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GEOTECHNICAL FEASIBILITY INVESTIGATION
NEWPORT/BANNING RANCH PROJECT,
COUNTY OF ORANGE, CALIFORNIA

Prepared for:

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October 8, 1993

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1.0 EXECUTIVE SUMMARY

This feasibility report is intended to provide general geologic and geotechnical recommendations to be used in the planning and preliminary design of the residential/commercial development of the West Newport Oil Company property. The property is located predominantly in unincorporated territory of the County of Orange, California and partially in the City of Newport Beach.

The project is considered feasible from a geotechnical viewpoint. Listed below are the major geotechnical concerns that will require correction and/or consideration during design and construction:

1) Groundwater, liquefaction and settlement during lowland development.
2) Natural slope stability and setbacks.
3) Cut and fill slope stability.
4) Possible active fault (North Branch Fault) and setbacks.
5) Environmental remediation of oil production facilities.
6) Fill placement against existing crib walls.
7) Geotechnical issues associated with the abandonment of oil production facilities.
8) Mitigation of hydro-collapse potential of some site soils.

2.0 INTRODUCTION

2.1 Background and Purpose

The project site is currently used for oil and gas exploration and production. Long range development plans call for the abandonment of oil production facilities and the development of both residential and commercial building sites within the upper mesa and the restoration of the lower wetlands area. Three previous geotechnical investigations have been conducted onsite (references).

The purpose of this firm's field investigation was to obtain fundamental geologic/geotechnical information to assess the feasibility of developing the site with regard to natural, cut and fill slope stability, natural bluff slope erosion, liquefaction potential, unsuitable soil removals and engineering and excavation characteristics of the site materials. Analysis of the data obtained in the field and laboratory test results provide the basis for this firm's recommendations for site preparation and grading, subsurface drainage, compaction standards and preliminary structural design criteria. It was not this firm's intention to duplicate the efforts of the previous studies but to review those reports in order to provide an opinion on the adequacy of their conclusion and supplement.

2.2 Scope of Study

The scope of this study consisted of the following tasks:

1) Drilling and sampling of seven (7) bucket auger borings.
2) Drilling and sampling of two (2) hollow stem auger borings.
3) One day of field mapping.
4) Laboratory analyses of field samples.
5) Transfer of existing and new geotechnical data on to 200-scale conceptual development and construction of geotechnical cross sections.
6) Feasibility analyses of areas of geotechnical concern within the project.

7) Preparation of this report to consolidate previous data and present geotechnical conclusions relative to the future development of the site.

2.3 Report Structure

The main text of this report is divided into the following sections. Executive Summary, Introduction, Project Description, Field and Laboratory Investigations, Geologic Conditions, Geotechnical Conclusions, Closure, and References. Included with this report are the following appendices.

A - Field Investigation
B - Laboratory Testing
C - Slope Stability Results
D - Grading Details

Accompanying this report is a base topographic map prepared by Fuscoe Engineering (Plate 1) that presents site geology; boring locations, geologic data from the borings, and a compilation of previous work by others.

2.4 Report Limitations

The conclusions and recommendations in this report are based on the data developed during the current field investigation, and on a review of the referenced reports. Specifically excluded from this report is any evaluation of the environmental concerns associated with the present and past oil operations and their abandonment. Those evaluations should be provided by a separate environmental consulting firm. Also excluded is any original evaluation of the recency of faulting at the site. This evaluation is presented in Reference 2. This report is intended to provide recommendations relative to the feasibility of developing the site, identify constraints to that development, and establish preliminary design criteria. It is not specific to a development plan and will require supplementation when development details are available.

3.0 PROJECT DESCRIPTION

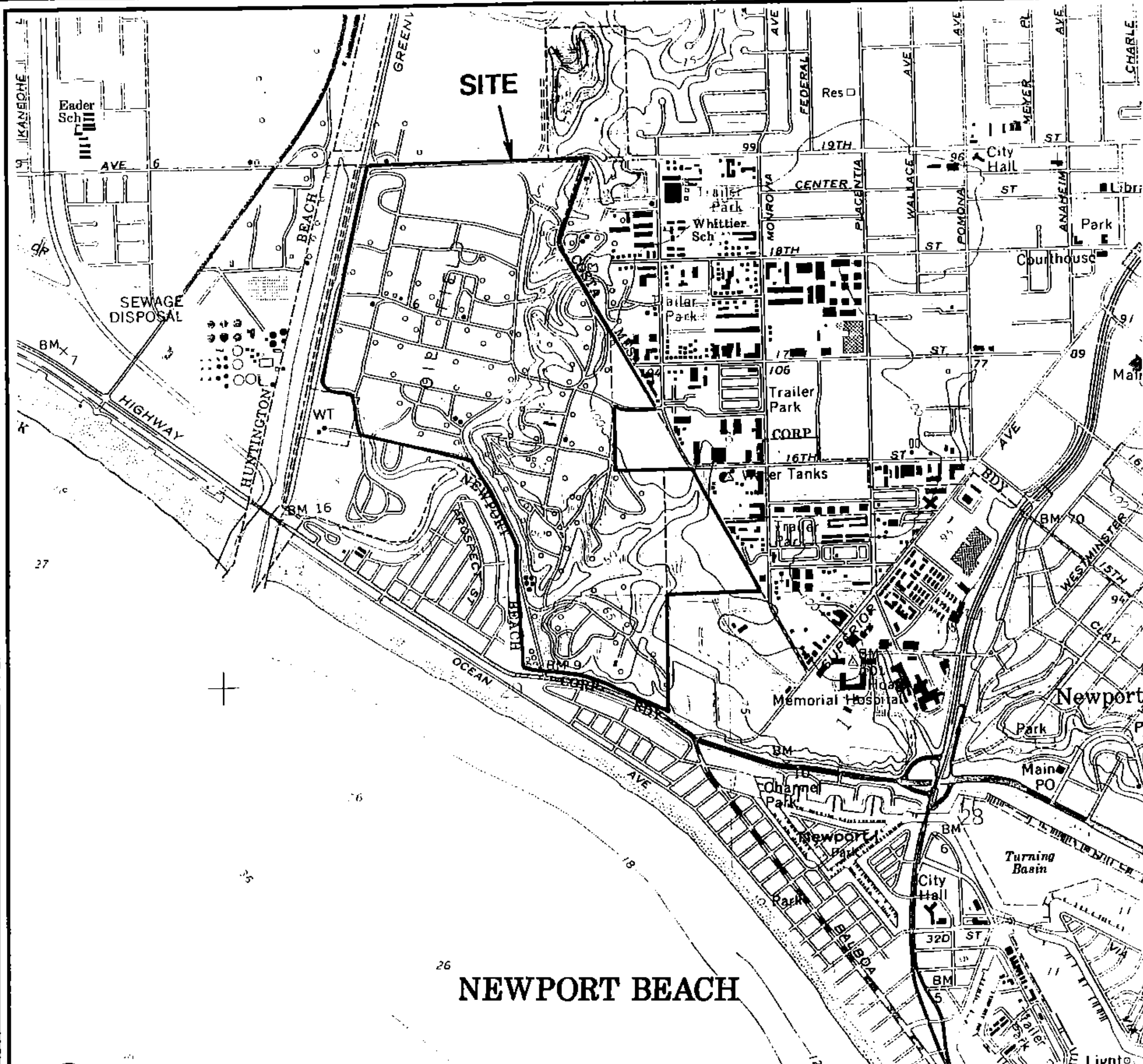
3.1 Site Location and Description

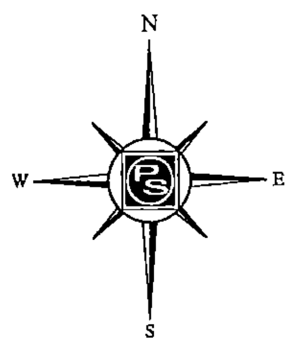
The project site consists of approximately 360 acres situated northerly of Pacific Coast Highway, easterly of the Santa Ana River Channel, southerly of 19th Street and westerly of the city limits of Costa Mesa. A majority of the property is located within unincorporated territory of the County of Orange, the remainder lies within the City of Newport Beach. Access to the site is via locked gates at the western terminus of 17th street and off Pacific Coast Highway. A site location map (Figure 1) is provided herein.

The parcel is roughly rectangular in shape, the western one third of the property consists of low-lying wetlands which rise abruptly along an east-west to north/northwest trending escarpment forming a relatively flat topped mesa. Elevations average approximately 6 feet (M.S.L.) in the wetlands while the mesa surface ranges from approximately 50 feet to a maximum height of 105 feet. The mesa has been dissected by several westerly draining canyons; the most prominent of these is located within the southern portion of the mesa.

The property has been a producing oil field since the early 1940's, and as such, numerous modifications to the mesa surface have resulted. Drill pads, pipelines, roads, and structures are scattered throughout the site as well as the remains of abandoned roads and facilities.

The wetland area and drainage courses contain thick accumulations of bushes, trees and plants. The vegetation on the mesa surface and escarpment varies from





0 2000 4000

SITE LOCATION MAP

NEWPORT-BANNING RANCH

FIGURE 1

SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC MAP
NEWPORT BEACH QUADRANGLE
SCALE: 1:24,000

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relatively dense growths of native weeds, grasses and bushes to very sparse grasses and weeds.

3.2 Proposed Development

Presently developing planning studies have been cursorily reviewed for this report. The provided development plan depicts eighteen planning areas within the mesa top, which comprises approximately 228 acres. The planned development is to consist of single family housing, townhome, condominium, apartment, commercial, school and park sites with attendant interior roads. The main connector off of Pacific Coast Highway, Bluff Road, is depicted with two alternatives. The first alternative consists of a cul-de-sac, terminating within the mesa surface. The second alternative consists of extending the road from the cul-de-sac, down the mesa, into the wetlands roughly paralleling the northwest mesa escarpment. This alignment is shown to tie into a proposed extension of 19th Street along the northern property line. Development of the second alternative will incorporate approximately 15 acres of wetlands. Outside of the Bluff Road extension, the remaining 116 acres of wetlands are to be restored to their natural condition. Due to environmental and development constraints, planning studies are still in progress and the ultimate development plan may vary significantly from the plans reviewed.

4.0 FIELD AND LABORATORY INVESTIGATIONS

4.1 Previous Geotechnical Studies

Previous geotechnical investigations performed in the subject area include studies by Woodward-Clyde Consultants (1985), The Earth Technology Corporation (1986) and Guptill and Heath (1981). Recommendations presented in those reports and all pertinent field and laboratory data developed in those studies were utilized in formulating our conclusions as well as the field program for the current study. Additionally, locations of pertinent borings and trenches conducted for the previous studies are shown on the accompanying geologic maps. Specific field and laboratory data are presented in the original reports. Pacific Soils Engineering, Inc., has reviewed the information contained in the reference reports, finds the information generally sufficient, and has utilized the information to formulate the conclusions presented herein. Pacific Soils Engineering, Inc., provides no guarantee or warranty as to the accuracy of the previous studies or the developed data.

4.2 Current Geotechnical Study

4.2.1 Subsurface Exploration

The subsurface exploration program completed for this investigation was directed towards refining the assumed onsite geologic relationships. Data from subsurface excavations were utilized in the analysis of the anticipated residential/commercial site development.

A truck mounted bucket auger drill rig equipped with a 30-inch-diameter bucket was used to advance 7 bucket auger borings within the mesa. The borings were drilled to determine the engineering characteristics and structure of the lithologic units. The geology borings were sampled and downhole logged by an engineering geologist. The borings ranged in depth from 17 feet to 70 feet. Boring locations are shown on the accompanying plans and the logs of the borings are presented in Appendix A.

Two hollowstem auger borings were advanced in the lowland areas where groundwater was anticipated at shallow depths. The borings were drilled to determine the engineering characteristics of the alluvium. Standard penetration tests and ring samples were collected to analyze the potential for liquefaction and settlement analysis. The borings ranged in depth from 52 feet to 60 feet. Boring locations are shown on the development plan and the boring logs are presented in Appendix A.

4.2.2 Sampling Program

Representative bulk samples were obtained from the bucket auger borings when various lithologic changes occurred. Relatively undisturbed ring samples were obtained at predetermined 5- or 10-foot intervals. Ring samples were obtained by driving a Modified California Sampler into the material a total of 12 inches, or until refusal. The Modified California Sampler is a split spoon-type sampler, which has an inside diameter of 2.5 inches and a tapered cutting tip at the lower end. The barrel is lined with thin brass rings, each 1 inch in length. Material is retained within the brass rings during the driving of the sampler. The hollowstem borings were sampled with a split barrel sampler for standard penetration tests (SPT) as well as with a thin walled split spoon sampler in accordance with ASTM:D 3550. The SPT samples were obtained by driving a 1 1/2 inch inside diameter sampler 18 inches into the material with a 140 pound hammer falling 30 inches. Blow counts were recorded for each 6 inch segment of penetration. The samples were transported to Pacific Soils' laboratory for testing. The results of the laboratory testing are presented in Appendix B of this report.

4.3 Future Geotechnical Studies

Future geotechnical studies are recommended in conjunction with advanced planning and site development studies. Subsurface investigations specifically addressing grading plans for site development are recommended. Additionally, a need for further evaluation of the recency of movement along the North Branch Fault was recommended in Reference 3 and is reiterated herein.

5.0 GEOLOGIC CONDITIONS

5.1 Geologic and Geomorphic Setting

The highland portion of the site is located on the southwestern edge of Newport Mesa, an uplifted, predominantly marine, terrace surface. The lowlands occupy the pre-existing alluviated channel of the Santa Ana River.

The Terrace Deposits have been tentatively correlated with three marine oxygen isotope stages. The stages represent variations in sea level corresponding with glacial and interglacial periods. Stages 9, 7 and 5 have been assigned to the subject site by ERTEC (1986). These marine sediments range in age from 300,000 years-old, Stage 9; 200,000 years-old, Stage 7; and 80,000 to 120,000 years-old, Stage 5.

No attempt was made to determine or assign a stage to the Terrace Deposits as encountered during this firm's investigation as it is beyond the scope of our proposal. Therefore, as a feasibility level investigation for geotechnical engineering purposes, we have grouped all terrace sediments together and assigned a collective term of "Marine Terrace Deposit" to these materials.

5.2 STRATIGRAPHY

5.2.1 San Pedro Sands Formation (Qsp?)

Quaternary and possibly Late Pliocene bedrock units, underlying the marine terrace capped mesa and exposed along the majority of the bluff face, have been tentatively assigned to the San Pedro Sands Formation. This designation is consistent with the mapping presented on the Geologic Map of Orange County compiled by P.K. Morton and R.V. Miller (CDMG Bulletin 204, Plate 1). At this location, the unit is silty fine to medium grained sandstone with occasional thin to thick cobble beds. The yellowish brown to tan unit is moderately hard and moderately cemented. Broad and distinct cross-bedding is common throughout the unit as well as numerous fining upward sequences.

5.2.2 Marine Terrace Deposits (Qtm)

Terrace deposits are characterized by massive to well stratified fine to coarse-grained, micaceous sands and silty sands that are light gray, white to gray/tan, locally cross-bedded and biotorbated, generally poorly to moderately indurated, uncemented and friable. Interstratified with the sands are combinations of sandy silt and silty clay which represent lower energy depositional environments such as a tidal flat or back bay. Contacts between differing sediments are generally undulatory, gradational ,and near horizontal.

5.2.3 Alluvium (Qal)

Subsurface samples of alluvium obtained from the hollowstem auger borings indicate that these sediments are characterized by brown, yellow-brown, green gray and gray combinations of fine grained sandy silt, silty sand, clayey silts and medium to coarse-grained sand.

5.2.4 Colluvium (Qcol)

Colluvium is a surficial deposit resulting from weathering and downslope movement of bedrock materials on active slopes. Within Newport-Banning Ranch colluvium is found on the gently sloping surfaces overlying terrace deposits and bedrock. These deposits are characterized by silty/clayey sands and sands that are porous and medium dense. Depth of colluvium varies from 4 feet to as much as 15 feet.

5.2.5 Soil

The physical and chemical weathering of exposed geologic surfaces has resulted in the development of a soil profile over the undisturbed portions of the site.

This unit is characterized by red brown to dark red brown sandy silts with minor amounts of clay in a generally damp to moist, moderately dense, massive, porous condition. This unit varies in thickness, as observed in the borings, from less than 1 foot to over 8 feet.

5.2.6 Artificial Fill (unmapped)

Locally significant amounts of artificial fill are scattered throughout the site. The composition of the fill materials varies widely, however, most of these deposits consist of combinations of colluvium, alluvium and terrace deposits excavated from onsite sources. The thickest deposits of fill exist subjacent to hillside road cuts and ramps from the mesa to the lowlands. Due to the irregularity of occurrence and available map scale, fills onsite are not mapped.

5.3 Geologic Structure

5.3.1 Tectonic Framework

Jennings (1985) has defined eight structural provinces within California that have been classified by predominant regional fault trends and similar fold structure (Figure 2). These provinces are in turn divided into blocks and sub-blocks that are defined by "major Quaternary faults". These blocks and sub-blocks exhibit similar structural features. Within this framework, the subject site can be classified as belonging to Structural Province I, Peninsular Range Block, Santa Ana Sub-Block.

The Structural Province I is controlled by the dominant northwest trend of the San Andreas Fault and is divided into two blocks; the Coast Range Block and the Peninsular Range Block. The Peninsular Range Block, in which this site is located, is characterized by a series of parallel northwest trending faults that exhibit right lateral dip-slip movement. These faults are terminated by the Transverse Range Block to the north and extend southward to the Baja Peninsula. These northwest trending faults divide the Peninsular Range Block into eight sub-blocks. The Santa Ana

SOUTHERN CALIFORNIA

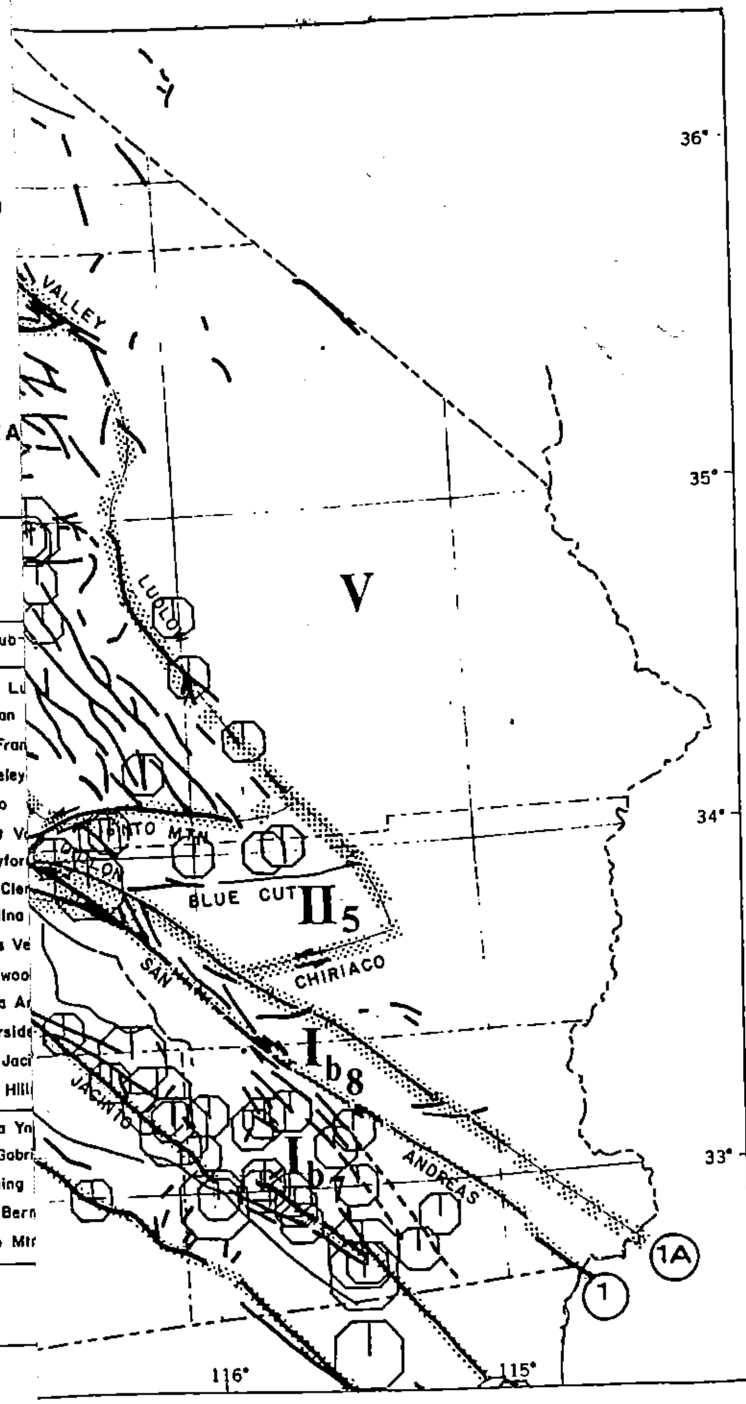
MAGNITUDE

.... 5.0 TO 5.9

.... 6.0 TO 6.9

.... 7.0 TO 7.9

.... 8.0 OR GREA



50 100 MILES

50 100 KILOMETERS

FAULT PATTERNS
(Defining Blocks and Sublocks)

Structural Province	Predominant Fault Trend	Blocks		Sub-	
I	NW (San Andreas trend)	a	Coast Ranges	1	Santa Lu
				2	Gabilan
				3	San Fran
				4	Berkeley
				5	Diablo
				6	Great V
				7	Stonyfor
		b	Peninsular Ranges	1	San Cle
				2	Catalina
				3	Palos Ve
				4	Inglewoo
				5	Santa A
				6	Riverside
				7	San Jaci
				8	Indio Hill
II	E-W (transverse trend)		Transverse Ranges	1	Santa Yn
				2	San Gabr
				3	Banning
				4	San Bern
				5	Pinto Mtr
III	NE (Garlock trend)	a	Mojave		
		b	Tehachapi		
IV	N-S (Owens Valley trend)	a	Kern Canyon		
		b	Panamint		
		c	Death Valley		
		d	Warner		
		e	East Sierra		
		f	Cascade		
		g	Gorda		
V	Multiple		Sonoran Desert		
VI	Complex		Sierra Nevada		
VII	Thrusts		Klamath		
VIII	Complex		Modoc	1	Alturas
				2	Eagle La
				3	Diamond
				4	Medicine

TER JENNINGS (1985)

FIGURE 2

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Sub-block, one of the eight sub-blocks, is bound to the west by the Newport-Inglewood fault zone and to the east by the Elsinore fault zone. The subject site is located in the western portion of the Santa Ana Sub-block lies adjacent to the Newport-Inglewood fault zone and is 15 miles southwesterly of the Elsinore fault zone.

5.3.2 <u>Regional Mapped Faults</u>

There are several large fault systems in the region surrounding the subject site. These fault systems have been studied extensively and in a large part control the geologic structure of Southern California. The prominent regional fault systems the Pelican Hill, Newport-Inglewood, Elsinore, Whittier, San Jacinto, and San Andreas faults.

<u>Newport - Inglewood Fault System</u>

The Newport - Inglewood fault system is located adjacent to and within the subject site. This fault system extends northwesterly from a point approximately 5 miles offshore of Laguna Beach to the Santa Monica Mountains. The Newport-Inglewood fault system is characterized by a series of en echelon (sub-parallel) faults. These faults exhibit considerable offset at depth with little or no evidence of surface displacement.

<u>Elsinore Fault System</u>

The Elsinore fault system is located approximately 21 miles northeasterly of the subject site. This fault system trends northwesterly from the Gulf of California to Santa Ana Canyon. Movement along the Elsinore fault system includes right lateral horizontal displacement. Major vertical components of slip, however, have also been identified.

<u>Whittier Fault System</u>

The Whittier fault system is located approximately 21 miles northerly of the subject site. This fault system is the main spur of the Elsinore Fault System and extends northwesterly from the Santa Ana Canyon through the Puente Hills to the Santa Monica Mountains. The Whittier fault system is a right lateral reverse fault that dips to the northeast.

<u>San Jacinto Fault System</u>

The San Jacinto fault system lies approximately 46 miles northeasterly of the subject site. The San Jacinto is the major sub-member of the San Andreas fault system and can be traced from a point near Cajon Pass, where it branches out from the San Andreas, southerly to the Mexican border. The San Jacinto fault parallels the San Andreas fault over the majority of its length and, like the San Andreas, movement is primarily right lateral.

San Andreas Fault System

The San Andreas fault system lies approximately 53 miles northeasterly of the subject site. In California, the San Andreas extends northwesterly from the Mexican border to Point Arena where it continues offshore before turning to the west in the vicinity of Cape Mendocino. The San Andreas is the major structural feature in California and defines a transform boundary between the Pacific and North American tectonic plates. Due to the length and complexity of this fault system, it has been divided into sections on the basis of general trend. The southern portion of the San Andreas, which extends from the Gulf of California to the Transverse Ranges, is closest to the subject site. Displacement along this section, as is characteristic of the entire length, is right lateral.

5.3.3 Site Faults

As presented in The Earth Technology Corporation Report (ERTEC 1986, Reference 3), two distinct zones of faulting have been identified within the subject site. The North Branch and North Branch Splay fault zones traverse the property in a northwest orientation. As depicted on Figure 4 of the ERTEC report and shown on Plate 1, the North Branch fault lies subparallel to the western mesa escarpment and intercepts the extreme western tip of the mesa in the vicinity of the tank farm. The North Branch Splay fault traverses the central portion of the mesa escarpment approximately 600 feet northeast of the North Branch fault.

The results of the ERTEC investigation indicate that the North Branch Splay fault zone is not active as per the Alquist-Priolo Special Studies Zone Act and does not warrant a setback for one and two-story residential and commercial buildings. However, they do recommend that caution be exercised in planning critical facilities (three-story buildings, schools, fire stations) across the trend of the fault traces.

The tectonic origin and age of the last displacement along the trace of the North Branch Fault remains unanswered. This fault will require further study to define the zone and determine its activity level. Building setback zones may be required for this fault based upon the results of future investigations.

5.3.4 Folding

The Marine Terrace deposits are essentially flat-lying with a near horizontal basal contact with the San Pedro Sands Formation (Qsp?). Bedding within the San Pedro Sands Formation (Qsp?) fluctuates greatly due to the expansive and broad cross bedding developed during deposition. Local mapping and reoriented blocks were observed at and near the mapped shears.

5.4 Seismicity

The subject site is located in southern California, which is a tectonically active area. The type and magnitude of seismic hazards affecting a site are dependent on the distance to causative faults and the intensity and magnitude of the seismic event. The seismic hazard may be primary, such as surface rupture and/or ground shaking or secondary, such as liquefaction and/or ground lurching.

An active fault may exist within or adjacent to the site. The probability of primary surface rupture or deformation at the site is, therefore, unknown. Ground shaking hazards caused by earthquakes along active regional faults do exist. A maximum credible bedrock acceleration of 0.7g has been assigned to site based upon information contained in Greensfelder (1975) and attenuation curves by Maulcin and Jones (1992). A seismic coefficient of .15g is generally held to be appropriate for pseudostatic stability analyses and has been used in this report, however, a more detailed site seismicity evaluation utilizing both probabilistic and deterministic methods is warranted for site specific structural design.

Secondary earthquake hazards include liquefaction, seismically-induced subsidence, and earthquake-induced landsliding. Liquefaction and subsidence are usually associated with relatively strong seismic shaking, shallow ground water, and the presence of loose, sandy soils or alluvial deposits. The potential for liquefaction is discussed in Section 6 of this report.

5.5 Groundwater

Groundwater was encountered during the field investigation for this study and during previous studies. Hollowstem borings HB-1 and HB-2 encountered groundwater at 6 feet and 0 feet in elevation, respectively. Groundwater observed in Boring 6 was encountered at an elevation of 10 feet.

Although not encountered, groundwater within the mesa, should it exist, will occur as a period condition of limited areal extent and should not pose a constraint to development. However, shallow groundwater elevations within the wetlands are most likely constant and of larger areal extent. The effects of shallow groundwater, as it relates to liquefaction and subsidence within the wetlands is discussed in Section 6 of this report.

6.0 GEOTECHNICAL CONCLUSIONS

Newport-Banning Ranch is considered suitable, from a geotechnical standpoint for the proposed residential/commercial development, provided that the identified geotechnical constraints are properly addressed and mitigated during site development. Presented below, are the geotechnical concerns identified by this study or previous studies as possibly affecting site development. The combined data base of this and the referenced report establishes a basis for reviewing planning studies however, more detailed studies are anticipated to properly address grading recommendations for a specific design.

6.1 Slope Stability

6.1.1 Cut Slopes

Cut slopes which expose unsupported (daylighted) bedding will require removal and replacement with design buttress fills to satisfy Code required gross stability. Cut slopes exposing the San Pedro Sands Formation may require this remediation. However, due to the broad, cross-bedded character of the unit, continuous, low-strength bedding planes could be locally absent. Hence, geologic mapping of specific cut slopes during grading may provide a cost savings versus designing slope remediations based on "worst-case scenario" utilizing subsurface data.

The San Pedro Sands Formation and the Marine Terrace Deposits are moderately to highly erosive and will not be surficially stable in some areas. Erosion control measures, such as erosion control blankets, slope face adhesives and/or judicious landscaping, may be necessary.

6.1.2 Fill Slopes

Fill slopes, when properly constructed, will be grossly stable to at least the analyzed height of 60 feet. Sixty feet was picked as an estimate of the possible highest proposed fill slope. Two calculations justifying fill slopes constructed from locally derived materials are presented in Appendix C. These calculations utilized two different sets of remolded shear strength values; however, due to the low to noncohesive character of the site materials, fill slopes should be anticipated to be moderately to highly erosive and will not be surficially stable. Two surficial stability calculation were presented in Appendix C utilizing the two different sets of remolded shear strength values. One calculation meets the Code required safety factors and one does not. Hence, erosion control measures, such as erosion control blankets, slope face adhesives and/or judicious landscaping, may be necessary.

6.1.3 Natural Slopes

Natural and previously graded slopes surround the highlands portion of the site. These slopes approach heights of 60 feet and are comprised of Marine Terrace Deposits and San Pedro Sands (?). Slope ratios vary from 1:1 to 3:1 (horizontal to vertical). These slopes are considered grossly stable under present conditions where they exist at a ratio of 2:1 or flatter. Slopes steeper than 2:1 are marginally stable and may not provide the required 1.5 factor-of-safety. These slopes are moderately to highly erosive, are surficially unstable and would be subject to deep erosion if left as they exist. If these slopes are rendered into fill or cut slopes, then the above discussion applies. If the development concept calls for maintaining these natural bluffs, then a building setback would be recommended. The recommended structure setback for slopes existing at ratios of 2:1 and flatter is 15 horizontal feet from top of slope. For slopes steeper than 2:1, a setback of 15 feet from a point established by a 2:1 projection from the toe of slope to the graded pad elevation, is recommended. Additionally, the site should be graded such that all surface waters are directed away from all slopes.

6.2 Liquefaction Potential

A detailed discussion of the previous liquefaction evaluation is presented in Reference 1. Liquefaction is the phenomenon where the buildup of excess pore pressures, in saturated granular soils due to seismic agitation, results in a "quick" or "liquefied" condition. At that time, structures supported by the granular soils are subject to bearing failure. Liquefaction potential in the highlands portion of the property is considered nil due to the lack of high groundwater and the in-place density of the terrace deposits.

However, the liquefaction potential in the lowland areas is considered high as discussed in Reference 1. This firm's hollowstem borings were advanced to substantiate and further evaluate those conclusions. Based on those borings and an analysis utilizing Liquefy 2, a liquefaction analysis software tool, liquefaction potential is considered high in the upper portion of the alluvium onsite. Mitigation measures for this condition would be removal of the upper portions of the alluvium and replacement with a compacted fill and/or provision of sufficient confining stress to reduce the potential. Prior to site development a more in-depth subsurface exploration program and liquefaction assessment should be conducted if development is planned for the lowland areas.

6.3 Earthquake Hazards

Liquefaction and tsunamis are secondary earthquake hazards and are discussed in separate subsections of this report. Surface rupture is a primary earthquake hazard and ground shaking is a secondary earthquake hazard. Both will be discussed within this subsection.

Throughout southern California, ground shaking, as a result of earthquakes, is a constant potential hazard. This relative potential for damage from the hazard is a function of the type and magnitude of earthquake event and the distance of the site from the event. Newport-Banning Ranch is in close proximity to or on the Newport-Inglewood zone of deformation and an event on that fault has the greatest potential to cause significant ground shaking at the site. A maximum credible acceleration of 0.7g has been presented in the seismicity section of this report and an acceleration of 0.15g is being utilized in our stability calculations. An in-depth probabilistic analysis of this potential should be undertaken prior to structural design in order to determine an appropriate seismic design acceleration for structures at the site.

Surface rupture is a break in the ground surface on top of a seismically triggered fault. The potential for surface rupture on this site is a concern due to the projected surface traces of the North Branch Splay fault and the North Branch fault. Both traces are projected to the ground surface based on data developed from the historical and abundant oil exploration and production well data around and on the site. Both projected traces correlate with faults identified in exposures existing and excavated at the site. A detailed description and study of these faults are presented in Reference 3. That study concluded that:

"Faulting within the North Branch Splay zone of faulting is pre-Holocene in age and requires no setbacks from fault traces for one- and two-story residential and commercial structures.

The fault traces of the North Branch Splay are late Pleistocene in age with evidence for periodic movement. Although fault slope is demonstrated as pre-Holocene, future surface displacement cannot be precluded even though the possibility may be remote. Therefore, caution should be exercised in planning high-rise buildings (over 3 stories) or critical facilities (e.g. schools, fire stations) across the trend of these fault traces. Site-specific field exploration may be warranted to evaluate the magnitude and probability of surface displacement for critical facilities.

Although the faulting in the bluff spatially associated with the North Branch fault appears similar in age to the faulting documented along the North Branch Splay fault, uncertainties in tectonic origin and age need to be better explained. Those uncertainties stem from the lack of knowledge about the location of the North Branch fault trace and its association or lack thereof to the faulting observed in the bluff. We recommend that future studies of those fault traces be conducted to better define the zone width and activity if habitable structures are planned across the fault traces."

6.4 Excavation of Earth Materials

The general excavation characteristics for the typical onsite materials (soil, alluvium, colluvium, marine terrace deposits, San Pedro Sands) are classified as easily rippable. The estimated production based on a single-shank Caterpillar Model D-9G or equivalent dozer is 2,250 cubic yard/hour.

6.5 Generator and Disposal of Over-sized Material

Very minimal oversized material (material larger than 0.67 feet) is anticipated for the project. These materials may be encountered in the cobble beds of the San Pedro Sands. They can be incorporated into the fills in accordance with Plate G-10 of the attached Earthwork/Grading Details (Appendix D).

Other environmental concerns not withstanding, oversized concrete generated from the demolition of oil production facilities may also be incorporated into the fills as described above provided that any extruding steel is removed from the rubble and the rubble is free of hazardous material.

6.6 Unsuitable Soil Removals

All compressible and porous soil, alluvium, colluvium, uncontrolled artificial fill, weathered marine terrace deposits, and weathered San Pedro Sands, will require removal in fill areas and shallow cuts and replacement with compacted fills in accordance with ASTM:D 1557-91. Removal should be to competent material or within 2 feet of groundwater. Table I summarizes the anticipated removal depths for the various geologic units.

TABLE I

GEOLOGIC UNIT (MAP SYMBOL)	EST. REMOVAL DEPTH (FT.)
Soil	1-5 (all)
Alluvium	1-6 (2 feet above groundwater)
Colluvium	1-12 (all or 2 feet above groundwater)
Uncontrolled Artificial Fill	1-10 (all)
Weathered Marine Terrace Deposits	1-5 (all)
Weathered San Pedro Sands	1-5 (all)

6.7 Subsurface Drainage

Subsurface drainage will be required below fills in all major canyon areas of the site. Except where special conditions exist, subdrains should consist of 6-inch and 8-inch perforated pipe surrounded by at least 9 cubic ft./ft. of rock satisfying the requirements of OCEMA and the City of Newport Beach. Typically the initial 500 lineal feet of drain can consist of 6-inch pipe, transitioning to 8-inch pipe downstream from that point (See Plate G-1 and G-2). Drains will typically be terminated at approximately 10 feet below finish grade. All buttress and stabilization fills should be provided with drains as detailed on Plate G-3. Upper stage drains should be expected for the higher slopes.

6.8 Expansive Soils

All onsite materials tested or observed during this study have a very low to low expansion potential. Foundations and slab designs should anticipate these conditions.

6.9 Deep Fills

Deeper fills are subject to settlement under the weight of the upper portions of the fill. These settlements can be significant for fill depths exceeding approximately 50 feet and can become very significant for fills in excess of 100 feet. This criteria should not be a major economic or logistic concern since the majority of onsite materials are granular and will experience the majority of their settlement during construction. Settlement monitoring of deep fills (>50 feet) should be anticipated.

6.10 Settlement Of Alluvium

Saturated alluvium exists in the lowland portion of the site. Any alluvium left in-place below fills should be saturated but will be subject to settlements and post-grading development delays. These settlements and delays could affect installation of improvements and utilities. Settlement monitoring, construction delays, staging, and/or surcharges could be required depending upon the type of improvement, sensitivity to settlement, and schedules. These concerns should be evaluated when plans are available.

6.11 Filling Against Existing Crib Wall

Conceptual development plans reviewed to date indicate filling against the existing crib wall (Plate 1) will be required. This can be accomplished, however, care must be taken to insure that the open cells are suitably filled (compacted fill, crushed rock, slurry, etc.). The effects of the fill on the superjacent structures should be evaluated when details are available. Additionally, any drainage devices associated with the wall or the existing canyon fill should be maintained and tied into the subsurface drainage systems for this project.

6.12 Geotechnical Concerns Associated with Oil Production Facility Abandonment

Environmental remedial measures for the abandonment of the oil production facilities, including wells, are being prepared by others. The wells will have to be removed and capped in accordance with the criteria established by the State of California and local agencies. It is anticipated that those abandonments and remedial procedures will involve excavations below proposed fills and cuts. All remedial excavations will require re-filling with compacted fill per ASTM:D 1557-91 prior to ultimate development.

6.13 Potential Oil Field Subsidence

A detailed analysis and discussion on the potential for oil field subsidence is presented in Reference 1. The conclusion of that study was that "oil field subsidence does not appear to be a major planning consideration". This firm concurs with that conclusion.

6.14 Potential for Tsunami Run-up

This concern is discussed at length in Reference 1. The conclusion presented is that "tsunami run-up is unlikely to be a major constraint to planning the development." This firm concurs with that conclusion.

6.15 Hydro-Collapse Potential

The Marine Terrace deposits display the grain size, density, and in situ moisture content that can be subject to hydro-collapse. Limited testing of these materials (Plates B-6, B-7, B-8, and B-9) indicates a slight (<1%) potential for hydro-collapse under a load of 1 tsf. This potential will be most significant under design fills and/or higher loading conditions and where differential wetting occurs. This potential could require mitigation during development. Mitigations can include overexcavation/replacement, provision of drainage, and/or foundation designs. The need for such mitigations, in consideration of specific loading conditions, should be evaluated in detail when development plans and structure sitings are available.

Work Order 500236
October 8, 1993

7.0 CLOSURE

7.1 Limitations

This report is based on the project as described and the information obtained from the borings at the approximate locations indicated on the plans. The findings are based on the results of the field, laboratory, and office investigations combined with an interpolation and extrapolation of conditions between and beyond the boring locations. The findings are also based on data from previous investigations contained in the referenced reports. The results reflect an interpretation of the limited direct evidence obtained. The recommendations presented in this report are based on the assumption that an appropriate level of geotechnical analysis and review will be provided when development plans are available.

The data, opinions, and recommendations of this report are intended to be used for preliminary design purposes only and are not intended to be used as a basis for final design or construction. They have no applicability to any other design elements or to any other locations and, any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of Pacific Soils Engineering, Inc.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

By: DEAN C. ARMSTRONG,
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Dist: (6) Addressee
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DCA:JBC/lo-01

8.0 REFERENCES:

1. Preliminary Geotechnical Engineering Studies, Long Range Planning Program, West Newport Oil Company, by Woodward-Clyde Consultants dated June 21, 1985 (Project No. 41890A).

2. Surface Faulting Along the Newport-Inglewood Zone at Deformation, by Guptill, P.D., and Heath, E.G., California Geology, pp. 136-148, 1981.

3. Geological Evaluation of Faulting Potential, West Newport Oil Field, Orange County, California by Earth Technology Corporation dated July 31, 1986 (Project No. 86-820-01)

APPENDIX A

Field Investigation

A total of seven bucket auger borings and two hollowstem auger borings were drilled for this study at the locations indicated on the enclosed plans (Sheets L-1 through L-15). These borings ranged in depth from 17 to 70 feet. Logs of these borings are presented on Plates A-1 through A-9.

Relatively undisturbed samples were obtained from the borings for detailed laboratory testing laboratory by driving a sampling spoon into the material. A split-barrel type spoon was used, having an inside diameter of 2.5 inches, with a tapered cutting tip at the lower end. The barrel is lined with thin brass rings, each 1 inch in length. The spoons penetrated into the soil below the depth of boring approximately 12 inches. The central portion of the sample was retained for testing.

A samples were sealed in air-tight containers in the natural field condition and transported to the laboratory. Bulk samples were also obtained from the borings.

Blow counts are noted for each sample obtained on the Geotechnical Boring Logs. The boring excavations were backfilled upon completion of drilling and sampling.

GEOTECHNICAL BORING LOG

PROJECT NO.	500236	PROJECT NAME	Newport Oil
DATE STARTED	6/9/93	GROUND ELEV.	85.0
DATE FINISHED	6/9/93	GW DEPTH (FT)	
DRILLER	LEDEZMA	DRIVE WT.	varies
TYPE OF DRILL RIG	30" BUCKET AUGER	DROP	12"
BORING DESIG.	B-1	LOGGED BY	TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	85			3548lbs		SOIL reddish brown silty sand with some clay, damp, dense, porous, roots				
						TERRACE DEPOSIT (Qtm): yellow tan micaceous fine- to medium-grained sand, damp, dense, massive, roots	5.3	104	23	
5	80	D/B		PUSH		gray white micaceous medium grained sand, damp, moderately dense to dense, minor sloughing, very friable, massive gradational color change to reddish brown				
					B:N70E,2NW	greenish tan, very fine-grained micaceous sandy silt, damp, dense, sharp contact with sand above	3.3	92	11	DS
10	75	D		1		gradational change to silty micaceous very fine-grained sand, damp, dense, moderately well stratified/lensing, occasional charcoal streaks, discontinuous biotite laminations				
					B:N35W,6SW	sharp contact with red brown micaceous very fine-grained sandy silt, damp to moist, dense				
					B:N15W,4SW	sharp contact with greenish gray micaceous silt, moist, dense, 1/4-1/2" thick carbonate layer at contact, occasional red oxidation streaks, moderately well stratified				
15	70					interstratified light gray-white fine- to medium-grained micaceous sand, moist, dense, friable, no cement, undulatory continuous contacts, near horizontal, occasional near vertical worm burrows, occasional thin +1 1/2" interbeds of dark gray silty mud				
					B:N55W,8NE	SAN PEDRO SAND (Qsp?): sharp contact with gray micaceous silt, moist, dense, occasional shell fragments, occasional streaks of light yellow tan micaceous sand	8.6	123	64	
20	65	D		2		discontinuous shell wash horizon, moderately bioturbated zone, worm burrows, continuous lithology since @ 19 feet above				
				2577lbs		gradational change to gray tan micaceous fine-grained sand, moist, dense, occasional gravel (subround) pebbles, massive, occasional red oxidation streaks				
25	60					gradational change to medium-grained sand				
					B:N75E,4SE	gradational change to medium- to coarse-grained sand, with abundant subrounded gravel with pebbles, moist, dense, friable				
						sharp contact with fine- to medium-grained sand, horizontal				
						red brown micaceous very fine-grained sand lens	6.7	97	24	DS
30	55	D		4		alternating fining upward sequences of coarse- to fine-grained sand, cross bedded, near horizontal contacts bioturbated sand approximately 6 to 8 inches thick				
						a 1-foot thick shell wash horizon within medium- to coarse-grained sand with subround to round gravel at base, horizontal				
						gray-tan very fine-grained micaceous sand, moist, dense, friable, bioturbated, cross-bedded, laminated				
35	50					shell wash horizon as above at 32.5 feet				
						gray-white medium- to coarse-grained sand, near horizontal cross-bedded				
	45									

SAMPLE TYPES:
- [D] DRIVE (RING) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

- GROUNDWATER
- SEEPAGE
- [B] BEDDING PLANE
- [J] JOINTING
- [C] CONTACT
- [F] FAULT
- [S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/9/93
DATE FINISHED 6/9/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 85.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-1
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	45	D		5			gradational change to very coarse-grained sand with gravel	13.2	105	60	
						B:N75W,22SW	erosional/undulatory contact with gray silt and interstratified very fine-grained micaceous sand, bioturbated, predominately silt				
45	40					B:N65W,19SW	continuous lithology to total depth as above at 41 feet				
				1648lbs							
		D		9			Total Depth 50 ft. No Water, No Caving	1.8	105	8	

SAMPLE TYPES:
[D] DRIVE (RING) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
[B] BEDDING PLANE
[J] JOINTING
[C] CONTACT
[F] FAULT
[S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/9/93
DATE FINISHED 6/9/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 82.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-2
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
0				3548lbs			ARTIFICIAL FILL brown silty fine-grained sand, moist, dense, scattered roots and occasional pebbles, massive				
	80						TERRACE DEPOSIT (Qtm): reddish brown silty very fine-grained sand , moist, dense, occasional pockets of yellow tan very fine-grained sand, massive				
5		D		PUSH			gradational change to yellow tan very fine-grained micaceous sand, damp, moderately dense, massive gray-white very fine- to fine grained sand, damp, dense, very friable, caving approximate 1 foot deep	3.3	101	13	
	75										
10		D		1			gradational change to very fine grained micaceous sandy silt, moist, dense, occasional streaks of biotite, lenses of pure silt, occasional carbonates predominately silt with some clay, moist, dense, occasional lenses of very fine-grained micaceous sand	30.5	90	94	
	70					approx. B:N50E,8NW	gray-white very fine- to fine-grained micaceous sand, damp, dense, uncemented, very friable, boring is belled, massive				
15	65	B		1							MAX DS EI CHEM
20							continuous lithology since above at 14 feet approximately 2-inch thick discontinuous shell wash horizon				
	60			2577lbs							
25	55										
						approx. B:N20E,4SE	continuous lithology since above at 14 feet continuous clay seam, light gray brown approximately 3 to 4 inches thick, bedded, within sand as above at 14 feet				
30		D		3			undulatory 1 to 1-1/2 inch thick shell wash horizon in sand as above at 14 feet, occasional subround pebbles	3.5	91	11	
	50										
35	45						discontinuous shellwash horizons in medium-to coarse-grained sand, occasional subround pebbles, horizontal				
							SAN PEDRO SAND (Qsp?): horizontal contacts with gray-white, medium- to coarse-grained sand with abundant scattered shell				

SAMPLE TYPES:
- D DRIVE (RING) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

PACIFIC SOILS ENGINEERING, INC.

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/9/93
DATE FINISHED 6/9/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 82.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-2
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		D		4			fragments, occasional gravel and pebbles horizontal contacts with sand as above at 14 feet	4.7	92	15	
	40						occasional shell wash horizons, worm burrows, bioturbated sand as above at 14 feet, near horizontal contacts				
45	35			1648lbs			gradational change to very fine-grained micaceous sand, light tan-gray, laminated with biotite, occasional red oxidation streaks				
							gray-tan very fine-grained micaceous sandy silt, damp, dense, occasional shell fragments at contact, horizontal contact	20.1	102	84	DS
50		D		4							
	30					B:N35W,19SW	predominately gray, tan gray, green gray micaceous silt, moist dense, moderately well stratified with thin beds of light tan very fine-grained micaceous sand continuous lithology since above at 53 feet				
55	25										
60		D/B		3		B:N25W,19SW		21.6	100	85	
	20										
65						B:N20W,21SW					
	15										
70		D		4			continuous lithology as above at 53 feet to total depth at 70 feet	16.3	96	59	
							Total Depth 70 feet No Water Caving from 6 to 10 feet, 14 to 29 feet and 39 to 47 feet				

SAMPLE TYPES:
[D] DRIVE (RING) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
[B] BEDDING PLANE
[J] JOINTING
[C] CONTACT
[F] FAULT
[S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/10/93
DATE FINISHED 6/10/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 99.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-3
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
0	99			3548lbs			**ARTIFICIAL FILL** red-brown sandy clayey silt, damp, moderately dense, porous, pinsize air voids, massive				
5	95	D/B		1				14.1	114	79	
							TERRACE DEPOSIT (Qtm): light red tan fine-grained micaceous sand, damp, dense, massive gradational change to reddish yellow tan silty very fine-grained micaceous sand				
10	90	D		2		approx. B:N5W,8NE	+ 2-inch thick gray-brown clayey silt lens with occasional carbonates below is gray-tan to orange-tan very fine-grained micaceous sand, damp, dense, massive	13.8	90	42	
							gray-green clayey silt, damp, dense, horizontal, contact, interstratified dark gray clay lenses, near horizontal cuts, red-brown oxidation, some carbonates				
15	85					approx. B:NS,4E					
						approx. C:N40W,16NE	light gray-white very fine-grained micaceous sand, damp, dense, very friable, no cement, massive weakly cross-bedded minor caving within sand as above at 18 feet				
20	80										
25	75	D		2577lbs 3			light gray fine- to medium-grained micaceous sand, damp, dense, interstratified/lenses of shell wash horizons, undulatory/continuous contact with sand above	2.6	100	10	
30	70						undulatory contact with light gray medium-grained micaceous sand, damp, dense, massive continuous lithology to total depth at 32 feet				
							Total Depth 32 feet No Water Caving from 21 to 23 feet NOTE: Soil Contaminated to Total Depth				
		D		4				2.7	96	10	

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

PACIFIC SOILS ENGINEERING, INC.

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/10/93
DATE FINISHED 6/10/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 72.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-4
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
				3548lbs.			ARTIFICIAL FILL brown silty sand, damp, dense, asphalt				
	70						SOIL reddish brown silty fine-grained sand with some clay, damp, dense to very dense, slight magnesium development, slightly porous, moderately well-cemented	6.9	115	40	
5		D		4							
	65						TERRACE DEPOSIT (Qtm): light yellowish gray-tan very fine- to fine-grained micaceous sand, damp, dense, loose/friable, no cohesion	0.7	93	2	
10		D		1							
	60						light yellow-tan silty very fine-grained micaceous sand, dry to damp, dense, loose/friable, uncemented				
15											
	55						continuous lithology since above at 12 feet Total Depth 17 feet No Water Caving from 12 to 17 feet				

SAMPLE TYPES:
[D] DRIVE (RING) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
[B] BEDDING PLANE
[J] JOINTING
[C] CONTACT
[F] FAULT
[S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/10/93
DATE FINISHED 6/10/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 65.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-5
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
0	65			3548lbs			ARTIFICIAL FILL mottled brown-tan and dark brown silty sand, damp, dense, scattered rock fragments, brick fragments				
							TERRACE DEPOSIT (Qtm): yellow-tan very fine-grained sandy silt, damp to moist, dense, massive	20.9	103	88	
5	60	D		PUSH/6" TAP/6"		B:N50W,9NE	red-brown, yellow-tan, blue-grey silt, moist, dense, moderately well stratified, thinly stratified				
						approx. B:N35W,5NE	light gray-white fine-grained sand, damp, dense, scattered carbonate occasional roots gradational change to light grey-white very fine-grained micaceous sand, damp, dense, massive, roots				
10	55							5.5	93	18	MAX DS EI CHEM
		D/B		1			undulatory/near horizontal contact with yellowish grey silty fine- to medium-grained sand, damp to moist, dense, massive, scattered carbonates, orange-red oxidation staining, occasional rip up clasts of brown silt				
15	50						undulatory/near horizontal cut with blue-gray clayey silt, moist, dense, common carbonate pods, interstratified gray-brown fine-grained sand				
							SAN PEDRO SAND (Qsp?): undulatory/near horizontal contact with gray-white fine-grained micaceous sand, damp, dense, occasional subround pebbles and abundant carbonates at contact	3.7	98	14	
20	45	D		2			undulatory horizontal bed of subround pebbles and scattered shell fragments approximately 6 inches thick, below light gray-white, fine- to medium-grained micaceous sand (beach), moist, dense, friable, uncemented, moderately well stratified with coarse-grained sand,				
						B:N15W,15SW	laminated with biotite, occasionally cross-bedded gradational change to fine-grained sand				
				2577lbs			gradational change to medium-grained sand, repeating fining upwards sequences				
25	40						occasional yellow-red oxidation staining				
							approximately 2 inches thick bed of interstratified silt and very fine grained sand, horizontal contact	6.8	99	26	
30	35	D		5			sand as above at 20 feet				
							cross-bedded horizontal lens of unoxidized sand, color change to blue-gray 1/2-inch thick gray clay bed at base of sand, (fining upwards sequences) undulatory/continuous near horizontal				
35	30						light blue-gray medium-grained sand, damp, dense, moderately well stratified gradational change to fine- to very fine-grained sand (fining upwards sequences)				
							gray-brown very fine-grained sandy silt, moist, dense, undulatory/near horizontal contact; interstratified thin beds of very fine-grained blue-gray micaceous sand and gray silty clay, occasional gravel/pebbles				
	25										

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-5

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/10/93
DATE FINISHED 6/10/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 65.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-5
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
								6.0	106	28	
	25	D		4							
						B:N70E,3NW	4-inch thick dark blue-gray silty clay bed, moist, stiff, below is a dark gray very fine-grained sandy silt, moist, dense				
45	20						scattered well cemented clasts of bioturbated (worm burrows) sand, very hard, very dense, localized pods and lenses of shell fragments in dark gray very fine-grained sandy silt				
				1648lbs.			continuous lithology since above at 42 feet to total depth at 50 feet				
								28.6	93	95	
50	15	D		4			Total Depth 50 feet No Water Caving from 9.5 to 13.5 feet				

SAMPLE TYPES:
[D] DRIVE (RING) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE
[B] BEDDING PLANE
[J] JOINTING
[C] CONTACT
[F] FAULT
[S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-5

GEOTECHNICAL BORING LOG

PROJECT NO.	500236	PROJECT NAME	Newport Oil	BORING DESIG.	B-6
DATE STARTED	6/11/93	GROUND ELEV.	55.0	LOGGED BY	TMC
DATE FINISHED	6/11/93	GW DEPTH (FT)	45.00		
DRILLER	LEDEZMA	DRIVE WT.	varies		
TYPE OF DRILL RIG	30" BUCKET AUGER	DROP	12"		

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	55			3548lbs			ARTIFICIAL FILL silty sand and asphalt on native soils	12.7	120	86	CON
5	50	D		3			SOIL red-brown very fine-grained sandy silt with some clay, moist, dense, massive, scattered coarse-grained lithic fragments				
							TERRACE DEPOSIT (Qtm): yellow-tan fine-grained micaceous sand, moist, dense, massive	8.4	110	42	CON
10	45	D		2			interstratified gray-tan very fine-grained micaceous sand and brown to gray-tan silt, damp, moderately dense to dense, friable, no cement				
						approx. C:N40E,7NW	gray-tan very fine- to fine-grained micaceous sand, damp, dense, friable, no cement, gravel and subround pebbles at contact with interstratified silt and sand above, common carbonates at contact near horizontal				
15	40										
						C:N25W,19SW	SAND PEDRO SAND (Qsp?): sharp contact with tan-gray very fine-grained micaceous sandy silt, moist, dense, scattered gravel, occasional shell fragments, red oxidation, massive				
20	35						undulatory/near horizontal 6-inch thick bed of gray fine-grained micaceous sand	16.2	105	73	
		D		2			silt as above at 17 feet				
				2577lbs			gray-tan fine- to coarse-grained sand, damp, dense, orange-red oxidation staining, undulatory near horizontal contact, clean (no fines, little mica) noncemented, very friable				
25	30						very well stratified, color banded 1/2 to 2-inch thick with gray, red-orange, yellow-tan, light brown, numerous fining upwards sequences				
						approx. B:NS,7E	very well stratified - alternating 1/2 to 2-inch thick beds of very fine-, fine-, medium-, to coarse-grained sand, no fines, clean, shell fragments at base				
30	25						tan-gray clayey silt, moist, dense, approximately 8 inches thick	3.1	103	13	CON
		D		5			fine- to medium-grained sand, moist, dense, common shell fragments, occasional gravel, subround pebbles, coarse-grained at base				
35	20						gray very fine-grained micaceous sandy silt, moist, dense, slight caving, friable, no cement, color banded along stratification by oxidation staining, very thinly stratified, unoxidized sandy silt is gray blue continuous lithology since 33 feet above				
	15										

SAMPLE TYPES:
- D DRIVE (RING) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-6

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/11/93
DATE FINISHED 6/11/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 55.0
GW DEPTH (FT) 45.00
DRIVE WT. varies
DROP 12"

BORING DESIG. B-6
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	15	D		5			continuous lithology since 33 feet above	4.9	92	16	
45	10			1648lbs			continuous lithology since 33 feet above, water seepage (moderate) into boring, severe caving continuous lithology since at 33 feet above to total depth at 50 feet				
50	5	D		3			Total Depth 50 feet Water at 45 feet Caving from 33 to 40 feet	29.6	92	96	

SAMPLE TYPES:
- [D] DRIVE (RING) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

- GROUNDWATER
- SEEPAGE
- [B] BEDDING PLANE
- [J] JOINTING
- [C] CONTACT
- [F] FAULT
- [S] SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-6

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/11/93
DATE FINISHED 6/11/93
DRILLER LEDEZMA
TYPE OF DRILL RIG 30" BUCKET AUGER

PROJECT NAME Newport Oil
GROUND ELEV. 95.0
GW DEPTH (FT)
DRIVE WT. varies
DROP 12"

BORING DESIG. B-7
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	ATTITUDES	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
0	95			3548lbs			SOIL dark red-brown sandy silt with some clay, damp to moist, moderately dense, roots, voids, porous, massive				
							TERRACE DEPOSIT (Qtm): orange-tan silty fine-grained sand, damp, dense, massive	11.0	116	66	
5	90	D		2							
							light yellow-tan very fine-grained micaceous sandy silt, damp, dense, massive moderately well stratified, carbonates along bedding	4.0	96	14	CON
10	85	D		1							
						C:N30W,8SW	light gray-white very fine-grained micaceous sand, damp, dense, friable, no cement, boring is belled interstratified thin beds of gray silt and yellow-tan very fine- to fine-grained micaceous sand, moist, dense, moderately well stratified				
15	80					B:N25W,7SW					
							light gray-white very fine- to fine-grained micaceous sand, damp, dense, friable, no cement, presaturated, occasional shell fragments, orange-red oxidation, scattered very coarse-grained quartz/lithics continuous lithology to total depth at 30 feet	1.6	90	5	
20	75	D		1							
25	70			2577lbs							
								3.3	99	13	
30	65	D		2			Total Depth 30 feet No water Minor Caving from 19 feet to Total Depth				

SAMPLE TYPES:
- D DRIVE (RING) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

PACIFIC SOILS ENGINEERING, INC.

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/15/93
DATE FINISHED 6/15/93
DRILLER Discovery
TYPE OF DRILL RIG Hollowstem

PROJECT NAME Newport Oil
GROUND ELEV. 12.0
GW DEPTH (FT) 6.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. HB-1
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS/FT	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
					ALLUVIUM (Qal):				
	10								
5		S	20	SM	brown silty fine to medium grained sand				SA
					water				
	5	D	16			20.4	106	94	
10		S	10	SP-SM	brown silty medium grained sand				SA
	0								
15		S	7	ML	brown silty medium grained sand and gray brown fine grained sandy silt				SA
	-5	D	15		medium coarse grained sand, falling out of tube add sand trap and sample again	18.9	113	99	
20		S	7	SM	yellow brown very fine grained silt				SA
	-10	D	15		lost sample, re-obtain with sand trap	21.4	108	99	
25		S	14	SM	gray brown very fine grained sandy silt				
	-15	D	not recorded			19.1	111	99	
30		S	14	SM	SAN PEDRO SAND (Qsp?): yellow brown fine to medium grained silty sand				SA
	-20								
35		S	17	SM	yellow brown and gray brown silty fine to medium grained sand				SA
	-25	D	30		NON RETURNS				

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.

PLATE A-8

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/15/93
DATE FINISHED 6/15/93
DRILLER Discovery
TYPE OF DRILL RIG Hollowstem

PROJECT NAME Newport Oil
GROUND ELEV. 12.0
GW DEPTH (FT) 6.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. HB-1
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		S		14		SP-SM	yellow gray brown silty fine to medium grained sand				SA
	-30										
											SA
						ML	green gray very fine grained sandy clayey silt				
45		S		45							
	-35							23.5	104	99	
		D		35							SA
50		S		61		ML	green gray clayey silt, dry	31.9	92	101	
	-40	D		63			Total Depth 52 feet Water at 6 feet				

SAMPLE TYPES:
[D] DRIVE (RING) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE
[T] TUBE SAMPLE

GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.

PLATE A-8

GEOTECHNICAL BORING LOG

PROJECT NO. 500236
DATE STARTED 6/15/93
DATE FINISHED 6/15/93
DRILLER Discovery
TYPE OF DRILL RIG Hollowstem

PROJECT NAME Newport Oil
GROUND ELEV. 6.0
GW DEPTH (FT) 6.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. HB-2
LOGGED BY TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	BLOWS/FT	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
	5				ALLUVIUM (Qal):				
5	0	S	7	ML	green gray, very fine grained micaceous sandy silt; water				SA
						35.3	90	109	
		D	9						SA
10	-5	S	8	ML	dark green gray very fine grained micaceous sandy silt and medium grained sand with abundant shell fragments				
									SA
15	-10	S	25	SM	a little gravel at tip; dark green gray very fine grained micaceous sandy silt and medium grained sand with abundant shell fragments				
						17.3	110	88	
		D	28						SA
20	-15	S	32	SP-SM	dark green gray medium to coarse grained sand with gravel				
25	-20	S	39	SP	dark green gray medium to coarse grained sand with gravel				
						23.6	103	100	
		D	79/11"						SA
30	-25	S	46	SP-SM	green gray medium to coarse grained sand				
									SA
35	-30	S	35	SM	dark green gray micaceous silt				
						19.4	112	99	
		D	76/6"						

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE   T TUBE SAMPLE

▼ GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.

GEOTECHNICAL BORING LOG

PROJECT NO.	500236	PROJECT NAME	Newport Oil
DATE STARTED	6/15/93	GROUND ELEV.	6.0
DATE FINISHED	6/15/93	GW DEPTH (FT)	6.00
DRILLER	Discovery	DRIVE WT.	140 lbs.
TYPE OF DRILL RIG	Hollowstem	DROP	30"
BORING DESIG.	HB-2	LOGGED BY	TMC

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY DENSITY (pcf)	SATURATION (%)	OTHER TESTS
	-35	S		61		SP-SM	green gray medium to coarse grained sand				SA
45	-40	S		84/11"		SP	gray medium to coarse grained sand				SA
		D		70			gray medium grained sand	22.8	105	100	
50	-45	S		83		SP	gray medium to coarse grained sand				SA
55	-50	S		66		SP-SM	gray medium coarse grained sand				SA
		D		82			gray coarse grained sand with abundant gravel at tip	19.1	112	98	
60		S		38		SP-SM	gray fine to medium grained sand				SA

Total Depth 60 feet
Water at 6 feet

SAMPLE TYPES:
D DRIVE (RING) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER

PACIFIC SOILS ENGINEERING, INC.

Work Order 500236
October 8, 1993

APPENDIX B

Laboratory Testing

The results of laboratory testing performed during this study are enclosed within this appendix. The following laboratory tests were performed on representative samples in accordance with the applicable latest standards or methods from the ASTM or the Uniform Building Code (U.B.C).

Moisture and In Place Density

The field moisture content and in situ dry density determinations were performed on relatively undisturbed ring and core samples obtained from the borings. The moisture content was obtained in accordance with ASTM:D 2216. The in situ dry density was computed using the net weight of the entire sample. The results of these tests are presented in the boring logs.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM:D 2487 and D 2488.

Consolidation Tests

The consolidation tests were performed on selected relatively undisturbed or remolded soils samples in accordance with procedures outlined in ASTM:D 2435. Samples were placed in a consolidometer and loads were applied incrementally in geometric progression.

The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Hydroconsolidation (collapse) and expansion characteristics were also evaluated by monitoring the change in volume with saturation while specimen was confined under a constant normal stress.

The consolidation test results are graphically presented on the consolidation curves accompanying this appendix.

__Direct Shear Tests__

Direct shear tests were performed on selected undisturbed and remolded samples that were saturated under a surcharge approximately equal to the applied normal force during testing. The apparatus used is in conformance with the requirements outlined in ASTM:D 3080. The test specimens, 2.5 inches in diameter and 1 inch in height, were subjected to simple shear along a plane at mid-height.

The samples were sheared under various normal loads, a different specimen being used for each normal load. A strain rate of 0.050 inches per minute was used to determine shear strength values. The specimens were sheared until the shear stress reached a constant value or until the sample deformation had reached approximately 10 percent of the original diameter.

The peak shear stress values obtained from the tests were plotted versus applied normal pressures. The best-fitting straight lines were drawn through the plotted points to obtain the shear strength envelopes. The cohesion and angle of internal friction of the soil materials were determined from the shear strength envelopes. The direct shear test results are presented herein.

Test results for undisturbed and remolded samples are shown on figures accompanying this appendix.

__Hydrometer Analysis__

Particle size determinations were conducted to aid in classification of the soils (modified hydrometer portion ASTM:D 422-72). Results are shown on accompanying Table B-1.

Expansion Index

Expansion Index Tests were conducted in accordance with U.B.C. Standard 29-2. Results are shown on the accompanying Table B-1.

Laboratory Maximum Density

Laboratory maximum density and optimum moisture content were determined on samples of the subsurface materials to determine the suitability of these soils for compaction. Tests were conducted in accordance with ASTM:D 1557-78. Results of these tests are shown on the accompanying Table B-1.

Sieve Analysis

Particle size determinations by sieve analysis were conducted to aid in classification of the soils. The tests were conducted in accordance with ASTM:C 136-84. The results of these tests are presented in the accompanying Table B-1.

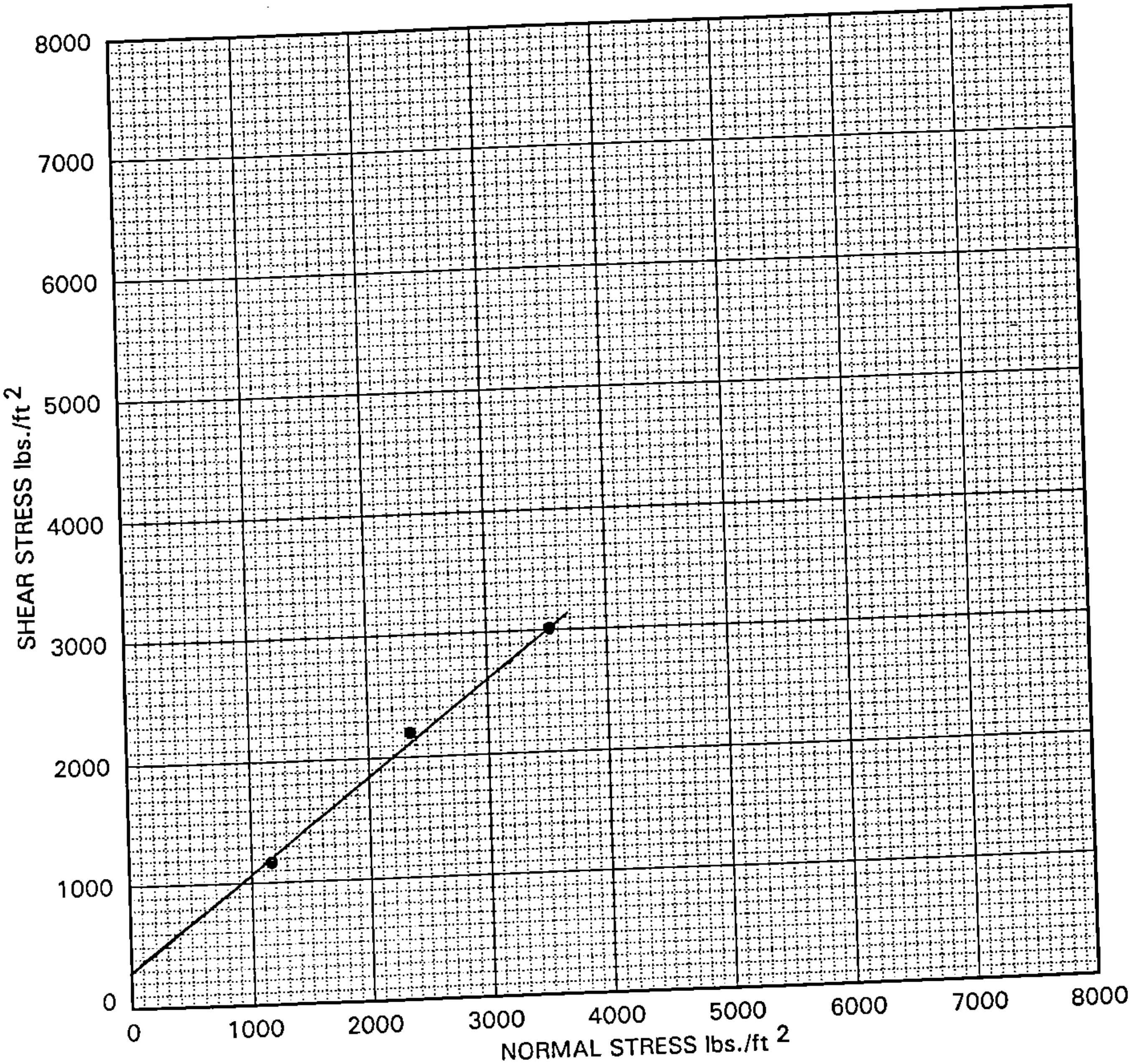
Chemical Tests

Chemical tests were conducted to determine soluble sulfate concentrations of the representative materials. Results of these tests are presented on Plate B-15 of this appendix.

TABLE B-1
W.O. 500236
SUMMARY OF LABORATORY TEST DATA

Boring	Depth (feet)	Soil Description	Group Classif-ication	In Situ Dry Density	In Situ Moist. Content	% Passing No. 4 Sieve	% Passing No. 200 Sieve	% Finer Than 0.005 mm	Max. Dry Density	Opt. Moist. Content	Tests
B-1	5.0	Silty Sand (Qtm)	SM	103.7	5.3	100	31	19			
B-1	10.0	Silty Sand (Qtm)	SM	91.8	3.3	100	23	7			DS
B-1	30.0	Silty Sand (Qsp)	SM	96.7	6.7	100	23	5			DS
B-2	18.0	Silty Sand (Qtm)	SM			100	14	7	103.7	15.5	MAX DS EI=0 CHEM
B-2	50.0	Sandy Silt (Qsp)	ML	102.5	20.1	100	85	22			DS
B-2	60.0	Silt (Qsp)	ML	100.1	21.6	100	96	34			
B-3	5.0	Clayey Silt (af)	ML	113.9	14.1	100	61	36			
B-5	12.0	Sand (Qtm)	SP	93.1	5.5	100	7	3	106.5	17.3	MAX DS EI=0 CHEM
B-6	5.0	Silt (Soil)	ML	120.4	12.7	100	63	30			CON
B-6	10.0	Silty Sand (Qtm)	SM	109.7	8.4	100	37	23			CON
B-6	31.5	Sand with Silt (Qsp)	SP-SM	103.0	3.1	100	12	5			CON
B-7	10.0	Silt (Qtm)	ML	96.4	4.0	100	60	8			CON
HB-1	5.0	Silty Sand (Qal)	SM			100	27				SA
HB-1	10.0	Sand with Silt (Qal)	SP-SM			100	12				SA
HB-1	15.0	Sandy Silt (Qal)	ML			100	56				SA
HB-1	20.0	Silty Sand (Qal)	SM			100	38				SA
HB-1	25.0	Silty Sand (Qal)	SM			100	34				
HB-1	30.0	Silty Sand (Qsp)	SM			100	40				SA
HB-1	35.0	Silty Sand (Qsp)	SM			100	30				SA
HB-1	40.0	Sand with Silt (Qsp)	SP-SM			100	15				SA
HB-1	45.0	Silt (Qsp)	ML			100	91				SA
HB-1	50.0	Silt (Qspm)	ML			100	93				SA
HB-2	5.0	Silt (Qal)	ML			100	89				SA
HB-2	10.0	Silt (Qal)	ML			100	61				SA
HB-2	15.0	Silty Sand (Qal)	SM			100	24				SA
HB-2	20.0	Sand with Silt (Qal)	SP-SM			59	6				SA
HB-2	25.0	Sand (Qal)	SP			71	5				
HB-2	30.0	Sand with Silt (Qal)	SP-SM			94	10				SA
HB-2	35.0	Silty Sand (Qal)	SM			100	41				SA
HB-2	40.0	Sand with Silt (Qal)	SP-SM			90	10				SA
HB-2	45.0	Sand (Qal)	SP			100	4				SA
HB-2	50.0	Sand (Qal)	SP			100	4				SA
HB-2	55.0	Sand with Silt (Qal)	SP-SM			100	8				SA
HB-2	60.0	Sand with Silt (Qal)	SP-SM			99	12				SA

DIRECT SHEAR TESTS
UNDISTURBED



Silty Sand (Qtm)	COHESION 300 psf.
SM	FRICTION ANGLE 37.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-1	10.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
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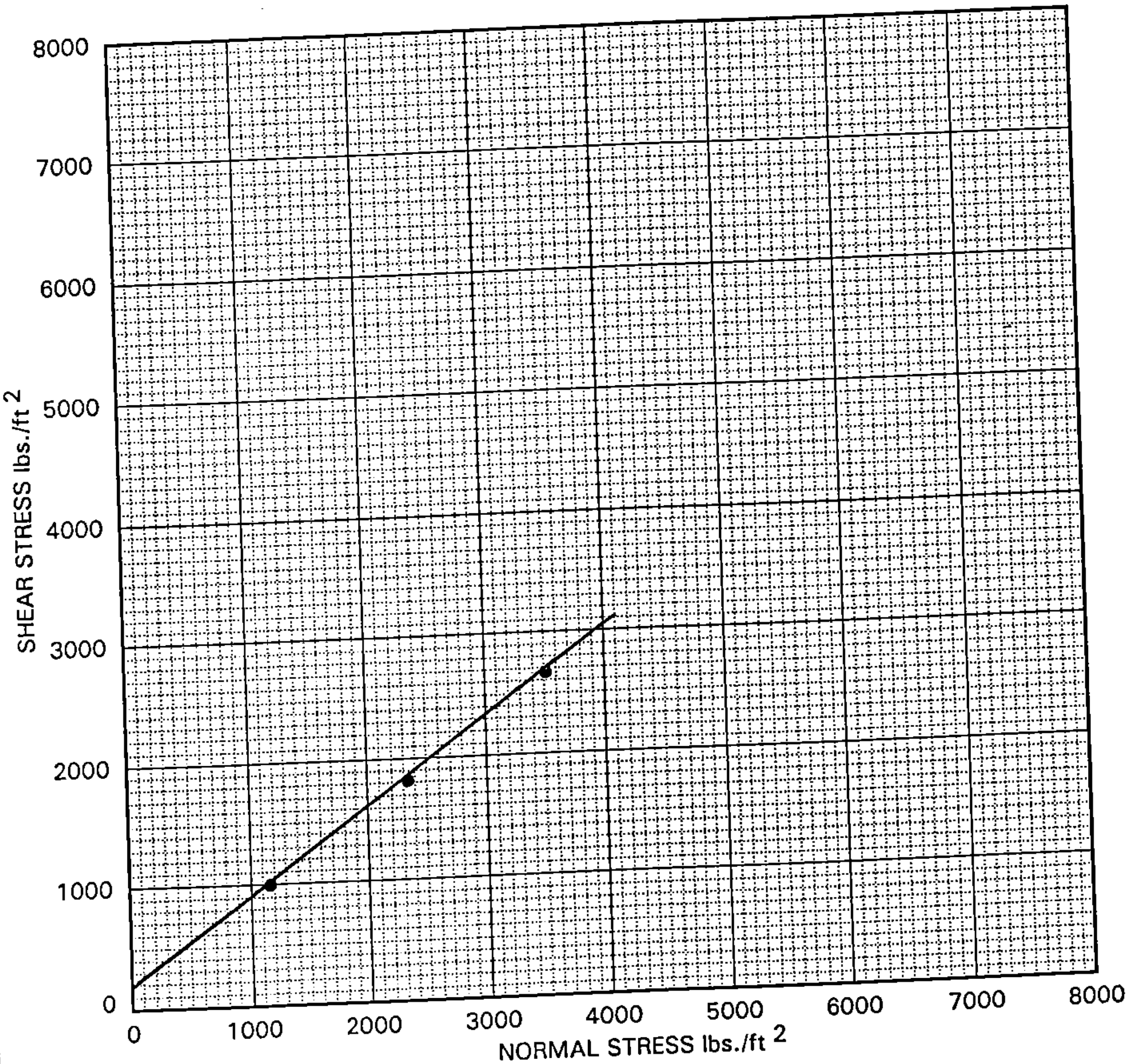
W.O. 500236 PLATE B-1

DIRECT SHEAR TESTS
UNDISTURBED



Silty Sand (Qsp)	COHESION 200 psf.
SM	FRICTION ANGLE 35.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-1	30.00			

DIRECT SHEAR TEST

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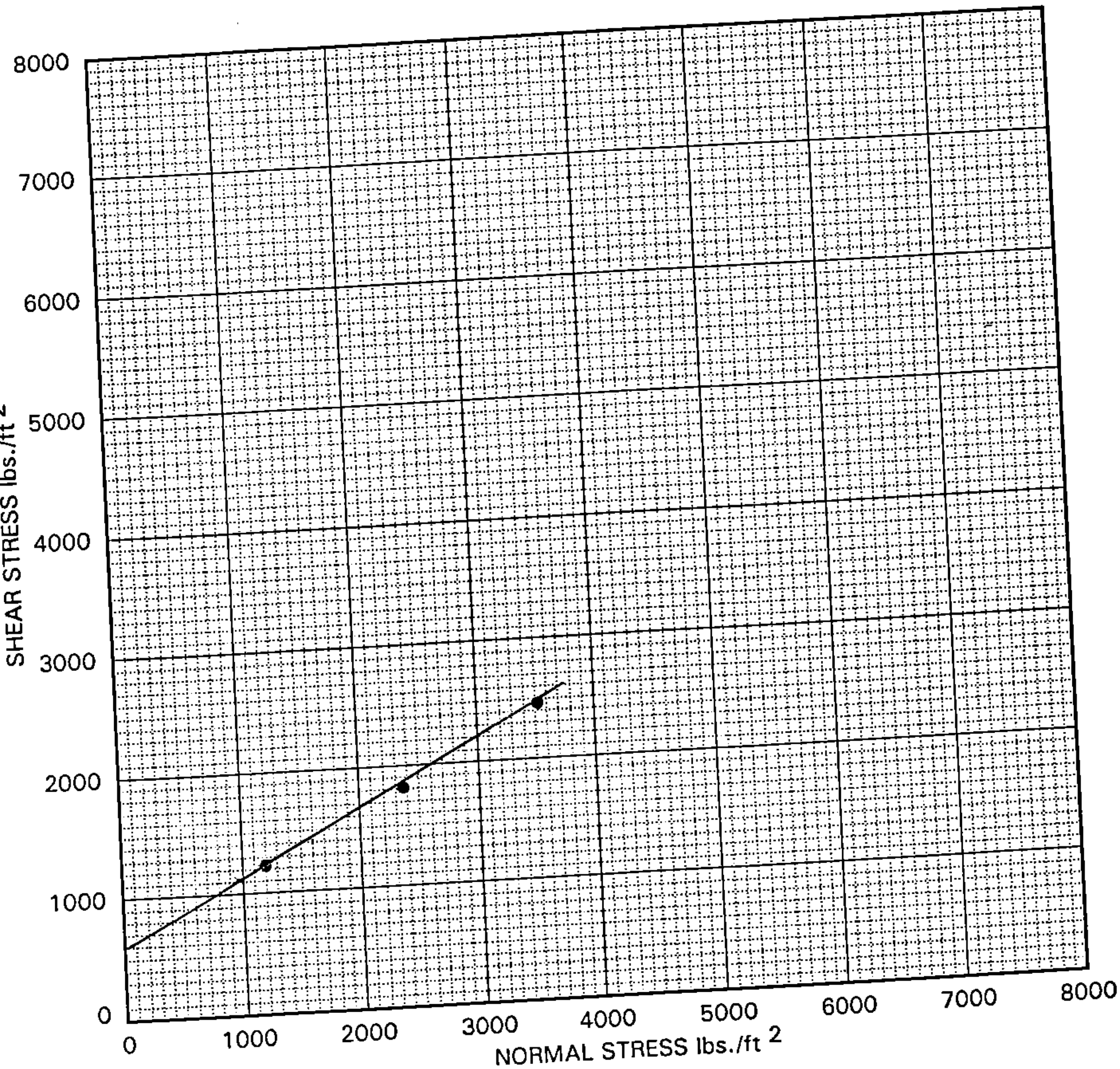
W.O. 500236

PLATE B-2

DIRECT SHEAR TESTS
REMOLDED



	COHESION 600 psf.
Silty Sand (Qtm)	FRICTION ANGLE 28.0 degrees
SM	

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-2	18.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
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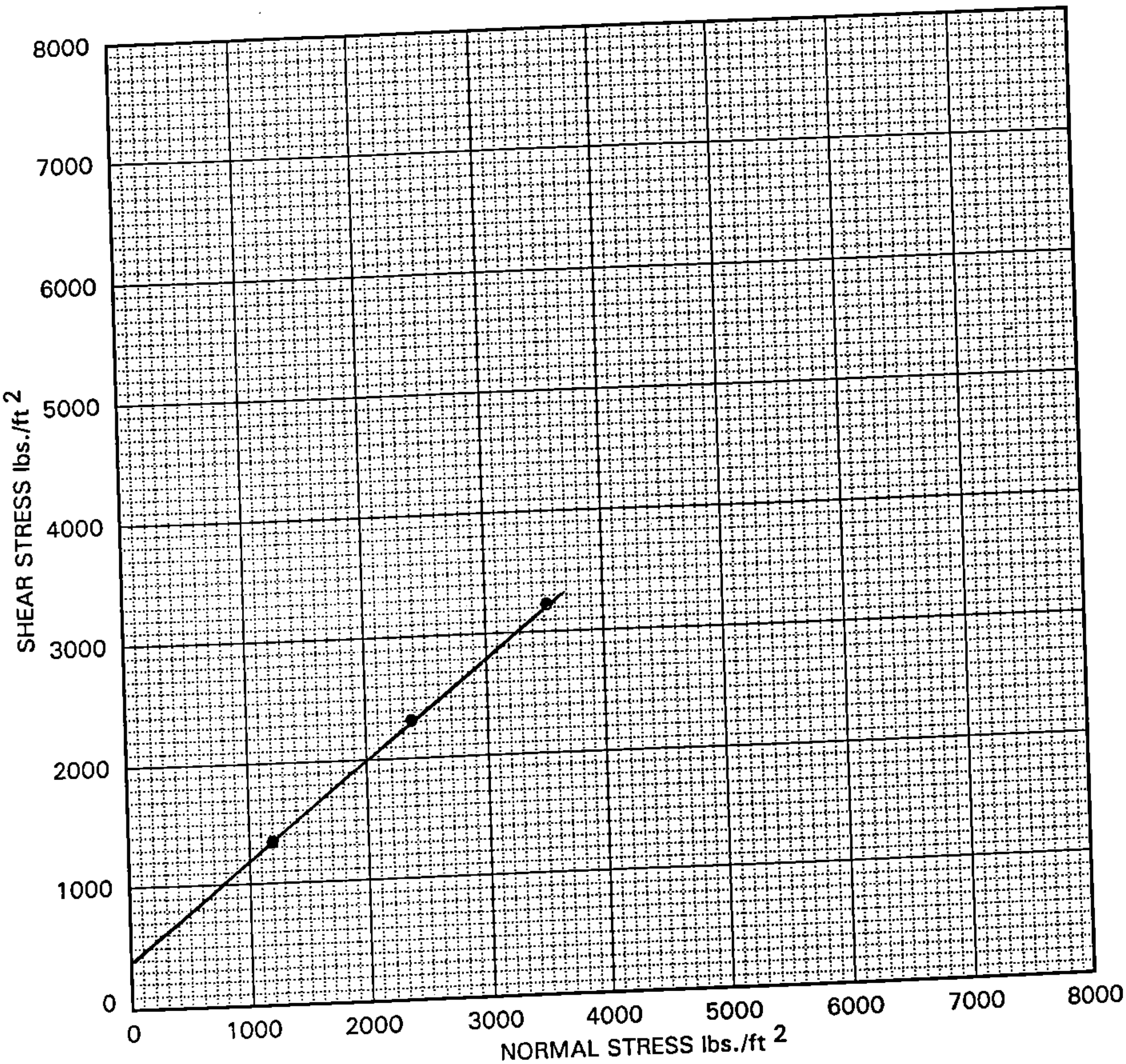
W.O. 500236

PLATE B-3

DIRECT SHEAR TESTS
UNDISTURBED



Sandy Silt (Qsp)	COHESION 400 psf.
ML	FRICTION ANGLE 38.0 degrees

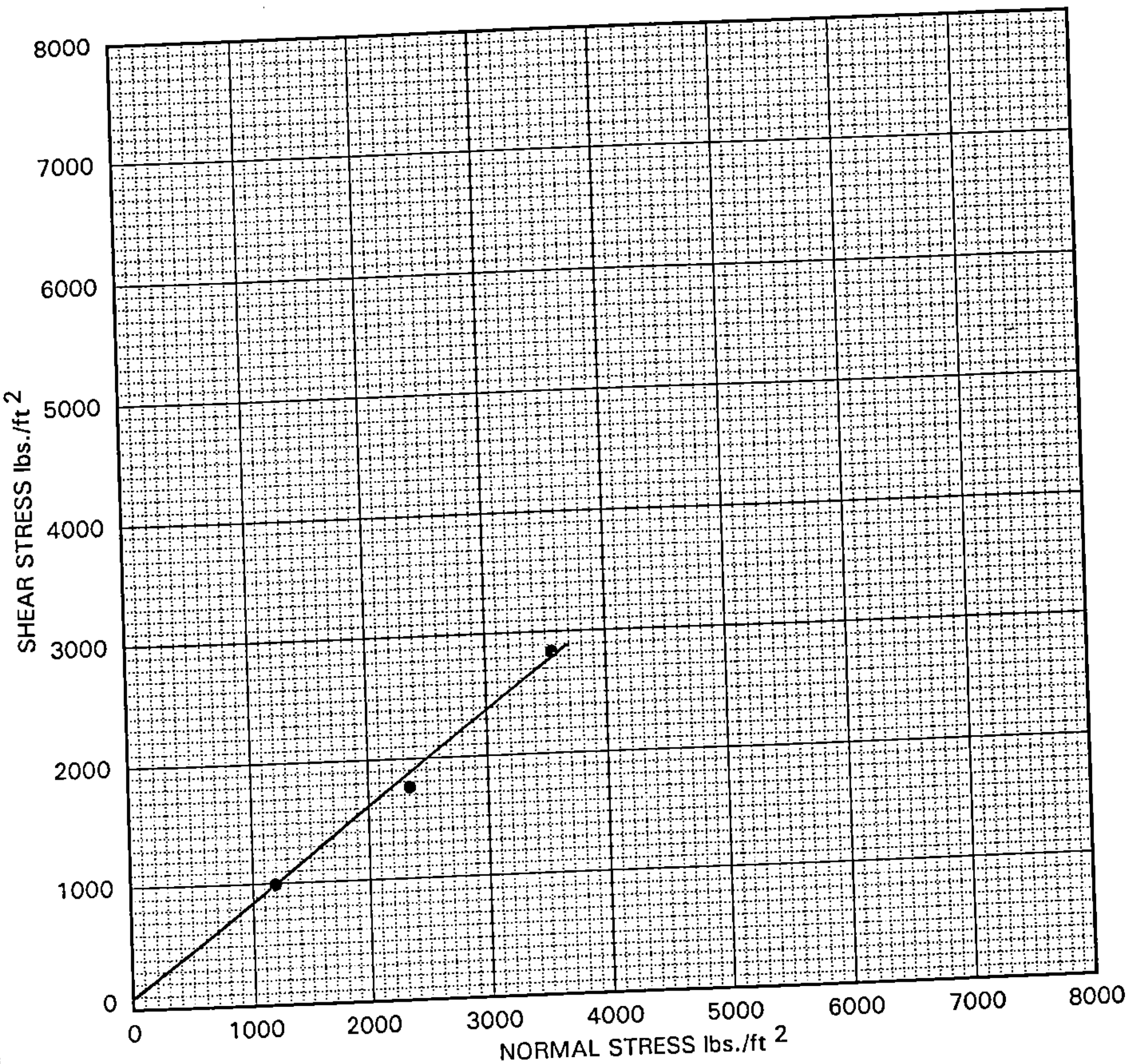
symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-2	50.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500236 PLATE B-4

DIRECT SHEAR TESTS
REMOLDED



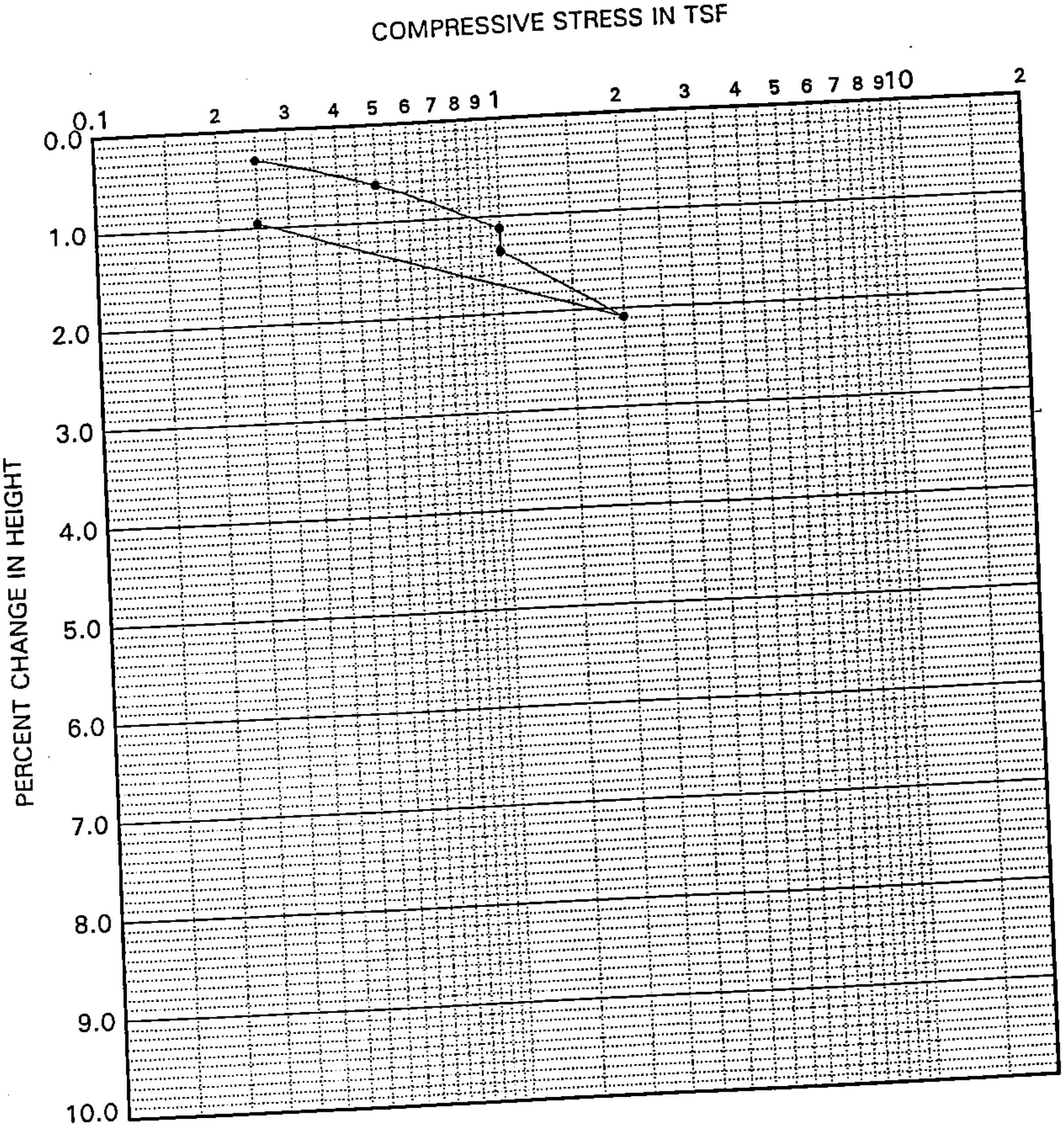
Sand (Qtm)	COHESION 100 psf.
SP	FRICTION ANGLE 37.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-5	12.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500236 PLATE B-5



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-6	5.00	120.40	12.70	63.0	ML	Silt (Soil)

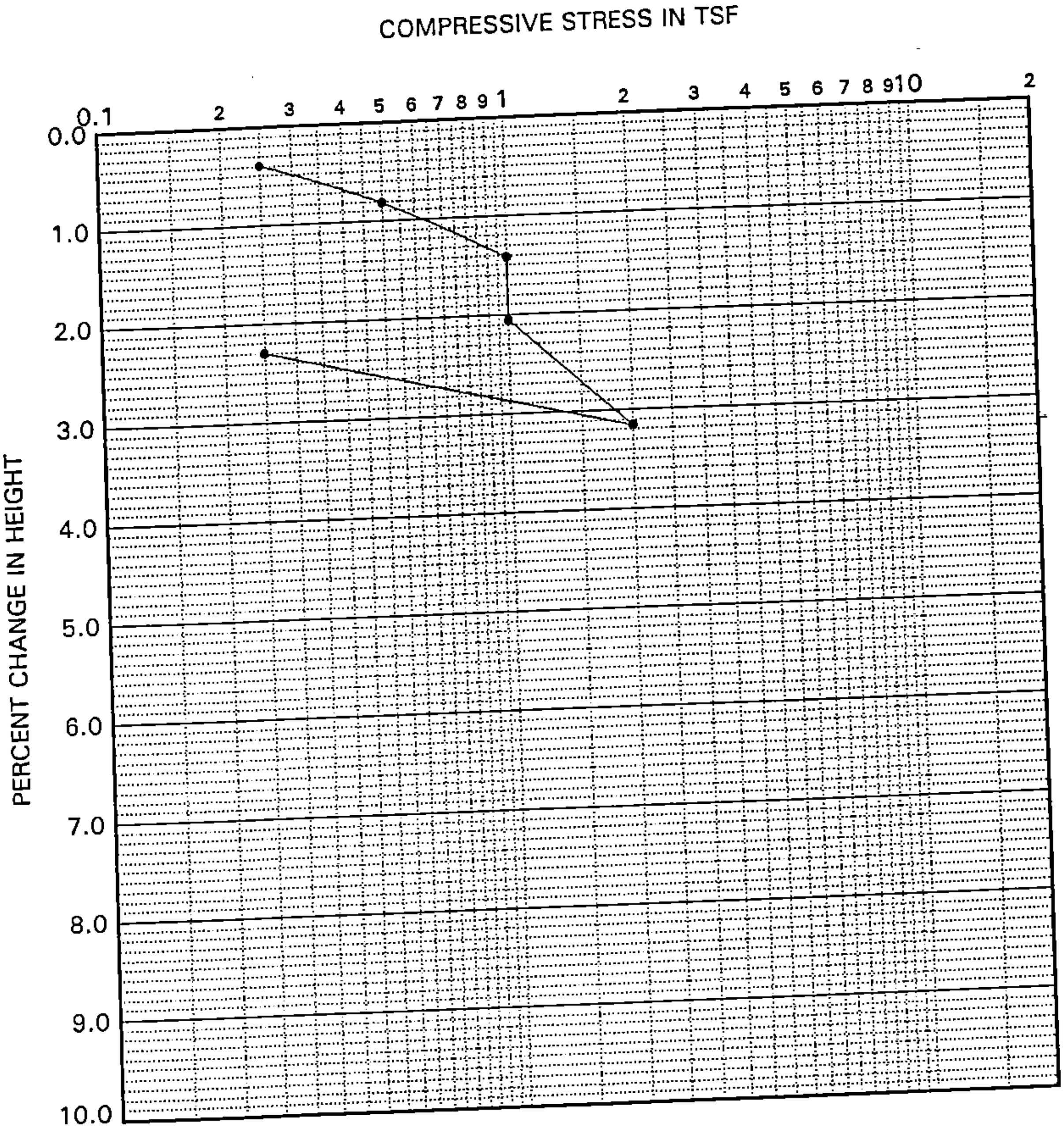
REMARKS: Water added at 1 tsf.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500236

PLATE B-6



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-6	10.00	109.70	8.40	37.0	SM	Silty Sand (Qtm)

REMARKS: Water added at 1 tsf.

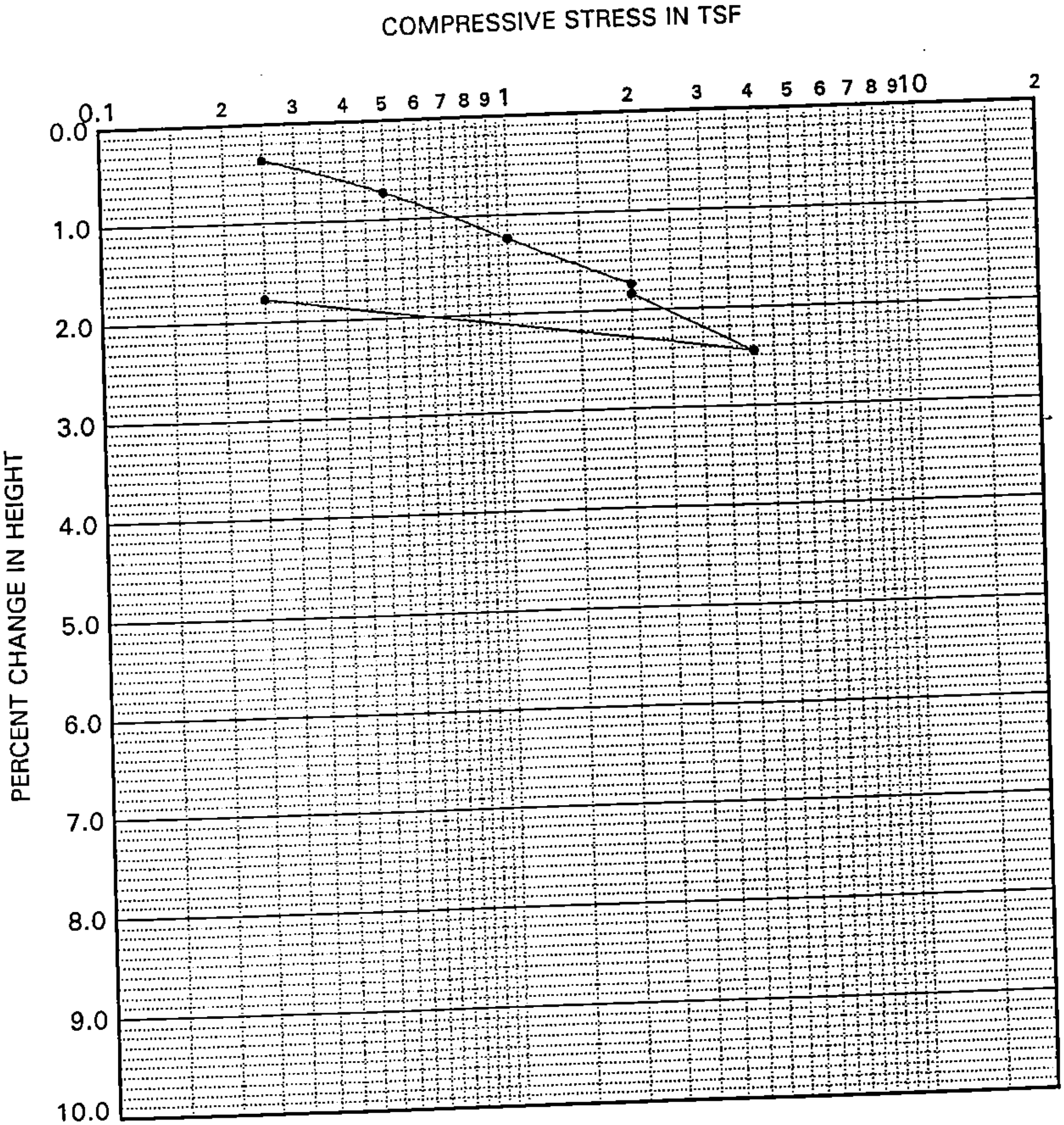
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500236

PLATE B-7



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-6	31.50	103.00	3.10	12.0	SP-SM	Sand with Silt (Qsp)

REMARKS: Water added at 2 tsf.

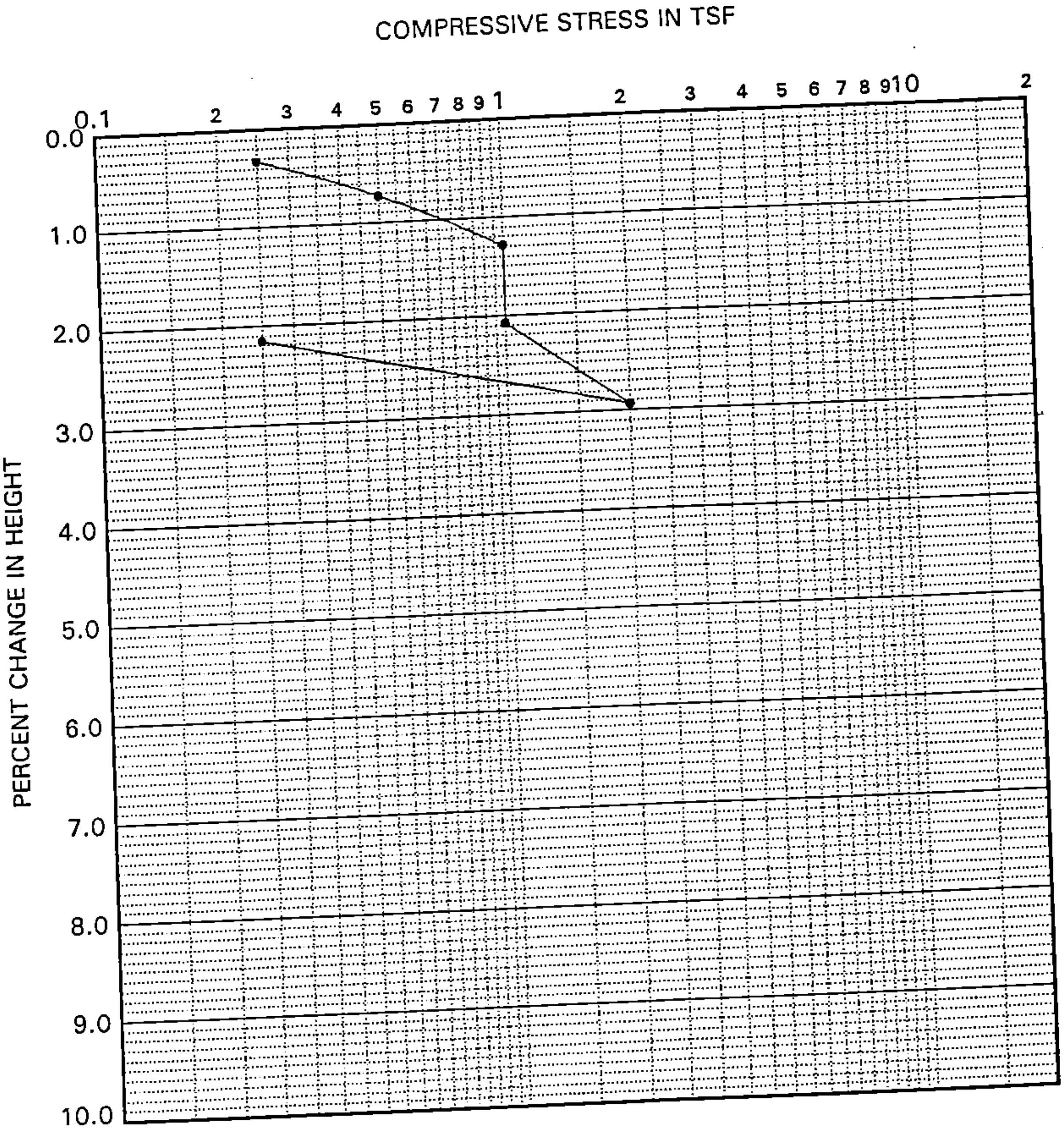
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500236

PLATE B-8



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-7	10.00	96.40	4.00	60.0	ML	Silt (Qtm)

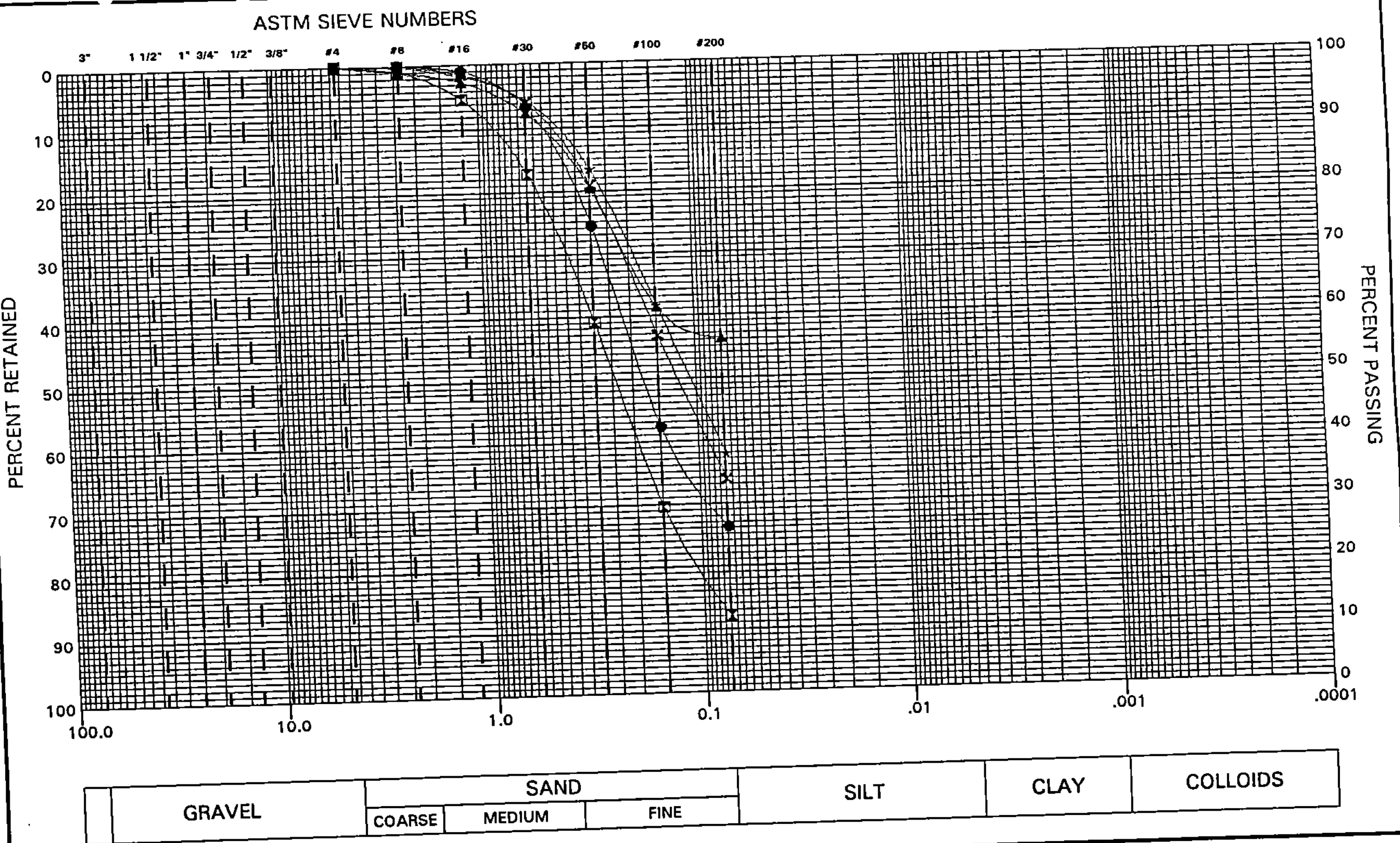
REMARKS: Water added at 1 tsf.

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500236

PLATE B-9

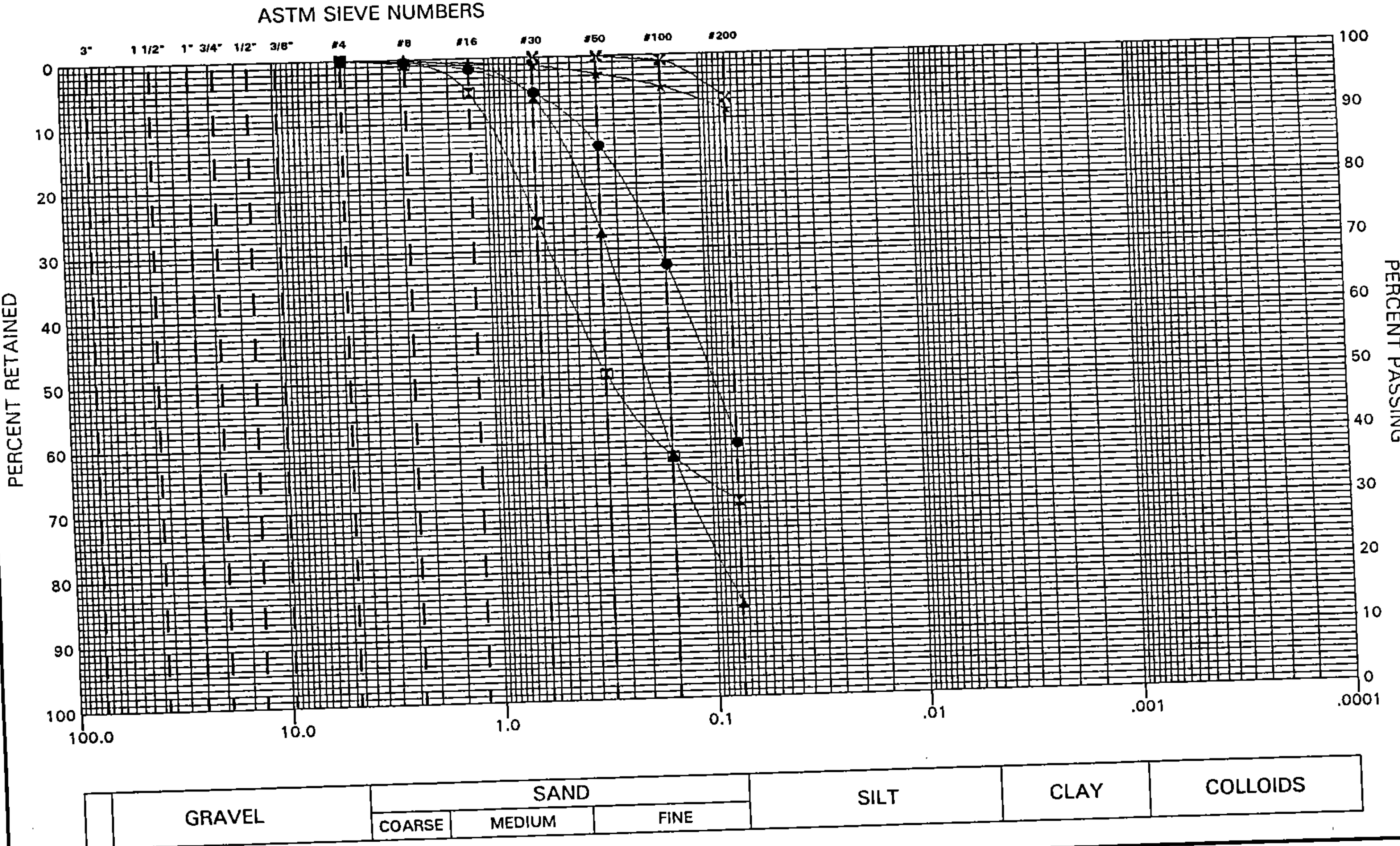


symbol	boring or trench	depth(ft.)	L.L.	P.L.	sand equiv.	% passing #200 sieve	group symbol	typical names
●	HB-1	5.00				26.5	SM	Silty Sand (Qal)
⊠	HB-1	10.00				12.3	SP-SM	Sand with Silt (Qal)
▲	HB-1	15.00				56.3	ML	Sandy Silt (Qal)
★	HB-1	20.00				38.3	SM	Silty Sand (Qal)
✕	HB-1	25.00				34.1	SM	Silty Sand (Qal)

GRAIN SIZE DISTRIBUTION

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE. STE 514 TUSTIN, CA 92680 714-730-2122

W.O. 500236 PLATE B-10



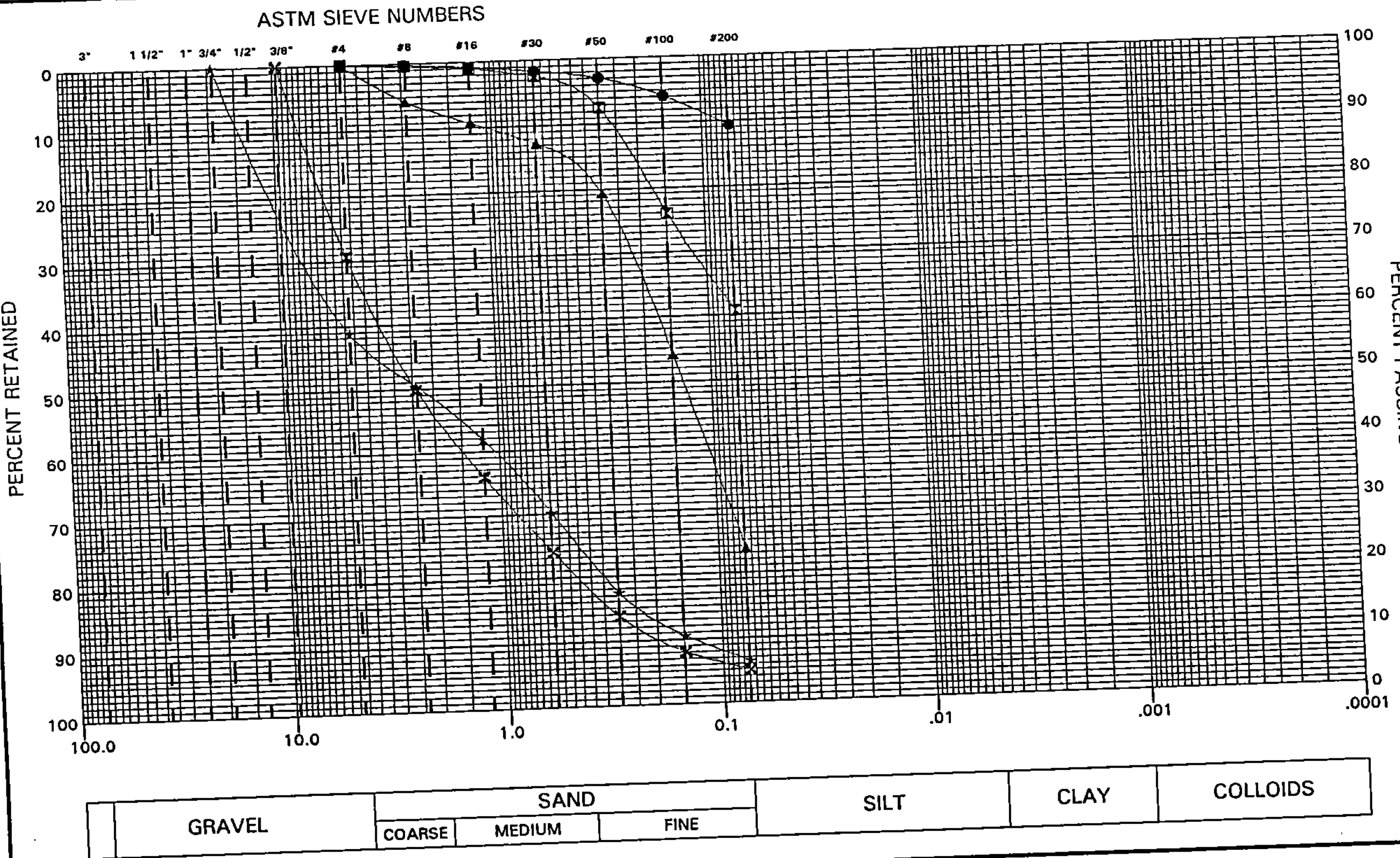
symbol	boring or trench	depth(ft.)	L.L.	P.L.	sand equiv.	% passing #200 sieve	group symbol	typical names
●	HB-1	30.00				39.8	SM	Silty Sand (Qsp)
⌧	HB-1	35.00				30.3	SM	Silty Sand (Qsp)
▲	HB-1	40.00				14.7	SP-SM	Sand with Silt (Qsp)
★	HB-1	45.00				91.4	ML	Silt (Qsp)
✕	HB-1	50.00				93.2	ML	Silt (Qspm)

GRAIN SIZE DISTRIBUTION

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE. STE 514 TUSTIN, CA 92680 714-730-2122

W.O. 500236 PLATE B-11

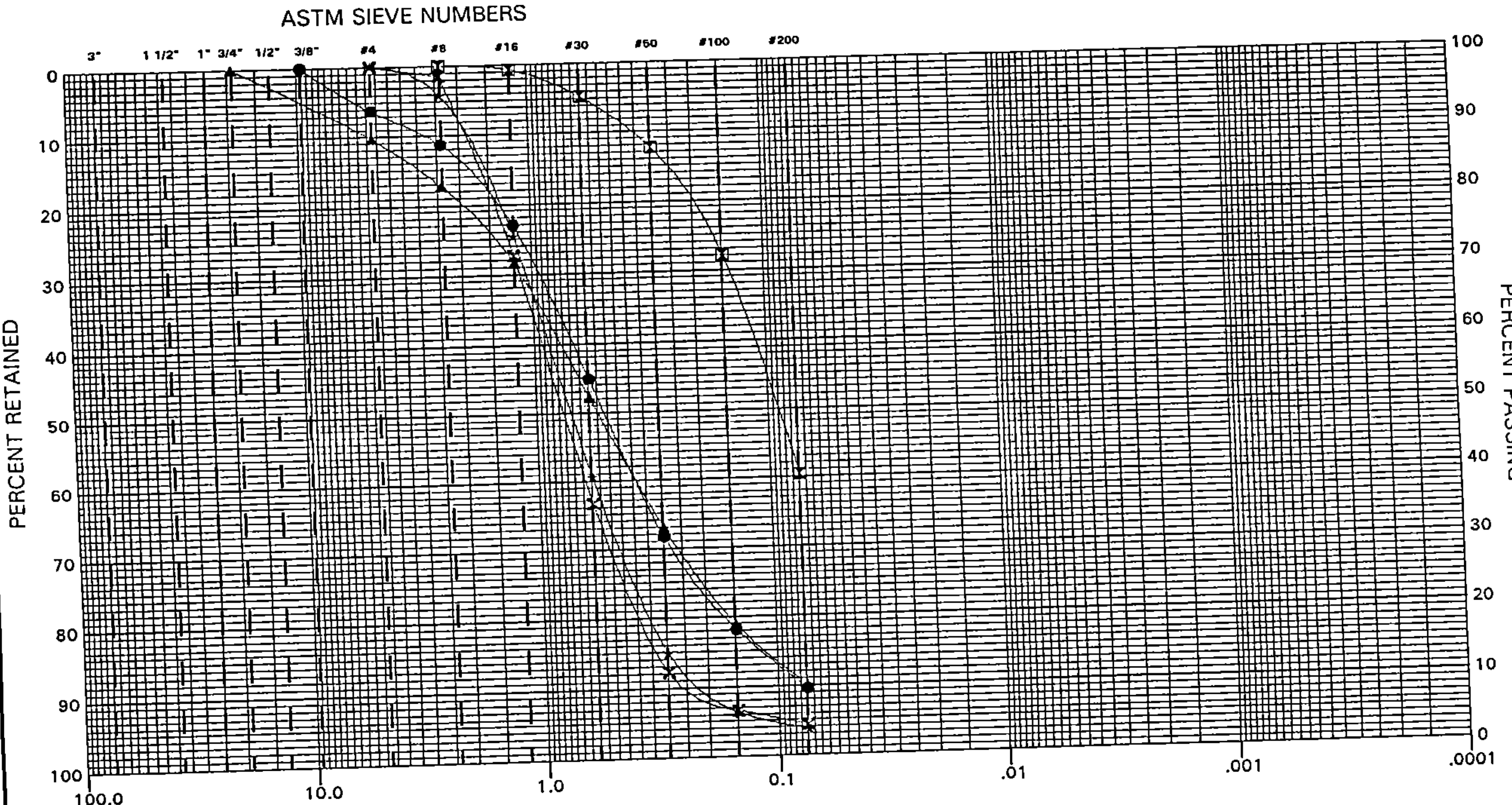


symbol	boring or trench	depth(ft.)	L.L.	P.L.	sand equiv.	% passing #200 sieve	group symbol	typical names
●	HB-2	5.00				89.4	ML	Silt (Qal)
⊠	HB-2	10.00				60.8	ML	Silt (Qal)
▲	HB-2	15.00				24.3	SM	Silty Sand (Qal)
★	HB-2	20.00				6.5	SP-SM	Sand with Silt (Qal)
✕	HB-2	25.00				5.1	SP	Sand (Qal)

GRAIN SIZE DISTRIBUTION

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE. STE 514 TUSTIN, CA 92680 714-730-2122

W.O. 500236 PLATE B-12



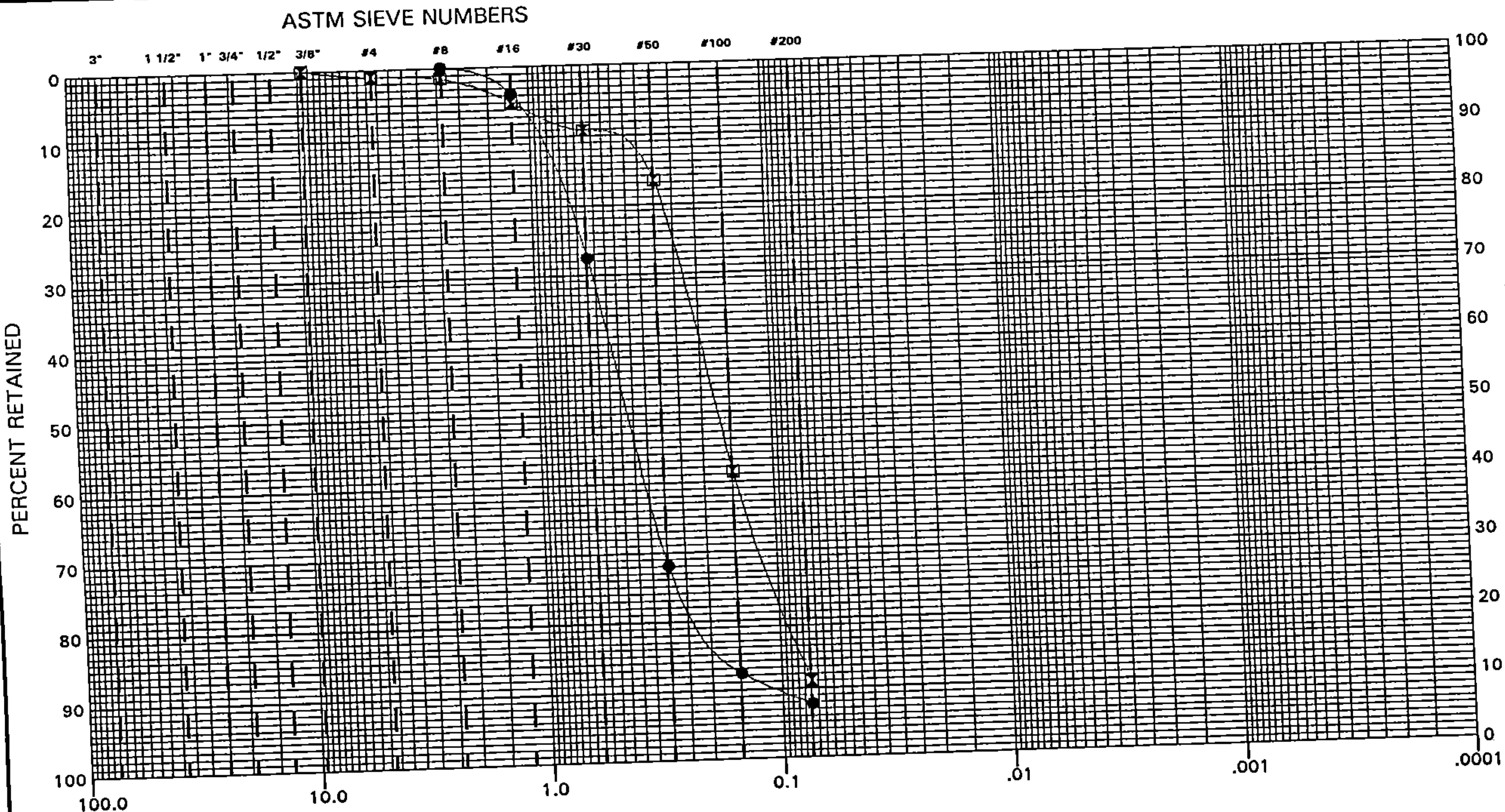
symbol	boring or trench	depth(ft.)	L.L.	P.L.	sand equiv.	% passing #200 sieve	group symbol	typical names
●	HB-2	30.00				9.7	SP-SM	Sand with Silt (Qal)
⊠	HB-2	35.00				40.8	SM	Silty Sand (Qal)
▲	HB-2	40.00				10.2	SP-SM	Sand with Silt (Qal)
★	HB-2	45.00				3.7	SP	Sand (Qal)
✕	HB-2	50.00				4.3	SP	Sand (Qal)

GRAIN SIZE DISTRIBUTION

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE. STE 514 TUSTIN, CA 92680 714-730-2122

W.O. 500236 PLATE B-13



symbol	boring or trench	depth(ft.)	L.L.	P.L.	sand equiv.	% passing #200 sieve	group symbol	typical names
●	HB-2	55.00				7.8	SP-SM	Sand with Silt (Qal)
⊠	HB-2	60.00				11.6	SP-SM	Sand with Silt (Qal)

GRAIN SIZE DISTRIBUTION

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE. STE 514 TUSTIN, CA 92680 714-730-2122

W.O. 500236 PLATE B-14

Applied P & Ch Laboratory
4068 E. Mission Blvd., Pomona, CA 91766
Tel: (909) 623-8148 Fax: (909) 623-3190

APCL Analytical Report

Service ID #: 801-933202
Collected by: R B
Collected on: 06/25/93
Sample description:
Soil Samples 500236

Received : 06/29/93
Tested : 07/02/93
Reported : 07/02/93

Submitted to:
Pacific Soils Engineering, Inc.
Attention: Keeney Van Horn
10653 Progress Way
Cypress, CA 90630
Tel: (714)220-0770 Fax: (714)220-9589

Analysis of Soil

Component Analyzed	Method	Unit	MDL	Concentration: 500236 B-2 10' 93-3202-2	Concentration: 500236 B-5 13' 93-3202-3
pH	150.1/9045	pH unit	±0.01	—	—
Sulfate (SO_4^{--})	375.4	mg/kg	1	23	124
Chloride Cl^-	325.3	mg/kg	1	—	—

MDL : Method Detection Limit
— : The analysis has not been required for that sample.

Respectfully submitted,

Jack, Y. Zhang, Ph. D.,
Director
Applied P & Ch Laboratory

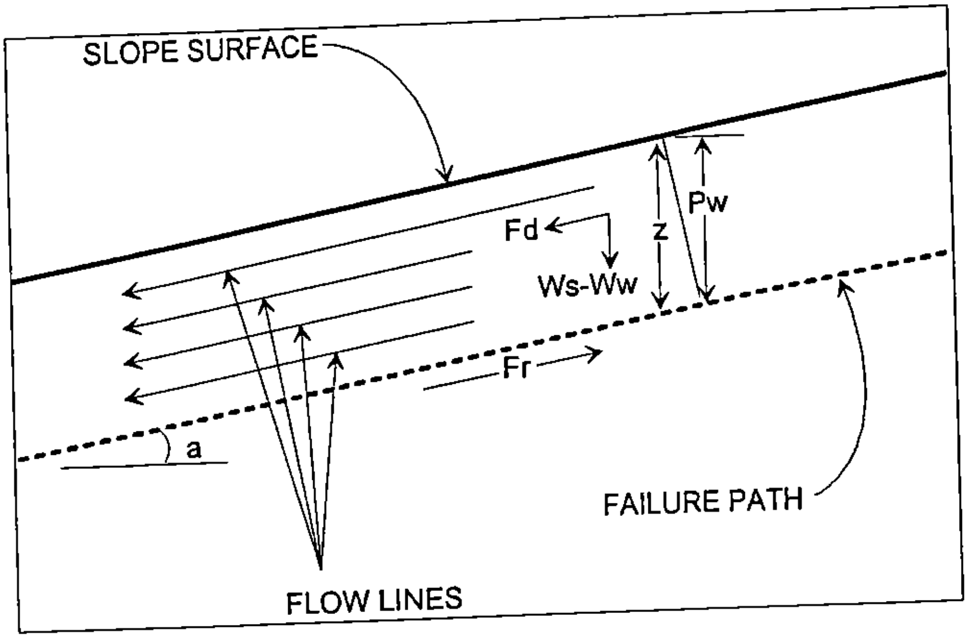
CADHS ELAP CERTIFICATION NUMBER 1431

PLATE B-15

APPENDIX C

Slope Stability Results

SURFICIAL SLOPE STABILITY



Assume: (1) Saturation To Slope Surface
(2) Sufficient Permeability To Establish Water Flow

Pw = Water Pressure Head = (z)(cos^2(a))
Ws = Saturated Soil Unit Weight
Ww = Unit Weight of Water (62.4 lb/cu.ft.)
u = Pore Water Pressure = (Ww)(z)(cos^2(a))
z = Layer Thickness
a = Angle of Slope
phi = Angle of Friction
c = Cohesion
Fd = (0.5)(z)(Ws)(sin(2a))
Fr = (z)(Ws-Ww)(cos^2(a))(tan(phi)) + c
Factor of Safety (FS) = Fr/Fd

FILL

Given:

Ws (pcf)	z (ft)	a (degrees)	a (radians)	phi (degrees)	phi (radians)	c (psf)
110	4	26	0.453787	32	0.558507	100

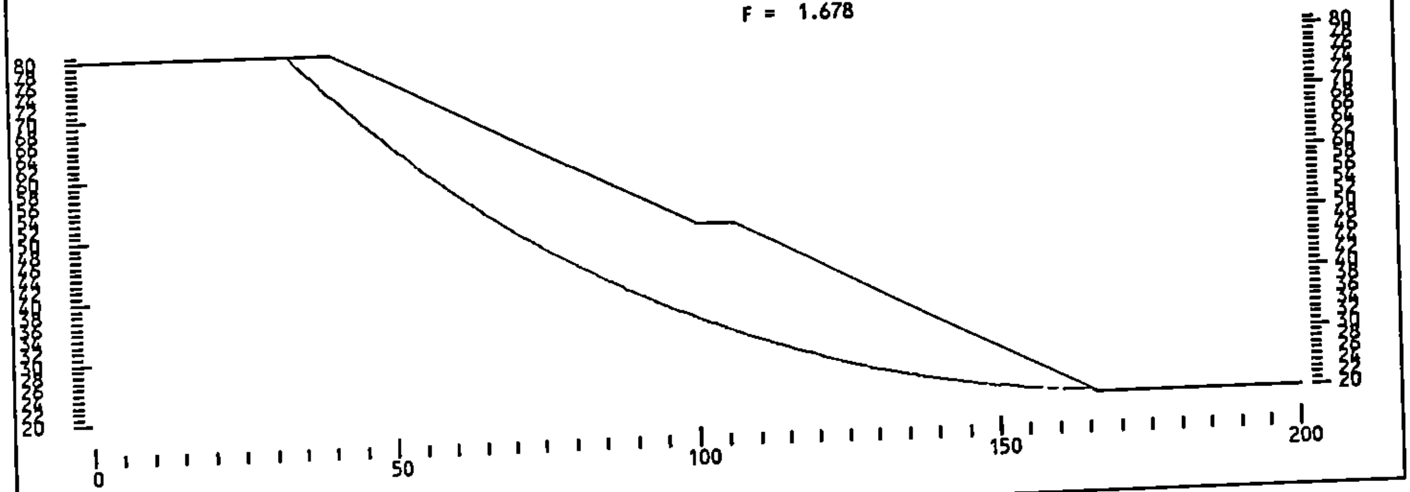
Calculations:

Pw	u	Fd	Fr	FS
3.23	201.63	173.36	196.11	1.13

Material	Unit Wt pcf	C psf	Phi deg	Piezo Surf.	Ru
FILL	110	100	32	0	0

Pacific Soils Engrg. - Tustin CA
W.O. 500236
NEWPORT BANNING RANCH
10/4/93
60 FT. FILL SLOPE ANALYSIS
STATIC CASE
50236FIL.GSL

F = 1.678



DATA FILE NAME..... C:\GS32\50236FIL.GSL

Job No.	W.O. 500236
Title	NEWPORT BANNING RANCH
Date	10/4/93
Label A	60 FT. FILL SLOPE ANALYSIS
Label B	STATIC CASE

Max Slice Width	5
Set Neg. Normals to zero	N
No. of Materials	1
Seismic Acceleration	0
External Forces	0
Piezometric Surfaces	0
Unit Wt. of Pore Fluid	62.4

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surface	Ru Value
# 1 -FILL	110	100	32	0	0

Upper Surface of Material # 1 (FILL)

X-Coord	Y-Coord
0	80
40	80
100	50
106	50
166	20
200	20

There are no explicit external forces in the data set.

GSLOPE 3.21

LIMIT EQUILIBRIUM SLOPE STABILITY ANALYSIS

Licensed by MITRE Software Corporation, Edmonton, Canada for use at:-

Pacific Soils Engrg. - Tustin CA

Results are for Bishop's Modified Method unless otherwise noted.

File C:\GS32\50236FIL.GSL   Output dated 10-04-1993 at 08:52:35

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surface	Ru Value
# 1 -FILL	110	100	32	0	0

X-centre	Y-centre	Radius	Factor of Safety	Iterations	Slices	M Alpha Warnings
150.00	188.00	168.00	1.7628	5	31	0
150.00	188.00	169.00	1.7729	5	33	0
150.00	188.00	170.00	1.7925	5	36	0
150.00	188.00	171.00	1.8145	5	37	0
150.00	188.00	172.00	1.8388	5	38	0
154.00	188.00	168.00	1.7313	5	30	0
154.00	188.00	169.00	1.7456	5	34	0
154.00	188.00	170.00	1.7672	5	35	0
154.00	188.00	171.00	1.7914	5	36	0
154.00	188.00	172.00	1.8178	5	37	0
158.00	188.00	168.00	1.7072	5	30	0
158.00	188.00	169.00	1.7266	5	34	0
158.00	188.00	170.00	1.7503	5	35	0
158.00	188.00	171.00	1.7766	5	36	0
158.00	188.00	172.00	1.8052	5	38	0
162.00	188.00	168.00	1.6920	5	29	0
162.00	188.00	169.00	1.7184	5	33	0
162.00	188.00	170.00	1.7439	5	35	0
162.00	188.00	171.00	1.7722	5	37	0
162.00	188.00	172.00	1.8024	5	38	0
166.00	188.00	168.00	1.6895	5	29	0
166.00	188.00	169.00	1.7242	5	33	0
166.00	188.00	170.00	1.7512	5	36	0
166.00	188.00	171.00	1.7807	5	37	0
166.00	188.00	172.00	SURFACE OUTSIDE GEOMETRY			
170.00	188.00	168.00	1.7032	5	26	0
170.00	188.00	169.00	1.7500	5	32	0
170.00	188.00	170.00	1.7772	5	36	0
170.00	188.00	171.00	SURFACE OUTSIDE GEOMETRY			
170.00	188.00	172.00	SURFACE OUTSIDE GEOMETRY			
174.00	188.00	168.00	1.7235	5	25	0
174.00	188.00	169.00	1.7901	5	32	0
174.00	188.00	170.00	1.8232	5	34	0
174.00	188.00	171.00	SURFACE OUTSIDE GEOMETRY			

			SURFACE OUTSIDE GEOMETRY			
178.00	188.00	168.00	1.7522	5	23	0
178.00	188.00	169.00	1.8456	5	32	0
178.00	188.00	170.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	188.00	171.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	188.00	172.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	188.00	168.00	1.7930	5	22	0
182.00	188.00	169.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	188.00	170.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	188.00	171.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	188.00	172.00				
			SURFACE OUTSIDE GEOMETRY			
150.00	192.00	172.00	1.7725	5	32	0
150.00	192.00	173.00	1.7832	5	34	0
150.00	192.00	174.00	1.8028	5	36	0
150.00	192.00	175.00	1.8250	5	37	0
150.00	192.00	176.00	1.8497	5	39	0
154.00	192.00	172.00	1.7391	5	31	0
154.00	192.00	173.00	1.7538	5	34	0
154.00	192.00	174.00	1.7757	5	35	0
154.00	192.00	175.00	1.8003	5	38	0
154.00	192.00	176.00	1.8269	5	39	0
158.00	192.00	172.00	1.7122	5	30	0
158.00	192.00	173.00	1.7323	5	34	0
158.00	192.00	174.00	1.7567	5	36	0
158.00	192.00	175.00	1.7834	5	37	0
158.00	192.00	176.00	1.8120	5	38	0
162.00	192.00	172.00	1.6935	5	29	0
162.00	192.00	173.00	1.7206	5	33	0
162.00	192.00	174.00	1.7470	5	36	0
162.00	192.00	175.00	1.7757	5	37	0
162.00	192.00	176.00	1.8063	5	38	0
166.00	192.00	172.00	1.6856	5	29	0
166.00	192.00	173.00	1.7216	5	34	0
166.00	192.00	174.00	1.7495	5	36	0
166.00	192.00	175.00	1.7799	5	37	0
166.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	192.00	172.00	1.6944	5	28	0
170.00	192.00	173.00	1.7398	5	34	0
170.00	192.00	174.00	1.7686	5	36	0
170.00	192.00	175.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	192.00	172.00	1.7141	5	25	0
174.00	192.00	173.00	1.7783	5	33	0
174.00	192.00	174.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	192.00	175.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	192.00	172.00	1.7416	5	24	0
178.00	192.00	173.00	1.8304	5	32	0
178.00	192.00	174.00				

178.00	192.00	175.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	192.00	172.00	1.7803	5	22	0
182.00	192.00	173.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	192.00	174.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	192.00	175.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
150.00	196.00	176.00	1.7828	5	32	0
150.00	196.00	177.00	1.7939	5	34	0
150.00	196.00	178.00	1.8139	5	37	0
150.00	196.00	179.00	1.8364	5	38	0
150.00	196.00	180.00	1.8610	5	39	0
154.00	196.00	176.00	1.7477	5	31	0
154.00	196.00	177.00	1.7629	5	34	0
154.00	196.00	178.00	1.7853	5	36	0
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166.00	196.00	176.00	1.6847	5	30	0
166.00	196.00	177.00	1.7212	5	34	0
166.00	196.00	178.00	1.7499	5	36	0
166.00	196.00	179.00	1.7811	5	38	0
166.00	196.00	180.00				
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170.00	196.00	177.00	1.7329	5	34	0
170.00	196.00	178.00	1.7632	5	37	0
170.00	196.00	179.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	196.00	180.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	196.00	176.00	1.7051	5	26	0
174.00	196.00	177.00	1.7667	5	33	0
174.00	196.00	178.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	196.00	179.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	196.00	180.00				
			SURFACE OUTSIDE GEOMETRY			
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178.00	196.00	178.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	196.00	179.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	196.00	180.00				
			SURFACE OUTSIDE GEOMETRY			

182.00	196.00	177.00				
		SURFACE OUTSIDE GEOMETRY				
182.00	196.00	178.00				
		SURFACE OUTSIDE GEOMETRY				
182.00	196.00	179.00				
		SURFACE OUTSIDE GEOMETRY				
182.00	196.00	180.00				
		SURFACE OUTSIDE GEOMETRY				
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150.00	200.00	182.00	1.8255	5	37	0
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162.00	200.00	181.00	1.7300	5	35	0
162.00	200.00	182.00	1.7572	5	36	0
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162.00	200.00	184.00				
		SURFACE OUTSIDE GEOMETRY				
166.00	200.00	180.00	1.6857	5	30	0
166.00	200.00	181.00	1.7227	5	34	0
166.00	200.00	182.00	1.7524	5	37	0
166.00	200.00	183.00	1.7839	5	38	0
166.00	200.00	184.00				
		SURFACE OUTSIDE GEOMETRY				
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170.00	200.00	182.00	1.7604	5	37	0
170.00	200.00	183.00				
		SURFACE OUTSIDE GEOMETRY				
170.00	200.00	184.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	200.00	180.00	1.6961	5	28	0
174.00	200.00	181.00	1.7549	5	35	0
174.00	200.00	182.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	200.00	183.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	200.00	184.00				
		SURFACE OUTSIDE GEOMETRY				
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178.00	200.00	181.00	1.8023	5	34	0
178.00	200.00	182.00				
		SURFACE OUTSIDE GEOMETRY				
178.00	200.00	183.00				
		SURFACE OUTSIDE GEOMETRY				
178.00	200.00	184.00				
		SURFACE OUTSIDE GEOMETRY				
182.00	200.00	180.00	1.7559	5	24	0
182.00	200.00	181.00				
		SURFACE OUTSIDE GEOMETRY				
182.00	200.00	182.00				

182.00	200.00	183.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	200.00	184.00				
			SURFACE OUTSIDE GEOMETRY			
150.00	204.00	184.00	1.8056	5	33	0
150.00	204.00	185.00	1.8173	5	35	0
150.00	204.00	186.00	1.8375	5	37	0
150.00	204.00	187.00	1.8601	5	38	0
150.00	204.00	188.00	1.8851	5	40	0
154.00	204.00	184.00	1.7675	5	32	0
154.00	204.00	185.00	1.7835	5	35	0
154.00	204.00	186.00	1.8061	5	37	0
154.00	204.00	187.00	1.8313	5	39	0
154.00	204.00	188.00	1.8583	5	40	0
158.00	204.00	184.00	1.7346	5	31	0
158.00	204.00	185.00	1.7562	5	35	0
158.00	204.00	186.00	1.7815	5	37	0
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162.00	204.00	186.00	1.7642	5	37	0
162.00	204.00	187.00	1.7939	5	38	0
162.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	204.00	184.00	1.6885	5	30	0
166.00	204.00	185.00	1.7262	5	35	0
166.00	204.00	186.00	1.7561	5	37	0
166.00	204.00	187.00	1.7881	5	38	0
166.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
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170.00	204.00	186.00	1.7598	5	37	0
170.00	204.00	187.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	204.00	184.00	1.6869	5	28	0
174.00	204.00	185.00	1.7462	5	35	0
174.00	204.00	186.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	204.00	187.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	204.00	184.00	1.7111	5	26	0
178.00	204.00	185.00	1.7890	5	34	0
178.00	204.00	186.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	204.00	187.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	204.00	184.00	1.7440	5	24	0
182.00	204.00	185.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	204.00	186.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	204.00	187.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	204.00	188.00				

150.00	208.00	188.00	1.8176	5	33	0
150.00	208.00	189.00	1.8296	5	35	0
150.00	208.00	190.00	1.8501	5	38	0
150.00	208.00	191.00	1.8729	5	39	0
150.00	208.00	192.00	1.8977	5	40	0
154.00	208.00	188.00	1.7784	5	32	0
154.00	208.00	189.00	1.7948	5	36	0
154.00	208.00	190.00	1.8176	5	38	0
154.00	208.00	191.00	1.8427	5	39	0
154.00	208.00	192.00	1.8698	5	40	0
158.00	208.00	188.00	1.7438	5	31	0
158.00	208.00	189.00	1.7660	5	36	0
158.00	208.00	190.00	1.7913	5	37	0
158.00	208.00	191.00	1.8187	5	39	0
158.00	208.00	192.00	1.8482	5	41	0
162.00	208.00	188.00	1.7151	5	31	0
162.00	208.00	189.00	1.7442	5	36	0
162.00	208.00	190.00	1.7720	5	37	0
162.00	208.00	191.00	1.8019	5	38	0
162.00	208.00	192.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	208.00	188.00	1.6931	5	31	0
166.00	208.00	189.00	1.7309	5	35	0
166.00	208.00	190.00	1.7612	5	37	0
166.00	208.00	191.00	1.7936	5	39	0
166.00	208.00	192.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	208.00	188.00	1.6805	5	29	0
170.00	208.00	189.00	1.7283	5	35	0
170.00	208.00	190.00	1.7612	5	38	0
170.00	208.00	191.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	208.00	192.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	208.00	188.00	1.6811	5	28	0
174.00	208.00	189.00	1.7409	5	36	0
174.00	208.00	190.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	208.00	191.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	208.00	192.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	208.00	188.00	1.7015	5	26	0
178.00	208.00	189.00	1.7754	5	36	0
178.00	208.00	190.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	208.00	191.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	208.00	192.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	208.00	188.00	1.7326	5	25	0
182.00	208.00	189.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	208.00	190.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	208.00	191.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	208.00	192.00				
			SURFACE OUTSIDE GEOMETRY			
150.00	212.00	192.00	1.8301	5	33	0
150.00	212.00	193.00	1.8425	5	36	0
150.00	212.00	194.00	1.8629	5	38	0

150.00	212.00	196.00	1.9105	4	40	0
154.00	212.00	192.00	1.7899	5	33	0
154.00	212.00	193.00	1.8065	5	36	0
154.00	212.00	194.00	1.8294	5	38	0
154.00	212.00	195.00	1.8545	5	39	0
154.00	212.00	196.00	1.8818	5	41	0
158.00	212.00	192.00	1.7540	5	32	0
158.00	212.00	193.00	1.7763	5	36	0
158.00	212.00	194.00	1.8017	5	37	0
158.00	212.00	195.00	1.8294	5	40	0
158.00	212.00	196.00	1.8588	5	41	0
162.00	212.00	192.00	1.7233	5	31	0
162.00	212.00	193.00	1.7526	5	36	0
162.00	212.00	194.00	1.7808	5	38	0
162.00	212.00	195.00	1.8108	5	40	0
162.00	212.00	196.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	212.00	192.00	1.6988	5	31	0
166.00	212.00	193.00	1.7367	5	35	0
166.00	212.00	194.00	1.7676	5	38	0
166.00	212.00	195.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	212.00	196.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	212.00	192.00	1.6827	5	29	0
170.00	212.00	193.00	1.7309	5	36	0
170.00	212.00	194.00	1.7641	5	38	0
170.00	212.00	195.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	212.00	196.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	212.00	192.00	1.6783	5	29	0
174.00	212.00	193.00	1.7380	5	36	0
174.00	212.00	194.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	212.00	195.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	212.00	196.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	212.00	192.00	1.6910	5	28	0
178.00	212.00	193.00	1.7643	5	36	0
178.00	212.00	194.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	212.00	195.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	212.00	196.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	212.00	192.00	1.7216	5	26	0
182.00	212.00	193.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	212.00	194.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	212.00	195.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	212.00	196.00				
			SURFACE OUTSIDE GEOMETRY			
150.00	216.00	196.00	1.8431	5	34	0
150.00	216.00	197.00	1.8555	5	36	0
150.00	216.00	198.00	1.8760	5	38	0
150.00	216.00	199.00	1.8990	4	40	0
150.00	216.00	200.00	1.9239	4	41	0
154.00	216.00	196.00	1.8018	5	33	0

154.00	216.00	198.00	1.8415	5	38	0
154.00	216.00	199.00	1.8669	5	40	0
154.00	216.00	200.00	1.8941	5	41	0
158.00	216.00	196.00	1.7646	5	32	0
158.00	216.00	197.00	1.7871	5	36	0
158.00	216.00	198.00	1.8128	5	39	0
158.00	216.00	199.00	1.8404	5	40	0
158.00	216.00	200.00	1.8699	5	41	0
162.00	216.00	196.00	1.7322	5	31	0
162.00	216.00	197.00	1.7619	5	37	0
162.00	216.00	198.00	1.7901	5	38	0
162.00	216.00	199.00	1.8202	5	40	0
162.00	216.00	200.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	216.00	196.00	1.7057	5	32	0
166.00	216.00	197.00	1.7439	5	36	0
166.00	216.00	198.00	1.7748	5	38	0
166.00	216.00	199.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	216.00	200.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	216.00	196.00	1.6867	5	30	0
170.00	216.00	197.00	1.7347	5	36	0
170.00	216.00	198.00	1.7683	5	38	0
170.00	216.00	199.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	216.00	200.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	216.00	196.00	1.6777	5	29	0
174.00	216.00	197.00	1.7374	5	36	0
174.00	216.00	198.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	216.00	199.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	216.00	200.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	216.00	196.00	1.6835	5	28	0
178.00	216.00	197.00	1.7567	5	36	0
178.00	216.00	198.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	216.00	199.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	216.00	200.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	216.00	196.00	1.7109	5	26	0
182.00	216.00	197.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	216.00	198.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	216.00	199.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	216.00	200.00				
			SURFACE OUTSIDE GEOMETRY			
150.00	220.00	200.00	1.8563	5	34	0
150.00	220.00	201.00	1.8689	5	36	0
150.00	220.00	202.00	1.8896	5	39	0
150.00	220.00	203.00	1.9124	4	40	0
150.00	220.00	204.00	1.9374	4	41	0
154.00	220.00	200.00	1.8140	5	33	0
154.00	220.00	201.00	1.8312	5	37	0
154.00	220.00	202.00	1.8542	5	39	0
154.00	220.00	203.00	1.8795	5	40	0

158.00	220.00	200.00	1.7757	5	32	0
158.00	220.00	201.00	1.7986	5	37	0
158.00	220.00	202.00	1.8242	5	39	0
158.00	220.00	203.00	1.8519	5	40	0
158.00	220.00	204.00	1.8816	5	42	0
162.00	220.00	200.00	1.7421	5	32	0
162.00	220.00	201.00	1.7718	5	37	0
162.00	220.00	202.00	1.8001	5	38	0
162.00	220.00	203.00	1.8304	5	41	0
162.00	220.00	204.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	220.00	200.00	1.7135	5	32	0
166.00	220.00	201.00	1.7517	5	37	0
166.00	220.00	202.00	1.7827	5	38	0
166.00	220.00	203.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	220.00	204.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	220.00	200.00	1.6919	5	30	0
170.00	220.00	201.00	1.7398	5	36	0
170.00	220.00	202.00	1.7739	5	39	0
170.00	220.00	203.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	220.00	204.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	220.00	200.00	1.6791	5	29	0
174.00	220.00	201.00	1.7388	5	37	0
174.00	220.00	202.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	220.00	203.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	220.00	204.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	220.00	200.00	1.6791	5	28	0
178.00	220.00	201.00	1.7522	5	37	0
178.00	220.00	202.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	220.00	203.00				
			SURFACE OUTSIDE GEOMETRY			
178.00	220.00	204.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	220.00	200.00	1.6995	5	28	0
182.00	220.00	201.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	220.00	202.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	220.00	203.00				
			SURFACE OUTSIDE GEOMETRY			
182.00	220.00	204.00				
			SURFACE OUTSIDE GEOMETRY			

Minimum Bishop Factor of Safety this run:

174.00	216.00	196.00	1.6777	5	29	0

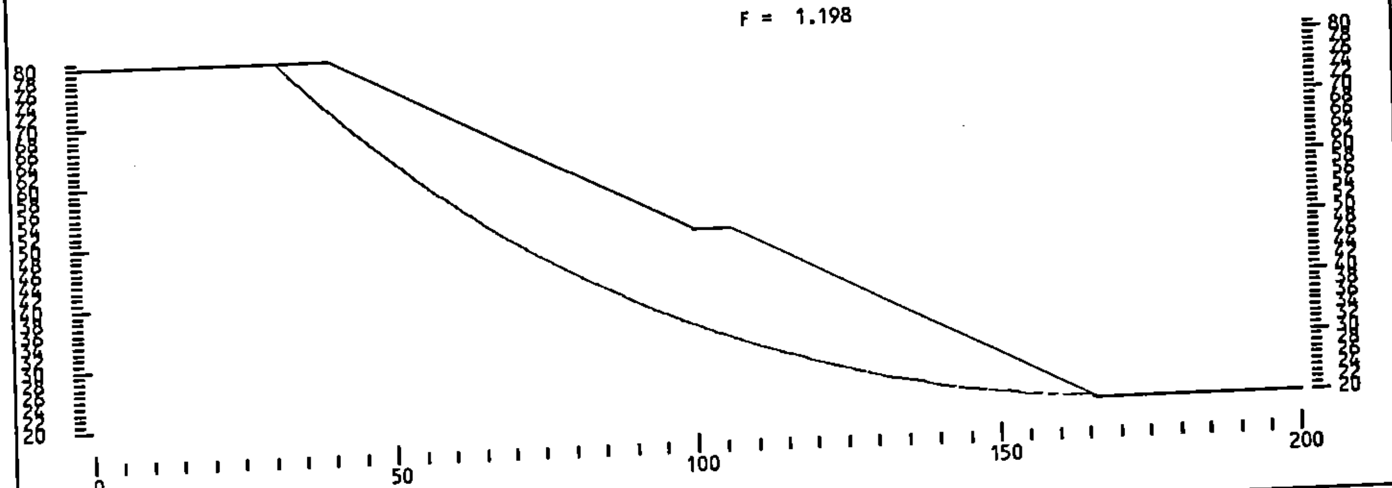
Material	Unit Wt pcf	C psf	Phi deg	Piezo Surf.	Ru
FILL	110	100	32	0	0

PSeismic coefficient = .15

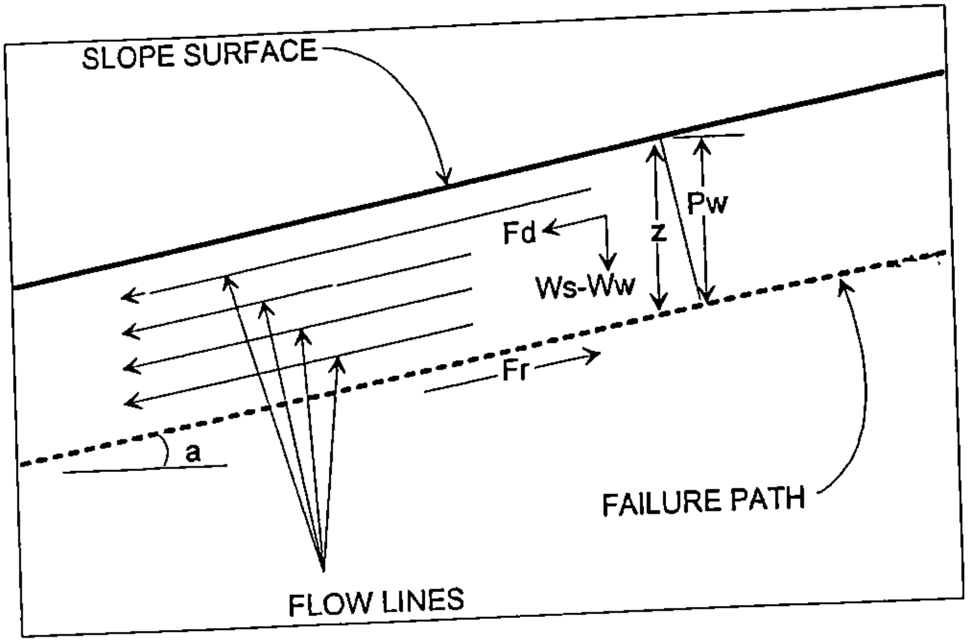
Pacific Soils Engrg. - Tustin CA
W.O. 500236
NEWPORT BANNING RANCH
10/4/93
60 FT. FILL SLOPE ANALYSIS

50236FIL.GSL

F = 1.198



SURFICIAL SLOPE STABILITY



Assume: (1) Saturation To Slope Surface
(2) Sufficient Permeability To Establish Water Flow

Pw = Water Pressure Head = (z)(cos^2(a))
Ws = Saturated Soil Unit Weight
Ww = Unit Weight of Water (62.4 lb/cu.ft.)
u = Pore Water Pressure = (Ww)(z)(cos^2(a))
z = Layer Thickness
a = Angle of Slope
phi = Angle of Friction
c = Cohesion
Fd = (0.5)(z)(Ws)(sin(2a))
Fr = (z)(Ws-Ww)(cos^2(a))(tan(phi)) + c
Factor of Safety (FS) = Fr/Fd

FILL

Given:

Ws (pcf)	z (ft)	a (degrees)	a (radians)	phi (degrees)	phi (radians)	c (psf)
110	4	26	0.453787	30	0.5236	300

Calculations:

Pw	u	Fd	Fr	**FS**
3.23	201.63	173.36	388.80	**2.24**

Material	Unit Wt pcf	C psf	Phi deg	Piezo Surf.	Ru
FILL	110	300	30	0	0

Pacific Soils Engrg. - Tustin CA

W.O. 500236

NEWPORT BANNING RANCH

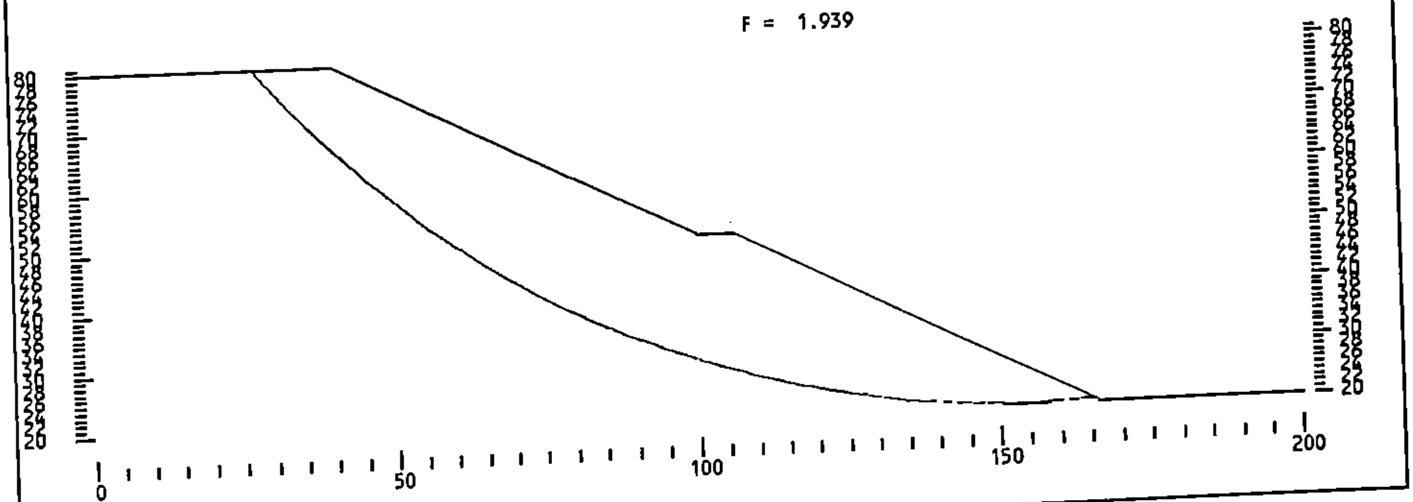
10/4/93

60 FT. FILL SLOPE ANALYSIS

STATIC CASE

50236FIL.GSL

F = 1.939



DATA FILE NAME..... C:\GS32\50236FIL.GSL

Job No.	W.O. 500236
Title	NEWPORT BANNING RANCH
Date	10/4/93
Label A	60 FT. FILL SLOPE ANALYSIS
Label B	STATIC CASE

Max Slice Width	5
Set Neg. Normals to zero	N
No. of Materials	1
Seismic Acceleration	0
External Forces	0
Piezometric Surfaces	0
Unit Wt. of Pore Fluid	62.4

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surface	Ru Value
# 1 -FILL	110	300	30	0	0

Upper Surface of Material # 1 (FILL)

X-Coord	Y-Coord
0	80
40	80
100	50
106	50
166	20
200	20

There are no explicit external forces in the data set.

GSLOPE 3.21

LIMIT EQUILIBRIUM SLOPE STABILITY ANALYSIS

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Pacific Soils Engrg. - Tustin CA

Results are for Bishop's Modified Method unless otherwise noted.

File C:\GS32\50236FIL.GSL   Output dated 10-04-1993 at 09:06:53

Material	Unit Wt	Cohesion	Friction Angle	Piezo Surface	Ru Value
# 1 -FILL	110	300	30	0	0

X-centre	Y-centre	Radius	Factor of Safety	Iterations	Slices	M Alpha Warnings
142.00	176.00	156.00	1.9748	5	32	0
142.00	176.00	157.00	1.9746	5	32	0
142.00	176.00	158.00	1.9776	5	34	0
142.00	176.00	159.00	1.9933	5	35	0
142.00	176.00	160.00	2.0102	4	37	0
146.00	176.00	156.00	1.9537	5	31	0
146.00	176.00	157.00	1.9508	5	31	0
146.00	176.00	158.00	1.9624	5	34	0
146.00	176.00	159.00	1.9794	5	36	0
146.00	176.00	160.00	1.9970	5	37	0
150.00	176.00	156.00	1.9424	5	30	0
150.00	176.00	157.00	1.9406	5	32	0
150.00	176.00	158.00	1.9590	5	34	0
150.00	176.00	159.00	1.9762	5	35	0
150.00	176.00	160.00	1.9943	5	36	0
154.00	176.00	156.00	1.9434	5	29	0
154.00	176.00	157.00	1.9511	5	33	0
154.00	176.00	158.00	1.9691	5	34	0
154.00	176.00	159.00	1.9861	5	35	0
154.00	176.00	160.00	2.0041	5	36	0
158.00	176.00	156.00	1.9611	5	28	0
158.00	176.00	157.00	1.9803	5	32	0
158.00	176.00	158.00	1.9968	5	34	0
158.00	176.00	159.00	2.0125	5	35	0
158.00	176.00	160.00	2.0296	5	37	0
162.00	176.00	156.00	2.0028	5	28	0
162.00	176.00	157.00	2.0355	5	32	0
162.00	176.00	158.00	2.0483	5	34	0
162.00	176.00	159.00	2.0606	5	35	0
162.00	176.00	160.00	2.0750	5	37	0
166.00	176.00	156.00	2.0600	5	26	0
166.00	176.00	157.00	2.1201	5	31	0
166.00	176.00	158.00	2.1317	5	33	0
166.00	176.00	159.00	2.1394	5	36	0
166.00	176.00	160.00	SURFACE OUTSIDE GEOMETRY			
170.00	176.00	156.00	2.1308	5	24	0
170.00	176.00	157.00	2.2256	5	31	0

170.00	176.00	159.00				
		SURFACE OUTSIDE GEOMETRY				
170.00	176.00	160.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	176.00	156.00	2.2231	5	23	0
174.00	176.00	157.00	2.3652	5	30	0
174.00	176.00	158.00	2.3720	5	32	0
174.00	176.00	159.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	176.00	160.00				
		SURFACE OUTSIDE GEOMETRY				
142.00	180.00	160.00	1.9817	5	32	0
142.00	180.00	161.00	1.9820	5	32	0
142.00	180.00	162.00	1.9863	5	35	0
142.00	180.00	163.00	2.0024	4	36	0
142.00	180.00	164.00	2.0194	4	37	0
146.00	180.00	160.00	1.9581	5	31	0
146.00	180.00	161.00	1.9562	5	32	0
146.00	180.00	162.00	1.9690	5	35	0
146.00	180.00	163.00	1.9863	5	36	0
146.00	180.00	164.00	2.0042	4	37	0
150.00	180.00	160.00	1.9434	5	30	0
150.00	180.00	161.00	1.9436	5	33	0
150.00	180.00	162.00	1.9625	5	34	0
150.00	180.00	163.00	1.9804	5	36	0
150.00	180.00	164.00	1.9991	5	37	0
154.00	180.00	160.00	1.9402	5	30	0
154.00	180.00	161.00	1.9496	5	33	0
154.00	180.00	162.00	1.9687	5	34	0
154.00	180.00	163.00	1.9867	5	35	0
154.00	180.00	164.00	2.0058	5	37	0
158.00	180.00	160.00	1.9515	5	29	0
158.00	180.00	161.00	1.9727	5	32	0
158.00	180.00	162.00	1.9908	5	34	0
158.00	180.00	163.00	2.0083	5	36	0
158.00	180.00	164.00	2.0264	5	37	0
162.00	180.00	160.00	1.9834	5	28	0
162.00	180.00	161.00	2.0189	5	32	0
162.00	180.00	162.00	2.0345	5	35	0
162.00	180.00	163.00	2.0492	5	36	0
162.00	180.00	164.00	2.0652	5	37	0
166.00	180.00	160.00	2.0405	5	27	0
166.00	180.00	161.00	2.0984	5	33	0
166.00	180.00	162.00	2.1076	5	35	0
166.00	180.00	163.00	2.1170	5	36	0
166.00	180.00	164.00				
		SURFACE OUTSIDE GEOMETRY				
170.00	180.00	160.00	2.1082	5	25	0
170.00	180.00	161.00	2.1994	5	31	0
170.00	180.00	162.00	2.2104	5	33	0
170.00	180.00	163.00				
		SURFACE OUTSIDE GEOMETRY				
170.00	180.00	164.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	180.00	160.00	2.1958	5	23	0
174.00	180.00	161.00	2.3323	5	31	0
174.00	180.00	162.00	2.3395	5	32	0
174.00	180.00	163.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	180.00	164.00				
		SURFACE OUTSIDE GEOMETRY				
142.00	184.00	164.00	1.9897	5	32	0

142.00	184.00	166.00	1.9955	4	35	0
142.00	184.00	167.00	2.0121	4	36	0
142.00	184.00	168.00	2.0294	4	37	0
146.00	184.00	164.00	1.9641	5	32	0
146.00	184.00	165.00	1.9625	5	32	0
146.00	184.00	166.00	1.9765	5	35	0
146.00	184.00	167.00	1.9941	4	36	0
146.00	184.00	168.00	2.0128	4	38	0
150.00	184.00	164.00	1.9465	5	31	0
150.00	184.00	165.00	1.9478	5	33	0
150.00	184.00	166.00	1.9674	5	34	0
150.00	184.00	167.00	1.9862	5	37	0
150.00	184.00	168.00	2.0054	5	38	0
154.00	184.00	164.00	1.9391	5	30	0
154.00	184.00	165.00	1.9501	5	33	0
154.00	184.00	166.00	1.9704	5	35	0
154.00	184.00	167.00	1.9893	5	36	0
154.00	184.00	168.00	2.0088	5	37	0
158.00	184.00	164.00	1.9448	5	29	0
158.00	184.00	165.00	1.9681	5	34	0
158.00	184.00	166.00	1.9877	5	35	0
158.00	184.00	167.00	2.0061	5	36	0
158.00	184.00	168.00	2.0253	5	37	0
162.00	184.00	164.00	1.9686	5	28	0
162.00	184.00	165.00	2.0066	5	33	0
162.00	184.00	166.00	2.0242	5	35	0
162.00	184.00	167.00	2.0408	5	36	0
162.00	184.00	168.00	2.0584	5	37	0
166.00	184.00	164.00	2.0189	5	29	0
166.00	184.00	165.00	2.0741	5	33	0
166.00	184.00	166.00	2.0869	5	35	0
166.00	184.00	167.00	2.0993	5	36	0
166.00	184.00	168.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	184.00	164.00	2.0860	5	25	0
170.00	184.00	165.00	2.1745	5	32	0
170.00	184.00	166.00	2.1856	5	33	0
170.00	184.00	167.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	184.00	168.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	184.00	164.00	2.1698	5	24	0
174.00	184.00	165.00	2.3003	5	31	0
174.00	184.00	166.00	2.3088	5	33	0
174.00	184.00	167.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	184.00	168.00				
			SURFACE OUTSIDE GEOMETRY			
142.00	188.00	168.00	1.9988	5	33	0
142.00	188.00	169.00	1.9997	4	33	0
142.00	188.00	170.00	2.0056	4	35	0
142.00	188.00	171.00	2.0227	4	37	0
142.00	188.00	172.00	2.0403	4	38	0
146.00	188.00	168.00	1.9710	5	32	0
146.00	188.00	169.00	1.9699	5	32	0
146.00	188.00	170.00	1.9851	5	36	0
146.00	188.00	171.00	2.0031	4	37	0
146.00	188.00	172.00	2.0219	4	38	0
150.00	188.00	168.00	1.9507	5	31	0
150.00	188.00	169.00	1.9533	5	33	0
150.00	188.00	170.00	1.9737	5	36	0
150.00	188.00	171.00	1.9928	5	37	0

154.00	188.00	168.00	1.9398	5	30	0
154.00	188.00	169.00	1.9526	5	34	0
154.00	188.00	170.00	1.9734	5	35	0
154.00	188.00	171.00	1.9930	5	36	0
154.00	188.00	172.00	2.0131	5	37	0
158.00	188.00	168.00	1.9411	5	30	0
158.00	188.00	169.00	1.9658	5	34	0
158.00	188.00	170.00	1.9865	5	35	0
158.00	188.00	171.00	2.0060	5	36	0
158.00	188.00	172.00	2.0263	5	38	0
162.00	188.00	168.00	1.9580	5	29	0
162.00	188.00	169.00	1.9975	5	33	0
162.00	188.00	170.00	2.0169	5	35	0
162.00	188.00	171.00	2.0353	5	37	0
162.00	188.00	172.00	2.0544	5	38	0
166.00	188.00	168.00	1.9977	5	29	0
166.00	188.00	169.00	2.0549	5	33	0
166.00	188.00	170.00	2.0710	5	36	0
166.00	188.00	171.00	2.0860	5	37	0
166.00	188.00	172.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	188.00	168.00	2.0649	5	26	0
170.00	188.00	169.00	2.1502	5	32	0
170.00	188.00	170.00	2.1585	5	36	0
170.00	188.00	171.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	188.00	172.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	188.00	168.00	2.1447	5	25	0
174.00	188.00	169.00	2.2701	5	32	0
174.00	188.00	170.00	2.2793	5	34	0
174.00	188.00	171.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	188.00	172.00				
			SURFACE OUTSIDE GEOMETRY			
142.00	192.00	172.00	2.0084	4	33	0
142.00	192.00	173.00	2.0095	4	33	0
142.00	192.00	174.00	2.0166	4	36	0
142.00	192.00	175.00	2.0337	4	37	0
142.00	192.00	176.00	2.0515	4	38	0
146.00	192.00	172.00	1.9788	5	32	0
146.00	192.00	173.00	1.9784	5	33	0
146.00	192.00	174.00	1.9942	4	36	0
146.00	192.00	175.00	2.0126	4	37	0
146.00	192.00	176.00	2.0317	4	38	0
150.00	192.00	172.00	1.9565	5	32	0
150.00	192.00	173.00	1.9602	5	34	0
150.00	192.00	174.00	1.9809	5	36	0
150.00	192.00	175.00	2.0003	4	37	0
150.00	192.00	176.00	2.0205	4	39	0
154.00	192.00	172.00	1.9425	5	31	0
154.00	192.00	173.00	1.9563	5	34	0
154.00	192.00	174.00	1.9778	5	35	0
154.00	192.00	175.00	1.9982	5	38	0
154.00	192.00	176.00	2.0188	4	39	0
158.00	192.00	172.00	1.9394	5	30	0
158.00	192.00	173.00	1.9654	5	34	0
158.00	192.00	174.00	1.9874	5	36	0
158.00	192.00	175.00	2.0077	5	37	0
158.00	192.00	176.00	2.0286	5	38	0
162.00	192.00	172.00	1.9504	5	29	0
162.00	192.00	173.00	1.9914	5	33	0

162.00	192.00	175.00	2.0321	5	37	0
162.00	192.00	176.00	2.0522	5	38	0
166.00	192.00	172.00	1.9812	5	29	0
166.00	192.00	173.00	2.0404	5	34	0
166.00	192.00	174.00	2.0587	5	36	0
166.00	192.00	175.00	2.0758	5	37	0
166.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	192.00	172.00	2.0424	5	28	0
170.00	192.00	173.00	2.1223	5	34	0
170.00	192.00	174.00	2.1345	5	36	0
170.00	192.00	175.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	192.00	172.00	2.1202	5	25	0
174.00	192.00	173.00	2.2411	5	33	0
174.00	192.00	174.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	192.00	175.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	192.00	176.00				
			SURFACE OUTSIDE GEOMETRY			
142.00	196.00	176.00	2.0189	4	34	0
142.00	196.00	177.00	2.0203	4	34	0
142.00	196.00	178.00	2.0278	4	36	0
142.00	196.00	179.00	2.0452	4	37	0
142.00	196.00	180.00	2.0635	4	39	0
146.00	196.00	176.00	1.9877	5	33	0
146.00	196.00	177.00	1.9874	5	33	0
146.00	196.00	178.00	2.0041	4	36	0
146.00	196.00	179.00	2.0230	4	38	0
146.00	196.00	180.00	2.0424	4	39	0
150.00	196.00	176.00	1.9631	5	32	0
150.00	196.00	177.00	1.9678	5	34	0
150.00	196.00	178.00	1.9891	5	37	0
150.00	196.00	179.00	2.0089	4	38	0
150.00	196.00	180.00	2.0293	4	39	0
154.00	196.00	176.00	1.9464	5	31	0
154.00	196.00	177.00	1.9613	5	34	0
154.00	196.00	178.00	1.9836	5	36	0
154.00	196.00	179.00	2.0043	5	38	0
154.00	196.00	180.00	2.0253	4	39	0
158.00	196.00	176.00	1.9396	5	30	0
158.00	196.00	177.00	1.9671	5	35	0
158.00	196.00	178.00	1.9897	5	36	0
158.00	196.00	179.00	2.0107	5	37	0
158.00	196.00	180.00	2.0322	5	38	0
162.00	196.00	176.00	1.9457	5	30	0
162.00	196.00	177.00	1.9880	5	34	0
162.00	196.00	178.00	2.0102	5	36	0
162.00	196.00	179.00	2.0308	5	37	0
162.00	196.00	180.00	2.0521	5	39	0
166.00	196.00	176.00	1.9691	5	30	0
166.00	196.00	177.00	2.0294	5	34	0
166.00	196.00	178.00	2.0497	5	36	0
166.00	196.00	179.00	2.0687	5	38	0
166.00	196.00	180.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	196.00	176.00	2.0184	5	28	0
170.00	196.00	177.00	2.0999	5	34	0
170.00	196.00	178.00	2.1156	5	37	0

SURFACE OUTSIDE GEOMETRY

170.00	196.00	180.00				

SURFACE OUTSIDE GEOMETRY

174.00	196.00	176.00	2.0969	5	26	0
174.00	196.00	177.00	2.2130	5	33	0
174.00	196.00	178.00				

SURFACE OUTSIDE GEOMETRY

174.00	196.00	179.00				

SURFACE OUTSIDE GEOMETRY

174.00	196.00	180.00				

SURFACE OUTSIDE GEOMETRY

142.00	200.00	180.00	2.0298	4	34	0
142.00	200.00	181.00	2.0313	4	34	0
142.00	200.00	182.00	2.0396	4	36	0
142.00	200.00	183.00	2.0574	4	38	0
142.00	200.00	184.00	2.0756	4	39	0
146.00	200.00	180.00	1.9971	5	33	0
146.00	200.00	181.00	1.9970	4	33	0
146.00	200.00	182.00	2.0148	4	37	0
146.00	200.00	183.00	2.0338	4	38	0
146.00	200.00	184.00	2.0533	4	39	0
150.00	200.00	180.00	1.9706	5	32	0
150.00	200.00	181.00	1.9765	5	35	0
150.00	200.00	182.00	1.9979	4	37	0
150.00	200.00	183.00	2.0181	4	38	0
150.00	200.00	184.00	2.0387	4	39	0
154.00	200.00	180.00	1.9517	5	32	0
154.00	200.00	181.00	1.9676	5	35	0
154.00	200.00	182.00	1.9902	5	36	0
154.00	200.00	183.00	2.0112	4	38	0
154.00	200.00	184.00	2.0330	4	40	0
158.00	200.00	180.00	1.9417	5	31	0
158.00	200.00	181.00	1.9700	5	35	0
158.00	200.00	182.00	1.9933	5	36	0
158.00	200.00	183.00	2.0151	5	39	0
158.00	200.00	184.00	2.0371	4	40	0
162.00	200.00	180.00	1.9432	5	30	0
162.00	200.00	181.00	1.9864	5	35	0
162.00	200.00	182.00	2.0097	5	36	0
162.00	200.00	183.00	2.0315	5	38	0
162.00	200.00	184.00				

SURFACE OUTSIDE GEOMETRY

166.00	200.00	180.00	1.9601	5	30	0
166.00	200.00	181.00	2.0214	5	34	0
166.00	200.00	182.00	2.0436	5	37	0
166.00	200.00	183.00	2.0639	5	38	0
166.00	200.00	184.00				

SURFACE OUTSIDE GEOMETRY

170.00	200.00	180.00	1.9997	5	28	0
170.00	200.00	181.00	2.0823	5	35	0
170.00	200.00	182.00	2.1008	5	37	0
170.00	200.00	183.00				

SURFACE OUTSIDE GEOMETRY

170.00	200.00	184.00				

SURFACE OUTSIDE GEOMETRY

174.00	200.00	180.00	2.0737	5	28	0
174.00	200.00	181.00	2.1815	5	35	0
174.00	200.00	182.00				

SURFACE OUTSIDE GEOMETRY

174.00	200.00	183.00				

SURFACE OUTSIDE GEOMETRY

174.00	200.00	184.00				

142.00	204.00	184.00	2.0412	4	34	0
142.00	204.00	185.00	2.0431	4	35	0
142.00	204.00	186.00	2.0520	4	37	0
142.00	204.00	187.00	2.0698	4	38	0
142.00	204.00	188.00	2.0882	4	39	0
146.00	204.00	184.00	2.0070	4	33	0
146.00	204.00	185.00	2.0075	4	34	0
146.00	204.00	186.00	2.0259	4	37	0
146.00	204.00	187.00	2.0451	4	38	0
146.00	204.00	188.00	2.0650	4	40	0
150.00	204.00	184.00	1.9792	5	33	0
150.00	204.00	185.00	1.9857	5	35	0
150.00	204.00	186.00	2.0074	4	37	0
150.00	204.00	187.00	2.0279	4	38	0
150.00	204.00	188.00	2.0490	4	40	0
154.00	204.00	184.00	1.9579	5	32	0
154.00	204.00	185.00	1.9747	5	35	0
154.00	204.00	186.00	1.9977	5	37	0
154.00	204.00	187.00	2.0193	4	39	0
154.00	204.00	188.00	2.0412	4	40	0
158.00	204.00	184.00	1.9450	5	31	0
158.00	204.00	185.00	1.9742	5	35	0
158.00	204.00	186.00	1.9983	5	37	0
158.00	204.00	187.00	2.0205	5	39	0
158.00	204.00	188.00	2.0429	4	40	0
162.00	204.00	184.00	1.9426	5	30	0
162.00	204.00	185.00	1.9869	5	36	0
162.00	204.00	186.00	2.0111	5	37	0
162.00	204.00	187.00	2.0334	5	38	0
162.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
166.00	204.00	184.00	1.9540	5	30	0
166.00	204.00	185.00	2.0163	5	35	0
166.00	204.00	186.00	2.0397	5	37	0
166.00	204.00	187.00	2.0611	5	38	0
166.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	204.00	184.00	1.9855	5	29	0
170.00	204.00	185.00	2.0687	5	35	0
170.00	204.00	186.00	2.0894	5	37	0
170.00	204.00	187.00				
			SURFACE OUTSIDE GEOMETRY			
170.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	204.00	184.00	2.0461	5	28	0
174.00	204.00	185.00	2.1546	5	35	0
174.00	204.00	186.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	204.00	187.00				
			SURFACE OUTSIDE GEOMETRY			
174.00	204.00	188.00				
			SURFACE OUTSIDE GEOMETRY			
142.00	208.00	188.00	2.0532	4	35	0
142.00	208.00	189.00	2.0550	4	35	0
142.00	208.00	190.00	2.0646	4	37	0
142.00	208.00	191.00	2.0825	4	38	0
142.00	208.00	192.00				
			SURFACE OUTSIDE GEOMETRY			
146.00	208.00	188.00	2.0178	4	34	0
146.00	208.00	189.00	2.0183	4	34	0
146.00	208.00	190.00	2.0374	4	37	0
146.00	208.00	191.00	2.0570	4	39	0

150.00	208.00	188.00	1.9882	5	33	0
150.00	208.00	189.00	1.9954	4	35	0
150.00	208.00	190.00	2.0177	4	38	0
150.00	208.00	191.00	2.0384	4	39	0
150.00	208.00	192.00	2.0596	4	40	0
154.00	208.00	188.00	1.9650	5	32	0
154.00	208.00	189.00	1.9828	5	36	0
154.00	208.00	190.00	2.0061	4	38	0
154.00	208.00	191.00	2.0279	4	39	0
154.00	208.00	192.00	2.0501	4	40	0
158.00	208.00	188.00	1.9495	5	31	0
158.00	208.00	189.00	1.9797	5	36	0
158.00	208.00	190.00	2.0042	5	37	0
158.00	208.00	191.00	2.0267	4	39	0
158.00	208.00	192.00	2.0498	4	41	0
162.00	208.00	188.00	1.9439	5	31	0
162.00	208.00	189.00	1.9887	5	36	0
162.00	208.00	190.00	2.0137	5	37	0
162.00	208.00	191.00	2.0367	5	38	0
162.00	208.00	192.00				
		SURFACE OUTSIDE GEOMETRY				
166.00	208.00	188.00	1.9506	5	31	0
166.00	208.00	189.00	2.0132	5	35	0
166.00	208.00	190.00	2.0377	5	37	0
166.00	208.00	191.00	2.0605	5	39	0
166.00	208.00	192.00				
		SURFACE OUTSIDE GEOMETRY				
170.00	208.00	188.00	1.9747	5	29	0
170.00	208.00	189.00	2.0583	5	35	0
170.00	208.00	190.00	2.0811	5	38	0
170.00	208.00	191.00				
		SURFACE OUTSIDE GEOMETRY				
170.00	208.00	192.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	208.00	188.00	2.0243	5	28	0
174.00	208.00	189.00	2.1332	5	36	0
174.00	208.00	190.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	208.00	191.00				
		SURFACE OUTSIDE GEOMETRY				
174.00	208.00	192.00				
		SURFACE OUTSIDE GEOMETRY				

Minimum Bishop Factor of Safety this run:

154.00	184.00	164.00	1.9391	5	30	0

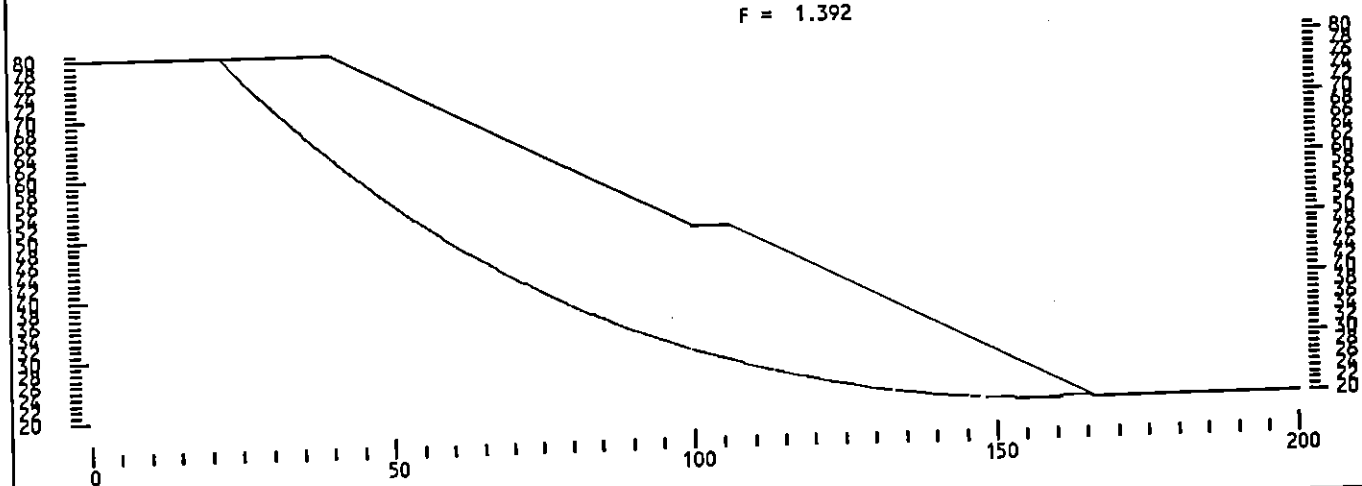
Material	Unit Wt pcf	C psf	Phi deg	Piezo Surf.	Ru
FILL	110	300	30	0	0

PSeismic coefficient = .15

Pacific Soils Engrg. - Tustin CA
W.O. 500236
NEWPORT BANNING RANCH
10/4/93
60 FT. FILL SLOPE ANALYSIS

50236FIL.GSL

F = 1.392



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* L I Q U E F Y 2 *
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EMPIRICAL PREDICTION OF
EARTHQUAKE-INDUCED LIQUEFACTION POTENTIAL

JOB NUMBER: W.O. 500236 DATE: Monday, October 11, 1993

JOB NAME: Newport Oil

LIQUEFACTION CALCULATION NAME: r1hb1

SOIL-PROFILE NAME: hb1

GROUND WATER DEPTH: 6.0 ft

DESIGN EARTHQUAKE MAGNITUDE: 7.50

SITE PEAK GROUND ACCELERATION: 0.700 g

K sigma BOUND: M

rd BOUND: M

N60 CORRECTION: 1.00

FIELD SPT N-VALUES < 10 FT DEEP ARE NOT CORRECTED FOR SHORT LENGTH OF DRIVE RODS

NOTE: Relative density values listed below are estimated using equations of Giuliani and Nicoll (1982).

LIQUEFACTION ANALYSIS SUMMARY

Seed and Others [1985] Method

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	Est.D r (%)	C N	CORR. (N1)60 (B/ft)	LIQUE. STRESS RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
1	0.25	0.016	0.016	16	69	@	@	@	@	@	@ @
1	0.75	0.048	0.048	16	69	@	@	@	@	@	@ @
1	1.25	0.080	0.080	16	69	@	@	@	@	@	@ @
1	1.75	0.112	0.112	16	69	@	@	@	@	@	@ @
1	2.25	0.144	0.144	16	69	@	@	@	@	@	@ @
1	2.75	0.175	0.175	16	69	@	@	@	@	@	@ @
1	3.25	0.207	0.207	16	69	@	@	@	@	@	@ @
1	3.75	0.239	0.239	16	69	@	@	@	@	@	@ @
1	4.25	0.271	0.271	16	69	@	@	@	@	@	@ @
1	4.75	0.303	0.303	16	69	@	@	@	@	@	@ @
1	5.25	0.335	0.335	16	69	@	@	@	@	@	@ @
1	5.75	0.367	0.367	16	69	@	@	@	@	@	@ @
1	6.25	0.399	0.391	16	69	1.487	23.2	Infin	0.987	0.458	Infin
1	6.75	0.431	0.407	16	69	1.487	23.2	Infin	0.986	0.475	Infin
1	7.25	0.463	0.424	16	69	1.487	23.2	Infin	0.985	0.490	Infin
1	7.75	0.494	0.440	16	69	1.487	23.2	Infin	0.984	0.503	Infin
1	8.25	0.526	0.456	16	69	1.487	23.2	Infin	0.983	0.516	Infin
1	8.75	0.558	0.472	16	69	1.487	23.2	Infin	0.982	0.528	Infin
1	9.25	0.590	0.489	16	69	1.487	23.2	Infin	0.981	0.539	Infin
1	9.75	0.622	0.505	16	69	1.487	23.2	Infin	0.980	0.549	Infin
1	10.25	0.654	0.521	16	69	1.487	23.2	Infin	0.979	0.559	Infin
1	10.75	0.686	0.538	16	69	1.487	23.2	Infin	0.978	0.568	Infin
1	11.25	0.718	0.554	16	69	1.487	23.2	Infin	0.977	0.576	Infin
1	11.75	0.750	0.570	16	69	1.487	23.2	Infin	0.976	0.584	Infin
1	12.25	0.782	0.587	16	69	1.487	23.2	Infin	0.975	0.591	Infin
1	12.75	0.813	0.603	16	69	1.487	23.2	Infin	0.973	0.598	Infin
1	13.25	0.845	0.619	16	69	1.487	23.2	Infin	0.972	0.604	Infin
1	13.75	0.877	0.635	16	69	1.487	23.2	Infin	0.971	0.610	Infin
1	14.25	0.909	0.652	16	69	1.487	23.2	Infin	0.970	0.616	Infin
1	14.75	0.941	0.668	16	69	1.487	23.2	Infin	0.969	0.621	Infin
2	15.25	0.974	0.685	11	53	1.183	13.0	0.226	0.968	0.626	0.36
2	15.75	1.007	0.703	11	53	1.183	13.0	0.226	0.967	0.630	0.36
2	16.25	1.041	0.721	11	53	1.183	13.0	0.226	0.966	0.634	0.36
2	16.75	1.075	0.739	11	53	1.183	13.0	0.226	0.965	0.638	0.35
2	17.25	1.108	0.757	11	53	1.183	13.0	0.226	0.964	0.642	0.35
2	17.75	1.142	0.775	11	53	1.183	13.0	0.226	0.962	0.645	0.35
3	18.25	1.175	0.793	11	51	1.098	12.1	0.214	0.961	0.648	0.33
3	18.75	1.209	0.811	11	51	1.098	12.1	0.214	0.960	0.651	0.33
3	19.25	1.243	0.829	11	51	1.098	12.1	0.214	0.959	0.654	0.33
3	19.75	1.276	0.847	11	51	1.098	12.1	0.214	0.958	0.657	0.33
4	20.25	1.309	0.865	13	54	0.984	13.0	0.226	0.957	0.659	0.34
4	20.75	1.342	0.882	13	54	0.984	13.0	0.226	0.955	0.661	0.34
4	21.25	1.375	0.900	13	54	0.984	13.0	0.226	0.954	0.663	0.34
4	21.75	1.408	0.917	13	54	0.984	13.0	0.226	0.952	0.665	0.34
4	22.25	1.441	0.934	13	54	0.984	13.0	0.226	0.951	0.667	0.34
4	22.75	1.474	0.951	13	54	0.984	13.0	0.226	0.949	0.669	0.34

Seed and Others [1985] Method

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	Est. D_r (%)	C_N	CORR. (N1)60 (B/ft)	LIQUE. STRESS RATIO	r_d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
4	23.25	1.507	0.969	13	54	0.984	13.0	0.226	0.947	0.671	0.34
4	23.75	1.540	0.986	13	54	0.984	13.0	0.226	0.946	0.672	0.34
4	24.25	1.573	1.003	13	54	0.984	13.0	0.226	0.944	0.673	0.34
4	24.75	1.606	1.021	13	54	0.984	13.0	0.225	0.943	0.675	0.33
4	25.25	1.639	1.038	13	54	0.984	13.0	0.225	0.941	0.676	0.33
4	25.75	1.672	1.055	13	54	0.984	13.0	0.225	0.939	0.676	0.33
4	26.25	1.705	1.073	13	54	0.984	13.0	0.225	0.937	0.677	0.33
4	26.75	1.737	1.090	13	54	0.984	13.0	0.224	0.934	0.678	0.33
4	27.25	1.770	1.107	13	54	0.984	13.0	0.224	0.932	0.678	0.33
4	27.75	1.803	1.125	13	54	0.984	13.0	0.224	0.930	0.678	0.33
4	28.25	1.836	1.142	13	54	0.984	13.0	0.224	0.928	0.679	0.33
4	28.75	1.869	1.159	13	54	0.984	13.0	0.224	0.926	0.679	0.33
4	29.25	1.902	1.177	13	54	0.984	13.0	0.224	0.923	0.679	0.33
4	29.75	1.935	1.194	13	54	0.984	13.0	0.223	0.921	0.679	0.33
5	30.25	1.968	1.211	18	57	0.829	14.5	0.228	0.919	0.679	0.34
5	30.75	2.001	1.229	18	57	0.829	14.5	0.228	0.916	0.678	0.34
5	31.25	2.034	1.246	18	57	0.829	14.5	0.228	0.913	0.678	0.34
5	31.75	2.067	1.264	18	57	0.829	14.5	0.228	0.910	0.677	0.34
5	32.25	2.100	1.281	18	57	0.829	14.5	0.228	0.907	0.677	0.34
5	32.75	2.133	1.298	18	57	0.829	14.5	0.228	0.904	0.676	0.34
5	33.25	2.166	1.316	18	57	0.829	14.5	0.228	0.901	0.675	0.34
5	33.75	2.199	1.333	18	57	0.829	14.5	0.228	0.899	0.674	0.34
5	34.25	2.232	1.351	18	57	0.829	14.5	0.227	0.896	0.674	0.34
5	34.75	2.265	1.368	18	57	0.829	14.5	0.227	0.893	0.673	0.34
5	35.25	2.298	1.385	18	57	0.829	14.5	0.227	0.890	0.671	0.34
5	35.75	2.331	1.403	18	57	0.829	14.5	0.227	0.886	0.670	0.34
5	36.25	2.364	1.420	18	57	0.829	14.5	0.227	0.882	0.668	0.34
5	36.75	2.397	1.438	18	57	0.829	14.5	0.227	0.878	0.666	0.34
5	37.25	2.430	1.455	18	57	0.829	14.5	0.226	0.874	0.664	0.34
5	37.75	2.463	1.472	18	57	0.829	14.5	0.226	0.870	0.662	0.34
5	38.25	2.496	1.490	18	57	0.829	14.5	0.226	0.866	0.660	0.34
5	38.75	2.529	1.507	18	57	0.829	14.5	0.226	0.862	0.658	0.34
5	39.25	2.562	1.525	18	57	0.829	14.5	0.226	0.858	0.656	0.34
5	39.75	2.595	1.542	18	57	0.829	14.5	0.225	0.854	0.654	0.34
5	40.25	2.628	1.559	18	57	0.829	14.5	0.225	0.850	0.652	0.35
5	40.75	2.661	1.577	18	57	0.829	14.5	0.225	0.845	0.649	0.35
5	41.25	2.694	1.594	18	57	0.829	14.5	0.225	0.840	0.646	0.35
5	41.75	2.727	1.612	18	57	0.829	14.5	0.224	0.836	0.643	0.35
5	42.25	2.760	1.629	18	57	0.829	14.5	0.224	0.831	0.640	0.35
5	42.75	2.793	1.646	18	57	0.829	14.5	0.224	0.826	0.637	0.35
5	43.25	2.826	1.664	18	57	0.829	14.5	0.224	0.821	0.634	0.35
5	43.75	2.859	1.681	18	57	0.829	14.5	0.224	0.816	0.631	0.35
5	44.25	2.892	1.699	18	57	0.829	14.5	0.223	0.811	0.628	0.36
5	44.75	2.925	1.716	18	57	0.829	14.5	0.223	0.806	0.625	0.36
6	45.25	2.955	1.731	49	~	~	~	~	~	~	--
6	45.75	2.982	1.742	49	~	~	~	~	~	~	--
6	46.25	3.010	1.754	49	~	~	~	~	~	~	--
6	46.75	3.037	1.765	49	~	~	~	~	~	~	--
6	47.25	3.064	1.777	49	~	~	~	~	~	~	--
6	47.75	3.091	1.789	49	~	~	~	~	~	~	--

Seed and Others [1985] Method

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	Est.D_r (%)	C_N	CORR. (N1)60 (B/ft)	LIQUE. STRESS RATIO	r_d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
6	48.25	3.119	1.800	49	~	~	~	~	~	~	~~
6	48.75	3.146	1.812	49	~	~	~	~	~	~	~~
6	49.25	3.173	1.824	49	~	~	~	~	~	~	~~
6	49.75	3.200	1.835	49	~	~	~	~	~	~	~~
6	50.25	3.228	1.847	49	~	~	~	~	~	~	~~
6	50.75	3.255	1.859	49	~	~	~	~	~	~	~~
6	51.25	3.282	1.870	49	~	~	~	~	~	~	~~
6	51.75	3.309	1.882	49	~	~	~	~	~	~	~~

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* L I Q U E F Y 2 *
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EMPIRICAL PREDICTION OF
EARTHQUAKE-INDUCED LIQUEFACTION POTENTIAL

JOB NUMBER: W.O. 500236 DATE: Monday, October 11, 1993

JOB NAME: Newport Oil

LIQUEFACTION CALCULATION NAME: r1hb2

SOIL-PROFILE NAME: hb2

GROUND WATER DEPTH: 6.0 ft

DESIGN EARTHQUAKE MAGNITUDE: 7.50

SITE PEAK GROUND ACCELERATION: 0.700 g

K sigma BOUND: M

rd BOUND: M

N60 CORRECTION: 1.00

FIELD SPT N-VALUES < 10 FT DEEP ARE NOT CORRECTED FOR SHORT LENGTH OF DRIVE RODS

NOTE: Relative density values listed below are estimated using equations of Giuliani and Nicoll (1982).

LIQUEFACTION ANALYSIS SUMMARY

Seed and Others [1985] Method

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	Est. D_r (%)	C_N	CORR. (N1)60 (B/ft)	LIQUE. STRESS RATIO	r_d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
1	0.25	0.015	0.015	8	~	@	@	@	@	@	@ @
1	0.75	0.046	0.046	8	~	@	@	@	@	@	@ @
1	1.25	0.076	0.076	8	~	@	@	@	@	@	@ @
1	1.75	0.107	0.107	8	~	@	@	@	@	@	@ @
1	2.25	0.137	0.137	8	~	@	@	@	@	@	@ @
1	2.75	0.168	0.168	8	~	@	@	@	@	@	@ @
1	3.25	0.198	0.198	8	~	@	@	@	@	@	@ @
1	3.75	0.228	0.228	8	~	@	@	@	@	@	@ @
1	4.25	0.259	0.259	8	~	@	@	@	@	@	@ @
1	4.75	0.289	0.289	8	~	@	@	@	@	@	@ @
1	5.25	0.320	0.320	8	~	@	@	@	@	@	@ @
1	5.75	0.350	0.350	8	~	@	@	@	@	@	@ @
1	6.25	0.381	0.373	8	~	~	~	~	~	~	--
1	6.75	0.411	0.388	8	~	~	~	~	~	~	--
1	7.25	0.442	0.403	8	~	~	~	~	~	~	--
1	7.75	0.472	0.417	8	~	~	~	~	~	~	--
1	8.25	0.502	0.432	8	~	~	~	~	~	~	--
1	8.75	0.533	0.447	8	~	~	~	~	~	~	--
1	9.25	0.563	0.462	8	~	~	~	~	~	~	--
1	9.75	0.594	0.477	8	~	~	~	~	~	~	--
1	10.25	0.624	0.492	8	~	~	~	~	~	~	--
1	10.75	0.655	0.507	8	~	~	~	~	~	~	--
1	11.25	0.685	0.521	8	~	~	~	~	~	~	--
1	11.75	0.716	0.536	8	~	~	~	~	~	~	--
1	12.25	0.746	0.551	8	~	~	~	~	~	~	--
1	12.75	0.777	0.566	8	~	~	~	~	~	~	--
1	13.25	0.807	0.581	8	~	~	~	~	~	~	--
1	13.75	0.837	0.596	8	~	~	~	~	~	~	--
1	14.25	0.868	0.610	8	~	~	~	~	~	~	--
1	14.75	0.898	0.625	8	~	~	~	~	~	~	--
2	15.25	0.930	0.641	27	83	1.194	32.4	Infin	0.968	0.639	Infin
2	15.75	0.962	0.658	27	83	1.194	32.4	Infin	0.967	0.643	Infin
2	16.25	0.994	0.674	27	83	1.194	32.4	Infin	0.966	0.648	Infin
2	16.75	1.026	0.691	27	83	1.194	32.4	Infin	0.965	0.652	Infin
2	17.25	1.059	0.708	27	83	1.194	32.4	Infin	0.964	0.656	Infin
2	17.75	1.091	0.724	27	83	1.194	32.4	Infin	0.963	0.660	Infin
2	18.25	1.123	0.741	27	83	1.194	32.4	Infin	0.961	0.663	Infin
2	18.75	1.155	0.758	27	83	1.194	32.4	Infin	0.960	0.666	Infin
2	19.25	1.188	0.774	27	83	1.194	32.4	Infin	0.959	0.669	Infin
2	19.75	1.220	0.791	27	83	1.194	32.4	Infin	0.958	0.672	Infin
3	20.25	1.252	0.807	41	95	0.988	40.8	Infin	0.957	0.675	Infin
3	20.75	1.284	0.824	41	95	0.988	40.8	Infin	0.955	0.678	Infin
3	21.25	1.316	0.840	41	95	0.988	40.8	Infin	0.954	0.680	Infin
3	21.75	1.347	0.856	41	95	0.988	40.8	Infin	0.952	0.682	Infin
3	22.25	1.379	0.872	41	95	0.988	40.8	Infin	0.951	0.684	Infin
3	22.75	1.411	0.888	41	95	0.988	40.8	Infin	0.949	0.686	Infin

Seed and Others [1985] Method

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	Est.D r (%)	C N	CORR. (N1)60 (B/ft)	LIQUE. STRESS RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
3	23.25	1.443	0.905	41	95	0.988	40.8	Infin	0.947	0.688	Infin
3	23.75	1.475	0.921	41	95	0.988	40.8	Infin	0.946	0.689	Infin
3	24.25	1.507	0.937	41	95	0.988	40.8	Infin	0.944	0.691	Infin
3	24.75	1.538	0.953	41	95	0.988	40.8	Infin	0.943	0.692	Infin
3	25.25	1.570	0.970	41	95	0.988	40.8	Infin	0.941	0.693	Infin
3	25.75	1.602	0.986	41	95	0.988	40.8	Infin	0.939	0.694	Infin
3	26.25	1.634	1.002	41	95	0.988	40.8	Infin	0.937	0.695	Infin
3	26.75	1.666	1.018	41	95	0.988	40.8	Infin	0.934	0.695	Infin
3	27.25	1.698	1.035	41	95	0.988	40.8	Infin	0.932	0.696	Infin
3	27.75	1.729	1.051	41	95	0.988	40.8	Infin	0.930	0.696	Infin
3	28.25	1.761	1.067	41	95	0.988	40.8	Infin	0.928	0.697	Infin
3	28.75	1.793	1.083	41	95	0.988	40.8	Infin	0.926	0.697	Infin
3	29.25	1.825	1.099	41	95	0.988	40.8	Infin	0.923	0.697	Infin
3	29.75	1.857	1.116	41	95	0.988	40.8	Infin	0.921	0.698	Infin
3	30.25	1.888	1.132	41	95	0.988	40.8	Infin	0.919	0.697	Infin
3	30.75	1.920	1.148	41	95	0.988	40.8	Infin	0.916	0.697	Infin
3	31.25	1.952	1.164	41	95	0.988	40.8	Infin	0.913	0.696	Infin
3	31.75	1.984	1.181	41	95	0.988	40.8	Infin	0.910	0.696	Infin
3	32.25	2.016	1.197	41	95	0.988	40.8	Infin	0.907	0.695	Infin
3	32.75	2.048	1.213	41	95	0.988	40.8	Infin	0.904	0.695	Infin
3	33.25	2.079	1.229	41	95	0.988	40.8	Infin	0.902	0.694	Infin
3	33.75	2.111	1.245	41	95	0.988	40.8	Infin	0.899	0.693	Infin
3	34.25	2.143	1.262	41	95	0.988	40.8	Infin	0.896	0.692	Infin
3	34.75	2.175	1.278	41	95	0.988	40.8	Infin	0.893	0.692	Infin
4	35.25	2.207	1.295	35	82	0.881	30.9	Infin	0.890	0.690	Infin
4	35.75	2.241	1.312	35	82	0.881	30.9	Infin	0.886	0.688	Infin
4	36.25	2.274	1.330	35	82	0.881	30.9	Infin	0.882	0.686	Infin
4	36.75	2.307	1.348	35	82	0.881	30.9	Infin	0.878	0.684	Infin
4	37.25	2.340	1.365	35	82	0.881	30.9	Infin	0.874	0.682	Infin
4	37.75	2.374	1.383	35	82	0.881	30.9	Infin	0.870	0.679	Infin
4	38.25	2.407	1.401	35	82	0.881	30.9	Infin	0.866	0.677	Infin
4	38.75	2.440	1.418	35	82	0.881	30.9	Infin	0.862	0.675	Infin
4	39.25	2.473	1.436	35	82	0.881	30.9	Infin	0.858	0.673	Infin
4	39.75	2.507	1.454	35	82	0.881	30.9	Infin	0.855	0.670	Infin
5	40.25	2.540	1.471	70	106	0.779	54.1	Infin	0.850	0.668	Infin
5	40.75	2.573	1.488	70	106	0.779	54.1	Infin	0.845	0.665	Infin
5	41.25	2.605	1.505	70	106	0.779	54.1	Infin	0.840	0.662	Infin
5	41.75	2.638	1.523	70	106	0.779	54.1	Infin	0.836	0.659	Infin
5	42.25	2.671	1.540	70	106	0.779	54.1	Infin	0.831	0.656	Infin
5	42.75	2.704	1.557	70	106	0.779	54.1	Infin	0.826	0.653	Infin
5	43.25	2.737	1.574	70	106	0.779	54.1	Infin	0.821	0.649	Infin
5	43.75	2.769	1.591	70	106	0.779	54.1	Infin	0.816	0.646	Infin
5	44.25	2.802	1.609	70	106	0.779	54.1	Infin	0.811	0.643	Infin
5	44.75	2.835	1.626	70	106	0.779	54.1	Infin	0.806	0.640	Infin
5	45.25	2.868	1.643	70	106	0.779	54.1	Infin	0.801	0.636	Infin
5	45.75	2.900	1.660	70	106	0.779	54.1	Infin	0.796	0.633	Infin
5	46.25	2.933	1.677	70	106	0.779	54.1	Infin	0.791	0.629	Infin
5	46.75	2.966	1.695	70	106	0.779	54.1	Infin	0.786	0.626	Infin
5	47.25	2.999	1.712	70	106	0.779	54.1	Infin	0.781	0.622	Infin
5	47.75	3.032	1.729	70	106	0.779	54.1	Infin	0.776	0.619	Infin

Seed and Others [1985] Method

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	Est. D_r (%)	C_N	CORR. (N1)60 (B/ft)	LIQUE. STRESS RATIO	r_d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
5	48.25	3.064	1.746	70	106	0.779	54.1	Infin	0.771	0.615	Infin
5	48.75	3.097	1.763	70	106	0.779	54.1	Infin	0.765	0.612	Infin
5	49.25	3.130	1.781	70	106	0.779	54.1	Infin	0.760	0.608	Infin
5	49.75	3.163	1.798	70	106	0.779	54.1	Infin	0.755	0.604	Infin
5	50.25	3.196	1.815	70	106	0.779	54.1	Infin	0.750	0.601	Infin
5	50.75	3.228	1.832	70	106	0.779	54.1	Infin	0.745	0.598	Infin
5	51.25	3.261	1.849	70	106	0.779	54.1	Infin	0.741	0.594	Infin
5	51.75	3.294	1.867	70	106	0.779	54.1	Infin	0.736	0.591	Infin
5	52.25	3.327	1.884	70	106	0.779	54.1	Infin	0.731	0.588	Infin
5	52.75	3.360	1.901	70	106	0.779	54.1	Infin	0.726	0.584	Infin
5	53.25	3.392	1.918	70	106	0.779	54.1	Infin	0.722	0.581	Infin
5	53.75	3.425	1.935	70	106	0.779	54.1	Infin	0.717	0.577	Infin
5	54.25	3.458	1.953	70	106	0.779	54.1	Infin	0.712	0.574	Infin
5	54.75	3.491	1.970	70	106	0.779	54.1	Infin	0.707	0.570	Infin
5	55.25	3.524	1.987	70	106	0.779	54.1	Infin	0.703	0.567	Infin
5	55.75	3.556	2.004	70	106	0.779	54.1	Infin	0.698	0.564	Infin
5	56.25	3.589	2.021	70	106	0.779	54.1	Infin	0.694	0.560	Infin
5	56.75	3.622	2.039	70	106	0.779	54.1	Infin	0.689	0.557	Infin
5	57.25	3.655	2.056	70	106	0.779	54.1	Infin	0.684	0.554	Infin
5	57.75	3.688	2.073	70	106	0.779	54.1	Infin	0.680	0.550	Infin
5	58.25	3.720	2.090	70	106	0.779	54.1	Infin	0.675	0.547	Infin
5	58.75	3.753	2.107	70	106	0.779	54.1	Infin	0.671	0.543	Infin
5	59.25	3.786	2.125	70	106	0.779	54.1	Infin	0.666	0.540	Infin
5	59.75	3.819	2.142	70	106	0.779	54.1	Infin	0.661	0.537	Infin