

# **Grading / Geotech**



Grading / Geotech

## **This Document Contains:**

Geotechnical Reviews (data)  
Mitigation Recommendation Report  
Soil Analysis  
Soils Reports

**ENG-PERMIT FILES**

# LETTER OF TRANSMITTAL



## City of San Clemente

Sandy Norman, Engineering Technician

Phone: (949) 361-6144 Fax: (949) 366-4741

To: David Peter  
1519 Calle Valle  
San Clemente, CA 92672  
(949) 492-3735

VIA FACSIMILE: (949) 492-1891

Date: March 30, 2004  
Subject: 606 E. Ave San Juan  
Geotechnical Review

Project No.: 04-14

Account No. : 001-414-43535

### The Following Items Are Transmitted Herewith:

- |   |   |
|---|---|
| 1 | Copy of Summary Sheet and Report Review Checklist by Dr. Peter Borella dated March 28, 2004 pertaining to "Preliminary Geotechnical Investigation of Distressed Property, 606 E. Avenida San Juan, February 25, 2002" by Peter & Associates, Inc. |
|   |   |

### The Above Are Submitted:

- |                          |                   |                                     |                      |
|--------------------------|-------------------|-------------------------------------|----------------------|
| <input type="checkbox"/> | At Your Request   | <input checked="" type="checkbox"/> | For Revision         |
| <input type="checkbox"/> | For Your Review   | <input checked="" type="checkbox"/> | For Action           |
| <input type="checkbox"/> | For Your Approval | <input type="checkbox"/>            | For Your Information |
| <input type="checkbox"/> | For Signature     | <input type="checkbox"/>            | For Your Files       |

### Remarks:

Please read all of Dr. Borella's comments and **return 3 copies of corrections/revisions to Sandy Norman at the City of San Clemente, Engineering Division.** If you have any questions, please contact Dr. Borella at (949) 494-3566.

Cc: Geofile #04-14  
Jeanette Schotanus

**Summary Sheet San Clemente Geotechnical Review****Date:** March 28, 2004**Job No.** 04-14**Report accepted****Report needs revision and/or additional information** X

Additional geotechnical study will be needed along with a complete suite of stability analyses. The observed distress may be associated with a larger scale land movement rather than that suggested by this limited survey.

**See review comments.**

Date March 28, 2004

Job No:04-14

**City of San Clemente  
Report Review Checklist  
Geotechnical Report**

**Report by:**

Peter and Associates, Inc.

**(Firm's name)**

Lan N. Pham, Director

**(Signed by)**

G.E. 686

**(Registration, Certification)**

**2. Title of report(s)**

Preliminary Geotechnical Investigation of Distressed Residential Property, 606 E. Avenida San Juan, San Clemente, California, JN 01G1474, February 25, 2002.

Updated letter regarding Geotechnical Acceptance of Our Preliminary Geotechnical Investigation Report Dated Feb. 25, 2002 as Updated Report for Repair of Distressed Residential Structure, 606 E. Avenida San Juan, dated March 16, 2004.

One copy of Foundation Stabilization Plans by Peter and Associates, dated 12/1/03

**3. Purpose of report:**

Geotechnical investigation and Recommendations for Stabilization of highly distressed home.

**4. Accepted for review?      Yes X      No**  
**If no, why?**

**5. Adequate index/base maps?      Yes      No X      If no, what is needed?**  
Please provide a copy of the original grading map for the site and area.

**6. Is the General Scope of report adequate?**  
**Yes      No X      If no, what is wrong?**

A major investigation for this lot and surrounded area is recommended. The residence is highly distressed and is tilted. Further research of the area, addition borings and mapping by the C.E.G. of record along with aerial photographic interpretation will be needed to insure that this is not a developing landslide and does not encompass a larger area then just this one home.

**7. Adequate geotechnical map?      Yes      No X      If no, what is wrong?**

The areas of cracking and tilting are to be placed on the map to show if the separations are continuous and extend beyond the property limits. Other distress in the area has been sited with only a pipe and board temporary fix. Also place all geology, bedding orientation, fracture patterns, depth of fill, etc. on the map. The location of new deep borings, etc. An accurately surveyed topographic map showing all contours on the lot and adjacent areas will be needed to evaluate slope stability.

8. **Adequate cross sections?** Yes                      No    ☒    **If no, explain.**

Additional cross sections based on deep borings will be needed on the lot. Borings to at least the bottom of the street (60 feet plus) will be needed to insure that a larger landslide does not exist. If adverse conditions are encountered then at least three borings will be needed to define a plane of weakness. The proposed remediation will add weight to the upper portions of the slope and if the designed caissons do not penetrate potential slide surfaces and provide sufficient vertical and lateral support then the remediation will fail. **This investigation is to be performed under the supervision of the CEG. of record.** Who is BLR? No bedding orientations, joint patterns etc. were observed or measured. Munson only logged 6-inch borings.

9. **Any internal inconsistencies between maps, logs and cross sections?** Yes    ☒    No                      **If yes, explain.**

Insufficient data has been presented to evaluate the conditions on the slope.

10. **Is laboratory work adequate and appropriate?**

Yes                      No    ☒    **If no, explain.**

Additional analysis will most likely be needed to evaluate slope stability.

11. **Is analysis of data appropriate and correct?**

Yes                      No    ☒    **If no, explain.**

A complete suite of stability analyses will be needed to the bottom of the slopes both in the direction of the 60-foot high slope and the 30-foot high slope. Multiple slide surface should be analyzed. Most likely back calculations will be needed to determine the shear values present on the slope as the factor of safety of the slope is less than one. Based on this information what additional lateral forces will be needed to be added to the caisson grade beam system to achieve acceptable factors of safety of 1.5 static and 1.1 pseudostatic.

12. **Are conclusions reached and recommendations made appropriate and correct?** Yes                      No    ☒    **If no, explain.**

To be evaluated in the response

13. **Are reports approved (accepted) as adequate?**

Yes                      No    ☒    **If no, explain.**

See comments above and below

14. **Miscellaneous comments and questions:**

1. Please review the final grading and foundations plans. Insuring that your recommendations are included. Please sign and stamp the plans after your acceptance.
2. The C.E.G. of record is to sign all geotechnical reports and plans.

Please feel free to contact me. Perhaps a meeting should be arranged to address this property.

REVIEWED BY: Borella Geology Inc.

(Firm's name)

900 North Coast Highway

(Address)

Laguna Beach, California, 92651

(City, State, zip)

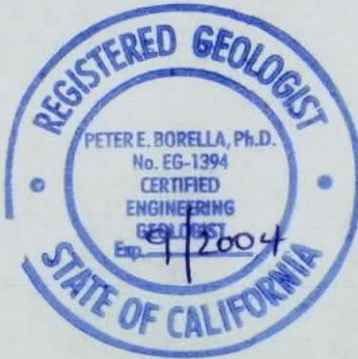
949-494-3566

(Area code and telephone number, extension)

(Signature of Reviewer)

C.E.G. #1394

(Registration and certification number)



REFERENCES:



# *Peter and Associates*

Engineers, Geologists, Surveyors, Inc.  
Civil, Municipal, Mining  
Geological, Foundations

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E-mail: PeterAssoc@AOL.com

04030991

February 25, 2002

Mrs. Jeannette Schotanus  
606 E. Avenida San Juan  
San Clemente, CA 92672



SUBJECT: Preliminary Geotechnical Investigation of Distressed Residential Property, 606 E. Avenida San Juan, San Clemente, California

JN 01G1474

Dear Mrs. Schotanus:

In accordance with your authorization, Peter and Associates, Inc. performed a preliminary geotechnical investigation of the residential property located at 606 E. Avenida San Juan, San Clemente, California.

The purpose of our investigation was to assess the existing geotechnical conditions at the site in order to find the cause, or causes, of the distress, and to provide preliminary geotechnical recommendations for repair of the distressed structure.

Our investigation generally consisted of: research and review of previous data pertinent to the site; reconnaissance to evaluate existing surface conditions at the property; exploratory borings; laboratory testing of selected undisturbed drive ring and bulk samples; and engineering analysis and evaluation of all relevant data to develop our conclusions and recommendations.

This report summarizes the investigation findings, and provides our conclusions and recommendations within the limitation of the authorized scope of work.

## Site Location and Description

The subject site is Lot 1 of Tract 3981, located on the upper portion of East Avenida San Juan near (east of) Avenida Salvador in the southeast portion of San Clemente. Refer to the attached street index map.

The property comprises a graded pad with a 60± ft. high descending 1.5H:1V slope at the rear (westerly) and a 30± ft. high descending 1.5H:1V slope on the north side. A 13± ft. high ascending side yard slope exists on the south side of the lot.

The existing residence consists of a one-story wood-framed structure with an attached two-car garage supported by shallow footings and slabs-on-grad.

Exterior concrete slabs and a covered patio exist in the rear yard. An existing 2.5± ft. high block wall is located along the top of the rear descending slope. The rear slope is currently covered with thick, healthy, deep-rooted acacia.

#### Summary of Distress

In general, distress noted in the structure consist of cracks/separations on house walls and interior and exterior concrete slabs-on-grade. Old and re-opened patched cracks were noted. Cracking and tilting of the block wall located along the top of the rear descending slope was observed. The columns supporting the patio cover tilt. The structure is separating from it's brick chimney by as much as 1-in. at it's worst section.

Cracking, tilting, lateral movement of concrete sidewalk along the northerly side yard above the top of the northerly descending slope was noted.

The most severe observed distress was a 4± wide separation between the rear house wall and the rear exterior concrete slabs with a deep crack into the underlying earth materials.

#### Subgrade Exploration and Laboratory Testing

Two (2) test holes were drilled at the site using a mini-drill rig equipped with 24-in. diameter bucket auger. The approximate locations of the drilled test holes are depicted on the Geotechnical Map; the geotechnical logs of the drilled holes are included in Appendix B.

As the borings were advanced, relatively undisturbed soil samples were secured using a steel tube sampler lined with 1-inch high, thin-wall brass rings. The sampler was driven into undisturbed earth materials by using a standard 140 lb. steel hammer freely dropped 30-in. The blow counts are included on the geotechnical boring logs.

Laboratory testing consisting of moisture content and dry density, pocket penetrometer, and direct shear was performed in general accordance with ASTM and/or UBC test methods on selected samples to obtain engineering characteristics of the underlying earth materials. The test methods and results are included in Appendix C, with the exception of the field moisture content, in-situ dry densities, and pocket penetrometer readings of the undisturbed ring samples, which are included on the geotechnical boring logs. A soluble sulfate content test was performed by Del Mar Analytical; the test results are also included in Appendix C.

#### Site Geotechnical Conditions

In general, the subject residential structure is underlain by compacted fill materials which were placed in 1963± during the rough grading of Tract 3981. The compacted fill generally consisted of silty clay. Beneath the existing fill was Capistrano Formation clayey siltstone bedrock. The bedrock was encountered in our rear yard boring B-12 at approximately 14 feet below the existing ground surface and in the front yard boring B-1 at approximately 10 feet. Some seepage,



but no free-standing ground water level was encountered in our borings. The clayey siltstone bedrock materials have very high moisture contents varying from approximately 25% to 33%. The fill materials have a relatively lower moisture content of approximately 11 to 17% in Boring B-1, and 26-27% in Boring B-2.

Unoxidized bedrock was encountered at 38 1/2± ft. in Boring 1, and at 35± ft. in Boring 2.

According to Reference 1 (Figure 1), the bedrock strata dips gently southeast (e.g., 2 to 17 degrees). Relative to the terrain, it is generally neutral to the natural terrain and cut slope portion, and therefore, is considered favorable for gross bedrock stability.

### Slope Stability

Based on the previous data, the upper portion of the rear slope was a fill, and the bottom portion of the rear slope was a cut. (See Cross Section A-A') Surficial failure occurred previously (in 1982) on the adjacent rear slope of the southerly neighboring property (Lot 2), which has similar fill over cut slope conditions (but not on the subject rear slope of Lot 1). The surficial failure of the southerly neighboring rear slope was previously repaired by installing a revetment system of twelve level rows of pipes and boards.

The rear slope is currently covered with healthy, thick, deep-rooted acacia. No evidence of surficial failure was observed.

We believe the rear slope at the site is subject to creep, an imperceptibly slow, downslope movement of the surface and near slope face earth materials (on sloping terrain under the perpetual force of gravity), and slope creep has contributed to the observed distress at the site. Note that per Mrs. Jeanette Schotanus, when she bought the property in 1968, only hairline cracks were observed on the interior concrete slabs (when the carpet was removed for replacement) but not the currently observed severe distress.

### Conclusions and Recommendations

The observed distress at the subject site was primarily due to settlement of the underlying existing fill caused by infiltration of water into the soils. Soil expansion/heaving has also contributed to some distress. Slope creep has also caused lateral movement of the objects located within the creep-affected zone near the top of the descending slopes, including rear patio slabs, rear patio cover columns, rear fence wall, and northerly sidewalk concrete slabs, etc.

Proper improvement and maintenance of surface drainage to reduce the potential surface water entering the underlying soils would reduce (but not totally stop) the potential for additional distress.

To prevent the potential for additional distress in the future, existing objects should be underpinned with a caisson and grade beam system.

Existing distressed slabs-on-grade can be removed and replaced with structural slabs, which can be connected to the caissons and grade beam system.

### Underpinning the Residential Structure

A caisson and grade beam system can be installed to underpin the existing residential structure. (Note: It is not necessary, but the existing fill materials underlying the residential structure can also be additionally densified by compaction grouting.)

### Caissons

Caissons should be at least 24-inches in diameter and should be embedded through the existing fill into the underlying competent bedrock a minimum depth equal to the thickness of the existing fill. The estimated depths of competent bedrock vary from approximately 14-ft. along the rear (westerly) wall to  $13\pm$  ft. along the northerly side wall, and  $10\pm$  ft. in the front area of the house.

Caissons should be installed to support the perimeter walls and interior walls of the house. Locations and depths of caissons must be properly determined by a qualified civil/structural engineer in consultation with the project geotechnical engineer. Final structural design of caissons and grade-beams/haunches should be geotechnically reviewed by the geotechnical engineer and/or the city engineer prior to construction.

For vertical support of a caisson, skin friction value of 1000 psf of bonding area between caisson and surrounding competent bedrock may be used. (The existing fill materials above the bedrock contact should be conservatively excluded from the friction resistance calculations.) A passive resistance value of 400 psf, with the maximum value of 4,000 psf, may be used for the competent bedrock materials. (Again, the existing fill materials should be excluded from the passive resistance calculations).

A friction coefficient of 0.25 may be used at the concrete and soil interface.

A soil unit weight of 120 pcf can be used. An allowable bearing pressure of 1,000 psf can be conservatively used for a shallow footing/grade beam/haunch, if any.

In addition, for caissons to be located within the potential creep affected zone near the descending slopes, a lateral creep force of 1,000 pounds per foot of depth for the creep affected zone should be used for structural design calculations. The thickness of the creep-affected zone can be [conservatively] assumed to be the thickness of the existing fill, approximately 15-ft. for the northerly side, and 16-ft. for the rear. The lateral creep force should also be conservatively used for other caissons located far from the slope (with the creep/fill thickness of  $10\pm$  ft.).

### Interior Slabs-on-Grade

Cracked interior slab portions, or the whole slabs, can be removed and replaced with new ones. New slabs-on-grade should be fully 5-inches thick (actual), be reinforced with #3

rebars at 12-inches on centers, each way, and be placed at mid-height of the slab. The slabs may be tied to the footings/grade beams/caissons as directed by the structural engineer (such as with dowels consisting of #3 rebars placed at maximum 24-inches on centers in the footings and bent 3 feet into the slabs).

New slabs should be underlain by 6-inches of clean sand or crushed rock. For moisture sensitive floor areas, the slabs should also be underlain by a 10-mil polyethylene moisture barrier (such as a Visqueen) sandwiched between a 2-inch thick clean sand [or crushed rock] layer above and a 4-inch thick clean sand [or crushed rock] layer below. **The moisture barrier should be properly lapped and sealed at joints and around any breaks such as openings for utility conduits.**

The existing underlying soils are anticipated to have high moisture contents. Therefore, pre-saturation of the slab subgrade earth materials is probably not required. However, this will be determined by the geotechnical engineer based on the exposed conditions after completion of excavations.

#### Other Recommendations for Reducing Slab Cracking

While not a geotechnical issue, the potential for slab cracking may also be reduced by careful control of water/cement ratio and slump of concrete. The contractor should take appropriate curing precautions during the pouring of concrete in hot weather to reduce cracking of slabs.

A slip sheet (or equivalent) can be utilized if grouted tile, marble tile, or other crack-sensitive floor covering is planned directly on concrete slabs.

#### Exterior Concrete Flatwork

Because of expansive soil forces, exterior concrete flatwork has the potential for cracking and/or heaving. To reduce the potential for excessive cracking and/or heaving, concrete slab should be a minimum of 4-inches thick and should be provided with construction or weakened plane joints at frequent intervals (e.g., every 6-feet or less), as well as a minimum 4-inch thick layer of crushed rock, gravel, or clean sand. Pre-saturation of the slab subgrade, to a minimum of 140 percent of the optimum moisture content, to a minimum depth of 24-inches should be considered. Reinforcing the slabs with #3 bars at 18-inches on centers, both directions, at slab mid-height, should also be considered.

Deepening the edges of concrete slabs (such as to 18-inches below the adjacent grade) should also be considered to reduce lateral migration of soil moisture into the slab subgrade.

For slab portions located within the slope creep affected zone, special structural designs, such as structurally connecting with caissons/footings and/or additional deepening the edge of the slab to 3-4 ft. deep, should be considered to reduce the potential adverse creep effects.

#### Cement Type for Concrete in Contact with Earth Materials

Test data indicate the on-site earth materials have a negligible water soluble sulfate content; therefore, per 1997 UBC, Type V cement with a maximum water/cement ratio of 0.45 and a minimum concrete strength  $f'_c$  of 4,500 psi is not required. Type II cement with a lower concrete strength to be designed by the structural engineer can be used for concrete in contact with on-site earth materials.

#### Option: Caissons Supporting Rear Fence Wall

The existing rear fence wall can be removed and replaced with a new one to be supported by a grade beam and caisson system. For areas near the house walls, the caissons to support the house walls can be used to support the fence wall by using an extended haunch. The location of the caissons will be determined by the project civil/structural engineer in consultation with the geotechnical engineer.

The above recommended geotechnical criteria can be utilized for caisson design. The thickness of the creep-affected zone can be conservatively assumed to be the thickness of the existing fill materials at the caisson locations, approximately 15-ft. for the northerly side yard and 16-ft. for the rear side yard.

#### Faulting and Seismicity

The subject site is located within Seismic Zone Factor 4, in Southern California, which is a tectonically active area; therefore the owner(s) of this property should be aware of the seismic risks.

The type and magnitude of seismic hazards affecting a site are dependent on the distance to causative faults, the intensity and magnitude of the seismic event, and ground conditions. The seismic hazard may be primary, such as surface rupture and/or ground shaking; or secondary, such as liquefaction and/or ground lurching.

No active faults are known to exist along, or to cross, the site. Therefore, the probability of primary surface rupture or deformation at the site is considered very low.

The Newport-Inglewood Structural Zone (NISZ) is located approximately 7 kilometers from the site. This fault is considered to be a major active fault capable of generating significant ground-shaking at the site in the event of a future earthquake.

In summary, this property is not subject to any special seismic hazard as compared to other nearby properties in similar geologic environments. It is not designated as a special studies zone under the Alquist-Priolo Special Studies Act. A design in accordance with the applicable Uniform Building Code and seismic design parameters published by the Structural Engineers Association of California is anticipated to satisfactorily mitigate potential effects of ground shaking. The following data are considered applicable using the 1998 CDMG Published Data Sources and the applicable tables in 1997 UBC:

The subject site is located within Seismic Zone Factor 4;  $Z = 0.4$   
 Closest known seismic source type = The Newport-Inglewood Fault = B fault  
 Proximity to source = 7 km  
 Soil profile type =  $S_D$

Near source effect factors:

$$N_A = 1.0$$

$$N_V = 1.12$$

Seismic co-efficients:

$$C_A = 0.44 \quad N_A = 0.44$$

$$C_V = 0.64 \quad N_V = 0.7168$$

### Liquefaction

Liquefaction is the phenomenon where the buildup of excess pore pressures in saturated, loose, predominantly granular (sandy) soils by seismic agitation results in a temporary "quick" or "liquefied" condition. Loose granular soils do not exist at this site (site is underlain by clayey materials); therefore, liquefaction potential is considered low for the site terrain.

The potential for other secondary seismic effects, such as seiche or dynamic settlement, is considered nil and very low, respectively

### Surface Drainage and Maintenance

In general, the yard areas of the site should be re-graded to ensure surface water flows away from all improvement structures and into a drainage system for outletting. No drainage runoff should be directed onto adjacent properties, and no runoff from graded surfaces should be directed onto descending slopes.

If the existing exterior concrete slabs are not to be totally removed and replaced with new ones, cracks/separations on exterior slabs should be properly sealed/repared and maintained.

We recommend the use of area drains, with sufficient inlet grates, to facilitate surface drainage.

Roof gutters and downspouts should be, checked and repaired as needed, to direct all roof drainage to a non-erodable finish surface. Downspouts should be directly connected to a drain pipe system for outletting. Roof drains, gutters and downspouts should be maintained to function, as intended.

Area drains, graded berms and swales, if any, are designed to carry surface water from pad areas, and should not be blocked or destroyed.

Subdrain outlets, if any, should be maintained to prevent burial or other blockage.

Irrigation of yard landscaping should be applied as short duration watering at minimal rates required for support of plant life.

Water should not be allowed to pond anywhere at the site (i.e., no undermined depressions allowed!).

The property should be frequently monitored for uncontrolled water, such as leaky sewer, water, domestic, irrigation, or drainpipes, and any identified source should be repaired (and maintained).

**It is emphasized that proper drainage of the lot be provided and maintained in order to reduce the potential for surface water infiltrating the underlying soil, which may cause additional earth movement and additional structural distress.**

#### Slope Maintenance

The adjacent descending slopes should be continued to be properly maintained to reduce the potential of slope creep. Bare areas on the slope face should be properly replanted with deep-rooted ground cover plants.

#### Geotechnical Observation and Testing During Repair Construction

It is recommended that geotechnical observations and/or testing be performed by the geotechnical consultant at the following stages:

1. During caisson drilling to verify the adequacy of underlying earth materials.
2. During compaction grouting application, if any.
3. After excavation for shallow footings/grade beams/haunches and slabs, if any, to verify the adequacy of underlying materials.



4. After pre-saturation of slab subgrade earth materials, if any, prior to pouring concrete.
5. When/if any unusual geotechnical conditions are encountered.

#### Geotechnical Impact on Neighboring Properties

Adverse geotechnical impact of the proposed repair on neighboring properties is considered insignificant, provided the recommendations in this report are properly implemented.

#### Closure

The findings, conclusions and recommendations of this report are based on information as derived or interpreted from our limited investigation. Although not anticipated, our recommendations (which are considered preliminary) are subject to revision if geotechnical conditions exposed during construction significantly differ from our preliminary findings and interpretations.

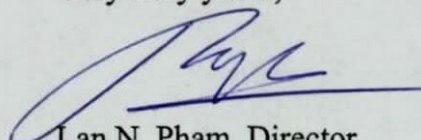
Our recommendations are considered minimum and may be superseded by more restrictive requirements of the design engineer, building codes, or governing agencies.

The following are attached and complete our report:

- Appendix A - References
- Appendix B - Geotechnical Boring Logs (of Lot 1 & Lot 2)
- Appendix C - Laboratory Test Methods and Results
- Figure 1 - Street Index Map
- Figure 2 - Previous General Topographic Map
- Figure 3 - Previous Generalized Geologic Map (with Explanation Sheet)
- Figure 5 - Site Plan/Geotechnical Map
- Figure 6 - Cross Section A-A'
- Figure 7 - Cross Section B-B'

If you have any questions or require clarification, please contact this office. This opportunity to be of service is sincerely appreciated.

Very truly yours,

  
Lan N. Pham, Director  
Geotechnical Engineering  
RGE 686, Exp. 3/31/03



## **APPENDIX A**

### **REFERENCES**

## REFERENCES

JN01G1474

1. California Department of Conservation, Division of Mines and Geology 1988, "Planning Scenario for a Major Earthquake on the Newport-Inglewood Fault Zone", Special Publication 99, published in 1988.
2. California Division of Mines and Geology, 1968, "Natural Slope Stability as Related to Geology, San Clemente Arca, Orange and San Diego Counties, California", Special Report 98, published in 1968.
3. California Division of Mines and Geology, Department of Conservation, 1998 (Published by International Conference of Building Officials), "Maps of Known Active Fault Near Source zones in California and Adjacent Portions of Nevada", (Sheet N-35, Newport-Inglewood Fault), Scale  $\frac{1}{4}$ " = 1 km, dated 1998.
4. Uniform Building Code (UBC), 1997, Volume 2, Structural Engineering Design Provisions, Seismic Zone Map of the United States, Figure 16-2, Tables 16-I, 16-J, 16-Q, 16-R, 16-S, 16-T, 16-U and Table 19-A-4, dated 1997.
5. USGS, California Department of Water Resources, 1968, 1975, "Topographic Map, San Clemente Quadrangle, California, 7.5 Minute Series", dated 1968, photo-revised 1975.
6. G. A. Nicoll and Associates, Inc., 1982, "Slope Reconnaissance, 610 Avenida San Juan, San Clemente, California", Project No. 2619, dated 8/26/1982.
7. G. A. Nicoll and Associates, Inc., 1983, "Slope Repair Report, 610 Avenida San Juan, San Clemente, California", Project No. 2619-51, dated 1/28/83.
8. H.V. Lawmaster & Company, 1963, "Foundation Soil Investigation, Tract No. 3981, Avenida San Juan & Avenida Salvadore, San Clemente, California" File No. 63-358, dated 10/2/1963
9. H.V. Lawmaster & Company, 1964, "Soil Compaction Tests, Final Report, Tract No. 3981, East Avenida San Juan & Avenida Salvador, San Clemente, Orange County, California", File No. 63-503, dated February 27, 1964.
10. William R. Munson, Inc. 1989, "Engineering Geology Property Evaluation/Study and Limited Manometer Level Survey; 610 Avenida San Juan, San Clemente, California", (Lot 2 of Tract 3981), dated 9/11/1989.
11. William R. Munson, Inc. 1998, "Limited Subsurface Geotechnical Investigation and Update of Floor Levelness Data and Site Conditions; 610 East Avenida San Juan, 'Salvador Summit', San Clemente, California, (Lot 2, Tract 3981)", Project No. 97762, dated 4/28/1998.
12. William R. Munson, Inc., 2001, "Non-Intrusive Geotechnical Assessment (Handout Document Package, Inclusive of Appendices A-E), Site Work AND/OR ORAL REPORT

CONSULTATION, Jeanette Schotanus, 606 E. Avenida San Juan, San Clemente, CA", dated 2/12/01.

## **APPENDIX B**

### **GEOTECHNICAL BORING LOGS (LOT 1 & LOT 2)**

# GEOTECHNICAL BORING LOG

DATE 12/27/01 - 12/28/01 DRILL HOLE NO. 1 SHEET 1 OF 2  
 PROJECT Schotanus JOB NO. 01G1474  
 DRILLING CO. Peter Drilling TYPE OF RIG Mini  
 HOLE DIAMETER 24" DRIVE WEIGHT 140lbs DROP 30 in.  
 ELEVATION TOP OF HOLE \_\_\_\_\_ REF. OR DATUM Back of Garage

DEPTH (FEET)		POCKET PENETROMETER TSF	SAMPLE NO.	BLOWS PER 1/2 FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOILS CLASS. (U.S.C.S.)	LOGGED BY <u>BLR</u> SAMPLED BY <u>BLR</u>
0	BAG							0-2' Yellowish Lt. brnish grey clayey silt, moist Stiff - very stiff. Fine gravel size chips of Siltstone and lobble size chunks of earthy dark brn clay inclusions throughout fill.
2	Af	4.5+	1	10 18 18	96.7	15.5	CL	2' sample - Same artificial fill derived from Capistrano Formation (Tc) and slope wash (Qw) Mottled
5		4.5+	2	6 10 22	107.3	11.5	CL	5' sample - same + Trace brown silty sand
								FILL
10	BAG	4.5+	3	5 8 11	98.3	17.0	CL	10' sample Dk brn earthy clay, Very moist, very stiff. Siltstone chips, Mottled
								FILL
15	BAG oxid. Tc	3.75	4	3 8 12	94.6	28.7	CL	14' Yellowish grey clayey silt, Increase in moisture - wet weathered oxidized bedrock Capistrano Formation (Tc)
								15' sample Same + small pocket of med orange sand. Fractures with rust and Gypsum veins. Stiff, very moist Oxidized bedrock
20		4.5+	5	4 14 30	99.1	26.4	CL	17 1/2' very stiff 20' sample - same
								24' Increasing hardness
25		4.5+	6	8 24 44 5"	96.7	29.4	CL	25' sample - same - Fractured; Gypsum, rust veins - colored bands grey, rust brn, and olive.
								29 1/2' - light brn siltstone with blueish green veins Water drips noticed on Auger, source depth unknown

1519 CALLE VALLE, SAN CLEMENTE, CA. 92672

**PETER and ASSOCIATES**

ENGINEERS  
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JOB NUMBER

**01G1474**

JOB NAME

**Schotanus**



# GEOTECHNICAL BORING LOG

DATE 12/27/01 - 12/28/01 DRILL HOLE NO. 1 SHEET 2 OF 2  
 PROJECT Schotanus JOB NO. 0161474  
 DRILLING CO. Peter Drilling TYPE OF RIG Mini  
 HOLE DIAMETER 24" DRIVE WEIGHT 140lbs DROP 30 in.  
 ELEVATION TOP OF HOLE \_\_\_\_\_ REF. OR DATUM Back of Garage

DEPTH (FEET)	POCKET PENETROMETER TSF	SAMPLE NO.	BLOWS PER 1/2 FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOILS CLASS. (U.S.C.S.)	LOGGED BY <u>BLR</u> SAMPLED BY <u>BLR</u>
30	4.5+	7	10 34 42	96.3	25.8	CL	30' sample Lt. brownish grey siltstone, very moist. very stiff. *END OF DAY 1 12-27-01 7 AM 1/2 of 1st Bucket contained saturated silt.
35	4.5+	8	10 37 40 1/5"	95.9	26.1	CL	35' sample Dark Grey. Bands of dk brn, red rust. 36' steam coming off extracted silt warm to the touch. 38 1/2' Black unoxidized bedrock
40	UNOX. Tc 4.5	9	18 42 1/4"	95.7	30.0	CL	40' sample same. <ul style="list-style-type: none"> <li>- End of hole</li> <li>- Total Depth: 40'</li> <li>- Very high moisture @ 14'; Wet</li> <li>- No Caving</li> <li>- 7 AM 12-28-01 1/2 of 1st Bucket Contained Saturated silt.</li> <li>- Hdr Back filled with cuttings</li> </ul>

# GEOTECHNICAL BORING LOG

DATE 12/2/01 DRILL HOLE NO. 2 SHEET 1 OF 2  
 PROJECT Schotanus JOB NO. 0161474  
 DRILLING CO. Peter Drilling TYPE OF RIG Mini  
 HOLE DIAMETER 24" DRIVE WEIGHT 140 lbs DROP 30 in.  
 ELEVATION TOP OF HOLE \_\_\_\_\_ REF. OR DATUM Front of Garage - Next to Driveway

DEPTH (FEET)		POCKET PENETROMETER TSF	SAMPLE NO.	BLOWS PER 1/2 FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOILS CLASS (U.S.C.S.)	LOGGED BY <u>BLR</u>	SAMPLED BY <u>BLR</u>
0									
2		4.5+	1	4 7 10	104.1	27.2	CL	0-2' Yellowish Lt. brnish grey clayey silt + fine sand, v. moist, very stiff, roots. Fine gravel size chips of siltstone and cobble size chunks of earthy dark brn clay inclusions throughout fill. <u>2' sample</u> same artificial fill derived from Capistrano Formation (T <sub>c</sub> ) and Slope Wash (Q <sub>sw</sub> ) mottled <u>5' sample</u> Earthy dk brn clay, very stiff, very moist. Lt grey clayey silt + yellow veins in sample head FILL	
5	A <sub>f</sub>	4.5+	2	4 5 6	94.4	26.3	CL		
10	δ seepage δ	3.75	3	3 7 16	98.1	26.6	CL		
15	oxid T <sub>c</sub>	4.5+	4	4 9 20	98.5	25.3	CL	<u>10' sample</u> — Yellowish brn grey clayey silt — Water seepage @ 10' + 12 1/2' Very Moist, stiff, rust, Gypsum veins. Capistrano Formation Siltstone Oxid. Bedrock 12 1/2' Capistrano Formation siltstone (Oxid) Bedrock Yellowish grey siltstone very moist very stiff. Yellow stained bands. <u>15' sample</u> — same Increasing hardness with depth.	
20		4.5+	5	8 18 28	95.2	28.5	CL		
25		4.5+	6	7 22	95.0	28.4	CL		
								<u>20' sample</u> same - rust stains throughout. <u>25' sample</u> same - brownish grey color.	

# GEOTECHNICAL BORING LOG

DATE 12/28/01 DRILL HOLE NO. 2 SHEET 2 OF 2  
 PROJECT Schotanus JOB NO. 01G1474  
 DRILLING CO. Peter Drilling TYPE OF RIG Mini  
 HOLE DIAMETER 24" DRIVE WEIGHT 140lbs DROP 30 In.  
 ELEVATION TOP OF HOLE \_\_\_\_\_ REF. OR DATUM Front of Garage - North of Driveway

DEPTH (FEET)	POCKET PENETROMETER TSF	SAMPLE NO.	BLOWS PER 1/2 FOOT	DRY DENSITY PCF	MOISTURE CONTENT, %	SOILS CLASS (U.S.C.S.)	LOGGED BY <u>BLR</u> SAMPLED BY <u>BLR</u>
30	4.5+		6 18 40 1/2"	85.8	32.8	CL	30' Sample Same Increasing hardness 32' orange, brown, + light grey bands siltstone Gypsum Abundant. 34 1/2' Black unoxidized siltstone 35' Sample Same
35	4.5+		10	92.7	30.7	CL	- End of hole - Total depth: 35' - Seepage @ 10' + 12 1/2' - Very Minor Caving @ 12' - Hole backfilled with cuttings

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 (949) 492-1891

JOB NUMBER

01G1474

JOB NAME

Schotanus

EQUIPMENT USED: *Limited access flight auger*

ELEVATION: *top of slope @ pit to hole*

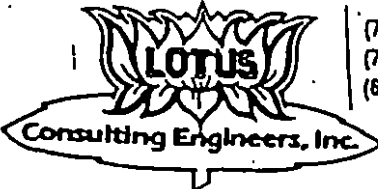
LOGGED BY: *WRM*

GROUNDWATER: *None*

HOLE DIAM.: *6- INCH*

FIELDWORK: *12-5-97*

ELEV.	BLOWS FOOT	SAMPLE			FIELD MOISTURE (%)	DRY DENSITY (P.C.F.)	DEPTH FEET	GRAPHIC SYMBOL	U.S.C.S. SYMBOL	DETAILED DESCRIPTION  COLOR, MOISTURE, CONSISTENCY, ETC.	HOLE NO.  <i>1</i>
		BULK	DRIVE	PUSH							
	<i>6 1/6"</i>		<i>1</i>				<i>1</i>			<p><i>Silt, very fine sandy (B/L Silt, very fine sand), pale yellowish brown &amp; yellowish gray, humid; friable &amp; med. loose to med. dense</i></p> <p><i>Common inclusions of earthy dark brown silty clay &amp; pale yellowish brown/gray siltstone fragments; humid</i></p> <p><i>Silt, sl. very fine sandy w/ common admixed pebble size fragments of yellow siltstone, humid; firm</i></p> <p><i>trace to sl. very fine sandy humid to sl. moist</i></p> <p><i>Silt, trace of v. fine sandy &amp; nil to trace of clay, w/ some admixed siltstone fragments, pale olive gray - olive gray brown w/ yellow; humid to sl. moist, firm</i></p> <p><i>occas. clayey fine to medium sand</i></p> <p><i>Silt, sl. clayey to clayey w/ minor v. fine sand; w/ admixed grit-to-pebble size siltstone fragments &amp; some inclusions of earthy dark brown silty clay (topsoil); pale olive brown w/ yell. brown &amp; dark brown; sl. moist; firm</i></p>	<i>1</i>
	<i>8 1/6"</i>						<i>2</i>				
	<i>11 1/6"</i>						<i>3</i>				
	<i>9 1/6"</i>		<i>2</i>				<i>4</i>				
	<i>12 1/6"</i>	<i>1</i>					<i>5</i>				
	<i>14 1/6"</i>						<i>6</i>				
	<i>8 1/6"</i>		<i>3</i>				<i>7</i>				
	<i>14 1/6"</i>						<i>8</i>				
	<i>19 1/6"</i>						<i>9</i>				
	<i>9 1/6"</i>		<i>4</i>				<i>10</i>				
	<i>13 1/6"</i>						<i>11</i>				
	<i>16 1/6"</i>						<i>12</i>				
							<i>13</i>				
	<i>8 1/6"</i>		<i>5</i>				<i>14</i>				
	<i>12 1/6"</i>						<i>15</i>				
	<i>14 1/6"</i>						<i>16</i>				
							<i>17</i>				
	<i>7 1/6"</i>						<i>18</i>				
	<i>9 1/6"</i>		<i>2</i>				<i>19</i>				
	<i>11 1/6"</i>		<i>6</i>				<i>20</i>				
							<i>21</i>				
							<i>22</i>				
							<i>23</i>				
	<i>10 1/6"</i>						<i>24</i>				
	<i>14 1/6"</i>		<i>7</i>				<i>25</i>				
	<i>20 1/6"</i>										



(714) 768-4466 ORANGE CO.

(714) 820-1015 RIVERSIDE CO.

(619) 722-4056 SAN DIEGO CO.

From Ref. 11.

Munson, 1998

N.R.- NO RECOVERY

BLOWS/FOOT-350 FOOT-LB. ENERGY/BLOW

PUSHED-3" DIAMETER SHELBY TUBES

LOG OF BORING

FIGURE NO.

PROJECT NO.

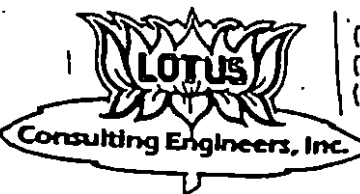
REPORT DATE

SHEET 1 OF 2

A-1-1

EQUIPMENT USED: *Limited access flight auger*ELEVATION: *top of slope @ pit deck*LOGGED BY: *WRM*GROUNDWATER: *None*HOLE DIAM.: *6-INCH*FIELDWORK: *12-5-97*

ELEV.	BLOWS FOOT	SAMPLE			FIELD MOISTURE (%)	DRY DENSITY (P.C.F.)	DEPTH FEET	GRAPHIC SYMBOL	U.S.C.S. SYMBOL	DETAILED DESCRIPTION COLOR, MOISTURE, CONSISTENCY, ETC.	HOLE NO. <i>1</i>
		BULK	DRIVE	PUSH							
							26			<i>Silt, silty clayey to clayey w/ minor v. fine sand in cont'd</i>	
							27				
							28				
							29			<i>clayey</i>	
							30				
							31				
							32			<i>Clay, silty, mod dk brown, moist - v. moist</i>	
							33				
							34				
							35			<i>Siltstone, mod. gray w/ yellow &amp; some orange brown, humid - sl. moist</i>	
							36				
							37				
							38			<i>End of Boring @ 32'</i>	
							39				
							40				
							41				
							42				
							43				
							44				
							45				
							46				
							47				
							48				
							49				
							50				



(714) 768-4466 ORANGE CO.  
(714) 820-1015 RIVERSIDE CO.  
(619) 722-4058 SAN DIEGO CO.

From Ref. 11  
Munson, 1998

N.R. - NO RECOVERY

BLOWS/FOOT-350 FOOT-LB. ENERGY/BLOW  
PUSHED-3" DIAMETER SHELBY TUBES

## LOG OF BORING

PROJECT  
NO.

REPORT DATE

SHEET  
2 OF 2

FIGURE  
NO.  
A-1-1

EQUIPMENT USED: *Limited access flytender*ELEVATION: *rear yard deck  
adj to living room*LOGGED BY: *WRM*GROUNDWATER: *None*HOLE DIAM.: *6- INCH*FIELDWORK: *12-5-97*

ELEV.	BLOWS FOOT	SAMPLE			FIELD MOISTURE (%)	DRY DENSITY (P.C.F.)	DEPTH FEET	GRAPHIC SYMBOL	U.S.C.S. SYMBOL	DETAILED DESCRIPTION COLOR, MOISTURE, CONSISTENCY, ETC.	HOLE NO. <u>2</u>
		BULK	DRIVE	PUSH							
	5/6" 10/6" 11/6"	1			4-ring recovery		1			<p><i>3 1/2" concrete deck</i> Silt, sl. very fine sandy w/ trace of clay &amp; occas. - common admix of siltstone fragments; pale olive gray w/ yellow, yellowish brown &amp; orange brown, humid to sl. moist; friable in part</p> <p>- minor medium sand fraction w/ some earthy dark brown silty clay inclusions</p> <p>Smaller siltstone fragments</p>	
	5/6" 7 1/6" 6 1/6"	2					2				
	5/6" 10/6" 16 1/6"	3			3-ring recovery		3				
	5/6" 10/6" 12 1/6"	4					4				
							5				
							6				
							7				
							8				
							9				
							10				
							11				
							12				
							13				
							14				
							15				
	3 1/6" 10 1/6" 14 1/6"	5					16				
							17				
							18				
							19				
							20				
	7 1/6" 18 1/6" 29 1/6"	6					21				
							22				
							23				
							24				
							25				
										Siltstone, pale olive gray w/ yellow & orange brown, sl. moist, v. firm clean to trace of clay	

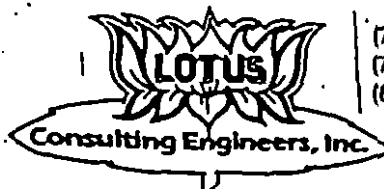
N.R.-NO RECOVERY  
BLOWS/FOOT-350 FOOT-LB. ENERGY/BLOW  
PUSHED-3" DIAMETER SHELBY TUBES

## LOG OF BORING

FIGURE

PROJECT  
NO.

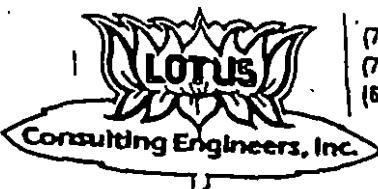
REPORT DATE

SHEET  
1 OF 2NO.  
A-1-2(714) 768-4455 ORANGE CO.  
(714) 820-1015 RIVERSIDE CO.  
(619) 722-4056 SAN DIEGO CO.From Ref. 11.  
Munson, 1998



EQUIPMENT USED: <i>Limited access flight auger</i>		ELEVATION: <i>Rear yard deck 24' to living room</i>	LOGGED BY: <i>WRM</i>
GROUNDWATER: <i>Zone</i>		HOLE DIAM.: <i>6 - INCH</i>	FIELDWORK: <i>12-5-97</i>

ELEV.	BLOWS FOOT	SAMPLE			FIELD MOISTURE (%)	DRY DENSITY (P.C.F.)	DEPTH FEET	GRAPHIC SYMBOL	U.S.C.S. SYMBOL	DETAILED DESCRIPTION COLOR, MOISTURE, CONSISTENCY, ETC.	HOLE NO.
	10 1/4 24 1/6 28 1/6		7				26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	T <sub>2</sub>		Siltstone cont'd  End of boring @ 26 1/2' dust + lintations (viz. darkness & rain)	2



(714) 768-4466 ORANGE CO.  
 (714) 820-1015 RIVERSIDE CO.  
 (619) 722-4058 SAN DIEGO CO.  
 From Ref 11  
 Munson, 1998

N.R.-NO RECOVERY BLOWS/FOOT-350 FOOT-LB. ENERGY/BLOW PUSHED-3" DIAMETER SHELBY TUBES		
LOG OF BORING		FIGURE NO.
PROJECT NO.	REPORT DATE	SHEET 2 OF 2
		A-1-2

## **APPENDIX C**

### **LABORATORY TEST METHODS AND RESULTS**

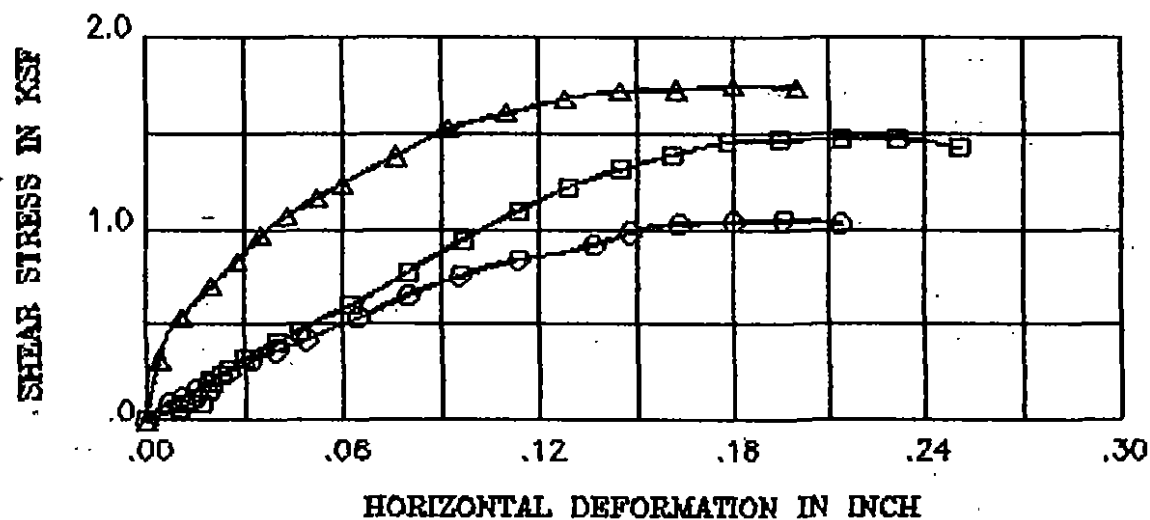
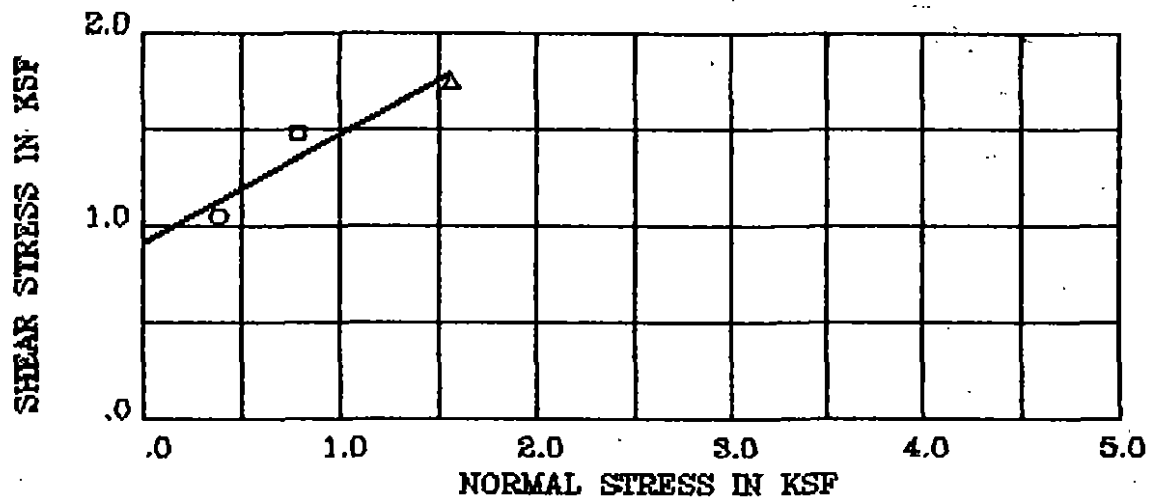
## LABORATORY TESTING

### Moisture Content and Dry Density Tests

Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings and/or trenches. The tests were performed in general accordance with ASTM Test Method D4959. The test results are presented on the boring and/or trench logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

### Direct Shear Tests

Direct shear tests were performed on selected undisturbed samples (or remolded where noted), in general accordance with ASTM Test Method D3080. The specimens were soaked for a minimum of 24 hours for clayey materials, and approximately one hour for sandy materials under a surcharge equal to the applied normal force during testing. For clayey materials, after transfer of the specimen to the shear box and reloading the specimen, pore pressure set up in the specimen due to the transfer was allowed to dissipate for a period of approximately one hour prior to application of shearing force. For sandy materials, soaking was performed directly in the shear box to reduce the disturbance of the specimens. The specimens were tested under various normal loads, and a different specimen was used for each normal load. The specimens were sheared in a motor-driven, strain controlled, direct-shear testing apparatus at a strain rate of approximately 0.05 inch per minute. The test results were plotted on the "Direct Shear" form and included in this appendix.



BORING/SAMPLE : 1 DEPTH (ft) : 20  
 DESCRIPTION : SLTSTONE BEDROCK  
 STRENGTH INTERCEPT (C) : .913 KSF (PEAK STRENGTH)  
 FRICTION ANGLE (PHI) : 29.1 DEG

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	NORMAL STRESS (ksf)	PEAK SHEAR (ksf)	RESIDUAL SHEAR (ksf)
○	26.6	97.7	.724	.39	1.05	1.03
□	28.0	94.4	.785	.79	1.47	1.42
△	27.6	94.4	.785	1.57	1.74	1.73

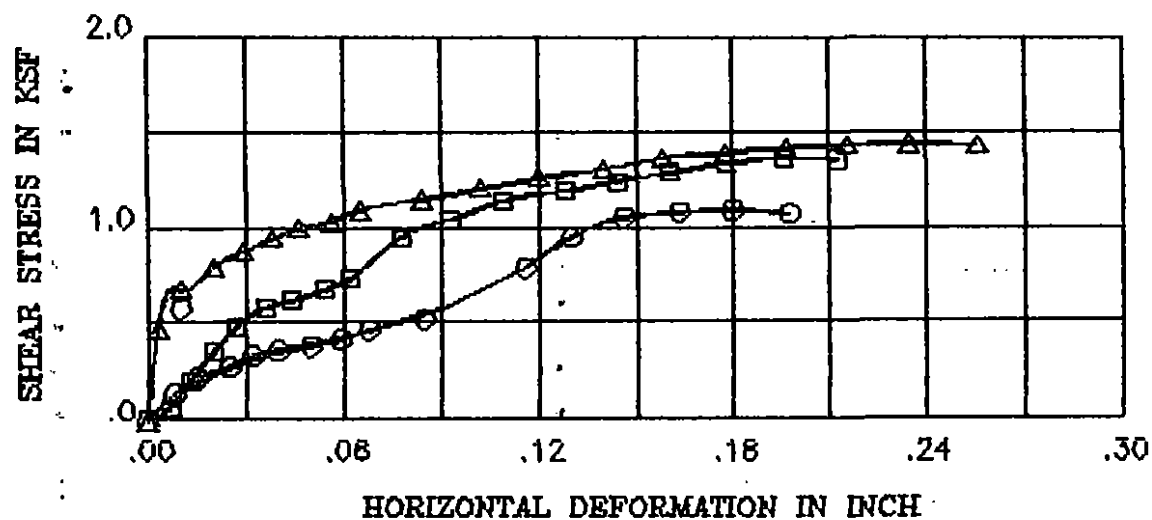
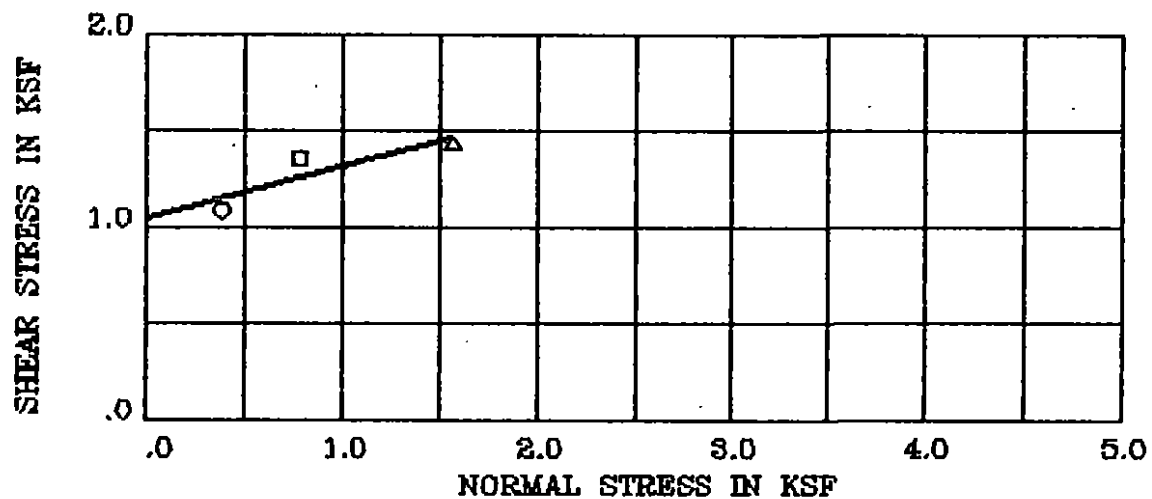
Remark :

Project No.01G1474

SCHOTANUS

PETER &  
ASSOCIATES

DIRECT SHEAR TEST

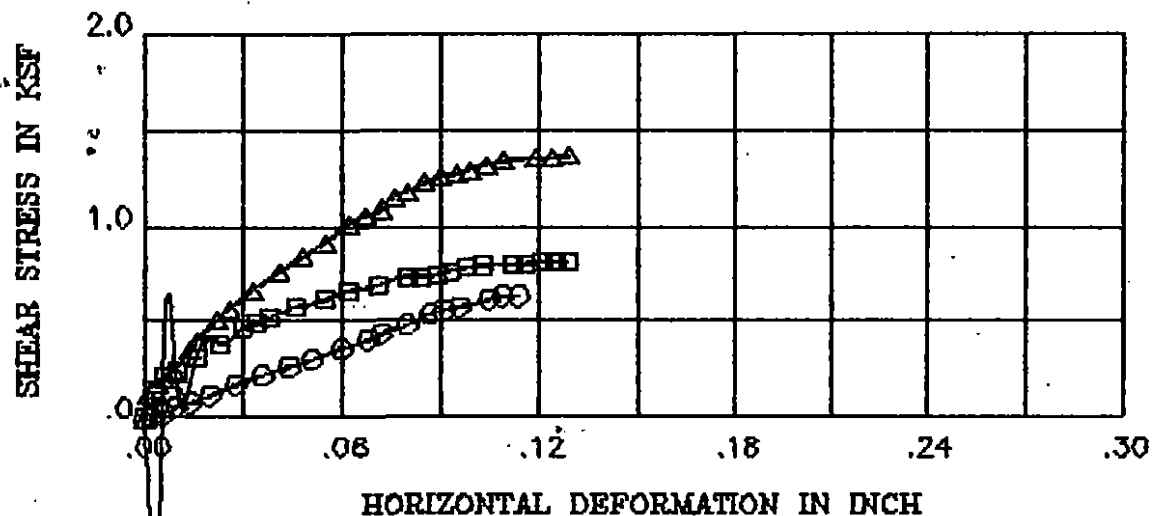
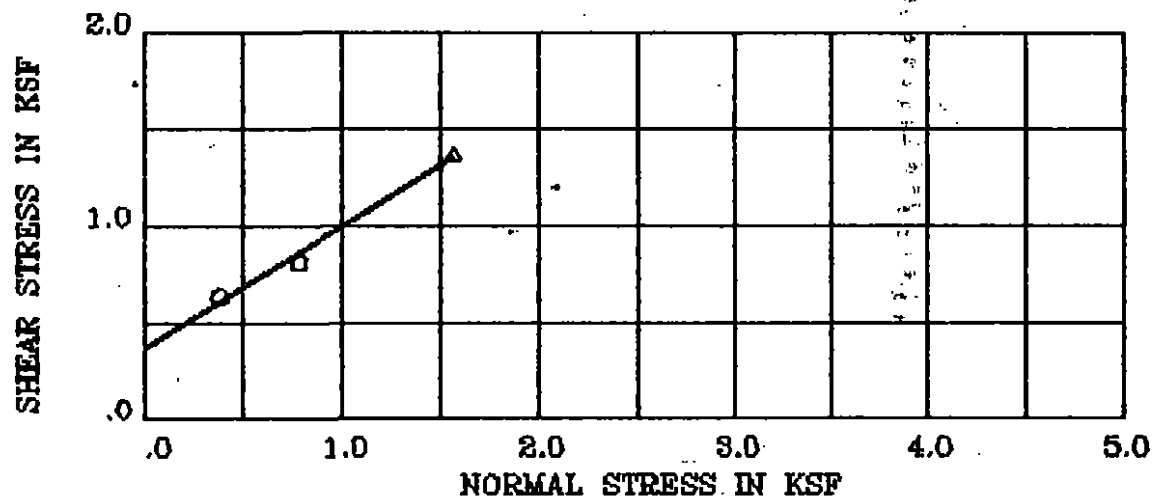


BORING/SAMPLE : 2 DEPTH (ft) : 5  
 DESCRIPTION : ARTIFICIAL FILL—SILT—1ST BREAK BEFORE RESHEARS  
 STRENGTH INTERCEPT (C) : 1.048 KSF  
 FRICTION ANGLE (PHI) : 14.9 DEG (PEAK STRENGTH)

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	NORMAL STRESS (ksf)	PEAK SHEAR (ksf)	RESIDUAL SHEAR (ksf)
○	23.5	98.9	.704	.38	1.08	1.06
□	22.7	98.9	.704	.78	1.36	1.35
△	27.6	89.0	.893	1.57	1.43	1.42

Remark :

Project No.01G1474	SCHOTANUS
PETER & ASSOCIATES	DIRECT SHEAR TEST



BORING/SAMPLE : 2 DEPTH (ft) : 10  
 DESCRIPTION :  
 STRENGTH INTERCEPT (C) : .361 KSF  
 FRICTION ANGLE (PHI) : 32.2 DEG (PEAK STRENGTH)

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	NORMAL STRESS (ksf)	PEAK SHEAR (ksf)	RESIDUAL SHEAR (ksf)
O	25.0	96.3	.760	.38	.63	.63
□	25.8	95.5	.774	.79	.81	.81
Δ	25.7	95.5	.775	1.57	1.37	1.37

Remark :

Project No.01G1474	SCHOTANUS
PETER & ASSOCIATES	DIRECT SHEAR TEST





Del Mar Analytical

2852 Alton Ave., Irvine, CA 92606 (949) 261-1022 FAX (949) 261-1228  
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370-4867 FAX (909) 370-1046  
7277 Hayvenhurst, Suite B-12, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843  
9484 Chesapeake Dr., Suite 805, San Diego, CA 92123 (858) 505-8596 FAX (858) 505-9689  
9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851  
2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

Peter and Associates  
1519 Calle Valle  
San Clemente, CA 92672  
Attention: Lan N. Pham

Project ID: Sulfate  
01G1474/Schotanus  
Report Number: ILA0036

Sampled: 12/27/01  
Received: 01/03/02

### INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
<div>% %</div>								
Sample ID: ILA0036-01 (Schotanus B1@ 0-2' - Soil)								
Soluble Sulfate	EPA 300.0	I2A0454	0.00050	0.023	1	1/4/02	1/7/02	

↳ Negligible

Del Mar Analytical, Irvine  
Xuan Huong Dang  
Project Manager

The results pertain only to the samples tested in the laboratory. This report shall not be reproduced,  
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ILA0036 <Page 2 of 4>

**SOUTH & CENTRAL  
SECTION**

**PACIFIC  
OCEAN**

## FIGURE 1

U.S.G.S., United States Department of the Interior, Geological Survey, 1968, 1975,  
"Topographic Map, San Clemente Quadrangle, California", 7.5 Minute Series, Scale  
1:24,000 (1"=2,000 ft., or 1"=0.38 mi.) dated 1968, photo revised 1975. Exp. 200%

PICO

5

Hanson  
Sch.

Our Lady of Fatima  
Sch.

34

Clear Lake

SITE 1

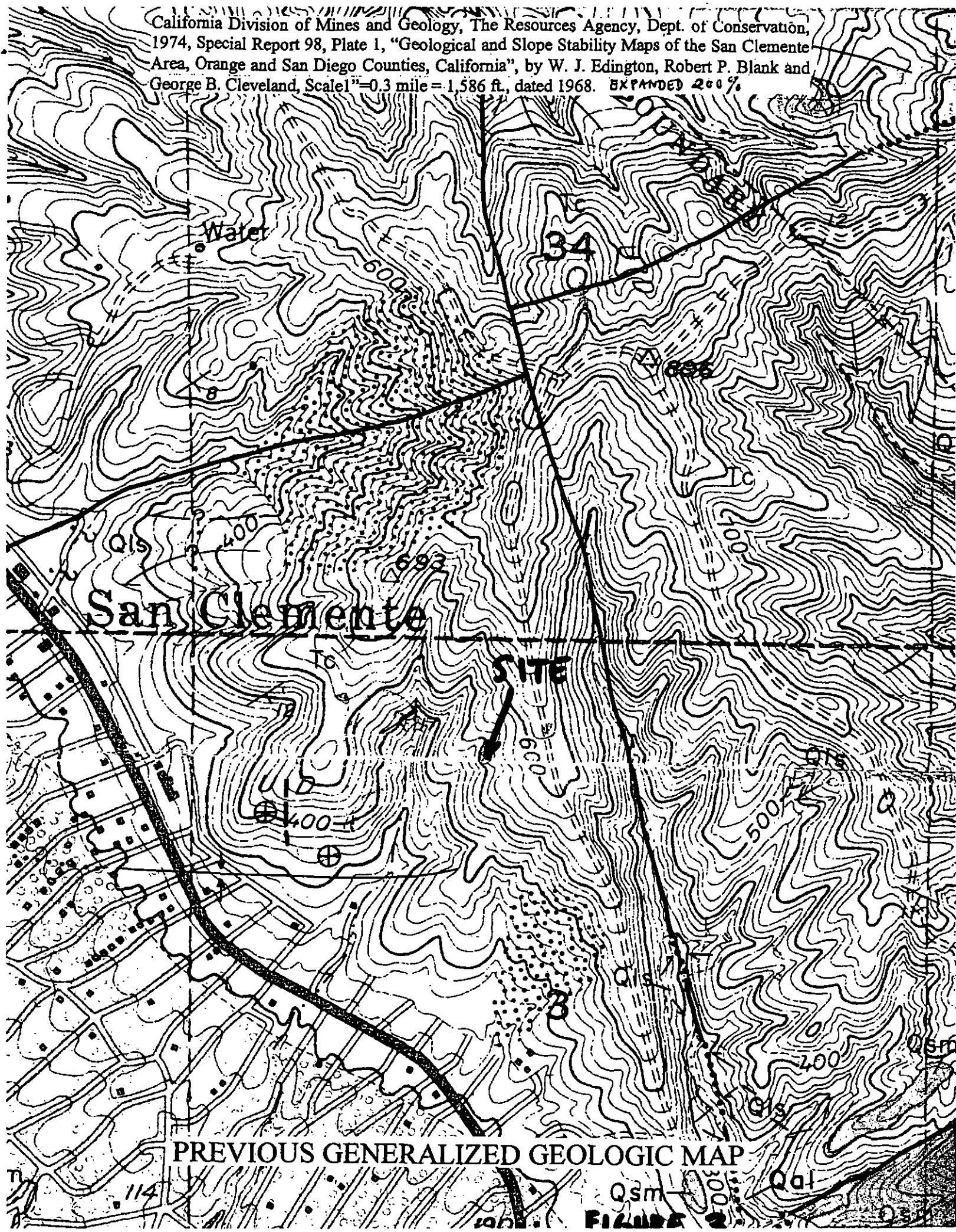
INTERMITTENT

Pier

BM 185

PREVIOUS  
GENERAL TOPOGRAPHIC MAP

FIGURE 2

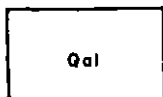


PREVIOUS GENERALIZED GEOLOGIC MAP

FIGURE 2

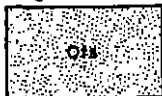
# GENERALIZED GEOLOGIC MAP

## EXPLANATION



### Aluvium, beach sand and pond deposits

**Aluvium:** mainly, light-colored, poorly consolidated silt, sand, and gravel. Along San Juan and Cristianitos-San Mateo drainages locally contains high proportion of fragments common to San Onofre Breccia. **Beach sand:** light-colored, unconsolidated sand along modern strandline. **Pond deposits:** in depressions behind landslide blocks; dark brownish gray, pale gray weathering; poorly bedded and consolidated, clay to sand-size sediments up to 50 feet thick; locally silt-washed and subject to minor sloughing. Recognized only locally, but probably unit is more widespread in large landslides.



### Stream terrace deposits

Low-lying deposits forming aprons along floodplains of major drainage courses; dark brown, poorly consolidated, poorly bedded, adobe-like, fine-grained sediments at least 15 feet thick; subject to minor sloughing. Cobbles of dominantly San Onofre Breccia locally deposited along San Juan drainage. Broad aprons of fine-grained materials at mouths of drainage courses near coast may be, in part, estuarine in origin.



### Nonmarine terrace deposits

Ancient alluvial cover on marine terrace deposits in coastal area; brownish gray, fairly well consolidated, poorly bedded, fine-grained sediments greater than 10 feet thick; locally comprised in part of tabular chips of hard buff to white shale; locally grades into stream channels of pebbles and cobbles of milky quartz, and black, dark gray, green, purple and pinkish white volcanic rocks; stands in near vertical slopes but subject to minor sloughing. Lies unconformably on marine terrace deposits.



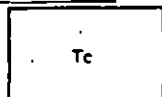
### Marine terrace deposits

Forms cap on main marine terrace surface and overlies Capistrano and San Mateo Formations along coastal area; pale buff to reddish tan, poorly consolidated, faintly bedded, cross-bedded, medium-grained sandstone; locally silt washed; locally fossiliferous with a few pholad-bored cobbles; grades southward along coast to pebble and cobble conglomerate; base locally saturated with groundwater. Lies unconformably on Capistrano and San Mateo Formations. Also includes remnants of older deposits lying at higher elevations.



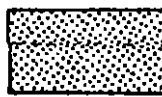
### San Mateo Formation of Woodford (1925)

Locally distributed in southeastern part of area; pale grayish brown, poorly bedded, coarse arkosic sandstone; comprised of angular feldspar, quartz, and biotite fragments; thin pebble and cobble partings of quartz, quartzite, granite, gneiss, and schist fragments derived from San Onofre Breccia; thin, fine sandy partings and local iron-rich zones; silt washed; locally landslide on steep slopes. Unconformably overlies Capistrano Formation. Contact with Capistrano locally exhibits load casts and flame structures and subrounded fragments of Capistrano mudstone occur from a few inches to a few feet above lower contact, indicating formation may be, in part, a turbidite.



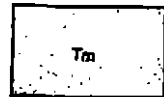
### Capistrano Formation

Widely distributed in southern and western part of area; pale gray, pale greenish to bluish gray, poorly consolidated, massive to poorly bedded, silty shale and mudstone; local coarse buff to pale brown sandstone and siltstone lenses especially near base; locally gypsiferous; in gradational contact with underlying Monterey Formation; forms gradual slopes; most widely landslide formation in area. Foraminifers at locality no. 2 indicate lower Mohanian age at depth. Locally Capistrano Formation may be capped by Niguel Formation of Vedder and others (1957).



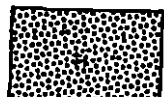
### Ancient landslide terrain

Terrain where local morphologic expression is lacking, but general appearance of landscape suggests ancient landslide



### Monterey Formation

Covers large areas west of the Cristianitos fault in the northern half of the area; white, pale gray, and buff, thin-bedded shale and mudstone; distonaceous, especially in lower half of section; platy siliceous shales common to the Monterey Formation in some areas, not observed locally; upper 200 feet of section as mapped includes siltstones and shales which are transitional from typical Monterey Formation to typical Capistrano Formation; forms rounded, grass and mustard-weed covered slopes, devoid of brush and trees, and mantled with black soil; the presence of cactus and sagebrush along with a change from the typical black to a sandy, yellow-brown soil in areas of Monterey Formation is generally indicative of lowest part of Capistrano Formation; outcrops generally limited to occasional exposures in stream bottoms; interfingers with San Onofre Breccia and conformably overlain by Capistrano Formation; very commonly landslide; transitional zone along with Capistrano Formation are most widely landslide rocks in the area; most readily identified by topography, vegetation and black soil. Foraminifers at locality no. 3 indicate lower Mohanian age; at locality no. 4, lower Mohanian age to a depth of 180 feet (questionable Luisian fossils were found near the surface).



### Topanga Formation

Limited distribution in northwestern part of area; light buff to dark brown, massive, calcareous, arkosic sandstone; medium to coarse grained, poorly sorted, moderately to well indurated, with local conglomerate lenses; comprised predominantly of angular feldspar, quartz and biotite, with numerous fragments of glaucophane schist; megafossils common; forms prominent outcrops; base not exposed, conformably (?) overlain by San Onofre Breccia. Most readily identified by brown color, coarse texture, schist fragments and abundant megafossils. Questionable Topanga Formation shown (Tn).



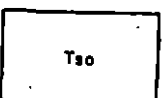
### Sespe and Vaqueros Formations (undifferentiated)

Locally distributed along Cristianitos fault; buff, massive, fine- to coarse-grained, poorly sorted, poorly cemented, arkosic sandstone; locally conglomeratic; lies conformably on Santiago Formation; minor outcrops not mapped. Formations encountered in drill hole below landslide deposits at locality no. 1, 22 feet below surface.



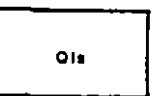
### Santiago Formation

Widely distributed on northeast side of Cristianitos fault; white to gray, massive, fine- to coarse-grained, poorly sorted, uncemented, poorly to moderately consolidated, friable, arkosic sandstone; locally comprised of thin interbeds of greenish gray siltstone.



### San Onofre Breccia

Crops out from place to place along the northwest-trending high ridge immediately west of the Cristianitos fault in the northern half of the area; large slabs and boulders of blue-green glaucophane schist in a matrix of red and gray conglomerate and coarse-grained sandstone; well indurated, poorly sorted, angular fragments of a variety of igneous and metamorphic lithologies; typically forms steep slopes with a very dense cover of chaparral; locally conformably (?) overlies Topanga Formation and is both interfingered with and overlain by Monterey Formation; subject to landsliding where slopes are over-steepened and undercut. Most readily identified by dense vegetation, rocky soil and abundance of schist fragments.



### Landslide deposits

Confined to relatively small areas in side canyon failures, but may spread out over wide areas along major stream courses. Disordered blocks to highly fragmented debris commonly derived from one formation unit or locally comprised of a mixture of two or more formations. Arrows (↗ ↘ ↙ ↚) show principal directions of movement; terrain suspected of extensive landslide morphologies shown (Tn).

FIGURE 3

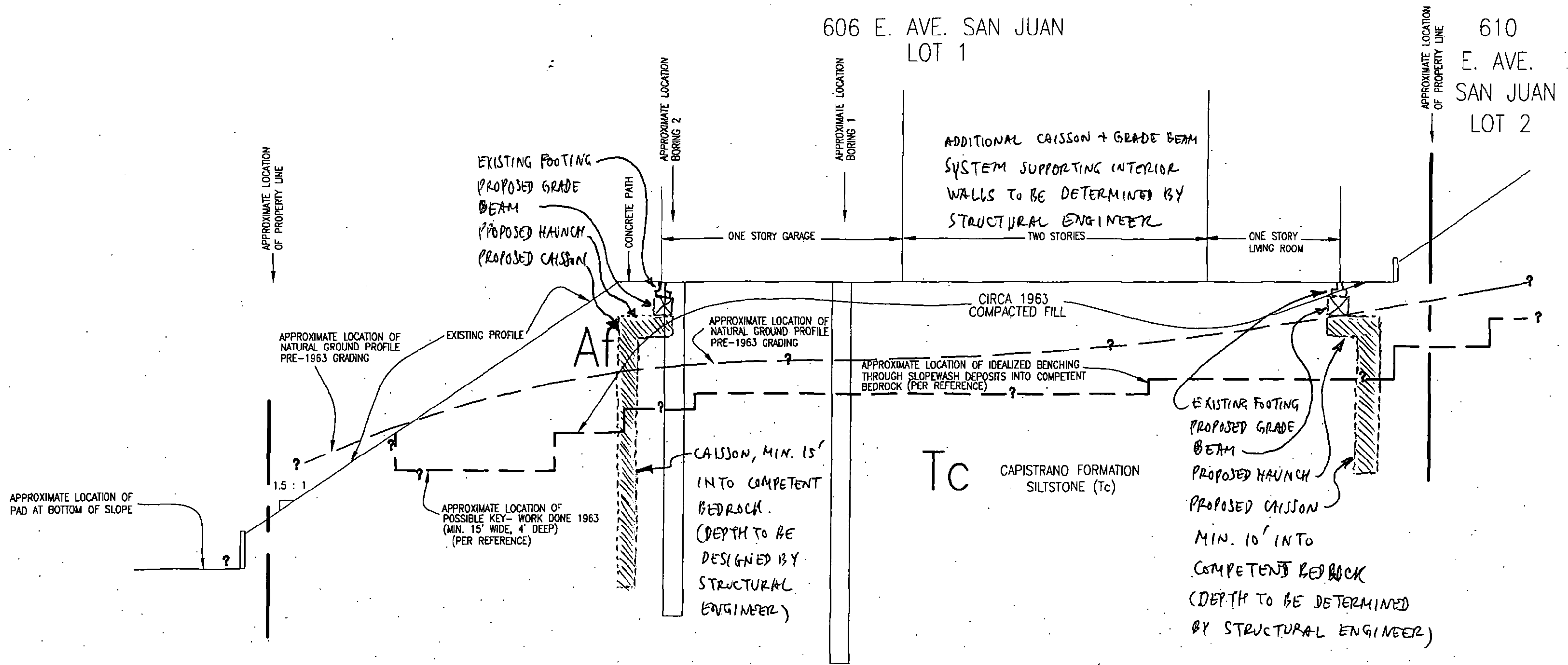
A





**PREVIOUS FIELD DENSITY TEST LOCATION MAP**

**FIGURE 4**



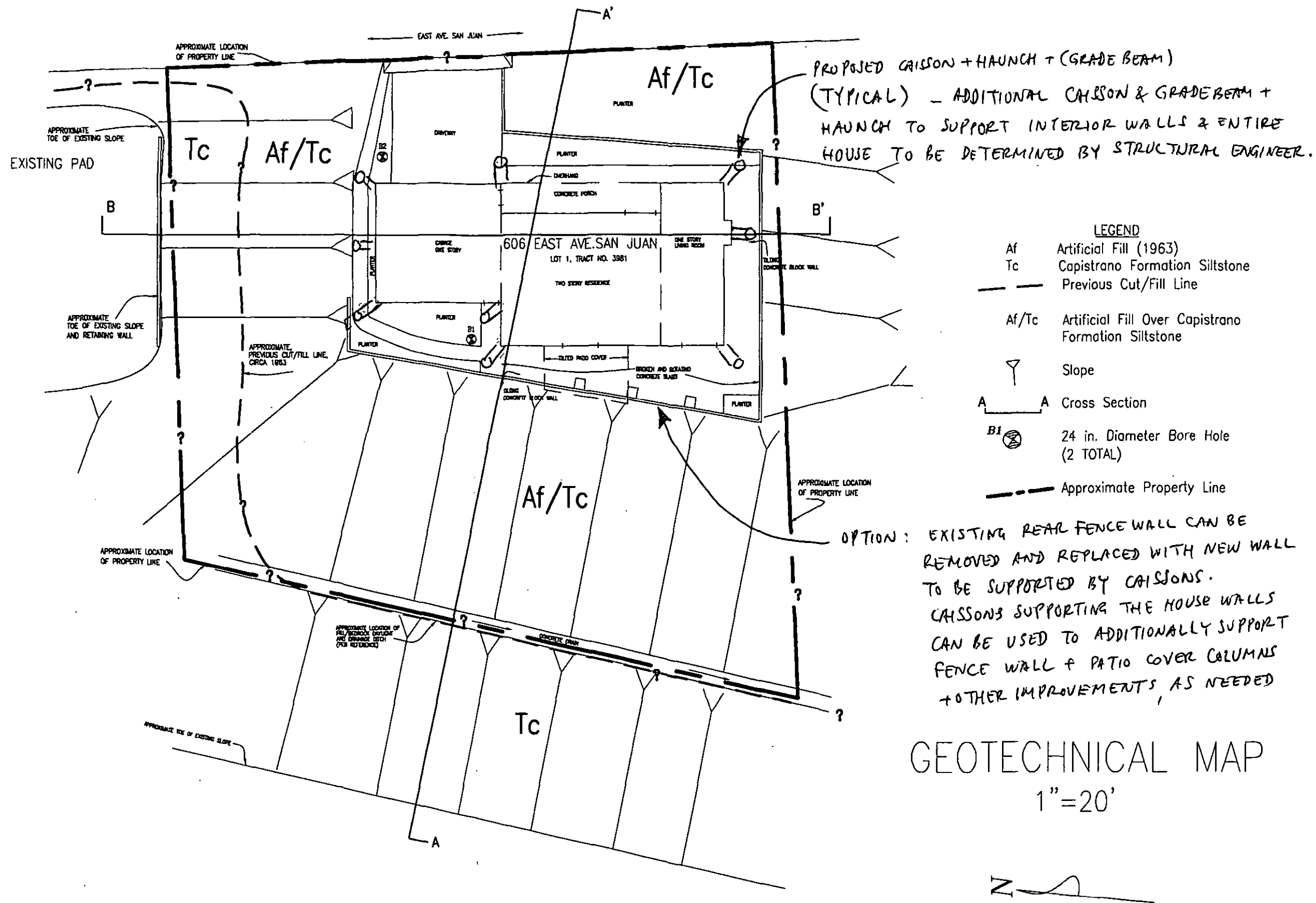
# GEOTECHNICAL CROSS SECTION B-B'

1"=10'

FIGURE 7









# LETTER OF TRANSMITTAL

## City of San Clemente

Sandy Norman, Senior Engineering Technician

Phone: (949) 361-6144 Fax: (949) 366-4741

To: Dr. Peter Borella  
1000 N. Coast Highway, Ste.#1  
Laguna Beach, CA 92651

Date: August 14, 2007  
Subject: 606 E Avenida San Juan  
New SFR  
Geotechnical Review

Project #: ENG07-051

Caisson 10' into Vendor #: 2627  
inspection competent Rock  
30° Analeis - banded length of 30'  
into bedrock

The Following Items Are Transmitted Herewith:

1	Copy of "Preliminary Geotechnical Investigation for Foundation Design Proposed New Residential Construction, 606 E Avenida San Juan" by Geofirm dated July 17, 2007.
1	Copy of "Precise Grading Plan for 606 E. Avenida San Juan" by JRV Engineering, Inc. dated 7/24/07 sheets 1-3 of 3.

### The Above Are Submitted:

- ☐ At Your Request  
☒ For Your Review  
☐ For Your Approval  
☐ For Signature

- ☐ For Revision  
☐ For Action  
☐ For Your Information  
☐ For Your Files

### Remarks:

cc: Zachary Ponsen

8/20/07  
Site Visit  
Disturbed home  
movement  
steep slope  
report OK



801 Glenneyre St. • Suite F • Laguna Beach • CA 92651  
(949) 494-2122 • FAX (949) 497-0270

RECEIVED  
AUG 03 2007  
City of San Clemente  
Engineering Div.

July 17, 2007

Mr. William Hendricksen  
c/o Jeff Thompson Development, Inc.  
1611 South Ola Vista  
San Clemente, California 92672

Project No: 71736-00  
Report No: 07-6055r

Subject: **Preliminary Geotechnical Investigation for Foundation Design**  
Proposed New Residential Construction  
606 Avenida San Juan  
San Clemente, California

## **INTRODUCTION**

This report presents the results of a geotechnical investigation for the proposed construction of a new, two-story single-family residence with basement on the subject property. Our understanding of the proposed improvement is based on our review of the architectural plans prepared by Anders Lasater Architects.

The conclusions and recommendations of this report are preliminary due to the absence of specific foundation plans, the formulation of which is partially dependent upon recommendations herein.

## **Scope of Investigation**

The investigation included the following:

1. Review of pertinent geotechnical literature, including certain published regional and nearby site specific reports and maps.
2. Geologic reconnaissance of the property and surrounding areas.
3. Excavation and geologic down-hole logging of two bucket auger borings to determine the character, structure, and distribution of earth materials and to obtain bulk and relatively undisturbed soil samples for laboratory testing.
4. Laboratory testing of samples to determine maximum density/optimum moisture, in-situ moisture/density, expansion index, Atterberg limits, shear strength, consolidation potential, soluble sulfates and corrosivity characteristics of representative materials.

5. Preparation of two topographic-geologic cross sections relating site conditions to proposed development and depicting certain geotechnical recommendations.
6. Geotechnical analysis of subsurface conditions as related to slope stability, foundation design and construction recommendations.
7. Preparation of this report and illustrations.

### Accompanying Illustrations and Appendices

Figure 1	-	USGS Geologic Location Map
Figure 2	-	CDMG Seismic Hazards Map
Figure 3	=	Retaining Wall Subdrain Detail
Figure 4	=	Geotechnical Plot Plan
Figure 5	-	Geotechnical Cross Section A-A'
Figure 6	-	Geotechnical Cross Section B-B'
Appendix A	-	References and Aerial Photographs
Appendix B	-	Boring Logs
Appendix C	=	Field Exploration, Sampling, and Laboratory Test Results
Appendix D	-	Engineering Stability Analysis
Appendix E	-	Standard Grading Specifications
Appendix F	-	Utility Trench Backfill Guidelines
Appendix G	=	Maintenance of Hillside Homes

### Site Description

The property is located in a 1960's residential community in the hills above Verde Canyon in southern San Clemente. The approximately square-shaped lot fronts 120+ feet on Avenida San Juan to the east and extends westerly 98' to 131+ feet to the rear property boundary in the descending slope. The property consists of a level building pad with an existing single-story residence supported by a 1.5:1 (horizontal: vertical) ratio rear slope that descends 70+ feet to the lower lots on Avenida San Juan. The property is flanked to the north and south by similar residences, with terraced ascending and descending slopes of 16 and 10+ feet, respectively. Grade changes within the property are accommodated with 1.5:1 (horizontal: vertical) ratio slopes, with elevations from 504 to 552+ feet.

The existing residence and site improvements are significantly distressed. The distress includes moderate to large cracks in the exterior stucco, wracking of the residence frame, separations between the residence and the chimney, and separations between the flatwork and foundation stemwall. The rear yard patio slab, back yard and side yard walls, and canopy cover exhibit tilts, cracks, and separations. The property distress was investigated by others (Peter and Associates, 2002). Their study included two borings (logs and location not available) and determined the distress to be associated with settlement, expansive soils, and slope creep. No formal slope stability analyses were conducted.

### **Proposed Development**

Proposed construction consists of a new two-story steel and wood frame residence with all new hardscape improvements. The foundations are anticipated to consist of caissons and structural slabs.

### **GEOTECHNICAL CONDITIONS**

#### **Earth Materials**

The site is underlain at the surface and at shallow depths by bedrock strata of the Capistrano Formation of Mio-Pliocene Age. As exposed during our subsurface investigation, the bedrock strata typically consist of moderately hard, brown to dark green-gray, thinly to thickly bedded, clayey siltstone. This deposit is considered suitable for structural support of improvements. The westerly portion of the property is mantled with thickening wedge of fill. The fill consists light to dark olive-gray to black organic silty clay and clayey silt. The fill material is considered unsuitable for the support of structures.

Laboratory testing indicates the near surface soils have a medium to high expansion potential and negligible soluble sulfate concentration. Electrical resistivity tests indicate a moderate corrosion potential for buried metal.

#### **Geologic Structure**

The regional structure of the Capistrano Formation in this portion of San Clemente is characterized as flat to gently dipping strata that has been locally and subtly folded. Based on down-hole observations, exposures indicate bedding is inclined 6 to 36 degrees, but overall inclined 8 to 12 degrees from horizontal, down toward the east. This results in a favorable and supported topographic-structural condition in the bedrock below the lot. Adverse structure and weakened bedding surfaces were not observed. Bedding structure was observed to be well defined, thinly to thickly bedded, and interrupted by northwest-oriented, moderate to steeply dipping jointing.

#### **Slope Stability**

No evidence of former gross slope instability affecting the site has been observed on the basis of map and literature review, interpretation of aerial photographs, and our field investigation.

Engineering stability analyses were performed to evaluate the gross stability of the lot, including consideration of seismic loading for the post-construction conditions. The analyses were performed on the geometry depicted on Cross Section A-A' using the GSTABL7 computer program and Janbu's method. Strength parameters utilized for the analyses were as determined from laboratory testing of onsite materials and engineering judgment. Strength parameters utilized are considered reasonable and within an appropriate range for the materials encountered.

The calculated factors-of-safety against failure under proposed construction conditions and possible seismic loading are presented in Appendix D. The existing 1.5:1 (horizontal:vertical) ratio fill slope at the rear of the lot does not meet current grading code requirements for gross stability factor of safety. However, the calculated factors-of-safety for proposed conditions with deep foundations are above the minimum level of 1.5 for development, and the factors-of-safety under seismic loading are also above the accepted level of 1.1. The 1.5 and 1.1 factors-of-safety for gross stability and seismic stability are utilized in the City of San Clemente Grading Code.

The rear slope is also considered prone to surficial instability and creep.

### Groundwater

No evidence of groundwater was observed during the site investigation, including drilling to 50 feet below the lot. The possibility of intermittent onsite perched groundwater activity is not precluded, although it is not anticipated to be a development constraint.

### Surface Drainage

No evidence of erosive discharge onto or from the property was noted. Proposed development will modify and possibly increase surface discharge, which must be intercepted, controlled and conducted offsite by appropriate engineering design and construction to preclude potentially damaging erosion or saturation of earth materials.

### Seismic Considerations

#### Published Studies

One of the principals of seismic analyses and prediction is the premise that earthquakes are more likely to occur on geologically younger faults, and less likely to occur on older faults. For many years studies have described faults with Holocene movement (within the last 11,000 years) as "Active", and faults with documented Pleistocene movement (within the last 1.6 million years) and with undetermined Holocene movement as "Potentially Active". Informally, many studies have described faults documented to have no Holocene movement as "Inactive". Recent geologic and seismic publications are attempting to clarify the nomenclature describing faults to more accurately represent the potential affects from earthquakes.

Reports by the California Division of Mines and Geology indicate faults with documented Holocene or Historic (within the last 200 years) movement should be considered Active. However, Potentially Active faults are more appropriately characterized in terms of the last period of documented movement. The Fault Activity Map of California (Jennings, C.W., 1994) defines four categories for onshore Potentially Active faults. The categories are associated with the time of the last displacement evidenced on a given fault and are summarized in Table 1.

**Table 1, Definitions of Fault Activity in California**

Activity	Category	Recency of Movement
Active	Historic	Within the last 200 years
	Holocene	Within the last 11,000 years
Potentially Active	Late Quaternary	Within the last 700,000 years
	Quaternary	Within the last 1.6 million years
	Late Cenozoic	Possibly within the last 1.6 million years
	Pre-Quaternary	Before the last 1.6 million years

It is important to note these categories embrace all Pre-Holocene faults as Potentially Active, and provide no methodology to designate a given fault as "Inactive". Although the likelihood of an earthquake or movement to occur on a given fault significantly decreases with inactivity over geologic time, the potential for such events to occur on any fault cannot be eliminated within the current level of understanding.

#### **Local and Regional Faults**

The closest published active fault to the site is the offshore extension of the Newport-Inglewood Fault Zone, approximately 5.2 miles west-southwest (Blake, T.F., 2000; CGS/2004). Other active faults in the vicinity of the site include the San Joaquin Hills, approximately 11.9 miles to the north; the Elsinore Fault, approximately 21.1 miles southeast; the Coronado Bank Fault, approximately 21.4 miles southwest; the Palos Verdes Fault, approximately 21.9 miles to the northwest; and the San Andreas Fault, approximately 54.7 miles to the northeast.

The offshore portion of the Newport-Inglewood Fault zone is indicated in published reports as being a Potentially Active and Quaternary fault (Jennings, C.W., 1994). This interpretation is not universally shared, as this portion of the Newport-Inglewood Fault is included as a potential seismic source in the computer programs utilized to model ground motions for this study (Blake, T.F., 2000). With the fault's location approximately 5.2 miles to the west, it is calculated as the most significant seismic source to affect this site. Given the present level of understanding of this offshore structure it is, in our opinion, appropriate to include this portion of the fault as a causative seismic feature.

#### **Ground Motion Analyses**

The potential ground motions from earthquakes that could impact the sites were analyzed through probabilistic methods. The probabilistic method considers the regional seismic history and the slip rates of faults within a 100-mile radius of the subject site. Utilizing attenuation relationships (Bozorgnia, et al., 1999, unconstrained/soft rock), one can estimate the ground motion history of the site and attempt to predict the probability of future accelerations within a given period of time. The study indicates the greatest site acceleration from 1800 to 2004 was

approximately 0.07g and occurred during a magnitude 6.3 Long Beach Earthquake 24.9 miles from the site on March 11, 1933. For the purposes of prediction, the peak acceleration with a 10 percent probability of exceedance in 50 years was determined to be 0.3g.

It is noted that the estimation of peak ground accelerations presented above is provided for the interest of the client and is required by local (City or County) review agencies. The values derived are not directly utilized in structural design of residential structures. Seismic parameters for use by the structural engineer in accordance with 2001 California Building Code in design of the proposed structure(s) are presented in the recommendations portion of this report.

### Secondary Seismic Hazards

Review of the Seismic Hazards Zones Map (CDMG, 1998) for the San Clemente Quadrangle, Figure 2, indicates this lot is not located within a "zone of required investigation" for liquefaction, but is supported by a zone for earthquake induced landslides. Stability analyses under pseudostatic conditions indicate the existing fill slope is not adequately stable, but will achieve adequate stability with proposed deep foundations. Recommendations for proper design are provided herein.

Other secondary seismic hazards can include deep rupture, shallow ground cracking, and settlement. With the absence of active faulting onsite, the potential for deep fault rupture is not present. The potential for shallow ground cracking to occur during an earthquake is a possibility at any site, but does not pose a significant hazard to site development. Given the improvements will be founded on bedrock deposits, seismically induced settlement is considered unlikely to impact new construction.

### CONCLUSIONS

1. The proposed construction is considered feasible and safe from a geotechnical viewpoint provided the recommendations of this report are followed during design, construction, and maintenance of the subject property. Proposed development should not adversely affect adjacent properties, providing appropriate engineering design, construction methods, and care are utilized during construction.
2. The property is immediately underlain by bedrock of the Capistrano Formation, which is overlain by a thickening wedge of fill toward the rear slope. The distress in the existing structure appears related to settlement and instability in the fill deposits.
3. Based upon laboratory testing, the soil materials on this lot have a medium to high expansion potential, have a negligible soluble sulfate concentration, and a moderate corrosion potential to buried metals.



4. The fill material composing the rear slope is inadequately stable and subject to creep. Foundation elements are recommended to be designed for lateral loading within the zone of fill soil and slope influence.
5. No active faults are known to transect the site and therefore the site is not expected to be adversely affected by surface rupturing. It will, however, be affected by ground motions from earthquakes during the design life of the residence.
6. Groundwater is not anticipated to be a construction nuisance.
7. Adverse surface discharge onto or off the site is not anticipated provided proper engineering design and post-construction site grading are implemented.
8. The proposed residential improvements may be supported on caissons founded in bedrock, with structural slabs.

## RECOMMENDATIONS

### Grading and Earthwork

Grading is anticipated to consist of the removal of existing material as necessary to construct proposed building pad grades at locations of proposed construction, and overexcavation and recompaction to depths of 3 feet in hardscape areas. All grading should be performed in accordance with the Standard Grading Specifications in Appendix E. Any processing, overexcavation, and recompaction should be observed, tested, and approved in writing by a representative of this firm.

#### 1. Removal of Existing Improvements

Any existing vegetation, organic materials and/or construction and demolition debris in structural areas should be removed and disposed of offsite.

#### 2. Compaction Standard

All onsite soil materials are anticipated to be suitable for re-use as general compacted fill (not for retaining wall backfill) providing they are free of rubble and debris. All materials should be placed with at least 140 percent of optimum moisture content and compacted under the observation and testing of the soil engineer to at least 90 percent of the maximum dry density as determined by ASTM D 1557-02.

#### 3. Imported Soils

Onsite soils are unsuitable for retaining wall backfill. Imported soils for walls must be granular, free-draining, and non-expansive (gravel, pea-gravel, or clean sand).

Imported soils should be approved by Geofirm prior to transport to the site.

4. Construction Slopes

Temporary excavations may be cut vertically to depths of 5 feet; deeper excavations should be laid back at a 1:1 (horizontal:vertical) ratio. Shoring may be required where space limitations prevent laybacks.

5. Shoring

Shoring should be designed in accordance with the retaining wall and caisson foundation recommendations presented herein. In addition, the design and construction should consider that onsite soils may have zones which are prone to caving and/or settlement. Vibratory techniques for placement of piles or steel sheet piling should not be utilized, as damage to adjoining property improvements may otherwise occur. It is the contractor's responsibility to develop appropriate means and methods of construction to avoid damage to adjacent properties. Casing of excavations may also be warranted.

If temporary shoring elements are to be removed, the builder and homeowner must be aware that such removal could result in settlement and possible damage to improvements on the adjacent property. The adjacent property owners must be advised of the risks and the builder should provide arrangements to repair any possible damages.

The contractor should also recognize the risk of leaving voids during removal of shoring elements. Lagging plates and piles should therefore be removed slowly and the voids created should be filled immediately. Consideration should be given to continuously injecting grout at the base of the piles and plates as they are being removed to fill the resultant voids.

Structural Design of Foundations

A caisson foundation system or caisson and tieback anchor system is recommended to achieve adequate long-term stability of the site. The caisson and possible tieback system should be designed to resist a total lateral load of 20 kips per lineal foot. This load may be distributed over multiple caisson rows and/or into a row of tieback anchors.

Comments Pertaining To Expansive Soils

Earth materials to be exposed at finish grades exhibit a medium to high expansion potential. We recommend that the foundations and slabs be designed to resist the effects of expansive soils in accordance with Section 1815 of the 2001 California Building Code, utilizing a conventional foundation system with a deepened perimeter footing. Foundations and slabs should be designed for the intended use and loading by the Structural Engineer. The design should consider the expansion potential of the subgrade soils and other appropriate soil related criteria.

Our recommendations are considered to be generally consistent with the standards of practice. They are based on both analytical methods and empirical methods derived from experience with similar geotechnical conditions. These recommendations are considered the minimum necessary for the likely soil conditions and are not intended to supersede the design of the Structural Engineer or criteria of governing agencies.

Although there is no known economical method of totally preventing movement due to expansive soils, current state-of-the-practice in the Southern California area dictates substantial reinforcement, slab thickening, moisture barriers, and pre-soaking of subgrade soils as methods of minimizing the effects of expansive soils. Reasonable mitigation of expansive soil effects is considered feasible from a geotechnical viewpoint utilizing such methods, although it is noted that some future distress cannot be precluded when building on expansive soils.

#### Comments Pertaining to Soil Creep

It is generally accepted that soil creep is a surficial slope instability condition which is progressive in character and caused in this climatic environment by expansion and contraction of sloping earth materials under the influence of moisture changes and gravity. The potential for structural distress of shallow foundation systems placed in or adjacent to creeping materials is high, as the creep process removes downslope support for conventional footings. Soil creep will primarily affect the pad area within 15 feet of the top of the rear slope.

Potential distress associated with creep-induced foundation deformations should be anticipated and minimized with appropriate design which considers that most of the downslope movement of creep-prone materials occur in the first 10+ feet of depth of sloping earth material.

Additionally, deformations caused by creep movement cannot be entirely precluded, and it is the intent of these recommendations only to minimize their perception. Other design considerations which will minimize the perception of movement include use of flexible rather than frangible surfacing materials.

#### 1. Caissons

Caissons utilized for foundation support should be twenty-four inch diameter and embedded a minimum of 10 feet into competent bedrock below the fill. Caissons may be designed for a dead plus live load end bearing value of 10000 pounds per square foot and skin friction of 500 pounds per square foot below the fill only. These values may be increased by one-third for wind and seismic forces. Lateral resistance may be computed utilizing 400 pounds per square foot per foot of depth for competent bedrock below the fill, acting on a tributary area of twice the caisson diameter. Settlement is anticipated to be nil. A minimum 24-inch diameter caisson is required in order to verify proper cleanout by the contractor and to allow visual observation and confirmation by the engineering geologist.

Caisson design in the fill zone should recognize that soil creep movement will remove downslope support. Caissons adjacent to the rear slope should be design to resist lateral pressure loading of 75 pounds per cubic foot equivalent fluid pressure to a depth of 10 feet at the edge of slope. Passive resistance may be taken only below the creep zone. Final caisson design should address both creep loading and lateral stability loading, whichever is greater; however, these need not be combined.

## 2. Tieback Anchors

If required, the tieback anchors design should include pressure grouting throughout the bonded length of the tieback. A bond stress of 30 pounds per square inch (psi) may be used in the preliminary design for pressure-grouted anchors between the Capistrano Formation bedrock and the grout. If post-grouting is employed, no more than three post-grouting phases should be performed.

The tieback anchors should be inclined downward at a nominal 30 degrees from horizontal. The tiebacks should be unbonded within the fill and have a minimum bond length of 30 feet in the bedrock. To increase spacing of the bond zone between anchors, anchors may be drilled 5 degrees above and below the 30-degree inclination.

We recommend that the design and construction criteria presented in the Post-Tensioning Institute's manual, *Recommendations for Prestressed Rock and Soil Anchors*, 1996 edition, be incorporated into the tieback anchor specifications and details. We have referenced portions of the manual in the following sections where appropriate:

### a. Corrosion Protection

Considering the potentially corrosive nature of the site soil and bedrock materials, we recommend that, as a minimum, all anchors for long-term stability be designed as encapsulated Class I anchors set forth in the latest edition of the Post-Tensioning Institute (PTI) manual for prestressed rock and soil anchors (PTI, 1996). In lieu of retaining a grouting/concrete expert, it is recommended that PTI recommendations be utilized which requires Type V cement, a maximum water cement ratio of 0.45, and a minimum compressive strength of 3000 psi. In addition, it is recommended that all grade beam/anchor blocks and anchorages be properly protected by concrete cover or sealed against corrosion.

### b. Performance Testing

Performance testing shall be done for 2 anchors. The anchors to be performance tested will be located near the ends of the system. Testing will be done in general accordance with the criteria set forth in the PTI Recommendations for Prestressed Rock and Soil Anchors, 1996 edition, and subject to observation by our firm. Just

prior to testing, the hydraulic jack, pump, and gauge system should be calibrated by an independent testing laboratory.

Test loads (TL) for these anchors will be 133 percent of the design load (DL). Alignment loads (AL) may be taken as 10 percent of the DL. During performance testing the AL should be applied and then the loading sequence of 0.25 DL, 0.50 DL, 0.75 DL, 1.00 DL, 1.2 DL and then 1.33 DL. The test load at 1.33 DL shall not exceed 80 percent of the minimum tensile strength of the anchor tendons. During each stage of the performance testing the total movement during the load cycle, residual movement at the AL after cycling, and elastic movement at the load cycle shall be recorded and plotted to assess anchor loading and performance. During each increment of load application the total movement of the pulling head shall be recorded to the nearest 0.001-inch with respect to a previously established fixed reference point. The load increment will be held no more than one minute to obtain the movement reading before the next load is applied. At the TL, movement readings will be taken at 1, 2, 3, 4, 5, 6, and 10 minutes. If the total creep movement exceeds 0.04-inch between 1 and 10 minutes, the TL shall be maintained for an additional 50 minutes with movement readings taken every 10 minutes.

The total creep movement shall not exceed 0.10 inch over a 10-minute period in order for the anchor to be approved for the design load.

c. Extended Creep Tests

We recommend that at least one anchor be subjected to extended creep testing. Extended creep testing should conform to the cyclic loading pattern for performance testing except that the loads shall be held constant as follows:

Load	Time, Minutes
AL	
0.25 DL	10
0.50 DL	30
0.75 DL	30
1.00 DL	45
1.2 DL	60
1.33 DL	300

Creep movement readings are to be made at the following time intervals: 1, 2, 3, 4, 5, 6, 10, 15, 20, 25, 30, 45, 60, 75, 90, 100, 120, 150, 180, 210, 240, 270, and 300 minutes.

If the creep rate exceeds 0.08 inch over any logarithmic cycle, the time of observation may be extended to establish if the creep rate diminishes to the 0.08 inch per logarithmic cycle of time.

d. Proof Testing

All other anchors shall be proof tested to 1.33 DL, with the load being maintained constant for at least 10 minutes. Total movement readings are to be the same as for performance testing at the Total Load. At the conclusion of the proof loading, the anchors may then be reduced to the DL and locked off.

If the total creep movement exceeds 0.04 inch between 1 and 10 minutes, the TL shall be maintained for an additional 50 minutes with movement readings taken every 10 minutes. The total creep movement shall not exceed 0.10 inch over a 10-minute period in order for the anchor to be approved for the design load.

3. Structural Slabs

All slabs are anticipated to be structural elements spanning between caissons and grade beams, and should be designed by the structural engineer. Control against moisture penetration of slabs should be achieved by placing a 15-mil vapor retarder beneath the slab in accordance with ASTM E 1745 and E 1643. The membrane should be underlain by at least 4 inches of  $\frac{1}{2}$  to  $\frac{3}{4}$  inch open graded gravel.

Design of Retaining Walls

1. Structural Design of Retaining Walls

Active pressure forces acting on walls retaining level backfill may be designed using an equivalent fluid density of 35 pounds per cubic foot if backfilled with geotechnically approved, granular non-cohesive soils and free to rotate during backfilling (refer to Figure 3 for backcut and backfill geometry). Walls retaining level onsite soils should be designed for an equivalent fluid pressure of 75 pounds per cubic foot. Wall rotation on the order of 0.1 percent of the wall height should be anticipated and considered in design of walls and adjacent hardscaping. Restrained walls should be designed for a pressure of 50 percent greater than that for unrestrained walls.

## 2. Subdrains

The drainage scheme depicted on Figure 3 or an approved alternative should be used to control seepage forces behind retaining walls.

## 3. Wall Excavations

Wall excavations will require slope laybacks of 1:1 (horizontal:vertical) where higher than 5 feet. Shoring may be required where space limitations prevent laybacks.

## Concrete

Laboratory testing of onsite soils indicate a negligible soluble sulfate concentration. It is recommended that the concrete mix be designed by a concrete expert. Alternatively, the design may be based upon the recommendations as presented in Table 19-A-4 of the 2001 California Building Code, which permits Type II cement. Recommendations for design water-cement ratio and compressive strength are deferred to the structural engineer.

## Seismic Design

Based on the geotechnical data presented above and the location of the site on the Active Fault Near Sources Zones Map N-34 (ICBO, 1998), the following seismic parameters for the 2001 CBC are recommended:

**2001 CBC Seismic Design Criteria**

Table	Design Parameters
16-I	Zone Factor $Z = 0.40$
16-J	Soil Profile Type: $S_D$
16-Q	Seismic Coefficient $C_a = 0.44$
16-R	Seismic Coefficient $C_v = 0.70$
16-S*	Near Source Factor $N_a = 1.0$
16-T*	Near Source Factor $N_v = 1.1$
16-U	Seismic Source Type: B

\*Closest distance to seismic source = 7.8 km

## Hardscape Design and Construction

All significant hardscape elements should utilize caissons and structural slabs. Isolated elements which can tolerate soil movement may be designed conventionally as recommended below.

Spread footings in recompacted fill may be designed for an allowable bearing value of 1000 pounds per square foot with a minimum width of 15 inches and a minimum embedment of 24 inches below the lowest adjacent grade. The design value may be increased one-third for short

duration wind or seismic loading. Total and differential settlements are anticipated to be on the order of  $1\frac{1}{2}$  and  $3/4\frac{1}{2}$  inch, respectively, over a distance of 20 feet.

Lateral loads may be resisted by passive pressure forces and by friction acting on the bottom of footings. The allowable passive pressure forces may be computed using an equivalent fluid density of 100 pounds per cubic foot for fill, and a coefficient of friction of 0.25 may be used in computing the frictional resistance. Friction resistance and passive pressure may be combined without reduction.

Flatwork elements should be a minimum 5 inches thick (actual) and reinforced with No. 4 bars 16 inches on center both ways. An 18-inch reinforced thickened edge should also be utilized for significant elements. Subgrade presaturation to 140 percent of optimum is recommended to a depth of 18 inches. All hardscape subgrade should be approved by the geotechnical consultant prior to placement of concrete.

Concrete flatwork should be divided into as nearly square panels as possible. Joints should be provided at maximum 6 feet intervals to give articulation to the concrete panels. Landscaping and planters adjacent to concrete flatwork should be designed in such a manner as to direct drainage away from concrete areas to approved outlets. Planters located adjacent to principal foundation elements should be sealed and drained; this is especially important if located upon retaining wall backfills.

Landscape design should include consideration of subsurface drains beneath high water use areas. It is recommended that deep-rooted, low water need plants be selected for general landscaping purposes to minimize irrigation requirements and consequent saturation of underlying soils.

Hardscape improvements constructed in rear slope areas should utilize integrated caisson/grade beam/deepened footing/structural slab construction or should be constructed as independent floating members which can tolerate slope movement.

#### Utility Trench Backfill

Utility trench backfill should be placed in accordance with Appendix F, Utility Trench Backfill Guidelines. It is the owners and contractors responsibility to inform subcontractors of these requirements and to notify Geofirm when backfill placement is to begin.

#### Foundation Plan Review

In order to help assure conformance with recommendations of this report and as a condition of the issue of this report, the undersigned should review final foundation plans and specifications prior to submission of such to the building official for issuance of permits. Such review is to be performed only for the limited purpose of checking for conformance with the design concept and



the information provided herein. This review shall not include review of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. Geofirm's review shall be conducted with reasonable promptness while allowing sufficient time in our judgment to permit adequate review. Review of a specific item shall not indicate that Geofirm has reviewed the entire system of which the item is a component. Geofirm shall not be responsible for any deviation from the Construction Documents not brought to our attention in writing by the Contractor. Geofirm shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

### **Observation and Testing**

As a condition of the use of this report, it is required that geotechnical construction observation will be conducted by Geofirm to observe proper removal of unsuitable materials, that foundation excavations are clean and founded in competent material, to test for proper moisture content and proper degree of compaction of fill, to test placement of wall and trench backfill materials, and to confirm design assumptions.

A Geofirm representative shall visit the site at intervals appropriate to the stage of construction, as notified by the Contractor, in order to observe the progress and quality of the work completed by the Contractor. Such visits and observation are not intended to be an exhaustive check or a detailed inspection of the Contractor's work but rather are to allow Geofirm, as an experienced professional, to become generally familiar with the work in progress and to determine, in general, if the work is proceeding in accordance with the recommendations of this report.

Geofirm shall not supervise, direct, or have control over the Contractor's work nor have any responsibility for the construction means, methods, techniques, sequences, or procedures selected by the Contractor nor the Contractor's safety precautions or programs in connection with the work. These rights and responsibilities are solely those of the Contractor.

Geofirm shall not be responsible for any acts or omission of the Contractor, subcontractor, any entity performing any portion of the work, or any agents or employees of any of them. Geofirm does not guarantee the performance of the Contractor and shall not be responsible for the Contractor's failure to perform its work in accordance with the Contractor documents or any applicable law, codes, rules or regulations.

These observations are beyond the scope of this investigation and budget and are conducted on a time and material basis. The responsibility for timely notification of the start of construction and ongoing geotechnically involved phases of construction is that of the owner and his contractor. Typically, at least 24 hours notice is required.

July 17, 2007

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### Jobsite Safety

Neither the professional activities of Geofirm, nor the presence of Geofirm's employees and subconsultants at a construction/project site, shall relieve the General Contractor of its obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordination the work in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. Geofirm and its personnel have no authority to exercise any control over any construction contractor or its employees in connection with their work or any health or safety programs or procedures. The General Contractor shall be solely responsible for jobsite safety.

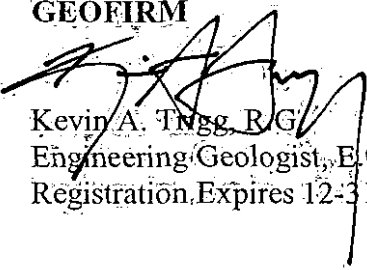
### LIMITATIONS

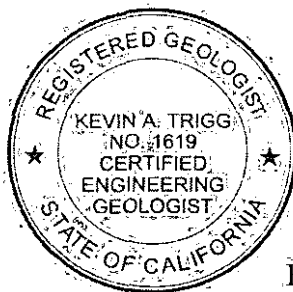
This investigation has been conducted in accordance with generally accepted practice in the engineering geologic and soils engineering field. No further warranty is offered or implied. Conclusions and recommendations presented are based on subsurface conditions encountered, and are not meant to imply a control of nature. As site geotechnical conditions may alter with time, the recommendations presented herein are considered valid for a time period of one year from the report date. The recommendations are also specific to the current proposed additions and improvements. Changes in proposed land use or development may require supplemental investigation or recommendations. Also, independent use of this report in any form cannot be approved unless specific written verification of the applicability of the recommendations is obtained from this firm.


Thank you for this opportunity to be of service. If you have any questions, please contact this office.

Respectfully submitted,

**GEOFIRM**

  
Kevin A. Trigg, R.G.  
Engineering Geologist, E.G. 1619  
Registration Expires 12-31-08

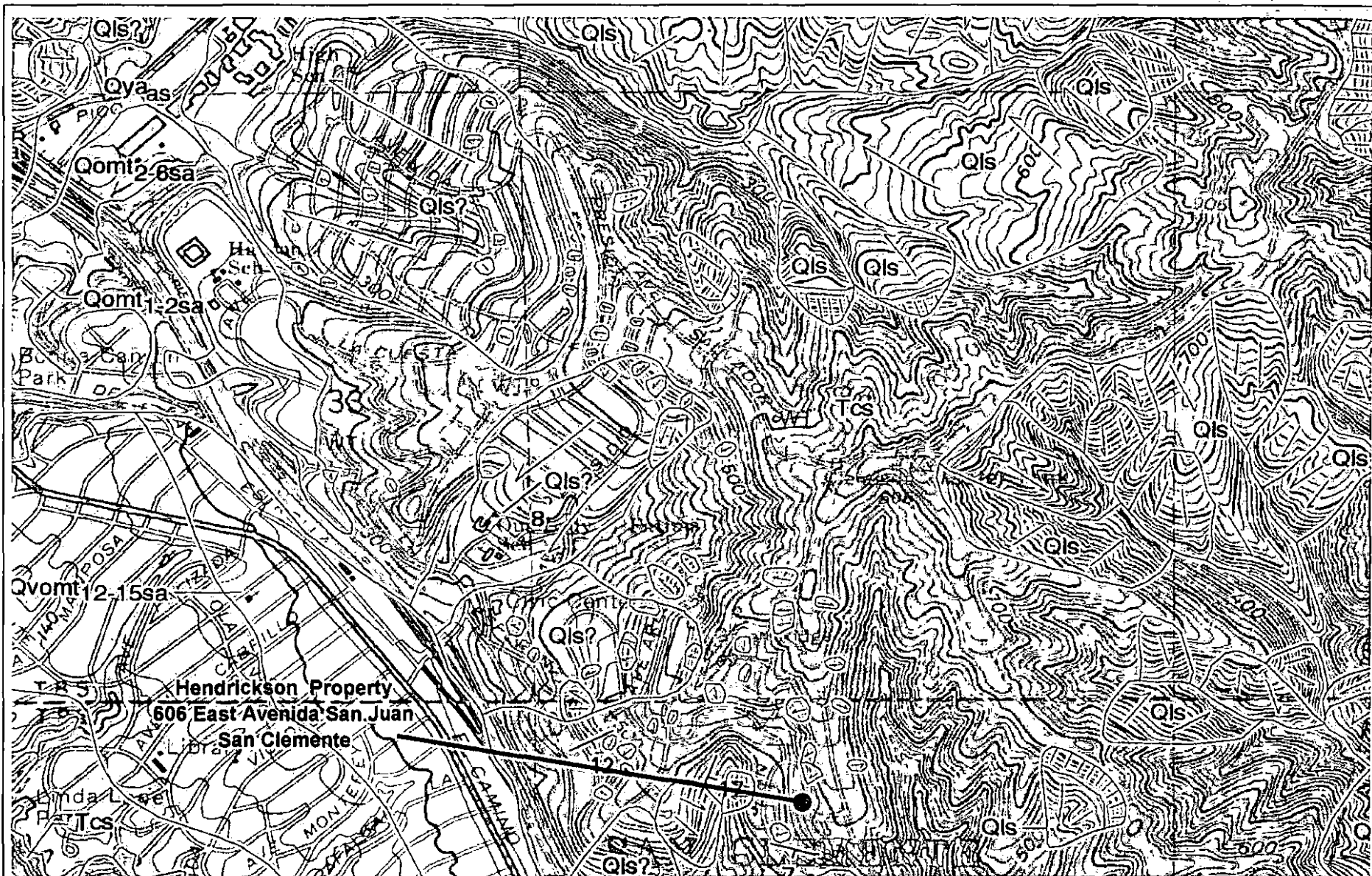


  
Hannes H. Richter, P.E.  
Geotechnical Engineer, G.E. 717  
Registration Expires 3-31-08  
Date Signed: 7/17/07



KAT/HHR:fp

Distribution: (5) to Addressee



# USGS Geologic Location Map, San Clemente 7.5' Quadrangle

JOB NO.:

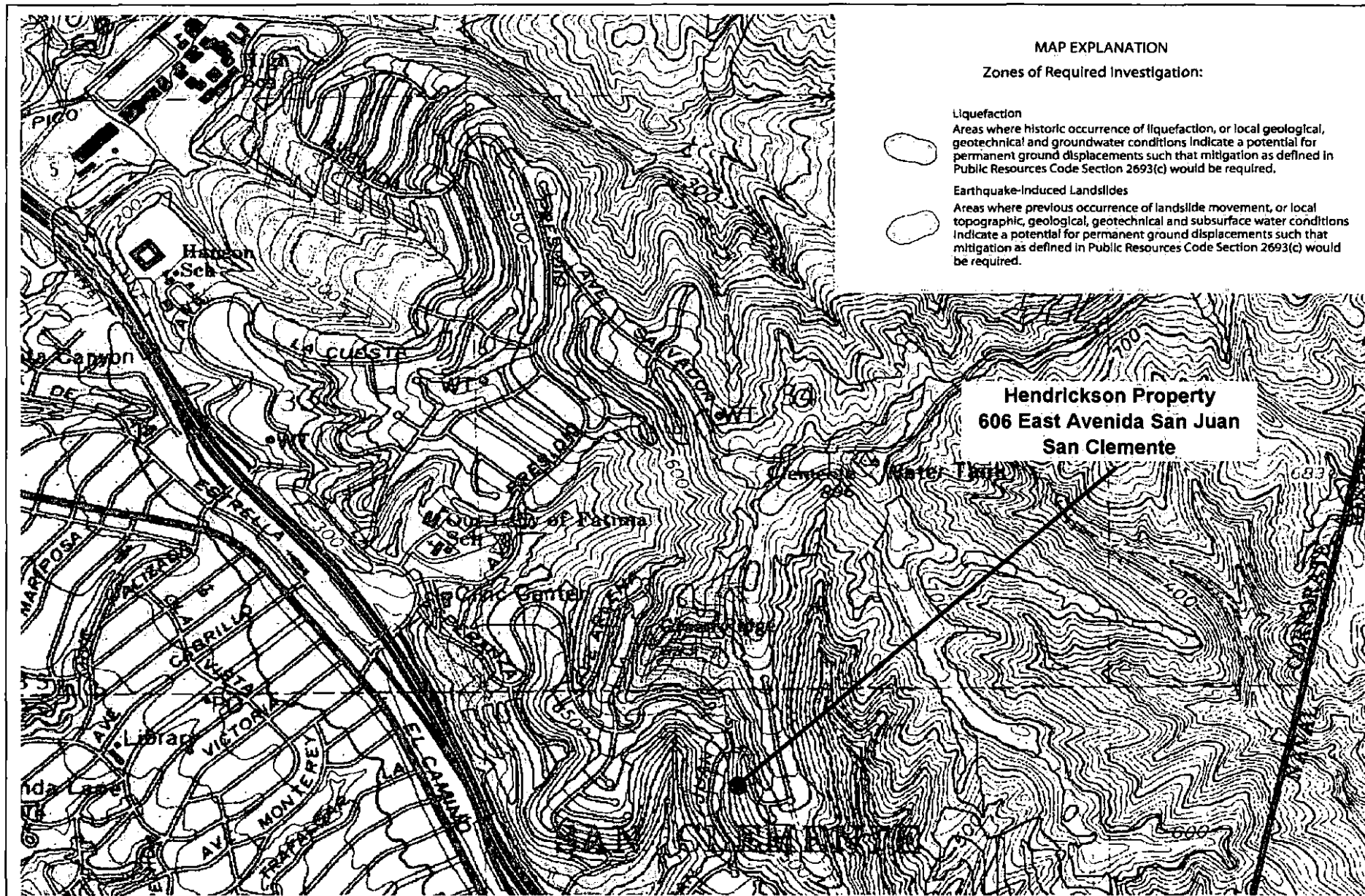
71736-00

DATE:

July 2007

FIGURE:

1



# **CDMG Seismic Hazards Map, San Clemente Quadrangle**

JOB NO.:

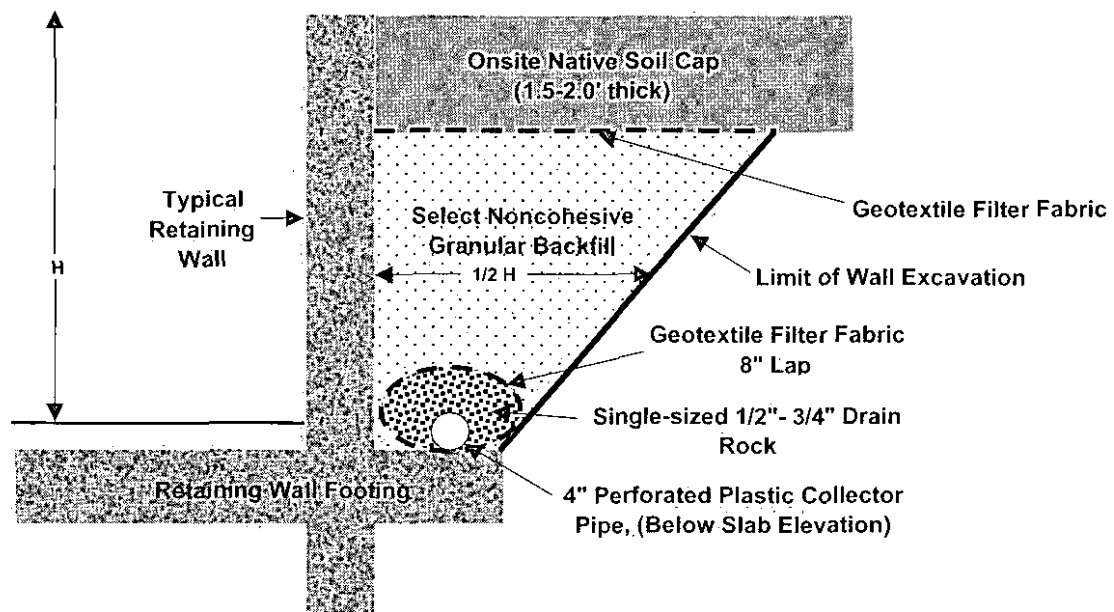
71736-00

DATE:

July 2007

FIGURE:

2

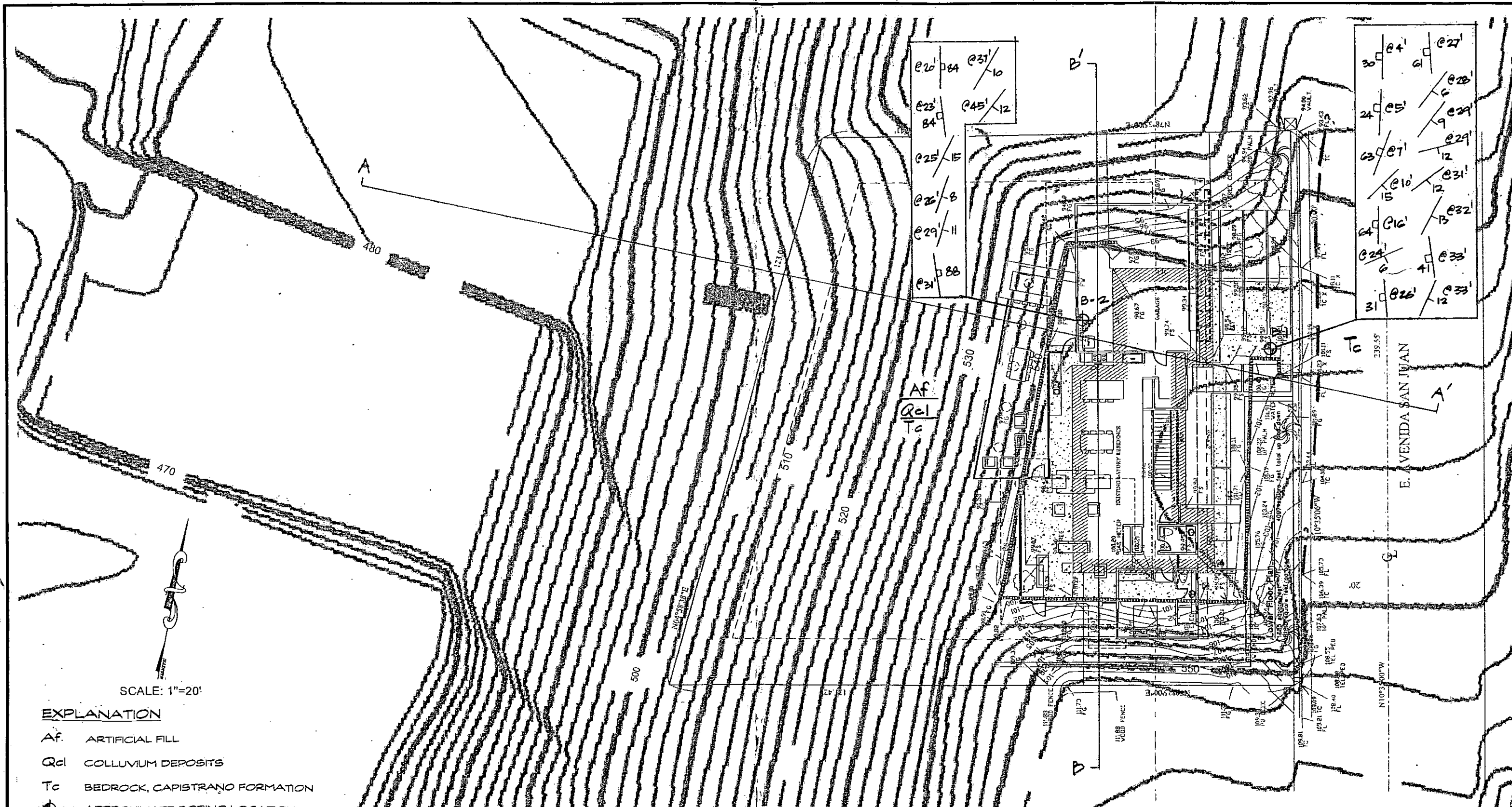


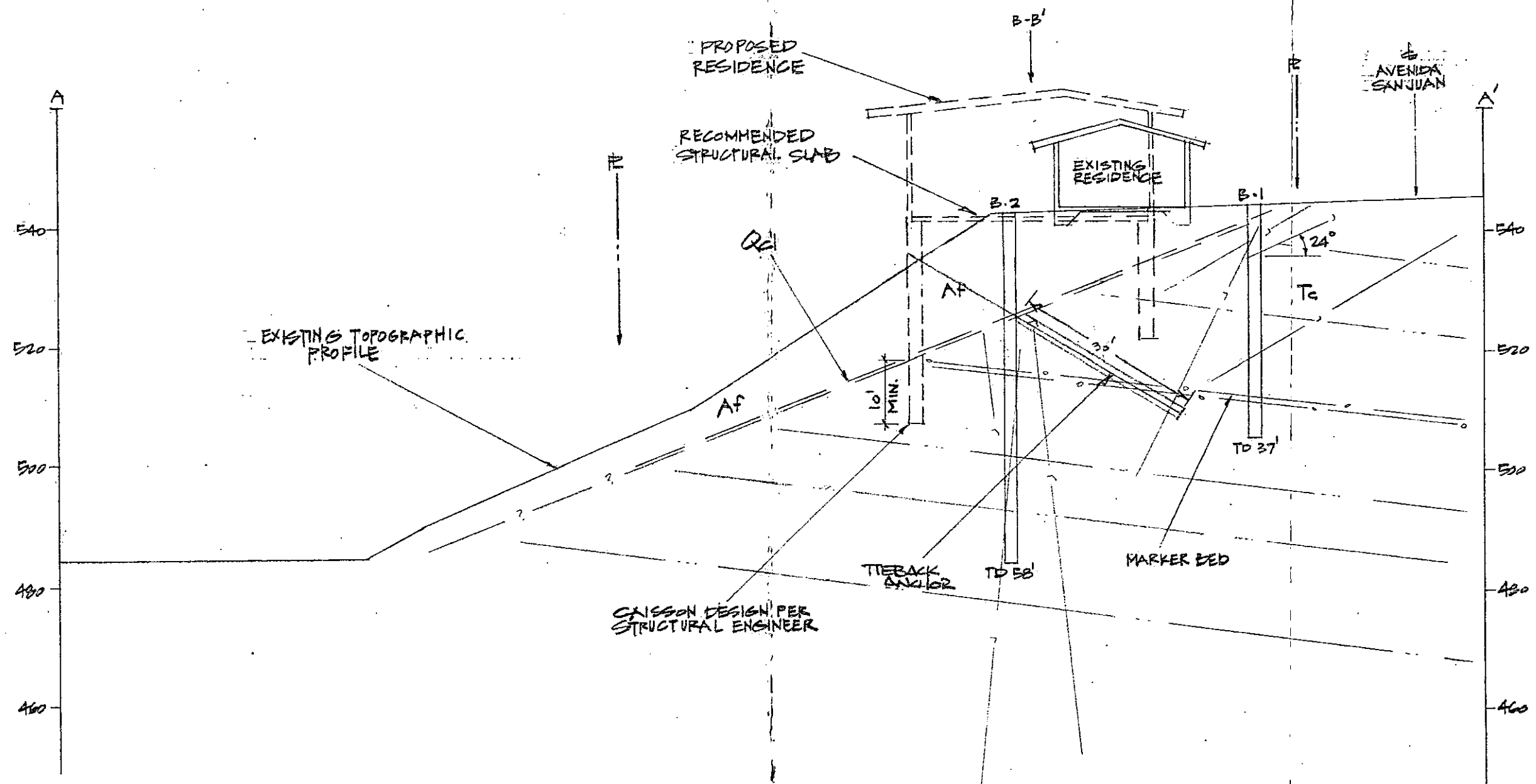
**Notes:** This system consists of a geotextile fabric-wrapped gravel envelope. Collection is with a 4-inch diameter perforated plastic pipe embedded in the gravel envelope and tied to a 4-inch diameter non-perforated plastic pipe which discharges at convenient locations. The outlet pipe should be placed such that the flow gradient is not less than 2.0 percent. The geotextile fabric-wrapped gravel envelope should be placed at a similar gradient

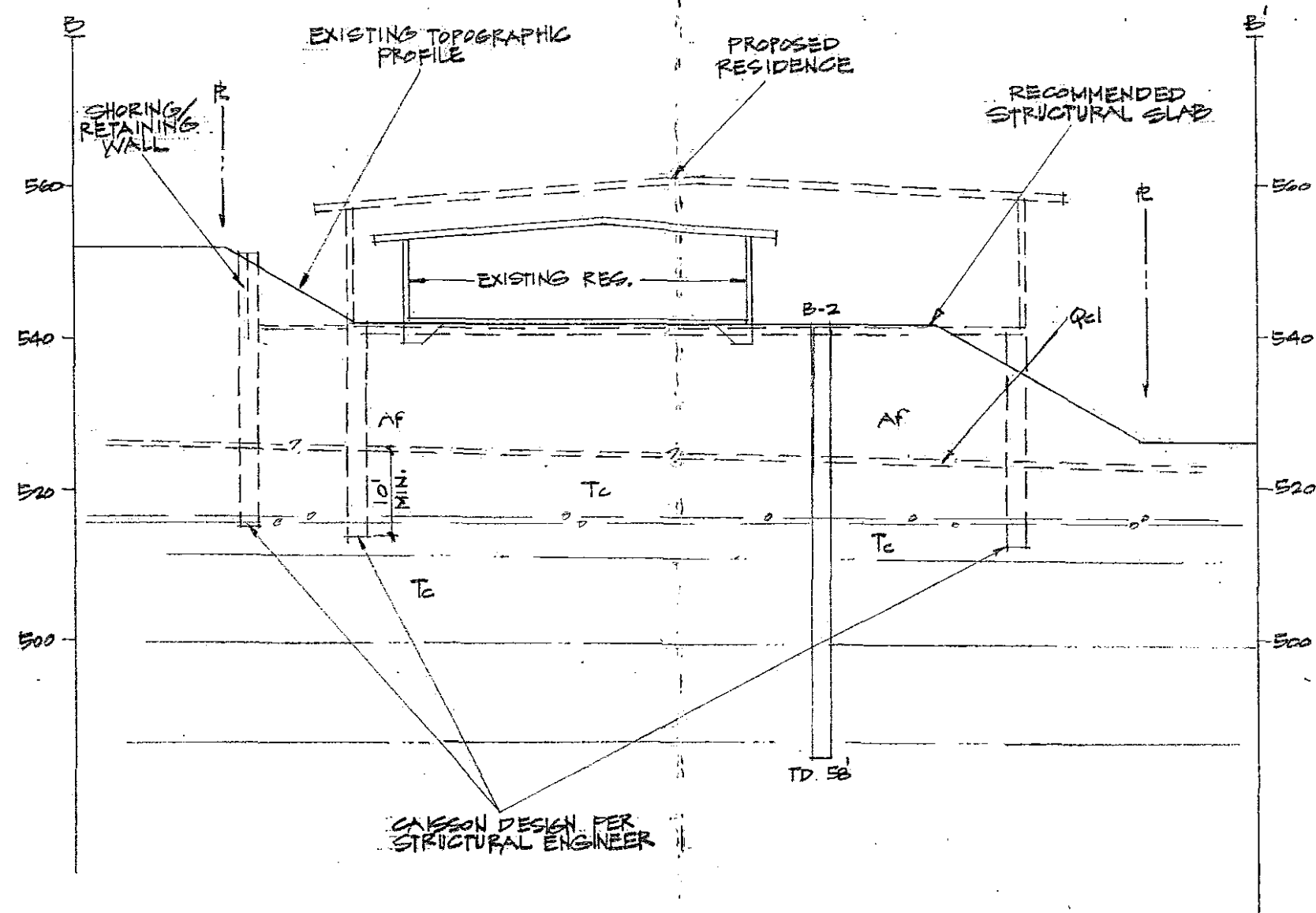
All drain pipes should be Schedule 40 PVC or ABS SDR-35. Perforations may be either bored 1/4-inch diameter holes or 3/16-inch slots placed on the bottom one-third of the pipe perimeter. If the pipe is to be bored, a minimum of 10 holes should be uniformly placed per foot of length. If slots are made, they should not exceed 2-1/2 inches in length and should not be closer than 2 inches. Total length of slots should not be less than 50 percent of the pipe length and should be uniformly spaced.

The fabric pore spaces should not exceed equivalent 30 mesh openings or be less than equivalent 100 mesh openings. The fabric should be placed such that a minimum lap of 8-inches exists at all splices.











APPENDIX A  
REFERENCES

## APPENDIX A

### REFERENCES

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APPENDIX B  
BORING LOGS

Date(s) Logged: 5/25/2007

Logged By: JLH

LOCATION: Driveway

Ground Elevation 542'

Method of Drilling: Limited Access with 24" Bucket

Drilling Company: South Coast Drilling

Drop: 30 inches

Weight(s): 140 lbs

BORING NO.: BA-1

Description

Laboratory  
Test(s)

Depth (')	Soil Classification	Blows/ft	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	Description	Laboratory Test(s)	Depth (')
0							<b>ARTIFICIAL FILL (0-1.5'):</b> Light olive tan to gray and yellow-tan clayey SILT to silty CLAY; dry to slightly moist, soft to medium stiff, scattered roots to 1/2" dia., composed of siltstone bedrock clasts.		0
1									1
2							<b>COCLOVION (1.5-2.5'):</b> Dark brown clayey SILT to silty CLAY (topsoil); medium stiff, slightly moist, hollow sound when struck by hammer, clasts in matrix of medium brown clay, scattered caliche stringers, root casts. @1.5-2.5': Bedrock contact; increased caliche along contact, indistinctly irregular contact, multiple roots to 1/4" dia.	C:N12W/32SW	2
3									3
4								J:N10W/30SW	4
5		12					<b>CAPISTRANO FORMATION (2.5-38'):</b> @2.5': Silty SANDSTONE to sandy SILTSTONE; highly weathered, closely fractured/jointed, significant jarosite precipitate, iron staining and gypsum seams along structures. @3.5-5.5': Medium gray SILTSTONE to clayey SILTSTONE; massive, scattered jarosite/iron staining, medium hard. @4': Light gray clayey SILTSTONE with indistinct and discontinuous bedding, moderate low-angle joints/fractures lined with jarosite. Attitude along joint. @5.5': Light gray clayey SILTSTONE; thinly to thickly bedded, micro thin iron staining and jarosite precipitation along bedding, medium hard, competent, local iron-stained sandstone beds. Attitude along jarosite-lined joint. @7': Attitude along joint, scattered roots continue. @8-10': Less hard, moderately disarticulated locally, increased gypsum seams along bedding. @10-15': Moist. @10': 1/2" thick red/orange iron-stained bed. @12-17': Light gray SILTSTONE; yellow jarosite lined bedding prevalent. @13': Continues oxidized light gray clayey SILTSTONE; locally gypsum and iron stained, medium hard to soft, thinly bedded. @15': Roots not observed below this depth. @15.5': Light blue-gray micaceous, fine-grained SANDSTONE beds, friable, medium hard.	J:N8W/24SW	5
6		26							6
7								J:N112E/63NE	7
8									8
9									9
10		10						B:N35E/15SE	10
11		24							11
12									12
13									13
14									14
15		13							15
16		29					@17-24': Locally soft in proximity to joints, moist, competent overall. @17': Attitude along jarosite-lined joint.	J:N11W/64SW	16
17									17
18									18
19									19
20									20

Project No.: 71736-00

LOG OF BORING

Figure No.: b1

GEOFIRM

Date(s) Logged: 5/25/2007

Logged By: JLH

Method of Drilling: Limited Access with 24" Bucket

Drilling Company: South Coast Drilling

Drop: 30 inches

Weight(s): 140 lbs

LOCATION: NW patio corner at top of slope

Ground Elevation: 542'

Depth (')	Soil Classification	Blows/ft	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	BORING NO.: BA-1 (continued)	Description	Laboratory Test(s)	Depth (')
20		13					<b>CAPISTRANO FORMATION (continued):</b> @20.5': Iron-stained <b>SANDSTONE</b> bed in sampler tip. Adjacent material consists of medium gray thinly bedded clayey <b>SILTSTONE</b> ; medium hard, micro thin iron staining along beds.			20
21		24	X							21
22										22
23							@23-24': Medium gray, hard, gypsum/iron coated joints remain present, bedding thin to thick			23
24							@24': Attitude along bedding.	B:N54E/6SE		24
25							@26.5': Attitude along one of several parallel gypsum lined joints.			25
26							@28': Medium gray clayey <b>SILTSTONE</b> to silty <b>CLAYSTONE</b> ; continued medium hard, thin bedded, locally up to 1-inch thick gypsum seams along bedding, bedding locally iron-stained, moist, Attitude along iron-banded joint.	J:N15W/31SW		26
27							@28'5": Attitude along bedding.	J:N15W/61SW		27
28							@29': Attitude along bedding.	B:N24W/36SW		28
29							@29'7": 1-inch thick orange, iron-stained, fine-grained, encircles hole, friable, thin dark laminae. Hard to medium hard, medium gray-brown clayey <b>SILTSTONE</b> above and below bed. Attitude along bed.	B:N25E/9SE B:N62E/12SE		29
30		15					@30.5': Light gray clayey <b>SILTSTONE</b> ; medium hard, thin bedded, iron-staining along bedding, competent, uniform texture.			30
31		27	X				@31'5" - 32' 1": Cream, purple and orange; medium hard, thinly bedded <b>CLAYSTONE</b> , between two blue-gray, dark fine-grained sand beds, gypsum seam along bedding above upper sand bed.	B:N40E/12SE		31
32							@32'4": unoxidized			32
33							@32.5': Bedding attitude in unoxidized zone.	B:N16E/13NW J:N19W/41SW B:N13E/12SE		33
34							@33': Attitude along banded joint. Bedrock is dark gray to black unoxidized <b>SILTSTONE</b> below 33'; hard, micaceous, platy to massive.			34
35							@35': Increased moisture.			35
36										36
37		17					@37': Dark gray to black <b>SILTSTONE</b> ; hard, micaceous, local white sandstone bioturbation.			37
38		50/5.5"	X							38
39							TOTAL DRILL DEPTH 37 FEET SAMPLED TO 38 FEET NO GROUNDWATER LOGGED TO 33.5 FEET BACKFILLED AND TAMPED			39
40										40

Project No.: 71736-00

LOG OF BORING

Figure No.: b2

GEOFIRM

Date(s) Logged: 5/24/2007

Logged By: JLH

Method of Drilling: Limited Access 24" Bucket

Drilling Company: South Coast Drilling

Drop: 30 inches

Weight(s): 140 lbs

LOCATION: Rear patio corner at top of slope

Ground Elevation: 542'

Depth (')	Soil Classification	Blows/ft	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	BORING NO.: BA-2 Description	Attitudes	Depth (')
0							<b>ARTIFICIAL FILL (0-17.5'):</b> @0-8': Light gray to olive brown <b>SILT</b> ; very dry, soft to stiff, scattered roots to 1/2" dia., clasts of dark brown residual topsoil and light tan sandy bedrock (thin layered).		0
1									1
2									2
3									3
4									4
5		12							5
6		15							6
7									7
8							@8': Light gray clayey <b>SILT</b> ; dry, scattered fine- to coarse-grained angular sandstone cobbles and pebbles, soft to stiff.		8
9									9
10		6					@13.5': Zone of dark brown to black clayey <b>SILT</b> topsoil clasts; soft to stiff, dry to slightly moist, scattered roots.		10
11		11					@13.5-17': Continued variable layers of light olive <b>SILT</b> , <b>SAND</b> and dark brown topsoil; dry to slightly moist, soft/loose to stiff/medium dense, scattered clasts of thinly bedded cemented sandstone.		11
12							@17-17.5': Base of fill consists of a 2-inch thick black clayey <b>SILT</b> (topsoil) that is stiff, slightly moist, and contains scattered sandstone cobbles and roots.		12
13									13
14							<b>COLLUVIUM (17.5-18'):</b> Dark gray-brown to black clayey <b>SILT</b> to silty <b>CLAY</b> (topsoil); soft, porous, multiple disarticulated weathered bedrock clasts, scattered fine and large roots.		14
15		6							15
16		9					<b>CAPISTRANO FORMATION (18-50'):</b> @19': Light gray and tan to olive <b>SILTSTONE</b> ; medium hard, slightly moist to moist, moderately weathered, closely fractured/jointed, jarosite, gypsum seams and iron staining common along bedding and parallel to joints (banded), local open structure (joints/fractures) 1/8 inch wide, local sandy interbeds, typically thinly to thickly bedded.		16
17									17
18									18
19									19
20									20

C:N32E/16NW

Project No.: 71736-00

LOG OF BORING

Figure No.: b3

GEOFIRM

Date(s) Logged: 5/24/2007

Logged By: JLH

LOCATION: Rear patio corner at top of slope

Ground Elevation:

Method of Drilling: Limited Access 24" Bucket

Drilling Company: South Coast Drilling

Drop: 30 inches

Weight(s): 140 lbs

Depth (')	Soil Classification	Blows/ft	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	BORING NO.: BA-2 (continued)	Description	Attitudes	Depth (')
20		12					CAPISTRANO FORMATION (continued):		J:N11W/84NE	20
21		18	X							21
22										22
23									J:N18W/84SW	23
24										24
25								@25': 1-inch thick orange <b>SANDSTONE</b> ; iron-stained, fine-grained, encircles hole, friable.	B:N14E/15SE	25
26								@26.5-27'2": Cream, purple and orange <b>BENTONITE</b> ; medium hard, thinly bedded <b>CLAYSTONE</b> , sandwiched between two blue-gray micaceous, dark, fine-grained sandstone beds, gypsum seam along bedding above upper sand bed.	B:N5E/8SE	26
27								@25-30': Scattered gypsum-lined bedding and jointing continue; locally root matted and iron stained.		27
28								@28': Bedrock consists of locally highly disarticulated/sheared clayey <b>SILTSTONE</b> in close proximity to joints; soft, moist, local gypsum seams along shears/fracture surfaces, locally polished/striated shear planes, scattered root hairs. Thin interbeds of completely iron stained yellow orange sandstone.	B:N6E/11SE	28
29								@29': Manganese Oxide staining along joint/fracture surfaces, scattered root hairs.		29
30		15						@30'3": Tan to medium orange <b>SANDSTONE</b> 1/2" thick, fine- to medium-grained, friable.		30
31		29	X					@32': Attitude on joint.	J:N19W/88NE	31
32										32
33										33
34										34
35								@37'5": Black ellipsoidal-shaped unoxidation with diffuse margins in medium gray brown clayey <b>SILTSTONE</b> to silty <b>CLAYSTONE</b> with discontinuous precipitation of cream-colored jarosite along structures.		35
36								@38'3": White to orange tan <b>SANDSTONE</b> ; cross-bedded, 1-2 inches thick, locally cemented, locally friable, micaceous, gypsum seam at base.	B:N19E/10SE	36
37								@37': Moderately disarticulated/sheared/polished, hard.		37
38								@37.5': Incipient unoxidation boundary; dark gray to black clayey <b>SILTSTONE</b> ; thickly to indistinctly thinly bedded, micaceous, medium hard.		38
39										39
40										40

Project No.: 71736-00

## LOG OF BORING

Figure No.: b4



Date(s) Logged: 5/24/2007

Logged By: JLH

LOCATION: Rear patio corner at top of slope

Ground Elevation: 542'

Method of Drilling: Limited Access 24" Bucket

Drilling Company: South Coast Drilling

Drop: 30 inches

Weight(s): 140 lbs

Depth (')	Soil Classification	Blows/ft	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	BORING NO.: BA-2 (continued)	Attitudes	Depth (')
40		20					<b>CAPISTRANO FORMATION (continued):</b> <b>@40:5':</b> Dark gray to black <b>SILTSTONE</b> ; unoxidized, hard, thickly to indistinctly thinly bedded, micaceous, local white sandstone bioturbation. <b>@40-42':</b> Black unoxidized clayey <b>SILTSTONE</b> . <b>@42':</b> Gray brown clayey <b>SILTSTONE</b> , oxidized.  <b>@43':</b> Medium to light gray <b>SILTSTONE</b> ; hard, very thinly bedded (apparent only by presence of iron/jarosite along bedding), gypsum lined joints continue.  <b>@45-45.5':</b> Distinctively vari-colored $\pm 4$ -inch thick <b>SANDSTONE-CLAYSTONE</b> ; 1- inch thick ochre-yellow-orange and iron stained reddish claystone overlain in sequence by 1/2-inch thick blue-gray micaceous fine-grained sandstone, 1-inch thick tan sandstone, and 2-inch thick blue-gray sandstone. Sequence bounded above and below by dark gray to black unoxidized <b>SILTSTONE</b> , planar bedding surface at base. <b>@47':</b> Orange-yellow iron-stained fine-grained <b>SANDSTONE</b> interbedded with medium gray <b>SILTSTONE</b> ; damp due to porosity, medium hard, well bedded, friable. <b>@48':</b> Dark gray to black <b>SILTSTONE</b> ; medium hard, discontinuous thin beds, local white sandstone bioturbation, thickly bedded, slightly moist. <b>@50':</b> Sample tip reveals complete unoxidized dark gray black clayey <b>SILTSTONE</b> to <b>SILTSTONE</b> , hard.	B:N26E/12SE	40
41		47	X						41
42									42
43									43
44									44
45									45
46									46
47									47
48									48
49									49
50		33							50
51		50/4"	X						51
52							TOTAL DRILL DEPTH 50 FEET SAMPLED TO 51 FEET NO GROUNDWATER LOGGED TO 48 FEET BACKFILLED AND TAMPED		52
53									53
54									54
55									55
56									56
57									57
58									58
59									59
60									60

Project No.: 71736-00

## LOG OF BORING

Figure No.: b5

GEOFIRM

APPENDIX C

FIELD EXPLORATION, SAMPLING, AND LABORATORY TEST RESULTS

## APPENDIX C

### FIELD EXPLORATION, SAMPLING, AND LABORATORY TEST RESULTS

#### I. Field Exploration Procedures

##### A. Field Exploration

Subsurface soils were exposed by excavation of a drilled shaft using a limited access bucket auger drilling rig. Core sampling was conducted at regular intervals as the drilling progressed. After the excavation was completed, the shafts were physically reviewed "downhole" by an Engineering Geologist. Logs of these observations are provided in Appendix B.

##### B. Sampling

###### 1. Core Samples

Core samples of subsurface materials were obtained by driving a steel barrel drive sampler with a 140 pound hammer that is raised and permitted to fall 30 inches. The sampler has an outside diameter of 3.0 inches and is lined with a series of 1-inch high brass rings having an inside diameter of 2.43 inches. A drive shoe is placed on the tip of sampler to hold the liners in place during sampling.

The samples were removed from the sample barrel in the brass rings, placed in moisture tight containers and transported to the laboratory for testing. Records of the number of blows required to effect each 12 inches of penetration were made.

###### 2. Disaggregated Samples

Large bulk samples of typical soil types were bagged from the trench spoils and were transported to the laboratory for classification and physical testing.

## II. Laboratory Testing Procedures

### A. Expansion Index Test

An expansion index was performed in accordance with UBC Standard No. 29-2. The results of the test are tabulated below:

Sample Designation:	-	BA-2 @ 0-3'
Expansion Index:	-	85
Expansion Classification:	-	Medium

### B. Atterberg Limits Test

Atterberg Limits were determined in accordance with ASTM D4318. The results are tabulated below:

Liquid <u>Limit</u>	Plastic <u>Limit</u>	Plasticity <u>Index</u>	Soil <u>Classification</u>	Sample <u>Location</u>
40	18	22	CL	BA-2 @ 0-3'

### C. Corrosivity

Sample Designation	-	BA-2 @ 0-3'
Soluble Sulfates	-	0.0219 percent
pH	-	7.4
Electrical Resistivity	-	1360 ohm-cm (saturated)

### D. Maximum Density and Optimum Moisture Determinations

Optimum moisture and maximum density were determined in accordance with Test Designation ASTM D 1557-02. These results are tabulated below:

	Optimum Moisture	Maximum Dry Density
<u>Sample Location</u>	<u>Content (%)</u>	<u>(pcf)</u>
BA-2 @ 0-3'	15.0	115.0

### E. Direct Shear Tests

Direct shear tests were performed in general accordance with ASTM D 3080 on specimens of bedrock material inundated before and during testing. The direct shear machine employed was a conventional single shear, strain-controlled device. The shearing strength parameters were obtained by fitting a straight line through

three points of peak shear strength versus total normal stress. The total normal stress range used was 2000 to 8000 pounds per square foot. Results from the tests are summarized on Figures C-1 and C-2.

F. Consolidation Tests

Incremental consolidation tests were conducted on undisturbed fill soil specimens in accordance with ASTM D2435. The test results are graphically depicted on Figure C-3 and C-4.

● = PEAK  
 ▲ = ULTIMATE

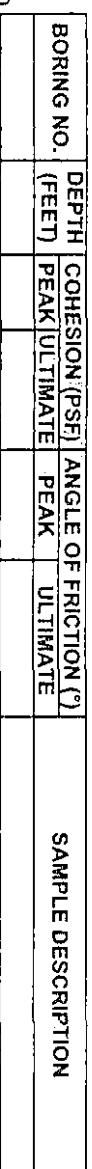


FIGURE NO.: C-1

8000

6000

4000

2000

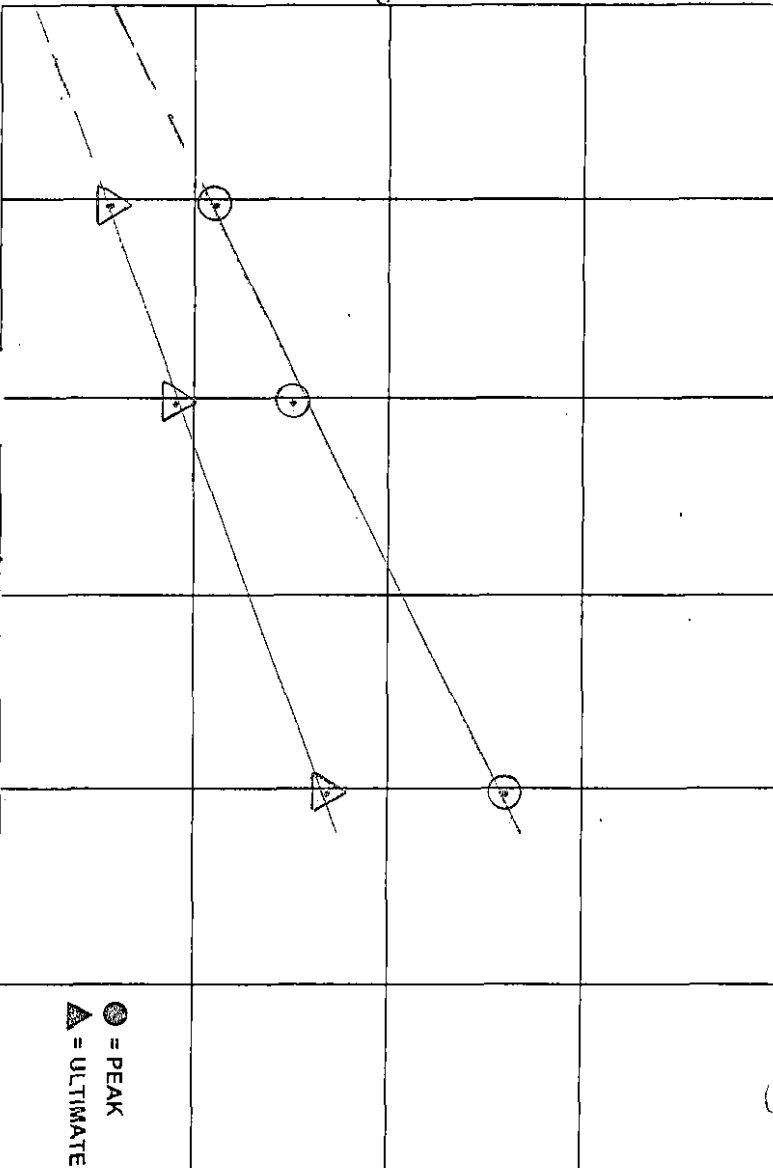
0 2000 4000 6000 8000 10000 12000

NORMAL LOAD (PSF)

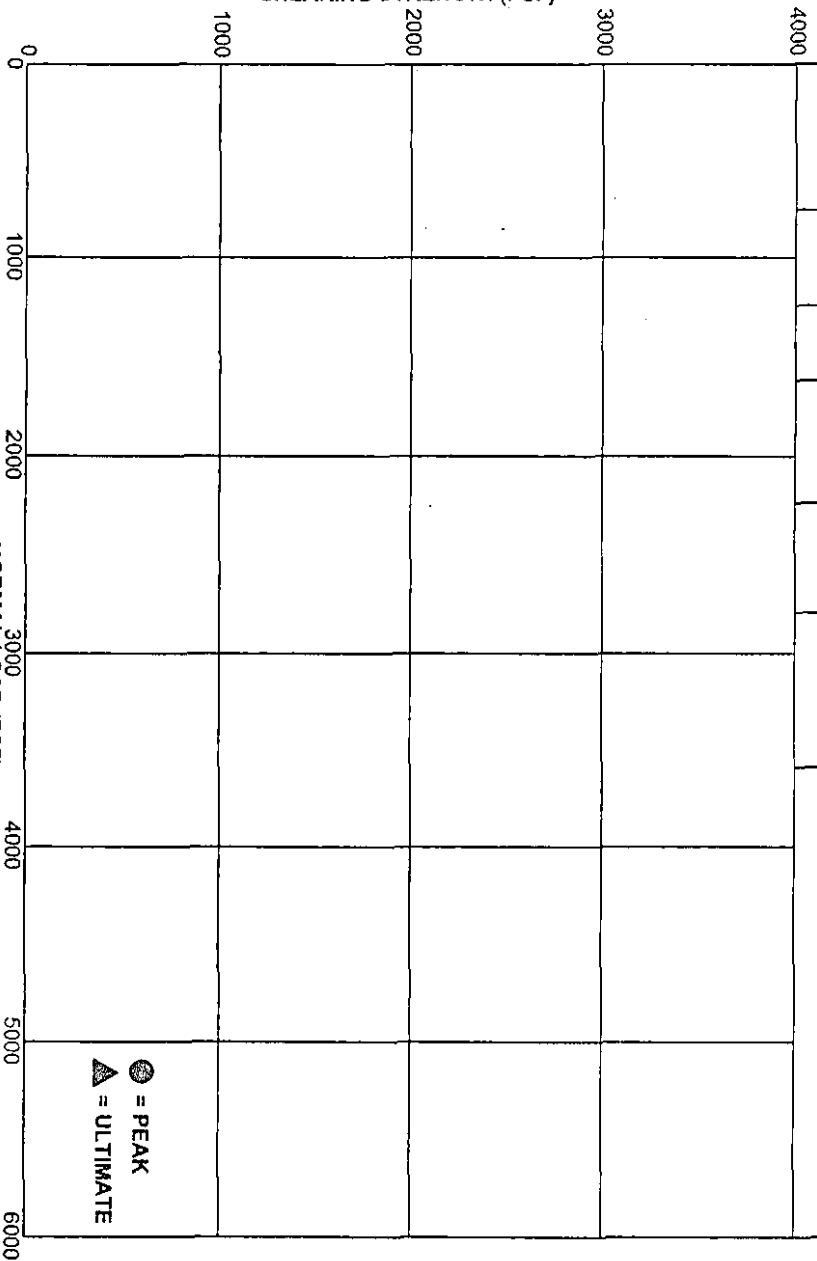
● = PEAK  
▲ = ULTIMATE

BORING NO.	DEPTH (FEET)	COHESION (PSF) PEAK	COHESION (PSF) ULTIMATE	ANGLE OF FRICTION (°) PEAK	ANGLE OF FRICTION (°) ULTIMATE	SAMPLE DESCRIPTION
BA-2	30.5'	1150	350	26	20	SC) Undisturbed - Submerged

SHEARING STRENGTH (PSF)



SHEARING STRENGTH (PSF)

● = PEAK  
▲ = ULTIMATE

BORING NO.	DEPTH (FEET)	COHESION (PSF) PEAK	COHESION (PSF) ULTIMATE	ANGLE OF FRICTION (°) PEAK	ANGLE OF FRICTION (°) ULTIMATE	SAMPLE DESCRIPTION

SM

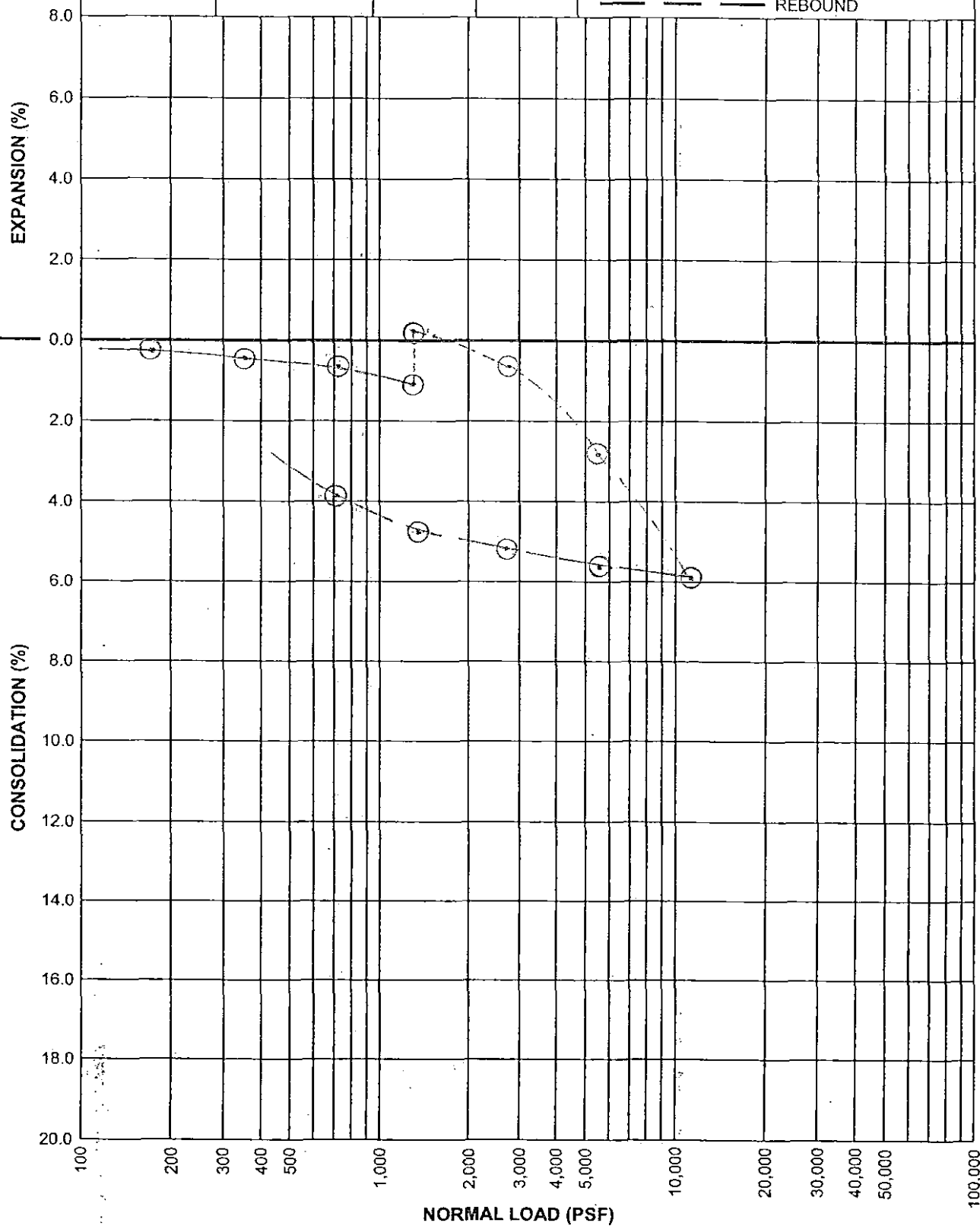
JOB NO.: 71736-00

DATE:

## SHEAR STRENGTH TEST

FIGURE NO.: C-2

BORING NO.	DEPTH (FEET)	SYMBOL	TEST NO.	EXPLANATION
BA-2	10.5'	●		FIELD MOISTURE
				SAMPLE SATURATED
				REBOUND



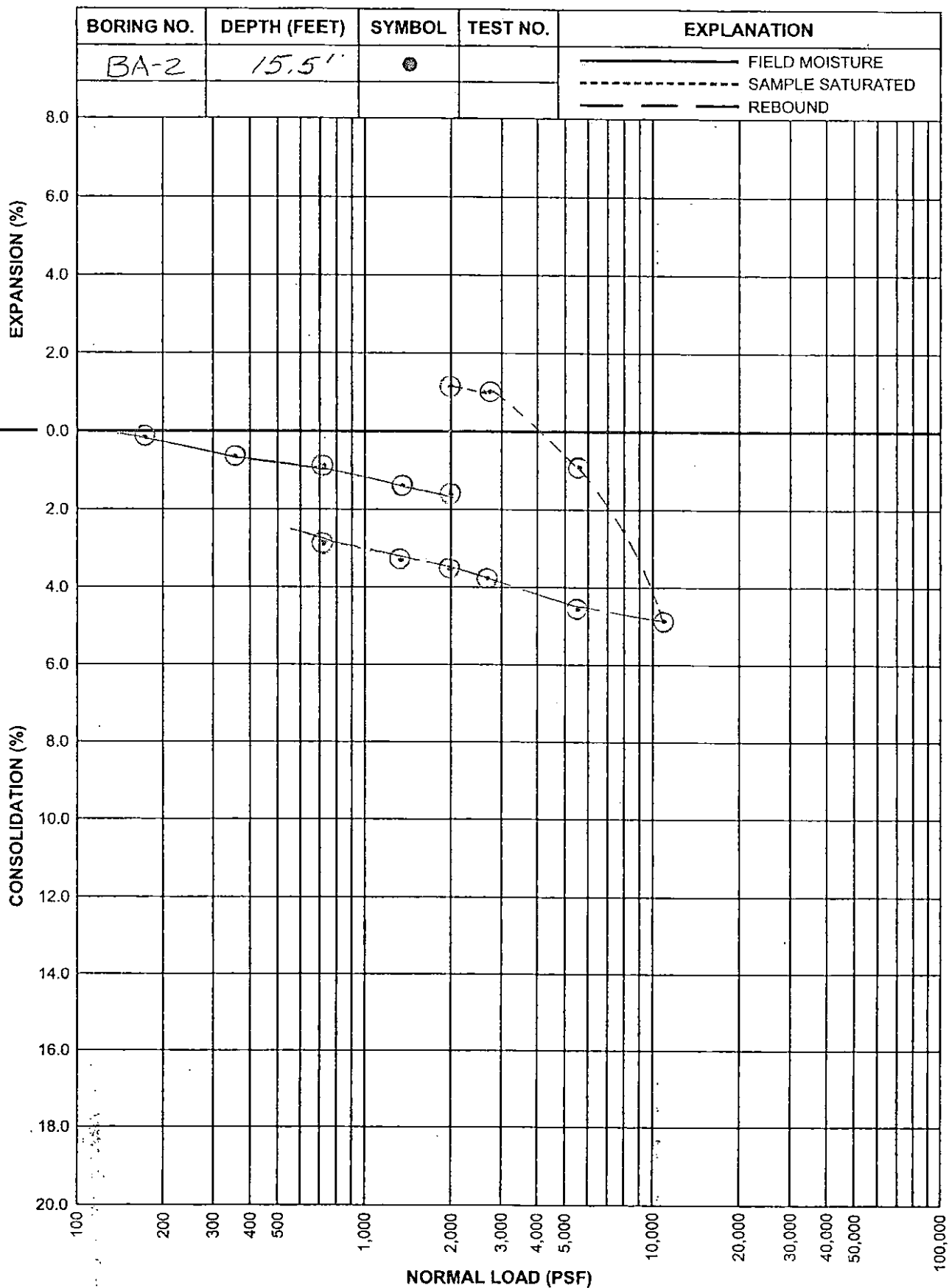
# LOAD CONSOLIDATION TEST

JOB NO.: 71736-00

DATE:

FIGURE NO.: C-3





### LOAD CONSOLIDATION TEST

JOB NO.: 71736-00

DATE:

FIGURE NO.: C4

APPENDIX D

ENGINEERING STABILITY ANALYSES

## APPENDIX D

### ENGINEERING STABILITY ANALYSES

#### GENERAL

Engineering stability analyses were performed to assess the minimum Factors of Safety (FS) against future movement of the slope located within the subject property. The analyses were performed with the actual geologic conditions.

The "GSTABL7" slope stability program (developed by Gary H. Gregory, P.E. of Gregory Geotechnical Software) in conjunction with STEDwin (a graphical User Interface developed by Harald W. Van Aller, P.E.) were utilized for the stability analyses of the slope mass. The computer program utilizes the limit equilibrium theory for the calculation of the minimum Factor of Safety (FS).

#### SHEAR STRENGTH PARAMETERS

The shear strength parameters utilized in our stability analyses are presented in Table D-1, below. These values were based on laboratory testing, local experience in similar soils and engineering judgment, and are considered reasonable and representative of the on-site materials.

**TABLE D-1  
SUMMARY OF STRENGTH PARAMETERS**

Material Type	Bulk Density $\gamma_m$ (pcf)	Bulk Density $\gamma_s$ (pcf)	Pseudostatic & Static Condition	
			Cohesion c (psf)	Friction Angle $\phi$ (deg)
Fill - Af	115	120	100	25
Capistrano Formation Bedrock - Tc - Across Bedding	120	125	700	26
Capistrano Formation Bedrock - Tc - Along Bedding	120	125	200	13

## ANALYSES

Slope stability analyses were performed for the slope located within the property using Cross Section A-A'. Based on our analyses, we recommend that a pier system providing a resisting lateral force of 20,000 lbs per lineal foot be constructed along the side of the house near the top of slope. The piers should extend a minimum of 35 feet below slab subgrade (10 feet minimum into bedrock). Analyses were made with the proposed grades. The required factors of safety (FS) were achieved with the inclusion of the pier system.

The Factor of Safety (FS) criteria adopted for verifying the adequacy of the stability of the slope for the final design are as follows:

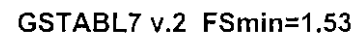
Static Conditions	–	$FS \geq 1.5$
Pseudostatic Conditions	–	$FS \geq 1.1$
Assumed Lateral Force (Seismic)	–	0.15g

The results of the analyses are presented in Table D-2 and Figures D-1 and D-2. Any revisions to the grading plans may require additional analyses and revisions to the recommendations presented herein.

**TABLE D-2**  
**SUMMARY OF STABILITY ANALYSES**

Section	Static FOS	Seismic FOS	File name	Figure No.	Comments
A-A'	1.53	1.20	a-3a	D-1.1	Circular mode. The analyses were made with the inclusion of a pier system extending a minimum of 35 feet below slab subgrade (10 feet minimum into bedrock), providing a resisting lateral force of 20,000 lbs per lineal foot.
			a-3as	D-1.2	
A-A'	1.64	1.24	a-2a	D-2.1	Circular mode. The analyses were made with the inclusion of a pier system, extend a minimum of 35 feet below slab subgrade (10 feet minimum into bedrock), providing a resisting lateral force of 20,000 lbs per lineal foot.
			a-2as	D-2.2	

j:\71736-00 hendr\ssala-3a.plt Run By: Geofirm 6/11/2007 04:18PM



## D-1.1



\*\*\* GSTABL7 \*\*\*

\*\* GSTABL7 by Garry H. Gregory, P.E. \*\*

2006 \*\* \*\* Original Version 1.0, January 1996; Current Version 2.005, Sept.

(All Rights Reserved-Unauthorized Use Prohibited)

\*\*\*\*\*  
\*

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.

(Includes Spencer & Morgenstern-Price Type Analysis)

Including Pier/Pile, Reinforcement, Soil Nail, Tieback,

Nonlinear Undrained Shear Strength, Curved Phi Envelope,

Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water

Surfaces, Pseudo-Static & Newmark Earthquake, and Applied

Forces.

\*\*\*\*\*  
\*

Analysis Run Date: 6/11/2007

Time of Run: 04:18PM

Run By: Geofirm

Input Data Filename: J:\71736-00 Hendr\SSA\a-3a.in

Output Filename: J:\71736-00 Hendr\SSA\a-3a.OUT

Unit System: English

Plotted Output Filename: J:\71736-00 Hendr\SSA\a-3a.PLT

PROBLEM DESCRIPTION: 71736-00, Hendrickson, section A-A',  
, Circular mode, static, with piers

BOUNDARY COORDINATES

10 Top Boundaries

12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	484.00	50.00	485.00	2
2	50.00	485.00	60.00	490.00	1
3	60.00	490.00	103.00	510.00	1
4	103.00	510.00	137.00	533.00	1

5	137.00	533.00	137.10	542.50	1
6	137.10	542.50	151.00	542.50	1
7	151.00	542.50	178.00	542.50	1
8	178.00	542.50	178.10	543.50	1
9	178.10	543.50	201.00	544.00	1
10	201.00	544.00	240.00	545.00	2
11	50.00	485.00	60.00	486.00	2
12	60.00	486.00	201.00	544.00	2

User Specified Y-Origin = 450.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

#### ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	115.0	120.0	100.0	25.0	0.00	0.0	0
2	120.0	125.0	0.0	0.0	0.00	0.0	0

#### ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-9.0	700.00	26.00
2	-6.0	200.00	13.00
3	90.0	700.00	26.00

#### ANISOTROPIC SOIL NOTES:

- (1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
- (2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
- (3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

1

# PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	138.00	542.50	20000.0	1.0	90.00	35.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of  
Piers/Piles  
Assuming A Uniform Distribution Of Load Horizontally Between  
Individual Piers/Piles.

1

A Critical Failure Surface Searching Method, Using A Random  
Technique For Generating Circular Surfaces, Has Been Specified.

13200 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 66 Points Equally Spaced  
Along The Ground Surface Between X = 65.00(ft)  
and X = 130.00(ft)

Each Surface Terminates Between X = 151.00(ft)  
and X = 240.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation  
At Which A Surface Extends Is Y = 450.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Evaluated. They Are  
Ordered - Most Critical First.

\* \* Safety Factors Are Calculated By The Modified Bishop Method \* \*

Total Number of Trial Surfaces Attempted = 0



Number of Trial Surfaces With Valid FS = 0

Statistical Data On All Valid FS Values:

FS Max = 0.000 FS Min = 500.000 FS Ave = NaN  
Standard Deviation = 0.000 Coefficient of Variation = NaN

%

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	87.000	502.558
2	91.989	502.883
3	96.949	503.518
4	101.859	504.463
5	106.700	505.712
6	111.454	507.262
7	116.102	509.105
8	120.625	511.236
9	125.007	513.644
10	129.229	516.322
11	133.276	519.259
12	137.131	522.443
13	140.780	525.861
14	144.208	529.501
15	147.402	533.348
16	150.350	537.387
17	153.039	541.602
18	153.536	542.500

79.873 Circle Center At X = 84.335 ; Y = 582.387 ; and Radius =

Factor of Safety  
\*\*\* 1.530 \*\*\*

Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water	Water	Tie	Tie	Earthquake		
			Force Top	Force Bot	Force Norm	Force Tan	Force Hor	Force Ver	Surcharge Load
			(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	76.000	497.442
2	80.938	498.228
3	85.845	499.186
4	90.717	500.312
5	95.546	501.607
6	100.328	503.069
7	105.056	504.695
8	109.725	506.484
9	114.329	508.434
10	118.863	510.542
11	123.321	512.806
12	127.698	515.223
13	131.988	517.791
14	136.187	520.505
15	140.290	523.363
16	144.291	526.362
17	148.185	529.498
18	151.969	532.767
19	155.637	536.165
20	159.185	539.688
21	161.828	542.500

144.268 Circle Center At X = 55.776 ; Y = 640.285 ; and Radius =

Factor of Safety  
\*\*\* 1.542 \*\*\*

1

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.000	501.628
2	89.966	502.214
3	94.897	503.041
4	99.782	504.106
5	104.610	505.407
6	109.369	506.940
7	114.048	508.703
8	118.636	510.691
9	123.122	512.899
10	127.495	515.323
11	131.746	517.955
12	135.864	520.791
13	139.839	523.824
14	143.662	527.046
15	147.325	530.450

16	150.818	534.027
17	154.133	537.770
18	157.263	541.669
19	157.866	542.500

102.979 Circle Center At X = 75.412 ; Y = 604.159 ; and Radius =

Factor of Safety  
\*\*\* 1.554 \*\*\*

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	74.000	496.512
2	78.932	497.333
3	83.833	498.326
4	88.696	499.487
5	93.516	500.818
6	98.286	502.314
7	103.002	503.976
8	107.658	505.800
9	112.247	507.785
10	116.764	509.928
11	121.205	512.226
12	125.562	514.677
13	129.832	517.279
14	134.010	520.027
15	138.089	522.918
16	142.065	525.949
17	145.934	529.117
18	149.690	532.417
19	153.330	535.845
20	156.848	539.398
21	159.714	542.500

143.957 Circle Center At X = 52.816 ; Y = 638.901 ; and Radius =

Factor of Safety  
\*\*\* 1.560 \*\*\*

1

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.000	501.163
2	88.948	501.880
3	93.867	502.778
4	98.749	503.856
5	103.589	505.113
6	108.379	506.547
7	113.113	508.156
8	117.785	509.938
9	122.388	511.890
10	126.916	514.009
11	131.364	516.294
12	135.724	518.741
13	139.992	521.346
14	144.161	524.106
15	148.226	527.017
16	152.182	530.076
17	156.022	533.278
18	159.742	536.619
19	163.337	540.094
20	165.649	542.500

135.928      Circle Center At X =    67.011 ; Y =    636.025 ; and Radius =

Factor of Safety  
\*\*\*    1.567    \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.000	495.581
2	76.908	496.539
3	81.785	497.639
4	86.628	498.881
5	91.433	500.265
6	96.195	501.789
7	100.911	503.451
8	105.576	505.250
9	110.186	507.185
10	114.738	509.254
11	119.227	511.456
12	123.650	513.788
13	128.003	516.248
14	132.282	518.834
15	136.484	521.544
16	140.604	524.377
17	144.640	527.328

18	148.588	530.396
19	152.445	533.579
20	156.206	536.873
21	159.870	540.275
22	162.129	542.500

170.744 Circle Center At X = 41.795 ; Y = 663.632 ; and Radius =

Factor of Safety  
\*\*\* 1.576 \*\*\*

1

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.000	500.698
2	87.943	501.452
3	92.849	502.418
4	97.708	503.593
5	102.513	504.977
6	107.254	506.565
7	111.923	508.356
8	116.510	510.345
9	121.007	512.530
10	125.407	514.906
11	129.700	517.469
12	133.879	520.214
13	137.937	523.135
14	141.865	526.229
15	145.657	529.488
16	149.305	532.907
17	152.803	536.480
18	156.144	540.199
19	158.039	542.500

116.374 Circle Center At X = 67.921 ; Y = 616.091 ; and Radius =

Factor of Safety  
\*\*\* 1.576 \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point	X-Surf	Y-Surf
-------	--------	--------

No.	(ft)	(ft)
1	73.000	496.047
2	77.901	497.036
3	82.774	498.156
4	87.615	499.406
5	92.422	500.783
6	97.190	502.288
7	101.917	503.919
8	106.598	505.675
9	111.231	507.556
10	115.812	509.558
11	120.339	511.682
12	124.807	513.926
13	129.214	516.287
14	133.557	518.765
15	137.833	521.358
16	142.038	524.063
17	146.169	526.879
18	150.224	529.804
19	154.200	532.836
20	158.094	535.972
21	161.903	539.211
22	165.568	542.500

187.973      Circle Center At X =    38.237 ; Y =    680.777 ; and Radius =

Factor of Safety  
 \*\*\*    1.577    \*\*\*

1

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.000	503.488
2	93.962	504.107
3	98.888	504.959
4	103.769	506.045
5	108.593	507.360
6	113.349	508.903
7	118.026	510.670
8	122.615	512.657
9	127.104	514.859
10	131.483	517.271
11	135.744	519.888
12	139.875	522.705
13	143.868	525.714
14	147.714	528.909
15	151.404	532.283

16	154.930	535.828
17	158.284	539.536
18	160.719	542.500

105.278 Circle Center At X = 78.490 ; Y = 608.240 ; and Radius =

Factor of Safety  
\*\*\* 1.577 \*\*\*

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.000	500.698
2	87.973	501.220
3	92.908	502.021
4	97.791	503.097
5	102.606	504.446
6	107.337	506.062
7	111.971	507.941
8	116.491	510.077
9	120.885	512.463
10	125.138	515.092
11	129.237	517.956
12	133.169	521.044
13	136.922	524.349
14	140.483	527.858
15	143.842	531.562
16	146.988	535.448
17	149.911	539.505
18	151.823	542.500

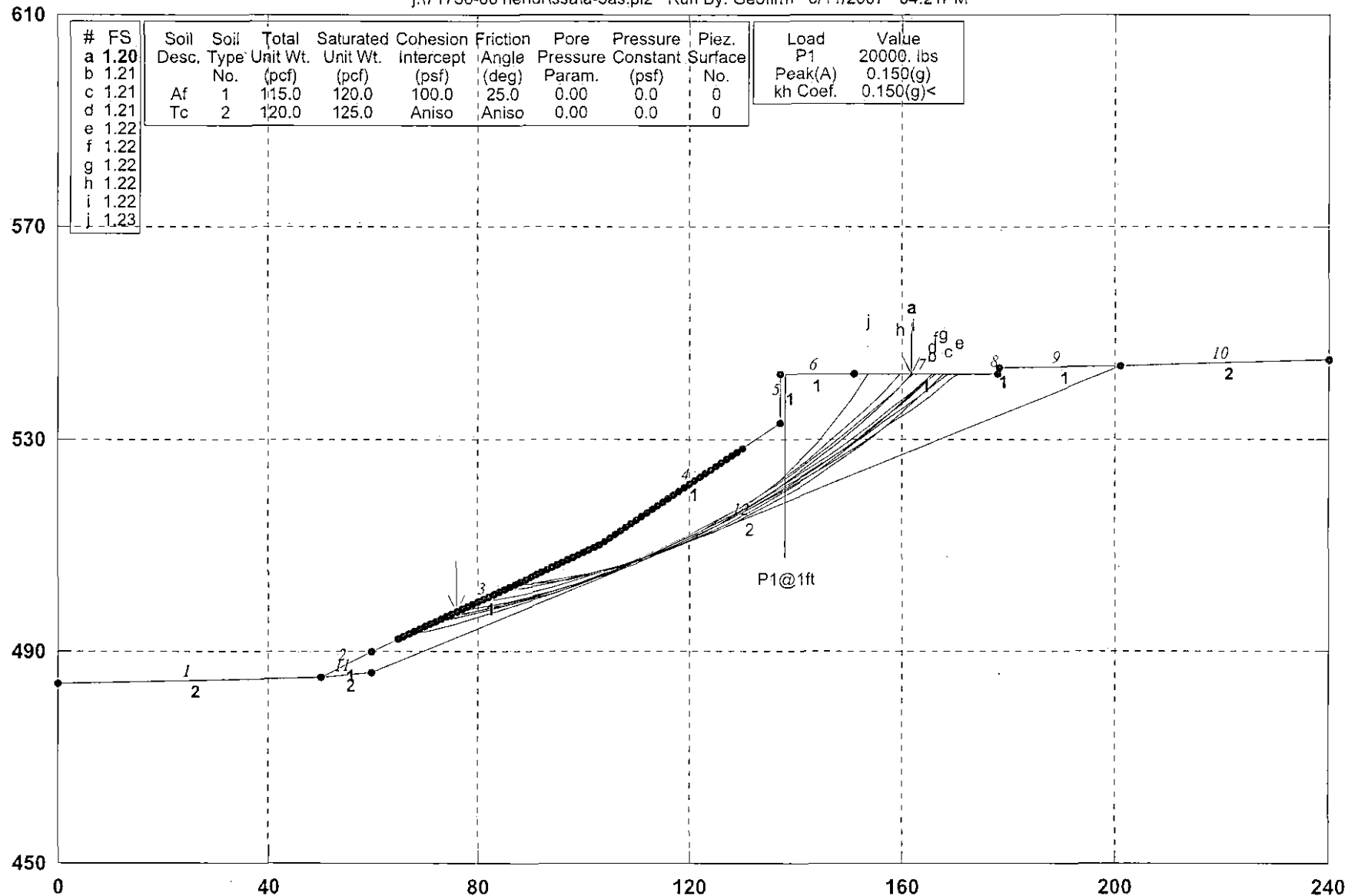
88.989 Circle Center At X = 76.213 ; Y = 589.428 ; and Radius =

Factor of Safety  
\*\*\* 1.578 \*\*\*

\*\*\*\* END OF GSTABL7 OUTPUT \*\*\*\*

# 71736-00, Hendrickson, section A-A', , Circular mode, seismic, with piers

j:\71736-00 hendr\ssala-3as.pl2 Run By: Geofirm 6/11/2007 04:21PM



GSTABL7 v.2 FSmin=1.20

Safety Factors Are Calculated By The Modified Bishop Method





\*\*\* GSTABL7 \*\*\*

\*\* GSTABL7 by Garry H. Gregory, P.E. \*\*

2006 \*\* \*\* Original Version 1.0, January 1996; Current Version 2.005, Sept.

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\*\*\*\*\*  
\*

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.

(Includes Spencer & Morgenstern-Price Type Analysis)

Including Pier/Pile, Reinforcement, Soil Nail, Tieback,

Nonlinear Undrained Shear Strength, Curved Phi Envelope,

Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water

Surfaces, Pseudo-Static & Newmark Earthquake, and Applied

Forces.

\*\*\*\*\*  
\*

Analysis Run Date: 6/11/2007  
Time of Run: 04:21PM  
Run By: Geofirm  
Input Data Filename: J:\71736-00 Hendr\SSA\A-3as.in  
Output Filename: J:\71736-00 Hendr\SSA\A-3as.OUT  
Unit System: English

Plotted Output Filename: J:\71736-00 Hendr\SSA\A-3as.PLT

PROBLEM DESCRIPTION: 71736-00, Hendrickson, section A-A',  
, Circular mode, seismic, with piers

BOUNDARY COORDINATES

10 Top Boundaries  
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	484.00	50.00	485.00	2
2	50.00	485.00	60.00	490.00	1
3	60.00	490.00	103.00	510.00	1
4	103.00	510.00	137.00	533.00	1

5	137.00	533.00	137.10	542.50	1
6	137.10	542.50	151.00	542.50	1
7	151.00	542.50	178.00	542.50	1
8	178.00	542.50	178.10	543.50	1
9	178.10	543.50	201.00	544.00	1
10	201.00	544.00	240.00	545.00	2
11	50.00	485.00	60.00	486.00	2
12	60.00	486.00	201.00	544.00	2

User Specified Y-Origin = 450.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

#### ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	115.0	120.0	100.0	25.0	0.00	0.0	0
2	120.0	125.0	0.0	0.0	0.00	0.0	0

#### ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-9.0	700.00	26.00
2	-6.0	200.00	13.00
3	90.0	700.00	26.00

#### ANISOTROPIC SOIL NOTES:

- (1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
- (2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
- (3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)  
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)  
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

#### PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	138.00	542.50	20000.0	1.0	90.00	35.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of  
Piers/Piles

Assuming A Uniform Distribution Of Load Horizontally Between  
Individual Piers/Piles.

1

A Critical Failure Surface Searching Method, Using A Random  
Technique For Generating Circular Surfaces, Has Been Specified.

13200 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 66 Points Equally Spaced  
Along The Ground Surface Between X = 65.00(ft)  
and X = 130.00(ft)

Each Surface Terminates Between X = 151.00(ft)  
and X = 240.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation  
At Which A Surface Extends Is Y = 450.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Evaluated. They Are  
Ordered - Most Critical First.

\* \* Safety Factors Are Calculated By The Modified Bishop Method \* \*

Total Number of Trial Surfaces Attempted = 0

Number of Trial Surfaces With Valid FS = 0

Statistical Data On All Valid FS Values:

FS Max = 0.000 FS Min = 500.000 FS Ave = NaN

Standard Deviation = 0.000 Coefficient of Variation = NaN

%

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf. (ft)	Y-Surf (ft)
1	76.000	497.442
2	80.938	498.228
3	85.845	499.186
4	90.717	500.312
5	95.546	501.607
6	100.328	503.069
7	105.056	504.695
8	109.725	506.484
9	114.329	508.434
10	118.863	510.542
11	123.321	512.806
12	127.698	515.223
13	131.988	517.791
14	136.187	520.505
15	140.290	523.363
16	144.291	526.362
17	148.185	529.498
18	151.969	532.767
19	155.637	536.165
20	159.185	539.688
21	161.828	542.500

144.268

Circle Center At X = 55.776 ; Y = 640.285 ; and Radius =

Factor of Safety  
\*\*\* 1.200 \*\*\*

Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water	Water	Tie	Tie	Earthquake		
			Force Top (lbs)	Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Force Hor (lbs)	Force Ver (lbs)	Surcharge Load (lbs)

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.000	501.163
2	88.948	501.880
3	93.867	502.778
4	98.749	503.856
5	103.589	505.113
6	108.379	506.547
7	113.113	508.156
8	117.785	509.938
9	122.388	511.890
10	126.916	514.009
11	131.364	516.294
12	135.724	518.741
13	139.992	521.346
14	144.161	524.106
15	148.226	527.017
16	152.182	530.076
17	156.022	533.278
18	159.742	536.619
19	163.337	540.094
20	165.649	542.500

Circle Center At X = 67.011 ; Y = 636.025 ; and Radius = 135.928

Factor of Safety  
\*\*\* 1.211 \*\*\*

1

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	66.000	492.791
2	70.871	493.918
3	75.719	495.144
4	80.540	496.468
5	85.334	497.889
6	90.098	499.408
7	94.830	501.023

8	99.528	502.734
9	104.190	504.540
10	108.815	506.441
11	113.400	508.435
12	117.944	510.522
13	122.444	512.700
14	126.899	514.970
15	131.308	517.329
16	135.667	519.778
17	139.976	522.315
18	144.232	524.938
19	148.434	527.648
20	152.580	530.443
21	156.669	533.321
22	160.698	536.281
23	164.667	539.323
24	168.572	542.445
25	168.639	542.500

Circle Center At X = 12.957 ; Y = 733.135 ; and Radius = 246.128

Factor of Safety  
\*\*\* 1.214 \*\*\*

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	73.000	496.047
2	77.901	497.036
3	82.774	498.156
4	87.615	499.406
5	92.422	500.783
6	97.190	502.288
7	101.917	503.919
8	106.598	505.675
9	111.231	507.556
10	115.812	509.558
11	120.339	511.682
12	124.807	513.926
13	129.214	516.287
14	133.557	518.765
15	137.833	521.358
16	142.038	524.063
17	146.169	526.879
18	150.224	529.804
19	154.200	532.836
20	158.094	535.972
21	161.903	539.211
22	165.568	542.500

187.973      Circle Center At X =    38.237 ; Y =    680.777 ; and Radius =

Factor of Safety  
\*\*\*      1.214      \*\*\*

1

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	71.000	495.116
2	75.879	496.208
3	80.735	497.402
4	85.564	498.698
5	90.365	500.095
6	95.135	501.593
7	99.873	503.192
8	104.576	504.889
9	109.242	506.686
10	113.869	508.580
11	118.455	510.571
12	122.999	512.659
13	127.497	514.842
14	131.948	517.119
15	136.351	519.489
16	140.703	521.951
17	145.001	524.505
18	149.245	527.148
19	153.433	529.881
20	157.562	532.701
21	161.630	535.607
22	165.637	538.598
23	169.579	541.673
24	170.594	542.500

237.197      Circle Center At X =    21.685 ; Y =    727.130 ; and Radius =

Factor of Safety  
\*\*\*      1.216      \*\*\*

Failure Surface Specified By 21 Coordinate Points

Point	X-Surf	Y-Surf
-------	--------	--------

No.	(ft)	(ft)
1	79.000	498.837
2	83.921	499.724
3	88.812	500.760
4	93.670	501.944
5	98.489	503.276
6	103.266	504.754
7	107.995	506.376
8	112.673	508.142
9	117.295	510.049
10	121.857	512.096
11	126.354	514.281
12	130.783	516.602
13	135.139	519.056
14	139.419	521.642
15	143.617	524.357
16	147.731	527.198
17	151.757	530.164
18	155.691	533.250
19	159.529	536.455
20	163.267	539.775
21	166.154	542.500

164.269 Circle Center At X = 52.332 ; Y = 660.927 ; and Radius =

Factor of Safety  
\*\*\* 1.217 \*\*\*

1

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	86.000	502.093
2	90.953	502.775
3	95.878	503.638
4	100.768	504.681
5	105.617	505.902
6	110.418	507.299
7	115.164	508.872
8	119.850	510.616
9	124.468	512.531
10	129.014	514.614
11	133.480	516.862
12	137.862	519.271
13	142.152	521.839
14	146.345	524.563
15	150.435	527.438
16	154.418	530.461



17	158.288	533.627
18	162.039	536.933
19	165.667	540.374
20	167.750	542.500

136.455 Circle Center At X = 69.886 ; Y = 637.594 ; and Radius =

Factor of Safety  
\*\*\* 1.220 \*\*\*

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	74.000	496.512
2	78.932	497.333
3	83.833	498.326
4	88.696	499.487
5	93.516	500.818
6	98.286	502.314
7	103.002	503.976
8	107.658	505.800
9	112.247	507.785
10	116.764	509.928
11	121.205	512.226
12	125.562	514.677
13	129.832	517.279
14	134.010	520.027
15	138.089	522.918
16	142.065	525.949
17	145.934	529.117
18	149.690	532.417
19	153.330	535.845
20	156.848	539.398
21	159.714	542.500

143.957 Circle Center At X = 52.816 ; Y = 638.901 ; and Radius =

Factor of Safety  
\*\*\* 1.220 \*\*\*

1

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	72.000	495.581
2	76.908	496.539
3	81.785	497.639
4	86.628	498.881
5	91.433	500.265
6	96.195	501.789
7	100.911	503.451
8	105.576	505.250
9	110.186	507.185
10	114.738	509.254
11	119.227	511.456
12	123.650	513.788
13	128.003	516.248
14	132.282	518.834
15	136.484	521.544
16	140.604	524.377
17	144.640	527.328
18	148.588	530.396
19	152.445	533.579
20	156.206	536.873
21	159.870	540.275
22	162.129	542.500

Circle Center At X = 41.795 ; Y = 663.632 ; and Radius = 170.744

Factor of Safety  
\*\*\* 1.224 \*\*\*

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	87.000	502.558
2	91.989	502.883
3	96.949	503.518
4	101.859	504.463
5	106.700	505.712
6	111.454	507.262
7	116.102	509.105
8	120.625	511.236
9	125.007	513.644
10	129.229	516.322
11	133.276	519.259
12	137.131	522.443
13	140.780	525.861
14	144.208	529.501
15	147.402	533.348

16	150.350	537.387
17	153.039	541.602
18	153.536	542.500

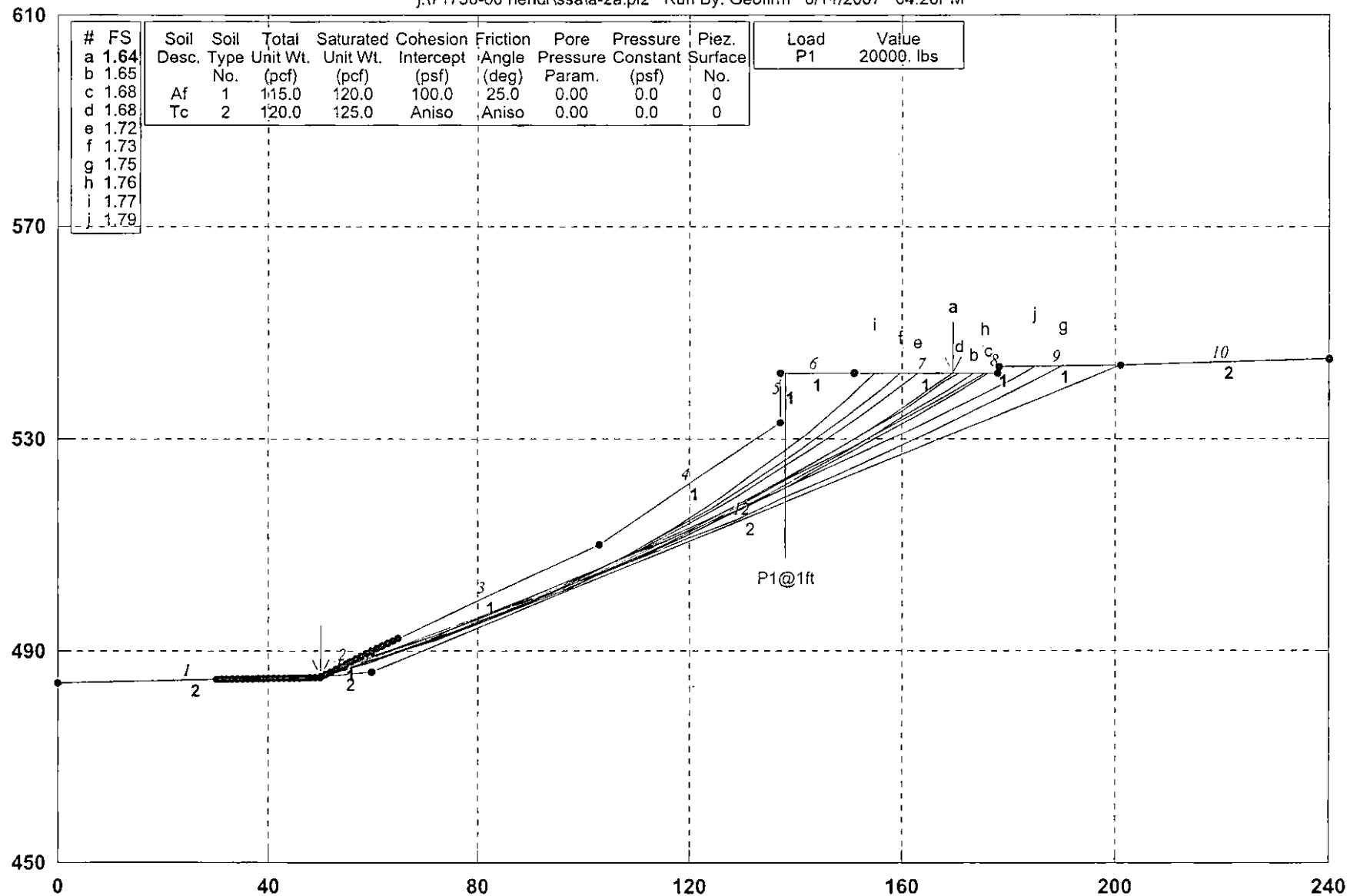
79.873 Circle Center At X = 84.335 ; Y = 582.387 ; and Radius =

Factor of Safety  
\*\*\* 1.225 \*\*\*

\*\*\*\* END OF GSTABL7 OUTPUT \*\*\*\*

# 71736-00, Hendrickson, section A-A', , Circular mode, static, with piers

j:\71736-00 hendr\ssala-2a.pl2 Run By: Geofirm 6/11/2007 04:26PM



GSTABL7 v.2 FSmin=1.64

Safety Factors Are Calculated By The Modified Bishop Method



\*\*\* GSTABL7 \*\*\*

\*\* GSTABL7 by Garry H. Gregory, P.E. \*\*

2006 \*\* \*\* Original Version 1.0, January 1996; Current Version 2.005, Sept.

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\*\*\*\*\*

\*

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.

(Includes Spencer & Morgenstern-Price Type Analysis)

Including Pier/Pile, Reinforcement, Soil Nail, Tieback,

Nonlinear Undrained Shear Strength, Curved Phi Envelope,

Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water

Surfaces, Pseudo-Static & Newmark Earthquake, and Applied

Forces.

\*\*\*\*\*

\*

Analysis Run Date: 6/11/2007  
Time of Run: 04:26PM  
Run By: Geofirm  
Input Data Filename: J:\71736-00 Hendr\SSA\a-2a.in  
Output Filename: J:\71736-00 Hendr\SSA\a-2a.OUT  
Unit System: English

Plotted Output Filename: J:\71736-00 Hendr\SSA\a-2a.PLT

PROBLEM DESCRIPTION: 71736-00, Hendrickson, section A-A',  
, Circular mode, static, with piers

BOUNDARY COORDINATES

10 Top Boundaries  
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	484.00	50.00	485.00	2
2	50.00	485.00	60.00	490.00	1
3	60.00	490.00	103.00	510.00	1
4	103.00	510.00	137.00	533.00	1

5	137.00	533.00	137.10	542.50	1
6	137.10	542.50	151.00	542.50	1
7	151.00	542.50	178.00	542.50	1
8	178.00	542.50	178.10	543.50	1
9	178.10	543.50	201.00	544.00	1
10	201.00	544.00	240.00	545.00	2
11	50.00	485.00	60.00	486.00	2
12	60.00	486.00	201.00	544.00	2

User Specified Y-Origin = 450.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

#### ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	115.0	120.0	100.0	25.0	0.00	0.0	0
2	120.0	125.0	0.0	0.0	0.00	0.0	0

#### ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-9.0	700.00	26.00
2	-6.0	200.00	13.00
3	90.0	700.00	26.00

#### ANISOTROPIC SOIL NOTES:

- (1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
- (2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
- (3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

1

PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	138.00	542.50	20000.0	1.0	90.00	35.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of  
Piers/Piles  
Assuming A Uniform Distribution Of Load Horizontally Between  
Individual Piers/Piles.

1

A Critical Failure Surface Searching Method, Using A Random  
Technique For Generating Circular Surfaces, Has Been Specified.

7200 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 36 Points Equally Spaced  
Along The Ground Surface Between X = 30.00(ft)  
and X = 65.00(ft)

Each Surface Terminates Between X = 151.00(ft)  
and X = 240.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation  
At Which A Surface Extends Is Y = 450.00(ft)

10.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Evaluated. They Are  
Ordered - Most Critical First.

\* \* Safety Factors Are Calculated By The Modified Bishop Method \* \*

Total Number of Trial Surfaces Attempted = 0

Number of Trial Surfaces With Valid FS = 0

Statistical Data On All Valid FS Values:

FS Max = 0.000 FS Min = 500.000 FS Ave = NaN  
Standard Deviation = 0.000 Coefficient of Variation = NaN

%

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	485.000
2	59.584	487.854
3	69.091	490.954
4	78.516	494.298
5	87.851	497.883
6	97.091	501.707
7	106.229	505.768
8	115.260	510.063
9	124.177	514.589
10	132.975	519.342
11	141.647	524.321
12	150.189	529.522
13	158.594	534.940
14	166.856	540.574
15	169.531	542.500

Circle Center At X = -56.054 ; Y = 858.648 ; and Radius = 388.408

Factor of Safety  
\*\*\* 1.636 \*\*\*

Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water	Water	Tie	Tie	Earthquake		
			Force Top	Force Bot	Force Norm	Force Tan	Force Hor	Force Ver	Surcharge Load
			(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
--------------	----------------	----------------



1	51.000	485.500
2	60.564	488.422
3	70.060	491.556
4	79.484	494.901
5	88.831	498.454
6	98.098	502.214
7	107.278	506.179
8	116.368	510.347
9	125.363	514.716
10	134.258	519.285
11	143.050	524.050
12	151.734	529.009
13	160.305	534.160
14	168.760	539.500
15	173.283	542.500

Circle Center At X = -75.632 ; Y = 917.051 ; and Radius = 449.747

Factor of Safety  
\*\*\* 1.649 \*\*\*

1

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.000	486.500
2	62.542	489.490
3	72.024	492.667
4	81.442	496.030
5	90.792	499.576
6	100.071	503.305
7	109.274	507.216
8	118.399	511.307
9	127.442	515.576
10	136.400	520.021
11	145.269	524.642
12	154.045	529.435
13	162.725	534.400
14	171.306	539.534
15	176.049	542.500

Circle Center At X = -94.589 ; Y = 974.209 ; and Radius = 509.551

Factor of Safety  
\*\*\* 1.678 \*\*\*

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.000	485.500
2	60.541	488.495
3	70.011	491.708
4	79.405	495.135
5	88.719	498.776
6	97.947	502.629
7	107.085	506.691
8	116.128	510.960
9	125.071	515.435
10	133.909	520.112
11	142.639	524.990
12	151.255	530.065
13	159.753	535.336
14	168.129	540.800
15	170.610	542.500

438.339 Circle Center At X = -75.524 ; Y = 905.181 ; and Radius =

Factor of Safety  
\*\*\* 1.680 \*\*\*

1

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	55.000	487.500
2	64.582	490.359
3	74.067	493.527
4	83.445	497.001
5	92.705	500.776
6	101.838	504.849
7	110.834	509.215
8	119.685	513.870
9	128.380	518.809
10	136.910	524.028
11	145.268	529.519
12	153.443	535.278
13	161.427	541.299
14	162.917	542.500

308.267      Circle Center At X =    -28.292 ; Y =    784.302 ; and Radius =

Factor of Safety  
\*\*\*    1.716    \*\*\*

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.000	485.500
2	60.603	488.291
3	70.101	491.419
4	79.483	494.879
5	88.738	498.667
6	97.853	502.779
7	106.819	507.209
8	115.622	511.952
9	124.254	517.002
10	132.702	522.352
11	140.957	527.997
12	149.007	533.928
13	156.844	540.140
14	159.616	542.500

283.199      Circle Center At X =    -23.167 ; Y =    758.814 ; and Radius =

Factor of Safety  
\*\*\*    1.729    \*\*\*

1

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.000	487.000
2	63.500	490.121
3	72.965	493.349
4	82.393	496.683
5	91.783	500.122
6	101.134	503.665
7	110.445	507.314
8	119.714	511.067
9	128.941	514.923

10	138.123	518.883
11	147.261	522.945
12	156.353	527.109
13	165.397	531.375
14	174.393	535.742
15	183.340	540.209
16	190.267	543.766

Circle Center At X = -219.313 ; Y = 1335.029 ; and Radius =  
890.985

Factor of Safety  
\*\*\* 1.749 \*\*\*

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	485.000
2	59.449	488.274
3	68.848	491.689
4	78.195	495.244
5	87.487	498.938
6	96.723	502.771
7	105.901	506.742
8	115.018	510.850
9	124.073	515.094
10	133.063	519.473
11	141.987	523.986
12	150.842	528.632
13	159.627	533.410
14	168.339	538.319
15	175.507	542.500

Circle Center At X = -164.034 ; Y = 1118.026 ; and Radius =  
668.230

Factor of Safety  
\*\*\* 1.757 \*\*\*

1

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
--------------	----------------	----------------

1	53.000	486.500
2	62.661	489.083
3	72.196	492.095
4	81.587	495.531
5	90.816	499.383
6	99.862	503.645
7	108.709	508.306
8	117.339	513.359
9	125.734	518.792
10	133.878	524.596
11	141.754	530.757
12	149.346	537.265
13	154.928	542.500

223.544 Circle Center At X = 0.106 ; Y = 703.696 ; and Radius =

Factor of Safety  
\*\*\* 1.769 \*\*\*

Failure Surface Specified By 16 Coordinate Points

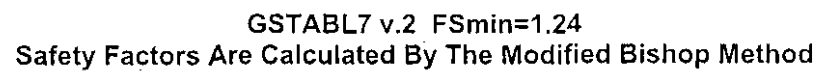
Point No.	X-Surf (ft)	Y-Surf (ft)
1	52.000	486.000
2	61.427	489.337
3	70.819	492.770
4	80.175	496.299
5	89.495	499.924
6	98.778	503.644
7	108.021	507.459
8	117.226	511.369
9	126.389	515.372
10	135.512	519.469
11	144.591	523.659
12	153.628	527.942
13	162.620	532.317
14	171.567	536.784
15	180.467	541.342
16	184.858	543.648

974.583 Circle Center At X = -268.430 ; Y = 1406.401 ; and Radius =

Factor of Safety  
\*\*\* 1.791 \*\*\*

\*\*\*\* END OF GSTABL7 OUTPUT \*\*\*\*

j:\171736-00 hendrissala-2as.pl2 Run By: Geofirm 6/11/2007 04:24PM



\*\*\* GSTABL7 \*\*\*

\*\* GSTABL7 by Garry H. Gregory, P.E. \*\*

2006 \*\* \*\* Original Version 1.0, January 1996; Current Version 2.005, Sept.

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\*

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.  
(Includes Spencer & Morgenstern-Price Type Analysis)  
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,  
Nonlinear Undrained Shear Strength, Curved Phi Envelope,  
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water  
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied

Forces.

\*\*\*\*\*  
\*

Analysis Run Date: 6/11/2007  
Time of Run: 04:24PM  
Run By: Geofirm  
Input Data Filename: J:\71736-00 Hendr\SSA\A-2as.in  
Output Filename: J:\71736-00 Hendr\SSA\A-2as.OUT  
Unit System: English

Plotted Output Filename: J:\71736-00 Hendr\SSA\A-2as.PLT

PROBLEM DESCRIPTION: 71736-00, Hendrickson, section A-A',  
, Circular mode, seismic, with piers

BOUNDARY COORDINATES

10 Top Boundaries  
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	484.00	50.00	485.00	2
2	50.00	485.00	60.00	490.00	1
3	60.00	490.00	103.00	510.00	1
4	103.00	510.00	137.00	533.00	1



5	137.00	533.00	137.10	542.50	1
6	137.10	542.50	151.00	542.50	1
7	151.00	542.50	178.00	542.50	1
8	178.00	542.50	178.10	543.50	1
9	178.10	543.50	201.00	544.00	1
10	201.00	544.00	240.00	545.00	2
11	50.00	485.00	60.00	486.00	2
12	60.00	486.00	201.00	544.00	2

User Specified Y-Origin = 450.00(ft)

Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

1

#### ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	115.0	120.0	100.0	25.0	0.00	0.0	0
2	120.0	125.0	0.0	0.0	0.00	0.0	0

#### ANISOTROPIC STRENGTH PARAMETERS

1 soil type(s)

Soil Type 2 Is Anisotropic

Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	-9.0	700.00	26.00
2	-6.0	200.00	13.00
3	90.0	700.00	26.00

#### ANISOTROPIC SOIL NOTES:

- (1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
- (2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
- (3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.150(g)  
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)  
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)

Specified Seismic Pore-Pressure Factor = 0.000

1

#### PIER/PILE LOAD(S)

1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	138.00	542.50	20000.0	1.0	90.00	35.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of  
Piers/Piles

Assuming A Uniform Distribution Of Load Horizontally Between  
Individual Piers/Piles.

1

A Critical Failure Surface Searching Method, Using A Random  
Technique For Generating Circular Surfaces, Has Been Specified.

7200 Trial Surfaces Have Been Generated.

200 Surface(s) Initiate(s) From Each Of 36 Points Equally Spaced  
Along The Ground Surface Between X = 30.00(ft)  
and X = 65.00(ft)

Each Surface Terminates Between X = 151.00(ft)  
and X = 240.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation  
At Which A Surface Extends Is Y = 450.00(ft)

10.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial  
Failure Surfaces Evaluated. They Are  
Ordered - Most Critical First.

\* \* Safety Factors Are Calculated By The Modified Bishop Method \* \*

Total Number of Trial Surfaces Attempted = 0

Number of Trial Surfaces With Valid FS = 0

Statistical Data On All Valid FS Values:

FS Max = 0.000 FS Min = 500.000 FS Ave = NaN

Standard Deviation = 0.000 Coefficient of Variation = NaN

%

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.000	485.500
2	60.564	488.422
3	70.060	491.556
4	79.484	494.901
5	88.831	498.454
6	98.098	502.214
7	107.278	506.179
8	116.368	510.347
9	125.363	514.716
10	134.258	519.285
11	143.050	524.050
12	151.734	529.009
13	160.305	534.160
14	168.760	539.500
15	173.283	542.500

Circle Center At X = -75.632 ; Y = 917.051 ; and Radius = 449.747

Factor of Safety  
\*\*\* 1.236 \*\*\*

Individual data on the 0 slices

Slice No.	Width (ft)	Weight (lbs)	Water	Water	Tie	Tie	Earthquake		Surcharge Load (lbs)
			Force Top (lbs)	Force Bot (lbs)	Force Norm (lbs)	Force Tan (lbs)	Force Hor (lbs)	Force Ver (lbs)	

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	485.000
2	59.584	487.854
3	69.091	490.954
4	78.516	494.298
5	87.851	497.883
6	97.091	501.707
7	106.229	505.768
8	115.260	510.063
9	124.177	514.589
10	132.975	519.342
11	141.647	524.321
12	150.189	529.522
13	158.594	534.940
14	166.856	540.574
15	169.531	542.500

388.408 Circle Center At X = -56.054 ; Y = 858.648 ; and Radius =

Factor of Safety  
\*\*\* 1.238 \*\*\*

1

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.000	486.500
2	62.542	489.490
3	72.024	492.667
4	81.442	496.030
5	90.792	499.576
6	100.071	503.305
7	109.274	507.216
8	118.399	511.307
9	127.442	515.576
10	136.400	520.021
11	145.269	524.642
12	154.045	529.435
13	162.725	534.400
14	171.306	539.534
15	176.049	542.500

509.551 Circle Center At X = -94.589 ; Y = 974.209 ; and Radius =

Factor of Safety  
\*\*\* 1.249 \*\*\*

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	54.000	487.000
2	63.500	490.121
3	72.965	493.349
4	82.393	496.683
5	91.783	500.122
6	101.134	503.665
7	110.445	507.314
8	119.714	511.067
9	128.941	514.923
10	138.123	518.883
11	147.261	522.945
12	156.353	527.109
13	165.397	531.375
14	174.393	535.742
15	183.340	540.209
16	190.267	543.766

Circle Center At X = -219.313 ; Y = 1335.029 ; and Radius =  
890.985

Factor of Safety  
\*\*\* 1.263 \*\*\*

1

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	51.000	485.500
2	60.541	488.495
3	70.011	491.708
4	79.405	495.135
5	88.719	498.776
6	97.947	502.629
7	107.085	506.691
8	116.128	510.960
9	125.071	515.435

10	133.909	520.112
11	142.639	524.990
12	151.255	530.065
13	159.753	535.336
14	168.129	540.800
15	170.610	542.500

438.339 Circle Center At X = -75.524 ; Y = 905.181 ; and Radius =

Factor of Safety  
\*\*\* 1.268 \*\*\*

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	485.000
2	59.449	488.274
3	68.848	491.689
4	78.195	495.244
5	87.487	498.938
6	96.723	502.771
7	105.901	506.742
8	115.018	510.850
9	124.073	515.094
10	133.063	519.473
11	141.987	523.986
12	150.842	528.632
13	159.627	533.410
14	168.339	538.319
15	175.507	542.500

668.230 Circle Center At X = -164.034 ; Y = 1118.026 ; and Radius =

Factor of Safety  
\*\*\* 1.309 \*\*\*

1

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	52.000	486.000

2	61.427	489.337
3	70.819	492.770
4	80.175	496.299
5	89.495	499.924
6	98.778	503.644
7	108.021	507.459
8	117.226	511.369
9	126.389	515.372
10	135.512	519.469
11	144.591	523.659
12	153.628	527.942
13	162.620	532.317
14	171.567	536.784
15	180.467	541.342
16	184.858	543.648

Circle Center At X = -268.430 ; Y = 1406.401 ; and Radius = 974.583

Factor of Safety  
\*\*\* 1.309 \*\*\*

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	50.000	485.000
2	59.379	488.469
3	68.741	491.984
4	78.085	495.545
5	87.412	499.153
6	96.721	502.806
7	106.011	506.506
8	115.283	510.252
9	124.536	514.044
10	133.770	517.881
11	142.986	521.765
12	152.182	525.693
13	161.358	529.668
14	170.514	533.688
15	179.651	537.753
16	188.767	541.863
17	193.066	543.827

Circle Center At X = -645.421 ; Y = 2379.843 ; and Radius = 2018.425

Factor of Safety  
\*\*\* 1.320 \*\*\*

## Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	55.000	487.500
2	64.582	490.359
3	74.067	493.527
4	83.445	497.001
5	92.705	500.776
6	101.838	504.849
7	110.834	509.215
8	119.685	513.870
9	128.380	518.809
10	136.910	524.028
11	145.268	529.519
12	153.443	535.278
13	161.427	541.299
14	162.917	542.500

Circle Center At X = -28.292 ; Y = 784.302 ; and Radius =  
308.267

Factor of Safety  
\*\*\* 1.323 \*\*\*

## Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	53.000	486.500
2	62.425	489.842
3	71.805	493.308
4	81.139	496.896
5	90.425	500.606
6	99.662	504.438
7	108.848	508.391
8	117.981	512.464
9	127.060	516.656
10	136.083	520.967
11	145.048	525.396
12	153.955	529.943
13	162.801	534.605
14	171.586	539.384
15	177.140	542.500



Circle Center At X = -197.070 ; Y = 1206.653 ; and Radius =  
762.335

Factor of Safety  
\*\*\* 1.335 \*\*\*

\*\*\*\* END OF GSTABL7 OUTPUT \*\*\*\*

APPENDIX E

STANDARD GRADING GUIDELINES

## APPENDIX E

### STANDARD GRADING GUIDELINES

#### GENERAL

These Guidelines present the usual and minimum requirements for grading operations inspected by Geofirm or its designated representative. No deviation from these guidelines will be allowed, except where specifically superseded in the geotechnical report signed by a registered geotechnical engineer.

The placement, spreading, mixing, watering and compaction of the fills in strict accordance with these guidelines shall be the sole responsibility of the contractor. The construction, excavation, and placement of fill shall be under the direct observation of the geotechnical engineer or any person or persons employed by the licensed geotechnical engineer signing the soils report. If unsatisfactory soil-related conditions exist, the geotechnical engineer shall have the authority to reject the compacted fill ground and, if necessary, excavation equipment will be shut down to permit completion of compaction. Conformance with these specifications will be discussed in the final report issued by the geotechnical engineer.

#### SITE PREPARATION

All brush, vegetation and other deleterious material such as rubbish shall be collected, piled and removed from the site prior to placing fill, leaving the site clear and free from objectionable material.

Soil, alluvium, or rock materials determined by the geotechnical engineer as being unsuitable for placement in compacted fills shall be removed from the site. Any material incorporated as part of a compacted fill must be approved by the geotechnical engineer.

The surface shall then be plowed or scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used. After the area to receive fill has been cleared and scarified, it shall be disced or bladed by the contractor until it is uniform and free from large clods, brought to the proper moisture content and compacted to minimum requirements. If the scarified zone is greater than 12 inches in depth, the excess shall be removed and placed in lifts restricted to 6 inches.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines or others not located prior to grading are to be removed or treated in a manner prescribed by the geotechnical engineer.

## **MATERIALS**

Materials for compacted fill shall consist of materials approved by the geotechnical engineer. These materials may be excavated from the cut area or imported from other approved sources, and soils from one or more sources may be blended. Fill soils shall be free from organic vegetable matter and other unsuitable substances. Normally, the material shall contain no rocks or hard lumps greater than 6 inches in size and shall contain at least 50 percent of material smaller than 1/4-inch in size. Materials greater than 4 inches in size shall be placed so that they are completely surrounded by compacted fines; no nesting of rocks shall be permitted. No material of a perishable, spongy, or otherwise of an unsuitable nature shall be used in the fill soils.

Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the geotechnical engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the geotechnical engineer as soon as possible.

## **PLACING, SPREADING, AND COMPACTING FILL MATERIAL**

The material used in the compacting process shall be evenly spread, watered, processed and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer.

When the moisture content of the fill material is below that specified by the geotechnical engineer, water shall be added by the contractor until the moisture content is near optimum as specified.

When the moisture content of the fill material is above that specified by the geotechnical engineer, the fill material shall be aerated by the contractor by blading, mixing, or other satisfactory methods until the moisture content is near optimum as specified.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to 90 percent of the maximum laboratory density in compliance with ASTM D: 1557 (five layers). Compaction shall be accomplished by sheepfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes to obtain the desired density uniformly.

A minimum relative compaction of 90 percent out to the finished slope face of all fill slopes will be required. Compacting of the slopes shall be accomplished by backrolling the slopes in increments of 2 to 5 feet in elevation gain or by overbuilding and cutting back to the compacted inner core, or by any other procedure which produces the required compaction.

### **GRADING INSPECTIONS**

The geotechnical engineer shall inspect the placement of fill during the grading process and will file a written report upon completion of grading stating his observations as to compliance with these specifications.

One density test shall be required for each 2 vertical feet of fill placed, or one for each 1,000 cubic yards of fill, whichever requires the greater number of tests.

Any cleanouts and processed ground to receive fill must be inspected by the geotechnical engineer and/or engineering geologist prior to any fill placement. The contractor shall notify the geotechnical engineer when these areas are ready for inspection.

### **PROTECTION OF WORK**

During the grading process and prior to the complete construction of permanent drainage controls, it shall be the responsibility of the contractor to provide good drainage and prevent ponding of water and damage to adjoining properties or to finished work on the site.

After the geotechnical engineer has terminated his inspections of the completed grading, no further excavations and/or filling shall be performed without the approval of the geotechnical engineer, if it is to be subject to the recommendations of this report.

APPENDIX F

UTILITY TRENCH BACKFILL GUIDELINES

## APPENDIX F

### UTILITY TRENCH BACKFILL GUIDELINES

The following guidelines pertinent to utility trench backfills have been adopted by the County of Orange, Environmental Management Agency Grading Section, effective March 31, 1986. The application of the guidelines is strictly enforced by the County reviewers and inspectors.

1. Each utility subcontractor (gas, electric, water, sewer, telephone, cable TV, irrigation, drainage, etc.) shall submit to the developer for dissemination to his consultants (civil engineer, geotechnical engineer, and utility contractor) a plot plan of all utility lines installed under his purview which identifies line type, material, size, depth, and approximate location.
2. The developer or his agent shall provide a composite plot plan of all utilities or a copy of all individual utility plot plans to his geotechnical engineer for use in evaluating whether all utility trench backfills are suitable for the intended use.
3. The geotechnical engineer shall provide the County with a report which includes a plot plan showing the location of all utility trenches which:
  - A. Are located within the load influence zone of a structure (1:1 projection)
  - B. Are located beneath any hardscape
  - C. Are parallel and in close proximity to the top or toe of a slope and may adversely impact slope stability if improperly backfilled
  - D. Are located on the face of a slope in a trench 18 or more inches in depth.

Typically, trenches that are less than 18 inches in depth will not be within the load influence zone if located next to a structure, and will not have a significant effect on slope stability if constructed near the top or toe of a slope and need not be shown on the plot plan unless determined to be significant by the geotechnical engineer. This plot plan may be prepared by someone other than the geotechnical engineer, but must meet his approval.

4. Backfill compaction test locations must be shown on the plot plan described in No. 3 above, and a table of test data provided in the geotechnical report.
5. The geotechnical report (utility trench backfill) must state that all utility trenches within the subject lots have been backfilled in a manner suitable for the intended use. This includes the backfill of all trenches shown on the plot plan described in No. 3 and the backfill of those trenches which did not need to be plotted on this plan.

APPENDIX G

MAINTENANCE OF HILLSIDE PROPERTIES



## APPENDIX G

### MAINTENANCE OF HILLSIDE HOME SITES

Sites graded in hillsides require maintenance and repair of slopes and drainage. The City of Los Angeles, Department of Building and Safety has published a Homeowner's Guide (June 1974) containing "Recommendations for Maintenance of Graded Sites," which are pertinent to all graded sites:

"It is incumbent upon the hillside property owner to maintain his property in a manner which will assure the continued stability of the property. The following are recommendations regarding slope and yard maintenance in graded hillside areas:

1. Maintain existing slope planting, provide new approved planting where indicated, and maintain irrigation systems in working order.
2. Maintain paved diverter terraces, interceptor terraces, downdrains, appurtenances such as inlets, and velocity reducer structures in a clean condition and in good repair.
3. Earth berms prevent water from flowing over slope. It is important that these berms be maintained.
4. Standing storm water on the pad area directly above the descending slopes, whether natural, cut or fill, is a major contributor toward slope failure. It is important that the pad drainage be maintained at a minimum of 2 percent to the street or other approved location to prevent this situation.
5. Side swales which direct water around the house should be maintained so that they will not become ineffective.
6. Catch basins, grates, and subsurface drainage piping should be kept free of silt and debris.
7. Roof gutters and downspouts should be inspected periodically to assure that they are not broken or clogged. All non-erosive drainage devices should be kept clean and in good repair.
8. Extensive landscaping or revision to the property may seriously alter the surface drainage pattern. When landscaping, homeowners should avoid disrupting flow patterns created when the property was original graded. It should be remembered that normal property drainage in hillside areas is from the rear yard to the street. Some properties drain to natural water courses.
9. Any problems such as erosion should be repaired immediately in order that more serious problems may be averted.
10. Rodent activity should be controlled to prevent water penetration and loosening of the soil.
11. Care should be exercised to prevent loose fill from being placed on a grading site, especially on slopes."