UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

IN-SITU MEASUREMENTS OF SEISMIC VELOCITY AT 16 LOCATIONS IN THE LOS ANGELES, CALIFORNIA REGION

by

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Open-File Report 84-681

CONTENTS

INTRODUCTION

Studies conducted in the San Francisco Bay region (Borcherdt, Gibbs, and Fumal, 1981) have shown that average shear-wave velocity can be related to quantitative estimates of ground motion such as amplification from nuclear explosions and earthquake intensity. Furthermore, when certain physical properties of the geologic materials such as texture, hardness and fracture spacing are described during geologic mapping, a method can be used to predict shear-wave velocity from descriptions of geologic units (Fumal, 1978). By measuring shear-wave velocities in representative geologic units, regional maps depicting the earthquake hazard can be compiled.

These studies are presently being extended to the Los Angeles Basin and Oxnard-Ventura, California areas. To date, shear and compressional waves have been measured in boreholes at 84 locations. Three previous reports (Gibbs, Fumal and Roth, 1980; and Fumal, Gibbs and Roth, 1981, 1982) summarized geologic and seismic data at sites 1-27, 28-46, and 47-68, respectively. This report presents data for sites 69-84. At each location seismic travel times are measured in drill holes, normally at 2.5 m intervals to a depth of 30 m. Geologic logs are compiled from drill cuttings, undisturbed samples and penetrometer samples. The data provide a detailed comparison of geologic and seismic characteristics and parameters for estimating strong earthquake ground motions quantitatively at each of the sites.

SELECTION AND LOCATION OF SITES

The selection of sites in this study has been guided by the availability of other data in the Los Angeles area that are applicable to the overall problem of estimating earthquake ground motions. These data are (1) strong motion records from the 1971 San Fernando earthquake, (2) ground motion recorded from nuclear explosions and (3) geologic mapping. The sites in this report are all at strong motion stations which were used by Joyner and others (1981) to derive new attenuation relations for peak horizontal acceleration and velocity. The shear wave velocity and geologic data in this report will be used to modify these relationships to include dependence on site geology. A map showing generalized locations of sites 69-84 is given in Figure 1. Detailed locations are shown in Figures 4-17.

DRILLING AND SAMPLING PROCEDURES

At each site selected, a hole 12 cm in diameter is drilled to a depth of 30 m using a truck-mounted drill and a rock bit with mud and water circulation. The boring is then cased with 7.6 cm diameter PVC plastic pipe and backfilled with drill cuttings and "pea" gravel. Casing insured accessibility of the hole and provided a secure clamping surface for the seismic probe.

Samples are taken in each of the holes at depths of approximately 3 m, 7.5 m, 30 m, and at boundaries defined by continuously monitoring the drill cuttings and the drill reaction. The type and number of samples taken at each site is determined by the type of material, the number of significant lithologic boundaries, and variations in weathering.

In soils, standard penetration measurements are made and undisturbed samples are taken using a "Pitcher" core barrel and a "Shelby" thin tube liner. Pitcher barrel samples are also taken in soils with large amounts of hard rock fragments and in firm rock. Samples are obtained in hard rock using a core barrel with a diamond core bit.

RECORDING PROCEDURES

Compressional waves are generated at each site by the vertical impact of a sledge hammer on a steel plate. A signal produced by the opening of a switch attached to the hammer is recorded for determining origin time.

Shear waves are generated using the horizontal traction source introduced by Kobayashi (1959) and discussed by Warrick (1974). Briefly, the method consists of applying a horizontal impact to a large timber (244 x 30 x 18 cm). The timber is placed on a flattened soil surface and held firmly in place by the front wheels of a truck. A steel pipe extends through the timber and supports a 30 kg hammer to which is attached an impact switch. The specially constructed hammer rolls on bearings and is driven a distance of 45 cm along the pipe before impacting the timber. The "horizontal traction" source generates a signal with a high proportion of S-wave energy compared to P-wave energy. The timber is struck twice, once in each direction. The two impacts reverse the polarity of the S-waves but not the polarity of the smaller amounts of P-wave energy. Comparison of the signals from the two reversed impacts provides an important tool for identifying the onset of the S-wave.

The timber is offset 2.0 m from the hole and a three-component geophone package (natural frequency 14 Hz) is placed within 9 cm of its center. The signals recorded from the surface geophones are used to monitor the input signals and determine the origin time for the generated S-waves. The arrangement of timber, steel plate, and surface geophone package is illustrated in figure 2.

The P-waves generated by a vertical impact on the steel plate and the S-waves generated by striking the timber in both directions are recorded separately. This procedure is repeated for each 2.5 m interval (closer spacing is sometimes used to obtain a velocity in thin layers) in the drill hole.

Two downhole geophones were used in this study. One has an inflatable diaphragm and a declinometer which under most circumstances permits orientation of the horizontal geophones from the surface. Proper orientation (parallel and perpendicular to the source) aids in identifying the onset of the S-wave. A second downhole geophone was used as a backup instrument in several holes in this study. This geophone has a spring clamping mechanism and cannot be oriented from the surface. Both instruments detect three components of motion.

The signals from the downhole and surface seismometers and the impact switches are recorded on photographic paper. The velocity unit-impulse response of the recording system is essentially flat from 2 Hz to above 100 Hz. A detailed description of the recording instrumentation is presented by Warrick and others (1961). The recording oscillograph is modified for this project by adding 500 Hz galvanometers and increasing the paper speed to 46 cm/sec.

GEOLOGIC DATA

Description of Samples

Portions of each of the samples are examined and described in the laboratory. The terms used for the descriptions are summarized on figure 3. The sample descriptions are presented in the left-hand columns of figures 18-33.

The soil samples are described using the field techniques of the Soil Conservation Service and those specified for the Unified Soil Classification System. Descriptions include soil texture, color, amount and size of coarse grains, plasticity, dry and wet consistency, and moisture condition. Texture refers to the relative proportions of clay, silt, and sand particles less than 2 mm in diameter. The dominant color of the soil and prominent mottles are determined from the Munsell soil color charts.

Descriptions of rock samples include rock name, weathering condition, color, grain size, hardness, and fracture spacing. Classifications of rock hardness and fracture spacing are those used by Ellen and others (1972) in describing hillside materials in San Mateo County, California. The weathering classification is modified from that used by Aetron-Blume-Atkinson (1965) in describing Tertiary sedimentary rocks in the foothills of the Santa Cruz Mountains, California.

Geologic Log

Geologic logs are compiled for each hole using the field log descriptions of the samples (figures 18-33). The field log is based on the reaction of the drill rig, a continuous record of drill cuttings, preliminary on-site inspection of samples, and inspection of nearby exposures.

Most information needed for describing relatively well-sorted soils and such properties of rock as lithology, color, and hardness are readily obtained from cuttings. Inspection of samples and nearby outcrops is also necessary to determine the nature of poorly sorted materials and to determine fracture spacing. Reaction of the drill rig is also useful in determining degree of fracturing as the rate of penetration in rock is highest for very closely fractured and crushed materials and drilling roughness generally is at a maximum in closely to moderately fractured rock. In-situ consistency of soil is determined largely from standard penetration measurements and rate of drill penetration.

Density Measurements

Values for density are required to calculate elastic moduli from measurements of seismic velocity. Densities were measured for the diamond core samples and most of the penetration samples by weighing a small piece of sample and obtaining its volume by the mercury displacement method. A different procedure was used for very friable materials such as grus or poorly-sorted materials which necessitated using a large sample. A section was cut from the Shelby tube containing the sample, its height and diameter measured and the sample extruded for weighing.

While the accuracy of the density measurements is generally sufficient for calculation of elastic moduli, a number of the samples used to obtain densities were not entirely representative of the material in-situ. Penetration samples were somewhat disturbed and many had dried out before measurements could be made. Densities of hard rock obtained using intact fragments may be higher than in-situ densities by approximately 0.1-0.2 gm/cc, depending on the number and openness of fractures.

SEISMIC DATA

Identification of Shear Wave Onset

To aid in the identification of the shear wave arrivals, the signals recorded by each of the three components of the downhole seismometer package from impacting the timber in opposite directions with the horizontal hammer are superimposed and traced on a common time base (figs. 34-49). The S-wave group is easily identified when displayed in this manner, by a 180° phase inversion. The onset of the S-wave is chosen as the start of the first clearly inverted phase in the group. The interpretation proceeds from the bottom record, to the top using phase correlation at each recording depth. The onset of the S-wave arrival (arrows) and the first peak of the S-wave arrival (dots) are identified for each depth and are indicated on figures 34-49 for each site.

It was not possible at every site to control orientation of the downhole seismometer package because of high viscosity drilling mud left in the hole; hence, the relative S-wave amplitudes recorded on the two horizontal seismometers vary with depth. The S-wave arrival is generally most easily identified on the horizontal seismogram with the largest amplitude. Comparison of the signals recorded on the horizontal sensors with that recorded on the vertical sensor shows that the S-wave amplitude generated by the horizontal traction source is generally several times as large as the P-wave amplitude.

On many of the horizontal seismograms some P-wave signal is apparent prior to the onset of the S-wave. Some P-wave energy is generated by the horizontal traction source and some probably results from conversion of S to P at seismic boundaries. In some cases the polarity of this P-wave signal is reversed and careful consideration of the entire record section is required to identify the S-arrival. In general, the onset of the S-wave is easier to identify at sites underlain by the various types of soil than for sites underlain by the more consolidated rock units.

Travel Times and Average Velocities

To determine the travel time for the S-wave onset identified from the record sections (figures 34-49), the following times are measured with respect to a 100 Hz standard signal recorded on the records:

1) t_1 time of break in signal from impact switch
2) t_2 onset time of S-wave arrival on inline uphole geophone
3) t_3 onset time of identified S-wave arrival on downhole sensors

The time considered to be the origin time for the S-wave recorded on the downhole sensor is the onset time of the S-wave arrival on the uphole inline sensor. To reduce the uncertainties in determining this origin time, an average travel time from the source to the uphole geophone (t_A) is determined from the set of values, $t_2 - t_1$, measured at each depth. The travel time for the first S-arrival is given by

$$t_s = (t_3 - t_1) - t_A.$$

A corrected S-wave travel time (t_s), corresponding to the travel time for a vertical ray path, is computed from $t_{s_c} = t_s \cdot C$ where C corresponds to a timing correction (cosine of the angle of ray incidence) due to the distance the plank is offset from the center of the hole (usually 2.0 m). Average velocities from the surface are determined by dividing the corrected travel time by the corresponding depth. The travel time for the first S-wave peak is determined similarly. The origin corrections ($t_2 - t_1$), the travel times of the first S-wave arrival and the first S-wave peak (t_s), the corrected travel times for the first S-wave arrival and the first S-wave peak (t_{s_c}), and the average corresponding velocities computed at each site are presented in tables 1-16.

The travel times for the P-waves generated by a vertical impact on a steel plate are determined in the same way as for the S-waves, except that the origin time for the P-wave is given by the impact switch as no origin correction was found to be necessary. The travel times, the corrected travel times, and the average velocities for the P-waves are also presented in tables 1-16. (Note: record sections for vertical hammer not shown).

<u>Interval Velocities and Elastic Moduli</u>

Calculation of interval velocities and elastic moduli requires determination of depth intervals over which the velocity is approximately constant within the uncertainty of the travel-time measurements. To determine these depth intervals, the travel time data (tables 1-16) are plotted as a function of depth and the geologic logs are simplified and displayed graphically with the travel time curves (figs. 50-65). Depth intervals for velocity determinations are selected on the basis of distinct changes in slope of the travel time plots. For those geologic materials with S-wave velocities greater than 350 m/sec, the intervals are required to contain at least four travel time measurements to avoid determining a velocity from a travel time differential due in large part to measurement error.

Velocities are calculated for each of the selected intervals (tables 17-32) from the slope of the linear regression line which best fits the travel time data in a least squares sense (Borcherdt and Healy, 1968, eqs. 3.1-3.5).

The equation of the linear-regression line which best fits, in a least-squares sense, a sample on n pairs of time-depth coordinates $(x_1,t_1),....(x_n,t_n)$ is

$$t(x) = a + b\,(x - \overline{x})$$

where $$\overline{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \;, \quad a = \frac{1}{n} \sum_{i=1}^{n} t_i \;,$$

the intercept is $$\text{INCPT} = \frac{1}{n} \sum_{i=1}^{n} t_i - b\overline{x} \;, \text{ and}$$

the slope is $$b = \sum_{i=1}^{n} w_i t_i$$

with $$w_i \equiv (x_i - \overline{x})/D \text{ and } D \equiv \sum_{k=1}^{n} (x_k - \overline{x})^2$$

The desired velocity (VEL) is given by $V = 1/b$. Assuming the standard statistical model (Borcherdt and Healy, 1968), the 68.3 confidence level, uncertainty interval (UNC INT) for the velocity is estimated by

$$\left(\frac{1}{b+S_b}, \frac{1}{b-S_b}\right) ,$$

where $$S_b \simeq \frac{1}{(n-2)D} \sum_{i=1}^{n} (t_i - t(x_i))^2$$

is the standard error of the regression coefficient.

For these depth intervals with measurements of density (ρ), the shear modulus (SHEAR MOD, M) and bulk modulus (BULK MOD, K) is calculated (tables 17-32) using the linear elastic equations:

$$M = \rho V_s{}^2$$

and $$K = \rho V_p{}^2 - \frac{4}{3} M$$

Poisson's ratio (σ) is calculated (tables 17-32) using

$$\sigma = \frac{\left(\frac{V_p}{V_s}\right)^2 - 2}{2\left(\frac{V_p}{V_s}\right)^2 - 2}$$

SUMMARY

This report presents seismic velocities measured in the near surface geologic materials at 16 locations in the Los Angeles, California area. S-wave and P-wave measurments were made at 2 1/2 m intervals in drill holes generally to a depth of about 30 m. Geologic logs were compiled by continuously monitoring drill cuttings and by analysis of cored samples.

Density measurements were made from samples for the calculation of elastic moduli.

Previous studies in the San Francisco Bay region (Borcherdt et al., 1981) have shown that average shear velocity can be correlated with ground motion amplification recorded from nuclear explosions and with observed intensities from the 1906 earthquake. A detailed study using shear velocity data from 59 locations (Fumal, 1978) has shown that certain physical properties of the near surface geologic materials can be used to predict velocity. Measurements of shear velocity at a number of strategic locations will permit a regional classification of seismically distinct velocity units which may be useful for seismic zonation.

ACKNOWLEDGEMENTS

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FIGURES

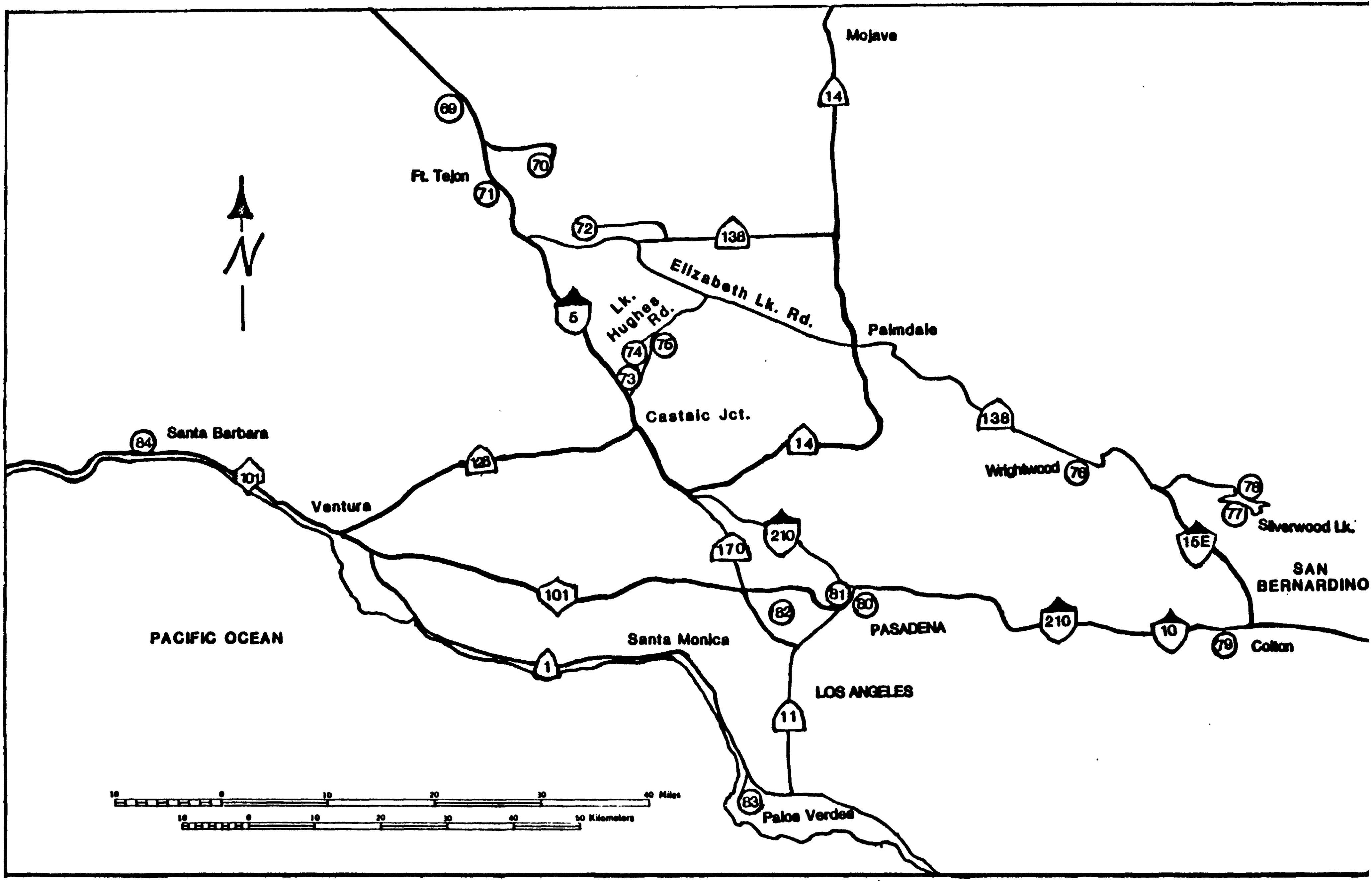


Figure 1. Generalized map of the Los Angeles region showing the approximate locations of shear-wave sites. Detailed locations are shown in figures 4-17.

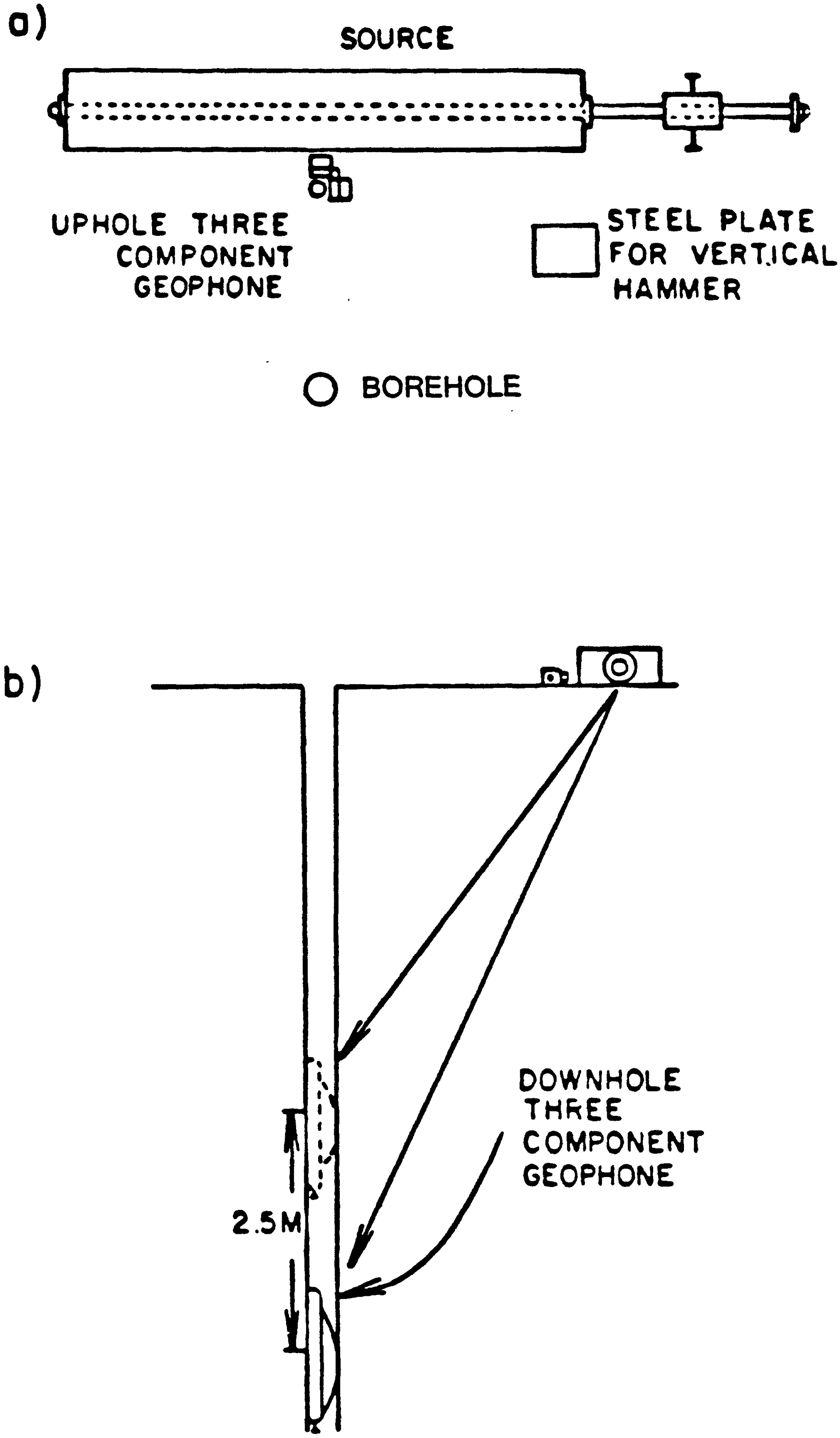


Figure 2. Details of field apparatus: (a) Plan view of hammer and plank, and (b) vertical section showing three-component downhole geophone.

ALTITUDE:

DATE:

GEOLOGIC MAP UNIT:
[1]Dibblee, 1966
[2]Dibblee, 1967
[3]Dibblee, 1973
[4]Dutcher and Garrett, 1963
[5]Lamar, 1970
[6]Shannon and Wilson, 1978
[7]Shannon and Wilson, 1980
[8]Wood and Dale, 1964
[9]Woodring et al., 1946

SAMPLE DESCRIPTION | Density (gm/cc) | Blows/Feet | Sampling | Graphic Log | Depth (meters) | **DESCRIPTION**

SAMPLING:

Standard penetration sample taken inside a 1 1/4" I.D. split-spoon driven 18" into the soil with a 140 lb. weight falling 30" at the top of the drill rod.

Blow count for last 12" or, if penetration <12", for depth driven as noted. 14; 54/3"

Pitcher undisturbed sample taken inside a 3" I.D. Shelby thin tube mounted in a Pitcher core barrel. P

Sample taken inside a 3" I.D. Shelby tube mounted on end of drill rod and pushed into soil. S

Rock core taken inside a NX size core barrel with a diamond bit. C

Rock hardness: response to hand and geologic hammer: (Ellen et al., 1972)

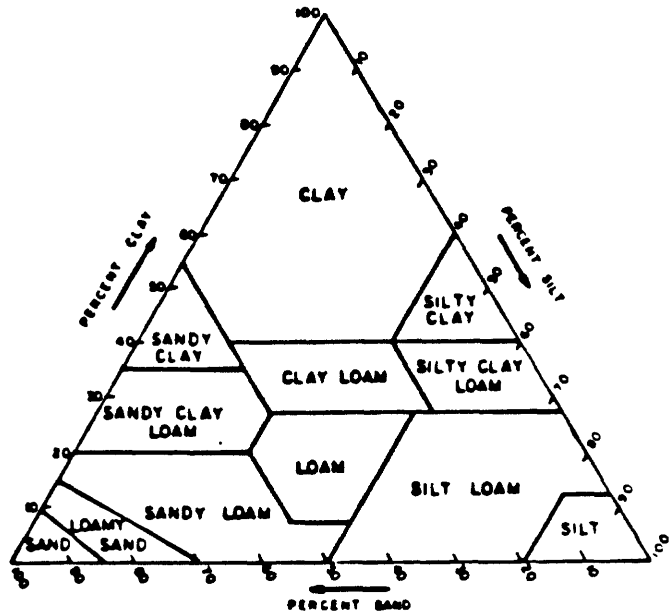
hard - hammer bounces off with solid sound
firm - hammer dents with thud, pick point dents or penetrates slightly
soft - pick point penetrates
friable material can be crumbled into individual grains by hand.

Fracture spacing: (Ellen et al., 1972)

cm	in	fracture spacing
0-1	0-1/2	v. close
1-5	1/2-2	close
5-30	2-12	moderate
30-100	12-36	wide
>100	>36	v. wide

Weathering: (Aetron-Blume-Atkinson, 1965)
Fresh: no visible signs of weathering
Slight: no visible decomposition of minerals, slight discoloration
Moderate: slight decomposition of minerals and disintegration of rock, deep and thorough discoloration
Decomposed: extensive decomposition of minerals and complete disintegration of rock but original structure is preserved.

Texture: the relative proportions of clay, silt, and sand below 2 mm. Proportions of larger particles are indicated by modifiers of textural class names. Determination is made in the field mainly by feeling the moist soil (Soil Survey Staff, 1951).



Color: Standard Munsell color names are given for the dominant color of the moist soil and for prominent mottles.

Plasticity: estimated from the strength of air dried sample and toughness of thread formed when soil is rolled at the plastic limit (Sowers and Sowers, 1970).

plasticity	dry strength	field test
non plastic	v. low	falls apart easily
slightly	slight	easily crushed
medium	medium	friable with difficulty
highly	high	cannot crush with fingers

Relative density of sand and consistency of clay is correlated with penetration resistance: (Terzaghi and Peck 1948)

blows/ft.	relative density	blows/ft.	consistency
0-4	v. loose	<2	v. soft
4-10	loose	2-4	soft
10-30	medium	4-8	medium
30-50	dense	8-15	stiff
>50	v. dense	15-30	v. stiff
		>30	hard

CL, MH, etc.: Unified Soil Classification Group Symbol (U. S. Army Corps of Engineers, 1960)

Figure 3 Explanation of terms used in geologic logs.

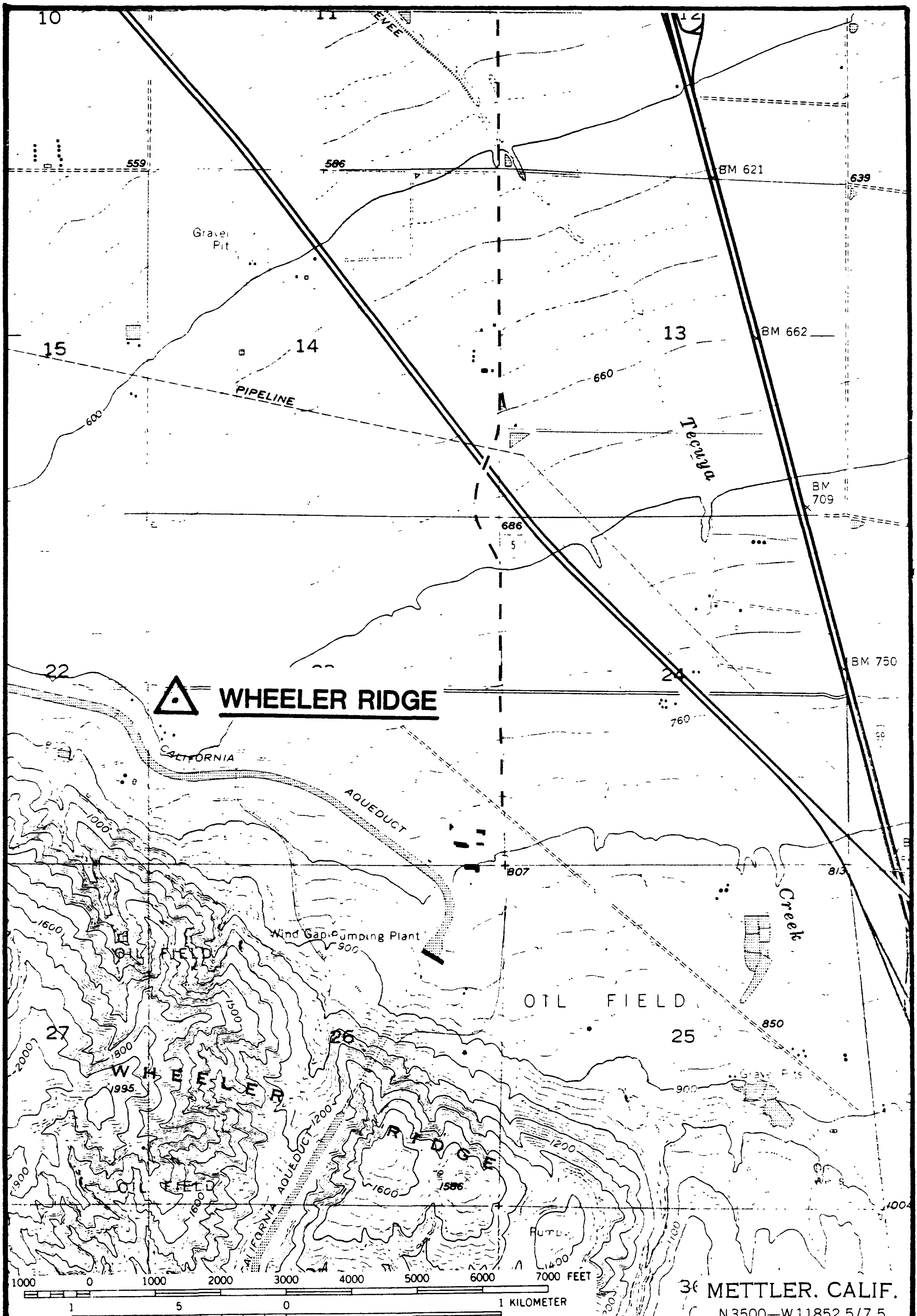

WHEELER RIDGE
METTLER. CALIF.
N3500—W11852.5/7.5
Gravel Pit
PIPELINE
Tecuya
Creek
CALIFORNIA
AQUEDUCT
Wind Gap Pumping Plant
OIL FIELD
WHEELER RIDGE
OIL FIELD
BM 621
BM 662
BM 709
BM 750
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER

Figure 4

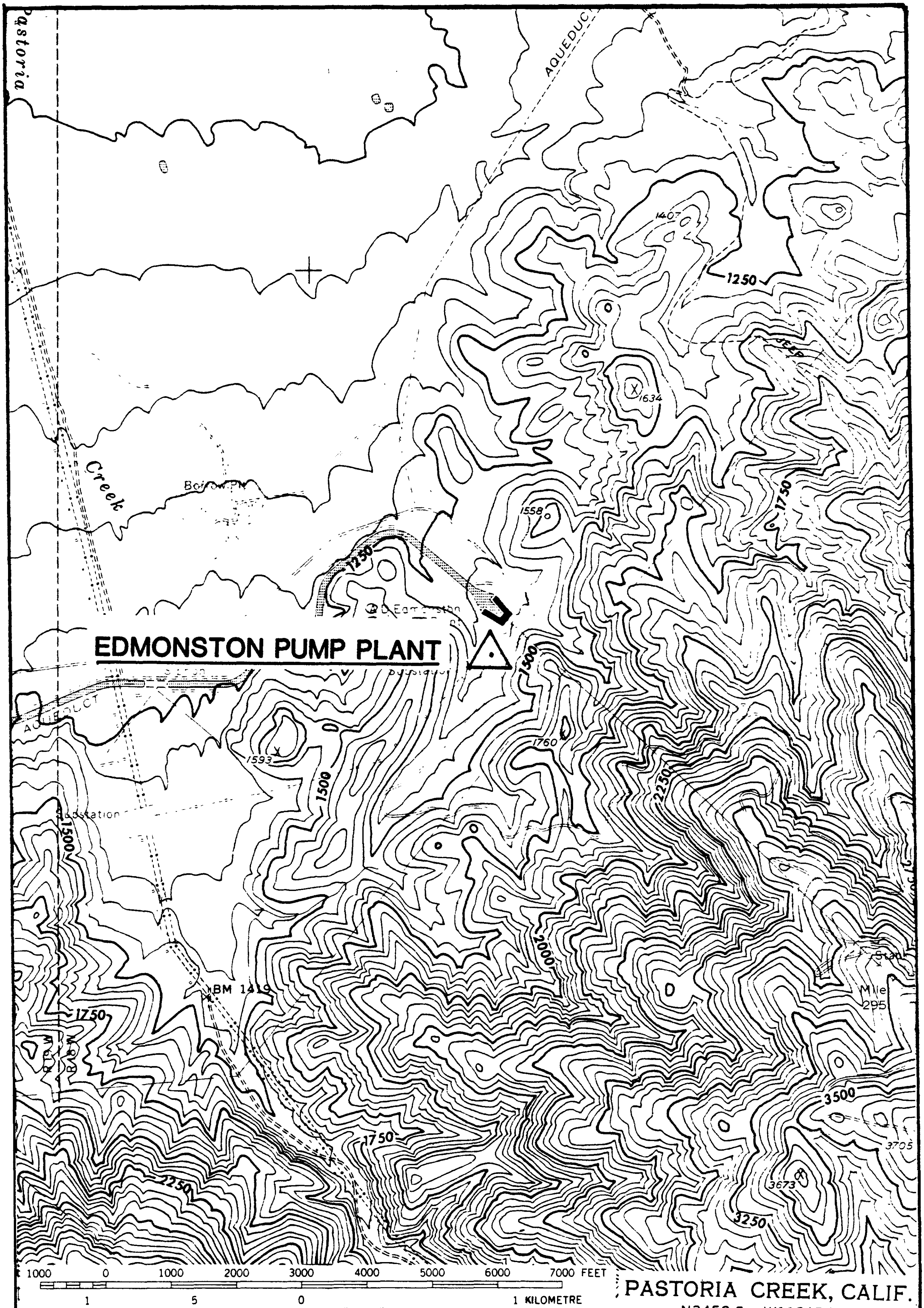

EDMONSTON PUMP PLANT
Pastoria
Creek
AQUEDUCT
AQUEDUC
Borrow Pit
Substation
BM 1419
JEEP
1250
1500
1750
2000
2250
3250
3500
1407
1634
1558
1593
1760
3673
3705
Mile
295
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETRE
PASTORIA CREEK, CALIF.
N3452.5—W11845/7.5

Figure 5

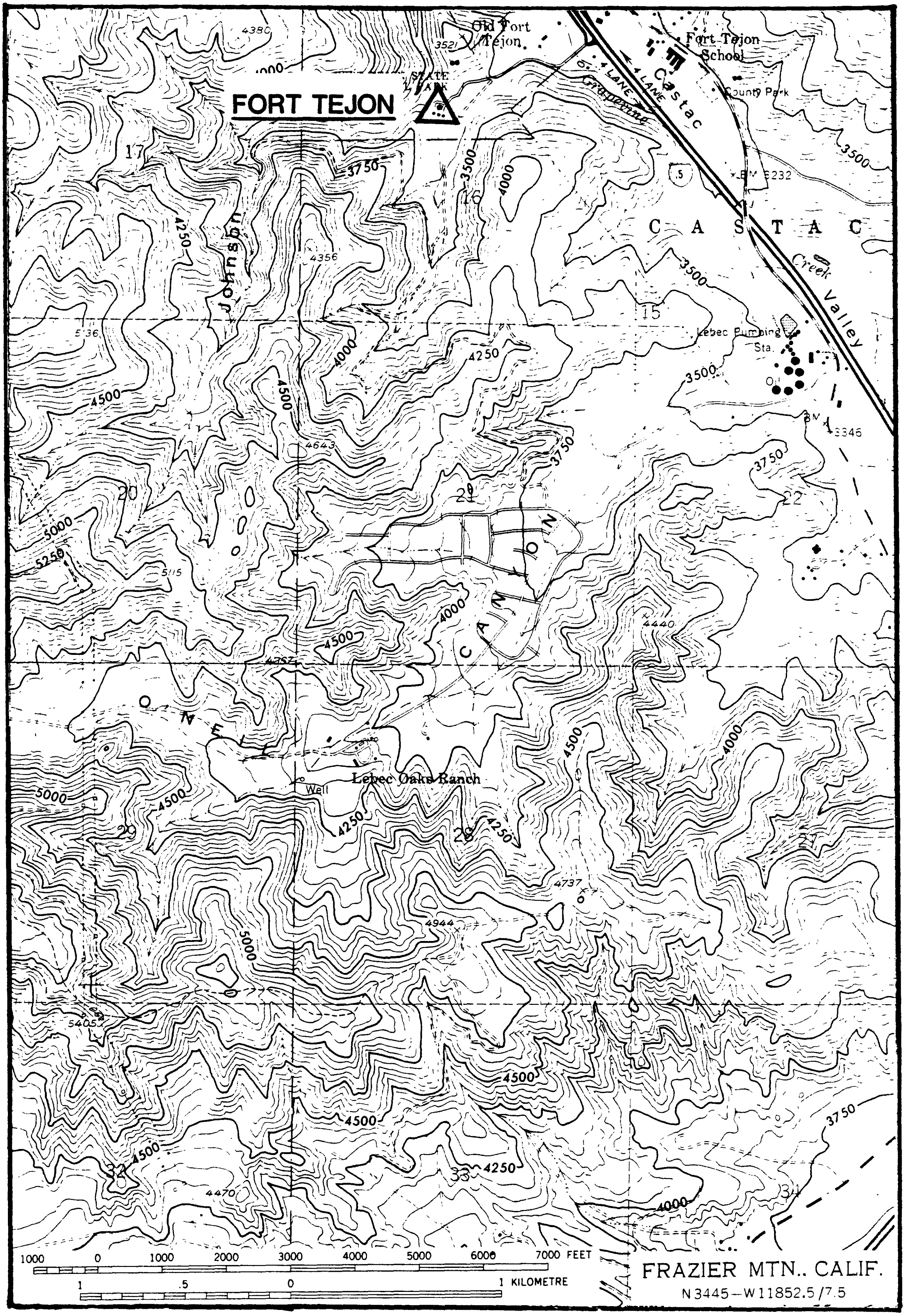

FORT TEJON
Old Fort Tejon
STATE PARK
Fort Tejon School
County Park
Castac
Grapevine
4 LANE
C A S T A C
Creek
Valley
Johnson
Lebec Pumping Sta.
Oil
CANYON
O N E I L L
Lebec Oaks Ranch
Well
BM 3346
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETRE
FRAZIER MTN., CALIF.
N3445—W11852.5/7.5

Figure 6

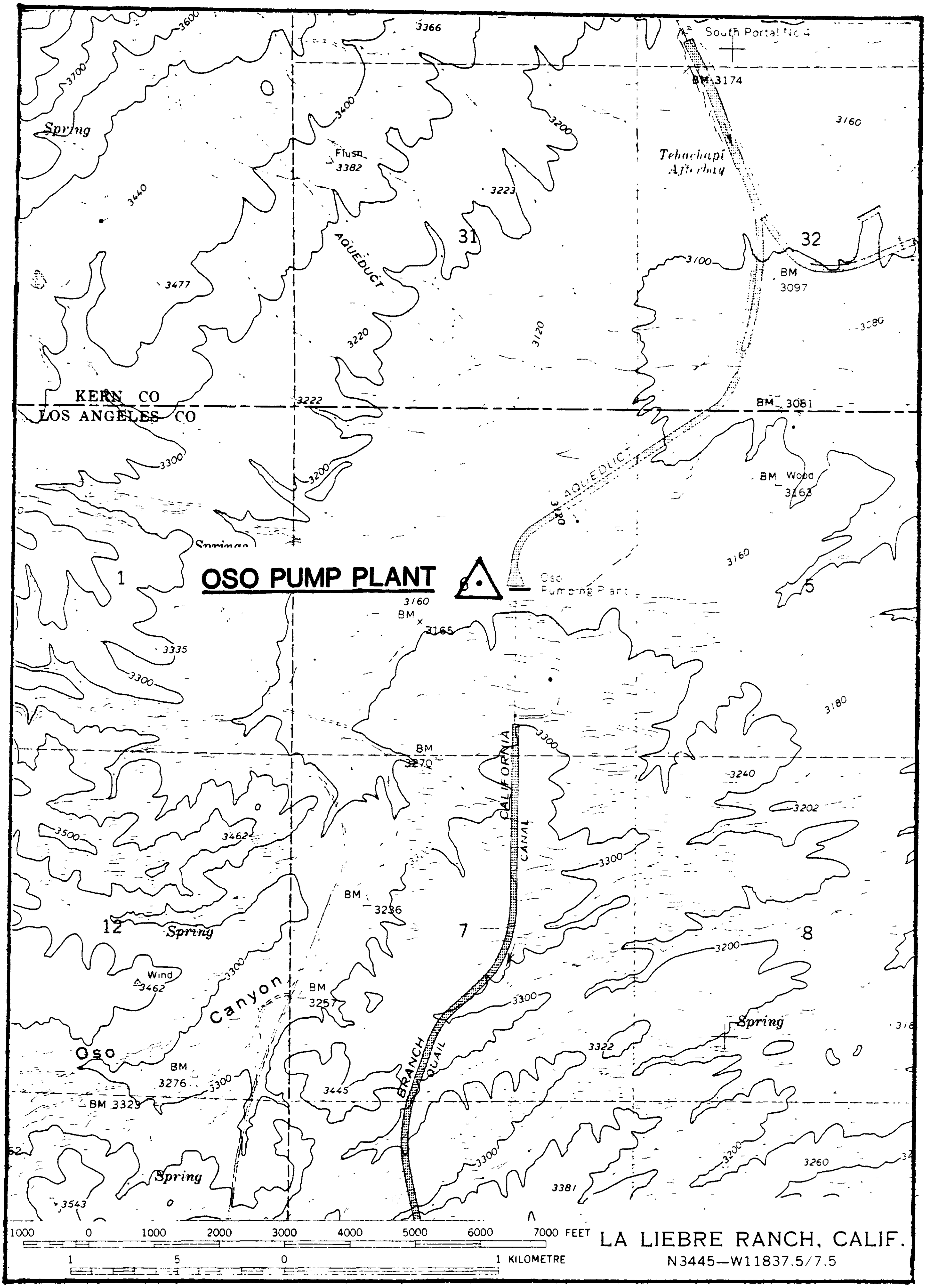

OSO PUMP PLANT
South Portal No 4
BM 3174
Tehachapi Afterbay
AQUEDUCT
KERN CO
LOS ANGELES CO
Oso Pumping Plant
CALIFORNIA AQUEDUCT
CALIFORNIA CANAL
QUAIL BRANCH
Oso Canyon
Spring
Springs
Wind 3462
Flush 3382
BM Wood 3163
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETRE
LA LIEBRE RANCH, CALIF.
N3445—W11837.5/7.5

Figure 7

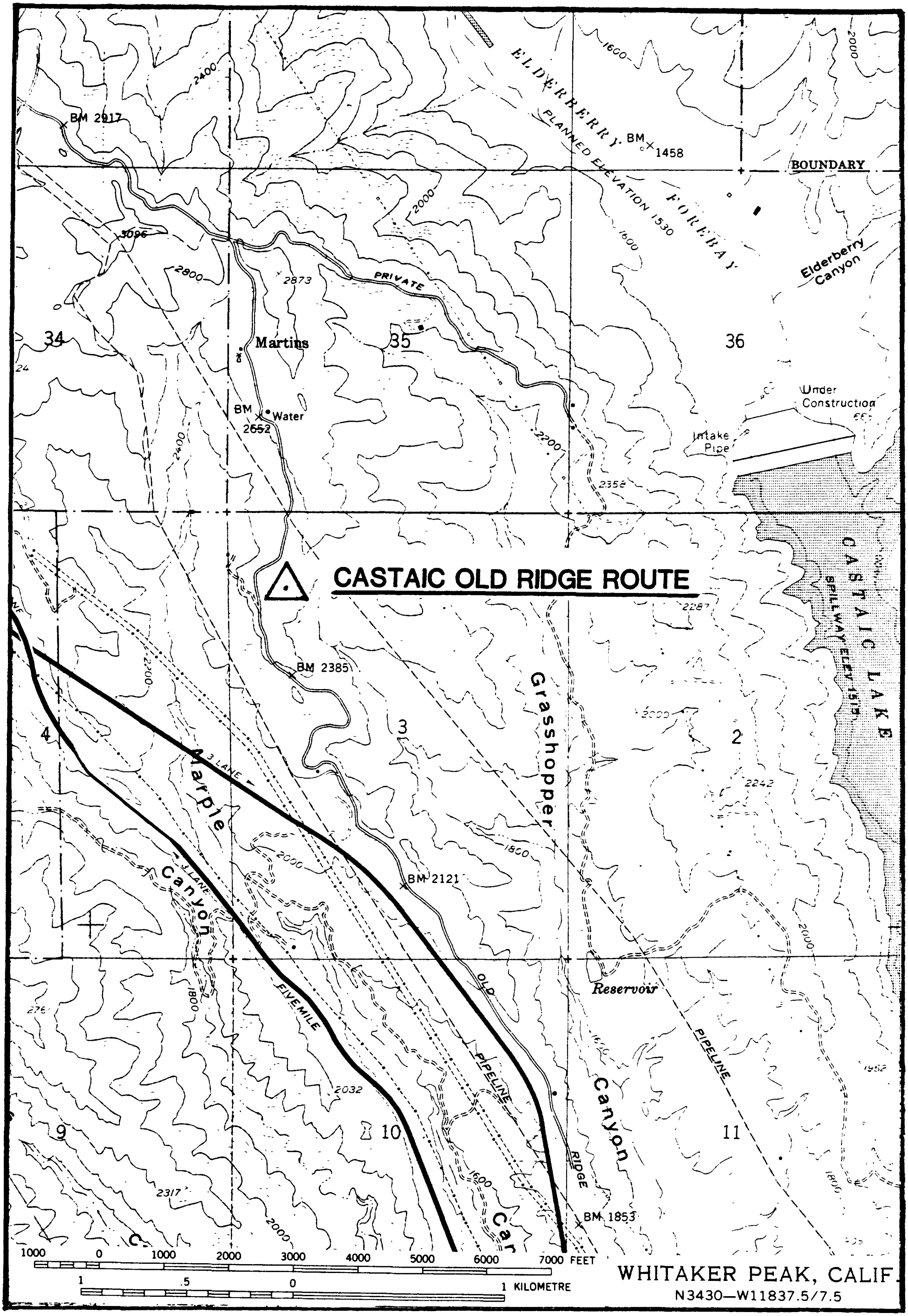

CASTAIC OLD RIDGE ROUTE
ELDERBERRY FOREBAY
PLANNED ELEVATION 1530
BOUNDARY
Elderberry Canyon
Martins
Water
PRIVATE
Under Construction
Intake Pipe
CASTAIC LAKE
SPILLWAY ELEV 1515
Grasshopper Canyon
Marple Canyon
3 LANE
FIVEMILE
PIPELINE
OLD RIDGE
Reservoir
BM 2917
BM 1458
BM 2652
BM 2385
BM 2121
BM 1853
34
35
36
3
2
4
9
10
11
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETRE
WHITAKER PEAK, CALIF.
N3430—W11837.5/7.5

Figure 8

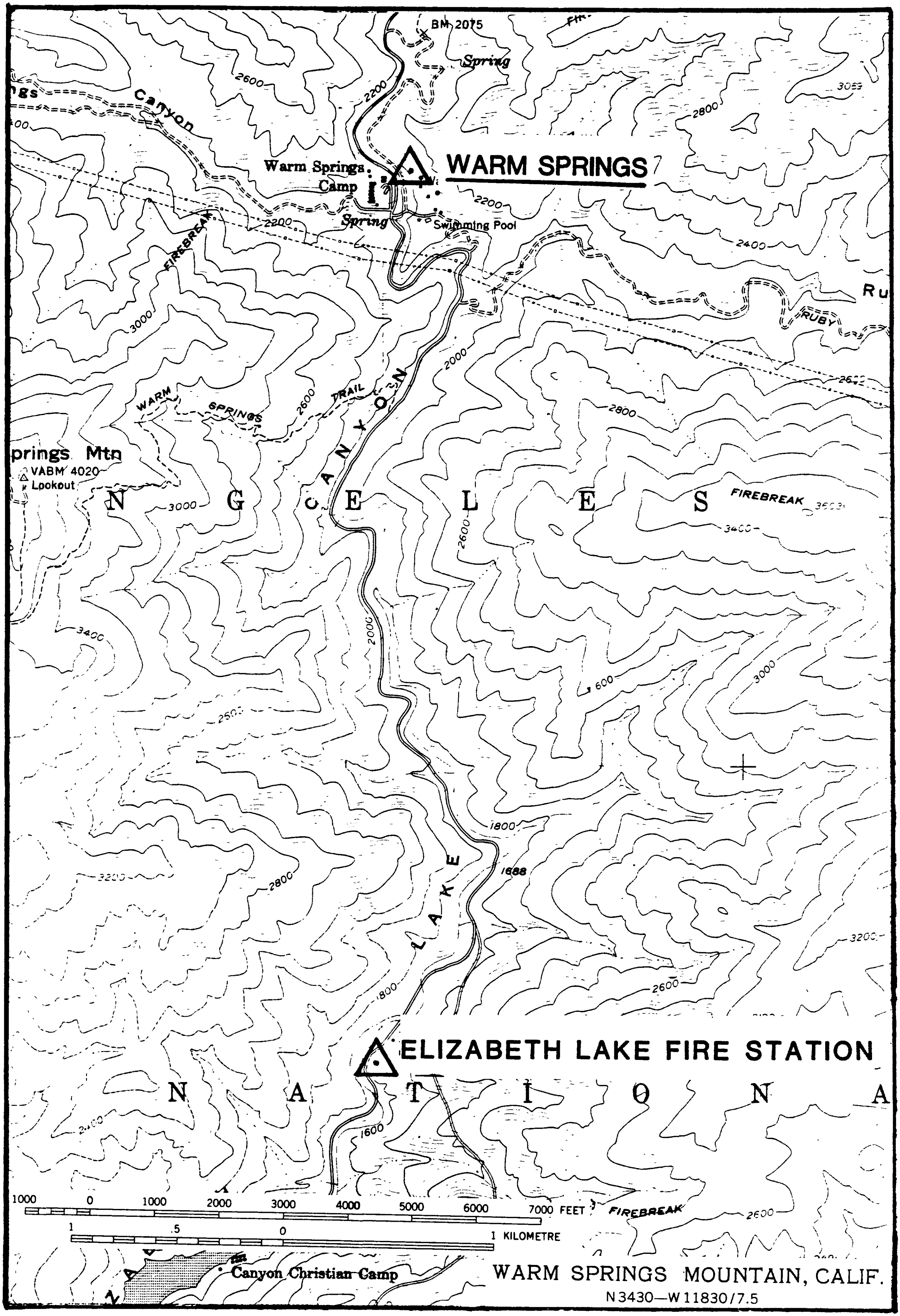

BM 2075
Spring
Canyon
WARM SPRINGS
Warm Springs Camp
Spring
Swimming Pool
FIREBREAK
WARM SPRINGS TRAIL
CANYON
Ruby
springs Mtn
VABM 4020
Lookout
N G E L E S
FIREBREAK
LAKE
ELIZABETH LAKE FIRE STATION
N A T I O N A
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETRE
FIREBREAK
Canyon Christian Camp
WARM SPRINGS MOUNTAIN, CALIF.
N3430—W11830/7.5

Figure 9

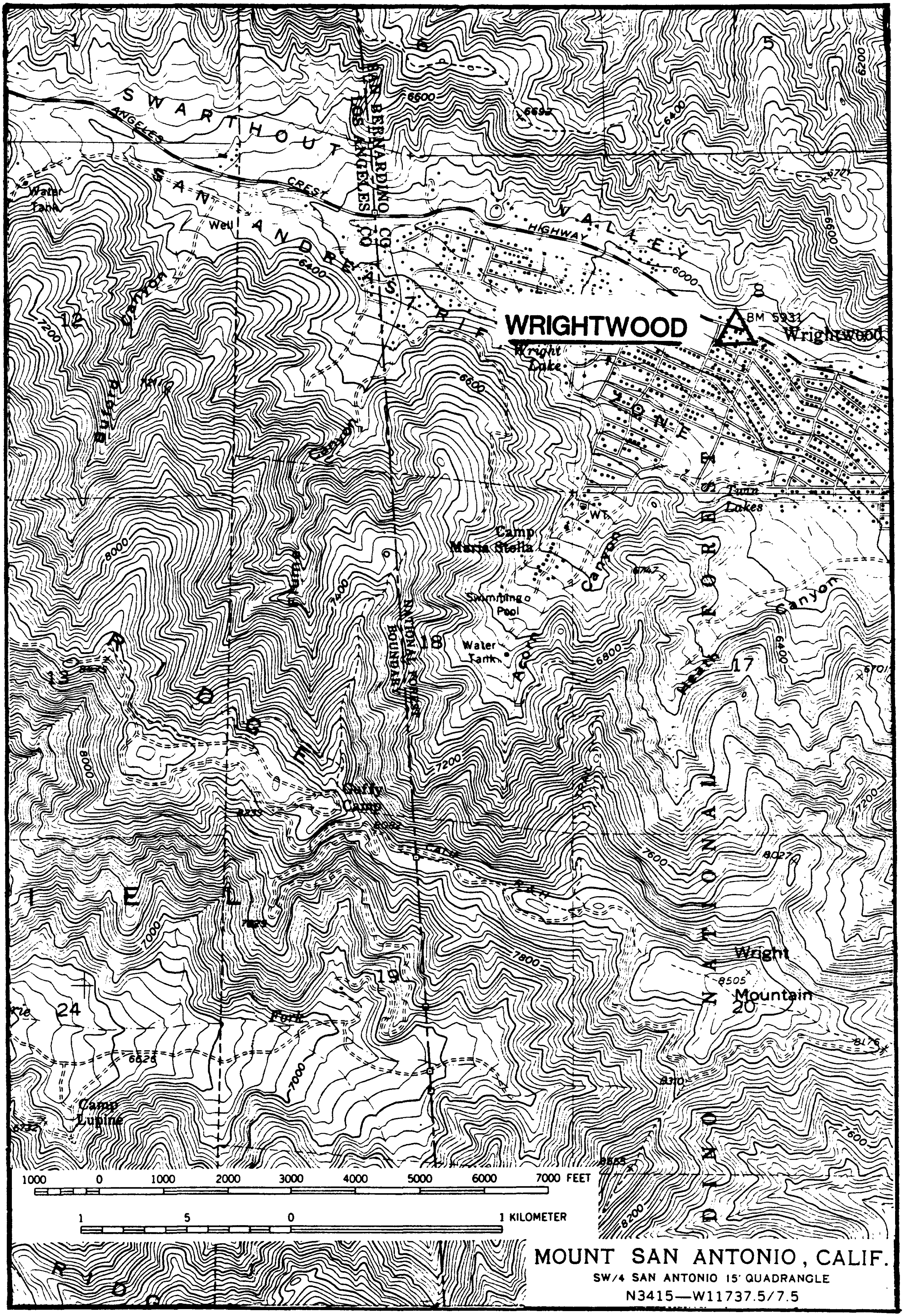

SWARTHOUT VALLEY
SAN ANDREAS RIFT
ANGELES CREST HIGHWAY
SAN BERNARDINO CO
LOS ANGELES CO
WRIGHTWOOD
BM 5931
Wrightwood
Wright Lake
Water Tank
Well
Twin Lakes
Camp Maria Stella
Swimming Pool
Water Tank
Canyon
Acorn
Heath
Guffy Camp
Camp Lupine
Wright Mountain
8505
Fork
NATIONAL FOREST BOUNDARY
ANGELES NATIONAL FOREST
RIDGE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
MOUNT SAN ANTONIO, CALIF.
SW/4 SAN ANTONIO 15' QUADRANGLE
N3415—W11737.5/7.5

Figure 10

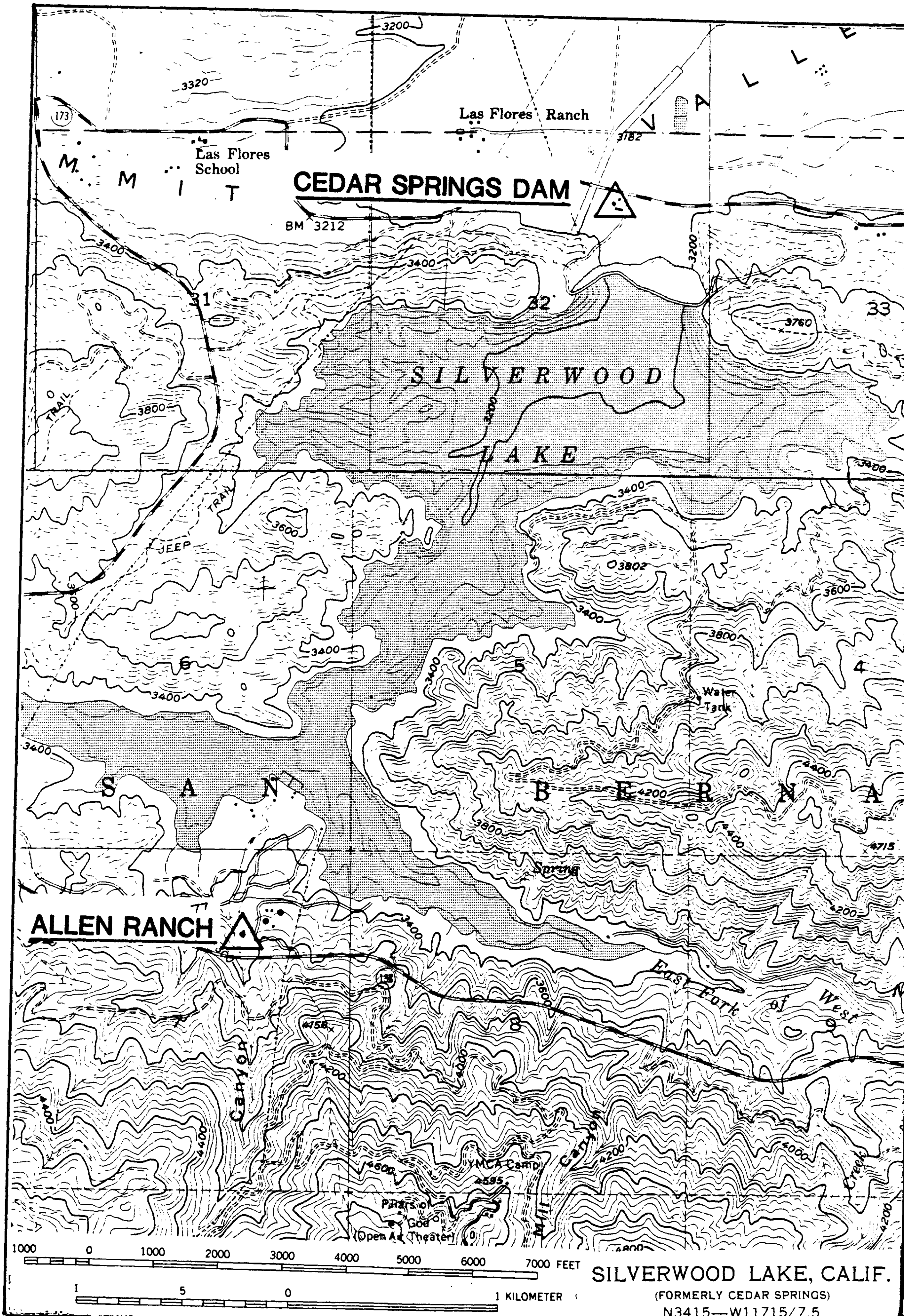

CEDAR SPRINGS DAM
ALLEN RANCH
SILVERWOOD LAKE
Las Flores Ranch
Las Flores School
BM 3212
East Fork of West
YMCA Camp
Pillars of God (Open Air Theater)
Water Tank
Spring
Canyon
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
SILVERWOOD LAKE, CALIF.
(FORMERLY CEDAR SPRINGS)
N3415—W11715/7.5

Figure 11

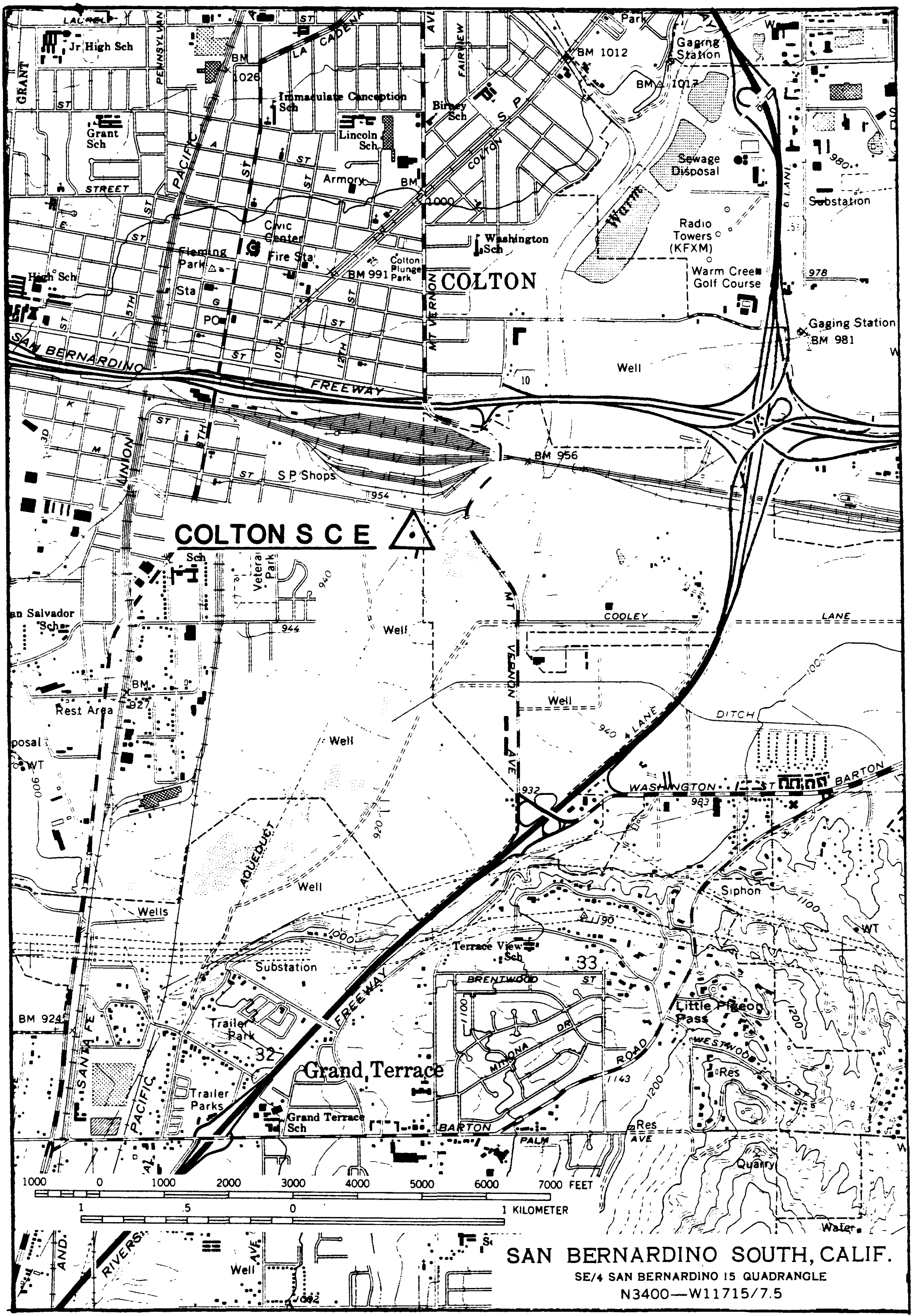

COLTON S C E
COLTON
Grand Terrace
SAN BERNARDINO FREEWAY
S P Shops
Civic Center
Fire Sta
Fleming Park
High Sch
Grant Sch
Jr High Sch
Immaculate Conception Sch
Lincoln Sch
Armory
Washington Sch
Colton Plunge Park
Sewage Disposal
Radio Towers (KFXM)
Warm Creek Golf Course
Gaging Station
Substation
COOLEY LANE
WASHINGTON ST
BARTON
Terrace View Sch
Trailer Park
Trailer Parks
Grand Terrace Sch
Little Pigeon Pass
Siphon
AQUEDUCT
Rest Area
Quarry
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
SAN BERNARDINO SOUTH, CALIF.
SE/4 SAN BERNARDINO 15 QUADRANGLE
N3400—W11715/7.5

Figure 12

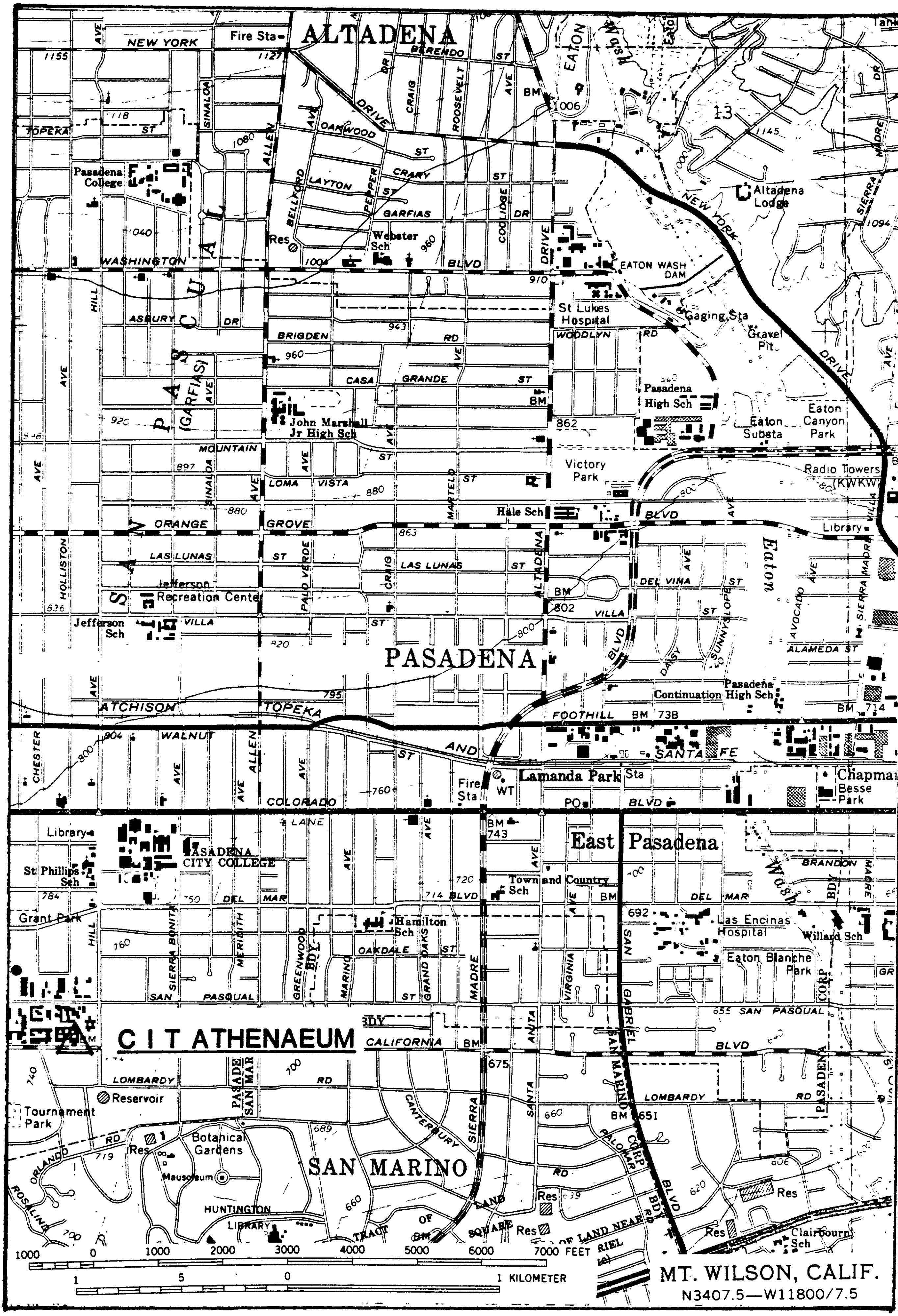

ALTADENA
PASADENA
East Pasadena
SAN MARINO
C I T ATHENAEUM
NEW YORK
Fire Sta
BERENDO
TOPEKA ST
OAKWOOD
CRARY ST
LAYTON ST
GARFIAS
WASHINGTON BLVD
Pasadena College
Webster Sch
Res
EATON WASH DAM
St Lukes Hospital
Gaging Sta
Gravel Pit
Altadena Lodge
NEW YORK DRIVE
ASBURY DR
BRIGDEN RD
WOODLYN RD
CASA GRANDE ST
Pasadena High Sch
John Marshall Jr High Sch
Eaton Substa
Eaton Canyon Park
MOUNTAIN ST
Victory Park
Radio Towers (KWKW)
LOMA VISTA
Hale Sch
ORANGE GROVE BLVD
Library
LAS LUNAS ST
Jefferson Recreation Center
DEL VINA ST
Eaton
Jefferson Sch
VILLA ST
ALAMEDA ST
Pasadena Continuation High Sch
ATCHISON TOPEKA AND SANTA FE
FOOTHILL
WALNUT ST
Lamanda Park Sta
Fire Sta
WT
Chapman
Besse Park
COLORADO BLVD
PO
Library
PASADENA CITY COLLEGE
St Phillips Sch
Town and Country Sch
BRANDON
DEL MAR BLVD
Grant Park
Hamilton Sch
Las Encinas Hospital
Willard Sch
OAKDALE ST
Eaton Blanche Park
SAN PASQUAL ST
CALIFORNIA BLVD
LOMBARDY RD
Reservoir
Tournament Park
Botanical Gardens
Mausoleum
HUNTINGTON LIBRARY
Clairbourn Sch
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER
MT. WILSON, CALIF.
N3407.5—W11800/7.5

Figure 13

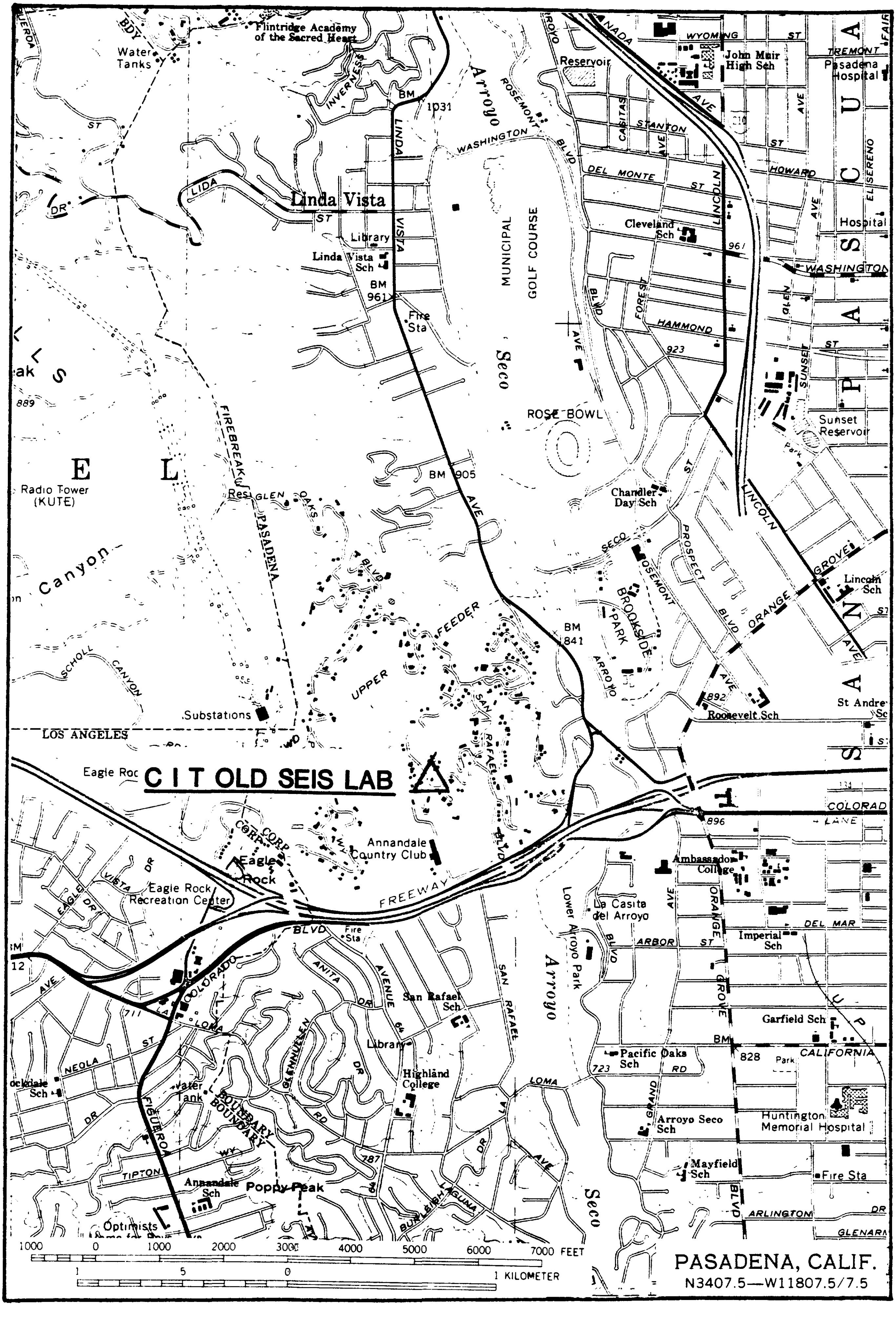

C I T OLD SEIS LAB
PASADENA, CALIF.
N3407.5—W11807.5/7.5
Flintridge Academy of the Sacred Heart
Water Tanks
Linda Vista
Library
Linda Vista Sch
Fire Sta
MUNICIPAL GOLF COURSE
Arroyo
Seco
ROSE BOWL
John Muir High Sch
Pasadena Hospital
Reservoir
Cleveland Sch
Hospital
Sunset Reservoir
Chandler Day Sch
Lincoln Sch
BROOKSIDE PARK
Roosevelt Sch
St Andre
Radio Tower (KUTE)
Canyon
SCHOLL CANYON
FIREBREAK
UPPER FEEDER
Substations
LOS ANGELES
Eagle Rock
Annandale Country Club
FREEWAY
Eagle Rock Recreation Center
Ambassador College
La Casita del Arroyo
Lower Arroyo Park
Imperial Sch
San Rafael Sch
Library
Highland College
Garfield Sch
Pacific Oaks Sch
Arroyo Seco Sch
Huntington Memorial Hospital
Mayfield Sch
Fire Sta
Water Tank
BOUNDARY
Annandale Sch
Poppy Peak
Optimists
Rockdale Sch
COLORADO
FIGUEROA
CALIFORNIA
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

Figure 14


GRIFFITH OBSERVATORY
Greek Theater
Griffith Observatory
Golf Course
Vermont
Aberdeen Canyon
Nursery
LOS FELIZ BLVD
Mother of Good Counsel Sch
Immaculate Heart College
Cheremoya Ave Sch
Hospital
Fire Sta
HOLLYWOOD BLVD
Los Feliz Sch
Barnsdall Park
Olive Hill
Grant Sch
Radio Sta (KNXT)
Radio Tower (KTTV)
SUNSET BLVD
Twentieth Century Fox Studios
Cedars of Lebanon Hospital
Allied Artists Studios
TV Studio (KTLA)
Le Conte Jr H S
FOUNTAIN AVE
HOLLYWOOD
Ramona Sch
SANTA MONICA BLVD
Hollywood Memorial Park (Cem)
Santa Monica Blvd Sch
Immaculate Heart of Mary Sch
Lockwood Ave Sch
Los Angeles City College
Lemon Grove Park
Desilu Studios
Paramount Studios
MELROSE AVE
Parking Area
Dayton Hts Sch
Van Ness Ave Sch
ROSEWOOD
Alexandria Ave Sch
Police Sta
BEVERLY BLVD
Burns Park
Library
Virgil Jr H S
Temple Hospital
Bellevue Park
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
HOLLYWOOD, CALIF.
N3400—W11815/7.5

Figure 15

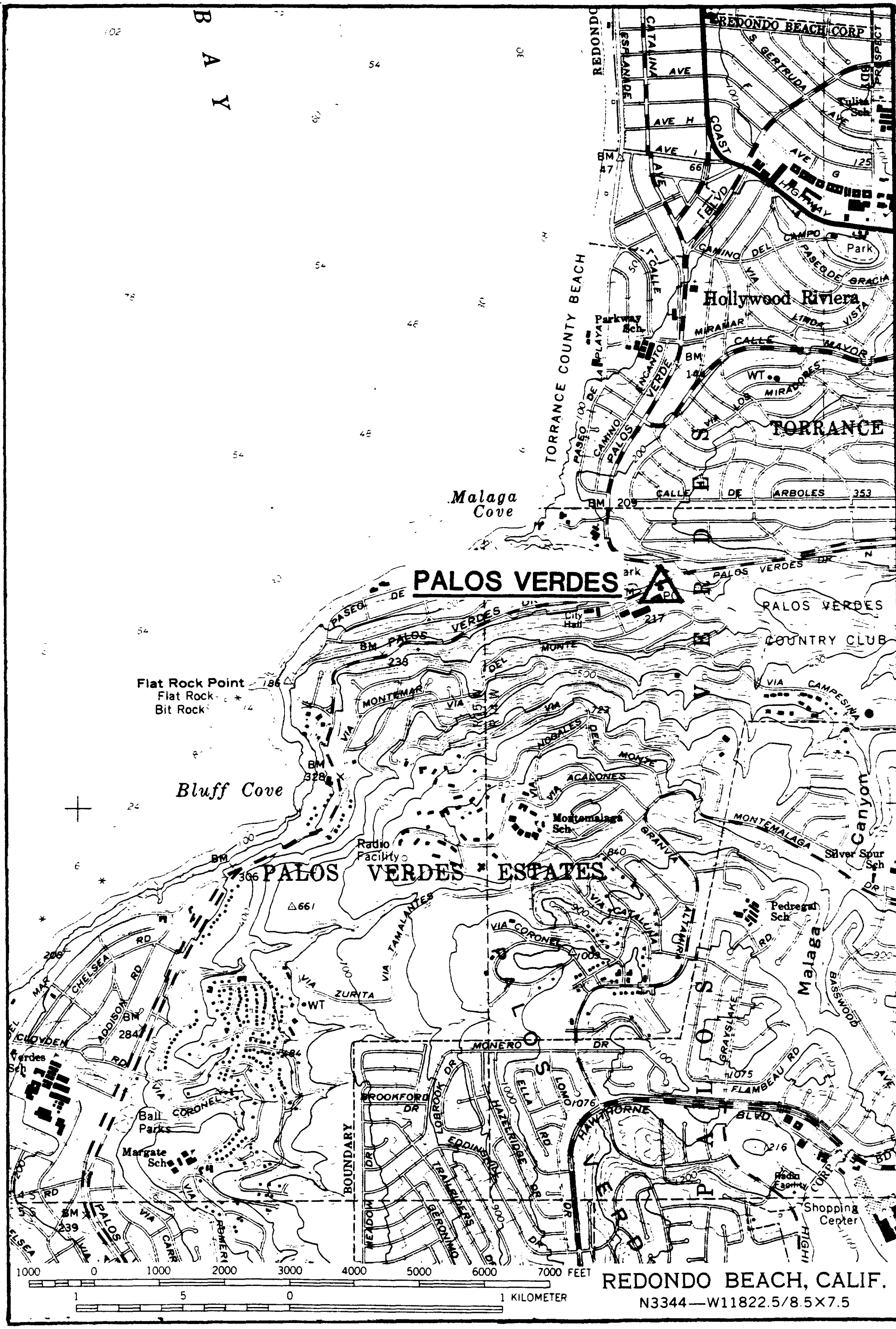
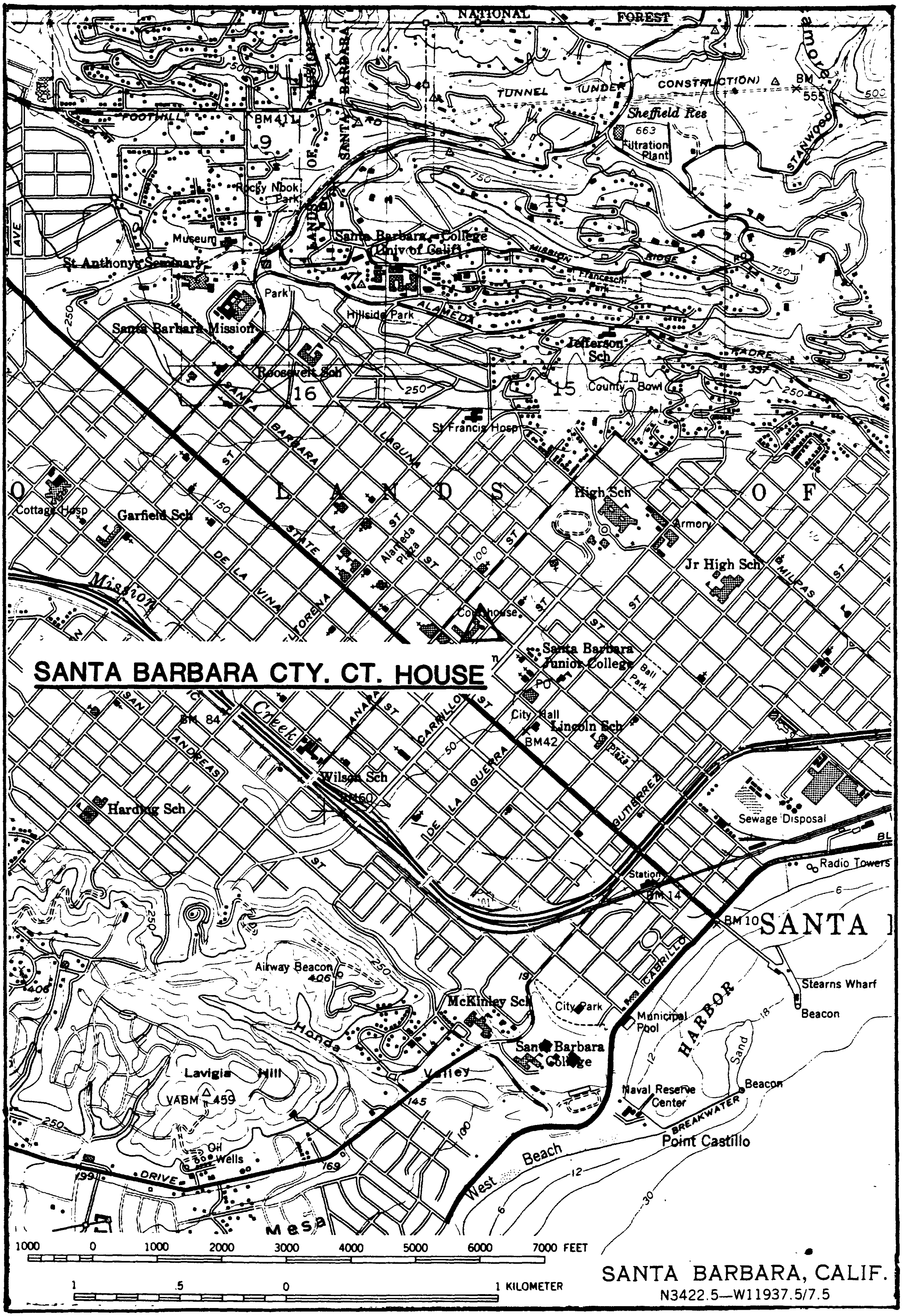

BAY
REDONDO BEACH CORP
Hollywood Riviera
TORRANCE
TORRANCE COUNTY BEACH
Parkway Sch
Malaga Cove
PALOS VERDES
City Hall
PALOS VERDES COUNTRY CLUB
Flat Rock Point
Flat Rock
Bit Rock
Bluff Cove
Radio Facility
PALOS VERDES ESTATES
Montemalaga Sch
Silver Spur Sch
Pedregal Sch
Malaga Canyon
Ball Parks
Margate Sch
Shopping Center
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
REDONDO BEACH, CALIF.
N3344—W11822.5/8.5X7.5

Figure 16



SANTA BARBARA CTY. CT. HOUSE
NATIONAL
FOREST
TUNNEL
(UNDER
CONSTRUCTION)
Sheffield Res
Filtration Plant
FOOTHILL
BM 411
Rocky Nook Park
Museum
St Anthonys Seminary
Santa Barbara College (Univ of Calif)
MISSION
RIDGE
Franceschi Park
Park
Hillside Park
ALAMEDA
Santa Barbara Mission
Jefferson Sch
Roosevelt Sch
County Bowl
St Francis Hosp
SANTA BARBARA
LAGUNA
STATE
LANDS OF
Cottage Hosp
Garfield Sch
High Sch
Armory
Jr High Sch
MILPAS
DE LA VINA
Alameda Plaza
Courthouse
Mission
Santa Barbara Junior College
Ball Park
PO
City Hall
Lincoln Sch
BM42
Plaza
SAN ANDREAS
Creek
BM 84
ANAPAMU ST
CARRILLO ST
DE LA GUERRA
Wilson Sch
BM60
Harding Sch
GUTIERREZ
Sewage Disposal
Radio Towers
Station
BM 14
BM 10
SANTA
CABRILLO
Stearns Wharf
Beacon
Airway Beacon
406
McKinley Sch
City Park
Municipal Pool
HARBOR
Sand
Honda
Valley
Santa Barbara College
Lavigia Hill
VABM 459
Naval Reserve Center
Beacon
BREAKWATER
Point Castillo
West Beach
Oil Wells
DRIVE
Mesa
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
SANTA BARBARA, CALIF.
N3422.5—W11937.5/7.5

Figure 17

ALTITUDE: 680'

DATE: 7/28/81

LOCATION:
Lat. 35°01'34"N
Long. 119°59'30"N

QUADRANGLE:
METTLER, CA

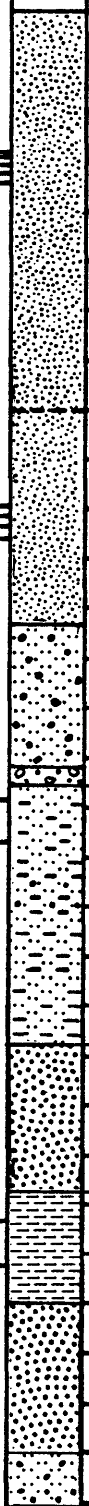
HOLE No. 69

SITE: WHEELER RIDGE

GEOLOGIC MAP UNIT: Qya younger alluvium[8]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Depth (meters)	DESCRIPTION
				0	SAND, dk. brown, poorly sorted, mostly fine to coarse grained, some rounded gravel to 40 mm, angular to sub rounded, granitic, loose to medium dense. (SW)
No recovery-loose sand		12			
				5	
					denser, lt. yellowish brown
SAND, lt. yellowish brown, poorly sorted, mostly medium to v. coarse grained, some gravel to 15 mm, v. dense (SW)		56		10	
					grading to: LOAMY SAND and SANDY LOAM
					grading to:
				15	GRAVELLY SAND, dk. greyish brown, volcanic
SILTY CLAY LOAM, lt. olive brown, v. firm, medium plasticity. (CL)			P		SILTY CLAY LOAM and CLAY LOAM, lt. olive brown, v. firm, medium plasticity. (CL)
				20	
					SAND, brown, moderately well-sorted, mostly coarse to v. coarse-grained, 10% fine gravel, angular to subrounded granitic. (SP)
CLAY, lt. olive brown, v. firm, medium plasticity. (CL)			P	25	CLAY, lt. olive brown, medium moist, v. firm. (CL)
					SAND, brown, poorly sorted, some gravel to 10 mm, angular to subangular, granitic, v. dense. (SW)
					V. FINE SANDY LOAM, yellowish brown
				30	

Graphic Log:



COMMENTS:
Figure 18

LOGGED BY: T. FUMAL

ALTITUDE: 1370'

DATE: 7/28/81

LOCATION:
Lat. 34°56'28"N
Long. 118°49'28"N

QUADRANGLE: PASTORIA CREEK, CA.

HOLE No. 70

SITE: EDMONSTON PUMPING PLANT 6

GEOLOGIC MAP UNIT: Qoa older alluvium
qd Quartz diorite to diorite

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	FINE SANDY LOAM, dk. greyish brown
DIORITE, deeply weathered, dk. yellowish brown, texture is SANDY LOAM.		25/2"			5	DIORITE, deeply weathered, dk. yellowish brown, texture is COARSE SANDY LOAM, some fine gravel to 4 mm.
DIORITE, deeply to moderately weathered, v. dk. grey, firm to hard, mostly v. close to close fracture, some is friable to sand sized.			P		10, 15	DIORITE deeply to moderately weathered, v. dk. grey, firm to hard, v. close to close fracture spacing, substantial is friable to sand size.
GNEISS, moderately weathered, olive grey, most is hard, v. close to close fracture, some is friable to sand size.			P		20, 25, 30	DIORITE, moderately weathered, olive grey, hard to firm, v. close to close fracture spacing, some friable to sand size.

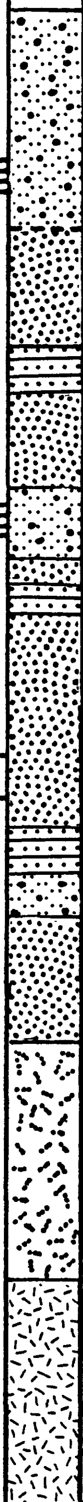
COMMENTS: Drilling rate: 7-16 m 2.5 - 3 min/ft
> 16 m 4 min/ft

LOGGED BY: T. FUMAL

Figure 19

ALTITUDE: 3330' **DATE:** 7/29/81	**LOCATION:** **Lat.** 34°52'16" **Long.** 118°53'54" **QUADRANGLE:** FRAZIER MTN., CA.	**HOLE No.** 71 **SITE:** FORT TEJON **GEOLOGIC MAP UNIT:** Qal Alluvium[6] / qd Quartz diorite

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
SANDY LOAM, yellowish brown, poorly sorted, sand is mostly coarse-grained or finer, some fine gravel to 4 mm, granitic. Medium dense. (SM)		13			0	SANDY LOAM, V. dk. brown to yellowish brown, poorly sorty, most is coarse sand or finer, some fine granitic gravel to 4 mm. (SM)
					5	grading coarser to: V. COARSE SAND, angular, granitic
V. FINE SANDY LOAM, yellowish brown, with lenses of well-sorted, SAND to v. coarse size, dense. (SM-SW)		47			10	SAND, dk. yellowish brown, well-sorted medium to v. coarse grained, some fine granitic gravel. Includes lenses of V. FINE SANDY LOAM and SANDY CLAY LOAM, yellowish brown. (SP-SC)
SAND, dk. yellowish brown, well-sorted, medium to v. coarse grained, some fine granitic gravel, angular to subangular. (SP)			P		15	
					20	GRANITIC GRUS, moderately weathered yellowish brown, some fresh fragments.
					25	GRANODIORITE, white, dk. green, slightly weathered to fresh, hard, strongly saussuritized, closely to moderately fractured.
					30	CONTINUED ON FOLLOWING FIGURE



COMMENTS:
Figure 20

LOGGED BY: T. FUMAL

ALTITUDE: 3330'

DATE: 7/29/81

LOCATION:
Lat. 34°52'16"
Long. 118°53'54"

QUADRANGLE: FRAZIER MTN., CA.

HOLE No. 71

SITE: FORT TEJON

GEOLOGIC MAP UNIT: Qal Alluvium[6]; qd Quartz diorite

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					30	
GRANODIORITE, white, dk. green, hard, fresh but strongly saussuritized, most is moderately fractured, some is close, sections of core crushed and porous.			C		35	
					40	
					45	
					50	
					55	
					60	

COMMENTS:
Figure 20 (continued)

LOGGED BY:

ALTITUDE: 3125'

DATE: 7/30/81

LOCATION:
Lat. 34°48'40"N
Long. 118°43'14"W

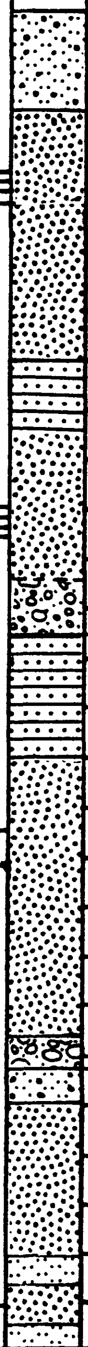
QUADRANGLE: LA LIEBRE RANCH, CA.

HOLE No. 72

SITE: OSO PUMPING PLANT

GEOLOGIC MAP UNIT: Qa Alluvium[2]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	SANDY LOAM, dk. greyish brown, poorly sorted to v. coarse size. (SM)
SAND, yellowish brown, moderately well-sorted, mostly medium to v. coarse grained, 10% fine gravel to 10 mm, angular to subangular, medium dense. (SP-SW)		22				grading to: SAND, yellowish brown, moderately well-sorted, most is medium to v. coarse sand, 10% fine gravel to 10 mm, angular to subangular, medium dense. (SW)
					5	V. COARSE SAND, 15-20% gravel to 10 ~~mm.~~ (SW)
SAND, dk. yellowish brown, moderately well-sorted, mostly coarse to v. coarse grained, 10-20% gravel to 20 mm, dense. (SP)		34			10	FINE SANDY CLAY LOAM, greyish brown grading to: SAND, dk. brown to yellowish brown, moderately well-sorted, mostly coarse to v. coarse grained, 10-20% gravel to 20 mm, dense. (SP) grading to: SANDY GRAVEL, yellowish brown, to 30mm
						SANDY CLAY LOAM, yellowish brown. (SC)
SAND, yellowish brown, well-sorted, coarse grained, subangular to subrounded. (SP)			P		15	grading to: SAND, yellowish brown, well-sorted mostly medium to v. coarse grained. (SP)
					20	grading to: SANDY GRAVEL
						SANDY LOAM, dk. yellowish brown grading to: SAND, yellowish brown, well-sorted, medium to coarse grained. Includes lenses of SILT LOAM. (ML-SP)
SAND, yellowish brown, well-sorted, medium to coarse grained. (SP) SILT LOAM, yellowish brown, quick. (ML)			P		25	
					30	



COMMENTS: Figure 21

LOGGED BY: T. FUMAL

ALTITUDE: 2560'

DATE: 8/4/81

LOCATION:
Lat. 34°33'22"N
Long. 118°38'54"W

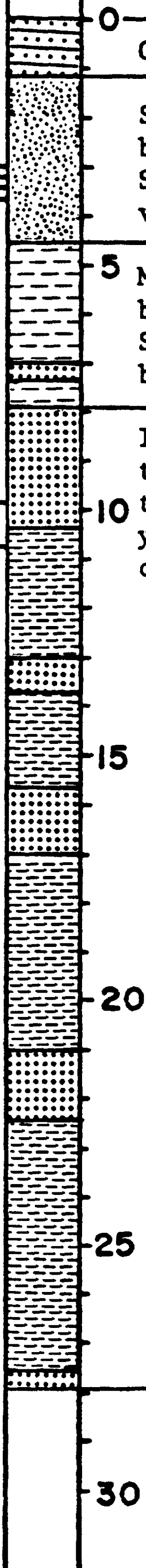
QUADRANGLE: WHITAKER PEAK, CA.

HOLE No. 73

SITE: CASTAIC OLD RIDGE ROUTE

GEOLOGIC MAP UNIT: Mc Castaic Fm.

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Depth (meters)	DESCRIPTION
				0	CLAY LOAM, dk. reddish brown (CH)
SANDSTONE, deeply weathered, brownish yellow, texture is LOAMY FINE SAND. (SM)		29			SANDSTONE, deeply weatherd, strong brown to brownish yellow, texture is SANDY LOAM to LOAMY SAND, mostly v. fine to fine sand. (SM)
				5	MUDSTONE, deeply weathered, yellowish brown to greyish brown, soft to firm. Some hard sandstone and shale lenses below 7 m.
SANDSTONE, deeply weathered, yellowish brown, fine grained, most is soft and friable, substantial is hard and closely fractured MUDSTONE, lt. olive brown, soft to firm. Close fracture, texture is SILTY CLAY LOAM.			P	10	Interbedded MUDSTONE, lt. olive brown to greyish brown, soft to firm, close to moderate fracture and SANDSTONE yellowish brown to grey, firm to hard, close to moderate and wider fracture.



COMMENTS: Lost circulation at top of each sandstone bed. Lost circulation at 21.2 m and never regained it.

LOGGED BY: T. FUMAL

Figure 22

ALTITUDE: 1635'

DATE: 8/5/81

LOCATION:
Lat. 34°34'15"
Long. 118°33'35"

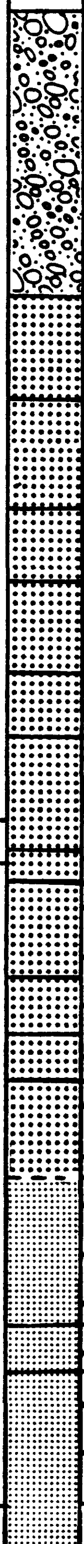
QUADRANGLE: WARM SPRINGS MTN., CA.

HOLE No. 74

SITE: ELIZABETH LAKE FIRE STATION

GEOLOGIC MAP UNIT: EP San Francisquito Fm.[7]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	SANDY GRAVEL, mostly yellowish brown to greyish brown sandstone, some siltstone and granite, well-sorted, most is 10-30 mm, subangular. (GP)
					5	SANDSTONE, yellowish brown, moderately to slightly weathered, hard, fine-grained, close to moderate fracture spacing close to v. close.
					10	Fresh, grey
						c. to m.
						c. to v. c
						c. to m.
					15	c. to v.c.
SANDSTONE, grey, fresh, fine to medium grained, hard, close to v. close fracture spacing.			P			c. to m.
						c. to v.c.
					20	c. to m.
						c. to v.c.
						c. to m.
						SILTSTONE, black, hard
					25	
						c. to v.c.
						c. to m.
SILTSTONE and V. FINE SANDSTONE, black, fresh, hard, close to moderate fracture spacing.			C		30	



COMMENTS:
Figure 23

LOGGED BY: T. FUMAL

ALTITUDE: 2060

DATE: 8/6/81

LOCATION:
Lat. 34°36'30"N
Long. 118°33'30"W

QUADRANGLE: WARM SPRINGS MTN., CA.

HOLE No. 75

SITE: WARM SPRINGS CAMP

GEOLOGIC MAP UNIT: Sgn Sawtooth Gneiss[6]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	SANDY LOAM, brown grading to: SANDY GRAVEL, white, granitic, most is 5-20 mm, angular, hard.
						GRANITIC GNEISS and AMPHIBOLITE, moderately to slightly weathered, white to v. dk. greyish brown, v. close to close fracture spacing.
					5	
GRANITIC GNEISS, lt. grey, fresh, v. hard, most is moderately fractured, some is close.			C		10	GRANITIC GNEISS, lt. grey, fresh, v. hard, moderate to close fracture spacing.
					15	
						Moderate and wider fracture spacing.
					20	
					25	
					30	

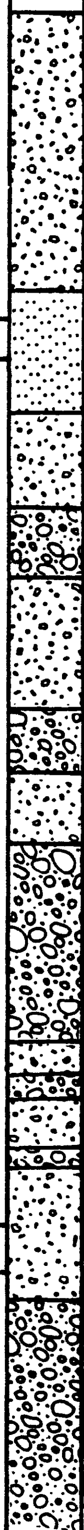
COMMENTS: Drilling rate: 10-15 m 5-6 min/ft
v. slow below 17.5 m

Figure 24

LOGGED BY: T. FUMAL

ALTITUDE: 5930' DATE: 8/10/81	LOCATION: Lat. 34°21'39" Long. 117°38'00" QUADRANGLE: MOUNT SAN ANTONIO, CA.	HOLE No. 76 SITE: WRIGHTWOOD GEOLOGIC MAP UNIT: Qal Alluvium[7]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0–5.5	SANDY GRAVEL, v. dk. grey, moderately-well sorted to 15 mm, angular fragments of black schist and qtz vein material.
SILT LOAM, olive grey, poorly sorted, 20-30% black schist sand to fine gravel, angular.			P		5.5–8	SILT LOAM, olive grey, poorly sorted, 20-30% black schist sand and fine gravel, angular. (ML-SM).
					8–14	SANDY GRAVEL, v. dk. grey, moderately well sorted to 15 mm, angular fragments of black schist and qtz vein material. Includes beds of coarse GRAVEL.
GRAVELLY SAND, olive grey, v. firm, poorly sorted, 30% gravel of flat, black schist fragments and quartz vein material.			P		14–30	GRAVEL, v. dk. grey, moderately well sorted to 60 mm, some cobbles and boulders, angular black schist and quartz vein material. Includes beds of poorly sorted GRAVELLY SAND and SANDY GRAVEL.



Depth scale (meters): 0, 5, 10, 15, 20, 25, 30

COMMENTS: Figure 25	LOGGED BY: S. MATHIESON

ALTITUDE: 3515'

DATE: 8/11/81

LOCATION:
Lat. 34°16'38"N
Long. 117°20'04"W

QUADRANGLE: SILVERWOOD LAKE, CA.

HOLE No. 77

SITE: ALLEN RANCH

GEOLOGIC MAP UNIT: *grd* (p6g) Granodiorite[7]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0–1.5	SANDY LOAM, dk. brown, high content of organic matter, wood, etc. (Fill).
GRANODIORITE, fresh, hard, 40 cm core unfractured.			C		1.5–5	BOULDER GRAVEL, fresh, hard granodiorite, to 2.1 m in diameter.
					5–14	GRANODIORITE GRUS, deeply to moderately weathered, yellowish brown, v. close to close fracture spacing.
					14–22	GRANODIORITE, fresh, hard, moderate and wider fracture spacing.

Depth scale: 0, 5, 10, 15, 20, 25, 30

COMMENTS: Drilling rate slower than 15 min/ft below 14 m.

LOGGED BY: S. MATHIESON

Figure 26

ALTITUDE: 3180'

DATE: 8/17/81

LOCATION:
Lat. 34°18'27"N
Long. 117°18'53"

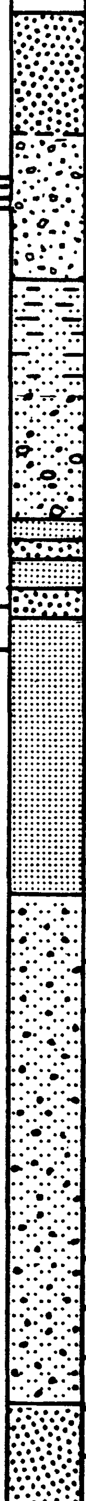
QUADRANGLE: SILVERWOOD LAKE, CA.

HOLE No. 78

SITE: CEDAR SPRINGS DAM

GEOLOGIC MAP UNIT: Qal Alluvium[7]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/ Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	SAND, dk, brown, poorly sorted to v. coarse sand. (SM) grading to: GRAVELLY SAND and SANDY GRAVEL, yellowish brown, v. poorly sorted to 10 mm, some friable granitic cobbles, v. dense. (SP-GP)
GRAVELLY SAND, yellowish brown, v. poorly sorted, mostly coarse sand to fine gravel, some friable granitic cobbles, v. dense. (SW)		65				
					5	SILTY CLAY LOAM, yellowish brown (CL) grading to: SANDY LOAM, yellowish brown, poorly sorted to v. coarse sand, some granitic cobbles. (SW)
					10	SILTSTONE, v. pale brown to brown texture is silty clay loam, v. firm, high plasticity. Includes beds of moderately well sorted SAND to coarse size. (CH-SW)
SAND, lt. brownish grey, moderately well sorted to coarse sand (SW). SILTSTONE, brown, texture is silty clay loam, v. firm, high plasticity. (CH)			P			
					15	
						SANDY LOAM, yellowish brown, poorly sorted to v. coarse size, v. dense. (SM)
					20	
					25	grading to: V. COARSE SAND, lt. yellowish brown, well-sorted, granitic, some granitic cobbles and boulders. (SP)
					30	Continued on next figure.



COMMENTS:

Figure 27

LOGGED BY: S. MATHIESON

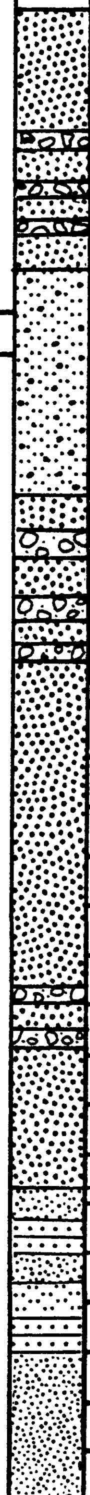
ALTITUDE:	LOCATION: Lat. Long.	HOLE No.
DATE:	QUADRANGLE:	SITE: CEDAR SPRINGS DAM GEOLOGIC MAP UNIT:

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					30	
					35	
					40	
					45	
					50	
					55	
					60	

COMMENTS:	LOGGED BY:
Figure 27	

ALTITUDE: 950'	LOCATION: Lat. 34°03'35"N Long. 117°18'47"W	HOLE No. 79
DATE: 8/19/81	QUADRANGLE: SAN BERNARDINO SOUTH, CA.	SITE: COLTON SCE GEOLOGIC MAP UNIT: Qyal Alluvium[4]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	SAND, fresh, granitic, well sorted, coarse to v. coarse angular to subrounded. Includes beds of gravel to cobble size.
V. FINE SANDY LOAM, dk. olive brown, micaceous, moist, v. firm. (ML)			P		5	V. FINE SANDY LOAM, dk. olive brown, micaceous, moist, v. firm. (ML)
					10	SAND, olive brown, well-sorted, mostly coarse to v. coarse. Includes lenses of granitic cobbles and gravel. (SP-GP)
					15	
					20	
					25	SAND, yellowish brown, with lenses of silt loam and clay loam. (SC)
					30	



COMMENTS:

Figure 28

LOGGED BY: S. MATHIESON

ALTITUDE: 747'	**LOCATION:** Lat. 34°08'10" Long. 118°07'17"W	**HOLE No.** 80
DATE: 8/20/81	**QUADRANGLE:** MT. WILSON, CA.	**SITE:** CIT ATHENAEUM
		GEOLOGIC MAP UNIT: Qt Terrace Deposits

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Depth (meters)	DESCRIPTION
				0	SAND, dk. yellowish brown, poorly sorted, mostly medium to v. coarse sand, some granitic gravel to 30 mm, angular to subrounded, dense to v. dense. (SW)
SAND, yellowish brown, poorly sorted, mostly finer than v. coarse sand, some gravel to 30 mm, granitic, v. dense. (SW)		73		5	
				10	GRAVELLY SAND, yellowish brown (SP)
				15	grading to: SAND, lt. yellowish brown, poorly sorted, mostly coarse to v. coarse, 10-20% gravel to 10 mm, angular to subangular. (SP) grading to: GRAVEL, to 30 mm.
				20	GRAVELLY SAND, yellowish brown, mostly coarse to v. coarse grained. (SP) grading to: GRAVELLY SANDY LOAM, dk. yellowish brown, v. poorly sorted, 30% gravel to 10 mm, subangular to subrounded. (SW)
				25	SANDY CLAY LOAM, dk. greyish brown, medium plasticity, sand is mostly medium or finer. (CL)
				30	GRAVELLY SAND, dk. yellowish brown. (SP)

COMMENTS: Figure 29

LOGGED BY: S. MATHIESON

ALTITUDE: 980'

DATE: 8/24/81

LOCATION:
Lat. 34°08'51"N
Long. 118°10'16"W

QUADRANGLE: PASADENA, CA.

HOLE No. 81

SITE: CIT OLD SEISMOLOGICAL LAB

GEOLOGIC MAP UNIT: gr granitic basement rocks[7]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	GRANITIC GRUS, yellowish brown to lt. yellowish brown, easily friable to sand size, some fine gravel, angular to subangular. Deeply weathered quartz montonite.
GRANITIC GRUS, lt. yellowish brown, easily friable to v. coarse sand, v. small amount of mafic minerals.		77/6"			5	
						QUARTZ MONZONITE, deeply to moderately weathered, yellowish brown to white, some fresh fragments, firm rock mass, v. close to close fracture spacing, substantial is friable to sand size.
					10	
						QUARTZ MONZONITE, lt. grey, fresh 10-15% mafic minerals, slightly sausseritized, hard, medium grained, close to moderate fracture spacing.
QUARTZ MONZONITE, lt. grey, 15% mafic minerals, fresh, hard, medium grained, mostly close fracture spacing substantial moderate, slightly sausseritized, chlorite fracture coatings.			C		15	
					20	
					25	
					30	

COMMENTS: Drilling rate: 6-12 m 2-3 min/ft
15-30 m 4.5-5.5 min/ft

LOGGED BY: S. MATHIESON

Figure 30

ALTITUDE: 1130' **DATE:** 8/25/81	**LOCATION:** Lat. 34°07'13"N Long. 118°17'56"W **QUADRANGLE:** HOLLYWOOD, CA.	**HOLE No.** 82 **SITE:** GRIFFITH OBSERVATORY **GEOLOGIC MAP UNIT:** fgd Feliz Granodiorite

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0–5	GRANODIORITE GRUS, deeply weatherd, yellowish brown, easily friable to coarse to v. coarse sand.
					5–30	GRANODIORITE, deeply to moderately weathered, mottled white, black and strong brown, firm to hard, mostly close to v. close fracture spacing, substantial is friable to sand sized. Includes zones of dark, metamorphosed country rock.
GRANODIORITE, mottled black, white, strong brown, moderately weathered hard, close to v. close fracture spacing.			P		20–21	

Depth scale (meters): 0, 5, 10, 15, 20, 25, 30

COMMENTS: Drilling rate: 10-25 m 2.5-3 min/ft.

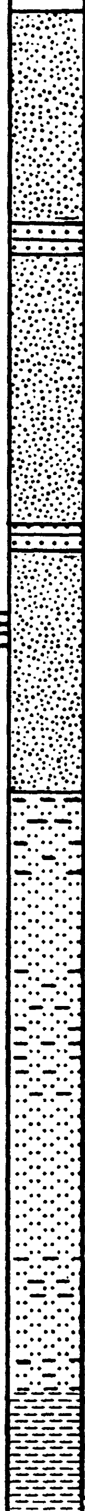
LOGGED BY: S. MATHIESON

Figure 31

ALTITUDE: 200'	LOCATION: Lat. 33°48'01"N Long. 118°23'16"W	HOLE No. 83
DATE: 8/26/82	QUADRANGLE: REDONDO BEACH, CA.	SITE: PALOS VERDES GEOLOGIC MAP UNIT: Qtc Nonmarine terrace cover; Tm Monterey shale

9

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Graphic Log	Depth (meters)	DESCRIPTION
					0	SAND, yellowish brown, well-sorted, fine to medium grained, subangular to subrounded, dense to v. dense. Includes lenses of CLAY LOAM. (SP-CL)
					5	
					10	
SAND, yellowish brown, well-sorted, fine to medium grained, v. dense. (SP)		70				
					15	SILT LOAM and SILTY CLAY LOAM, dk. brown to black, v. stiff, some v. coarse sand, wet. (ML)
					20	
					25	
						MUDSTONE, hard, black.
					30	



COMMENTS:
Figure 32

LOGGED BY:
S. MATHIESON

ALTITUDE: 75'	**LOCATION:** Lat. 34°25'28"N Long. 119°42'05"W	**HOLE No.** 84
DATE: 8/31/81	**QUADRANGLE:** SANTA BARBARA, CA.	**SITE:** SANTA BARBARA COUNTY COURTHOUSE
		GEOLOGIC MAP UNIT: Qfg Fanglomerate[1]

SAMPLE DESCRIPTION	Density (gm/cc)	Blows/Foot	Sampling	Depth (meters)	DESCRIPTION
				0	SANDY LOAM, strong brown, mostly fine to medium sand. (SM) grading to: SANDY GRAVEL, yellowish brown, mostly hard sandstone, some shale, angular to subrounded, some boulders to 40 cm.
				5	SANDY CLAY LOAM and LOAM, strong brown, v. firm, poorly sorted, most is finer than medium sand. Some fine sandstone gravel, moist. (CL)
LOAM, strong brown sand is v. fine grained, v. firm, moist. (SM)			P	10	
				15	SANDY GRAVEL, yellowish brown, 90% is hard, fine sandstone gravel to 20 mm, angular to subrounded, occasional boulders to 60 cm. (GP)
					SANDY CLAY LOAM, strong brown.
				20	SANDY GRAVEL, occasional boulders to 30 cm. (GP)
				25	SANDY CLAY LOAM and SANDY LOAM strong brown to yellowish brown, most is fine sand, some gravel, v. firm. (CL-SM)
				30	

Graphic Log

COMMENTS:
Figure 33

LOGGED BY: T. FUMAL

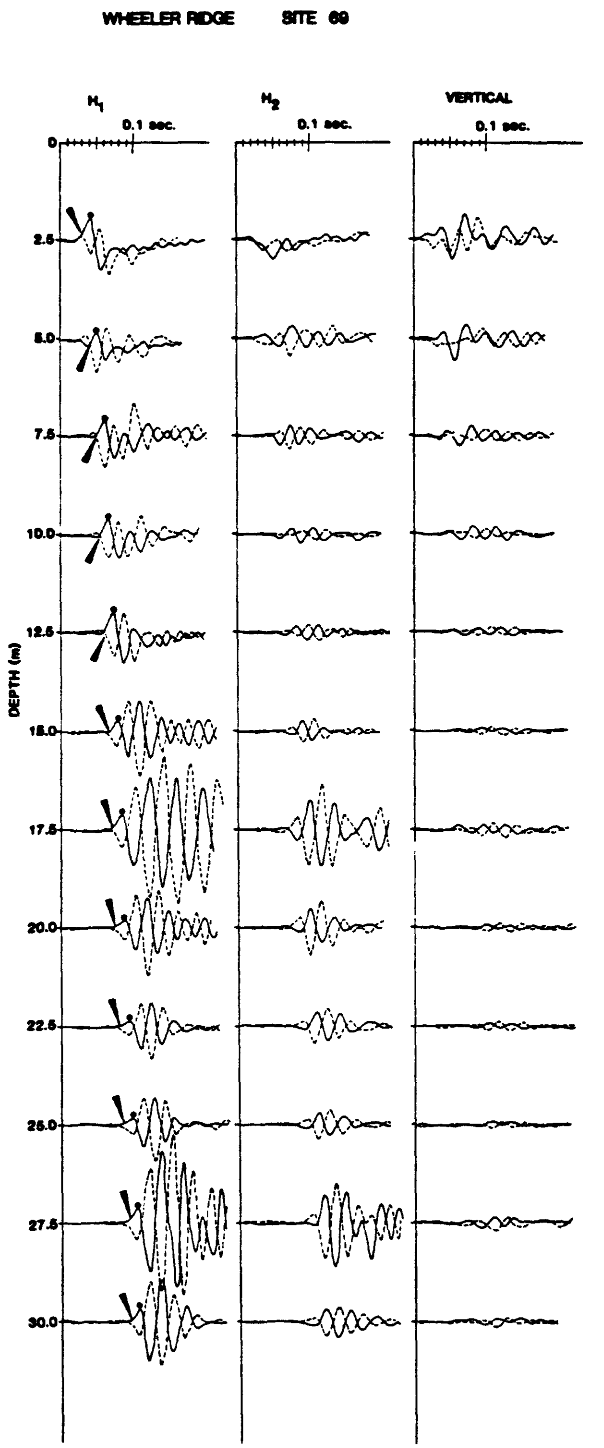


Figure 34

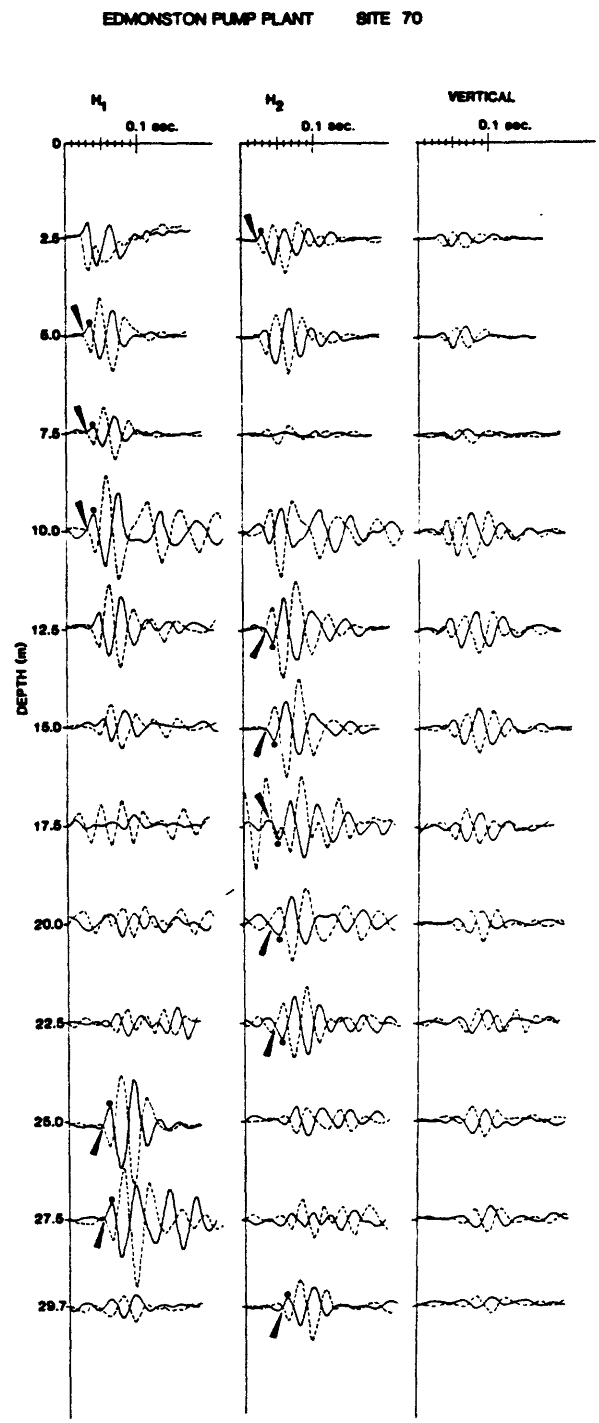


Figure 35

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.

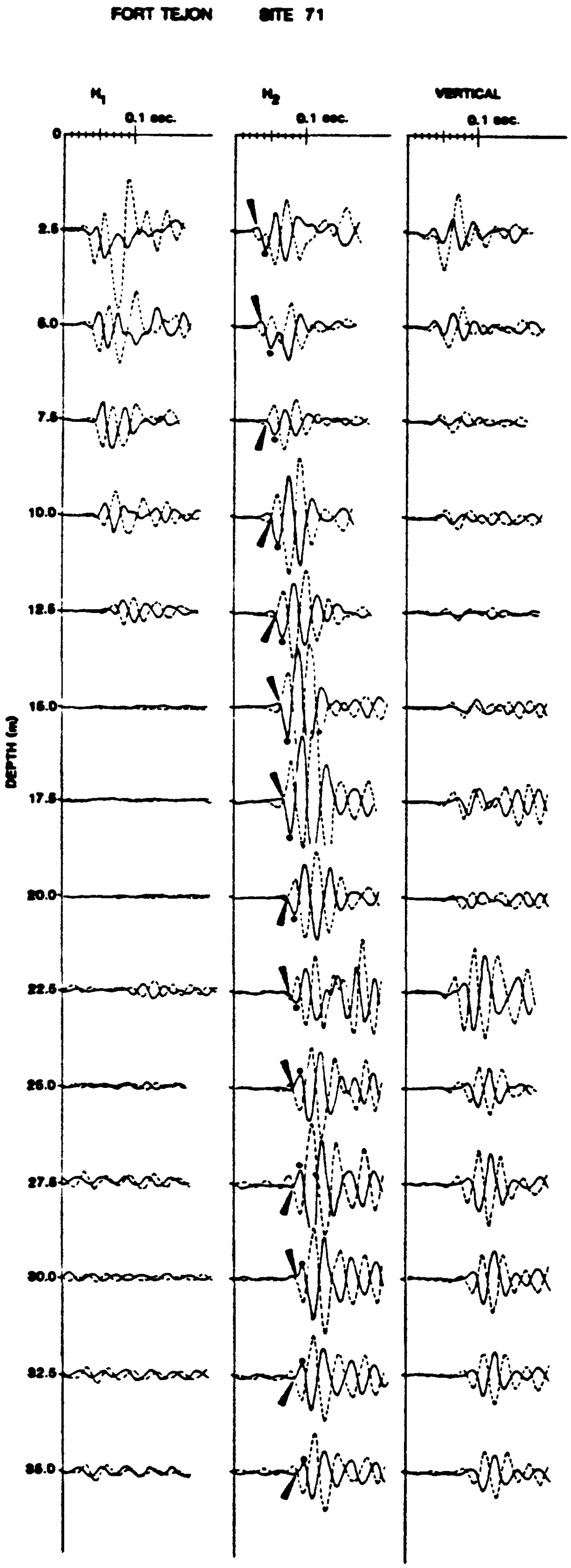


Figure 36

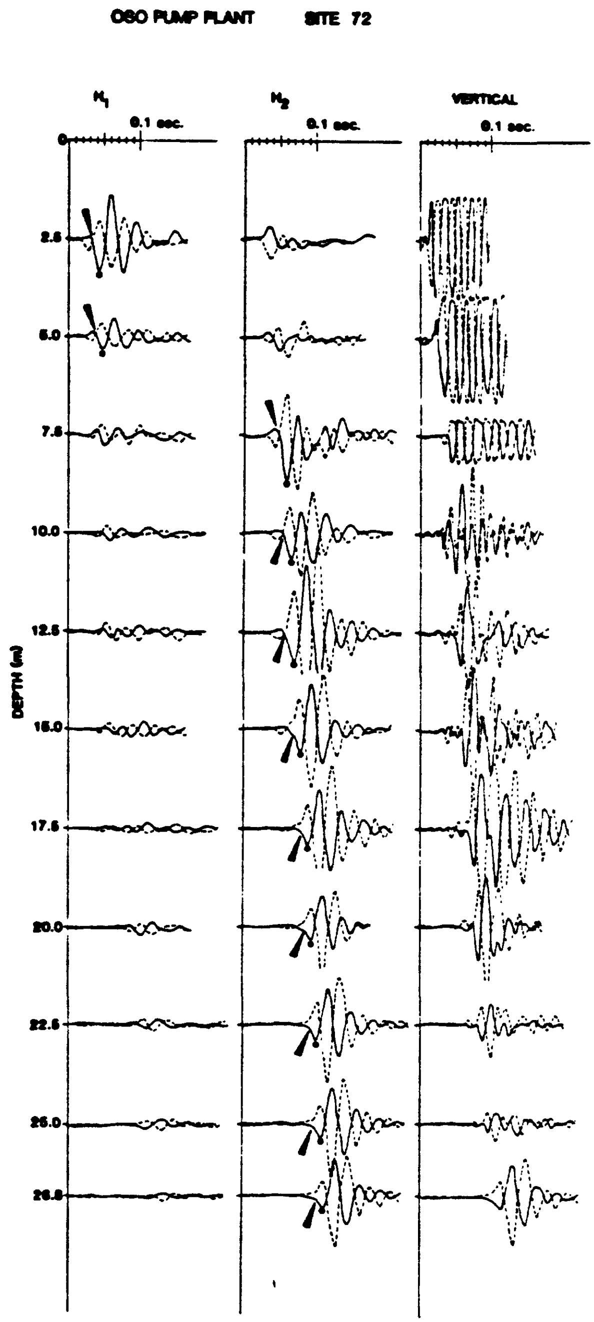


Figure 37

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.

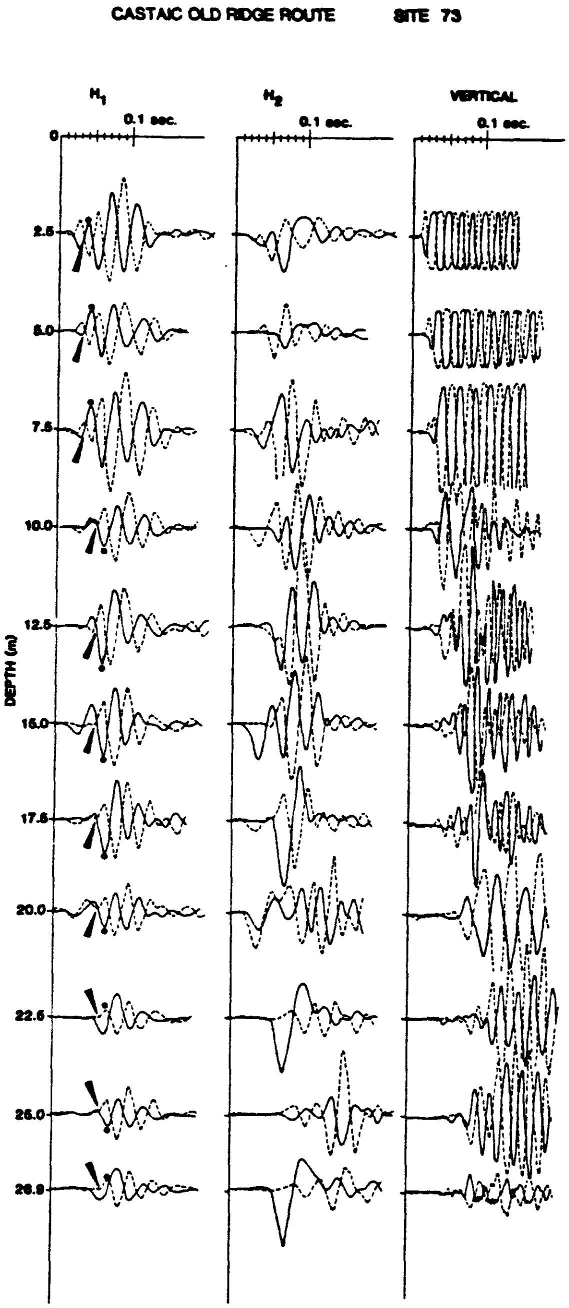


Figure 38

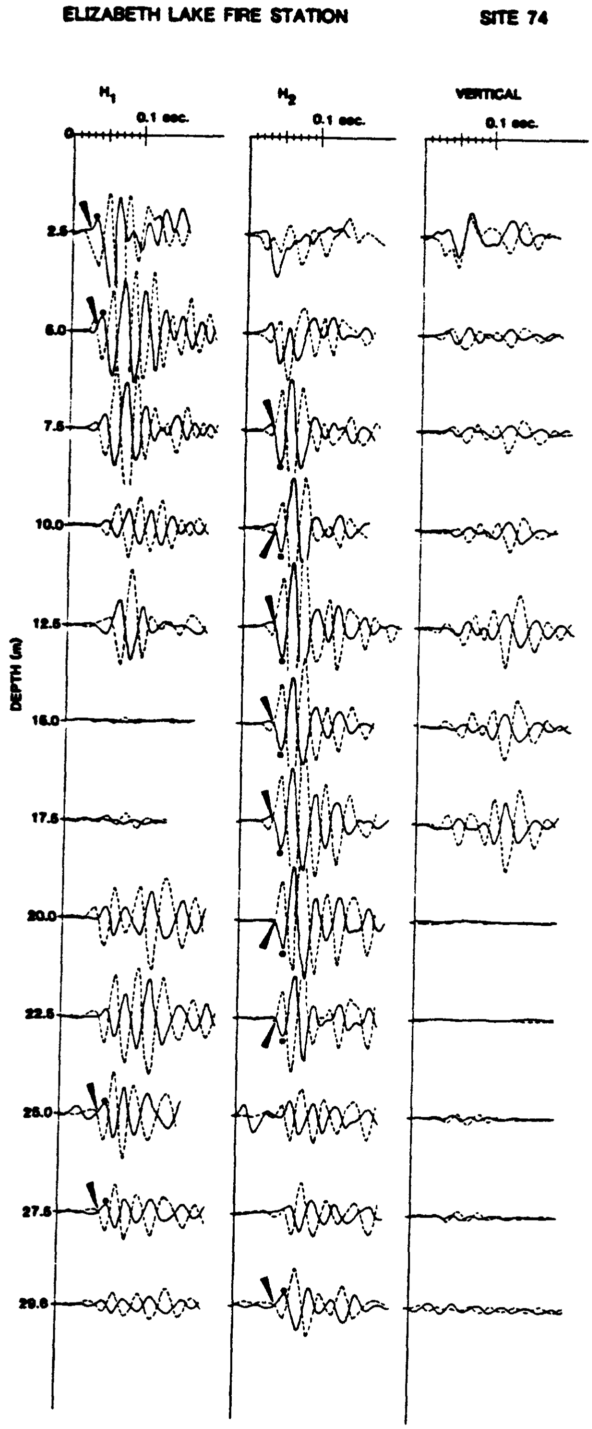


Figure 39

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.

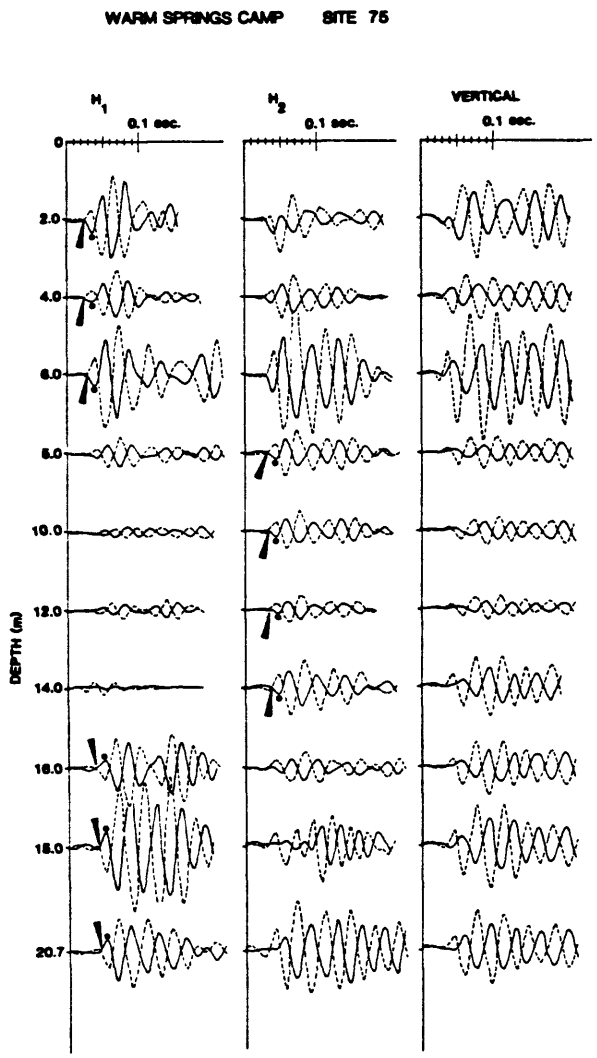


Figure 40

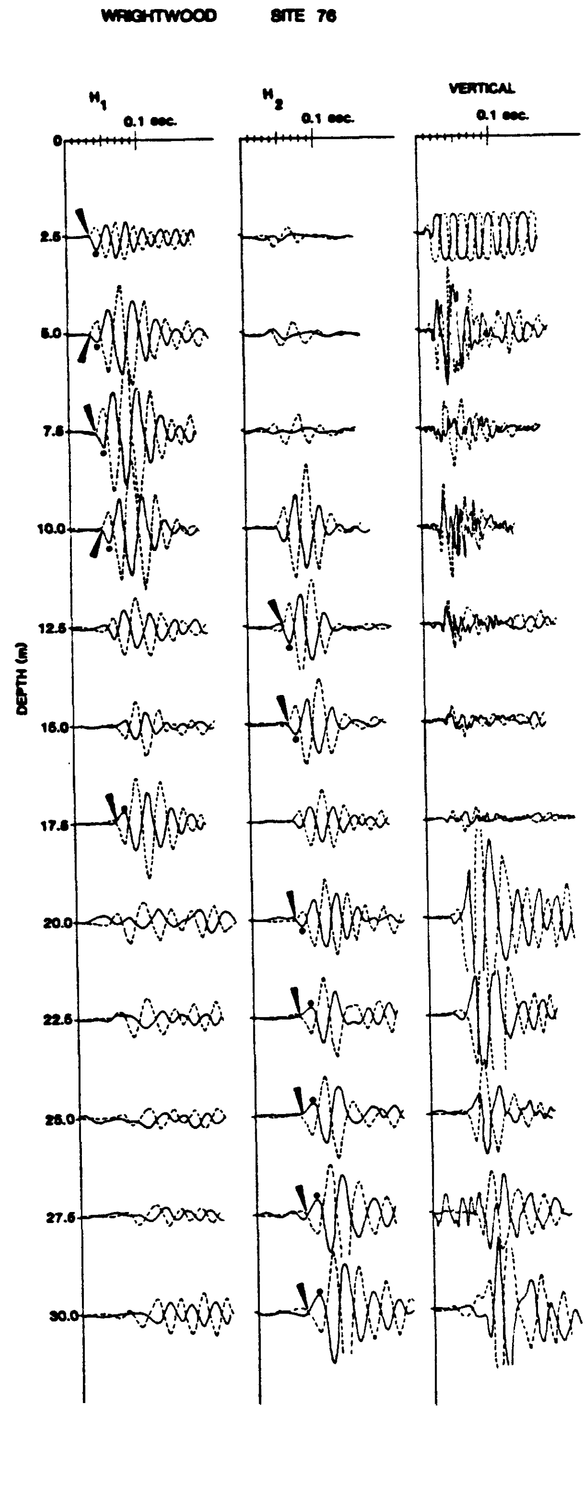


Figure 41

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.

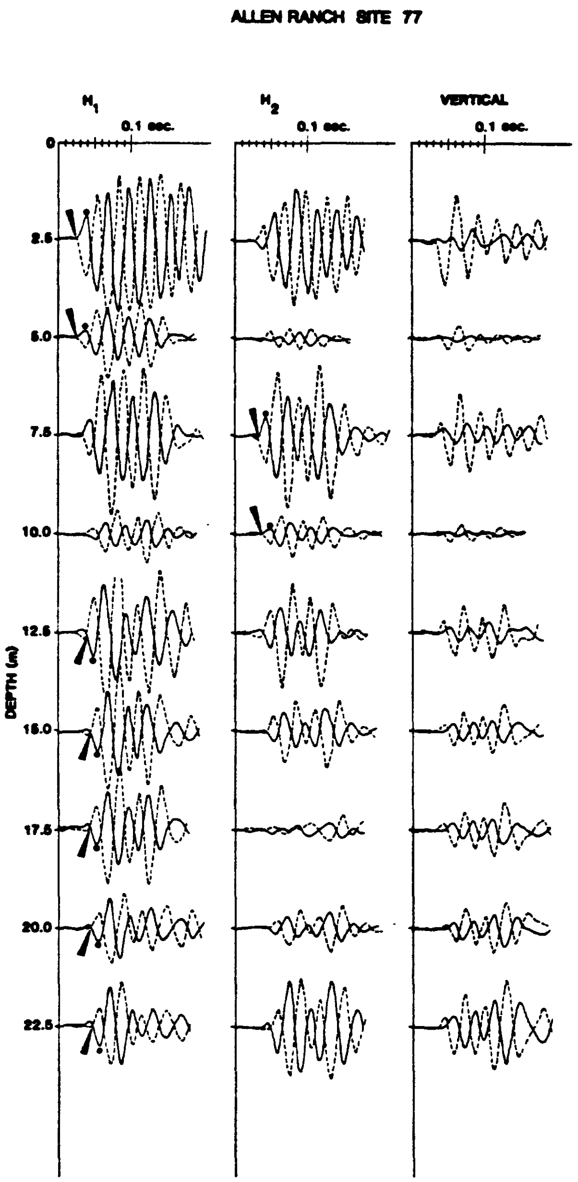


Figure 42

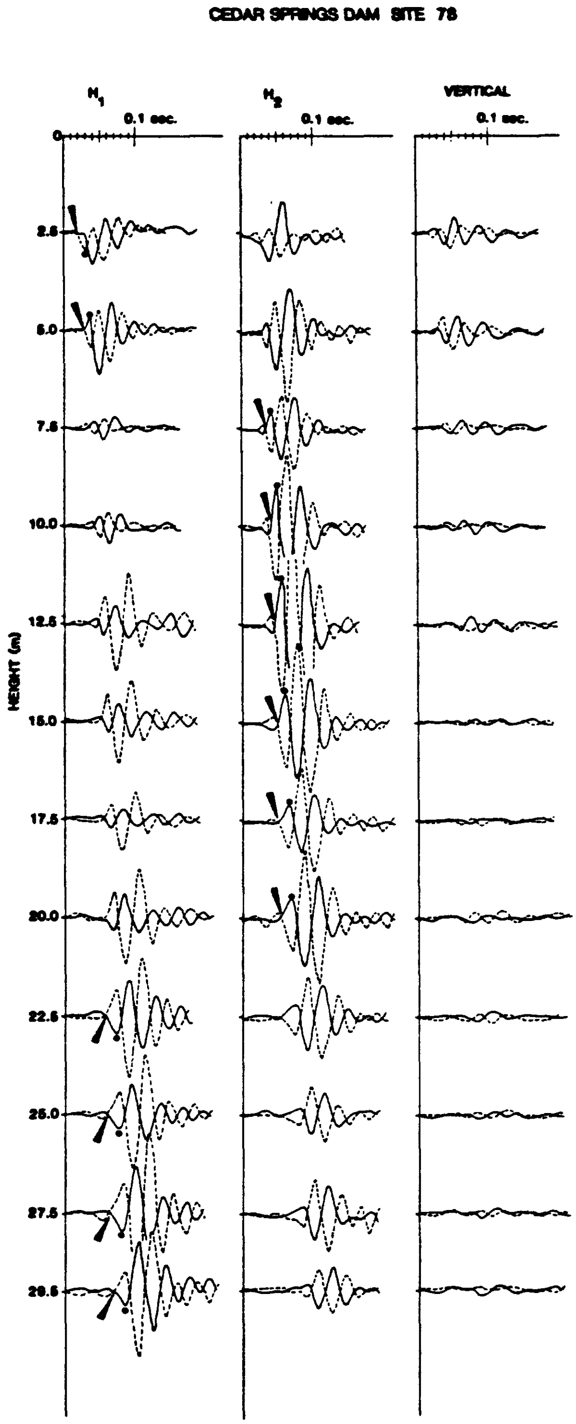


Figure 43

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.

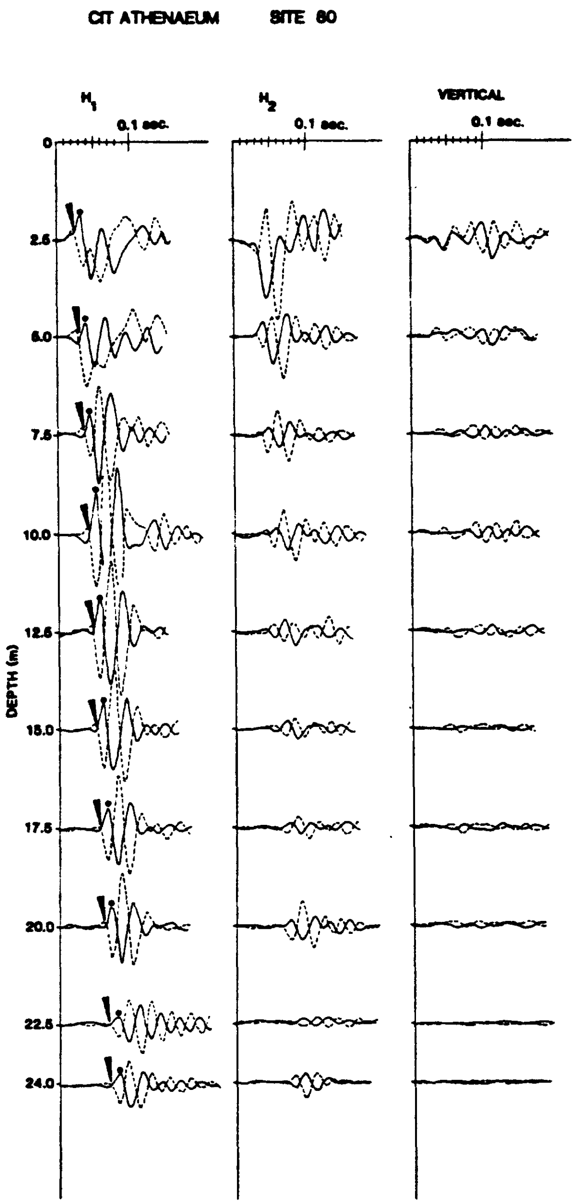


Figure 44

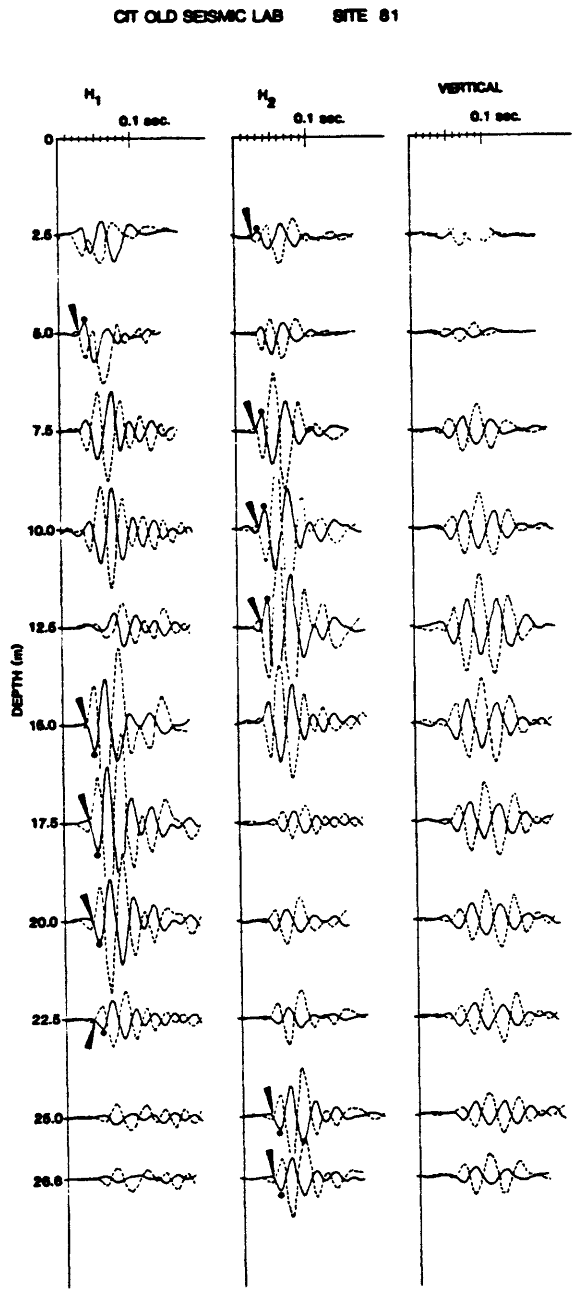


Figure 45

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.

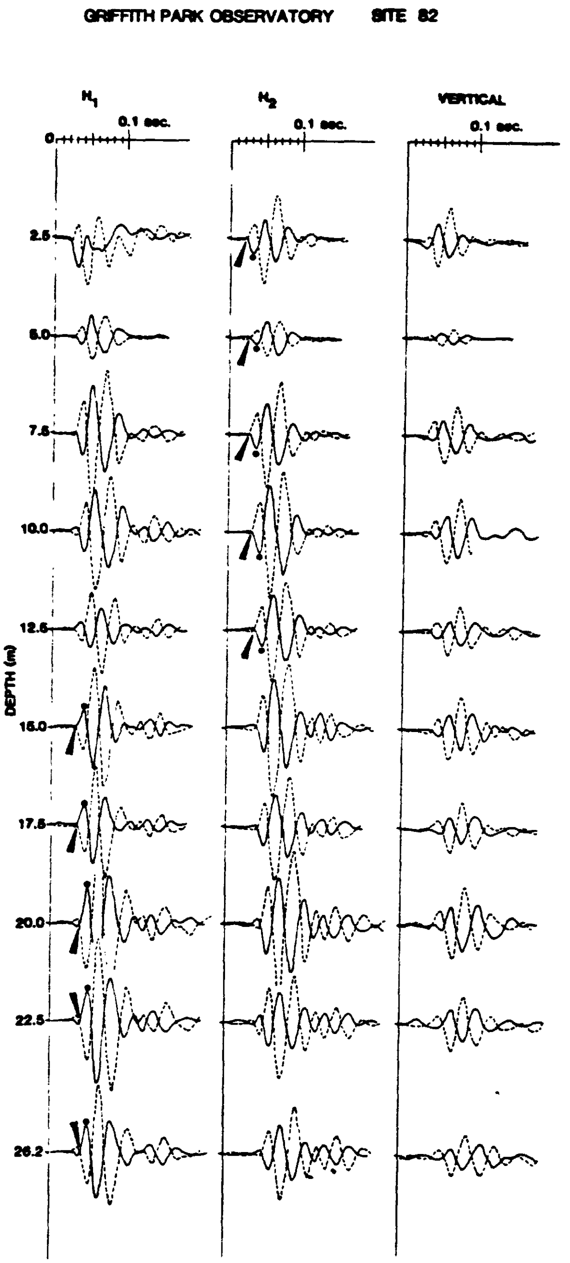


Figure 46

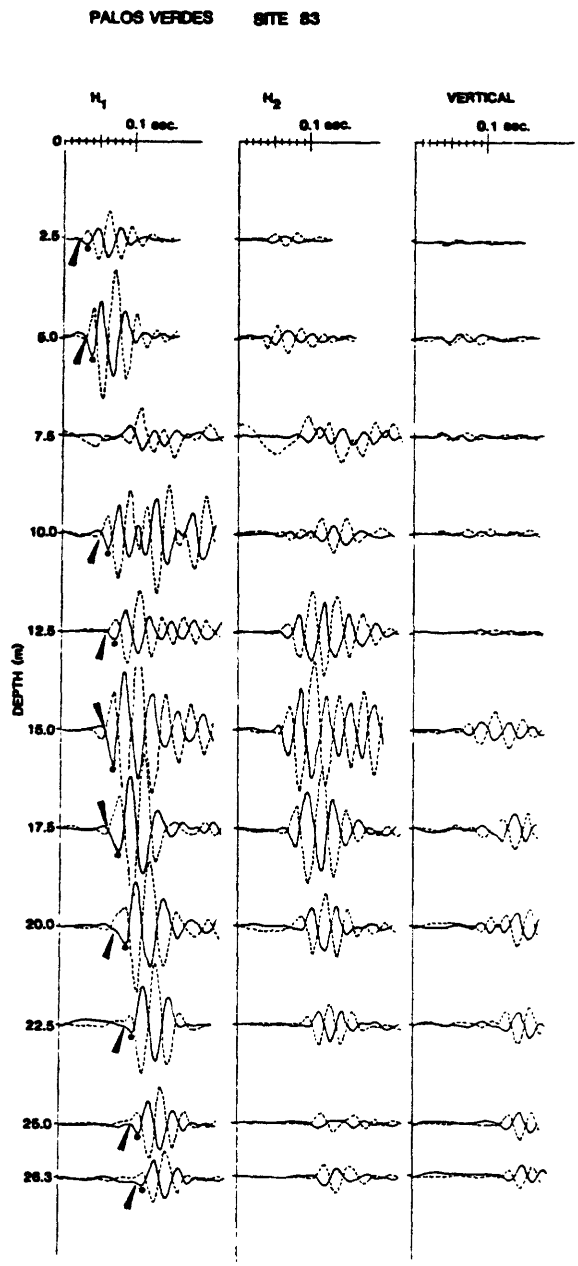
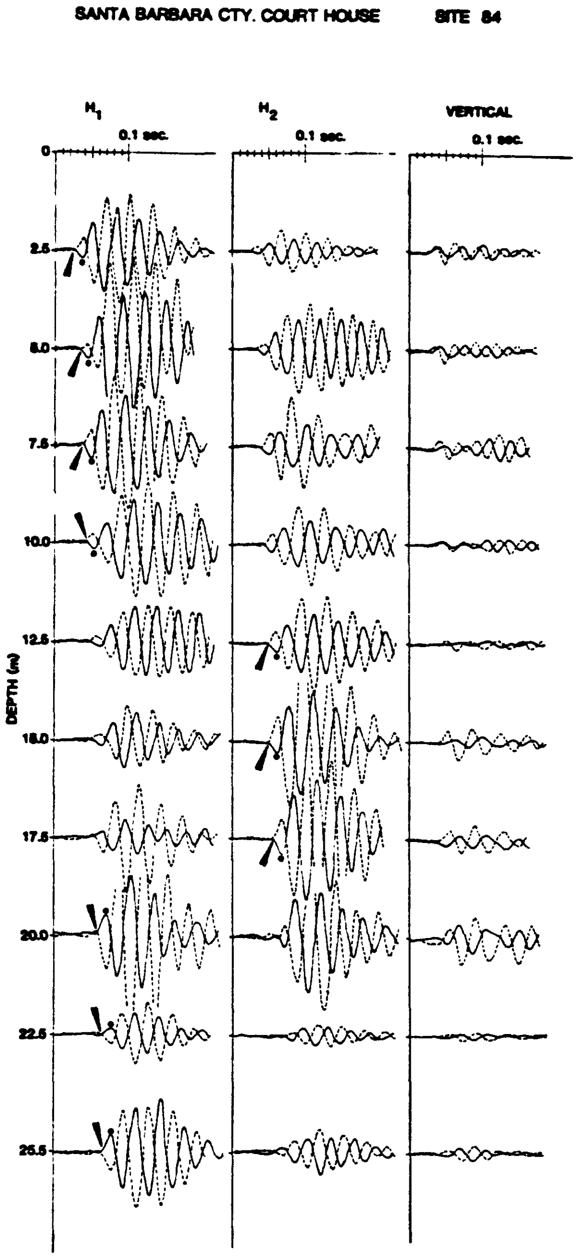


Figure 47

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.



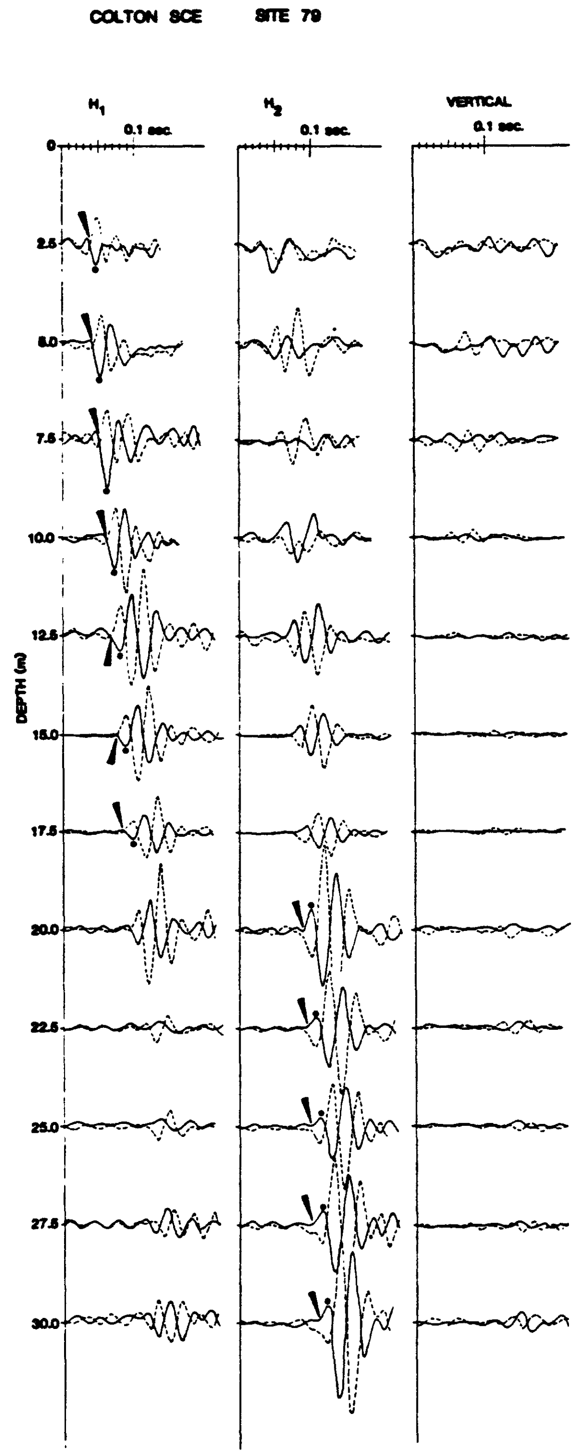


Figure 48

Figure 49

Record sections obtained for the three components of the downhole seismometer package using the horizontal traction source. Picks of S-wave first break and peak shown by arrow and dot, respectively.

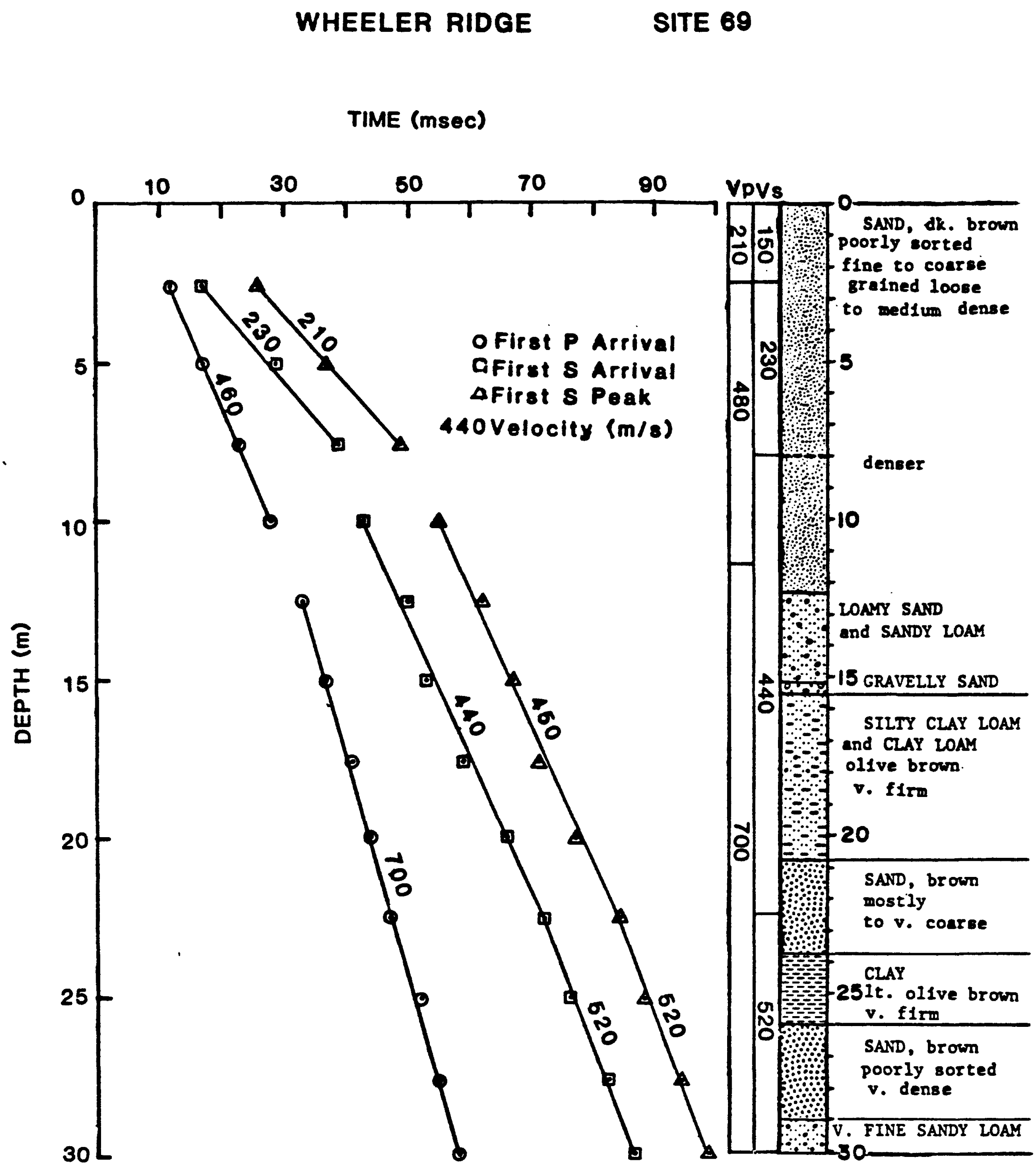

WHEELER RIDGE
SITE 69
TIME (msec)
10
30
50
70
90
DEPTH (m)
0
5
10
15
20
25
30
o First P Arrival
□ First S Arrival
△ First S Peak
440 Velocity (m/s)
210
230
460
440
460
700
620
620
Vp
Vs
210
150
480
230
440
700
520
SAND, dk. brown poorly sorted fine to coarse grained loose to medium dense
denser
LOAMY SAND and SANDY LOAM
GRAVELLY SAND
SILTY CLAY LOAM and CLAY LOAM olive brown v. firm
SAND, brown mostly to v. coarse
CLAY lt. olive brown v. firm
SAND, brown poorly sorted v. dense
V. FINE SANDY LOAM

Figure 50

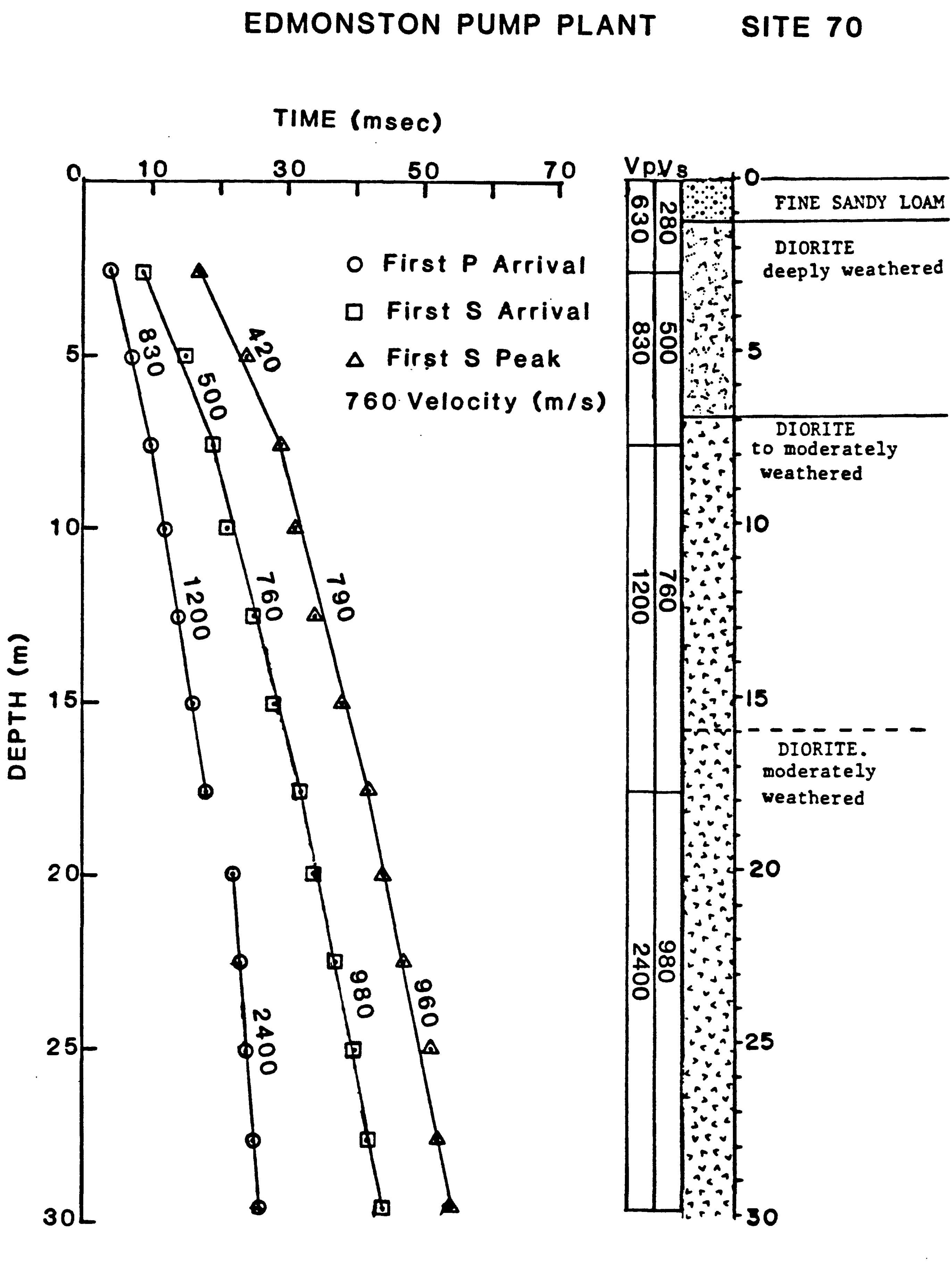
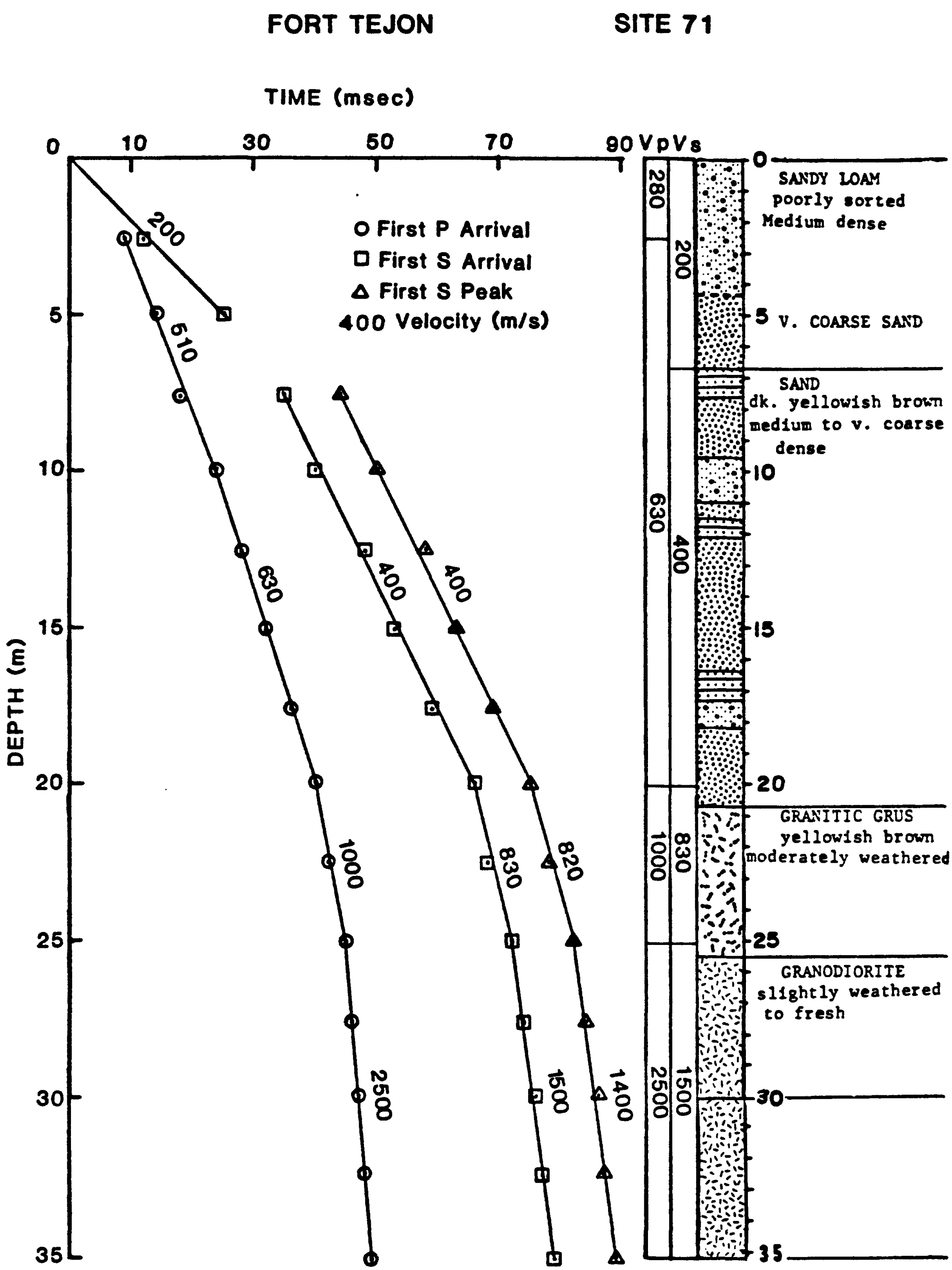

EDMONSTON PUMP PLANT
SITE 70
TIME (msec)
0
10
30
50
70
DEPTH (m)
5
10
15
20
25
30
First P Arrival
First S Arrival
First S Peak
760 Velocity (m/s)
830
500
420
1200
760
790
2400
980
960
Vp
Vs
630
280
FINE SANDY LOAM
DIORITE
deeply weathered
DIORITE
to moderately
weathered
DIORITE.
moderately
weathered

Figure 51



FORT TEJON
SITE 71
TIME (msec)
0
10
30
50
70
90
Vp
Vs
DEPTH (m)
5
10
15
20
25
30
35
O First P Arrival
□ First S Arrival
△ First S Peak
400 Velocity (m/s)
200
610
630
1000
2500
400
400
830
820
1500
1400
280
200
630
400
1000
830
2500
1500
SANDY LOAM
poorly sorted
Medium dense
V. COARSE SAND
SAND
dk. yellowish brown
medium to v. coarse
dense
GRANITIC GRUS
yellowish brown
moderately weathered
GRANODIORITE
slightly weathered
to fresh

Figure 52

OSC PUMP PLANT SITE 72

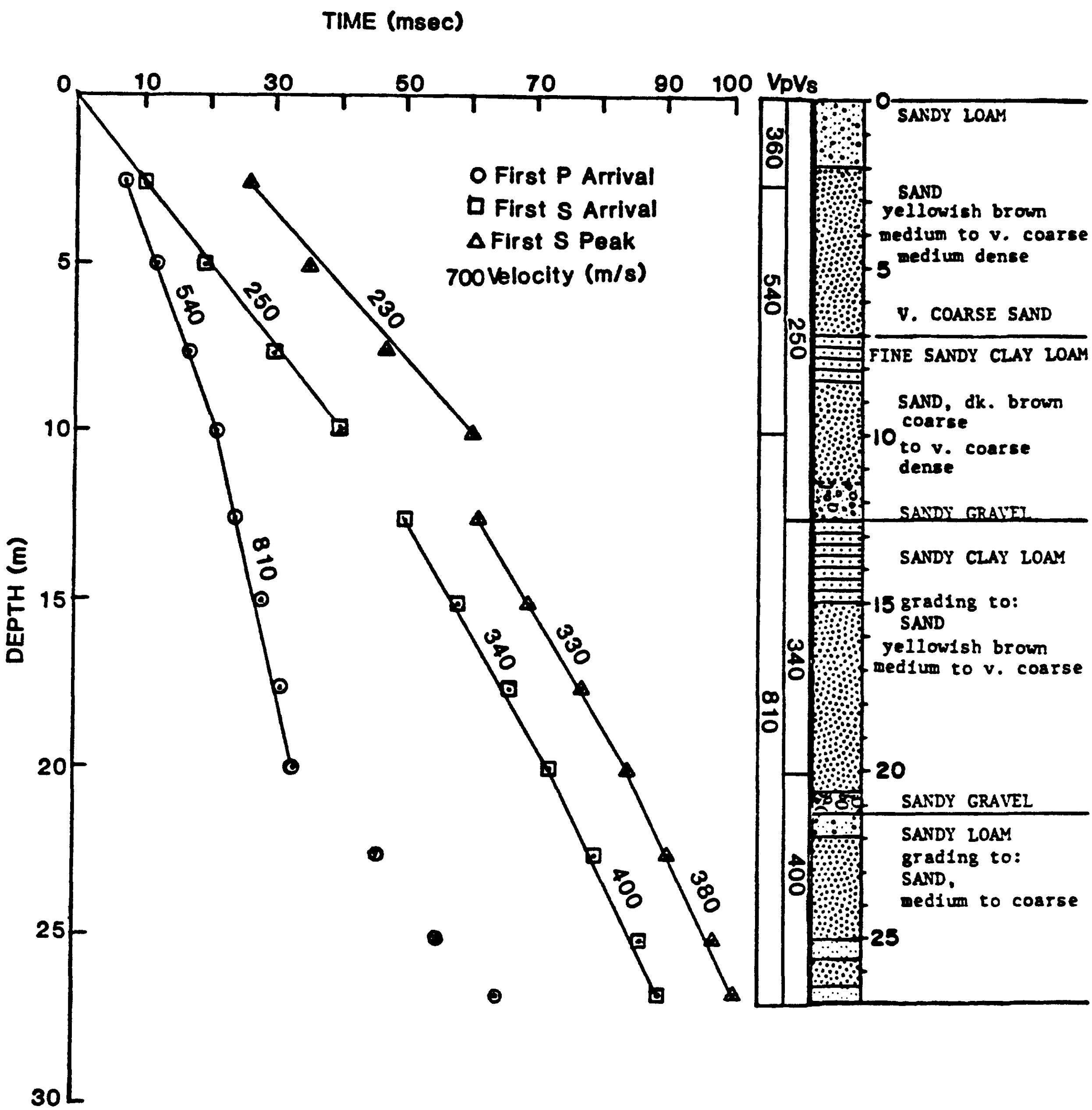


Figure 53

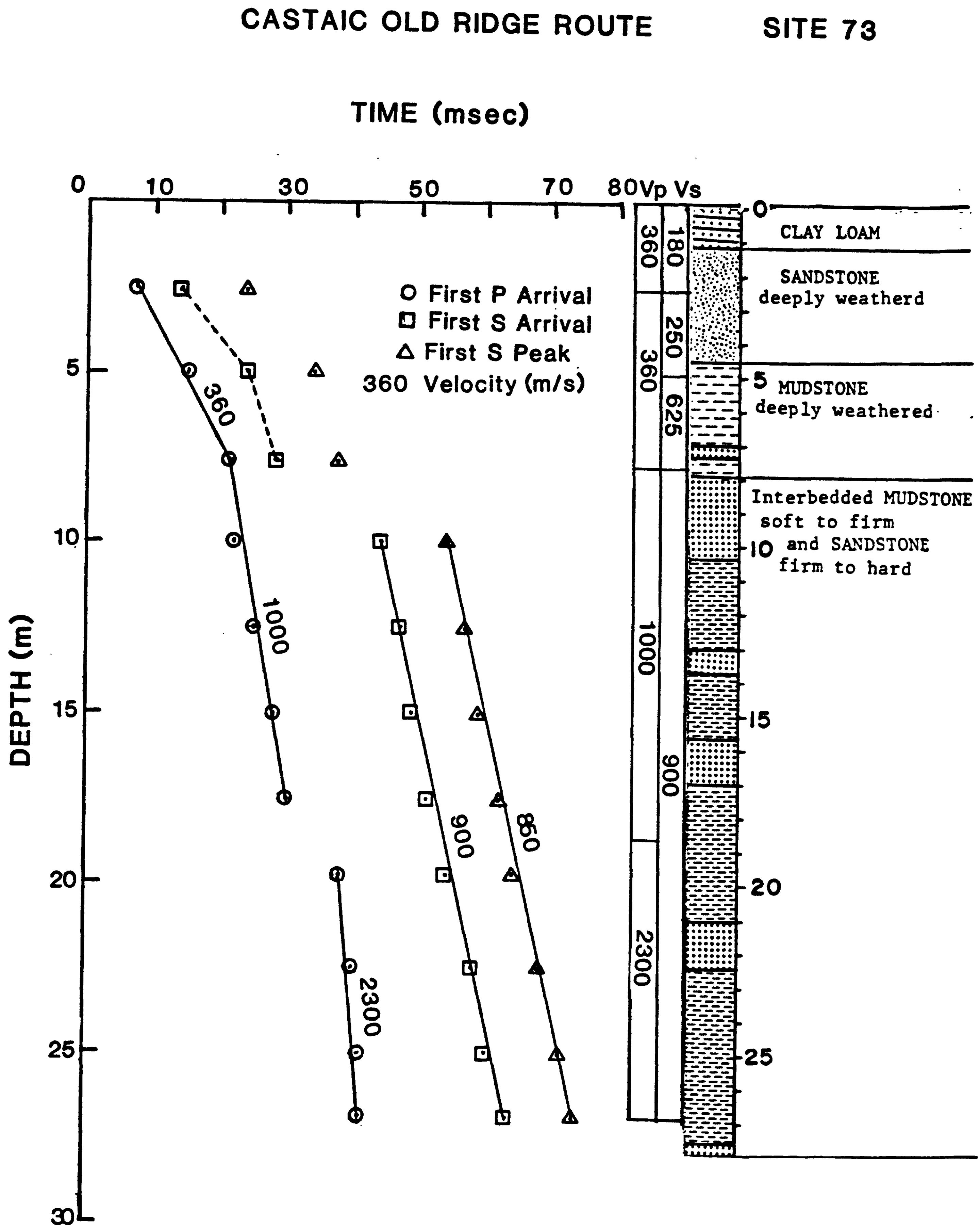

CASTAIC OLD RIDGE ROUTE
SITE 73
TIME (msec)
0
10
30
50
70
80
Vp
Vs
DEPTH (m)
5
10
15
20
25
30
O First P Arrival
□ First S Arrival
△ First S Peak
360 Velocity (m/s)
360
1000
2300
900
850
180
250
625
CLAY LOAM
SANDSTONE
deeply weatherd
MUDSTONE
deeply weathered
Interbedded MUDSTONE
soft to firm
and SANDSTONE
firm to hard

Figure 54

ELIZABETH LAKE FIRE STATION SITE 74

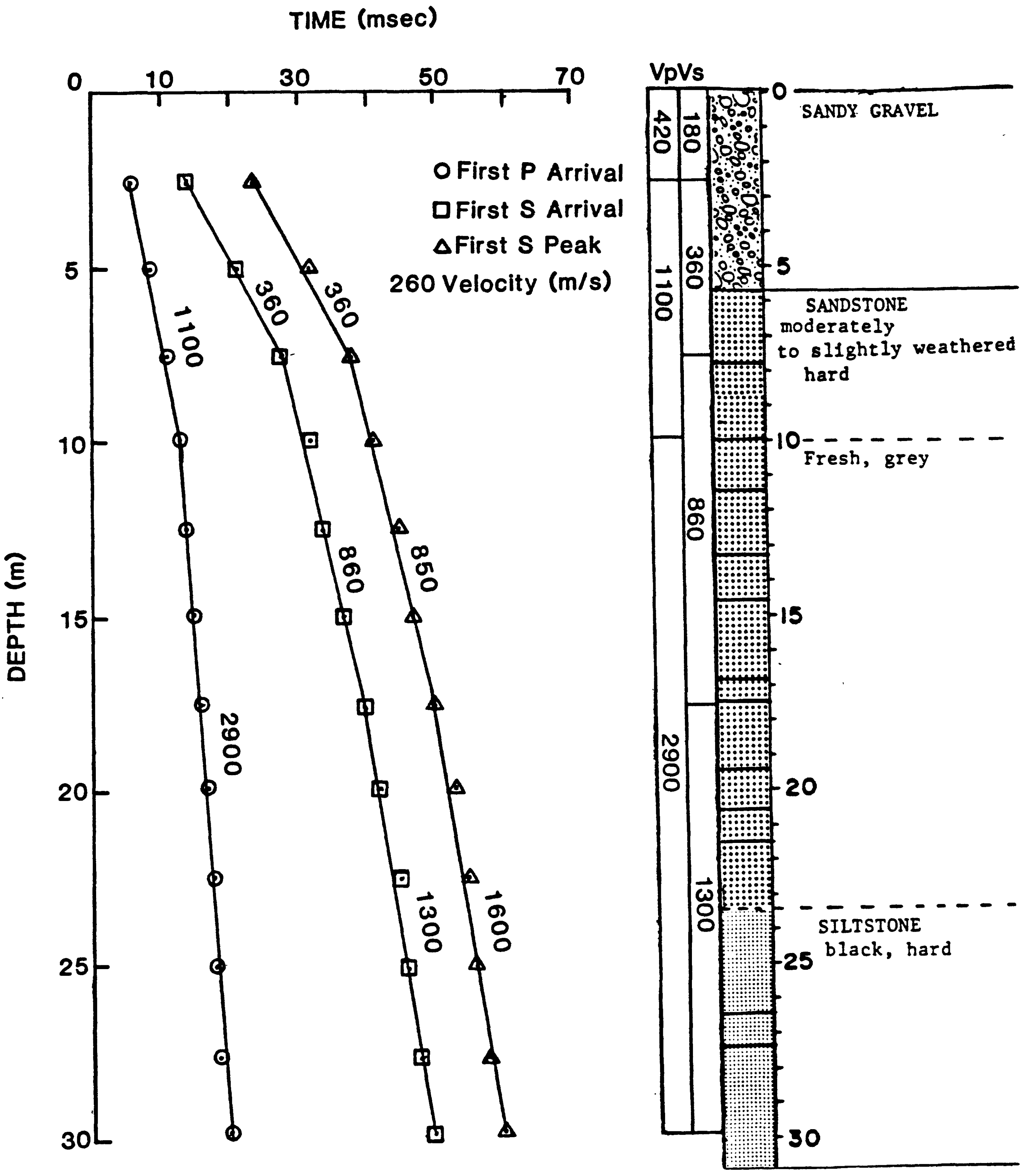


Figure 55

WARM SPRINGS CAMP SITE 75

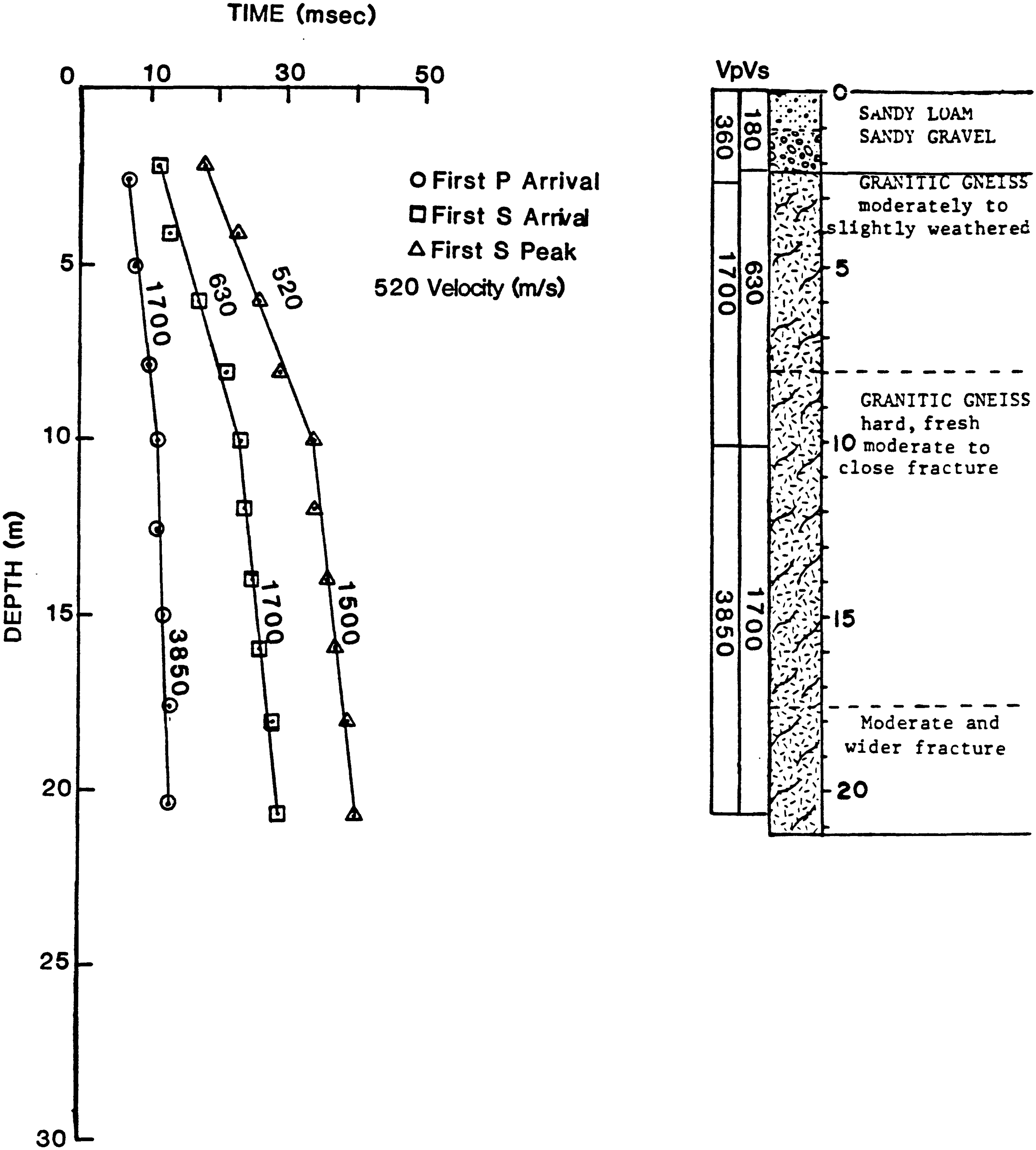


Figure 56

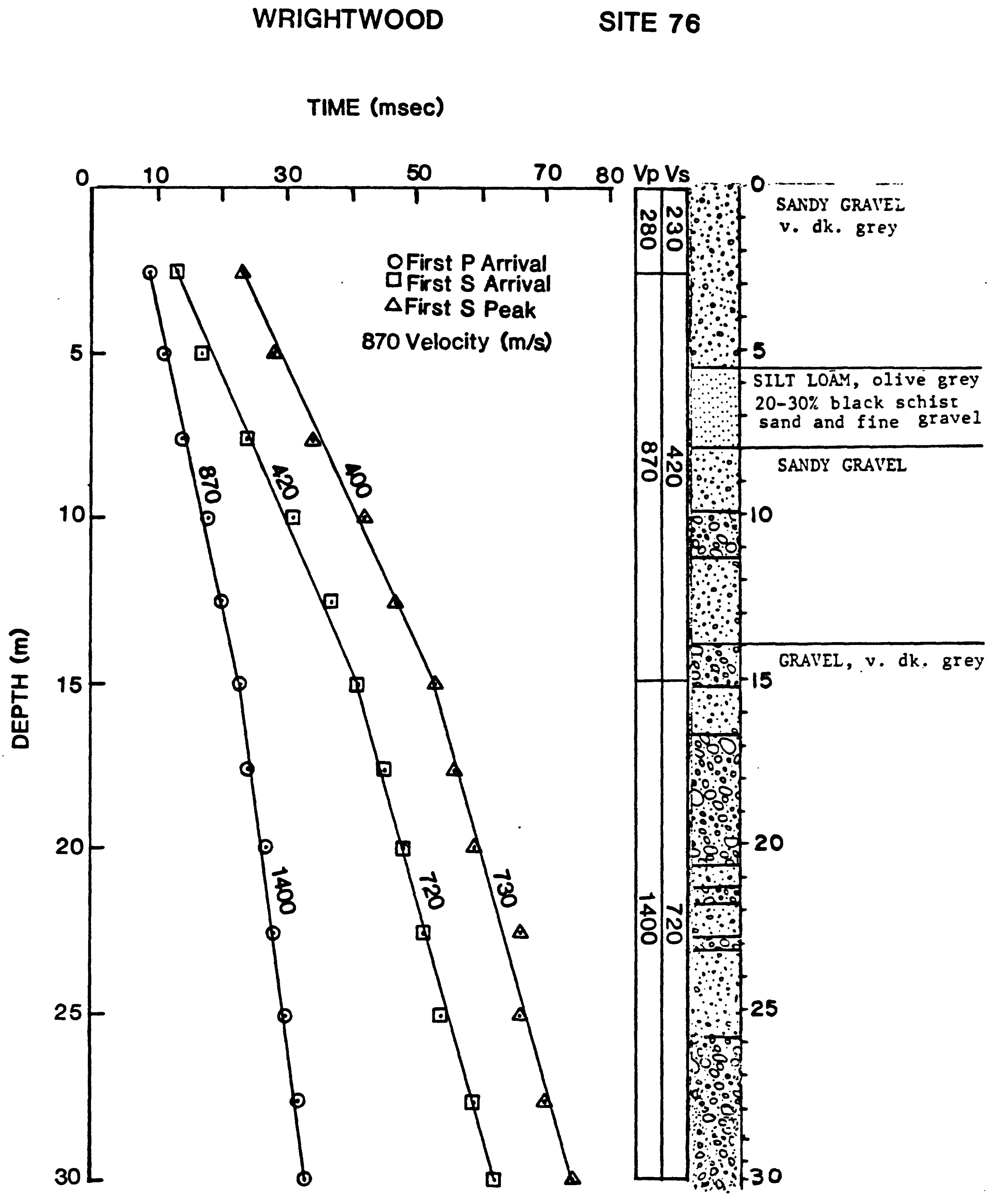

WRIGHTWOOD
SITE 76
TIME (msec)
0
10
30
50
70
80
Vp
Vs
DEPTH (m)
5
10
15
20
25
30
First P Arrival
First S Arrival
First S Peak
870 Velocity (m/s)
870
420
400
1400
720
730
280
230
SANDY GRAVEL
v. dk. grey
SILT LOAM, olive grey
20-30% black schist
sand and fine gravel
SANDY GRAVEL
GRAVEL, v. dk. grey

Figure 57

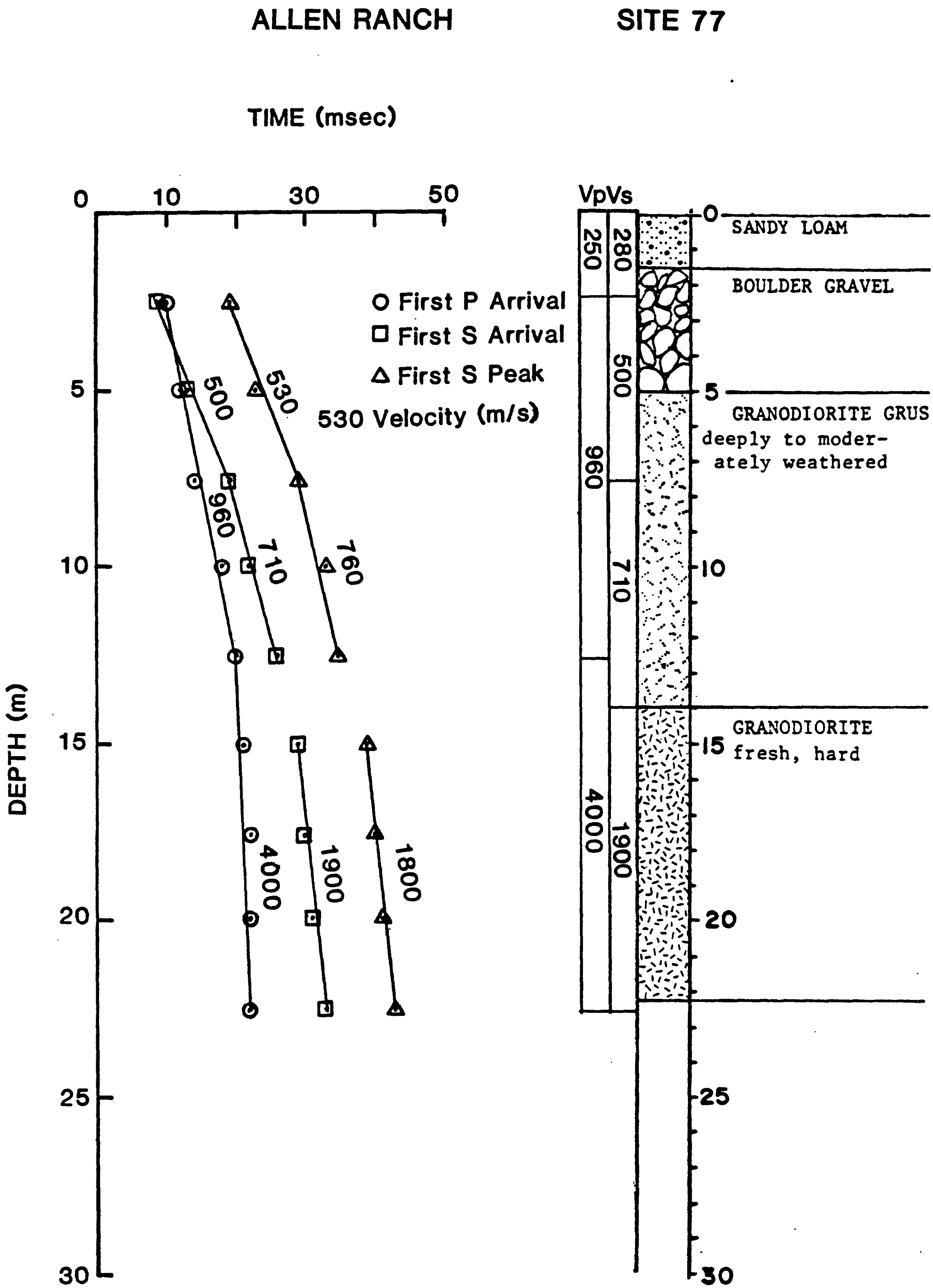
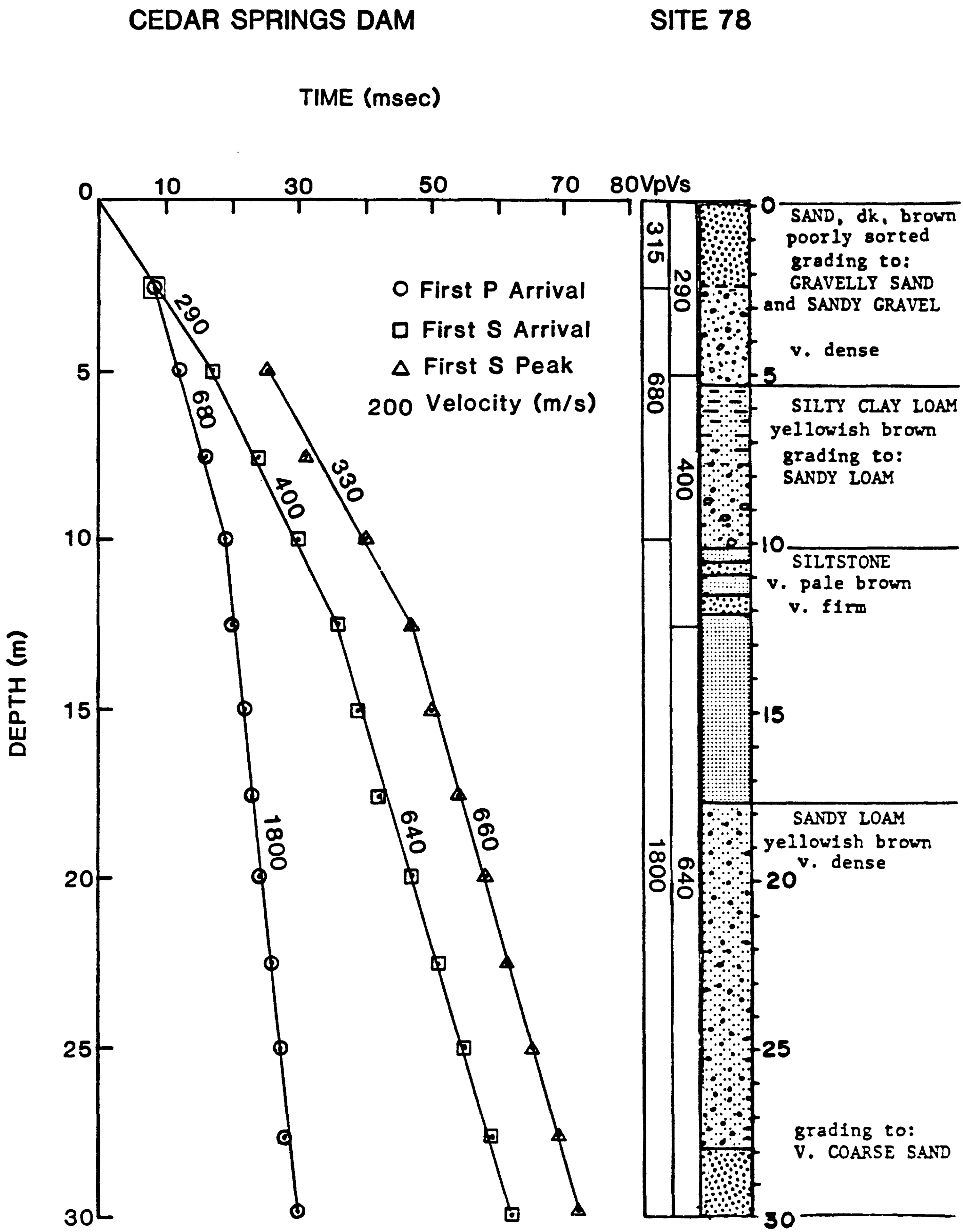

ALLEN RANCH
SITE 77
TIME (msec)
0
10
30
50
DEPTH (m)
5
10
15
20
25
30
First P Arrival
First S Arrival
First S Peak
530 Velocity (m/s)
530
500
960
710
760
4000
1900
1800
VpVs
250
280
500
960
710
4000
1900
SANDY LOAM
BOULDER GRAVEL
GRANODIORITE GRUS
deeply to moder-
ately weathered
GRANODIORITE
fresh, hard

Figure 58



CEDAR SPRINGS DAM
SITE 78
TIME (msec)
0
10
30
50
70
80
VpVs
DEPTH (m)
5
10
15
20
25
30
O First P Arrival
□ First S Arrival
△ First S Peak
200 Velocity (m/s)
290
680
400
330
1800
640
660
315
SAND, dk, brown poorly sorted grading to: GRAVELLY SAND and SANDY GRAVEL
v. dense
SILTY CLAY LOAM yellowish brown grading to: SANDY LOAM
SILTSTONE v. pale brown v. firm
SANDY LOAM yellowish brown v. dense
grading to: V. COARSE SAND

Figure 59

COLTON SCE SITE 79

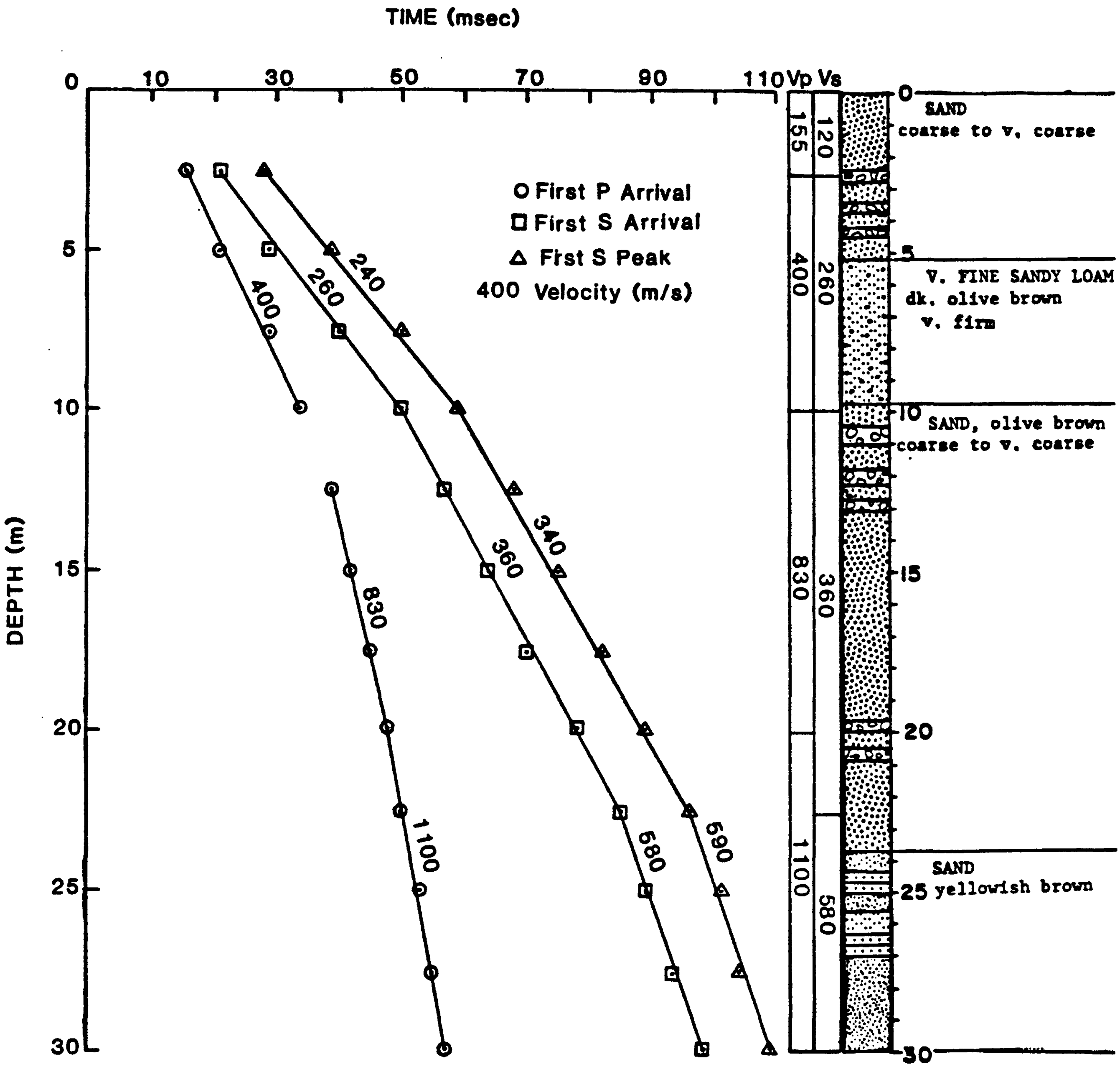


Figure 60

C I T ATHENAEUM SITE 80

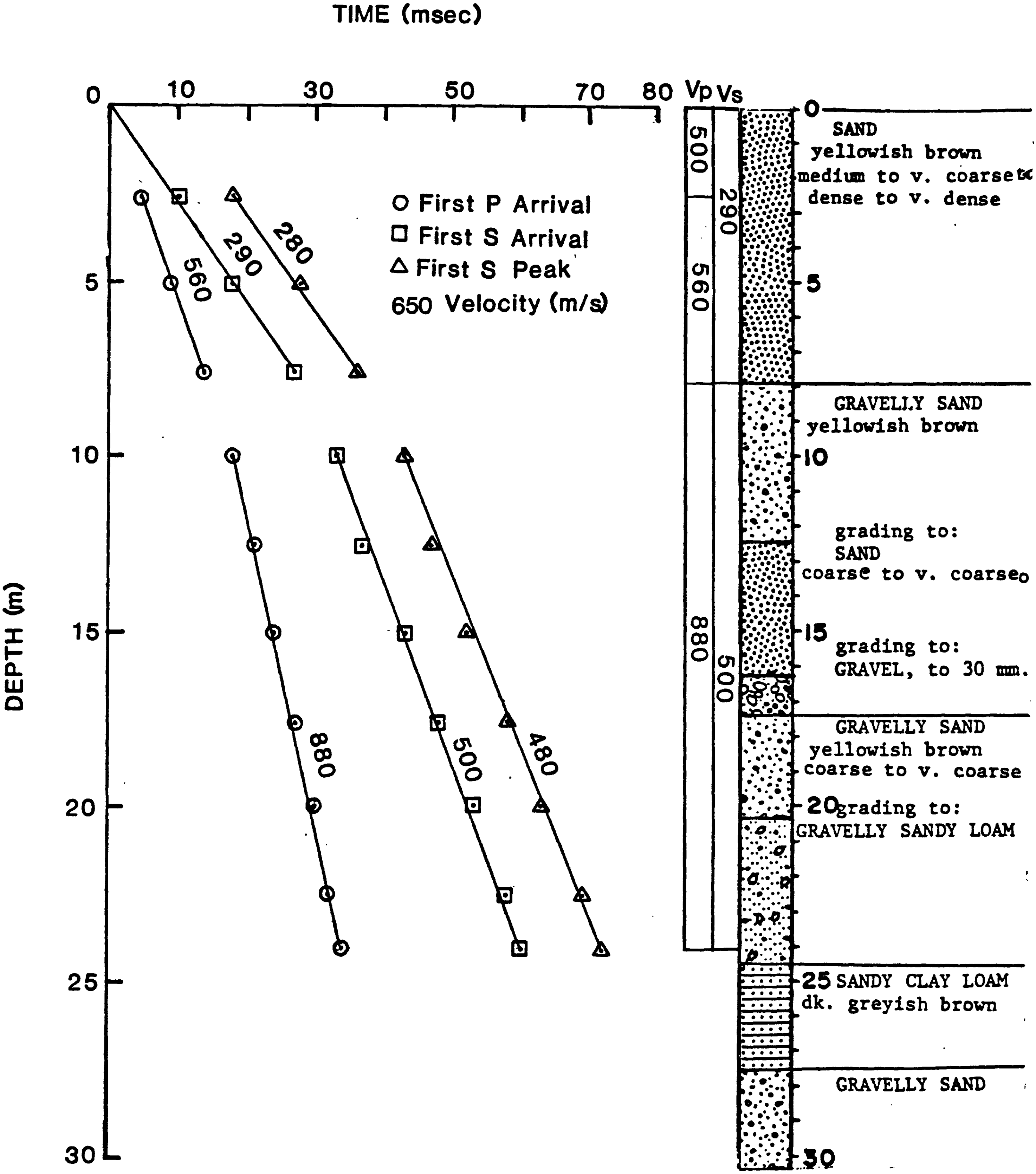


Figure 61

C I T OLD SEIS LAB SITE 81

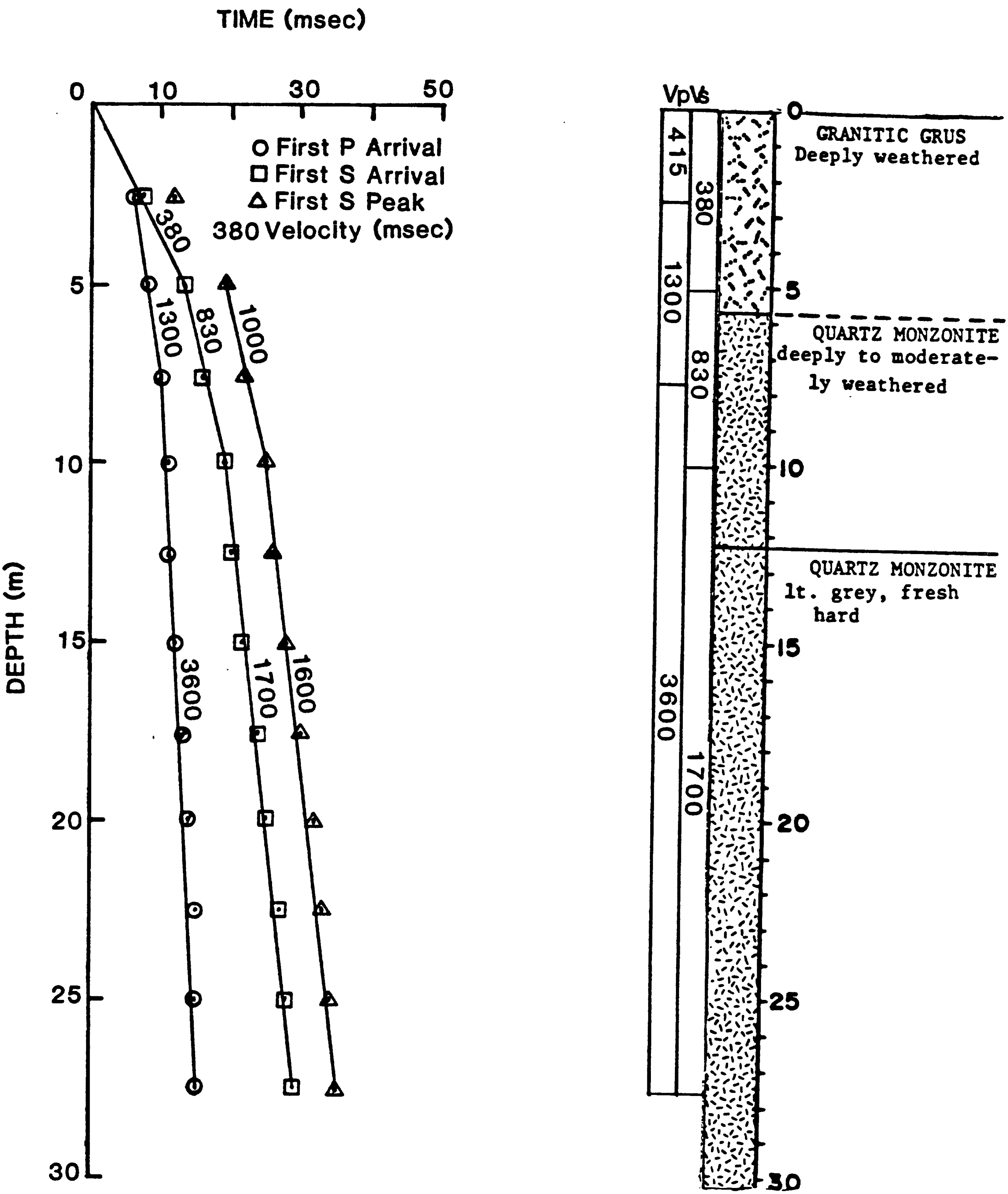


Figure 62

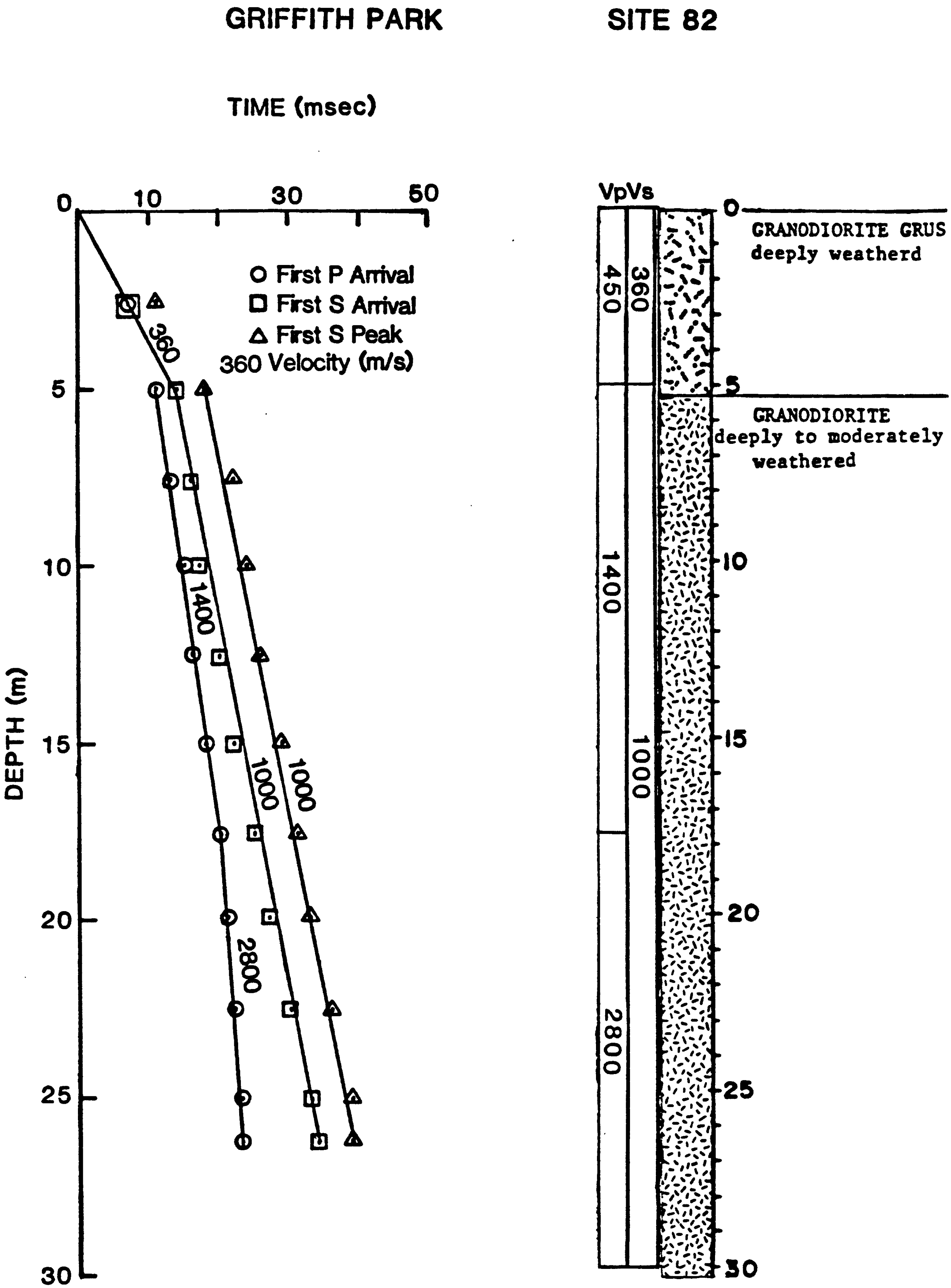

GRIFFITH PARK
SITE 82
TIME (msec)
0
10
30
50
First P Arrival
First S Arrival
First S Peak
360 Velocity (m/s)
360
1400
1000
1000
2800
DEPTH (m)
5
10
15
20
25
30
VpVs
450
360
1400
1000
2800
GRANODIORITE GRUS
deeply weatherd
GRANODIORITE
deeply to moderately
weathered

Figure 63

PALOS VERDES SITE 83

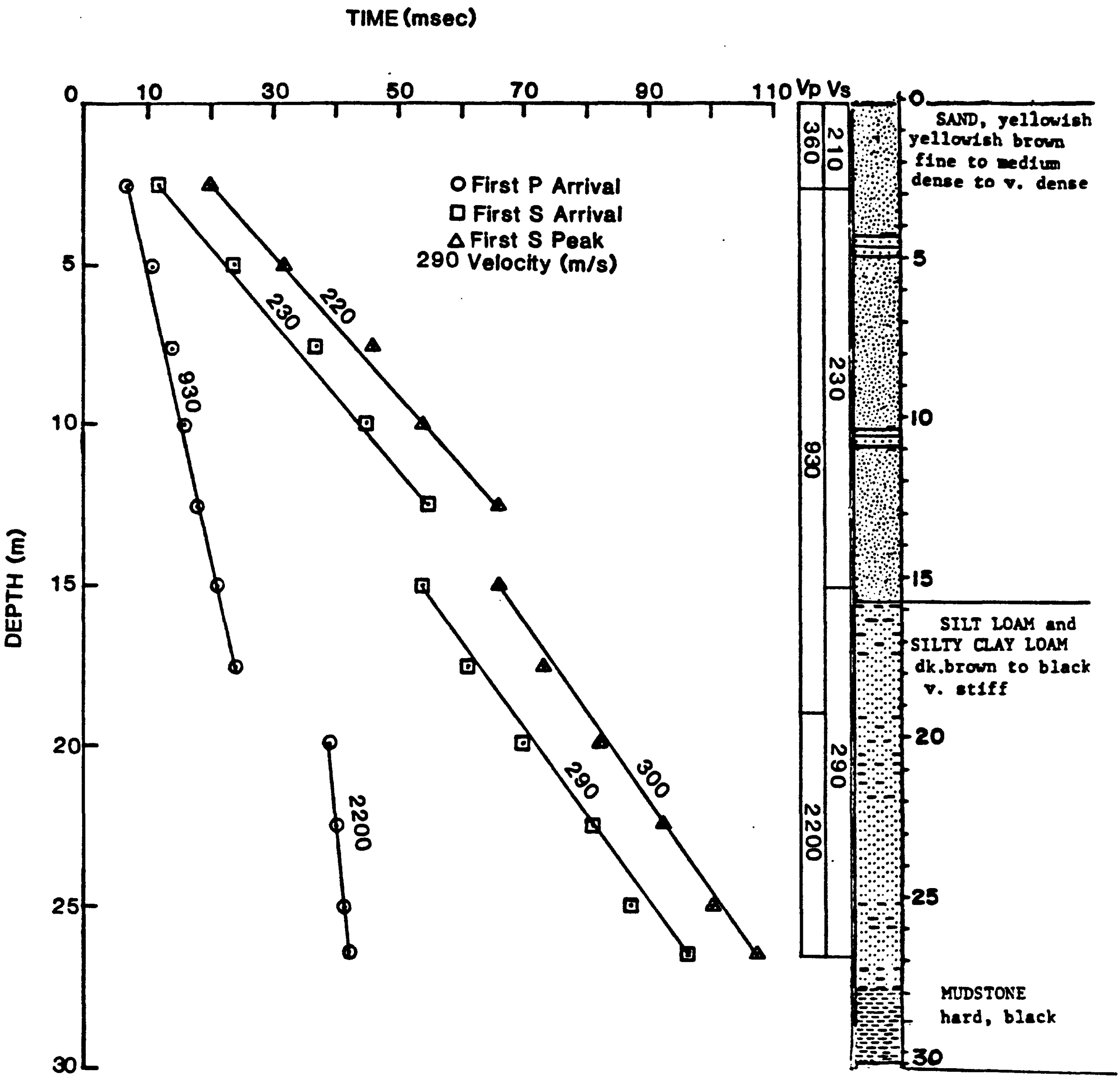


Figure 64

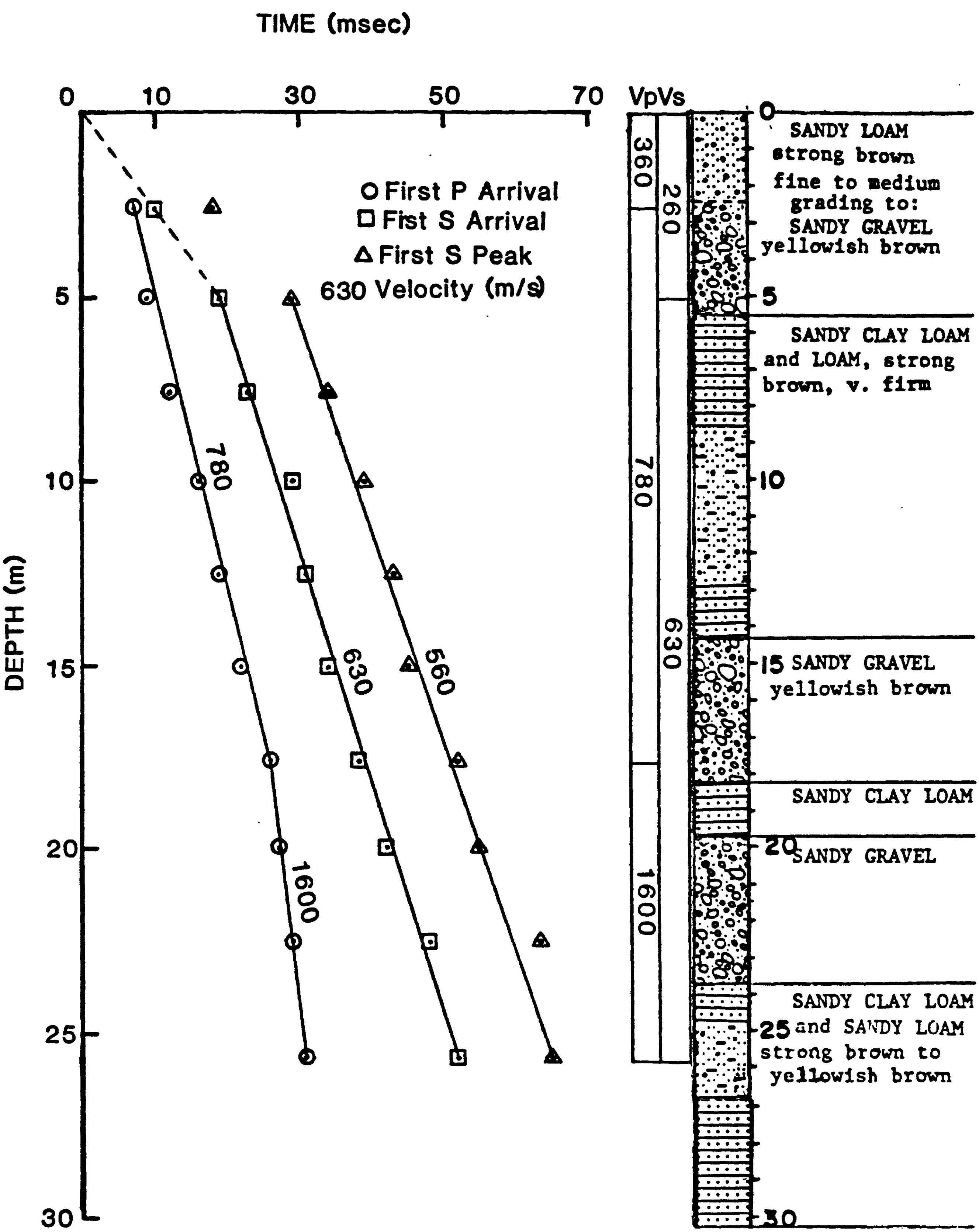

TIME (msec)
0
10
30
50
70
DEPTH (m)
5
10
15
20
25
30
First P Arrival
Fist S Arrival
First S Peak
630 Velocity (m/s)
780
630
560
1600
VpVs
360
260
780
630
1600
SANDY LOAM
strong brown
fine to medium
grading to:
SANDY GRAVEL
yellowish brown
SANDY CLAY LOAM
and LOAM, strong
brown, v. firm
SANDY GRAVEL
yellowish brown
SANDY CLAY LOAM
SANDY GRAVEL
SANDY CLAY LOAM
and SANDY LOAM
strong brown to
yellowish brown

Figure 65

TABLE 1

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 69 WHEELER RIDGE DATE LOGGED 3-20-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.009

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.011	0.022	0.017	150
5.0	0.011	0.031	0.029	170
7.5	0.012	0.041	0.039	190
10.0	0.010	0.044	0.043	230
12.5	0.009	0.051	0.050	250
15.0	0.009	0.054	0.053	280
17.5	0.008	0.060	0.059	300
20.0	0.008	0.066	0.066	300
22.5	0.008	0.072	0.072	310
25.0	0.008	0.076	0.076	330
27.5	0.008	0.082	0.082	340
30.0	0.008	0.086	0.086	350

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.033	0.026	0.015	0.012	210
5.0	0.040	0.037	0.018	0.017	290
7.5	0.051	0.049	0.024	0.023	330
10.0	0.056	0.055	0.029	0.028	360
12.5	0.063	0.062	0.033	0.033	380
15.0	0.068	0.067	0.037	0.037	410
17.5	0.072	0.071	0.041	0.041	430
20.0	0.078	0.077	0.044	0.044	450
22.5	0.084	0.084	0.047	0.047	480
25.0	0.088	0.088	0.052	0.052	480
27.5	0.094	0.094	0.055	0.055	500
30.0	0.098	0.098	0.058	0.058	520

TABLE 2

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 70 EDMONSTON PUMPING PLANT DATE LOGGED 3-21-82
BLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.007

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.007	0.012	0.009	280
5.0	0.007	0.016	0.015	330
7.5	0.006	0.020	0.019	390
10.0	0.007	0.021	0.021	480
12.5	0.007	0.025	0.025	500
15.0	0.007	0.028	0.028	540
17.5	0.008	0.032	0.032	550
20.0	0.007	0.034	0.034	590
22.5	0.007	0.037	0.037	610
25.0	0.007	0.040	0.040	630
27.5	0.008	0.042	0.042	650
29.6	0.007	0.044	0.044	670

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.022	0.017	0.005	0.004	630
5.0	0.026	0.024	0.008	0.007	710
7.5	0.030	0.029	0.010	0.010	750
10.0	0.032	0.031	0.012	0.012	830
12.5	0.035	0.034	0.014	0.014	890
15.0	0.038	0.038	0.016	0.016	940
17.5	0.042	0.042	0.018	0.018	970
20.0	0.044	0.044	0.022	0.022	910
22.5	0.047	0.047	0.023	0.023	980
25.0	0.051	0.051	0.024	0.024	1000
27.5	0.052	0.052	0.025	0.025	1100
29.6	0.054	0.054	0.026	0.026	1100

TABLE 3

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 71 FORT TEJON DATE LOGGED 3-20-82
BLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.010

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.010	0.015	0.012	210
5.0	0.010	0.027	0.025	200
7.5	0.010	0.036	0.035	210
10.0	0.010	0.041	0.040	250
12.5	0.010	0.049	0.048	260
15.0	0.010	0.054	0.053	280
17.5	0.010	0.060	0.059	300
20.0	0.010	0.066	0.066	300
22.5	0.010	0.068	0.068	330
25.0	0.009	0.072	0.072	350
27.5	0.010	0.074	0.074	370
30.0	0.010	0.076	0.076	390
32.5	0.012	0.077	0.077	420
35.0	0.011	0.079	0.079	440

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.033	0.026	0.011	0.009	280
5.0	0.041	0.038	0.015	0.014	360
7.5	0.046	0.044	0.019	0.018	420
10.0	0.051	0.050	0.024	0.024	420
12.5	0.059	0.058	0.028	0.028	450
15.0	0.064	0.063	0.032	0.032	470
17.5	0.070	0.069	0.036	0.036	490
20.0	0.076	0.075	0.040	0.040	500
22.5	0.078	0.078	0.042	0.042	540
25.0	0.082	0.082	0.045	0.045	560
27.5	0.084	0.084	0.046	0.046	600
30.0	0.086	0.086	0.047	0.047	640
32.5	0.087	0.087	0.048	0.048	680
35.0	0.089	0.089	0.049	0.049	710

TABLE 4

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 72 OSO PUMPING PLANT DATE LOGGED 3-23-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.010

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.010	0.013	0.010	250
5.0	0.010	0.020	0.019	260
7.5	0.010	0.031	0.030	250
10.0	0.010	0.041	0.040	250
12.5	0.010	0.051	0.050	250
15.0	0.010	0.059	0.058	260
17.5	0.010	0.066	0.066	270
20.0	0.010	0.072	0.072	280
22.5	0.010	0.079	0.079	280
25.0	0.010	0.086	0.086	290
26.8	0.010	0.089	0.089	300

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.033	0.026	0.009	0.007	360
5.0	0.038	0.035	0.013	0.012	420
7.5	0.049	0.047	0.018	0.017	440
10.0	0.061	0.060	0.021	0.021	480
12.5	0.062	0.061	0.024	0.024	520
15.0	0.070	0.069	0.028	0.028	540
17.5	0.078	0.077	0.031	0.031	560
20.0	0.084	0.084	0.033	0.033	610
22.5	0.090	0.090	0.046	0.046	490
25.0	0.097	0.097	0.055	0.055	450
26.8	0.100	0.100	0.064	0.064	420

TABLE 5

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 73 CASTAIC OLD RIDGE ROUTE DATE LOGGED 3-22-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.008

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.008	0.018	0.014	180
5.0	0.008	0.025	0.024	210
7.5	0.007	0.029	0.028	270
10.0	0.008	0.044	0.044	230
12.5	0.007	0.047	0.047	270
15.0	0.007	0.049	0.049	310
17.5	0.007	0.051	0.051	340
19.8	0.008	0.054	0.054	370
22.5	0.008	0.058	0.058	390
25.0	0.008	0.060	0.060	420
26.9	0.008	0.063	0.063	430

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.031	0.024	0.009	0.007	360
5.0	0.036	0.034	0.016	0.015	330
7.5	0.039	0.038	0.022	0.021	360
10.0	0.054	0.053	0.022	0.022	450
12.5	0.057	0.057	0.025	0.025	500
15.0	0.059	0.059	0.028	0.028	540
17.5	0.062	0.062	0.030	0.030	580
19.8	0.064	0.064	0.038	0.038	520
22.5	0.068	0.068	0.040	0.040	560
25.0	0.071	0.071	0.041	0.041	610
26.9	0.073	0.073	0.041	0.041	660

TABLE 6

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 74 ELIZABETH LAKE F S DATE LOGGED 3-19-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.009

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.009	0.018	0.014	180
5.0	0.009	0.023	0.022	230
7.5	0.009	0.029	0.028	270
10.0	0.009	0.032	0.032	310
12.5	0.009	0.034	0.034	370
15.0	0.009	0.037	0.037	410
17.5	0.009	0.040	0.040	440
20.0	0.009	0.042	0.042	480
22.5	0.009	0.045	0.045	500
25.0	0.009	0.046	0.046	540
27.5	0.008	0.048	0.048	570
29.8	0.008	0.050	0.050	600

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.030	0.024	0.008	0.006	420
5.0	0.034	0.032	0.010	0.009	560
7.5	0.039	0.038	0.011	0.011	680
10.0	0.042	0.041	0.013	0.013	770
12.5	0.045	0.045	0.014	0.014	890
15.0	0.047	0.047	0.015	0.015	1000
17.5	0.050	0.050	0.016	0.016	1100
20.0	0.053	0.053	0.017	0.017	1200
22.5	0.055	0.055	0.018	0.018	1300
25.0	0.056	0.056	0.018	0.018	1400
27.5	0.058	0.058	0.019	0.019	1400
29.8	0.060	0.060	0.020	0.020	1500

TABLE 7

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 75 WARM SPRINGS CAMP DATE LOGGED 3-19-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.010

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)	FIRST S PEAK (S)	CORR S PEAK (S)
2.0	0.011	0.015	0.011	180	0.025	0.018
4.0	0.010	0.014	0.013	310	0.025	0.023
6.0	0.010	0.017	0.017	350	0.027	0.026
8.0	0.010	0.021	0.021	380	0.030	0.029
10.0	0.010	0.023	0.023	430	0.034	0.034
12.0	0.010	0.024	0.024	500	0.034	0.034
14.0	0.010	0.025	0.025	560	0.036	0.036
16.0	0.010	0.026	0.026	620	0.037	0.037
18.0	0.008	0.028	0.028	640	0.039	0.039
20.7	0.007	0.029	0.029	710	0.040	0.040

DEPTH (M)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.009	0.007	360
5.0	0.009	0.008	630
7.5	0.010	0.010	750
10.0	0.011	0.011	910
12.5	0.011	0.011	1100
15.0	0.012	0.012	1300
17.5	0.013	0.013	1300
20.5	0.013	0.013	1600

TABLE 8

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 76 WRIGHTWOOD DATE LOGGED 3-23-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.011

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.012	0.015	0.011	230
5.0	0.011	0.018	0.016	310
7.5	0.012	0.024	0.023	330
10.0	0.011	0.031	0.030	330
12.5	0.010	0.039	0.038	330
15.0	0.013	0.042	0.041	370
17.5	0.012	0.046	0.045	390
20.0	0.012	0.049	0.048	420
22.5	0.011	0.052	0.051	440
25.0	0.012	0.055	0.054	460
27.5	0.010	0.059	0.059	470
30.0	0.010	0.062	0.062	480

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.028	0.022	0.011	0.009	280
5.0	0.029	0.027	0.012	0.011	450
7.5	0.036	0.034	0.015	0.014	540
10.0	0.043	0.042	0.018	0.018	560
12.5	0.049	0.048	0.020	0.020	630
15.0	0.054	0.053	0.023	0.023	650
17.5	0.057	0.056	0.024	0.024	730
20.0	0.060	0.059	0.027	0.027	740
22.5	0.065	0.064	0.028	0.028	800
25.0	0.067	0.066	0.030	0.030	830
27.5	0.071	0.070	0.032	0.032	860
30.0	0.074	0.074	0.033	0.033	910

TABLE 9

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 77 ALLEN RANCH DATE LOGGED 3-24-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.013

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.013	0.012	0.009	280
5.0	0.013	0.014	0.013	380
7.5	0.013	0.020	0.019	390
10.0	0.013	0.023	0.022	450
12.5	0.013	0.026	0.026	480
15.0	0.014	0.029	0.029	520
17.5	0.013	0.030	0.030	580
20.0	0.013	0.031	0.031	650
22.5	0.013	0.033	0.033	680

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.025	0.019	0.013	0.010	250
5.0	0.025	0.023	0.013	0.012	420
7.5	0.030	0.029	0.014	0.014	540
10.0	0.034	0.033	0.018	0.018	560
12.5	0.036	0.035	0.020	0.020	630
15.0	0.039	0.039	0.021	0.021	710
17.5	0.040	0.040	0.022	0.022	800
20.0	0.041	0.041	0.022	0.022	910
22.5	0.043	0.043	0.023	0.023	980

TABLE 10

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 78 CEDAR SPRINGS DAM DATE LOGGED 3-18-82
BLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.010

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.010	0.010	0.008	310
5.0	0.010	0.018	0.017	290
7.5	0.009	0.024	0.024	310
10.0	0.009	0.030	0.030	330
12.5	0.011	0.036	0.036	350
15.0	0.010	0.039	0.039	380
17.5	0.008	0.042	0.042	420
20.0	0.010	0.047	0.047	430
22.5	0.010	0.051	0.051	440
25.0	0.010	0.055	0.055	450
27.5	0.009	0.059	0.059	470
29.5	0.009	0.062	0.062	480

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.019	0.015	0.010	0.008	310
5.0	0.026	0.025	0.013	0.012	420
7.5	0.032	0.031	0.017	0.016	470
10.0	0.040	0.040	0.019	0.019	530
12.5	0.047	0.047	0.020	0.020	630
15.0	0.050	0.050	0.022	0.022	680
17.5	0.054	0.054	0.023	0.023	760
20.0	0.058	0.058	0.024	0.024	830
22.5	0.061	0.061	0.026	0.026	870
25.0	0.065	0.065	0.027	0.027	930
27.5	0.069	0.069	0.028	0.028	980
29.5	0.072	0.072	0.030	0.030	980

TABLE 11

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 79 COLTON S C E DATE LOGGED 3-16-82
BLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.009

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.009	0.027	0.021	120
5.0	0.009	0.032	0.029	170
7.5	0.010	0.042	0.040	190
10.0	0.009	0.051	0.050	200
12.5	0.010	0.058	0.057	220
15.0	0.010	0.065	0.064	230
17.5	0.009	0.071	0.070	250
20.0	0.009	0.079	0.078	260
22.5	0.009	0.086	0.085	260
25.0	0.009	0.090	0.089	280
27.5	0.010	0.094	0.093	300
30.0	0.009	0.099	0.098	310

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.036	0.028	0.020	0.016	160
5.0	0.042	0.039	0.023	0.021	240
7.5	0.052	0.050	0.030	0.029	260
10.0	0.061	0.059	0.035	0.034	290
12.5	0.069	0.068	0.040	0.039	320
15.0	0.076	0.075	0.042	0.042	360
17.5	0.083	0.082	0.045	0.045	390
20.0	0.090	0.089	0.048	0.048	420
22.5	0.097	0.096	0.050	0.050	450
25.0	0.102	0.101	0.053	0.053	470
27.5	0.105	0.104	0.055	0.055	500
30.0	0.110	0.109	0.057	0.057	530

TABLE 12

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 80 C I T ATHENAEUM DATE LOGGED 3-15-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.008

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.008	0.013	0.010	250
5.0	0.008	0.019	0.018	280
7.5	0.008	0.028	0.027	280
10.0	0.008	0.034	0.033	300
12.5	0.008	0.038	0.037	340
15.0	0.008	0.043	0.043	350
17.5	0.008	0.048	0.048	360
20.0	0.008	0.053	0.053	380
22.5	0.009	0.058	0.058	390
24.0	0.008	0.060	0.060	400

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.023	0.018	0.007	0.005	500
5.0	0.030	0.028	0.010	0.009	560
7.5	0.037	0.036	0.014	0.014	540
10.0	0.044	0.043	0.018	0.018	560
12.5	0.048	0.047	0.021	0.021	600
15.0	0.053	0.052	0.024	0.024	630
17.5	0.058	0.058	0.027	0.027	650
20.0	0.063	0.063	0.030	0.030	670
22.5	0.069	0.069	0.032	0.032	700
24.0	0.072	0.072	0.034	0.034	710

TABLE 13

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 81   CIT OLD SEIS LAB   DATE LOGGED 3-15-82
BLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.003

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.003	0.009	0.007	360
5.0	0.003	0.014	0.013	380
7.5	0.003	0.017	0.016	470
10.0	0.003	0.019	0.019	530
12.5	0.003	0.020	0.020	630
15.0	0.003	0.022	0.022	680
17.5	0.003	0.024	0.024	730
20.0	0.003	0.025	0.025	800
22.5	0.003	0.027	0.027	830
25.0	0.003	0.028	0.028	890
27.4	0.003	0.029	0.029	940

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.015	0.012	0.008	0.006	420
5.0	0.021	0.019	0.009	0.008	630
7.5	0.023	0.022	0.010	0.010	750
10.0	0.025	0.025	0.011	0.011	910
12.5	0.026	0.026	0.011	0.011	1100
15.0	0.028	0.028	0.012	0.012	1300
17.5	0.030	0.030	0.013	0.013	1300
20.0	0.032	0.032	0.014	0.014	1400
22.5	0.033	0.033	0.015	0.015	1500
25.0	0.034	0.034	0.015	0.015	1700
27.4	0.035	0.035	0.015	0.015	1800

TABLE 14

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 82   GRIFFITH PARK   DATE LOGGED 3-16-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.004

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.004	0.009	0.007	360
5.0	0.005	0.015	0.014	360
7.5	0.004	0.017	0.016	470
10.0	0.004	0.018	0.017	590
12.5	0.004	0.021	0.020	630
15.0	0.004	0.023	0.022	680
17.5	0.004	0.026	0.025	700
20.0	0.004	0.028	0.027	740
22.5	0.004	0.030	0.030	750
25.0	0.006	0.033	0.033	760
26.2	0.005	0.034	0.034	770

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.015	0.011	0.009	0.007	360
5.0	0.020	0.018	0.012	0.011	450
7.5	0.023	0.022	0.013	0.013	580
10.0	0.025	0.024	0.015	0.015	670
12.5	0.027	0.026	0.016	0.016	780
15.0	0.030	0.029	0.018	0.018	830
17.5	0.032	0.031	0.020	0.020	880
20.0	0.034	0.033	0.021	0.021	950
22.5	0.037	0.036	0.022	0.022	1000
25.0	0.039	0.039	0.023	0.023	1100
26.2	0.039	0.039	0.023	0.023	1100

TABLE 15

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 83 PALOS VERDES DATE LOGGED 3-26-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.006

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.006	0.016	0.012	210
5.0	0.005	0.026	0.024	210
7.5	0.007	0.038	0.037	200
10.0	0.007	0.046	0.045	220
12.5	0.007	0.056	0.055	230
15.0	0.007	0.055	0.054	280
17.5	0.006	0.061	0.061	290
20.0	0.006	0.070	0.070	290
22.5	0.005	0.081	0.081	280
25.0	0.005	0.087	0.087	290
26.3	0.006	0.096	0.096	270

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.026	0.020	0.009	0.007	360
5.0	0.035	0.032	0.012	0.011	450
7.5	0.048	0.046	0.015	0.014	540
10.0	0.055	0.054	0.016	0.016	630
12.5	0.067	0.066	0.018	0.018	690
15.0	0.067	0.066	0.021	0.021	710
17.5	0.074	0.073	0.024	0.024	730
20.0	0.082	0.082	0.038	0.038	530
22.5	0.092	0.092	0.040	0.040	560
25.0	0.100	0.100	0.041	0.041	610
26.3	0.107	0.107	0.042	0.042	630

TABLE 16

TRAVEL-TIMES AND AVERAGE VELOCITIES

SITE NO. 84   SANTA BARBARA   DATE LOGGED 3-27-82
PLANK DIST= 2.0 PLATE DIST= 2.0 AVE ORIGIN CORR= 0.013

DEPTH (M)	ORIGIN CORR (S)	FIRST S ARRIVAL (S)	CORR S TIME (S)	AVE VEL S WAVE (M/S)
2.5	0.012	0.012	0.010	250
5.0	0.012	0.020	0.019	260
7.5	0.013	0.024	0.023	330
10.0	0.013	0.029	0.029	340
12.5	0.013	0.031	0.031	400
15.0	0.013	0.034	0.034	440
17.5	0.013	0.038	0.038	460
20.0	0.013	0.042	0.042	480
22.5	0.013	0.048	0.048	470
25.5	0.013	0.052	0.052	490

DEPTH (M)	FIRST S PEAK (S)	CORR S PEAK (S)	P TIME (S)	CORR P TIME (S)	AVE VEL P WAVE (M/S)
2.5	0.023	0.018	0.009	0.007	360
5.0	0.031	0.029	0.010	0.009	560
7.5	0.035	0.034	0.012	0.012	630
10.0	0.040	0.039	0.016	0.016	630
12.5	0.043	0.043	0.019	0.019	660
15.0	0.045	0.045	0.022	0.022	680
17.5	0.052	0.052	0.026	0.026	670
20.0	0.055	0.055	0.027	0.027	740
22.5	0.063	0.063	0.029	0.029	780
25.5	0.065	0.065	0.031	0.031	820

TABLE 17

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 69 WHEELER RIDGE

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
2.5- 7.5	3	0.006	230	(220, 240)	0.014	210	(210, 220)
10.0-22.5	6	0.020	440	(420, 460)	0.033	450	(440, 470)
22.5-30.0	4	0.029	520	(490, 550)	0.040	520	(490, 550)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	FIRST P ARRIVAL VEL (M/S)	FIRST P ARRIVAL UNC INT (M/S)
2.5-10.0	4	0.007	460	(450, 480)
12.5-30.0	8	0.015	700	(680, 710)
12.5-30.0	8	0.015	700	(680, 710)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSON'S RATIO
230	2.5- 7.5	460	2.5-10.0					0.331
440	10.0-22.5	700	12.5-30.0	15.9	1.88	3600	4300	0.171
520	22.5-30.0	700	12.5-30.0	24.4	1.82	4900	2300	-.116

TABLE 18

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 70 EDMONSTON PUMPING PLANT

FIRST S ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.004	500	(450, 570)
7.5-17.5	5	0.008	760	(720, 800)
17.5-29.6	6	0.014	980	(950,1000)

FIRST S PEAK

INCPT (S)	VEL (M/S)	UNC INT (M/S)
0.012	420	(380, 470)
0.019	790	(750, 830)
0.023	960	(900,1000)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.001	830	(830, 830)
7.5-17.5	5	0.004	1200	(1200,1200)
20.0-29.6	5	0.014	2400	(2400,2500)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
500	2.5- 7.5	830	2.5- 7.5					0.219
760	7.5-17.5	1200	7.5-17.5	10.0	2.33	13000	19000	0.165
980	17.5-29.6	2400	20.0-29.6					0.400

TABLE 19

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 71 FORT TEJON

		FIRST S ARRIVAL			FIRST S PEAK		
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.001	220	(200, 240)	0.017	270	(230, 330)
7.5-20.0	6	0.016	400	(390, 410)	0.026	400	(390, 410)
20.0-25.0	3	0.042	830	(700,1000)	0.051	820	(690,1000)
25.0-35.0	5	0.055	1500	(1400,1600)	0.065	1400	(1400,1500)

		FIRST P ARRIVAL		
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.004	510	(480, 540)
10.0-20.0	5	0.008	630	(630, 630)
20.0-25.0	3	0.020	1000	(900,1100)
25.0-35.0	5	0.035	2500	(2500,2500)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
220	2.5- 7.5	510	2.5-10.0					0.389
400	7.5-20.0	630	10.0-20.0	15.0	2.10	3400	3700	0.163
830	20.0-25.0	1000	20.0-25.0					-.606
1500	25.0-35.0	2500	25.0-35.0					0.219

TABLE 20

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 72 OSO PUMPING PLANT

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
2.5-10.0	4	-.000	250	(240, 250)	0.014	220	(210, 230)
12.5-20.0	4	0.013	340	(320, 350)	0.024	330	(320, 350)
20.0-26.8	4	0.021	390	(370, 420)	0.035	410	(390, 440)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	FIRST P ARRIVAL VEL (M/S)	FIRST P ARRIVAL UNC INT (M/S)
2.5-10.0	4	0.003	530	(510, 550)
10.0-20.0	5	0.009	810	(760, 860)
10.0-20.0	5	0.009	810	(760, 860)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
250	2.5-10.0	530	2.5-10.0					0.357
340	12.5-20.0	810	10.0-20.0	16.8	1.92	2200	9600	0.394
390	20.0-26.8	810	10.0-20.0	26.2	2.03	3100	9000	0.345

TABLE 21

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 73 CASTAIC OLD RIDGE ROUTE

	FIRST S ARRIVAL				FIRST S PEAK		
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)	INCPT (S)	VEL (M/S)	UNC INT (M/S)
10.0-26.9	8	0.033	900	(870, 940)	0.042	850	(830, 870)
10.0-26.9	8	0.033	900	(870, 940)	0.042	850	(830, 870)
10.0-26.9	8	0.033	900	(870, 940)	0.042	850	(830, 870)

	FIRST P ARRIVAL			
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.000	360	(330, 390)
7.5-17.5	5	0.013	1000	(960,1100)
19.8-26.9	4	0.030	2300	(1800,3100)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
900	10.0-26.9	1000	7.5-17.5					-1.632
900	10.0-26.9	2300	19.8-26.9					0.410

TABLE 22

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 74 ELIZABETH LAKE P S

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
2.5- 7.5	3	0.007	360	(330, 390)	0.017	350	(320, 380)
7.5-17.5	5	0.020	860	(820, 910)	0.029	850	(810, 890)
17.5-29.8	6	0.026	1300	(1200,1300)	0.037	1300	(1200,1400)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	FIRST P ARRIVAL VEL (M/S)	FIRST P ARRIVAL UNC INT (M/S)
2.5-10.0	4	0.004	1100	(1000,1200)
10.0-29.8	9	0.010	2900	(2800,3100)
10.0-29.8	9	0.010	2900	(2800,3100)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
360	2.5- 7.5	1100	2.5-10.0					0.439
860	7.5-17.5	2900	10.0-29.8	16.1	1.85	14000	140000	0.452
1300	17.5-29.8	2900	10.0-29.8					0.374

TABLE 23

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 75 WARM SPRINGS CAMP

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
2.0-10.0	5	0.007	630	(580, 670)	0.014	520	(500, 540)
10.0-20.7	6	0.017	1700	(1600,1800)	0.027	1500	(1400,1600)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	FIRST P ARRIVAL VEL (M/S)	FIRST P ARRIVAL UNC INT (M/S)
2.5-10.0		0.005	1700	(1400,2100)
10.0-20.5	5	0.009	3850	(3620,4110)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
630	2.0-10.0	1700	2.5-10.0					.420
1700	10.0-20.7	3850	10.0-20.5	10.4	2.61	76000	110000	.379

TABLE 24

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 76 WRIGHTWOOD

		FIRST S ARRIVAL			FIRST S PEAK		
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.003	370	(350, 380)	0.014	370	(350, 380)
15.0-30.0	7	0.020	720	(700, 750)	0.032	730	(700, 750)

		FIRST P ARRIVAL		
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-15.0	6	0.006	870	(830, 910)
15.0-30.0	7	0.012	1400	(1400,1500)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	(G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
370	2.5-12.5	870	2.5-15.0	6.1	2.15	2900	12000	0.390
720	15.0-30.0	1400	15.0-30.0	24.4	2.24	12000	30000	0.320

TABLE 25

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 77 ALLEN RANCH

		FIRST S ARRIVAL			FIRST S PEAK		
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.004	500	(450, 570)	0.014	530	(470, 610)
7.5-12.5	3	0.008	710	(660, 780)	0.019	760	(640, 900)
15.0-22.5	4	0.021	1900	(1700,2200)	0.030	1800	(1600,2100)

		FIRST P ARRIVAL		
DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.007	960	(850,1000)
12.5-22.5	5	0.018	4000	(2800,6200)
12.5-22.5	5	0.018	4000	(2800,6200)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	(G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
500	2.5- 7.5	960	2.5-12.5	4.5	2.70	6700	16000	0.315
710	7.5-12.5	960	2.5-12.5					0.086
1900	15.0-22.5	4000	12.5-22.5					0.354

TABLE 26

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 78 CEDAR SPRINGS DAM

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
5.0-12.5	4	0.005	400	(390, 410)	0.009	330	(320, 340)
12.5-29.5	8	0.016	640	(620, 650)	0.028	660	(660, 670)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.005	680	(650, 710)
10.0-29.5	9	0.013	1800	(1800,1900)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
400	5.0-12.5	680	2.5-10.0	12.2	2.20	3500	5400	0.237
640	12.5-29.5	1800	10.0-29.5					0.428

TABLE 27

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 79 COLTON S C E

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
2.5-10.0	4	0.011	260	(240, 270)	0.017	240	(230, 240)
10.0-22.5	6	0.022	360	(350, 360)	0.031	340	(340, 350)
22.5-30.0	4	0.046	580	(560, 610)	0.058	590	(550, 630)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-10.0	4	0.009	400	(380, 430)
12.5-20.0	4	0.024	830	(830, 830)
20.0-30.0	5	0.030	1100	(1000,1100)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
260	2.5-10.0	400	2.5-10.0	6.1	1.86	1200	1800	0.134
360	10.0-22.5	830	12.5-20.0					0.386
580	22.5-30.0	1100	20.0-30.0					0.307

TABLE 28

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 80   C I T ATHENAEUM

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
2.5- 7.5	3	0.001	290	(280, 300)	0.009	280	(260, 300)
10.0-24.0	7	0.013	500	(490, 510)	0.022	480	(470, 490)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	FIRST P ARRIVAL VEL (M/S)	FIRST P ARRIVAL UNC INT (M/S)
2.5- 7.5	3	0.000	560	(520, 590)
10.0-24.0	7	0.007	880	(860, 900)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSON'S RATIO
290	2.5- 7.5	560	2.5- 7.5					0.315
500	10.0-24.0	880	10.0-24.0					0.259

TABLE 29

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 81 CIT OLD SEIS LAB

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-10.0	3	0.007	830	(830, 830)	0.015	1000	(950,1000)
10.0-27.4	8	0.013	1700	(1600,1700)	0.018	1600	(1500,1700)

FIRST P ARRIVAL

DEPTH INT (M)	NO MEAS	INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5- 7.5	3	0.004	1300	(1300,1300)
7.5-27.4	5	0.008	3600	(3300,3900)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	(G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO	
830	5.0-10.0	1300	2.5- 7.5					0.156	.156
1700	10.0-27.4	3600	7.5-27.4	14.4	2.57	71000	230000	0.356	.356

TABLE 30

SITE NO. 82 GRIFFITH PARK

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-26.2	10	0.008	1000	(1000,1100)	0.014	1000	(1000,1100)
5.0-26.2	10	0.008	1000	(1000,1100)	0.014	1000	(1000,1100)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)
5.0-17.5	6	0.008	1400	(1400,1500)
17.5-26.2	5	0.014	2800	(2600,3000)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
1000	5.0-26.2	1400	5.0-17.5	20.0	2.30	25000	15000	-.021
1000	5.0-26.2	2800	17.5-26.2	20.0	2.30	25000	140000	0.427

TABLE 31

SITE NO. 83 PALOS VERDES

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)	FIRST S PEAK INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-12.5	5	0.002	230	(220, 250)	0.010	220	(210, 230)
15.0-25.0	5	0.002	290	(280, 310)	0.015	300	(290, 310)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	VEL (M/S)	UNC INT (M/S)
2.5-17.5	7	0.005	930	(890, 980)
20.0-26.3	4	0.026	1600	(1500,1800)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSONS RATIO
230	2.5-12.5	930	2.5-17.5					0.467
290	15.0-25.0	1600	20.0-26.3					0.484

TABLE 32

INTERVAL VELOCITIES AND ELASTIC MODULI

SITE NO. 84 SANTA BARBARA

DEPTH INT (M)	NO MEAS	FIRST S ARRIVAL INCPT (S)	FIRST S ARRIVAL VEL (M/S)	FIRST S ARRIVAL UNC INT (M/S)	FIRST S PEAK INCPT (S)	FIRST S PEAK VEL (M/S)	FIRST S PEAK UNC INT (M/S)
5.0-25.5	9	0.011	630	(610, 660)	0.020	560	(540, 590)
5.0-25.5	9	0.011	630	(610, 660)	0.020	560	(540, 590)

DEPTH INT (M)	NO MEAS	FIRST P ARRIVAL INCPT (S)	FIRST P ARRIVAL VEL (M/S)	FIRST P ARRIVAL UNC INT (M/S)
2.5-17.5	7	0.003	780	(750, 800)
17.5-25.5	4	0.015	1600	(1400,1700)

S VEL (M/S)	DEPTH INT (M)	P VEL (M/S)	DEPTH INT (M)	DENSITY DEPTH (M)	DENSITY (G/CC)	SHEAR MOD (BARS)	BULK MOD (BARS)	POISSON'S RATIO
630	5.0-25.5	780	2.5-17.5	10.0	2.10	8400	1500	-.438
630	5.0-25.5	1600	17.5-25.5	10.0	2.10	8400	40000	0.408