>Q</sup> PI plots below "A" line.




**Design Maps Detailed Report**

ASCE 7-10 Standard (33.1281°N, 117.0909°W)

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

**Section 11.4.1 — Mapped Acceleration Parameters**

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

From [Figure 22-1](#) <sup>[1]</sup>

$S_s = 1.030 \text{ g}$

From [Figure 22-2](#) <sup>[2]</sup>

$S_1 = 0.399 \text{ g}$

**Section 11.4.2 — Site Class**

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

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
Any profile with more than 10 ft of soil having the characteristics:			
<ul style="list-style-type: none"> <li>• Plasticity index <math>PI &gt; 20</math>,</li> <li>• Moisture content <math>w \geq 40\%</math>, and</li> <li>• Undrained shear strength <math>\bar{s}_u &lt; 500</math> psf</li> </ul>			
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft<sup>2</sup> = 0.0479 kN/m<sup>2</sup>

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

Table 11.4-1: Site Coefficient  $F_a$ 

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

Note: Use straight-line interpolation for intermediate values of  $S_s$

**For Site Class = D and  $S_s = 1.030$  g,  $F_a = 1.088$**

Table 11.4-2: Site Coefficient  $F_v$ 

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

Note: Use straight-line interpolation for intermediate values of  $S_1$

**For Site Class = D and  $S_1 = 0.399$  g,  $F_v = 1.601$**

**Equation (11.4-1):**

$$S_{MS} = F_a S_S = 1.088 \times 1.030 = 1.121 \text{ g}$$

**Equation (11.4-2):**

$$S_{M1} = F_v S_1 = 1.601 \times 0.399 = 0.640 \text{ g}$$

### Section 11.4.4 — Design Spectral Acceleration Parameters

**Equation (11.4-3):**

$$S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.121 = 0.747 \text{ g}$$

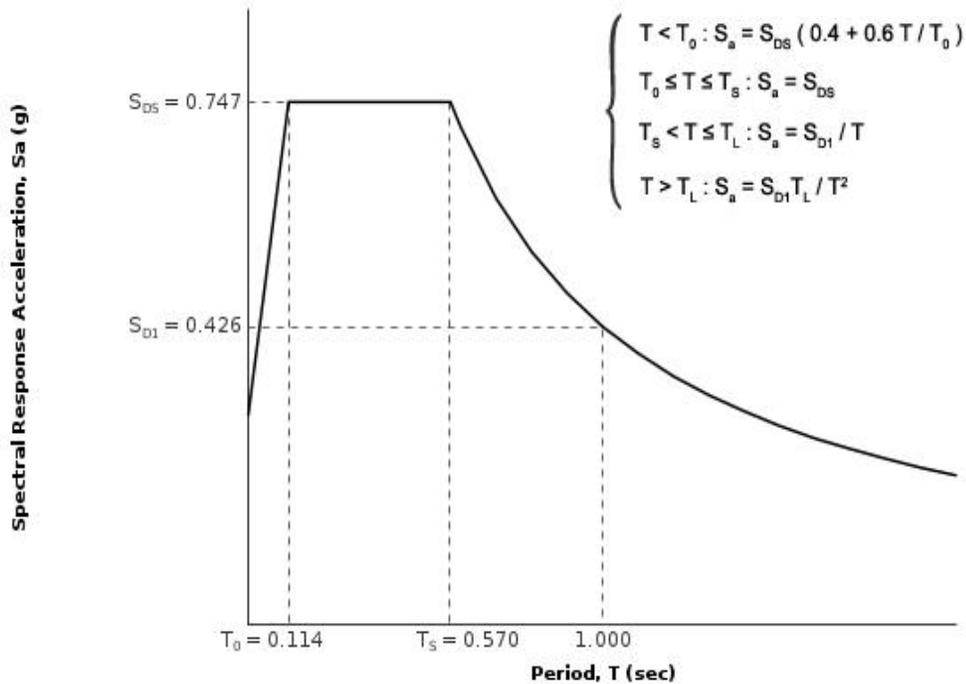
**Equation (11.4-4):**

$$S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.640 = 0.426 \text{ g}$$

### Section 11.4.5 — Design Response Spectrum

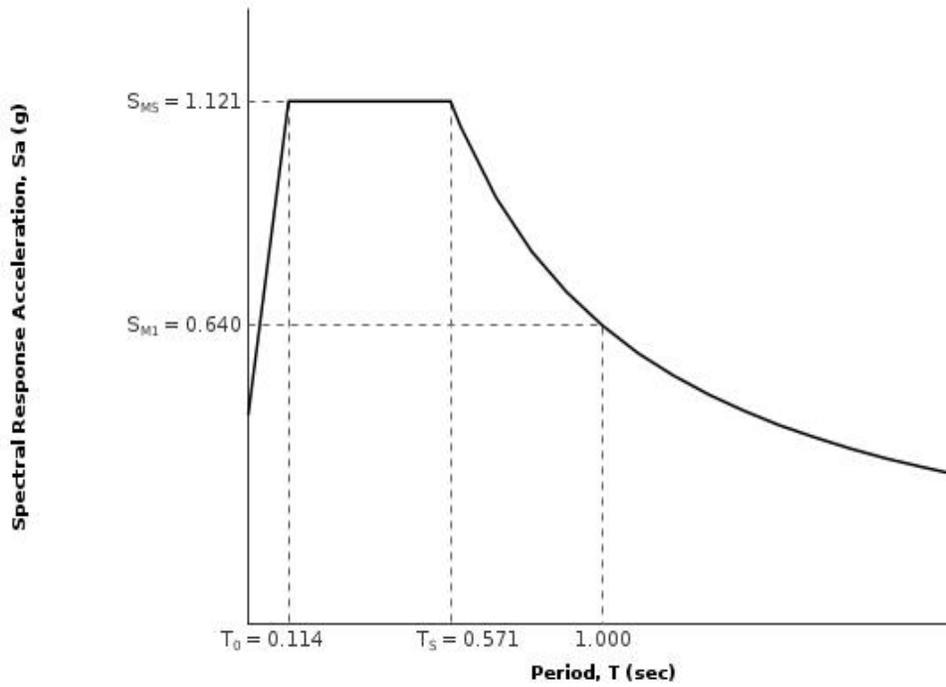
From [Figure 22-12](#) <sup>[3]</sup> $T_L = 8$  seconds

Figure 11.4-1: Design Response Spectrum



### Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE<sub>R</sub>) Response Spectrum

The MCE<sub>R</sub> Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



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

From [Figure 22-7](#) <sup>[4]</sup>

$$PGA = 0.385$$

**Equation (11.8-1):**

$$PGA_M = F_{PGA} PGA = 1.115 \times 0.385 = 0.43 \text{ g}$$

Table 11.8-1: Site Coefficient  $F_{PGA}$

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

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

**For Site Class = D and PGA = 0.385 g,  $F_{PGA} = 1.115$**

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

From [Figure 22-17](#) <sup>[5]</sup>

$$C_{RS} = 1.031$$

From [Figure 22-18](#) <sup>[6]</sup>

$$C_{R1} = 1.071$$

## Section 11.6 – Seismic Design Category

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

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

For Risk Category = I and  $S_{DS} = 0.747 g$ , Seismic Design Category = D

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

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

For Risk Category = I and  $S_{D1} = 0.426 g$ , Seismic Design Category = D

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

Seismic Design Category  $\equiv$  "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

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

### References

1. Figure 22-1: [http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010\\_ASCE-7\\_Figure\\_22-1.pdf](http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf)
2. Figure 22-2: [http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010\\_ASCE-7\\_Figure\\_22-2.pdf](http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf)
3. Figure 22-12: [http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010\\_ASCE-7\\_Figure\\_22-12.pdf](http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf)
4. Figure 22-7: [http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010\\_ASCE-7\\_Figure\\_22-7.pdf](http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf)
5. Figure 22-17: [http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010\\_ASCE-7\\_Figure\\_22-17.pdf](http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf)
6. Figure 22-18: [http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010\\_ASCE-7\\_Figure\\_22-18.pdf](http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf)

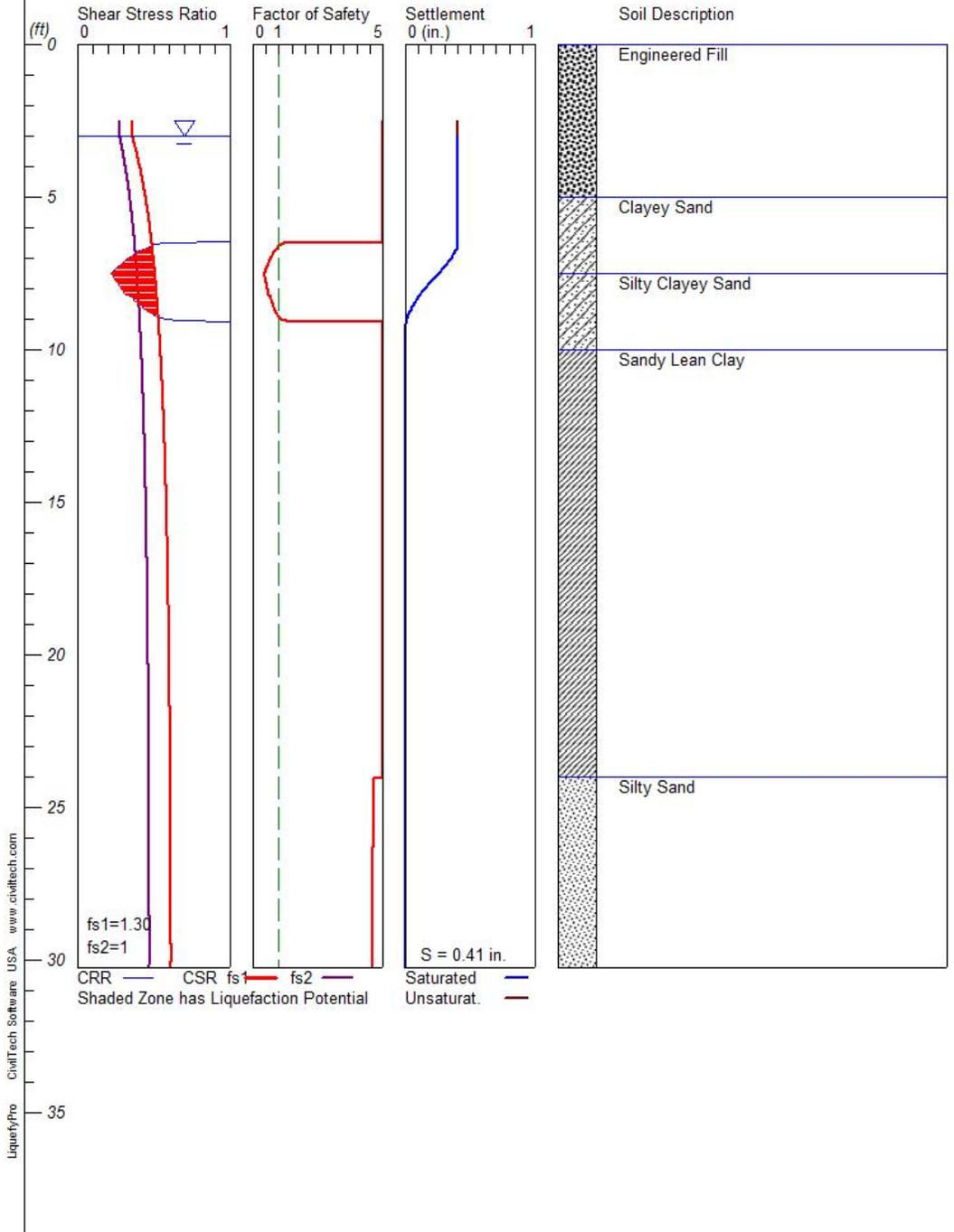
**APPENDIX D**  
**LIQUEFACTION ANALYSIS**

# LIQUEFACTION ANALYSIS

## Escondido Development

**Hole No.=B-2    Water Depth=3 ft**

**Magnitude=6.55  
Acceleration=0.43g**



LiquefyPro CivilTech Software USA www.civiltech.com

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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: N:\Projects\2016\60165245\Working  
Files\Calculations-Analyses\B2.Liq  
Title: Escondido Development  
Subtitle: 60165245

Surface Elev. =  
Hole No. =B-2  
Depth of Hole= 30.25 ft  
Water Table during Earthquake= 3.00 ft  
Water Table during In-Situ Testing= 14.00 ft  
Max. Acceleration= 0.43 g  
Earthquake Magnitude= 6.55

Input Data:

Surface Elev. =  
Hole No. =B-2  
Depth of Hole=30.25 ft  
Water Table during Earthquake= 3.00 ft  
Water Table during In-Situ Testing= 14.00 ft  
Max. Acceleration=0.43 g  
Earthquake Magnitude=6.55  
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction\*
5. Settlement Calculation in: All zones\*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1.05
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.3  
Plot two CSR (fs1=User, fs2=1)
10. Use Curve Smoothing: Yes\*

\* Recommended Options

B2. sum

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
2.50	25.00	125.00	20.00
5.00	25.00	125.00	20.00
7.50	6.00	125.00	20.00
10.00	9.00	125.00	NoLi q
15.00	12.00	125.00	NoLi q
20.00	20.00	125.00	NoLi q
25.00	100.00	125.00	20.00
30.00	100.00	125.00	20.00

Output Results:

Settlement of Saturated Sands=0.41 in.  
 Settlement of Unsaturated Sands=0.00 in.  
 Total Settlement of Saturated and Unsaturated Sands=0.41 in.  
 Differential Settlement=0.203 to 0.268 in.

Depth ft	CRRm	CSRfs	F. S.	S_sat. in.	S_dry in.	S_all in.
2.50	2.83	0.36	5.00	0.41	0.00	0.41
3.50	2.83	0.39	5.00	0.41	0.00	0.41
4.50	2.83	0.43	5.00	0.41	0.00	0.41
5.50	2.83	0.46	5.00	0.41	0.00	0.41
6.50	0.57	0.49	1.17	0.40	0.00	0.40
7.50	0.22	0.51	0.43*	0.25	0.00	0.25
8.50	0.40	0.52	0.76*	0.06	0.00	0.06
9.50	2.83	0.54	5.00	0.00	0.00	0.00
10.50	2.00	0.55	5.00	0.00	0.00	0.00
11.50	2.00	0.56	5.00	0.00	0.00	0.00
12.50	2.00	0.57	5.00	0.00	0.00	0.00
13.50	2.00	0.57	5.00	0.00	0.00	0.00
14.50	2.00	0.58	5.00	0.00	0.00	0.00
15.50	2.00	0.58	5.00	0.00	0.00	0.00
16.50	2.00	0.59	5.00	0.00	0.00	0.00
17.50	2.00	0.59	5.00	0.00	0.00	0.00
18.50	2.00	0.60	5.00	0.00	0.00	0.00
19.50	2.00	0.60	5.00	0.00	0.00	0.00
20.50	2.00	0.60	5.00	0.00	0.00	0.00
21.50	2.00	0.60	5.00	0.00	0.00	0.00
22.50	2.00	0.61	5.00	0.00	0.00	0.00
23.50	2.00	0.61	5.00	0.00	0.00	0.00
24.50	2.83	0.61	4.65	0.00	0.00	0.00
25.50	2.83	0.61	4.64	0.00	0.00	0.00
26.50	2.83	0.61	4.63	0.00	0.00	0.00

				B2. sum		
27.50	2.83	0.61	4.63	0.00	0.00	0.00
28.50	2.83	0.61	4.62	0.00	0.00	0.00
29.50	2.83	0.61	4.62	0.00	0.00	0.00

---

\* F. S. <1, Liquefaction Potential Zone  
(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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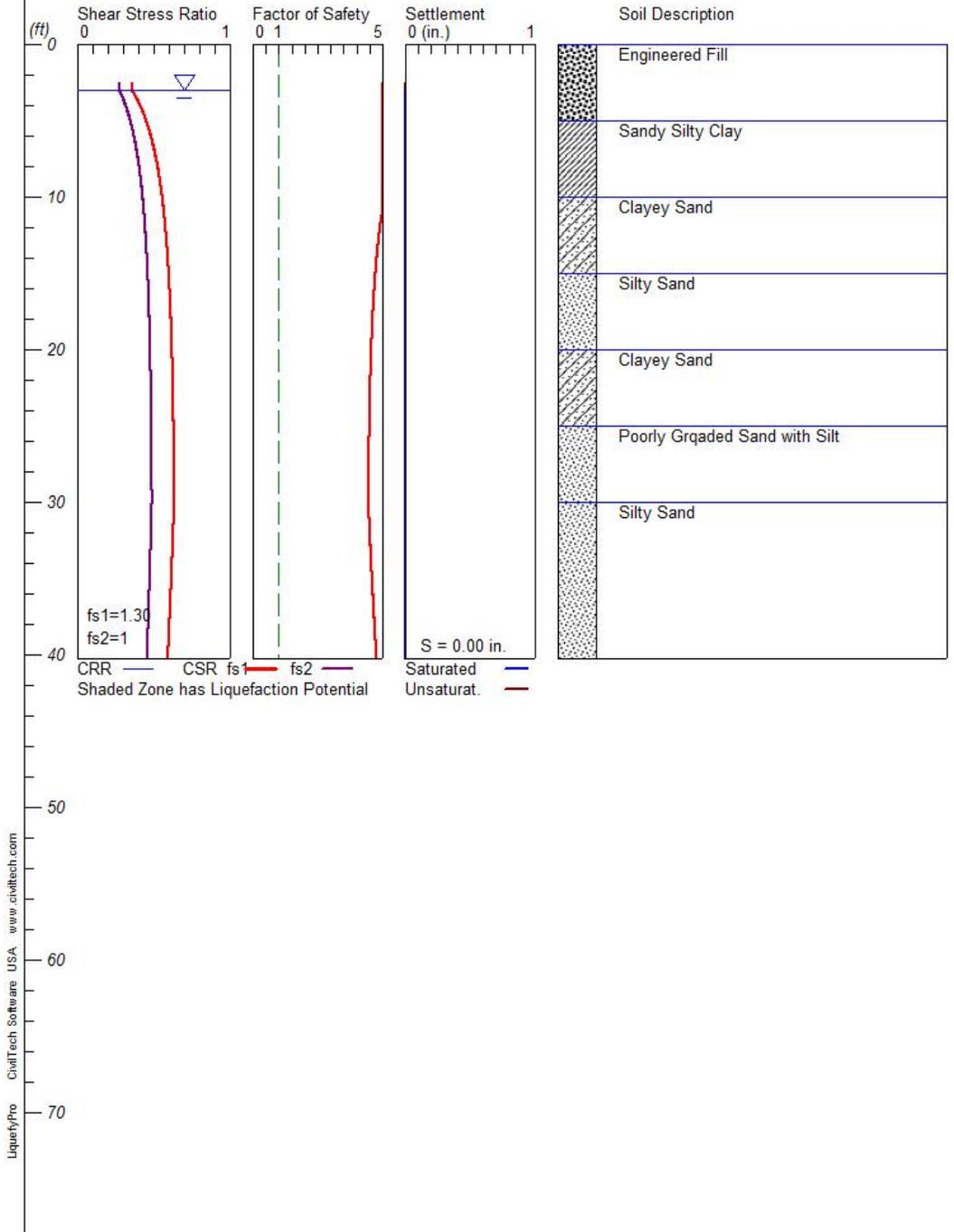
1 atm (atmosphere)	= 1 tsf (ton/ft <sup>2</sup> )
CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F. S.	Factor of Safety against Liquefaction, F. S. =CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

# LIQUEFACTION ANALYSIS

## Escondido Development

**Hole No.=B-6    Water Depth=3 ft**

**Magnitude=6.55  
Acceleration=0.43g**



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LIQUEFACTION ANALYSIS SUMMARY

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Input File Name: N:\Projects\2016\60165245\Working  
Files\Calculations-Analyses\B6.Liq  
Title: Escondido Development  
Subtitle: 60165245

Surface Elev. =  
Hole No. =B-6  
Depth of Hole= 40.25 ft  
Water Table during Earthquake= 3.00 ft  
Water Table during In-Situ Testing= 15.00 ft  
Max. Acceleration= 0.43 g  
Earthquake Magnitude= 6.55

Input Data:

Surface Elev. =  
Hole No. =B-6  
Depth of Hole=40.25 ft  
Water Table during Earthquake= 3.00 ft  
Water Table during In-Situ Testing= 15.00 ft  
Max. Acceleration=0.43 g  
Earthquake Magnitude=6.55  
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction\*
5. Settlement Calculation in: All zones\*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1.05
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.3  
Plot two CSR (fs1=User, fs2=1)
10. Use Curve Smoothing: Yes\*

\* Recommended Options

B6. sum

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
2.50	25.00	120.00	50.00
5.00	100.00	120.00	NoLi q
10.00	17.00	120.00	31.00
15.00	28.00	120.00	13.00
20.00	57.00	120.00	13.00
25.00	100.00	120.00	13.00
30.00	100.00	120.00	13.00
35.00	100.00	120.00	13.00
40.00	100.00	120.00	13.00

Output Results:

Settlement of Saturated Sands=0.00 in.  
 Settlement of Unsaturated Sands=0.00 in.  
 Total Settlement of Saturated and Unsaturated Sands=0.00 in.  
 Differential Settlement=0.000 to 0.000 in.

Depth ft	CRRm	CSRfs	F. S.	S_sat. in.	S_dry in.	S_all in.
2.50	2.83	0.36	5.00	0.00	0.00	0.00
3.50	2.83	0.39	5.00	0.00	0.00	0.00
4.50	2.83	0.43	5.00	0.00	0.00	0.00
5.50	2.00	0.47	5.00	0.00	0.00	0.00
6.50	2.00	0.49	5.00	0.00	0.00	0.00
7.50	2.00	0.52	5.00	0.00	0.00	0.00
8.50	2.00	0.53	5.00	0.00	0.00	0.00
9.50	2.00	0.55	5.00	0.00	0.00	0.00
10.50	2.83	0.56	5.00	0.00	0.00	0.00
11.50	2.83	0.57	4.94	0.00	0.00	0.00
12.50	2.83	0.58	4.86	0.00	0.00	0.00
13.50	2.83	0.59	4.80	0.00	0.00	0.00
14.50	2.83	0.60	4.75	0.00	0.00	0.00
15.50	2.83	0.60	4.70	0.00	0.00	0.00
16.50	2.83	0.61	4.66	0.00	0.00	0.00
17.50	2.83	0.61	4.63	0.00	0.00	0.00
18.50	2.83	0.61	4.60	0.00	0.00	0.00
19.50	2.83	0.62	4.58	0.00	0.00	0.00
20.50	2.83	0.62	4.56	0.00	0.00	0.00
21.50	2.83	0.62	4.54	0.00	0.00	0.00
22.50	2.83	0.63	4.52	0.00	0.00	0.00
23.50	2.83	0.63	4.51	0.00	0.00	0.00
24.50	2.83	0.63	4.50	0.00	0.00	0.00
25.50	2.83	0.63	4.49	0.00	0.00	0.00

				B6. sum		
26.50	2.83	0.63	4.48	0.00	0.00	0.00
27.50	2.83	0.63	4.47	0.00	0.00	0.00
28.50	2.83	0.63	4.47	0.00	0.00	0.00
29.50	2.83	0.63	4.46	0.00	0.00	0.00
30.50	2.83	0.63	4.47	0.00	0.00	0.00
31.50	2.83	0.63	4.50	0.00	0.00	0.00
32.50	2.83	0.62	4.52	0.00	0.00	0.00
33.50	2.83	0.62	4.55	0.00	0.00	0.00
34.50	2.83	0.62	4.58	0.00	0.00	0.00
35.50	2.83	0.61	4.61	0.00	0.00	0.00
36.50	2.83	0.61	4.65	0.00	0.00	0.00
37.50	2.83	0.60	4.68	0.00	0.00	0.00
38.50	2.83	0.60	4.71	0.00	0.00	0.00
39.50	2.83	0.60	4.75	0.00	0.00	0.00

---

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

---

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
NoLi q                      No-Liquefy Soils