



## **REPORT OF GEOTECHNICAL INVESTIGATION**

**Proposed Residential and Retail Mixed Development  
Southwest Corner of Rose Drive and Alta Vista Street  
City of Placentia, California**

**Prepared For:**

**SC Placentia Development, LP**

**2151 Michelson Drive, Suite 140  
Irvine, California 92612**

**Project No. 6736.17**

**September 30, 2017**



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**SC Placentia Development, LP**  
2151 Michelson Drive, Suite 140  
Irvine, California 92612

Attention Mr. Paul Conzelman

Subject: **REPORT OF GEOTECHNICAL INVESTIGATION**  
Proposed Residential and Retail Mixed Development  
Southeast Corner of Rose Drive and Alta Vista Street  
City of Placentia, California

Gentlemen:

Presented herewith is the Report of Geotechnical Investigation (the Soils Report) prepared by Associated Soils Engineering, Inc. (ASE) for the proposed new Residential and Retail Mixed Development (the Development) consisting of one (1) 10,000-square-foot retail building (the Building) and 54 single-family dwellings (the SFD's) to be located at the above subject location, in the City of Placentia, California (the Site). This work was conducted in accordance with ASE's Proposal No. P17-092, dated June 8, 2017, which received your subsequent authorization.

The subject geotechnical investigation was planned and performed based on the relevant development information provided by your office. Provided information included a Conceptual Site Plan, Drawing No. SP02, prepared by kty Architecture & Planning, dated April 3, 2017, that shows the planned site layout, the retail building exterior parking, residential loop drive, and the developments/roadways around the site perimeters. The same plan was provided to SCS Engineers on which they also plotted the approximate locations of eight (8) capped oil wells within the confines of the property. In addition, selected documentation provided by your office with regard to past remediation and grading works on properties that include the Site and the neighboring lots, as per listed in Appendix C of this Soils Report, have also been reviewed by ASE.

The purpose of this study was to evaluate the subsurface soils conditions at the Site, followed by performance of engineering analyses and formulation/assembly of recommendations for the geotechnical design and construction pertinent to the Building and the SFD's. ASE's study has concluded that construction of the Building and the SFD's is geotechnically feasible provided that the recommendations and design guidelines with respect to ground preparation and foundation construction presented in the Soils Report are incorporated in the project plans and design, and implemented during construction. This

Soils Report also presents 1) the findings of the geotechnical field investigation, 2) the summary of potential geological/seismic hazard assessment, and 3) the results of laboratory tests performed.

We at ASE appreciate the opportunity to provide our professional services on this important project, and look forward to assisting you during construction phase of the Buildings of the Development.

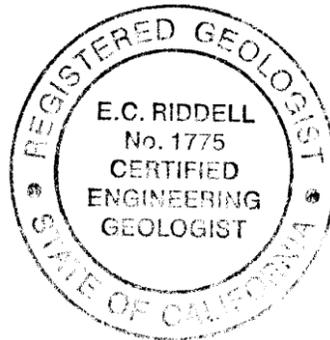
If you have any questions or require additional information, please contact the undersigned.

Respectfully submitted,  
**ASSOCIATED SOILS ENGINEERING, INC.**

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## **1.0 INTRODUCTION**

This Soils Report presents the results of ASE's geotechnical investigation for the proposed new Residential and Retail Mixed Development (the Development), located on an approximate 8.44 acre parcel at the southeast corner of Rose Drive and Alta Vista Street, in the City of Placentia, California (the Site). The approximate location of the Site is shown on Figure 1, Site Location Map. The purpose of this investigation was to evaluate the general subsurface soil conditions at the Site and provide geotechnical recommendations for the design and construction of the proposed Development. This Soils Report presents the summary of the documents reviewed, the data collected and the results of ASE's engineering evaluations/analyses, which provide the basis for the formulation of relevant geotechnical conclusions and recommendations.

### **1.1 Project Description**

The following provided information is understood to be applicable to the subject project at the time of this Soils Report preparation.

#### **1.1.1 Building/Development Concepts:**

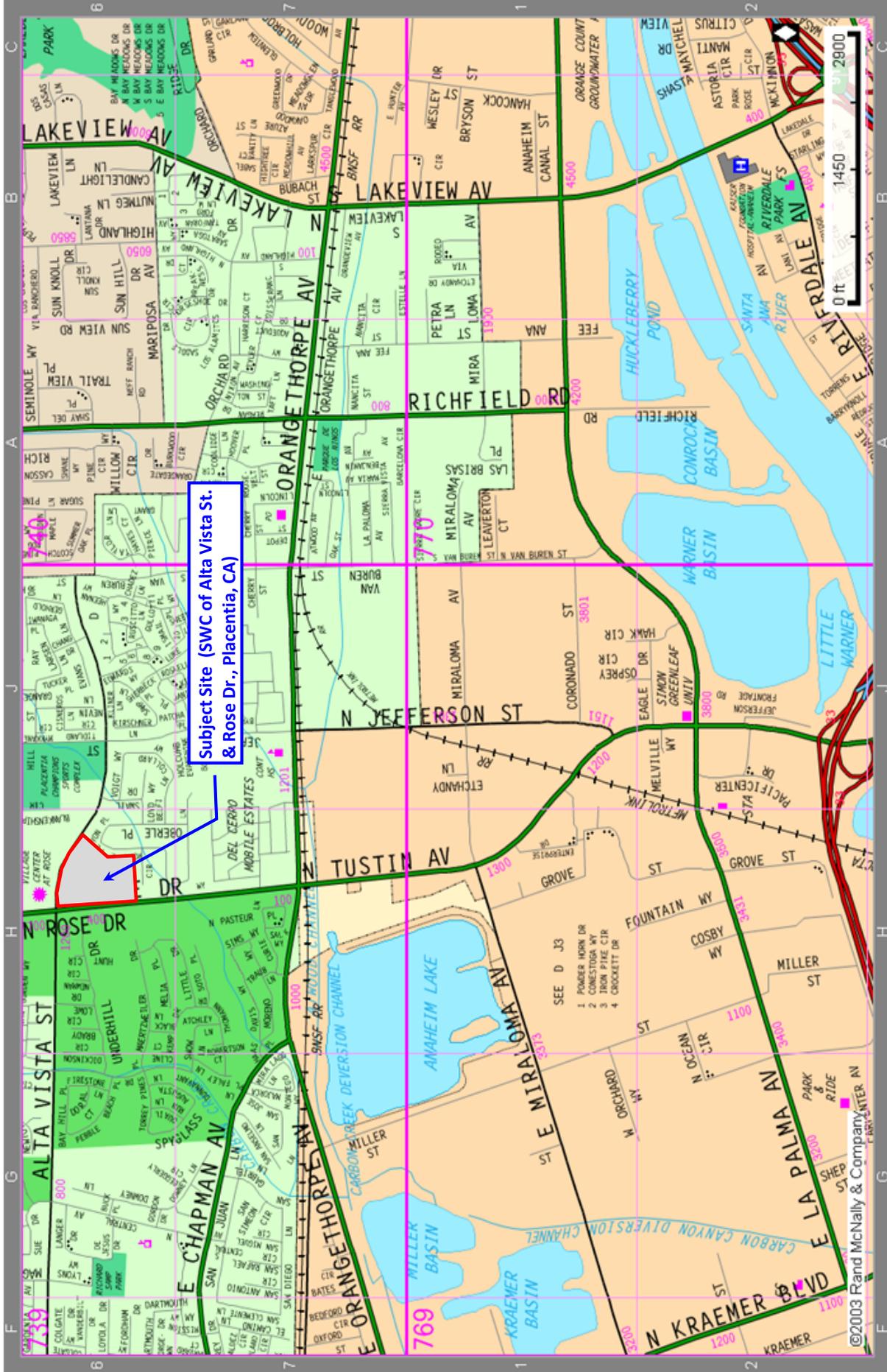
It is ASE's understanding that the Development is to consist of 1) a 10,000 square-foot retail building (the Building) with associated parking stalls, driveway, landscape, utilities and signage that will occupy the northwest corner of the Site in a roughly triangular area, and 2) 54 single-family dwellings (the SFD's), with associated driving loop, landscaping, utilities and fence walls. The Building and the SFD's will likely be one (1) through three (3) story in height, and consist of frame and masonry construction.

#### **1.1.2 Structural Loading:**

For geotechnical evaluation purposes, ASE assumed that the Building and the SFD's will be supported by isolated pad footings with maximum concentrated column load (dead plus live loads) on the order of 100 kips and 50 kips, respectively, and by continuous spread footings with maximum line load (dead plus live loads) of approximately 4,000 and 3,000 pounds per linear foot, respectively. Tolerable total and differential settlements resulted from the aforementioned structural loadings on the order of one (1) inch and one-third (1/3) inch over a 30-foot distance, respectively, have also been assumed by ASE.

### **1.2 Scope of Exploration**

In accomplishing the subject investigation, ASE's scope of work included the performance of the following tasks:



Subject Site (SWC of Alta Vista St. & Rose Dr., Placentia, CA)

 <p><b>ASSOCIATED</b> SOILS ENGINEERING, INC. Consulting Geotechnical Engineers</p>	<p><b>Associated Soils Engineering, Inc.</b> 2860 Walnut Avenue Signal Hill, CA 90755 Tel (562) 426-7990 Fax (562) 426-1842</p>	
	<p><b>Site Location Map</b></p>	
<p>Proj. Name:</p>	<p>Prop. Residential &amp; Retail Mixed Development SWC of Rose Drive &amp; Alta Vista St., Placentia, CA</p>	
<p>Figure 1</p>	<p>Proj. No.:</p>	<p>6736.17</p>
	<p>Date:</p>	<p>September, 2017</p>

- A. Review of readily available background information, including public geotechnical literature, geologic maps, seismic hazard maps, and literature relevant to the subject Site.
- B. A geotechnical site reconnaissance to observe the general surficial soil conditions at the Site and to select boring locations, followed by notification to Underground Service Alert of the planned boring locations 72 hours prior to field exploration.
- C. Field exploration consisting of drilling twelve (12) exploratory borings to depths of 6 feet to 31 feet 6 inches deep, measured from respective existing grades. Field logging and sampling of the soils encountered were carried out in the exploratory borings. Locations of the exploratory borings on site are shown on the Boring Location Plan, Plate A.
- D. Laboratory testing on retrieved representative soil samples for classification and for determination of pertinent engineering properties.
- E. Engineering analyses of data obtained from literature review, the site and laboratory testing covering the following aspects:
  - Evaluation of general subsurface conditions and description of types, distribution, and engineering characteristics of subsurface materials.
  - Assessment of geologic/seismic hazards and, if applicable, recommendation of mitigative measures, based on the pertinent criteria required by the California Geological Survey (CGS).
  - Determination of the seismic design parameters in accordance with Chapters 16 and 18 of the California Building Code, 2016 Edition (2016 CBC).
  - Evaluation of the suitability of on-site soils for foundation support, followed by establishment of qualification criteria for on-site or imported fill material.
  - Recommendations for site grading and subgrade preparation, including temporary excavation and shoring.
  - Recommendations for design of footing foundations, including allowable soils bearing capacity, estimated settlement, and lateral resistance.
  - Recommendations for subgrade preparation for slab-on-grade support, and for minimum thickness/reinforcement recommendations.
  - Recommendations for asphaltic concrete (AC) and Portland cement concrete (PCC) pavements.
  - Evaluation of the corrosion and expansion potential of the on-site materials.
  - Measurement of percolation rate of site soils required for the planning and design of on-site stormwater dispersal system.

F. Preparation of this Soils Report presenting the work performed and data acquired, as well as summarizing our conclusions and geotechnical recommendations for the design and construction of foundation supporting the proposed Development.

*Please note that ASE's geotechnical investigation did not include any evaluation or assessment of hazardous or toxic materials which may or may not exist on or beneath the site. ASE does not consult in the field of potential site contamination/mitigation.*

## **2.0 SITE AND SUBSURFACE CONDITIONS**

### **2.1 Location**

The Development is to be located on an approximate 8.44 acre, irregular shape parcel at the southeast corner of Rose Drive and Alta Vista Street, in the City of Placentia, California. The following information pertaining to site conditions was logged during the course of ASE's field work.

### **2.2 Boundary Conditions and Existing Development**

The subject Site is bound to the north by Alta Vista Street, with a commercial center and oil field property beyond. Rose Drive is west of the Site, with a residential development including a portion of Alta Vista Country Club beyond. Existing single-family dwellings are to the immediate east and south of the Site.

Currently the Site exhibits a relatively undulating terrain, with a maximum elevation differential of approximately twelve (12) feet across the Site. The low point is generally near the center of the Site, and the higher points are along the site perimeter, with the highest point near the northwest site corner. The surface is covered with a moderate growth of wild grasses and weeds.

Based on the information provided by your office, this undeveloped property is an ex-oil field production site with all previous wells capped off since the late 1990's, and has since been idle without any activities on site. The provided Conceptual Site Plan indicated eight (8) wells were on site and capped off. A few vent wells are still protruding above the ground surface. In addition, a storm drain was shown traversing north-southerly across roughly three-quarters (3/4) of the Site.

### **2.3 Subsurface Conditions**

The subsurface soils descriptions presented hereunder have been interpreted from conditions exposed during the field investigation and/or information inferred from the reviewed geologic literature. As such, it is likely that not all of the subsurface conditions at the Site could be captured or represented. It is therefore essential that the Geotechnical Consultant's engineer or geologist be on site during grading and foundation construction such that information/recommendations deciphered during preliminary geotechnical investigation phase could be verified and, if necessary, amended as appropriate.

### 2.3.1 Artificial Fill (af):

Artificial fill was observed in each of ASE's twelve (12) borings ranging from a minimum of one (1) foot in Boring B-6, to extending beyond the terminal exploratory depth of 31 feet 6 inches in Boring B-4. The encountered artificial fill generally consists of silty sands, silty sands with clay, clayey sands, clayey sands with gravel, clean sands, silty clays, silty clays with sand, sandy clays, clayey silts with sand, sandy silts, and sandy silts with clay, with some brick, wood, asphalt and concrete pieces, and has been classified as "undocumented fill" and evaluated accordingly.

### 2.3.2 Older Fan Deposits (Qvof):

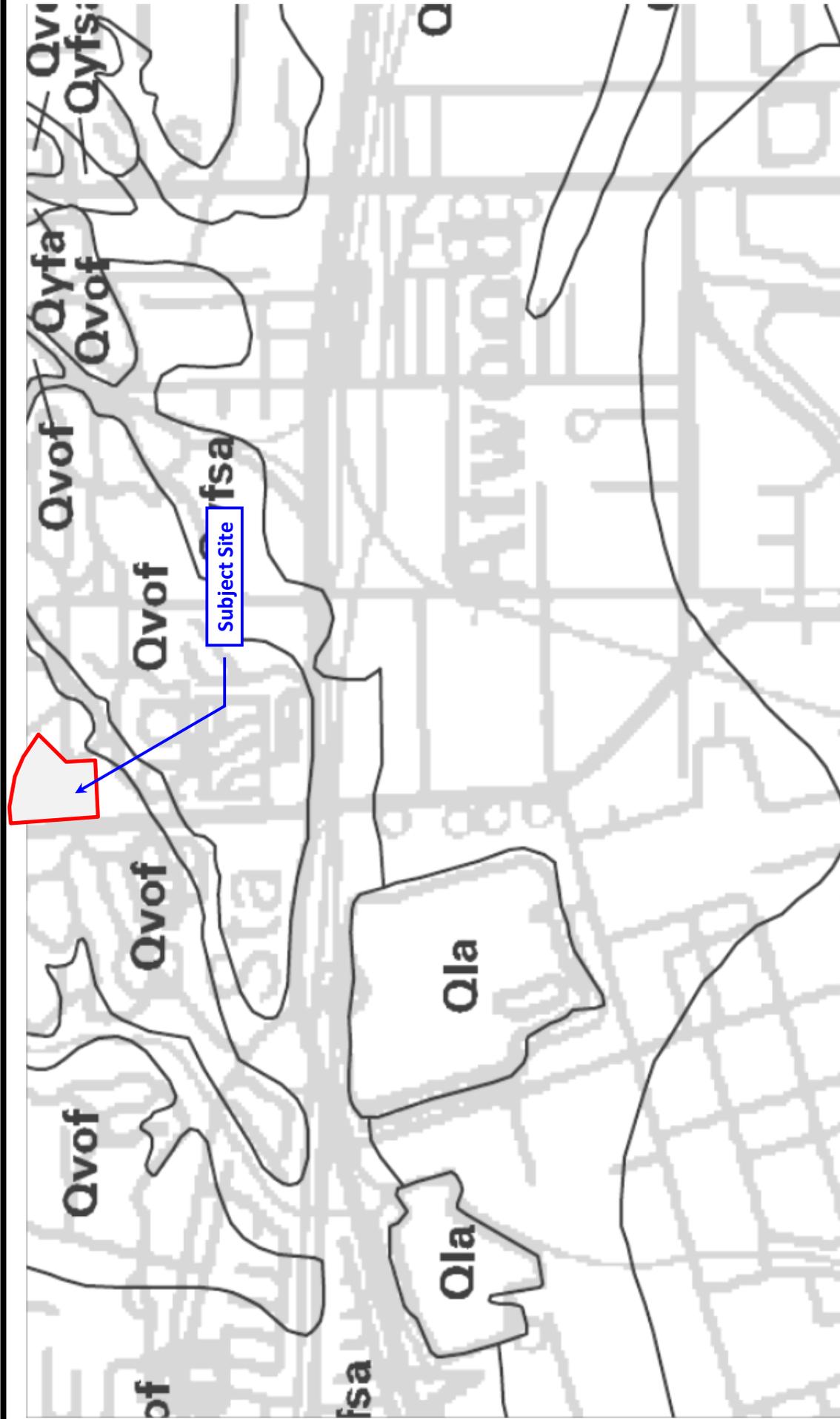
Native site soils consisting of late Pleistocene to Holocene-age older fan deposits were encountered on site beneath the fill soils in each of the exploratory borings (with the exception of Boring B-4, and shallow percolation Borings B-11 and B-12) to the maximum explored depth of 31 feet 6 inches. Per Reference 6, the older fan deposits are characterized as unconsolidated sand, silt and clay deposits associated with the lowlands of the Santa Ana River and Carbon Creek. In specific, the on-site fan deposits consist of medium dense to very dense sands with gravel, clayey sands, silty sands, sands, and sands with silt, and stiff to hard clayey silts, clayey silts with sand, silts, silts with sand, silts with clay, sandy silts with clay, sandy silts, silty clays, silty clays with sand, and sandy clays. Figure 2, Local Geologic Map, an excerpt from CGS (1997, revised 2001; Reference 6), shows geologic material distribution in the vicinity of the subject Site.

Blow counts recorded from advancing Standard Penetration Test (SPT) sampler and Modified California barrel sampler empirically indicate that the granular, sandy strata of on-site older fan deposits soils are in a medium dense to very dense condition, whereas the fine-grained, cohesive strata (i.e. silts/clays) generally exhibit stiff to hard consistencies. Site subsurface soils were, in general, in a dry to very moist condition within the explored depths at the time of ASE's site investigation.

More detailed descriptions of soils encountered and conditions observed during the subsurface exploration are shown in the Field Logs of Boring B-1 through B-12 in Appendix A, together with information including soil classifications, depths and types of soil samples, blow counts, field dry densities and moisture contents, and corresponding laboratory tests performed.

## 2.4 **Groundwater and Caving**

During field exploration, groundwater was not encountered within the maximum explored depth of 31 feet 6 inches below grade in Borings B-1, B-4 and B-9. Published data in Seismic Hazard Zone Report 011 for the Orange 7.5-Minute Quadrangle, Orange County, California by CGS (1997, revised 2001), appears to indicate that the historic high groundwater level in the subject area is greater than 50 feet deep. A search on Google Earth indicates that the subject Site is approximately 284 to 296 feet above Mean Sea Level (MSL).



(Excerpted from the Quaternary Geologic Map of the Orange 7.5-Minute Quadrangles, California Division of Mines and Geology, Seismic Hazard Zone Report 011, 1997)

<b>LEGEND</b>	 <p>Approximate Site Location</p>	<p><b>Associated Soils Engineering, Inc.</b>          2860 Walnut Avenue          Signal Hill, CA 90755          Tel (562) 426-7990 Fax (562) 426-1842</p>	Project:	<p><b>Prop. Residential &amp; Retail Mixed Development</b>          SWC of Rose Drive &amp; Alta Vista St., Placentia, CA</p>
	<p><b>Q<sub>vof</sub></b>          Late Pleistocene older fan deposits consisting of dense and very dense sand and gravel with interbedded sand and silty sand</p>		Figure 2	Date:
			Proj. No.:	6736.17
			<b>Local Geologic Map</b>	

Information available from the State of California Department of Water Resources website ([www.water.ca.gov/waterdatalibrary/groundwater/hydrographs](http://www.water.ca.gov/waterdatalibrary/groundwater/hydrographs)) indicates that the historic high groundwater level in Well No. 03S09W33N003S, approximately 0.9 mile southeast of the Site and located on the south side of Miraloma Avenue between Jefferson Street and Van Buren Street, was 47.36 feet below ground surface elevation on February 4, 1981. The ground surface elevation of the well is 246.97 feet above MSL, or 37.03 to 49.03 feet lower than Site grades. The depth to groundwater for the most recent reading in this well (taken October 28, 1986) was 62.8 feet below well grade.

Additional information from the State of California Water Resources Control Board Geotracker website (<http://geotracker.waterboards.ca.gov>) indicates that the groundwater elevation in groundwater monitoring well MW-9, located at the southeast corner of North Rose Drive and Yorba Linda Boulevard (Shell Oil: 1202 Yorba Linda Boulevard), was 38.84 feet below grade on December 19, 2006. The ground surface elevation at this site location (taken from Google Earth images) is 309 to 315 feet above MSL, which is approximately 13 to 31 feet higher than site grades.

Generally, seasonal and long-term fluctuations in the groundwater may occur as a result of variations in subsurface conditions, rainfall, run-off conditions and other factors. Therefore, variations from observations made in ASE's exploratory borings may occur, as ASE's exploratory borings were not meant for long-term groundwater monitoring.

The use of hollow-stem augers during drilling precluded observation of potential caving conditions which may have otherwise occurred in an uncased hole. Caving and/or sloughing were not measured during the extraction of auger stem at the completion of boring operations. However, caving and/or soil sloughing may be likely in excavations greater in dimension than our exploratory borings.

## **2.5 Utilities**

No overhead or underground utilities were encountered or disturbed during the course of ASE's on-site exploration. Vents from previous on-site oil production operations are present on the property, as is a riser from the previously noted storm drain crossing the Site. Overhead and underground lines are present along site perimeter streets. Other utilities, though not known at the time of this report preparation, may be present on site, and should be located and incorporated into site development plans accordingly.

## **3.0 FAULTING AND SEISMICITY**

Placentia, like the rest of southern California, is located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional faults such as the San Andreas, San Jacinto, Newport-Inglewood and Whittier-Elsinore fault zones.

By the definition of CGS, an active fault is one which has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). The CGS has defined a potentially active fault as any fault which has been active during the Quaternary Period (approximately the last 1,600,000 years). These definitions are used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Geologic Hazard Zones Act of 1972 and as subsequently revised in 1997 as the Alquist-Priolo Earthquake Fault Zoning Act and Earthquake Fault Zones. The intent of the act is to require fault investigations on sites located within Special Studies Zones to preclude new construction of certain inhabited structures across the trace of active faults. The subject Site is not located within the Alquist-Priolo Earthquake Fault Zone. No evidence of active or potentially active faulting was observed during our investigation. In addition, the site is not located within a seismic hazard zone per CGS's mapping.

Several sources were researched for information pertaining to site seismicity. The majority of data was obtained from the program, EQFAULT, by Blake (2000) that allows for an estimation of peak horizontal ground acceleration (PGA) using a data file of approximately 150 digitized California faults. This program compiles information including the dominant type of faulting within a particular region, the maximum earthquake magnitude each fault is capable of generating, the estimated slip-rate for each fault, and the approximate location of the fault trace. Printouts of the results of the fault search for the Site are shown as Plates I-1 and I-2 in Appendix B.

### **3.1 Deterministic Analysis**

The Site is likely to be subject to strong seismic ground shaking during the life of the project. Based on the referenced literature and deterministic analysis performed with the EQFAULT software, the Puente Hills Blind Thrust Fault, approximately 4.9 miles (7.9 km) from the Site, would probably generate the most severe site ground motions. A Maximum Probable Earthquake (MPE), i.e. the maximum earthquake that is considered likely to occur during a 100-year time interval, of 7.1 Mw (moment magnitude as per USGS) has been assessed along the Puente Hills Blind Thrust Fault. As shown on Plate I-2 in Appendix B, estimated PGA resulting from a MPE event on the Puente Hills Blind Thrust Fault is on the order of 0.470g should this event occur at the fault's closest approach to the Site. Other nearby active faults include the Whittier Fault and the Chino-Central Avenue (Elsinore) Fault, located approximately 3.2 miles (5.1 km) and 9.9 miles (15.9 km) away, respectively. In sum, approximately 42 active or potentially active faults have been found within 62 miles (100 km) of the Site.

### **3.2 Probabilistic Analysis**

The seismicity of the Site was evaluated utilizing probabilistic analysis available from CGS ([www.quake.ca.gov/gmaps/PSHA/psha\\_interpolator.html](http://www.quake.ca.gov/gmaps/PSHA/psha_interpolator.html)). The Maximum Probable Earthquake (MPE) and the Maximum Considered Earthquake (MCE) that carry 10 percent and 2 percent exceedance probabilities, respectively, in 50 years have been considered. Based on a typical damping ratio of 5% and a  $V_s^{30}$  value of 387 m/sec, derived from the "Set Site Parameters for Web Services" function as part of the "Hazard

Spectrum Calculator (Local)” application available from the “OPENSHA” website, three spectral acceleration values representing peak ground acceleration (PGA), spectral acceleration for structural period of 0.2 second (Sa – 0.2 sec; typical of low-rise buildings) and spectral acceleration for structural period of 1.0 second (Sa – 1.0 sec; typical of multi-story buildings) have been analyzed and are tabulated below.

Seismic Acceleration Values from CGS’s Ground Motion Interpolator (2008)						
Latitude	Longitude	V <sub>s</sub> <sup>30</sup> (m/sec)	Scenario	Acceleration (g)		
				PGA	Sa – 0.2 sec	Sa – 1.0 sec
N 33.8754°	W 117.8428°	387	MPE <sup>1</sup>	0.420	0.961	0.436
			MCE <sup>2</sup>	0.734	1.666	0.826

1. MPE scenario carries a 10% exceedance probability in 50 years.

2. MCE scenario carries a 2% exceedance probability in 50 years.

### 3.3 2016 CBC Seismic Design Parameters

The earthquake design requirements listed in 2016 CBC and other governing standards account for faults classified as "active", in accordance with the most recent fault listing as per the United States Geological Survey (USGS) or the CGS. The seismic design of the proposed structures should be implemented in accordance with the applicable provisions stipulated in 2016 CBC unless otherwise specified by the governing authority having jurisdiction over the project.

The 2016 CBC seismic design criteria for the Site based on a Site Class of “D”, a Risk Category II and a scenario of Risk-Targeted Maximum Considered Earthquake (MCE<sub>R</sub>) that carries a 2% exceedance probability in 50 years had been determined utilizing the U.S. Seismic Design Maps web-application available from the Seismic Design Maps and Tools webpage on the website of Earthquake Hazard Program of USGS (<http://earthquake.usgs.gov/hazards/designmaps/usdesign.php>). Summaries of the seismic coefficients for the Site are presented in the table below.

2016 CBC SEISMIC DESIGN PARAMETERS					
Site Latitude:	N 33.8754°	Site Longitude:	W 117.8428°	Risk Category <sup>a</sup>	II
Seismic Parameter				Recommended Value	
Site Class <sup>b</sup>				D	
Soil Profile Name <sup>b</sup>				Stiff Soil Profile	
Site Coefficient, Fa <sup>c</sup>				1.0	
Site Coefficient, Fv <sup>d</sup>				1.5	
0.2-Second Spectral Response Acceleration, S <sub>s</sub> <sup>e</sup>				1.827g	
1.0-Second Spectral Response Acceleration, S <sub>1</sub> <sup>f</sup>				0.654g	
Adjusted 0.2-Second Spectral Response Acceleration, S <sub>MS</sub> <sup>g</sup>				1.827g	
Adjusted 1.0-Second Spectral Response Acceleration, S <sub>M1</sub> <sup>h</sup>				0.981g	
Design 0.2-Second Spectral Response Acceleration, S <sub>DS</sub> <sup>i</sup>				1.218g	
Design 1.0-Second Spectral Response Acceleration, S <sub>D1</sub> <sup>j</sup>				0.654g	
Long -Period Transition Period, T <sub>L</sub> <sup>k</sup>				8 sec	
Mapped MCE <sub>G</sub> Geometric Mean Peak Ground Acceleration, PGA <sup>l</sup>				0.678g	
Site Coefficient, F <sub>PGA</sub> <sup>m</sup>				1.0	
MCE <sub>G</sub> Peak Ground Acceleration adjusted for Site Class Effect, PGA <sub>M</sub> <sup>n</sup>				0.678g	

(continued)

Risk Category	I or II or III	IV
Seismic Design Category based on $SD_5^o$	D	D
Seismic Design Category based on $SD_1^p$	D	D
a Per 2016 CBC Table 1604.5	i Per 2016 CBC Equation 16-39	
b Per 2016 CBC Section 1613.3.2	j Per 2016 CBC Equation 16-40	
c Per 2016 CBC Table 1613.3.3(1)	k Per ASCE 7-10 Figure 22-12	
d Per 2016 CBC Table 1613.3.3(2)	l Per ASCE 7-10 Figure 22-7	
e Per 2016 CBC Figure 1613.3.1(1)	m Per ASCE 7-10 Table 11.8-1	
f Per 2016 CBC Figure 1613.3.1(2)	n Per ASCE 7-10 Equation 11.8-1 = $PGA \times F_{PGA}$	
g Per 2016 CBC Equation 16-37	o Per 2016 CBC Table 1613.3.5(1)	
h Per 2016 CBC Equation 16-38	p Per 2016 CBC Table 1613.3.5(2)	

Please note that conformance to the 2016 CBC seismic design criteria does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not take place during the occurrence of a  $MCE_R$  event. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive. Following a major earthquake, a building may be damaged beyond repair, yet not collapse. The Structural Consultant should review the pertinent parameters to evaluate the seismic design.

## 4.0 GEOLOGIC HAZARDS

### 4.1 Surface Fault Rupture and Ground Shaking

The Site is not located within an Alquist-Priolo Earthquake Fault Zone. No known active or potentially active faults are shown crossing the Site on published maps reviewed. No evidence for active faulting was encountered in the exploratory excavations performed during this evaluation. The risk of surface rupture at the Site is considered very low.

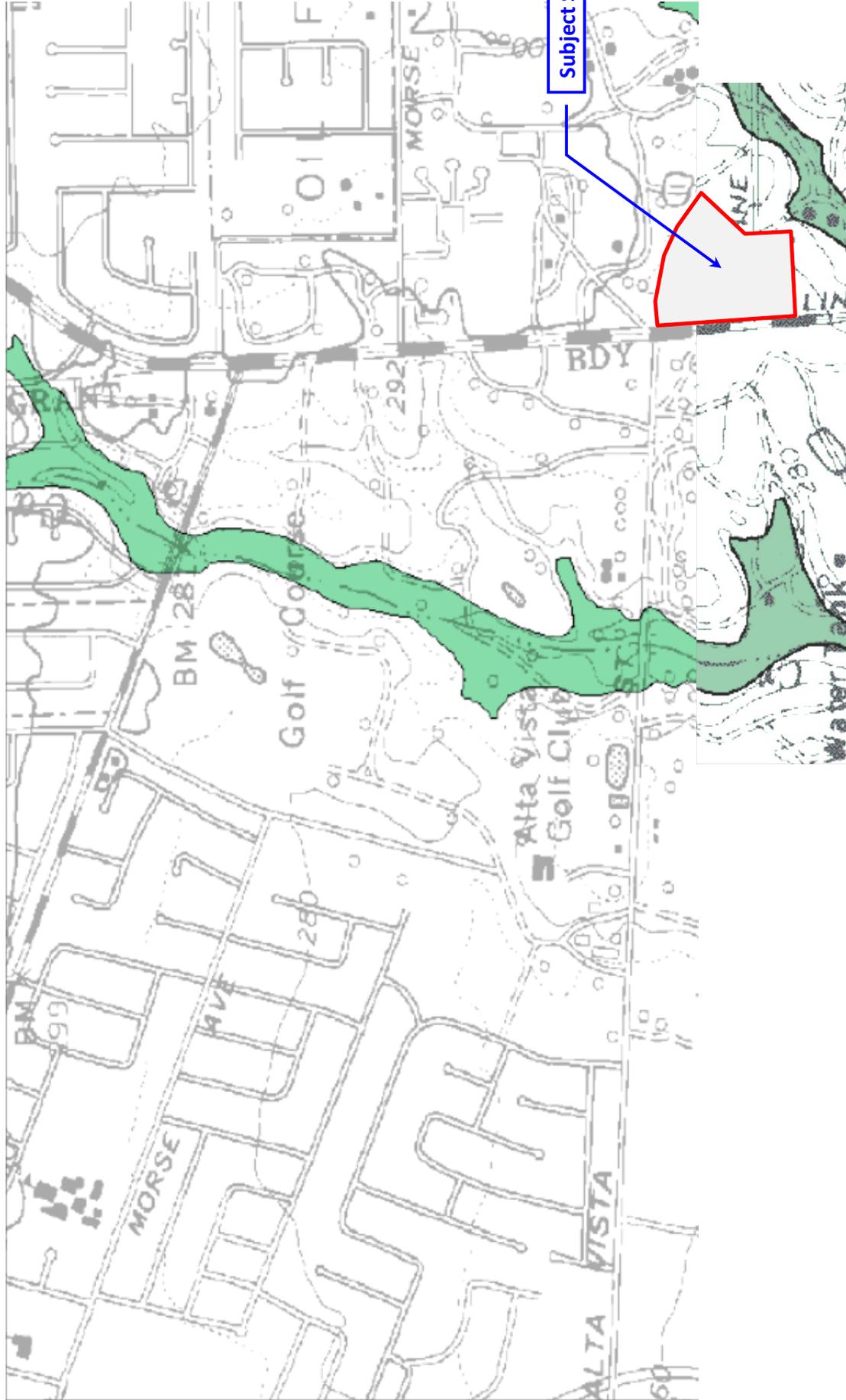
Being in close proximity to several known active and potentially active faults, severe ground shaking should be expected during the life of the proposed development.

### 4.2 Seismic Hazards

#### 4.2.1 Liquefaction:

As evidenced in Figure 3, Local Seismic Hazard Map, the Site is not within, but is near, an area that has been identified to be susceptible to seismically-induced liquefaction, when subject to a MPE or MCE seismic event.

The term "liquefaction" describes a phenomenon in which a saturated cohesionless soil loses strength and acquires a degree of mobility as a result of strong ground shaking during an earthquake. The factors known to influence liquefaction potential include soil type and depth, grain size, relative density, groundwater level, degree of saturation, and both the intensity and duration of ground shaking.



*(Partial Extracts and Combination of the State of California Seismic Hazard Zones Official Maps for Orange and Yorba Linda Quadrangles dated April 15, 1998 and August 11, 2005, respectively)*

<b>LEGEND</b>	Approximate Site Location	<b>Associated Soils Engineering, Inc.</b> 2860 Walnut Avenue Signal Hill, CA 90755 Tel (562) 426-7990 Fax (562) 426-1842	<b>Project:</b>	<b>Prop. Residential &amp; Retail Mixed Development SWC of Rose Drive &amp; Alta Vista St., Placentia, CA</b>	
	Potential Landslide Hazard Area		<b>Figure 3</b>	<b>Local Seismic Hazard Map</b>	
Potential Liquefaction Hazard Area	 SOILS ENGINEERING, INC. Consulting Geotechnical Engineers	<b>Proj. No.:</b>	<b>6736.17</b>	<b>Date:</b>	<b>September, 2017</b>

The soils to the maximum explored depth of 31 feet 6 inches generally consist of stiff to hard, fine-grained silty/clayey fill and native soils, loose to medium dense granular fill soils, and medium dense to very dense granular native soils. Therefore, considering that 1) groundwater was not encountered in Borings B-1, B-4 and B-9 to a maximum explored depth of 31 feet 6 inches below existing grades, 2) historic high groundwater in wells near the vicinity of the Site, which is in the non-liquefaction zone, is typically greater than 38.84 to 93.0 feet below site grade based on ASE's review of literature and State groundwater monitoring website, and 3) the existing site fine-grained native soils exhibit stiff to hard consistency and the native granular soils are in a medium dense to very dense state within the depths explored, the likelihood of occurrence of seismically-induced liquefaction at the Site is deemed negligible.

#### 4.2.2 Seismic Settlements:

Ground accelerations emitted from a seismic event can cause densification of loose soils both above and below the groundwater table that may result in settlements on ground surface due to volumetric compression of soil mass. This phenomenon is often referred to as seismic settlement and commonly takes place in relatively clean sands, as well as soils with low plasticity and less fines.

While the site soils encountered consist predominantly of stiff to hard, fine-grained silty/clayey soils and medium dense to very dense granular native soils, and are considered non-liquefiable due to the deep groundwater elevation beneath the Site, the earth materials on site above the groundwater level may still undergo seismically-induced densification, which is estimated not to exceed 1/4 inch or 1/2 inch, when subject to a MPE or MCE seismic event, respectively.

#### 4.2.3 Earthquake-Induced Landslides:

There is no indication that recent landslides or unstable slope conditions exist on or adjacent to the project Site that would otherwise result in an obvious landslide hazard to the proposed development or adjacent properties.

ASE's review of the same geohazard map from which Figure 3 has been excerpted from indicates that the Site is not located within an area identified as having a potential for earthquake-induced landslides. Due to the lack of significant unretained relief on or adjacent to the Site, the potential for earthquake induced landslides in the future is considered nil.

#### 4.2.4 Lateral Spreading:

Lateral spreading, a phenomenon associated with seismically-induced soil liquefaction, is a display of lateral displacement of soils due to inertial motion and lack of lateral support during or post liquefaction. It is typically exemplified by the formation of vertical cracks on the surface of liquefied

soils, and usually takes place on gently sloping ground or level ground with nearby free surface such as drainage or stream channel. Since there is no presence of free surface on or nearby the Site, and since seismically-induced liquefaction is anticipated to have minimal impact if it were to take place on or near the Site, the potential for the occurrence of liquefaction-induced lateral spreading is deemed unlikely on the subject Site.

#### 4.2.5 Tsunamis and Seiches:

Due to the elevation of the Site and absence of nearby waterfront, hazard from a tsunami is nil.

Seiches are rhythmic movements of water within a lake or other enclosed or semi-enclosed body of water, generally caused by earthquakes. Since no lakes or other enclosed bodies of water lie on or near the Site, the hazard from seiches is not present at the Site.

#### 4.2.6 Flood Hazards:

The Site was located on the ESRII/FEMA Hazard Awareness site. The Site is not located within the limits of the 100 year flood plain per FEMA Flood Insurance Rate Maps (Map Nos. 06059C0152J and 06059C0064J, maps both revised December 3, 2009), but is located in an area of 2-percent-annual-chance flood, and an area shown as being protected from the 1-percent-annual-chance flood hazard by a levee system.

## 5.0 GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

Based on the results of field exploration, laboratory testing, and engineering analysis, it is ASE's geotechnical opinion that the proposed Development is geotechnically feasible on the Site, provided that the site grading and foundation design criteria recommended herein are incorporated into the project plans and specifications and implemented during construction.

Please note that ASE's recommendations presented in this Soils Report do not take into account any environmental remedial or supplemental measures that might be needed with regard to site preparation. Should any required environmental measures be in conflict with geotechnical recommendations presented in this Soils Report, the Geotechnical Consultant should be contacted for proper evaluation and formulation of appropriate, alternative geotechnical recommendations.

The major geotechnical factors affecting the design and construction of the proposed Building and the SFD's include the following:

1. Soil disturbances as a result of site demolition and clearing operations.
2. Presence of varying thicknesses of undocumented fill soils across the Site, with undocumented fill in some areas extending to significant depths of 20 feet or greater below grade.

3. Transitional situation between native soils and undocumented fill will necessitate the adoption of foundation systems for the Building and the SFD's to be more tolerant to changing subgrade support condition within building pads.

In consideration of the above factors, it is ASE's opinion that overexcavation and backfilling with properly compacted fill in the building pads of the Building and the SFD's, as recommended herein, will be essential to reduce unfavorable foundation and slab displacement as a consequence of total and differential settlements of underlying soils, and to provide satisfactory bearing stratum for the proposed Building and SFD's. The grading recommendations provided herein should be reviewed when final project concept and grading plans are available. It is assumed that the proposed finish grades will be close to the existing site grades ( $\pm$  one to eight feet).

Conventional shallow foundations comprising continuous spread footings and isolated pad footings, together with slab-on-grade, bearing on approved compacted fill soils are deemed suitable for structural support. In addition, ASE also provides recommendations for alternative Post-tensioned (PT) slabs.

## **5.1 Site Preparation**

### **5.1.1 Existing Improvements:**

Prior to grading operations, it will be necessary to remove designated existing construction, including any remaining buried obstructions, which may be in the areas of proposed Development construction. Structure removal should include foundations. Any remnant concrete flatwork or asphaltic concrete (AC) pavements should also be removed from the areas of proposed construction. Concrete and asphalt fragments from site demolition operations should be disposed of off-site, unless they can be stockpiled and processed to meet specifications for Crushed Miscellaneous Base (CMB), or Processed Miscellaneous Base (PMB), as outlined in Sections 200-2.4 or 200-2.5, respectively, of the latest edition of the "Standard Specifications for Public Works Construction (the Greenbook), and reused as fill or base material.

### **5.1.2 Surface Vegetation:**

Surface vegetation should be stripped from areas of proposed construction. Stripping should penetrate six (6) inches into surface soils. Any soil contaminated with organic matter (such as root systems or strippings mixed into the soil) should be disposed of off-site or set aside for future use in non-structural landscaped areas. Removal of trees and shrubs should include rootballs and attendant root systems.

### 5.1.3 Underground Utilities:

Any underground utilities to be abandoned within the zone of proposed construction should be cut off a minimum of five (5) feet from the area of the new structures. The ends of cut-off lines should be plugged a minimum of five (5) feet with concrete exhibiting minimum shrinkage characteristics to prevent water migration to or from hollow lines. Capping of lines may also be required should the plug be subject to any line pressure.

Alternatively, deep hollow lines may be left in place provided they are filled with concrete or 2-sack control density fill (slurry fill). No filled line should be permitted closer than two (2) feet from the bottom of future footings, unless it has been evaluated and approved by the Geotechnical Consultant. However, local ordinances relative to abandonment of underground utilities, if more restrictive, should be complied with.

## 5.2 Site Grading

In view of reducing the adverse effects associated with the development of excessive total or differential settlement underneath the Building and the SFD's, and the appurtenant improvements within the Development, as well as to ensure uniform bearing competency for the foundations, preparation of on-site soils are recommended in the following sections.

Please note that, unless otherwise specifically discussed and recommended in Section 5.2, the criteria, requirements and recommendations regarding site grading stipulated in Appendix D, General Earthwork and Grading Specifications and Appendix J of the 2016 CBC, whichever are more stringent, should be considered for the planning and implementation of site grading.

### 5.2.1 Undocumented Fill/Disturbed Native Soils:

All undocumented fill soils, as discussed in Section 2.3.1 above, encountered during site grading in the areas impacting the building pads of the Building and the SFD's, as well as any native soils disturbed during demolition and clearing operations, should be excavated full depth under the observation and confirmation by the Geotechnical Consultant. Lateral extent of overexcavation beyond building perimeters, where possible, should be to a minimum distance equal to the depth of undocumented fill/disturbed soil encountered or five (5) feet, whichever is greater.

While no Site-specific grading plan was available from any of the reviewed reports listed in Appendix C, a map entitled "Excavation Area Detail Area 1" from Reference No. 29 listed in Appendix C, which is copied and attached as Exhibit 1 in Appendix C, appears to show the original topography of the site area bordered by Alta Vista Street, Rose Drive and Pine Street. The approximate extents of depths of undocumented fill for the aforementioned site area could be preliminarily interpreted from Exhibit 1

for site grading planning purpose. However, it should be noted that the site area (hereinafter referred to as the “Southerly Portion”) to the east and south of Rose Drive and Pine Street, respectively, was not covered in Exhibit 1. As such, the extent and depths of undocumented fill in the Southerly Portion will need to be verified by the Geotechnical Consultant during site grading. To aid in the determination of possible undocumented fill thicknesses across the Site, ASE has superimposed the boring numbers and locations from the current investigation onto Exhibit 1, together with the thicknesses of undocumented fill encountered in each boring, for reference.

For other secondary improvements such as free-standing walls, hardscape or pavement, the lateral extent of removal should be to a minimum distance equal to the depth of undocumented fill/disturbed soils encountered or one (1) foot, whichever is greater.

The exposed excavation bottom should be scarified/reworked to a minimum one (1) foot depth and recompact to a minimum 90 percent relative compaction with a minimum moisture content of two (2) percentage points above optimum moisture content prior to backfilling with approved soils as specified in Section 5.2.8. Unless otherwise stated, the measurement of relative compaction in this report should always refer to ASTM D1557-12 Test Method.

#### 5.2.2 Expansive Soils:

Laboratory test results on near surface soil samples indicate a “Low” soil expansion potential (i.e. Expansion Indices, EI’s, = 38 and 45 per ASTM D4829-11 Test Method) as defined in 2016 CBC. Nonetheless, it may be desirable that the soil expansion potential be re-evaluated through additional testing during or after rough grading operations to verify the design adequacy of foundation or slab-on-grade against the re-tested soil expansion potential as heterogeneity within soil mass is not uncommon.

Lightly loaded structural elements could undergo movements upon prolonged moisture inundation that could potentially result in distress to shallow foundations and/or slabs due to the "Low" expansion potential of site soils. Design provisions such as adequate reinforcements, deeper foundations or other measures may help alleviate the effects of soils expansion but may not completely eliminate the problem.

#### 5.2.3 Remedial Grading:

To provide acceptable support for building foundations and slabs, it is recommended that on-site soils within the footprints of the Building and the SFD’s of the Development be overexcavated and removed uniformly to a minimum depth of four (4) feet below existing grade, or two and one-half (2.5) feet below the bottom of the lowest footing, whichever is lower, and replaced with properly compacted fill such that the building foundations and slabs are supported on a re-engineered,

compacted fill layer. The excavation bottoms should be near uniform. The overexcavation should extend laterally to a minimum distance of five (5) feet beyond the respective building perimeters, wherever possible.

The upper two (2) feet of compacted fill should consist of “Very Low” to “Low” expansive, granular, material (Expansion Index, EI, per ASTM D4829-11 Test Method not greater than 50), compacted to at least 90 percent relative compaction with minimum moisture content of two (2) percentage above optimum moisture content. On-site subgrade soils at their present state generally exhibit EI’s within the preferred value and, thus, are deemed suitable for re-use as fill with no depth limitation.

Soils exposed at excavation bottoms to a depth of one (1) foot should be scarified, reworked and recompacted to exhibit a minimum 90 percent relative compaction with a minimum moisture content of two (2) percentage points above the optimum moisture content prior to receiving fill placement. The exposed excavation bottom should be observed, tested, and approved by the Geotechnical Consultant prior to placing compacted fill. In case of the presence of localized loose soils, the overexcavation needs to be deepened accordingly to delete the loose soil condition. However, this deepened overexcavation may be terminated when the exposed native, undisturbed soils exhibit a natural relative compaction greater than 85 percent, subject to the testing and inspection by the representative from the Geotechnical Consultant.

The Geotechnical Consultant should be provided with appropriate foundation details and staking during grading to verify that depths and/or locations of the recommended overexcavation are adequate. For areas on site that grading recommendations stipulated in both Sections 5.2.1 and 5.2.3 apply, the more stringent grading criteria between the two sections should govern.

The depth of overexcavation should be reviewed by the Geotechnical Consultant during the actual construction. Any subsurface obstruction, buried structural elements, and unsuitable material encountered during grading, should be immediately brought to the attention of the Geotechnical Consultant for proper exposure, removal and processing, as recommended.

#### 5.2.4 Temporary Excavation:

Excavations of site soils 4 feet or deeper should be temporarily shored or sloped in accordance with Cal OSHA requirements.

##### a) Temporary Sloping:

In areas where excavations deeper than 4 feet are not adjacent to existing structures of public right-of-ways, sloping procedures may be utilized for temporary excavations. It is recommended that temporary slopes in both fill and native soils be graded no steeper than

1.5:1 (H:V) for excavations up to 20 feet in depth. The above temporary slope criteria is based on level soils conditions behind temporary slopes with no surcharge loading (structures, traffic) within a lateral distance behind the top of slope equivalent to the slope height.

It is recommended that excavated soils be placed a minimum lateral distance from top of slope equal to the height of slope. A minimum setback distance equivalent to the slope height should be maintained between the top of slope and heavy excavation/grading equipment. Should running sand conditions be experienced during excavation operations, flattening of cut slope faces, or other special procedures may be required to achieve stable, temporary slopes.

Soil conditions should be reviewed by the Geotechnical Consultant as excavation progresses to verify acceptability of temporary slopes. Final temporary cut slope design will be dependent upon the soil conditions encountered, construction procedures and schedule.

b) Temporary Shoring:

Temporary shoring will be required for those excavations where temporary sloping as specified above is not feasible.

Temporary cantilever shoring, if used, should be designed to resist an active earth pressure of 40 pounds per cubic foot (pcf) equivalent fluid pressure (EFP) for level soil conditions behind shoring. The resultant lateral deflection of shoring and surficial settlement immediately behind shoring are estimated to be on the order of one (1) to one and one half (1 ½) percent of the shored excavation depth. Should this ground deformation be intolerable to the existing structure, ASE should be consulted for more detailed analysis and further recommendations.

The design shoring should also include surcharge loading effects of existing structures and anticipated traffic, including delivery and construction equipment, when loading is within a distance from the shoring equal to the depth of excavation.

In addition to the above, a minimum uniform lateral pressure of 100 pounds per square foot (psf) in the upper ten (10) feet of shoring should be incorporated in the design when normal traffic is permitted within ten (10) feet of the shoring.

5.2.5 Exterior Slab-on-Grade/Concrete Flatwork/Hardscape/Pavement Support:

For the purpose of reducing future unsightly and uneven movements and cracks of any newly re-constructed exterior slab-on-grade, concrete flatwork, hardscape, or pavement, it is recommended that the upper eighteen (18) inches of soils below the bottom of and one (1) foot laterally beyond the footprint of exterior concrete slab-on-grade/concrete flatwork/hardscape/pavement should

consist predominantly of "Very Low" to "Low" expansive, suitable site, import or blended material (EI ≤ 50), compacted to at least 90 percent relative compaction with a minimum moisture content of two (2) percentage points above optimum moisture content. Prior to placement of the above recommended fill layer, the upper six (6) inches of exposed subgrade should be reworked to at least 90 percent relative compaction with a minimum moisture of two (2) percentage points above optimum moisture content.

From geotechnical viewpoint, new landscape area with only softscape is not subject to subgrade preparation and remedial grading requirements mentioned in Sections 5.2.1, 5.2.3 and 5.2.5.

5.2.6 Bulking and Shrinkage:

Bulking and shrinkage occur when soils are excavated and recompacted on site. For estimating purposes, ASE recommends that a shrinkage factor on the order of 15 to 20 percent be considered for excavated and recompacted site soils. As the actual shrinkage will vary greatly with the depth of removal, stripping loss, and actual field conditions at the time of grading, it will be desirable that the shrinkage factor be re-evaluated during grading. In addition, subsidence between one-half (1/2) inch and one (1) inch should be considered on compacted fill due to heavy machinery loading, varying fill thicknesses, and movement.

5.2.7 Suitable Soils and Imported Soils:

Unless otherwise noted, any soil re-used or imported as fill for the completion of subgrade preparation should consist of predominantly "Very Low" to "Low" expansive, granular material exhibiting an EI not greater than 50, and should be exhibiting a relatively uniform gradation, free of debris, particles greater than 4 inches in maximum dimension, organic matter or other deleterious materials.

Unless otherwise approved by the Geotechnical Consultant, any import fill materials should also comply with the following soil corrosivity criteria with respect to the desired concrete and reinforcement protection.

<b>Corrosivity Criteria for Select Fill and General Fill</b>			
<b>Soluble Sulfate (% by weight) <sup>(1)</sup></b>	<b>Soluble Chloride (ppm) <sup>(2)</sup></b>	<b>Resistivity Value (ohm-cm) <sup>(3)</sup></b>	<b>pH-Value <sup>(4)</sup></b>
≤ 0.1	≤ 500	≥ 2000	7.0 ~ 8.8

(1) California Test Method 417. (2) California Test Method 422. (3) ASTM G57 Test Method. (4) California Test Method 532.

All site soils, blended material and proposed import material must be approved by the Geotechnical Consultant or his representative, prior to its use and arrival on site, and should be subjected to continuing verification testing during site grading.

### 5.2.8 Backfilling and Compaction Requirements:

Existing site soils at their present state and composition, unless indicated or tested otherwise, are considered suitable for re-use as fill during site grading within the footprints of the Building and the SFD's, flatworks, non-structural or landscape areas, and backfilling of utility trenches, provided they are 1) free of debris, particles greater than 4 inches in maximum dimension, organic matter or other deleterious materials, 2) are not environmentally contaminated, and 3) adequately moisture conditioned to permit achieving the required compaction. No nesting of large particles (2 to 4-inch size) should be permitted during backfilling operations.

Site soils and/or import materials approved for use as fill should be placed in loose horizontal lifts not exceeding 8 inches, moisture conditioned to a minimum of two (2) percentage points above optimum moisture content per ASTM D1557-12 Test Method, unless otherwise stated. For fill soils to be placed greater than ten (10) feet deep from finish subgrade, in order to minimize future surcharge-induced settlement, a minimum relative compaction of 92 percent should be attained when placed. A minimum 90 percent relative compaction should be attained for fill soils to be placed within ten (10) feet from finish subgrade.

### 5.2.9 Tests and Observations:

All subgrade preparation, compaction, and backfill operations should be performed under the observation of and testing by the Geotechnical Consultant's field representative. An adequate number of field tests should be taken to ensure compliance with this report and local ordinances. If it is determined during grading that site soils require overexcavation to greater depths for obtaining proper support for the proposed structures, this additional work should be performed in accordance with the recommendations of the Geotechnical Consultant.

Imported fill soils or base materials should be examined by a representative of this office, and tested as necessary for evaluating their suitability for use as fill prior to being hauled to the Site. Final acceptance of any imported soil will be based upon review and testing of the soil actually delivered to the Site. All blended soils to be used as fill must be tested and approved by the Geotechnical Consultant prior to being used for fill placement.

## 5.3 Foundation Design

It is ASE's opinion that 1) conventional continuous spread footings and isolated pad footings and/or 2) PT slabs, bearing on approved compacted fill soils, may be used to provide foundation support for the Building and the SFD's, provided that the site grading recommendations presented in Section 5.2 above are incorporated in project planning and design, and implemented during site construction. Presented below

are the recommended geotechnical design and construction criteria for shallow footing foundation with slab-on-grade, and for alternative PT slabs.

5.3.1 Conventional Shallow Footing Foundation:

a) Minimum Footing Dimension and Reinforcement:

In order to mobilize sufficient soils bearing capacity supporting the new footings for the planned Building and SFD construction, it is recommended that the following tabulated minimum footing embedments, widths and reinforcements for various footing types be considered.

<b>Minimum Footing Dimension &amp; Reinforcement</b>					
<b>Continuous Spread Footing/Strip Footing</b>			<b>Isolated Pad Footing</b>		
<b>Depth<sup>(1)</sup> (in)</b>	<b>Width (in)</b>	<b>Reinforcement<sup>(2)</sup></b>	<b>Depth<sup>(1)</sup> (in)</b>	<b>Width (in)</b>	<b>Reinforcement<sup>(2)</sup></b>
18	15	Four #4 bars – two near the top and two near the bottom	18	24 square	Four #4 bars – two near the top and two near the bottom, applied bi-axially

(1) Footing embedment measured from the nearest adjacent lowest soils grade.

(2) Based strictly from geotechnical point of view.

Foundation design details such as concrete strength, reinforcements, etc. should be established by the Structural Consultant.

b) Allowable Soils Bearing Capacity:

For footings complying with the minimum dimension requirements stipulated in Section 5.3.1 a) above, the allowable soils bearing capacities, inclusive of both dead and live loads, should be as per tabulated below:

<b>Allowable Soils Bearing Capacity (psf)</b>		<b>Increase per 12- inch Increment in Footing Width (psf)</b>	<b>Increase per 12- inch Increment in Footing Depth (psf)</b>	<b>Maximum Composite Ceiling Value (psf)</b>
<b>Continuous Spread Footing/ Strip Footing</b>	<b>Isolated Pad Footing</b>			
2,500	2,500	100	500	3,500

The above allowable bearing capacities may be increased by one-third (1/3) when subject to short-term, transient loading induced by wind or seismic activities.

c) Lateral Resistance:

Resistance to lateral loads can be assumed to be provided by passive lateral earth pressure and by friction acting on structural components in permanent contact with the subgrade soils.

For site preparation implemented as per recommended in the above Section 5.2, lateral resistance on the sides of foundations may be computed using a passive lateral earth pressure of 250 pcf EFP for footings embedded into approved compacted fill soils, subject to a maximum of 2,500 psf. An ultimate coefficient of friction on the order of 0.36 may also be used for structural dead load acting between the footing bottom and the supporting soils. The above passive lateral earth pressure may be used in conjunction with the ultimate coefficient of friction in calculating composite lateral resistance, provided the passive lateral earth pressure value is reduced by one-third (1/3). The composite lateral resistance may be increased by one-third (1/3) under short term, transient wind or seismic loading.

d) Static Settlements:

Total static settlements resulting from compression of subgrade soils for conventional footings designed and constructed in accordance with the above criteria, and supporting maximum assumed dead plus live (D+L) column and wall loads mentioned in Section 1.1.2 above, are not anticipated to exceed one (1) inch, upon implementation of site preparation as per recommended in Section 5.2 above. A differential settlement on the order of one-third (1/3) inch over a distance of 30 feet is anticipated between similarly loaded adjacent isolated pad footings, as well as for continuous wall footings over a distance of approximately 30 feet.

Please be reminded that the Geotechnical Consultant should be contracted for further evaluation and recommendations, as necessary, should final design structural loads exceed the maximum loads assumed in the above analyses by more than ten (10) percent.

5.3.2 Post-tensioned (PT) Slab Alternative:

Post-tensioned slabs should be designed based on the latest PTI design method (Reference 29), which is stipulated in References 27 and 28. Both of References 27 and 28 are part of the PT-slab design procedures per Section 1808.6.2 of 2016 CBC. The slabs should be designed for the differential settlement over the width of the building presented in Section 5.3.2 a) below. The subgrade soils engineered as per recommended in Section 5.2 above should be able to provide an allowable soils bearing capacity on the order of 1,200 psf for the PT slabs.

The following table presents suggested minimum coefficients to be used for soils with different degrees of expansion potential.

PTI METOD (3 <sup>RD</sup> EDITION) DESIGN PARAMETERS					
Thornswaite Index	-20	Soil Fabric Factor, Ft	1.0	Equilibrium Suction, pF	3.909
Surface Equilibrium Wet Suction, (pF) <sub>wet</sub>	3.0 <sup>a</sup>	Surface Equilibrium Dry Suction, (pF) <sub>dry</sub>	4.5 <sup>a</sup>		
Soil Expansion Classification	Very Low (EI ≤ 20)	Low (20 < EI ≤ 50)	Medium (50 < EI ≤ 90)	High (90 < EI ≤ 130)	

(continued)

<b>(e<sub>m</sub>) edge lift (ft)<sup>b</sup></b>	5.20 <sup>c</sup>	4.64 <sup>c</sup>	4.13 <sup>c</sup>	3.78 <sup>c</sup>
<b>(e<sub>m</sub>) center lift (ft)<sup>b</sup></b>	9.00 <sup>c</sup>	9.00 <sup>c</sup>	8.55 <sup>c</sup>	7.34 <sup>c</sup>
<b>(y<sub>m</sub>) edge lift (in)</b>	0.25	0.62	1.11	1.61
<b>(y<sub>m</sub>) center lift (in)</b>	0.10	0.25	0.43	0.60

a. Values per PTI recommendations.

b. Soil parameters such as Atterberg Limits and % passing #200 have been derived from typical values available from Day (2005), Bowles (1996), and PTI (2004).

c. Governed by soil aspect consideration.

For the site soils encountered, if adopted, ASE recommends that the pertinent PT slab design parameters for the "Low" Soils Expansion Classification tabulated above be considered for preliminary PT slab design, subject to further EI verification during grading. Please note that the above tabulated coefficients are considered minimums and may not be adequate to represent worst-case conditions such as adverse drainage and/or improper landscaping and maintenance. The above parameters are applicable provided structures have gutters and downspouts and positive drainage is maintained away from structures.

Deepened footings/edges around the slab perimeter must be used to minimize non-uniform surface moisture migration (from an outside source) beneath the slab. An edge depth of at least 12 inches should be considered for soils with "Low" to "Very Low" EI's and 18 inches for soils with "Medium" to "High" EI's. The bottom of the deepened footing/edge should be designed to resist tension.

PT slabs often develop a "dishing" or "arching" characteristic due to the fluctuation of soil moisture content underlying the perimeter and center slab. All areas to receive concrete should be presaturated to a depth of eighteen (18) inches such that the soil within this zone is approximately at optimum moisture to not more than four (4) percent above optimum moisture content. The Geotechnical Consultant should verify all subgrades that are pre-soaked within 24 hours of concrete placement.

The entire PT slab within each building should be underlain by an impermeable vapor barrier (minimum 10-mil-thick polyvinyl chloride membrane). A minimum 12-inch overlap between visqueen sheets should be ensured during placement. All visqueen sheets should be puncture free prior to slab construction, and should be sandwiched top and bottom by two (2) inches of clean sand (S.E. ≥ 30 per ASTM D 2419-09 Test Method) prior to placement of concrete. Alternatively, the combination of visqueen and sand layers may be eliminated with the use of Stego Wrap 15-mil Class A Vapor Barrier. The concrete slab shall consist of a concrete mix design which will address bleeding, shrinking and curling.

a) Static Settlements:

Tabulated below are the estimated static settlements anticipated to occur at the base of the PT slab foundation supporting a building structure with the assumed slab dimensions and the assumed loading, following the site grading recommended in Section 5.2.

Structure	Assumed Slab Dimension	Uniform Applied Pressure, psf	Estimated Static Settlement (inches)	
			Center	Corner
Two-Story Building	35' x 55'	500	1.00	0.50

Actual settlements may be greater or less, dependent on load distribution across the planned PT slab construction, final PT slab dimension and PT slab rigidity. The Geotechnical Consultant should be consulted for potential settlements associated with PT slabs of different dimensions and/or loading. If the PT slab are to be designed and constructed as a rigid unit, estimated total static settlement across the PT slab is anticipated to be on the order of 2/3 of the value of the corresponding center settlement, i.e. 0.67 inch, with a differential movement on the order of 0.33 inch for the building dimension tabulated above.

Please be reminded that the Geotechnical Consultant should be contracted for further evaluation and recommendations, as necessary, should final design structural loads exceed the maximum loads assumed in the above analyses by more than ten (10) percent.

5.3.3 Retaining Walls:

Cantilevered retaining walls should be designed for an "active" lateral earth pressure value tabulated below for approved granular backfill soils and level backfill conditions, whereas an "At-rest" lateral earth pressure value for approved granular backfill and level backfill conditions tabulated below should be used for top-restrained retaining walls. Retaining walls subject to uniform surcharge loads should be designed for an additional uniform lateral pressure equal to one-third (1/3) and one-half (1/2) of the anticipated surcharge pressure over the full retained height of the retaining wall (measuring from the top of wall to the heel of wall footing) for cantilevered and top-restrained wall fixity conditions, respectively, as shown in Figure 4, Nearby Building Surcharge Consideration and Retaining Wall Drainage Details. Any retaining wall with a retained height exceeding six (6) feet should additionally be designed to resist seismic lateral earth pressure. The Geotechnical Consultant should be consulted if this condition exists, or if the local governing agency requires the retaining wall to be designed for seismic lateral earth pressure regardless of the retained height. Footings should be reinforced as recommended to by Structural Consultant. Appropriate back drainage should be provided to avoid excessive build-up of hydrostatic wall pressures.

Retaining Wall Design Parameter	Value
Allowable Soils Bearing Capacity	2,500 psf <sup>(1)(2)</sup>
Active Pressure [ <u>site soils backfill</u> : level]	40 pcf EFP <sup>(3)</sup>
At-rest Pressure [ <u>site soils backfill</u> : level]	62 pcf EFP <sup>(3)</sup>
Passive Pressure (per foot of depth)	250 pcf EFP, subject to a ceiling value of 2,500 psf <sup>(4)</sup>
Coefficient of Friction	0.36 <sup>(4)</sup>
Minimum Footing Depth	18 inches
Minimum Footing Width	15 inches
Minimum Reinforcement	Four No. 4 rebar - 2 near top and 2 near bottom

(1) Based on compliance with earthwork recommendations per Section 5.2 of this Soils Report.

(2) Allowable soils bearing capacity increase for larger retaining wall footings should be as per Section 5.3.2 b).

(3) Design values assuming a drained condition with "Very Low" to "Low" expansive materials ( $EI \leq 50$ ) within the backfill zone and no surcharge loading conditions.

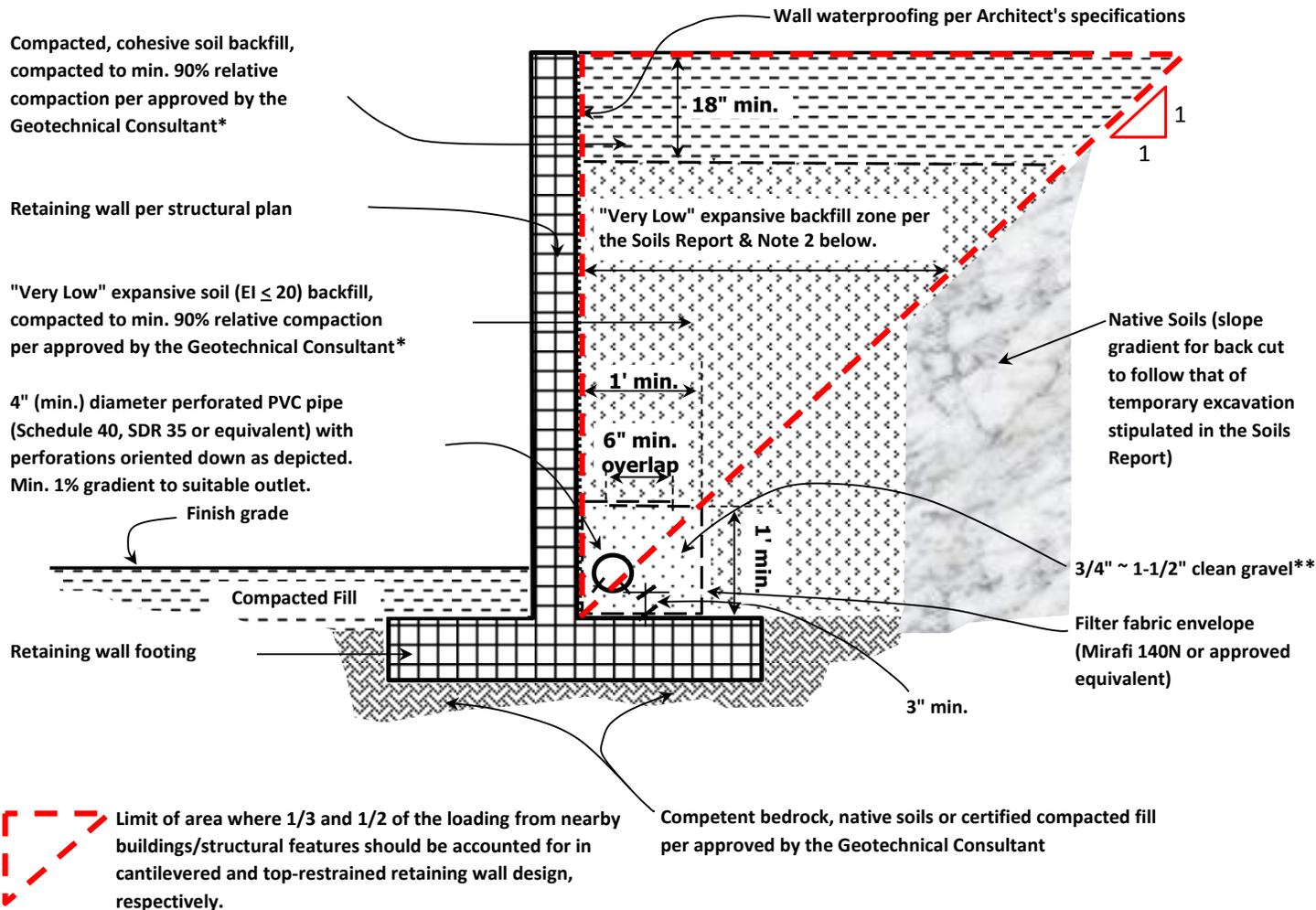
(4) Passive lateral resistance may be combined with frictional resistance provided the passive lateral earth pressure is reduced by 1/3. See Section 5.3.1c.

The Geotechnical Consultant should be on-site during temporary back cut and retaining wall construction to inspect and evaluate the stability of cuts and, if necessary, to provide additional remedial or mitigative recommendations.

Preferably, the backfill should consist of approved "Very Low" to "Low" expansive material (i.e.  $EI \leq 50$ ) and should be compacted to a minimum relative compaction of 90 percent. The width of the "Very Low" to "Low" expansive (i.e.  $EI \leq 50$ ) backfill zone should be a minimum of one (1) foot measured from the rear side of the stem of the retaining wall, or the space between the rear side of the stem and the heel of the retaining wall, or one-half (1/2) of the retained height of the retaining wall, whichever is greater. Flooding or jetting of backfill should not be permitted. Granular backfill should be capped with 18 inches (minimum) of relatively impervious fill to seal the backfill and prevent saturation. Figure 4 illustrates the general configuration and requirements for retaining wall drainage. Should any conflict noticed between recommendations stated in this report and those shown in Figure 4, the fore should govern. Other retaining wall drainage alternatives may be considered but should first be reviewed and approved by the Geotechnical Consultant prior to implementation.

Should the space behind the new retaining wall be too tight to implement the above recommended backfill effort, as an alternative, 1.5-sack control density fill (slurry fill) may be used in lieu of regular soil backfill, provided that the integrity and functionality of wall backdrain is protected and maintained.

It should be noted that the use of heavy compaction equipment in close proximity to retaining structures can result in wall pressures exceeding design values and corresponding wall movement



SPECIFICATIONS FOR CALTRANS CLASS II PERMEABLE MATERIAL	
U.S. STANDARD SIEVE SIZE	% PASSING
1"	100
3/4"	90 ~ 100
3/8"	40 ~ 100
No. 4	25 ~ 40
No. 8	18 ~ 33
No. 30	5 ~ 15
No. 50	0 ~ 7
No. 200	0 ~ 3
Sand Equivalent > 75	

\* Based on ASTM D-1557-02

\*\* If Caltrans Class II permeable material (see gradation to left) is used in place of 3/4" ~ 1-1/2" gravel, filter fabric may be deleted. Caltrans Class 2 permeable material should be compacted to minimum 90 percent relative compaction. Unless otherwise specified, a minimum of 1 cubic foot of gravel should be used for each 1 foot run of drain.

Note 1: Composite drainage products such as Contech C-Drain, Miradrain or J-Drain may be used as alternative to gravel or Class II. Installation should be performed in accordance with manufacturer's specifications.

Note2: Min. Extent of "Very Low" expansion backfill zone should be as per indicated by the red-dotted wedge area behind retaining wall.

Schematic Not To Scale

 <p>Associated Soils Engineering, Inc. 2860 Walnut Avenue Signal Hill, CA 90755 Tel (562) 426-7990 Fax (562) 426-1842</p>	Project:	Prop. Residential & Retail Mixed Development SWC of Rose Drive & Alta Vista St., Placentia, CA		
	Figure 4	Nearby Building Surcharge Consideration & Retaining Wall Drainage Details		
	Proj. No.:	6736.17	Date:	September, 2017

greater than that normally associated with the development of active or at-rest conditions. In this regard, the contractor should take appropriate precautions during the backfill placement.

#### 5.3.4 Footing/Foundation Observation:

All footing/foundation excavations should be observed by the Geotechnical Consultant's representative to verify minimum embedment depths and competency of bearing soils. Such observations should be made prior to placement of any reinforcing steel or concrete.

### 5.4 Slabs-On-Grade

Concrete floor slabs in the Building and the SFD's and exterior concrete flatwork/hardscape should be supported on properly compacted soils as recommended in the Site Grading section (i.e. Section 5.2) of this report. The slab subgrade soils should also be proof-rolled just prior to construction to provide a firm, unyielding surface, especially if the subgrade has been disturbed or loosened by the passage of construction traffic. Final compaction and testing of slab subgrade should be performed just prior to placement of concrete.

For structural design of concrete slabs supported by approved compacted "Very Low" to "Low" expansive fill ( $EI \leq 50$ ), a modulus of subgrade reaction ("k") on the order of 80 pounds per square inch per inch (psi/in or pci) and an allowable bearing capacity of 800 psf may be used. Interior and exterior slabs should be properly designed and reinforced for the construction and service loading conditions. To minimize future slab distress, geotechnically, it would be prudent to provide a minimum actual slab thickness of four (4) inches with minimum reinforcement consisting of number 4 reinforcing bars spaced maximum 18 inches on centers each way placed at mid-slab. The structural details, such as slab thickness, concrete strength, amount and type of reinforcements, joint spacing, etc., should be established by the Structural Consultant in accordance with pertinent sections in 2016 CBC.

The entirety of any new slabs within the Buildings should be underlain by an impermeable vapor barrier (minimum 10-mil-thick visqueen) per 2016 CRC Section R506.2.3. A minimum 12-inch overlap between visqueen sheets should be ensured during placement. All visqueen sheets should be puncture free prior to slab construction, and should be sandwiched top and bottom by two (2) inches of clean sand (Sand Equivalent, S.E.,  $\geq 30$  per ASTM D2419-14 Test Method). Alternatively, the combination of visqueen and sand layers may be eliminated with the use of Stego Wrap 15-mil Class A Vapor Barrier. The concrete slab shall consist of a concrete mix design which will address bleeding, shrinking and curling.

Exterior slabs should be properly jointed to limit the number of concrete shrinkage cracks. For long/thin sections, such as sidewalks, expansion or control joints should be provided at spacing intervals equal to the width of the section. Slabs between 5 and 10 feet in minimum dimension should have a control joint at centerline. Slabs greater than 10 feet in minimum dimension should have joints such that unjointed

sections do not exceed 10 feet in maximum dimension. Where flatwork adjoins structures, it is recommended that a foam joint or similar expansion material be utilized. Joint depth and spacing should conform to the ACI recommendations. It is, however, cautioned that uneven heaving of exterior slabs may develop in the future when prolonged irrigation or seepage permeates the subgrade soil, especially in areas that expansive soil pockets exist due to inadequate control or inspection of earthwork construction.

### 5.5 **Asphaltic Concrete (AC) Flexural Pavement Design**

The finish grade at the subject Site is anticipated to be underlain by compacted structural fill consisting of site soils. For preliminary pavement design purposes, a laboratory tested R-Value of 5 has been utilized considering the site soils as subgrade soils. Three (3) traffic indices ("TI") of 4.5, 5.5 and 7.0, together with the tested R-Value, have been utilized for the development of preliminary recommendations for the pavement sections. Analyses performed in accordance with the current edition of the Caltrans Highway Design Manual, and assuming compliance with site preparation recommendations, it is recommended that the following AC pavement structural sections be used:

Traffic Index (TI)	Pavement Section Alternatives		Remark
	AC <sup>(1)</sup> (inches)	AB <sup>(2)</sup> (inches)	
4.5	3.0	8.5/5.0 <sup>(3)</sup>	For auto parking stalls.
	4.0	6.0/4.0 <sup>(3)</sup>	
5.5	3.0	12.0/8.0 <sup>(3)</sup>	For auto circulation aisles.
	4.0	10.0/6.5 <sup>(3)</sup>	
7.0	5.0	13.5/9.0 <sup>(3)</sup>	For fire lanes and truck access ways/entry and exits.
	6.0	11.5/7.5 <sup>(3)</sup>	

(1) Asphaltic Concrete.

(2) CAB or CMB, Greenbook sections 200-2.2 and 200-2.4, respectively, compacted to at least 95% relative compaction.

(3) Base reinforced by placement of a layer of geogrid (Tensar BX-1100, Mirafi BXG-11 or equivalent) at bottom of base layer.

Please be reminded that the above preliminary pavement section recommendations have been established based purely on procedures stipulated in Caltrans Manual. Governing authority should be consulted for minimum pavement section requirements and, if more stringent than that recommended by ASE, be complied with. It is recommended that R-Value testing be performed on representative soil samples after rough grading on the upper 2 feet to confirm/modify applicability of the above pavement sections.

The aggregate base should conform to the Crushed Aggregate Base (CAB), Crushed Miscellaneous Base (CMB), or Processed Miscellaneous Base (PMB) requirements per Sections 200-2.2, 200-2.4, or 200-2.5 of the Greenbook, respectively. The base course should be compacted to a minimum relative compaction of 95% at a minimum of one (1) percentage point above the optimum moisture content. Field testing should be used to verify compaction, aggregate gradation, and compacted thickness.

The asphalt concrete pavement should be compacted to 95% of the unit weight as tested in accordance with the Hveem procedure. The asphalt concrete material shall conform to Type III, Class C2 or C3, of the Greenbook. All subgrade and aggregate base materials should be proof-rolled by heavy rubber tire equipment to verify that the subgrade and base grade are in a non-yielding condition.

If the paved areas are to be used during construction, or if the type and frequency of traffic is greater than assumed in the design, the pavement section should be re-evaluated for the anticipated traffic.

## 5.6 Portland Cement Concrete (PCC) Pavements

The following concrete pavement sections are based on load safety factors of 1.0 and 1.1, and a modulus of subgrade reaction ("k" Value) of 80 pounds per cubic inch for site soils compacted as subgrade material, and the design procedures presented in the Portland Cement Association bulletin "Thickness Design for Concrete Highway and Street Pavements" (EB109.01P), 1984. A design service life of 20 years was assumed for the design of the Portland cement concrete pavement section.

Concrete Flexural Strength (psi) <sup>(1)</sup>	Pavement Thickness (in) <sup>(2)</sup> , <sup>(4)</sup>	Pavement Thickness (in) <sup>(3)</sup> , <sup>(4)</sup>
600	6.0	7.0
650	5.5	6.5

(1) Represents 90-day flexural strength. Based on Figure 10 of Reference 21, concrete with 28-day unconfined compressive strength values of 4000 and 4500 psi typically correlates to 90-day flexural strength values of 600 and 650 psi, respectively.

(2) Load Safety Factor = 1.0 (Auto Parking Stalls)

(3) Load Safety Factor = 1.1 (Fire Lanes/Truck Traffic Areas/Entry and Exits)

(4) Assumes no PCC shoulder or curb.

The Structural Consultant should establish the design details of the concrete pavement section, including reinforcements, concrete strength, and joint and load transfer requirements. It is recommended that edges of concrete pavements which are not adjacent to existing buildings, or are adjacent to planter areas, be downturned a minimum of 12 inches or be constructed with curbing to prevent water infiltration to subgrade soils. If edges are downturned or curbing is constructed, the above pavement thicknesses should be decreased by 1/2 inch.

The upper one (1) foot of exposed subgrade soils beneath concrete pavements should be further compacted to a minimum 95 percent relative compaction with a minimum moisture content of two (2) percentage points above optimum moisture content. Subgrade soils should exhibit a firm, unyielding surface in addition to the recommended compaction. Final compaction and testing of pavement subgrade should be performed just prior to placement of aggregate base and/or concreting. Other pertinent subgrade preparation measures stipulated in the "Thickness Design for Concrete Highway and Street Pavements" (EB109.01P), 1984, or required by the jurisdictional municipal authorities should be followed accordingly.

## **5.7 Site Drainage**

Per Section 1804.4 of 2016 CBC, a minimum 5% descending gradient away from the Development Buildings for a minimum distance of 10 feet should be incorporated for earth grade placed adjacent to the foundation. This descending gradient may be reduced to 2% for any impervious areas, such as concrete paved walkways, within the 10-foot zone. For areas where the 10-foot drainage distance is not attainable, alternative measure such as concrete-lined swales having a minimum 2% gradient may be adopted to divert the water away from the Buildings, provided that a minimum 5% gradient is maintained in the distance between the building footprint and the diversion measure such as swales. For more specific site drainage guidelines, the Project Civil Consultant should refer to the pertinent sections in 2016 CBC.

Any planter areas to be placed adjacent to structure perimeters should be provided with solid bottoms and a drainage pipe, to divert water away from foundation and slab subgrade soils. Excessive moisture variations in site soils could result in significant volume changes and movement.

## **5.8 Soil Corrosivity Evaluation**

Soils corrosivity tests were performed on a representative sample of site soil. These tests are meant to determine the corrosive potential of on-site soils to proposed concrete foundations/flatwork and underground metal conduit. The soils corrosivity test results are presented in Appendix A.

### **5.8.1 Concrete Corrosion:**

Disintegration of concrete may be attributed to the chemical reaction of soils sulfates and hydrated lime and calcium aluminate with the cement. The severity of the reaction resulting in expansion and disruption of the cement is primarily a function of the concentration of soluble sulfates and the water-cement ratio of the concrete.

Soluble sulfate contents of 0.012%, 0.128% and 0.328% by weight have been recorded from testing per California Test Method (CTM) 417 conducted on on-site soils, as indicated in Appendix A. Per Table 4.2.1 of ACI 318-14, soils exhibiting soluble content less than 0.1% by weight are classified as having "Not Applicable" sulfate exposure and "S0" sulfate exposure category, soils exhibiting soluble content equal to and between 0.1% and 0.2% by weight are classified as having "Moderate" sulfate exposure and "S1" sulfate exposure category, and soils exhibiting soluble content equal to and between 0.2% and 2.0% by weight are classified as having "Severe" sulfate exposure and "S2" sulfate exposure category. As such, for structural features to be in direct contact with on-site soils, the tested "S0" sulfate exposure category indicates that there should be no special geotechnical restriction on the type of Portland cement or water cement ration to be used, as per stipulated in Table 4.3.1 of ACI 318-14, whereas the tested "S1" and "S2" sulfate exposure categories indicates

that there will be special geotechnical restrictions on cement and water as stipulated in the referenced table.

#### 5.8.2 Metal Corrosion:

In the evaluation of soil corrosivity to metal, the hydrogen ion concentrates (pH) and the electrical resistivity of the site and backfill soils are the principal variables in determining the service life of ferrous metal conduit. The pH of soil and water is a measure of acidity or alkalinity, while the resistivity is a measure of the soils resistance to the flow of electrical current.

Currently available design charts indicate that corrosion rates decrease with increasing resistivities and increasing alkalinities. It can also be noted that for alkaline soils, the corrosion rate is more influenced by resistivity than by pH.

Resistivity values of 657, 895 and 11,400 ohm-cm per ASTM G57 Test Method coupled with respective pH-values of 7.63, 7.44 and 8.93 per CTM 643 classifies the on-site soils tested to be very corrosive, corrosive and non-corrosive, respectively, to buried ferrous metals. Based on CTM 643, the year to perforation for 18-gauge steel in contact with soils of similar resistivity and pH-value is approximately 21, 24 and greater than 50 years for the very corrosive, corrosive and non-corrosive on-site soils, respectively. In lieu of additional testing, alternative piping materials, i.e. plastic piping, may be used instead of metal if longer service life is desired or required for utility pipes and fittings in direct contact with site soils with very corrosive and corrosive resistivity values. These resistivity values of on-site soils may also have implications to other building materials and depths of embedment for steel reinforcement, etc. It is recommended that a qualified corrosion consultant be engaged to review the building plans.

Soluble chloride contents of 12 to 56 ppm were recorded in our laboratory tests per CTM 422. Per Caltrans guidelines and specifications (References 19 and 20), soils exhibiting soluble chloride contents exceeding 500 ppm are considered “corrosive”. The soils are thus classified as “non-corrosive” per Caltrans criterion. In addition, special measure in terms of rebar protection against chloride corrosion under Exposure Class “C0” stipulated in Tables 4.2.1 and 4.3.1 of ACI 318-14 may be required as a result of the soluble chloride content tested. However, the compliance with the corrosivity criteria stipulated in Section 5.2.7 above will ensure that no other particular reinforcement protection measure will be needed for foundations in contact with import fill.

Due to the relatively large ranges of the tested site soils’ soluble sulfate contents and resistivity values/pH-values, for preliminary planning purpose, the Civil and Structural Consultants should consider the pertinent sulfate-resistant and rebar protection requirements based on the proximity of the planned building/structural improvement towards the corresponding ASE’s exploratory boring location where the

soil samples for corrosivity testing were obtained. Nonetheless, additional soils corrosivity testing should be performed on soil samples collected from finish subgrade after the completion of site grading to verify the adequacy of design soils corrosivity values and, if necessary, to adjust the concrete's design mix, cement type, rebar protection, piping protection etc., as appropriate.

## **5.9 Utility Trenches**

All trenches should be backfilled with approved fill material compacted to relative compaction of not less than 90 percent per ASTM D1557-12 Test Method. Care should be taken during backfilling to prevent utility line damage.

The on-site soils may be used for backfilling utility trenches from one (1) foot above the top of pipe to the surface, provided the material is free of organic matter and deleterious substances. Any soft and/or loose materials or fill encountered at pipe invert should be removed and replaced with properly compacted fill or adequate bedding material.

Some of the on-site soils (i.e. granular, sandy soils encountered in Boring B-6) may be considered suitable for bedding or shading of utilities. Site or imported soils for pipe bedding should consist of non-expansive granular soils. Bedding materials should consist of sand with a Sand Equivalent value (ASTM D 2419-14 Test Method) not less than 30.

If sandy soils are used for trench backfill, the backfill should be topped with a minimum 2-foot thick cap of compacted fine-grained, cohesive soil. Also, a minimum 10-foot length of trench at the entrance and exit points of buildings should be backfilled with fine-grained soils to serve as a plug to prevent water migration into structure foundation support zones.

The walls of temporary construction trenches may not be stable when excavated nearly vertical due to the potential for caving. Shoring of excavation walls or flattening of slopes as stipulated in Section 5.2.4 above will be required if excavation depths greater than 4 feet are necessary. Trenches should be located so as not to impair the bearing capacity of soils or cause settlement under foundations. As a guide, trenches parallel to foundations should be clear of a 45-degree plane extending outward and downward from the edge of the foundations. All work associated with trenches, excavations and shoring must conform to the State of California Safety Code (CAL-OSHA).

## **5.10 Plan Review, Observations and Testing**

Once foundation and grading plans are completed, they should be forwarded to the Geotechnical Consultant for review of conformance with the intent of these recommendations and criteria presented in the pertinent sections of this report.

All excavations should be observed by a representative of this office to verify minimum embedment depths, competency of bearing soils and that the excavations are free of loose and disturbed materials. Such observations should be made prior to placement of any fill, reinforcing steel or concrete. All grading and fill compaction should be performed under the observation of and testing by a Geotechnical Consultant or his representative.

## **6.0 FIELD PERCOLATION TEST DATA**

After overnight presoaking, percolation tests were performed using the “Normal” method (i.e. 6 hour test with 30-minute reading intervals), according to the Orange County Technical Guidance Document Appendices (Appendix VII) procedures modified to test the cross sectional zone of typical soils within the level of anticipated storm water infiltration (e.g. approximately 1 foot to 5 feet below existing grade in Borings B-11 and B-12, and approximately 5 feet to 10 feet below existing grade in Boring B-10).

Field percolation testing was conducted on June 21, 2017. Stabilized field percolation test data indicates pre-adjusted percolation test rates of approximately 120 minutes per inch (mpi) for clean water at the location of Boring B-10, and zero minutes per inch (mpi) for clean water at the locations of Borings B-11 and B-12. Field percolation test data is presented on the attached Plates H-1 through H-3 in Appendix A, whereas tabulated below are the measured field percolation rates and the corresponding infiltration rate calculated from the Porchet Method of Percolation Rate Conversion.

<b>Test Location</b>	<b>Measured Field Percolation Rate (Minutes/Inch)</b>	<b>Converted Infiltration Rate (Inches/Hour) *</b>
B-10	120.0	0.012
B-11	0.0	0.0
B-12	0.0	0.0

\* Porchet Method Conversion from Percolation Rate, using a factor of Safety of 2.

The rates presented above are anticipated to be the fastest rates that can be absorbed by the site soils at the respective boring locations. However, with time and depending on the degree of saturation of soils and other factors, the percolation rate may reduce which is typical for sewage disposal or stormwater dispersal fields.

In reference to the Orange County Technical Guidance Document Appendices (Appendix VII), soils are considered potentially feasible for infiltration if the measured infiltration rate is greater than 0.3 inch per hour. Therefore, soils in the vicinities of Borings B-10, B-11 and B-12 are not considered suitable for the planning and installation of an on-site storm water dispersal system.

Please be informed that during installation of on-site storm water dispersal system, the following factors should be noted:

- The degree of compactive effort in the upper 1 to 1.5 feet of soils above any filter material should be between 90 and 92 percent relative compaction. As any greater compactive efforts in the soil strata of water retention system construction may cause the percolation rates to reduce substantially, it is not advisable to impose significant structural loading in these areas, from a geotechnical viewpoint.
- The rate of water transmission from the filter material to the soil will be limited the porosity characteristics of the fabric wrap around the filter material.

## **7.0 CLOSURE**

This report has been prepared for the exclusive use of **SC Placentia Development, LP** (the Client) and their subconsultants for use in design and construction of the proposed Development. The report has not been prepared for use by other parties, and may not contain sufficient information for purposes of other parties.

The Client is responsible for ensuring the information and recommendations contained in this report are brought to the attention of the Owner or the other design consultants, incorporated into the project plans, and implemented by project contractors. This report should be named on project plans as a part of the project specifications.

We request and recommend notification should any of the following occur:

1. Final plans for site development indicate utilization of areas not originally proposed for construction.
2. Structural loading conditions vary from those utilized for evaluation and preparation of this report.
3. The site is not developed within 12 months following the date of this report.
4. Change of ownership of property that would render the proposed development indicated in this report irrelevant or significantly different.

If changes or delays do occur, this office should be notified and provided with finalized plans of site development for our review to enable us to provide the necessary recommendations for additional work and/or updating of the report. Any charges for such review and necessary recommendations would be at the prevailing rate at the time of performing review work.

The findings contained in this report are based upon our evaluation and interpretation of the information obtained from the limited number of test borings and the results of laboratory testing and engineering analysis. As part of the engineering analysis it has been assumed, and is expected, that the geotechnical conditions existing across the area of study are similar to those encountered in the test excavations.

However, no warranty is expressed or implied as to the conditions at locations or depths other than those excavated. Should conditions encountered during construction differ significantly from those described in this report, this office should be contacted immediately for recommendations prior to continuation of work.

Our findings and recommendations were obtained in accordance with generally accepted current professional principles and local practice in geotechnical engineering and reflect our best professional judgment. We make no other warranty, either express or implied.

These recommendations are, however, dependent on the aforementioned assumption of uniformity and upon proper quality control of engineered fill and foundations. Geotechnical observations and testing should be provided on a continuous basis during grading at the site to confirm preliminary design assumptions and to verify conformance with the intent of our recommendations. If parties other than Associated Soils Engineering, Inc. are engaged to provide geotechnical services during construction, they must be informed that they will be required to assume complete responsibility for the geotechnical phase of the project by either concurring with the recommendations in this report or providing alternative recommendations.

This concludes our scope of services as indicated in our revised proposal dated June 8, 2017, however, our report is subject to review by the controlling authorities for the project. Any further geotechnical services that may be required of our office to respond to questions/comments of the controlling authorities after their review of the report will be performed on a time-and-expense basis as per our current fee schedule. We would not proceed with any response to report review comments/questions without authorization from your office.

We appreciate your business and are prepared to assist you with construction-related services.

## **APPENDIX A**

The following Appendices contain the substantiating data and laboratory test results to complement the engineering evaluations and recommendations contained in the report.

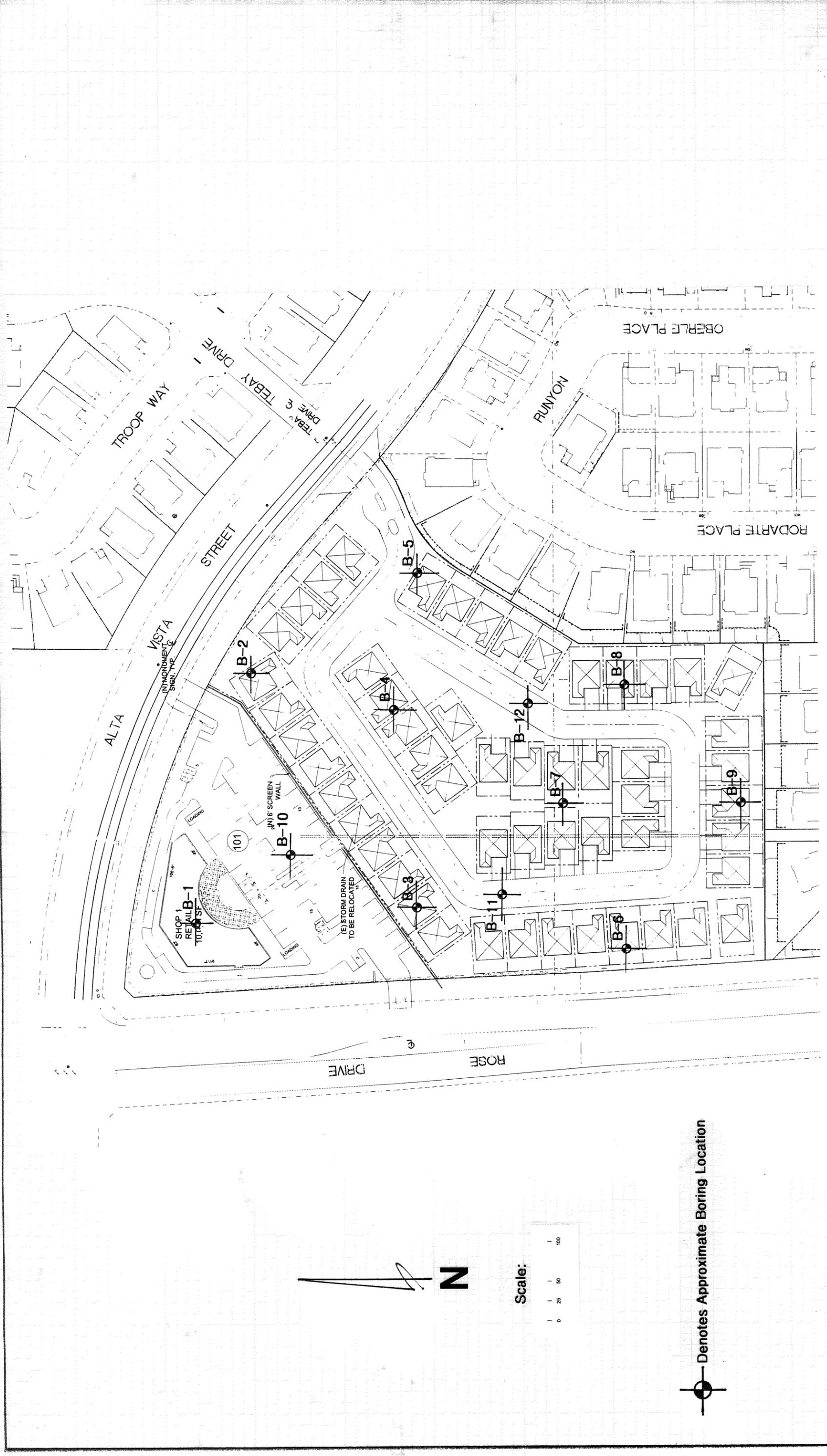
### **Site Exploration**

On June 19 and 20, 2017, field explorations were performed by drilling twelve (12) test borings at the approximate locations indicated on the attached Boring Location Plan, Plate A. The exploratory borings were drilled by Choice Drilling, Inc., utilizing a truck mounted, CME 75 rotary drilling rig equipped with 8-inch diameter continuous flight, hollow-stem rotary augers. The borings extended to depths of 6 feet to 31 feet 6 inches from the existing grades.

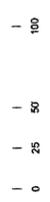
Continuous observations of the materials encountered in the borings were recorded in the field. The soils were classified in the field by visual and textural examination and these classifications were supplemented by obtaining bulk soil samples for future examination in the laboratory. Relatively undisturbed samples of soils were extracted in a Modified California barrel sampler lined with 2.416-inch diameter by one-inch high rings and tipped with tapered cutting shoe. Additional samples were obtained in a Standard Penetration sampler in accordance with specifications outlined in ASTM D1586-08a Test Method. All samples were secured in moisture-resistant bags immediately after retrieval from exploratory boring to minimize the loss of field moisture, followed by timely transportation to ASE's laboratory for ensuing testing. Upon completion of exploration, the borings were backfilled with excavated materials and compacted by tamping.

Description of the soils encountered, depth of samples, field density and moisture content of tested samples, respective laboratory tests performed, as well as Standard Penetration Test ("N" Values) and Modified California barrel sampler blow counts are presented in the attached Field Logs of Borings ("B" Plates).

Plate A	Boring Location Plan
Plates B-1 through B-12	Field Logs of Borings



Scale:



● Denotes Approximate Boring Location

SOURCE: CONCEPTUAL SITE PLAN, Drawing No. SP02, prepared by kigy Architecture + Planning, dated 4/3/2017.



Associated Soils Engineering, Inc.  
BORING LOCATION PLAN

Project #	6736.17	Plate	A
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# FIELD LOG OF BORING B-1

Sheet 1 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/19/2017</b> Drilled By: <b>Choice Drilling, Inc.</b> Rig Make/Model: <b>CME 95</b> Drilling Method: <b>Hollow-stem Auger</b> Hole Diameter: <b>8 Inches</b>	Logged By: <b>Gary L. Martin</b> Total Depth: <b>31 Feet 6 Inches</b> Hammer Type: <b>Automatic</b> Hammer Weight/Drop: <b>140 Lb./±30 In.</b> Surface Elevation: <b>N/A</b>
--	--

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "IN" or (Blows/ft.)								
0	0				ML	SANDY SILT WITH CLAY: FILL-Light yellowish brown, damp, fine-grained sand, with some gravel				MAX DENSITY, EXPANSION, REMOLD SHEAR, CORROSIVITY TESTS
		11/6" (Ring)			SM	SILTY SAND: FILL-Dark grayish brown, moist, fine to medium-grained sand	108.2	15.1		
		15/6" (Ring)			SC					
					CL	CLAYEY SAND: FILL-Brown and yellowish brown, with olive yellow, moist, fine-grained sand	115.1	14.7		
					CL					
5	5		29(Ring)		CL	SANDY CLAY: FILL-Yellowish brown, moist, fine-grained sand				
					CL	SILTY CLAY WITH SAND: FILL-Dark grayist brown, moist, fine-grained sand	113.8	11.1		
					CL	SILTY CLAY: FILL-Brown and yellowish brown, moist, with some calcareous inclusions				
					CL	SILTY CLAY WITH SAND: FILL-Olive brown, with brownish yellow and gray, moist, fine to medium-grained sand *insufficient sample for density				
10	10				ML	SANDY SILT: FILL-Light yellowish brown with brown, moist, fine-grained sand, with lens Silty Clay (CL)	*	10.5		
		11/6" (Ring)								
		17/6" (Ring)								
					ML	SANDY SILT WITH CLAY: FILL-Light yellowish brown, moist, fine-grained sand, with lens Silty Clay (CL)	118.3	11.1		
					ML	SANDY SILT WITH CLAY: NATIVE-Light yellowish brown, moist, fine-grained sand, trace calcareous veins				
15	15									CONSOL, SHEAR
		10/6" (Ring)					89.1	19.2		



# FIELD LOG OF BORING B - 1

Sheet 2 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK	DRIVE TYPE, "N" or (Blows/ft.)							
			13/6" (Ring)		ML	CLAYEY SILT: Light olive brown,moist to very moist	101.2	22.2		
20	20		17(Ring)		ML	SILT WITH CLAY: Light yellowish brown,very moist	96.2	25.8		
25	25		12/6" (Ring) 15/6" (Ring)		CL	SILTY CLAY: Yellowish brown,moist	100.4	19.1		
					ML	SANDY SILT WITH CLAY: Light yellowish brown,moist,fine-grained sand	110.6	13.3		
30	30		19(SPT)		CL	SILTY CLAY: Yellowish brown with dark grayish brown,moist,trace calcareous concretions		22.0		



# FIELD LOG OF BORING B-2

Sheet 1 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: **6/19/2017**

Logged By: **Gary L. Martin**

Drilled By: **Choice Drilling, Inc.**

Total Depth: **31 Feet**

Rig Make/Model: **CME 95**

Hammer Type: **Automatic**

Drilling Method: **Hollow-stem Auger**

Hammer Weight/Drop: **140 Lb./±30 In.**

Hole Diameter: **8 Inches**

Surface Elevation: **N/A**

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "IN" or (Blows/ft.)								
0	0				ML	SANDY SILT WITH CLAY: FILL-Light yellowish brown,damp,fine-grained sand,with some gravel				
			35(Ring)		SC	CLAYEY SAND WITH GRAVEL: FILL-Light brownish gray with yellowish brown,damp,fine to medium-grained sand	119.3	5.3		
			10/6" (Ring)		SC	CLAYEY SAND WITH GRAVEL: FILL-Grayish brown,trace light gray and brownish yellow,damp,fine to coarse-grained sand	108.8	6.0		
			12/6" (Ring)		CL	SANDY CLAY: FILL-Olive brown,trace yellow and yellowish brown,moist,fine to coarse-grained sand,with some gravel	121.7	9.1		
			9/6" (Ring)		CL	SILTY CLAY: FILL-Dark brown with yellowish brown,moist,trace fine sand	112.6	15.7		
			15/6" (Ring)		CL	SILTY CLAY: FILL-Yellowish brown and dark brown,moist,with some gravel,trace fine to medium sand	108.2	14.3		
					CL	SILTY CLAY WITH SAND: NATIVE-Olive,moist,fine-grained sand				
			16/6" (Ring)		SM	SILTY SAND: Light olive brown,trace pale yellow,damp,fine to coarse-grained sand	112.0	3.0		



# FIELD LOG OF BORING B - 2

Sheet 2 of 2

Project: *Residential and Retail Mixed Development-Placentia*

Location: *Rose Drive & Alta Vista Street* Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "N" or (Blows/ft.)								
		32/6" (Ring)			SM	SILTY SAND: Light yellowish brown, dry, fine to coarse-grained sand	110.6	2.1		
20	20	78(Ring)			CL	SANDY CLAY: Yellowish brown, moist, fine to coarse-grained sand, with some gravel	125.7	9.9		
25	25	61(SPT)			SC	CLAYEY SAND: Yellowish brown, damp, fine to coarse-grained sand, trace gravel		7.0		
30	30	18/6" (Ring)			SC	same as above, becoming light olive brown with brownish yellow	117.7	6.5		
		21/6" (Ring)			CL	SILTY CLAY: Yellowish brown with light olive brown, moist	112.8	17.0		



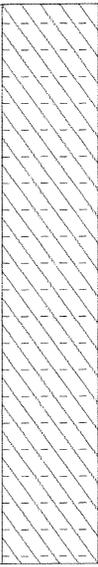
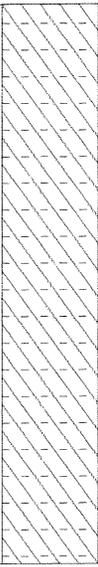
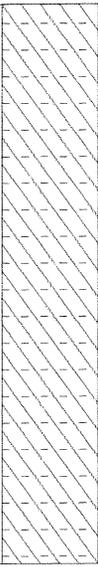


# FIELD LOG OF BORING B - 3

Sheet 2 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK	DRIVE TYPE, "N" or (Blows/ft.)							
20	20		11(SPT)		CL	SILTY CLAY: Yellowish brown with light olive brown, very moist to moist, trace calcareous inclusions and veins (white)		27.4		
25	25		37(Ring)		CL	same as above	100.2	24.2		
30	30		38(Ring)		CL	same as above, becoming light olive brown	111.8	17.7		



# FIELD LOG OF BORING B-4

Sheet 1 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/19/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>31 Feet 6 Inches</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "IN" or	(Blows/ft.)							
0	0				ML	SANDY SILT: FILL-Light olive brown, damp to moist, fine-grained sand, with some clay				
		7/6" (Ring)			CL	SILTY CLAY: FILL-Olive gray, moist, trace fine sand	100.8	21.0		
		22/6" (Ring)			SM	SILTY SAND WITH CLAY: FILL-Yellowish brown with light yellowish brown, moist, fine to medium-grained sand, with some gravel	118.4	9.4		
5	5	10/6" (Ring)			SC	CLAYEY SAND: FILL-Olive brown, moist, fine to medium-grained sand, trace gravel	112.0	10.4		
		12/6" (Ring)			CL		117.6	10.1		
						SILTY CLAY: FILL-Olive brown with yellowish brown, moist, with some fine to medium sand, with concrete piece				
10	10	6/6" (Ring)			SC	CLAYEY SAND WITH GRAVEL: FILL-Light olive brown, moist, fine to coarse-grained sand	108.9	8.2		
		8/6" (Ring)			CL	SILTY CLAY: FILL-Light olive brown with dark gray, moist, with some fine to medium sand	17.2	11.9		
15	15	11/6" (Ring)			CL	same as above, becoming yellowish brown	116.2	12.9		



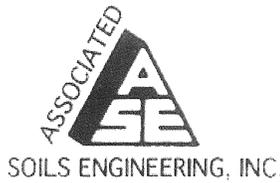
# FIELD LOG OF BORING B - 4

Sheet 2 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "N" or (Blows/ft.)								
		14/6" (Ring)			CL	SILTY CLAY: FILL-Dark grayish brown with yellowish brown,moist,trace fine to coarse sand	118.1	13.9		
20	20	9/6" (Ring)			CL	SILTY CLAY: FILL-Olive brown with olive gary,moist,with some fine to medium sand	108.1	15.2		
		13/6" (Ring)			SM		SILTY SAND WITH CLAY: FILL-Light olive brown,trace black,moist,fine to medium-grained sand,trace gravel,with concrete pieces	118.9	8.2	
25	25	8/6" (Ring)			CL	SANDY CLAY: FILL-Olive brown to dark grayish brown,moist,fine to medium-grained sand,trace gravel	115.7	11.9		
		10/6" (Ring)			SC	CLAYEY SAND: FILL-Olive brown,trace brownish yellow,moist,fine to medium-grained sand,trace gravel,with concrete piece at 25.5 feet depth	*	10.7		
						*insufficient sample for density				
30	30	12(SPT)			SC	same as above,becoming light olive brown withn trace dark grayish brown		8.7		



# FIELD LOG OF BORING B-5

Sheet 1 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/19/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>30 Feet</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "IN" or (Blows/ft.)								
0	0				ML	SANDY SILT: FILL-Light yellowish brown,damp,fine-grained sand,trace clay and gravel				
		19(Ring)			ML	SANDY SILT WITH CLAY: FILL-Grayish brown,moist,fine to medium-grained sand,trace gravel	112.7	9.3		CONSOL,SHEAR
		15/6" (Ring)			SM	SILTY SAND WITH CLAY: FILL-Light olive brown,moist,fine to medium-grained sand,with some gravel,with small AC pieces	118.9	11.7		
		23/6" (Ring)			SM	SILTY SAND: FILL-Light olive brown,damp,fine to medium-grained sand,with some gravel	125.0	5.6		
		12/6" (Ring)			ML	CLAYEY SILT WITH SAND: NATIVE-Light olive brown with brownish yellow,moist,fine-grained sand	110.7	17.0		CONSOL
		16/6" (Ring)			CL	SANDY CLAY: Light olive brown,moist,fine to medium-grained sand,trace gravel	123.9	12.5		
		10/6" (Ring)			SM	SILTY SAND: Light yellowish brown,damp to moist,fine-grained sand	100.7	8.8		CONSOL





# FIELD LOG OF BORING B-6

Sheet 1 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/20/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>30 Feet</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK	DRIVE TYPE, "N" or (Blows/ft.)							
0	0				ML	SANDY SILT WITH CLAY: FILL-Light brownish gray, dry, fine-grained sand, with some gravel				MAX DENSITY, EXPANSION, REMOLD SHEAR CORROSIIVITY TESTS, CONSOL, SHEAR
			22(Ring)		SP	SAND: NATIVE-Pale yellow, dry, fine to medium-grained sand, trace gravel	110.5	1.5		
5	5				SP	same as above	108.4	3.1		
			18(Ring)		CL	SILTY CLAY: Pale olive, trace yellowish brown, very moist, with calcareous concretions	94.3	29.0		CONSOL
15	15				ML	SILT WITH SAND: Pale olive, moist, fine-grained sand, trace clay	96.1	22.3		CONSOL
			35(Ring)							



# FIELD LOG OF BORING B - 6

Sheet 2 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "N" or (Blows/ft.)								
20	20	16/6" (Ring)			ML	SILT WITH SAND: Olive, moist, fine-grained sand	97.9	18.7	CONSOL	
		30/6" (Ring)			ML	SILT: Pale olive, moist to very moist	95.4	26.2		
25	25	18(SPT)			ML	CLAYEY SILT: Pale olive, trace yellowish brown, very moist		29.9		
30	30	77(Ring)			SP	SAND WITH GRAVEL: Pale olive with dark gray, dry, fine to coarse-grained sand	132.6	1.8		





# FIELD LOG OF BORING B - 7

Sheet 2 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "N" or (Blows/ft.)								
20	20	20(SPT)			CL	SILTY CLAY: Yellowish brown, trace olive gray, moist, with some calcareous inclusions/veins		22.0		
25	25	42(Ring)			CL	SILTY CLAY: Light olive brown, moist, with calcareous veins	107.7	19.8		
					SC	CLAYEY SAND: Brownish yellow, moist, fine to medium-grained sand				
30	30	70(Ring)			CL	SILTY CLAY: Yellowish brown, moist, trace fine sand	116.8	16.3		



# FIELD LOG OF BORING B-8

Sheet 1 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/20/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>30 Feet</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "IN" or	(Blows/ft.)							
0	0				SM	SILTY SAND: FILL-Yellowish brown, damp to moist, fine-grained sand, trace clay				MAX DENSITY, EXPANSION, REMOLD SHEAR CORROSIVITY TESTS
		5/6" (Ring)			SC	CLAYEY SAND: FILL-Olive brown with brownish yellow, moist, fine to medium-grained sand, trace gravel	108.2	16.6		
		7/6" (Ring)			SC		117.3	12.2		
					SM	CLAYEY SAND: FILL-Dark brown, trace yellowish brown, moist, fine to medium-grained sand, trace gravel				
5	5	8/6" (Ring)			SM	SILTY SAND: FILL-Light olive brown with grayish brown, moist, fine to medium-grained sand, with some clay, trace gravel	122.3	10.6		
		9/6" (Ring)			SM		114.8	12.1		
					CL	SANDY CLAY: FILL-Dark grayish brown, trace dark yellowish brown, moist, fine to medium-grained sand				
10	10	9/6" (Ring)			SC	CLAYEY SAND: FILL-Dark grayish brown with dark yellowish brown, moist, fine to medium-grained sand, trace gravel	112.9	16.2		
		15/6" (Ring)			SC		115.2	14.2		
					SM	SILTY SAND: FILL-Light olive brown, damp to moist, fine to medium-grained sand, trace clay and gravel				
15	15	15/6" (Ring)			SP	SAND: FILL-Light yellowish brown, damp, fine to medium-grained sand, trace gravel	118.7	7.0		
		16/5" (Ring)			CL		11.4	3.6		
					CL	SILTY CLAY: FILL-Yellowish brown, trace light olive brown, moist				



# FIELD LOG OF BORING B - 8

Sheet 2 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "N" or (Blows/ft.)								
20	20	18/6" (Ring)			CL	SILTY CLAY WITH SAND: FILL-Dark grayist brown, trace dark yellowish brown and light oliv ebrown, moist, fine-grained sand	120.7	12.8		
		37/6" (Ring)			SM	SILTY SAND: FILL-Gray with very dark grayish brown and olive, moist, fine to medium-grained sand, trace fine gravel, with lens Silty Clay with Sand (CL)	125.2	9.4		
25	25	+			CL	SANDY CLAY: FILL-Dark grayish brown with olive brown, damp, fine to medium-grained sand, with some gravel		7.0		
		18(SPT)			SM	SILTY SAND: FILL-Light olive brown, moist, fine to coarse-grained sand, with some clay		11.7		
30	30	16/6" (Ring)			CL	SILTY CLAY WITH SAND: FILL-Olive brown with dark gray, moist, fine to medium-grained sand, trace gravel	117.8	13.4		
		19/6" (Ring)			SC	CLAYEY SAND: NATIVE-Yellow to yellowish brown, moist, fine to coarse-grained sand, with some gravel *insufficient sample for density	*	14.0		



# FIELD LOG OF BORING B-9

Sheet 1 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/20/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>31 Feet 6 Inches</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "IN" or (Blows/ft.)								
0	0				CL	SILTY CLAY WITH SAND: FILL-Light gray, dry, fine-grained sand, with some gravel				
					ML					
					SM					
		22(Ring)				SANDY SILT WITH CLAY: FILL-Light olive brown, damp, fine-grained sand, with some gravel	119.9	9.3		
					SC	SILTY SAND WITH CLAY: FILL-Light olive brown to olive brown, moist, fine to coarse-grained sand, with some gravel	116.6	11.8		
5	5	7/6"(Ring)					102.5	19.8		
		11/6"(Ring)			SM	CLAYEY SAND: FILL-Light olive brown with brownish yellow, moist, fine to medium-grained sand, with concrete pieces				
						SILTY SAND WITH CLAY: FILL-Light olive gray with yellow and brownish yellow, moist, fine to medium-grained sand				
					CL					
10	10	14/6"(Ring)				SANDY CLAY: FILL-Light olive brown with pale yellow, moist, fine-grained sand, trace gravel, with concrete pieces	111.6	16.8		
		17/6"(Ring)			SM	SILTY SAND WITH CLAY: FILL-Olive brown with olive yellow, moist, fine to medium-grained sand, trace gravel	127.0	12.9		
					CL					
						SILTY CLAY: FILL-Dark grayish brown, trace dark gray and yellowish brown, moist, with some fine to medium sand, with concrete pieces				
15	15	7/6"(Ring)					109.9	15.6		
		9/6"(Ring)			SM	SILTY SAND: FILL-Olive yellow and olive, moist, fine-grained sand, trace clay and gravel	*	11.7		
						*insufficient sample for density				



# FIELD LOG OF BORING B - 9

Sheet 2 of 2

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "N" or (Blows/ft.)								
20	20	34(Ring)		SM	SM	SILTY SAND WITH CLAY: FILL-Light olive brown with dark gray,moist,fine to medium-grained sand,trace gravel	111.1	23.4		
25	25	15/5" (Ring)		SC	SC	CLAYEY SAND: FILL-Olive brown with yellow,moist,fine to medium-grained sand,with some gravel,with organics and wood pieces	117.0	11.4		
		17/6" (Ring)		SC	SC	CLAYEY SAND: FILL-Olive brown with yellowish brown,moist,fine to medium-grained sand,trace gravel	113.7	10.2		
30	30	20(SPT)		SP	SP	SAND: NATIVE-Light yellowish brown,damp,fine to coarse-grained sand,with some gravel,with small lens Silty Clay (CL)		6.4		



# FIELD LOG OF BORING B-10

Sheet 1 of 1

Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/20/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>11 Feet 6 Inches</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE TYPE, "N" or	(Blows/ft.)							
0	0				ML	SANDY SILT WITH CLAY: FILL-Light olive brown,damp,fine-grained sand,with rebar piece				R-VALUE
		7/6"(Ring)			CL	SILTY CLAY: FILL-Olive gray with dark gray,moist,trace gravel	100.6	20.2		
		7/6"(Ring)			CL	SANDY CLAY: FILL-Olive brown,trace yellowish brown and gray,moist,fine to medium-grained sand,trace gravel	108.4	14.1		
5	5	20(Ring)			ML	SANDY SILT: FILL-Grayish brown,damp to moist,fine-grained sand,trace clay	112.4	8.1		
					CL	SANDY CLAY: FILL-Light olive brown,trace white and very dark grayish brown,moist,fine to medium-grained sand,trace garvel				
		14(SPT)			ML	CLAYEY SILT: NATIVE-Light yellowish brown with white,moist,with calcareous veins		22.7		
10	10									
15	15									
<p>NOTE:Boring backfilled with site soils to ten feet three inch (10' 3") depth. Ten feet three inch (10' 3") length of 6-inch I.D. PVC pipe (two pieces-upper 5' 3" piece solid;lower 5' piece slotted) placed in boring with the annular area backfilled with pea gravel to depth of four (4) feet below surface. Remainder of annular area backfilled with site sandy silt with clay soils to depth of one (1) foot below surface, with upper one (1) foot filled with pea gravel to surface. Gravel (2.5") placed at bottom of pipe and percolation test performed after minimum 24 hours of presoaking.</p>										



# FIELD LOG OF BORING B-11

Sheet 1 of 1

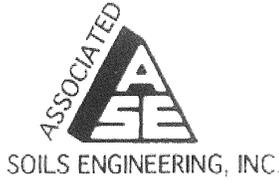
Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/20/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>6 Feet</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE	TYPE, "N" or (Blows/ft.)							
0	0									
					ML	SANDY SILT WITH CLAY: FILL-Light brownish gray, dry, fine-grained sand, with some gravel				
					CL	SILTY CLAY: FILL-Grayish brown with dark grayish brown and yellowish brown, moist, with some fine to medium sand and gravel, with small brick pieces	106.7	12.4		
		21(Ring)								
					SC	CLAYEY SAND: FILL-Light olive brown with yellow, moist, fine to medium-grained sand		9.9		
		19(SPT)								
5	5									
<p>NOTE: Boring backfilled with site soils to five feet one and one-half inch (5' 1.5") depth. Five feet one and one-half inch (5' 1.5") length of 6-inch I.D. slotted PVC pipe (one piece) placed in boring with the annular area backfilled with pea gravel to surface. Gravel (2.5") placed at bottom of pipe and percolation test performed after minimum 24 hours of presoaking.</p>										



# FIELD LOG OF BORING B-12

Sheet 1 of 1

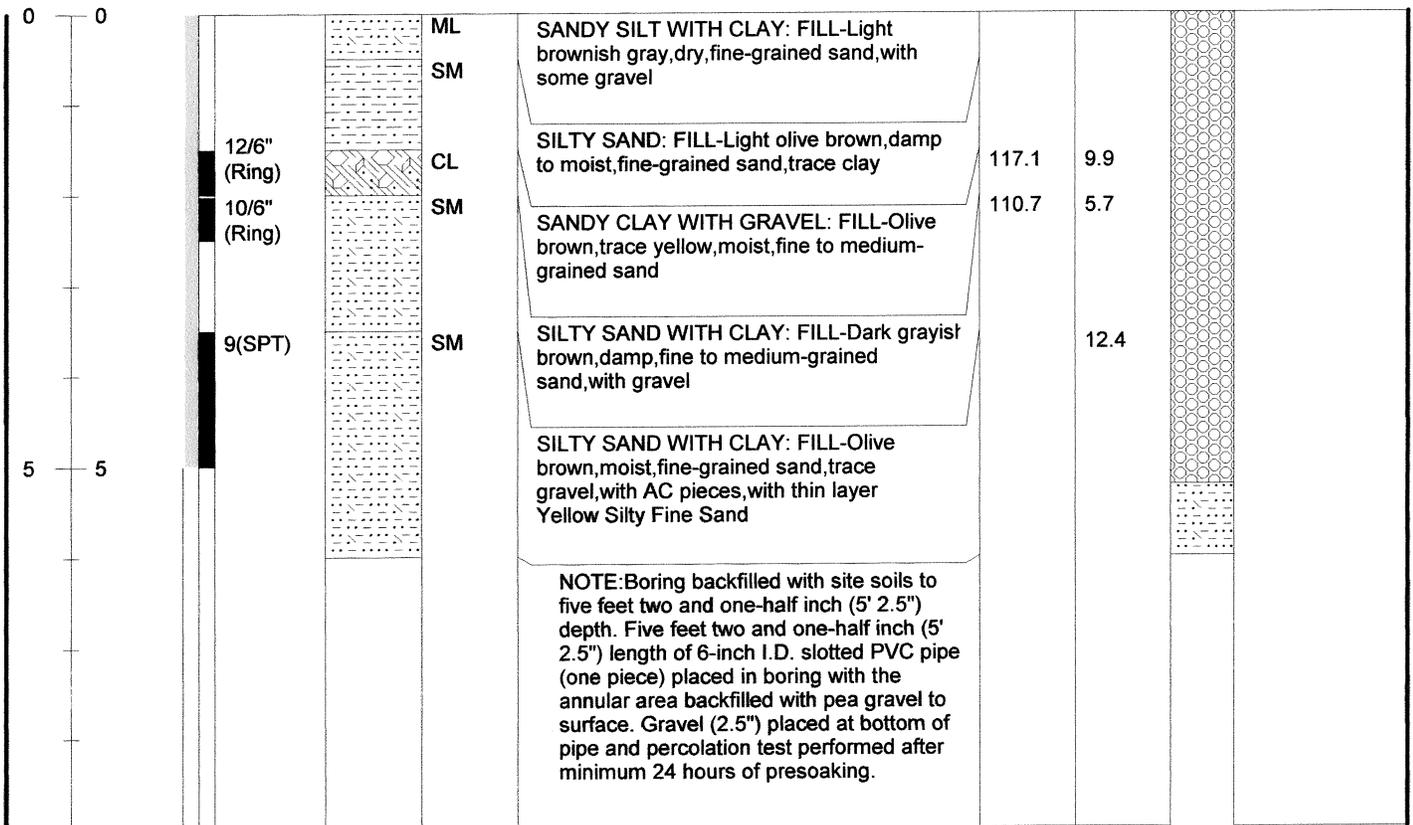
Project: **Residential and Retail Mixed Development-Placentia**

Location: **Rose Drive & Alta Vista Street** Project No. **6736.17**

Dates(s) Drilled: <b>6/20/2017</b>	Logged By: <b>Gary L. Martin</b>
Drilled By: <b>Choice Drilling, Inc.</b>	Total Depth: <b>6 Feet</b>
Rig Make/Model: <b>CME 95</b>	Hammer Type: <b>Automatic</b>
Drilling Method: <b>Hollow-stem Auger</b>	Hammer Weight/Drop: <b>140 Lb./±30 In.</b>
Hole Diameter: <b>8 Inches</b>	Surface Elevation: <b>N/A</b>

Comments: Groundwater not encountered. Backfill not determined.

DEPTH (Ft.)	ELEVATION (MSL)	SAMPLE INTERVALS		LITHOLOGY	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (Pcf)	MOISTURE CONTENT (%)	WELL COMPLETION	OTHER TESTS
		BULK DRIVE	TYPE, "N" or (Blows/ft.)							



## Laboratory Tests

After samples were visually classified in the laboratory, a testing program aimed at generating sufficient data for subsequent evaluation was established and implemented.

- Moisture Content and Density Tests

The undisturbed soil retained within the rings of the Modified California barrel sampler was tested in the laboratory to determine in-place dry density and moisture content. Test results are presented on the Field Logs of Boring, Plates B-1 through B-12.

- Consolidation and Direct Shear Tests

Consolidation (ASTM D2435-11 Test Method) and direct shear (ASTM D3080-11 Test Method) tests were performed on selected relatively undisturbed and remolded samples to determine the settlement characteristics and shear strength parameters of various soil samples, respectively. The results of these tests are shown graphically on the appended "C" and "D" Plates.

- Soil Corrosivity Tests

Tests of soluble sulfate and chloride contents were performed in accordance with CTM's 417 and 422, respectively, to assess the degree of corrosivity of the subgrade soils with regard to concrete and normal grade steel. Resistivity and ph-value tests were performed in accordance with ASTM G57 Test Method and CTM 643 to assess the degree of corrosivity of the subgrade soils with regard to ferrous metal piping. The test results are shown below.

<b>Sample ID</b>	<b>Sulfate Content <sup>(1)</sup> (%)/ Degree of Severity</b>	<b>Chloride Content <sup>(2)</sup> (ppm) / Degree of Severity</b>	<b>Resistivity <sup>(3)</sup> (OHM-cm)/ Degree of Corrosivity</b>	<b>Ph- Value <sup>(4)</sup></b>
B-1 @ 0-5'	0.328/Severe	12/Not Applicable	657/Very Corrosive	7.63
B-6 @ 0-5'	0.012/Not Applicable	56/Not Applicable	11,400/Non-Corrosive	8.33
B-8 @ 0-5'	0.128/Moderate	46/Not Applicable	895/Corrosive	7.44

(1) California Test Method 417. (2) California Test Method 422. (3) ASTM G57 Test Method. (4) California Test Method 643.

- Maximum Dry Density/Optimum Moisture Content Tests

Maximum density tests were conducted in accordance with ASTM D1557-12, Method A, using 5 equal layers, 25 blows each layer, 10-pound hammer, 18 inch drop in a 1/30 cubic foot mold. The results are as follows:

<b>Sample ID</b>	<b>Maximum Dry Density (pcf)</b>	<b>Optimum Moisture Content (%)</b>	<b>Material Classification</b>
B-1 @ 0 - 5'	127.0	10.5	SC
B-6 @ 0 - 5'	118.5	13.0	SP-SM
B-8 @ 0 - 5'	125.5	9.0	ML

**Laboratory Tests** – continued

- Expansion Tests

Expansion tests were performed on soil samples to determine the swell characteristics. The expansion tests were conducted in accordance with ASTM D4829-11 test procedures. The expansion samples were remolded to approximately 90 percent relative compaction at near optimum moisture content subjected to 144 pounds per square foot surcharge load and were saturated.

Sample ID	Molded Dry Density (pcf)	Molded Moisture Content (%)	% Saturation	Expansion Index (EI)	Expansion Classification
B-1 @ 0 - 5'	113.7	8.2	45.8	38	Low
B-8 @ 0 - 5'	113.0	9.4	50.6	45	Low

- "R" Value Analysis

The following "R" Value Stabilometer results were obtained in accordance with California 301 test procedures.

Stabilometer Results	Trial #1	Trial #2
Dry Density as molded, pcf	111.0	107.4
Moisture content as molded, %	17.0	19.2
Expansion Pressure, dial reading 10 <sup>4</sup>	-	44
Exudation Pressure, psi	*	*
Stabilometer "R" Value	*	*
<b>Classification:</b> Olive Brown Fine to Medium Sandy Clay		
<b>Source:</b> Boring B-10 @ 0 - 5'		

\*Soil extruded out of mold before water, therefore exudation pressure was not determined. Test specifications therefore assign the sample and "R" Value of 5.

Plates C-1 through C-13

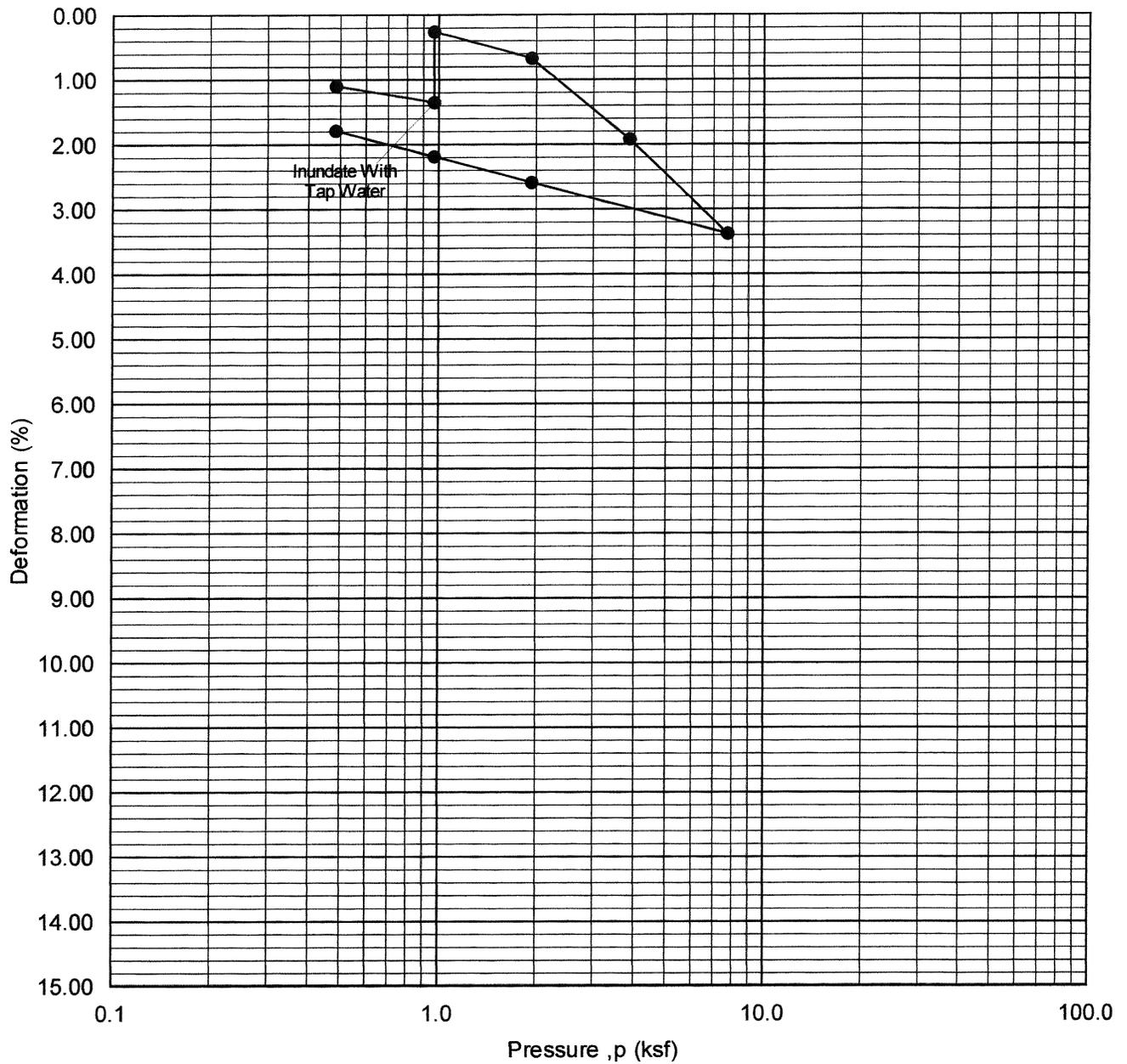
Uni-axial Consolidation Test Results

Plates D-1 through D-8

Direct Shear Test Results

Plates H-1 through H-3

Field Percolation Data Sheets



Boring No. : B-1  
 Depth (ft.) : 5.0  
 Sample Type: Silty Clay

Dry Density (pcf) = 113.8  
 Moisture (%) = 11.1

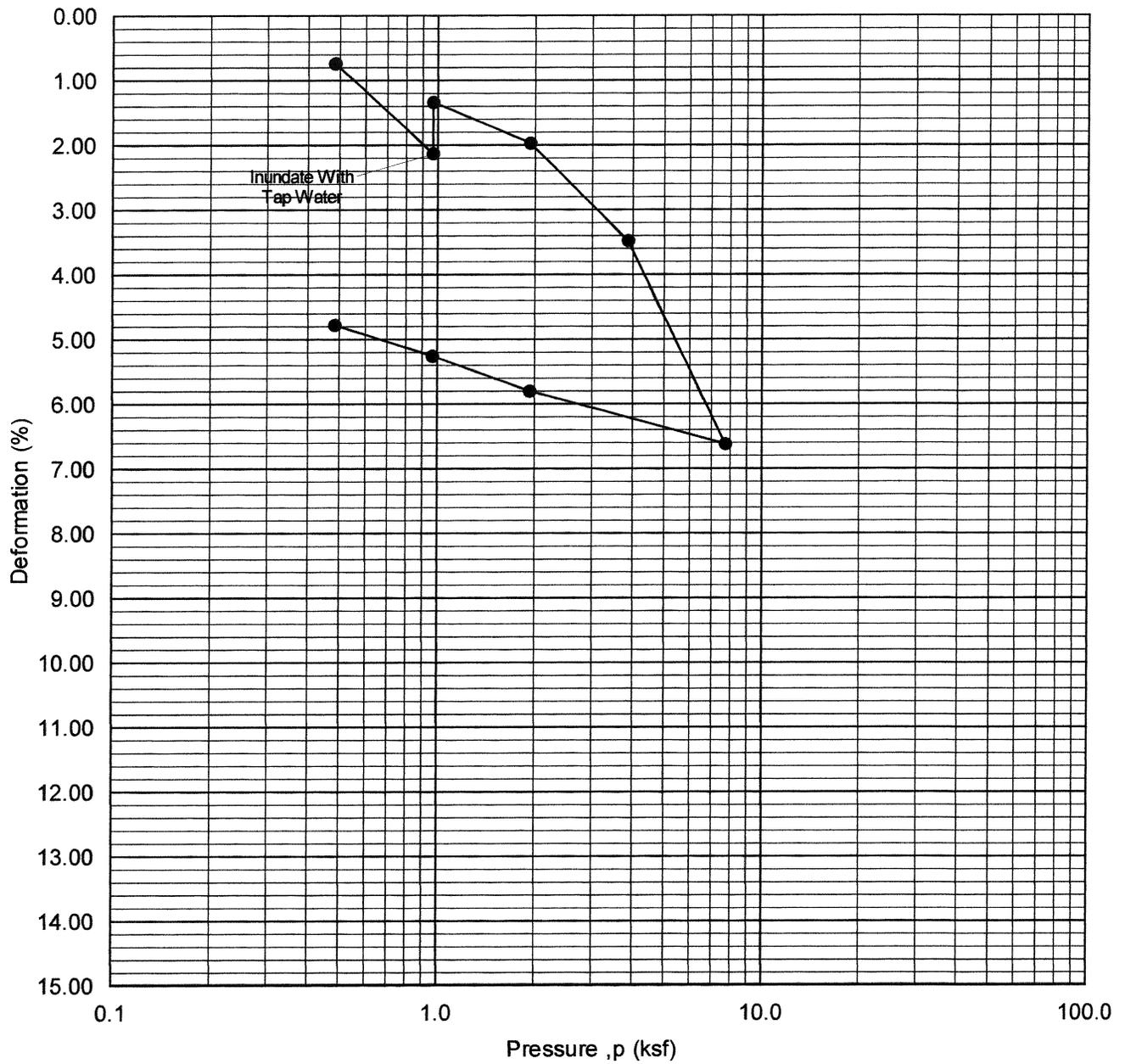
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-1**



Boring No. : B-1  
 Depth (ft.) : 15.0  
 Sample Type: Fine Sandy Silt with Clay

Dry Density (pcf) = 89.1  
 Moisture (%) = 19.2

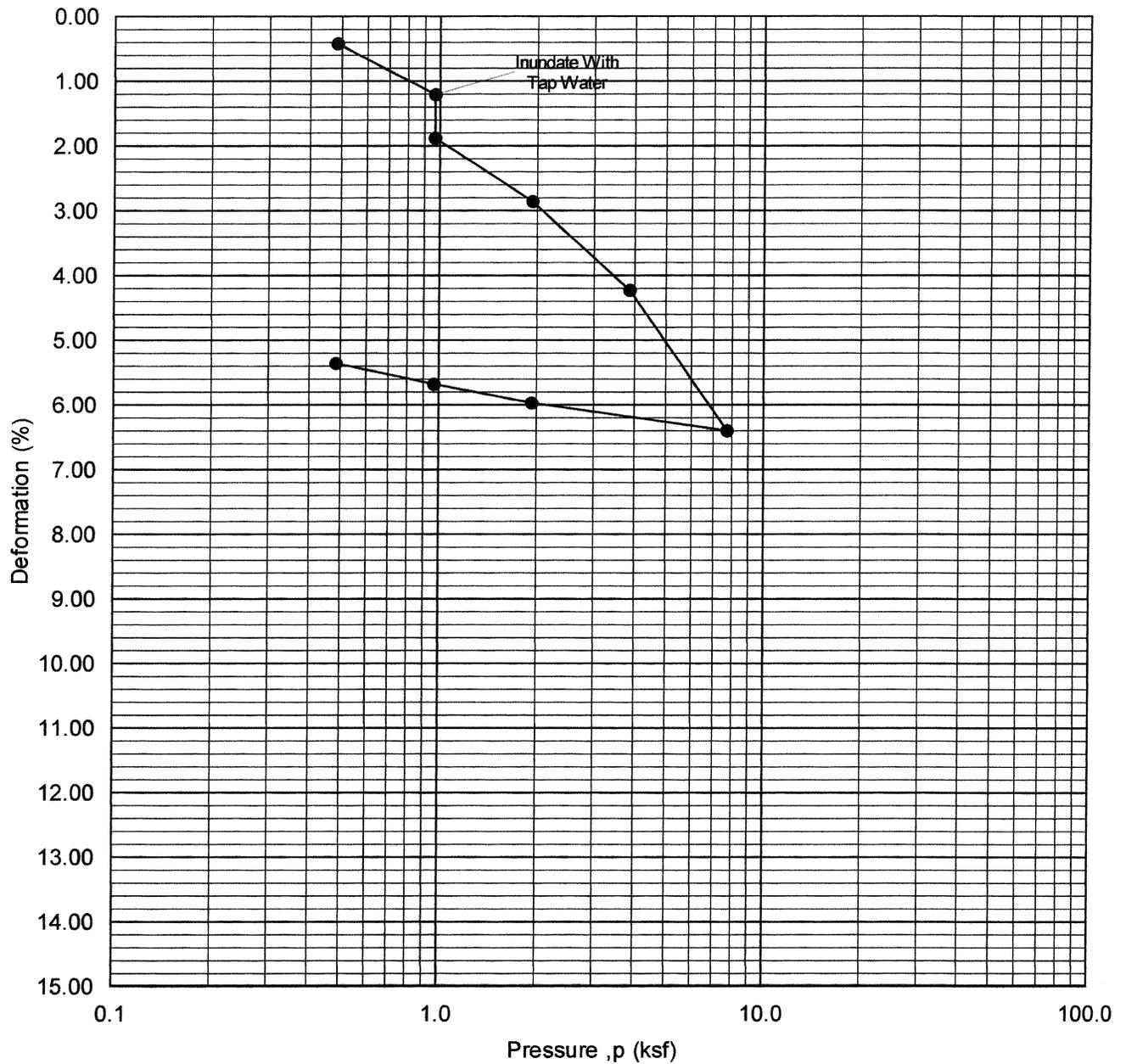
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-2**



Boring No. : B-3  
 Depth (ft.) : 5.0  
 Sample Type: Silt

Dry Density (pcf) = 96.0  
 Moisture (%) = 9.3

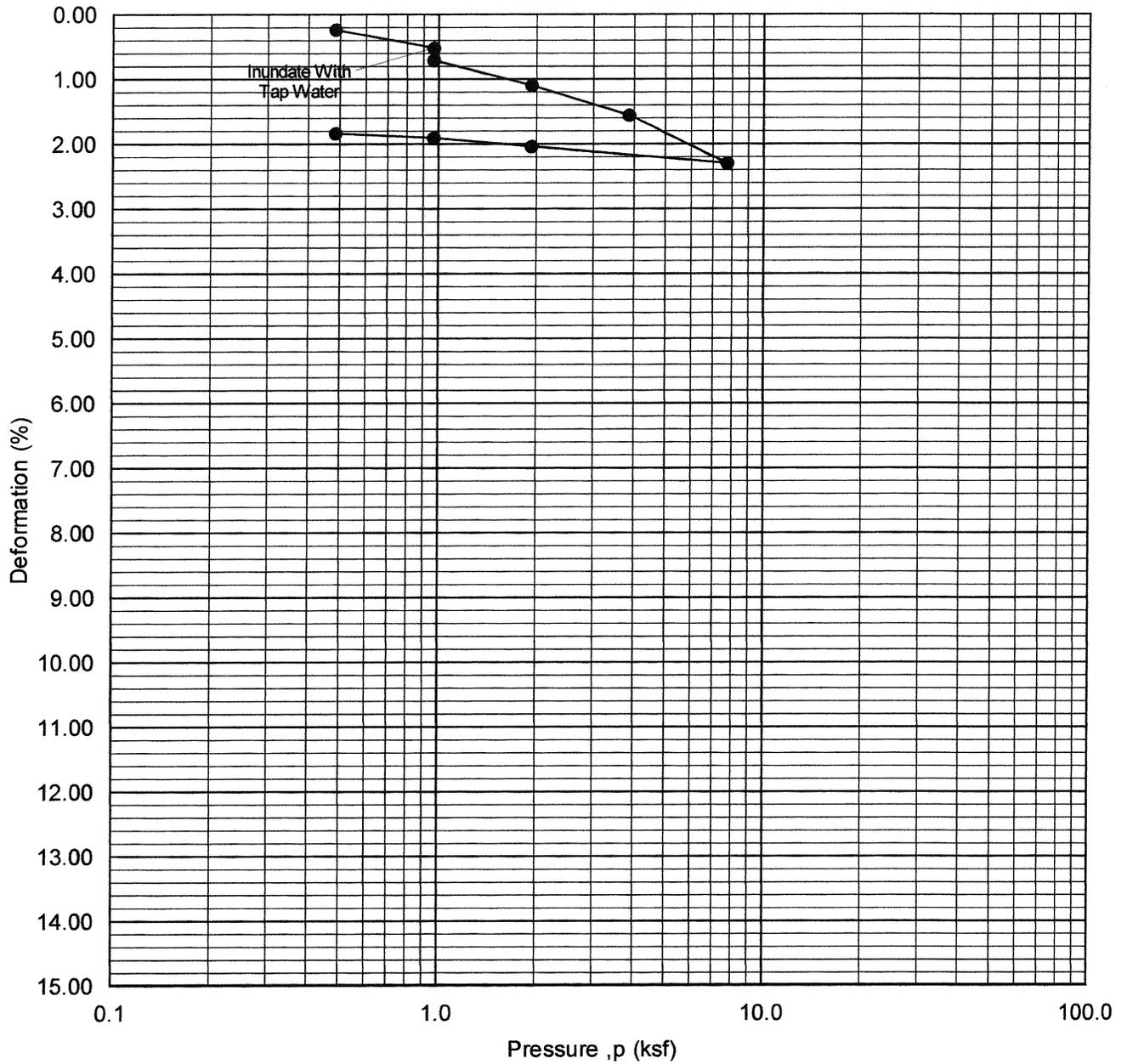
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-3**



Boring No. : B-3  
 Depth (ft.) : 10.5  
 Sample Type: Fine to Medium Sand with Silt

Dry Density (pcf) = 113.0  
 Moisture (%) = 2.1

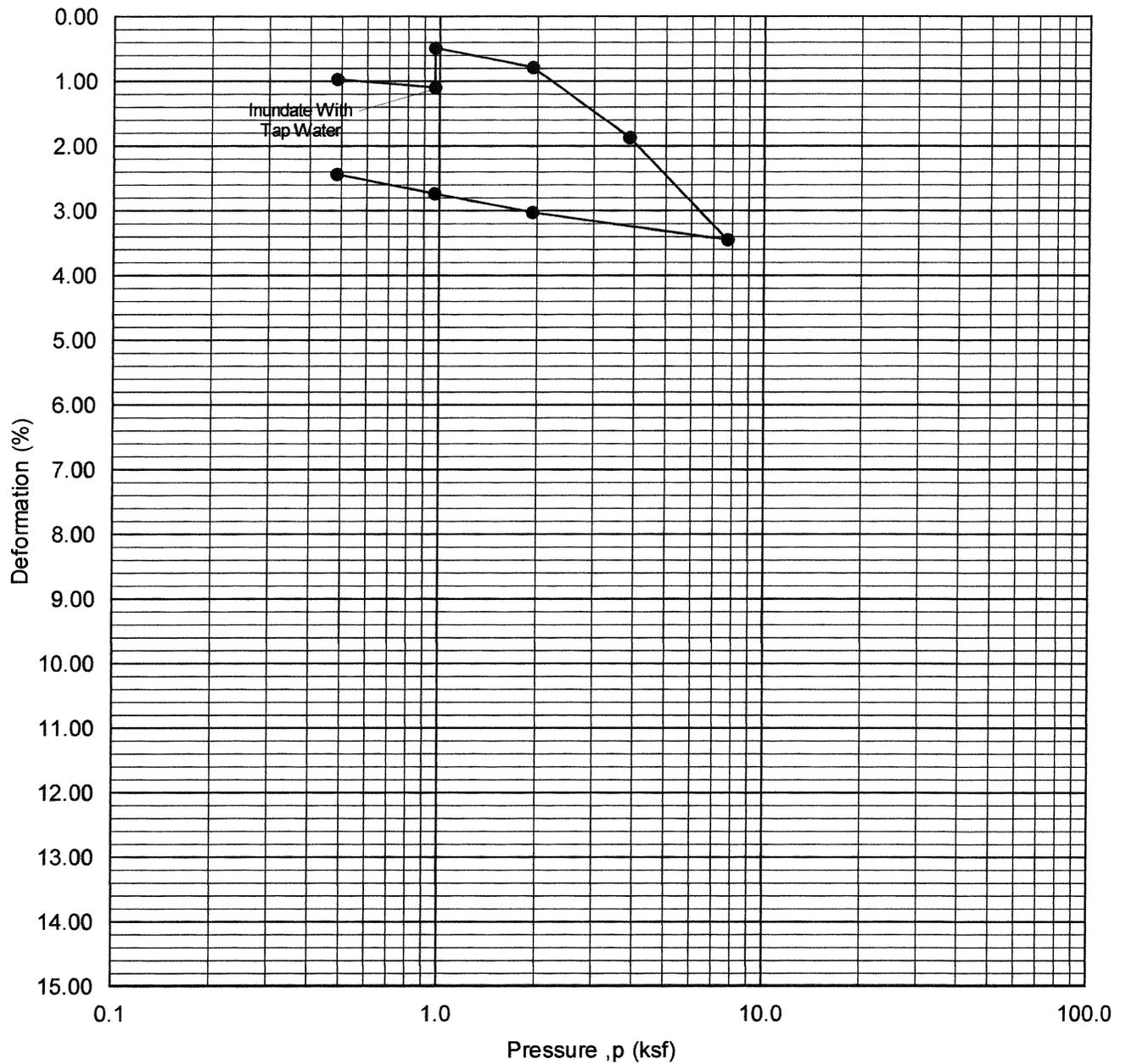
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-4**



Boring No. : B-5

Depth (ft.) : 2.0

Sample Type: Fine to Medium Sandy Silt with Clay

Dry Density (pcf) = 112.7

Moisture (%) = 9.3

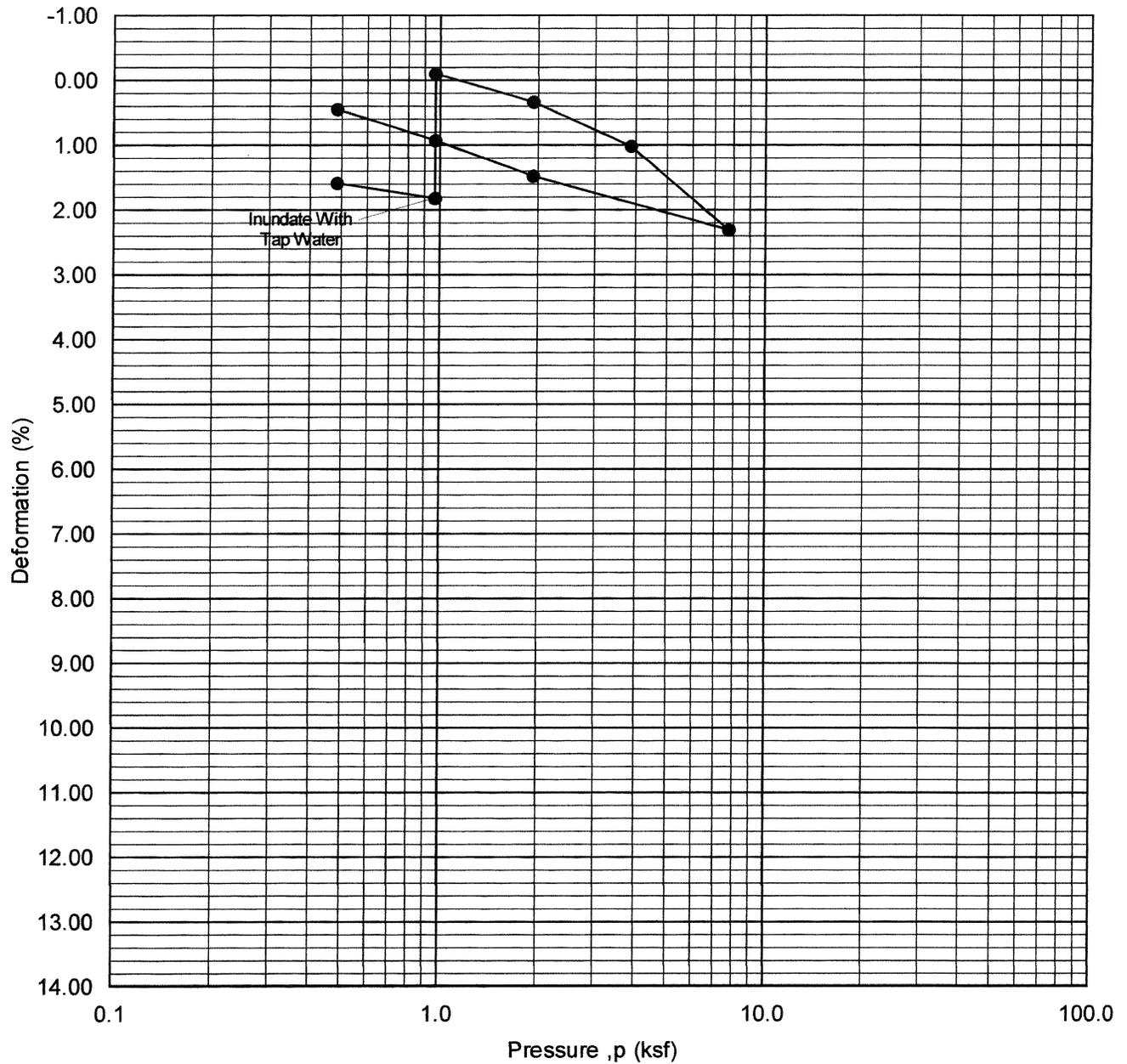
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-5**



Boring No. : B-5  
 Depth (ft.) : 10.0  
 Sample Type: Clayey Silt with Fine Sand

Dry Density (pcf) = 110.7  
 Moisture (%) = 17.0

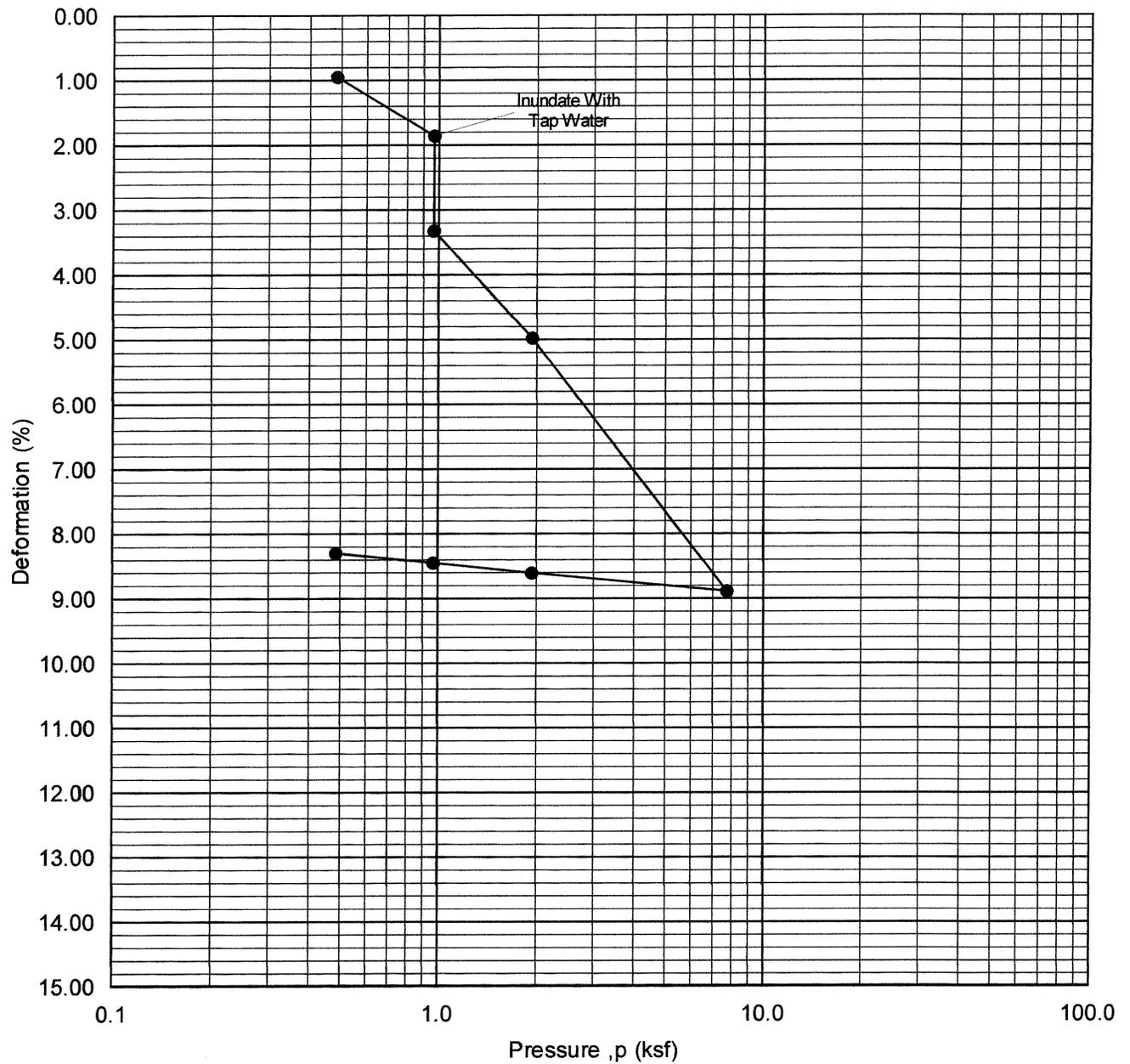
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-6**



Boring No. : B-5  
 Depth (ft.) : 15.0  
 Sample Type: Silty Fine Sand

Dry Density (pcf) = 100.7  
 Moisture (%) = 8.8

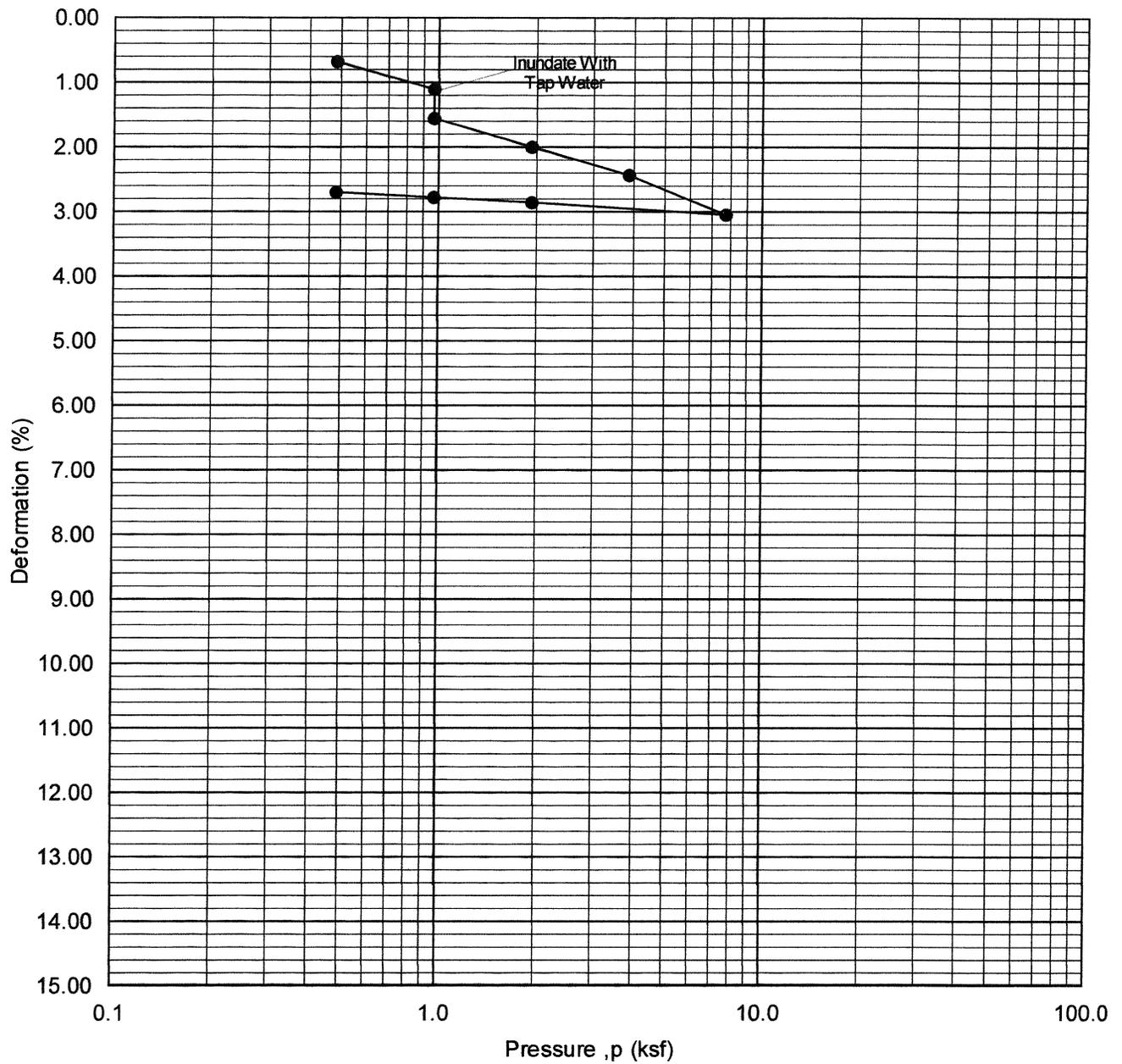
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-7**



Boring No. : B-6

Depth (ft.) : 2.0

Sample Type: Fine to Medium Sand with trace Gravel

Dry Density (pcf) = 110.5

Moisture (%) = 1.5

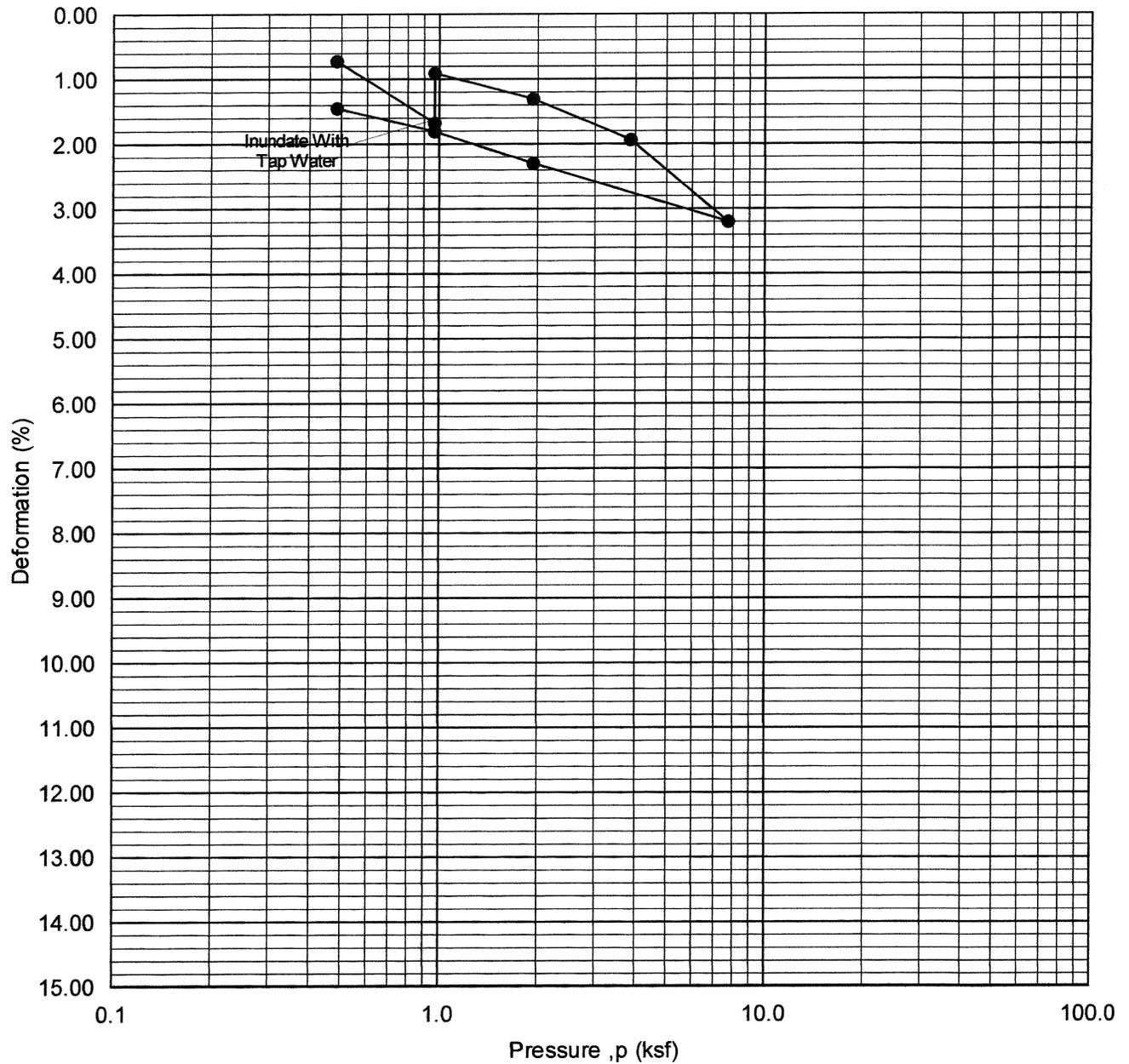
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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PROPERTIES OF SOILS  
(ASTM D 2435)

**PLATE C-8**



Boring No. : B-6  
 Depth (ft.) : 10.0  
 Sample Type: Silty Clay

Dry Density (pcf) = 94.3  
 Moisture (%) = 29.0

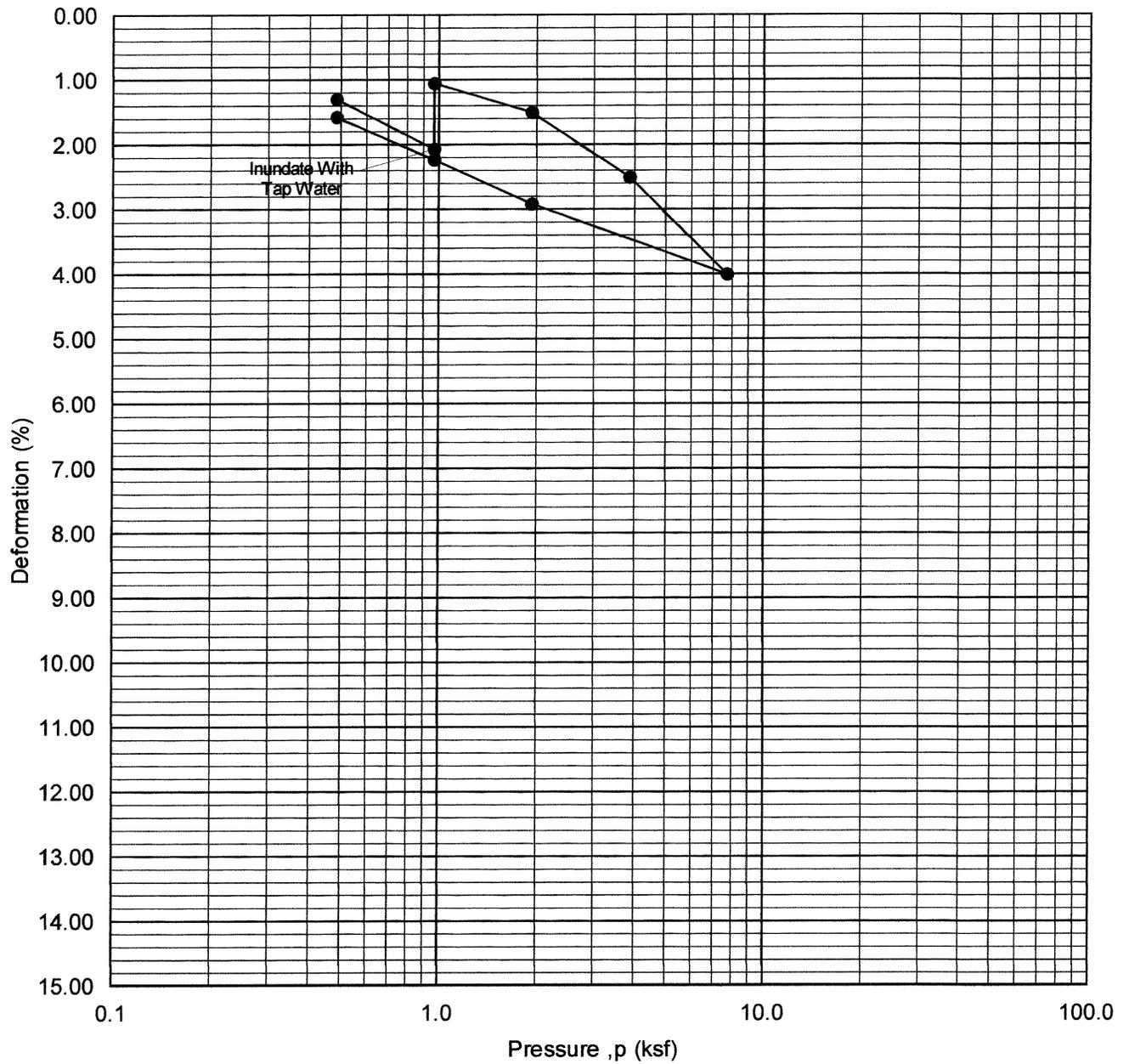
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-9**



Boring No. : B-6  
 Depth (ft.) : 15.0  
 Sample Type: Silt with Fine Sand and trace Clay

Dry Density (pcf) = 96.1  
 Moisture (%) = 22.3

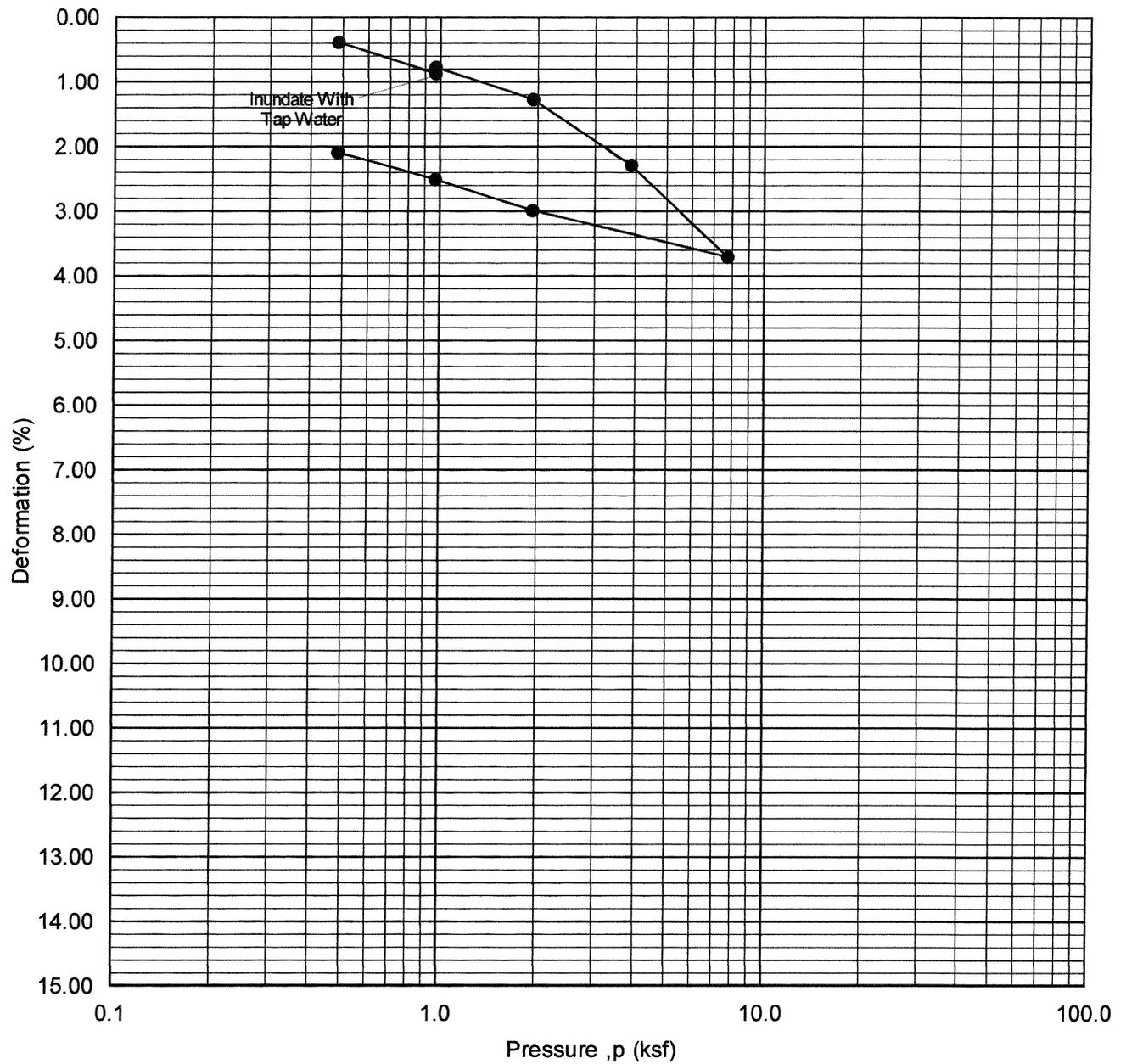
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-10**



Boring No. : B-6  
 Depth (ft.) : 20.0  
 Sample Type: Silt with Fine Sand

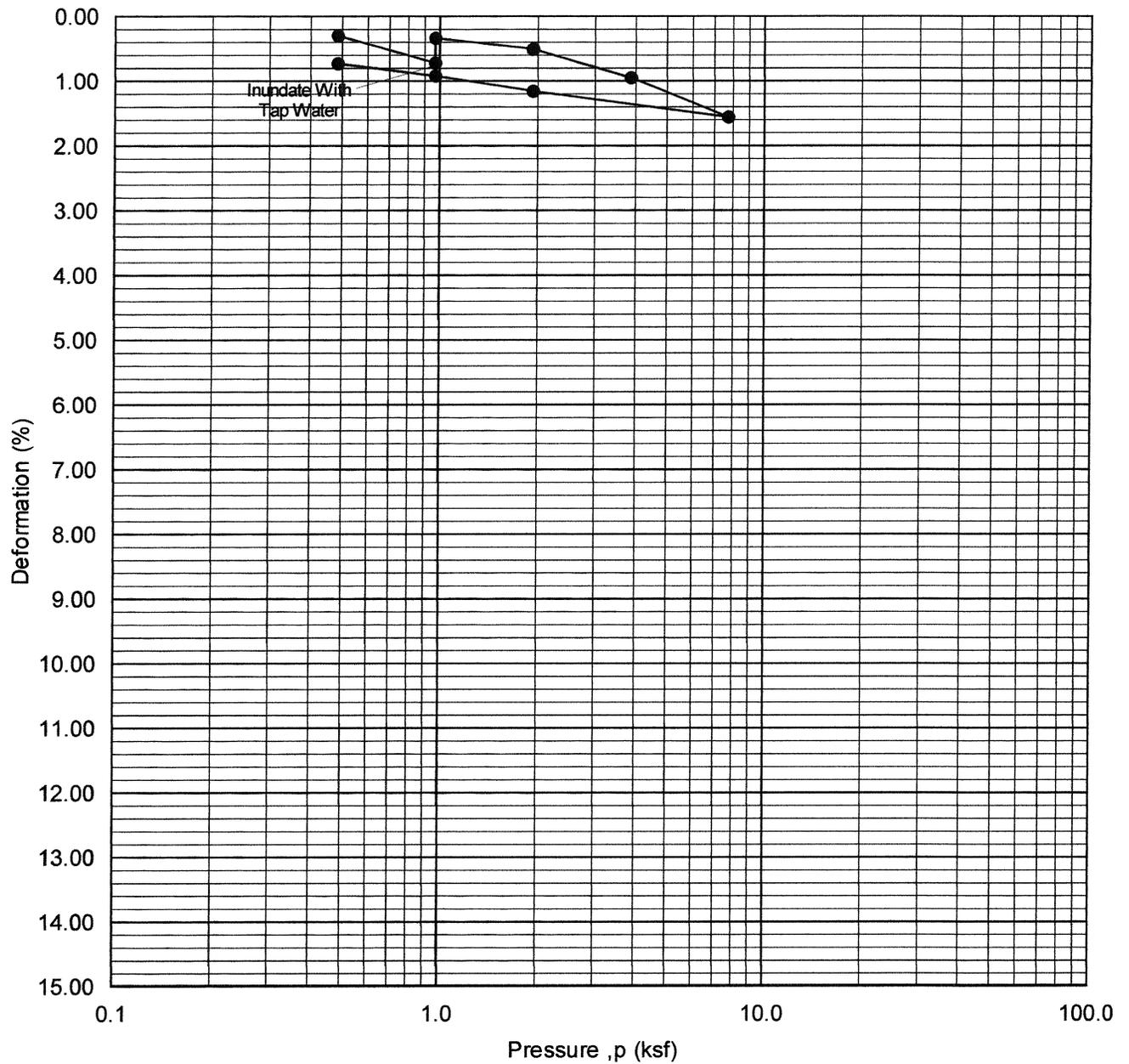
Dry Density (pcf) = 97.9  
 Moisture (%) = 18.7

Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)



Boring No. : B-7  
 Depth (ft.) : 5.0  
 Sample Type: Silty Clay with Fine to Coarse Sand

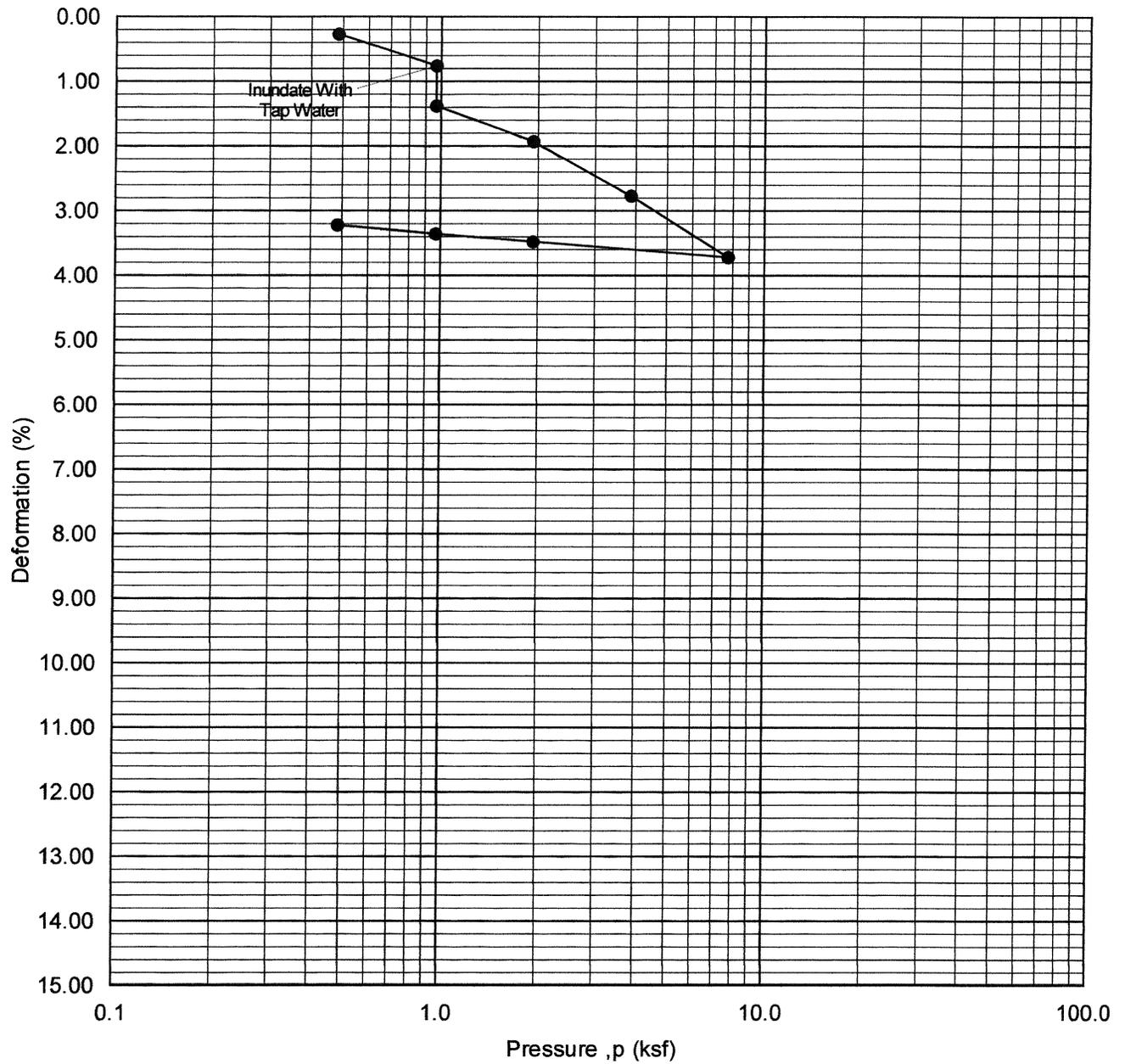
Dry Density (pcf) = 122.1  
 Moisture (%) = 12.4

Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)



Boring No. : B-7

Depth (ft.) : 10.0

Sample Type: Fine to Coarse Sand with some Gravel

Dry Density (pcf) = 114.9

Moisture (%) = 2.8

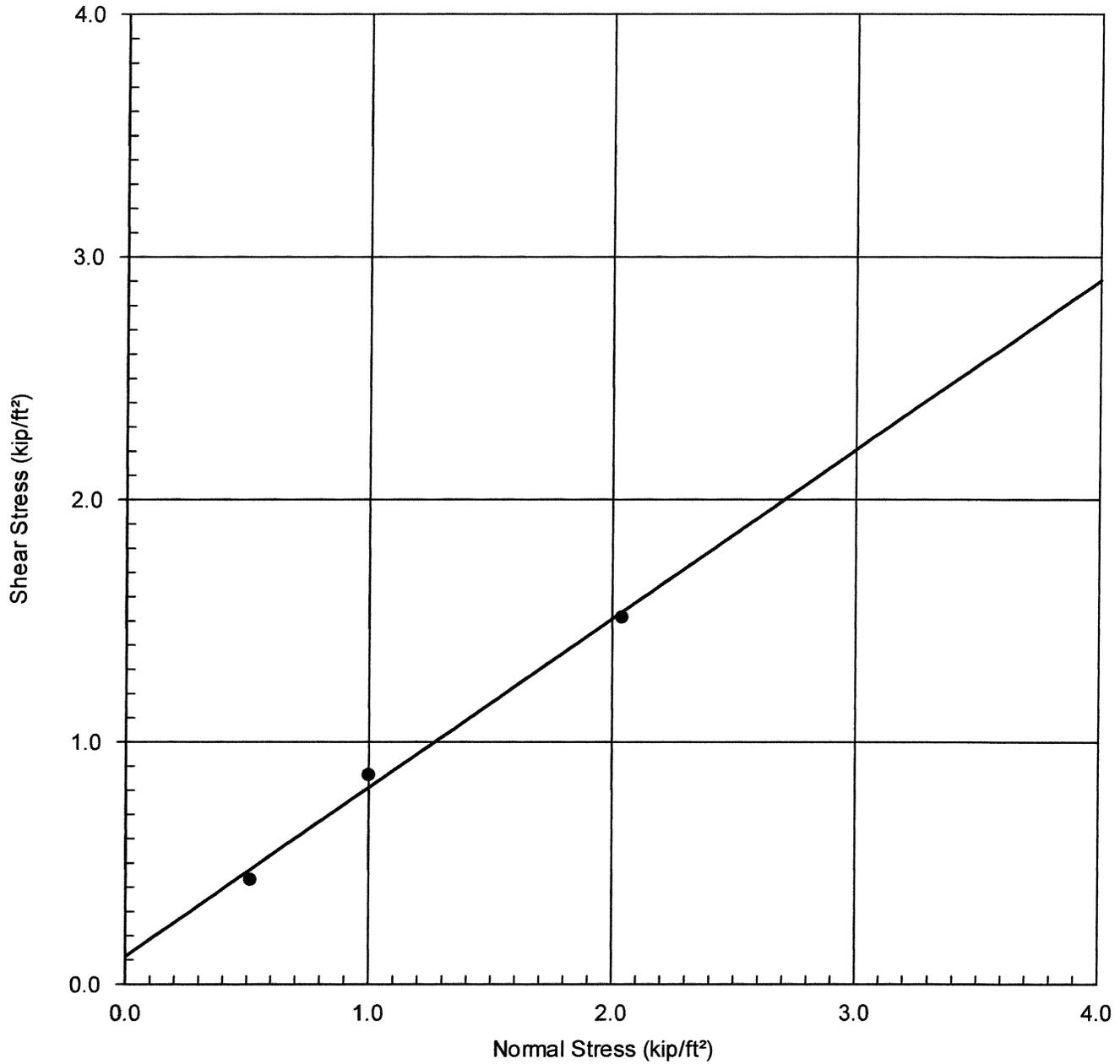
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

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ONE-DIMENSIONAL CONSOLIDATION  
 PROPERTIES OF SOILS  
 (ASTM D 2435)

**PLATE C-13**



Boring No. : B-1  
 Depth (ft.) : 5.0  
 Sample Type : Relatively Undisturbed  
 Soil Type : Silty Clay with Fine Sand

Cohesion(C) = 115 psf  
 Friction ( $\phi$ ) = 34.5°  
 Dry Density (pcf) = 113.8  
 Moisture (%) = 11.1

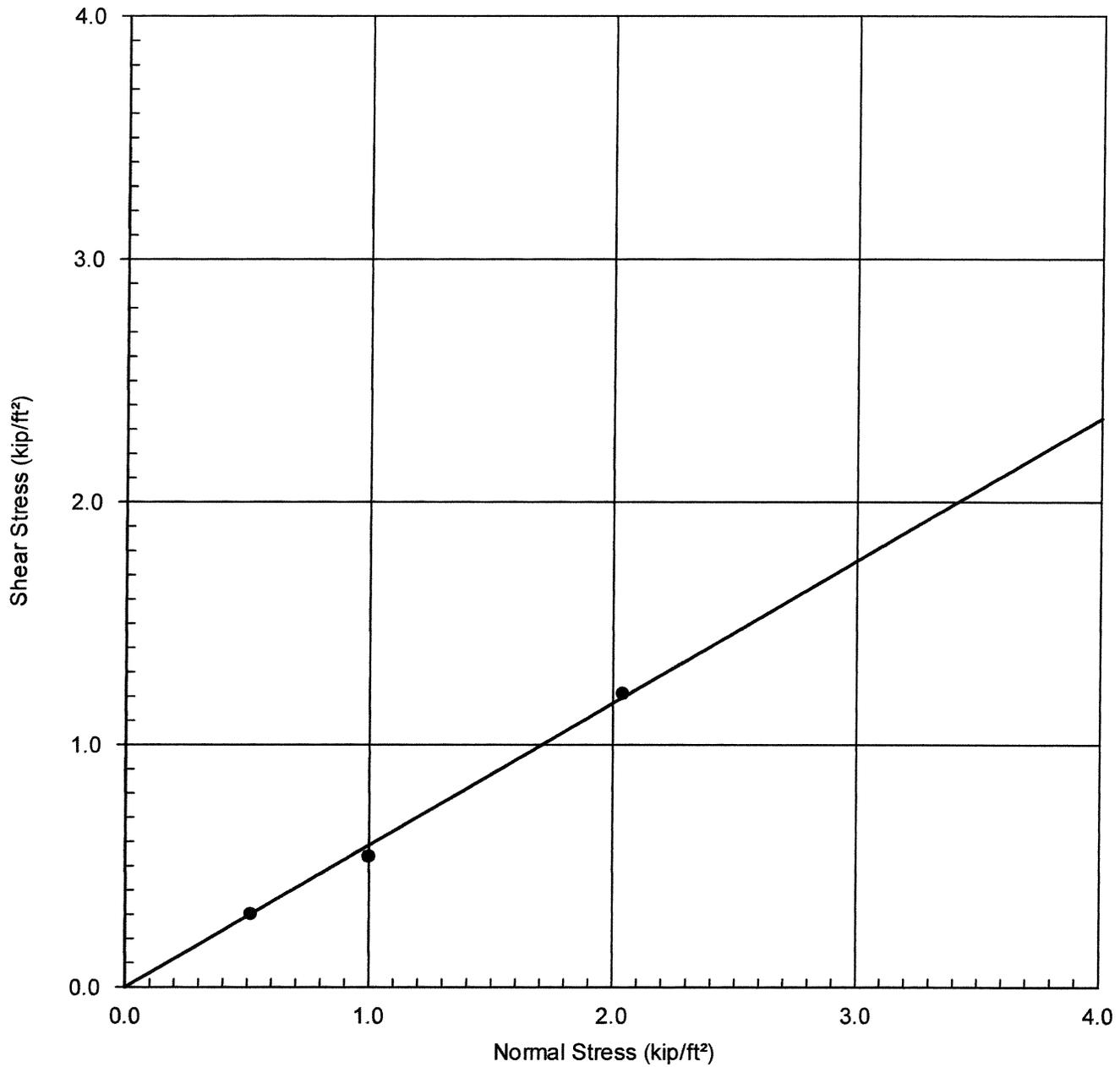
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
(ASTM D 3080)

**PLATE D-1**



Boring No. : B-3  
 Depth (ft.) : 5.0  
 Sample Type : Relatively Undisturbed  
 Soil Type : Silt

Cohesion(C) = 0 psf  
 Friction ( $\phi$ ) = 31°  
 Dry Density (pcf) = 96.0  
 Moisture (%) = 9.3

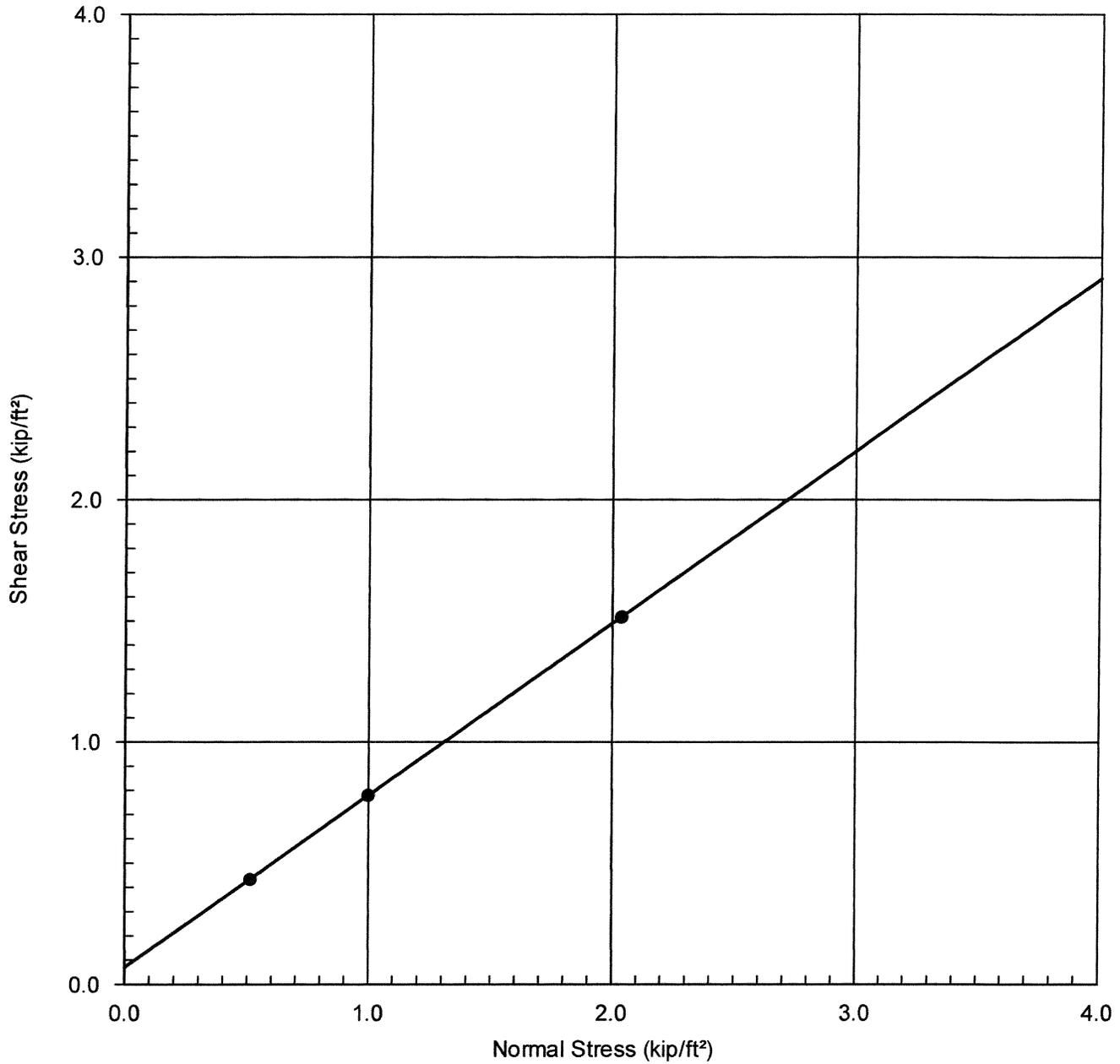
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
 (ASTM D 3080)

**PLATE D-2**



Boring No. : B-5  
 Depth (ft.) : 2.0  
 Sample Type : Relatively Undisturbed  
 Soil Type : Fine to Medium Sandy Silt with Clay

Cohesion(C) = 70 psf  
 Friction ( $\phi$ ) = 35°  
 Dry Density (pcf) = 112.7  
 Moisture (%) = 9.3

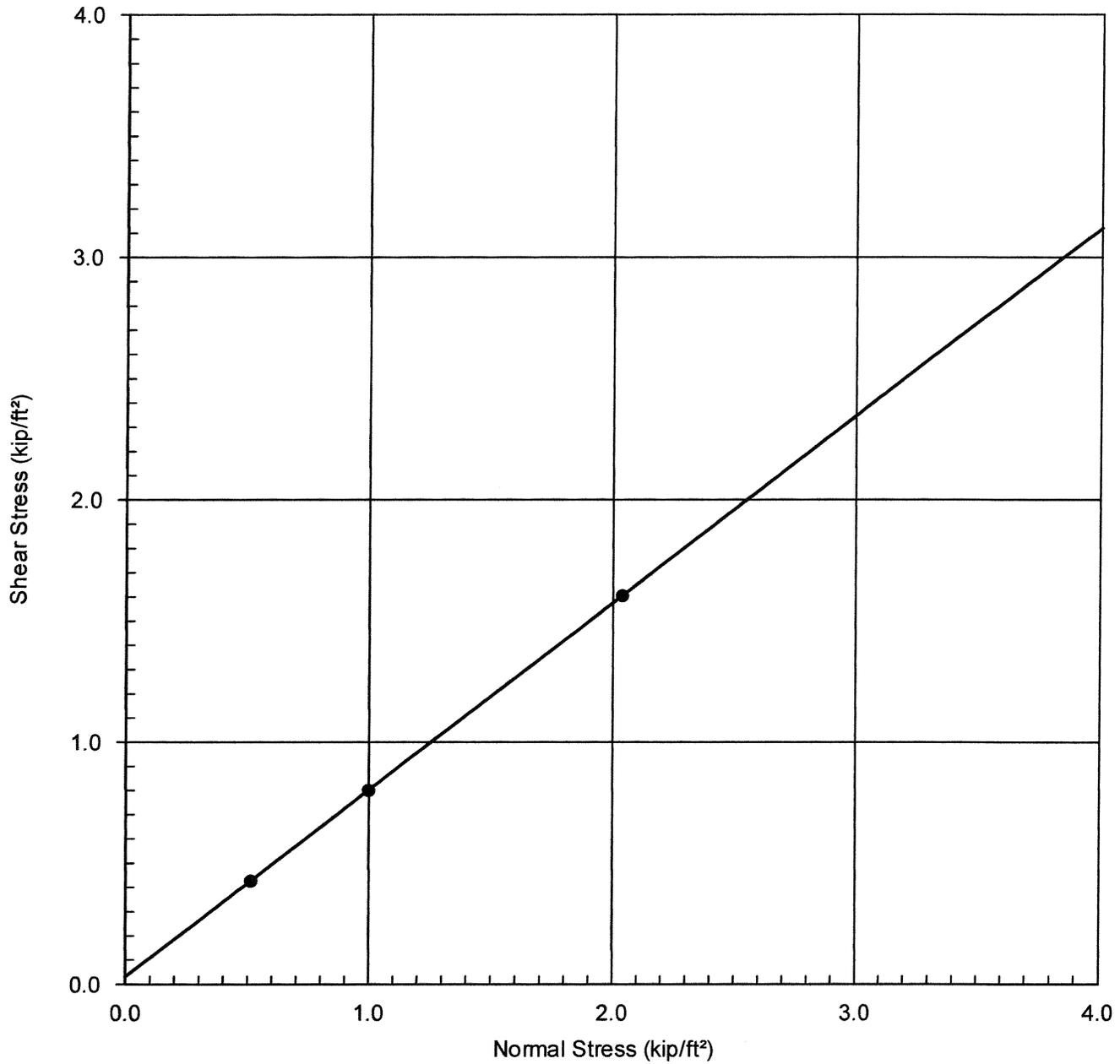
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
(ASTM D 3080)

**PLATE D-3**



Boring No. : B-6  
 Depth (ft.) : 2.0  
 Sample Type : Relatively Undisturbed  
 Soil Type : Fine to Medium Sand

Cohesion(C) = 30 psf  
 Friction ( $\phi$ ) = 37.5°  
 Dry Density (pcf) = 110.5  
 Moisture (%) = 1.5

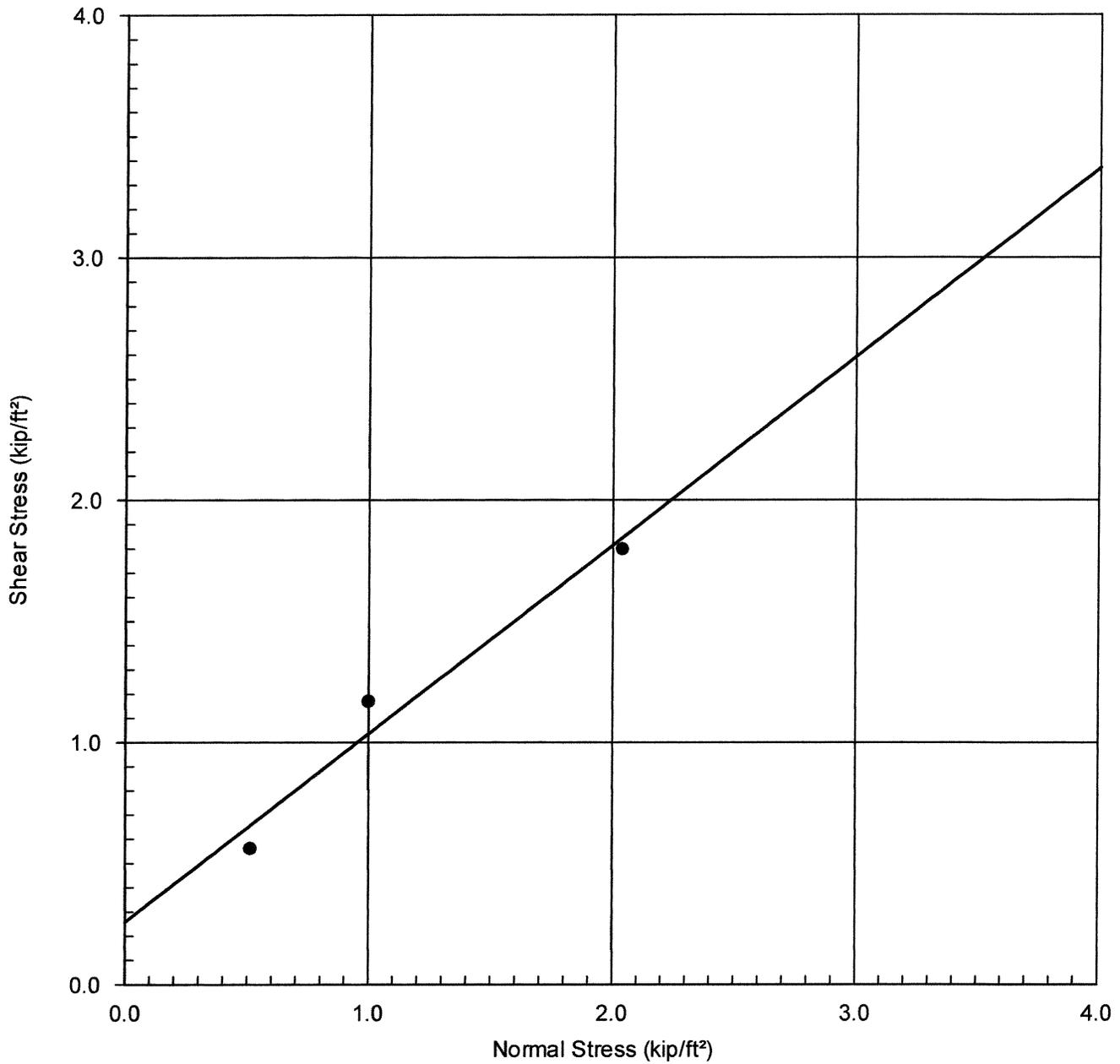
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
(ASTM D 3080)

**PLATE D-4**



Boring No. : B-7  
 Depth (ft.) : 5.0  
 Sample Type : Relatively Undisturbed  
 Soil Type : Silty Clay with Fine to Coarse Sand

Cohesion(C) = 255 psf  
 Friction ( $\phi$ ) = 37.5°  
 Dry Density (pcf) = 122.1  
 Moisture (%) = 12.4

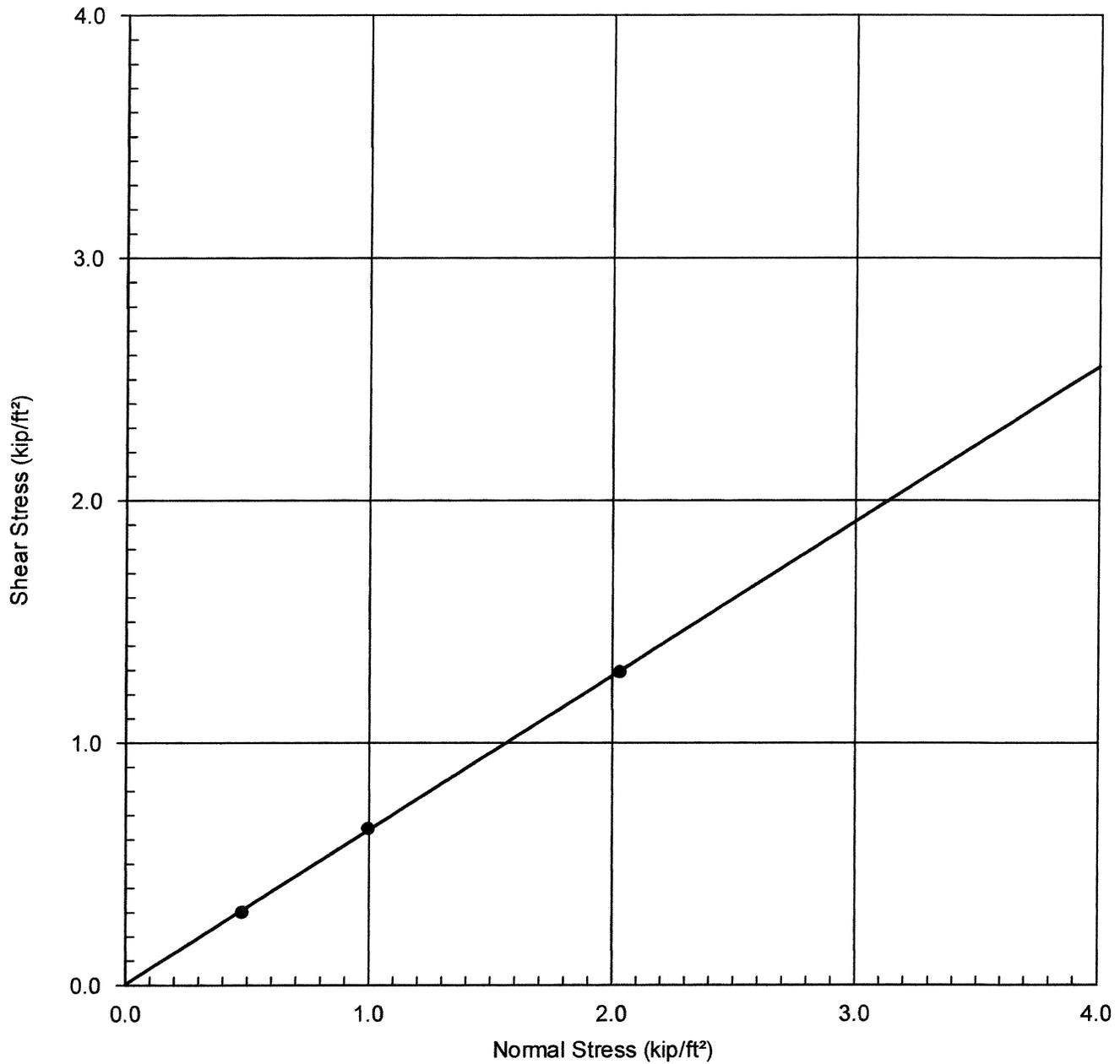
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
 (ASTM D 3080)

**PLATE D-5**



Boring No. : B-1  
 Depth (ft.) : 0-5  
 Sample Type : Remolded (90% of Maximum Density)  
 Soil Type : Fine Sandy Clay

Cohesion(C) = 5 psf  
 Friction ( $\phi$ ) = 32.5°  
 Dry Density (pcf) = 114.3  
 Moisture (%) = 10.5

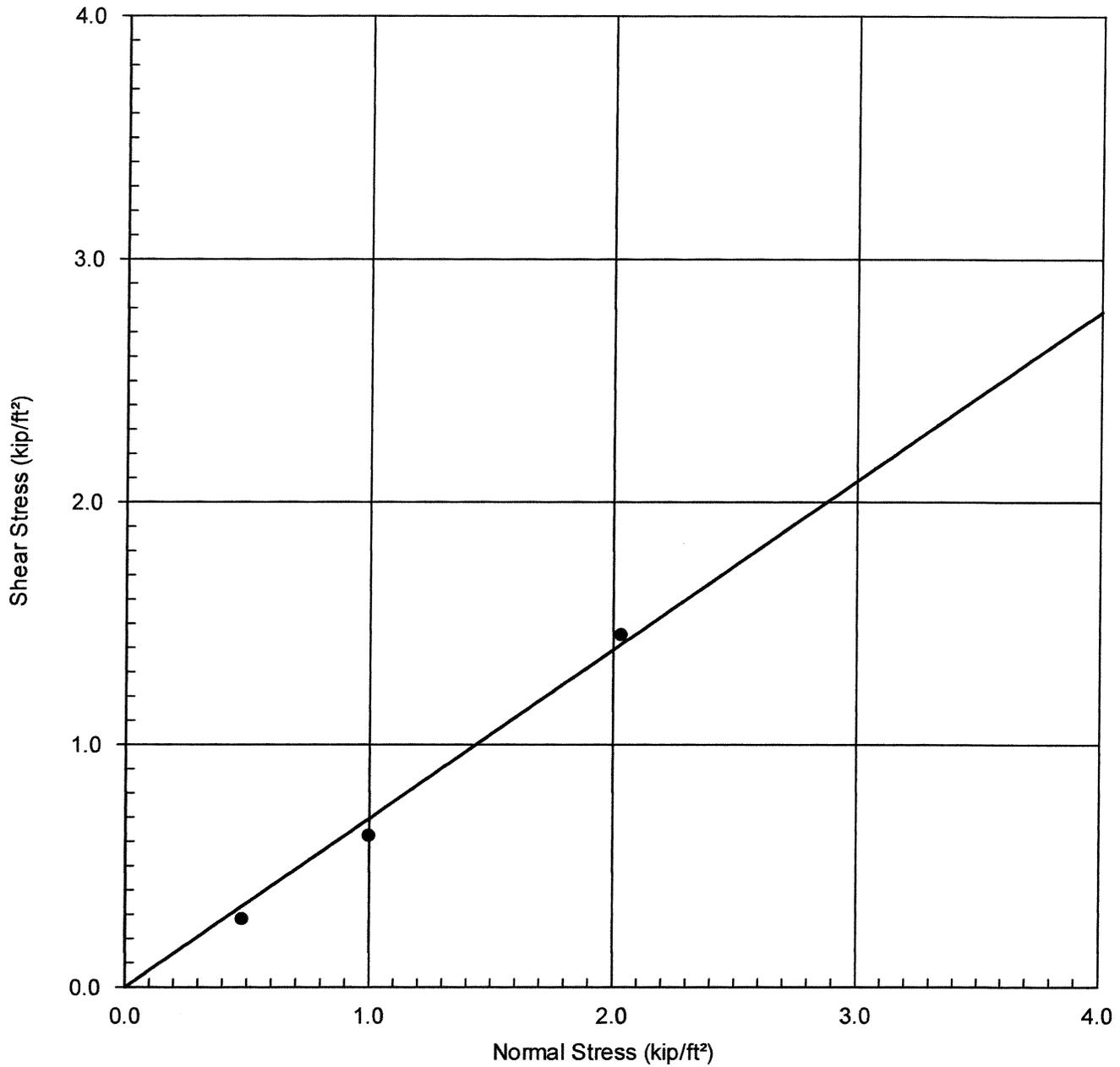
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
(ASTM D 3080)

**PLATE D-6**



Boring No. : B-6  
 Depth (ft.) : 0-5  
 Sample Type : Remolded (90% of Maximum Density)  
 Soil Type : Fine to Medium Sand with Silt

Cohesion(C) = 0 psf  
 Friction ( $\phi$ ) = 37°  
 Dry Density (pcf) = 106.7  
 Moisture (%) = 13.0

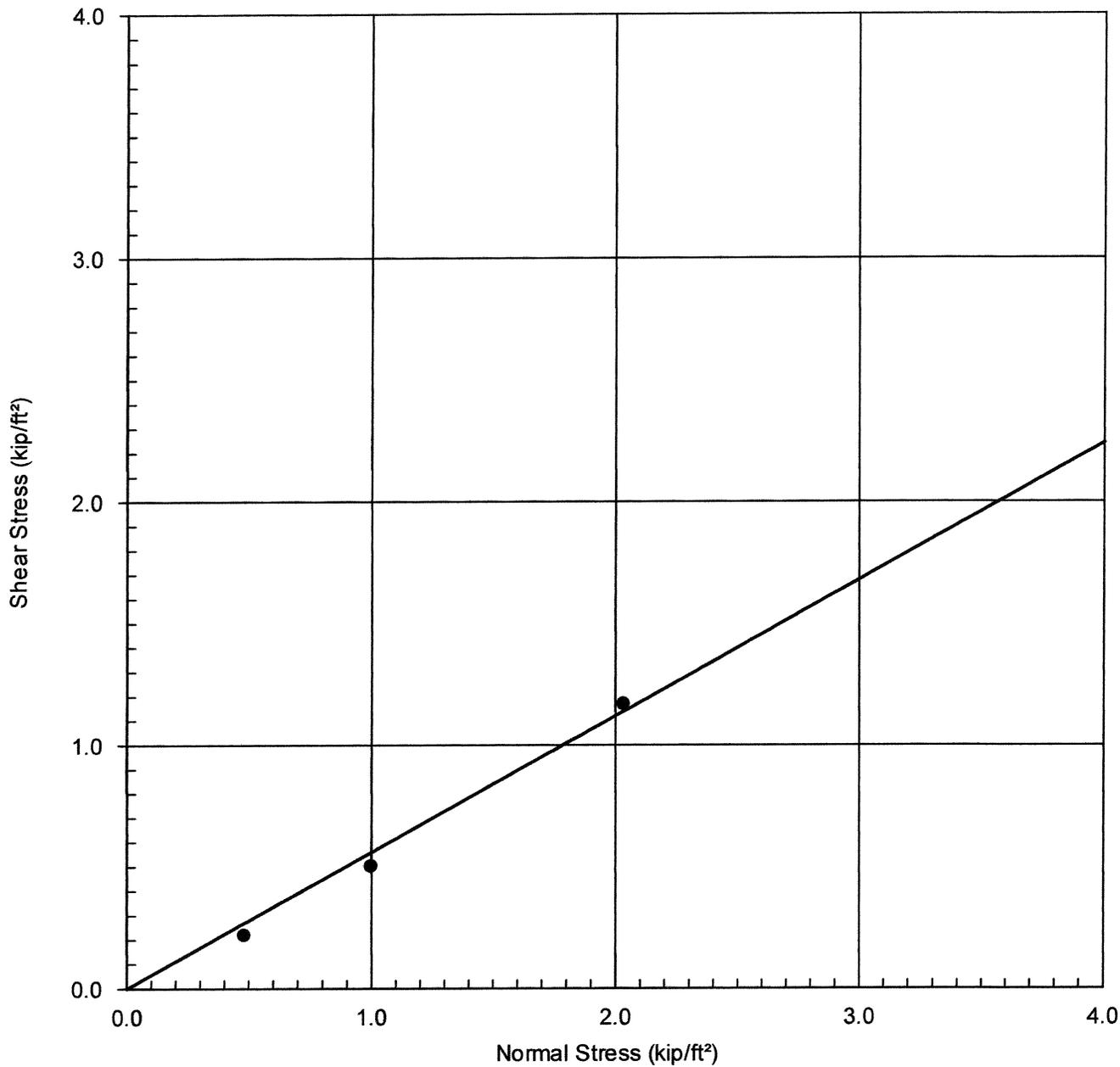
Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
(ASTM D 3080)

**PLATE D-7**



Boring No. : B-8  
 Depth (ft.) : 0-5  
 Sample Type : Remolded (90% of Maximum Density)  
 Soil Type : Clayey Fine to Medium Sand

Cohesion(C) = 0 psf  
 Friction ( $\phi$ ) = 31.5°  
 Dry Density (pcf) = 113.0  
 Moisture (%) = 9.0

Project Name: Residential and Retail Mixed Development-Placentia

Project No.: 6736.17

ASSOCIATED SOILS ENGINEERING, INC.

DIRECT SHEAR TEST RESULTS  
(ASTM D 3080)

**PLATE D-8**

**PERCOLATION DATA SHEET**

Project: Proposed Residential and Retail Mixed Development Job No.: 6736.17

Southeast Corner of Rose Drive and Alta Vista Street, Placentia, California

Test Hole No.: B-10 Date Excavated: 6/20/2017 Depth of Test Hole: 10' 2.5"

Soil Classification: Fine to Medium Sandy Clay/Clayey Silt

Presoak:  Actual Percolation Tested By: Mike Doyle Date: 6/21/2017

(2.5" Gravel on Bottom)

**USE NORMAL SANDY (CIRCLE ONE) SOIL CRITERIA**

Time	Time Interval (Min.)	Total Elapsed Time (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ In Water Level (Inches)	Percolation Rate (Min./Inches)
<u>5:30</u> <u>6:00</u>	30	30	-16.75	-17.0	0.25	120.0
<u>6:00</u> <u>6:30</u>	30	60	-17.0	-17.25	0.25	120.0
<u>6:30</u> <u>7:00</u>	30	90	-17.25	-17.5	0.25	120.0
<u>7:00</u> <u>7:30</u>	30	120	-17.5	-17.75	0.25	120.0
<u>7:30</u> <u>8:00</u>	30	150	-17.75	-18.0	0.25	120.0
<u>8:00</u> <u>8:30</u>	30	180	-18.0	-18.25	0.25	120.0
<u>8:30</u> <u>9:00</u>	30	210	-18.25	-18.5	0.25	120.0
<u>9:00</u> <u>9:30</u>	30	240	-18.5	-18.75	0.25	120.0
<u>9:30</u> <u>10:00</u>	30	270	-18.75	-19.0	0.25	120.0
<u>10:00</u> <u>10:30</u>	30	300	-19.0	-19.25	0.25	120.0
<u>10:30</u> <u>11:00</u>	30	330	-19.25	-19.5	0.25	120.0
<u>11:00</u> <u>11:30</u>	30	360	-19.5	-19.75	0.25	120.0

**PLATE H-1**

**PERCOLATION DATA SHEET**

Project: Proposed Residential and Retail Mixed Development Job No.: 6736.17

Southeast Corner of Rose Drive and Alta Vista Street, Placentia, California

Test Hole No.: B-11 Date Excavated: 6/20/2017 Depth of Test Hole: 5' 1.5"

Soil Classification: Clayey Fine to Medium Sandy Clay/Silty Clay

Presoak: √ Actual Percolation Tested By: Mike Doyle Date: 6/21/2017

(2.5" Gravel on Bottom)

**USE NORMAL SANDY (CIRCLE ONE) SOIL CRITERIA**

Time	Time Interval (Min.)	Total Elapsed Time (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ In Water Level (Inches)	Percolation Rate (Min./Inches)
<u>5:25</u> <u>5:55</u>	30	30	-9.75	-10.0	0.25	120.0
<u>5:55</u> <u>6:25</u>	30	60	-8.25	-8.0	0.25	120.0
<u>6:25</u> <u>6:55</u>	30	90	-9.0	-9.25	0.25	120.0
<u>6:55</u> <u>7:25</u>	30	120	-8.0	-8.25	0.25	120.0
<u>7:25</u> <u>7:55</u>	30	150	-7.25	-7.75	0.50	60.0
<u>7:55</u> <u>8:25</u>	30	180	-8.0	-8.25	0.25	120.0
<u>8:25</u> <u>8:55</u>	30	210	-9.25	-9.25	0	-
<u>8:55</u> <u>9:25</u>	30	240	-9.25	-9.25	0	-
<u>9:25</u> <u>9:55</u>	30	270	-9.25	-9.25	0	-
<u>9:55</u> <u>10:25</u>	30	300	-9.25	-9.25	0	-
<u>10:25</u> <u>10:55</u>	30	330	-9.25	-9.25	0	-
<u>10:55</u> <u>11:25</u>	30	360	-9.25	-9.25	0	-

**PLATE H-2**

**PERCOLATION DATA SHEET**

Project: Proposed Residential and Retail Mixed Development Job No.: 6736.17

Southeast Corner of Rose Drive and Alta Vista Street, Placentia, California

Test Hole No.: B-12 Date Excavated: 6/20/2017 Depth of Test Hole: 5' 2.5"

Soil Classification: Silty Fine Sand/Fine to Medium Sandy Clay/Silty Fine to Medium Sand with Clay

Presoak: √ Actual Percolation Tested By: Mike Doyle Date: 6/21/2017

(2.5" Gravel on Bottom)

**USE NORMAL SANDY (CIRCLE ONE) SOIL CRITERIA**

Time	Time Interval (Min.)	Total Elapsed Time (Min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Δ In Water Level (Inches)	Percolation Rate (Min./Inches)
<u>5:20</u> <u>5:50</u>	30	30	-10.0	-10.0	0	-
<u>5:50</u> <u>6:20</u>	30	60	-10.0	-10.0	0	-
<u>6:20</u> <u>6:50</u>	30	90	-10.0	-10.0	0	-
<u>6:50</u> <u>7:20</u>	30	120	-10.0	-10.0	0	-
<u>7:20</u> <u>7:50</u>	30	150	-10.0	-10.0	0	-
<u>7:50</u> <u>8:20</u>	30	180	-10.0	-10.0	0	-
<u>8:20</u> <u>8:50</u>	30	210	-10.0	-10.0	0	-
<u>8:50</u> <u>9:20</u>	30	240	-10.0	-10.0	0	-
<u>9:20</u> <u>9:50</u>	30	270	-10.0	-10.0	0	-
<u>9:50</u> <u>10:20</u>	30	300	-10.0	-10.0	0	-
<u>10:20</u> <u>10:50</u>	30	330	-10.0	-10.0	0	-
<u>10:50</u> <u>11:20</u>	30	360	-10.0	-10.0	0	-

**PLATE H-3**

**APPENDIX B - SITE FAULTING/SEISMICITY DATA**

Plates I-1 and I-2

EQFAULT – Deterministic Estimation of Peak Acceleration from  
Digitized Faults

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*****  
*  
*   E Q F A U L T   *  
*  
*   Version 3.00   *  
*  
*****
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DETERMINISTIC ESTIMATION OF  
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 6736.17

DATE: 06-09-2017

JOB NAME: Proposed Residential and Retail Mixed Development  
SE Corner of Rose Drive and Alta Vista Street, Placentia, CA  
CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: C:\Program Files\EQFAULT1\Cgsflte.dat

SITE COORDINATES:  
SITE LATITUDE: 33.8754  
SITE LONGITUDE: 117.8428

SEARCH RADIUS: 62 mi

ATTENUATION RELATION: 20) Sadigh et al. (1997) Horiz. - Soil  
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0  
DISTANCE MEASURE: clodis  
SCOND: 0  
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:  
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: C:\Program Files\EQFAULT1\Cgsflte.dat

MINIMUM DEPTH VALUE (km): 0.0

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EQFAULT SUMMARY  
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DETERMINISTIC SITE PARAMETERS  
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ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT		
		MAXIMUM EARTHQUAKE MAG. (Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
WHITTIER	3.2( 5.1)	6.8	0.404	X
PUENTE HILLS BLIND THRUST	4.9( 7.9)	7.1	0.470	X
CHINO-CENTRAL AVE. (Elsinore)	9.9( 15.9)	6.7	0.275	IX
SAN JOSE	11.5( 18.5)	6.4	0.205	VIII
ELSINORE (GLEN IVY)	11.9( 19.1)	6.8	0.194	VIII
SAN JOAQUIN HILLS	12.9( 20.7)	6.6	0.210	VIII
NEWPORT-INGLEWOOD (L.A.Basin)	16.2( 26.1)	7.1	0.173	VIII
SIERRA MADRE	17.8( 28.6)	7.2	0.216	VIII
CUCAMONGA	18.5( 29.7)	6.9	0.177	VIII
UPPER ELYSIAN PARK BLIND THRUST	19.9( 32.1)	6.4	0.118	VII
NEWPORT-INGLEWOOD (Offshore)	20.1( 32.3)	7.1	0.142	VIII
RAYMOND	21.6( 34.8)	6.5	0.117	VII
CLAMSHELL-SAWPIT	22.7( 36.6)	6.5	0.110	VII
VERDUGO	25.1( 40.4)	6.9	0.129	VIII
PALOS VERDES	25.3( 40.7)	7.3	0.127	VIII
HOLLYWOOD	27.9( 44.9)	6.4	0.079	VII
SAN JACINTO-SAN BERNARDINO	31.6( 50.9)	6.7	0.067	VI
ELSINORE (TEMECULA)	32.6( 52.5)	6.8	0.069	VI
SAN ANDREAS - Mojave M-1c-3	34.6( 55.7)	7.4	0.097	VII
SAN ANDREAS - 1857 Rupture M-2a	34.6( 55.7)	7.8	0.125	VII
SAN ANDREAS - Cho-Moj M-1b-1	34.6( 55.7)	7.8	0.125	VII
SAN ANDREAS - whole M-1a	34.6( 55.7)	8.0	0.140	VIII
SAN ANDREAS - SB-Coach. M-1b-2	34.8( 56.0)	7.7	0.117	VII
SAN ANDREAS - SB-Coach. M-2b	34.8( 56.0)	7.7	0.117	VII
SAN ANDREAS - San Bernardino M-1	34.8( 56.0)	7.5	0.103	VII
SANTA MONICA	35.5( 57.1)	6.6	0.069	VI
SAN JACINTO-SAN JACINTO VALLEY	36.3( 58.4)	6.9	0.065	VI
CLEGHORN	37.1( 59.7)	6.5	0.047	VI
SIERRA MADRE (San Fernando)	38.0( 61.2)	6.7	0.068	VI
SAN GABRIEL	39.5( 63.6)	7.2	0.073	VII
MALIBU COAST	41.0( 66.0)	6.7	0.062	VI
CORONADO BANK	42.2( 67.9)	7.6	0.089	VII
NORTHRIDGE (E. Oak Ridge)	42.5( 68.4)	7.0	0.074	VII
NORTH FRONTAL FAULT ZONE (west)	44.8( 72.1)	7.2	0.080	VII
SANTA SUSANA	48.6( 78.2)	6.7	0.049	VI
ANACAPA-DUME	49.5( 79.6)	7.5	0.088	VII
SAN JACINTO-ANZA	53.9( 86.8)	7.2	0.049	VI
HOLSER	54.5( 87.7)	6.5	0.036	V
SIMI-SANTA ROSA	56.7( 91.3)	7.0	0.051	VI
ROSE CANYON	57.3( 92.2)	7.2	0.046	VI

DETERMINISTIC SITE PARAMETERS

Page 2

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT		
		MAXIMUM EARTHQUAKE MAG. (Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
ELSINORE (JULIAN)	58.8( 94.6)	7.1	0.041	V
OAK RIDGE (Onshore)	60.8( 97.9)	7.0	0.046	VI

\*\*\*\*\*  
-END OF SEARCH- 42 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE WHITTIER FAULT IS CLOSEST TO THE SITE.  
IT IS ABOUT 3.2 MILES (5.1 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.4704 g

**APPENDIX C – LIST OF PAST ENVIRONMENTAL REMEDIATION AND GEOTECHNICAL GRADING REPORTS**  
**REVIEWED BY ASE**

Exhibit 1

Copy of “Excavation Area Detail Area 1” from Ref. No. 29

**PLACENTIA DEVELOPMENT COMPANY  
Bibliography**

REF. NO.	PREPARED BY	TITLE	THEIR PROJECT NO.	PREPARED FOR	DATED	LOCATION
1	HUNTER/GREGG	Results of a Site Assessment Investigation, Yarnell Lease, Placentia, CA	none	Brougham Realty	January 30, 1989	Box 58
2	HARDING ESE	Phase I Site Assessment of a 27.5-Acre Property within the Richfield Oil Field, Placentia	6-90-4273 (not on file)	Unocal	January 25, 1990	Exhibit B & JT's
3	HUNTER/GREGG	Results of a Site Assessment Investigation, Yarnell Lease, Placentia, CA (REVISED - Originally printed Jan. 30, 1989)	none	Brougham Realty	February 1, 1991	Box 58
4	HARDING ESE	Phase I Site Assessment of a 5.5-Acre Property within the Bradford Lease in Placentia	6-90-4273 (not on file)	Unocal	March 20, 1991	Exhibit B & JT's
5	HARDING ESE	Results of a Phase II Site Assessment for a Proposed Commercial Development within the Richfield Oil Field in Placentia (Volume I)	6-90-4273 (not on file)	Unocal	May 10, 1991	Exhibit B & JT's
6	HARDING ESE	Results of a Phase II Site Assessment for a Proposed Commercial Development within the Richfield Oil Field in Placentia	not on file	not specified	May 10, 1991	Exhibit B
7	HARDING ESE	Site Map	6-90-4273	Union Bradford	July 11, 1991	Box 58
8	HARDING ESE	Results of a Phase I Site Assessment of the Bradford Property in Placentia, CA (3 copies)	6-91-4344	Union Oil Co. of CA	August 15, 1991	Box 58
9	HARDING ESE	Results of a Phase II Site Assessment of the Bradford Property in Placentia	6-91-4376 (not on file)	Union Oil Co. of CA	September 6, 1991	Exhibit B & JT's
10	HARDING ESE	Remedial Action Plan for the Site of a Proposed Commercial Development within the Richfield Oil Field in Placentia	not on file	not specified	October 3, 1991	Exhibit B
11	HARDING ESE	Laboratory Results of Samples Collected Within Alta Vista Parkway Extension, Near Jefferson Street in Placentia, CA	6-91-4422	Unocal Oil & Gas	March 25, 1992	Box 58
12	HARDING ESE	Remedial Action Plan for Leaking Underground Storage Tank Clean Up Located within the Richfield Oil Field	not on file	not specified	June 19, 1992	Exhibit B
13	HARDING ESE	Results of Drilling & Soil Sampling Conducted in an Excavation Along the Proposed Alta Vista Parkway Within the Unocal Richfield Remediation Project, Placentia, CA	6-90-4273/0001	Union Oil Co. of CA	June 23, 1992	Box 58
14	HARDING ESE	Remedial Action Plan for the Bradford Property located within the Richfield Oil Field in Placentia	not on file	not specified	July 13, 1992	Exhibit B
15	County of Orange Health Care Agency	Case Closure - Unocal-Chapman Lease, Rose & Alta Vista, Placentia, CA 92670	88IC62	Unocal Corporation	August 10, 1992	On Shelf

**PLACENTIA DEVELOPMENT COMPANY  
Bibliography**

REF. NO.	PREPARED BY	TITLE	THEIR PROJECT NO.	PREPARED FOR	DATED	LOCATION
16	HARDING ESE	PCB-Impacted-Soil at a Parcel Within the Unocal Union Bradford Property, Placentia, CA	6-92-4595	Orange County Health Care Agency	November 6, 1992	Box 52
17	HARDING ESE	PCB-Impacted-Soil at a Parcel Within the Unocal Union Bradford Property, Placentia, CA	6-92-4595	Orange County Health Care Agency	November 6, 1992	Box 58
18	HARDING ESE	Report on mitigation of PCB-Impacted-Soil at the Unocal Union Bradford Property, Placentia, CA	6-92-4595	Orange County Health Care Agency	April 5, 1993	Box 52
19	HARDING ESE	Report on mitigation of PCB-Impacted-Soil at the Unocal Union Bradford Property, Placentia, CA	6-92-4595	Orange County Health Care Agency	April 5, 1993	Box 58
20	EBERHART & STONE	Interim Mass Grading Geotechnical Report - Parcels 3 & 4, East Placentia Project, Placentia, CA	W.O. 160700.35	Unocal Land & Dev. Co.	June 3, 1993	Box 52
21	HARDING ESE	Final Report of Remediation of Soil Impacted by Volatile Petroleum Hydrocarbons at the Unocal Richfield Property in Placentia, CA	not on file	not specified	June 3, 1993	Exhibit B
22	HARDING ESE	Final Report of Soil Remediation at the Unocal Placentia Park Wite in Placentia, CA	not on file	not specified	June 7, 1993	Exhibit B
23	HARDING ESE	Final Report of Soil Remediation at the Unocal Richfield Shopping Center Development Property in Placentia, CA	6-90-4273	Union Oil Co. of CA	October 8, 1993	Box 58
24	HARDING ESE	Final Report of Soil Remediation at the Unocal Richfield Shopping Center Development Property in Placentia, CA (Volume II)	6-90-4273	Unocal Land & Dev. Co.	October 8, 1993	Box 58
25	BACA ASSOC.	Compaction Monitoring Report No. 1 - Street Development Grading, Alta Vista Drive, Street Improvement Project C.F.D. No. 89-1, City of Placentia, CA	A-0884-1	City of Placentia	October 18, 1993	Box 58
26	BACA ASSOC.	Compaction Monitoring Report No. 2 - Street Improvement Grading, Buena vista Avenue, Van Buren Street & Rose Drive, Street Improvement Project C.F.D. No. 89-1, City of Placentia, CA	A-0884-1	City of Placentia	October 20, 1993	Box 58
27	BACA ASSOC.	Compaction Monitoring Report No. 3 - Street Development Grading, Jefferson Street, Street Improvement Project C.F.D. No. 89-1, City of Placentia, CA	A-0884-1	City of Placentia	October 22, 1993	Box 58
28	County of Orange Health Care Agency	Letter stating that No Further Action is required at the Unocal Richfield property with regard to the underground storage tank	not on file	Richard Salisbury	November 3, 1993	Exhibit B

**PLACENTIA DEVELOPMENT COMPANY  
Bibliography**

REF. NO.	PREPARED BY	TITLE	THEIR PROJECT NO.	PREPARED FOR	DATED	LOCATION
29	HARDING ESE	Final Report of Soil Remediation at the Unocal Richfield Commercial Development Property in Placentia, CA	6-90-4273	Union Oil Co. of CA	February 18, 1994	Box 58
30	HARDING ESE	Results of Soil/Groundwater Sampling of a Boring/Well at the Unocal Union Bradford Property in Placentia, CA	6-92-4595	CA Regional Water Quality Control Board	March 18, 1994	Box 58
31	HARDING ESE	Results of Groundwater Sampling of Well MW-1 at the Unocal Union Bradford Property in Placentia, CA	6-92-4595	CA Regional Water Quality Control Board	October 26, 1994	Box 58
32	HARDING ESE	Request for Abandonment of Monitoring Well MW-1 & Site Closure with Respect to Groundwater at the Unocal Union Bradford Property in Placentia, CA	6-92-4595	CA Regional Water Quality Control Board	November 9, 1994	Box 58
33	HARDING ESE	Additional PCB Soil Mitigation & Sampling at the Unocal Union Bradford Property Letter	not on file	County of Orange Health Care Agency	December 13, 1994	Exhibit B
34	County of Orange Health Care Agency	Letter wherein the Agency approves Unocal's proposal for Additional Mitigation and Sampling of PCB's	not on file	Unocal	December 19, 1994	Exhibit B
35	HARDING ESE	Updates on East Coyote, Hartwell/Sterns, & Union Bradford	none	Union Oil Co. of CA	December 20, 1994	Box 58
36	HARDING ESE	Request for Abandonment of Monitoring Well MW-1 & Site Closure with Respect to Groundwater at the Unocal Union Bradford Property in Placentia, CA	6-92-4595	CA Regional Water Quality Control Board	May 9, 1995	Box 58
37	HARDING ESE	Confirmation of Verbal Approval of a Request for Abandonment of Monitoring Well MW-1 & Site Closure with respect to Groundwater at the Unocal Union Bradford Property in Placentia, CA	6-92-4595	CA Regional Water Quality Control Board	June 20, 1995	Box 58
38	HARDING ESE	Abandonment of Monitoring Well MW-1 & Site Closure with Respect to Groundwater at the Unocal Union Bradford Property in Placentia, CA	6-92-4595	CA Regional Water Quality Control Board	June 27, 1995	Box 58
39	HARDING ESE	Abandonment of Monitoring Well MW-1 & Site Closure with Respect to Groundwater at the Unocal Union Bradford Property in Placentia, CA	6-92-4595	CA Regional Water Quality Control Board	October 20, 1995	Box 58
40	HARDING ESE	Addendum Report for Richfield Shopping Center Site Remediation	not on file	not specified	January 19, 1996	Exhibit B
41	HARDING ESE	Status of Remediation at the Bradford Property in Placentia, CA	6-92-4595	Unocal Diversified Businesses	March 18, 1997	Box 58
42	QST Environ. (formerly ESE)	Summary of Limited Assessments - Unocal's Union Bradford Property, Placentia, CA	6-92-4595	Unocal Diversified Businesses	December 9, 1997	Box 58

**PLACENTIA DEVELOPMENT COMPANY  
Bibliography**

REF. NO.	PREPARED BY	TITLE	THEIR PROJECT NO.	PREPARED FOR	DATED	LOCATION
43	not specified	List of Documents - East Placentia Parcel 2, 3 & 4 and the Bradford Fee, Alta Vista between Rose & Jefferson, Placentia, CA	Exhibit B	not specified	January 21, 1998	Box 58
44	Lawyers Title	Supplement Escrow Instructions	19555-KR	Jay Steinman, Esq.	May 21, 1998	Box 58
45	SHAPELL	Letter of Intent Regarding Acquisition & Development of Placentia Property	none	Bridgemark Corp.	July 17, 1998	Box 52
46	QST Environ. (formerly ESE)	Proposal for Phase I, Environmental Site Assessment at the Bridgemark Corporation, Placentia Development, Placentia, CA	64-98-000-999-0198	Bridgemark Corp.	September 16, 1998	Box 52
47	LGS	Natural Hazard Disclosure Statement	IA98113	not specified	September 30, 1998	Box 52
48	Lawyers Title	Agreement of Sale & Escrow Instructions	21140-KR	Bradford Brothers & Shapell Industries	October 5, 1998	Box 52
49	QST Environ. (formerly ESE)	Current Sampling Locations	692-4595	Unocal Union Bradford	October 23, 1998	Box 58
50	QST Environ. (formerly ESE)	PCB Remediation work Plan for the Unocal Bradford Property, Placentia, CA	6-92-4595	Orange County Health Care Agency	November 2, 1998	Box 58
51	SHAPELL	Placentia Property Partnership Agreement	292273.09	Margaret Leong	November 4, 1998	Box 52
52	Union Oil Co.	Agreement & Declaration of Covenants, conditions, Restrictions, Indemnities, Waivers & Releases (Blank copy)	none	Bridgemark Corp.	December 9, 1998	Box 58
53	UNOCAL	Placentia Parcels, Placentia Development Co. LLC (Letter listing escrow documents)	none	Shapell Industries	December 11, 1998	Box 52
54	UNOCAL	Unocal East Placentia Parcels, Escrow # 19555-KR, Policy No. 9800397-12 (Letter listing document deposit in escrow)	none	Lawyers Title Co.	December 11, 1998	Box 52
55	Lawyers Title	Assignment, Acceptance, Consent & Second Amendment to Agreement for Sale of Real Property & Escrow Instructions	19555-KR	Union Oil Co. of CA & Bridgemark	December 11, 1998	Box 58
56	Union Oil Co.	Agreement & Declaration of Covenants, Conditions, Restrictions, Indemnities, Waivers & Releases (Blank copy)	none	Placentia Development Co.	December 14, 1998	Box 52
57	Union Oil Co.	Assignment of Revocable Signboard License	DIP 250701	Placentia Development Co.	December 15, 1998	Box 52
58	Union Oil Co.	Assignment of Revocable License Agreement	DIP 250701	Placentia Development Co.	December 15, 1998	Box 52
59	Union Oil Co.	Grant Deed	1998/0864995	Placentia Development Co.	December 15, 1998	Box 52

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REF. NO.	PREPARED BY	TITLE	THEIR PROJECT NO.	PREPARED FOR	DATED	LOCATION
60	QST Environ. (formerly ESE)	Closure Report for PCB Remediation at the Unocal Bradford Property, Placentia, CA	6-92-4595	Orange County Health Care Agency	January 14, 1999	Box 52
61	QST Environ. (formerly ESE)	Closure Report for PCB Remediation - Unocal Bradford Property, Alta Vista & Jefferson Streets, Placentia, CA (Volumes I)	692-4595	Unocal Corporation	January 14, 1999	Box 52
62	QST Environ. (formerly ESE)	Closure Report for PCB Remediation - Unocal Bradford Property, Alta Vista & Jefferson Streets, Placentia, CA (Volumes II)	692-4595	Unocal Corporation	January 14, 1999	Box 52
63	QST Environ. (formerly ESE)	Summary of Previous Work & Recommendations for Tracts 15699 & 15700 In Placentia, CA	64-99-022-0001	Bridgemark Corp.	March 5, 1999	Box 52
	Orange County Health Care Agency	Remedial Action on PBC Contamination letter	OCHCA Case # 92IC6	Unocal-California	March 25, 1999	Box 58
64	QST Environ. (formerly ESE)	Proposed Workplan for the Assessment of Chemicals of concern Related to Nursery Activities on Tracts 15699 & 15700 located in Placentia, CA	64-99-022-0100	Orange County Health Care Agency	June 16, 1999	Box 52
65	QST Environ. (formerly ESE)	Proposed Workplan for the Assessment of Oilfield Related Activities on Tracts 15699 & 15700 located in Placentia, CA	64-99-022-0001	Orange County Health Care Agency	June 16, 1999	Box 52
66	QST Environ. (formerly ESE)	Proposed Workplans for Oilfield, Commercial & Nursery / Agricultural Related Environmental Site Assessments for Tracts 15699 & 15700 located in Placentia, CA	64-99-022-0001	Bridgemark Corp.	June 16, 1999	Box 52
67	QST Environ. (formerly ESE)	Proposed Workplans for the Assessment of Chemicals of Concern Related to the Activities of the Engine Shop on Tracts 15699 & 15700 located in Placentia, CA	64-99-022-0001 (not on file)	Orange County Health Care Agency	June 16, 1999	JT's File
68	HARDING ESE	Proposal & Cost Estimate to Complete Phase II Assessment Work Plans for the Placentia Development Co., LLC Property (Tracts 15699 & 15700) in Placentia, CA	64-99-000-999/012	Placentia Development Co.	August 3, 1999	Box 52
69	PEGGY TABAS	Memorandum - Tracts 15699, 15700, Placentia / Environmental Remediation	none	Shapell Industries	August 9, 1999	Box 52
70	not specified	Abandonment, Accommodation & Remediation Agreement (Draft / Red-Lined)	332629.2	PDC & Bridgemark Corp.	August 26, 1999	Box 52
71	SHAPELL	Unocal & Bradford Properties Environmental clean-up (Letter introducing Glenn Tofani & GeoKinetics)	none	Bridgemark Corp.	September 22, 1999	Box 52

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REF. NO.	PREPARED BY	TITLE	THEIR PROJECT NO.	PREPARED FOR	DATED	LOCATION
72	GeoKinetics	Placentia Development Company - Review of Draft Abandonment, Accommodation & Remediation Agreement Dated August 26, 1999	1082-E	Jackson, DeMarco & Peckenpaugh	October 11, 1999	Box 52
73	not specified	Abandonment, Accommodation & Remediation Agreement (Draft)	none	PDC & Bridgemark Corp.	October 27, 1999	Box 52
74	BRIDGEMARK	Abandonment, Accommodation & Remediation Agreement (Draft)	344255.2	Placentia Development Co.	November 29, 1999	Box 52
75	BRIDGEMARK	Abandonment, Accommodation & Remediation Agreement (Draft / Red-Lined)	344255.RED	Placentia Development Co.	November 29, 1999	Box 52
76	BRIDGEMARK	Abandonment, Accommodation & Remediation Agreement (Draft)	344255.2	Placentia Development Co.	December 6, 1999	Box 52
77	BRIDGEMARK	Abandonment, Accommodation & Remediation Agreement (Draft / Red-Lined)	344255.RED	Placentia Development Co.	December 6, 1999	Box 52
78	BRADFORD BROTHERS	Amendment to Agreement of Sale & Escrow Instructions	344043.2	Shapell Industries	December 7, 1999	Box 52
79	ROD REYNOLDS	Abandonment, Accommodation & Remediation Agreement	none	PDC & Bridgemark Corp.	December 14, 1999	Box 52
80	JACKSON, DeMARCO & PECKENPAUGH	PDC / Bridgemark Abandonment, Accommodation and Remediation Agreement (Discussion letter)	none	Bridgemark Corp. & The Law Offices of Rod Reynolds	December 29, 1999	Box 52
81	HARDING ESE	Proposed Workplan for a Limited Environmental Assessment of Tracts 15699 & 15700 Located in Placentia, CA	64-99-022-0200	Orange County Health Care Agency	January 31, 2000	Box 52
82	HARDING ESE	Limited Site Assessment Report Excavation & Remediation Plan for Lead Impacted Soil at Tract 15699, Placentia, CA	64-99-022	Orange County Health Care Agency	March 8, 2000	On Shelf
83	PETRA	Geotechnical Investigation, Proposed Residential Development, Tentative Tract Nos. 15699 & 15700, City of Placentia, Orange County, CA	J.N. 412-99	S & S Construction	March 20, 2000	J.D.C. File
84	PETRA	Geotechnical Investigation, Proposed Residential Development, Tentative Tract Nos. 15699 & 15700, City of Placentia, Orange County, CA	J.N. 412-99	S & S Construction	March 22, 2000	On Shelf
85	PETRA	Limited Site Assessment Report Excavation & Remediation Plan for Lead Impacted Soil at Tract 15699, Placentia, CA	64-99-022	Bridgemark Corp.	April 12, 2000	Box 52
86	HARDING ESE	Limited Phase II Assessment Report And Remedial Action Plan for Petroleum Hydrocarbon Impacted Soil at Tracts 15699 & 15700 in Placentia, California	64-99-022	Bridgemark Corp.	April 19, 2000	Box 52

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REF. NO.	PREPARED BY	TITLE	THEIR PROJECT NO.	PREPARED FOR	DATED	LOCATION
87	PETRA	Geotechnical Investigation, Proposed Commercial Development, Southeast Corner of the Intersection of Rose Drive & Alta Vista Street, Lot 184 of Tentative Tract No. 15699 & 15700, City of Placentia, Orange County, CA	J.N. 412-99	S & S Construction	May 10, 2000	On Shelf
88	HARDING ESE	Limited Phase II Assessment Report And Remedial Action Plan for Petroleum Hydrocarbon Impacted Soil at Tracts 15699 & 15700 in Placentia, California	64-99-022	Bridgemark Corp.	May 17, 2000	On Shelf
89	ESE	Limited Phase II Assessment Report And Remedial Action Plan for Petroleum Hydrocarbon Impacted Soil at Tracts 15699 & 15700 in Placentia, California	64-99-022	Bridgemark Corp.	May 17, 2000	Box 52
90	County of Orange Health Care Agency	Assessment Report & Remedial Action Plan dated May 17, 2000	00IC09	Harding ESE	June 1, 2000	Box 52
91	ESE	Additional Site Assessment Report and Closure Request for Lead-Containing Soil at Tract 15699, Placentia, CA	64-99-022	Orange County Health Care Agency	June 12, 2000	Box 52
92	County of Orange Health Care Agency	Case Closure - PCB-Impacted Soil Only	92IC6	Unocal Corporation	July 25, 2000	Box 58
93	CITY OF PLACENTIA	Grading Permit	600009	Placentia Development Co.	September 25, 2000	On Shelf
94	S & S CONST.	Storm-Water Pollution Prevention Plan - Proposed Residential Subdivision: Alta Vista Street, Placentia, CA; North & South of Alta vista Street Between Rose Drive & Jefferson Street (Bound copies of Grading Permit, Notice of Intent letters, etc.)	none	Field copy	November 1, 2000	J.D.C. File
95	BRADFORD BROTHERS	Fax Letter Regarding the two 1000 Gallon Tanks Adjacent to Pine Street on Aqua Tibia Ranch	none	Bridgemark Corp.	November 29, 2000	On Shelf
96	BRIDGEMARK	Your Memorandum Dated December 11, 2000 - Environmental Documents Requested (letter listing report copies)	none	GeoKinetics	December 11, 2000	Box 58
97	HARDING ESE	Information regarding Estimated Soil Volumes Tract 15699	649022	Bridgemark Corp.	December 13, 2000	On Shelf

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98	HARDING ESE	Current Status of Remedial Work & Future Soil Placement Criteria For Sump 1, Texaco Bradford Well 8, Santa Fe Well 2B, Union Bradford Wells 6, 7, 8, 10, and 11, Bradford Well 1, Treatment Area 1 (Lifts 1&2), Treatment Area 2 (Lifts 1&2), Treatment Area 3 (Lift 1), and Treatment Area 4 (Lift 1 and Close Out) located in Tract 15699 in Placentia, CA	649022.11	Bridgemark Corp.	December 15, 2000	On Shelf
99	HARDING ESE	Current Status of Remedial Work & Soil Placement Criteria, Selected Areas Within Tract 15699, Placentia, CA	649022.11	Bridgemark Corp.	December 19, 2000	On Shelf
100	HARDING ESE	Remediation Status, Placentia Development Company, Tract Nos. 15699, 15700, Placentia, CA	649022.11	Bridgemark Corp.	December 28, 2000	On Shelf
101	HARDING ESE	Asbestos Abatement / Excavation Completion, Vacant Field, Southeast corner of Rose & Alta Vista, Placentia, CA	649022.11	Bridgemark Corp.	December 28, 2000	On Shelf
102	R. Y. SALISBURY MILLER ENVIRONMENTAL	Letter reviewing documents pertaining to Areas 1-4 related to PCB Contaminated Soils	none	GeoKinetics	December 29, 2000	On Shelf
103	HARDING ESE	Oil Well - Placentia (Copies of Manifests)	none	GeoKinetics	January 3, 2001	On Shelf
104	HARDING ESE	Current Status of Remedial Work & Soil Placement Criteria, Selected Areas Within Tract 15699, Placentia, CA	649022.11	Bridgemark Corp.	January 25, 2001	On Shelf
105	GeoKinetics	Placentia Development Company, Tentative Tracts 15699 & 15700 - PCB Screening of Concrete Debris	1082-E	Placentia Development Co.	February 6, 2001	On Shelf
106	HARDING ESE	Proposal to Leave Residual Petroleum Hydrocarbons in Place - Bridgemark Corporation, Tract 15699 - Placentia, CA	649022.11	Orange County Health Care Agency	May 24, 2001	On Shelf
107	HARDING ESE	Current Status of Remedial Work, Tract 15699, Placentia, CA (Draft)	649022.11	Bridgemark Corp.	July 2, 2001	On Shelf
108	HARDING ESE	Response to PDC Information Request, Tract 15699, Placentia, CA	649022.11	Bridgemark Corp.	July 10, 2001	On Shelf
109	HARDING ESE	Current Status of Remedial Work, Tract 15699, Placentia, CA	649022.11	Bridgemark Corp.	July 25, 2001	On Shelf
110	HARDING ESE	Remediation Status, Treatment Areas, Well 4T-B, Well 6T-B, Tract 15699, Placentia, CA	649022.11	Bridgemark Corp.	August 2, 2001	On Shelf
111	HARDING ESE	Remediation Status, Tract 15699 (South of Pine Street), Placentia, CA	649022.11	Bridgemark Corp.	August 17, 2001	On Shelf

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112	HARDING ESE	Volume / Cost Estimate to Complete Site Remediation, Tract 15699 (South of Pine Street), Placentia, CA	649022.11	Bridgemark Corp.	September 7, 2001	On Shelf
113	HARDING ESE	Current Status of Remedial Work, Tract 15699, Placentia, CA	649022.11	Bridgemark Corp.	September 18, 2001	On Shelf
114	BRIDGEMARK	Placentia Area, Orange County, CA, Placentia Development Co. (Letter regarding hydrocarbon impacted soil in Area A)	none	Shapell Industries	October 4, 2001	On Shelf
115	HARDING ESE	Proposal to Leave Residual Petroleum Hydrocarbons in Place - Bridgemark Corporation, Tract 15699 Well 5B, Placentia, CA	649022.11	Orange County Health Care Agency	October 4, 2001	On Shelf
116	County of Orange Health Care Agency	Proposal to Leave Residual Petroleum Hydrocarbons in Place - Bridgemark Corporation, Tract 15699 Well 5B, Placentia, CA	00IC9	Harding ESE	October 5, 2001	On Shelf
117	PTD	Calculations for Post-Tensioned Slab-On-Grade Foundations - Low, Medium & High Expansive Soils	01-306	S & S Construction	October 18, 2001	On Shelf
118	BRIDGEMARK	Placentia Area, Orange County, CA, Placentia Development Co. (Letter regarding hydrocarbon impacted soil in Area B)	none	Shapell Industries	November 8, 2001	On Shelf
119	HARDING ESE	Proposal to Leave Residual Petroleum Hydrocarbons in Place - Bridgemark Corporation, Tract 15699 - Bradford 5.5 acre parcel, Placentia, CA	649022.11	Orange County Health Care Agency	November 14, 2001	On Shelf
120	County of Orange Health Care Agency	Proposal to Leave Residual Hydrocarbons in Place - Bridgemark Tract 15699 (5.5-Acre Parcel) 1210 Alta Vista St., Placentia, CA 92870	00IC9	Harding ESE	November 15, 2001	On Shelf
121	BRIDGEMARK	Placentia Area, Orange County, CA, Placentia Development Co. (Letter regarding reabandonment of five wells)	none	Shapell Industries	December 18, 2001	On Shelf
122	BRIDGEMARK	Placentia Area, Orange County, CA, Placentia Development Co. (Letter regarding reabandonment of five wells)	none	Shapell Industries	December 19, 2001	On Shelf
123	(HARDING ESE for) Bridgemark Corporation	Draft Report for Soil Remediation Activities at Bridgemark Corporation, Tract 15699, Located at the Southeast Corner of Alta Vista Avenue & Rose Drive, Placentia, CA (Volumes I)	649022	Orange County Health Care Agency	February 22, 2002	On Shelf
124	(HARDING ESE for) Bridgemark Corporation	Draft Report for Soil Remediation Activities at Bridgemark Corporation, Tract 15699, Located at the Southeast Corner of Alta Vista Avenue & Rose Drive, Placentia, CA (Volumes II)	649022	Orange County Health Care Agency	February 22, 2002	On Shelf

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125	(HARDING ESE for) Bridgemark Corporation	Final Report for Soil Remediation Activities at Bridgemark Corporation, Tract 15699, Located at the Southeast Corner of Alta Vista Avenue & Rose Drive, Placentia, CA (Volumes I)	649022	Orange County Health Care Agency	March 11, 2002	On Shelf
126	(HARDING ESE for) Bridgemark Corporation	Final Report for Soil Remediation Activities at Bridgemark Corporation, Tract 15699, Located at the Southeast Corner of Alta Vista Avenue & Rose Drive, Placentia, CA (Volumes II)	649022	Orange County Health Care Agency	March 11, 2002	On Shelf
127	D.O.G.G.R.	Plan Review, PDC Rose Crest Development (Model Homes), Tract 15699 (Rose Drive & Alta Vista, SE corner)	PL-02-005	GeoKinetics	March 19, 2002	On Shelf
128	ORANGE COUNTY FIRE AUTHORITY	Methane Gas Soil Mitigation Plan - Tract #15699, Placentia	S/R # 69829	GeoKinetics	March 20, 2002	On Shelf
129	PETRA	Geotechnical Report of Rough Grading & Review of Precise Grading Plans, Proposed Model Site & Parking Area, Lots 173-180 of Tract no. 15699, City of Placentia, CA	J.N. 412-99	S & S Construction	March 20, 2002	On Shelf



SOURCE: EXCAVATION AREA DETAIL, AREA 1, prepared by Environmental Science & Engineering, Inc., dated 9/22/1993.

	<b>ASSOCIATED SOILS ENGINEERING</b>	<b>EXCAVATION AREA DETAIL AREA 1</b>	<b>JOB NUMBER</b>	<b>EXHIBIT</b>
			6736.17	<b>1</b>

## APPENDIX D GENERAL EARTHWORK AND GRADING SPECIFICATIONS

### **1.0 GENERAL**

- 1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the project-specific Geotechnical Report(s) (Geotechnical Report). These Specifications are a part of the recommendations contained in the Geotechnical Report. In case of conflict, the specific recommendations in the Geotechnical Report shall supersede these more general specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the Geotechnical Report.
- 1.2 The Geotechnical Consultant of Record: Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved Geotechnical Report and accepting the adequacy of the preliminary Geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the Geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditions and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

- 1.3 **The Earthwork Contractor:** The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, Geotechnical Report and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved Geotechnical Report and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

## **2.0 PREPARATION OF AREAS TO BE FILLED**

- 2.1 **Clearing and Grubbing:** Vegetation, such as brush grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. All organic materials should be nested prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

- 2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.
- 2.3 Overexcavation: In addition to removals and overexcavations recommended in the approved Geotechnical Report and the grading plan(s), soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.
- 2.4 Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 (H:V) shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.
- 2.5 Evaluation/Acceptance of Fill Areas: All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

### **3.0 FILL MATERIAL**

- 3.1 General: Material to be used as fill essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, strong corrosivity, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.
- 3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be

placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

- 3.3 Import: If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. of the potential import source. The Geotechnical Consultant shall be notified at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

#### **4.0 FILL PLACEMENT AND COMPACTION**

- 4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.
- 4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain relatively uniform moisture content at or slightly over optimum. Maximum dry density and optimum soil moisture content tests shall be performed in accordance with the latest edition of the American Society of Testing and Materials (ASTM) D1557 Test Method.
- 4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (or relative compaction) per the latest edition of ASTM D1557 Test Method. Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.
- 4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent per the latest edition of ASTM D1557 Test Method.
- 4.5 Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of

compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces, near areas of high moisture content, and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing: Tests shall be taken as intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

## 5.0 SUBDRAIN INSTALLATION

Subdrain systems shall be installed in accordance with the approved Geotechnical Report, the grading plan(s), and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

## 6.0 EXCAVATION

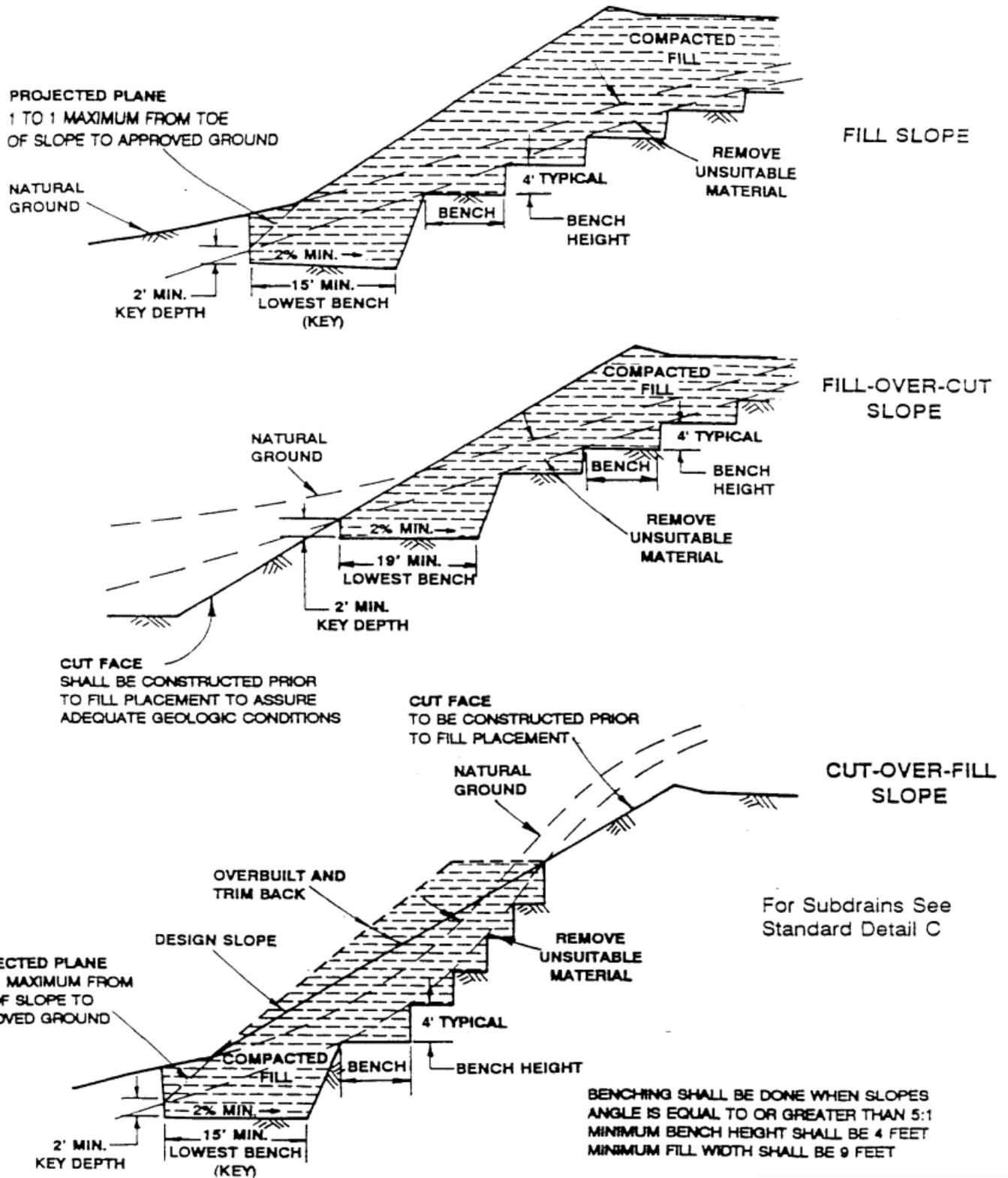
Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on Geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

## 7.0 TRENCH BACKFILLS

7.1 Safety: The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations.

- 7.2 Bedding and Backfill: All bedding and backfill of utility trenches shall be performed in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent (Cal Test 217) greater than 30 (SE>30). The bedding shall be placed to 1 foot above the top of the conduit to the surface.
- 7.3 Lift Thickness: Lift thickness of trench backfill shall not exceed those allowed in the latest edition of Standard Specifications of Public Works Construction (i.e. "Green Book") unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum required relative compaction by his alternative equipment and method.
- 7.4 Observation and Testing: If acceptable by the Geotechnical Consultant, the jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

Details A	Keying & Benching
Details B	Oversize Rock Disposal
Details C	Canyon Subdrains
Details D	Buttress or Replacement Fill Subdrains
Details E	Transition Lot Fills & Side Hill Fills



Schematic Not To Scale



**Associated Soils Engineering, Inc.**

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Tel (562) 426-7990 Fax (562) 426-1842

Project:

Prop. Residential & Retail Mixed Development  
SWC of Rose Drive & Alta Vista St., Placentia, CA

Details  
"A"

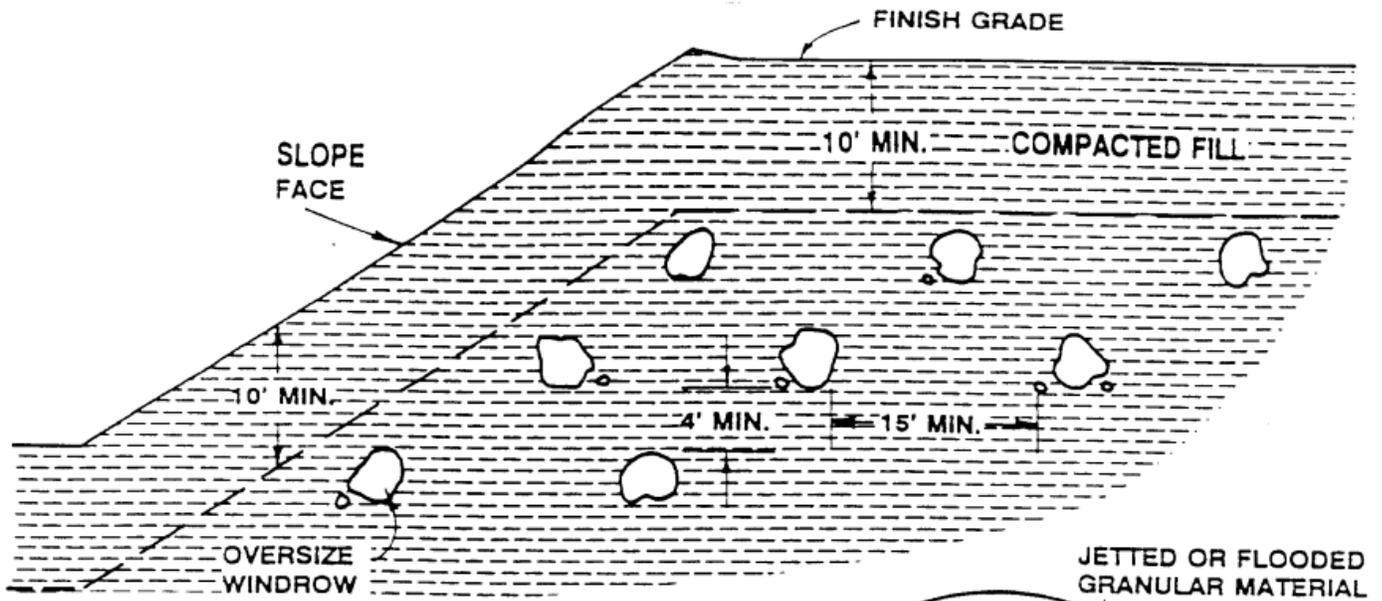
**KEYING & BENCHING**

Proj. No.:

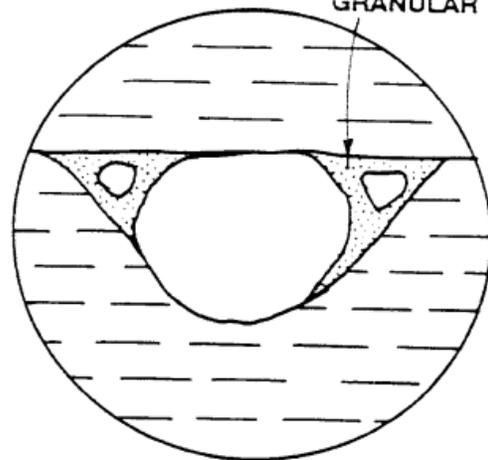
6736.17

Date:

September, 2017

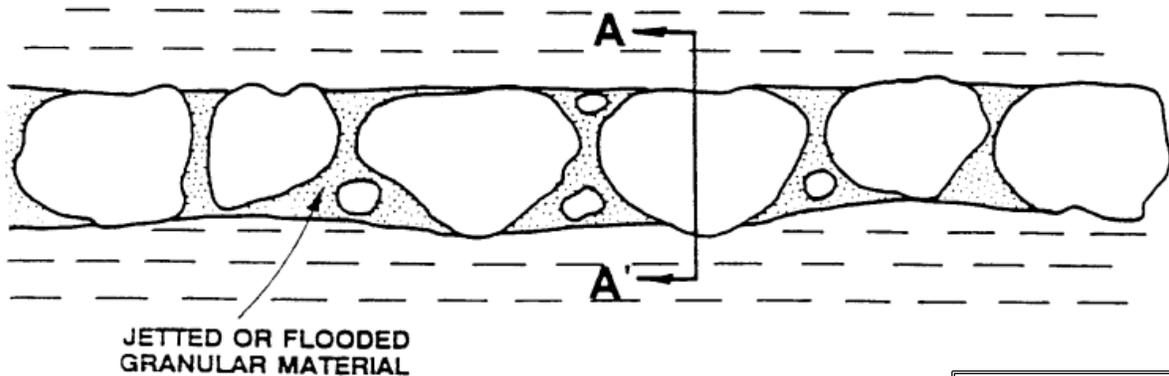


- Oversize rock is larger than 8 inches in largest dimension.
- Excavate a trench in the compacted fill deep enough to bury all the rock.
- Backfill with granular soil jetted or flooded in place to fill all the voids.
- Do not bury rock within 10 feet of finish grade.
- Windrow of buried rock shall be parallel to the finished slope fill.



ELEVATION A-A'

PROFILE ALONG WINDROW



Schematic Not To Scale

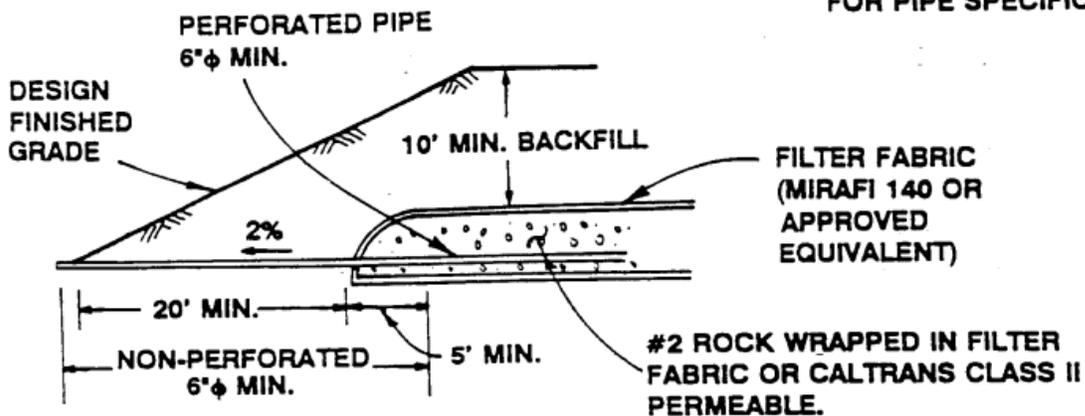
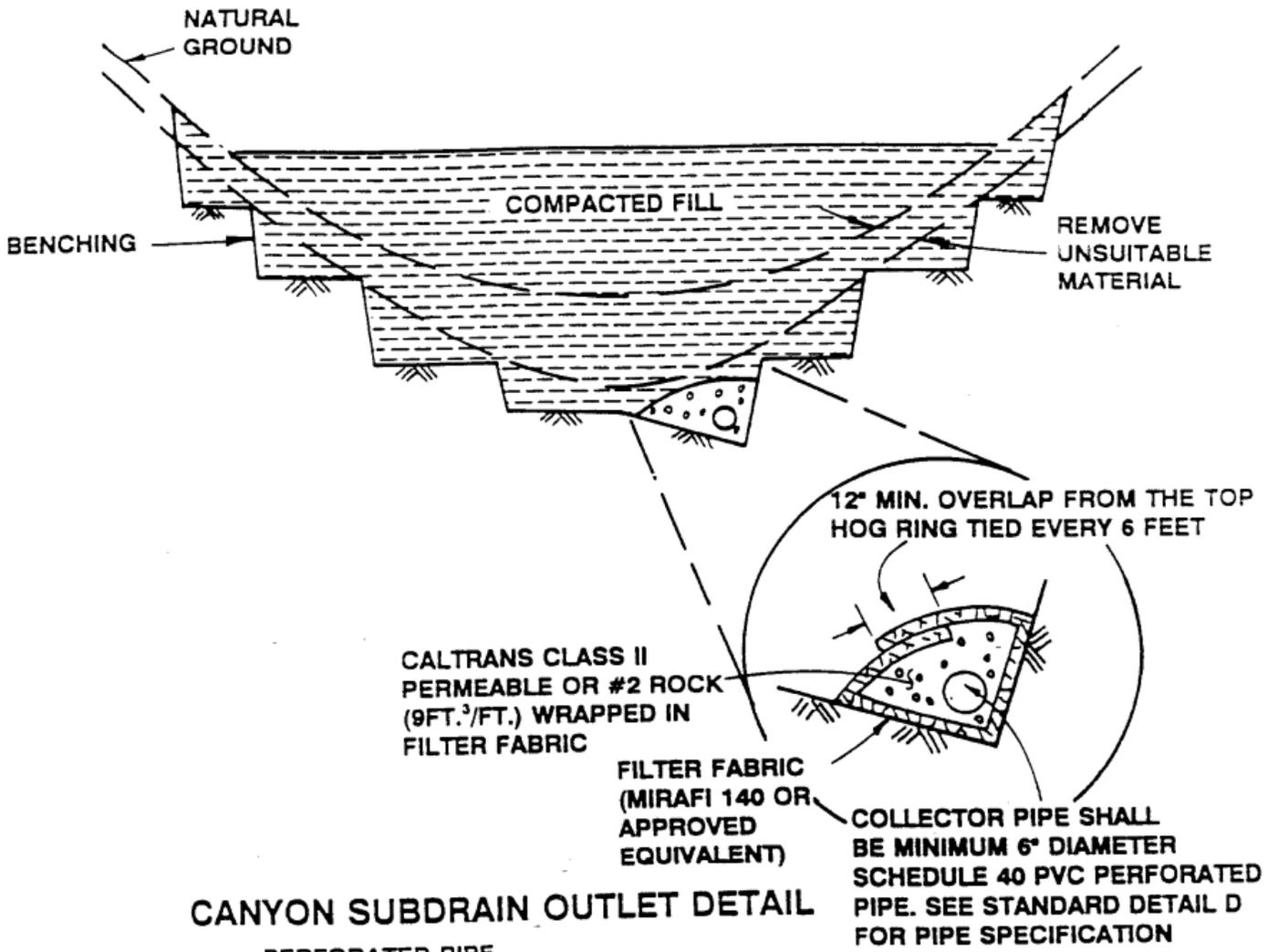


Associated Soils Engineering, Inc.

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Tel (562) 426-7990 Fax (562) 426-1842

Project:	Prop. Residential & Retail Mixed Development SWC of Rose Drive & Alta Vista St., Placentia, CA		
Details "B"	OVERSIZE ROCK DISPOSAL		
Proj. No.:	6736.17	Date:	September, 2017



Schematic Not To Scale



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Details  
"C"

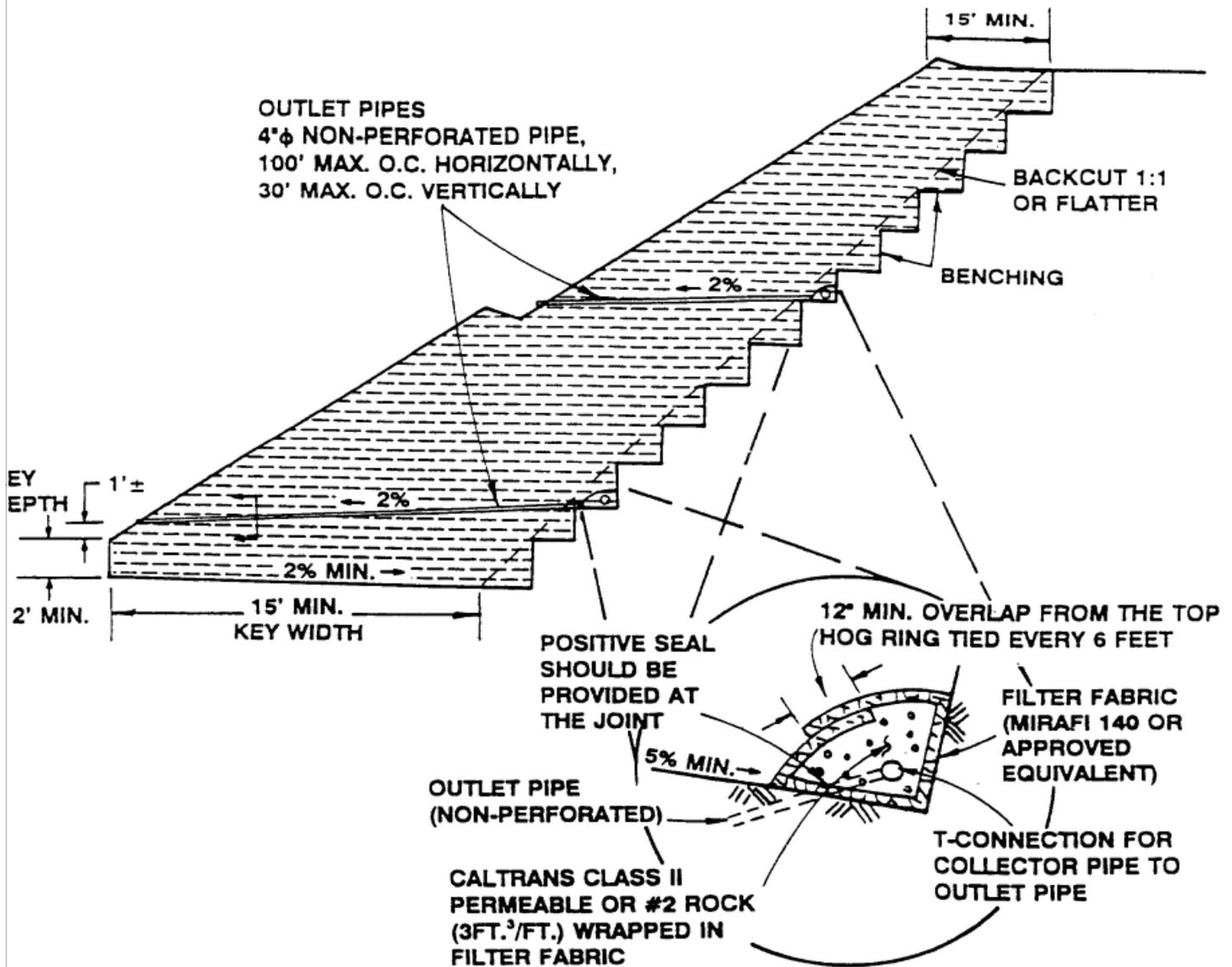
**CANYON SUBDRAINS**

Proj. No.:

6736.17

Date:

September, 2017



- **SUBDRAIN INSTALLATION** - Subdrain collector pipe shall be installed with perforations down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be  $\frac{1}{4}$ " to  $\frac{1}{2}$ " if drilled holes are used. All subdrain pipes shall have a gradient at least 2% towards the outlet.
- **SUBDRAIN PIPE** - Subdrain pipe shall be ASTM D2751, SDR 23.5 or ASTM D1527, Schedule 40, or ASTM D3034, SDR 23.5, Schedule 40 Polyvinyl Chloride Plastic (PVC) pipe.
- All outlet pipe shall be placed in a trench no wider than twice the subdrain pipe. Pipe shall be in soil of  $SE_{\geq 30}$  jetted or flooded in place except for the outside 5 feet which shall be native soil backfill.

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Details

**BUTTRESS OR REPLACEMENT FILL  
SUBDRAINS**

"D"

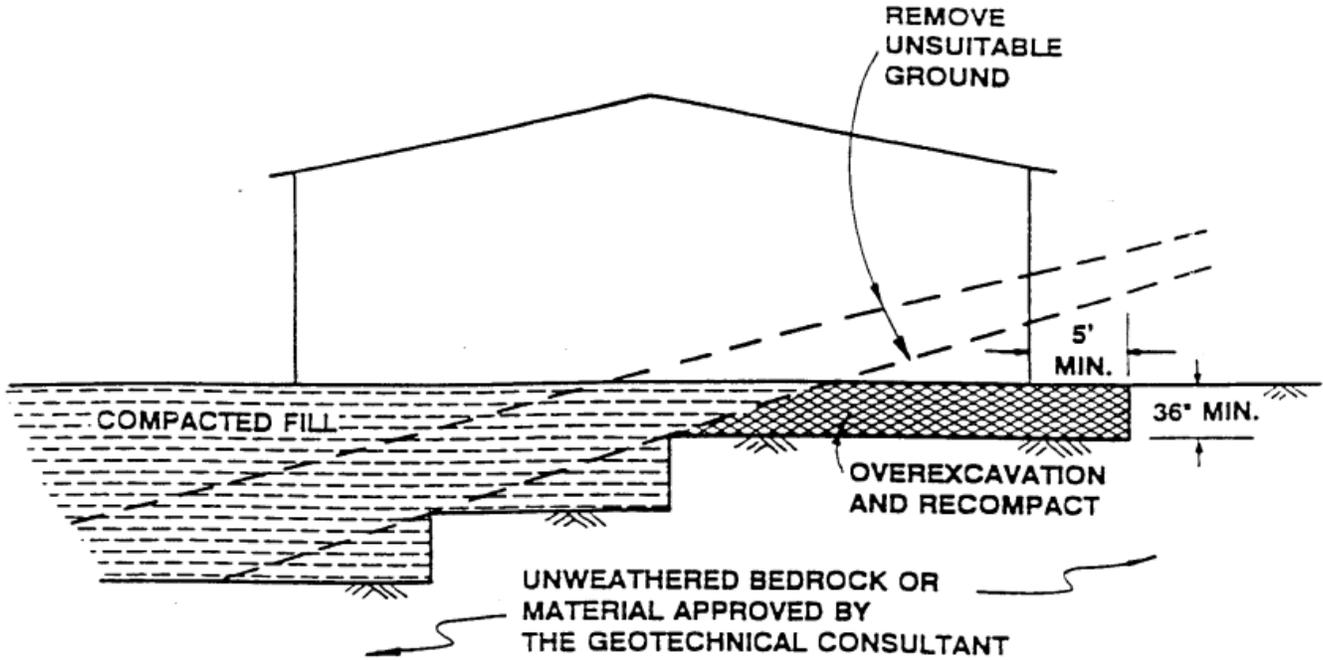
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6736.17

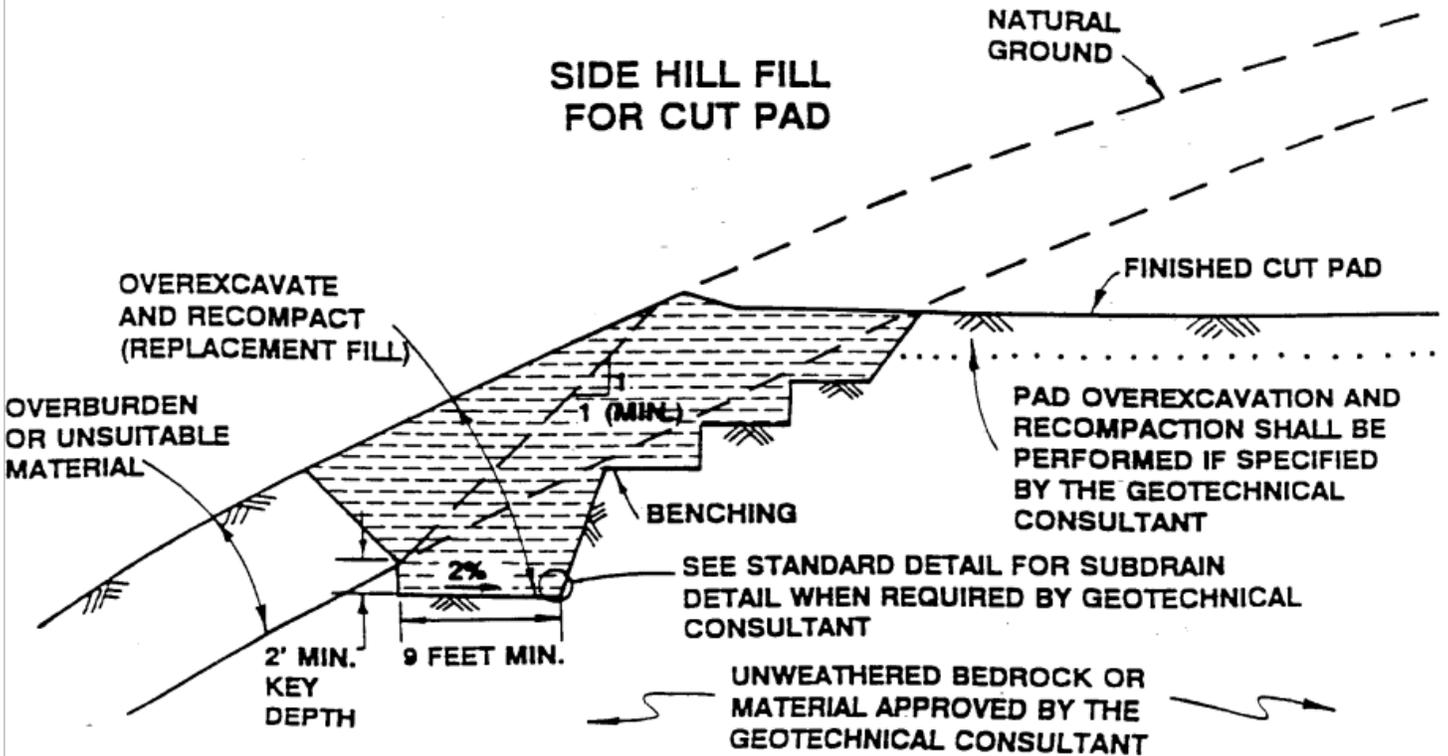
Date:

September, 2017

## CUT AND CUT-FILL LOT



## SIDE HILL FILL FOR CUT PAD



Schematic Not To Scale



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Signal Hill, CA 90755

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Project:	Prop. Residential & Retail Mixed Development SWC of Rose Drive & Alta Vista St., Placentia, CA		
Details "E"	<b>TRANSITION LOT FILLS &amp; SIDE HILL FILLS</b>		
Proj. No.:	6736.17	Date:	September, 2017

## **APPENDIX E - LIST OF REFERENCES**

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