LEIGHTON AND ASSOCIATES, INC.
Geotechnical and Environmental Engineering Consultants

LIMITED EVALUATION OF LIQUEFACTION AND CONSOLIDATION POTENTIAL, PHASE 1, JACUMBA VALLEY RANCH DEVELOPMENT, SAN DIEGO COUNTY, CALIFORNIA

January 21, 1991

UPDATED EVALUATION OF CONSOLIDATION POTENTIAL, PHASE 1, JACUMBA VALLEY RANCH DEVELOPMENT, SAN DIEGO COUNTY, CALIFORNIA

February 27, 1991

Project No. 4900381-05

PREPARED FOR:

JACUMBA VALLEY PARTNERSHIP
2423 Camino Del Rio South, Suite 212
San Diego, California 92108

3934 MURPHY CANYON ROAD, SUITE B205, SAN DIEGO, CALIFORNIA 92123

(619) 292-8030 • (800) 447-2626
FAX (619) 292-0771

LEIGHTON AND ASSOCIATES, INC.
Geotechnical and Environmental Engineering Consultants

January 21, 1991

Project No. 4900381-05

To: Jacumba Valley Ranch
2423 Camino Del Rio South, Suite 212
San Diego, California 92108

Attention: Mr. Karl Turecek

Subject: Limited Evaluation of Liquefaction and Consolidation Potential, Phase 1, Jacumba Valley Ranch Development, San Diego County, California

Introduction

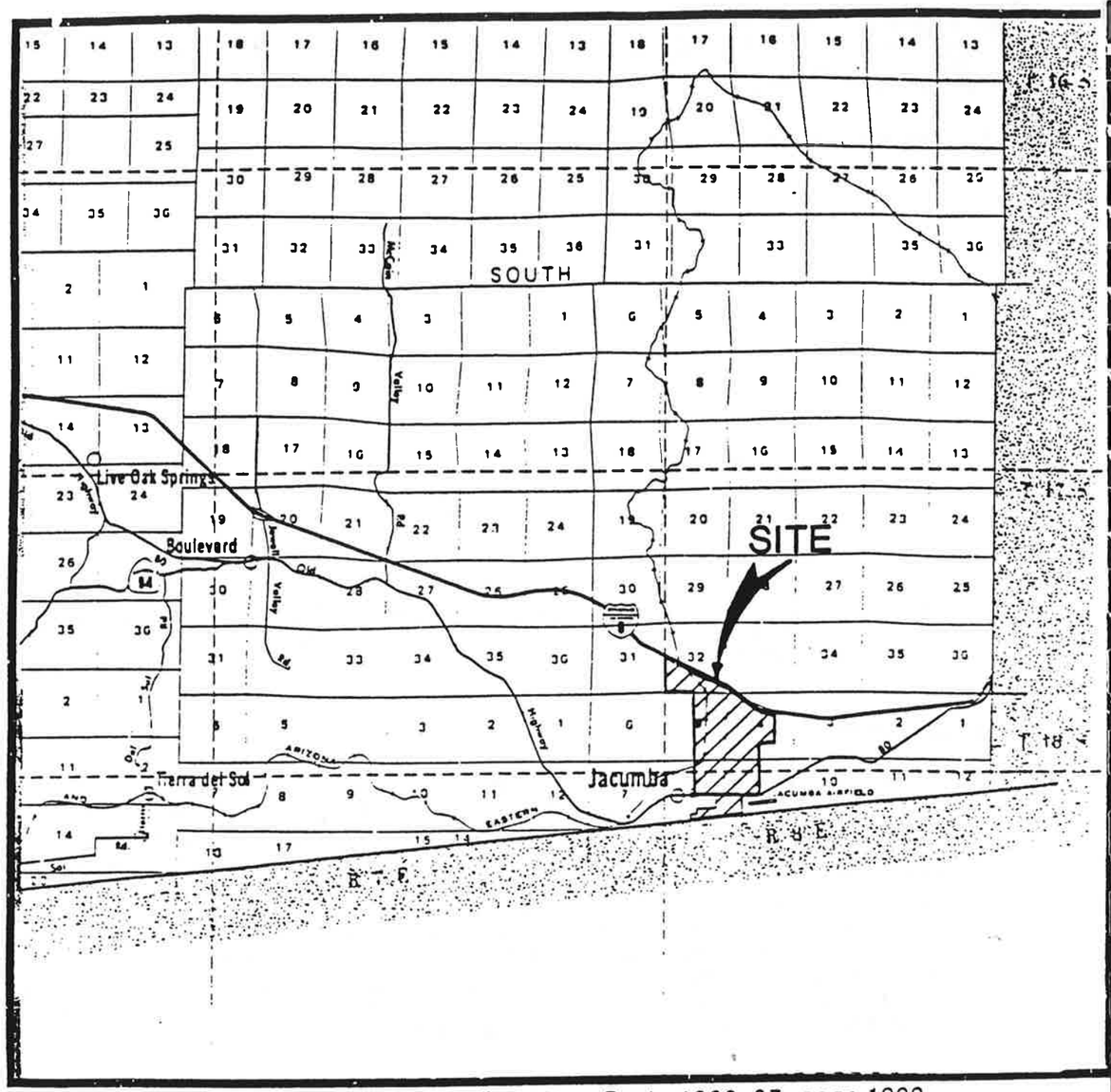
In accordance with your request, we have performed a limited geotechnical evaluation of the liquefaction and consolidation potential in the first phase of the proposed development. Plans for this phase include an 18-hole golf course, waste water treatment plant, hotel, school, congregate care center, and retail and commercial structures, along with associated streets, utilities, and drainage channels. We have concentrated our evaluation principally in areas underlain by alluvium (Qal and Qfn on Plate 1) as these are the areas thought most likely to be subject to liquefaction and consolidation. We understand that a maximum of 4 feet of fill is proposed in some areas. In addition, we have performed a limited evaluation of the soil in the drainage areas for use as structural fill and have evaluated drainage channel slope stability.

Accompanying Maps and Appendices

Figure 1 - Site Location Map - Page 2
Plate 1 - Geotechnical Map - In Pocket
Appendix A - References
Appendix B - Boring and Trench Logs
Appendix C - Laboratory Test Results

3934 MURPHY CANYON ROAD, SUITE B205, SAN DIEGO, CALIFORNIA 92123

(619) 292-8030 • (800) 447-2626
FAX (619) 292-0771



BASE MAP: Aerial-Foto Map Book, 1986-87, page 1009
Original by Aerial Graphics.

N

0 2.2 4.4
scale miles

JACUMBA VALLEY RANCH

Figure 1

SITE LOCATION MAP

Project No. 4900381-05

LEIGHTON and ASSOCIATES INCORPORATED

Scope of Services

Our scope of services to date has included:

- Logging and sampling 13 small-diameter borings and 6 backhoe trenches.
- Field and laboratory testing to evaluate pertinent engineering properties of the soil samples.
- Geotechnical evaluation of data obtained during our investigation.
- Preparation of this report presenting the results of our evaluation.

Field Investigation

On December 11 through 14, 1990, 13 small-diameter borings were excavated on site. The borings were excavated to a maximum depth of approximately 50 feet or until bedrock was encountered (whichever was shallower) with a truck-mounted Mobil B-61 drill rig with 8-inch hollow stem augers. The borings were sampled and logged by a geologist from our firm. Borings were sampled with a Standard Penetration Test (SPT) split spoon sampler and a Modified California ring sampler. Bulk and relatively undisturbed ring samples were collected for visual classification and laboratory testing. Ground water levels at the time of drilling are recorded on the logs. On December 18, 1990, 6 backhoe trenches were excavated on site by Jacumba Valley Ranch. The trenches were logged and sampled by a geologist from our firm. The approximate locations and logs of the borings and trenches are presented on Plate 1 and in Appendix B, respectively.

Seismicity

As discussed in our Land Use Feasibility Study (Appendix A, Reference 5), the seismic hazard thought most likely to impact the subject site is ground shaking produced by a large earthquake on one of the major active regional faults. A maximum probable event on the Elsinore fault (considered the design earthquake for this site) is expected to produce a peak horizontal bedrock acceleration of 0.30g and a repeatable ground acceleration of 0.20g. The effects of seismic shaking can be reduced by adhering to the Uniform Building Code or state-of-the-art design parameters of the Structural Engineers Association of California.

Liquefaction Potential

During an earthquake, ground shaking may cause loss of soil strength (liquefaction) in loose saturated sandy soils, resulting in excessive settlement damage and/or possible failure of surface structures. The likelihood of liquefaction depends on the intensity and duration of the ground shaking, the

soil characteristics, and the depth to ground water. A simplified analytical method, based on empirical correlations, relating the field occurrence of liquefaction to the earthquake magnitude and acceleration, cyclic shear resistance of the soils, and Standard Penetration Test (SPT) results (Appendix A, Reference 7) was used to evaluate the liquefaction potential of the recent alluvium (Qal) and older alluvium (Qfn). The formational materials (Tjl, Tja, Tmg) are not considered to have a significant liquefaction potential. The Geotechnical Map (Plate 1) shows the approximate extent of these units.

The ground water levels we encountered in our borings ranged from approximately 5 to 40 feet below the existing ground surface. We believe that these levels are likely to be significantly lower than historic high ground water conditions due to the ongoing drought. In our evaluation, we have assumed ground water levels 5 feet higher than those actually encountered.

The soils encountered in the upper portions of the alluvium were generally described as medium dense, silty fine to medium sand and stiff, sandy to clayey silt. Standard Penetration Test (SPT) blow count values (in the upper 30 feet) ranged from 19 to 49 with an average blow count of 31 blows per foot. Based on the results of our investigation, the calculated factor of safety against liquefaction is greater than 1.5, indicating a low potential for liquefaction at the site due to the design earthquake. Further, the addition of up to 4 feet of fill soils in selected areas across the site should reduce the potential for liquefaction in those areas receiving fill.

Dynamic Settlement

Dynamic settlement due to earthquake shaking was evaluated in the alluvial areas using the method described by Tokimatsu and Seed (Appendix A, Reference 9). The design earthquake (which has an estimated return period of 100 years) may induce a total settlement at the site on the order of 3/4 to 1 inch. Differential settlement of the alluvium due to earthquake-induced dynamic settlement is estimated to be on the order of 1/4 to 1/2 inch across 100 feet of ground surface. The addition of fill soils should reduce the potential for dynamic settlement.

Consolidation

Consolidation of soils is a relatively long-term process that may occur when pore pressures in soil of relatively low permeability (such as a silty or clayey soil) increase upon loading (due to additional fill placement, structures, etc.). Settlement of granular soils (sands and gravels) is the term used for the process of relatively short-term soil densification due to application of a load. Hydroconsolidation may also occur when a soil undergoes wetting or saturation after a load is applied. Consolidation, settlement, and hydroconsolidation may result in soil densification and ground subsidence.

The potential for long-term consolidation of the soils at the site is considered low due to the relatively high blow counts, the limited quantities of highly clayey materials encountered in our borings and trenches, and the relatively minor fill loads anticipated.

The potential for settlement of the existing granular alluvial soils was evaluated based on consolidation test results (Appendix C) and the assumption that no more than 4 feet of fill soils (above existing grades) will be added at the site. The building loads are assumed to be typical for this type of relatively light construction. Larger loads may be anticipated for the waste water treatment plant.

To reduce the potential for settlement, we recommend that portions of the alluvial soils under the proposed structures be removed and recompacted and that construction be delayed for a period of time after the addition of fill soils so that differential settlement may be reduced to tolerable limits. The following preliminary recommendations are based on a maximum total and differential settlement of 1 inch and 1/2 inch, respectively.

Type of Structure	Estimated Depth of Removal and Recompaction (feet below existing grade)
1- and 2-Story, School, Hotel Congregate Care, and Residential Structures	2 - 4
Waste Water Treatment Plant	3 - 5

The above values are preliminary and should be refined based on actual building loads and site-specific geotechnical investigations.

Thickness of Proposed Fill (above existing grade) in feet	Delay of Building Construction after Grading (months)
≤2	0
≤3	1
≤4	2

We do not believe these delays should pose significant constraints to construction provided that a phased construction approach can be accomplished.

To reduce the potential for hydroconsolidation of alluvial soils, the base of the removal area should be thoroughly wetted after removal of the existing soils and prior to recompaction. Specific grading recommendations will be provided in the geotechnical investigation reports.

Suitability of Material In Drainages for Use as Fill Soils

Based on our visual evaluation and laboratory testing of samples obtained from the five backhoe trenches located in the existing drainages, (one of the backhoe trenches was located outside of the drainage areas for purposes of evaluating rippability and other properties) this material should be generally suitable as structural fill. Visual evaluation generally indicates a very low expansion potential for the majority of this material. However, laboratory testing (Appendix C) indicates a medium expansion potential for the siltier portions. Soils with a medium expansion potential are generally not desirable within 3 feet of finish grade. The material generally varied from a fine sandy silt to a fine to coarse sand with gravels and cobbles. Scattered roots were noted in some of the near-surface soils. The clean, sandy portions may have a moderate to high erosion potential. This material is anticipated to have an adequate bearing capacity (for lighlty loaded structures) when compacted as fill soils.

Drainage Channel Slope Stability

We understand that unlined drainage channels are proposed to conduct storm water across the site. We further understand the proposed channel walls (up to 5 feet in height) are to be constructed at inclinations of approximately 5:1 (horizontal to vertical). Based on direct shear tests performed on remolded representative soil samples, these slopes should be grossly stable at the proposed inclinations. Channel erosion protection is generally under the purview of the civil engineer as evaluation of erosion and scour is based on water quantity and flow velocity. We have provided grain-size analyses of representative samples (Appendix C) for this evaluation. Clean, fine sand (without a significant portion of silt or clay to act as a binding agent) should be avoided in use as a channel liner unless adequately protected from erosion and scour.

Summary

Based on the results of our limited evaluation, it is our opinion that the proposed development is feasible from a geotechnical standpoint provided that the concerns presented herein are addressed into the project design.

We note that additional geotechnical investigation is recommended to provide site-specific foundation and grading recommendations.

If you have any questions regarding our report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Douglas F. Roff, CEG 1480
Project Geologist

Gene Custenborder, CEG 1319
Chief Geologist

Joseph G. Franzone, RCE 39552
Chief Engineer

DFR/GC/JGF/jss

Distribution: (6) Addressee
(6) Brian F. Mooney Associates
Attention: Mr. Brian F. Mooney

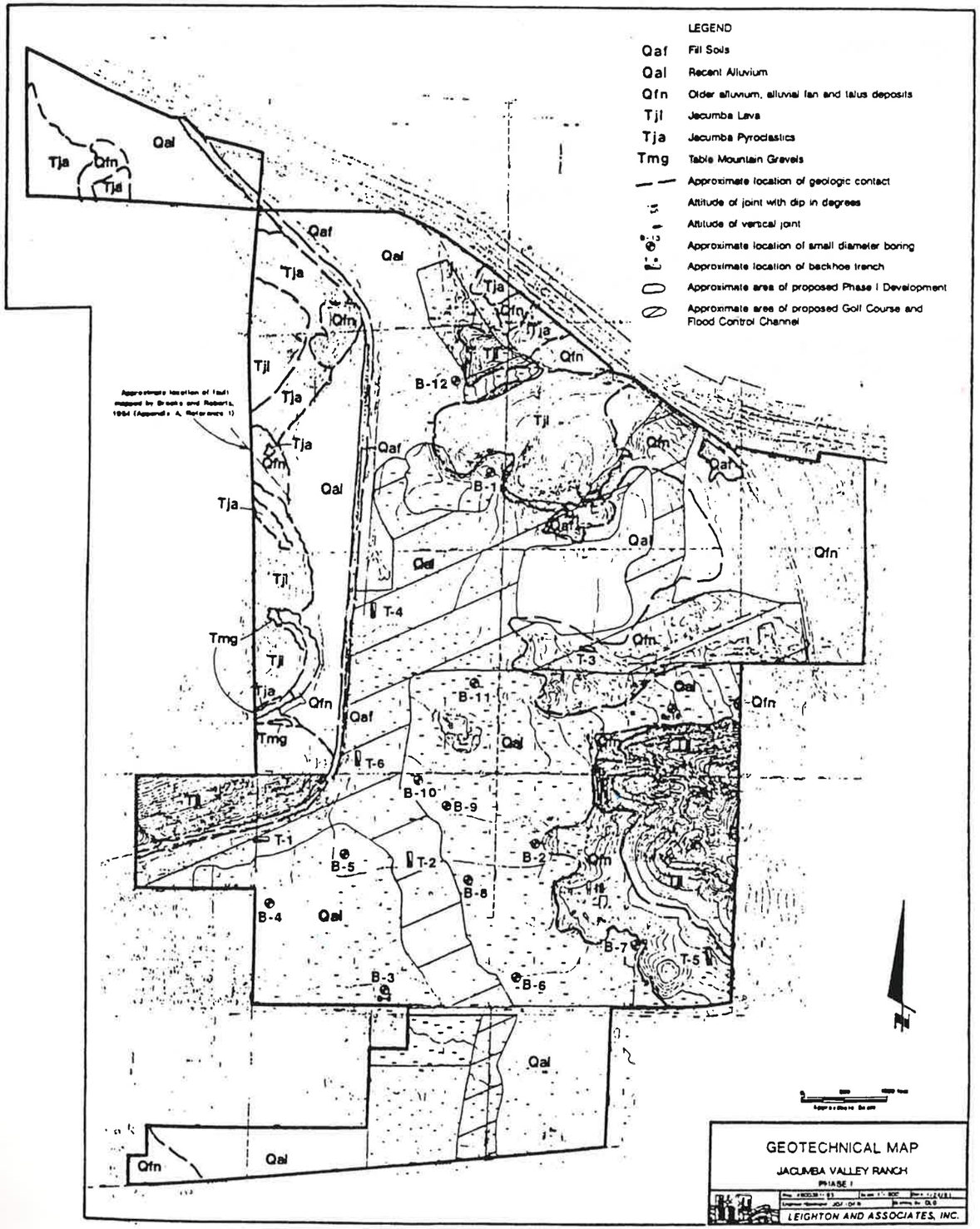

LEGEND
Qaf Fill Soils
Qal Recent Alluvium
Qfn Older alluvium, alluvial fan and talus deposits
Tjl Jacumba Lava
Tja Jacumba Pyroclastics
Tmg Table Mountain Gravels
Approximate location of geologic contact
Attitude of joint with dip in degrees
Attitude of vertical joint
Approximate location of small diameter boring
Approximate location of backhoe trench
Approximate area of proposed Phase I Development
Approximate area of proposed Golf Course and Flood Control Channel
Approximate location of fault mapped by Brooks and Roberts, 1984 (Appendix A, Reference 1)
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
T-1
T-2
T-3
T-4
T-5
T-6
GEOTECHNICAL MAP
JACUMBA VALLEY RANCH
PHASE I
LEIGHTON AND ASSOCIATES, INC.

Plate 1

APPENDIX A

REFERENCES

1. Brooks, B. and Roberts, E., 1954, Geology of the Jacumba Area, San Diego and Imperial Counties, California Division of Mines and Geology, Bulletin 170, Map Sheet 23.

2. Greensfelder, R.W., 1974, Maximum Credible Rock Acceleration from Earthquakes in California: California Division of Mines and Geology, Map Sheet 23.

3. Hart, E.W., 1988, Fault-Rupture Hazard Zones in California: California Division of Mines and Geology. Special Publication 42.

4. Jennings, C.W., 1975, Fault Map of California, California Division of Mines and Geology, California Geologic Data Map Series, Map No. 1.

5. Leighton and Associates, 1990, Geotechnical Land-Use Feasibility Study, Jacumba Valley Ranch Development, San Diego County, California, Project No. 4900381-01, dated April 27.

6. Ploessel, M.R., and Slosson, J.E., 1974, Repeatable High Ground Acceleration from Earthquakes: California Geology, Vol. 27, No. 9, P. 195-199.

7. Seed, Idriss, and Arango, 1983, Evaluation of Liquefaction Potential Using Field Performance Data, ASCE, Vol. 109, No. 3, March.

8. Strand, R.G. 1962, Geologic Map of California - San Diego - El Centro Sheet, California Division of Mines and Geology.

9. Tokimatsu and Seed, 1987, Evaluation of Settlement in Sands due to Earthquake Shaking, ASCE, Vol. 113, No. 8, August.

10. Weber, F.H., 1963, Geology and Mineral Resources of San Diego County, California, California Division of Mines and Geology, County Report 3.

EXPLANATION OF GEOTECHNICAL TRENCH LOG

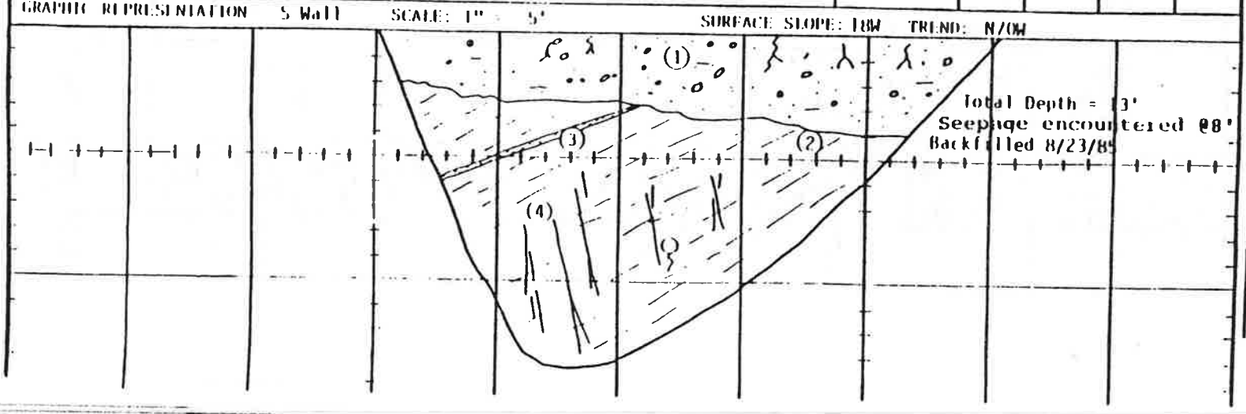
Project Name: _____ Logged By: _____

Project Number: _____ Elevation: _____ TRENCH NO. _____

Equipment: _____ Location: _____

GEOLOGIC ATTITUDES	DATE: DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES: U.S.C.S.	Sample No.	Moisture (%)	Density (% Compaction)
	FILL A few desiccation cracks at surface up to 1/4- to 1/2-inch wide	Qaf	SM	① @ 0-1'		
	0-4' Light brown, slightly damp, loose to medium dense, silty very fine- to medium grained sand; abundant chunks of light gray silty/very fine-grained sandy clay, several wood and thin roots, porous, several subangular cobbles (1)			K-1 @ 3'	12.6	118.7 (89)
c: Sharp	POINT LOMA FORMATION @4' Gray, slightly damp, very stiff, fine sandy siltstone/claystone; with thick interlaminae or very thin lenses of light yellow-brown, silty fine-grained sandstone, highly fractured and blocky, several roots along fractures (2)	Kp	MH/CH	J-1 @ 5'	24.2	115.0
b:N82E/28S	(3) Light yellowish brown fined grained sandstone, continuous along wall					
J:N5E/62W	(4) Light joint system, spacing 4 to 6 inches, iron oxide along fractures					

GRAPHIC REPRESENTATION S Wall SCALE: 1" = 5' SURFACE SLOPE: 18W TREND: N/0W



LOG OF TRENCH NO. _____

Bulk Sample

Field Density Test in accordance with ASTM 2937-83

Percent of Maximum Density

Single relatively undisturbed ring sample

Attitudes Strike/Dip
(B) = Bedding
(C) = Contact
(J) = Joint
(F) = Fracture
(CS) = Clay Seam

Graphic Log
- silt
- sand
- clay
- caliche pods
- caliche stringers
- contact
- fracture
- clast
- cemented zone
- root hairs
- clay rip-up clasts
- heavy mineral laminae
- pockets of gravel
- seepage

SOIL-A - (3/86)

Leighton & Associates

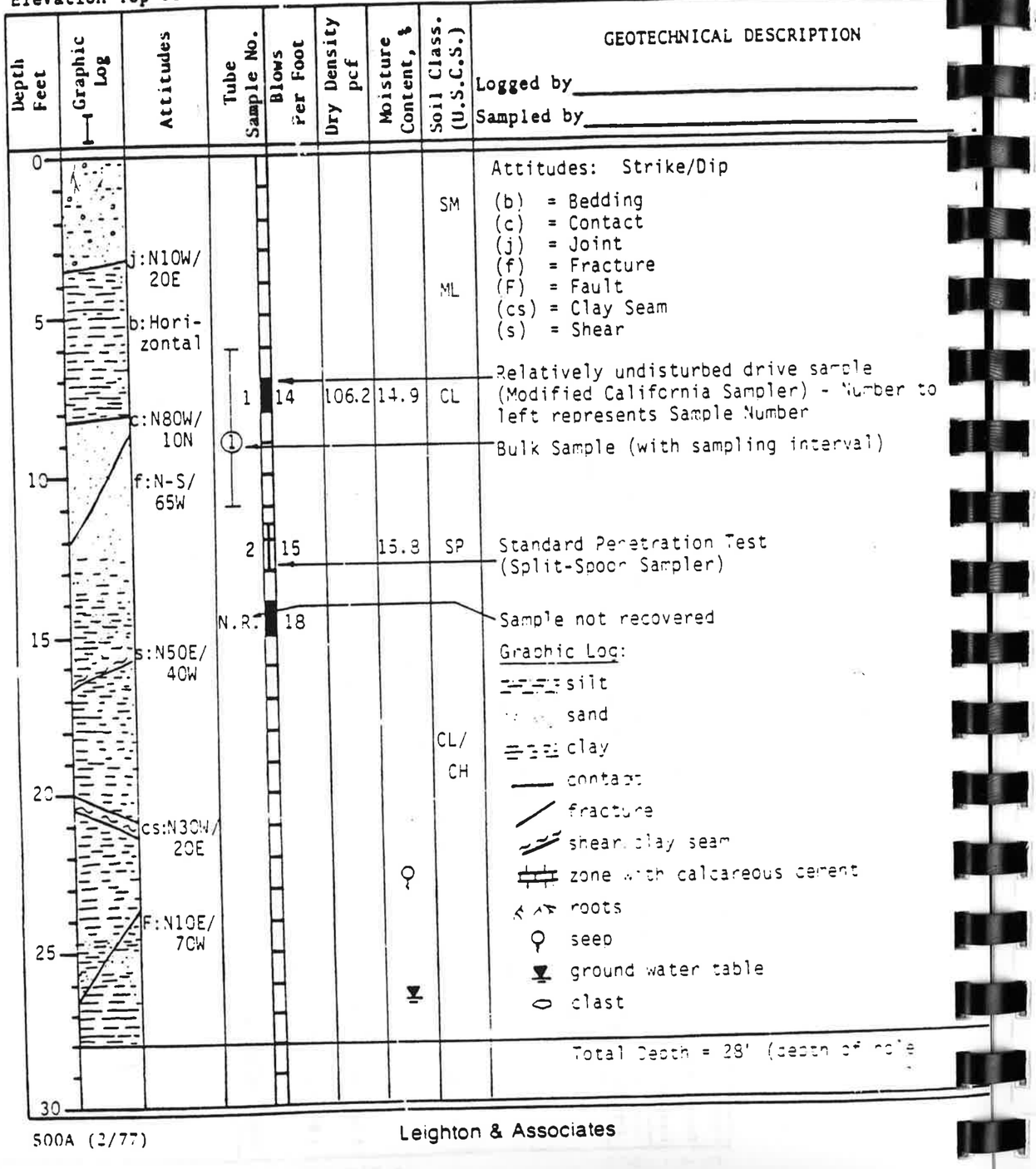
Date _____ Drill Hole No. _____ Sheet ___ of ___

Project _____ Job No. _____

Drilling Co. _____ Type of Rig _____

Hole Diameter _____ Drive Weight _____ Drop _____ in.

Elevation Top of Hole _____ Ref. or Datum _____



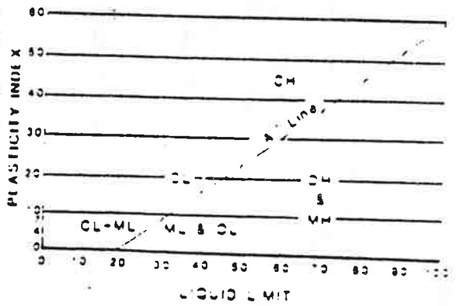
500A (2/77) Leighton & Associates

COARSE GRAINED SOILS (More than 1/2 of soil > no. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > no. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction < no. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (More than 1/2 of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

CLASSIFICATION CHART
(Unified Soil Classification System)

CLASSIFICATION	RANGE OF GRAIN SIZES U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

GRAIN SIZE CHART



PLASTICITY CHART

METHOD OF SOIL CLASSIFICATION

501-A - (3/77)

Leighton & Associates

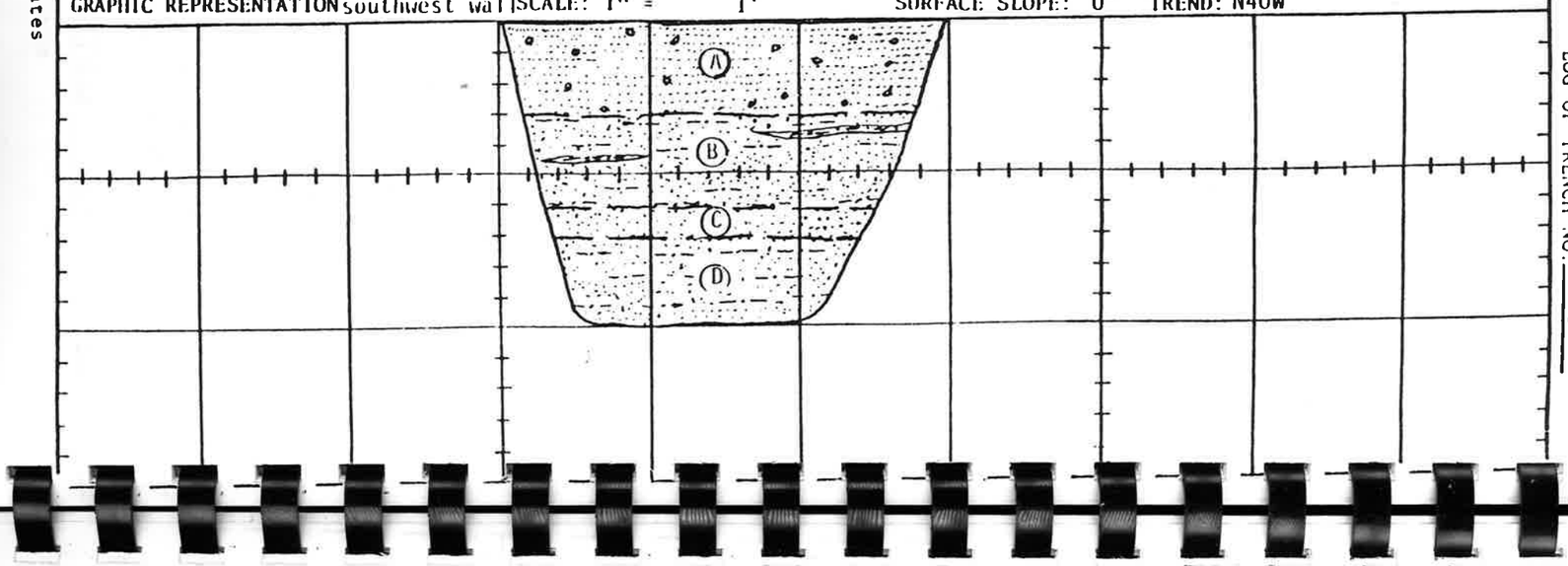
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,790'
Location: See Plate 1

TRENCH NO. T-1

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM					
	(A) @0'-3': Gray-white, loose, dry, fine to very coarse sand; abundant pebbles, finely bedded		SW	(1) @ 0'-3'		
	(B) @3'-6': Dark brown, moist, medium dense, silty, fine to medium sand; few coarse-grained constituents, micaceous, some pods and discontinuous lenses of very silty, fine to medium sand		SM			
	(C) @6'-7': Dark brown, moist, medium dense, fine to coarse sand; micaceous		SW			
	(D) @7'-10': Dark brown, moist, medium dense, fine to medium sandy silt		ML	(2) @ 8'-10'		
	Total Depth = 10 feet No Ground Water Encountered at Time of Trenching Backfilled: 12/18/90					

GRAPHIC REPRESENTATION southwest wall SCALE: 1" = 1' SURFACE SLOPE: 0° TREND: N40W



LOG OF TRENCH NO: T-1

501-A - (3/77)

Leighton & Associates

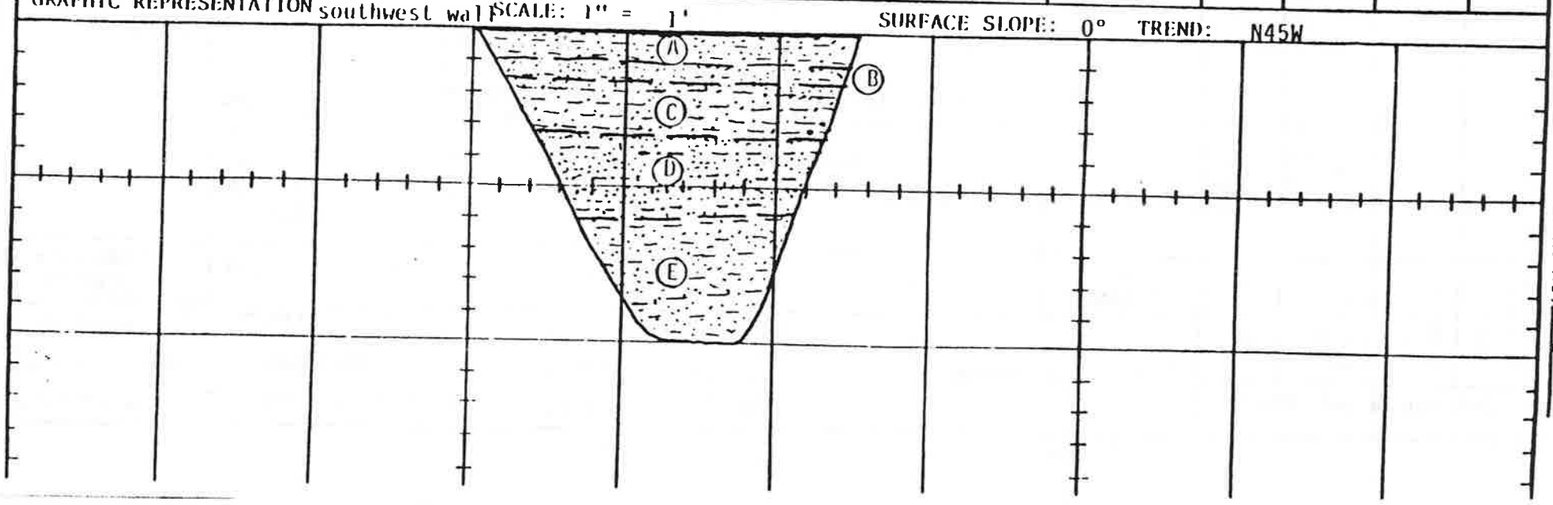
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,775'
Location: See Plate 1

TRENCH NO. T-2

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM					
	(A) @0'-1': Dark brown and olive-brown, moist, medium dense, fine sandy silt/silty fine sand; sparse roots, slightly porous, micaceous	Qal	ML/SM	(1) @ 0'-3'		
	(B) @1'-1.4': Light brown, moist, medium dense, silty fine sand		SM			
	(C) @1.4'-3': Mottled dark olive-brown and brown, moist to wet, medium dense, fine sandy silt; few roots, abundant red-brown stringers (infilled borrows?), abundant caliche stringers		ML			
	(D) @3'-6': Mottled olive-brown and orange-brown, moist to wet, medium dense, fine sandy silt micaceous, slightly porous		ML	(2) @ 4'-6'		
	@6'-10': Becomes fine sandy silt/silty fine sand		ML/SM			
	Total Depth - 10 feet Ground Water Seepage Encountered at 6 feet at time of trenching					

GRAPHIC REPRESENTATION southwest wall SCALE: 1" = 1' SURFACE SLOPE: 0° TREND: N45W



LOG OF TRENCH NO: T-2

501-A - (3/77)

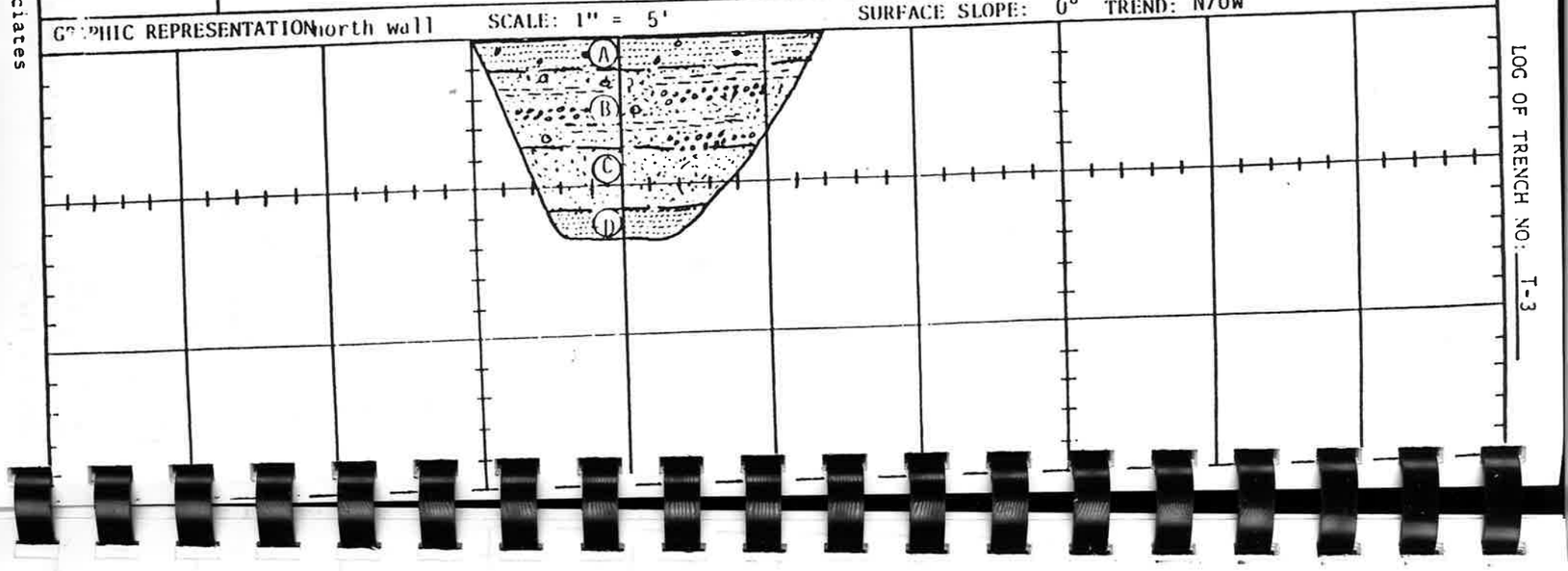
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,780'
Location: See Plate 1

TRENCH NO. T-3

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM					
	(A) @0'-1': Gray-white, dry, loose, fine to very coarse sand; some pebbles, finely bedded	Qal	SM-SW	(1) @ 1'-3'		
	(B) @1'-3.5': Gray-brown, dry to damp, loose, fine to very coarse sand; few discontinuous silt layers approximately 1/2 inch thick, some discontinous sandy pebble lenses, rare clasts to 3 inch diameter			(2) @ 5'-7'		
	(C) @3.5'-6': Gray-brown, dry to damp, loose, fine to very coarse sand; few pebbles					
	(D) @6'-7': Gray-brown, dry to damp, loose, very coarse sand; finely bedded		SM-SP			
	Total Depth = 7 feet No Ground Water Seepage Encountered at Time of Trenching Backfilled: 12/18/90					

GRAPHIC REPRESENTATION north wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: N70W



LOG OF TRENCH NO: T-3

Leighton & Associates

501-A - (3/77)

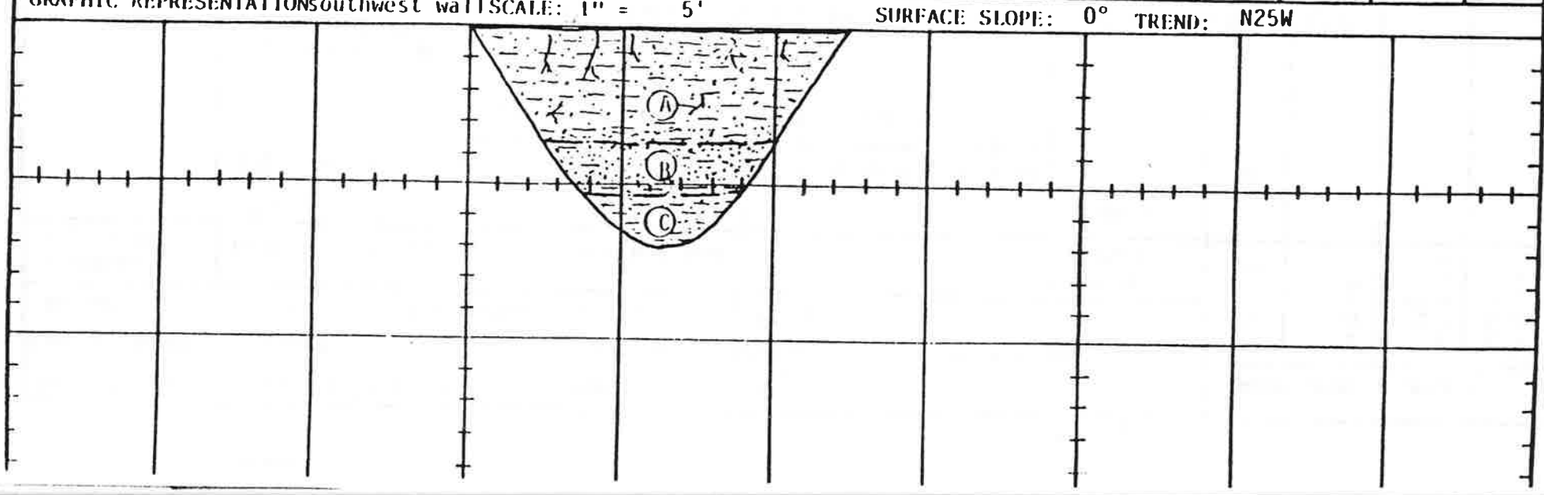
Project Name: Jacumba Valley Ranch
Project Number: 4900381-05
Equipment: Case 680C Backhoe

Logged By: DLL
Elevation: ±2,755'
Location: See Plate 1

TRENCH NO. T-4

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM	Qal				
	(A) @0'-3.5': Dark brown to black, moist to wet, medium dense, fine to medium sandy silt; porous, abundant roots and rootlets, micaceous		ML	(1) @ 0'-3'		
	(B) @3.5'-5.5': Mottled dark olive-brown and brown, and orange brown, wet to saturated, dense, very silty fine sand/fine sandy silt; porous, few roots, some medium-coarse grained constituents		ML/SM			
	(C) @5.5'-7.0': Dark brown to olive-brown, saturated, medium dense, fine to medium sandy silt; micaceous		ML			
	Total Depth = 7 feet Ground Water Seepage Encountered at 4 feet at Time of Trenching Backfilled: 12/18/90					

GRAPHIC REPRESENTATION southwest wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: N25W



LOG OF TRENCH NO: T-4

Leighton & Associates

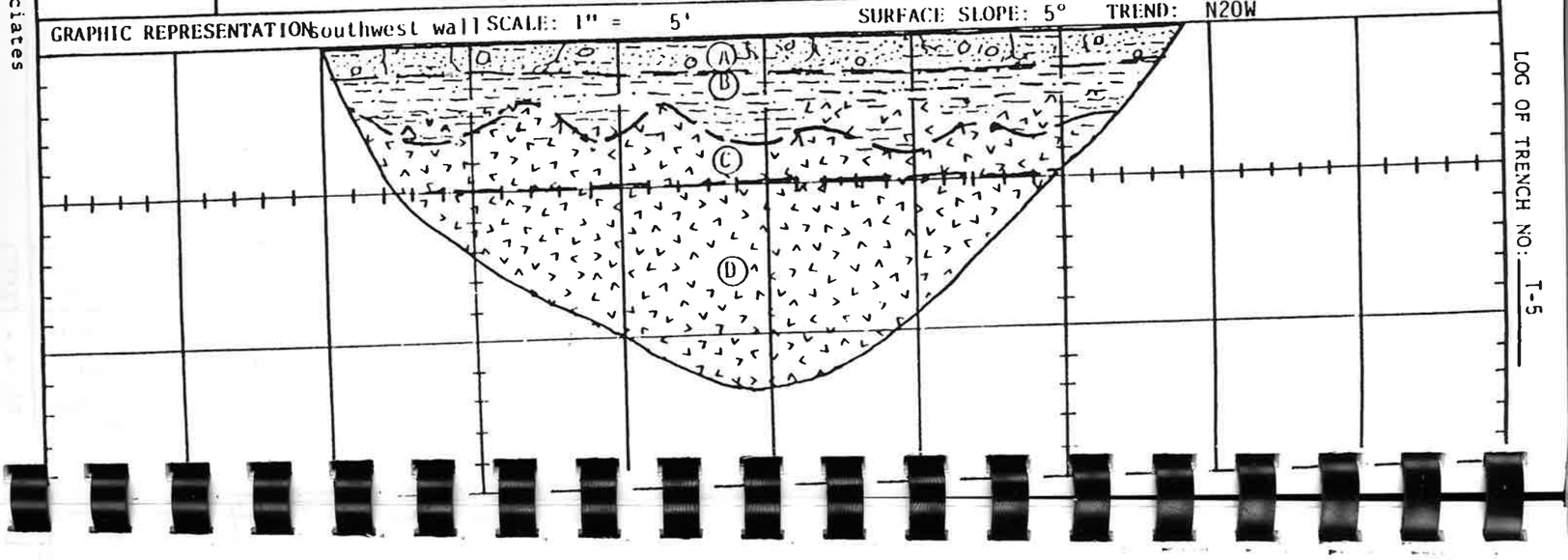
501-A - (3/77)

Leighton & Associates

Project Name: Jacumba Valley Ranch | Logged By: DLL
Project Number: 4900381-05 | Elevation: ±2,820' | TRENCH NO. T-5
Equipment: Link Belt LS 5800 Trackhoe | Location: See Plate 1

GEOLOGIC ATTITUDES	DATE: 12/18/90 DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	TOPSOIL	Topsoil				
	(A) @0'-1': Brown, dry, loose, silty, fine to medium sand; abundant rootlets throughout, moderate amount of cobbles to 5-inch diameter, slightly porous, desiccated		SM			
	OLDER ALLUVIUM					
	(B) @1'-2': Brown, dry, loose to medium dense, fine to medium sandy silt; trace of clay, slightly desiccated	Qfn	ML	(1) @ 1'-2'		
	JACUMBA LAVA					
	(C) @2'-5': Mottled pinkish white, dry, dense rhyolitic tuff bed; intermixed with volcanic clasts and zones and pods of alluvium; very weathered, slightly desiccated, slightly friable	Tjl				

GRAPHIC REPRESENTATION Southwest wall SCALE: 1" = 5' SURFACE SLOPE: 5° TREND: N20W



LOG OF TRENCH NO: T-5

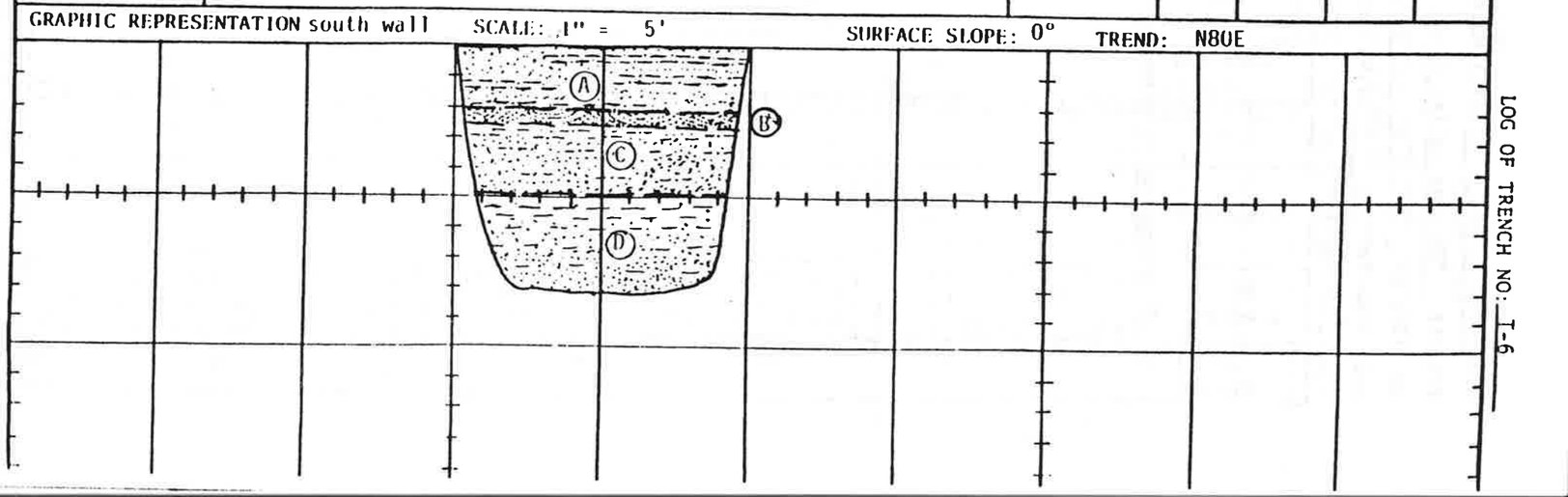
501-A - (3/77)

Leighton & Associates

Project Name: Jacumba Valley Ranch | Logged By: DLL
Project Number: 4900381-05 | Elevation: | TRENCH NO. T-6
Equipment: Case 680C Backhoe | Location:

GEOLOGIC ATTITUDES	DATE: DESCRIPTION:	GEOLOGIC UNIT	ENGINEERING PROPERTIES U.S.C.S.	Sample No.	Moisture (%)	Density (pcf)
	ALLUVIUM	Qal				
	(A) @0'-2': Alternating gray, dry, loose, fine to coarse sand and gray, dry, loose silt; silt layers 1/4-inch to 1-inch thick		ML & SM	(1) @ 2'-5'		
	(B) @2'-2.5': Gray, dry, loose, fine sand; finely laminated cross bedding, concoidal lenses of fine to coarse sand, manganese lamanae		SP			
	(C) @2.5'-5': Brown, damp, medium dense, silty fine to medium sand; grades to brown, damp, medium dense, fine to medium sand		SM & SW			
C: sharp, horizontal	(D) @5'-8': Dark brown, wet to saturated, medium dense, fine to medium sandy silt, grades to silty, fine sand; slightly porous, minor roothairs		ML & SW	(2) @ 5'-8'		
	Total Depth = 8 feet Ground Water Seepage Encountered at 7 feet					

GRAPHIC REPRESENTATION south wall SCALE: 1" = 5' SURFACE SLOPE: 0° TREND: N80E



LOG OF TRENCH NO: T-6

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-1 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,760' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	22		23.8	ML	@5': Brown, dry, very stiff, slightly fine sandy silt @7': Becomes clayey
10			2	22		▽		@10': Dark brown, moist to wet, very stiff clayey silt slightly micaceous
15			3	28				@15': Dark brown, saturated, very stiff, clayey silt; some fine grains, rare pebbles
20			4	41			SC	@20': Dark brown, saturated, dense, clayey fine to coarse sand; numerous pebbles
25			5	37				@25': Dark brown, saturated, dense, slightly clayey fine to very coase sand; numerous pebbles to 1" diameter
30								

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-1 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,760' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	38			SW	@30': Brown-gray, wet, dense, fine to coarse sand; numerous red, fine-grained volcanics
35			7	50/2"			SM/GM	@35': Brown, saturated, very dense, silty fine to very coarse sand/silty to sandy gravel (volcanic gravel) Refusal at 36.5 feet due to bedrock
40								Total depth = 36.5 feet Ground water encountered at 11 feet at time of drilling

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-2 Sheet 1 of 1

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,778' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	17		▽	SM	@5': Olive-brown, wet, medium dense, silty fine to medium sand; slightly micaceous
10			2	24			ML	@10': Olive-brown to light orange-brown, wet, medium dense, fine sandy silt, micaceous
15			3	28			ML/SM	@15': Mottled brown, olive-tan and orange brown, wet, medium dense, silty very fine sand/very fine sandy silt; few root hairs, micaceous
20			4	41			SM	@20': Mottled brown, olive-brown and orange-brown, wet, dense, silty fine sand; contact to brown, saturated, dense, sandy gravel
25			5	90/7"				JACUMBA LAVA @25': Mottled pinkish white, wet, very dense volcanic rock
								Total depth = 27 feet (refusal on bedrock) Ground water encountered at 6 feet at time of drilling
30								

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-3 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,790' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	31			SM	@5': Brown, moist, dense, silty fine sand; few rootlets
10			2	30	102.4	21.2		@10': Mottled orange-brown and brown, wet dense, silty fine sand; few rootlets, slightly micaceous
15			3	35			ML/SM	@15': Mottled orange-tan and brown, wet, dense, silty very fine sand/very fine sandy silt; some carbon-stained flecks
20			4	61	98.3	31.5	ML	@20': Mottled orange-brown and brown, wet to saturated, very dense, fine sandy silt
25			5	39			SM	@25': Light brown, wet, dense, silty fine to medium sand; contact to dark brown, wet, dense, silty, fine sand; more silty than above contact
30								

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/11/90 Drill Hole No. B-3 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,790' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	20	(N.R.)		SM	@30': Brown, saturated, medium dense, silty fine sand; slightly micaceous
35								
40			7	70			ML/ SM	@40': Mottled brown and orange-brown, wet, very dense, silty fine sand/fine sandy silt; slightly micacous, carbon-stained pods
45								
50			8	84	(N.R.)		SM	@50': Brown, saturated, dense, silty fine sand
55								Total depth = 51 feet Ground water encountered at 12 feet at time of drilling

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-4 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,786' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	41	98.2	18.6	SM	@5': Brown, moist, dense, silty fine to coarse sand; micaceous
								@7': Becomes siltier
10			2	33			SM & SW	@10': Dark brown, wet, dense, slightly silty fine to medium sand and gray, wet, fine to coarse sand; micaceous
15			3	78	106.4	24.5	SM	@15': Brown, saturated, very dense, silty, fine to medium sand
20			4	35				@20': Gray, wet, dense, slightly silty fine to coarse sand; some interbeds of brown, clayey silt (up to 2" thick)
25			5	36			CL SW	@25': Red-brown, wet, very stiff, silty clay/clayey silt; gradational contact with gray, saturated, dense, fine to coarse sand
30								

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-4 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,786' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	36	(N.R.)			
35								
40			7	82			SW	@40': Gray, saturated, very dense, fine to coarse sand
45								
							SM	@50': Light brown, saturated, dense to very dense, slightly silty, fine to medium sand
50			8	50				
								Total depth = 51.5 feet Ground water encountered at 9 feet at time of drilling
55								

500\ (2/??)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-5 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,777' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	24		23.6	SM	@5': Mottled brown and red-brown, wet, medium dense, very silty fine sand; micaceous
10			2	26		▽	ML	@9': Becomes clayey @10': Mottled red-brown and brown, wet, very stiff, fine sandy silt; trace of clay, few carbonized flecks
15			3	41			CL-SM	@15': Mottled red-brown and brown, wet, dense interbedded silty clay/very silty fine sand; some carbonized thin (1/16" thick) beds, silty clay is finely laminated
20			4	49			SW	@20': Brown, wet, dense fine to medium sand; few coarse grains, micaceous
25			5	28			SM/ML SW	@25': Mottled red-brown, wet, medium dense, fine sandy silt/silty fine sand; trace of clay, some finely laminated clay layers. Sharp contact with brown, fine to medium sand with trace of silt (2 samples obtained
30								

500\ (2/??)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-5 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,777' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	38			ML-SM	@30': Mottled red-brown and brown, wet, dense, clayey silt to silty fine sand
40			7	38			SW	@40': Brown, saturated, dense, fine to medium sand; trace of silt
50			8	67				@50': Brown, saturated, very dense, fine to coarse sand; trace of silt
								Total depth = 51.5 feet Ground water encountered at 9 feet at time of drilling
55								

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-6 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,788' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	19		8.5	SM	@5': Light brown, moist, medium dense, silty fine sand; micaceous
10			2	42	105.7	10.8		
15			3	48			SW	@15': Brown, wet, dense, fine to coarse sand; micaceous, trace of silt
20			4	76	(N.R.)			
25			5	20			CL/ML	@25': Mottled red-brown and brown, wet, very stiff, silty clay/clayey silt; trace of fine sand
30								

GEOTECHNICAL BORING LOG

Date 12/12/90 Drill Hole No. B-6 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,788' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	47	93.7 (Partial recovery)	28.1		@30': Same as at 25'
35								
40			7	64 (N.R.)				
45								
50			8	47			CL/ ML	@50': Mottled olive-brown, wet, hard clayey silt/silty clay
								Total depth = 51.5 feet Ground water encountered at 11.5 feet at time of drilling
55								

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-7 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,792' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	26	97.5	11.8	SM	@5': Brown, damp to moist, medium dense, very silty, fine to medium sand; micaceous trace of clay, rare pebbles
10			2	22				@10': Light reddish brown, moist, medium dense, very silty fine to medium sand; slightly micaceous; trace of clay, moderate volcanic pebbles
15			3	43	112.1	15.2	SC/ SM	@15': Light reddish brown, moist, medium dense, clayey to silty, fine to coarse sand
20			4	66				JACUMBA LAVA @20': Mottled red, white and black, saturated, very dense, very weathered volcanic rock
25			5	89 (N.R.)				
30								

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-7 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,792' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
30			5	50/2" (N.R.)				@30': Black, slightly weathered basaltic volcanic rock
								Total depth = 33 feet Ground water encountered at 9 feet at time of drilling
35								

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-8 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,781' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
0			1					ALLUVIUM
5			1	28	93.8	27.3	SM	@5': Olive-brown and orange-brown, wet, medium dense, silty fine sand; few rootle slightly micaceous
10			2	50			ML/SM	@10': Mottled orange-brown and olive-brow saturated, dense, silty fine sand/fine sandy silt; some carbonized thin (1/16" thick) layers
15			3	28	95.4	30.7	ML/CL	@15': Mottled orange-brown and olive-brown, saturated, clayey silt/silty clay; some carbonized flecks and staining, few medium-sized grains
20			4	48			SM	@20': Light brown and olive-brown, wet, dense, silty fine sand; micaceous, some brown, silty/clayey layers up to 1/2" thi.
25			5	34	113.9	16.8		@25': Light brown, wet, dense, slightly silty, fine to coarse sand
30								

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-8 Sheet 2 of 2-

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,781' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	35			ML/MH	@30': Mottled olive, olive-brown, and orange-brown, wet, hard clayey silt, trace of fine sand, micaceous, some thin clay layers
35								
40			7	20 (N.R.)				
45								
50			8	100			SM	@50': Brown, wet, very dense, very silty, fine to medium sand; approximately 5 percent coarse grains, micaceous
55								Total depth = 51.5 feet Ground water encountered at 8.5 feet at time of drilling

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-9 Sheet 1 of 2 -

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,774' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							CL/ML	ALLUVIUM @0': Dark brown, moist to wet, very stiff, silty clay/clayey silt
5			1	20			CL/ML	@5': Mottled dark olive-brown and orange-brown, wet, very stiff, clayey silt/silty clay; trace of fine sand
10			2	24	(N.R.)			
15			3	72	74.0	36.9	CL	@15': Mottled orange-brown and brown, saturated, very dense, fine sandy clay
20			4	32			SM	@22': Brown, wet, dense, very silty fine sand; micaceous, sharp contact to red-brown and brown, silty clay/clayey silt
25			5	21	(N.R.)		CL/ML	

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-9 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,774' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	46			ML/SM	@30': Brown, wet, dense, silty very fine sand/very fine sandy silt; micaceous, grades to:
35							CL/ML	orange-brown and brown, silty clay/clayey silt
40			7	52	80.1	20.6	ML/CL	@40': Mottled olive-brown and orange-brown wet, hard, silty clay/clayey silt
45								
50			8	44			CL/SC	@50': Mottled orange-brown and brown, wet, dense, fine to medium sandy clay/clayey sand
								Total depth = 51.5 feet Ground water encountered at 7 feet at time of drilling
55								

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-10 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,770' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								ALLUVIUM
5			1	23		▽	CL/ML	@5': Mottled olive-brown and orange-brown, wet, very stiff silty clay/clayey silt; micaceous trace of fine sand
10			2	29	88.7	34.2	ML/SM	@12': Mottled olive-brown and orange-brown saturated, medium dense, fine sandy silt/silty fine sand; micaceous
15			3	37			SM	@15': Mottled olive-brown and orange-brown wet, dense, silty fine sand; sample had one 3" thick layer of olive-brown and brown, laminated clay and silt
20			4	38	87.8	34.0	SC/SM	@20': Light brown, saturated, dense, silty and clayey fine to medium sand; micaceous
25			5	43			CL/SM	@25': Mottled olive-brown and red-brown wet, dense, fine sandy clay to silty clayey sand
30								

500A (2/77)

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/13/90 Drill Hole No. B-10 Sheet 2 of 2-

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,770' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
30			6	50/2"	(N.R.)			
35								
40			7	68			ML/ SM	@40': Brown, wet, very dense, very fine sandy silt/silty very fine sand
								Total depth = 41.5 feet Ground water encountered at 6 feet at time of drilling
45								

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-11 Sheet 1 of 2-

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,766' Ref. or Datum mean sea level

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
								Logged by DLL Sampled by DLL
0								ALLUVIUM
5			1	22		▽	ML	@5': Mottled olive-brown and orange-brown, wet, medium dense, fine sandy silt; micaceous, trace of clay
10			2	36	112.1	19.1	SM& CL	@10': Brown, saturated, dense, silty fine to coarse sand and brown, saturated stiff, slightly sandy clay
15			3	30			CL	@15': Mottled olive-brown and orange-brown, wet, very stiff to hard, fine sandy clay; micaceous
20			4	55	(N.R.)			
25			5	32				@25': Mottled red-brown and olive-brown, saturated, hard, slightly silty clay; numerous carbonized flecks, micaceous, some caliche stringers and pods
30								

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-11 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,766' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	70 (N.R.)			CL	@30': Brown, saturated, hard, clay
35								
40			7	50/4"			SW	@40': Brownish gray, wet, very dense, fine to coarse sand
45								
50			8	50/3"	117.6	14.0	SC	@50': Light reddish brown, saturated, very dense, clayey, fine to coarse sand
								Total depth = 51 feet Ground water encountered at 5 feet at time of drilling
55								

500A (2/

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-12 Sheet 1 of 1

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0							SM	ALLUVIUM @0': Brown, damp, medium dense, silty fine to coarse sand
5			1	20		8.4	SM/SW	@5': Brown, damp, medium dense, trace to slightly silty, fine to medium sand; few gravels, approximately 5 to 10 percent coarse grains
10			2	21				@10': Same as at 5' but fine to very coarse grained and wet
15			3	26			SW	@15': Gray-brown, wet, medium dense, fine to coarse sand
20			4	50/5"				JACUMBA LAVA @20': Red and black, very dense, weathered volcanic rock
								Total depth = 22 feet (Refusal on Bedrock) Ground water encountered at 13.5 feet at time of drilling
25								
30								

500A (2/

Leighton & Associates

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-13 Sheet 1 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,791' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0			1					ALLUVIUM
5			1	23		7.0	ML/SM	@5': Brown, damp, medium dense, fine sandy silty/silty fine sand; few pebbles
10			2	41		4.3	SW	@10': Brown, damp, dense, fine to medium sand; few thin (1/4" thick) silt layers, some pebbles More pebbles with depth
15			3	75		2.2		@15': Brown, damp, very dense, fine to coarse sand; some pebbles
								@18': Abundant pebbles to 2" diameter
20			4	50/4"		2.3		
25			5	30/6"		2.2	SM	@26': Becomes silty sand
30								

GEOTECHNICAL BORING LOG

Date 12/14/90 Drill Hole No. B-13 Sheet 2 of 2

Project Jacumba Valley Ranch Job No. 4900381-05

Drilling Co. Layne Environmental Type of Rig Mobile B-61

Hole Diameter 8" Drive Weight 140 lbs. Drop 30 in.

Elevation Top of Hole ±2,791' Ref. or Datum mean sea level

Logged by DLL

Sampled by DLL

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30			6	38			SM	@30": Brown, damp, dense, silty fine to medium sand; rare pebbles, one 1/2" thick clay layer
35								
40			7	81			SW	@40': Brown, wet, very dense, fine to medium sand; few pebbles, approximatley 5 to 10 percent coarse grains
45								
50			8	34				@50': Same as at 40' but dense
55								Total depth = 51.5 feet Ground water encountered at 40 feet at time of drilling

APPENDIX C

LABORATORY TESTING PROCEDURES

Moisture and Density Tests: Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings and/or trenches. The results of these tests are presented in the boring and/or trench logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

Classification Tests: Typical materials were subjected to mechanical grain-size analysis by wet sieving from U.S. Standard brass screens (ASTM D422-65). Hydrometer analyses were performed where appreciable quantities of fines were encountered. The data was evaluated in determining the classification of the materials. The grain-size distribution curves are presented in the test data and the Unified Soil Classification is presented in both the test data and the boring and/or trench logs.

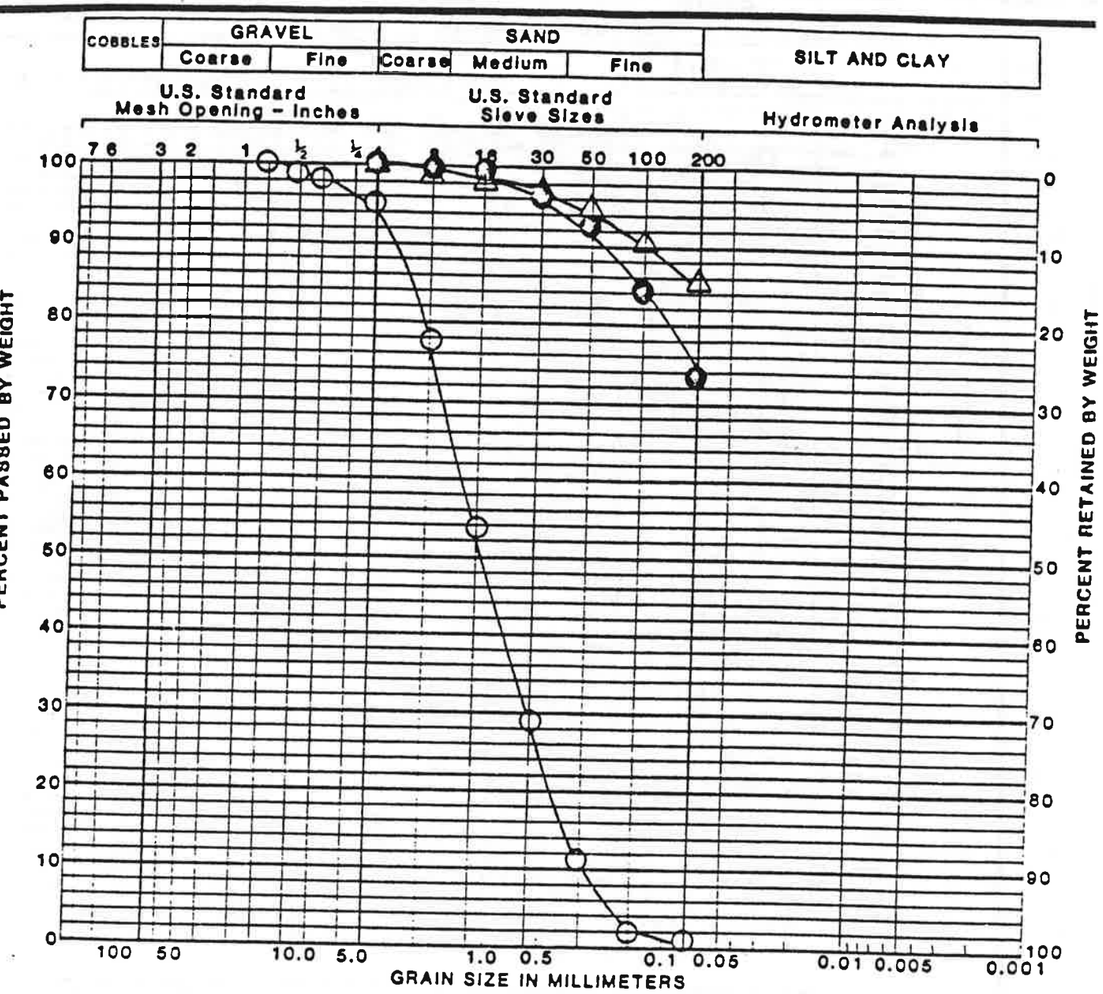
Direct Shear Tests: Direct shear tests were performed on selected remolded and/or undisturbed samples which were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period f approximately 1 hour prior to application of shearing force. The samples were tested under various normal loads, a different specimen being used for each normal load. The samples were sheared in a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of 0.05 inch per minute. After a travel of 0.300 inch of the direct shear machine, the motor was stopped and the sample was allowed to "relax" for approximately 15 minutes. The "relaxed" and "peak" shear values were recorded. It is anticipated that, in a majority of samples tested, the 15 minutes relaxing of the sample is sufficient to allow dissipation of pore pressures set up in the samples due to application of shearing force. The relaxed values are therefore judged to be a good estimation of effective strength parameters. The test results were plotted on the "Direct Shear Summary".

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557-78 (five layers). The results of these tests are presented in the test data.

APPENDIX C (Cont'd.)

Expansion Index Tests: The expansion potential of selected materials was evaluated by the Expansion Index Test, U.B.C. Standard No. 29-2. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the test data.

Consolidation Tests: Consolidation tests were performed on selected, relatively undisturbed samples recovered from the sampler. Samples were placed in a consolidomter and loads were applied 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. The consolidation pressure curves are presented in the test data. Where applicable, time-rates of consolidation were also recorded. A plot of these rates can be used to estimate time of consolidation.



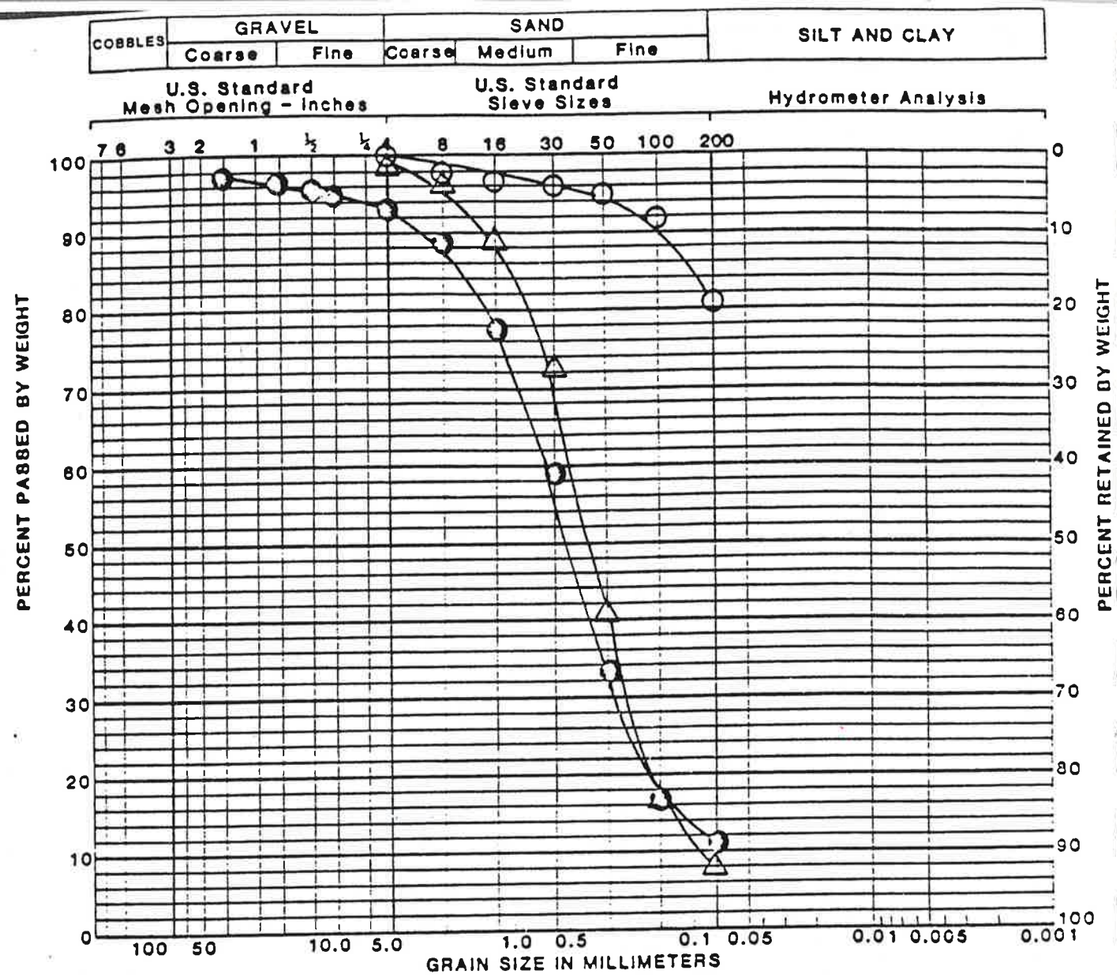
SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
○	T-1 (1) @ 0 - 3'				SW
●	T-1 (2) @ 8' - 10'				ML
△	T-2 (1) @ 0 - 3'				ML

*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

Project No. 4900381-05
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
○	T-2 (2) @ 4' - 6'				ML
●	T-3 (1) @ 1' - 3'				SM-SW
△	T-3 (2) @ 5' - 7'				SM-SW

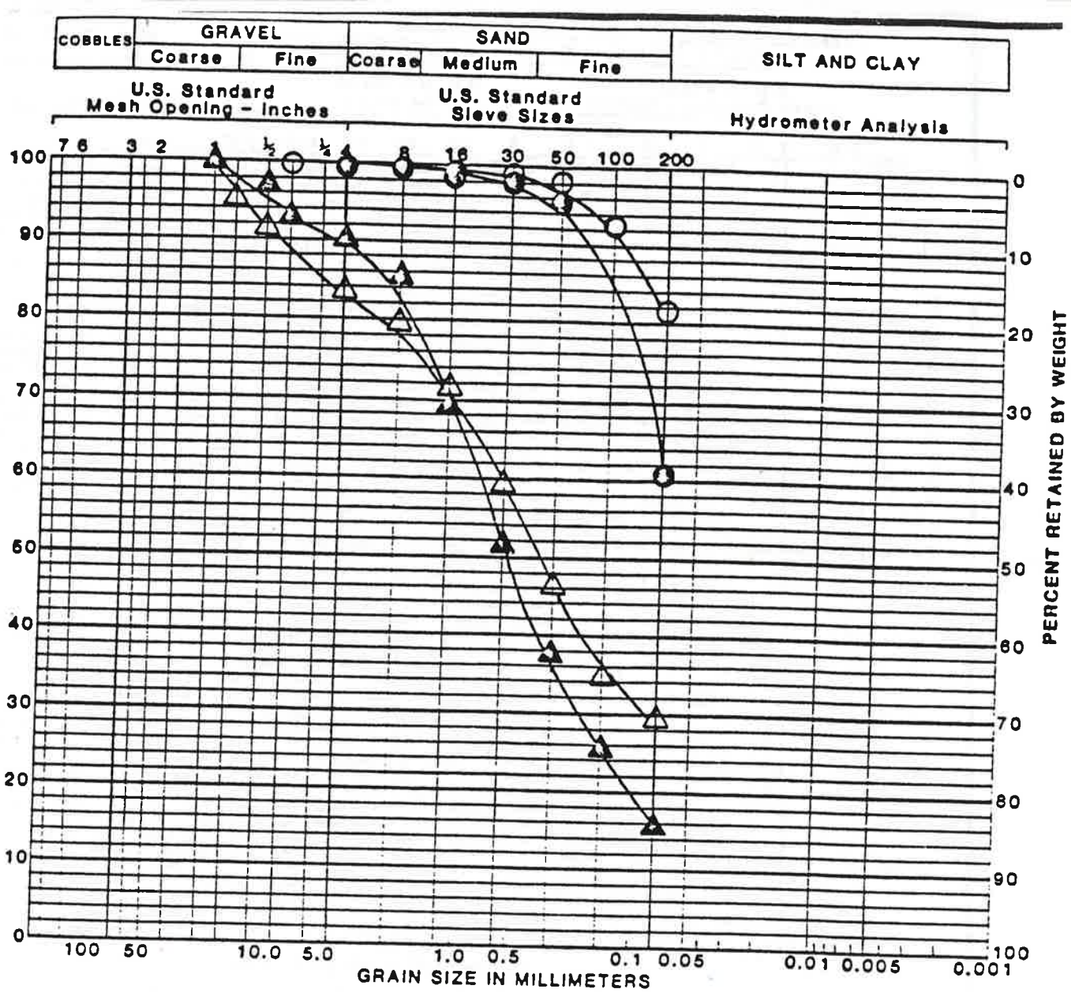
*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

LEIGHTON and ASSOCIATES L&A

Project No. 4900381-06
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
○	B-2 (2) @ 10'-11.5'				ML
●	B-3 (4) @ 20'-21.5'				ML
△	B-7 (3) @ 15'-16'				SC/SM
▲	B-8 (5) @ 25'-26'				SM

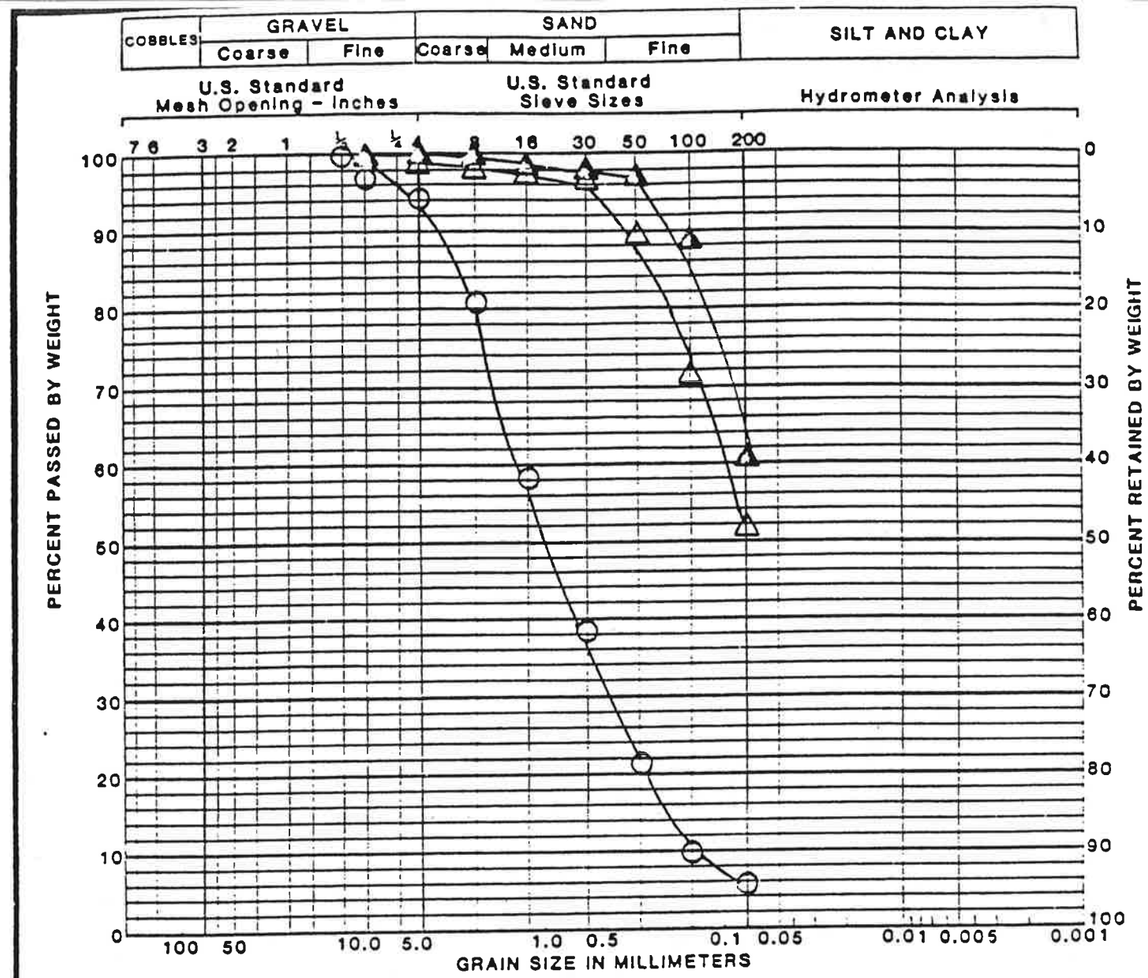
*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

LEIGHTON and ASSOCIATES L&A

Project No. 4900381-06
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



SYMBOL	SAMPLE LOCATION	LL*	PL*	PI*	SOIL TYPE
△	B-9 (4) @ 20'- 21.5'				CL
▲	B-11 (1) @ 5'-6.5'				ML
○	B-12 (3) @ 15'-16.5'				SW

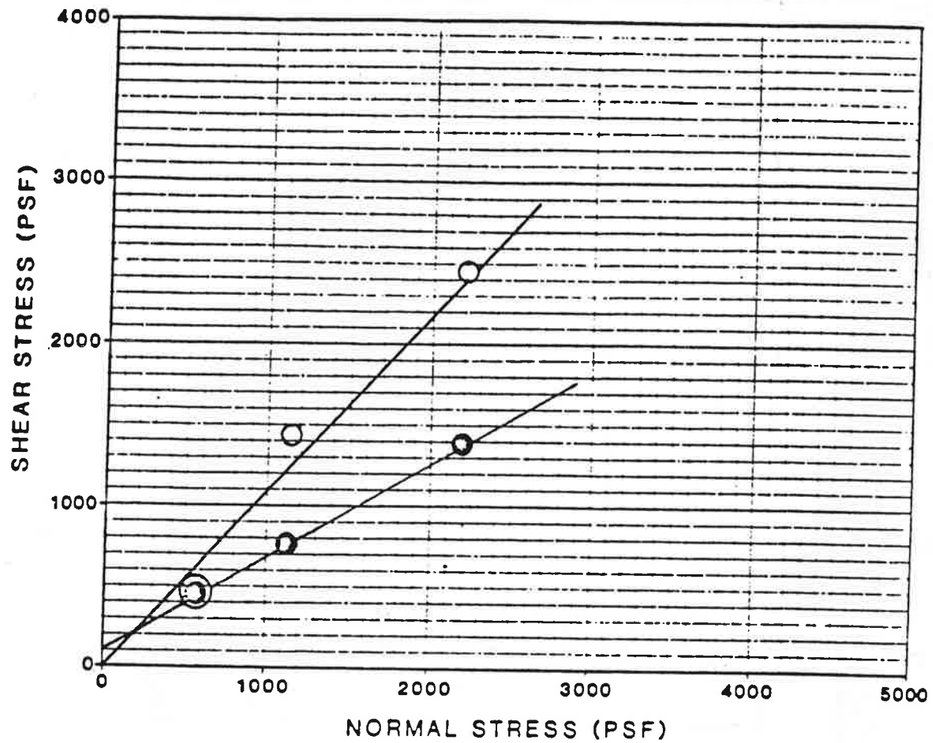
*LL Liquid Limit
*PL Plastic Limit
*PI Plasticity Index

Based on ASTM D422-72

LEIGHTON and ASSOCIATES L&A

Project No. 4900381-05
JACUMBA VALLEY RANCH

GRAIN SIZE ANALYSIS



DESCRIPTION	SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH (FEET)	COHESION (PSF)	FRICTION ANGLE	SOIL TYPE
Remolded to 90% of Maximum Dry	○	T-1	1	0 - 3'	0	48°	SW
Density at Opt Moisture Content	◘	T-2	1	0 - 3'	130	30°	SM-ML

Based on ASTM D3080-79

LEIGHTON and ASSOCIATES L&A

Project No. 4900381-05
JACUMBA VALLEY RANCH

DIRECT SHEAR TEST RESULTS

EXPANSION INDEX TEST RESULTS

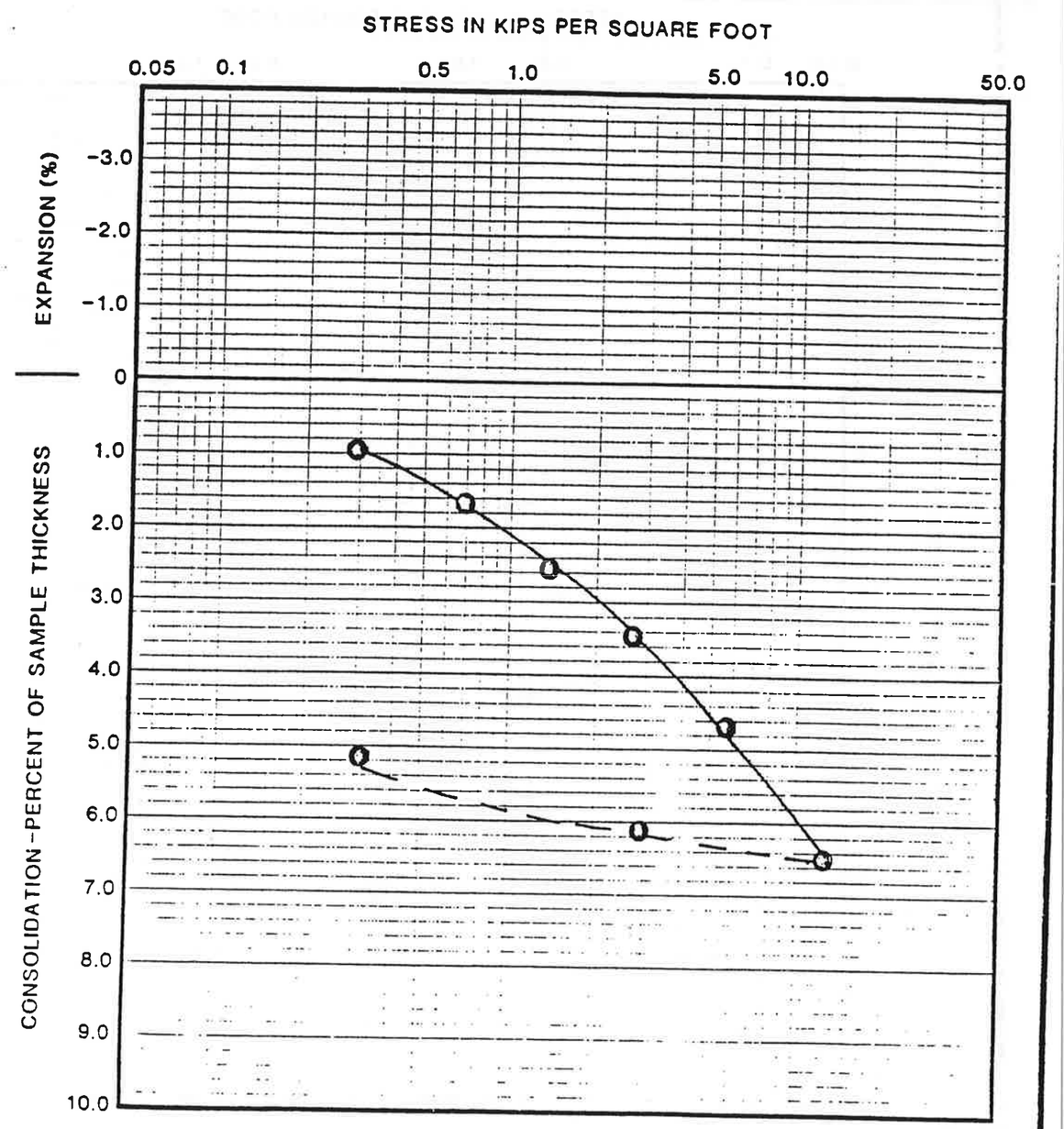
SAMPLE NO.	SAMPLE LOCATION	INITIAL MOISTURE (%)	COMPACTED DRY DENSITY (PCF)	FINAL MOISTURE (%)	VOLUMETRIC SWELL (%)	EXPANSION INDEX	EXPANSIVE POTENTIAL
(2)	T-2 @ 4'-6'	14.0	96.6	31.3	6.6	66	Medium
(1)	T-4 @ 0'-3'	11.5	104.6	24.0	5.1	51	Medium

MAXIMUM DENSITY TEST RESULTS

SAMPLE NO.	LOCATION	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
(1)	T-1 @ 0'-3'	115.5	14.5
(1)	T-2 @ 0'-3'	107.0	20.0
(2)	T-2 @ 4'-6'	110.0	14.0

Project No.4900381-05
JACUMBA VALLEY RANCH

EXPANSION INDEX AND MAXIMUM DENSITY TEST RESULTS

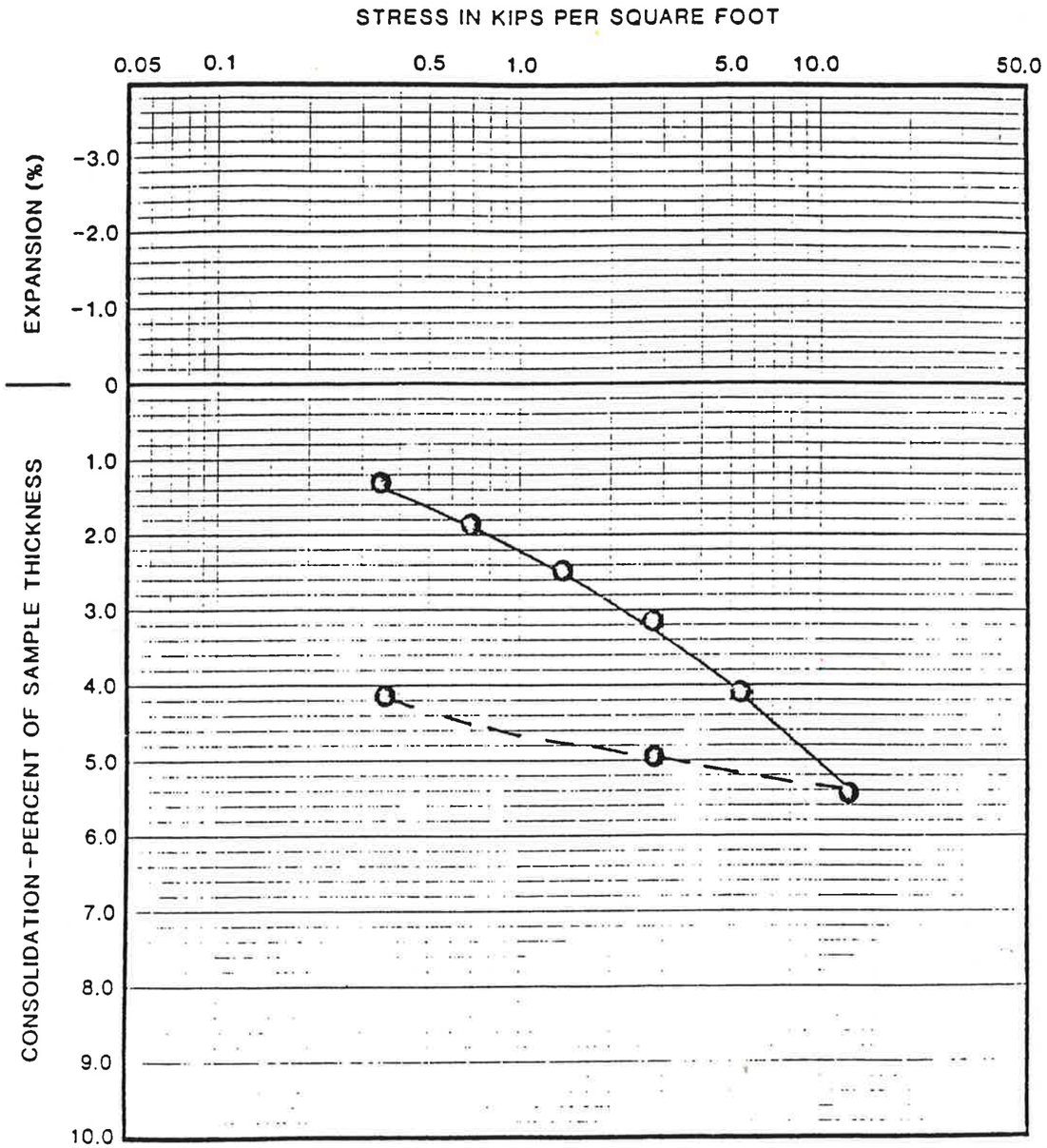


○ FIELD MOISTURE
● SATURATED
—— LOADING
– – – REBOUND

BORING NO.: B-3
SAMPLE NO.: 2
DEPTH (FT): 10-11
SOIL TYPE: SM

Project No. 4900381-05
JACUMBA VALLEY RANCH

CONSOLIDATION TEST RESULTS



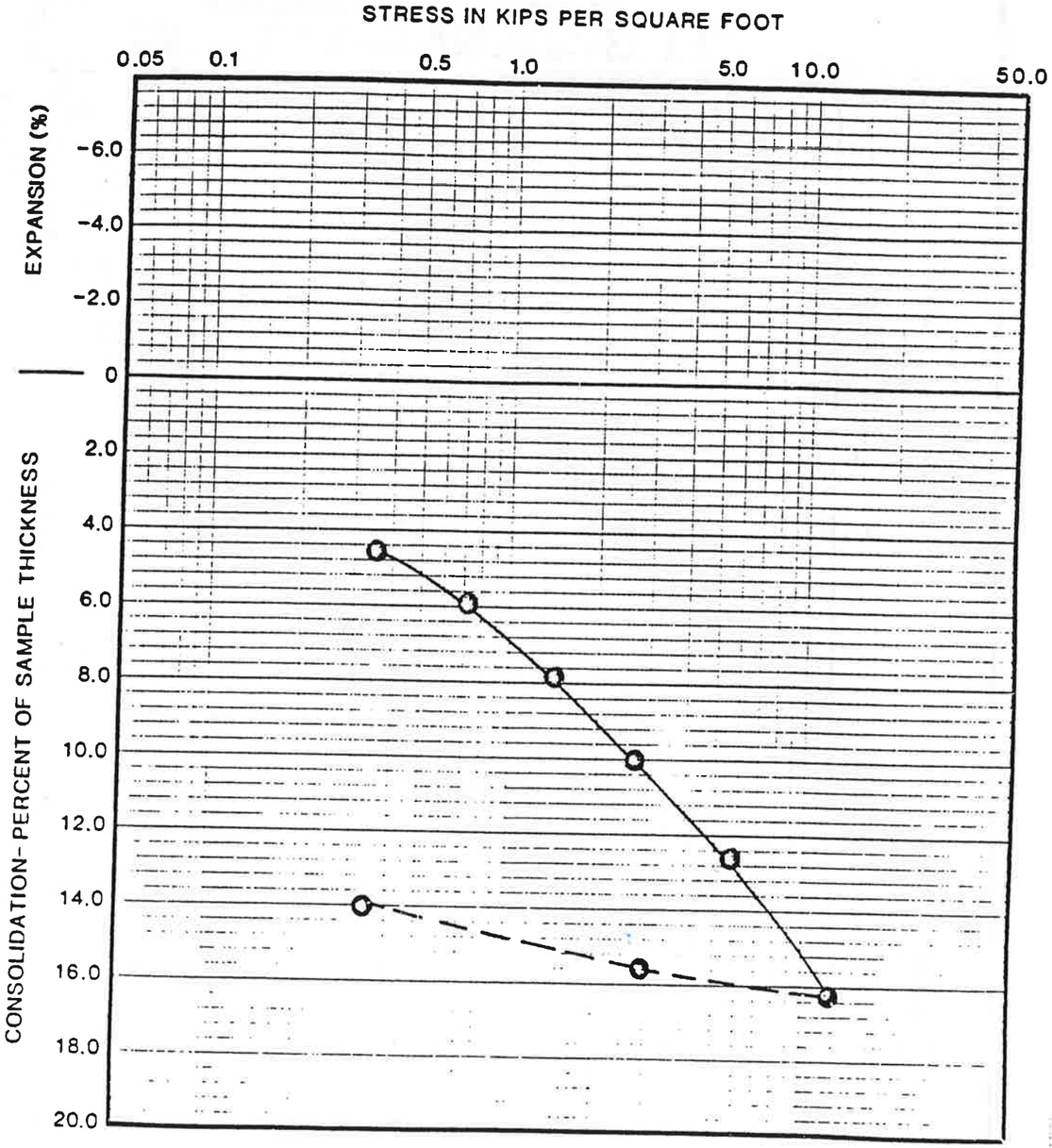
O FIELD MOISTURE
● SATURATED
—— LOADING
---- REBOUND

BORING NO.: B-6
SAMPLE NO.: 2
DEPTH (FT): [illegible]
SOIL TYPE: [illegible]

LEIGHTON and ASSOCIATES

Project No. 4900361-06
JACUMBA VALLEY RANCH

CONSOLIDATION TEST RESULTS



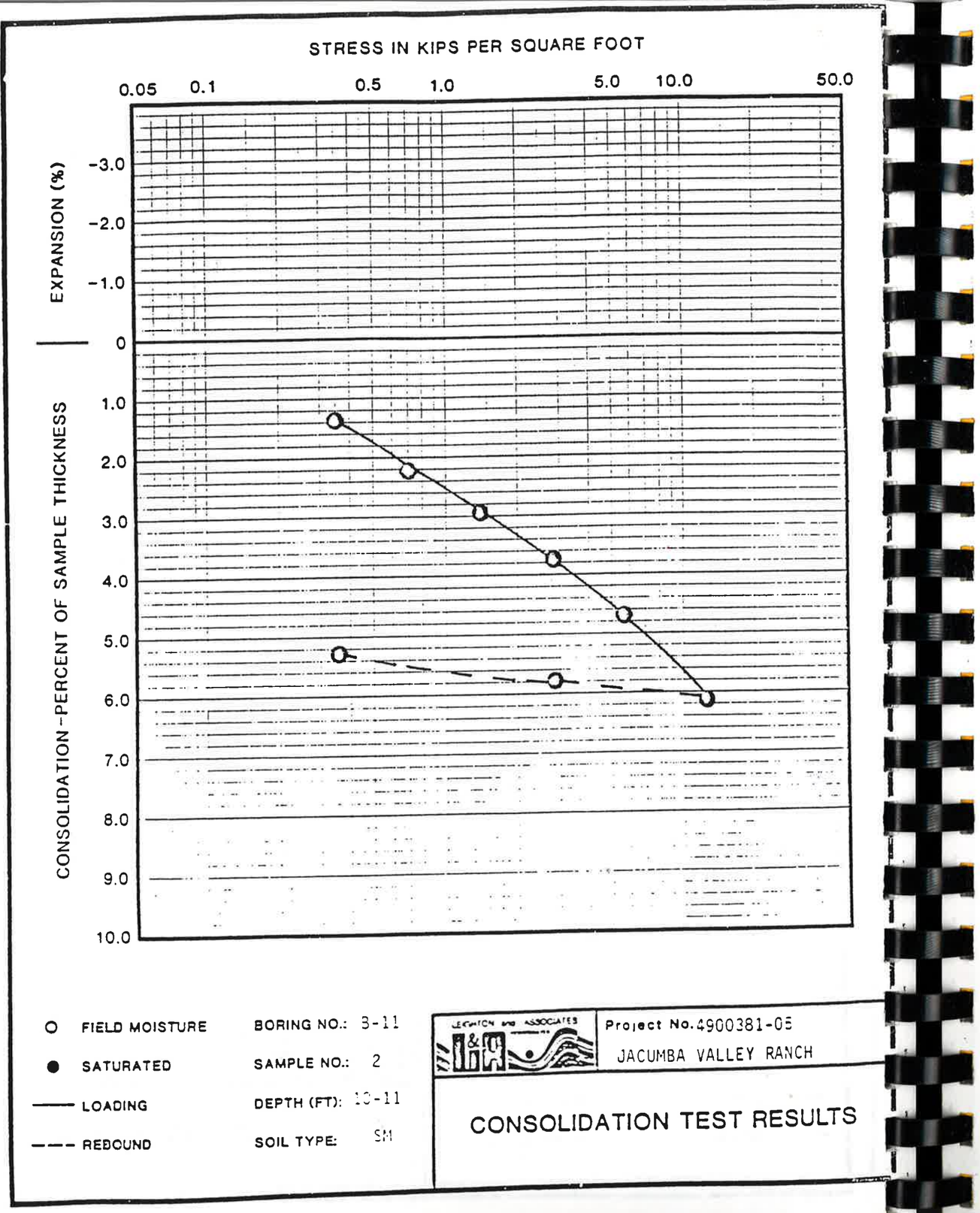
O FIELD MOISTURE
● SATURATED
—— LOADING
---- REBOUND

BORING NO.: B-10
SAMPLE NO.: 2
DEPTH (FT): 10-11'
SOIL TYPE: CL/ML

LEIGHTON and ASSOCIATES

Project No. 4900361-06
JACUMBA VALLEY RANCH

CONSOLIDATION TEST RESULTS



LEIGHTON AND ASSOCIATES, INC.
Geotechnical and Environmental Engineering Consultants

MAR 07 1991

February 27, 1991

Project No. 4900381-05

To: Jacumba Valley Ranch
2423 Camino del Rio South, Suite 212
San Diego, California 92108

Attention: Mr. Karl Turecek

Subject: Updated Evaluation of Consolidation Potential, Phase 1, Jacumba Valley Ranch Development, San Diego County, California

Reference: Leighton and Associates, Inc., 1991, Limited Evaluation of Liquefaction and Consolidation Potential, Phase 1, Jacumba Valley Ranch Development, San Diego County, California, Project No. 4900381-05, dated January 21

In accordance with your request, we performed an updated evaluation of the consolidation potential at the subject development. We understand that fills in Residential Area A are proposed to be up to approximately 20 feet thick (above existing grades). Our referenced report provided recommendations based on your previous assumption that the thickness of additional fill would be approximately 4 feet. In order to evaluate the consolidation potential due to the weight of the proposed fill soils (up to 20 feet thick), we have performed laboratory time-rate consolidation tests on ring samples collected as part of our previous study. We chose representative samples near the areas of proposed fills as shown on the computer printout prepared by F.J. Willert Contracting Company, Inc. Based on our laboratory data (attached), we recommend the following delays after the completion of grading until the construction of settlement-sensitive structures in order to reduce the total and differential settlement to approximately 1 inch and 1/2 inch, respectively.

Thickness of Proposed Fill Above Existing Grade (feet)	Delay of Construction after Grading (months)
≤ 2	0
≤ 3	1
≤ 4	2
≤ 5	3
≤10	4
≤15	6
≤20	8

Maximum settlement of the existing soils below the areas of thickest proposed fill soils (approximately 20 feet thick) is estimated to range from 4 to 6 inches.

3934 MURPHY CANYON ROAD, SUITE B205, SAN DIEGO, CALIFORNIA 92123

(619) 292-8030 • (800) 447-2626
FAX (619) 292-0771