GEOTECHNICAL BORING LOG LB-14

Date	7-17-02	**Sheet**	3 of 3
Project	Mountaingate, Tract 53072	**Project No.**	03-0381-002
Drilling Co.	Tri-Valley Drilling	**Type of Rig**	Bucket-Auger
Hole Diameter	24"	**Drive Weight**	(0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"
Elevation Top of Hole	1380'	**Location**	See Geotechnical Map

Logged By JBW/JGS
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1320	60		N65W,72SW S: N20E,18SE @61' F_o: N65E,14NW S: N60E,79SE @62' F_o: N70E,22NW N65E,15NW	R-6	10				SLATE, medium gray, moist to very moist, moderately hard, highly fractured, chaotic. @61' a shear, 1" thick, SANDY SILT; water seepage above the shear.	
1315	65			DHR-1 G-1	N/A N/A				@66.9' Qls-8 Basal Rupture Surface: 3" thick, SANDY GRAVELLY CLAY, very moist, firm to stiff, moderately plastic; with localized pulverized slate fragments; Torvane Test = 0.85 Kg/cm_2 (with larger wheel) and 0.6 Kg/cm_2 (with smaller wheel).	
			@66.9' BRS: N20W,25SW @69' S: N45E,25NW						<u>**BEDROCK: SANTA MONICA SLATE (Jsm):**</u> SLATE, medium gray, moist, hard to very hard, with blocky texture; locally foliated; with localized shearing along foliations.	
1310	70			R-7	36/10"				@69.7' quartzite lense, about 2' long and 1" thick.	
			@72' F_o: N20E,30NW N-S,13W @73' S: N60W,45SW @73.7' F_T: N45E,43SE						@72' SLATE is gray, moist, hard with a blocky texture, fractured.	
1305	75		@75.8' S: N80W,45SW						@75.8' shear zone along foliations, 2" - 3" thick; with localized secondary sericite mineral (white mineral); minor water seepage along the shear zone.	
1300	80		@80' F_o: E-W,34N	R-8	31/10"				@80' SLATE is medium gray, moist to very moist, moderately hard to hard, fractured, with localized pyrite mineral and water seepage along fractures; locally foliated.	
1295	85								**Total depth drilled = 85'.** **Total depth sampled = 81'.** **Boring downhole logged to 82'.** **Seepage encountered at 43', 50', 61', 75.8' and 80'.** **Groundwater not encountered.** **Boring backfilled wtih cuttings.**	
1290	90									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-15

Date 7-19-02 | Sheet 1 of 4

Project Mountaingate, Tract 53072 | Project No. 03-0381-002

Drilling Co. Tri-Valley Drilling | Type of Rig Bucket-Auger

Hole Diameter 24" | Drive Weight (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs | Drop 12"

Elevation Top of Hole 1410' | Location See Geotechnical Map

Logged By DPJ/JBW/JGS

Sampled By DPJ/JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1410	0								**LANDSLIDE DEBRIS (Qls-8):** SLATE: light brown to gray brown, slightly moist, loose, highly broken, highly weathered, rootlets, locally pulverized and lacks structure.	
1405	5			B-1						
			@8' S: E-W,18N						@8' shear zone, continuous around half of boring; SLATE above and below is chaotic, open voids to 1/2" wide.	
1400	10			R-1	4				SLATE: light grayish brown, slightly moist, moderately hard, weathered, broken, fractured, with iron oxide staining along fractures.	
1395	15								@15.2' CLAY seam, light orange brown, weathered, continuous around half of boring, undulatory.	
1390	20		@19.5' F_0: N40E,38SE	R-2	6				@19.5' SLATE, medium gray, slightly moist, moderately hard to hard, highly fractured, chaotic, open voids, iron oxide staining along fractures.	
1385	25		@25' F_0: N70W,15SW F_0: N40E,10SE						@25' SLATE, becomes blocky, highly fractured, locally pulverized; open voids to 1" wide, iron oxide staining, with white secondary mineral sericite and rootlets along fractures; localized foliation.	
1380	30									

SAMPLE TYPES:
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-15

Date 7-19-02 **Sheet** 2 **of** 4

Project Mountaingate, Tract 53072 **Project No.** 03-0381-002

Drilling Co. Tri-Valley Drilling **Type of Rig** Bucket-Auger

Hole Diameter 24" **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"

Elevation Top of Hole 1410' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By DPJ/JBW/JGS Sampled By DPJ/JBW	Type of Tests
1380	30								@30'-51.5' heavy caving and casing was installed for downhole logging.	
				R-3	9					
1375	35									
1370	40									
				R-4	4					
1365	45									
1360	50									
				R-5	8				@51.5' bottom of casing.	
			@52.8' S: N45W,25NE						@52.8' shear zone: 1"-3" thick, GRAVELLY CLAY, dark gray, moist, firm, well developed; below shear zone, SLATE is blocky to moderately fractured, fractures are filled with gravelly silty clay.	
1355	55								@55' SLATE, medium olive brown, highly fractured; fractures filled with clay; the clay is medium olive brown, moist, soft, plastic.	
			@58.6' S: N30W,30NE N45W,25NE N25W,32NE						@58.6' CLAY bed; 1" thick, medium olive brown, moist to wet, soft, plastic, well developed around the boring. Torvane test - 0.15 kg/cm^2.	
1350	60									

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GEOTECHNICAL BORING LOG LB-15

Date 7-19-02 | **Sheet** 3 **of** 4
Project Mountaingate, Tract 53072 | **Project No.** 03-0381-002
Drilling Co. Tri-Valley Drilling | **Type of Rig** Bucket-Auger
Hole Diameter 24" | **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"
Elevation Top of Hole 1410' | **Location** See Geotechnical Map

Logged By DPJ/JBW/JGS
Sampled By DPJ/JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1350	60		@60' F_oN60W,28NE	R-6	31				SLATE: medium gray, moist, medium hard moderately to highly sheared, weathered; isolated rock fragments and quartzite fragments up to 2 inches in size.	
			@63' S: N15W,20SW						@63' shear zone; GRAVELLY SANDY CLAY, 2" to 3" thick, gray, moist, firm to stiff, plastic. Pocket Penetrometer Test - 1.25 ton/ft²/kg/cm².	
1345	65		@65' S: N10W,27SW N35W,30SW @65.5' S: N68W,20SW @67' S: E-W,55S						@65' shear zone: 1" to 1.5" thick, GRAVELLY SANDY CLAY, medium gray, moist, firm to stiff, slightly to medium plasticity @65.5' shear zone: 1"-1.5" thick, GRAVELLY SILT, dark gray, highly pulverized slate. @67' shear zone: 1" thick.	
1340	70			R-7	5 for 12"					
1335	75		@76.5' S: N45W,18SW @77' S: N-S,53W						@76.5' shear zone: 1/4" to 1/2" thick, GRAVELLY CLAY, gray to olive brown, moist to wet, firm well developed. @77' shear zone: GRAVELLY SILTY CLAY, gray to olive brown. @78' Qls-8 Basal Rupture Surface: GRAVELLY CLAY with a 1" to 2" thick clay at the base, dark gray, moist, firm, plastic, well developed; below shear zone, a quartzite vein, 6" thick, with white secondary mineral sericite was observed; quartzite is fractured.	
			@78' BRS: N10E,25NW N20E,20NW							
1330	80		@80.5' F_o: N45E,30SE	R-8	65 for 3"				**BEDROCK:SANTA MONICA SLATE (Jsm):** SLATE, gray to olive grayish brown, moist, hard to very hard, massive, moderately fractured, localized foliation and quartzite veins; localized shearing along foliation.	
1325	85		@85' J: N40E,65SE						@85' prominent joint set.	
1320	90									

SAMPLE TYPES:

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TYPE OF TESTS:

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GEOTECHNICAL BORING LOG LB-15

Date 7-19-02 **Sheet** 4 **of** 4
Project Mountaingate, Tract 53072 **Project No.** 03-0381-002
Drilling Co. Tri-Valley Drilling **Type of Rig** Bucket-Auger
Hole Diameter 24" **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"
Elevation Top of Hole 1410' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By DPJ/JBW/JGS Sampled By DPJ/JBW	Type of Tests
1320	90			R-9	47					
									Total depth drilled = 90'. Total depth sampled = 91'. Boring downhole logged to 90'. Groundwater not encountered. Caving zone between 30' and 51.5' Casing was installed in the boring between 30' and 51.5' Boring backfilled wtih cuttings.	
1315	95									
1310	100									
1305	105									
1300	110									
1295	115									
1290	120									

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TYPE OF TESTS:
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GEOTECHNICAL BORING LOG LB-16

Date 7-25-02 **Sheet** 1 **of** 3
Project Mountaingate, Tract 53072 **Project No.** 03-0381-002
Drilling Co. Tri-Valley **Type of Rig** Bucket-Auger
Hole Diameter 24" **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"
Elevation Top of Hole 1480' **Location** See Geotechnical Map

Logged By JBW/JGS
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1480	0								**SLUMP? (Qs?)/LANDSLIDE DEBRIS (Qls?):** @0'-10': CASING (Plastic); boring was caving in the upper 5 to 7 feet.	
1475	5									
1470	10		@10' J_1: N30W,68NE	R-1	12				@10' SLATE, medium gray, slightly moist, blocky, fractured, open fractures ranging from 1/4" to 3" wide on north side of boring; open fractures not as visible on south side of boring.	
			@12.3' S: N30W,68NE						@12.3' shear with roots; shear offsets open fracture at 10' by 6"-8"; below shear slate is more fractured.	
1465	15									
			@16.4' S:N20E,15SE						@16.4' shear zone, CLAYEY SILT, yellowish orange; below shear the SLATE is medium gray, moist, blocky.	
			@17' J_1: N13W,70NE						@17' open fracture, lined with roots to 1/4" wide, same fracture set observed at 10' (J_1).	
			@19' J_2: N20W,80SW						@19' another open fracture (J_2) to 1" wide, lined with roots.	
1460	20			R-2	4					
									@22' fractures (J_1 and J_2) from above converge; 1" thick fractures are infilled with SANDY SILT.	
1455	25		@25' S: N80W,58SW J: N85W,85SW						@25' fracture zone from above widens to 2' the southwest side of boring is more broken with respect to northeast side of boring.	
1450	30									

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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-16

Date 7-25-02 **Sheet** 2 **of** 3

Project Mountaingate, Tract 53072 **Project No.** 03-0381-002

Drilling Co. Tri-Valley **Type of Rig** Bucket-Auger

Hole Diameter 24" **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"

Elevation Top of Hole 1480' **Location** See Geotechnical Map

Logged By JBW/JGS

Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1450	30									
			@31' J: N15W,83SW	R-3	8				@31' open fracture, rough surfaces, 2"-3" wide 2' deep; locally developed olive-brown clay coating along fractures.	
									@33' SLATE, is blocky, less oxidized than above, with a significant decrease in fractures (fractures are hard to see), fractures are predominantly closed with localized clayey infill, decrease in moisture along fractures.	
1445	35		@34' J: N73W,60NE @35' J: N25W,76SW @36' J: N85W,70NE						@34' prominent joint set. @36' SLATE is blocky, prominent joint set fracturing decreases.	
			@38' J: N65W,75SW J: N78W,70NE S: N39E,53SE S: N10E,65SE @38.5' F_0: N70E,20NW F_0: N60E,15NW @41' J: N63E,85SE						@37' pyrite along foliation. @38.5' olive-gray clay along foliation and jointing surfaces (locally); SLATE, becomes less fractured and more coherent than above **BEDROCK:SANTA MONICA SLATE (Jsm):** SLATE, gray and grayish brown, slightly moist, hard, massive, slightly to moderately fractured, with localized shears.	
1440	40			R-4	40					
1435	45		@48.5' F_1: N55W,63SW @51' F_1: N30W,63SW						@44' SILTY CLAY, moist, localized fractures with a yellowish-orange coating along fractures; localized shearing along fractures.	
1430	50		@53.2' F_2: N25W,53NE F_2: N40W,48NE F_2: N35W,47NE						@48.5' fault with an olive gray CLAY, wet, soft; SLATE on the southwest side of boring is moderately to highly fractured; fractures have an olive gray clay, moist to wet, soft, plastic.	
			@54' S: N42W,48NE @56' S: N35W,47NE S: N55W,37NE	R-5	32				prominent fracture set with olive gray clay infill (1/8" to 1/16" thick). @53.2 a fault (F_2) with a well developed clay seam; the fault truncates the fractures from above.	
1425	55								@56' fault (F_2) exits the boring on the northeast side; the SLATE below the fault is medium gray, moist, hard to very hard, and slightly to moderately fractured; with localized shears.	
1420	60									

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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-16

Date 7-25-02 | Sheet 3 of 3
Project Mountaingate, Tract 53072 | Project No. 03-0381-002
Drilling Co. Tri-Valley | Type of Rig Bucket-Auger
Hole Diameter 24" | Drive Weight (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs | Drop 12"
Elevation Top of Hole 1480' | Location See Geotechnical Map

Logged By JBW/JGS
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1420	60			R-6	25 for 6"				SLATE, medium gray, moist hard, blocky texture, moderately fractured.	
									Total drilled depth 60'. Sampled to 61.5'. Boring downhole logged to 58'. Groundwater not encountered. Boring backfilled with cuttings.	
1415	65									
1410	70									
1405	75									
1400	80									
1395	85									
1390	90									

SAMPLE TYPES:
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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-17

Date 7-28-02 **Sheet** 1 **of** 3

Project Mountaingate, Tract 53072 **Project No.** 03-0381-002

Drilling Co. Tri-Valley Drilling **Type of Rig** Bucket-Auger

Hole Diameter 24" **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"

Elevation Top of Hole 1490' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By JBW/JGS Sampled By JBW	Type of Tests
1490	0								**SLUMP?(Qs?):LANDSLIDE DEBRIS? (Qls?):** SLATE: grayish brown to medium gray, dry, moderately hard to hard (locally), massive to slightly foliated, moderately to highly fractured, with prominent shear zones; fractures are generally open to 3/4", localized infilled fractures; fractures have iron oxide staining along surfaces; small roots and rootlets were observed along fractures and sheared zones.	
			@4' S: N5W,15SW						@ 4' shear zone, 1.5" to 2" thick, broken up slate, with iron oxide staining.	
1485	5		@6' S: E-W,4S							
									@7' open fractures with roots, 1/4" to 1/2" open.	
1480	10		@9.5' J: N15E,75SE	R-1	26				@ 9.5' open fracture, 1/4" to 1/2" open.	
			@11' S: N80E,36SE E-W,39S						@11' shear zone, SANDY GRAVELLY CLAY, orange yellow, slighltly moist, slickensided planes, shear zone continuous around boring, 1.5" open fracture from above truncates at shear zone; slate below shear zone is oxidized and fractured.	
			@11.8 S: N85W,35SW						@ 11.8' shear zone, CLAYEY SILT, 1" thick, slate below shear zone is medium gray to grayish orange brown, slightly moist, moderately fractured, slightly foliated and oxidized.	
1475	15									
			@ 16' S: N35E,30SE N35E,46SE						@ 16' shear zone along foliation, 1.5" thick, pulverized slate, medium gray to black, moist, sheared with slickensides and polished surfaces.	
			@18' J: N25E,85SE S: N20E,38NW N18E,24NW						@ 18' shear zone, with an undulatory contact with a 1/4" thick clay at the base, continuous around boring.	
1470	20		@20.5' J: N15E,70SE	R-2	8 for 0"				@ 20.5' fracture infilled with SILTY SAND, 1/2" thick, predominant joint set.	
			@21.8' J: N25E,60SE						@ 21.8'-23' shear zone with a GRAVELLY CLAY seam at top and bottom; shear surface is continuous around boring.	
			@23' S: N15E,22NW N25E,19NW N10W,16SW N13W,14SW N5W,11SW						**BEDROCK:SANTA MONICA SLATE (Jsm):** SLATE: medium grayish brown to medium gray, moist, moderately hard to hard, massive, slightly less fractured than above; fractures are predominantly tight/closed with localized infilled fractures and iron oxide staining.	
1465	25		@25.5 J: N13E,60SE N25E,75SE						@ 25.5' fracture surfaces are moist, iron oxide stained, and contain sericite (white secondary mineral).	
			@27' F_o: N-S, 18W S: N23E,40SE						@ 27' SLATE, becomes slightly foliated with localized sheared zones along foliation.	
1460	30									

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LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-17

Date 7-28-02 **Sheet** 2 **of** 3

Project Mountaingate, Tract 53072 **Project No.** 03-0381-002

Drilling Co. Tri-Valley Drilling **Type of Rig** Bucket-Auger

Hole Diameter 24" **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"

Elevation Top of Hole 1490' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By JBW/JGS Sampled By JBW	Type of Tests
1460	30		N72E,11NW N55E,14NW @29' S_1: N45W,16NE S_1: N5W,14SW @30' S: N20W,22NE N40E,22SE	R-3	34				@ 29.8' two shears, S1 is a sheared clay, gray and white, soft to stiff; S2 is a 3"-6" thick multi-sheared slate with a distinct flaky texture and polished surfaces; the S_2 zone thins in the up dip direction (NE) where it is truncated by S1. SLATE, medium grey to brown, slightly moist, hard, moderately fractured with shearing along foliation; sericite and pyrite found along foliation and fracture planes. @ 31.2' shearing along foliation. @ 34' shearing along fracture.	
1455	35		@31.2' S: N60E,20NW @32.6' S: N65E,68SE J: N56W,67SW @34' S: N20E,35SE @35' J: N-S,55E @36.5' J:						@ 37' clay seam along shear. @ 37'-41' SLATE, medium gray, slightly moist, moderately fractured, locally sheared with iron oxide staining and sericite along foliation and joints.	
1450	40		N47E,55SE @37' S: N40E,35NW @38' S: N55W,53NE J: N37E,66SE J: N62W,50SW	R-4	19 for 6"				@ 41'-71' SLATE, medium gray, slightly moist, slightly fractured, massive, hard to very hard; less shearing and fracturing, localized iron oxide staining with sericite along fractures and shear surfaces.	
1445	45		@39' J: N60E,41SE @42.3' J: N40E,55SE @43.5 J: N60W,70NE @44' S: N85E,72NW @45' S: N80E,60SE						@ 48'-51' fractures have thin SANDY SILT to SANDY CLAY infill, light orange to orange.	
1440	50		@47' S: N60E,65SE @48' J: N85W,90 @49' J: N15W,60SW @53' J: E-W,80S @54' S: N45E,14NW	B-2					@ 53' moisture along fracture surfaces. @ 54' faint foliation with sericite mineral.	
1435	55		@56' S: N65E,45SE @58' S: N68E,34SE J:						@ 58' minor shearing with clay seams. @ 59' minor shearing along foliation.	
1430	60									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-17

Date 7-28-02 — Sheet 3 of 3
Project Mountaingate, Tract 53072 — Project No. 03-0381-002
Drilling Co. Tri-Valley Drilling — Type of Rig Bucket-Auger
Hole Diameter 24" — Drive Weight (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs Drop 12"
Elevation Top of Hole 1490' — Location See Geotechnical Map

Logged By JBW/JGS
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1430	60		N55E,65NW @59' J: N60E,75SE S: N67E,75NW	B-3					@ 60' increase in moisture; SLATE is medium gray, hard to very hard, blocky texture, slightly fractured.	
									@ 62'-63' water seepage observed in slightly fractured slate.	
1425	65								@ 66' free water surface.	
1420	70			B-4						
									Total drilled depth 70'. Sampled to 70'. Boring downhole logged to 66'. Water seepage between 62' and 63'. Groundwater surface at 66'. Boring backfilled with cuttings.	
1415	75									
1410	80									
1405	85									
1400	90									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-18

Date 7-25-02 | Sheet 1 of 1

Project Mountaingate, Tract 53072 | Project No. 03-0381-002

Drilling Co. Roy Brothers Drilling | Type of Rig Track Bucket Auger

Hole Diameter 24" | Drive Weight | Drop "

Elevation Top of Hole 1545' | Location See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By JGS Sampled By JBW	Type of Tests
1545	0								**LANDSLIDE DEBRIS (Qls-3):** SILTY SAND with GRAVEL (top soil/colluvium), light brown to olive gray-brown, dry, loose to medium dense.	
1540	5								SANDSTONE, light brown to light gray, dry, massive, fine-grained, friable, moderately fractured, fractures are open up to 3" wide with roots.	
									@8': SANDY SILTSTONE to SILTY SANDSTONE, light brown to light gray, dry, open fractures, very hard, cemented, slightly metamorphosed.	
1535	10		@9' J: N40E,87NW N30E,75NW						@9': SANDSTONE, southeast side: fine grained, hard; northeast side: less cemented, moderately hard, friable. @10': SILTY SAND, medium brown to light brown, slightly moist, moderately loose. @12': SILTSTONE/FINE-GRAINED SANDSTONE, light brown to light gray, slightly moist; slightly fractured, very hard, cemented, slightly metamorphosed.	
1530	15								**Total Depth 15'.** **No samples taken.** **Boring downhole logged to 15'.** **No groundwater.** **Boring backfilled with cuttings.** **Auger refusal at 15'.**	
1525	20									
1520	25									
1515	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-19

Date 7-23-02 **Sheet** 1 **of** 3
Project Mountaingate, Tract 53072 **Project No.** 03-0381-002
Drilling Co. Roy Brothers Drilling **Type of Rig** Track Bucket Auger
Hole Diameter 24" **Drive Weight** **Drop** "
Elevation Top of Hole 1430' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By JBW/JGS Sampled By JBW	Type of Tests
1430	0								**LANDSLIDE DEBRIS (Qls-2a):** SLATE: medium grayish brown and gray, dry to slightly moist, soft to medium hard, broken, moderately to highly weathered; with localized remnant foliation.	
1425	5									
			@8' Fo: N-S,35W							
									@ 9' shear zone: slate, medium brown to medium gray, slightly moist, pulverized, highly fractured, highly weathered, with white clayey mineral (sericite).	
1420	10		@9.5' S: N20W,14SW							
1415	15								@ 14'-21' SLATE, slightly moist, highly fractured, with open fractures up to 1" on the eastside of boring; blocky, localized and fractured, with quartzite veins; wedge failures causing caving and ravelling, (boring opens up to approximately 3' to 4' in diameter); roots and rootlets observed along fractures.	
			@16' J: E-W,63S							
1410	20									
									@ 21'-25' back to the highly broken SLATE, grayish orange-brown, highly weathered, with localized relic foliation.	
1405	25		@25' S: N20W,20SW N50W,25SW						@ 25' shear zone, 3"-4" thick, SILT with SAND and GRAVEL, dark gray to black, dry; gravel consists of slate rock fragments. SLATE below shear zone is blocky and highly fractured; with localized raveling zones.	
1400	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
SA SIEVE ANALYSIS
CU TRIAXIAL SHEAR
EI EXPANSION INDEX
RV R-VALUE

GEOTECHNICAL BORING LOG LB-19

Date 7-23-02 **Sheet** 2 **of** 3

Project Mountaingate, Tract 53072 **Project No.** 03-0381-002

Drilling Co. Roy Brothers Drilling **Type of Rig** Track Bucket Auger

Hole Diameter 24" **Drive Weight** **Drop** "

Elevation Top of Hole 1430' **Location** See Geotechnical Map

Logged By JBW/JGS

Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1400	30		@30' S: N5E,37NW						@ 30' shear, 1" thick SILTY CLAY with rock fragments; SLATE below shear is medium gray to dark gray, slightly moist, highly fractured to pulverized.	
			@33' S: N45W,23NE						@ 33' shear zone, 3" to 4" thick, clay with sand and gravel (slate fragments); SLATE below shear zone is slightly moist, highly fractured, with sheared and fractured quartzite veins (with localized raveling zones).	
1395	35									
			@37' S: N60E,38NW						@ 39.5' another shear zone; 1" to 2" thick, same as above.	
1390	40		@39.5' S: N80W,30SW							
			@41.5' S: N20E,17SE @42' S:N63E,36SE						@ 41.5' shear zone, 3" to 6" thick, top of shear zone is unoxidized; bottom 1" is oxidized, SILTY SAND with white clay mineral (sericite); slickenlines above and below.	
									@46' Qls-2a Rupture Surface, 2" to 3" thick sheared zone, well developed around the boring, with a 1/4" thick clay at the base, medium to dark gray, moist, firm to stiff, with polished surfaces.	
1385	45									
			@46' BRS: N50E,28SE N65E,35SE						<u>LANDSLIDE DEBRIS (Qls-2):</u> SLATE: medium to dark gray, moderately hard to hard, moderately to highly fractured, with localized sheared and broken zones; moderately to highly weathered; with localized remnant foliation.	
1380	50		@50' F_O: N80E,48SE							
			@52.5' J: N78W,70NE						@53' thin shear; the SLATE below the shear is moderately to highly fractured, with rotated and folded fractures; iron oxide staining along fractures, localized open fractures up to 1/2" open, some fractures have a silty sand infill (dark gray).	
1375	55								@ 56.5' Qls-2 Basal Rupture Surface; 1" to 2" thick CLAY, gray, moist, firm to stiff, well developed around the boring.	
			@56.5' BRS: N5E,18NW N10W,25SW @57' F_O: N34E,72SE						<u>BEDROCK:SANTA MONICA SLATE (JSM):</u> SLATE, gray to dark gray, slightly moist, hard, moderately fractured; massive to slightly foliated; localized quartzite veins up to 2" thick; localized iron oxide along foliation.	
1370	60									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- SA SIEVE ANALYSIS
- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

GEOTECHNICAL BORING LOG LB-19

Date	7-23-02	**Sheet**	3 **of** 3
Project	Mountaingate, Tract 53072	**Project No.**	03-0381-002
Drilling Co.	Roy Brothers Drilling	**Type of Rig**	Track Bucket Auger
Hole Diameter	24" **Drive Weight**	**Drop**	"
Elevation Top of Hole	1430' **Location**	See Geotechnical Map	

Logged By JBW/JGS
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1370	60		@60' S: N25E,22SE Fo: E-W,35S @62' S: E-W, 50S @62' S: 80W,40SW @63.5' Fo: N60W,64NE @64' S:N70W,30SW						SLATE, gray to dark gray, slightly moist, hard, moderately fractured; massive to slightly foliated; localized quartzite veins up to 2" thick; localized iron oxide along foliation. @62' shear zone, 1" to 2" thick, predominantly GRAVELY SILT with a clayey texture, gray, moist, firm to stiff. @64' another shear, 1" thick, same as above, upper shear at 62' ties in with shear at the down dip side of boring. SLATE below lower shear is medium gray, slightly moist, hard, massive, moderately fractured, fractures are closed, with localized iron oxide staining.	
1365	65									
1360	70								**Total Depth 70'.** **No samples taken.** **Boring downhole logged to 70'.** **No groundwater.** **Boring backfilled with cuttings.**	
1355	75									
1350	80									
1345	85									
1340	90									

SAMPLE TYPES:		TYPE OF TESTS:	
S SPLIT SPOON	G GRAB SAMPLE	DS DIRECT SHEAR	SA SIEVE ANALYSIS
R RING SAMPLE	SH SHELBY TUBE	MD MAXIMUM DENSITY	CU TRIAXIAL SHEAR
B BULK SAMPLE		CN CONSOLIDATION	EI EXPANSION INDEX
T TUBE SAMPLE		CR CORROSION	RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-20

Date 7-24-02 | Sheet 1 of 3
Project Mountaingate, Tract 53072 | Project No. 03-0381-002
Drilling Co. Roy Brothers Drilling | Type of Rig Track Bucket Auger
Hole Diameter 24" | Drive Weight | Drop "
Elevation Top of Hole 1385' | Location See Geotechnical Map

Logged By JGS
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1385	0								**LANDSLIDE DEBRIS (Qls-3a/Qls-3):** SILTY SAND, light brown to medium brown, dry, loose, to moderately dense.	
1380	5								@5' SLATE, medium gray, slightly moist to dry, highly fractured, rootlets along fractures tight, fractures filled.	
			@6' F_0: N40E,35SE							
1375	10									
			@13' F_0: N60W30SW J_0: E-W,85N						@13' SLATE, medium gray, slightly moist, highly fractured, fractures 1/4" thick, fractures filled, rootlets along fractures; boring ravelling along wedge failures to 4' diameter; trend of oblong shape boring = E-W,85N.	
1370	15									
			@19' S: N55E,38SE						@19' SLATE, medium gray , highly fractured, blocky slightly moist, hard; shear zone composed of SLATE, slightly moist, medium gray to dark gray, highly pulverized, rootlets along fractures.	
1365	20									
									@24' SLATE, medium gray to dark gray, slightly moist, totally pulverized; shear zone composed of silty gravel.	
1360	25								SLATE, medium gray to dark gray, slightly moist, moderately hard, blocky.	
			@26.5' S: N75E,50SE							
1355	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
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EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-20

Date 7-24-02 **Sheet** 2 **of** 3

Project Mountaingate, Tract 53072 **Project No.** 03-0381-002

Drilling Co. Roy Brothers Drilling **Type of Rig** Track Bucket Auger

Hole Diameter 24" **Drive Weight** **Drop** "

Elevation Top of Hole 1385' **Location** See Geotechnical Map

Logged By JGS

Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1355	30		@30' S: N20W,15NE						@30' shear zone, GRAVELLY SILT, to SILTY SAND, highly fractured, white clay mineral (sericite).	
1350	35		@35' J_0: N75W,65SW F_0: N75W,33NE						@35' prominent joint set.	
			@38' J_0: E-W,65S J_0: N10E,65SE						@38' slate medium gray, moist, highly fractured, blocky, localized open fractures, no rootlets.	
1345	40									
									@42' SLATE, medium gray to dark gray, completely pulverized with isolated blocky zones, matrix is CLAYEY SILT, gray to medium gray and greenish brown moist to very moist, firm to stiff, moderately hard, massive appearance with localized zones of white clay mineral (sericite).	
1340	45									
1335	50									
1330	55									
			@58' S: N55W,15SW						@58' shear zone, SLATE, yellowish brown, fractured and pulverized as above.	
1325	60									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
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- CU TRIAXIAL SHEAR
- EI EXPANSION INDEX
- RV R-VALUE

GEOTECHNICAL BORING LOG LB-20

Date 7-24-02 **Sheet** 3 **of** 3
Project Mountaingate, Tract 53072 **Project No.** 03-0381-002
Drilling Co. Roy Brothers Drilling **Type of Rig** Track Bucket Auger
Hole Diameter 24" **Drive Weight** **Drop** "
Elevation Top of Hole 1385' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By JGS; Sampled By JBW)	Type of Tests
1325	60								@60' SLATE, medium gray, slightly moist, blocky.	
									Total Depth 62'. **No samples taken.** **Boring downhole logged to 62'.** **No groundwater.** **Boring backfilled with cuttings.**	
1320	65									
1315	70									
1310	75									
1305	80									
1300	85									
1295	90									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
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RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-21

Date 8-1-02
Project Mountaingate, Tract 53072 — **Project No.** 03-0381-002
Drilling Co. Tri-Valley Drilling — **Type of Rig** Bucket-Auger
Hole Diameter 24" — **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs — **Drop** 12"
Elevation Top of Hole 1565' — **Location** See Geotechnical Map

Logged By JGS
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
1565	0								**BEDROCK:MODELO FORMATION (Tm):** SANDSTONE, medium grained, light yellowish brown, slightly moist, massive, moderately hard, slightly friable, slightly fractured.	
				B-1						
1560	5			R-1	7					
			@8.5' J: N50E,68NW	B-2					@8.5' slight iron oxide staining on fractured surfaces.	
1555	10									
			@11' J: N40E,80NW	R-2	6					
			@13.9' C: N80E,16SE N80E,15SE N75E,20SE J: N50E,75NW N60W,85NE @15.7' B: N70E,15SE @18' N50E,80SE N20E,85NW						@13.9' sharp, well defined contact with a fine-grained SANDSTONE, slightly moist, highly cemented, very hard, slightly to moderately fractured; fractures are tight, filled with calcium carbonate to 1/4"; contact is 1/4" to 1/2" altered calcium carbonate. @14.8' SANDSTONE, fine-grained, medium brown, slightly moist, very hard, massive to crudely bedded, slightly fractured, calcium carbonate along fractures. @19' SILTSTONE, medium brown, slightly moist, slightly fractured, very hard, cemented.	
1550	15									
1545	20			B-3						
1540	25		@24.5' J: N25E,75NW J: N50E,80SE @25' J: N35E,65NW J: N35E,60SE	B-4					@24.5' SANDSTONE, medium brown, slightly moist, moderately fractured; fractures are filled with silt, iron oxide staining and rootlets along fracture planes. @27' SANDSTONE, well cemented, hard to very hard, tight, slightly fractured. very hard drilling below 27'.	
1535	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- SH SHELBY TUBE

TYPE OF TESTS:
- DS DIRECT SHEAR
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GEOTECHNICAL BORING LOG LB-21

Date 8-1-02 **Sheet** 2 **of** 2
Project Mountaingate, Tract 53072 **Project No.** 03-0381-002
Drilling Co. Tri-Valley Drilling **Type of Rig** Bucket-Auger
Hole Diameter 24" **Drive Weight** (0'-28'=5952, 28'-55'=3921, 55'-84'=2531, 84'-114'=1407) lbs **Drop** 12"
Elevation Top of Hole 1565' **Location** See Geotechnical Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION Logged By JGS Sampled By JBW	Type of Tests
1535	30								Total Depth drilled = 31'. Sampled to 27'. Boring downhole logged to 30'. Groundwater not encountered. Boring backfilled with cuttings. Auger refusal at 31 feet.	
1530	35									
1525	40									
1520	45									
1515	50									
1510	55									
1505	60									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
SH SHELBY TUBE

TYPE OF TESTS:
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LEIGHTON AND ASSOCIATES, INC.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	DESCRIPTIONS
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size.)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size.)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size.)	SILTS AND CLAYS (Liquid limit LESS than 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 AND CLAYS (Liquid limit GREATER than 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 silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

SILT or CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COURSE	FINE	COURSE		

No.200 No.40 No.10 No.4 3/4 in. 3 in. 12 in.

U. S. STANDARD SIEVE SIZE

G. A. NICOLL & ASSOCIATES, INC.

EARTH SCIENCE CONSULTANTS

Barclay-Hollander

Date: April, 1988

Project No: 3099-03

Figure No.: A-1

LOG OF BORING

Drill Rig: TRACK RIG	Boring Diameter: 24 inches	Boring Elevation: 1304± feet	Boring Number B-1
Date Drilled: 10/17/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ.FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
▭								BEDROCK	SLATE: gray-brown, dry, Silty, fractured very hard @2 feet: fracture: N80W, 41S @6 feet: roots, foliation: N46W, 26SW; fracture: N34E, vertical
	▭		4.9	–		5			@7.5 feet: foliation: N70W, 24S; fracture: N8E, vertical @9 feet: prominant fracture: N14W, vertical; and N8E, 38W; oxidized with roots to 10 feet
						10			@11 feet: foliation: N85W, 22S; fracture: N22E, vertical @12 feet: 4 inch SAND layer @12.5 feet: weathered Clayey layer, 2 inches thick, x-hole attitude: N80E, 40S
	▭		NR	NR		15			@14 feet: fracture: N31W, vertical, slightly open locally @15 feet: steep fractures @16 feet: slightly moist @17 feet: very hard, foliation: N6E, 49E and N6E, 25E; fracture: N57W, vertical and N33E, vertical @19 feet: foliation: N54E, 21SE @19.5 feet: fracture: N35W, vertical and N41E, vertical
						20			SANTA MONICA SLATE
						25			
						30			Bottom of Boring at 20.5 feet. Notes: 1) No ground water encountered 2) Refusal at 20.5 feet 3) Boring dow-hole logged and backfilled
						35			
						40			NR - Non-Recovery

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Barclay - Hollander

Project No.: 3099 -03

Figure No.: A-2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	1416.5± feet	B-2

Date Drilled: 10/21/85 JG

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.

Drive Energy Ft. Kips/Ft.	Field Moisture % Dry Weight	Dry Density Lb/Cu. Ft.	Shear Resistance Kips/Sq. Ft.
8.7	30.3	–	
14.5	5.2	–	
14.5	5.1	–	
14.5	7.5	–	
34.2	2.1	–	

Depth, Feet: 5, 10, 15, 20, 25, 30, 35, 40

Soil/Rock Type: POSSIBLE LANDSLIDE MATERIAL

Description and Remarks

SLATE: gray-brown, dry, moderately loose, broken, fractured

SLATE fragments in Silty SAND matrix

@5 feet: contact: N72E, 44SE

@6 feet: abundant caliche

@8-13 feet: caving

@9-10 feet: roots

@11-12 feet: fractures: N2E, 72W and N84E, 63S

@12 feet: fracture: N10E, 57SE

@13 feet: small roots

@14 feet: firmer but jumbled

@18-19 feet: caving

@19 feet: matrix comprises more than 50%

@25 feet: irregular caliche coated layer with subhorizontal attitude

@26-43 feet: heavy caving

@29 feet: very jumbled

@31-32 feet: wet

@33.5 feet: Rupture Zone: above is crushed slate fragments and Silty SAND matrix; below blocky fractured SLATE with 6-8 inch fracture spacing

@36 feet: Foliation: N12W, 30E

@37 feet: Fractures: N60E, 80W; within prominant fracture zone

@38 feet: Fractures: N7E, 67W

@39 feet: Rupture Surface: N5W, 36E; oxidized with caliche

@42 feet: Foliation: N36W, 35NE

@42.5 feet: Fractures: N14E, 37W and N19W, 62E

(continued on Figure A-3.2)

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 inches	Boring Elevation: 1416± feet	Boring Number B-2
Date Drilled: 10/22/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

(continued from Figure A-3.1)

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE
	☐	36.1	3.6	-		45		
	☐	43.0	7.2	-		55		
	☐	151.0	5.0	141.5		65		
	☐	21.6	10.0	126.0		80		

SOIL/ROCK TYPE (to 80 feet): POSSIBLE LANDSLIDE MATERIAL

Description and Remarks

@47.5 feet: Fracture Zone: N75E, vertical

@48 feet: soft weathered pockets of Silty SAND
SLATE has moisture on fractures

@51 feet: Fracture: N60W, 73SW; prominant foliation: N17W, 28NE

@54-58 feet: caving zone with fracture/fault trend N57W

@57 feet: Fracture: N13W, 64SW sheared foliation: N22W, 22NE

@58 feet: foliation: platy gray SLATE: N7W, 34SE

@60 feet: foliation: N18E, 35E

@62 feet: wet, CLAY coated fractures

@64 feet: foliation: N6E, 30E; caliche permeated, and sheared

@65 feet: foliation: N16E, 37E; wet, very fractured

@69.5 feet: yellow brown, Clayey SLATE

@73.5 feet: foliation: N10E, 37E; underlain by 6 inch gray-white CLAY layer, x-hole attitude: N22E, 23SE; underlain by oxidized wet SAND layer, 1 inch thick

@76 feet: cherty layer underlain by several thin plastic CLAY layers

@78 feet: Sandy CLAY with SLATE fragments: orange-brown, plastic, no apparent structure

@80 feet: Rupture Surface: x-hole attitude: N60W, 30SW; 1-2 inches wet, stiff, highly plastic CLAY; below is crushed wet SLATE

(continued on Figure A-3.3) LANDSLIDE MATERIAL

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	1416± feet	B-2
Date Drilled: 10/22/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

(continued from Figure A-3.2)

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
								POSSIBLE LANDSLIDE MATERIAL	@82.5 feet: foliation: N68E, 28SE; with a 1/4 inch and 1/2 inch CLAY lenses
						85			@86 feet: firmer with 1/8 to 1 inch open fractures
									@87 feet: drier
X	X	44.2	7.3	133.4					@88 feet: gouge-like appearance: moist, Clayey SILT matrix with gravelly SLATE fragments, locally oxidized
						90			@90 feet: faint slicks in sample tip
									@91 feet: slightly drier
	X	66.3	6.1	135.3		95			@95 feet: very fractured, short, faint slicks in sample tip
									POSSIBLE LANDSLIDE MATERIAL
						100			

Bottom of Boring at 96 feet.

Notes:

1) Heavy caving due to fracturing at 8-13 feet, 18-19 feet, 26-43 feet and 54-58 feet
2) No ground water encountered
3) Boring down-hole logged and backfilled

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	1548± feet	B-3
Date Drilled: 10/23-10/24 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
						0		BEDROCK	SILTSTONE: light yellow-brown, laminated, punky
									@2.5 feet: bedding: N45W, 4NE, thin oxidized layers
	X	23.2	22.6	108.1		5			@6.5 feet: very hard
									@9 feet: 2 inch cemented layer
									@9.5 feet: bedding: N5E, 14E; prominant fracture: N72E, vertical and N28W, vertical; Silicic shale
X	X	29.0	12.9	110.8		10			@10.5 feet: fracture: N32W, vertical, open 1/4 inch
						15			@15 feet: Silicic layer, 1 1/2 inch thick
									@16 feet: hard, brittle, platy bedded
									@17.5 feet: Sandy SILTSTONE: gray-brown, oxidized
									@19.5 feet: bedding: N5E, 14E; slightly moist, Silicic
	X	26.1	21.3	101.0		20			@22 feet: fractures: N55E, 79NW and N66W, vertical and N37E, 55NW; bedding: NS, 20E
						25			@26 feet: 8 inch cemented layer
									@27.8 feet: 12 inch cemented layer, poorly bedded
						30			@30.5-31 feet: SAND layer underlain by dark gray-brown cemented SILTSTONE
X	X	51.3	13.7	109.2					@32 feet: 3/4 inch gray, very moist Bentonite bed: N22E, 12E; bed swells to 1 1/2 inch and has internal slickensides; underlain by dark gray brittle SILTSTONE
						35			@34.5 feet: 6 inch SAND layer
									@35 feet: fracture zone: N6E, 52E
									@38 feet: polished shear: N2W, 85E; probable fault
	X	67.8	9.6	115.3		40			@39.5 feet: SAND layer: light gray, moist, underlain by dark brown platy SILTSTONE

(continued on Figure A-4.2)

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 inches	Boring Elevation: 1548± feet	Boring Number B-3
Date Drilled: 10/24 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE
	X	130.1	13.1	100.0		~50		BEDROCK
X	X	22.0	3.6	123.5		~60		BEDROCK

(continued from Figure A-4.1)

Description and Remarks

@42 feet: Clayey ASH beds: 1/8 and 1 inch thick, wet, highly plastic with internal shearing, underlain by hard and platy SILTSTONE:; bedding: NS, 15E

@43 feet: 3 inch light gray SAND layer

@44 feet: highly fractured zone: N5E, 86E

@47 feet: fault: N83E, vertical bedding: N38W, 7NE

@47.5 feet: 3/8 inch open fracture

@48 feet: very hard, cemented, dark brown

@51.4 feet: light gray 3/4 inch ash bed, Clayey

@51.5 - 55.5 feet: SAND: light gray, fine to medium grained, friable, very moist, massive underlain by hard SILTSTONE

@57.5 fractures: N52E, vertical and N53W, 80SW bedding: N9W, 15E

@59 feet: seepage

@61 feet: bottom of 2 inch ash bed: N29E, 15SE; undulatory, stiff, highly plastic, underlain by yellow-buff SAND and SILT

@62 feet: hard cemented layer

@62.5 feet: green-gray-brown fine, SANDSTONE

@68 feet: ground water level in boring

MODELO FORMATION

Bottom of Boring at 70.3 feet.

Notes:

1) No caving
2) Seepage at 59 feet
3) Boring down-hole logged and backfilled

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	1543± feet	B-4
Date Drilled: 10/25/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE: Bulk	SAMPLE: Tube	Drive Energy Ft. Kips/Ft.	Field Moisture % Dry Weight	Dry Density Lb/Cu. Ft.	Shear Resistance Kips/Sq. Ft.	Depth, Feet	Soil/Rock Symbol	Soil/Rock Type
		76.5	3.9	133.8		10		BEDROCK
		52.2	9.5	123.0		20		BEDROCK
		45.6	5.7	133.9		30		BEDROCK
		103.2	8.6	121.5		40		BEDROCK

Description and Remarks

SLATE: gray-brown, fractured, brittle

@ 2 feet: fracture: N76E, 39W

@3 feet: fracture: N10E, 46E; oxidized

@5 feet: firmer

@6 feet: 1/2 to 1 inch fracture spacing: N32E, 47NW, with small roots

@7 feet: fracture: N61E, 40NW

@8 feet: foliation: N70E, 38NW

@9.5 feet: very hard to 11 feet

@11 feet: fracture: N45W, 70SW; prominant

@14 feet: fracture: N37E, 54SE and N15E, 42NW

@16 feet: very fractured, but tight

@22 feet: fracture: N65W, 27NE; structure is poorly defined

@25 feet: sub-horizontal foliation and foliation: N69E, 11NW

@27 feet: foilation: N46E, 24NW; poorly defined

@28 feet: foliation: N58W, 26NE; very hard, competant bedrock

@33.5 feet: fracture: N53W, vertical and N26E, 80SE
foliation: N60E, 28NW

@38 feet: fracture: N60W, vertical; foliation dips NW

@41 feet: foliation dips NW

@44 feet: localized, discontinuous weathered zones

(Continued on Figure A-5.2)

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Project No.: 3099-03 | Figure No.: A-5.1

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 inches	Boring Elevation: 1543± feet	Boring Number
Date Drilled: 10/25/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		B-4

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	(continued from Figure A-5.1) Description and Remarks
								BEDROCK	@47 feet: foliation: EW, 12N fracture: N42E, 72SE and NS, 31W and N60W, 80NE
I						45			SANTA MONICA SLATE
	I	153.9	NR	NR		50			
									Bottom of Boring at 50.5 feet.
						55			NOTES: 1) No ground water encountered 2) No caving 3) Boring down-hole logged and backfilled NR - Non-Recovery

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Project No.: 3099-03 | Figure No.: A-5.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	1542± feet	B-5
Date Drilled: 10/25/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
						0		SC	Clayey SAND: dark brown, dry cracked TOPSOIL
								POSSIBLE LANDSLIDE MATERIAL	SAND and Clayey SAND: buff and orange-buff
									@3 feet: fractured Clayey SAND: random polished fractured surfaces
									@4.5 feet: CLAY bed: 1/4 inch thick, N47E, 24SE
	☐	29.0	9.5	-		5			@5.9 feet: very fractured
									@6 feet: SANDSTONE: fine, cemented, very hard
									@8.6 feet: prominent fracture zone: N17E, 54NW; 8 inches wide
	☐	37.7	8.8	104.8		10			@9.5 feet: fine-medium grained, friable, orange-brown, dry massive
									@13.5 feet: fracture: N37E, 73NW
☐						15			@11-21 feet: severly open fractured
									@15.9 feet: prominant fracture: 73W, vertical
									@17 feet: x-hole attitude on fracture: N24E, 32W
									@18.9 feet: fracture/fault: N70W, vertical POSSIBLE LANDSLIDE MATERIAL
						20		BED-ROCK	SANDSTONE: fine to medium, highly cemented MODELO FORMATION

Bottom of Boring at 21 feet.

Notes:

1) No ground water encountered
2) Caving from 11-21 feet
3) Refusal after coring at 21 feet
4) Boring down-hole logged and backfilled

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Barclay-Hollander

Project No.: 3099-03

Figure No.: A-6

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 inches	1541± feet	B-6

Date Drilled: 10/28/85 JG

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
X						0–3		SP/CL	SAND and CLAY: buff and orange-brown with root hairs; contact dips slightly downslope COLLUVIUM
X	X	11.6	4.6			3–6		BED-ROCK	SANDSTONE: medium grained, orange-brown, cemented, fractured MODELO FORMATION
									Bottom of Boring at 6 feet.

Bottom of Boring at 6 feet.

NOTES:

1) No ground water encountered
2) Caving from 3 to 6 feet
3) Refusal at 6 feet
4) Boring down-hole logged and backfilled

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Project No.: 3099-03 Figure No.: A-7

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 inches	Boring Elevation: 1574± feet	Boring Number B-7
Date Drilled: 10/28/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

Sample: Bulk	Sample: Tube	Drive Energy Ft. Kips/Ft.	Field Moisture % Dry Weight	Dry Density Lb./Cu. Ft.	Shear Resistance Kips/Sq. Ft.	Depth, Feet	Soil/Rock Symbol	Soil/Rock Type
	X	26.1	5.8	116.4		~6		BEDROCK
X						~8–10		BEDROCK
	X	26.1	7.2	117.6		~11		BEDROCK
	X	37.7	9.6	120.0		~19		BEDROCK
X						~24		BEDROCK

Description and Remarks

SANDSTONE: buff, dry to slightly moist, fine to medium grained, massive, slightly oxidized

@11 feet: root hair lined fracture filled with 1/8 inch of caliche: N17E, 82W

@11.5 feet: discontinuous oxidized layer: N50W, 30NE

@13.5 feet: caliche filled fracture

@19 feet: closed caliche filled fractures

@22 feet: medium grained, friable, no discernable bedding

MODELO FORMATION

Bottom of Boring at 24 feet.

NOTES:

1) No ground water encountered
2) No caving
3) Boring down-hole logged and backfilled

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Project No.: 3099-03 | Figure No.: A-8

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 inches	Boring Elevation: 1628± feet	Boring Number
Date Drilled: 10/29/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		B-8

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
						0–2		SM	Silty SAND with SLATE fragements COLLUVIUM
						2		LANDSLIDE MATERIAL	SLATE: dark gray-brown, weathered, fractured
						6			@6 feet: begin caving fractures: N36E, 84W and N27W, 58NE
						6.5			@6.5 feet: fracture: N32W, 45NE
						9.5			@9.5 feet: prominant fractures, en echelon: N8W, 37NE and N37W, 80SW
	X	20.3	4.6	–		10			@10 feet: fracture/foliation: NS, 40E
						10–13.5			@10-13.5 feet: pulverized, fracture: N28W, vertical
						15.5			@15.5 feet: probable foliation: NS, 40E
						19			@19 feet: severe caving
	X	11.6	3.5	139.7		20			@20 feet: shear plane: N4W, 32E; along crushed, weathered, wet layer; with average fracture spacing 1/4 to 2 inches
						23			@23 feet: moisture along fractures
X						25–27			LANDSLIDE MATERIAL
	X	24.7	3.9	–		30			
						33			Bottom of Boring at 33 feet.

Notes:

1) No ground water encountered
2) Severe caving from 6-33 feet
3) Boring down-hole logged and backfilled

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Project No.: 3099-03 | Figure No.: A-9

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 inches	Boring Elevation: 1504± feet	Boring Number B-9
Date Drilled: 10/29/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
								SC	Sandy CLAY: dark brown, slightly moist, cracked, with rootlets COLLUVIUM
						5		BEDROCK	SANDSTONE: buff yellow-brown, dry, friable, fine grained @4 feet: concretions @5-6 feet: light gray-brown, moist, with thin caliche veins @7 feet: caliche coated fracture/bedding: N23E, 40SE @8 feet: caliche coated bed with rootlets N15E, 22SE @9-11.5 feet: highly cemented layer @11.0 feet: open fracture 1/2 inch: N15E, 80W; N82W, vertical @11.5 feet: contact; bedding: N45E, 22SE @12 feet: orange-brown and dark gray, medium grained, hard, massive MODELO FORMATION
X (10)						10			
	X (13)	23.2	8.3	112.1					
						15			
						20			Bottom of Boring at 18 feet.
						25			Notes: 1) No ground water encountered 2) No caving 3) Boring down-hole logged and backfilled
						30			
						35			
						40			

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Project No.: 3099-03 | Figure No.: A-10

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24"	1509± feet	B-10 (1 of 3)

Date Drilled: 1/11/88 JG

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET
	X		6.2			10
X	X	129.2	6.4			20
	X	113.0	7.7			30
	X	124.4	3.1			40

SOIL/ROCK TYPE	Description and Remarks
CL	Silty CLAY — Pad Fill
CL	Silty CLAY: brown, very moist, medium stiff @ 2.5 feet: Sandy, fine-medium — Colluvium
Landslide Material	Displaced SLATE: gray-brown, very weathered & fractured, average fracture spacing ¼ inch @ 10 feet, foliation: N4E, 24W and N9W, 23W; prominent fractures: N86W, vertical; average fracture spacing 1½ inch @ 14 feet, fracture: N70W, 64N @ 17 feet, foliation: N72E, 41N; fracture trend: N14W, vertical @ 20.5 feet, shear: N32W, 53SW; on ¼ to 6 inch thick calichified broken layer @ 23 feet, foliation: N36E and N13E, 27W @ 24 feet, foliation: N22W, 26SW; fracture: EW, vertical and N3, 80E; with rootlets along ¼ to 8 inch thick shear zone with caliche @ 31.5 feet, foliation: N10W, 16SW @ 33 feet, foliation: N11W, 32W @ 34 feet, fractures: N77E, 62S and N58E, 76N and N76W, 68N and N10E, vertical; blocky fractures locally open 1/8 inch @ 36 feet, foliation: N25W, 85N and N54W, 155W fractures: N83W, vertical and N9W, vertical; along 1½ inch thick crushed, oxidized fractured zone @ 38 feet, foliation: N10W, 26SW; fractures: N28W, 55NE @ 41 feet: base of caved, fractured interval, with an irregular remolded layer consisting of fine slate chips in CLAY matrix @ 41-45 feet: very hard, coring required @ 44 feet: base of 1 foot thick crushed zone with rootlets, very weathered, slightly friable with basal 1 inch thick, remolded clayey seam: N28E, 18NW @ 44.5 feet, 1 inch thick remolded shear: N50W, 15NE; below hard, fractured, average spacing 2 to 4 inches

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24"	1509± feet	B-10
Date Drilled: 1/14/88 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		2 of 3

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU.FT.	SHEAR RESISTANCE KIPS/SQ.FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
						45–55		Landslide Material	@ 45 feet: root hairs on low angle, open fracture @ 46 feet, foliation: N32W, 23NE @ 47.5, foliation: N18E, 23NW; fracture: N82E, 59S @ 50 feet, foliation: N28E, 21W with remolded coating @ 53 feet, foliation: N20E, 33W; steep caliche coated fracture @ 50-55.6 feet, very oxidated, and fractured: N82E, 47S @ 55.6 feet, rupture surface: N28E, 14.5 NW; 1 to 2 inches wet plastic CLAY with slate chips @55.7 feet, basal rupture surface: N5, 23W; polished, striated down dip , undulatory, hard below Landslide Material
						55–60		Bedrock	Slate: dark gray, fractured @ 60.3 feet, ½ to 1 inch thick CLAY bed: N20E, 24NW @ 62.6: CLAY bed, folded, faulted, very fractured @ 68 feet, fracture: N48W, 57SW @ 68.3 shear: N60W, 35SW, consists of ½ to 5 inch thick black, slickensided CLAY; hard, steeply fractured below
▭			7.4			65–70		Bedrock	@ 74 feet, fracture: N82W, 80S; hard, very fractured; fracture: EW, 375 @ 77 feet, foliation: N80E, 18N; fracture: N37W, 72SW @ 79-81 feet: quartz veins @ 83.5 feet, foliation: horizontal
▭						70–75		Bedrock	
	▭		10.9			75–80		Bedrock	

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Project No.: 3099-03

Figure No.: A-11.1

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 "	1509½ feet	B-10
Date Drilled: 2/8/88 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		3 of 3

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY 1,000 KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU.FT.	SHEAR RESISTANCE KIPS/SQ.FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
									Slate: dark gray, fractured @ 84 feet, fracture, with slight trace of moisture on fractured surfaces @ 85 feet: quartz veins, ½ inch average fracture spacing @ 88 feet, foliation: N35W, 4NE; very fractured @ 89 feet: tighter
						85			
						90			
									Santa Monica Slate
						95			Bottom of boring @ 95 feet Note: 1) localized caving from 20 to 55 feet 2) no ground water encountered 3) boring down-hole logged and backfilled
						100			

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Project No.: 3099-03

Figure No.: A-11.2

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24"	1484± feet	B-11
Date Drilled: 1/12/88 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
						0–2		CL	Silty CLAY: with slate fragments — Pad Fill
						2–10		Slump Material	Displaced SLATE: @ 4.5 shear zone: 2 to 3 inch thick remolded soil with open fractured gravel above; and with root hairs @ 8 feet, rupture surface: N15E, 30W; harder below @ 10 feet, foliation: N58E, 33N, fracture: N85E, 60S; rupture surface with 3 inches remolded soil, bedrock broken below — Slump Material
10–15 (bulk)	10–11 (tube)		3.9			10–25		Bedrock	Slate: dark gray, hard, closed fractures @ 13 feet: steep random closed fractures @ 15 feet: discontinous fracture zone with root hairs @ 15.5 feet: shear with roots and polished CLAY surface: N70W, 39S @ 17 feet, fracture: shear: N80W, 48S @ 18.5 feet, fracture: N68W, 55S @ 19-20 feet, finely fractured, pulverized, with polished shears, appears fault related — Santa Monica Slate
	20 (tube)	110.3	6.1						

Bottom of boring @ 25 feet

Note:
1) no caving
2) no ground water encountered
3) boring down-hole logged, backfilled and tamped

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

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Project No.: 3099-03

Figure No.: A-12

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24"	1576± feet	B-12

Date Drilled: 1/12/88 JG

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU.FT.	SHEAR RESISTANCE KIPS/SQ.FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE
						0		CL
	▯	145.4	2.0			~10		Slump Material
	▯	126.7	7.7			~20		Bedrock

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

Description and Remarks

Silty CLAY — Pad Fill

Displaced SLATE:
gray-brown, very weathered
@ 1-2.5 feet, CLAYEY: with rootlets
@ 3 feet, foliation: N12E, 27W, very moist, CLAY coated fractures; drier and tighter below
@ 4 feet: very hard
@ 5 feet, foliation: sub-horizontal; fracture: N81E, vertical, base of creep zone with rootlet
@ 6 feet, foliation: N67E, 23NW
@ 8 feet, fracture: N9E, 58SE; with root hairs
@ 9 feet, foliation: N17E, 37W
@ 10 feet, shear: N75E, 19NW; poorly developed, with 2 to 3 inch crushed, remolded layer, very hard below
@ 10.5 feet, foliation: N43E, 28NW
@ 13 feet, rupture surface, generalized attitude shear; N45E, 28NW; 2 to 3 inch thick, oxidized, broken zone along foliation, very irregular — Slump Material

SLATE: fissile, fracture: N41W, vertical
@ 15-20 feet: very hard, pick rings — Santa Monica Slate

Bottom of boring @ 21 feet
Note:
1) no caving
2) no ground water encountered
3) boring down-hole logged, backfilled and tamped

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24'	1574± feet	B-13
Date Drilled: 1/12/88 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
						0–5		Slump Material	Silty SAND: fine-medium, saturated, medium dense @ 4.3 feet, broken, very loose zone, 8 inch thick @ 5 feet, rupture surface: N34E, 27NW; with 3 to 4 inch thick remolded soil above Slump Material
						5–15		Bedrock	SLATE: dark gray-brown, weathered, fractured @ 5.5 feet, foliation: N34E, 23NW @ 9 feet, fractures: EW, 65S; N13W, vertical; average fracture spacing 4 to 6 inches, fractures closed, foliation as above Santa Monica Slate
						15			Bottom of boring @ 15 feet Note: 1) no caving 2) no ground water encountered 3) boring down-hole logged, backfilled and tamped

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

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Project No.: 3099-03

Figure No.: A-14

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24"	1540± feet	
Date Drilled: 1/25/88 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		B-14

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
								CL	Sandy CLAY: brown, very moist, stiff
								SC	Clayey SAND: yellow-brown, very moist, dense, fine-medium grained
						5		SM	Silty SAND: medium-coarse, dark brown, moist, medium-dense, with SANDSTONE fragments
						10			
						15, 20, 25		Bedrock	SANDSTONE: medium-coarse, very fractured, poorly bedded; fractures open to ½ inch @ 15-17 feet: caving of angular blocks of bedrock due to being very fractured @ 15 feet, fracture: N44W, 56S @ 17 feet, fracture: N65W, 60S @ 18 feet bedding: N5E, 30NW
						30, 35, 40			Bottom of boring @ 30 feet Note: 1) severe caving @ 15-20 feet boring caves to 20 feet 2) no ground water encountered 3) boring down-hole logged to 20 feet and backfilled

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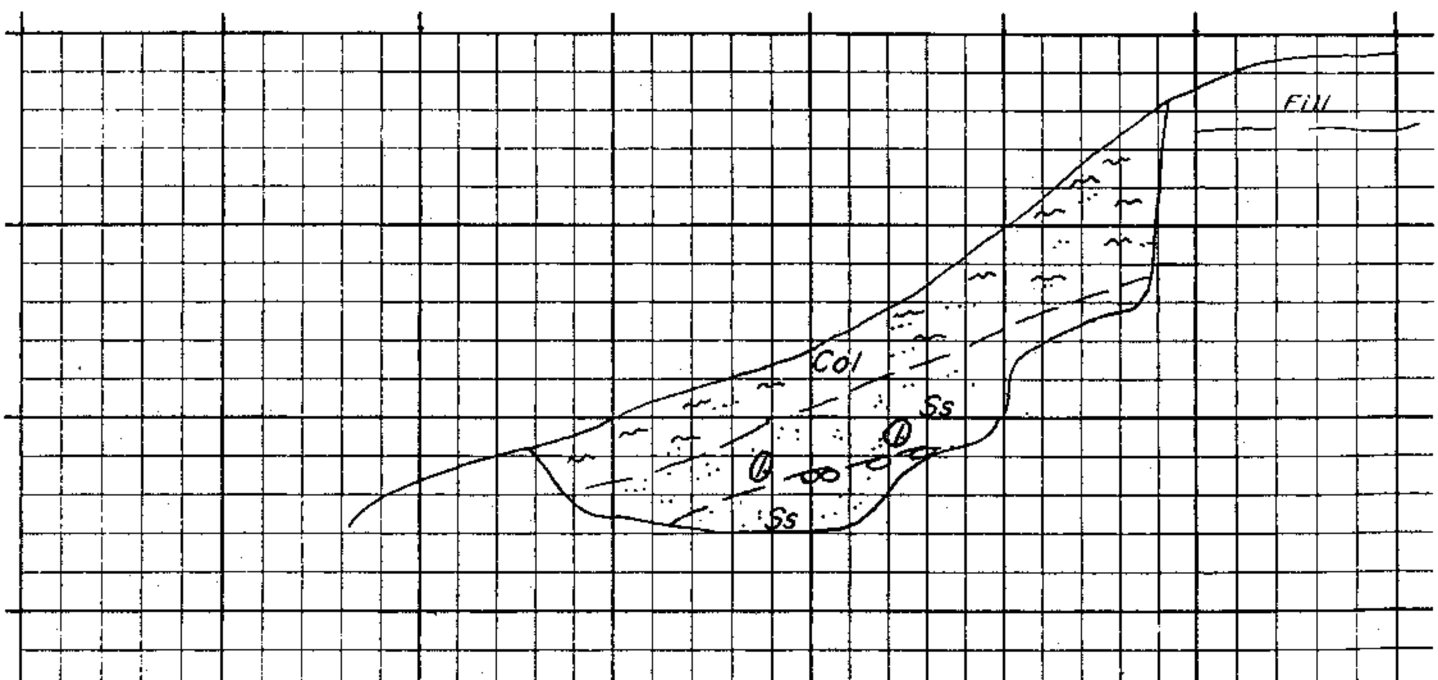
Project No.: 3099-03

Figure No.: A-15

LOG OF TEST PIT

Surface Elevation: 1518± feet Pit Orientation: N23W Pit Dimensions: 16x2x6 Ground Water Depth: None Encountered	Logged by: JG Date: 11/6/85 Equipment: Crawler Backhoe		Test Pit Number T-1

Depth (ft.)	Samples: Bulk	Samples: Tube	Drive Energy (ft.kips/ft)	Field Moisture (% of Dry Weight)	Dry Density (p.c.f.)	Soil Type (USCS)	Geologic / Engineering Description and Remarks	Geologic Attitudes
						SC	Clayey SAND: brown, slightly moist, loose to medium dense, fractured COLLUVIUM	
5							SANDSTONE: yellow-light brown, slightly moist, dense, massive, with concretionary bed at 4 feet; upper 2-3 feet of bedrock very weathered, friable, with Clayey SAND pockets below concretionary bed; SANDSTONE is very hard, dense, relatively unfractured, and is green-gray brown MODELO FORMATION	1)B:12E,23SE
10							Bottom of Pit at 6 feet. NOTES: 1) No ground water encountered 2) Test Pit backfilled	
15								



Surface Gradient: 27°

Scale: 1" = 5'

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Date: March, 1988

Project No: 3099-03

Figure No: A-16

LOG OF TEST PITS

Surface Elevation: 1484± feet **Pit Orientation:** N70E **Pit Dimensions:** 6x15x15 **Groundwater Depth:** None Encountered	**Logged By:** JG **Date:** 11/6/85 **Equipment:** Crawler Backhoe	**Test Pit Number** T-2

GEOLOGICAL Classification and Description	Depth (feet)	Graphic Symbol	Soil Type (USCS)	Samples: Bulk	Samples: In-Situ Density	ENGINEERING Classification and Description	Moisture (%)	Dry Density (p.c.f.)
GRABEN MATERIAL	5		ML			Gravelly Sandy SILT: brown-gray, slightly moist, soft, with highly developed pore spaces, gravel portion 10%, average size 1/8 to 1/2 inches		
	10					Clayey SLATE: blue-gray, moist, cracked, highly weathered		
LANDSLIDE MATERIAL								
	15					Bottom of Pit at 14 feet. Notes: 1) No ground water encountered 2) Test Pit backfilled		

Surface Elevation: **Pit Orientation:** **Pit Dimensions:** **Groundwater Depth:**	**Logged By:** **Date:** **Equipment:**	**Test Pit Number**

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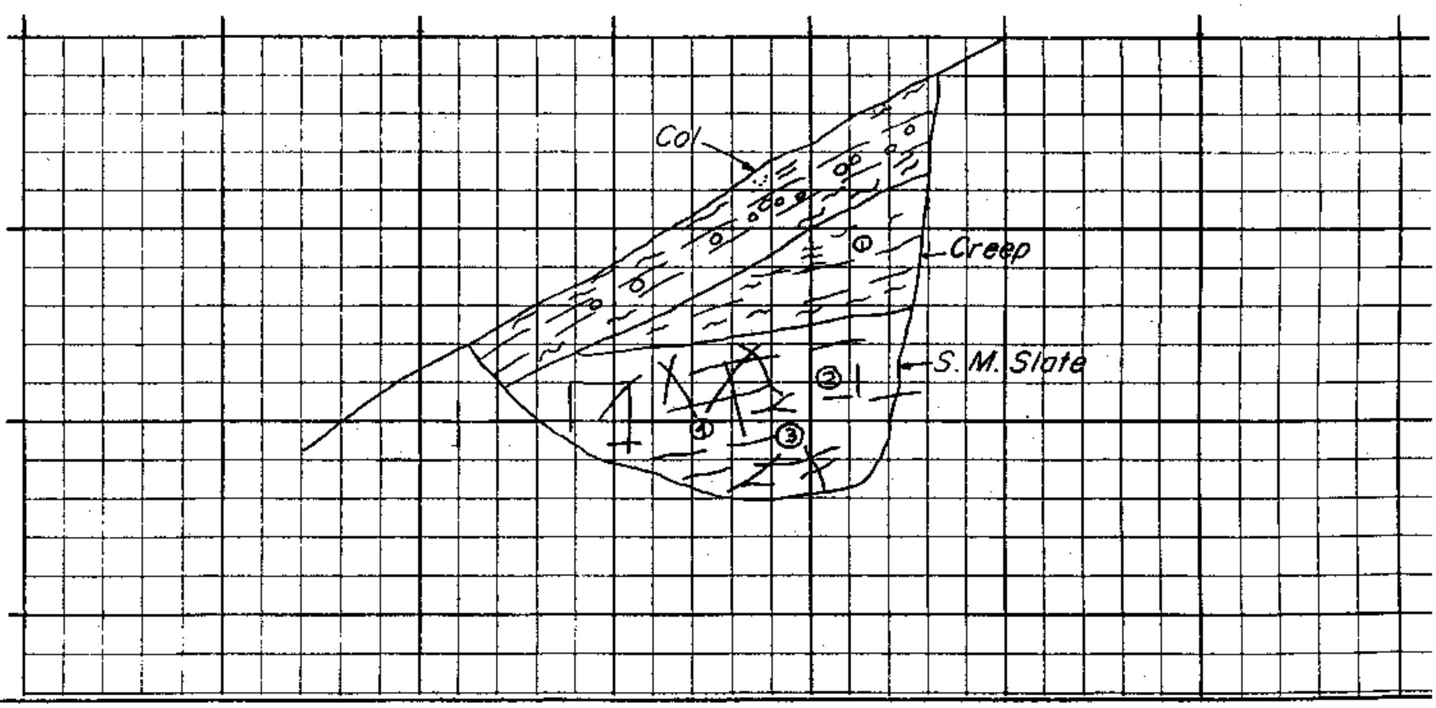
Date: March, 1988
Project No: 3099 3099-03
Figure No: A-17

LOG OF TEST PIT

Surface Elevation:	1515± feet	Logged by:	JG
Pit Orientation:	N53E	Date:	11/6/85
Pit Dimensions:	12x2x10.5	Equipment:	Crawler Backhoe
Ground Water Depth:	None Encountered	Test Pit Number	T-3

Depth (ft.)	Samples: Bulk	Samples: Tube	Drive Energy (ft.kips/ft)	Field Moisture (% of Dry Weight)	Dry Density (p.c.f.)	Soil Type (U.S.C.S.)	Geologic / Engineering Description and Remarks	Geologic Attitudes
						ML	Gravelly Sandy SILT: gray-brown, dry, loose with roots, with very gravelly layer COLLUVIUM	
5						BEDROCK	CREEP EFFECTED SLATE - orange-brown and gray, highly weathered SLATE, with down slope oriented shear planes along apparent dip of foliation SANTA MONICA SLATE	1)shear:N23W, 28SW
10						BEDROCK	SLATE: orange-gray-brown, very fractured, hard SANTA MONICA SLATE	2)fol:N45E, 43NW 3)fract:N62E, 53SE 4)fol:N27E, 34NW
15						BEDROCK	Bottom of Pit at 11 feet. Notes: 1) No ground water encountered 2) Test Pit backfilled	



Surface Gradient: 28° Scale: 1" = 5'

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Date: March, 1988

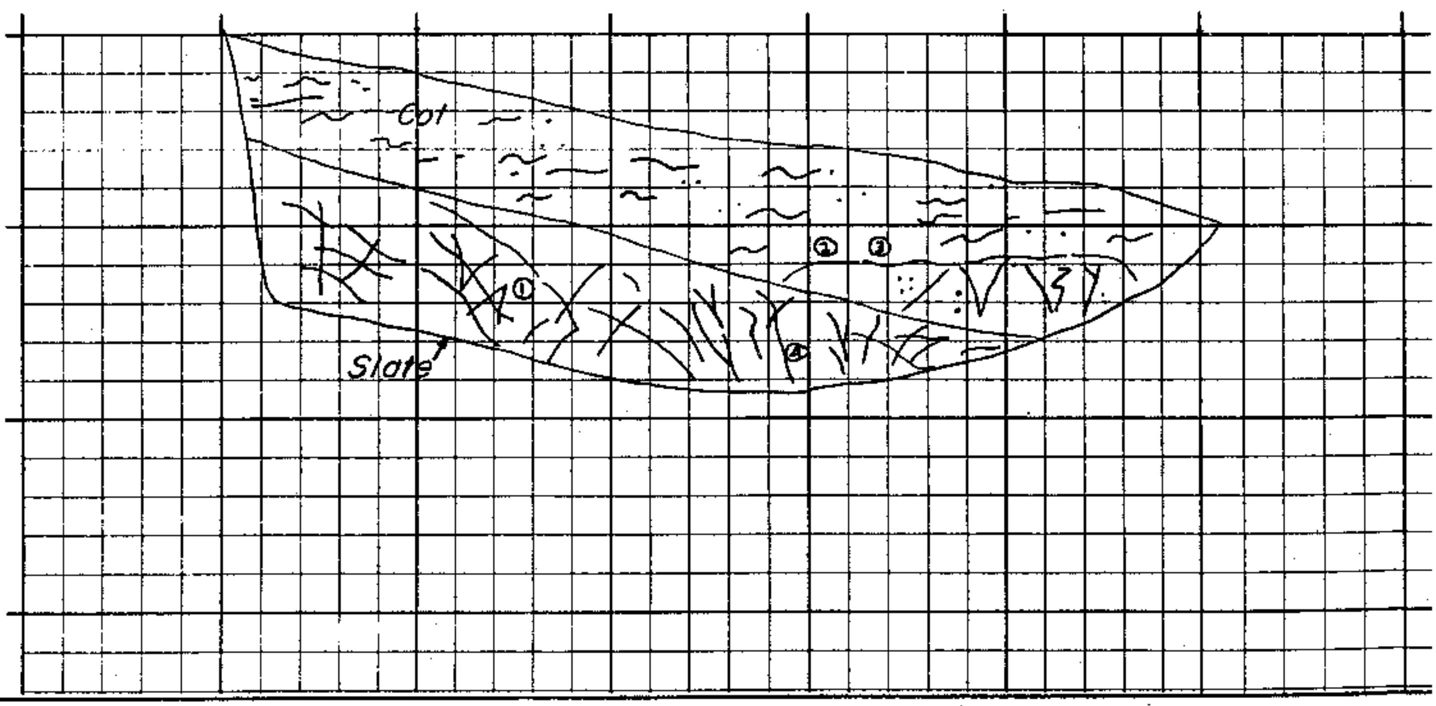
Project No: 3099-03

Figure No: A-18

LOG OF TEST PIT

Surface Elevation:	1562± feet	Logged by:	JG	Test Pit Numbe	
Pit Orientation:	N60W	Date:	11/6/85		T-4
Pit Dimensions:	26x2x6.5				
Ground Water Depth:	None Encountered	Equipment:	Crawler Backhoe		

Depth (ft.)	Samples: Bulk	Samples: Tube	Drive Energy (ft.kips/ft)	Field Moisture (% of Dry Weight)	Dry Density (p.c.f.)	Soil Type (U S C S)	Geologic / Engineering Description and Remarks	Geologic Attitudes
						SC	Gravelly Silty SAND: light brown, dry to slightly moist, moderately dense, with roots COLLUVIUM	
5						BED-ROCK	SANDSTONE: fine to medium grained, buff, massive, very fractured, contact with SLATE irregular MODELO FORMATION	1)fol:55E,37N 2)frac/flt: N10E,80W
10						BED-ROCK	SLATE: gray-brown, hard, very fractured, weathered, blocky, 2 inch average fracture spacing, fractures open and steep SANTA MONICA SLATE	3)fr/flt:N32E vertical 4)fol:N3E,59W
15							Bottom of Pit at 6.5 feet Note: 1) No ground water encountered 2) Test Pit backfilled	



Surface Gradient: 0 - 5°

Scale: 1" = 5'

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Date: March, 1988

Project No: 3099-03

Figure No: A-19

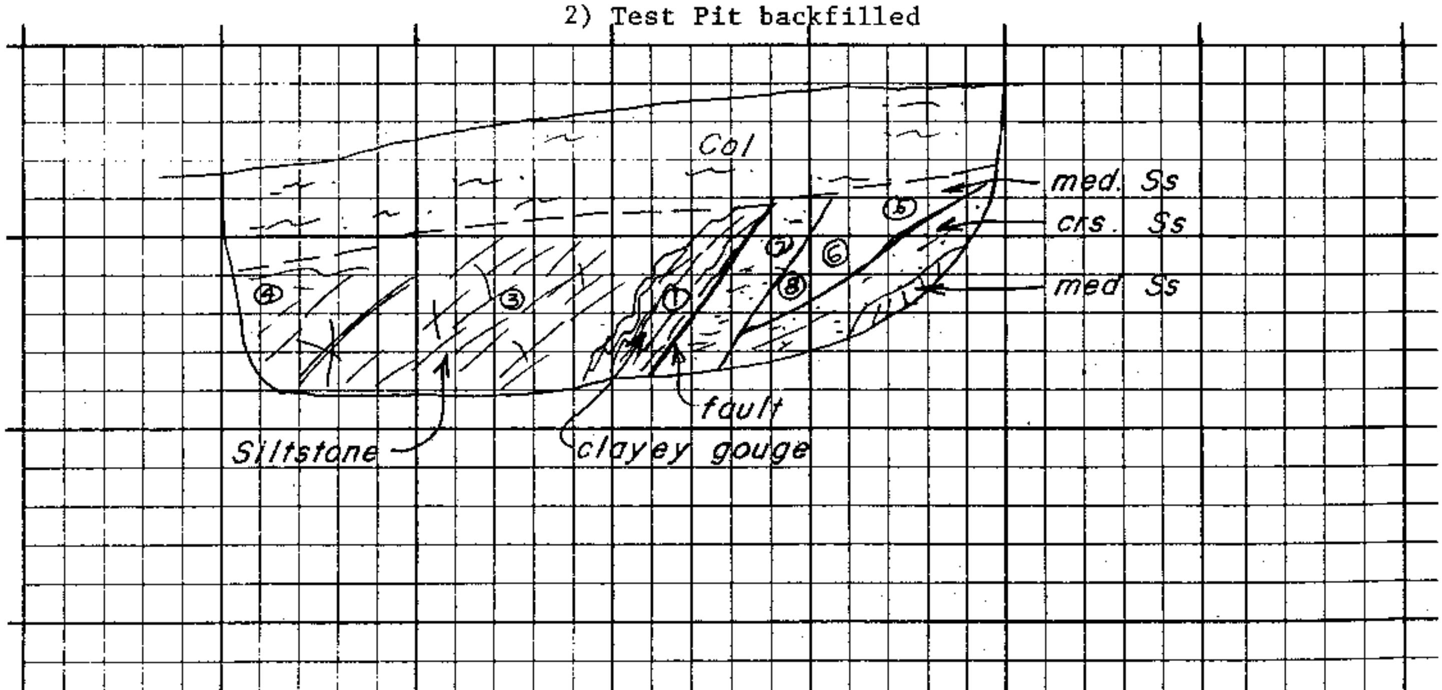
LOG OF TEST PIT

Surface Elevation:	1555± feet	Logged by:	JG
Pit Orientation:	N65W	Date:	11/7/85
Pit Dimensions:	20x2x6	Equipment:	Crawler
Ground Water Depth:	None Encountered	Test Pit Number	T-5

Depth (ft.)	Samples: Bulk	Samples: Tube	Drive Energy (ft.kips/ft.)	Field Moisture (% of Dry Weight)	Dry Density (p.c.f.)	Soil Type (U S C S)	Geologic / Engineering Description and Remarks	Geologic Attitudes
						SC	Gravelly Silty SAND: light brown, dry, loose with roots COLLUVIUM	
5						BEDROCK	SILTSTONE: light yellow-brown, gritty, very weathered, fractured, platy bedded FAULT: consists of 3/4 inch caliche filled fracture with roots, to west: 1 ft.± wide zone of fractured Clayey gouge, to east, 8 inch zone of oxidized friable SAND	1)Flt:N25E, 60NW & N40E 57NW 2)bdg:NS,28W 3)bdg:N46E, 35NW
10							Medium SANDSTONE: buff, medium to finely grained, cemented, hard, steeply fractured and open fractures	4)bdg:N21E, 41NW 5)N3E,34W
15							Coarse SANDSTONE: yellow and gray, massive, friable, medium to coarsely grained SANTA MONICA SLATE/MODELO FORMATION	6)N4W,28W 7)N50E,v. 8)N30W,v.

Bottom of Pit at 7 feet.

Notes: 1) No ground water encountered
2) Test Pit backfilled



Surface Gradient: 0-5°

Scale: 1"=5'

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Date: March, 1988

Project No: 3099-03

Figure No: A-20

LOG OF TEST PITS

Surface Elevation: 1458± feet Pit Orientation: N70E Pit Dimensions: 12x2x7 Groundwater Depth: None Encountered	Logged By: JG Date: 11/7/85 Equipment: Crawler Backhoe	Test Pit Number T-6

GEOLOGICAL Classification and Description	Depth (feet)	Graphic Symbol	Soil Type (USCS)	Samples: Bulk	Samples: In-Situ Density	ENGINEERING Classification and Description	Moisture (%)	Dry Density (p.c.f.)
COLLUVIUM					ML	Clayey SILT: dark brown, moist, stiff, with SILTSTONE fragments and with roots		
MODELO FORMATION						SANDSTONE: medium to coarsely grained, yellow-gray, massive, hard		
						Bottom of Pit at 7 feet. Notes: 1) No ground water encountered 2) Test Pit backfilled		

Surface Elevation: Pit Orientation: Pit Dimensions: Groundwater Depth:	Logged By: Date: Equipment:	Test Pit Number

GEOLOGICAL Classification and Description	Depth (feet)	Graphic Symbol	Soil Type (USCS)	Samples: Bulk	Samples: In-Situ Density	ENGINEERING Classification and Description	Moisture (%)	Dry Density (p.c.f.)

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Date: March, 1988
Project No: 3099-03
Figure No: A-21

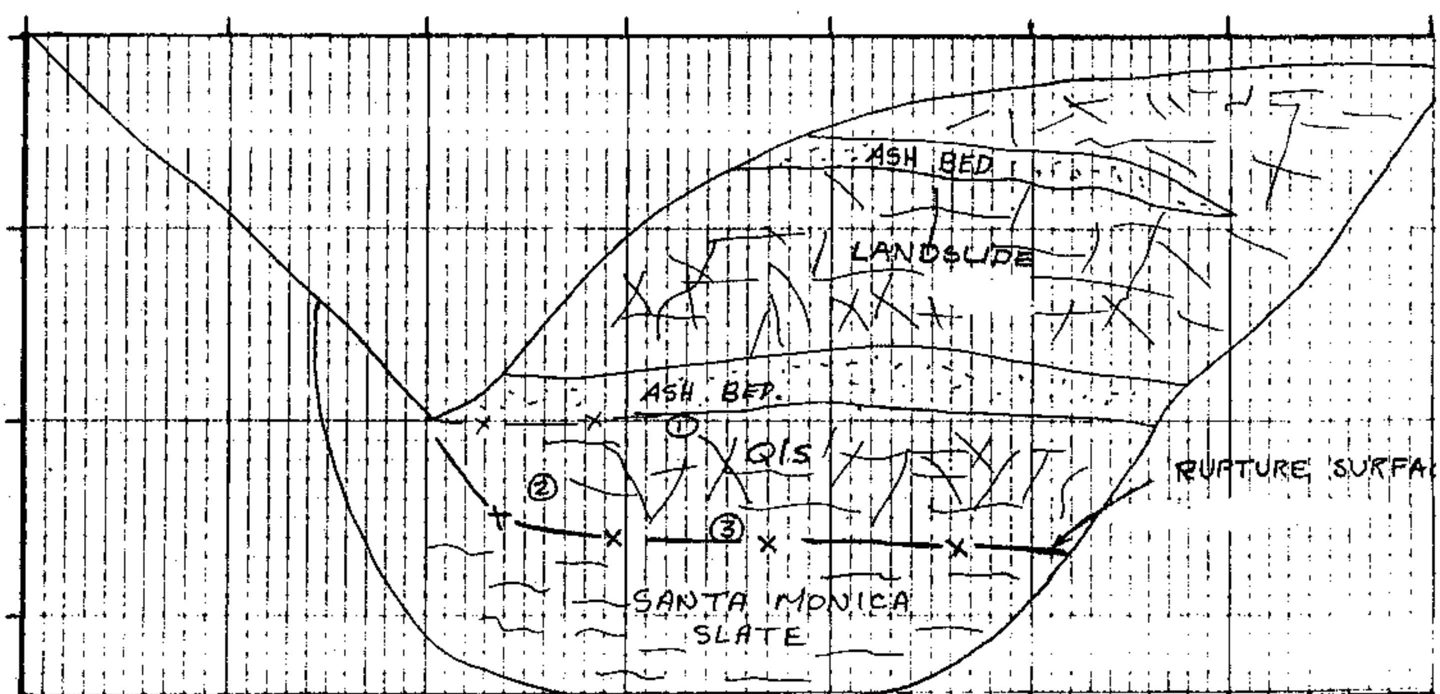
LOG OF TEST PIT

Surface Elevation: 1374-feet
Pit Orientation: N17W
Pit Dimensions: 25 X 15
Ground Water Depth: None Encountered

Logged by: JG
Date: 2/5/88
Equipment: TD 8

Test Pit Num
Dozer Pit
D-1

Depth (ft.)	Samples: Bulk	Samples: Tube	Drive Energy (ft.kips/ft)	Field Moisture (% of Dry Weight)	Dry Density (p.c.f.)	Soil Type (U S C S)	Geologic / Engineering Description and Remarks	Geologic Attitudes
5 10 15							LANDSLIDE MATERIAL - Slate, dark gray, very fractured, broken ASH BED - Silt: yellow-brown, very moist to saturated, friable RUPTURE SURFACE: smooth, polished, with CLAY film, and with slight seepage SANTA MONICA SLATE: dark gray, fractured very moist, very hard	1) foliatio 2) fracture N11W, 58 3) Rupture Surface: N9W, 9SW



Surface Gradient:

Scale: 1 inch : 5 feet

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Date: March, 1988

Project No: 3099-02

Figure No: A-22

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 Inches	1482± feet	B-1 -03

Date Drilled: 4/12-15/85 CHP/JG

This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.

From Project 3003

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
☐						0–8		LANDSLIDE MATERIAL	SLATE: gray-brown, dry, highly fractured @0-2 feet, caving @ 2 feet, attitude of fracture: N-S, vertical and N47E,52SE and N5E; vertical @ 3½ feet, general foliation attitude: N40W,43-46NE @3.8 feet, attitude of foliation: N49W,32NE weathered along foliation @ 5 feet, attitude of foliation: N39W,17NE strong trend of fractures: N4W,61SW @ 4-7 feet, very broken and open fractures to ½ inch with roots @ 5-8 feet, caving @ 7½ feet, highly fractured zone, bottom of slide, cross hole attitude; basal rupture: N73E,17NW LANDSLIDE MATERIAL
☐		20.1				8–30		BEDROCK	@ 8-9 feet, SLATE: attitude on 3 inch open fracture: N14E, vertical @ 9.7 feet, attitude of foliation: N50W,10NE attitude of fracture: N82E,80SE @ 10 feet, very dense, moisture and slightly clayey along fractures @ 10½ feet, attitude of foliation: N43W,18SW @ 11½ feet, 2 inch open fracture, rock is shattered, outside of fracture rock is very hard, foliation attitude: N26W,15SW @ 13 feet, clayey, moisture along fractures with ½ inch, 1 inch spacing @ 14 feet, attitude of foliation: N28W,25SW @ 15 feet, becomes very broken, slightly open fractures @ 16 feet, open fractures, very hard away from fractures SANTA MONICA SLATE
	☐	25.6							
☐									

BOTTOM OF BORING @ 30 FEET

Note:
1) No ground water
2) Caving from 0-2 feet and 5-8 feet
3) Boring downhole logged
4) Boring backfilled

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Project No.: 3099 -03 | Figure No.: A- 23

LOG OF BORING

Drill Rig:	Boring Diameter:	Boring Elevation:	Boring Number
Bucket Auger	24 Inches	1491± feet	B-2-03
Date Drilled: 4/15/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

From Project 3003

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
	X (approx. 2.5–3.5 ft)	25.6				0–17½		BEDROCK	SLATE: dark blue-gray, hard, dry, foliated @ 1 feet, attitude of foliation: N37E,36NW @ 3.5-4 feet, dark gray, clayey zone @ 4.5 feet, attitude of shear: N38W,27NE, very moist, with solution deposits @ 4.5 feet, highly fractured slate, weathered @ 6 feet, brittle @ 9 feet, very slight seepage, fracture attitude: N20E,33SE @ 10 feet, foliation dips 13°N, brittle @ 12.5 feet, attitude of foliation: N64W,22NE @ 14 feet, attitude of fracture: N86E, vertica very hard, slightly fractured to bottom SANTA MONICA SLATE
X (approx. 10–14 ft)			9						

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

BOTTOM OF BORING @ 17½ FEET

Note:
1) No caving
2) Small seep at 9 feet
3) Boring downhole logged
4) Refusal at 17½ feet
5) Boring backfilled

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Barclay Hollander

Project No.: 3099-03

Figure No.: A-24

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 Inches	Boring Elevation: 1487± feet	Boring Number B-3-03
Date Drilled: 4/15/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

From Project 3003

SAMPLE: BULK	SAMPLE: TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB./CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
	⊏⊐	31.0						BEDROCK	SLATE: dark gray, oxidized on fractures with 1 inch average spacing @ 2 feet, attitude of fracture: E-W; vertical @ 2 feet, attitude of foliation: N28E,24SE @ 3.1 feet, slightly clayey dark gray gracture zone, irregular dips at 10°-15° @ 3.4 feet, highly oxidized, very fractured @ 4 feet, attitude of foliation: N44E,25NW
	⊏⊐	42.0				5			@ 5.2-5.7 feet, weathered, softer zone, highly oxidized with carbonate staining @ 6.3 feet, probable foliation attitude: N27E,25NW @ 8 feet, general foliation attitude: N15W,17SW, very hard
	⊏⊐	43.1				10			@ 9.3 feet, attitude of fracture: N46W,80NE fractured, very moist, very weathered, possibl fault @ 10 feet, attitude of foliation: N44W,23SW hard to bottom SANTA MONICA SLATE
						15			
						20			BOTTOM OF BORING @ 17 FEET Note: 1) No caving 2) No ground water 3) Boring downhole logged 4) Boring backfilled
						25			
						30			
						35			
						40			

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Tustin, California

Barclay Hollander

Project No.: 3099-03

Figure No.: A-25

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 Inches	Boring Elevation: 1478± feet	Boring Number B-4 -03
Date Drilled: 4/15/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions.		

From Project 3003

SAMPLE BULK	SAMPLE TUBE	DRIVE ENERGY FT. KIPS/FT.	FIELD MOISTURE % DRY WEIGHT	DRY DENSITY LB/CU. FT.	SHEAR RESISTANCE KIPS/SQ. FT.	DEPTH, FEET	SOIL/ROCK SYMBOL	SOIL/ROCK TYPE	Description and Remarks
						0–18		BEDROCK	SLATE: dark gray, weathered, fracture spacing 1 to 4 inches, very hard @ 3.5 feet, attitude of foliation: N6E,23NW @ 5 feet, prominent en echelon fractures: N32E; vertical @ 6.7 feet, attitude of foliation: N22W,24SW @ 7 feet, very fractured, weathered @ 9.5 feet, foliation dips 10°N @ 11 feet, prominent fracture, attitude: N69W,75SW @ 11.2-13.6 feet, very hard layer @ 13.6 feet, hard, slightly fractured @ 13 feet, moisture on foliation, attitude of foliation: N39E,30SE SANTA MONICA SLATE
	▭	49.6				5			
	▭	69.4				10			
						18			BOTTOM OF BORING @ 18 FEET Note: 1) No caving 2) No ground water 3) Refusal at 18 feet 4) Boring downhole logged 5) Boring backfiled

Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

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Project No.: 3099-03 | Figure No.: A-26

LOG OF BORING

Drill Rig: Bucket Auger	Boring Diameter: 24 Inches	Boring Elevation: 1473± feet	Boring Number
Date Drilled: 4/16/85 JG	This log is a representation of subsurface conditions at the time and place of drilling. With the passage of time or at any other location there may be consequential changes in conditions		B-5-03

From Project 3003

SAMPLE Bulk	SAMPLE Tube	Drive Energy Ft. Kips/Ft.	Field Moisture % Dry Weight	Dry Density Lb/Cu. Ft.	Shear Resistance Kips/Sq. Ft.	Depth, Feet	Soil/Rock Symbol	Soil/Rock Type	Description and Remarks
						0		LANDSLIDE MATERIAL	Gravelley Silty SAND: gray-brown, with random SILTSTONE fragments, moist, moderately loose, porous
	X	<5.8							
X						5			
	X	11.9							@ 8.6-9.1 feet, very rocky layer with roots
	X	25.6				10			@ 11 feet, very rock and loose layer; cross-ho[illegible] attitude: N77W,56SW
									@ 13 feet, very broken, crushed
									@ 15 feet, porous
	X	31.0				15			@ 16 feet, medium dense, graben fracture: N76W,60S
									LANDSLIDE MATERIAL
								BEDROCK	@ 17.7 feet, SLATE: cross hole attitude: N70W,60S
									@ 20 feet, prominent fractures: N42E, vertical: N67W,35SW
	X	43.8				20			@ 20.5 feet, foliation: N62W,30S
									@ 21.5 feet, foliation, dips SW at 17°
									SANTA MONICA SLATE
						25			BOTTOM OF BORING @ 21.5 FEET
									Note: 1) Slight caving
									2) No ground water encountered
						30			3) Boring downhole logged
									4) Boring backfilled
						35			
						40			

APPENDIX C

GEOPHYSICAL SEISMIC REFRACTION SURVEYS

APPENDIX C

GEOPHYSICAL SEISMIC REFRACTION SURVEYS

Index

Reports

Subsurface Surveys, Seismic Refraction inv., Mountaingate, Santa Monica Hills, dated June 12, 2001.

_____, 2002a, Revised Report, Seismic Investigation, Mountaingate, Santa Monica Hills, dated August 30, 2002.

_____, 2002b, Addendum, Seismic Investigation, Mountaingate, Santa Monica Hills, dated September 26, 2002.

Figures

Sub Surface Surveys
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Telephone: (858) 481-8949 Facsimile: (858) 481-8998 E mail: geop@subsurfacesurveys.com

June 21, 2001

LEIGHTON & ASSOCIATES, Inc.
31344 Via Colinas, Suite 102
Westlake Village, CA 91362-6793

Attn: **Andy Hillstrand**
Garreth Mills

re: Seismic refraction inv., Mountaingate, Santa Monica Hills

This brief letter report is to present the findings of a seismic refraction survey carried out over ridge tops south of Mountaingate Drive in the Santa Monica Hills in Los Angeles, California (Fig.1) on May 31, June 1, 2001. Purpose of the survey was to determine the nature of the bedrock, depths to layer boundaries, and estimate rippability. Refraction shooting was carried out in two localities a short distance apart along graded ridge lines in the vicinity of Mountaingate Country Club. The survey consists of nine lines consisting of 14 discrete spreads. Line 1 is a composite of 6 spreads, shot back-to-back All other lines consist of single spreads.

A Bison 9024, 24 channel seismograph system, was applied to the task. This instrument has DIFP, digital instantaneous floating point. This translates into a computer-controlled seismograph that records incoming signals at all instrument settings, and these are analyzed by the computer, which then outputs optimum, balanced traces with maximum informational content.

The site is on graded terrain along a mountain ridge. Steep walled canyons define the edges of the flattened ridge tops. The more easterly site is on Jurassic/Triassic metamorphic rocks, dominantly on the Jurassic Santa Monica Slates. The slaty cleavage facilitates landsliding, and such landslide masses are fairly common locally. The more westerly site is on an apparent thin veneer of Upper Miocene Modello Formation . The latter unit is, locally, hard indurated sandstone.

Survey Design – The Line Location Map (Fig. 2) shows the positions and layout directions of the nine refraction lines. The layout was designed for coverage where building pads are planned. Line 1 is dominantly along the ridge line road. Lines 2, 3 & 4 are cross lines to the long line 1. The grading off of the ridge top has generally exposed bedrock at the surface, creating some difficulty in planting the geophones. Also, unweathered bedrock has generally been brought nearer the surface by the removal of native materials on the ridges. Lines 5 through 9, at the more westerly site, are along a narrower ridge top, and the lines are mostly along rim edges.

Except for line 6, geophone interval was 10 feet on all lines; consequently, spread lengths were 250 feet, measured from off end shot to far offset geophone. Shots were also 10 feet from near offset geophones. In addition to the two forward and reverse off end shots, a split spread shot

SITE LOCATION MAP

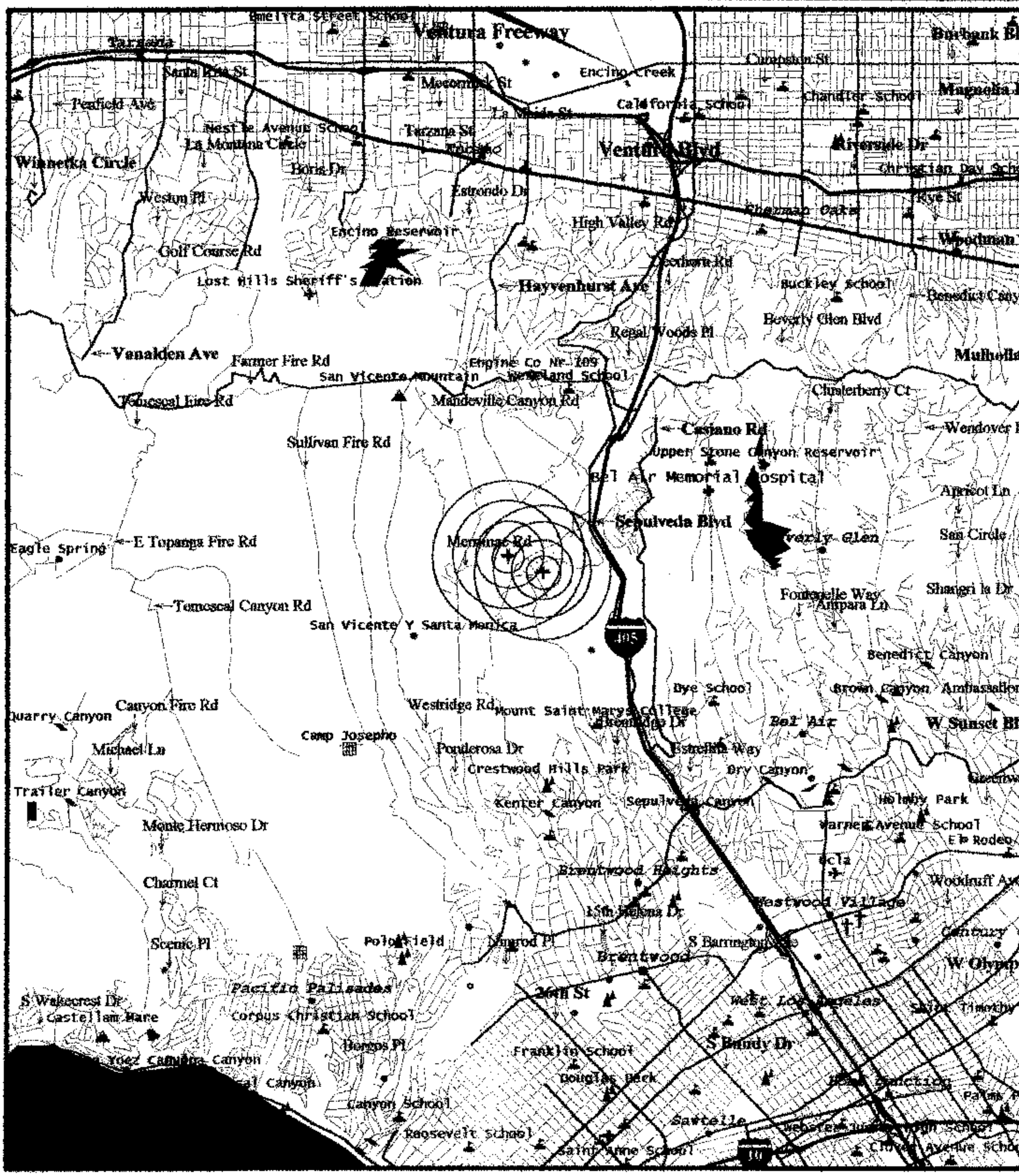


FIGURE 1

was fired between geophones 12 and 13. The geophone gap at this mid split spread shot was 20 feet to accommodate the shot. In order to provide greater detail, two non-symmetrical split spread shots were also fired between geophones 6 and 7, and 18 and 19. Geophone interval for line 6 was eight feet, and off end shots were eight feet from near offset geophones. The fore-shortened line 6 was necessary owing to space limitations on the graded top of the ridge. As aforementioned, line 1 is made up of six back-to-back spreads. There was a one geophone overlap of adjacent spreads to assure complete subsurface coverage. These spreads match well at their common overlaps, as they should; consequently, they may be combined into a continuous 1450 foot long line for display, if needed. The layout arrangement permitted an investigation to depths of approximately 75 feet, but about 60 feet under line 6.

Source was a heavy duty sledge hammer with an inertial switch. The hammer was slammed onto a metal plate that was coupled to the ground. Because of the relatively short spreads, the sledge hammer source was entirely adequate. Strong energy arrivals were not recorded at the far offset geophones owing to the low transmisivity in the sheared and cleaved bedrock. Vertical stacking was carried out to build energy and to serve as a "noise" abatement strategy. Still, with a computer "picking" program that has zoom, filtering, gain, trace isolation and balancing, and other features, there was no difficulty in picking any of the lines.

Elevations of all shot and geophone positions were surveyed in, and then input into the modeling program. Elevation of the forward shot point was arbitrarily taken to be zero feet, and then all other elevations along the given line were relative to the assumed value at the forward shot point. The contoured base map (see Fig. 2) was referenced to absolute elevation control, and by registering the lines to the detailed topographic map, relative elevations were converted to absolute elevations. Stakes were planted in the ground at the positions of the off end shots.

Brief Description of the Geophysical Method Applied – Seismic refraction investigates the subsurface by generating arrival time and offset distance information to determine the path and velocity of an elastic disturbance in the ground. The disturbance is created by shot, hammer, weight drop, or some comparable method for putting impulsive energy into the ground. Detectors are laid out at regular intervals in a line to measure the first arrival energy and the time of its arrival. The data are plotted in time-distance graphs, from which velocity of, and depth to, layers can be calculated. This is possible because rays (a continuum point on an expanding wave front) of the disturbance wave follows a direct route and is the first arrival energy at the close-in geophones. And the rays are refracted across layer boundaries where there is a difference in elastic and density properties. The critically refracted ray travels along the layer interface, at the speed of the lower layer, and continuously "feeds" energy back to the surface, to be successively detected by the line of geophones.

Shot are normally reversed from one end of the line to the other, to determine whether or not the layering is horizontal or dipping. And the split spread shot gives redundancy to improve the interpretation. The acquired data are computationally int ense. A ray-tracing computer program, SIPT2 in this instance, is used to iteratively honor all refracting surfaces, velocities, and to be able to consider a large number of layers, where they are present. A first energy arrival picking program, with such features as zoom, filtering, time stretching, separation of traces, AGC and balancing of traces, is also applied.

An independent approach to the analysis of seismic refraction data was applied to several of the spreads. It is referred to as the "Optimized Velocity Model", wherein the subsurface is mapped in terms of velocity classes. It is apparent that highest velocities are associated with the mechanically strongest rocks. The boundaries between velocity classes are determined as the least squares minimum velocity variation for all paths that converge at an array of points, each determined independently in turn. These displays, when compared to the "traditional" seismic sections, strengthen confidence in the interpretation when they converge to a common solution.

Interpretation – Monitor records are produced in the field with each shot (Fig. 3). These are prints of the raw data as it comes in to the recorder. They show the quality of the data, so that the operator can determine whether or not the data are pickable, or shots need to be repeated. Two representative monitor records are illustrated, a mid split spread shot from line 1, spread 5, and a reverse shot from line 1, spread 2. All arrivals are seen to be readily pickable on these raw records, although wind and traffic noise, is subtly detectable on the far offset traces. Atmospheric conditions were stable on the day of the survey; hence, wind was not an intractable problem. Traffic was relatively far away in an adjoining development.

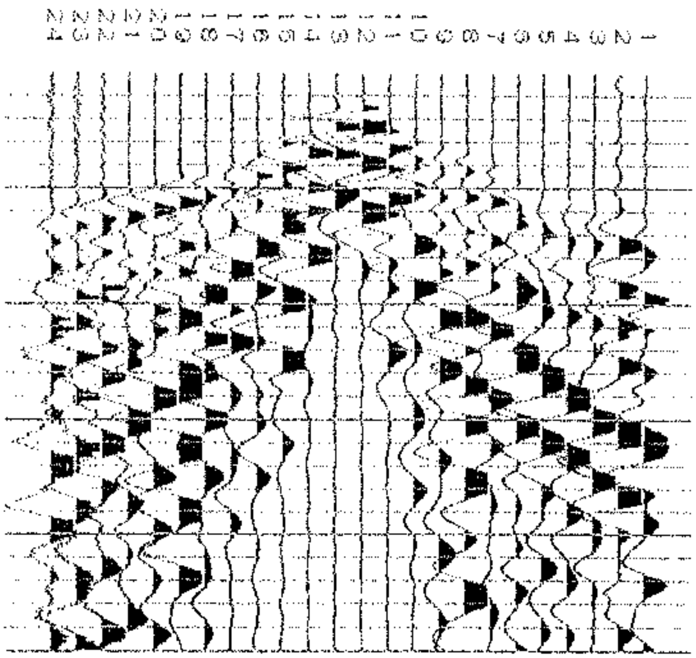
More of the shooting parameters are listed below the monitor records (Fig. 3).

The first pick information, geophone positions, shot locations and geometry of the spreads are input to a routine that produces a time-distance plot (e.g. line 6 data, Fig. 4). The eight curves express the wave arrivals from the five shots, forward, reverse, and three split spreads. The split spreads, however, produce two curves each going in opposite directions. The data, at this location, show slightly irregular plots and a subtly asymmetrical three-layer case, as is apparent from the three generalized straight lines superimposed on the forward curve.

The slight asymmetry and irregularity of the group of curves indicates that the layers are not entirely uniform and horizontal. Minor undulations in the curves, based on the raw data, are, to some extent, explained by the fact that elevation corrections are not yet applied to the data in the time-distance plot. And some of the irregularity is explained by lateral velocity changes. Minor variations in the positions of the "dog-legs" in the several curves are mostly an expression of the laterally changing thickness of the upper layers.

Models were calculated for the four lines (Figs. 5-16). Line 1, with multiple spreads, is displayed in pieces as single or double spreads. All remaining lines are displayed as single lines (spreads). Inasmuch as line 1 runs down the middle of the ridge, where grading has cut deeper into the natural earth, only two layers are depicted. Presumably the surface soil has all been removed. Lines 2 through 9 each show a three layer case. Soil remains on these cross lines, but is generally thin in the middle of the ridge. The topmost layer is interpreted to be soil and colluvium, but this material can be very thick on the outer rim edges of the ridge, due to landsliding and the pushing of layer 1 materials over the edges. It most cases, at least, this thickness is due to the inclusion of landslide masses, for example on the southwest end of line 3. Average velocity of the top layer is in the order of 1535 ft/sec, but varies from 1178 to 2422 ft/sec. This large variation is not surprising inasmuch as several types of materials are lumped into layer 1. Layer boundaries tend to mimic topography, and especially so when the original topographic profile is considered. This is to be expected when weathering processes play a significant role in the development of boundaries.

The second layer (or the first layer in the line 1 models where layer 1 materials have been removed) has an average thickness, where sampled, of approximately 20 feet, but to a small extent locally, even layer 2 has been modified by grading. Fracturing, relief, facing slope,



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Delay(ms) DFhc Out
Channels 24 DFnt Out
Samples 500 DFbp Out
Rec len 250ms Agc Off
Time scale = 10 (ms)/division.

PCH	GN	STK	EX	PCH	GN	STK	EX
+ 01	M	0003	07	+ 13	M	0003	15
+ 02	M	0003	06	+ 14	M	0003	14
+ 03	M	0003	08	+ 15	M	0003	12
+ 04	M	0003	09	+ 16	M	0003	12
+ 05	M	0003	09	+ 17	M	0003	12
+ 06	M	0003	09	+ 18	M	0003	11
+ 07	M	0003	10	+ 19	M	0003	09
+ 08	M	0003	10	+ 20	M	0003	09
+ 09	M	0003	12	+ 21	M	0003	08
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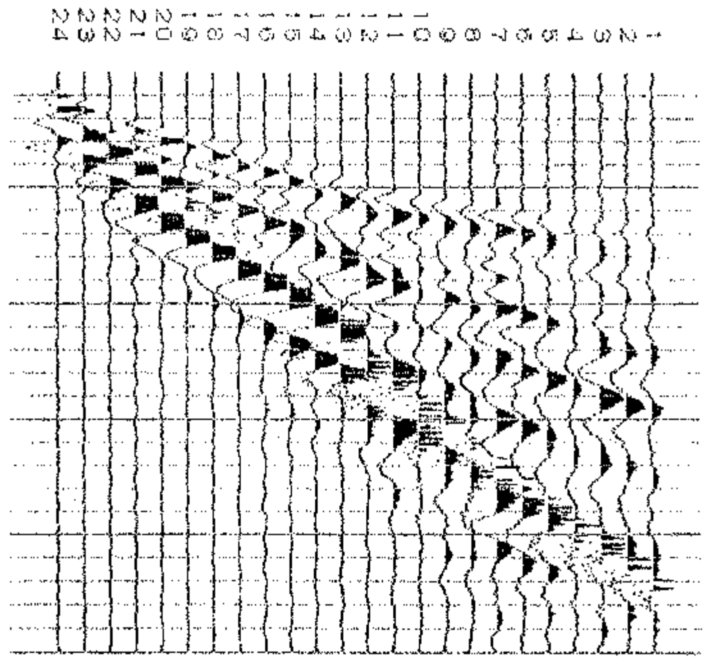
+ 11	M	0003	14	+ 23	M	0003	07
+ 12	M	0003	15	+ 24	M	0003	07



BISON 9000 SERIES

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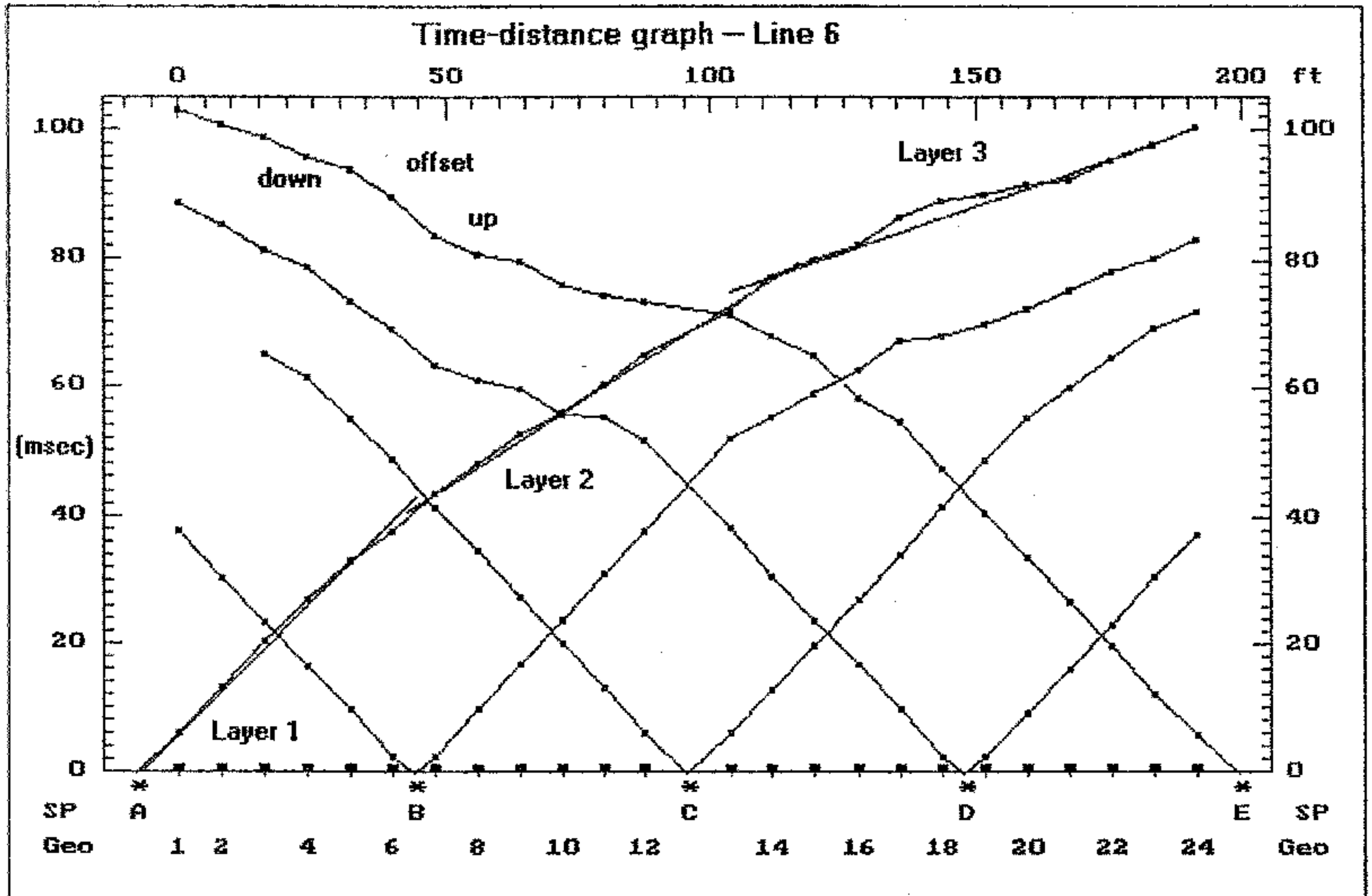
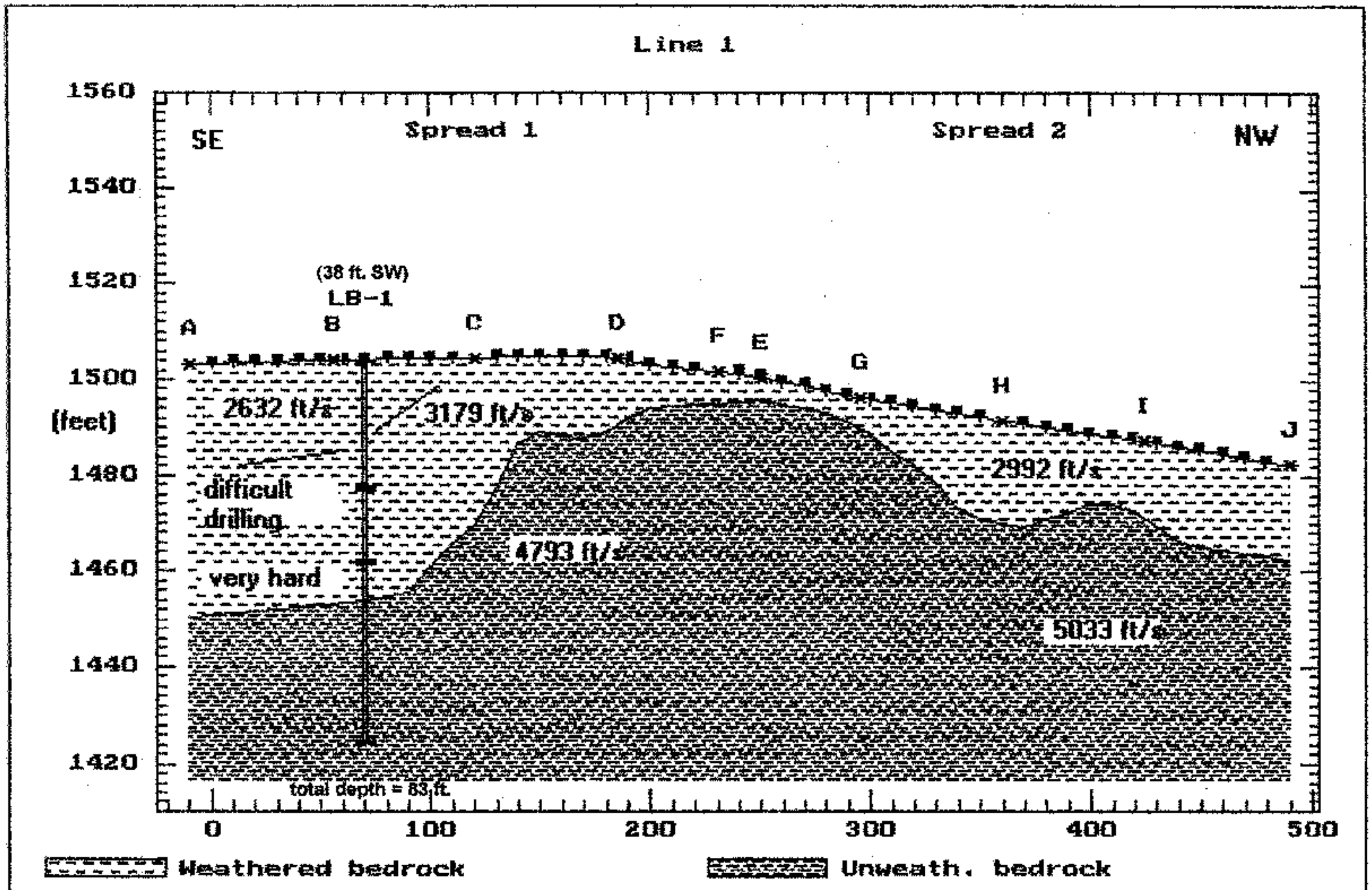
Delay(ms) DFhc Out
Channels 24 DFnt Out
Samples 500 DFbp Out
Rec len 250ms Agc Off
Time scale = 10 (ms)/division.

PCH	GN	STK	EX	PCH	GN	STK	EX
+ 01	M	0002	05	+ 13	M	0002	07
+ 02	M	0002	05	+ 14	M	0002	08
+ 03	M	0002	05	+ 15	M	0002	08
+ 04	M	0002	06	+ 16	M	0002	08
+ 05	M	0002	05	+ 17	M	0002	09
+ 06	M	0002	05	+ 18	M	0002	09
+ 07	M	0002	05	+ 19	M	0002	10
+ 08	M	0002	06	+ 20	M	0002	10
+ 09	M	0002	06	+ 21	M	0002	11
+ 10	M	0002	07	+ 22	M	0002	12
+ 11	M	0002	06	+ 23	M	0002	13
+ 12	M	0002	07	+ 24	M	0002	15

FIGURE 3

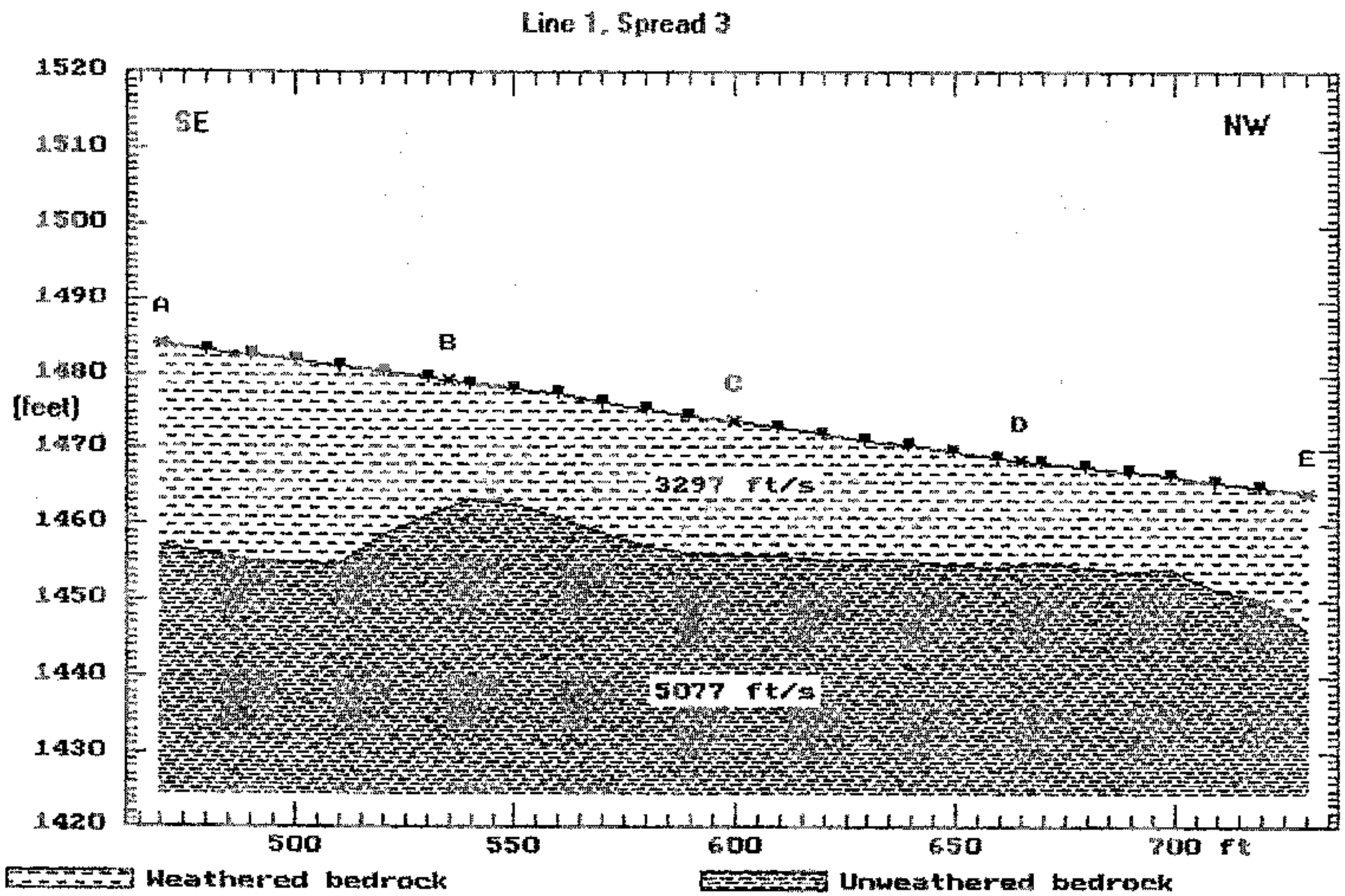


Seismic Refraction Survey 6/1/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 4

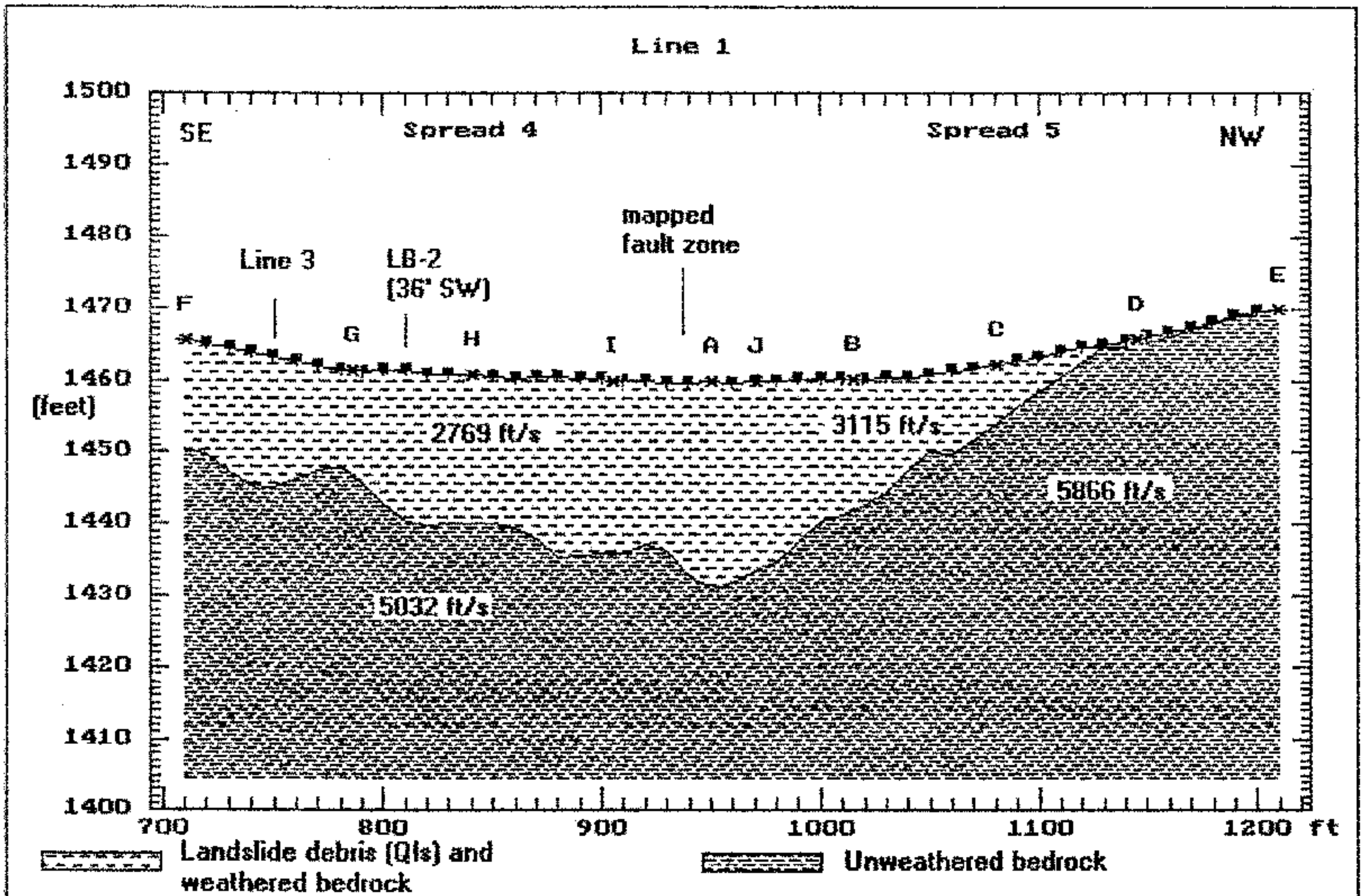


Seismic Refraction Survey 5/31/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California

FIGURE 5

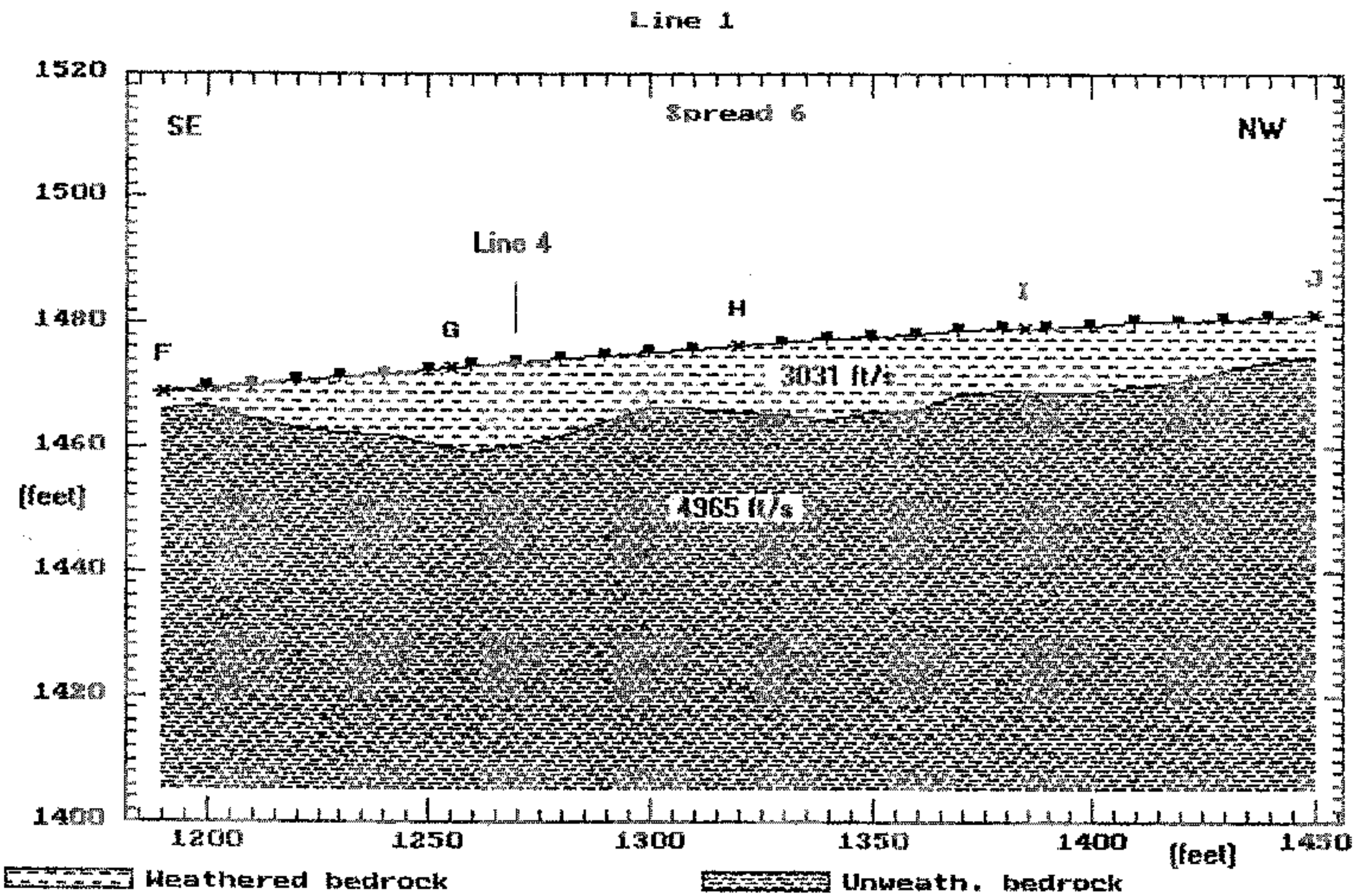


Seismic Refraction Survey 5/31/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 6

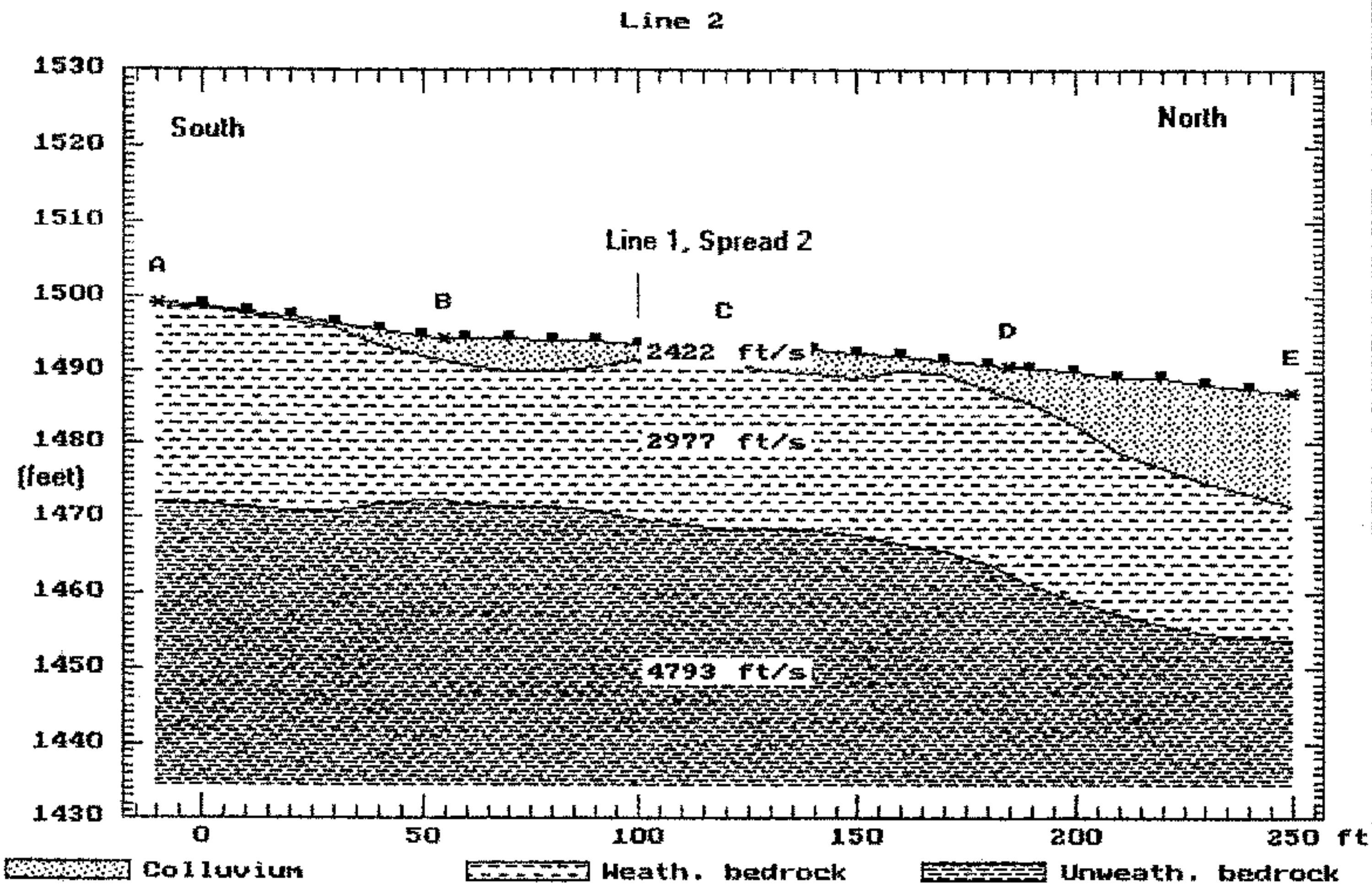


Seismic Refraction Survey 5/31/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California

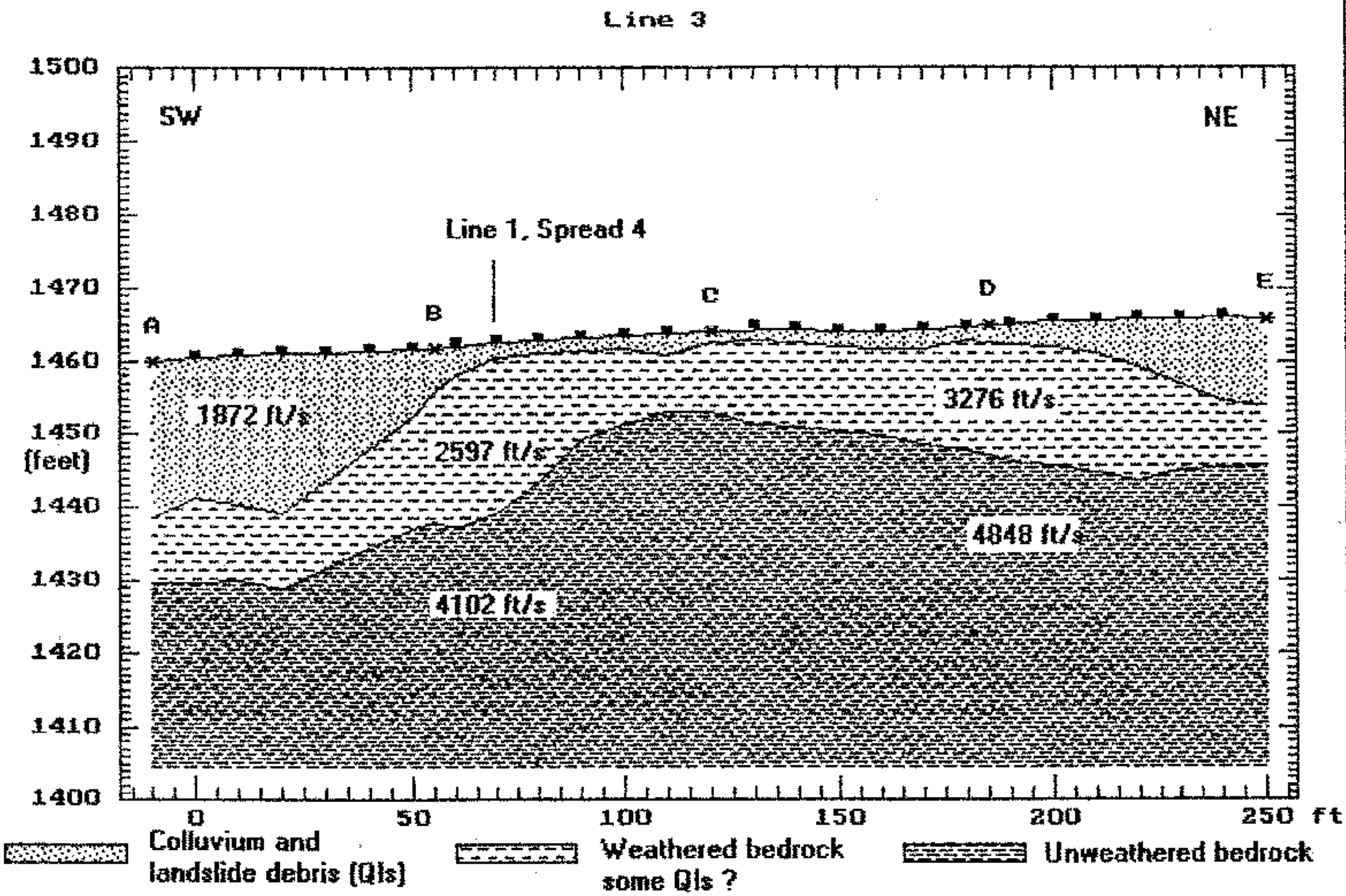
FIGURE 7



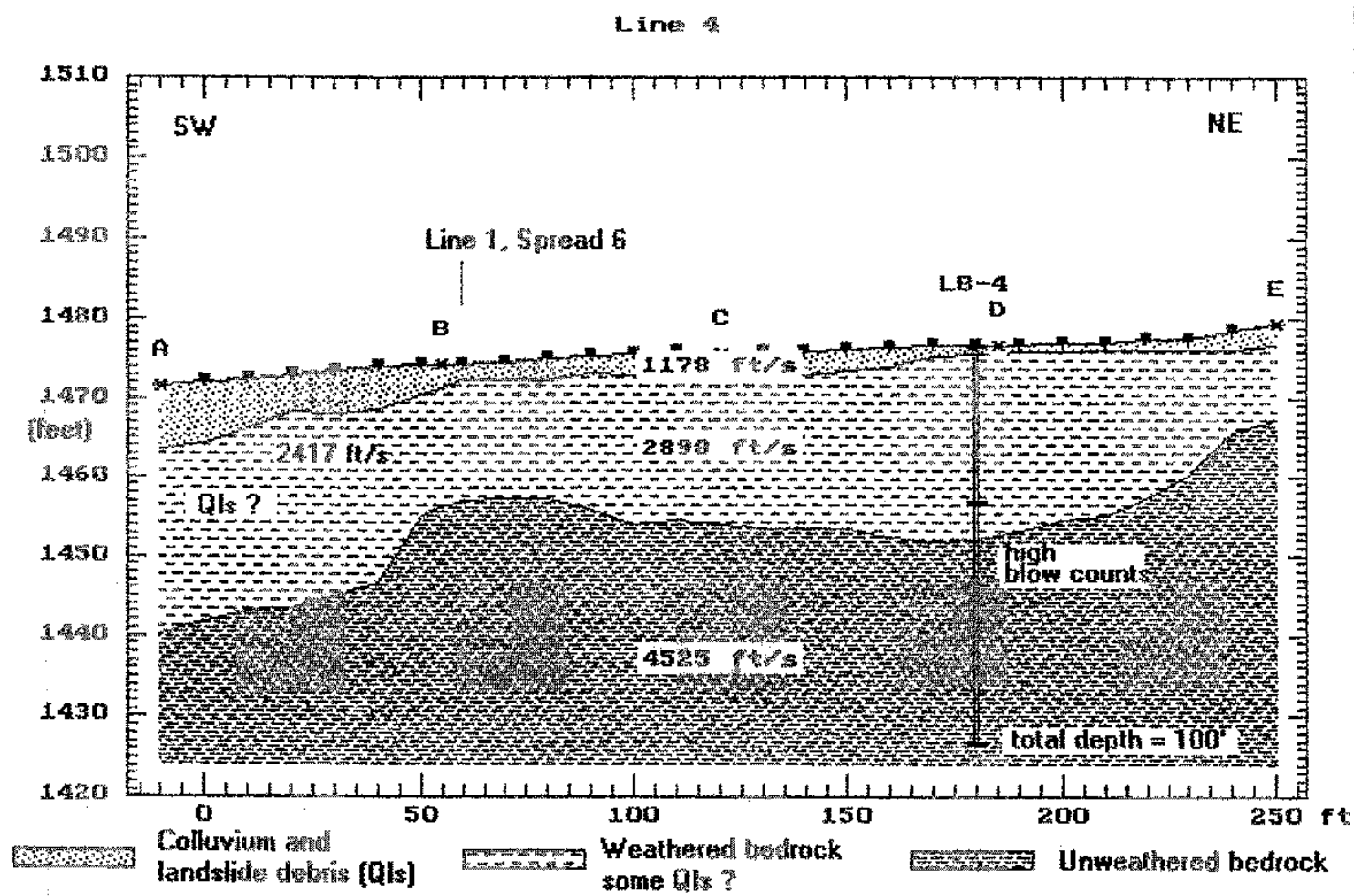
Seismic Refraction Survey 5/31/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 8



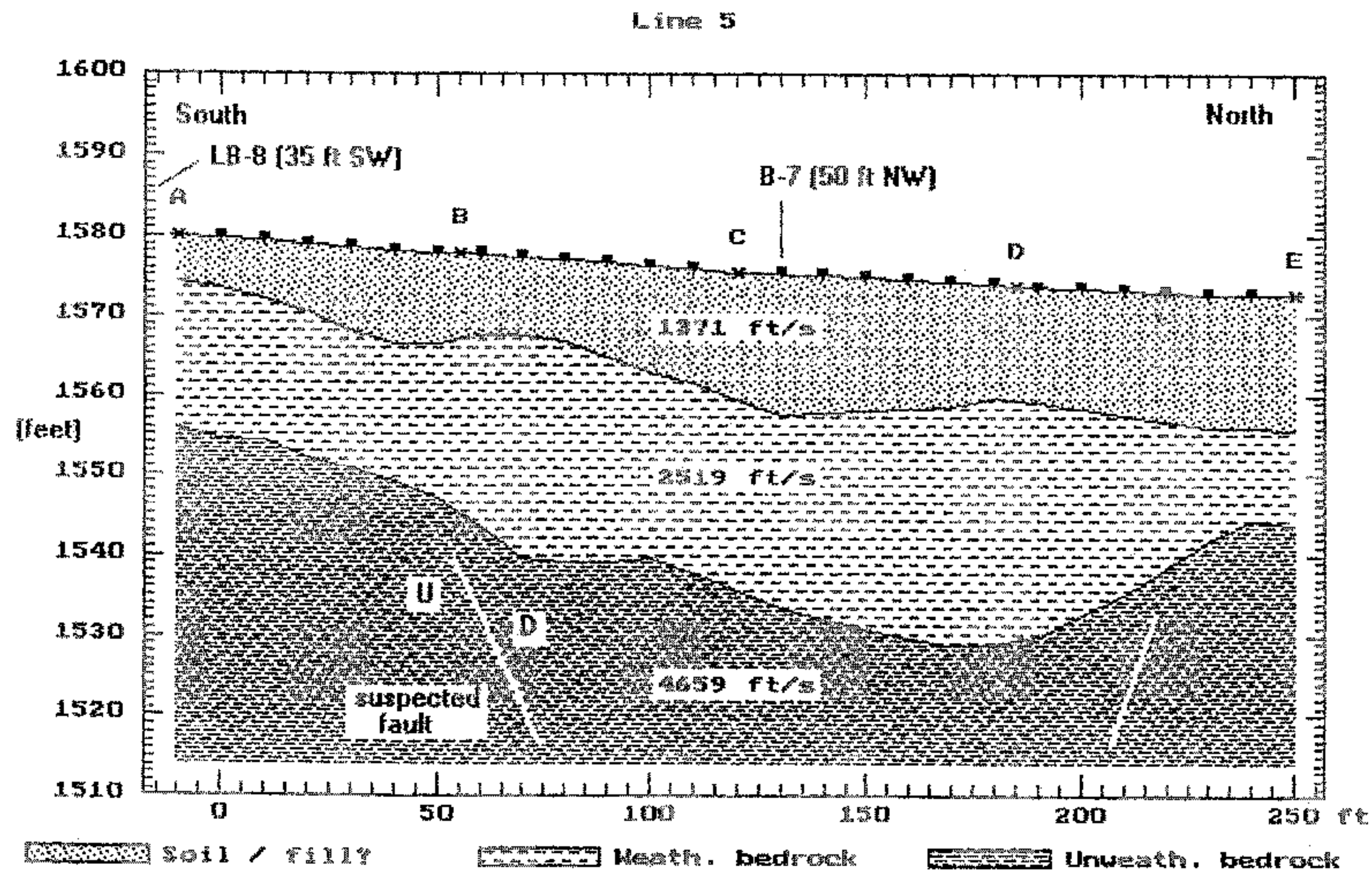
Seismic Refraction Survey 5/31/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 9



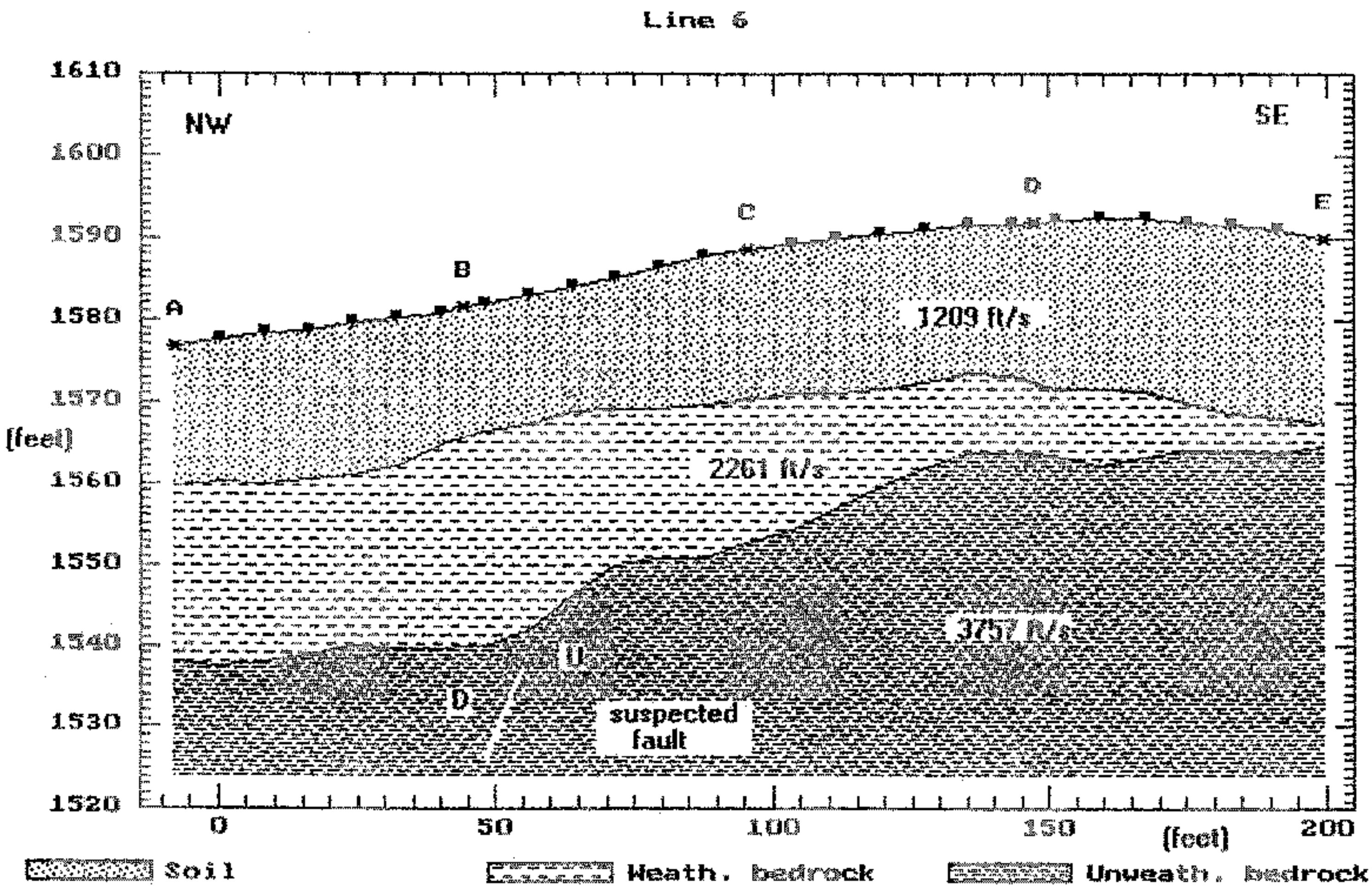
Seismic Refraction Survey 5/31/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 10



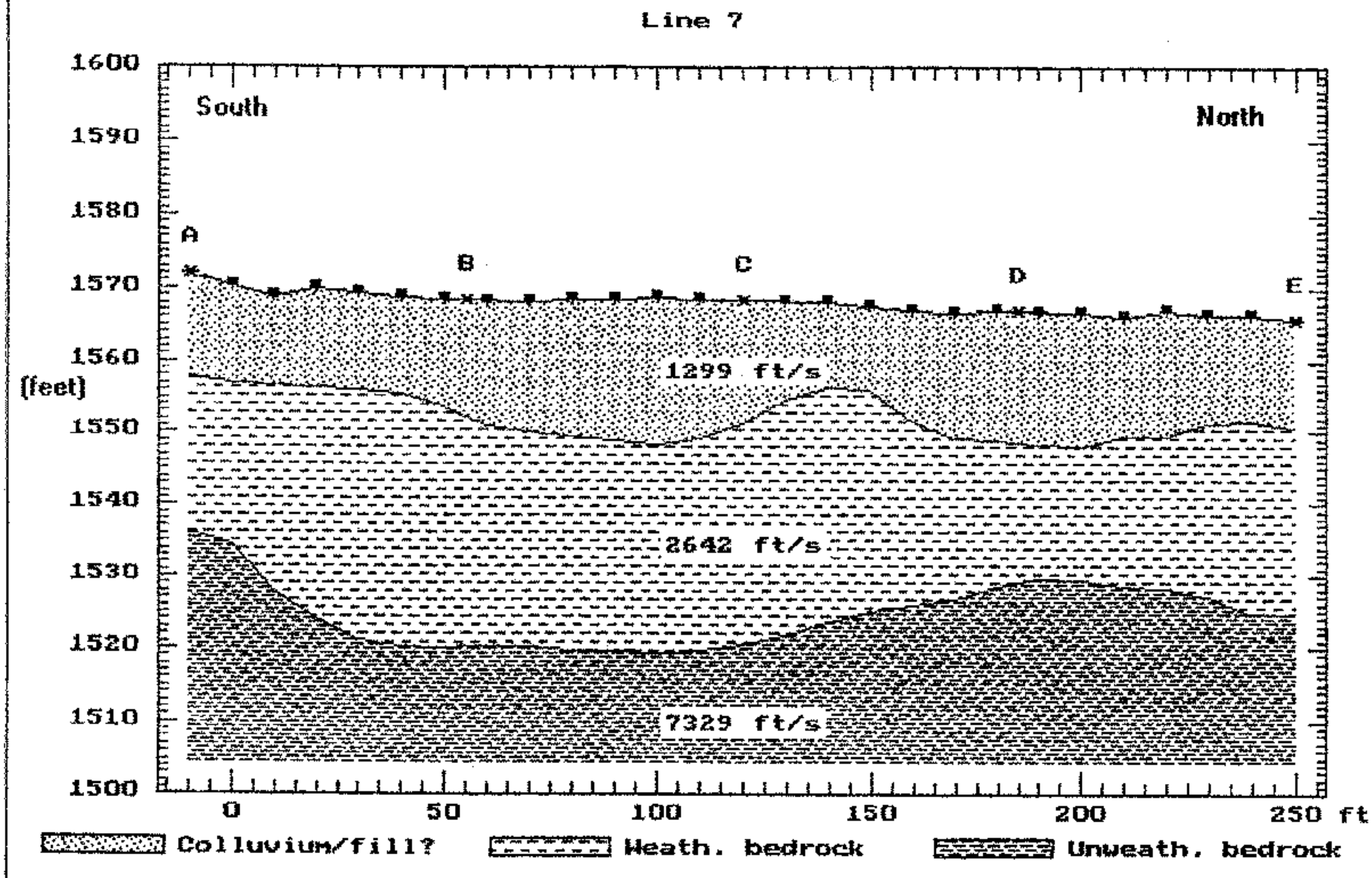
Seismic Refraction Survey 5/31/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE !!



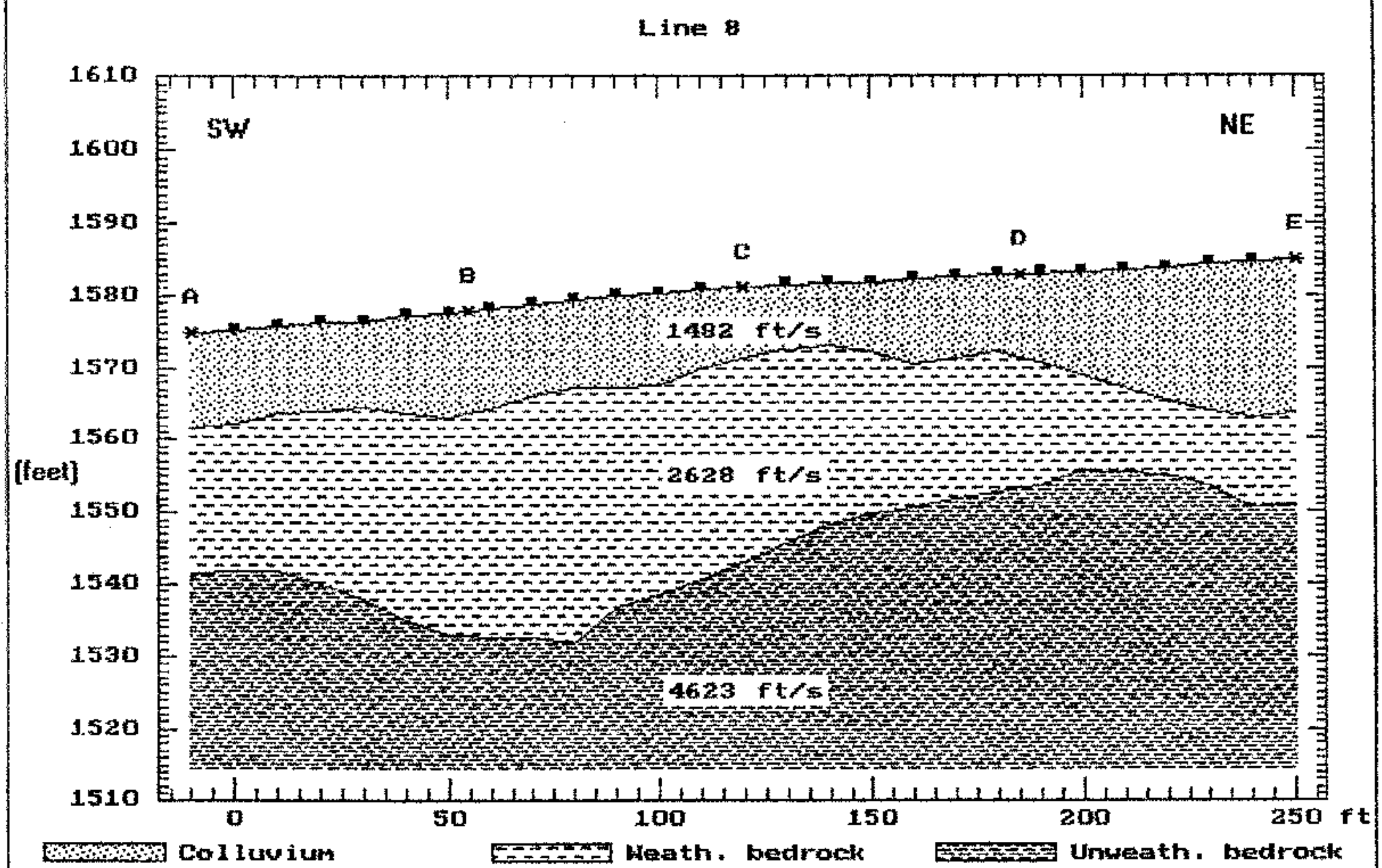
Seismic Refraction Survey 6/1/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 12



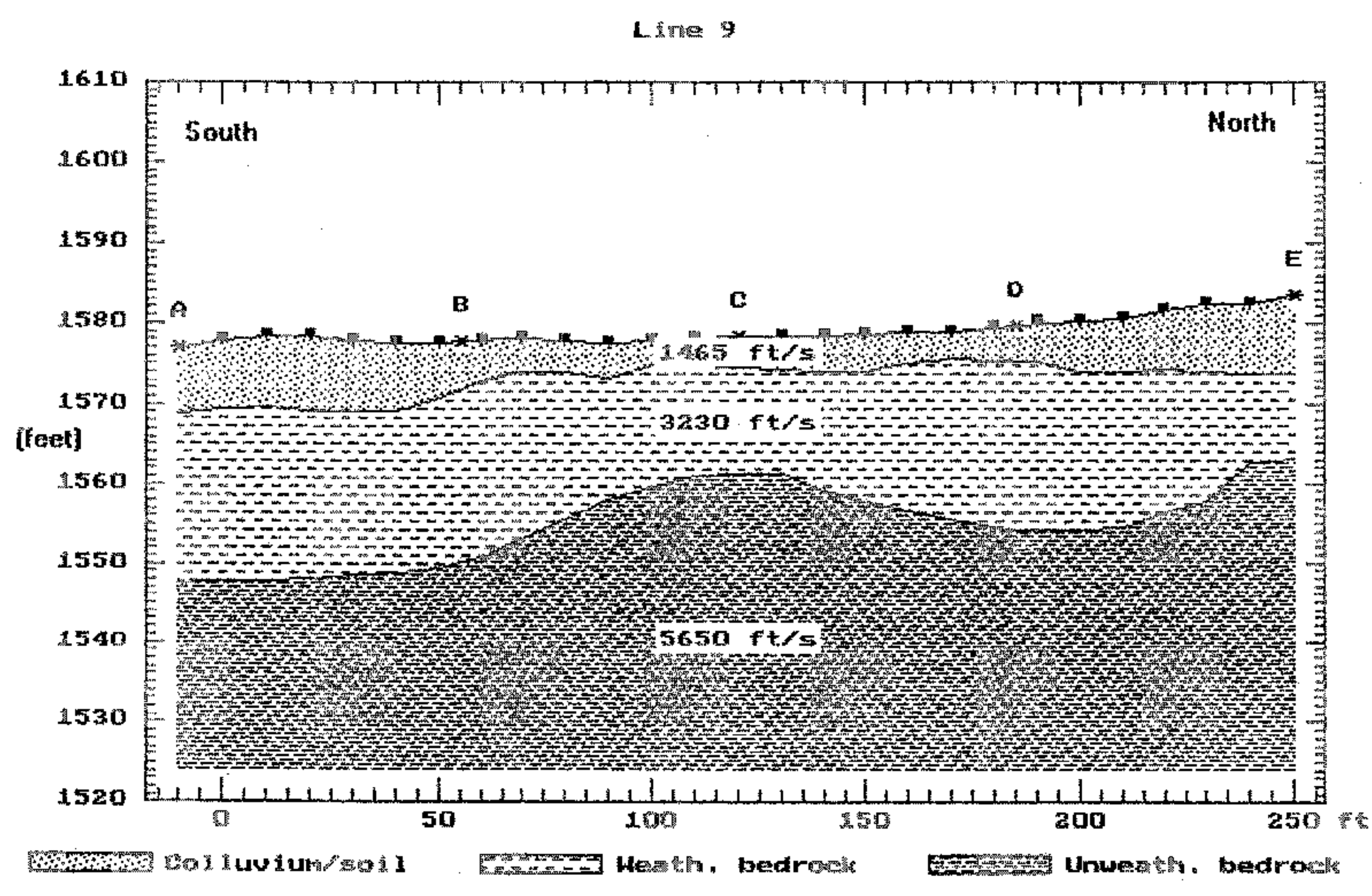
Seismic Refraction Survey 6/1/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 13



Seismic Refraction Survey 6/1/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 14



Seismic Refraction Survey 6/1/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 15



Seismic Refraction Survey 6/1/01	Mountaingate, Tract 53072
Project No. 03-0381-001	Los Angeles, California FIGURE 16

vegetation, lithology and other factors all contribute to variability of weathering. Fracturing is usually a major factor in that fracture zones admit air and water to deeper levels. Average velocity of layer 2 is 2865 ft/sec, with relatively low variation.

A third layer is continuous downward to, and probably significantly beyond, the depth of investigation, which is approximately 75 feet. Velocity of this material is in the order of 4305 ft/sec, with a range of 3760 to 7330 ft/sec. It is highly probable that the geologic interpretations of the topmost and lowest layers detected are correct; that is, the top layer is soil/colluvium and the deepest layer is metamorphosed crystalline rocks. It follows, therefore, that the middle layer is a weathered version of the third layer. The extra split spread shots made possible the local determination of velocities, and several velocity values are plotted on some models, which shows some lateral variation.

The "Optimized Velocity Models" were prepared for critical locations (Figs. 17-20). They can be compared to the "traditional" (black and white) models. The Optimized model of line 1, spread 1, can, for example, be compared to the left half of figure 5. Drill hole LB-1 occurs 38 feet southwest of the line. Because of this offset the boundaries in the bore do not fit the model very well, as might be expected in this high relief terrain. The high elevation block with a relatively high seismic velocity is faithfully depicted in both models. The trace of a high angle fault crosses line 1 beneath spread 5 near its conjunction with spread 4. There is a depressed locale in the 'traditional" model at this position (presumably due to deeper weathering where there is greater access for air and water), and there is a clear vertical low velocity locale in the "Optimized" model in the same place (see Figs. 7 and 18). The detailed shape of the subsurface boundaries are faithfully mimicked from one model to the other ("Optimized" to traditional, Figs. 20 to 13). A fault has been mapped at the northwest side of the high subsurface block. This appears to be expressed in both models.

It is clear from the Caterpillar Rippability Chart (Fig. 21) that layers 1 and 2 are rippable everywhere, and layer 3 should be considered rippable with heaviest equipment, but locally perhaps marginally rippable. The slaty cleavage is a favorable factor in the rippability of the Mesozoic metamorphic rocks. The Caterpillar Chart is empirical, but is based on thousands of samples of velocity vs rippability in terms of performance of various sized Cats. The chart illustrated is for a D9 Caterpillar.

Two representative photographs illustrate the terrain and the geology to some extent (Figs 22-23). The first photo (Fig. 22) is looking northwest along the long line 1. The grading of the ridge top is clearly depicted; the layer 2 rocks are seen at the surface; and the cross fault trace is seen to be coincident with the narrow spot in the ridge line (beyond the truck).

The second photo (Fig. 23) shows the layouts of lines 5 through 8. (Line 9 is just behind the camera in the foreground to the right. The fault that passes beneath line 6 has a trace that corresponds to the narrowest portion of the ridge top. It will be noted that the flora, mostly oak trees and brush, almost come together where the fault results in narrow a portion of the ridge.

Conclusions – The seismic data appear to indicate that there are three geologic layers present at the sites, namely soil/colluvium (includes landslide loosened materials), weathered metamorphic and Tertiary clastic rocks, and unweathered Jurassic and Tertiary sandstones rocks). The Jurassic slates have fissility, and this feature is expressed by relatively low seismic velocities. All three layers are shown to be rippable, although locally, heaviest equipment will be required, if cuts go

Seismic Refraction Survey
Project No. 03-0381-001
Recorded May 31, 2001

Mountaingate, Tract 53072
Los Angeles, California

Optimized Velocity Model - Line 1, Spread 1

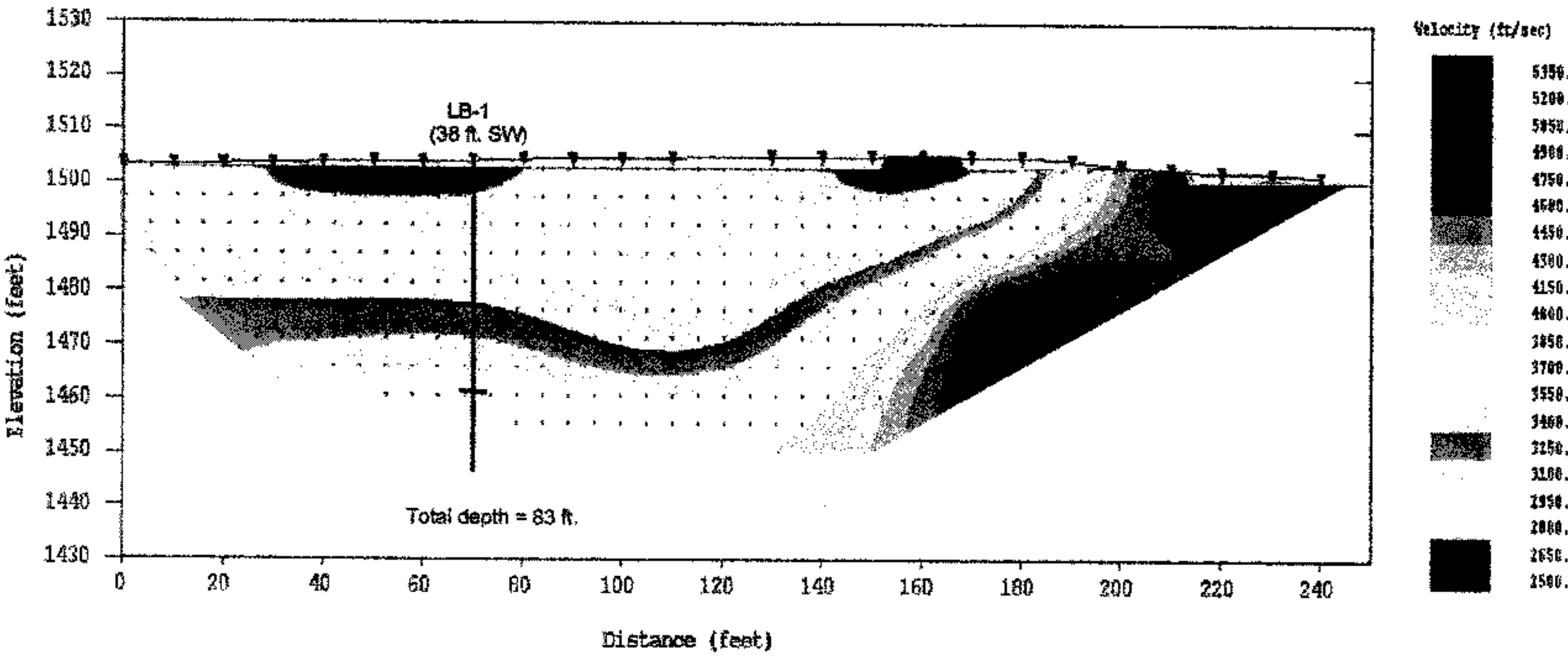


FIGURE 17

Seismic Refraction Survey
Project No. 03-0381-001
Recorded June 1, 2001

Mountaingate, Tract 53072
Los Angeles, California

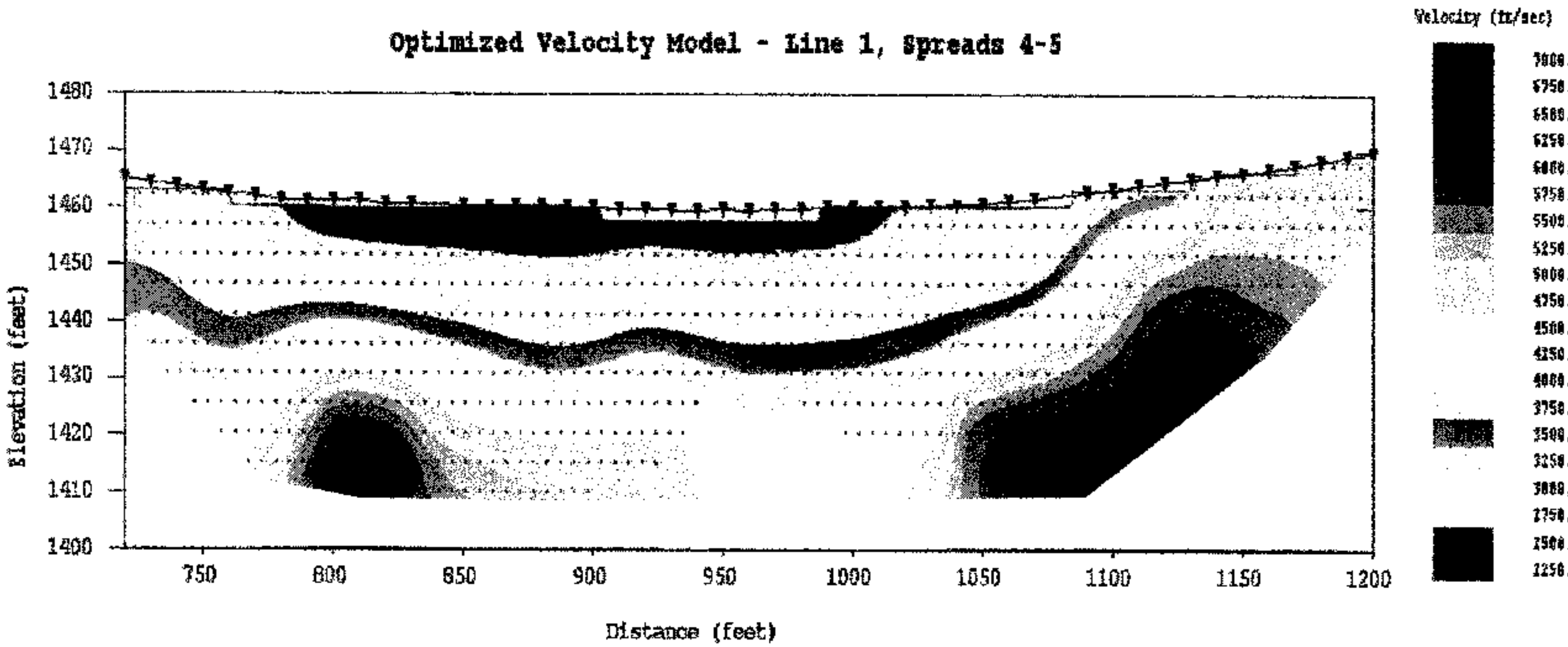


FIGURE 18

Seismic Refraction Survey
Project No. 03-0381-001
Recorded June 1, 2001

Mountaingate, Tract 53072
Los Angeles, California

Optimized Velocity Model - Line 5

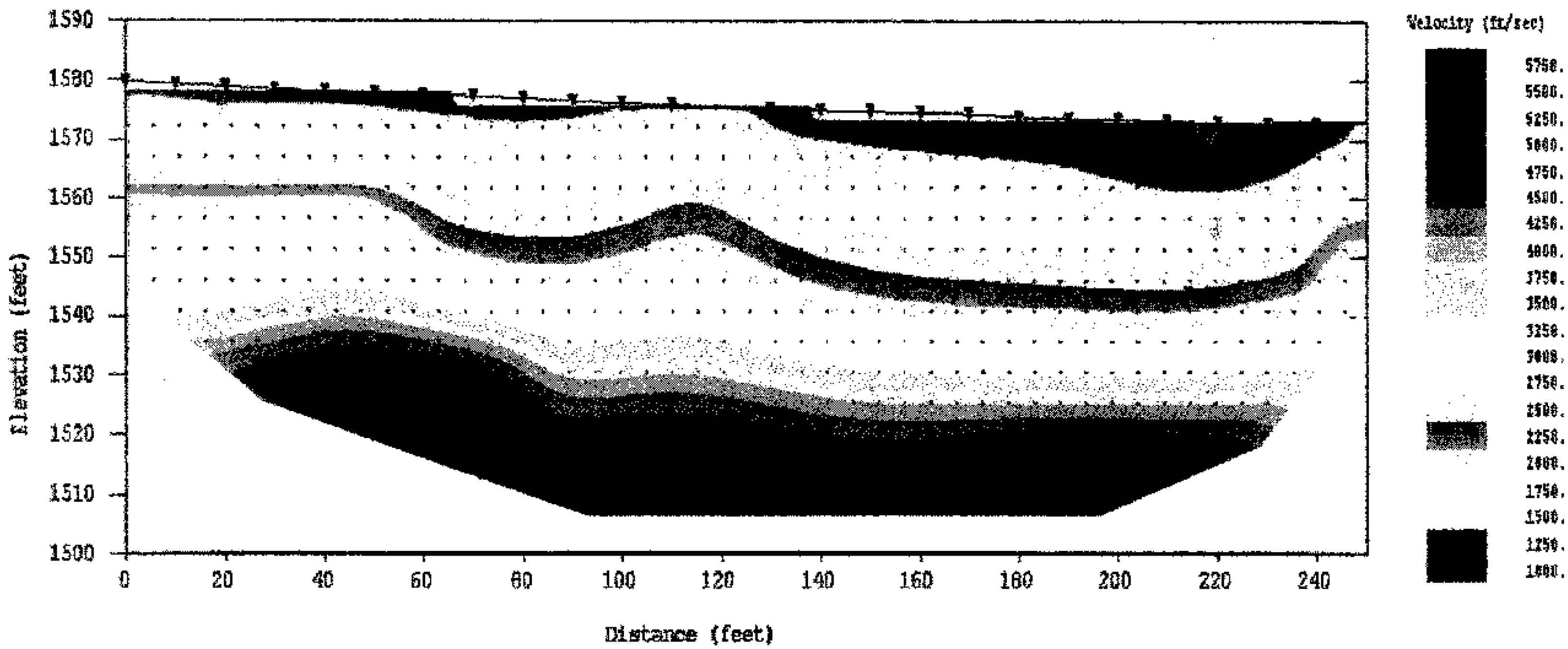


FIGURE 19

Seismic Refraction Survey
Project No. 03-0301-001
Recorded June 1, 2001

Mountaingate
Los Angeles, California

Optimized Velocity Model - Line 6

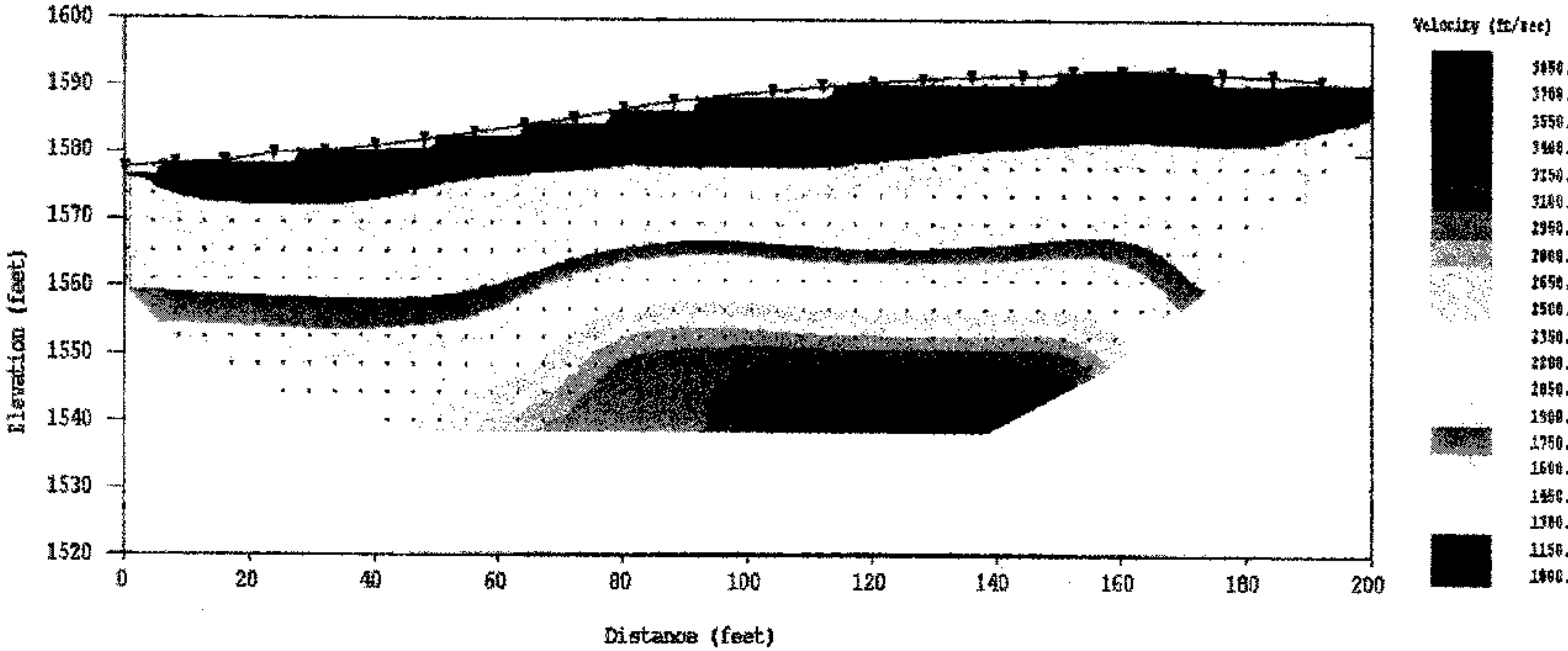


FIGURE 20

Site Photographs
Mountaingate Seismic Survey

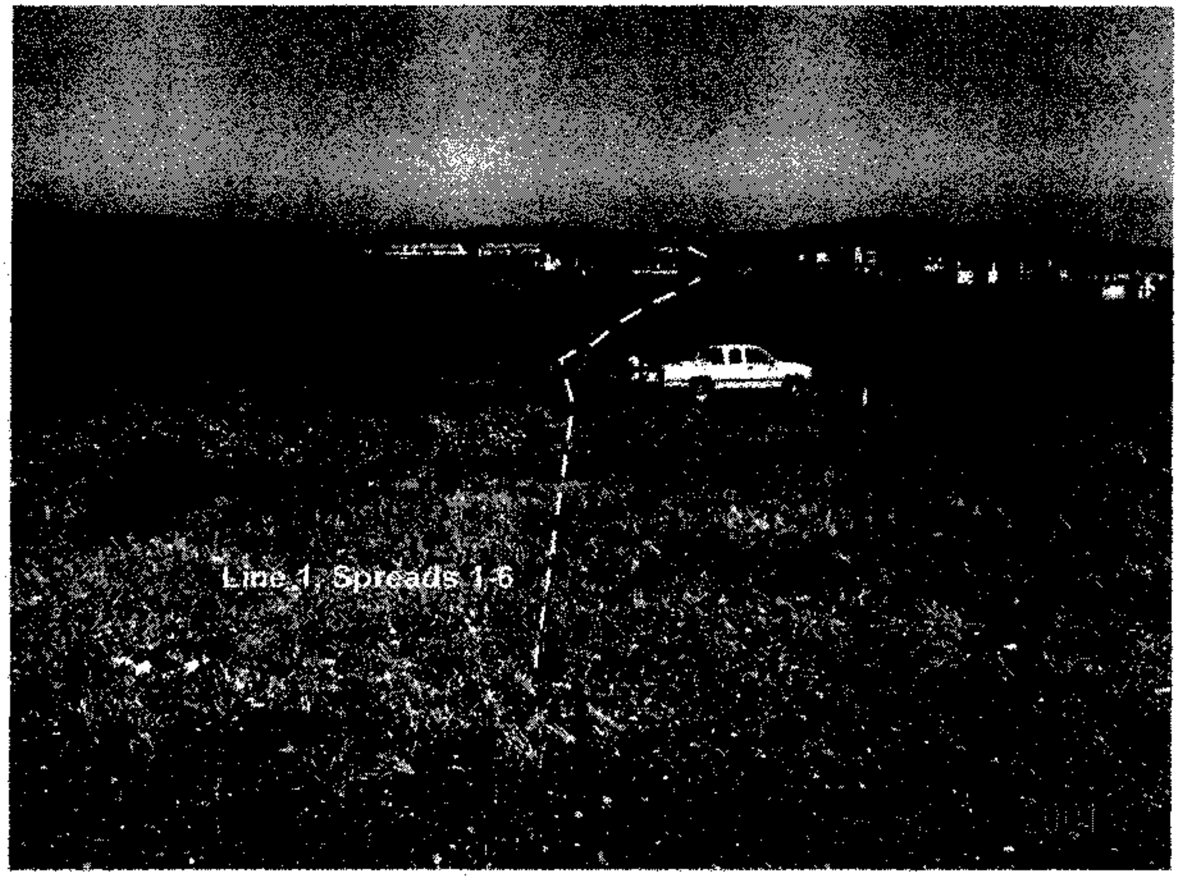


FIGURE 22

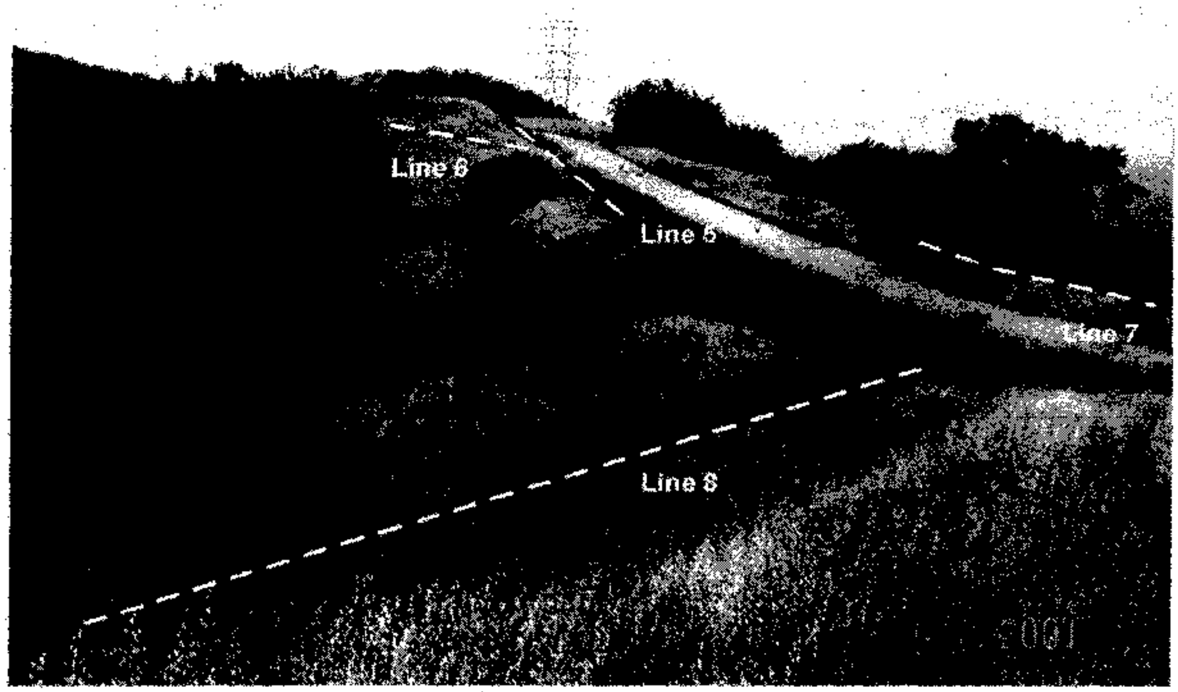


FIGURE 23

into the unweathered layer. The seismic data appears to confirm the presence of three faults that have been mapped in the areas of the two sites.

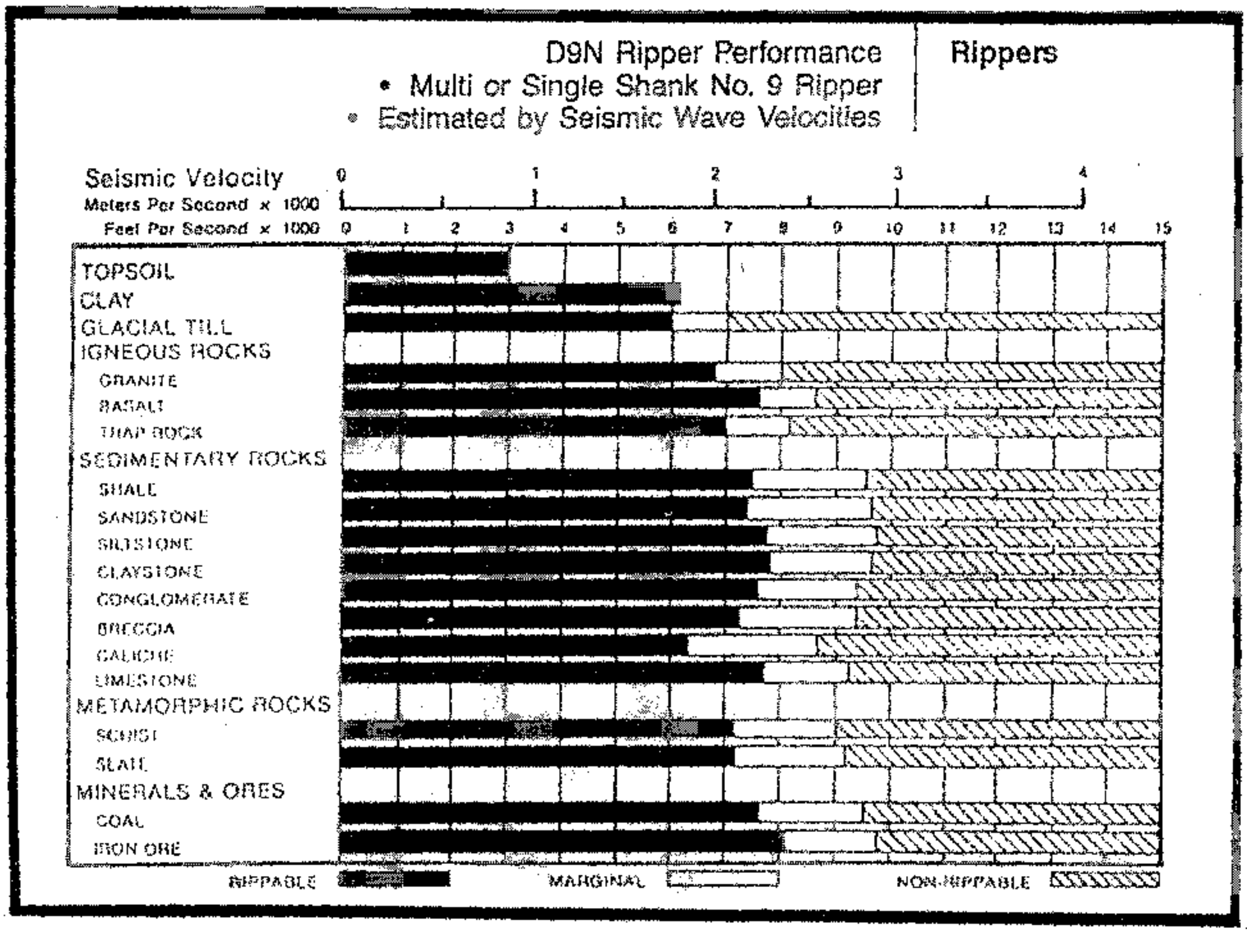


Figure 21. Caterpillar rippability chart

All data acquired in this project are in confidential file in the office. They are available for review by authorized persons at any time. The opportunity to participate in this project is very much appreciated. Please call, if there are questions.

Gary W. Crosby

Gary W. Crosby, PhD, GP 960

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August 30, 2002

Leighton and Associates
31344 Via Colinas, Suite 102
Westlake Village, CA 91362

Attn: Jose Sanchez

Re: Revised Report, Seismic Investigation, Mountaingate, Santa Monica Hills

This brief letter report is to present the findings of a seismic refraction survey carried out over several ridge tops, one south of Canyonback Road (Survey Area 1, Fig. 1) and the other south of Stoney Hill Road (Survey Area 2, Fig. 1), both located in the Santa Monica Hills north of Los Angeles, California on August 5-8, 2002. Purpose of the survey was to determine the orientation, extent, and thickness of multiple slumps and landslides. The survey included five lines consisting of 12 discrete spreads. Line 2 was a composite of 4 spreads, shot back-to-back. Lines 3 and 4 consisted of 3 spreads. Lines 1 and 5 consisted of a single spread each. In addition, an electrical resistivity survey was attempted consisting of one short line coincidental with the latter 1/3 of seismic Line 2. Its results were of limited usefulness at this particular site, although the data is presented here.

A Bison 9024, 24 channel seismograph system, was applied to the task. This instrument has DIFP, digital instantaneous floating point. This translates into a computer-controlled seismograph that records incoming signals at all instrument settings, and these are analyzed by the computer, which then outputs optimum, balanced traces with maximum informational content.

The site was on sloped terrain on the west side of both mountain ridges. Steep walled canyons define the edges of the flattened ridge tops. The more easterly site is on Jurassic/Triassic metamorphic rocks, primarily of the Jurassic Santa Monica Slate. The slaty cleavage facilitates landsliding, and such landslide masses are fairly common locally. The more westerly site has an apparent thin veneer of Upper Miocene Modello Formation over the slate. The Modello Formation is a hard indurated sandstone.

Survey Design – The line location maps for Survey Area 1 (Fig. 2) and Survey Area 2 (Fig. 3) shows the positions and layout directions of the five refraction lines and the single resistivity line. Lines associated with a previous survey performed on May 31, 2001 are also shown. The results of that survey were issued to Andy Hillstand and Garreth Mills of Leighton and Associates in a report dated June 21, 2001. The layout for this second phase of work was designed to obtain coverage where borings and test wells have suggested the existence of slumps and landslides. Seismic Lines 2 and 4 and Resistivity Line 1 run primarily parallel with the ridgeline at an approximate constant elevation. Seismic Lines 1, 3, and 5 traverse upslope to one degree or another, perpendicular to the ridge axis.

Except for Line 5, geophone interval was 15 feet on all lines, and, consequently, spread lengths were 345 feet. Off end shots were 10 feet from end geophones. In addition to the two forward and reverse off end shots, a split spread shot was fired between geophones 12 and 13. In order to provide greater detail, two non-symmetrical split spread shots were also fired between geophones 6 and 7, and 18 and 19. Geophone interval for Line 5 was 20 feet, and 10 foot off end shots, and symmetrical and non-symmetrical split spread shots were also utilized. The lengthening of Line 5 was necessary owing to time constraints and to minimize the difficulty of working on extreme slopes. As aforementioned, Lines 2-4 were made up of multiple back-to-back spreads. There was a four geophone or greater overlap of adjacent spreads to assure complete subsurface coverage. The layout arrangement permitted an investigation to depths of approximately 60 feet for Line 1 and at least 100 feet for all other lines.

Source was a 16-lbs sledge hammer with an inertial switch. The hammer was slammed onto a metal plate that was coupled to the ground. Strong energy arrivals were not recorded at the far offset geophones owing to the relatively long line lengths, low transmisivity in the sheared and cleaved bedrock, and destructive power line influence near Lines 1-3. Vertical stacking was carried out to build energy and to serve as a "noise" abatement strategy. Still, with a computer "picking" program that has zoom, filtering, gain, trace isolation and balancing, and other features, there was little difficulty in picking any of the lines.

Elevations of all shot and geophone positions were surveyed in, and then input into the modeling program. The elevation of the lowest geophone in each survey area was arbitrarily taken to be zero feet, and then all other elevations for each line within that survey area were taken relative to it. Stakes indicating line and station number (line length) were planted in the ground at the beginning and end of each line, and at intermediate locations for multi-spread lines.

Power lines near Survey Area 1 and extreme terrain in Survey Area 2 prevent the effective use of the resistivity method. A single 275 meter (902 ft) line was attempted in Survey Area 1 in which power line influence damaged all but the first 130 meters (427 ft). This method utilized 56 steel stake electrodes directly connected to the ground and spaced 5 meters (16.4 ft) apart. Its orientation was reverse from that of the seismic lines with line distance 0 meters starting to the north and increasing to the south. The end of Seismic Line 2 (1245 ft) corresponds to a resistivity line length of 35 meters. Like the seismic lines, electrode elevations were measured, and are also relative with zero arbitrarily assigned to the height of electrode one.

The designation number and approximate location of several borings in each survey area are also included on the line location maps. The well data was compared and correlated with that of the seismic, and plotted on the seismic profiles. Note also that the scaling and general positioning on both line location maps are approximate only.

Brief Description of the Geophysical Method Applied – Seismic refraction investigates the subsurface by generating arrival time and offset distance information to determine the path and velocity of an elastic disturbance in the ground. The disturbance is created by shot, hammer, weight drop, or some comparable method for putting impulsive energy into the ground. Detectors are laid out at regular intervals in a line to measure the first arrival energy and the time of its arrival. The data are plotted in time-distance graphs, from which velocity of, and depth to, layers can be calculated. This is possible because rays (a continuum point on an expanding wave front) of the disturbance wave follows a direct route and is the first arrival energy at the close-in geophones. And the rays are refracted across layer boundaries where there is a difference in elastic and density properties. The critically refracted ray travels along the layer interface, at the speed of the lower layer, and continuously "feeds" energy back to the surface, to be successively detected by the line of geophones.

Shot are normally reversed from one end of the line to the other, to determine whether or not the layering is horizontal or dipping. And the split spread shot gives redundancy to improve the interpretation. The acquired data are computationally intense. A ray-tracing computer program, SIPT2 in this instance, is used to iteratively honor all refracting surfaces, velocities, and to be able to consider a large number of layers, where they are present. A first energy arrival picking program, with such features as zoom, filtering, time stretching, separation of traces, AGC and balancing of traces, is also applied.

The 56 electrodes of the STING resistivity system are laid out in a straight line with the aforementioned spacing of 2 and 1 meter. All electrodes are connected to a cable with approximately 60 leads in the cable. With this set up each electrode can be interrogated independently. The computer that automatically schedules the readings interrogates four electrodes at a time, two are designated current electrodes and two are potential electrodes. As the measurements progress, the spacing is automatically increased in order to search successively deeper. The depth at which the current flows in the ground is a function of the spacing between current electrodes. Thus, an array of data points essentially from the surface to the maximum depth of investigation, plot on a vertical plane in the earth that is directly beneath the line. The plot points are contoured to represent the electrical field in the subsurface. If the ground were homogeneous, the contoured structure section would be simple and symmetrical. If there is structure or any kind of boundaries that separate geologic units of varying resistivity, the section will reflect that distribution of geologic entities, and can therefore, be quite irregular.

Interpretation and Conclusions – Monitor records are produced in the field with each shot (Fig. 4). These are prints of the raw data as it comes in to the recorder. They show the quality of the data, so that the operator can determine whether or not the data are pickable, or shots need to be repeated. Two representative monitor records are illustrated, a forward and mid-split-spread shot from Line 2, Spread 1. All arrivals are seen to be readily pickable on these raw records, although power line noise was subtly detectable on the far offset traces. Atmospheric conditions were stable on the day of the survey; hence, wind was not an intractable problem. Traffic and construction noise was a significant problem on Line 5 and the last spread on Line 4, requiring some suspect data to be eliminated from the modeling program.

More of the shooting parameters are listed below the monitor records (Fig. 4).

The first pick information, geophone positions, shot locations and geometry of the spreads are input to a routine that produces a time-distance plot (e.g. Line 2, Spread 1, Fig. 5). The eight curves express the wave arrivals from the five shots, forward, reverse, and three split spreads. The split spreads, however, produce two curves each going in opposite directions. The data, at this location, show slightly irregular plots and a subtly asymmetrical three-layer case, as is apparent from the three generalized straight lines superimposed on the forward curve.

The slight asymmetry and irregularity of the group of curves indicates that the layers are not entirely uniform and horizontal. Minor undulations in the curves, based on the raw data, are, to some extent, explained by the fact that elevation corrections are not yet applied to the data in the time-distance plot. And some of the irregularity is explained by lateral velocity changes. Minor variations in the positions of the "dog-legs" in the several curves are mostly an expression of the laterally changing thickness of the upper layers.

Models were calculated for the five seismic lines (Figs. 6-10), designed to show three layers, the first being a very low velocity surficial layer comprised of soil, colluvium, alluvium, or fill, depending on location. The second layer is interpreted to be slump or landslide debris, and portions of the Modello Formation as seen on Lines 1 and 3. The third layer is the base of the slump or landslide and the top of undisturbed bedrock, understood to be the Santa Monica Slate.

Line 1 (Fig. 6) appears to have imaged the upper portions of a landslide between line distance 0 and 85 ft, in which the interpreted bottom of the slide correlates very well with the boring logs. The fact that Layer 1 thickens considerably here suggest that this package possesses significantly lower velocities than undisturbed ground, as one would expect with slide debris. There is another wedge shaped package that is just starting to be imaged in the far upper right corner of the profile between line distance 285 and 345 ft, and this may be the Modello Formation. Seismic evidence, particularly with Line 3, suggests that the method cannot differentiate between slide debris and the sandstone. Rays traveling along the base of a landslide (or other intermediate velocity material) will jump and travel along the base of the sandstone when encountering the transition. Layer 2 thickens in the middle of the profile. This could be due to the fact that the line was shot along a dirt road built to access boring LB-9, and this event could be caused by thicker road fill. It may also be the very upper portions of an additional slump or slide, although this is difficult to determine using seismic data alone. Note that the velocities of Layer 2 in this area are somewhat higher that those further down the hill, suggesting more competent material.

Layer 2 within the entire left half of Line 2 (Fig. 7) is interpreted to be landslide with the base of the debris correlating very well with well data. The relatively slow velocities shown on the plot would be expected with broken, sheared, and fractured material. A second landslide, between line distance 1040 and 1245 ft, has an unusually high velocity for undeterminable reasons.

Layer 2 in Line 3 (Fig. 8) appears to have imaged both potential landslide material and the Modello Formation for reasons mentioned above. Both well log data for LB-21 (no landslide debris was encountered) and velocity differences suggest that slide material does not continue to the top of the ridge and over the other side. The seismic method appears to lack the ability to distinguish between the two and is assigning both packages as "Layer 2". It should be understood that the upper portion of the ridge is the Modello Formation and not landslide material. The thickening of Layer 1 on the ridge top is most likely due to fill for a paved road combined with increased weathering effects. A thin sliver of Layer 2 material is seen at the base of the slope, which may be the very lower portions of another landslide off to the side of the profile. Despite several attempts to reprocess Line 3 data using slightly different, yet valid, parameters, the position of the toe of the main slide never changed when viewed in the various plots. There is relative confidence in its interpreted position at line distance 320 ft. Erosional processes may have removed its lower portions since the seismic line between approximate line distance 0 and 300 ft was in a gully.

Areas of interpreted landslide material under Seismic Line 4 (Fig. 9) showed significantly higher velocities although the base of Layer 2 correlates with well data. Radical depth differences between LB-14 and LB-13 exist, which could be caused by a fault, although this could not be conclusively proven with seismic data. No geophysical data was acquired suggesting a fault other than what can be view in the profile. A narrowing of Layer 2 at line distance 260 ft necessitates the interpretation of the separate areas of Layer 2 as two possible slumps or landslides. It is unclear whether or not it is reasonable for the northern-most possible slump or landslide to be this wide.

Velocity variations in Layer 2 of Line 5 (Fig. 10) suggest differences in Layer 2's upper and lower portions. Sections of the lower package have much lower velocities (4200 ft/s) than those of the upper (5300 ft/s), with a possible minor boundary between the two occurring at line distance 210 ft (note the increase in velocity here over areas immediately above and below). Layer 1 also increases in thickness at the base of the gully, which is most likely due to an increase in colluvium and alluvium from the creek. Starting at LB-17, Layer 2 is observed to be a thin wedge extending all the way to the end of the survey line. This, most likely, is an artifact, and slide debris probably would not be found much further east of the boring.

The resistivity data (Fig. 11) also detected a landslide thought to be that of Qls-1 and similar to that observed in the seismic data (Fig. 7). It maps, however, the boundaries of a slide somewhat smaller than that detected with seismic. Nevertheless, both methods indicate a possible single, small, isolated slide in which its northern boundary does not extend further north than anticipated. It should be noted that the resistivity data should be viewed critically since it was collected in an area with known negative power line influences.

All data acquired in this project are in confidential file in the office. They are available for review by authorized persons at any time. The opportunity to participate in this project is very much appreciated. Please call, if there are questions.

Travis Crosby
Staff Geophysicist

Gary W. Crosby

Gary W. Crosby, Ph.D., GP 960
Senior Geol/Geophysicist

SITE LOCATION MAP

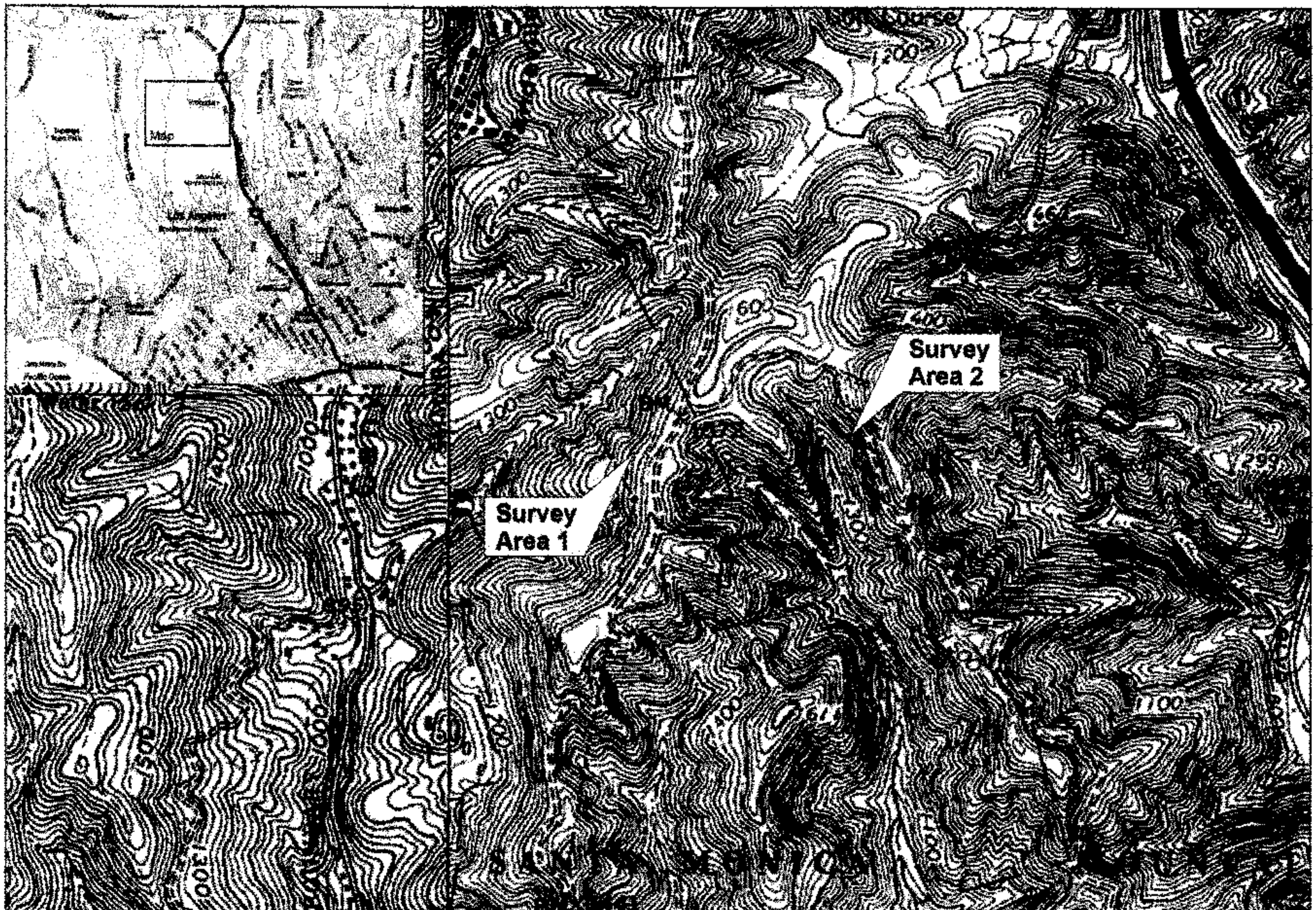

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FIGURE 1

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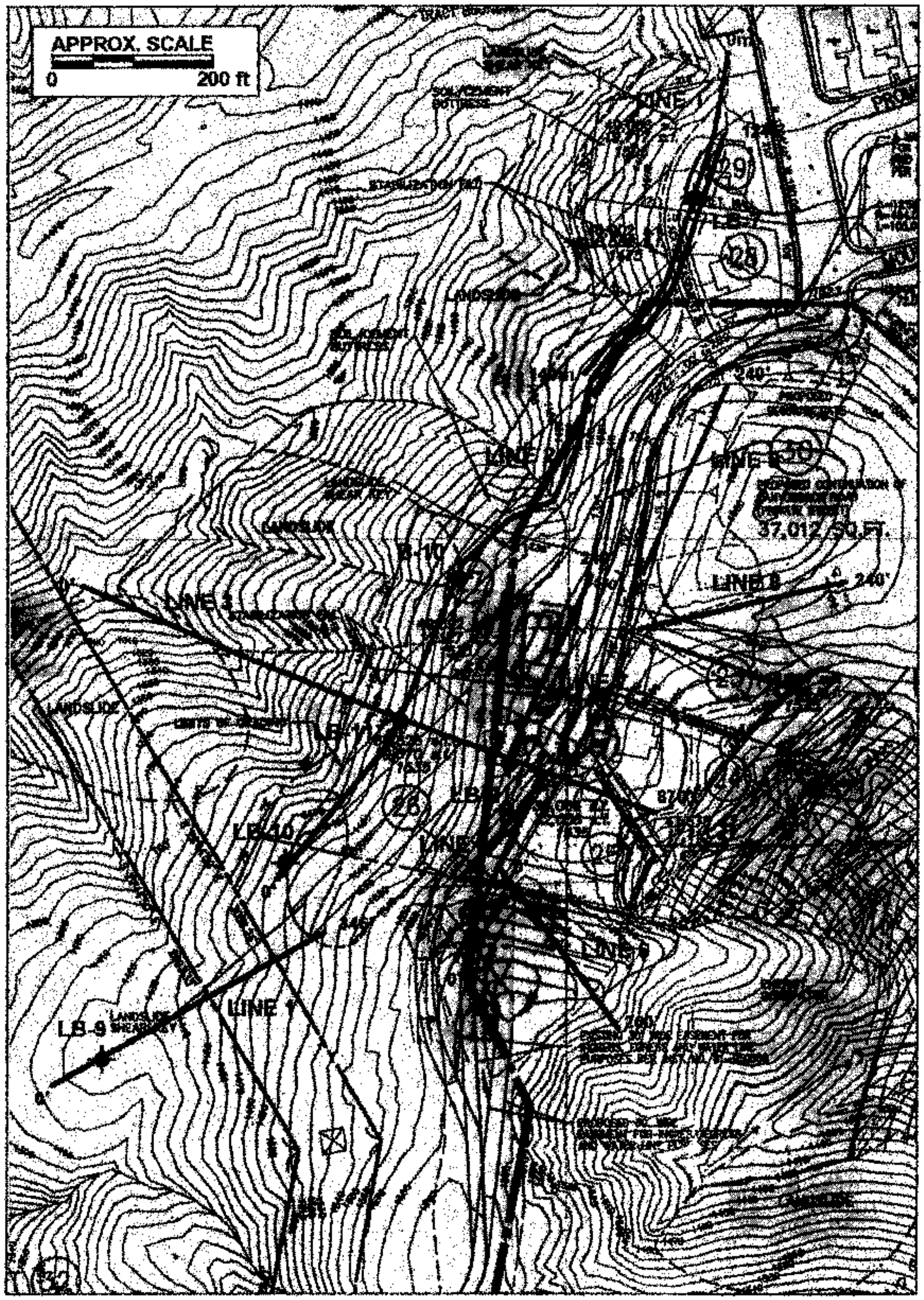
LINE LOCATION MAP

SURVEY AREA 1



Seismic Lines - Surveyed 5/31/01

Seismic Lines - Surveyed 8/5-8/02

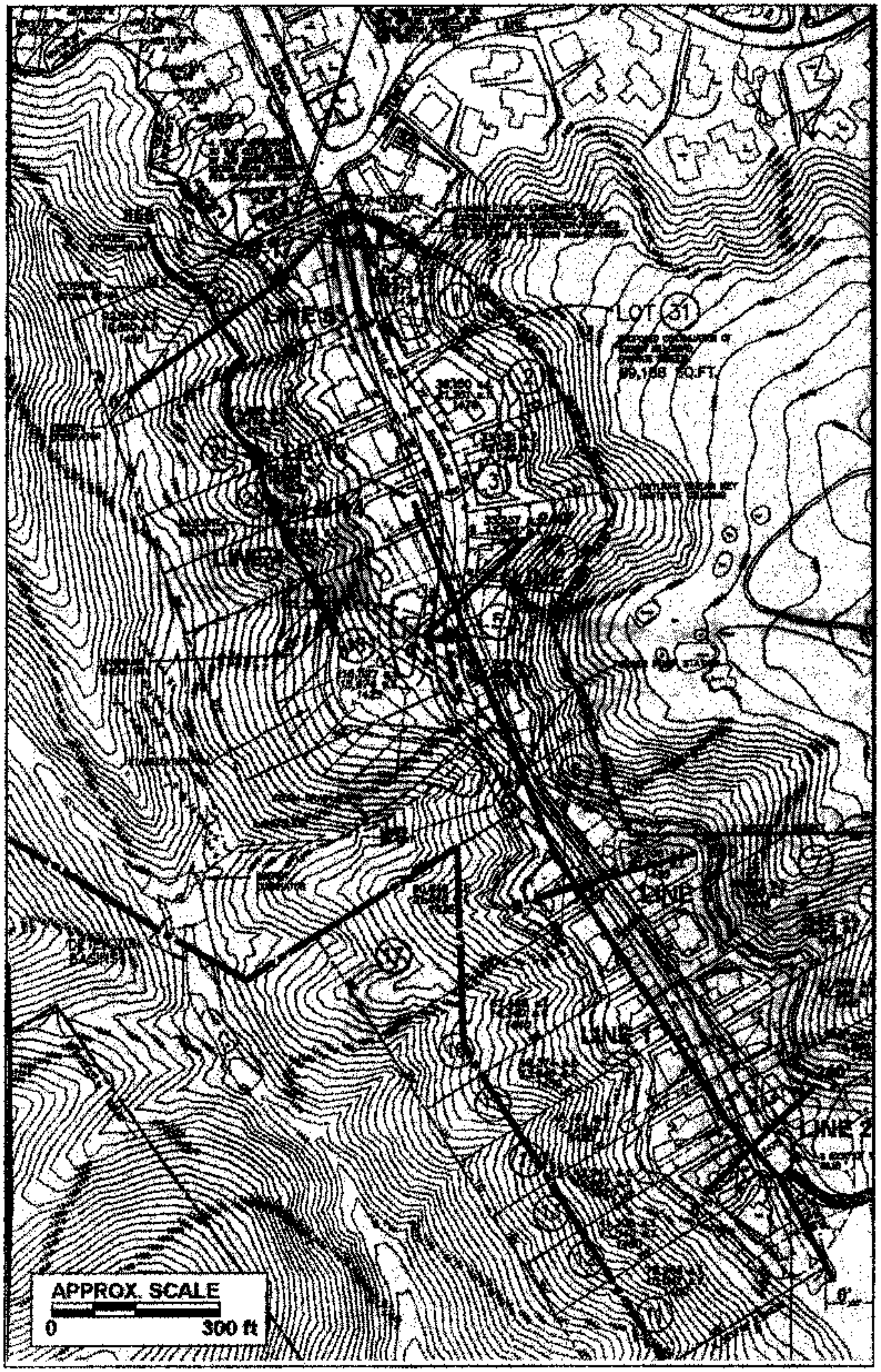
LB-1 ✦ Geotechnical Boring with Log Number

Resistivity Line - Surveyed 8/5/02

FIGURE 2

LINE LOCATION MAP

SURVEY AREA 2



Seismic Lines - Surveyed 5/31/01

Seismic Lines - Surveyed 8/5-8/02

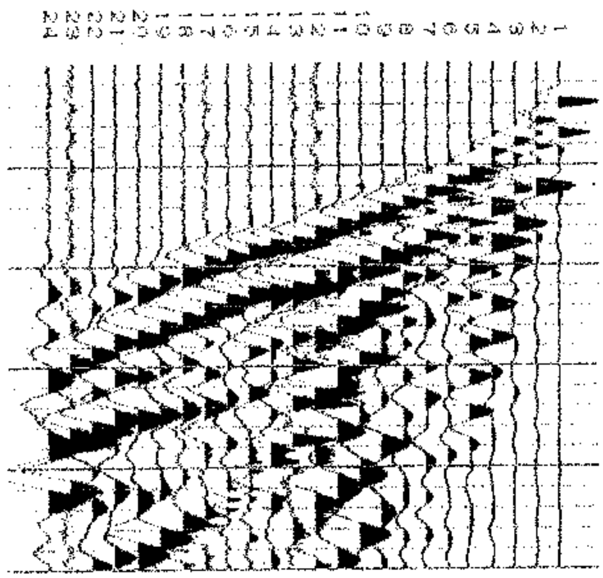
LB-1 Geotechnical Boring with Log Number

FIGURE 3

Sub Surface Surveys

MONITOR RECORDS

Seismic Line 2



BISON 9000 SERIES

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Delay(ms)                DFhc     Out
Channels      24         DFnt     Out
Samples      500         DFbp     Out
Rec len     250ms        Agc      Off
Time scale =  10   (ms)/division.
```

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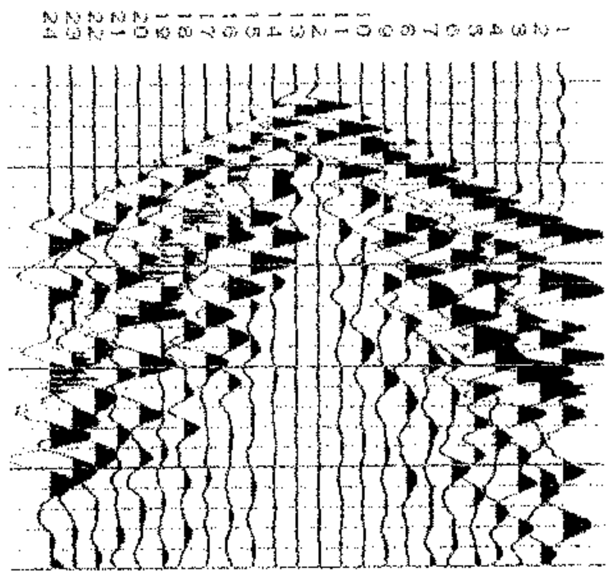
+ 01	M	0004	15	+ 13	M	0004	07
+ 02	M	0004	13	+ 14	M	0004	07
+ 03	M	0004	12	+ 15	M	0004	07
+ 04	M	0004	11	+ 16	M	0004	07
+ 05	M	0004	10	+ 17	M	0004	06
+ 06	M	0004	10	+ 18	M	0004	06
+ 07	M	0004	09	+ 19	M	0004	06
+ 08	M	0004	09	+ 20	M	0004	06
+ 09	M	0004	08	+ 21	M	0004	06
+ 10	M	0004	07	+ 22	M	0004	06
+ 11	M	0004	07	+ 23	M	0004	05
+ 12	M	0004	07	+ 24	M	0004	05



BISON 9000 SERIES

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Delay(ms)                DFhc     Out
Channels      24         DFnt     Out
Samples      500         DFbp     Out
Rec len     250ms        Agc      Off
Time scale =  10   (ms)/division.
```

PCH	GN	STK	EX	PCH	GN	STK	EX
+ 01	M	0003	06	+ 13	M	0003	16
+ 02	M	0003	07	+ 14	M	0003	12
+ 03	M	0003	07	+ 15	M	0003	11
+ 04	M	0003	08	+ 16	M	0003	10
+ 05	M	0003	08	+ 17	M	0003	09
+ 06	M	0003	08	+ 18	M	0003	08
+ 07	M	0003	09	+ 19	M	0003	09
+ 08	M	0003	09	+ 20	M	0003	08
+ 09	M	0003	10	+ 21	M	0003	08
+ 10	M	0003	11	+ 22	M	0003	08
+ 11	M	0003	12	+ 23	M	0003	08
+ 12	M	0003	16	+ 24	M	0003	07

FIGURE 4

SEISMIC DATA

Time/Distance Graph

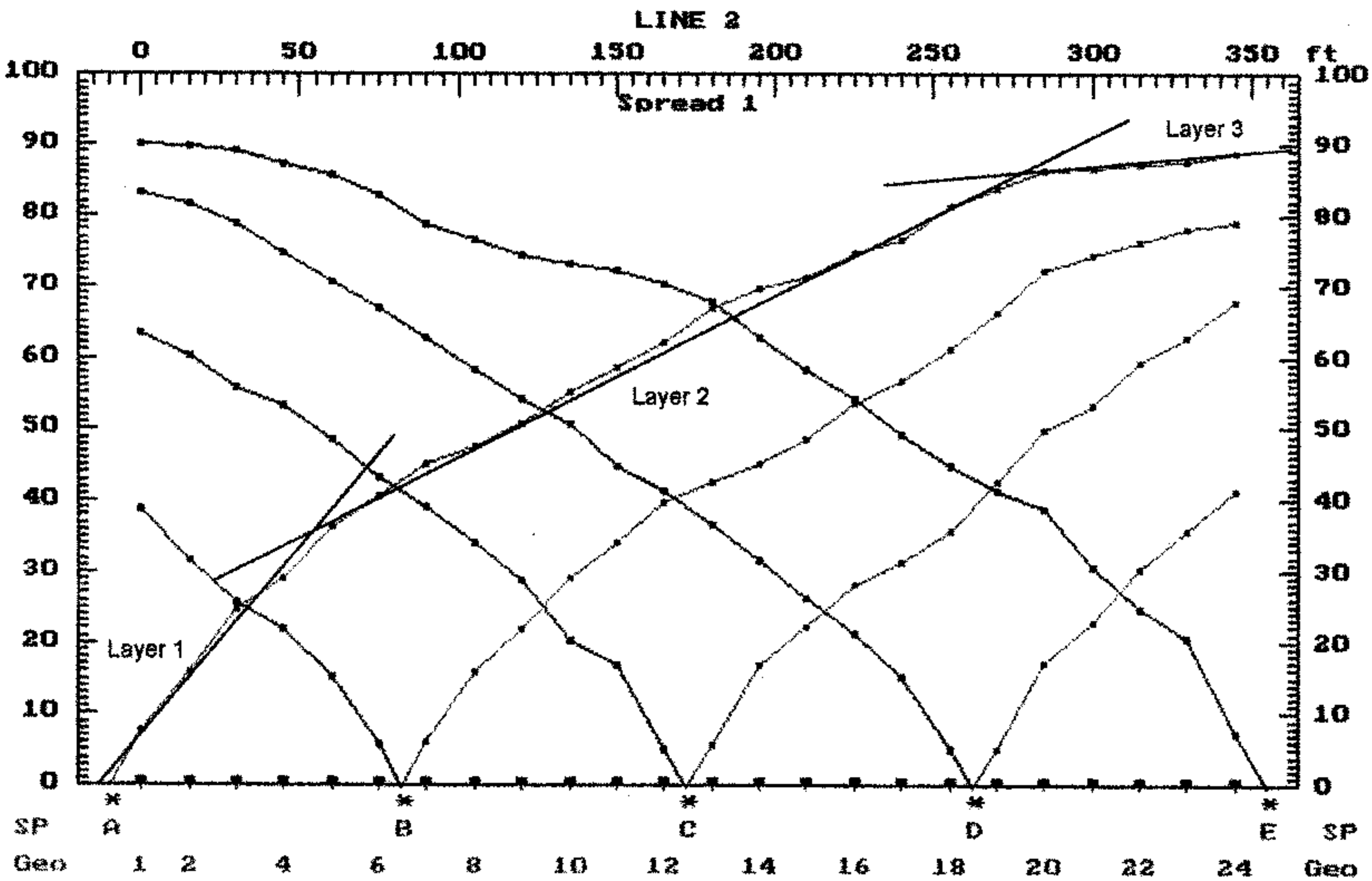
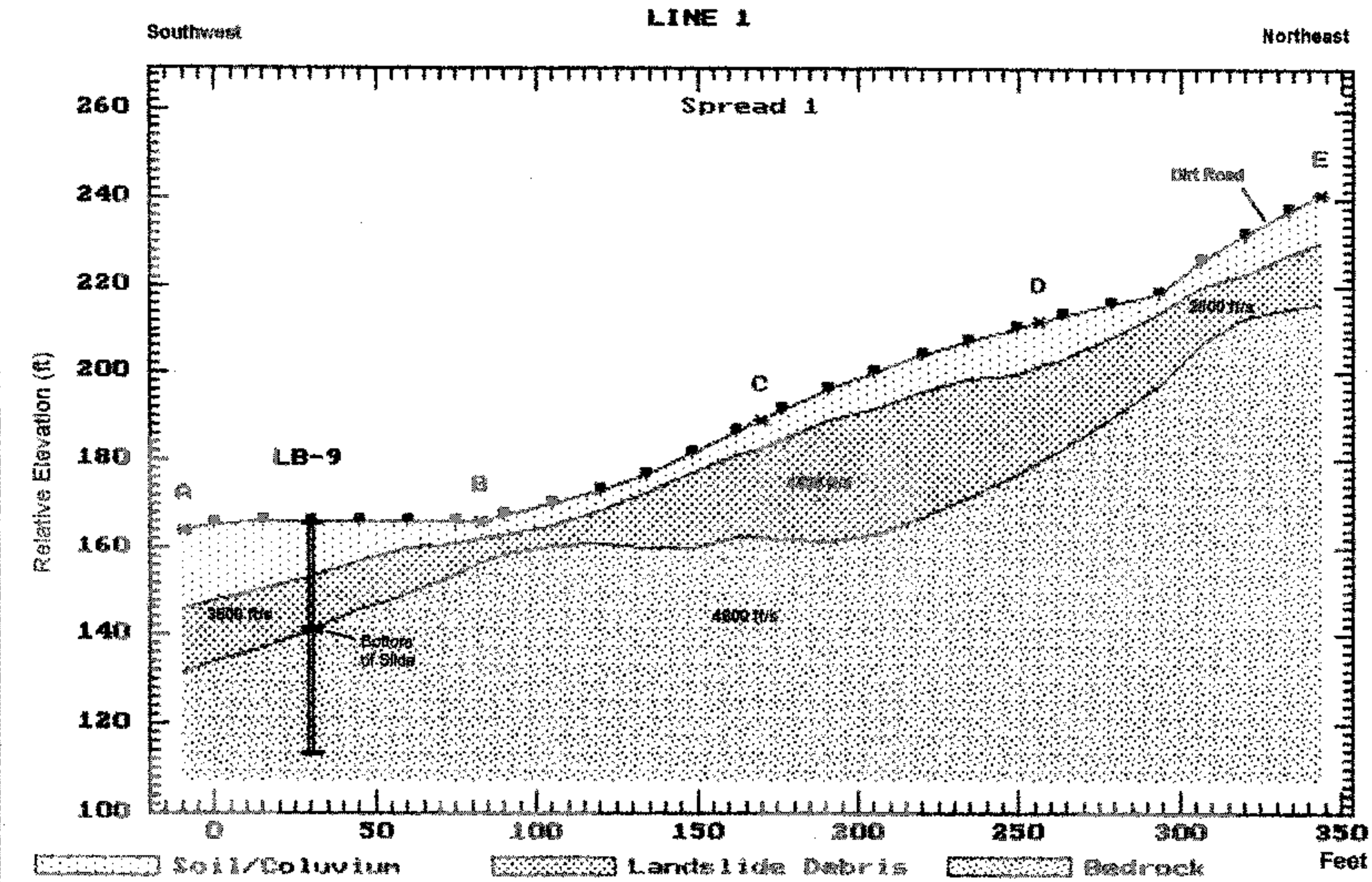


FIGURE 5

SEISMIC DATA

LINE 1

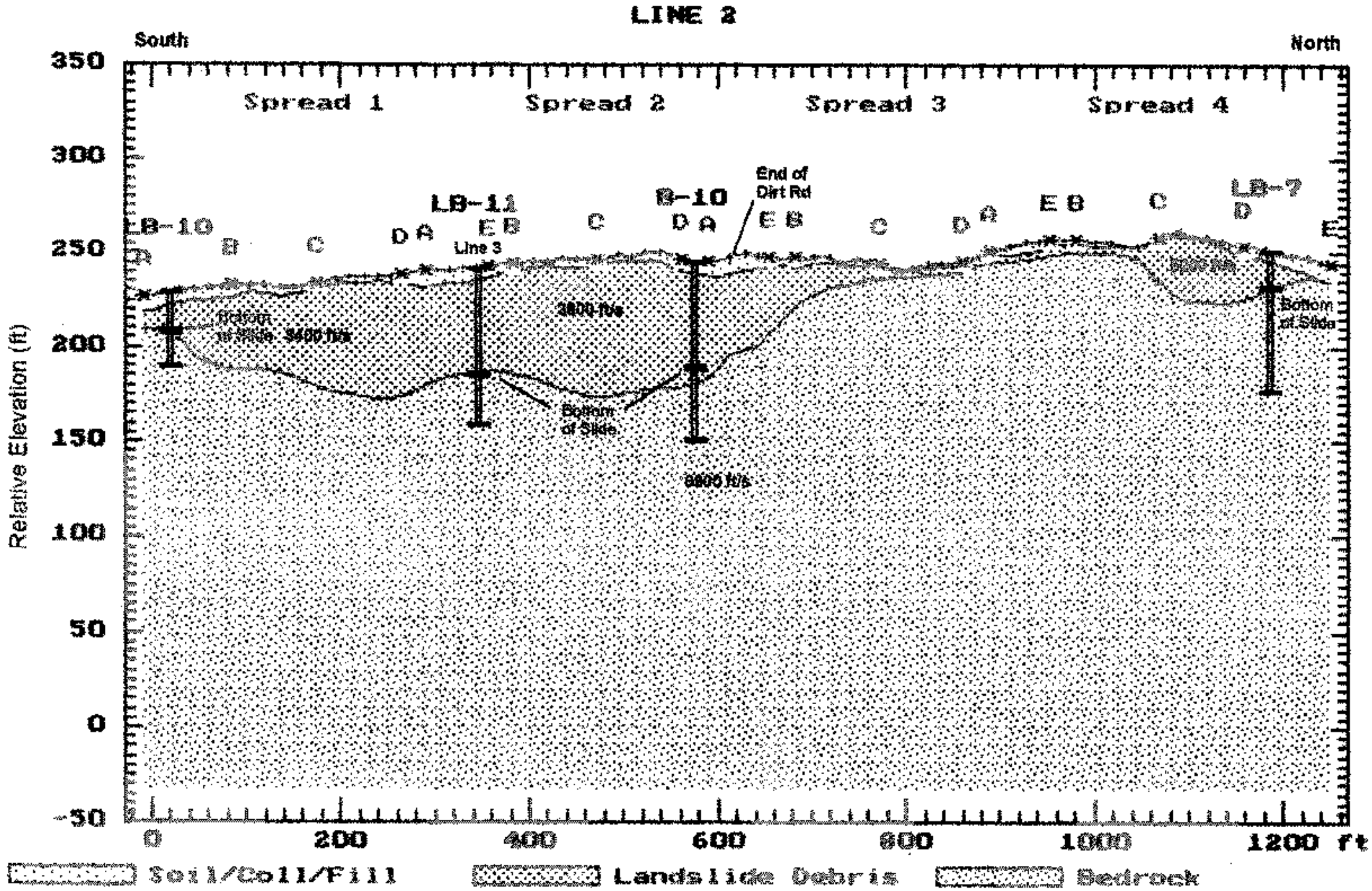


Seismic Refraction Survey 8/5/02	Mountaingate Project
Project Number 030381-002	Los Angeles, California

FIGURE 6

SEISMIC DATA

LINE 2



Seismic Refraction Survey 8/5/02	Mountaingate Project
Project Number 030301-002	Los Angeles, California

FIGURE 7

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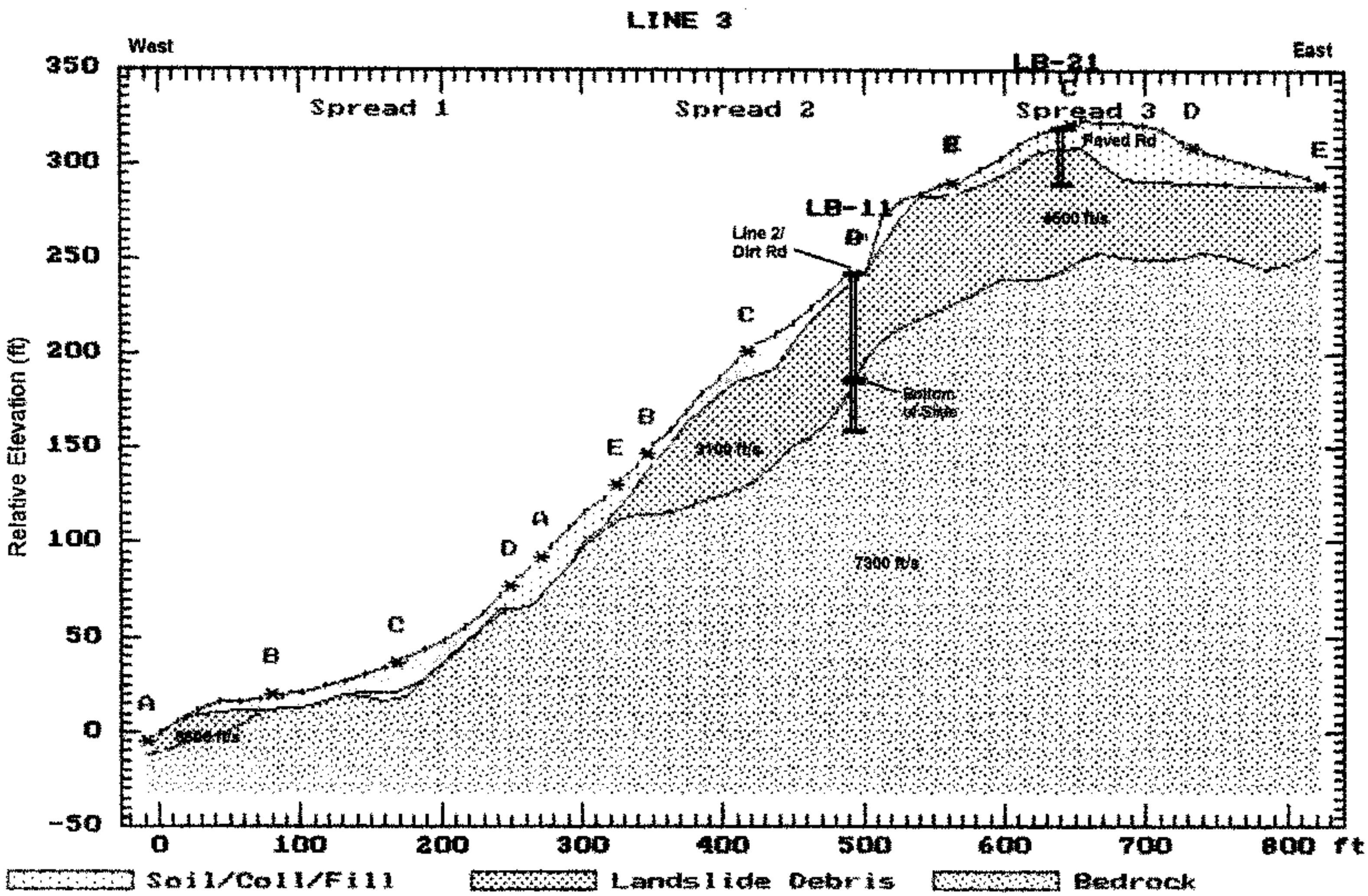
SEISMIC DATA

LINE 3

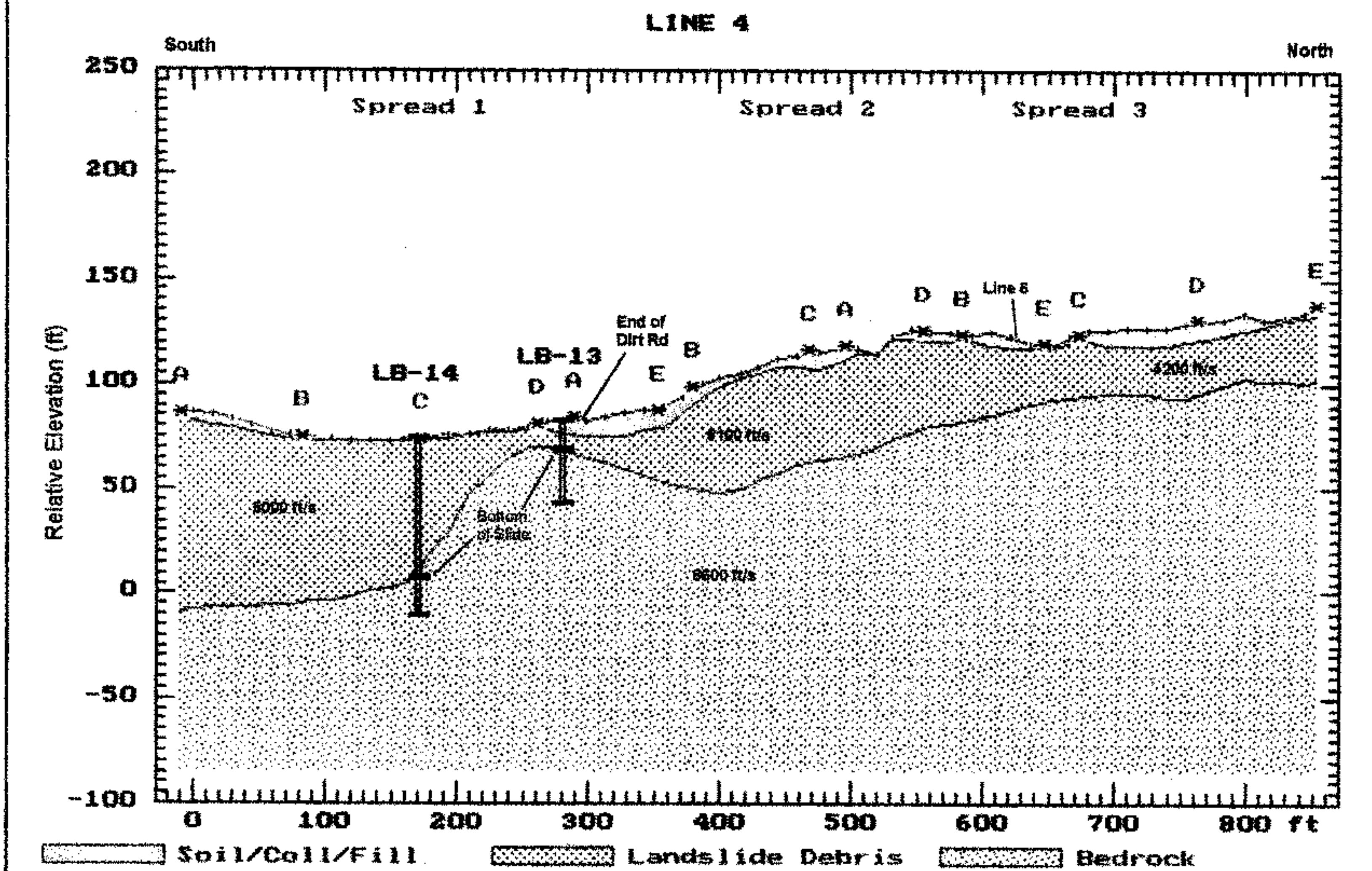


Seismic Refraction Survey 8/5/02	Mountaingate Project
Project Number 030381-002	Los Angeles, California

FIGURE 8

SEISMIC DATA

LINE 4

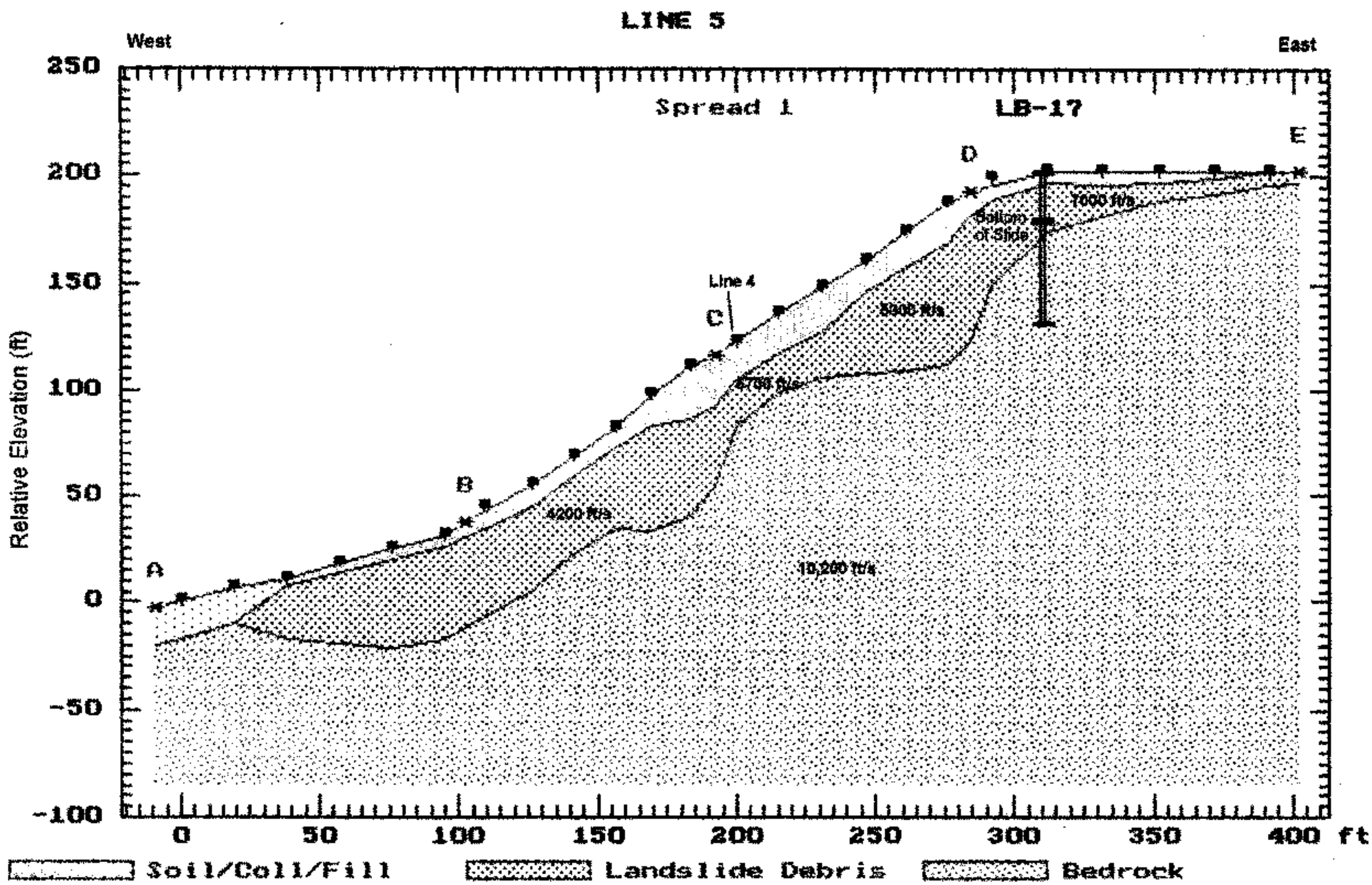


Seismic Refraction Survey 8/5/02	Mountaingate Project
Project Number 030381-002	Los Angeles, California

FIGURE 9

SEISMIC DATA

LINE 5



Seismic Refraction Survey 8/5/02	Mountaingate Project
Project Number 030381-002	Los Angeles, California

FIGURE 10

RESISTIVITY DATA

LINE 1

Resistivity Line 1

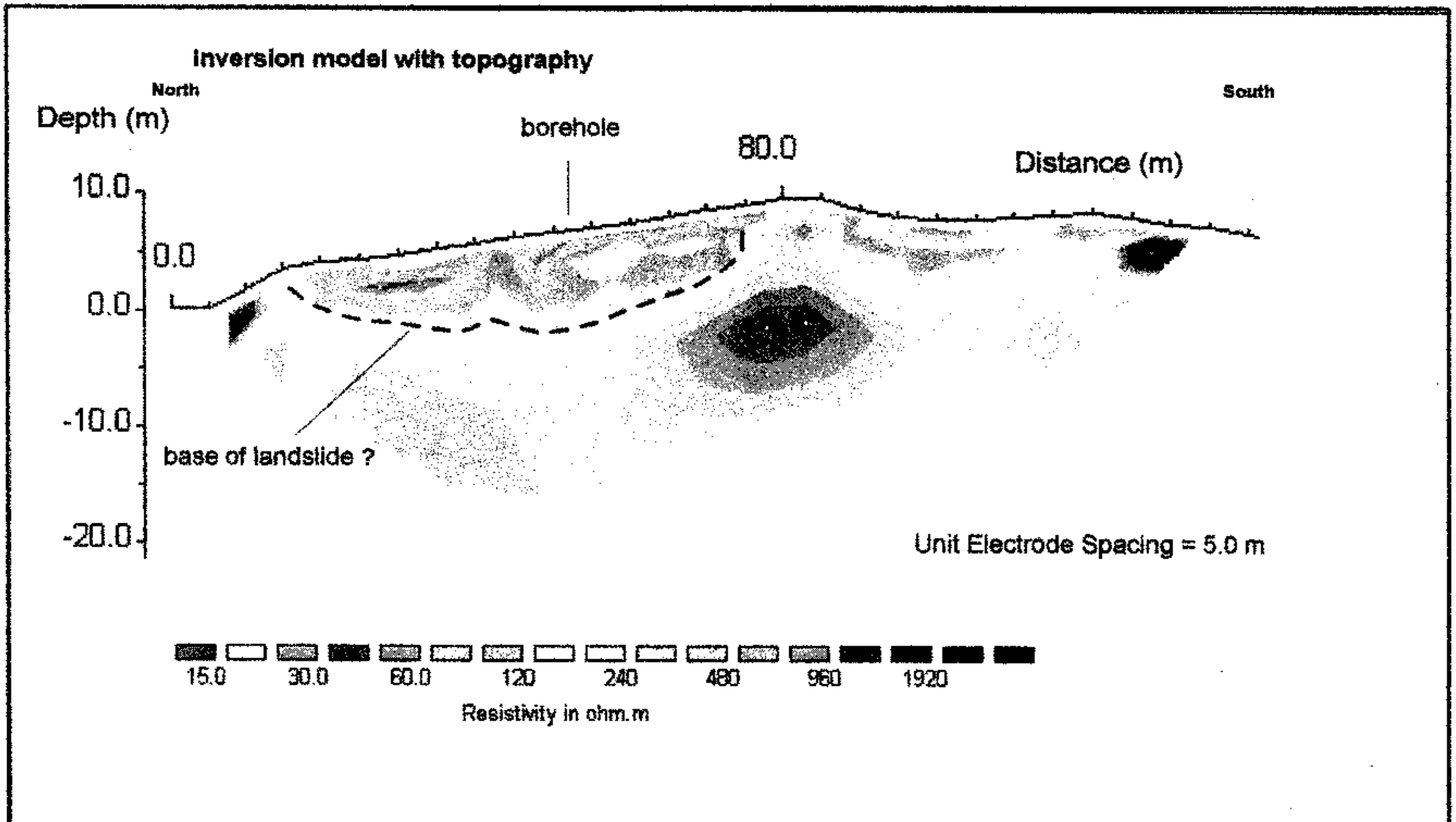


FIGURE 11

Sub Surface Surveys
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geop@subsurfacesurveys.com

September 26, 2002

Leighton & Associates, Inc.
31344 Via Colinas, Suite 102
Westlake Village, CA 91362

Project Number: 02-337

Attn: **Jose Sanchez**

re: Seismic investigation, Mountaingate, Santa Monica Hills

A-D-D-E-N-D-U-M

This addendum updates the original report, by the same title and project number. The original report was issued on August 18, 2002. The original report exhibited models prepared by "standard" processing techniques, specifically, using SIPT2 software. The addendum, utilizing the same data acquired in the field, exhibits models processed using "Optimum Velocity" software.

In our opinion the Optimum Velocity processing produces models that are closer to real world geology in situations such as those extant in the Mountaingate area. Here, slopes are at high angles and the geology is complex, with reflecting and refracting boundaries at various angles. The geologic complexity results from deformed strata, extensive landsliding, and significant structure in the Santa Monica Slates bedrock. The bedrock has well developed slaty cleavage which facilitates landsliding. And the slates, where involved in landsliding, are "loosened", that is, their compactness is disturbed, and the resulting geophysical expression is a lowering of seismic velocity. This further complicates the velocity distribustion. "Standard" processing, based on time-distance data pairs, is designed for layered rocks without excessive dips and excessive laterally varying thicknesses. Thus, minor discrepancies would be expected between the two differently processed models.

The original report should be referred to for descriptions of the seismic survey design, shooting parameters, local geology and seismic refraction methodology. The Optimum Velocity models are discussed here.

Data were acquired on line 1 utilizing a 15 foot geophone interval. There is approximately 80 feet of relief on the 345 foot long line (Fig. 1). The boundary between the hard, indurated Miocene Modello Sandstone and the underlying Jurassic Santa Monica Slates is probably within the darkest green color class. The drill control, in well LB-9, indicates that the bottom of the landslide mass is at the top, or near, of the yellow velocity class. There is major structure in the slates on the downhill end of the section. The landslide mass is humped up over the edge of the relatively high block.

Line 2 consist of four spreads back-to-back, but with an overlap of several geophones to assure complete subsurface coverage (Fig. 2). Two relatively high blocks are seen in the basement rocks. The displacement direction of the landslide block(s) is approximately perpendicular to the structure section. It is seen that drill control, superimposed on the seismic structure section, has the bottom of the landslide mass in different places within several color classes. This is probably near the truth. The "loosening" of the rock mass changes bulk density, and, in turn, lowers seismic velocity. The seismic data alone does not particularly indicate what rock units are to be found in the landslide mass, because the back scarp and the toe is not seen in the section.

Line 3, aligned roughly east-west, consist of three spreads back-to-back, with some overlap. Thus, the line runs down the slope (Fig. 3), and potentially encompasses the back scarp and possibly the toe. The model for line 3 data suggest that edges of a high structure basement block may have had some control on the development of the landslide back scarp and also a perturbation in the base slide surface near the bottom of the slope. That is, the two landslide masses depicted on the structure section were once continuous over the perturbation. The deeper block of metamorphic slates is still intact and is characterized by seismic velocities in the order of 10,000 ft/sec.

There are three spreads that make up line 4, similar to line 3 (Fig. 4). Lines 4 & 5 are in the east survey area. Basement structure is quite complex beneath line 4. The segmented blocks, at least three of them, are joined across high angle faults. Drill control suggests the configuration of the landslide mass is not simple where basement structure is complex. The person who logged well LB-14 saw evidence that prompted the interpretation of the bottom of the landslide mass occurring at relatively great depths. It is possible that the well was drilled into the fracture zone that is the fault structure that delimits the edge of one of the basement blocks. The plunging of the low velocity color classes on the south side of this block suggests the fault at this position has a relatively large displacement.

The geophone interval on line 5, in the east area, was 18 feet. There are strong hints in the model that the basement metamorphic rocks are structurally segmented (Fig. 5), as has been seen in other of the models. The 5 line trends southwest-northeast about perpendicular to the strike of the slope; consequently, the optimum view of the landslide mass is presented. The northeast end of the seismic line was laid out on a pad constructed with heavy earth moving equipment. Thus the back scarp has been removed. One drill hole establishes the position of the base of the landslide mass. Following the boundaries of the velocity color classes, from this well, puts the southwest end of the seismic model near the toe of the landslide mass.

Conclusions – Because of well developed slaty cleavage in the Santa Monica Slates, the tops of these basement metamorphic rocks can be, and in places are, incorporated into the landslide masses, where basement structure is high. The disruption of natural layering by landslide movements changes bulk density and, in turn, lowers seismic velocities. Thus, position of the base of landslide masses is not entirely clear in seismic data, at least in detail. The base of landslide masses, as revealed in the acquired seismic data, shows that the slide masses are somewhat controlled by highs and edges of basement blocks.

SubSurface Survey's professional personnel are trained and experienced and have completed thousands of projects since the company's inception in 1988. It is our policy to work diligently to bring this training and experience to bear to acquire quality data sets, which in turn, can provide clues useful in formulating our interpretations. Still, non-uniqueness of interpretations, methodological limitations, and non-target interferences are prevailing problems. SubSurface Surveys makes no guarantee either expressed or implied regarding the accuracy of the interpretations presented. And, in no event will SubSurface Surveys be liable for any direct, indirect, special, incidental, or consequential damage resulting from interpretations presented herewith.

All data generated on this project are in confidential file in this office, and are available for review by authorized persons at any time. The opportunity to participate in this investigation is very much appreciated. Please call, if there are questions.

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