APPLICATION OF PRIVATE SITE-SPECIFIC DATA TO REGIONAL EVALUATION OF EARTHQUAKE AND FAULTING POTENTIAL IN SOUTHERN CALIFORNIA

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PART I

INTRODUCTION AND SUMMARY

by

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INTRODUCTION

The electric utility industry has spent more than $50 million for geologic investigations of six nuclear plant (NP) sites in southern California. In addition, more than 500 individual investigations of residential and commercial sites within seven fault zones delineated under the Alquist-Priolo Special Studies Zone Act (AP) have been conducted in this part of the state, resulting in cumulative expenditures of millions of dollars. The two types of studies complement each other because the AP reports are usually fairly brief, covering limited areas within individual fault zones, whereas the NP reports, which concern regional geology and tectonics, are more comprehensive and cover relatively large areas around individual sites.

Part II of this report, "Annotated Bibliography of Geologic Reports Prepared for Nuclear Power Plant Sites in Southern California," includes index maps showing the approximate outline of areas covered by geologic reports for the six nuclear power plant sites in relation to principal faults in southern California. Part III, "Annotated Bibliography of Engineering Geology Reports Prepared to Satisfy the Alquist-Priolo Special Studies Zones Act in Southern California," has detailed strip maps along individual faults; symbols developed during this project show the location of individual AP investigations and the ages of faulted and unfaulted earth materials observed in the trenches. The purpose of these bibliographies is to make more available to assessments of seismic risk in urban areas of southern California the large volume of data generated by private industry on earthquake and surface-faulting potential for these specific sites.

We have not included references to published papers and theses concerning fault hazards, contractor reports of fault investigations for the U.S.G.S. Earthquake Hazards Reduction Program or reports concerning seismic safety of dams and facilities other than NP sites.

DISCUSSION

Nuclear Power Plant Site Studies

The number of reports in the bibliography for each NP site varies from 20 to 54; the reports describe the regional and site stratigraphy and structure, seismic history, foundation conditions and ground-motion characteristics. The NP reports vary greatly in length, scope of subject, degree of detail and direct relevance to the major faults of interest. Some reports are comparable to those of the AP bibliography in that they document in great detail the results of subsurface exploration by trenches and borings, and they indicate the location, characteristics and minimum age of last movement on faults. Others report, for example, investigations of large areas (tens to hundreds of square miles) to develop an understanding of Pleistocene-Holocene stratigraphy and geomorphology applicable to evaluating local and regional tectonic activity.

Diablo Canyon Nuclear Power Plant

This oceanfront site in San Luis Obispo County supports a nuclear plant that is constructed but not yet in operation. Particularly interesting geologic features are the coastal terrace platforms and their overlying deposits, stratification and deformation in the Monterey Formation, and the Hosgri fault offshore. Significant contributions of the investigations include: data from extensive onshore trenching and detailed mapping; data from comprehensive seismic-reflection profiling offshore; definition of the Hosgri fault and the variation in its characteristics along strike; discussions of the tectonic relationships and interaction among faults of the San Andreas system, the Transverse Ranges, and the transition zone between the Transverse and Coast Ranges; and the source of the 1927 Lompoc earthquake.

San Joaquin Nuclear Power Plant Site

This site was proposed by the Department of Water and Power of the City of Los Angeles in concert with several other utility companies. Although the site met with the approval of the NRC staff, the applicants stopped plans for construction after their proposal was rejected by voters in Kern County. Particularly interesting aspects of this site in the south-central San Joaquin Valley are the presence at depth of the Greeley fault beneath the site and the well-layered Plio-Pleistocene sediments conducive to detailed correlation by borehole-geophysical techniques and to dating by paleomagnetic methods. Important contributions of the investigations include (1) extensive seismic-reflection data on faults and their relationships, (2) determination of the sequence and chronology of soil-stratigraphic units for dating faults, and (3) the detailed definition of structures ranging in age from Eocene to Pleistocene.

Bolsa Island Nuclear Power - Desalting Plant Site

The construction of an artificial island was proposed by the Metropolitan Water District of Southern California in concert with other utility companies at a site a few miles offshore from Huntington Beach, but the island was never built. The site lies within or very near the offshore extension of the Newport-Inglewood zone of folds and faults. Particularly interesting are the interpretations of drilling and seismic-reflection data on the locations and upward extent of faults. The investigation of this site, conducted prior to implementation of the AEC/NRC Seismic and Geologic Siting Criteria, was not as extensive or comprehensive as those for other sites studied later.

San Onofre Nuclear Generating Station

A three-unit nuclear power plant has been constructed and licensed to operate on this oceanfront site by Southern California Edison Company and San Diego Gas and Electric Company. Geologic features of major interest at the site are marine and nonmarine terraces and their deposits, the stratigraphy and structure of the Capistrano Basin, the Cristianitos fault, conjugate joint-like shears in the San Mateo Formation, and the possible offshore extension of the Newport-Inglewood zone of folds and faults. The investigations for this site resulted in (1) the definition and characterization of the Offshore Zone of Deformation with regard to its earthquake potential, (2) the development of slip-rate/magnitude relationships along strike-slip faults for estimating earthquake potential, and (3) a description of the stratigraphy and structure of part of the southern California continental shelf.

Vidal Nuclear Power Plant Site

This site was investigated by Southern California Edison Company and proposed for a nuclear plant, but the plant has not been constructed. Gently sloping alluvial fans and aprons dominate the site vicinity and are incised to reveal the Pliocene Bouse Formation. Important contributions of the investigations include (1) age determination and description of the Bouse Formation and its contact with the underlying Osborne Formation as a widespread marker horizon, (2) interpretation of the relationships among several eastern-Mojave faults and the Death Valley fault zone, and (3) dating of alluvial fan surfaces and several soil and Pleistocene-Holocene sedimentary units by various methods.

Sundesert Nuclear Power Plant Site

This site along the Colorado River was proposed for a nuclear plant by San Diego Gas and Electric Company, but plans for construction have been canceled for economic reasons. Important geologic features at the site and in the region are the flat-lying sediments of the Bouse Formation, alluvial fan deposits, and terraces of the Colorado River. Significant contributions of the investigations include (1) detailed definition of the stratigraphy and structure of the Bouse Formation, (2) description of the depositional and geomorphic history of the lower Colorado River, (3) location of the 1852 Fort Yuma earthquake, (4) definition of faults in the Chocolate Mountains southeast of the Salton Trough and their disassociation with the San Andreas fault system, and (5) description of the Blythe Graben.

Alquist-Priolo Special Studies Zones Act Reports

The AP bibliography has 24 strip maps showing locations of reports along individual faults. For each report, one or more circles show the ages of rock units exposed and whether the units are faulted (Part III, Fig. 2). Lines through circles as extensions of faults indicate that the fault was exposed in the trench(es). Lines between numbers in the circle at right angles to the adjacent fault represent depositional contacts. Numbers inside the circle represent ages of earth materials exposed in the trenches:

1 - Holocene, <10,000 years old (recent alluvium)

2 - upper Pleistocene, 10,000 to 500,000 years old (older alluvium and alluvial terrace deposits)

3 - lower Pleistocene, 500,000 to 3,000,000 years old

4 - pre-Pleistocene, >3,000,000 years old

This bibliography should be useful for developers, engineers, engineering geologists and land-use planners in identifying potential problem areas and engineering geology reports applicable to a specific project. The maps and symbols also give an overview of the relative hazard from individual faults which verifies or improves knowledge of earthquake risk and provides a basis for further research. Significant results are summarized below.

Kern County Faults

Trench logs from 5 AP reports show faults that broke the ground surface during the 1952 Kern County earthquake and parallel faults that also revealed evidence of Holocene displacement (Part III, Fig. 3). Holocene displacement was reported in a trench across the Big Pine fault but no evidence of faulting was reported in two AP reports with trenches in Holocene and late Pleistocene sediments across the Garlock fault (Part III, Fig. 4). No organic material suitable for carbon 14 dating was reported from any of the trenches.

San Andreas Fault Zone

Trenches across the San Andreas fault and one of its branches, the Mission Creek fault, revealed abundant evidence of Holocene and late Pleistocene displacement across a zone of subparallel and anastomosing strands up to 1.7 km wide. Of 30 AP investigations reporting trenches in Holocene sediments across the principal strands of the San Andreas and Mission Creek faults, 27 reported evidence of displacement. Displaced sediments which may contain organic material datable by carbon 14 methods are reported from the following two sites along the San Andreas fault: City of San Bernardino no. 11 (Part III, Fig. 12), "dark gray to black clay, probably sag pond materials"; City of San Bernardino no. 45 (Part III, Fig. 13), "Carbon 14 sample indicated in wet organic clay 9 feet below surface adjacent to fault zone". No data on analysis of sample is given in report.

San Jacinto Fault Zone

Logs of trenches across strands of the San Jacinto fault zone report Holocene displacement across a zone of subparallel and en echelon faults. Of 40 AP investigations reporting trenches in Holocene sediments across principal strands of the San Jacinto fault zone, 35 describe displacement. Other trenches revealed secondary faults parallel to the principal strand forming a band of faults up to 200 m wide. None of the trench logs of displaced earth materials across the San Jacinto fault zone report organic material suitable for carbon 14 dating. Three reports (City of San Bernardino nos. 78, 84, and 85, Part III, Fig. 17) describe sand boils, blows, and dikes probably caused by shaking during earthquakes (Sieh, 1978). Riverside County report no. 94 (Part III, Fig. 19) describes "three displacement events with offsets up to 1 foot."

Elsinore Fault Zone

The Elsinore fault zone consists of subparallel and *en echelon* faults. Compared to the San Jacinto and San Andreas faults, trenches across the Elsinore fault zone found less evidence of Holocene or late Pleistocene displacement. Of 21 AP investigations reporting trenches in Holocene sediments across a principal strand of the Elsinore fault zone (Part III, Fig. 26), 10 reported displacement on the Glen Ivy North and Wildomar faults. No evidence of Holocene displacement has been found on the Willard or Chino faults. However, Heath *et al.* (1982) report stream offsets and fault scarps along the Chino fault in the Prado Dam - Corona area, north of the trenches shown on Fig. 26 (Part III), which suggests Holocene displacement. Engineering geology reports which describe fault offsets revealed in trenches across strands of the Elsinore fault have been used (Lamar and Swanson, 1981, 1982) to successfully guide a search for datable faulting events and provided the impetus for this study.

San Fernando Area Faults and Raymond Hill Fault

Trench logs from seven AP reports across faults which broke the ground surface during the 1971 San Fernando earthquake describe displaced Holocene and late Pleistocene sediments (Part III, Figs. 20 and 21). A log from a trench across the Raymond Hill fault describes faulting in older alluvium (Part III, Fig. 20). None of the reports describe organic material suitable for carbon 14 dating.

Inglewood-Newport Fault Zone

The Inglewood-Newport fault zone consists of a complex zone of parallel, branching and *en echelon* faults. Of 13 AP reports describing trenches in Holocene and upper Pleistocene deposits only one reports evidence of displacement. This result is suprising in view of seismic activity and abundant physiographic evidence of faulting along individual strands of the fault zone (Barrows, 1974).

REFERENCES

Barrows, A. G., 1974, A review of the geology and earthquake history of the Newport-Inglewood structural zone, southern California: Calif. Div. Mines and Geol., Spec. Rpt. 114, 115 p.

Heath, E. G., Jensen, D. E., and Lukesh, D. W., 1982, Style and age of deformation on the Chino fault: in Neotectonics in Southern California, Volume and Guidebook, Geol. Soc. Amer. Cordilleran Section, 78th Annual Meeting, p. 123-134.

Lamar, D. L., and Swanson, S. C., 1981, Study of seismic activity by selective trenching along the Elsinore fault zone, southern California: Lamar-Merifield Technical Report 81-4, Final Technical Report for U.S. Geological Survey Contract 14-08-0001-19144, 50 p.; also U.S. Geological Survey Open-File Report 81-882.

Lamar, D. L., and Swanson, S. C., 1982, Ages of displaced strata in trenches across Elsinore fault zone, southern California: presented at Cordilleran Section, Geol. Soc. Amer.

Sieh, K. E., 1978, Prehistoric large earthquakes produced by slip on the San Andreas fault at Pallett Creek, California: Jour. of Geophys. Res., v. 83, p. 3907-3939.

PART II

ANNOTATED BIBLIOGRAPHY OF GEOLOGIC REPORTS PREPARED FOR NUCLEAR POWER PLANT SITES IN SOUTHERN CALIFORNIA

by

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ILLUSTRATIONS

GLOSSARY OF ABBREVIATIONS

ACRS	Advisory Committee of Reactor Safeguards
AEC	Atomic Energy Commission (also USAEC)
CDMG	California Division of Mines and Geology
DBE	Design Basis Earthquake
FSAR	Final Safety Analysis Report
MEL	Maximum Earthquake Limit
NIFZ	Newport-Inglewood Fault Zone
NRC	Nuclear Regulatory Commission (Also USNRC)
OBE	Operational Basis Earthquake
OSFZ	Offshore Fault Zone
OZD	Offshore Zone of Deformation
PSAR	Preliminary Safety Analysis Report
SAFZ	San Andreas Fault Zone
SCOFZ	South Coast Offshore Fault Zone
SJNP	San Joaquin Nuclear Plant
SSE	Safe Shutdown Earthquake
SNP	Sundesert Nuclear Plant
SONGS	San Onofre Nuclear Generating Station
USAEC	United States Atomic Energy Commission (also AEC)
USGS	United States Geological Survey
USNRC	United States Nuclear Regulatory Commission (also NRC)
WEFZ	Whittier-Elsinore Fault Zone

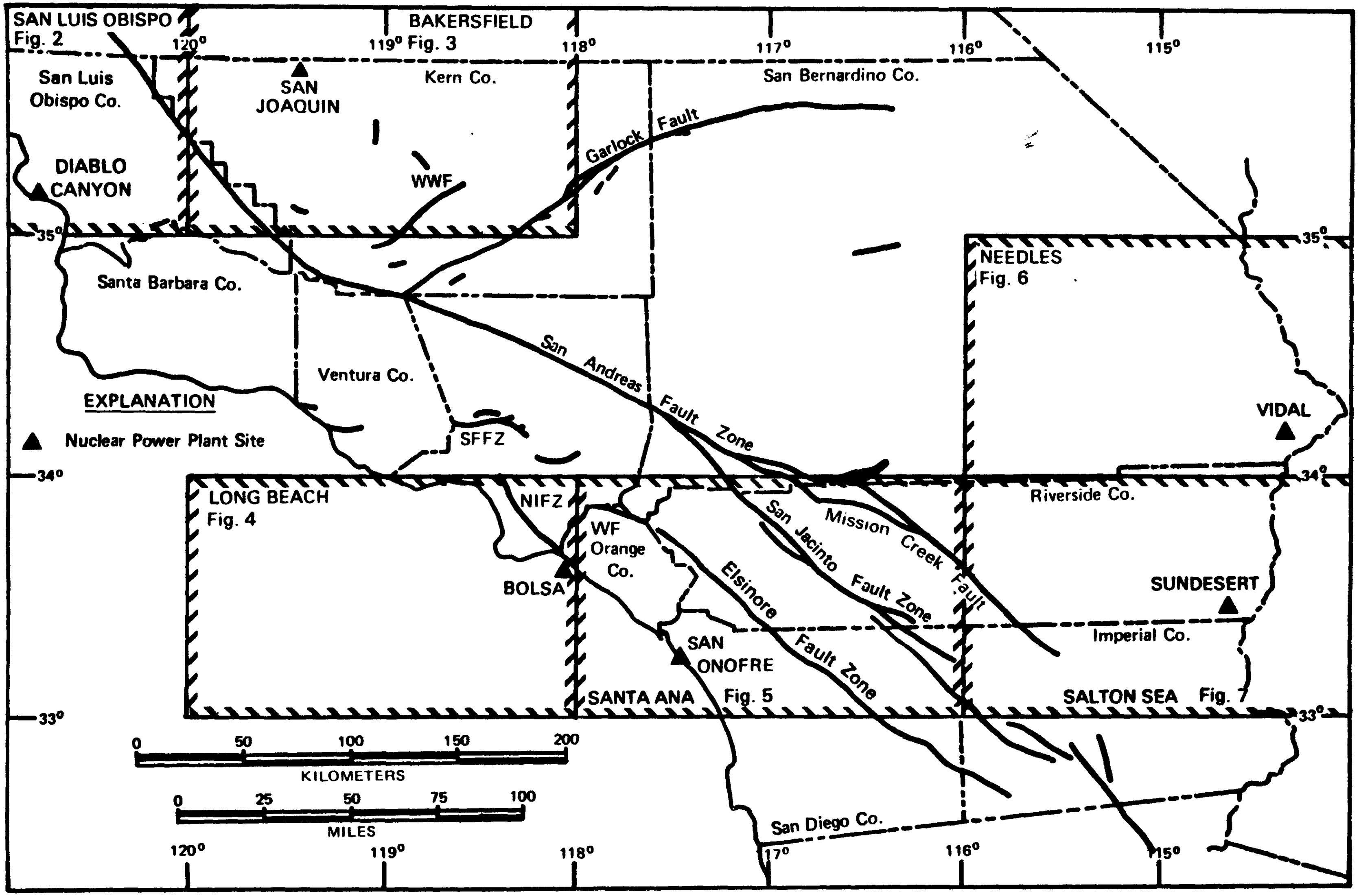
INTRODUCTION

Annotated bibliographies of geologic and related reports have been prepared for the following six nuclear power plant sites (Fig. 1):

Diablo Canyon Nuclear Power Plant
San Joaquin Nuclear Power Plant
Bolsa Island Nuclear Power Plant - Desalting Plant
San Onofre Nuclear Generating Station
Vidal Nuclear Power Plant
Sundesert Nuclear Power Plant

Nuclear plants have actually been constructed on the Diablo Canyon and San Onofre sites. The other locations remain as proposed sites, but ones which have been formally proposed to the Nuclear Regulatory Commission (NRC) and its predecessor agency the Atomic Energy Commission (AEC). Each site has been extensively investigated and documented with respect to geology and seismology, the amount of which depends on when the studies were done and on how far the project proceeded in regulatory review. Also included are geotechnical studies evaluating soil and foundation conditions and earthquake-engineering analyses of ground motion from postulated earthquakes.

Investigations of nuclear plant sites are governed by rules of the NRC, "Seismic and Geologic Siting Criteria for Nuclear Power Plants" (10 CFR, Part 100, Appendix A). These rules require comprehensive documentation of the stratigraphy, structure, geologic history and seismicity within 200 miles of a proposed site with increasing detail approaching the site. In particular, the absence of capable faults within, or projecting within, 5 miles of a site must be demonstrated by a reasonably thorough investigation. Also, the source of the potential earthquake judged to produce the strongest ground motion at the site during the plant's lifetime must be identified, and the nature of attenuation from source to site and the characteristics of ground motion at the site must be determined.



NIFZ: Newport-Inglewood fault zone; SFFZ: San Fernando fault zone; WF: Whittier fault; WWF: White Wolf fault.

Fig. 1 - Principal faults in southern California, locations of nuclear power plant sites, and outlines of detailed maps.

To satisfy NRC and design requirements, the investigations include geologic mapping, geophysical exploration, drilling and trenching. As in Alquist-Priolo studies, these investigations yield information on the location of faults, their characteristics, and minimum age of last displacement. However, they commonly go further in determining the absolute and relative ages of stratigraphic units used in dating fault movements and in describing and interpreting local and regional structural and tectonic relationships.

The references that follow are grouped by site, ordered by date, and located approximately on the figure preceding each site section. The list of references is, no doubt, incomplete despite the authors' attempts to search several sources including: Public Document Rooms of the NRC, libraries of the electric utility companies and their consultants, and the senior author's personal library. Additional documents brought to our attention by readers would be gratefully received and included, if possible, in revised editions.

We greatly appreciate and acknowledge the courtesy of ERTEC in Long Beach for granting us access to the documents in their library and for use of their copier. Merl Smith of the California Division of Mines and Geology (CDMG) kindly provided originals from the CDMG files for producing Figures 2-7.

Most documents originated by the NRC, or submitted to it for consideration, are placed in the commission's Public Document Room at 1717 H Street, N.W., Washington, D.C. for public inspection. In addition, documents related to specific facilities are available for inspection in local public document rooms in the vicinity of the nuclear facility and in the regional NRC office at the addresses listed below.

Nuclear Regulatory Commission Region V
Suite 202
1990 N. California Blvd.
Walnut Creek, CA 94596

Documents & Maps Dept.
California Polytechnic State University Library
San Luis Obispo, CA 93407

Mission Viejo Branch Library
24851 Chrisanta Drive
Mission Viejo, CA 92676

References not included in this bibliography, but which contain useful and interesting information, are the transcripts of public hearings on the nuclear plants. Transcripts represent the evidentiary record that becomes the basis for approval by the NRC for an applicant utility to construct, and later to operate, a nuclear plant at a particular site. Contained in this record are written and oral direct testimony by witnesses for all parties to the proceeding--the applicant, NRC, intervenors, state and federal agencies--as well as cross examinations, lawyers' arguments, and written briefs **pro** and **con** on the technical and other contentions under consideration. Although the transcripts are too voluminous and disjointed for most technical researchers to wade through, the curious and persistent reader will be rewarded by insights into the opposing geologic interpretation and judgments by experts for and against the project and by the variable ability of geologists to defend and sustain their positions. Information on the location and availability of hearing transcripts can be obtained from the regional NRC office in Walnut Creek.

DIABLO CANYON NUCLEAR POWER PLANT

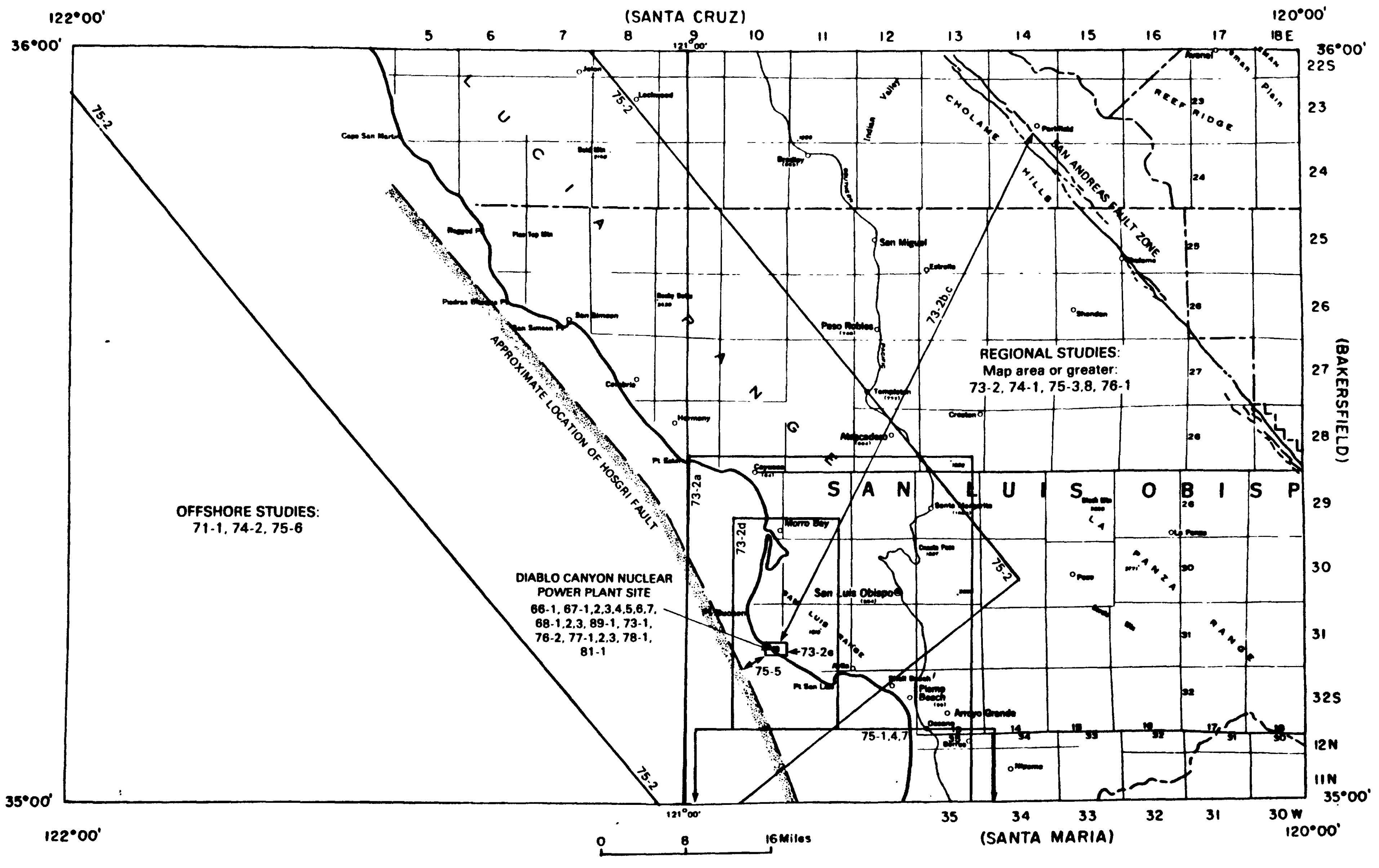


Fig. 2 - Areas covered by geologic studies for Diablo Canyon Nuclear Power Plant on San Luis Obispo sheet. See Fig. 1 for location.

SAN LUIS OBISPO, Diablo Canyon Site

66-1	Jahns, 1966
67-1	Pacific Gas & Electric (PG&E), 1967a
67-2	Jahns, 1967a
67-3	Jahns, 1967b
67-4	PG&E, 1967b
67-5	Benioff & Smith, 1967
67-6	Marine Advisers, 1967a
67-7	Marine Advisers, 1967b
68-1	John A. Blume & Assoc., 1968
68-2	PG&E, 1968
68-3	Jahns, 1968
69-1	John A. Blume & Assoc., 1969
71-1	Hoskins & Griffiths, 1971
73-1	Harding-Lawson Assoc., 1973
73-2	PG&E, 1973
73-2a*	PG&E (Site location and topography, 1:250,000), 1973a
73-2b*	PG&E (Earthquake epicenters, 200 mile radius), 1973b
73-2c*	PG&E (Faults and earthquake epicenters, 75 mile radius), 1973c
73-2d*	PG&E (Geologic map of the Morro Bay South and Port San Luis Quadrangles, 1"= 4000'), 1973d
73-2e*	Geologic map of Diablo Canyon coastal area, 1"= 400'), 1973e
74-1	Earth Science Associates, 1974
74-2	Teknekron, 1974
75-1	Engdahl, 1975
75-2	PG&E, 1975a
75-3	PG&E, 1975b
75-4	PG&E, 1975c
75-5	PG&E, 1975d
75-6	PG&E, 1975e
75-7	Smith, 1975
75-8	U.S. Nuclear Regulatory Commission (USNRC), 1975
76-1	USNRC, 1976a
76-2	USNRC, 1976b
77-1	Ang & Newmark, 1977
77-2	Bernreuter & Wight, 1977
77-3	PG&E, 1977
78-1	USNRC, 1978
81-1	Tera Corp., 1981

* Maps enclosed in 73-2.

DIABLO CANYON NUCLEAR POWER PLANT SITE (Fig. 2)

66-1 Jahns, R. H., 1966, Geology of the Diablo Canyon Power Plant site: consultants' report to PG&E in Preliminary Safety Analysis Report (67-1), Appendix B, 37 p.

Geologic assessment of the Diablo Canyon Power Plant site addressing the question of feasibility of the site for a nuclear plant in terms of geologic conditions. It is based mainly on a detailed study of bedrock and surficial deposits in natural exposures, and contains a geologic map and structure section. The report concludes that no special problems involving bearing strengths or ground stability are anticipated, and subsurface water should impose no serious difficulties. Further geologic and seismologic studies are recommended.

67-1 Pacific Gas and Electric Co., 1967a, Preliminary Safety Analysis Report, Diablo Canyon Site, 3 volumes.

Preliminary report submitted to the Atomic Energy Commission in support of the construction permit for Diablo Canyon Unit 1. Geology and seismology data are contained in Volume I, Section 2.5 (Geology) and Section 2.6 (Seismology). Geologic reports by Jahns (66-1, 67-2 and 67-3) are contained in Appendix B, and a report on seismology by Benioff and Smith (67-5) is contained in Appendix C. The report concludes that the site is suitable for a nuclear plant. The most recent faulting in the site vicinity occurred more than 100,000 years ago. The probability of surface fault rupture can be safely disregarded, and landslides do not threaten the proposed reactor.

67-2 Jahns, R. H., 1967a, Geology of the Diablo Canyon Power Plant site, supplementary report: consultants' report to PG&E in Preliminary Safety Analysis Report (67-1), Appendix B, 25 p.

Supplementary report dealing mainly with the results of subsurface geologic exploration at the Unit 1 site, including documentation in the form of photographs, detailed sketches, and geologic sections along four large exploratory trenches. It is concluded that the plant site is both feasible and suitable.

67-3 Jahns, R. H., 1967b, Geology of the Diablo Canyon Power Plant site, supplementary report II: consultants' report to PG&E in Preliminary Safety Analysis Report (67-1), Appendix B, 21 p.

A second supplementary geologic report focused on relationships of structural breaks that were recognized at the Unit 1 site and along the adjacent seacliff near the mouth of Diablo Canyon. The breaks represent two different kinds of minor deformation that probably are related to folding of the strata. This zone of breaks is not a major structural feature, is at least 100,000 years old, and does not correlate reasonably with any break or group of breaks exposed in the trenches at the plant site.

67-4 Pacific Gas and Electric Co., 1967b, Third Supplement to Preliminary Safety Analysis Report, Nuclear Plant, Diablo Canyon Site, 285 p.

Supplemental report including additional data on geology and seismology prepared in response to an NRC question regarding faults in the bedrock underlying a portion of the plant foundation and regarding the adequacy of trenching at the site.

67-5 Benioff, H., and Smith, S., 1967, Seismic evaluation of the Diablo Canyon site: Seismological Laboratory, Pasadena, California, in Preliminary Safety Analysis Report (67-1), Appendix C, 9 p.

Historical summary of earthquake activity in the immediate vicinity of the site and adjacent areas, and an estimation of the maximum earthquakes that can be expected during the life of the plant (M 7.25).

Earthquakes on the San Andreas fault (M 8.5), Nacimiento fault and offshore fault systems are discussed.

67-6 Marine Advisers, Inc., 1967a, Supplementary report on tsunami studies in Fourth Supplement to Preliminary Safety Analysis Report, Diablo Canyon Site, 16 p.

Report in response to concern expressed at a meeting of the PG&E and AEC committees "that there has been recent experience in Alaska and in the Mediterranean on nearby earthquakes of about M 7 producing waves 50 feet high. Two features are pointed out that could be suggested as making the Diablo Canyon area different from the areas specified: 1) no embayments that may provide funneling are found at Diablo Canyon; 2) the offshore relief is not as severe at Diablo Canyon. The report concludes that the necessary parameters for creation of a tsunami wave large enough to affect the site are lacking or are not found to be of adequate magnitudes at Diablo Canyon.

67-7 Marine Advisers, Inc., 1967b, Second supplement to report on tsunami potential at Diablo Canyon in Fourth Supplement to Preliminary Safety Analysis Report.

Report containing refraction pattern diagrams for distantly generated tsunamis. The resulting values were significantly less than from locally generated sources, so local systems were used for design.

68-1 John A. Blume & Associates, 1968, Dynamic elastic moduli of foundation earth materials, Diablo Nuclear Reactor Site in PG&E, Final Safety Analysis Report (73-2), Appendix 2.5A, 75 p.

Results of a study of the dynamic site response of materials underlying the reactor site. The purpose of the study was to determine elastic constants of the foundation rocks under anticipated structural loads.

The foundation material at Diablo Canyon site is a stratifed sequence of fine- to very fine-grained, deeply weathered sandstone. The rock is closely fractured, with tightly closed or healed fractures. Values for elastic moduli and Poisson's ratios are recommended for the site.

68-2 Pacific Gas and Electric Co., 1968, Preliminary Safety Analysis Report, Nuclear Unit 2, Diablo Canyon Site, 3 volumes.

Preliminary report submitted to the Atomic Energy Commission in support of the construction permit for Diablo Canyon Unit 2. Geology and seismology data are contained in Volume I, Section 2.4 (Geology) and Section 2.5 (Seismology). Additional investigations were made for Unit 2 including extensive trenching. The geologic reports previously contained in Appendix A of the PSAR for Unit 1 (67-1) are contained in Appendix B of this document. These include Jahns, 1966 (66-1), Jahns, 1967a (67-2), Jahns, 1967b (67-3) and Jahns, 1968 (68-3).

The report concludes that the Diablo Canyon site is geologically suitable for a nuclear plant, including the location selected for Unit 2. The bedrock is fully capable of carrying the intended loads. The most recent faulting in the vicinity of the site occurred more than 100,000 years ago and may well have taken place millions of years ago. The probability of surface fault rupture at the site is so remote that it can be safely disregarded. Landslides do not threaten the proposed Unit 2 reactor.

68-3 Jahns, R.H., 1968, Geology of the Diablo Canyon Power Plant site, supplementary report III, ground conditions at site for plant unit no. 2: consultant's report to PG&E, in Preliminary Safety Analysis Report, Nuclear Unit 2 (68-2), 21 p.

Supplementary report extending the earlier geologic appraisals to the area intended for Unit 2. It is based upon detailed study of new exploratory trenches excavated in the terrace area immediately south and southeast of older trenches. The report concludes that the posssibility of fault-induced permanent ground displacement within the subject property during the useful life of the proposed installation is sufficiently remote to be safely disregarded.

69-1 John A. Blume & Associates, 1969, Supplementary report on dynamic elastic moduli of foundation earth materials, Diablo Canyon Unit 2, nuclear reactor site in PG&E, Final Safety Analysis Report, Units 1 & 2 (73-2), Appendix 2.5B, 26 p.

Results of a supplemental geophysical investigation performed at the Unit 2 plant site. The additional work was required because the bedrock underlying Unit 2 was determined to be slightly different from that south of Unit 2. The seismic investigation described in this report confirmed the dynamic elastic moduli values previously recommended for Unit 1 (68-1).

71-1 Hoskins, E.G., and Griffiths, J.R., 1971, Hydrocarbon potential of northern and central California offshore, in Am. Assoc. Petroleum Geologists, Memoir 15, p. 212-228.

Geophysical exploration conducted by two geologists with the Shell Oil Company indicate the presence of a 90 mile long fault about 4-1/2 miles offshore from the Diablo Canyon plant site. Although this study was not conducted for the purpose of siting the power plant, it played a significant role in establishing the direction of subsequent studies of the site vicinity.

73-1 Harding-Lawson Associates, 1973, Stability evaluation, power plant cut slope, Diablo Canyon site, in PG&E, Final Safety Analysis Report, Units 1 & 2 (73-2), Appendix 2.5C, 202 p.

Results of an evaluation of the existing cut slope east of Units 1 and 2. Test borings and pits were excavated and laboratory tests were performed. The evaluation of stability of the cut slope assumed a horizontal earthquake acceleration of 0.4g. Conventional method of slices was used and checked by the modified Bishop's method. It was concluded that the slope will be stable during the double design earthquake. The computed upper bound of displacement is 10 inches, which would not damage adjacent safety-related structures.

73-2 Pacific Gas and Electric Co., 1973, Final Safety Analysis Report, Units 1 and 2, Diablo Canyon Site, USAEC Docket Nos. 50-275, 50-323.

Report submitted in support of applications to operate two nuclear power plant units at the PG&E Diablo Canyon site. The report has 85 amendments and is contained in 14 volumes. Geology and seismology data are contained primarily in Volume III, Section 2.5. Six appendices to Section 2.5 include reports by John A. Blume and Associates (68-1, 69-1), Harding-Lawson Associates (73-1), Earth Science Associates (74-1), and supplemental studies by PG&E (75-2 to 75-6).

Faults discussed include the San Andreas, Sur-Nacimiento, Rinconada (Nacimiento)-San Marcos-Jolon-San Antonio, San Simeon, Santa Lucia Bank. Additional local tectonic features discussed include West Huasna fault, Edna fault, San Miguelito fault and the east boundary of the offshore Santa Maria basin (Hosgri fault zone). Surficial deposits described include coastal terrace deposits, stream terrace deposits, landslide deposits, slump, creep and slope-wash deposits, and stream-laid deposits. In addition, midden deposits indicating early habitation by Indians were found at the site.

An outline of the Geology and Seismology section follows:

2.5.1 BASIC GEOLOGIC AND SEISMIC DATA

Location: Site location and topography are shown on Fig. 2.5-1.

Physiography

Site

Region

Geology and Seismology: Location of earthquake epicenters and regional features of geologic structure are shown on Figs. 2.5-2 and 2.5-3. Geologic and tectonic map of the region surrounding the site is presented in Fig. 2.5-4. Detailed information about the site geology is presented in Figs. 2.5-5 through 2.5-13.

Site Engineering Properties

Introduction - field and laboratory investigation

Exploratory trenches and boring locations are shown on Figs. 2.5-2, 2.5-8, 2.5-9 and 2.5-10.

Summary and correlation of data

Dynamic elastic moduli and Poisson's ratio

Founding material properties shown in Fig. 2.5-16.

Engineering backfill

Plan and profile view of excavation and backfill for major plant structures are shown in Figures 2.5-14 and 2.5-15.

Foundation bearing pressure

2.5.2 VIBRATORY GROUND MOTION

General Geologic Features

Regional Tectonic Setting and Seismicity

Table 2.5-1 - Listing of nature and effects of all significant historic earthquakes within 75 miles of the Diablo Canyon site.

Table 2.5-1A - Summary of revised epicenters of representative sample of events (19) off the coast of California near San Luis Obispo.

Table 2.5-2 - Displacement history of faults in the southern Coast Ranges.

Tectonic Features of the Central Coastal Region

San Andreas fault

Sur-Nacimiento fault zone

Rinconada (Nacimiento)-San Marcos-Jolon-San Antonio fault system

San Simeon fault

Santa Lucia Bank fault

Tectonic features in the vicinity of Diablo Canyon

West Huasna fault

Edna fault zone

San Miguelito fault zone

East boundary zone of the offshore Santa Maria Basin

Seismicity

Ground Accelerations and Response Spectra: Smooth response acceleration spectra are presented in Figs. 2.5-17 and 2.5-18.

Stratigraphy of the San Luis Range and Vicinity

Basement rocks

Tertiary rocks

Quaternary deposits

Structure of the San Luis Range and Vicinity

General features

San Luis-Pismo syncline

Los Osos Valley antiform

Edna and San Miguelito fault zone

Adjacent offshore area and east boundary of the offshore Santa Maria Basin

Landforms

General features

Marine terrace benches

Geologic History

Geology of the Diablo Canyon Power Plant Site, Units 1 & 2

General features

Bedrock units: Data from nearby exploratory oil wells is discussed

Structure

Tectonic structures underlying the region surrounding the site

Tectonic structures underlying the site

Surficial Deposits

Geologic Relationships at the Unit 1 and 2 Power Plant Site

Final Conclusions Regarding Site Geology

2.5.3 SURFACE FAULTING

2.5.4 STABILITY OF SUBSURFACE MATERIALS

2.5.5 SLOPE STABILITY

Introduction

Field exploration

Laboratory tests

Strength parameters

Subsurface conditions

Slope stability analysis

Additional studies

APPENDIX 2.5A - Dynamic elastic moduli of foundation earth materials (68-1)

APPENDIX 2.5B - Supplementary report on dynamic moduli of foundation earth materials (69-1)

APPENDIX 2.5C - Stability evaluation, power plant cut slope, Diablo Canyon site (73-1)

APPENDIX 2.5D - Geology of the Southern Coast Ranges and the adjoining offshore continental margin of California, with special reference to the geology in the vicinity of the San Luis Range and Estero Bay (74-1)

APPENDIX 2.5E - Additional geologic and seismologic studies - 1975 (75-2 to 75-6)

APPENDIX 2.5F - Additional geologic and seismologic studies - 1976 (NRC questions and answers)

The major conclusions regarding site geology include the following:

1) the reactor site is underlain by well-indurated, firm Monterey sandstone;

2) surficial deposits 3 to 35 feet thick include both marine and non-marine sediments of Pleistocene and Holocene age;
3) no evidence of a major fault has been recognized within or near the coastal area, and no such fault is present within the reactor site;
4) minor surfaces of disturbance, some of which plainly are faults, are present within the bedrock that underlies the power plant site, but none of these breaks offset the interface between bedrock and terrace deposits;
5) no landslide masses or other gross expressions of ground instability are present.

74-1 Earth Sciences Associates, 1974, Geology of the southern Coast Ranges and the adjoining offshore continental margin of California, with special reference to the geology in the vicinity of the San Luis Range and Estero Bay, in PG&E, Final Safety Analysis Report (73-2), Appendix 2.5D, 112 p.

Investigation conducted to establish a more complete geologic basis for assessing the seismic activity that could affect the plant site. The report describes the San Andreas, Sur-Nacimiento, Rinconada (Nacimiento)-San Marcos-Jolon-San Antonio, East Huasna, West Huasna-Suey, San Simeon and Santa Ynez faults. Major faults in the adjoining offshore continental margin are also discussed.

The report concludes that regional tectonic conditions affecting the southern Coast Ranges derive from the north-south compressive stress-strain system associated with crustal plate transform motion taking place along the San Andreas fault, and from the buoyant uplift of the ranges. The extensional stress-strain regime that exists in the adjacent offshore region may still be affected by extension resulting from a change of the plate motion pole of rotation that occurred some 10 to 12 million years ago; however, it is more likely that it simply results from the continued pulling-away of the offshore region from the rising Coast Ranges.

Seismic-reflection surveys and geologic interpretation of the offshore region between Cape San Martin and Point Arguello are contained in Appendix A. A gravity study of the continental borderland is contained in Appendix B.

74-2 Teknekron, Inc., 1974, Analysis of Offshore Seismicity in the Vicinity of the Diablo Canyon Nuclear Power Plant: consultant's report to PG&E, 145 p.

Epicenters in the offshore region near Diablo Canyon cannot be located more accurately than ±8 km. In the Santa Lucia Bank region the accuracy drops to ±13 km. Offshore structures on both the east and west margin of the Santa Maria Basin are seismically active. Focal mechanisms in the region preclude San Andreas type strike-slip mechanisms and indicate that the Diablo Canyon region is in a transition zone between San Andreas type tectonics to the east and extensional deformation in the Santa Maria Basin to the west.

75-1 Engdahl, E.R., 1975, Teleseismic Location of the 1927 Lompoc Earthquake: Tera Technical Report, Berkeley, 26 p.

A computer program was used to locate the 1927 earthquake with data reported in the International Seismological Summary and to estimate standard errors and joint confidence regions for the epicentral coordinates. On the basis of these instrumental locations and associated error analysis, it must be concluded that the location of the 1927 event is not known to better than 25 km at the 95 percent confidence level, and that it probably falls somewhere within the region covering the epicenter distribution shown on a map.

75-2 Pacific Gas and Electric Co., 1975a, The geology of the northern reaches of the Hosgri fault zone and the relationship of the Hosgri fault to the San Simeon fault, in PG&E, Final Safety Analysis Report (73-2), Appendix 2.5E.

Discussion prepared in response to an NRC request to provide additional documentation on the northern reaches of the Hosgri fault zone. Sixteen sparker seismic-reflection profiles are presented and discussed.

The Hosgri and San Simeon faults are adjacent and subparallel to one another from the latitude of Point Estero north to Ragged Point. As the Hosgri fault zone dies out, vertical displacements along the San Simeon fault increase. This apparent northward transference of strain release from the Hosgri fault zone to the San Simeon fault is completed south of Cape Martin. Several elements of geologic and seismic evidence indicate that there is no significant through-going connection between the Hosgri and San Simeon faults. The Hosgri fault dies out in a series of discontinuous branches and folds north of Point Piedras Blancas.

75-3 Pacific Gas and Electric Co., 1975b, Discussion and arguments for determining the maximum earthquake that can be expected on faults of various ranks within the southern Coast Ranges province of the San Andreas system, in PG&E, Final Safety Analysis Report (73-2), Appendix 2.5E.

Discussion prepared in response to an NRC request for the maximum earthquake that can be expected on faults of various ranks within the San Andreas system. The faults of the region are associated with four contrasting levels of seismic potential. These range from Level I, with which only the San Andreas fault is associated, down to Level IV, a minimum level presumed to exist throughout the Coast Ranges.

Geologic information on total fault length and total slip within a specified time period were used to determine the total seismic-moment characteristics and calculate maximum magnitudes.

Maximum Earthquake Expected on Faults of Various Ranks				
Fault	Length(km)	Depth(km)	Max. Slip(m)	Max. Mag.
First Order Branch (e.g., Calaveras, Hayward, San Gregorio)	160-320	15	9	8.2-8.4
Second Order (e.g., San Simeon, Nacimiento, Rinconada)	80-160	10	±1	6.3-6.5
Third Order (e.g., West Huasna, Edna)	Less than 80	10	±1	6.3

For comparison, also shown is the range of magnitudes predicted using curves of fault length versus magnitude.

Fault Rupture Length (km)	Magnitude Range
200	7.25-8.5
100	6.75-8.25
50	6.0-7.75
25	5.25-7.25

75-4 Pacific Gas and Electric Co., 1975c, Location and source of the 1927 Lompoc earthquake, **in** PG&E, Final Safety Analysis Report (73-2), Appendix 2.5E.

Study conducted in response to an NRC request for additional data on the 1927 Lompoc earthquake and consisting of a synthesis and re-analysis of previous work. The Lompoc fault is situated near the point where all seismological indications of the epicentral area of the 1927 earthquake converge or overlap. It has been active during Holocene time, and it is expected to produce predominantly dip-slip movement. It is therefore considered to represent the structural feature most likely to have been the source of the 1927 earthquake.

75-5 Pacific Gas and Electric Co., 1975d, An evaluation of the maximum credible earthquake on the Hosgri fault zone and associated site response spectrum comparisons, in PG&E, Final Safety Analysis Report (73-2), Appendix 2.5E.

Report prepared in response to an NRC question regarding derivation of the peak site ground acceleration caused by the maximum credible earthquake assumed to occur along the segment of the Hosgri fault nearest the site. Evaluation and comparison of the response spectrum associated with this event with the design response spectrum as well as a comparison of various response quantities are also included. A maximum credible earthquake of M 6.25 to 6.5 is derived.

75-6 Pacific Gas and Electric Co., 1975e, The geology of the region of intersection and merging of the offshore Santa Maria basin and Hosgri fault trends with the Transverse Ranges trends, in PG&E, Final Safety Analysis Report (73-2), Appendix 2.5E.

Discussion in response to an NRC request for additional documentation, including seismic-reflection profiles, on the intersection of the Hosgri fault zone with the Transverse Range faults. Thirty-five sparker seismic-reflection profiles are presented and interpreted on six plates.

75-7 Smith, S.W., 1975, Aftershocks of the 1927 Lompoc Earthquake, Tera Technical Report, Berkeley, 19 p.

Based on the Santa Barbara and Pasadena data, the center of aftershock activity appears to have been a distance of 111 and 260 km from these stations, respectively. Although the distance offshore is quite closely fixed at 25 km, there is little or no control on the north-south position. The combined S-P data and isoseismals yield a location of 34.65°N and 120.90°W.

75-8 U.S. Nuclear Regulatory Commission, 1975, Supplement No. 1 to the Safety Evaluation of the Diablo Canyon Nuclear Power Station Units 1 and 2, Division of Reactor Licensing, Washington, D.C., 49 p.

Review of investigations conducted since 1969. Offshore investigations of the Santa Maria basin by Hoskins and Griffith (71-1), Wagner (1974) and the U.S. Geological Survey. Evaluation of the potential of the Hosgri fault was continuing at the time of this supplement. A review of slope stability analysis concluded that slopes will remain stable during the Safe Shutdown Earthquake.

76-1 U.S. Nuclear Regulatory Commission, 1976a, Supplement No. 4 to the Safety Evaluation of the Diablo Canyon Nuclear Power Station Units 1 and 2, Division of Reactor Licensing, Washington, D.C., 46 p.

Discussion of characteristics of the Hosgri fault and the relationship between the San Simeon fault zone and Transverse Range structures to the Hosgri fault zone. Appendix C to this supplement concludes: the Hosgri fault is capable of a M 7.5 earthquake, the 1927 Lompoc earthquake could have occurred on the Hosgri fault, and a similar M 7.5 earthquake could occur in the future anywhere along the Hosgri fault.

76-2 U.S. Nuclear Regulatory Commission, 1976b, Supplement No. 5 to the Safety Evaluation of the Diablo Canyon Nuclear Power Station Units 1 and 2, Division of Reactor Licensing, Washington, D.C., 55 p.

Report recommending a postulated M 7.5 earthquake on the Hosgri fault with an effective horizontal ground acceleration of 0.75g. Supporting data submitted to the NRC by N.M. Newmark are presented in Appendix C of this supplement.

77-1 Ang, A.H.S., and Newmark, N.M., 1977, A Probabilistic Seismic Safety Assessment of the Diablo Canyon Nuclear Power Plant: Report to the NRC, N.M. Newmark Consulting Engineering Services, Urbana, Illinois.

Independent analysis of the Design Basis Earthquake and Operating Basis Earthquake (OBE), which concludes that the OBE ground motion with maximum acceleration of 0.2g is acceptable for the Diablo Canyon site.

77-2 Bernreuter, D.L., and Wight, L. H., 1977, Analysis of Diablo Canyon Site Response Spectra, Lawrence Livermore Laboratory, UCRL-52263, 60 p.

Provides confirmation that the ratio of peak velocity to peak acceleration is much smaller at a rock site than at a soil site. The report concludes that the level of ground motion at Diablo Canyon from a major nearby earthquake would have lower amplification factors than those specified in Regulatory Guide 1.60.

77-3 Pacific Gas and Electric Co., 1977, Seismic Evaluation for Postulated 7.5M Hosgri Earthquake, Units 1 and 2, Diablo Canyon Site.

Report arguing that the M 7.5 earthquake postulated by the U.S. Geological Survey, and the resulting ground acceleration at the site (0.75g), are excessive and that an earthquake of M 6.25 to 6.5 is the largest that reasonably can be expected to occur on the Hosgri fault. Nevertheless, the effects of a M 7 earthquake are presented.

78-1 U.S. Nuclear Regulatory Commission, 1978, Supplement No. 7 to the Safety Evaluation of the Diablo Canyon Nuclear Power Station Units 1 and 2, Division of Project Management, Washington, D.C., 147 p.

Defines terminology for earthquake design bases: Design earthquake (0.2g) is the Operating Basis Earthquake as defined in Appendix A to 10 CFR Part 100; Double Design Earthquake (0.4g) is the Safe Shutdown Earthquake. The Hosgri event (0.75g) is the basis approved for the seismic reevaluation. Contrary to the applicant's position, the NRC considers this to be the Safe Shutdown Earthquake. Slope stability is also discussed based on the Hosgri event. The applicant's assumptions regarding a nearshore generated tsunami are considered to be conservative.

81-1 Tera Corporation, 1981, Earthquake Emergency Planning at Diablo Canyon: Consultant's report to PG&E, 179 p. and appendices.

Natural seismic hazards of major concern to radiological emergency planning in the study area are ground shaking, landslides, liquefaction, settlement and tsunami. The potential effects of these hazards on transportation and communications are discussed. Specific evaluations rest on the assumption of a M 7.5 event on the Hosgri fault.

page 21 follows

SAN JOAQUIN NUCLEAR POWER PLANT SITE

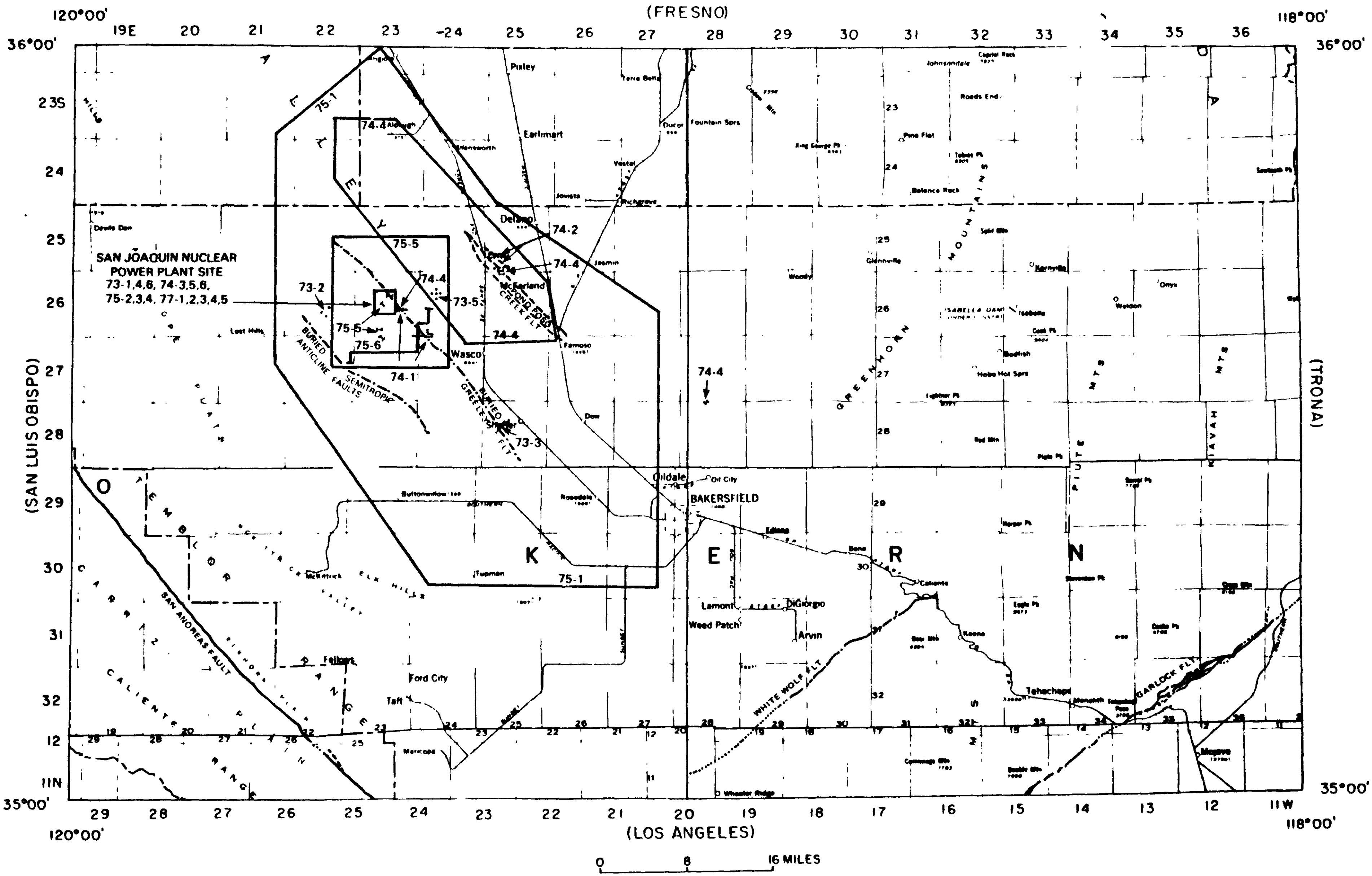


Fig. 3 - Areas covered by geologic studies for San Joaquin Nuclear Power Plant Site on Bakersfield sheet. See Fig. 1 for location.

BAKERSFIELD, San Joaquin Nuclear Power Site

73-1	Crosby, 1973	75-1	Farr, Mateker & Wu, 1975
73-2	Crosby, Anderson & Weber, 1973	75-2	Fugro, 1975a
73-3	Crosby, Siems, Anderson & Weber, 1973	75-3	Fugro, 1975b
73-4	Crosby, Siems & Weber, 1973	75-4	Fugro, 1975c
73-5	Crosby, Siems & Lane, 1973	75-5	Fugro, 1975d
73-6	Kukla, Opdyke & Lowrie, 1973	75-6	Fugro, 1975e
74-1	Crosby, Weber & Lane, 1974a	77-1	Fugro, 1977a
74-2	Crosby, Weber & Lane, 1974b	77-2	Fugro, 1977b
74-3	Fugro, 1974a	77-3	Fugro, 1977c
74-4	Fugro, 1974b	77-4	Keith, Feibusch & Assoc., 1977a
74-5	Fugro, 1974c	77-5	Keith, Feibusch & Assoc., 1977b
74-6	Dept. of Water & Power, City of Los Angeles, 1974		

SAN JOAQUIN NUCLEAR POWER PLANT SITE (Fig. 3)

73-1 Crosby, J.W., III, 1973, Geophysical logging capabilities and procedures, a status report: in San Joaquin Nuclear Project, Early Site Review Report (SJNP ESRR), Volume II, Appendix 2.5C, 11 p. (74-3)

Summary of downhole geophysical logging capabilities of the Geohydrology Section of Washington State University. The applications of spontaneous potential, single point resistivity, natural gamma, neutron-epithermal neutron, neutron gamma, and gamma-gamma logs to stratigraphic correlation are discussed.

73-2 Crosby, J.W., III, Anderson, J.V., and Weber, T.L., 1973, Geophysical logging investigations of the northwest Semitropic Gas Field: in SJNP ESRR, Volume III, Appendix 2.5F, Subappendix 3, p. 2.5F-37 to 2.5F-49. (74-3)

Results of geophysical logging of four borings in the Northwest Semitropic Gas Field 5-1/2 miles west of the SJNP site to demonstrate the persistence of diagnostic geophysical horizons throughout the area. The report contains six figures, including correlations and complete-suite profiles, plus Attachment 3A containing the soil classification boring logs.

73-3 Crosby, J.W., III, Siems, B.A., Anderson, J.V., and Weber, T.L., 1973, Interpretation of geophysical logs, Shafter Gas Field: in SJNP ESRR, Volume III, Appendix 2.5F, Subappendix 1, p. 2.5F-8 to 2.5F-26A40. (74-3)

Results of geophysical well-logging in the Shafter Gas Field to evaluate stratigraphic relations and structural features for evidence of Recent faulting. The geophysical logs suggest essentially horizontal stratigraphy with no structural displacements of any magnitude. The report contains 15 plates, including correlations and complete-suite profiles, plus an appendix containing the soil classification boring logs.

73-4 Crosby, J.W., III, Siems, B.A., and Weber, T.L., 1973, Interpretation of geophysical logs from San Joaquin Nuclear Project Site, Wasco, California: in SJNP ESRR, Volume II, Appendix 2.5A, 11 p. (74-3).

Interpretation and stratigraphic correlation of geophysical borehole logs for the SJNP site based on composite analysis of gamma-gamma log and natural gamma log suites. Six geophysical zones are defined and correlated to probable stratigraphic horizons. The report concludes that sufficiently well-defined markers are present at the site to permit precise definition of stratigraphic relationships. The report contains 49 figures, including gamma-gamma and natural gamma correlation, and complete-suite logs.

73-5 Crosby, J.W., III, Siems, B.A., Lane, G.B., 1973, Preliminary interpretation of geophysical logs near site area, Wasco, California: in SJNP ESRR, Volume III, Appendix 2.5F, Subappendix 4, p. 2.5F-37 to 2.5F-50A10. (74-3)

Results of a geophysical borehole study 4 miles northeast of the SJNP site describing six horizons at the SJNP site that are readily apparent and continuous. The report contains seven figures, including correlation and complete-suite profiles, plus Attachment 4A containing the soil classification boring logs.

73-6 Kukla, G.J., Opdyke, N.D., Lowrie, W.S., 1973, Paleomagnetism of San Joaquin Nuclear Project site, drillholes H-14, H-24, and H-35, in SJNP ESRR, Volume II, Appendix 2.5D, 7 p. (74-3)

Paleomagnetic analyses of 34 borehole samples from three borings. The results indicate that the Brunhes-Matuyama paleomagnetic time boundary (700,000 y. B.P.) is most probably 330 feet deep at the site. An average sedimentation rate of 0.4 feet/1000 years is calculated based upon the age of the Corcoran Clay (600,000 years) and its depth of 240 feet. Independent correlation of the Brunhes-Matuyama boundary is provided by an ash layer at a depth of 277 feet that correlates with the distant Bishop Tuff. The Bishop Tuff is known to be above the paleomagnetic boundary. The laboratory results are presented in four tables.

74-1 Crosby, J.W., III, Weber, T.L., and Lane, G.B., 1974a, Geophysical borehole studies, southeast site area, San Joaquin Nuclear Project: in SJNP ESRR, Volume III, Appendix 2F, Subappendix 2, p. 2.5F-26B to 2.5F-36. (74-3)

Two-part report on borehole investigations 4 miles southeast of the SJNP site consisting of geophysical logging of 16 borings drilled to depths between 400 and 500 feet to determine evidence for extending displacement along the deeply buried Greeley fault to a shallow depth beneath the SJNP site. The study concluded that continuous flat-lying strata, primarily the distinctive E-clay, overlie the deeply buried Greeley fault and show no indication of structural deformation.

This study also re-examined variations in the elevation of the base of the E-clay in 19 borings and concluded there is no evidence of offset in the geophysical horizons, although gentle northeasterly downwarping of the sediments was noted.

The report contains 26 figures, including correlation and complete-suite profiles, plus soil classification boring logs.

74-2 Crosby, J.W., III, Weber, T.L., Lane, G.B., 1974b, Interpretations of geophysical logs for the Pond fault: in SJNP ESRR, Volume III, Appendix 2.5F, Subappendix 5, p. 2.5F-50 to 2.5F-85W. (74-3)

A two-part report describing geophysical borehole investigations near the SJNP site at Peterson and Pond Roads in an area of possible Recent faulting. At the Peterson Road site, the borings were drilled to a depth of about 500 feet and logged. No diagnostic geophysical responses were encountered that could be used for correlation. The environment of sedimentation is postulated to be an alluvial fan.

At the Pond Road site, 11 borings logged to a depth of 500 feet revealed four geophysical horizons. Near-surface deformation greater than 60 feet is postulated to be due to faulting at the Pond Road site.

The report contains 25 figures, correlation and complete-suite profiles, plus soil classification boring logs.

74-3 Fugro, Inc., 1974a, San Joaquin Nuclear Project, Early Site Review Report (SJNP ESRR): Los Angeles Department of Water and Power, 6 volumes.

Preliminary study of the hydrology, geology, and seismology of the SJNP site near Wasco, California. Volume I contains a summary of hydrologic engineering (Section 2.4), geology and seismology (Section 2.5), and seismic engineering input (Section 3.7.1). The remaining five volumes contain appendices. Appendix 1.7A contains AEC questions and the applicants' responses. Appendices 2.5A to 2.5R are primarily consultants' reports of geologic and seismologic studies used in the site evaluation. Appendices which contain explanations of procedures, raw data, or test results include Appendices 1.7A, 2.5B, C, G, H, I, J, M, and 3.7A.

The faults analyzed for selection of the Safe Shutdown Earthquake (SSE) response spectrum are: (1) San Andreas, (2) White Wolf, (3) Greeley, (4) Semitropic, and (5) Pond-Poso Creek. The 0.35g SSE response spectrum was based on a hypothetical M 7 earthquake on the Pond-Poso Creek fault located 11 miles from the SJNP site. The ESRR concludes that it would be feasible from geologic and seismologic standpoints to construct a nuclear power plant at the SJNP site.

74-4 Fugro, Inc., 1974b, Offsite exploratory programs - Greeley fault, Northwest Semitropic fault, near-site subsurface investigation, and Pond-Poso Creek fault investigation: in SJNP ESRR, Volume III, Appendix 2.5F, p. 2.5F-1 to 2.5F-85W.(74-3)

Results of an extensive drilling and trenching program designed to detect displacement along fault traces projected toward or underlying the SJNP site. Interpretations of downhole geophysical data are included as five subappendices of Appendix 2.5F.

The results of these investigations are: (1) no evidence of faulting or folding of strata 700,000 years or younger can be found along traces of the Greeley fault in the Shafter Gas Field, 15 miles southeast of the SJNP site; (2) the mid-Pleistocene E-clay has no demonstrable evidence of vertical or horizontal offset across the Greeley fault in the southeastern part of the SJNP site; (3) re-examination of offset on the E-clay, previously reported by the U.S. Bureau of Reclamation, 4 miles southeast of the SJNP site, indicates that the structure is an unfaulted gentle northeasterly-sloping homocline; (4) no evidence for offset on the Northwest Semitropic fault younger than 600,000 to 700,000 years was found in the Northwest

Semitropic Gas Field 5-1/2 miles west of the SJNP site; (5) downhole geophysical studies 4 miles east of the SJNP site show good correlation among six geophysical horizons identified at the SJNP site (see Crosby, 73-1); (6) the results of airphoto, seismic profile, hydrologic, exploratory trenching, and downhole geophysical investigations of the Pond-Poso Creek fault, 11 miles northeast of the SJNP site, indicate predominantly near-vertical oblique-slip movement on the fault system and no evidence for strike-slip movement. The total cumulative apparent-vertical offset across three faults of the Pond-Poso Creek system is 32 feet, down on the south, with a fourth fault having at least 15 feet of vertical displacement.

74-5 Fugro, Inc., 1974c, San Joaquin Nuclear Project, In situ engineering seismic measurements for dynamic moduli: in SJNP ESRR, Volume IV, Appendix 2.5K, 27 p. (74-3)

Crosshole, downhole, and surface seismic-refraction data indicate the presence of three velocity zones beneath the SJNP site: (1) a 1000 ft/sec zone at the surface; (2) a ±2000 ft/sec zone between a depth of 5 and 60 feet; and (3) a 6000 ft/sec zone below a depth of 160 feet. The report contains eight figures showing the geophysical data-plots and the results.

74-6 Department of Water and Power of the City of Los Angeles, 1974, Feasibility Study Report for San Joaquin Nuclear Project, 3 volumes.

A three-volume report summarizing the feasibility of siting a nuclear generating station near Wasco, California. In Volume I the geology and seismology originally presented in the Early Site Review Report (74-3) is briefly outlined and the critical conclusions are restated. Volume III, the Appendix, contains 19 consultant reports not found in the ESRR. Appendix L contains a letter from W.C. Bryant on groundwater development costs.

75-1 Farr, J.B., Mateker, E.J., Jr., Wu, C., 1975, Interpretation of seismic reflection data for the San Joaquin Nuclear Project: in SJNP ESRR, Volume IIA, Appendix 2.5E, 83 p. (74-3)

Interpretations by Western Geophysical Company of 77 seismic-reflection profiles (530 line miles) within a 20-mile radius of the SJNP site. Four geophysical horizons were contoured to illustrate structure. Three northwest-trending major fault systems, the Pond-Poso Creek, the Greeley, and the Semitropic Anticline faults, were analyzed for amount and age of movement. The study concludes that: (1) the Pond-Poso Creek System, 11 miles northeast of the site, is a zone of normal faults, down on the southwest. At a depth of 875 to 1,500 feet, a Plio-Pleistocene horizon is displaced, but the displacement dies out 9 miles from the SJNP site. (2) The Greeley fault system consists of three different faults; the shallowest displacement occurs 20 miles southeast of SJNP within Pliocene strata at depths of no less than 8,000 feet. (3) The Semitropic Anticline fault system is southwest of the SJNP site and displaces Miocene strata at depths no shallower than 10,000 feet.

The report contains four tables listing fault displacements, 33 plates which are mostly structural sections, correlation sections, contour maps and isopach maps.

75-2 Fugro, Inc., 1975a, San Joaquin Nuclear Project, long period spectral response of the 1952 Kern County earthquake accelerograms: in SJNP ESRR, Volume IV, Appendix 2.5L, 5 p. (74-3)

Results of an analysis of the 1952 Kern County earthquake. In response to NRC questions on the long period (0.4 to 2.0 seconds) segments of the design response spectra, this analysis scaled the M 7.7 earthquake upward to a hypothetical M 8.5 event on the San Andreas fault 60 to 80 miles west of the SJNP site. The results indicate that a 0.35g design spectrum conservatively envelops the scaled spectra for all periods of interest.

75-3 Fugro, Inc., 1975b, Interpretation of structure contour and isopach maps, geophysical zone V, site and adjacent areas: in SJNP ESRR, Volume IV, Appendix 2.5N, 19 p. (74-3)

Compilation of data from borings at and adjacent to the SJNP site. The contour and isopach maps for the top and bottom of zone V (the E-clay) were drawn using three methods. The maps are computer-contoured, computer-contoured and hand-smoothed, and hand-contoured. The results of this compilation indicate no evidence of horizontal or vertical faulting. The data suggest that gentle northeast-dipping strata underlie the SJNP site. Nine figures are presented.

75-4 Fugro, Inc., 1975c, San Joaquin Nuclear Project, alternate interpretations of geotechnical data by others: in SJNP ESRR, Volume IV, Appendix 2.5O, 46 p. (74-3)

An eight-part report giving arguments for modifying or dismissing conclusions of previous authors about faults and fault activity in the southern San Joaquin Valley near the SJNP site. The topics discussed include: (1) left-lateral faulting through the SJNP site; (2) horizontal slickensides on cores of the Greeley fault; (3) northwest-trending structures underlying the southern San Joaquin Valley; (4) extensions of the Greeley fault; (5) the 1952 White Wolf earthquake surface fractures and surface markings; (6) faulting in the Rio Bravo Oil Field; and (7) faulting in the Semitropic Oil and Gas Field.

The report includes seven plates, including logs of trenches excavated along lineaments and a map of the 1952 White Wolf earthquake fractures (Plate 2.5O-2).

75-5 Fugro, Inc., 1975d, San Joaquin Nuclear Project, photogeologic analysis of the site vicinity: in SJNP ESRR, Volume IV, Appendix 2.5P, 10 p. (74-3)

An extensive photolineament study of the area surrounding the SJNP site. Four trenches were excavated across representative photolineaments to determine if lineations were caused by underlying structures. The report concludes that: (1) based on trenching, the northwest- and northeast-trending photolineaments are not related to underlying faults; (2) nearly all lineations are caused by the distributary system of the Poso Creek alluvial fan and by shoreline and dune deposits of Holocene Tulare Lake.

The report contains four figures showing the photolineaments and trench logs.

75-6 Fugro, Inc., 1975e, San Joaquin Nuclear Project, geologic logs of canal excavation, site vicinity: in SJNP ESRR, Volume V, Appendix 2.5Q, 26 p. (74-3)

Documentation of an investigation conducted during the construction of a 10-foot-deep, 20-mile-long irrigation canal a few miles south of the SJNP site. A 12.5-mile segment of the trench was inspected and logged to: (1) ascertain the extent and continuity of Pleistocene and Holocene alluvium near the SJNP site; (2) search for any displacement of soil from deeply buried structures such as the Greeley and Semitropic faults; (3) study the origin of the numerous photolineaments that cross the canal; and (4) date the sediments.

The report concludes that: (1) the continuity of soils was demonstrated; (2) no offsets or disruptions of soil horizons were present across the upward projections of the Greeley and Semitropic faults; (3) photolineaments are caused by contrasting soil types associated with buried stream channels and are nontectonic in origin; (4) no evidence of near-surface faulting was found; and (5) an age date of a paleosol exposed in the canal at a depth of 10 feet is to be determined.

The report contains 13 plates presenting logs of the canal slopes.

77-1 Fugro, Inc., 1977a, San Joaquin Nuclear Project, Additional studies demonstrating the conservatism in the Safe Shutdown Earthquake for the Pond-Poso Creek fault: in SJNP ESRR, Volume V, Appendix 2.5R, 181 p. (74-3)

A four-part report on the degree of conservatism of the design spectra for the Safe Shutdown Earthquake (SSE) postulating an M 7 earthquake on the Pond-Poso Creek fault with a hypocentral distance of 11 miles from the SJNP site.

Four studies by consultants demonstrate the conservatism of 0.35g design response spectra by: (1) scaling ten selected response spectra for the SJNP site conditions and showing that the 0.35g SSE describes greater shaking; (2) performing a regression analysis of a deep-alluvium data-set and showing the 0.35g SSE exceeds a mean-plus-one-standard-deviation level of response (Fugro, 77-2); scaling the response spectra earthquake records using spectral-intensity attenuation-relationships and showing the 0.35g SSE to be greater (77-4); and (4) showing by statistical analysis that the 0.35g SSE design response spectra represents a level of shaking that will occur once in one million to ten million years (77-5).

77-2 Fugro, Inc., 1977b, Applicants' procedure applied to the Pond-Poso Creek fault: in SJNP ESRR, Volume V, Appendix 2.5R, Subappendix 1, p. 2.5R-9 to 2.5R-41. (74-3)

Concise description of the Applicant's procedures and methods for determining the Safe Shutdown Earthquake (SSE) for SJNP based on a M 7 earthquake on the Pond-Poso Creek fault 11 miles away. The original four representative earthquakes used in the analysis are supplemented by six additional earthquakes. All earthquake response spectra have been scaled to the SSE magnitude/distance conditions for SJNP. The report concludes that the six additional response spectra add credibility to the 0.35g Regulatory Guide 160 design spectra previously presented in Section 2.5.2.10 of the SJNP ESRR.

The report contains 17 figures, mostly of scaled response spectra.

77-3 Fugro, Inc., 1977c, Response spectra for the Pond-Poso Creek fault SSE based on regression analyses of spectral ordinates: in SJNP ESRR, Volume V, Appendix 2.5R, Subappendix 2, p. 2.5R-42 to 2.5R-67. (74-3)

Summary of methods and results of analyses by the USGS and the applicants on recorded earthquake response spectra scaled to the 0.35g Regulatory Guide 160 Safe Shutdown Earthquake (0.35g SSE). Regression analyses were performed for a large data-set (23 to 96 records) which were classified as representing rock, soil, or deep-alluvium conditions. The mean-plus-one-standard-deviation curve was determined for each foundation condition. The results of this study indicate that the 0.35g SSE exceeds the curve for the "USGS data-set" and the deep-alluvium data-set. The deep-alluvium spectra best represent the SJNP site conditions.

The report contains six figures, mostly response spectra.

77-4 Keith, Feibusch and Associates, Engineers, 1977a, Response spectra for the Pond-Poso Creek fault SSE based upon a regression analysis of spectral intensity: in SJNP ESRR, Volume V, Appendix 2.5R, Subappendix 3, p. 2.5R-70 to 2.5R-109. (74-3)

Evaluation of the 0.35g Regulatory Guide 160 Safe Shutdown Earthquake (0.35g SSE) by using spectral-intensity values for determining the appropriate scaling factors of a selected number of recorded earthquakes. The 0.35g SSE is based on an M 7 earthquake on the Pond-Poso Creek fault 11 miles from the SJNP site. Selected response spectra of recorded ground motions were analyzed to determine the relationship among spectral intensity, magnitude, and source distance. The analyses were performed for three different soil categories: rock, soil and deep alluvium. Deep alluvium was found to be most representative of the SJNP site. The report concludes that the 0.35g SSE response spectra are conservative.

The report contains eight plates.

77-5 Keith, Feibusch and Associates, Engineers, 1977b, Probabilistic evaluation of the design response spectrum for the Pond-Poso Creek fault SSE: in SJNP ESRR, Volume V, Appendix 2.5R, Subappendix 4, p. 2.5R-110 to 2.5R-181. (74-3)

A probability model for the Pond-Poso Creek fault based on an analytical procedure developed by Cornell (1968). The study discusses determination of an earthquake magnitude-recurrence relationship using fault-displacement history, magnitude vs. fault displacement, and magnitude vs. rupture length data from the Pond-Poso Creek fault. The study also includes discussions of: (1) statistical implications of the spatial distribution of earthquakes along the fault; (2) attenuation of ground motion; (3) return period of ground motion amplitudes; and (4) sensitivity of the study's probabilistic results to variations in the parameters. This report concludes that the 0.35g Safe Shutdown Earthquake design response spectra are representative of a level of shaking that will occur once in one million to ten million years.

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BOLSA ISLAND NUCLEAR POWER - DESALTING PLANT SITE

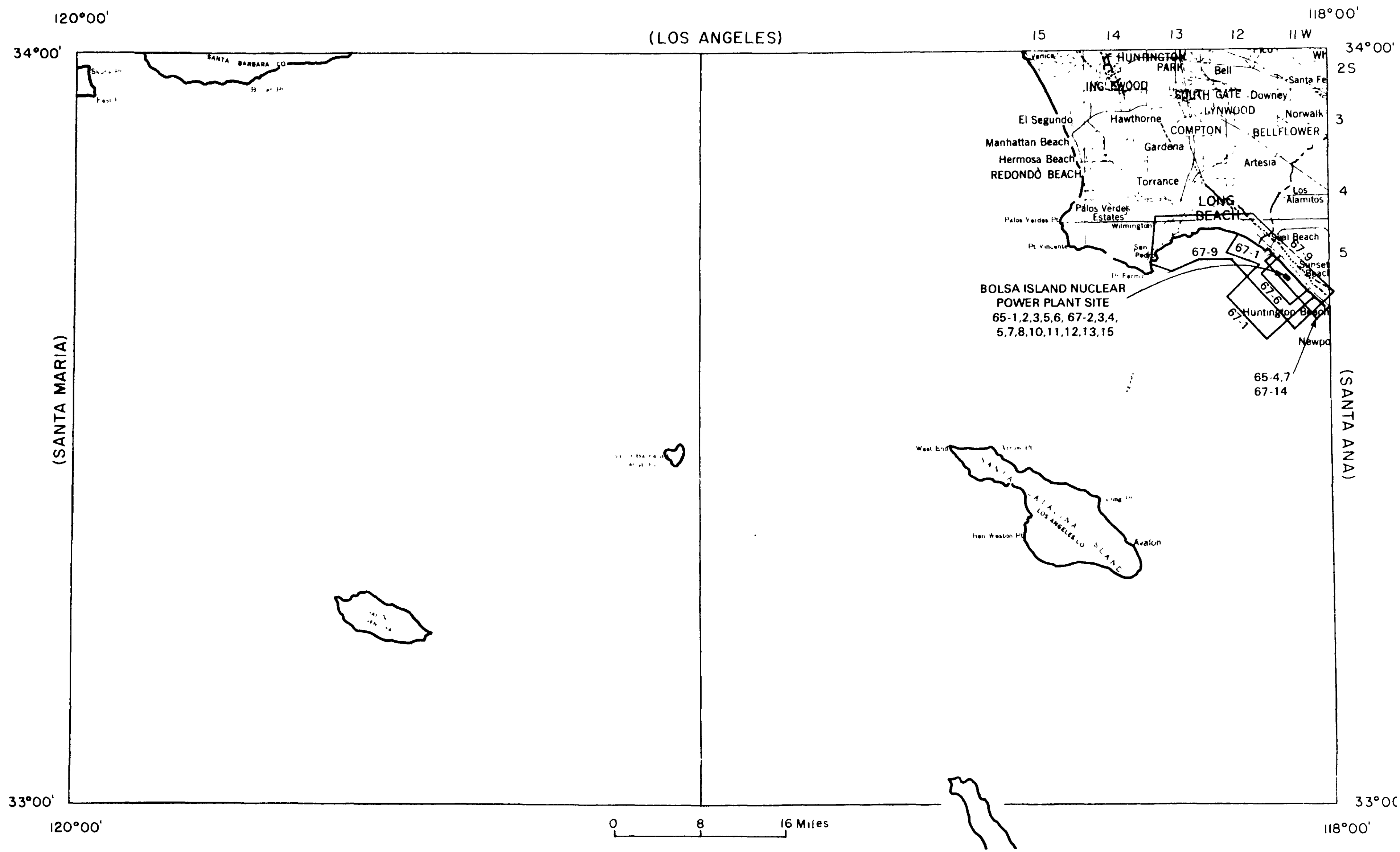

Fig. 4 - Areas covered by geologic studies for Bolsa Island Nuclear Power-Desalting Plant Site on Long Beach sheet. See Fig. 1 for location.

LONG BEACH, Bolsa Island Site

65-1	Bechtel, 1965	67-5	Dobrin, 1967
65-2	Benioff, 1965	67-6	Geophysical Services, Inc., 1967
65-3	Dames & Moore, 1965	67-7	Hughes, 1967
65-4	Edgerton, Germeshausen & Grier, 1965	67-8	Idriss, 1967
65-5	Housner, 1965	67-9	Law, 1967
65-6	Jahns, 1965	67-10	Linehan, 1967
65-7	Neel, 1965	67-11	Neel, 1967
67-1	Alpine Geophysical, 1967	67-12	U.S. Dept. Interior, 1967
67-2	Bechtel, 1967	67-13	Woodward-Clyde-Sherard & Assoc., 1967
67-3	Benioff, Housner & Jahns, 1967	67-14	Edgerton, Germeshausen & Grier, Inc., 1967
67-4	Dames & Moore, 1967	67-15	Dept. of Water and Power, City of Los Angeles, 1967

BOLSA ISLAND NUCLEAR POWER PLANT SITE (Fig. 4)

65-1 Bechtel Corp., December 1965, Engineering and Economic Feasibility Study, Phase I, II, and III, for a Combined Nuclear Power and Desalting Plant, Volumes I, II, and III.

Feasibility study of three potential plant sites at Irvine Ranch, Dana Point, and offshore Sunset Beach, California. Geologic and seismologic data are contained in Chapter 7 of Volume I (Nuclear Site Safety Analysis); Chapter 3 of Volume II (Site Analysis); Chapter 4 of Volume III (Site Analysis); and Appendices of Volumes I and II.

Volume I, phases I and II, has a brief summary of the geology and seismology of Irvine Ranch, Dana Point, and Bolsa Island sites. Appendix B contains letters on seismology by G.W. Housner (65-5) and H. Benioff (65-2).

Volume II, phase III, has a geologic analysis of Bolsa Island and Pelican Point (Irvine Ranch). Sparker surveys for Bolsa Island (EG&G, 65-4) indicate that below Bolsa Island two deep faults are covered by 900 feet of undisturbed sediments. Recommended seismic design criteria are 0.33g ground acceleration for Bolsa Island and 0.25g for Pelican Point. Appendix A contains geologic and seismologic reports by R.H. Jahns (65-6) and H.H. Neel (65-7) discussing the Irvine Ranch, Moro Canyon, Pelican Point, and Bolsa Island sites.

Volume III is a summary report on the Bolsa Island and Pelican Point sites.

65-2 Benioff, H., April 30, 1965, Seismic Report: in Bechtel Corp., December 1965, Engineering and Economic Feasibility Study, Volume I, Phase I and II, Appendix B-4, 3 p.

Letter describing the maximum intensity of shaking, tsunami hazard, and potential for liquefaction and faulting beneath the Bolsa Island site. The maximum intensity of shaking for the seismic period range up to 1.5 seconds would come from a M 6.0 earthquake on the Newport-Inglewood fault; for longer periods the maximum intensity would come from a M 8.0 earthquake on the San Andreas fault 50 miles away.

65-3 Dames and Moore, November 8, 1965, Preliminary soils and foundation investigation at Bolsa Island: in Bechtel Corp., 1965, Engineering and Economic Feasibility Study, Volume II, Phase III, Appendix F, 35 p. and appendices. (65-1)

Soils and foundation engineering study of the ocean floor at the site and a stability analysis of the proposed island. Appendix A is a discussion of the field program, including a discussion of the scope and results of the EG&G (65-4) Sonoprobe survey. Plates A-7A, A-7B, and A-8 present the sparker-boomer survey lines and partial records from the EG&G study.

65-4 Edgerton, Germeshausen, and Grier, Inc. (EG&G), September 1965, Spark Array and High-Resolution Boomer Surveys for Bolsa Island.

Seismic reflection study of the ocean floor at the proposed Bolsa Island site. This study indicates that the Huntington Beach "A" fault extends up to the ocean floor and may produce a topographic scarp. No complete copy of this report was located, but Bechtel Corp. reportedly has one in their San Francisco office. Summaries of this report are included in studies by Dames and Moore (65-3), Neel (65-7), and Bechtel Corp. (65-1).

65-5 Housner, G.W., May 10, 1965, Report to the Bechtel Corporation on seismic design criteria for a nuclear-fired desalting plant: in Bechtel Corp., December 1965, Engineering Feasibility Study, Volume I, Phase I and II, Appendix B-3, 6 p. (65-1)

A report recommending seismic design criteria for the Irvine Ranch, Dana Point, and Artificial Island sites. For the Irvine Ranch and Dana Point sites the response spectrum should be based on a M 8.0 earthquake on the San Andreas fault and should have a maximum ground acceleration of 0.25g. A response spectrum with a maximum ground acceleration of 0.33g from a M 7.0 earthquake on the Newport-Inglewood fault zone is recommended for the Bolsa Island site.

65-6 Jahns, R.H., November 17, 1965, Geologic and seismic factors pertinent to Irvine Ranch and Artificial Island sites: in Bechtel Corp., December 1965, Engineering and Economic Feasibility Study, Volume II, Phase III, Appendix A, 6 p. (65-1)

Brief description of the geology for the Pelican Point (Irvine Ranch) and Bolsa Island sites. The Newport-Inglewood fault zone is the most likely fault to affect the Bolsa Island site. An earthquake of no greater than M 7.0 and surface displacements not exceeding 3 feet can be expected. Ground displacement within or near the proposed site is unlikely. The effect of seismic shaking for Bolsa Island can be considered applicable to Pelican Point. The report concludes that there is no evidence for faults beneath the Pelican Point site, but breaks may exist beneath the terrace cover.

65-7 Neel, H.H., November 8, 1965, Geologic investigation of the Moro Canyon site, Pelican Point site, and the Sunset Beach-Huntington Beach area: in Bechtel Corp., December 1965, Engineering and Economic Feasibility Study, Volume II, Phase III, Appendix A, 17 p. (65-1)

Three-part report summarizing the geologic investigation of three potential sites for a nuclear-fired desalting plant. A detailed Bolsa Island report concludes that only one fault of the Newport-Inglewood fault zone, the Huntington Beach "A" fault, shows any indication of Recent movement. The proposed island site will be at least 1 mile away from this fault. A geologic map of the Bolsa Island site, scale 1 inch = 2,000 feet, is included.

The Pelican Point (Irvine Ranch) report concludes that the nearest major fault is part of the Pelican Hill fault system, which has no known Recent movement. A geologic map at a scale of 1 inch = 1,500 feet is included.

The Moro Canyon report concludes that the nearest fault is 1,000 feet east of the site and shows no evidence of Recent movement.

67-1 Alpine Geophysical Associates, Inc., 1967, Sparker arcer continuous seismic profiling survey: **in** Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix A, 28 p. (**67-2**)

Report on a continuous seismic-reflection survey for the Bolsa Island Nuclear Plant Site. This report does not repeat data from earlier preliminary reports (EG&G, 65-4; Bechtel, 65-1), but does add additional data and clarification of the previous results. The preliminary reports concluded that: (1) the upper 40 feet of sediments are horizontal or very gently sloping; (2) a good reflector, designated Horizon "A," occurs at a depth of about 200 feet and is traceable over the entire study area; (3) a second reflector, designated Horizon "B," about 50 to 80 feet below and parallel to Horizon "A," can be traced over most of the study area; (4) the geologic substructure of the upper sediments is that of a gentle, approximately west-northwest anticline; (5) no evidence for faulting could be found in Horizon "A" or "B"; and (6) sample profiles across the Palos Verdes fault demonstrate the ability of this system to recognize faults.

Data collected for this study include: (1) profiles across the Palos Verdes fault and the Huntington Harbor (Inglewood) fault, and profiles through the Bolsa Island site; (2) a contour map of Horizon "A," and (3) discussion of the geophysical and geologic features of the proposed island site. The report concludes there is no evidence of faulting within a 2-square mile area centered on the proposed site. However, the report does not rule out the possible existence of a strike-slip fault having no apparent vertical offset. There is also a review and rebuttal of previous data (Geophysical Services, Inc., 67-6) that had indicated faulting beneath Bolsa Island.

67-2 Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, 146 p.

Investigation to determine: (1) site geology; (2) seismicity; (3) geologic suitability; (4) engineering properties of the site's ocean-bottom soils; (5) engineering properties of the island fill material; and (6) design criteria recommendations. The scope included: (1) research of published and unpublished data from oil companies and various governmental agencies; (2) seismic-reflection profiling of the site area; (3) site drilling, sampling, and downhole geophysical logging to determine geologic structure and obtain soil samples; (4) laboratory testing of site and borrow-site soils; and (5) foundation and seismic engineering analyses.

The geology and seismicity section of the report discusses the following results of the exploration program: (1) two geophysical horizons, "A" and "B," are mappable across the site, with a profile resolution such that vertical offsets of 2 feet or greater could be identified, but no offsets were found beneath the site; (2) the drill hole data confirm that Horizon "A" is a lithologic unit; (3) microfossil analyses indicate the top of Horizon "A" is the top of the lower Pleistocene (500,000 y. B.P.); and (4) Carbon-14 analysis indicates that the Pleistocene/Recent boundary at the site is about 60 feet below sea level.

Also discussed on both a regional and site-specific scale are geomorphology, stratigraphy, structure, subsidence, and seismicity. The greatest source of local seismicity for the plant is the Newport-Inglewood fault zone 1 mile east of the site and the Palos Verdes fault 7 miles to the west. The San Andreas or San Jacinto faults pose the greatest regional seismic risk.

The report recommends that the Class I structures, those essential to the safe operation of the plant, be designed based on a response spectrum normalized to 0.30g acceleration, Operating Basis Earthquake. This recommendation is based on the assumption that a M 6.5 earthquake on the Newport-Inglewood fault zone or a M 8.0 earthquake on the more distant San Andreas or San Jacinto fault zones will occur within the life of the plant. The Safe Shutdown Earthquake response spectrum should be normalized to 0.45g acceleration, corresponding to a local M 7.5 or a distant M 8.5 event. Subsidence from various sources is estimated at 2.75 feet over the 50-year life expectancy of the plant. Sources of subsidence include: (1) tectonic downwarping at 0.02 feet per year; (2) ground water withdrawal, (no estimated amount); and (3) oil and gas withdrawal, 1.75 feet in 50 years.

67-3 Benioff, H., Housner, G.W., and Jahns, R.H., 1967, Geologic and seismic factors pertinent to design criteria: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix D, 6 p. (67-2)

Summary of the geology and seismology of the proposed Bolsa Island Nuclear Power/Desalting Plant Site. The geologic structure beneath the island site and nearby Newport-Inglewood fault zone are briefly reviewed. The possibility of future ground displacement within the site area was considered from four sources: (1) upward propagation of displacement along a fault beneath the site; (2) lurching of the ground during a major earthquake; (3) ground subsidence following subsurface-fluid withdrawal; and (4) subsidence due to compaction of unconsolidated sediments. The report concludes there is little possibility of a surface rupture beneath the proposed site and recommends a M 6.5 earthquake on the Newport-Inglewood fault zone or a M 8.0 earthquake on the San Andreas or San Jacinto faults be used for seismic design.

67-4 Dames and Moore, 1967, Results of laboratory tests, site investigation and technical services: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix G, 6 p. **(67-2)**

Results of laboratory tests performed on numerous samples taken from seven drill holes at the proposed Bolsa Island site. Tables and figures presenting moisture content and dry density, consolidation test data, specific gravity, and grain-size gradation curves are included.

67-5 Dobrin, M.B., 1967, Interpretation of Seismic Data from Vicinity of the Bolsa Island Site, 9 p.

Review of five offshore seismic-reflection studies performed for the Bolsa Island site. The report concludes that well-defined evidence exists for faulting in the offshore area surrounding the site, but that no evidence exists for faulting with vertical offsets greater than 5 to 10 feet beneath the site at depths shallower than 500 feet.

67-6 Geophysical Services, Inc., 1967, Reconnaissance structural interpretation - offshore Sunset Beach: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix C, 5 p. (67-2)

Structural map of a shallow geophysical horizon, thought to be the top of the lower Pico Formation, which was interpreted for the area around the proposed Bolsa Island site. The data used for the study consisted of 15 seismic-reflection profiles (migrated depth sections), nine SUE reflection-time record sections, and dip-log data from four adjacent oil wells. Because the quality of the seismic data was rated as poor, the resultant interpretation was rated fair to poor. The structural interpretation indicates a possibility of five faults near the Bolsa Island site.

67-7 Hughes, A.W., 1967, Report on seven core-residue concentrations: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix E, 1 p. (67-2)

Age and microfossil identification from core-residue concentrations taken between the 75- to 418-foot depths in Bechtel drill hole #101 at Bolsa Island. The results indicate that: (1) the 75- to 90-foot interval consists of Recent sands; (2) the 116- to 182-foot interval is Palos Verdes-upper Pleistocene-upper Hallian; and (3) the 233- to 418-foot interval is upper Pico-lower Pleistocene-lower Hallian.

67-8 Idriss, I.M., 1967, Methods for evaluating the seismic response of Bolsa Island: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix I, 6 p. (67-2)

Brief summary of the methods used in a finite element analysis of the proposed Bolsa Island site. The analysis evaluated the liquefaction potential and slope stability for the site using seismic motions recommended by Bechtel and the Site Advisory Committee (Benioff, Housner and Jahns).

67-9 Law, J., 1967, An estimate of future horizontal movement, vertical movement and surface strain: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix J, 14 p. (67-2)

Geology of the proposed Bolsa Island site, amounts of subsidence to date, and estimates of the future ultimate subsidence with accompanying ultimate horizontal and differential horizontal movement (strain). Discusses the possibility for Raleigh-wave earth tremors and the development of fissures or scarps due to subsidence. The appendices include discussions of the effects of the Wilmington and Goose Creek Oil Field subsidence. Contains 14 figures which show the existing and estimated effects of subsidence.

67-10 Linehan, D., 1967, Review of geophysical explorations: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix B, 3 p. (67-2)

Summary of results of the Alpine Geophysical Associates (67-1) seismic profile studies of the Bolsa Island site. The author concludes that, under optimum conditions, vertical displacements of 2 feet or greater can be identified by the sparker studies. Horizontal displacement on plunging arch-like structures, such as under Bolsa Island, should give apparent vertical displacement within a few hundred feet of purely horizontal movement. The author concludes from the sparker-arcer surveys that there is no evidence for faults underlying the Bolsa Island site.

67-11 Neel, H.H., 1967, Review of Bolsa Island Site geologic work: in Bechtel Corp., 1967, Investigation of the Bolsa Island Site, Appendix F, 6 p. (67-2)

Letter describing the three-phase history of site selection and the accuracy of supplemental work done by various consultants to determine whether faults exist beneath or near the proposed site. It is concluded that no discernible active faulting has taken place since the Pleistocene in or immediately near the Bolsa Island site and that no other geologic conditions exist which will adversely affect the site. A two-page supplemental letter from R.F. Herron (July 28, 1967) is also included for documentation. The Herron letter discusses the results and the accuracy of a seismic profile study undertaken for Bolsa Island under his supervision by EG&G Consultants (67-4).

67-12 United States Department of the Interior, October 1967, Geologic-seismological factors pertaining to the proposed construction of a nuclear power - desalting plant at Bolsa Island, California, 62 p.

Department of the Interior Advisory Committee report summarizing a geologic review of the proposed Bolsa Island Nuclear Power and Desalting Plant. The data base for this report is primarily that collected by Bechtel Corp.(67-2). This report discusses in detail the Newport-Inglewood fault zone (1 mile east of the site), structures beneath the site, the Safe

Shutdown Earthquake, local and regional subsidence, island foundation conditions, and the geo-seismic design criteria. The committee recommended that M8.0 and 8.5 earthquakes occurring on the Newport-Inglewood and San Andreas faults, respectively, be considered for the Safe Shutdown Earthquake. Appendix A is a letter from M.B. Dobrin (67-5) to the committee discussing the interpretation of seismic data.

67-13 Woodward-Clyde-Sherard and Associates, 1967, Results of laboratory tests on soils samples: in Bechtel Corp., 1967, Detailed Investigation of the Bolsa Island Site, Appendix H, 35 p. (67-2)

Results of laboratory tests performed on undisturbed and disturbed soil samples taken from drill holes at the proposed Bolsa Island site and on fill material from borrow areas. The testing included soil classification, relative density, consolidation, undrained-triaxial tests, and dynamic triaxial-compression tests. Contains seven tables and 102 figures.

67-14 Edgerton, Germeshausen, and Grier, Inc. (EG&G), July 28, 1967, Sparker and high-resolution boomer surveys for Bolsa Island, Phase III.

Results of a second seismic-reflection study of the ocean floor at the proposed Bolsa Island site. This study found no faults closer to the seafloor than 400 feet except possibly the Huntington "A" fault. Because of poor data-resolution, there is some question whether the Huntington "A" fault reaches the seafloor. No copies of this report were located, but detailed summaries of the study are given in the reports by Neel (67-11) and Herron (July 28, 1967), both of which are found in Appendix F of Bechtel's (67-2) detailed report.

67-15 Department of Water and Power, City of Los Angeles, August 1967, Preliminary safety analysis report, Bolsa Island Nuclear Power and Desalting Plant.

Preliminary report submitted in conjunction with Southern California Edison and San Diego Gas and Electric Co. to support the application for construction permit for the Bolsa Island Nuclear Power and Desalting Plant. The geologic and seismologic data are contained in part B of Volume I, Section 2 (Site and Environment) with subsections 2.3 (Geology and Seismicity) and 2.8 (Criteria).

Faults considered in the seismic design include the San Andreas and San Jacinto about 50 miles away, the Newport-Inglewood fault zone 1 mile to the northeast, and those of the Palos Verdes zone 7 miles to the southwest. The NIFZ has offset upper Pleistocene strata but not Recent deposits. Geophysical and site drilling studies indicate no "young," near-surface, en echelon or branching faults either immediately surrounding or under the proposed island site. The seismic design criteria considered a M 6.5 earthquake originating in the site vicinity and a M 8.0 earthquake on the San Andreas or San Jacinto to be highly probable within the next fifty years.

Figure 2.3-5 is a geologic map with accompanying eight cross-sections.

Smoothed response spectra were developed and normalized to 0.30g ground acceleration for the Operating Basis Earthquake (OBE) and 0.45g for the Safe Shutdown Earthquake (SSE).

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SAN ONOFRE NUCLEAR GENERATING STATION

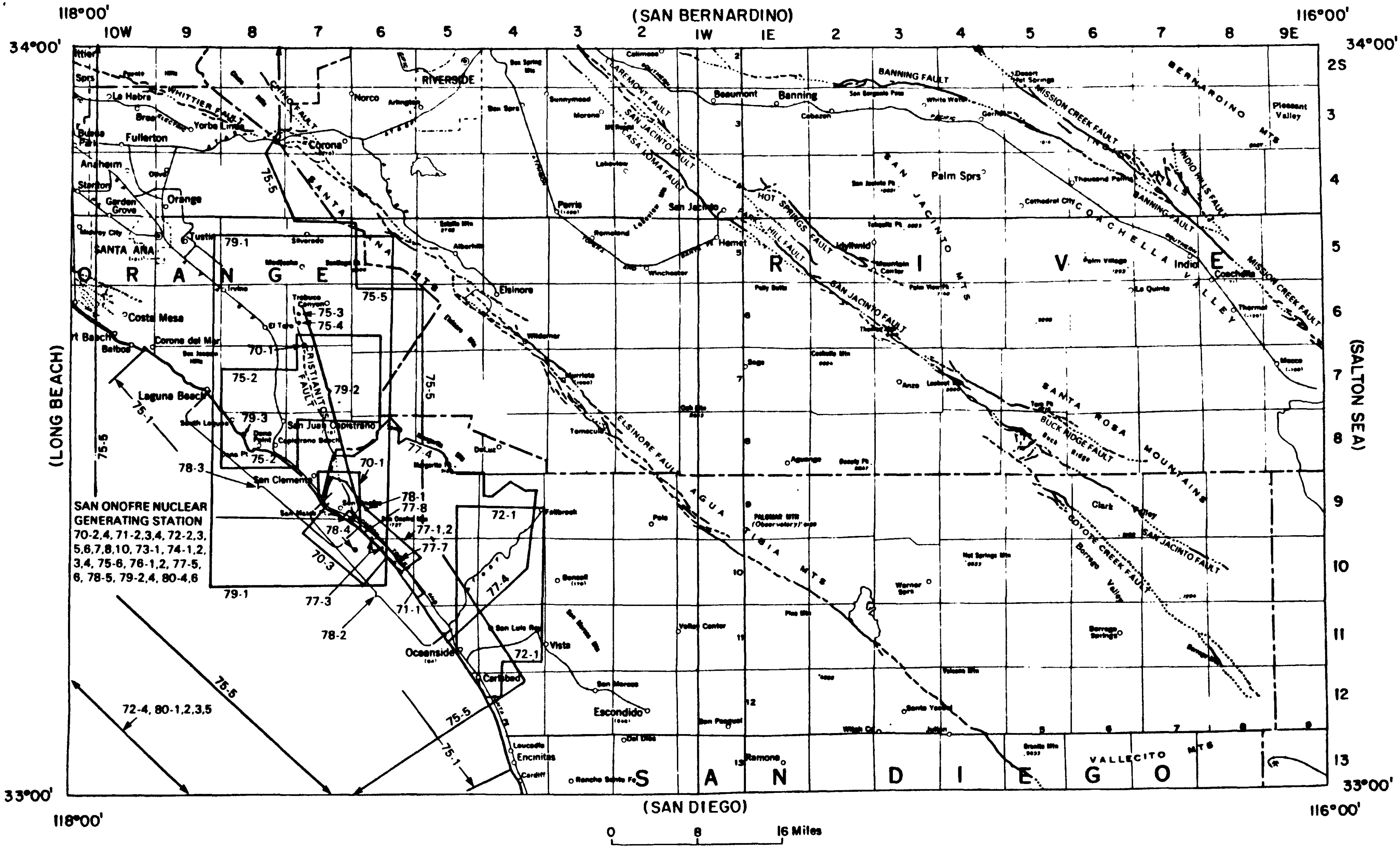

Fig. 5 - Areas covered by geologic studies for San Onofre Nuclear Generating Station on Santa Ana sheet. See Fig. 1 for location.

SANTA ANA, San Onofre Nuclear Generating Station

70-1 Converse, Davis & Assoc., 1970
70-2 Dames & Moore, 1970
70-3 Marine Advisers, 1970
70-4 Southern California Edison, 1970
71-1 Converse, Davis & Assoc., 1971
71-2 Southern California Edison, 1971a
71-3 Southern California Edison, 1971b
71-4 Woodward-McNeill & Assoc., 1971
72-1 Fugro, 1972
72-2 NOAA, 1972
72-3 U.S. Atomic Energy Comm., 1972
72-4 Western Geophysical, 1972
72-5 Woodward-McNeill & Assoc., 1972a
72-6 Woodward-McNeill & Assoc., 1972b
72-7 Southern California Edison, 1972
72-8 United States Geological Survey, 1972
72-9 California Division of Mines and Geology, 1972
72-10 Wilson, 1972
73-1 Woodward-McNeill & Assoc., 1973
74-1 Woodward-McNeill & Assoc., 1974a
74-2 Woodward-McNeill & Assoc., 1974b
74-3 Fugro, 1974a
74-4 Fugro, 1974b
75-1 Fugro, 1975a
75-2 Fugro, 1975b
75-3 Fugro, 1975c
75-4 Fugro, 1975d
75-5 West, 1975
75-6 Biehler, 1975
76-1 Fugro, 1976
76-2 Southern California Edison, 1976
77-1 Anderson, Warren & Assoc., 1977
77-2 Ehlig, 1977
77-3 Fugro, 1977a
77-4 Pickard, Lowe & Garrick, 1977
77-5 Southern California Edison, 1977a
77-6 Southern California Edison, 1977b
77-7 Fugro, 1977b
77-8 Shlemon & Assoc., Inc., 1977
78-1 Fugro, 1978
78-2 Shlemon & Assoc., Inc., 1978a
78-3 Shlemon & Assoc., Inc., 1978b
78-4 Woodward-Clyde Consultants, 1978a
78-5 Woodward-Clyde Consultants, 1978b
79-1 West, 1979
79-2 Woodward-Clyde Consultants, 1979
79-3 Shlemon & Assoc., Inc., 1979
79-4 Woodward-Clyde Consultants, 1979b
80-1 Menard, 1980
80-2 Morris, 1980
80-3 Slemmons, 1980
80-4 U.S. Nuclear Regulatory Comm., 1980
80-5 Greene & Kennedy, 1980
80-6 Woodward-Clyde Consultants, 1980

SAN ONOFRE NUCLEAR GENERATING STATION (Fig. 5)

70-1 Converse, Davis and Associates, 1970, Geologic report on the probability of ground displacement of faults in the vicinity of the San Onofre Nuclear Power Plant Site, Units 2 & 3, San Diego, California: in the PSAR for SONGS, Appendix 2A, 26 p. (70-4)

Preliminary fault evaluation for Units 2 and 3 at SONGS, drawn on existing data from the SONGS Unit 1 studies and other published and unpublished data supplemented by detailed geologic mapping and logging of excavations across the Cristianitos fault in: Plano Trabuco, the San Onofre Bluffs, and the seacliffs between SONGS and the Cristianitos fault. A detailed geologic map of the Cristianitos fault from San Mateo Canyon to the shoreline is included.

The report concludes that no faults could be found in the foundation rocks for the SONGS Units 2 and 3 site (San Mateo Formation) nor projected into the site, and that the Cristianitos fault has not displaced the ground surface for at least 80,000 years with no known historic seismicity.

70-2 Dames and Moore, Inc., 1970, Seismic and foundation studies for proposed Units 2 & 3, SONGS: in the PSAR for SONGS, Appendix 2B, 68 p. (70-4)

Foundation engineering and seismicity report for Units 2 and 3 of SONGS, including soil classification and analysis, foundation design criteria, and stability analyses. The seismicity section includes: (1) discussion of site dynamic-foundation characteristics; (2) table of historic earthquakes (Table IA), and major earthquakes of M 6.0 or greater (Table IB) that affected the SONGS area; (3) list of nearby earthquakes greater than VI on the Modified Mercalli Scale; (4) earthquake recurrence curves (Plates S-8A & S-8B); (5) SONGS Units 2 and 3 design earthquake characteristics (Table II) and site response spectra (Table III); and (6) discussion of the major fault zones around SONGS (Whittier-Elsinore fault zone, San Andreas fault zone, Newport-Inglewood fault zone, Offshore fault zone). Data used for the seismic hazard analysis were taken from existing literature. No field investigations of faults were undertaken.

This study concludes that an Operating Basis Earthquake (OBE) of 0.25g horizontal acceleration and a Design Basis Earthquake (DBE) of 0.40g horizontal acceleration are acceptable for SONGS Units 2 and 3.

70-3 Marine Advisers, Inc., April 24, 1970, Continuous seismic profiling investigations of the continental shelf off San Onofre, California: in the PSAR for SONGS, Appendix 2B, 28 p. (70-4)

Report of a continuous seismic profiling survey conducted offshore from SONGS using four systems: (1) Sparker; (2) High-Resolution Boomer; (3) 7-kHz High-Resolution Profiler; and (4) Side-Scan Sonar. The study investigated the offshore extensions of the Cristianitos and Newport-Inglewood fault zones (NIFZ) and mapped the geologic structure of the continental shelf and slope.

The report concludes: (1) no offshore faults project toward or through SONGS; (2) seaward from SONGS two faults cut a generally west-dipping homoclinal structure, with a minor fault "E" located 1 mile offshore and a major fault "A" located 5 miles offshore; (3) a possible branch of the NIFZ was detected offshore from Newport Beach, but its relation to fault "A" is unresolved; and (4) offshore the Cristianitos fault turns southeast and does not intersect fault "A" in the area studied. Figures include location of survey lines (Figs. 1-3), a structural contour map (Fig. 4), samples of seismic profiles (Figs. 5-8, 10 and 11), and the possible correlation between NIFZ and fault "A" (Fig. 9).

70-4 Southern California Edison Company and San Diego Gas and Electric Company, 1970, Preliminary Safety Analysis Report (PSAR) for San Onofre Nuclear Generating Station (SONGS), Units 2 and 3, 6 volumes.

Preliminary report submitted to the Atomic Energy Commission in support of the application for a construction permit for SONGS Units 2 and 3. This report has 21 amendments containing corrections, additions, and consultants' reports. Geologic and seismologic data are contained in Volume II, Section 2 ("Site and Environment") with Subsection 2.9 ("Geology") and 2.10 ("Seismology"). Subsection 2.9 is a brief summary of the general geologic setting for SONGS and refers to Appendices 2A and 2B for reports by Converse, Davis and Associates (70-1), and by Marine Advisers, Inc. (70-3) for details on surrounding onshore and offshore geology, respectively. Subsection 2.10 is a brief summary of site seismology and refers to Appendix 2B for a report by Dames and Moore (70-2) for details on the development of the seismic design criteria.

Faults considered in the seismic design included the Elsinore, San Jacinto, San Andreas, Newport-Inglewood, Cristianitos, and three unnamed offshore faults. The seismic evaluation concluded that an earthquake on the San Andreas, San Jacinto, or the offshore fault "A" was the most likely to affect SONGS. Smoothed response spectra were developed and normalized to 0.25g for the Operating Basis Earthquake (OBE) and to 0.50g for the Design Basis Earthquake (DBE).

Appendices and amendments to the PSAR containing additional geotechnical data and consultants' reports are as follows:

Appendix 2A: Converse, Davis and Associates, 1970, Geologic report on the probability of ground displacement of faults in the vicinity of the San Onofre Nuclear Power Plant Site, Units 2 & 3, San Diego, California. (70-1)

Appendix 2B: Marine Advisers, Inc., April 24, 1970, Continuous seismic profiling investigations of the continental shelf off San Onofre, California. (70-3)

Appendix 2C: Board of Technical Review, January 29, 1971a, Geologic structure of the continental shelf off San Onofre: Regional relationships and influence on seismicity. (71-2)

Appendix 2D: Southern California Edison Co., 1971, Responses to Atomic Energy Commission questions concerning seismology and geology at SONGS. (71-3)

Attachment 1: Effects on recorded data of being relatively near the rupture trace.

Attachment 2: Discussion of confirmation provided for San Onofre analytical model by San Fernando Earthquake results.

Appendix 2E: Southern California Edison Co., April 1, 1972, San Onofre site geology and seismicity, overall summary.

Attachment 1: Western Geophysical Company of America, March 7, 1972, Final report: San Onofre offshore investigations. (72-4)

Attachment 2: Woodward-McNeill and Associates, April 5, 1972, Estimates of site dynamic response, SONGS, Units 2 & 3. (72-6)

Attachment 3: Woodward-McNeill and Associates, March 13, 1972, Material properties studies, SONGS. (72-5)

Attachment 4: Fugro, Inc., April 6, 1972, Report of geologic and fault reconnaissance, vicinity of Oceanside, California. (72-1)

Appendix 2F: California Division of Mines and Geology, 1972, Report on the geologic investigation of the west branch of the Cristianitos fault in the Arroyo Trabuco area. (72-9)

Appendix 2G: Wilson, B.W., December 1972, Estimates of tsunami effect at San Onofre Nuclear Generating Station, Units 2 & 3, California. (72-10)

Appendix 2H: Woodward-McNeill and Associates, March 27, 1973, Evaluation of the stability of proposed 2:1 switchyard slopes and 1/2:1 slopes, SONGS, Units 2 & 3. (73-1)

Amendment No. 1 to Preliminary Safety Analysis Report for San Onofre Nuclear Generating Station, Units 2 and 3, Southern California Edison Company and San Diego Gas and Electric Company (PSAR - SONGS), August 31, 1970.

I. Additional information concerning geology and seismology:

1. Comparison of the geologic investigation of the San Onofre site with that required for surface faulting by the AEC tentative geologic and seismic siting criteria (included in subsection 1.8).

2. Comparison of the geologic and seismological conditions at San Onofre and Bolsa Island sites (included in subsection 1.8).

3. Additional data concerning age dating used in the study of the Cristianitos fault (additional data supporting conclusions of Appendix 2A, PSAR (included in subsection 2.9).

II. Appendix 2B replaced in entirety by:

1. Dames and Moore, April 15, 1970, Seismic and foundation studies, proposed Units 2 and 3, San Onofre Nuclear Generating Station, San Onofre, California. (70-2)

2. Marine Advisers, Inc., April 24, 1970, Continuous seismic profiling investigation of the continental shelf off San Onofre, California. (70-3)

III. Subsections and figures amended in Geology (2.9) and Seismicity (2.10) sections: 2.9.5, Areal Subsidence; Figure 2.9-2, Plot Plan & Geologic Map; 2.10.5, Site Seismic Evaluation; Figure 2.10-2, Smoothed Response Spectra. Other changes occur in: 2.5.1, Grading; 2.7, Hydrology; Appendix 2A, pp. 3, 6, 7 & 22; all of Appendix 2B.

Amendment No. 3, PSAR - SONGS, November 23, 1970

I. Response to specific items of interest: these items are of such a nature that it is not practical to include them in the text of the PSAR. Items of interest to geology and seismology are listed under Section 2, Site and Environment; questions include:

1. 28 ft tsunami discussion
2. Areas of offshore oil-withdrawal subsidence
3. Data on "areal subsidence" (PSAR 2.9.5)
4. Coastal terraces, stratigraphic position and minimum age (PSAR 2.9.4)
5. Summary of Dr. Leonard Palmer's dissertation on marine-terrace sequence and continuity (PSAR 2.9.4)
6. Additional data on Cristianitos fault (PSAR 2.9.4)
7. Offshore structures between faults "D" and "E" discussed further.
8. Additional discussion on Cristianitos fault geomorphic characteristics.

II. Sections replaced in Geology (2.9) and Seismicity (2.10) sections: 2.9.4, Structures; 2.9.5, Areal Subsidence; 2.9.6, Foundations; 2.9.7, Excavated Slopes; 2.10.5, Site Seismic Evaluation; 2.10.6, Installation of Strong Motion Earthquake Recording System.

Amendment No. 10, PSAR - SONGS, June 16, 1971

I. Response to specific items of interest; questions include:

1. 28 ft tsunami discussion
2. Cristianitos fault geomorphic features
3. Extension of fault "A" of Marine Advisers report (70-3)

II. Subsections and figures amended in Geology (2.9) and Seismicity (2.10) sections: 2.9.1, General; 2.9.2, Physiography; 2.9.5, Areal Subsidence; 2.9.7, Excavated Slopes; 2.10.2, Seismic Investigation; 2.10.4.3, Offshore Faults; 2.10.5, Site Seismic Evaluation; 2.10.6, Installation of Strong Motion Earthquake Recording System.

III. Appendix 2D - Responses to AEC questions concerning seismicity and geology. Discusses the offshore geology at the San Onofre site and includes calculations for site accelerations for a M 7 and larger event.

Amendment No. 11, PSAR - SONGS, April 1, 1972

I. Response to specific items of interest; questions include:

1. Comparison of geologic investigations with AEC siting criteria.
2. Additional data supporting offshore trend of Cristianitos fault.
3. Additional data for structures between faults "D" and "E" offshore.
4. Additional data for analysis of structures relating to Cristianitos fault.
5. Data to support seaward extension and seismic potential of the Pelican Hills fault.
6. Additional seismic design basis for Operating Basis Earthquake (OBE) and Design Basis Earthquake (DBE) response in Appendix 2E.
7. Discussion of displacement on Cristianitos fault near San Onofre.

II. Subsections and figures amended in Geology (2.9) and Seismicity (2.10) sections: 2.9.1, General; 2.9.2, Physiography; 2.9.4, Structures; 2.10.2, Seismic Investigations; 2.10.5, Site Seismic Evaluations.

III. Changes in or additions to appendices:

Appendix 2E added: "San Onofre Site geology and seismology" includes three additional consultants' reports:

Attachment 1: Western Geophysical Company of America, March 7, 1972, San Onofre offshore investigation. (72-4)

Attachment 2: Woodward-McNeill and Associates, April 5, 1972, Estimates of site dynamic response, San Onofre Nuclear Generating Station, Units 2 & 3. (72-6)

Attachment 3: Woodward-McNeill and Associates, March 13, 1972, Material property studies, San Onofre Nuclear Generating Station. (72-5)

Amendment No. 12, PSAR - SONGS, April 18, 1972

I. Appendix 2E, Attachment 4: Fugro, Inc., April 6, 1972, Report of geologic and fault reconnaissance, vicinity of Oceanside, California. (72-1)

II. Subsection and figure amended in Seismicity section (2.10): 2.10.6, Installation of Strong Motion Earthquake Recording System; Appendix 2E.

Amendment No. 13, PSAR - SONGS, May 15, 1972

Response to specific items of interest; questions include:

1. Expanded discussion on seismic design.
2. Comparison of site response spectra.
3. Comparison of geologic data with Western Geophysical's offshore data for Cristianitos fault.
4. Relationship between Cristianitos and South Coast Offshore fault.
5. Evidence supporting lack of activity on the Cristianitos fault.
6. Major offshore faults.
7. San Joaquin structural high.
8. South Coast Offshore fault and Rose Canyon fault compared.

Amendment No. 16, PSAR - SONGS, October 12, 1972

I. Discussion on slope stability analysis.

II. Discussion on study of the effects of a tsunami generated nearby from an offshore earthquake.

III. Design spectra for various values of damping and design basis acceleration time history.

IV. Appendix 2F: California Division of Mines and Geology, 1972, Report on the geologic investigation of the west branch of the Cristianitos fault in the Arroyo Trabuco area. (72-9)

Amendment 17, PSAR - SONGS, April 18, 1973

I. Appendix 2G: Wilson, B.W., December 1972, Estimate of tsunami effects at San Onofre Nuclear Generating Station, Units 2 & 3, California. (72-10)

II. Appendix 2H: Woodward-McNeill and Associates, March 27, 1973, Stability of proposed slopes for the proposed Units 2 & 3, San Onofre Nuclear Generating Station, San Onofre, California. (73-1)

71-1 Converse, Davis and Associates, June 4, 1971, Preliminary Geologic Report of the Coastal Central Portion of Camp Pendleton Marine Base, San Diego County, California, for City of Los Angeles, Department of Water and Power, 20 p. (71-1)

Siting study of 9 miles of seacliffs and adjacent inland areas from SONGS southeast to Aliso Canyon to examine the geologic conditions along the coast east of the Cristianitos fault. Five locations of terrace offsets are noted, but the report concludes that they are of nontectonic origin. The two appendices contain foraminiferal correlations of the bedrock.

71-2 Southern California Edison Company, Board of Technical Review, January 29, 1971a, Geologic structure of the continental shelf off San Onofre: Regional relationships and influence on seismicity: in PSAR for SONGS, Appendix 2C, 55 p. (70-4)

Findings of a group of consultants to SCE reviewing offshore data to evaluate the possible connection between fault "A" offshore from SONGS and the Newport-Inglewood fault zone (NIFZ). The Board concluded that: (1) structure near the edge of the continental shelf off SONGS is a gentle anticline-syncline with discontinuous faults; (2) the NIFZ dies out southeast of Laguna Beach; (3) the Cristianitos fault dies out about 10,000 feet offshore from SONGS; (4) the NIFZ is a localized zone of deformation caused by north-south compression during post-Oligocene time; Cenozoic activity dies out to the southeast with no related offshore geologic structure or seismicity south of Laguna Beach; and (5) the earthquake that could be felt by SONGS is limited by the NIFZ length (90 km) and will cause a 0.17g ground acceleration at SONGS, less than 0.25g previously estimated for a San Andreas rupture. The report contains 14 figures, mostly seismic-reflection profiles and profile location maps.

71-3 Southern California Edison Company, 1971b, Responses to Atomic Energy Commission questions concerning seismology and geology at SONGS: in PSAR for SONGS, Appendix 2D, p. 2D-1 to 2D-21. (70-4)

Report in response to AEC questions on the SONGS site geology and seismology. The report describes the offshore geology at SONGS and the basis for concluding that a major earthquake on the South Coast Offshore fault zone (SCOFZ) is not credible. Also included is a discussion of the SONGS' seismic design based on a hypothetical event on the SCOFZ. This report contains two attachments: (1) effects on recorded data of being relatively near the rupture trace; and (2) discussion of confirmation provided for San Onofre analytical model by San Fernando earthquake results.

71-4 Woodward-McNeill and Associates, October 14, 1971, Elastic and Damping Properties, Laydown Area, San Onofre Nuclear Generating Station, 8 p., 8 appendices.

Report giving the elastic and damping parameters of the SONGS area for the proposed expansion of Units 2 and 3. The data include modulus values from both field and laboratory measurements, hysteretic damping values, spatial damping values, spring constants, and various physical and mechanical properties of the soil and rock. The report includes eight appendices containing backup data for the conclusions.

72-1 Fugro, Inc., April 6, 1972, Report of geologic and fault reconnaissance, vicinity of Oceanside, California: in the PSAR for SONGS, Appendix 2E, Attachment 4, 8 p. (70-4)

Reconnaissance study using air-photo interpretation, previous geologic studies, and selected geologic field observations of 120 square miles including the City of Oceanside and Camp Pendleton Marine Base to identify major faults.

The report concludes that two roughly-parallel, north-northeast-striking high-angle faults trend from Camp De Luz (on Camp Pendleton) to the City of Oceanside. Observations at ten locations indicate these faults cut pre-Tertiary to middle Miocene rock and possibly Holocene marine and river terraces. Six plates show selected outcrop photos taken at the locations along the faults.

72-2 National Oceanic and Atmospheric Administration, 1972, Report on the site seismicity for the SONGS, Units 2 and 3, Seismological Investigations Group of the Earth Sciences Laboratories: in U.S. AEC Safety Evaluation of the SONGS Units 2 and 3, 1972, Appendix D, p. D1 to D7. (72-3)

Review of the SONGS PSAR (70-4) and the USGS (72-8) report. Concludes that the South Coast Offshore fault zone is the most critical fault for the

SONGS design and recommends that a 0.67g acceleration from an Intensity X (Modified Mercalli Scale) event within a few miles of the SONGS site be used for design.

72-3 United States Atomic Energy Commission, 1972, Safety Evaluation of the San Onofre Nuclear Generating Station Units No. 2 and 3, Docket Nos. 50-361 and 50-362, 112 p.

Report on the effects of a variety of man-made and natural hazards likely to occur at SONGS. Based upon its own consultants' studies, the AEC considers the South Coast Offshore Zone of Deformation to be continuous with the Newport-Inglewood fault zone and the Rose Canyon fault, giving a total length of deformation of 240 km. The AEC therefore recommends that an acceleration of 0.67g can be expected to affect SONGS from a maximum Intensity X (Modified Mercalli Scale) earthquake. The AEC indicates that the revision by Southern California Edison Company of the Design Basis Earthquake to 0.67g and the Operating Basis Earthquake to 0.33g is acceptable.

Two AEC-consultant reports used for seismic hazard evaluation are included in the appendices (see Appendix C, U.S. Geological Survey, 72-8 and Appendix D, NOAA, 72-2).

72-4 Western Geophysical Company of America, March 7, 1972, Final report: San Onofre offshore investigation: in the PSAR for SONGS, Appendix 2E, Attachment 1, 43 p. (70-4)

Geophysical surveys were conducted to provide a detailed picture of the subsurface structure down to acoustic basement in an area extending from Long Beach to Rose Canyon and westward to a line about 30 miles offshore from SONGS. The study includes interpretation of 1,000 line-miles of seismic-reflection and -refraction data, 450 line-miles of seaborne magnetometer data, and analysis of existing gravity data. The results are presented in a series of structural contour maps, fault anomaly maps, and annotated seismic profiles.

The report concludes that the Newport-Inglewood fault zone offsets upper Miocene strata and terminates offshore and southeast of Newport Beach against the San Joaquin Hills anticlinal high. The South Coast Offshore fault is closest to SONGS, strikes northwest-southeast and is approximately 5 miles from shore. This fault does not appear to connect with the Newport-Inglewood fault zone to the northwest or with the Rose Canyon fault to the southeast. The South Coast Offshore fault, about 40 miles long, has vertical and possibly right-lateral displacement. Displacement dies out in the uppermost Miocene-Pliocene strata.

72-5 Woodward-McNeill and Associates, March 13, 1972a, Material properties studies, SONGS: in the PSAR for SONGS, Appendix 2E, Attachment 3, 5 p. (70-4)

Foundation engineering study presenting the results of the measurement of the elastic and damping parameters of the soils at SONGS. Data collected from both field and laboratory measurements are presented. Appendices A to H present details on the investigation and include a report on seismic velocities by Weston Geophysical Engineering, Inc. (Appendix C).

72-6 Woodward-McNeill and Associates, April 5, 1972b, Estimates of site dynamic response, SONGS, Units 2 & 3: in the PSAR for SONGS, Appendix 2E, Attachment 2. (70-4)

Engineering report presenting soil/rock dynamic characteristics at SONGS and estimates of site response to earthquakes from hypothesized movement on postulated causative faults. Calculations are based on maximum accelerations of 0.12g and 0.5g, using a family of earthquakes with a broad range of earthquake characteristics, from several causative faults (San Andreas, San Jacinto, Elsinore, and Newport-Inglewood).

72-7 Southern California Edison Company, April 1, 1972, San Onofre site geology and seismology, overall summary: in the PSAR for SONGS, Appendix 2E, p. 2E-1 to 2E-23. (70-4)

Report updating the seismic design basis for SONGS Units 2 and 3, based on additional studies conducted since the original PSAR publication; these additional studies can be found in Appendices 2.5A to 2.5D of the PSAR for SONGS (70-4). Contains a detailed discussion of the South Coast Offshore fault zone (SCOFZ), the Rose Canyon fault, and the San Joaquin Hills structural high. Also included are discussions of seismic design criteria, including fault activity, site acceleration, Design Basis Earthquake (DBE), Operating Basis Earthquake (OBE), and site dynamic response. These topics are supported by three consultants' reports in the appendices.

The report concludes that although investigations of the SCOFZ indicate a low potential for rupture, Southern California Edison Company has hypothesized such an event and used it to determine the resultant site acceleration of SONGS. The resultant DBE site acceleration is 0.5g and the OBE is 0.25g.

72-8 United States Geological Survey, 1972, Review of relevant geology for San Onofre Nuclear Generating Station (SONGS); in U.S. Atomic Energy Commission Safety Evaluation for SONGS, 1972, Appendix C, p. C1 to C36. (72-3)

A concluding supplemental report reviewing the SONGS PSAR (70-4) and its amendments and appendices, with particular attention to the fault model for the Safe Shutdown Earthquake (SSE). Parts of a previous review report given to the AEC on July 2, 1971 are included in this appendix, but the details are not repeated. This report disagrees with the PSAR and the report by Western Geophysical Company (72-4) on the length and activity of the South Coast Offshore Zone of Deformation, and concludes that the SCOZD has been intermittently active since the middle Miocene, is a potentially-active continuous zone of deformation approximately 240 km long, and is located 5 miles from SONGS. This zone is recommended to be used for the SONGS SSE.

72-9 California Division of Mines and Geology, 1972, Report on the geologic investigation of the west branch of the Cristianitos fault in the Arroyo Trabuco area: in the PSAR for SONGS, Appendix 2F, 7 p. (70-4)

Report of a detailed geologic study on the Cristianitos fault, including a backhoe excavation to investigate possible evidence of Holocene displacement. The study concludes that suggestions of recent fault movement at the excavation area may be due to landsliding or rock creep. No evidence for Holocene faulting on the Cristianitos fault was found.

72-10 Wilson, B.W., December 1972, Estimates of tsunami effect at San Onofre Nuclear Generating Station, Units 2 and 3, California: in the PSAR for SONGS, Appendix 2G, 83 p. (70-4)

The possible effects of a tsunami generated by a hypothetical M 7.5 earthquake 5 miles offshore from SONGS were evaluated, assuming a horizontal strike-slip displacement of 7.5 meters and a vertical displacement of 2.2 meters. Maximum run-up and draw-down predicted from a M 7.5 earthquake is 4.8 meters (at high tide) and 2.8 meters (at low tide).

73-1 Woodward-McNeill and Associates, March 27, 1973, Evaluation of the stability of proposed 2:1 switchyard slopes and 1/2:1 slopes, SONGS, Units 2 & 3,in the PSAR for SONGS, Appendix 2H, 96 p. (70-4)

Soil engineering report evaluating the static and dynamic slope stability of proposed slopes at SONGS. The report contains ten figures and seven appendices.

74-1 Woodward-McNeill and Associates, 1974a, Analyses of Properties of Finer-grained San Mateo Sand, SONGS Units 2 & 3, San Onofre, California, 6 p.

Tests and analyses made for this study indicate the more fine-grained San Mateo Sand has static and dynamic strength of the same magnitude as previously determined for the more coarse-grained San Mateo Sand. Laboratory tests performed included static and dynamic triaxial tests, compaction tests, grain-size distribution tests and specific gravity tests.

74-2 Woodward-McNeill and Associates, December 19, 1974b, Offshore Liquefaction Evaluation for the Proposed Units 2 and 3, SONGS, San Onfore, California, 10 p.

Engineering report on the liquefaction potential of the San Mateo Sand which will underlie the proposed cooling-water intake and outtake system offshore from SONGS. The report presents dynamic strength characteristics of the San Mateo Sand, a finite element analysis using the SONGS Design

Basis Earthquake (DBE) and an analytical factor of safety against liquefaction. The reader is referred to Woodward-McNeill (73-1) on slope stability for SONGS Units 2 and 3 for DBE data.

74-3 Fugro, Inc., July 5, 1974a, Analysis of Geologic Features Revealed during Grading at San Onofre Nuclear Generating Station, Units 2 and 3, 32 p. and appendices.

Presents observations and conclusions about planar features revealed in foundation excavations during grading of SONGS Units 2 and 3. Discussed in this report are features in the San Mateo Formation which are discontinuous, conjugate, joint-like shears (named "A" features and "B" features according to orientation). They are postulated to have resulted from northwest-southeast regional compressional stresses. The features do not displace the overlying marine terrace platform and are therefore older than 70,000 - 130,000 years. Based on this investigation the features are not considered capable faults in terms of AEC criteria.

74-4 Fugro, Inc., November 1, 1974b, Analysis of C and D Type Features at the San Onofre Nuclear Generating Stations, 19 p. and appendices.

Presents observations and conclusions on geologic features revealed during the excavation of SONGS, Units 2 and 3, at a lower elevation than previous Type A and B features (74-3). The report concludes that the Type C features are short and diffuse, are entirely within the San Mateo Formation, and except for attitude are similar to Type A and B features. The Type D features are not continuous across the site, displace A and B features, do not displace the 70,000 to 130,000 year old marine terrace platform and their formation is consistent with the stress system that produced the Type A and B features. These features are not considered capable faults in terms of AEC criteria.

75-1 Fugro, Inc., September 12, 1975a, Summary of geomorphic and age data for the first emergent terrace (Qt_1) at SONGS: in Southern California Edison Co., 1976, Recent Geotechnical Studies, Southern Orange County, California, for SONGS Units 1, 2 & 3, Volume I, Enclosure 1, Appendix C, 52 p. (76-2)

Detailed geologic study of the Sangamon or first emergent terrace (Qt_1) at SONGS and its correlation with other Sangamon-age terrace from San Diego to Monterey, California (Fig. 3). A description is given of the Qt_1 terrace at SONGS, along with a summary of early-to-late Pleistocene geomorphic history of the SONGS area and diagrammatic cross sections. The lack of displacement of the basal Sangamon-age terrace gravel, which overlies the Cristianitos fault, is given as evidence of no movement on the Cristianitos fault for at least the last 120,000 years. The methods and reliability of uranium-series age determinations, and a listing of all age dates used for the Sangamon-age terrace correlation, are also discussed.

75-2 Fugro, Inc., September 15, 1975b, Geomorphic analysis of terraces in San Juan and Bell Canyons, Orange County, California: in Southern California Edison Co., 1976, Recent Geotechnical Studies, Southern Orange County, California, for SONGS Units 1, 2 & 3, Volume I, Enclosure 2, 21 p. (76-2)

Detailed geomorphic study of the stream and marine terraces of San Juan and Bell Canyons and of the Dana Point area to determine the ages of Quaternary stream deposits, and to demonstrate whether they are deformed across the Cristianitos fault. The terraces were mapped at a scale of 1 inch = 2,000 feet using map elevations and precise barometric altimeter measurements to obtain an overall accuracy of $\pm$ 2 feet in elevation. Stream-terrace profiles of the canyons indicate no warping, tilting or offset across the Cristianitos fault. The two lowest stream terraces in the canyons are correlated with marine terraces estimated to be 120,000 to 200,000 years old. The study concludes that no movement has occurred on the Cristianitos fault for at least 120,000 years.

75-3 Fugro, Inc., November 1, 1975c, Geologic investigation of the bulldozer excavation at the proposed Viejo Substation site: in Southern California Edison Co., 1976, Recent Geotechnical Studies, Southern Orange County, California, for SONGS Units 1, 2 & 3, Volume I, Enclosure 1, Appendix A, 2 p. (76-2)

Letter describing an investigation of the Cristianitos fault exposed in a bulldozer trench within a proposed electrical substation site. The trench was logged at a scale of 1 inch = 5 feet, with details at 1 inch = 2 feet. Four traces of the Cristianitos fault are exposed and have an average strike of N3°W. The largest fault juxtaposes Puente Formation against Capistrano Formation with displacement probably down on the west. A Pleistocene fluvial terrace deposit overlies the fault traces without displacement.

75-4 Fugro, Inc., November 14, 1975d, Geologic investigation of the Mission Viejo (F. Beach Leighton) bulldozer excavation: in Southern California Edison Co., 1976, Recent Geotechnical Studies, Southern Orange County, California, for SONGS Units 1, 2 & 3, Volume I, Enclosure 1, Appendix B, 3p. (76-2)

Letter summarizing findings from excavation of bulldozer and backhoe trenches to clarify and augment earlier findings of an investigation for a residential development across the Cristianitos fault. The trenches were logged at a scale of 1 inch = 2 feet and contained two vertical shears trending N5°W and displaying evidence of vertical slip. A previously described lime-filled crack does not relate to fault traces of the Cristianitos fault, but instead lies 8 to 12 feet southwest of the fault. Other lime-filled cracks in the overlying soil are related to the shrink-swell characteristics of the soil rather than to fault displacements. No evidence for Holocene movement on the Cristianitos fault was found.

75-5 West, J.C., November 1975, Generalized subsurface and geophysical study, Capistrano area, Orange County, California, for SONGS Units 2 and 3: in Southern California Edison Co., 1976, Recent Geotechnical Studies, Southern Orange County, California, Volume II, Enclosure 3. (76-2)

Report of an investigation of a 350 square-mile area in the Cristianitos Embayment adjacent to the Cristianitos fault and between the San Joaquin Hills and the Santa Ana Mountains to aid in the understanding of recent seismic activity of the area. Five subsurface contour maps and geologic structure sections were prepared using seismic-reflection profiles, gravity (820 stations), aeromagnetic (2,100 line miles), and well-log (118 wells) data. This report concludes that the Cristianitos fault is a normal fault with down-to-the-west vertical separation of between 1,700 to 4,000 feet in the central onshore portion. No significant movement appears to have occurred since late Pliocene time.

75-6 Biehler, S., November 1975, Seismological investigations of the San Juan Capistrano area, Orange County, California, for SONGS Units 2 & 3: in Southern California Edison Co., 1976, Recent Geotechnical Studies, Southern Orange County, California, Volume II, Enclosure 4, (76-2)

Evaluates the relationship between the central part of the Cristianitos fault and two earthquakes (M 3.8 and 3.3) that occurred on January 3, 1975, near San Juan Capistrano. The study included re-analysis of the original Caltech seismological data, establishment of a portable seismograph network (6 units) to monitor microseismicity, detonation of two calibration shots to develop a more accurate crustal model, review of historic seismicity, and analysis of oil company seismic-reflection data.

Conclusions of the report are: (1) the two earthquakes cannot be located on the Cristianitos fault; (2) the focal mechanisms indicate motion in the thrust-left-slip direction, opposite the geohistoric Cristianitos fault movement; (3) the earthquakes are associated with a northwest-dipping, northeast-trending fault, oblique to the Cristianitos fault; (4) microseismicity is very low for the Cristianitos fault; most of the activity recorded by the microseismic network is associated with the Elsinore fault. The author speculates that the January 3, 1975, earthquakes occurred from settlement within the Capistrano embayment.

The report contains 24 figures, 17 tables, and two appendices (8 figures, 6 tables). Most of the tables and figures deal with data from the main seismic events. Figure 23 is an aeromagnetic contour map of the Santa Barbara - San Pedro Channel (scale 1 inch = 1.5 miles; contour interval = 10 gammas). Figure 24 is a Bouguer gravity map of the Capistrano Embayment (scale 1 inch = 0.65 miles; contour level = 1 milligal).

76-1 Fugro, Inc., August 1976, Final report on geologic features at the San Onofre Nuclear Generating Station, Units 2 and 3: Consultants' report for Southern California Edison Co., 24 p.

Summarizes observations and conclusions on shears and other features in the San Mateo Formation found during the excavation of the SONGS Units 2 and 3 Containment Building foundations previously reported in Fugro (74-3, 74-4). The report concludes that offsets (Features A through D) are joint-like conjugate shears and are older than 120,000 years because they do not offset the first emergent marine terrace. A model is presented which reasons that the features were caused by north-south compression. Five drawings showing the SONGS Unit 2 and 3 excavations, profiles, and regional stress patterns are given. Appendix A gives five detailed photos and graphic logs of the geologic features.

76-2 Southern California Edison Company, 1976, Recent Geotechnical Studies, Southern Orange County, California, for SONGS Units 2 & 3, Volumes I & II.

This report includes six reports by consultants for SONGS indexed as follows:

Volume I:

Enclosure 1: Appendix A, Fugro, Inc., November 1, 1975c (75-3)
Appendix B, Fugro, Inc., November 14, 1975d (75-4)
Appendix C, Fugro, Inc., September 12, 1975a (75-1)

Enclosure 2: Fugro, Inc., September 15, 1975b (75-2)

Volume II:

Enclosure 3: West, J.C., November 1975 (75-5)

Enclosure 4: Biehler, S., 1975 (75-6)

For the annotations for these reports, refer to listing by author.

77-1 Anderson, Warren, and Associates, 1977, Results of microfossil identification and geologic age correlation, vicinity of SONGS, California: in Southern California Edison Co., 1977, Geotechnical Studies, Northern San Diego County, California, for SONGS Units 1, 2, & 3, Appendix A, Enclosure 3, 36 p. (77-6)

A sequence of letters identifying fossils from localities in Ehlig (77-2). Of interest is a Pacific Coast and Indo-Pacific regional correlation chart of calcareous and siliceous microplankton compiled by the consultants.

77-2 Ehlig, P.L., September 13, 1977, Geologic report on the area adjacent to the SONGS, northwestern San Diego County, California: in Southern California Edison Co., 1977, Geotechnical Studies, Northern San Diego County, California, for SONGS Units 1, 2, & 3, Enclosure 3, 40 p.

Geologic description of 60 square kilometers surrounding SONGS, from San Mateo Canyon southeastward to Las Pulgas Canyon, and inland from the shoreline to the eastern side of the San Onofre Mountains; includes a detailed geologic map of the coastal area surrounding SONGS. The investigation emphasized evidence bearing on the tectonic stability of the area, and the stability of the southern end of the Cristianitos embayment and its related faults.

The report concludes that: (1) the coastal area has been tectonically stable since late Pliocene, based on an undeformed marine terrace sequence and a continuous tuff unit near Horno Canyon; (2) the Cristianitos fault is the only major fault in the area, having 900 feet of down-on-west normal movement, the latest movement on which was before the formation of the lowest marine terrace (120,000 y. B.P.); and (3) four faults (the most notable is fault "E") mapped on the northwest flank of the San Onofre Mountains, east of the Cristianitos fault, are minor and show no evidence of Quaternary displacement.

The report includes three large map plates (scale 1 inch = 500 feet), seven cross-sections, a list of fossils (Table 1) and their locations (Fig. 3), and a stratigraphic column of the SONGS vicinity (Fig. 10). Appendix A is a fossil identification report prepared by Anderson, Warren, and Associates (77-1).

77-3 Fugro, Inc., October 15, 1977a, Report of geologic investigations, Trail Six (Area 1) and Horno Canyon (Area 2) landslides southeast of SONGS: in Southern California Edison Co., 1977, Geotechnical Studies, Northern San Diego County, California, for SONGS Units 1, 2, & 3, Enclosure 1, 31 p. (77-6)

Two coastal areas were investigated south of SONGS where extensive landsliding and offsetting of the 120,000 years old bedrock/terrace contact has occurred. In the Trail Six area offset of the contact does not extend beyond the landslide mass and is not coincident with other evidence of faults, thus indicating a nontectonic origin for the fractures. In the Horno Canyon area multiple episodes of landsliding have occurred, and the graben feature observed there is confined to an ancient landslide mass, likewise indicating that the displacement of the bedrock/terrace contact is not of tectonic origin. Numerous large and small scale maps, terrace profiles, and geologic cross-sections accompany the report.

77-4 Pickard, Lowe, and Garrick, Inc., April 1977, Nuclear Power Plant Siting, Camp Pendleton Marine Corps Base, for San Diego Gas and Electric Co., 124 p.

Preliminary study to screen areas for the siting of a nuclear generating station within Camp Pendleton using existing geologic, seismologic, population and base-operations data.

Section 4 of this report, the Safety Assessment, contains a summary of the geology/seismology of Camp Pendleton and includes a generalized geologic map (Fig. 4.6, scale about 1:110,000) and a fault and photolineament map of Camp Pendleton (Fig. 4.7, scale about 1:110,000).

77-5 Southern California Edison Company, March 21, 1977a, Final Safety Analysis Report (FSAR) for San Onofre Nuclear Generating Station (SONGS), 17 volumes.

A multidiscipline report in 17 volumes, with information on geology and seismology contained in Volume 3 and Volume 4.

Volume 3 contains a subsection on basic geology and seismic information, vibratory ground motion, surface faulting, stability of subsurface materials and foundations, slope stability, and embankments and dams. Subsection 2.5.1 (Basic Geology/Seismology) contains a brief discussion of the regional and local faults affecting SONGS. A major part of the volume is contained in subsection 2.5.2 (Vibratory Ground Motion) and deals with the regional seismicity and effects. Tables list: (1) the noninstrumented earthquakes within 200 miles (Table 2.5-1) and 50 miles (Table 2.5-3) of SONGS; (2) instrumented epicenters within 200 miles (Table 2.5-2) and 50 miles (Table 2.5-4); (3) strong motion records within 200 miles (Table 2.5-6); and (4) geologic failures from earthquakes within 200 miles (Table 2.5-7). Volume 3 contains 78 figures which include: geology and fault maps, cross-sections, subsidence map, accelerograms, plots of epicenters within 50-and 200-mile radii, and soil engineering results. Volume 4 contains appendices to the geotechnical engineering reports on SONGS.

77-6 Southern California Edison Co., October 1977b, Geotechnical Studies, Northern San Diego County, California, for SONGS, Units 1, 2 & 3.

This report contains five consultants' reports for SONGS, indexed as follows:

Enclosure 1: Fugro, Inc., October 15, 1977a (77-3)

Enclosure 2: Fugro, Inc., October 15, 1977b (77-7)

Enclosure 3: Ehlig, P.L., September 13, 1977 (77-2)

Appendix A - Anderson, Warren and Associates, 1977 (77-1)

Enclosure 4: Shlemon, R.J. and Associates, 1977 (77-8)

For annotation of these reports see reference by author.

77-7 Fugro, Inc., October 15, 1977b, Geologic investigations of offsets in Target Canyon, Camp Pendleton, California: in Southern California Edison Co., 1977, Geotechnical Studies, Northern San Diego County, California, SONGS, Units 1, 2 & 3, Enclosure 2, 29 p. (77-6)

Previously reported bedrock/terrace offsets in the Target Canyon area of Camp Pendleton, 6.5 miles south of SONGS, were investigated by trenching and logging of three excavations to expose the offsets. The report indicates that a 120,000-year-old bedrock/terrace contact is offset at seven localities within a zone measuring 1,000 feet by 2,000 feet with displacements of up to 14 inches. The evidence indicates primarily dip-slip movement along north to north-northeast striking faults.

The report concludes that several modes of tectonic or nontectonic origin may have caused the offsets, but that projection of the offset-zone would lie about 5 miles from SONGS. This location, combined with the probable small magnitude of the earthquake that might be associated with the faults, led the authors to conclude that the zone should not affect the already established seismic design criteria for SONGS Units 2 and 3.

77-8 Shlemon, R.J., and Associates, Inc., 1977, Geomorphic analysis of Fault "E," Camp Pendleton, California: in Southern California Edison Co., 1977, Geotechnical Studies, Northern San Diego County, California, for SONGS Units 1, 2 & 3, Enclosure 4, 12 p. (77-6)

Geomorphic study of fault "E" (Ehlig,77-2) in the coastal mountains and San Onofre Bluff areas southeast of SONGS. The report concludes that there is no evidence of displacement by fault "E" of the older (200,000 years) marine terraces (at elevation 350 ft) and that there is no other geomorphic evidence of young movement, i.e., spring lines, depressions, etc. Also, fault "E" does not offset the continental deposits of the San Onofre Bluffs which have a radiocarbon date greater than 37,000 years within the section. Using this age and assuming a sedimentation rate of about 1 ft/1,000 yr, the author estimates that the 100-foot-thick section of continental sediments is about 100,000 years old. The portions of the seacliff exposed indicate that the latest movement on fault "E" occurred before 25,000 - 30,000 years and very likely before 100,000 years ago. Appendix A is an age date from Geochron Labs.

78-1 Fugro, Inc., May 12, 1978, Geologic Investigation of Fault "E," Southeast of SONGS, San Onofre, California, 21 p.

Geologic investigation of the recently mapped northwest-striking fault "E" of Ehlig (77-2) located about 1-1/4 miles east of SONGS. Two trenches were excavated and logged at a scale of 1 inch = 5 feet. The report concludes that: (1) a marine terrace platform that is approximately 300,000 to 350,000 years old overlies Fault "E" and is not displaced; (2) the geomorphic, pedologic, and topographic evidence also suggests that there has been at least 300,000 years since the last movement along fault "E"; and (3) fault "E" is considered not capable according to criteria set forth by the NRC in 10 CFR 100, Appendix A.

78-2 Shlemon, R.J. and Associates, Inc., January 1978a, Late Quaternary Evolution of the Camp Pendleton - San Onofre State Beach Coastal Area, Northwestern San Diego County, California, for SONGS Units 2 & 3, 123 p.

The regional geology within several miles of SONGS was investigated to: (1) determine the Quaternary evolution of the Camp Pendleton - San

Onofre State Beach Coastal area, (CP-SOSB); (2) identify major coastal landforms; (3) date various Quaternary marine and nonmarine geologic units; and (4) identify and date the minimum age of last movement on any faults that may be found in the SONGS area.

The report concludes that: (1) nine distinct marine terrace deposits, at elevations from 55 feet to 1,250 feet, range in age from 125,000 to 780,000 years; (2) the alluvial fan deposit in the San Onofre Bluffs ranges from 125,000 years B.P. to the present, yielding a sedimentation rate of 10 to 25 cm/1,000 yr; (3) the coastal retreat of San Onofre Bluff is about 0.2 m/yr, similar to other central and southern California coastal areas; and (4) maximum uplift of CP-SOSB area for the last 125,000 years is about 4.2 cm/1,000 yr, indicating relative tectonic stability compared to elsewhere along coastal California.

The report contains tables listing: (1) radiocarbon age and location of continental samples in CP-SOSB area; (2) marine terrace areas and elevations in CP-SOSB area; and (3) tabulation of late Quaternary deformation rates of central and southern California coast.

78-3 Shlemon, R.J., and Associates, Inc., October 1978b, Late Quaternary Rates of Deformation, Laguna Beach - San Onofre State Beach, Orange and San Diego Counties, California, 40 p.

Late Quaternary (last 125,000 years) rates of deformation from Target Canyon to Laguna Beach, California, are estimated using the continuity and elevation of the first marine-terrace contact. Three components of deformation are evaluated: (1) regional up-to-northwest longitudinal tilt; (2) seaward tilt north of San Clemente; and (3) average uplift for the region during the last 125,000 years. The study results were compared to published rates of deformation for other southern California coastal areas, and are presented in Table 3.

The study concludes that: (1) the regional longitudinal uplift rate increases northward from 6 cm to 26 cm/1,000 yr from Target Canyon to Dana Point; (2) SONGS has a local uplift rate of 9 cm/1,000 yr and is relatively one of the most tectonically stable areas in southern California; and (3) any seaward tilt of the first emergent marine terrace between Camp Pendleton and Dana Point has been less than one degree.

78-4 Woodward-Clyde Consultants, July 14, 1978a, Geotechnical Evaluation of Potential Island and Offshore California LNG Import Terminal Sites, 106 p.

Geotechnical investigation for two island and five offshore LNG terminals to be located on and around Santa Rosa and Santa Cruz Islands, and offshore from Camp Pendleton. Generally discusses siting problems for the entire study area and provides limited site-specific geotechnical data as well as the results of a marine geophysical investigation for the five offshore sites. Figures and tables describe historic seismicity and faults around each site, but the reader is referred to a January 16, 1978, Woodward-Clyde Consultants report on the mainland LNG sites, Appendix A, for detailed summary of faulting and seismicity.

78-5 Woodward-Clyde Consultants, 1978b. Report on the results of analyses performed on well 8 at the SONGS Units 2 and 3, San Onofre, California: Consultants' Report for Southern California Edison Co., 34 p. and appendices.

Evaluation of a subsurface cavity at dewatering well 8 and its effect on the performance of the adjacent structures in terms of foundation bearing capacity. The effects of this cavity on settlement and bearing capacity of the containment structure were found to be very small and to not affect the integrity of the structure.

79-1 West, J.C., January 1979, Supplement to the Generalized Subsurface and Geophysical Study, Capistrano Area, Orange County, California, by West, J.D., 1975, 15 p. (75-5)

Supplements West (75-5) in response to NRC question 361.35 part (e) interpreting the relationship between onshore and offshore structures in the Capistrano Embayment. Two contour maps (top of Monterey and base of Tertiary - top of Cretaceous), six geologic structure sections, and four annotated seismic-reflection profiles are included.

The report concludes that major tectonic activity within 10 miles of SONGS took place prior to the end of Pliocene time (±2 m.y.B.P.), and the region has been tectonically quiet since that time, except for the South Coast Offshore Zone of Deformation (SCOZD), which had probable late Pleistocene movement. No late Pleistocene or younger faults were revealed within 5 miles of SONGS.

79-2 Woodward-Clyde Consultants, June 1979a, Report on the Evaluation of Maximum Earthquake and Site Ground Motion Parameters Associated with the Offshore Zone of Deformation for SONGS, 30 p.

Detailed geologic, seismologic, and earthquake engineering analyses are presented to estimate the maximum earthquake magnitude and maximum ground motion for the SONGS Design Basis Earthquake (DBE). The source of the DBE is the Offshore Zone of Deformation (OZD) about 5 miles (8 km) west of SONGS. The OZD is composed of the Newport-Inglewood Zone of Deformation (NIZD), the South Coast Offshore Zone of Deformation (SCOZD), and the Rose Canyon fault zone (RCFZ), which have a combined length of 145 miles (240 km). The DBE is estimated to be M 6-1/2, which yields a maximum ground acceleration of 0.67g at SONGS. An instrumental-mean and 84th-percentile response spectrum is developed from analysis of 56 earthquake records.

The report includes: detailed discussions of the NIZD, SCOZD, RCFZ, and the hypothesized OZD, and of worldwide strike-slip faults. The appendices include: a discussion and tabulation of data on the OZD based on geologic literature; correlation of E-logs from oil wells; seismic reflection profiles; analysis of teleseismic data from the Long Beach earthquake of 1933; a tabulation of data on displacements and slip-rates on major strike-slip faults in California and the world; a discussion of the development of peak acceleration-attenuation relationships for soil, combined soil and rock, and their applications to SONGS.

79-3 Shlemon, R.J. and Associates, Inc., July 1979, Late Cenozoic Stratigraphy, Capistrano Embayment, Coastal Area, Orange County, California, 27 p.

Discusses the late Cenozoic stratigraphic markers between SONGS and Dana Point. Absolute and relative ages of these markers are used to determine the age of the most recent movement on the Dana Point fault, and the subsurface Vaciadero and Carr faults. The report concludes that: (1) the 125,000-year-old Terrace 1 is tilted up to the north between SONGS and Dana Point; (2) the Dana Point fault displaces the Tertiary Capistrano Formation but not Terrace 1; (3) the Vaciadero and Carr faults do not displace either the upper Capistrano Formation or the overlying Quaternary deposits; and (4) the last faulting in the coastal portion of the Capistrano Embayment, between Dana Point and SONGS, occurred earlier than 125,000 years ago.

79-4 Woodward-Clye Consultants, 1979b, Report of the exploration/demobilization of wells 4 and 5, SONGS Units 2 & 3: Consultant's Report for Southern California Edison Co., 27 p. and appendices.

Investigation of the areas around wells 4 and 5 to detect and delineate possible cavities caused by dewatering operations. A small cavity in well 5 was stabilized by pressure grouting. Both wells were capped and considered demobilized.

80-1 Menard, H. W., November 26, 1980, Letter from U.S. Geological Survey to NRC reviewing geologic and seismologic data for SONGS Units 2 and 3; in USNRC Safety Evaluation Report, 1980, Appendix G, p. Gl to G7. (80-4)

Letter reviewing the geologic and seismologic data for SONGS Units 2 and 3, including an addendum to a previous USGS review by Morris (80-2). This and the Morris review conclude that: (1) the USGS generally concurs with Southern California Edison Company and its consultants on the history of the Cristianitos fault and its being capped by 125,000 y.B.P. terraces; (2) the Cristianitos fault is one of several faults in an offshore zone of deformation, the Cristianitos Zone of Deformation (CZD) of Morris (80-2); and (3) there is a lack of potential for movement on the Cristianitos fault in response to displacement on the offshore zone of deformation; and (4) the Cristianitos fault is not a capable fault. This review also contains a discussion of the slip-rate versus magnitude study used for estimating the maximum earthquake in the seismic design of SONGS, Units 2 and 3. The USGS expresses an opinion that the maximum earthquake limit (MEL) line should be steeper, i.e., larger magnitude earthquakes for small slip-rates.

80-2 Morris, R.H., August 13, 1980, Letter from the USGS to the NRC reviewing offshore seismic reflection profiles in vicinity of the Cristianitos fault, San Onofre, California, a study by H.G. Green (USGS) and M.P. Kennedy (CDMG): in USNRC Safety Evaluation Report, 1980, Appendix F, p. Fl to F23. (80-4)

Summarizes the results of a study to determine the seaward extension and structural relationships of the Cristianitos Zone of Deformation (CZD) and the Offshore Zone of Deformation (OZD) seismic-reflection data. Concludes that a structurally deformed zone of **en echelon** folds and faults extends south-to-southeastward offshore from SONGS along the expected CZD trend to within 1 km of the OZD where a data gap prevents positive connection between the two zones of deformation. No evidence of seafloor displacement was found on the CZD, but a probable Neogene age of deformation is postulated.

80-3 Slemmons, D.B., November 5, 1980, Letter to Nuclear Regulatory Commission on SONGS seismic design parameters: in USNRC Safety Evaluation Report, 1980, Appendix E, p. E1 to E28. (80-4)

Findings of a review of the Offshore Zone of Deformation (OZD) and its probable maximum earthquake including an analysis of fault capability, rate of slip, rupture length, displacement, degree of deformation, maximum historic earthquake, and maximum surface displacement. Concludes that a maximum earthquake of Ms 7 with a slip rate of 0.5 mm/yr should be used for characterizing the OZD in the design of SONGS, Units 2 and 3.

80-4 United States Nuclear Regulatory Commission, December 1980, Safety Evaluation Report (Geology and Seismology), Related to the Operation of San Onofre Nuclear Generating Station, Units 2 and 3, Docket Nos. 50-361 and 50-362, 34 p.

Summarizes findings originally published by the Atomic Energy Commission in a 1972 Safety Evaluation Report for SONGS Units 2 and 3 with the addition of a review of new data from investigations since that time. The report concludes that the new data have not changed the basic 1972 conclusion that a Safe Shutdown Earthquake of 0.67g should be used for SONGS Units 2 and 3. Appendices include: a letter from D. B. Slemmons to the NRC (80-3) evaluating the seismotectonic setting and reviewing methods of estimating the maximum earthquake on the Offshore Zone of Deformation; a letter (with addendum) from R. H. Morris (USGS) to the NRC (80-2) reviewing offshore seismic-reflection profiles in the vicinity of the Cristianitos fault; and a letter from H. W. Menard (USGS) to the NRC (80-1) that is an addendum to the earlier Morris letter.

80-5 Greene, H.G., and Kennedy, M.P., 1980, Addendum to: Review of offshore seismic reflection profiles in the vicinity of the Cristianitos fault, San Onofre, California: in USNRC Safety Evaluation Report, 1980, Appendix G, p. G1 to G11. (80-4)

Letter supplementing a previous USGS report (Morris, 80-2) that reviewed earlier offshore seismic profiles for the NRC. This letter reviews new seismic profiles. These new data (June 1980 by NEKTON, Inc.) include about 90 km of high-resolution watergun and 3.5 kHz seismic reflection profiles and side-scan sonographs. The new data support the previous conclusions (Morris, 80-2) that the Cristianitos Zone of Deformation (CZD) merges with or is truncated by the Offshore Zone of Deformation (OZD) offshore from SONGS, and that the CZD faults cut shallow strata that lie beneath a prominent unconformity and younger poorly stratified sediments.

80-6 Woodward-Clyde Consultants, 1980, Summary report on basic data from two onshore and six offshore geologic borings, SONGS Units 2 and 3, San Onofre, Consultant's Report for Southern California Edison Co., 10 p. and appendices.

Presents the location, methods, boring/geophysical logs, and age dating results of two onshore rotary and six offshore vibratory-core borings near SONGS. The onshore borings reached depths of 557 and 750 feet with sampling of the terrace deposits, San Mateo Formation; Monterey Formation, and San Onofre Breccia. The offshore vibratory cores recovered up to 47 feet of ocean bottom sediments.

Nannofossil analysis was performed on four samples taken from the 485 to 654 foot interval of the onshore borings. Nannofossil ages of middle Miocene, Luisian (650 feet) to late Miocene, top of lower Mohnian (485 feet) were determined. Seven radiometric age dates were determined from shells and organic material recovered in the offshore sampling. These ages ranged from 12,270 ± 340 years at 38.5 feet to 8,510 ± 265 years at 16.4 feet of sediment depth.

VIDAL NUCLEAR POWER PLANT SITE

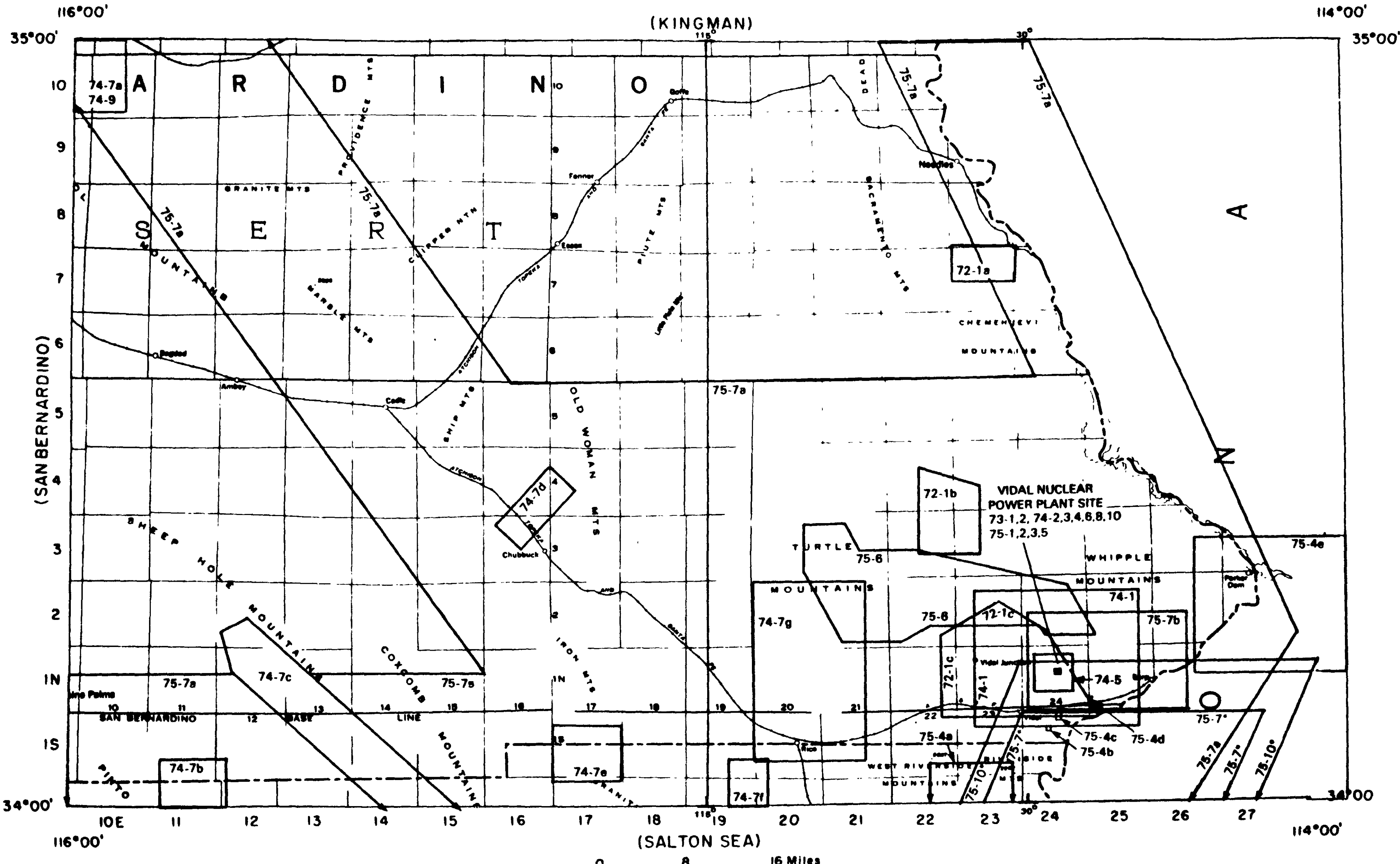

Fig. 6 - Areas covered by geologic studies for Vidal and Sundesert (*) Nuclear Power Plant Sites on Needles sheet. See Fig. 1 for location.

NEEDLES

<u>Vidal Site</u>

72-1	Fugro, 1972
73-1	Davis *et al*., 1973
73-2	Fugro, 1973
74-1	Bull *et al*., 1974
74-2	Southern California Edison, 1974a
74-3	Southern California Edison, 1974b
74-4	Woodward-McNeill & Assoc., 1974a
74-5	Woodward-McNeill & Assoc., 1974b
74-6	Woodward-McNeill & Assoc., 1974c
74-7a-g	Woodward-McNeill & Assoc., 1974d
74-8	Woodward-McNeill & Assoc., 1974e
74-9	Davis, 1974
74-10	Woodward-McNeill & Assoc., 1974f
75-1	Ku, 1975
75-2	Long, 1975
75-3	U.S. Nuclear Regulatory Commission, 1975
75-4a-e	Woodward-Clyde Consultants, 1975
75-5	Woodward-McNeill & Assoc., 1975a
75-6	Woodward-McNeill & Assoc., 1975b
75-7	Woodward-McNeill & Assoc., 1975c

<u>Sundesert Site</u> (see SALTON SEA, Fig. 7, for these references).

75-7*	Lee & Bell, 1975
75-10*	Orme, 1975

VIDAL NUCLEAR POWER PLANT SITE (Fig. 6)

72-1 Fugro, Inc., November 14, 1972, Geologic and Seismic Reconnaissance of the Eastern Mojave Desert and Proposed Nuclear Power Plant Sites, California, 25 p.

Presents the general geologic and seismologic characteristics of the eastern Mojave Desert as related to three alternate locations for the Vidal Nuclear Power Plant: (1) Vidal, Sec. 16, T1N, R24E, (2) Chemehuevi, Sec. 36, T4N, R23E, and (3) Needles, Secs. 9, 16, & 17, T1N, R23E. The report describes regional geology and lithology, Cenozoic sedimentary and alluvial units, and the seismic history of major faults within 130 miles of the sites. A high density of recorded seismicity is shown to have occurred west of a line extending from Baker to Blythe, California, about 50 miles west of the sites. The eastern Mojave Desert is typified by a low density of recorded seismicity with no earthquakes of M 4.0 or greater. The strongest intensity of historic ground shaking for the sites is estimated at V-VI (Modified Mercalli Scale). Three reconnaissance geologic maps, various scales, show the alluvial units of the areas surrounding the proposed sites.

73-1 Davis, G.C., 1973, Woodward-McNeill and Associates, Geologic studies in the eastern Mojave Desert: in Southern California Edison, 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume III, Appendix 2.5A, 15 p.

Summarizes evidence or lack of evidence for extending the active, strike-slip Death Valley fault zone southeastward from the Silver Lake area to the Rice-Vidal-Blythe area. Included is a discussion of faults in the Silver Lake area, Soda-Avawatz Mountains, Bristol Mountains, Granite-Old Dad Mountains, Kilbeck Hills-Old Woman Mountains and Riverside-Big Maria-Little Maria Mountains.

Concludes there is no evidence to support an hypothesis extending the Death Valley fault zone 150 miles to the Rice-Vidal-Blythe area. This report was originally presented in the Vidal Early Site Review Report by Woodward-McNeill (74-4) and in the report by Southern California Edison (74-2).

73-2 Fugro, Inc., January 22, 1973, Reconnaissance Subsurface Investigation, Proposed Vidal Site and Vicinity, Eastern Mojave Desert, 28 p.

A reconnaissance subsurface investigation of the Vidal site undertaken to determine evidence for the presence or absence of faults beneath the site and general site soil conditions. The 27 borings were placed in and around Sec. 16, T1N, R24E and drilled through the Pliocene Bouse Formation and into the Miocene Osborne Formation to depths between 137 and 566 feet. Trenches were placed across suspected surface fault traces located in Secs. 10 & 12, T1N, R24E, and Sec. 20, T1N, R25E, about 1 to 3 miles from the site. The report concludes (1) the Bouse Formation and Osborne Formation are continuous beneath the site with no evidence for faulting, (2) the Bouse-Osborne contact slopes southerly at a gradient of 4 percent, (3) the northwest-trending fault, whose nearest location is 3-1/4 miles northeast of the site, displaces Miocene Copper Basin Formation and Pliocene Bouse Formation, but not Quaternary units, (4) the lack of evidence suggests that near-site faulting need not be considered in site design, (5) regional seismic and historic geology suggest a Safe Shutdown Earthquake need not exceed 0.40g.

74-1 Bull, W.B., 1974, Woodward-McNeill and Associates, Geomorphic tectonic analysis of the Vidal region: in Southern California Edison, 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume III, Appendix 2.5B, 63 p.

Geomorphic study to evaluate possible Quaternary faulting within 5 miles of the Vidal site and to assess the regional Quaternary tectonic stability of the mountain fronts within 20 miles of the site.

Describes six sequences of Quaternary alluvial units ranging in age from 1.5 million years to the present and three types of tectonic regimes: (1) base-level fall in alluvium associated with tectonic and nontectonic mechanisms; (2) accumulation of the Bouse Formation sediments and overlying terrace deposits in response to regional uplift and tilting; and (3) evolution of fluvial systems crossing the mountain fronts.

Conclusions presented are: (1) three zones of base-level fall exist near the Vidal site, one of which occurred from 11,000 to 50,000 years ago and was caused by lateral cutting by the Colorado River; the others occurred before 500,000 years ago and are of uncertain origin; (2) regional uplift of 530 to 800 feet with regional tilting of 10 feet per mile has occurred near Vidal since completion of Bouse Formation deposition (greater than 3 million years ago); (3) mountain fronts in the Vidal region are not tectonically active; and (4) there is no geomorphic evidence of faulting, folding, or tilting during the last 500,000 years within a 20-mile radius of Vidal.

Contains eight tables and 35 figures. The report was originally presented in the Early Site Review Report by Woodward-McNeill (74-4) and can also be found in Volume II of Southern California Edison (74-2). There is an attachment in the Southern California Edison report (74-3) discussing strike-slip fault movement along a postulated fault near Savahia Peak. This attachment concludes that strike-slip movement along the postulated fault has not occurred during the last one million years.

74-2 Southern California Edison Co., 1974a, Information Concerning Geology and Seismology, Vidal Nuclear Generating Station, Units 1 and 2, 3 volumes.

Represents an updated Early Site Review Report (ESRR) by Woodward-McNeill and Associates (74-4). This report was submitted to the USNRC to provide geologic and seismologic information supporting the adequacy of the Safe Shutdown Earthquake. Discusses regional and site geology, vibratory ground motion and potential for surface faulting. Six appendices are contained in Volume II and III. See the ESRR (74-4) for a more detailed annotation.

74-3 Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2, 5 volumes.

Report submitted to the USNRC and ACRS to demonstrate the acceptability of the design acceleration for the Vidal Safe Shutdown Earthquake (SSE). Subjects covered in this report include: (1) geography and demography; (2) meteorology; (3) hydrology; (4) geology and seismology; and (5) seismic design. Volume I contains parts (1) to (3) listed above. Volumes II and III contain geology, seismology, and seismic design. Volumes III, IV and V contain appendices which include reports by consultants and AEC questions with SCE reponses. The geologic and seismologic discussions are expansions of the Early Site Review Report by Woodward-McNeill (74-4) and Southern California Edison (74-2).

The report states that the eastern Mojave Desert Province containing the Vidal site has a relatively low level of historic seismicity. The maximum reported earthquake for the Province had an epicentral intensity of V (Modified Mercalli Scale) and the largest recorded earthquake had a magnitude of 3.3.

The SSE for the Vidal site is represented by an AEC Regulatory Guide 1.60 spectrum normalized to 0.40g. This is a conservative estimate based on analysis of known historic earthquakes and fault-length vs. maximum-magnitude relationships. The SSE was developed assuming that the maximum historic earthquake would occur at the site. The San Andreas fault is 90 miles west of the site and was calculated to be capable of causing maximum ground acceleration at the site of 0.10g.

74-4 Woodward-McNeill and Associates, 1974a, Early Site Review Report for Vidal Nuclear Generating Station, Units 1 and 2, 3 volumes, 130 p.

Discusses in detail various aspects of geology, seismology, and foundation engineering for the proposed Vidal Nuclear Plant site about 10 miles west of Parker, Arizona. The scope of study for this report included: (1) literature review, (2) aerial photo interpretation, (3) near-site geologic investigations, (4) age-dating of selected igneous rock units, (5) fault and lineament mapping with trenching, (6) surface (magnetic and gravity anomaly) and subsurface (borehole and seismic refraction) geophysical surveys, (7) site-specific soils investigations (106 borings), and (8) laboratory testing of soil samples.

The report includes detailed discussions of the historic earthquakes of the Mojave Desert, identification of all capable faults, estimates of the maximum earthquake to affect the site, and a discussion of the Safe Shutdown Earthquake (SSE) and Operating Basis Earthquake (OBE).

Based on magnitude-intensity/acceleration relationships, the study identified 22 faults located in the Mojave Desert capable of generating an earthquake that will affect the site. The maximum earthquake in the near-site area is postulated not to exceed M 5.5. A maximum ground acceleration of 0.40g is recommended for the SSE and an acceleration of 0.20g is recommended for the OBE.

74-5 Woodward-McNeill and Associates, 1974b, Geophysical surveys: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume III, Appendix 2.5C, 14 p.

Summarizes the procedures and conclusions of various geophysical surveys conducted at the Vidal site. Geophysical surveys included: (1) ground magnetic; (2) gravity with Bouguer data reduction; (3) 12-channel seismic refraction; (4) downhole geophysical logging; and (5) crosshole shear-wave velocity measurements. The surveys were conducted to determine lateral correlation of boring data and geophysical parameters of the subsurface materials. The surveys indicate no major faulting beneath the Vidal site.

74-6 Woodward-McNeill and Associates, 1974c, Boring and test pits, static properties laboratory investigation, dynamic properties laboratory investigation: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume IV, Appendix 2.5D.

Compilation of the Vidal site boring and test pit logs and laboratory test results for a total of 106 borings and six test pits. The logs for the 27 borings drilled by Fugro, Inc.(73-2) are included.

74-7a-g Woodward-McNeill and Associates, 1974d, Geologic investigations of postulated extensions of the Pinto Mountain and Death Valley fault zones, eastern Mojave Desert: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5E, 49 p.

Summarizes geologic field investigations conducted in selected areas along postulated extensions of the Death Valley, Pinto Mountain, and Blue Cut faults. Conclusions are: (1) postulated extensions of the Death Valley and Pinto Mountain faults do not exist; (2) the Blue Cut fault is displaced by the northwest-trending Sheep Hole fault and does not extend eastward into the Eagle Mountains; and (3) these three faults are not a hazard to the Vidal plant. The report presents 27 figures, mostly geologic maps of selected local areas.

74-8 Woodward-McNeill and Associates, 1974e, Geologic studies of the hypothesized Pinto Mountain fault zone extension: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5E, Attachment B, 7 p.

Geologic studies along the eastern Pinto Mountain fault zone and its hypothesized eastward extension. The Pinto Mountain fault is an east-westerly oriented left-lateral strike-slip fault in an area of moderate seismicity with earthquakes up to M 5.0, but with no known recent surface rupture. The Pinto Mountain fault truncates the Mesquite fault, which is known to offset Quaternary sediments, and is therefore considered to be more recent. Although the Pinto Mountain fault can be traced 12 miles east of Twentynine Palms to the Tendertrap fault in Humbug Mountain, no evidence could be found for extending the Pinto Mountain fault farther to the east.

74-9 Davis, G.C., 1974, Geologic studies of the hypothesized Death Valley fault zone: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5E, Attachment A, 17 p.

Study of two northwest-trending physiographic lineaments in the Mojave Desert to evaluate whether they were caused by throughgoing structures hypothesized to be extensions of the Death Valley fault zone. The report discusses the faults of the Silver Lake-Halloran Hills, Soda Mountains, Bristol-Old Dad-Granite Mountain, Riverside-Big Maria-Arica Mountain areas and how these faults relate to the hypothesized extension of the Death Valley fault zone. Conclusions of the study are: (1) the amount of right-lateral displacement along the Death Valley fault zone near the Garlock fault is about 8 km; (2) the Death Valley fault zone probably terminates in the Silver Lake-Baker area; (3) the Death Valley fault zone and Avawatz fault zone are not correlative; and (4) it is possible that the Avawatz fault zone extends southward as far as the Bristol Mountains. The report is an attachment to a larger regional study performed by Woodward-McNeill and Associates (74-7a-g).

74-10 Woodward-McNeill and Associates, 1974f, Earthquake epicenter data: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5F, 49 p.

Computer printout listing earthquake epicenters for the periods 1902 to 1944 and January 1945 to May 1973. Epicenters are plotted on reduced topographic base maps of the Trona, Kingman, Williams, San Bernardino, Needles, Prescott, Santa Ana, Salton Sea, and Phoenix USGS 2° sheets. This report is also in the Early Site Review Report for the Vidal site by Woodward-McNeill and Asociates (74-4) and the report by Southern California Edison (74-2).

75-1 Ku, Teh-Lung, 1975, Th230/U234 dating of arid zone soil carbonates: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5G, Section B, 12 p.

Report summarizing the methodology and results of an age-measurement study using uranium series isotopes on authigenic carbonate (caliche) from paleosols of the Vidal region.

75-2 Long, A., 1975, Carbon-24 dating of arid soil carbonates: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2, (74-3), Volume V, Appendix 2.5G, Section C, 2 p.

Letter presenting the results of a Carbon-14 age dating study from paleosols in the Vidal region. The results of this study indicate that the unit "Q3" is Holocene and the other units are Pleistocene in age, i.e., 20,000 years or older.

75-3 United States Nuclear Regulatory Commission, 1975, Limited Early Site Review for the Vidal Nuclear Generating Station, Project No. 486, 31 p.

Evaluates the suitability of the Vidal Nuclear Plant site and presents a brief summary of site-planning history, site characteristics, and design criteria. Conclusions are: (1) there are no known geologic hazards present at the Vidal site which would preclude its use as a nuclear reactor station; (2) the proposed 0.40g acceleration for the Safe Shutdown Earthquake and the 0.20g acceleration for the Operating Basis Earthquake are adequately conservative and acceptable; and (3) the seismic input criteria established by Southern California Edison Company are acceptable for the early site review.

75-4a-e Woodward-Clyde Consultants, 1975, Supplemental geologic investigations: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5K, 15 p.

Describes trenching and geologic mapping to investigate lineaments and faults near the Vidal site. The geologic mapping program included reconnaissance mapping of faults within the southwestern Riverside Mountains, western Arizona, and the Buckskin-eastern Whipple Mountain areas.

The report concludes that: (1) lineaments along the Colorado River are remnant river-cut terraces; (2) in the southwestern Riverside Mountains, three of the previously mapped faults are old and do not extend beyond the area, and two faults proposed by others do not exist; (3) photogeologic studies of western Arizona indicate no evidence of capable faults within 25 miles of the Vidal site; and (4) in the Buckskin-eastern Whipple Mountains several northwest-trending faults exist, but no evidence was found to indicate they are capable faults. Trench logs and geologic maps (scales 1:24,000 and 1:40,000) accompany the report.

75-5 Woodward-McNeill and Associates, 1975a, Age dating of Late Tertiary and Quaternary deposits Vidal HTGR site: in Southern California Edison, 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5G, Section A, 17 p.

The first part of a three-part report of an age-dating study in the region around the Vidal site to gain absolute and/or relative ages for six alluvial sequences that surround the Vidal region. The geochronological techniques used in the study included: (1) paleomagnetic polar reversals; (2) carbon 14; (3) potassium-argon; and (4) uranium-ionium. The first section of the report summarizes the age dates, while the last two sections contain reports by consultants Ku (1975) and Long (1975).

75-6 Woodward-McNeill and Associates, 1975b, Photogeologic and reconnaissance mapping of the Castle Rock, Mopah and Whipple Mountain front: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics, Vidal Nuclear Generating Station, Units 1 and 2 (74-3), Volume V, Appendix 2.5I, 15 p.

Study of faulting along the southern Whipple Mountains and the eastern Mopah Range-Turtle Mountain areas using photogeologic mapping, site overflights, and limited surface investigations. Conclusions are: (1) the Castle Rock fault is not a major throughgoing fault and does not displace alluvial units; (2) faulting west of Castle Rock has not displaced an overlying alluvial unit whose age is estimated to be between 50,000 and 200,000 years B.P.; (3) faults in the Mopah Range offset Tertiary volcanic units but not alluvial units; and (4) faulting in the Whipple Mountain-Savahia Peak area is related to pre-Osborne Formation gravity sliding which occurred between 13.5 and 19-21 million years B.P. Three reconnaissance geologic maps are presented (scale 1:24,000).

75-7 Woodward-McNeill and Associates, 1975c, Relationship of the Bouse and Osborne formations in the vicinity of the Vidal Nuclear Generating Station site: in Southern California Edison Co., 1974b, Information Concerning Site Characteristics (74-3), Volume V, Appendix 2.5J, 5 p.

Stratigraphic relationships of the Bouse and Osborne Formations and their overlying alluvial units north and east of the Vidal site. This study consisted of geologic field mapping and analyzing subsurface borings to trace a known basal marl of the Bouse Formation. The results of this study indicate that: (1) the basal marl of the Bouse Formation can be extended from Earp, California, to about 3 miles east of the site, and then to the northeast; (2) the consistent outcrop pattern and gentle dip of the marl confirms that the Bouse Formation was deposited on a terrain similar to that of the present day; and (3) no evidence of fault offset in the basal marl between the site and Earp was found. A geologic map (scale 1:37,000±) with cross sections, electric logs, and three boring logs are included with the report.

SUNDESERT NUCLEAR POWER PLANT SITE

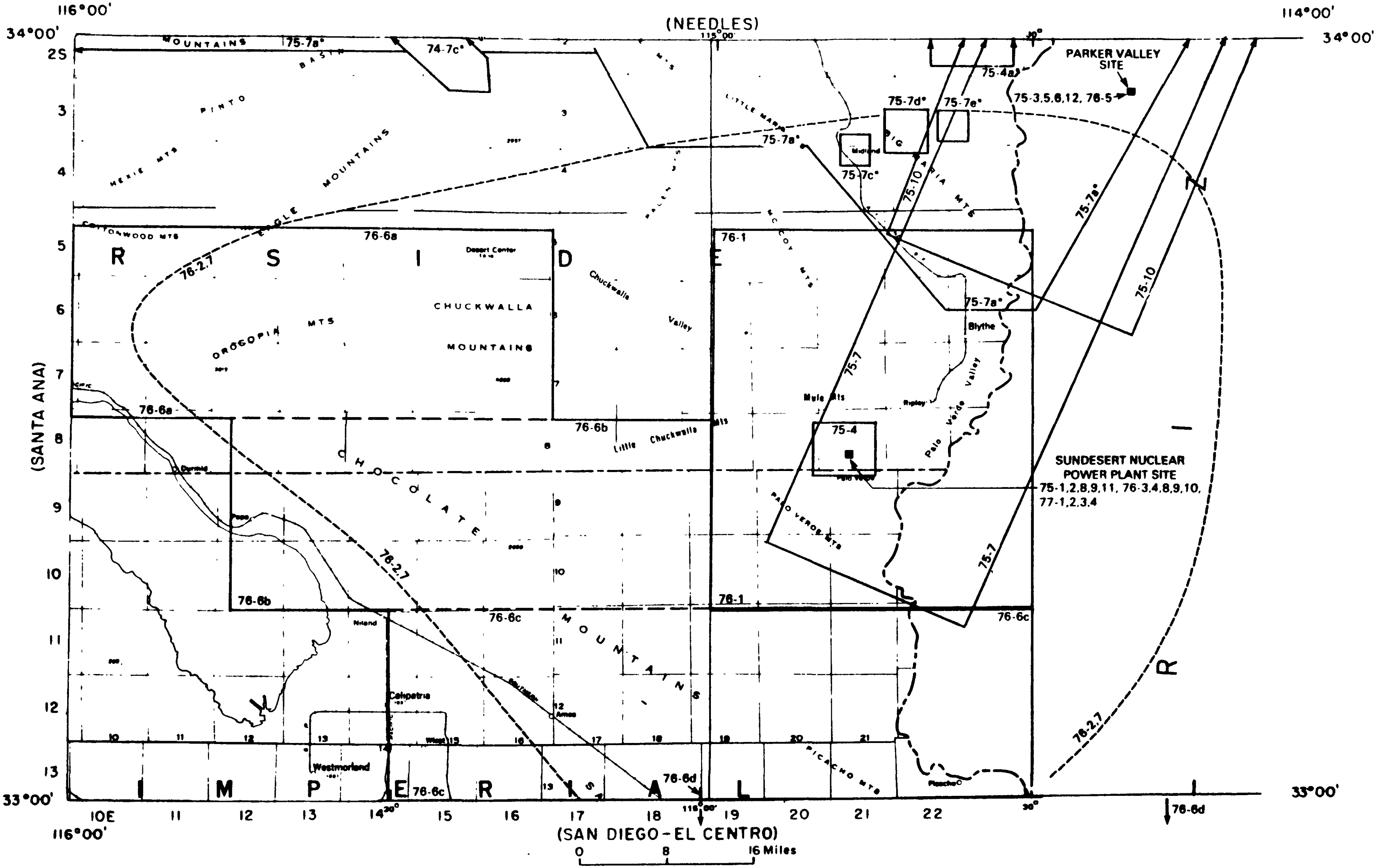

Fig. 7 - Areas covered by geologic studies for Sundesert and Vidal (*) Nuclear Power Plant Sites on Salton Sea sheet. See Fig. 1 for location.

SALTON SEA

<u>Sundesert Site</u>

75-1 Fritts, 1975

75-2 Fugro, 1975a

75-3 Fugro, 1975b

75-4 Hughes & Gauthier, 1975

75-5 Hughes & Hennon, 1975

75-6 Kukla & Opdyke, 1975

75-7 Lee & Bell, 1975

75-8 McLamore, 1975

75-9 Opdyke & Kukla, 1975

75-10 Orme, 1975

75-11 San Diego Gas & Electric, 1975

75-12 Summers, Castleberry & Crosby, 1975

76-1 Biehler, 1976

76-2 Bull, 1976

76-3 Crowell & Crowe, 1976

76-4 Fugro, 1976a

76-5 Fugro, 1976b

76-6a-d Murray, Bell & Crowe, 1976

76-7 Shlemon & Purcell, 1976

76-8 Summers, Castleberry & Crosby, 1976

76-9 Wirth Assoc., 1976a

76-10 Wirth Assoc., 1976b

77-1 Crosby & Smith, 1977

77-2 Fugro, 1977

77-3 San Diego Gas & Electric, 1977

77-4 Wirth Assoc., 1977

<u>Vidal Site</u>* (see NEEDLES, Fig. 6 , for these references).

74-7c* Woodward-McNeill, 1974d

75-4a* Woodward-Clyde Consultants, 1975

75-7a,c-e* Woodward-McNeill, 1975d

SUNDESERT NUCLEAR POWER PLANT SITE (Fig. 7)

75-1 Fritts, P.J., 1975, Micropaleontology, Sundesert Nuclear Plant, early site review report: in the SNP-PSAR, Volume 4, Appendix 2.5E of Appendix A. (75-11)

Microfossil identification of samples from drillholes and outcrops at and near the Sundesert Nuclear Project (SNP) site. The report discusses primarily the Bouse Formation, its environment of deposition, age, and correlation with the middle-to-upper portions of the mid-to-late Pliocene Imperial Formation at Fish Creek. The age of the Bouse Formation is placed at late Pliocene. Fossil-logs for ten drillholes and 15 trenches or outcrop samples are given.

75-2 Fugro, Inc., 1975a, Age dating techniques, Sundesert Nuclear Plant, early site review report: in the SNP-PSAR, Volume 5, Appendix 2.5J of Appendix A. (77-3)

Results from 28 age-dated samples collected in the lower Colorado River area to establish site geochronology. Dating methods included: (1) K/Ar; (2) radiocarbon; (3) amino-acid racemization; and (4) U/Th. Eight vertebrate fossils from the "Qrd" deposits were dated using amino-acid techniques. Five samples of pedogenic caliche taken from the SNP site were analyzed.

Addenda to the report include work by L.M. Mayer of Dartmouth College, who dated a fault gouge sample, J.L. Bada of Scripps Institute of Oceanography, who performed amino-acid racemization dating of a mammoth bone and several vertebrate samples; and Teh-Lung Ku of the University of Southern California, who performed U/Th age dating on caliche samples and a mammoth tusk.

75-3 Fugro, Inc., 1975b, Geotechnical Investigation, Parker Valley Alternate Site, Sundesert Nuclear Project, 2 volumes, 104 p.

Geologic and foundation engineering studies undertaken to locate a viable alternate site for the Sundesert Nuclear Project. The alternate site is located in Parker Valley approximately 15 miles south of Parker, Arizona, and about 42 miles northeast of the Blythe SNP site. The investigation included: (1) literature search; (2) aerial and remote-sensing mapping; (3) limited geologic mapping within a 25-mile radius of the site; (4) gravity, magnetic and downhole-seismic geophysical surveys; (5) excavation of 30 backhoe trenches and 48 borings; (6) age dating of surrounding rock units, caliche and fossils; (7) paleomagnetic polarity determinations for sediments; (8) soils engineering laboratory testing; and (9) reconaissance groundwater studies.

Quaternary age deposits are offset southwest of the Big Maria Mountains in the "Blythe Graben." Trenching of the graben-bounding faults indicates the 4 to 10 feet of vertical offset in old-to-intermediate-age alluvial fans. The report references the Early Site Review Report by San Diego Gas and Electric Company (75-11) for complete details on the "Blythe Graben."

Several aerial photolineaments and stratigraphic discontinuities were studied in the vicinity of the Parker Valley site. Subsurface investigations indicate that these features are localized and related to landsliding, consolidation, or differential erosion, and not to tectonic faulting. A regional seismicity study indicates there are 34 Quaternary faults within a 200-mile radius of the site. The faults thought to be capable of producing ground motion at the Parker Valley site are: (1) San Andreas (M 8.5); (2) Blythe Graben (M 5.0); (3) Chemehuevi Graben (M 5.5); (4) Kofa Mountain (M 5.5); and (5) Sheep Hole (M 7.0).

The Safe Shutdown Earthquake (SSE) recommended for the Parker Valley site is a Richter magnitude 8.5 on the San Andreas fault 81 miles to the southwest. The Parker Valley site response spectrum is based on a level of ground shaking scaled to 0.20g.

Besides the fault and seismic hazard studies, the report contains descriptions of the general geology of the site and vicinity, site groundwater, regional stratigraphy, and site foundation engineering properties. The report contains five tables, 48 figures, and five appendices (contained in Volume 2). Independent consultant reports are contained in Volume 2 and a supplemental gravity study (Fugro, 76-5) is in Volume 3.

75-4 Hughes, J., and Gauthier, J., 1975, Gravity and magnetic survey, Sundesert Nuclear Plant, Early Site Review Report: in the SNP-PSAR, Volume 5, Appendix 2.5I of Appendix A. **(77-3)**

Gravity and magnetic survey of the area surrounding the SNP site to detect any linear anomalies that might indicate bedrock faulting. No steep gravity or magnetic gradients were observed. The report contains 18 figures, several location maps, Bouguer and residual gravity maps, a total magnetic intensity map, and ten profiles.

75-5 Hughes, J.B., and Hennon. T.D., 1975, Gravity and magnetic survey of the Parker Valley alternate site: in Fugro, 1975, Geotechnical Investigation, Parker Valley Alternate Site, SNP, Volume 2, Appendix C, 12 p. (75-3)

Detailed study of the gravity and magnetic fields of the Parker Valley Alternate Site and the surrounding area. An elongated gravity and bedrock low (Fig. B) may be the result of a fault dipping 35° and striking east westerly along the northern boundary of the site. Displacement of 500 feet, down on the south, is indicated.

The report contains a location map, Bouguer gravity and residual gravity maps, a total magnetic intensity map, a bedrock elevation map, and nine cross sections. The report was supplemented by an additional gravity study reported by Fugro (76-5).

75-6 Kukla, G.J., and Opdyke, N., 1975, Paleomagnetic analysis of sediments at the Parker Valley Alternate Site: in Fugro (75-3), Geotechnical Investigation, Parker Valley Alternate Site, SNP, Volume 2, Appendix B, 17 p.

Remnant paleomagnetic determinations for 36 samples taken from two drillholes at the Parker Valley Alternate Site. Older fluvial deposits (QTrb) underlying the site are reversely magnetic from the ground surface to the sampled depth of 264 feet and are, therefore, older than the Brunes paleomagnetic epoch (700,000 years).

75-7 Lee, G.K., and Bell, J.W., 1975, Depositional and geomorphic history of the lower Colorado River, Sundesert Nuclear Plant Early Site Review Report: in the SNP-PSAR, Volume 3, Appendix 2.5D of Appendix A, 19 p. (77-3)

Regional geomorphic study along the lower Colorado River from Cibola, about 25 miles below Blythe, California, to about 3 miles above Parker, Arizona. The purpose of this study was to obtain information about alluvial units that could be used to demonstrate late Cenozoic structural deformation along the lower Colorado River.

The report discusses nine alluvial units that are younger than the late Pliocene Bouse Formation. Based upon present-day elevations of late Cenozoic alluvial units, basin subsidence and regional tilting of the lower Colorado River region took place before the middle Pleistocene. The undisturbed elevations of intermediate age fluvial deposits (Qrd-80,000 to 700,000 years old) indicate no recognizable deformation has occurred since late Pleistocene time. There has been some local fault displacement of alluvial units forming narrow grabens on the south side of the Big Maria Mountains, near Blythe, and in the Chemeheuvi Valley, near Needles. These disturbed alluvial units suggest movement on the Blythe graben is younger than 61,000 years with indications of movement throughout the last 100,000 years. The youngest undisturbed unit (Qf) has been determined to be a minimum of 6,000 years old by a uranium-thorium age date. There have been three cycles of downcutting followed by deposition since the end of the Bouse Formation. The present-day river level has agraded about 150 feet since the end of the Pleistocene. A map of the fluvial features is included.

75-8 McLamore, Reid, 1975, Seismic refraction survey, Sundesert Nuclear Plant, Early Site Review Report: in SNP-PSAR, Volume 5, Appendix 2.5H of Appendix A, 6 p. (77-3)

Reconnaissance seismic refraction study made in the SNP siting area having a total line-length of 18,000 feet. Three seismic-velocity layers typify the SNP site: (1) a 1,000- to 3,000-fps unit within the upper 10 feet consisting of unconsolidated fluvial sand, gravel and windblown detritus; (2) a middle 3,000- to 6,500-fps unit of consolidated fluvial sand and gravel with the lower part alluvial gravel; and (3) a lower 7,000- to 8,000-fps unit of clay and silt, probably the Bouse Formation. The report contains two seismic refraction profiles.

75-9 Opdyke, N., and Kukla, G.J., 1975, Preliminary report on magneto-stratigraphic study of sediments near Blythe, California and Parker Valley, Arizona, Sundesert Nuclear Plant Early Site Review Report: in the SNP-PSAR, Volume 3, Appendix 2.5B of Appendix A, 10 p. (77-3).

Paleomagnetic study of drillhole and outcrop samples of late Cenozoic sediments from the Blythe and Parker Valley areas. The purpose of this study was to determine minimum ages for the sediments and evaluate the potential for using magneto-horizons for correlation of drillhole data in the SNP siting area.

The study concluded that the older fluvial deposits (QTrb) have reverse polarity, are older than 0.7 m.y. B.P., and were possibly deposited in the Gilbert reverse polarity epoch (5.1 to 3.3 m.y.B.P.).

There are also some normal polarity layers which may be used for detailed hole-to-hole correlation. The intermediate-age fluvial deposits (Qrd) have normal polarity and were probably deposited during the Brunhes epoch, less than 0.7 m.y.B.P. However, the lower portion of these "Qrd" sediments may have been deposited during the reverse polarity Matuyama epoch, 2.4 to 0.7 m.y.B.P.

75-10 Orme, A.R., 1975, Photogeologic interpretation of structural lineaments in the lower Colorado Valley and vicinity, in Sundesert Nuclear Plant Early Site Review Report: in the SNP-PSAR, Volume 3, Appendix 2.5-C of Appendix A, 17 p. (77-3)

Regional photogeologic interpretation study of the structural lineaments and Quaternary tectonic features of the lower Colorado River between Lake Mead and the Gulf of California using ERTS satellite imagery and color airphotos.

The study concludes that: (1) there is no firm photogeologic evidence for Quaternary tectonism within the Blythe and Parker Valley areas; (2) photogeologic evidence indicates major tectonism within the siting area ceased before deposition of the Bouse Formation in Pliocene time; (3) late Tertiary fanglomerates bounding mountain ranges in the siting area appear to be undisturbed since deposition; (4) photogeologic evidence for Quaternary tectonism dies out towards the siting area; and (5) there is no photogeologic evidence for extending the Death Valley fault zone southeastward towards the site vicinity.

Three small scale maps show ERTS lineaments for the entire study area, and a larger scale map shows color photolineaments in the Parker Valley area.

75-11 San Diego Gas and Electric Company, 1975, Early Site Review Report for the Sundesert Nuclear Plant, Units 1 & 2, 6 volumes.

Preliminary study submitted to the NRC and the ACRS to determine the suitability of the proposed Blythe site with respect to: (1) demography and geography; (2) hydrology; and (3) geology and seismology. This report was later made a part of a more complete study, the Preliminary Safety Analysis Report (PSAR).

Sections of the report of geologic interest are: (1) Section 2.4, Hydrologic Engineering; (2) Section 2.5, Geology and Seismology; (3) Section 3.7.1, Seismic Input; and (4) Section 1.6A, Responses to NRC Questions.

Faults deemed capable of seismic activity were used in the analysis of the Safe Shutdown Earthquake (SSE) and are discussed in Section 2.5.2-8 and graphically presented in Fig. 2.5-49. The SSE was chosen to be a seismic event of magnitude 8.5 located 35 miles west of the SNP site. This corresponds to the nearest approach of the Sand Hill fault, which is assumed to be a part of the San Andreas system.

The report contains nine tables and 93 figures.

75-12 Summers, K.V., Castleberry, J.S., and Crosby, J.W. III, 1975, Geophysical downhole investigation: in Fugro, 1975, Geotechnical Investigation, Parker Valley Alternate Site, SNP, Volume 3, Appendix 2.5A of Appendix A, 8 p. (75-3)

Results of downhole geophysical logging of boreholes at the Parker Valley Alternate Site for the Sundesert Nuclear Project. Natural gamma, neutron-epithermal neutron, neutron-gamma, and gamma-gamma logs were obtained for all of the borings, with spontaneous potential and resistivity for most borings. Three main geophysical units and five subunits used for cross-borehole correlation are described. Four of the unit/subunits are good correlating horizons and have no abrupt changes in elevation. The report contains 39 figures, mostly suites of logs and correlation sections.

76-1 Biehler, S.,1976, Interpretation of regional and local gravity and aeromagnetic data, Sundesert Nuclear Plant, Early Site Review Report, in the SNP-PSAR, Volume 5, Appendix 2.5K of Appendix A, 9 p. (75-11)

Results of regional (within a 35-mile radius) and local (within a 15-mile radius) gravity studies, and a regional aeromagnetic study for the SNP site to identify major subsurface faults. The regional Bouguer anomaly map encompasses the entire Salton Sea and El Centro 2° topographic map sheets (scale 1:250,000) and was contoured at a 5 milligal interval. Regional gravity trends of the Salton Trough, the Transverse Ranges, and the Sonoran Desert are discussed. The local Bouguer anomaly study was contoured at a 2 milligal interval.

A zone of steep gravity gradients greater than 10 milligal/mile indicates that faults bound the northeast and southwest sides of McCoy Mountains and the northwest side of Mule Mountains northwest of the SNP site. The gravity data also indicate a deep, 4,500 to 9,000 foot, northwest-trending graben extending northwestward from Blythe along McCoy Wash. The aeromagnetic study indicates a general northwest-southeast trend in the anomaly patterns. Only a slight east-west structure is indicated along the Chiriaco fault by the aeromagnetics, but the anomaly does not extend to Blythe.

The report contains four figures, three anomaly maps and a gravity profile extending from the McCoy Mountains northeastward to the Big Maria Mountains.

76-2 Bull, W.B., 1976, Tectonic geomorphology of the Sundesert Nuclear Plant Site region, Early Site Review Report: in the SNP-PSAR, Volume 6, Appendix 2.5O of Appendix A, 28 p. (75-11)

Geomorphic study analyzing the Quaternary tectonic activity of the mountain fronts and mountain-bounding faults that occur from southwestern Arizona to the Salton Trough. The mountain fronts and selected faults are classified into one of three types of tectonic activity: (1) active; (2) slightly active; or (3) inactive, based upon the relative rates of activity of four geomorphic processes. The geomorphic processes include: (1) uplift; (2) channel downcutting; (3) piedmont deposition; and (4) piedmont erosion. In addition, the following characteristics are used to classify the relative tectonic activity of the mountain fronts: (1) basin alluvium; (2) areal features of the mountain fronts (i.e., asymmetry of the ranges); (3) sinuosity of the mountain fronts (perimeter of the mountains/overall length); and (4) valley morphology (rate of stream valley narrowing above mountain front, valley-floor width/valley-height ratio, and valley-width/valley-height ratio). The faults classified as active by this scheme include the Blue Cut and Eagle Mountain Mine faults, which bound Eagle Mountain on the north and southeast, respectively. Other faults such as the Clemens Well, Salton Creek, Chiriaco, and Sheep Hole are classified as inactive.

The study concludes that the region surrounding the SNP site is tectonically inactive, characterized by a lack of major faulting during the Quaternary, except for minor faulting in the Blythe Graben. The report contains three tables and 23 figures.

76-3 Crowell, J.C., and Crowe, B.M., 1976, The tectonic history of southeasternmost California, Sundesert Nuclear Plant Early Site Review Report: in the SNP-PSAR, Volume 6, Appendix 2.5N of Appendix A, 39 p. (75-11)

Tectonic history of the region surrounding the SNP site, with special emphasis on Quaternary events. The tectonic history is divided into: (1) pre-late Mesozoic events; (2) late Mesozoic thrusting; (3) Transverse-Ranges structures; (4) Basin-Range structure; (5) San Andreas fault-Salton Trough system; and (6) minor tectonic features.

The study concludes that active faults of the San Andreas-Salton Trough lie no closer than 40 miles to the Sundesert site. Strong active displacement on the San Andreas ends in the vicinity of Niland, where tectonic displacement sidesteps along a spreading center to the Imperial fault. Dip-slip faults subparalleling the Salton Trough and the San Andreas fault within the Chocolate Mountains are related to widening of the trough rather than to transform faulting.

76-4 Fugro, Inc., 1976a, Report of 1852 Fort Yuma earthquake, Sundesert Nuclear Plant, Early Site Review Report: in SNP-PSAR, Volume 6, Appendix 2.5P of Appendix A, 41 p. (75-11)

A review of previously published reports and a compilation and analysis of the original accounts of the 1852 Fort Yuma earthquake. Documented are the exact date of the earthquake and strong evidence for the epicenter location. The report concludes that: (1) the Fort Yuma earthquake occurred on November 29, 1852 at approximately noon; (2) the epicenter was located in the Salton Trough, probably 25 to 50 miles southwest of Yuma, Arizona; and (3) the magnitude of the event is estimated to have been between 6 and 7.

The report includes six figures and one table. The figures include a chronology of reports, the 1852 geographic setting, locations of the earthquake effects, a generalized fault map, and an earthquake epicenter location map. The table is a comparison chart of the effects of earthquakes in the Imperial Valley-Colorado Delta area.

76-5 Fugro, Inc., 1976b, Supplemental gravity survey, Parker Valley Alternate Site, Sundesert Nuclear Project: in Fugro, 1975, Geotechnical Investigation, Parker Valley Alternate Site, SNP, Volume 3, 7 p. (75-3)

Geophysical study (Fugro, 75-3) of a "linear tightening" of the bedrock gravity contours which were previously (Fugro,75-3) interpreted to represent a possible fault. The additional gravity data indicate that the previously reported east-west gravity lineation cannot now be interpreted as a fault; this is due to a reduction in the steepness of the gravity gradient and to a lack of alignment between the surrounding bedrock faults and the gravity lineaments.

The report contains 11 figures, a location map, Bouguer gravity and residual gravity maps, a bedrock elevation map, and seven cross sections.

76-6 Murray, K., Bell, J., and Crowe, B., 1976, Stratigraphy and structure of the Orocopia, Chocolate and Cargo Muchacho Mountains, southeastern California, Sundesert Nuclear Plant, Early Site Review Report: in the SNP-PSAR, Volume 5, Appendix 2.5L of Appendix A, 32 p. (77-3)

Results of a detailed geologic investigation to describe the geology and structural features of the region with attention focused on the relationship between the San Andreas fault system and faults within the mountains. The study incorporates previous work of numerous authors and detailed analyses of LANDSAT and black and white aerial photographs. Ground investigations were concentrated on areas of known or observed faulting.

The report concludes that: (1) the northwest-trending Tertiary and Quaternary faults in the Chocolate Mountains and southeast of the Salton Trough cannot be associated tectonically with the San Andreas fault system; (2) the Clemens Wells fault cannot be traced beyond the Orocopia Mountains, approximately 48 miles from Blythe; (3) the northwest-trending faults in the mountain southeast of Salton Creek are not capable, but those in the alluvial fans on the southwest flank of the mountains may be capable and related to the Salton Trough subsidence; and (4) the Salton Creek fault,38 miles from SNP, is 12 miles long and is considered capable.

The report contains ten figures which include a Mojave-Gila Deserts alluvial units correlation chart, an index of maps, a previous-studies location map, a location map of age-dated samples, stratigraphic columns, and general (1:125,000) and detailed (1:62,500) geologic maps.

76-7 Shlemon, R.J., and Purcell, C.W., 1976, Geomorphic reconnaissance, southeastern Mojave Desert, California and Arizona, Sundesert Nuclear Plant, Early Site Review Report: in SNP-PSAR, Volume 6, Appendix 2.5M of Appendix A, 28 p. (77-3)

Geomorphic study of the alluvial deposits within a 35-mile radius of the SNP site. The purpose of this study was to map the extent of the alluvium and to determine an approximate age of its various classes. The study concludes that at least three classes of alluvium, and occasionally an older fourth unit, can be delineated.

The alluvium is primarily of Quaternary age, although some may be as old as late Tertiary. Climatic changes probably controlled the regional alluviation, with tectonic pulses superimposed. The effects of "Wisconsin" and possibly the "Illinoian" epochs of pluviality and the criteria used for estimating ages of alluvial units in the southeastern Mojave Desert are discussed.

The report contains 14 figures, a location map, an alluvial deposits map (1:250,000) and 12 photos of various alluvial units.

76-8 Summers, K.V., Castleberry, J.S., and Crosby, J.W., III, 1976, Geophysical downhole investigation, Sundesert Nuclear Plant, Early Site Review Report, in the SNP-PSAR, Volume 3, Appendix 2.5A of Appendix A, 8 p. (77-3)

Interpretations of downhole geophysical logs from the SNP site. Natural gamma, neutron-epithermal neutron, neutron-gamma, gamma-gamma, and fluid temperature logs were obtained for each drillhole. Spontaneous potential and resistivity logs were taken in selected drillholes. Seven distinctive horizons are defined and discussed in the report. Elevation changes are noted, but no consistent anomalies are evident. The report contains 47 figures, mostly suites of logs and correlation sections.

76-9 Wirth Associates, 1976a, Phase one regional studies, Sundesert Nuclear Project, Transmission System Environmental Study, 360 p.

First report of a two-phase environmental analysis program conducted for the proposed Sundesert Nuclear Project Transmission System and covering most of southern California. The report is divided into seven sections, Section 2 of which contains geotechnical information. The geotechnical section is a 27-page review by Dames and Moore of the environmental impacts associated with construction and operation of the transmission line system. These impacts are: (1) seismic activity; (2) slope stability; (3) erosion potential; (4) sand dune and windblown sand; (5) expansive soils; (6) subsidence, liquefaction, hydrofraction, and soil/rock collapse; (7) flood hazard and debris flow; and (8) rare or unique geologic features. Faults with the greatest potential impact on the proposed transmission lines are the San Andreas, San Jacinto and Elsinore.

Six multicolored geotechnical maps are presented at a scale of 1:1,000,000 along with four tables listing major earthquakes, definitions of sensitivity levels and a final sensitivity analysis.

76-10 Wirth Associates, 1976b, Phase two corridor studies, Sundesert Nuclear Project, Transmission System Environmental Study, 360 p.

Second report of a transmission-line corridor study conducted for the proposed Sundesert Nuclear Project. The purpose of these studies was to assess the environmental impact of the construction and operation of the 500 KV transmission lines. The study reviewed in greater detail the corridors identified in Phase 1 (Wirth, 76-9).

Section 2 of the report contains geotechnical data and a discussion of geologic hazards similar to those in the earlier report. The report indicates that the greatest impact on the geologic environment would be from erosion. Northwest-trending faults with a potential impact on the transmission line include: (1) San Andreas system; (2) San Jacinto system; (3) Whittier-Elsinore fault.

One table of geotechnical hazards and eleven multicolored figures (scale 1:1,000,000) are presented in section 2.

77-1 Crosby, J.W., III, and Smith, B., 1977, Borehole geophysical logs, Sundesert Nuclear Plant, Units 1 & 2; in the SNP-PSAR, Volume 4, Appendix 2.5E, 2 p. (77-3)

The results of a borehole geophysical investigation conducted at the SNP site for Units 1 and 2. Natural gamma, point resistance, spontaneous potential, and caliper logs were obtained. The data from this study were compared to previous borehole geophysical logging studies done at the SNP site (Summers et al., 75-12) and indicated that no fault displacements are evident from data in the borehole logs. The report contains 28 figures, mostly correlation profiles and a complete suite of logs.

77-2 Fugro, Inc., 1977, Foundation Engineering Report, Power Plant Structures, Units 1 and 2, Sundesert Nuclear Project, 80 p.

Results of a site-specific foundation study for the power block of the SNP, Units 1 and 2. This study presents a description of the site's subsurface geologic units and a dynamic analysis of the subsidence and liquefaction potential using four selected earthquakes scaled to the 0.35g Safe Shutdown Earthquake. The report contains ten tables of soils properties and 75 figures, including eight subsurface profiles.

77-3 San Diego Gas and Electric Co., 1977, Preliminary Safety Analysis Report for the Sundesert Nuclear Power Plant, Units 1 and 2, 23 volumes.

Preliminary engineering and geotechnical report for the siting of a nuclear generating station near Blythe, California. Section 2 of the report contains discussions of: (1) geography - demography; (2) nearby facilities; (3) meteorology; (4) hydrologic engineering; and (5) geology, seismology, and geotechnical engineering. Also included is a six-volume appendix containing the Early Site Review Report (ESRR) by San Diego Gas and Electric Co. (75-11). The ESRR is referred to extensively for the geologic and seismologic discussions.

The Safe Shutdown Earthquake (SSE) for the site was selected to be a M 8.5 event on the Sand Hills fault of the San Andreas fault system, 35 miles west of the site. The SSE level of ground shaking was calculated by normalizing the NRC design response spectra to a 0.35g and 0.233g horizontal and vertical acceleration, respectively.

77-4 Wirth Associates, 1977, Devers to Rainbow Studies, Sundesert Nuclear Project Transmissions System Environmental Study, 785 p.

Study of a specific transmission line corridor for the Sundesert Nuclear Project which would extend from the Devers Substation near Desert Hot Springs, California, west through San Gorgonio Pass and thence southward to Rainbow Substation in northern San Diego County.

Section 2 of the report, 39 pages long, is divided into two parts. The first part is a general overview of the environmental conditions, the second an assessment of impact by geotechnical features. The geotechnical hazards evaluated are similar to those discussed in Phase 1 and 2 of the SNP Transmission Line Regional Studies (Wirth, 76-9, 76-10). The impact and seismic hazard from the San Andreas, San Jacinto and Whittier-Elsinore faults are briefly discussed with references to specific sections of the transmission lines.

Ten multicolored figures are included (scale 1:280,000±) which present maps of specific geotechnical hazards, a summary map, and the levels of environmental impact. Three tables summarize the geotechnical features, hazard potential, and impact level.

PART III

ANNOTATED BIBLIOGRAPHY OF ENGINEERING GEOLOGY REPORTS PREPARED TO SATISFY THE ALQUIST-PRIOLO SPECIAL STUDIES ZONES ACT IN SOUTHERN CALIFORNIA

by

D. L. Lamar and P. J. Scrivner

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ILLUSTRATIONS

ILLUSTRATIONS (cont'd.)

INTRODUCTION

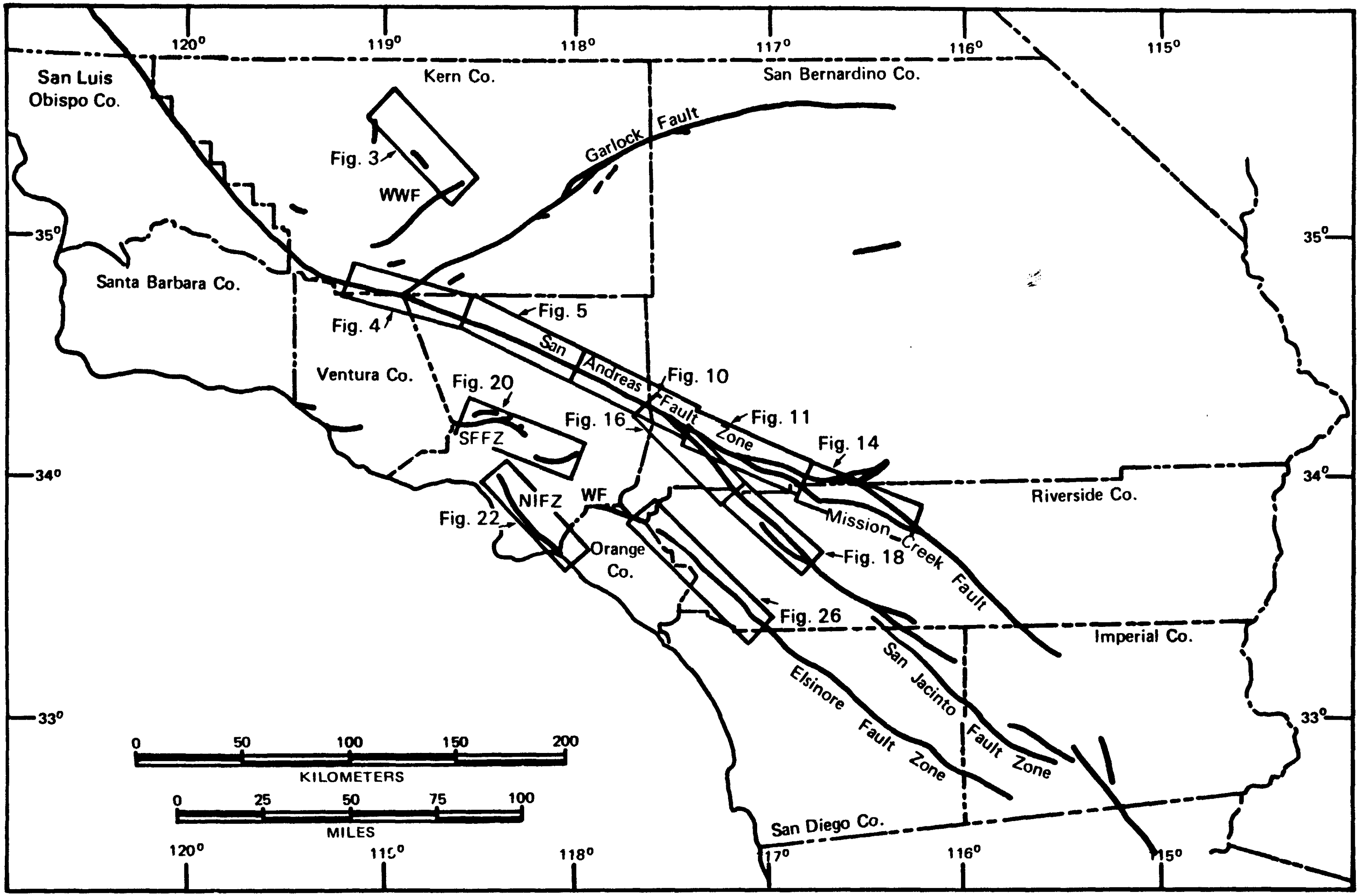
This annotated bibliography lists reports prepared to satisfy the Alquist-Priolo Special Studies Zones Act (AP); these reports include detailed trench logs across the following faults in southern California: San Andreas, San Jacinto, San Fernando, Inglewood-Newport, Whittier-Elsinore, Garlock, and White Wolf (Fig. 1).

Approach

Reports on file with the California Division of Mines and Geology (CDMG) and individual counties, cities and consultants were reviewed. It was found that many reports available locally have not been filed with the CDMG and, conversely, many reports filed with the CDMG are difficult to obtain locally because old files have been retired. For some jurisdictions, such as Riverside County, it was relatively easy to identify all appropriate reports; in others the AP reports were filed with many other engineering geology reports and difficult to separate. Initially it was planned to make the bibliography comprehensive and include all AP reports for southern California, but the volume of reports and time required to comb many local files made this impossible. It was also found that many AP studies did not include trenching and offered little or no new information; most of these were omitted. We attempted to include all of the most significant reports which describe either trenches with faulting or trenches located across a fault. We would appreciate information on such additional reports overlooked during our search or accomplished since for inclusion in possible revised editions.

Acknowledgments

The patience and cooperation of the following individuals in allowing access to their files, essential for the completion of this project, are gratefully acknowledged: Robert Sydnor and Earl Hart, California Division



NIFZ: Newport-Inglewood fault zone; SFFZ: San Fernando fault zone; WF: Whittier fault; WWF: White Wolf fault.

Fig. 1 - Principal faults in southern California covered by Alquist-Priolo Special Studies Zones (Hart, 1980) and outlines of detailed maps.

of Mines and Geology; Anthony Brown, Riverside County; Michael Smith and Mark Spikerman, Buena Engineers; Arthur Keene, David Poppler, Robert Smith, and James Shuttleworth, Los Angeles County Engineer; Lyle Timberlake, Kern County Public Works; Dennis Evans, Consultant to City of Signal Hill; Xeno Colazas and Larry Olson, City of Long Beach; Alrick Stenzel, City of Huntington Beach; and Cheri Leslie, Culver City Redevelopment Agency. We also thank Earl Hart, Richard Moore and Merl Smith, California Division of Mines and Geology, for loaning originals of maps and providing other materials. The report was reviewed by Drs. Paul M. Merifield and Mason L. Hill. The manuscript was typed by Miss Laurie Auerbach, and Miss Melanie Kissee and Miss Sandra Petitjean drafted the illustrations.

ALQUIST-PRIOLO SPECIAL STUDIES ZONES ACT (AP) REPORTS BIBLIOGRAPHY

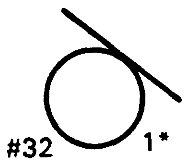
Locations of the study areas have been plotted on our file copies of the State of California Special Studies Zones 7-1/2 minute quadrangles prepared by the California Division of Mines and Geology, and are shown on smaller scale strip maps along individual fault zones (Fig. 1). The strip maps and bibliography indicate the appropriate 7-1/2 minute quadrangle. The reports on the study areas are identified on the maps and in the bibliography by numbers for each city and county. Reports for Riverside County are identified by the number assigned by the County geologist (Anthony Brown, personal communication, 1982). For other jurisdictions which did not have applicable numbering systems we have assigned the numbers (shown in parentheses) and included a brief site description. Reports on file with the California Division of Mines and Geology (CDMG) are identified by the CDMG number (Lo and Moreno, 1980, and personal communication, Earl Hart, 1983). The date of the report, investigating firm or geologist and project number, if any, are also included for identification.

The results of the investigation are summarized in a brief paragraph which indicates approximate depth(s) of trench(es), name of fault zone, name and age of rock units exposed in trench(es), units displaced and nature of

Potentially active faults shown on U.S. Geological Survey 7½ minute quadrangle with State of California Alquist-Priolo Special Studies Zones (AP) delineated by California Division of Mines and Geology.

Other faults referred to in engineering geology reports.

1* Physiographic evidence of faulting referred to in report.



Open circle indicates location of report with no trenching identified by Riverside County number (#32). Fault located to northeast on basis of physiographic evidence (1*).

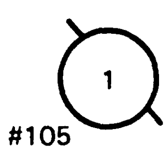
Ages of units reported in trenches:

1 <10,000 years old, Holocene alluvium.

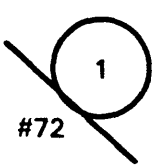
2 upper Pleistocene, 10,000 - 500,000 years old, older alluvium, alluvial terrace deposits, and Pauba Formation (Kennedy, 1977).

3 lower Pleistocene, 500,000 - 3,000,000 years old, Temecula Arkose (Kennedy, 1977).

4 pre-Pleistocene, >3,000,000 years old.

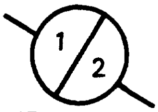


Number within circle indicates trench(es) dug where number indicates age(s) of units reported using the above key. This symbol indicates no evidence of faulting in Holocene alluvium (1) across fault and no older units penetrated by test trench(es).



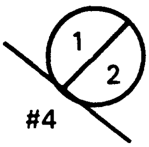
As above, except trench located northeast of fault.

Fig. 2 - Explanation of representative symbols for detailed maps (Figs. 3-26) showing locations of engineering geology reports.



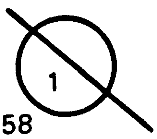
#5

No evidence of faulting in older alluvium (2) overlain by Holocene alluvium (1) in trench(es) across fault.



#4

As above, except trench located northeast of fault.



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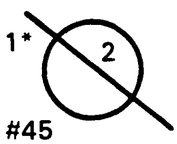
Line through circle indicates fault observed in trench cutting Holocene alluvium (1).



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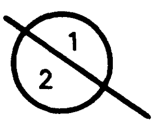
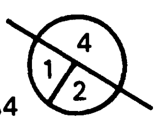
Physiographic evidence of faulting (1*) and faulted older fan deposits (2) in trench.



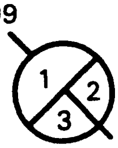
Holocene alluvium (1) faulted against Pauba Formation (2) in trench.



#34

Older alluvium (2) overlain by Holocene alluvium (1) faulted against pre-Pleistocene (4) bedrock in trench(es) across fault.

#199



Temecula Formation (3) faulted against Pauba Formation (2); line at right angle to fault and interruption of fault line indicates older faulted rock units are overlain unconformably by unfaulted Holocene alluvium (1).

Fig. 2 (continued)

faulting, if any, and other evidence of faulting. The results are also summarized graphically on the detailed maps (Figs. 3-26) by symbols developed for this project and defined in Fig. 2. These symbols, modified from a similar scheme presented by Ziony et al. (1973), allow quick determination of the results and locations of individual investigations identified by county or city number. The location of each report is shown by one or more circles which show diagrammatically the ages of rock units exposed and whether the units are faulted. A blank circle indicates no trenching. A number "1" with an asterisk outside the circle means that physiographic evidence of faulting is present. The numbers inside the circle represent ages of earth materials exposed in the trenches (Fig. 2).

Lines through circles as extensions of faults on the map indicate that the fault was exposed in the trench(es). Lines parallel to the fault through the circle indicate that subsidiary faults were observed in the trench(es). A circle located adjacent to the fault line shows position of the trench(es), i.e., northeast or southwest of fault. Lines between numbers in the circle at right angles to the adjacent fault represent depositional contacts observed in the trench. Figure 2 shows examples of most of the symbols illustrated on the detailed maps. Where more than one trench was logged with different results, data from the trench indicating the greatest earthquake hazards are summarized in the symbol.

Individual fault zones are discussed from north to south; the strip-maps and report summaries generally run from northwest to southeast.

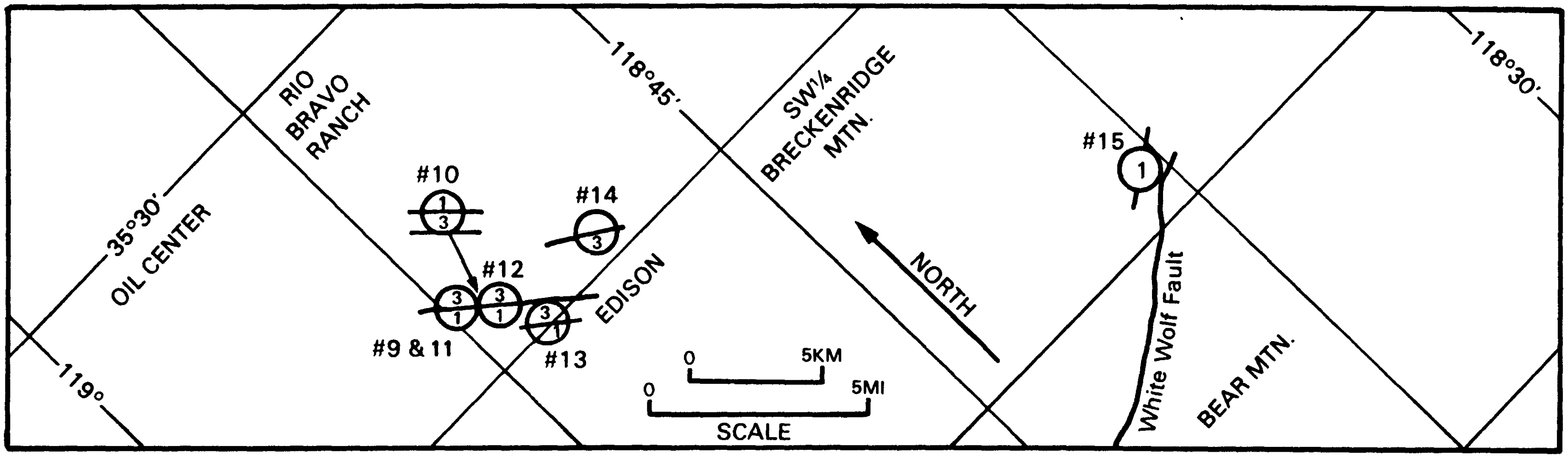


Fig. 3 - Locations of engineering geology reports along White Wolf and other faults that broke during the 1952 Kern County earthquake by Kern County number. See Fig. 1 for location and Fig. 2 for explanation of symbols.

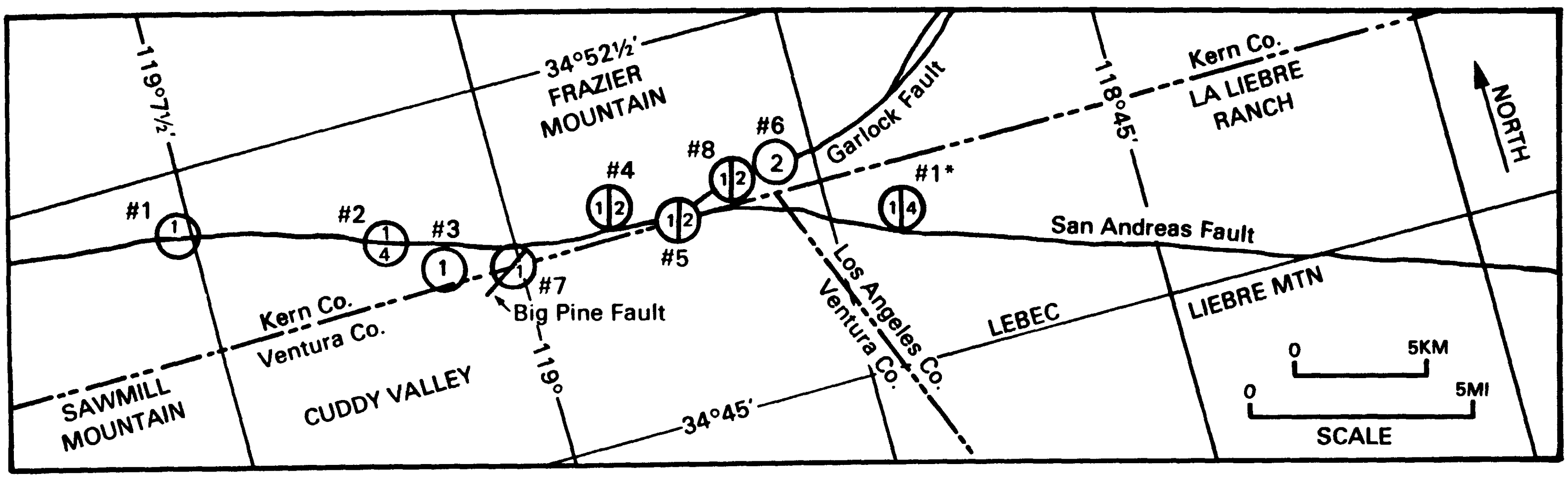


Fig. 4 - Locations of engineering geology reports along San Andreas, Big Pine and Garlock faults between Cuddy Valley and Liebre Mountain areas by Kern and Los Angeles (*) County numbers. See Fig. 1 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
1952 Earthquake Faults, Kern County (Fig. 3)						
Kern	(9)	950	Rio Bravo Ranch	10/78	William H. Park	Parcel Map No. 3040 Parcel 2
			Five trenches, 6 to 7 feet deep, across trace of 1952 Kern County earthquake rupture (CDMG, 1967ww). Trenches 1,4: faulting in Plio-Pleistocene age clay, sand and gravel deposits and overlying Holocene soil profile (Qp and Qal (?) of Smith,. 1964).			
Kern	(10)	263	Rio Bravo Ranch	4/78 (supersedes 7/76 report)	William H. Park	Parcel Map No. 3604
			Four trenches, 6 to 7 feet deep, northeast of trace of 1952 Kern County earthquake rupture (CDMG, 1976ww). Trench 1: normal faulting in gray and brown sandstones (Qp of Smith, 1964). Trench 3,4: normal faulting in white to gray sandstone and overlying "topsoil" (Qp and Qal (?) of Smith, 1964).			
Kern	(11)	1000	Rio Bravo Ranch	4/79	William H. Park	Parcel Map No. 5427 Parcel 1
			Two trenches, 7 to 10 feet deep, across trace of 1952 Kern County earthquake rupture (CDMG, 1976ww). Trenches 1,2: normal faulting with minimum vertical offset of 8 feet, in Plio-Pleistocene Kern River Series and clays, sands and gravels of Holocene age (Qp and Qal (?) of Smith, 1964).			
Kern	(12)	887	Rio Bravo Ranch	11/78	William H. Park	Parcel Map No. 4646 Parcels A and B
			Four trenches, 5 to 7 feet deep, across trace of 1952 Kern County earthquake rupture (CDMG, 1976ww). Trenches 1,3,4: normal faulting in Plio-Pleistocene Kern River Series and overlying clays, sands and gravels of Holocene Age (Qp and Qal (?) of Smith, 1964).			
Kern	(13)	1348	Rio Bravo Ranch	8/77	William H. Park	Parcel Map No. 3044 Parcel 4
			One trench, 6 feet deep, southwest of trace of 1952 Kern County earthquake rupture (CDMG, 1976ww). Normal faulting, with minimum estimated vertical displacement of 20 feet, in Plio-Pleistocene continental rocks and overlying Holocene soil (Qp and Qal (?) of Smith, 1964).			
Kern	(14)	1030	Rio Bravo Ranch	9/78	William H. Park	Parcel Map No. 4731
			Four trenches, 5 feet deep, across trace of 1952 Kern County earthquake rupture (CDMG, 1976ww). Trench 1: faulting in Plio-Pleistocene age sand and gravel deposits (Qp of Smith, 1964).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
1952 Earthquake Faults, Kern County (Fig. 3)						
Kern	(15)		SW 1/4 Breckenridge Mountain	6/79	William H. Park	Cummings Property Parcel Map No. 5266
			One trench, 7 feet deep, across subsidiary fault northwest of main trace of White Wolf fault (CDMG, 1976vv). No faulting in arkosic pebbly sand, silt and clay of Holocene age (Qal (?) of Smith, 1964).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Garlock and Big Pine Faults, Kern County (Fig. 4)						
Kern	(6)	663	Frazier Mtn.	8/19/77	John D. Merrill	Project #74088
			Four trenches, maximum depth 8-1/2 feet, across trace of Garlock fault (CDMG, 1974kk). Trenches 1-4: no faulting in Pleistocene terrace deposits (Qt of Jennings and Strand, 1969).			
Kern	(7)	72	Cuddy Valley	2/75	Bryant-Park and Associates, Inc.	Seventh Day Adventist Church and School Site, Lake of the Woods
			One trench, 6 feet deep, across Big Pine fault (CDMG, 1974jj). Normal faulting with 9 inches of vertical displacement in Holocene alluvium (Qal of Jennings and Strand, 1969).			
Kern	(8)	1429	Frazier Mtn.	6/18/81	Geoplan, Inc.	Project #15504
			Fourteen trenches, average depth 6 feet, across and south of trace of Garlock fault (CDMG, 1974kk). Trenches across Garlock fault show no faulting in fanglomerate or overlying residual soil (Qt and Qal of Jennings and Strand, 1969). Trench 14, south of Garlock fault, exposed subsidiary fault in granite, but does not displace overlying residual soil (gra and Qal of Jennings and Strand, 1969).			
San Andreas Fault, Kern County (Fig. 4)						
Kern	(1)	38	Sawmill Mtn.	03/4/70 10/22/71	F. Beach Leighton	Mill Potrero Development Area, Project #1620
			Seven trenches and thirty-eight pits, maximum depth 12 feet, across San Andreas fault (CDMG, 1974ll). Pits 2,3,8,10,12: "Ancestral soil zones, recent alluvium and slopewash debris are faulted and contorted within active trace of fault" (Qal of Jennings and Strand, 1969).			
Kern	(2)	214	Cuddy Valley	12/16/71	F. Beach Leighton and Associates, Inc.	Project #1652
			Seven test pits, unspecified depth, across San Andreas fault (CDMG, 1974jj). Pits 1-4: Highly sheared bedrock and recent faulting in older and Holocene alluvium (m-ls, ms, Qt and Qal of Jennings and Strand, 1969). Pits 5 and 7: faulted bedrock, but no faulting in overlying Holocene alluvium (Qal of Jennings and Strand, 1969).			
Kern	(3)	18	Cuddy Valley	10/25/74	Joseph A. Johnson	Lot 96, Tract 3348
			One trench, 5-1/2 feet deep, south of main trace of San Andreas fault (CDMG, 1974jj). No faulting in Holocene alluvium (Qal of Jennings and Strand, 1969).			

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San Andreas Fault, Kern County (Fig. 4)						
Kern	(4)	51	Frazier Mtn.	1/75	Bryant-Park and Associates, Inc.	Lot Nos. 7,8,9,10, Block 18, Tract 4, Frazier Mtn. Park
			One trench, 6 feet deep, north of San Andreas fault (CDMG, 1974kk). No faulting in "granitic fanglomerate" or overlying "pebbly, topsoil mantle" (Qt and Qal of Jennings and Strand, 1969).			
Kern	(5)	1466	Frazier Mtn.	1/25/82	Geoplan, Inc.	Project #15687
			Two trenches, maximum depth 6-1/2 feet, across trace of San Andreas fault (CDMG, 1974kk). Trenches 1,2: no faulting in "dark fanglomerate" or overlying Holocene alluvium (Qt and Qal of Jennings and Strand, 1969).			

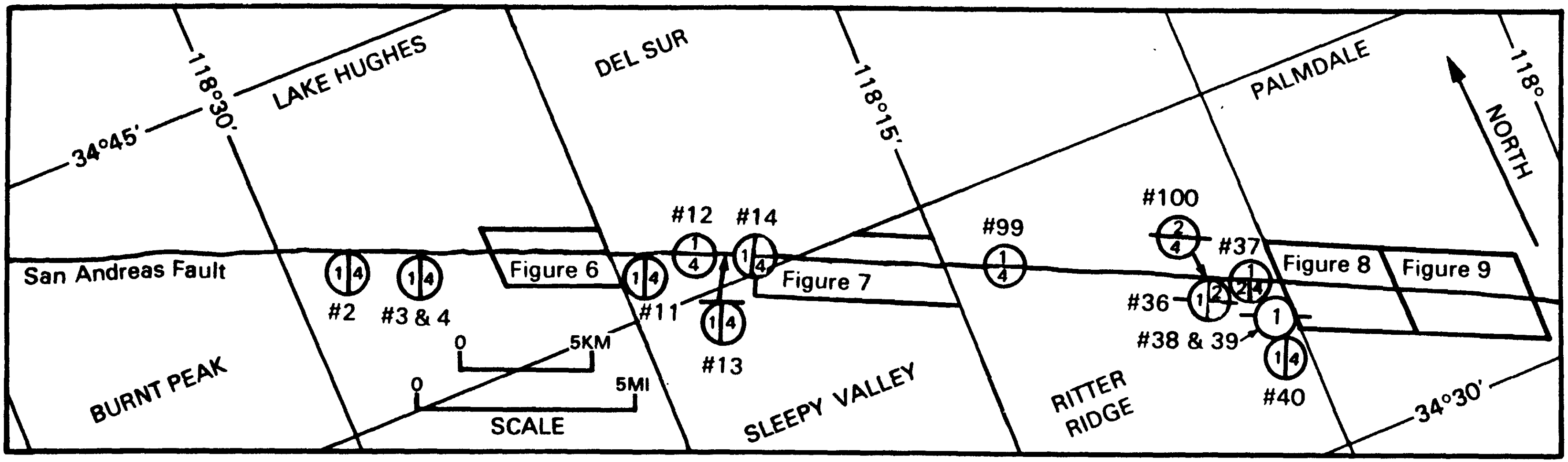

Fig. 5 - Locations of engineering geology reports along San Andreas fault between Lake Hughes and Palmdale areas by Los Angeles County number. See Fig. 1 for location and Fig. 2 for explanation of symbols.

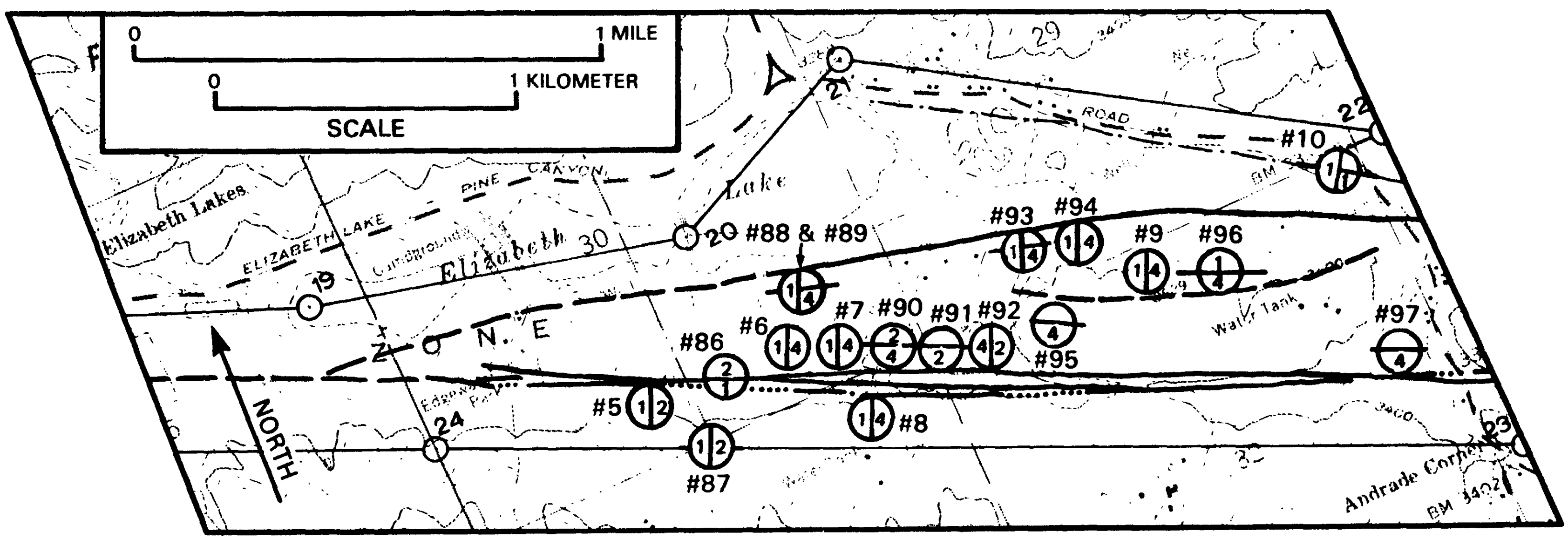

Fig. 6 - Locations of engineering geology reports along San Andreas fault in Lake Hughes area by Los Angeles County number. See Fig. 5 for location and Fig. 2 for explanation of symbols.

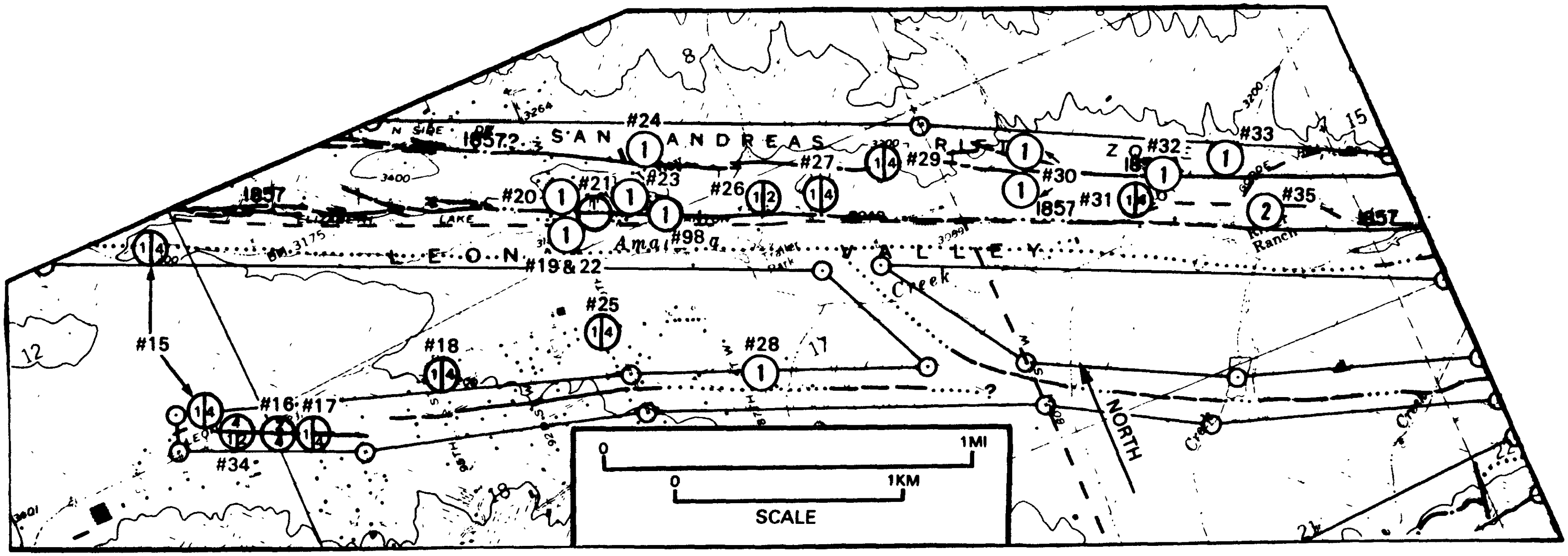

Fig. 7 - Locations of engineering geology reports along San Andreas fault in Sleepy Valley area by Los Angeles County number. See Fig. 5 for location and Fig. 2 for explanation of symbols.

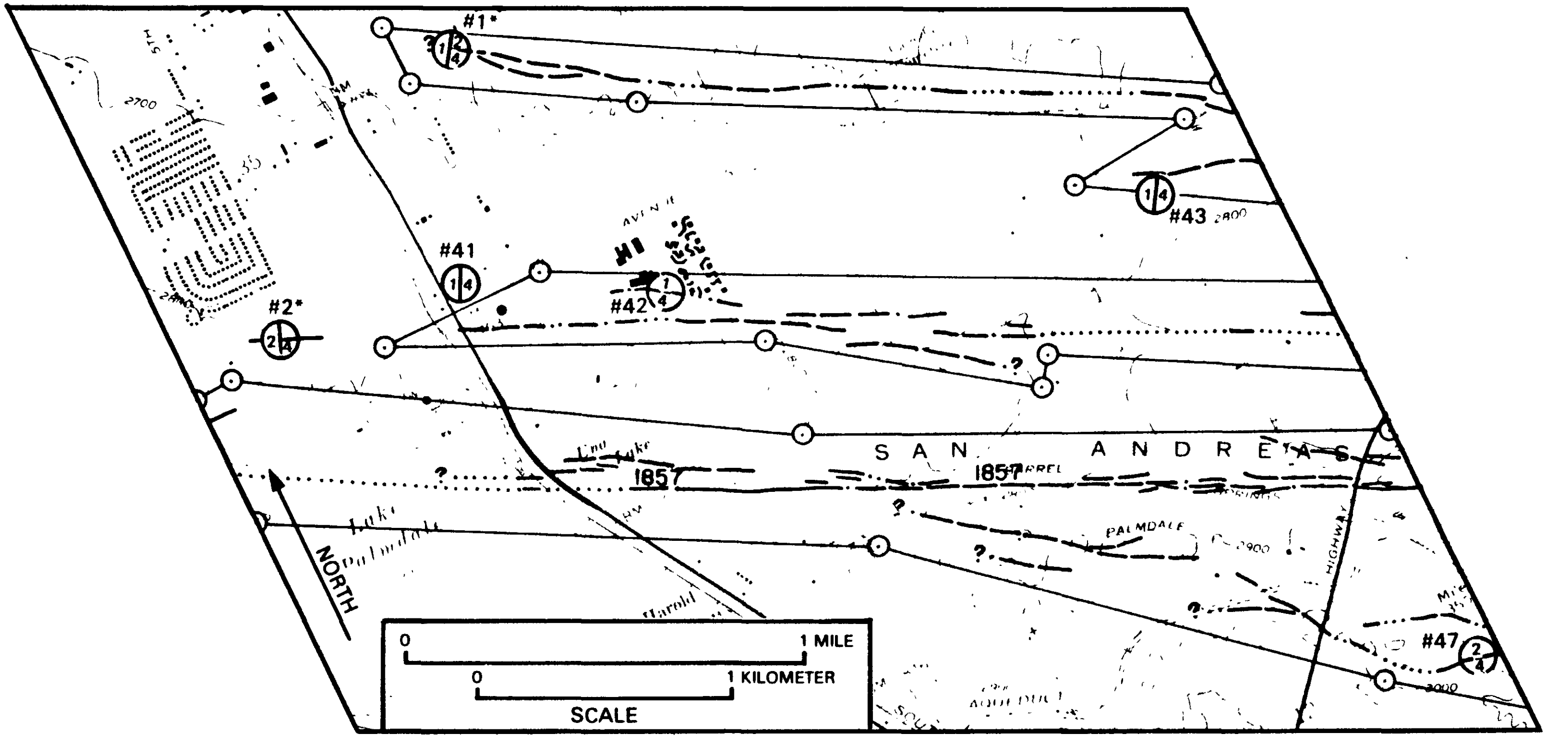

Fig. 8 - Locations of engineering geology reports along San Andreas fault in western Palmdale area by Los Angeles County and City of Palmdale (*) numbers. See Fig. 5 for location and Fig. 2 for explanation of symbols.

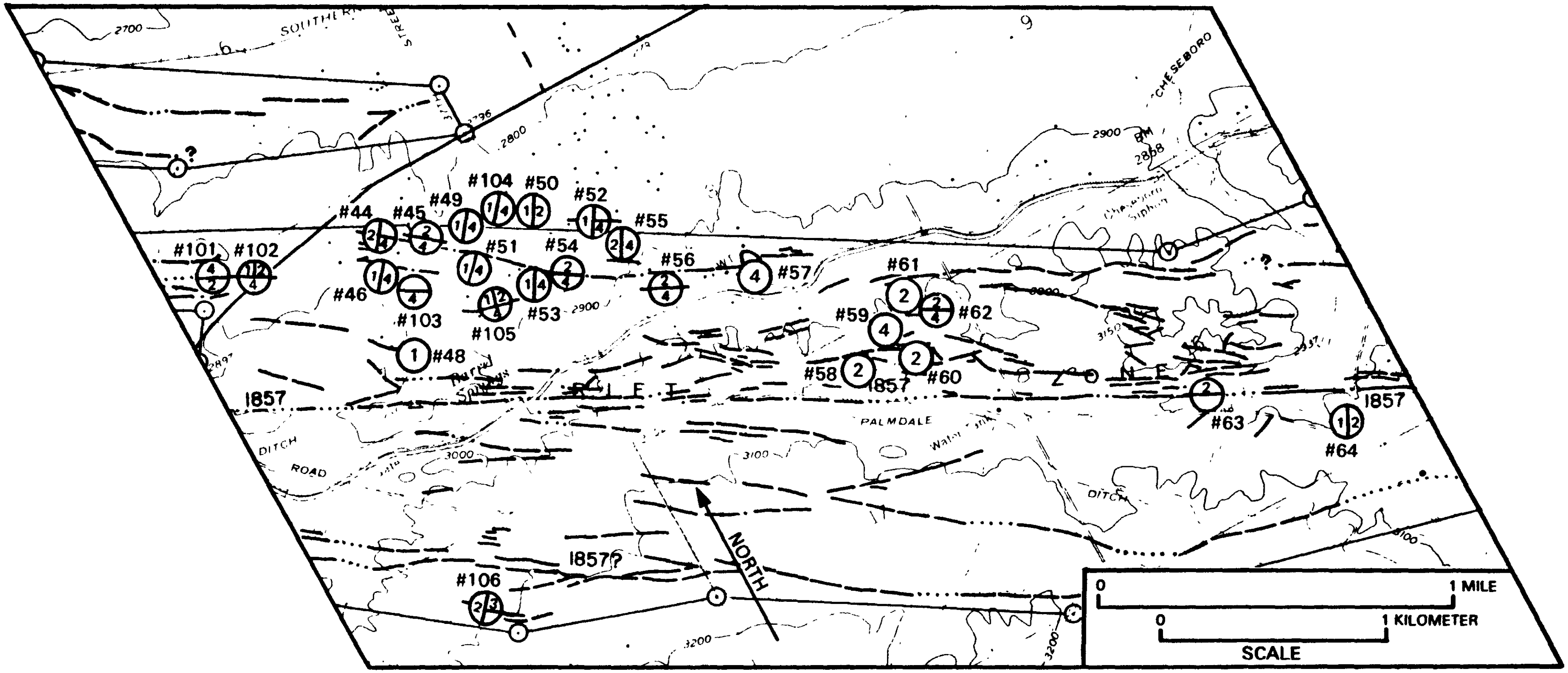

Fig. 9 - Locations of engineering geology reports along San Andreas fault in eastern Palmdale area by Los Angeles County number. See Fig. 5 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(1)	1241	Lebec	9/9/80	Michael V. Smith	File #8027-1. 38101 Gorman Post Road, Gorman.
			One trench, maximum depth 6 feet, northeast of San Andreas fault (CDMG, 1974t). No faulting in Plio-Pleistocene Hungry Valley Formation or Holocene alluvium (Puc and Qal of Jennings and Strand, 1969).			
Los Angeles	(2)	-	Lake Hughes	2/19/75 supplement: 5/03/78	Buena Engineers, Inc.	Job #B-1330-L01
			Three trenches and one pit, 6-12 feet deep, southwest of main trace of San Andreas fault (CDMG, 1974x). No faulting in quartz monzonite bedrock, fanglomerate or Holocene alluvium (ggd(?), Qf and Qal of Beeby, 1979).			
Los Angeles	(3)	-	Lake Hughes	5/4/72	Earl R. Morley, Jr.	Phase I, Forest Lakes Mobile Home Estates, Munz Lake.
			One trench, 15 feet deep, southwest of main trace of San Andreas fault (CDMG, 1974x). Jointing and shearing in granitic bedrock, but no faulting in Holocene alluvium (dgn and Qal of Beeby, 1979).			
Los Angeles	(4)	-	Lake Hughes	1/18/70	James E. Slosson and Associates	Proposed Manzanita Hills Village Mobile Home Park, vicinity of Lake Hughes.
			Six trenches, 4-9 feet deep, southwest of main trace of San Andreas fault (CDMG, 1974x). Trenches 2,3: fractured and sheared granodiorite bedrock, but no faulting in Holocene alluvium or fill material (ggd, Qal and af of Beeby, 1979). Trenches 5,6: highly weathered, fractured and sheared granodiorite with well-developed joints. Fault location approximately determined by changes in intensity of fracturing, shearing and jointing in granodiorite bedrock (ggd of Beeby, 1979).			
Los Angeles	(5)	1410	Lake Hughes	9/2/81	Geoplan, Inc.	Project #15578. 15530 West Alps Drive, Elizabeth Lake.
			One trench, unspecified depth, southwest of main trace of San Andreas fault (CDMG, 1974x). No faulting in older alluvial fan deposits or Holocene alluvium (Qof and Qal of Beeby, 1979).			
Los Angeles	(6)	1181	Lake Hughes	6/26/80	Michael V. Smith	File #8021-1. 42818 Apollo Drive, Elizabeth Lake.
			Two trenches, 6 feet deep, northeast of main trace of San Andreas fault (CDMG, 1974x). Trenches 1,2: No faulting in buff arkose or clay shale members of Pliocene Anaverde Formation or residual soil (Tab, Tas and Qpa of Beeby, 1979).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(7)	1425	Lake Hughes	10/26/81	Buena Engineers, Inc.	Job #B-1900-L01. Lot 44, Tract 19278, Apollo Drive, Elizabeth Lake.
			One trench, 6 1/2 feet deep, northeast of main trace of San Andreas fault (CDMG, 1974x). No faulting in buff arkose or clay shale member of the Pliocene Anaverde Formation or residual soil (Tab, Tas and Qal of Beeby, 1979).			
Los Angeles	(8)	1055	Lake Hughes	10/29/79	Michael V. Smith	File #7957-1. 14609 Flintstone Drive, Elizabeth Lake.
			One trench, 6 feet deep, southwest of main trace of San Andreas fault (CDMG, 1974x). No faulting in clay shale member of Pliocene Anaverde Formation or residual soil (Tas and Qal of Beeby, 1979).			
Los Angeles	(9)	25	Lake Hughes	7/27/74	William Waisgerber and Associates	Ref. No. 74183 L 053 E. Lot 77, Tract 24829, Clydesdale Road, Elizabeth Lake.
			One trench, maximum depth 5 feet, northeast of main trace of San Andreas fault (CDMG, 1974x). No faulting in arkosic sandstone bedrock or Holocene alluvium (Tab and Qsw of Beeby, 1979).			
Los Angeles	(10)	1377	Lake Hughes	8/7/81	Buena Engineers, Inc.	Job #B-1893-L01. 14370 Elizabeth Lake Road, Elizabeth Lake.
			Three trenches, maximum 8 feet deep, across subsidiary fault of North Branch San Andreas fault (CDMG, 1974x). Trench 2: faulting in Holocene fan deposits, but no faulting in overlying Holocene alluvium (Qf and Qal of Beeby, 1979).			
Los Angeles	(86 B*)	-	Lake Hughes	11/4/82	Buena Engineers, Inc.	Job #B-2014-L01
			Three trenches, 6 to 15 feet deep, across main trace of San Andreas fault (CDMG, 1974x). Trench 1: faulting in older alluvium and ponded alluvium (Qoa and Qpa of Beeby, 1979).			
Los Angeles	(87 B*)	-	Lake Hughes	6/18/81	Buena Engineers, Inc.	Job #B-1873-L01
			One trench, maximum depth 15 feet, across unnamed subsidiary fault southwest of main trace of San Andreas fault (Beeby, 1979). No faulting in older or Holocene fan deposits (Qof and Qal of Beeby, 1979).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(88 B*)	-	Lake Hughes	6/25/82	Buena Engineers, Inc.	Job #B-1986-L01
			Two trenches, 5 to 10 feet deep, northeast of main trace of San Andreas fault (CDMG, 1974x). Trench 1: faulting in clay shale member of Pliocene Anaverde Formation, but no faulting in overlying residual soil (Tas of Beeby, 1979).			
Los Angeles	(89)	-	Lake Hughes	12/12/79	Michael V. Smith	File #7963-3
			Two trenches, 6 feet deep, northeast of San Andreas fault (CDMG, 1974x). Trench 1: faulting in buff arkose and clay shale member of Pliocene Anaverde Formation. No faulting in overlying residual soil (Tab and Tas of Beeby, 1979).			
Los Angeles	(90 B*)	-	Lake Hughes	12/3/81	Buena Engineers, Inc.	Job #B-1920-L02
			Two trenches, maximum depth 9 feet, northeast of main trace of San Andreas fault (CDMG, 1974x). Trenches 1,2: possible faulting in buff arkose member of Pliocene Anaverde Formation and older alluvium (Tab and Qoa of Beeby, 1979).			
Los Angeles	(91)	-	Lake Hughes	10/12/81	Buena Engineers, Inc.	Job #B-1918-L01
			Three trenches, 5 to 8 feet deep, across subsidiary faults northeast of main trace of San Andreas fault (Beeby, 1979). Trenches 1,3 (Lots 48,50): faulting in older alluvium (Qoa of Beeby, 1979).			
Los Angeles	(92 B*)	-	Lake Hughes	3/25/82	Buena Engineers, Inc.	Job #B-1940-L01
			Two trenches, 5 feet deep, across subsidiary fault northeast of main trace of San Andreas fault (Beeby, 1979). Trenches 1,2: no faulting in buff arkose member of Pliocene Anaverde Formation, older alluvium or residual soil (Tab and Qoa of Beeby, 1979).			
Los Angeles	(93)	-	Lake Hughes	10/20/81	Buena Engineers, Inc.	Job #B-1930-L01
			Four trenches, 5 feet deep, northeast of main trace of San Andreas fault (CDMG, 1974x). Trench E-1: possible faulting in red arkose member of Pliocene Anaverde Formation (Tar of Beeby, 1979). Trench T-2: possible faulting in buff arkose and clay shale members of Pliocene Anaverde Formation. No faulting in residual soil (Tab and Tas of Beeby, 1979).			
Los Angeles	(94)	1452	Lake Hughes	9/22/81	Buena Engineers, Inc.	Job #B-1913-L01
			One trench, 7 feet deep, southwest of strand of San Andreas fault (CDMG, 1974x). No faulting in red arkose, buff arkose and clay shale members of Pliocene Anaverde Formation or residual soil (Tar, Tab and Tas of Beeby, 1979).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(95 B*)	-	Lake Hughes	11/19/82	Buena Engineers, Inc.	Job #B-2021-L01
			One trench, 5 to 9 feet deep, northeast of main trace of San Andreas fault (CDMG, 1974x). Faulting in buff arkose and clay shale members of Pliocene Anaverde Formation (Tab and Tas of Beeby, 1979).			
Los Angeles	(96 B*)	-	Lake Hughes	11/6/81	Buena Engineers, Inc.	Job #B-1926-L01
			One trench, 5 feet deep, northeast of main trace of San Andreas fault (CDMG, 1974x). Faulting in buff arkose and clay shale members of Pliocene Anaverde Formation and residual soil (Tab and Tas of Beeby, 1979).			
Los Angeles	(97)	-	Lake Hughes	6/7/82	Buena Engineers, Inc.	Job #B-1948-L03
			Two trenches, maximum depth 13 feet, northeast of main trace of San Andreas fault (CDMG, 1974x). Trench 2: faulting in buff arkose and clay shale members of Pliocene Anaverde Formation (Tab and Tas of Beeby, 1979) and fault placing Pre-Tertiary granitic rock against clay shale member of Pliocene Anaverde Formation (dgn and Tas of Beeby, 1979).			
Los Angeles	(11)	1414	Del Sur	10/8/81	Buena Engineers	Job #B-1864-L01. Tentative Minor Land Division Map #13877, Leona Valley.
			Three trenches, 4-6 feet deep, southwest of main trace of San Andreas fault (CDMG, 1979y). No faulting in pre-Tertiary diorite-gneiss complex, overlying fan deposits and Holocene alluvium or colluvium (dgn, Qf and Qal of Kahle, et al., 1975).			
Los Angeles	(12)	1195	Del Sur	5/26/80	Eberhart-Axten and Assoc., Inc.	W.O. 1072. PM #13113, Leona Valley.
			Eight trenches, averaging 7-8 feet deep, across the main trace, a splinter of the north branch and the ancestral trace of the San Andreas fault (CDMG, 1979y). Trenches 3,4,5,6,7: series of en echelon faults of the main trace of San Andreas expressed in "two primary sets" in Pliocene Anaverde buff arkose member, older fan deposits and Holocene alluvium (Tab, Qof and Qal (?) of Kahle, et al., 1975). Trench 8: ponded alluvium, gouge zones, brecciation and faulting on north branch of San Andreas in dark gray arkosic sandstone of Pliocene Anaverde Formation and Holocene alluvium (Tab and Qal of Kahle, et al., 1975). Trenches 1E,2,3,5: faulting on ancestral trace of San Andreas in shale and buff arkose members of Pliocene Anaverde Formation, older fan deposits and Holocene alluvium (Tab, Tas, Qof and Qal of Kahle, et al., 1975). In the northwest corner of the site, a geomorphically well-represented thrust fault has placed the shale units of the Pliocene Anaverde Formation against the buff arkose unit (Tab and Tas of Kahle, et al., 1975).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(13)	-	Del Sur	9/26/79	Michael V. Smith	File #7944-1. Tentative Land Division Map #11625, Leona Valley.
			One trench, 6 feet deep, southwest of San Andreas fault (CDMG, 1979y). No faulting in pre-Tertiary diorite-gneiss complex or residual soil (dgn and Qc of Kahle, et al., 1975).			
Los Angeles	(14)	-	Del Sur	9/28/79	John D. Merrill	Project #95976
			Two trenches, maximum depth 6 feet, across San Andreas fault (CDMG, 1979y). Trenches 1,2: Strong fracturing, shearing and clay gouge in pre-Tertiary hornblende diorite breccia bedrock and Pliocene Anaverde Formation (dgn and Tab (?) of Kahle, et al., 1975). No faulting in overlying residual soil (Ql of Kahle, et al., 1975).			
Los Angeles	(15)	1158	Sleepy Valley	4/18/80	Eberhart-Axten and Assoc., Inc.	W.O. 1071. Tentative Tract 39460, Leona Valley.
			Forty test pits, 5-15 feet deep, northeast of Leona Valley fault and southwest of San Andreas fault (CDMG, 1979z). No faulting in pre-Tertiary diorite-gneiss complex or overlying fan deposits and Holocene colluvium (dgn, Qof and Qal of Kahle, et al., 1975).			
Los Angeles	(16)	1484	Sleepy Valley	11/4/81	Buena Engineers, Inc.	Job. #B-1925-L01. Tentative Minor Land Division Map #14548, Leona Valley.
			Three trenches, 4-15 feet deep, across Leona Avenue and subsidiary faults (CDMG, 1979z). Trench C: fault gouge, fractures and numerous faults in pre-Tertiary diorite-gneiss complex, granite and overlying Pleistocene older fan deposits (dgn and Qof of Kahle, et al., 1975).			
Los Angeles	(17)	889	Sleepy Valley	12/11/78	Michael V. Smith	File #78-36. Tentative PM #11467, Leona Valley.
			Five trenches, 6-10 feet deep, across Leona Avenue fault (CDMG, 1979z). Trench 1: brecciation, shearing and faulting in pre-Tertiary diorite-gneiss complex. No faulting in overlying residual soil (dgn and Qal (?) of Kahle, et al., 1975).			
Los Angeles	(18)	-	Sleepy Valley	10/12/76	William Waisgerber and Associates	Reference #76287-EIR-0041. 9306 Leona Avenue, Leona Valley.
			One trench, maximum depth 12 feet, northeast of Leona Avenue fault (CDMG, 1979z). No faulting in arkosic sandstone or alluvium (Tar or Tab and Qal of Kahle, et al, 1975).			
Los Angeles	(19)	1056	Sleepy Valley	10/22/79	Michael V. Smith	File #78-21. 9211 Elizabeth Lake Road, Leona Valley.
			One trench, maximum depth 15 feet, southwest of San Andreas fault (CDMG, 1979z). No faulting in Holocene alluvium (Qal of Kahle, et al., 1975).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(20)	39	Sleepy Valley	9/21/78	Michael V. Smith	File #78-24. 9715 Elizabeth Lake Road, Leona Valley.
			One trench, maximum depth 15 feet, northeast of San Andreas fault (CDMG, 1979z). No faulting in Holocene alluvium (Qal of Kahle, et al., 1975).			
Los Angeles	(21)	313	Sleepy Valley	9/14/74	John O. Nigra	Project #874-752. 8847 Elizabeth Lake Road, Leona Valley.
			Four trenches, maximum depth 16 feet, across San Andreas fault (CDMG, 1979z). Trench 2: Faulting as evidenced by "marked vertical zone of demarcation placing pebbly alluvial interbeds, light tan in shade, against dark, organic, massive silty clay." (Qal of Kahle, et al., 1975).			
Los Angeles	(22)	-	Sleepy Valley	8/19/71	John D. Merrill	Project #11201. NW corner 90th St. West and Elizabeth Lake Road, Leona Valley.
			One trench, average depth 9 feet, southwest of San Andreas fault (CDMG, 1979z). No faulting in Holocene alluvium (Qal of Kahle, et al., 1975).			
Los Angeles	(23)	1029	Sleepy Valley	5/1/79	Michael V. Smith	File #7919-1. 8216 W. Calva St., Leona Valley.
			One trench, 8 feet deep, northeast of main trace of San Andreas fault (CDMG, 1979z). No faulting in Holocene fan deposits (Qf of Kahle, et al., 1975).			
Los Angeles	(24)	1354	Sleepy Valley	6/5/81	Buena Engineers, Inc.	Job #B-1858-L01. Portion of lot 9, Tract 28381, Leona Valley.
			One trench, maximum depth 7 1/2 feet, northeast of San Andreas fault (CDMG, 1979z). No faulting in "older" fan deposits (Qf of Kahle, et al., 1975).			
Los Angeles	(98)	-	Sleepy Valley	7/28/81	Buena Engineers, Inc.	Job #B-1845-L01
			Two trenches, 5 to 13 feet deep, across and northeast of main trace of San Andreas fault (CDMG, 1979z). Trenches 1,2: no faulting in Holocene fan deposits or alluvium.			
Los Angeles	(25)	4	Sleepy Valley	5/10/74	John D. Merrill	Project #42321. Lot 35, Tract 5148, Leona Valley.
			One trench and two test pits, maximum depth 10 feet, northeast of Leona Valley fault (CDMG, 1979z). No faulting in granite bedrock or Holocene alluvium (dgn and Qal of Kahle, et al., 1975).			
Los Angeles	(26)	-	Sleepy Valley	7/7/77	John D. Merrill	Project #74072. Vicinity of 8353 Elizabeth Lake Road, Leona Valley.
			One trench, maximum depth 7 feet, northeast of San Andreas fault (CDMG, 1979z). No faulting in "older" fan deposits or Holocene alluvium (Qf and Qal of Kahle, et al., 1975).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(27)	1516	Sleepy Valley	8/5/82	Geoplan, Inc.	Project #25812. 8555 Elizabeth Lake Road, Leona Valley.
			Two trenches, 14-15 feet deep, northeast of San Andreas fault (CDMG, 1979z). No faulting in buff and red arkose, colluvium or Holocene alluvium (Tar, Tab, Qc and Qal of Kahle, et al., 1975).			
Los Angeles	(28)	-	Sleepy Valley	5/13/71	William Waisgerber and Associates	Ref. No. 1025-L-033-E. Portion of lot 18, Tract 5148, south of Elizabeth Lake, Pine Canyon Road, east of 87th St. West, Leona Valley.
			One trench, unspecified depth, northeast of Leona Avenue fault (CDMG, 1979z). No faulting in Holocene alluvium (Qal of Kahle, et al., 1975).			
Los Angeles	(29)	-	Sleepy Valley	6/9/80	Michael V. Smith	File #8010-1. Tentative Minor Land Division Map #12807, Leona Valley.
			Four trenches, 5-16 feet deep, across trace of San Andreas fault (CDMG, 1979z). No faulting in buff arkosic sandstone of Pliocene Anaverde Formation or poorly consolidated Holocene fan deposits (Tab and Qf of Kahle, et al., 1975).			
Los Angeles	(30)	-	Sleepy Valley	1/26/78	John D. Merrill	Project #84360. Tentative PM #10233, Leona Valley.
			Two trenches, 5-13 feet deep, southwest and northeast of San Andreas fault (CDMG, 1979z). No faulting in Holocene fan deposits (Qf of Kahle, et al., 1975).			
Los Angeles	(31)	-	Sleepy Valley	8/10/71	John D. Merrill	Project #11181. Portions SE 1/4 NW 1/4 and SW 1/4 NE 1/4 section, 16, T6N, R13W, BBM, Leona Valley.
			One trench, unspecified depth, southwest of San Andreas fault (CDMG, 1979z). Intense fracturing, brecciation and slickensides, but no faulting, in "metagranite" or overlying alluvial deposits (dgn and Qf of Kahle, et al., 1975).			
Los Angeles	(32)	804	Sleepy Valley	6/29/78	John D. Merrill	Project #84572. PM #10754, Leona Valley.
			One trench, 5-10 feet deep, across San Andreas fault (CDMG, 1979z). No faulting in "older" alluvium (Qf of Kahle, et al., 1975).			
Los Angeles	(33)	-	Sleepy Valley	5/15/71	William Waisgerber and Associates	Ref. No. 1024 L 033 E. N 1/4 of S 1/2 of E 1/2 of E 1/2 of SW 1/4, of NE 1/4 of section 16, T6N, R13W, SBM, Leona Valley.
			One trench, maximum depth 9 feet, northeast of San Andreas fault (CDMG, 1979z). No faulting in "older" or Holocene alluvium (Qf and Qpa of Kahle, et al., 1975).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(34)	1484	Sleepy Valley	11/4/81	Buena Engineers, Inc.	Project #B-1925-L01
			Three trenches, 4-15 feet deep, across Leona Avenue fault (CDMG, 1979z). Trench C: faulting and fracturing in gneiss, Pleistocene fan deposits and Holocene alluvium (pls, Qof, and Qal of Kahle, et al., 1975).			
Los Angeles	(35)	-	Sleepy Valley	11/20/70	James E. Slosson and Associates	Kirkpatrick Property, Leona Valley
			Two trenches, 10 feet deep, northeast of strand of San Andreas fault (CDMG, 1979z). Trench 1: no faulting, but "possible secondary breaks in older alluvium associated to the principal 1857 trace" of the San Andreas (Qoa of Kahle, et al., 1975).			
Los Angeles	(99 B*)	-	Ritter Ridge	6/10/82	Buena Engineers, Inc.	Job #B-1985-L01
			Two trenches, 5 to 11 feet deep, across and southwest of north branch of San Andreas fault (CDMG, 1979aa). Trench 1: faulting in red arkose, buff arkose and clay shale members of Pliocene Anaverde Formation and Holocene alluvium (Tar, Tab, Tac and Qal of Barrows, et al., 1976).			
Los Angeles	(100)	1071	Ritter Ridge	9/10/79	Michael V. Smith	File #7946-1
			Five trenches, 5 to 11 feet deep, across main trace of San Andreas fault (CDMG, 1979aa). Trench 3: Faulting in Pleistocene Harold Formation (Qh of Barrows, et al., 1976). Trench 4: Faulting in red arkose member of Pliocene Anaverde Formation and older alluvium (Tar and Qoa of Barrows, et al., 1976). Trench 5: faulting in red arkose member of Pliocene Anaverde Formation (Tar of Barrows, et al., 1976).			
Los Angeles	(36)	1071A	Ritter Ridge	5/29/80	Michael V. Smith	File #7945-1. Parcel 13038, north of Avenue S, west of Tierra Subida Road.
			Four trenches, 5 feet deep, across subsidiary faults southwest of main trace of San Andreas fault (CDMG, 1979aa). Trench A-1: "probable" vertical faulting in older alluvium, but no faulting in overlying "residual soil" (Qoa and Qal of Barrows, et al., 1976). Trench A-2: Thrust or high angle reverse faulting on "pressure ridge which resulted from tectonic activity within the main San Andreas fault zone" in Pleistocene Nadeau Formation gravels (Qn of Barrows, et al., 1976).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(37)	1088	Ritter Ridge	9/10/79	Michael V. Smith	File #7946-1, Tentative Minor Land Division No. 12749, Palmdale.
			Five trenches, 5-13 feet deep, across San Andreas and subsidiary fault (CDMG, 1979aa). Trenches 3,4,5: Faulting in red arkose of Pliocene Anaverde Formation, Pleistocene Harold Formation and older alluvium (Tar, Qh and Qoa of Barrows, et al., 1976). Surface expressions of recent faulting, as "closed depressions, troughs, offset drainage, shatter ridges and ponded alluvium" observed on site. Apparent offsets in Holocene alluvium observed in immediate vicinity of site (Qal of Barrows, et al., 1976).			
Los Angeles	(38)	-	Ritter Ridge	7/17/79	Michael V. Smith	File #7932-1. Tentative Tract Map 37502, Palmdale.
			Two trenches and six test pits, 6-13 feet deep, across trace of unnamed fault (Nadeau fault ?) southwest of main trace of San Andreas fault (CDMG, 1979aa). No faulting in Holocene alluvium (Qal of Barrows, et al., 1976).			
Los Angeles	(39)	-	Ritter Ridge	5/73 Supplement: 7/25/73	Buena Engineers, Inc.	Job #B3-1200-L01, Tract No. 29313, Palmdale.
			One trench, 6-14 feet deep, across Nadeau fault (CDMG, 1979aa). No faulting in fanglomerate or alluvium (Qof (?) or Qoa (?) and Qal of Barrows, et al., 1976).			
Los Angeles	(40)	-	Ritter Ridge	8/77	Buena Engineers, Inc.	Job #B-1448-L01, 36305 El Camino Drive, Palmdale
			One trench, 6-12 feet deep, southwest of San Andreas fault (CDMG, 1979aa). No faulting in quartz monzonite bedrock or Holocene alluvium (gn (?) and Qal of Barrows, et al., 1976).			
Palmdale	(1)	-	Palmdale	8/24/79	Michael V. Smith	File #7948-1
			Nine trenches, maximum depth 10 feet, across Cemetery fault (CDMG, 1979bb). Trench 1: faults placing buff arkose member of Pliocene Anaverde Formation against older alluvium (Tab and Qoa of Barrows, et al., 1976). Trench 2: shearing and faulting in buff arkose member of Pliocene Anaverde Formation; faulting in older alluvium (Tab and Qoa of Barrows, et al., 1976). Trench 8: faulting in older alluvium, but no faulting in overlying Holocene alluvium (Qoa and Qal of Barrows, et al., 1976).			
Palmdale	(2)	-	Palmdale	1/13/81	Michael V. Smith	File #8044-1
			Three trenches, 5 to 12 feet deep, across projected trace of Littlerock fault (CDMG, 1979bb). Trench 3: faulting in buff arkose and clay shale members of Pliocene Anaverde Formation. No faulting in overlying older alluvium (Tab, Tac and Qoa of Barrows, et al., 1976).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(41)	-	Palmdale	2/11/74	Buena Engineers, Inc.	Job #B4-1271-L01, Antelope Valley Press Property, 1450 feet north of Avenue "S" between Sierra Hwy. and Tenth Street East, Palmdale
			One trench, 2-9 feet deep, northeast of Littlerock fault (CDMG, 1979bb). No shear zones or faulting in Pliocene Anaverde Formation or Holocene alluvium (Ta and Qal of Barrows, et al., 1976).			
Los Angeles	(42)	320	Palmdale	8/24/76	Moore and Taber	Job #1176-506, Palmdale General Hospital, 1215 E. Avenue "S", Palmdale
			One trench, 4-5 feet deep, across trace of fault northeast and parallel to Littlerock fault (CDMG, 1979bb). Faulting, shearing, slickenslides and gouge in pink to light gray arkosic sandstones of the Pliocene Anaverde Formation and overlying Holocene alluvium (Tab and Qal of Barrows, et al., 1976).			
Los Angeles	(43)	576	Palmdale	6/2/77	Lamar-Merifield	Job #PAL-4, Tract 31919, Lot 8
			Ten test pits, maximum depth 7 feet, southwest of Cemetery fault (CDMG, 1979bb). No faulting in granitic bedrock or overlying Holocene colluvium (gr and Qsw of Barows, et al., 1976).			
Los Angeles	(101 B*)	-	Palmdale	12/13/79	Michael V. Smith	File #7956-1
			Twelve trenches, 3 to 7 feet deep, across Littlerock fault (CDMG, 1979bb). Faulting, with at least nine significant faults, in red arkose member of Pliocene Anaverde Formation, "older alluvium and colluvium" (Tar, Qsw of Barrows, et al., 1976).			
Los Angeles	(102)	-	Palmdale	5/8/80	Michael V. Smith	File #7972-2
			Two trenches, 5 feet deep, across Littlerock and subsidiary faults (CDMG, 1979bb). Trench 1: red arkose member of Pliocene Anaverde Formation in fault contact with Pleistocene Nadeau gravel and Holocene alluvium (Tar, Qn and Qal of Barrows, et al., 1976). Another fault present placing Harold Formation (Pelona Schistbearing member) against Pleistocene Nadeau Gravel (Qhp and Qn of Barrows, et al., 1976).			
Los Angeles	(103 B*)	-	Palmdale	10/26/79	Michael V. Smith	File #7949-1
			Two trenches, maximum depth 5 feet, northeast of main trace of San Andreas fault (CDMG, 1979bb). Trench 1: Faulting and fracturing in "buff arkose" member of Pliocene Anaverde Formation (Tar of Barrows, et al., 1976).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(44)	1373	Palmdale	8/28/78	Michael V. Smith	File #78-20, 36222 32nd St. East, Palmdale
			Two trenches, 2 1/2 - 5 feet deep, across projected trace of Littlerock fault (CDMG, 1979bb). Trench 1: faulting in arkosic sandstones of Pliocene Anaverde Formation, but no faulting in overlying Pleistocene Nadeau Formation gravels (Ta and Qn of Barrows, et al., 1976).			
Los Angeles	(45)	-	Palmdale	3/25/81	Buena Engineers, Inc.	Job #B-1831-L01, Tax Parcels 3052-18-5 and 3-52-18-6, Palmdale
			Three trenches, 3-6 feet deep, across Littlerock fault (CDMG, 1979bb). Trenches 1,2: Red arkose member of Pliocene Anaverde Formation in fault contact with Pleistocene Nadeau sandy gravels (Tar and Qn of Barrows, et al., 1976). Trench 3: Fracturing, but no apparent faulting in Anaverde Formation (Ta of Barrows, et al., 1976).			
Los Angeles	(46)	914	Palmdale	11/21/78	Michael V. Smith	File #78-35, 3401 Ave T-6 East, Palmdale
			One trench, maximum depth 8 feet, southwest of Littlerock fault (CDMG, 1979bb). No faulting in Pliocene Anaverde Formation or Holocene alluvium (Tar and Qal of Barrows, et al., 1976).			
Los Angeles	(47)	-	Palmdale	2/8/71	Robert Stone and Associates, Inc.	Job #1-0-0170-02. Tract 26272, Old Nadeau Road, Palmdale.
			Thirty-nine trenches, maximum depth 15 feet, across Nadeau and subsidiary faults (CDMG, 1979bb). Trenches 2,13,17,27,28,34,36,37,38,39: shearing and faulting with up to 18 inches offset in Pliocene Punchbowl Formation and older alluvium (Tjh and Qoa of Barrows, et al., 1976).			
Los Angeles	(48)	1439	Palmdale	1/26/79	Michael V. Smith	File #7904-1, Tax Parcel 3052-17-7, 3315 Ave T-8, East Palmdale
			One trench, maximum depth 8 feet, northeast of San Andreas fault (CDMG, 1979bb). No faulting in slope wash or Holocene alluvium (Qsw and Qal of Barrows, et al., 1976).			
Los Angeles	(49)	913	Palmdale	1/24/79	Michael V. Smith	File #7902-1
			Two trenches, maximum depth 3 1/2 feet, north of Littlerock fault (CMDG, 1979bb). Trenches 1-2: no faulting in basement granite or Holocene alluvium (gr and Qal of Barrows, et al., 1976).			
Los Angeles	(104)	913	Palmdale	1/24/79	Michael V. Smith	File #7902-1, Tract No. 12275, Palmdale
			Two trenches, 2 - 3-1/2 feet deep, northeast of Littlerock fault (CDMG, 1979bb). No faulting in granitic bedrock or overlying Holocene alluvium (gr and Qal of Barrows, et al., 1976).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(105 B*)	-	Palmdale	6/2/81	Buena Engineers, Inc.	Job #1860-L01
			One trench, 5 to 6 feet deep, across trace of Littlerock fault (CDMG, 1979bb). Faulting in red arkose member of Pliocene Anaverde Formation, older alluvium and Holocene alluvium (Tar, Qoa and Qal of Barrows, et al., 1976).			
Los Angeles	(106)	1072	Palmdale	10/16/79	Michael V. Smith	File #7916-1
			Seven trenches, 5 feet deep, across Nadeau fault (CDMG, 1979bb). Trench 5: normal faulting with a minimum of two feet of displacement in lake and undifferentiated deposits of Pleistocene Harold Formation but no faulting in overlying older fan deposits (Qhl, Qh and Qof of Barrows, et al., 1976).			
Los Angeles	(50)	-	Palmdale	8/1/77	Buena Engineers, Inc.	Job #B-1454-L01 Ave. T-4 and 36th St. East, Palmdale
			One trench, 8 feet deep, northeast of Littlerock fault (CDMG, 1979bb). No faulting in gravelly sands (Nadeau Formation ?) or "sandy silts" (Holocene alluvium ?) (Qn and Qal of Barrows, et al., 1976).			
Los Angeles	(51)	924	Palmdale	7/26/78	Michael V. Smith	File #78-17, 3540 Ave. T-6 East, Palmdale
			One trench, 5 feet deep, southwest of Littlerock fault (CDMG, 1979bb). No faulting in Pliocene Anaverde Formation or Holocene alluvium (Tar and Qal of Barrows, et al., 1976).			
Los Angeles	(52)	1267	Palmdale	10/30/79	Michael V. Smith	File #7953-1, 3744 Ave. T-8 East, Palmdale
			One trench, 6 feet deep, northeast of Littlerock fault (CDMG, 1979bb). Possible faulting in buff arkose of Pliocene Anaverde Formation, but no faulting in older or Holocene alluvium (Tab, Qoa and Qal of Barrows, et al., 1976).			
Los Angeles	(53)	1027	Palmdale	8/14/79	Michael V. Smith	File #7943-1, 3647 Ave T-8 East, Palmdale
			One trench, 5 feet deep, southwest of Littlerock fault (CDMG, 1979bb). No faulting in Pliocene Anaverde Formation or Holocene alluvium (Tar and Qal of Barrows, et al., 1976).			
Los Angeles	(54)	1453	Palmdale	4/2/82	Buena Engineers, Inc.	Job #B-1967-L01, Tract No. 13435
			Five trenches, 4-6 feet deep, across trace of Littlerock and subsidiary faults (CDMG, 1979bb). Numerous faults, gouge and shear zones in Pliocene Anaverde Formation and older alluvium (Tar and Qoa of Barrows, et al., 1976).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(55)	1039	Palmdale	11/13/78	Michael V. Smith	File #78-33, 3822 Ave. T-8 East, Palmdale
			One trench, maximum depth 7 feet, northeast of Littlerock fault (CDMG, 1979bb). No faulting in Pliocene Anaverde Formation or overlying older alluvium (Ta and Qoa of Barrows, et al., 1976).			
Los Angeles	(56)	-	Palmdale	3/19/80	Michael V. Smith	File #8005-1, Tax Parcel No. 3052-25-9, 35848 40th St. East, Palmdale
			Three trenches, maximum depth 7 feet, southwest of Littlerock fault (CDMG, 1979bb). Trenches 1-3: Normal faulting and fault gouge in red arkose of Pliocene Anaverde Formation and older alluvium (Tar and Qoa of Barrows, et al., 1976).			
Los Angeles	(57)	1026	Palmdale	10/11/78	Michael V. Smith	File #78-26, 35808 42nd St. East, Palmdale
			One trench, 4-8 feet deep, southwest of Littlerock fault (CDMG, 1979bb). No faulting in red arkosic unit of Pliocene Anaverde Formation (Tar of Barrows, et al., 1976).			
Los Angeles	(58)	-	Palmdale	7/23/71	John O. Nigra	Project #177-642, 4310 Palmdale Hills Drive, Palmdale
			Three trenches, maximum depth 12 feet, northeast of main trace of San Andreas fault (CDMG, 1979bb). No faulting in Pleistocene fanglomerate or overlying sandy clay (Qn and Qhl or Qhp of Barrows, et al., 1976).			
Los Angeles	(59)	809	Palmdale	6/26/78	Michael V. Smith	File #78-14, East side of Alida Lane, 400 feet north of Palmdale Hills Estates.
			One trench, 6 1/2 feet deep, northeast of main trace of San Andreas fault (CDMG, 1979bb). Folding but no faulting in Pliocene Upper Anaverde Formation (Tac of Barrows, et al., 1976).			
Los Angeles	(60)	837	Palmdale	4/2/78	Michael V. Smith	File #78-4, Parcel 14, northwest corner of Palmdale Hills Drive and Alida Lane in Palmdale Hills Estates
			One trench, maximum depth 8 1/2 feet, northeast of main trace of San Andreas fault (CDMG, 1979bb). No faulting in Pleistocene siltstone and sandstones (Qhp of Barrows, et al., 1976).			
Los Angeles	(61)	-	Palmdale	3/3/78	John O Nigra	Project #278-912, 35532 Alida Lane, Palmdale
			Three trenches, average depth 6 feet, adjacent to trace of subsidiary fault northeast of San Andreas fault (CDMG, 1979bb). No evidence of faulting in Pleistocene conglomerate (Qn or Qhp of Barrows, et al., 1976).			

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San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(62)	-	Palmdale	8/16/71	John O. Nigra	Project #178-645, Lot 6 at Alida Lane, Palmdale
			Four trenches, maximum depth 13 feet, across trace of subsidiary fault northeast of San Andreas fault (CDMG, 1979bb). Trenches 1-4: Faulting and gouge zones in macerated granitic bedrock (gr of Barrows, _et al_., 1976). No faulting in overlying Pelona Schist derived conglomerate (Qn (?) of Barrows, _et al_., 1976). Extension of the fault line, as determined by trenching, to outcrop shows Pleistocene terrace conglomerate faulted against light-colored igneous rock (Qhp, Qn (?) and gr of Barrows, _et al_., 1976).			
Los Angeles	(63)	-	Palmdale	6/2/80	Michael V. Smith	File #7916-3. Wesleyan Hills Property, Tentative Tract No. 40114.
			Four trenches, 3-5 feet deep, across main trace of San Andreas and subsidiary faults (CDMG, 1979bb). Trench 1: shearing and faulting in lake deposits of upper Pleistocene Harold Formation and older alluvium (Qhl and Qoa of Barrows, _et al_, 1976). Trench 2: Faults placing undifferentiated member and lake deposits of upper Pleistocene Harold Formation against older alluvium (Qh, Qhl and Qoa of Barrows, _et al_, 1976). Trenches 3,4: faulting in Pleistocene boulder gravels and older alluvium (Qbg and Qoa of Barrows, _et al_, 1976).			
Los Angeles	(64)	1157	Palmdale	3/25/80	Michael V. Smith	File #8008-1, 5630 Barrel Springs Road, Palmdale
			One trench, maximum depth 7 feet, southwest of main trace of San Andreas fault (CDMG, 1979bb). No faulting in Pleistocene Harold Formation or Holocene alluvium (Qhg and Qal of Barrows, _et al_, 1976).			
Los Angeles	(65)	-	Littlerock	4/30/80	Michael V. Smith	File #7916-2. Palmaire Properties Ltd., Tentative Tract No. 40113.
			Five trenches, 3-6 feet deep, across trace of Littlerock fault or southeastern extension of Cemetery fault (CDMG, 1974ff). Trench 1: "probable faulting in Holocene fan deposits" (Qsw of Barrows, 1979a). Trench 2,3,4: faulting, shearing, jointing and offset aplite dike in granite (hqm of Barrows, 1979a).			
Los Angeles	(66)	-	Juniper Hills	4/26/74	John D. Merrill	Project #42293, Parcel Map 4072, South 106th Street East, Vicinity of Littlerock
			Three trenches, unspecified depth, across San Andreas fault (CDMG, 1974cc). Trenches 1,2: faulting in granitic and metamorphic bedrock and overlying Holocene alluvium (qd and Qal of Barrows, 1979a).			
Los Angeles	(107)	-	Valyermo	2/21/80	Michael V. Smith	File #7969-1
			Two trenches, 5 to 6 feet deep, across subsidiary fault northeast of main trace of San Andreas fault (CDMG, 1974s). Trenches 1,2: faulting in Holocene alluvium (Qal of Barrows, 1979b).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(67)	1217	Valyermo	7/31/80	Michael V. Smith	File #8024-1. Tentative PM #11434.
			Four trenches, 5-9 feet deep, south of Holcomb fault (CDMG, 1974s). No faulting in Holocene colluvium or alluvium (Qsw and Qal of Barrows, 1979b).			
Los Angeles	(68)	1317	Valyermo	3/27/80	Michael V. Smith	File #8006-1. 17300 Big Pines Hwy, Valyermo.
			One trench, maximum depth 7 feet, southwest of main trace of San Andreas fault (CDMG, 1974s). No faulting in "older" fan deposits or Holocene colluvium (Qsw (?) and Qal of Barrows, 1979b).			
Los Angeles	(69)	1178	Valyermo	4/22/80	Allan E. Seward	Job #0-257-6. 17610 Big Pines Hwy, Valyermo.
			Three trenches, maximum depth 8 1/2 feet, northeast of main trace of San Andreas fault (CDMG, 1974s). Trenches 1-3: Fracturing, but no faulting in older alluvium (Qoa of Barrows, 1979b).			
Los Angeles	(70)	1230	Mescal Creek	9/10/80	Michael V. Smith	File #8028-1. Harmony Pines Camp, Wrightwood.
			One trench, 7 feet deep, northeast of San Andreas fault (CDMG, 1974dd). No faulting in Holocene alluvium (Qal of Rogers, 1967).			
Los Angeles	(71)	-	Mescal Creek	1/20/81	Ryland-Cummings, Inc.	Project #80-27-03. Mount Kare Camp, Wrightwood.
			Four trenches, 6-8 feet deep, across San Andreas fault (CDMG, 1974dd). Trench 1: excavated across prominent trough created by erosion along San Andreas. The "change in stratification of alluvium and crushed granite bedrock" used as evidence for presence of fault (p€c and Qal of Rogers, 1967). Trenches 3,4: gouge and shear zones in fractured granite bedrock, but no faulting in Holocene alluvium (pCe and Qal of Rogers, 1967).			
Los Angeles	(72)	143	Mescal Creek	8/1/75	Richard G. Mead	Mount Kare Camp, Wrightwood.
			One trench, 12-14 feet deep, southwest of San Andreas fault (CDMG, 1974dd). No faulting in Holocene alluvium (Qal of Rogers, 1967).			
Los Angeles	(73)	147	Mescal Creek	8/15/75	Earl R. Morley, Jr.	Project #440-85. Camp Commerce, Wrightwood.
			Three trenches, maximum depth 10 feet, across San Andreas fault (CDMG, 1974dd). Trench 1: "rock flour, presence of badly oxidized orange-brown clay, silt fault gouge and slickenslided mylonite greenschist" stated as evidence for faulting in greenschist bedrock (?) (m of Rogers, 1967). Trenches 2,3: fracturing and shearing in granite gneiss (p€c of Rogers, 1967).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, Los Angeles County (Figs. 4-10)						
Los Angeles	(74)	579	Mount San Antonio	7/28/77	Pioneer Consultants	Job #2723-001. Holiday Hill Ski Lift, Wrightwood.
			Three trenches, 10-13 feet deep, southwest of San Andreas fault (CDMG, 1974ee). No faulting in Holocene alluvium (Qal of Rogers, 1967).			
Los Angeles	(75)	1402	Mount San Antonio	7/29/81	Allen E. Seward	Job #1-289-4. Tentative Tract No. 41777. Wrightwood.
			Forty-six trenches, maximum depth 12 feet, southwest of San Andreas fault (CDMG, 1974ee). No faulting in Holocene alluvium (Qal of Rogers, 1967).			

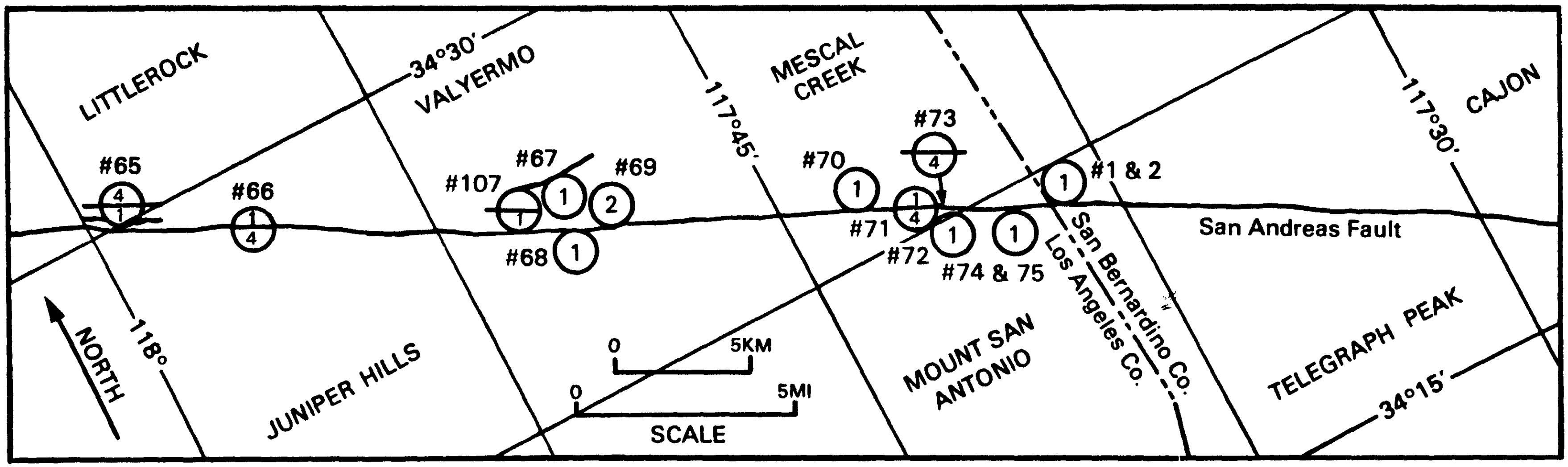

Fig. 10 - Locations of engineering geology reports along San Andreas fault between Littlerock and Telegraph Peak areas by Los Angeles and San Bernardino County numbers. See Fig. 1 for location and Fig. 2 for explanation of symbols.

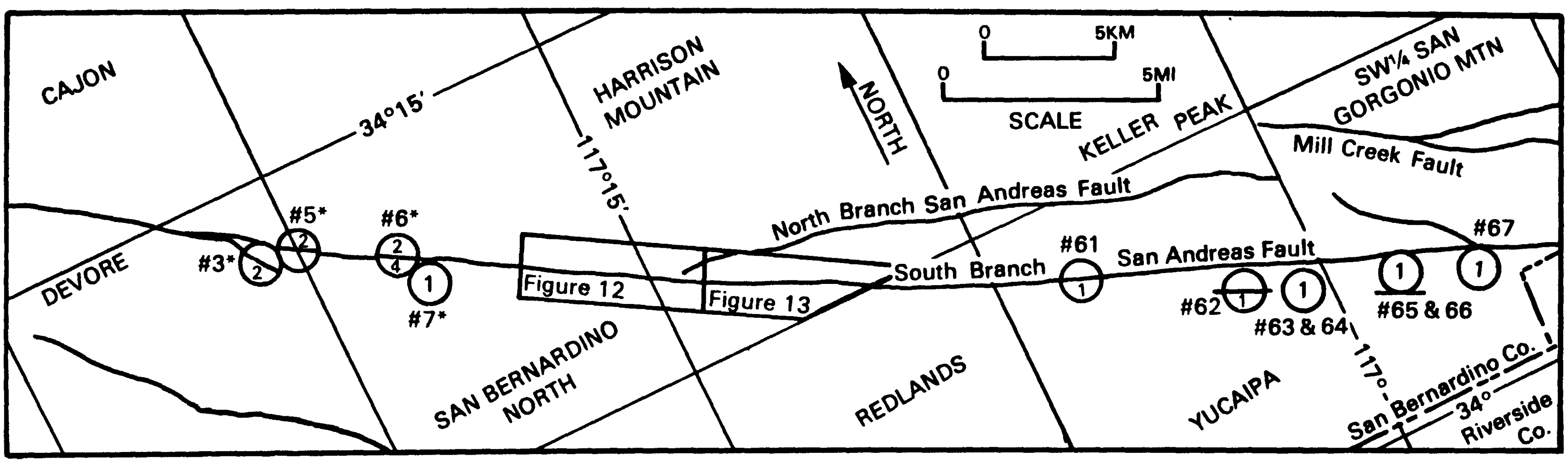

Fig. 11 - Locations of engineering geology reports along San Andreas fault between Devore and San Gorgonio Mountain areas by San Bernardino County and City (*) numbers. See Fig. 1 for location and Fig. 2 for explanation of symbols.

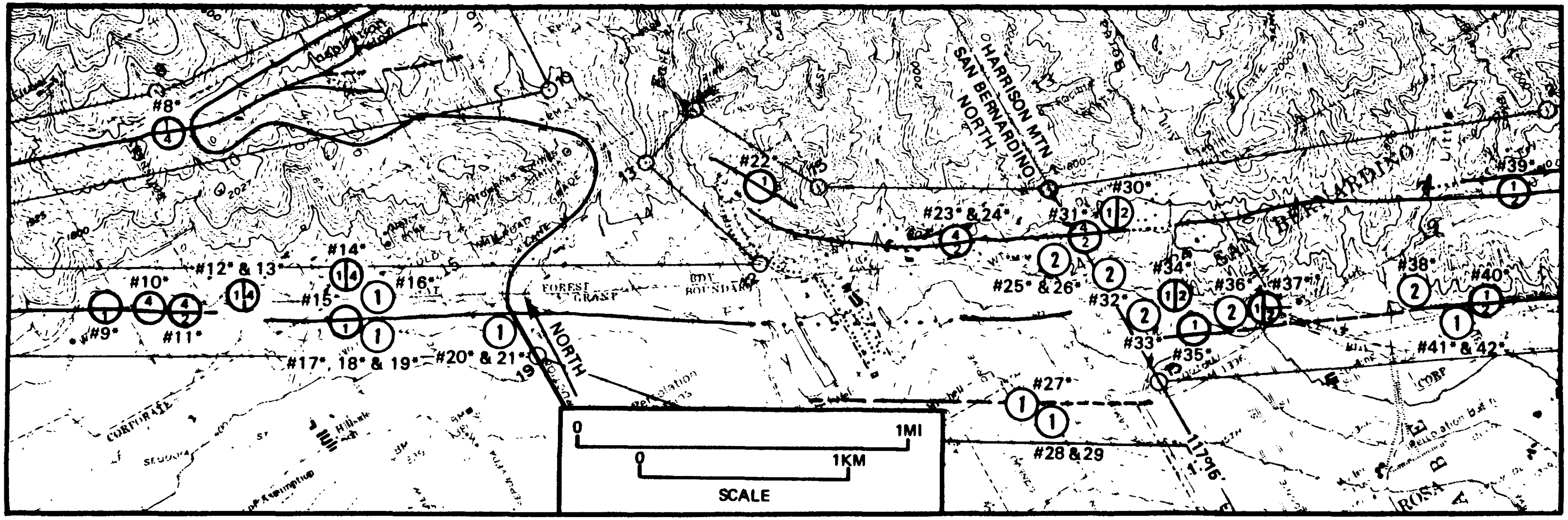

Fig. 12 - Locations of engineering geology reports along San Andreas fault in western San Bernardino area by San Bernardino County and City (*) numbers. See Fig. 11 for location and Fig. 2 for explanation of symbols.

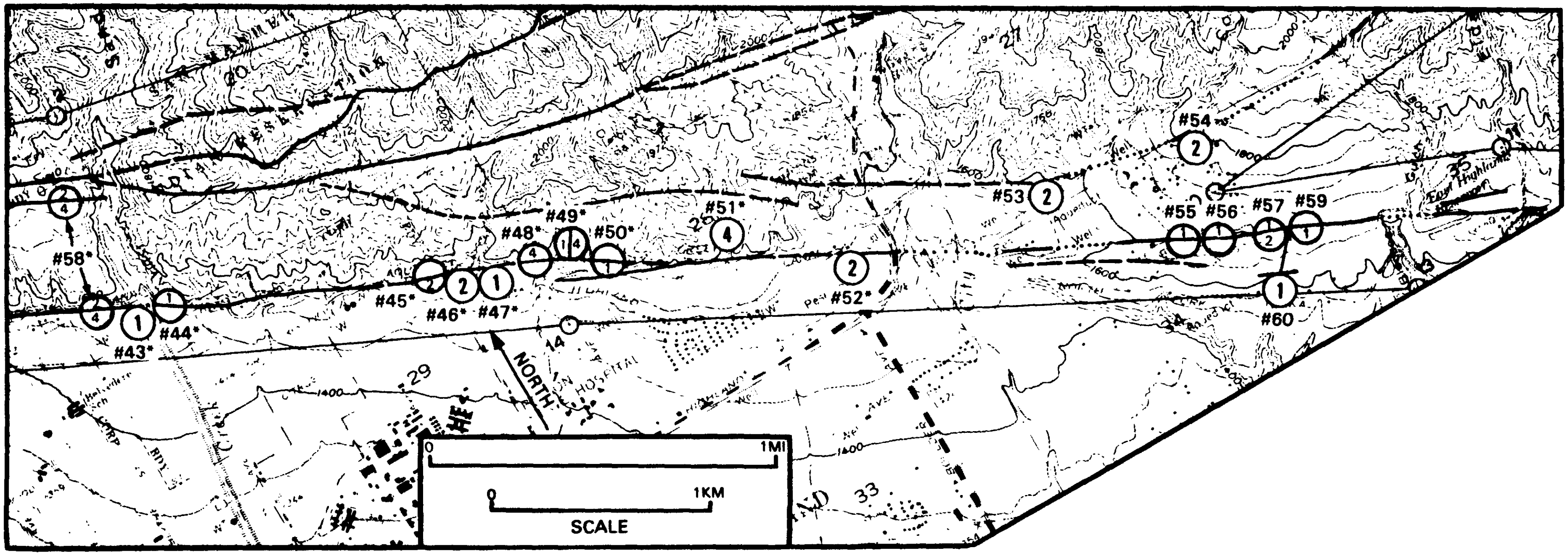

Fig. 13 - Locations of engineering geology reports along San Andreas fault in eastern San Bernardino area by San Bernardino County and City (*) numbers. See Fig. 11 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, San Bernardino County (Figs. 10-14)						
San Bernardino	(1)	149	Mount San Antonio	10/10/74	R.G. Mead	Tract No. 5383
			Trench up to 9 feet deep northeast of San Andreas fault (CDMG, 1974ee), no faulting in soil and alluvium.			
San Bernardino	(2)	91	Mount San Antonio	10/17/74	R.G. Mead	Tract No. 2400
			Trench, average depth 10 feet, directly northeast of San Andreas fault (CDMG, 1974ee), no faulting in soil and talus.			
(San Bernardino)	(3*)	649	Devore	11/15/77 02/17/81	G.A. Clopine	Lake Devore Mobile Home Estates
			Trench, average depth 10 feet, across Tokay Hill fault (CDMG, 1974mm), faulting in "Quaternary older alluvium."			
(San Bernardino)	(5*)	1507	Devore San Bernardino North	7/17/81	Gary S. Rasmussen and Associates	Project #1738-2
			Trenches, average depth 10 feet, across strands of San Andreas fault (CDMG, 1974mm,nn), faults 1 foot wide in older alluvium, 3 feet vertical offset.			
(San Bernardino)	(6*)	1498	San Bernardino North	11/19/80	Gary S. Rasmussen and Associates	Project #1639-2
			Cuts and trenches across strands of San Andreas fault (CDMG, 1974nn), gouge and fractures in granite and alluvium "as old as mid-Pleistocene."			
(San Bernardino)	(7*)	1096	San Bernardino North	1/28/80	Leighton and Associates	Project #679662-01
			Trench up to 11 feet deep south of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
(San Bernardino)	(8*)	1020	San Bernardino North	8/1/79	G.A. Clopine	6080 State Highway 18
			Trenches, 5 feet deep, across North Branch San Andreas fault (CDMG, 1974nn), Holocene alluvium faulted against quartz monzonite.			
(San Bernardino)	(9*)	647	San Bernardino North	1/4/78 3/19/78 6/24/78	G.A. Clopine	Tracts 10194, 10258, and 10259
			Trenches up to 12.5 feet deep across San Andreas fault (CDMG, 1974nn), 2 feet wide crushed and sheared zone in alluvium.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, San Bernardino County (Figs. 10-14)						
(San Bernardino)	(10*)	531	San Bernardino North	1/?/77	C. Price	Area No. 411 717-3
			Two trenches to depths of 8 feet directly northeast and on San Andreas fault (CDMG, 1974nn). "Shear zone" and "disturbed zone of sandstone and reddish brown silty sand" in Potatoe sandstone; not clear from report whether younger units (Recent alluvium and Pleistocene silty sand) are faulted.			
(San Bernardino)	(11*)	529	San Bernardino North	1/17/77	G.A. Clopine	North end of E and F Streets
			Three trenches and 2 pits within and southwest of San Andreas fault zone (CDMG, 1974nn), faults cut old alluvium and place older alluvium against Potatoe sandstone within 3.5 and 2.5 feet of surface. "Old alluvium" includes dark gray to black clay, "probably represents sag pond material".			
(San Bernardino)	(12*)	224	San Bernardino North	12/4/75	G.A. Clopine	Mayfield Ave. between 58th and 59th Streets.
			Two trenches to a maximum depth of 12.5 feet in unfaulted and unfractured alluvium resting on fractured Potatoe sandstone directly northeast of San Andreas fault (CDMG, 1974nn); no faulting.			
(San Bernardino)	(13*)	657	San Bernardino North	6/3/77	G.A. Clopine	Parcel 46
			Trench up to 8 feet deep located between strands of San Andreas fault zone (CDMG, 1974nn), no faulting in Potatoe sandstone overlain by Holocene alluvium.			
(San Bernardino)	(14*)	1489	San Bernardino North	9/11/79	Gary S. Rasmussen and Associates	Project #1447
			Trench up to 8 feet deep between strands of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium overlying Potatoe sandstone.			
(San Bernardino)	(15*)	645	San Bernardino North	6/2/77	Gary S. Rasmussen and Associates	Project #1204
			Four trenches up to 11.5 feet deep across two strands of San Andreas fault (CDMG, 1974nn), faulting of Holocene alluvium within 1.5 feet of surface.			
(San Bernardino)	(16*)	223	San Bernardino North	7/7/75	F.A. Fleming	54th Street near Sepulveda Avenue.
			Three trenches to depths of 10 to 14 feet in alluvium, directly northeast of San Andreas fault (CDMG, 1974nn), no evidence of faulting.			
(San Bernardino)	(17*)	656	San Bernardino North	1/19/77	C. Price	Lot 9, Block 154, page 6, S.B. Co.
			Trenches up to 9 feet deep southwest of San Andreas fault (CDMG, 1974nn), no faulting in alluvium.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
<u>San Andreas Fault, San Bernardino County (Figs. 10-14)</u>						
(San Bernardino)	(18*)	865	San Bernardino North	5/4/78	Gary S. Rasmussen and Associates	Project #1332
			Trench up to 10 feet deep southwest of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
(San Bernardino)	(19*)	637	San Bernardino North	8/19/77	Gary S. Rasmussen and Associates	Project #1235
			Trench up to 11 feet deep located 150 feet southwest of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
(San Bernardino)	(20*)	866	San Bernardino North	3/9/78	Gary S. Rasmussen and Associates	Project #1304
			Trench up to 11 feet deep southwest of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
(San Bernardino)	(21*)	1094	San Bernardino North	8/9/78	Gary S. Rasmussen and Associates	Project #1358
			Trenches up to 11 feet deep southwest of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
(San Bernardino)	(22*)	1089	San Bernardino North	9/12/77	Gary S. Rasmussen and Associates	Project #1233
			Trenches across strands of San Andreas fault (CDMG, 1974nn), faulting in Holocene alluvium.			
(San Bernardino)	(23*)	1084	San Bernardino North	8/1/78	Gary S. Rasmussen and Associates	Project #1377
			Trenches up to 11 feet deep across strand of San Andreas fault (CDMG, 1974nn), "probably late Pleistocene" terrace deposits faulted against Potatoe sandstone.			
(San Bernardino)	(24*)	1090	San Bernardino North	8/2/79	Gary S. Rasmussen and Associates	Project #1506
			Trenches and cuts across strands of San Andreas fault (CDMG, 1974nn), faulting in metamorphic rocks and "probably late Pleistocene" terrace deposits.			
(San Bernardino)	(25*)	268	San Bernardino North	5/20/76	G.A. Clopine	Bonita Vista Drive at Quail Canyon Road
			Two trenches to maximum depth of 13.5 feet in "red arkosic older alluvium" between two strands of San Andreas fault (CDMG, 1974nn), no faulting.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, San Bernardino County (Figs. 10-14)						
(San Bernardino)	(26*)	638	San Bernardino North	5/20/76 11/10/77	G.A. Clopine	Bonita Vista Drive at Quail Canyon Road
			Pit and trench between strands of San Andreas fault (CDMG, 1974nn) up to 11.75 feet deep, no faulting in older alluvium.			
(San Bernardino)	(27*)	655	San Bernardino North	6/24/77	Gary S. Rasmussen and Associates	Project #1212
			Trench up to 11 feet deep across strand of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
San Bernardino	(28)	712	San Bernardino North	4/17/78 4/19/78	Gary S. Rasmusser and Associates	Project #1336
			Trenches up to 11 feet deep southwest of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
San Bernardino	(29)	929	San Bernardino North	9/18/78	Gary S. Rasmussen and Associates	Project #1405
			Trenches southwest of San Andreas fault (CDMG, 1974nn), no faulting in Holocene alluvium.			
(San Bernardino)	(30*)	1505	Harrison Mtn.	12/30/81	G.A. Clopine	Chiquita Lane
			Trench, 9.5-10 feet deep, north of North Branch San Andreas fault (CDMG, 1974oo), no faulting in late Pleistocene and Holocene alluvium.			
(San Bernardino)	(31*)	648	Harrison Mtn.	12/9/77	G.A. Clopine	Tract No. 10220
			Trenches across North Branch San Andreas fault (CDMG, 1974oo), Potatoe sandstone faulted against Pleistocene older alluvium; 6 feet wide zone which extends to within 1 foot of surface.			
(San Bernardino)	(32*)	527	Harrison Mtn.	10/22/76	G.A. Clopine	1704 Bonita Vista Drive.
			Trenches, maximum depth 14 feet, between strands of San Andreas fault (CDMG, 1974oo), no faulting in "late Pleistocene older alluvium".			
(San Bernardino)	(33*)	1488	Harrison Mtn.	09/7/79 3/18/80	G.A. Clopine	Echo Drive
			Trenches, 10-15 feet deep, between branches of San Andreas fault (CDMG, 1974oo), no faulting in Quaternary alluvium.			
(San Bernardino)	(34*)	218	Harrison Mtn.	11/30/74	G.A. Clopine	Osbun Road
			Trenches, 9 to 13 feet deep, between strands of San Andreas fault (CDMG, 1974oo), no faulting in "older alluvium of late Pleistocene age" and "sag pond (lake) deposits".			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, San Bernardino County (Figs. 10-14)						
(San Bernardino)	(35*)	1083	Harrison Mtn.	8/10/78	Geo-Sec, Horne, Chance and Associates	Project #332
			Trenches, maximum depth 15 feet, across South Branch San Andreas fault (CDMG, 1974oo), faulting in alluvium.			
(San Bernardino)	(36*)	530	Harrison Mtn.	3/2/77	G.A. Clopine	1800 block E. Mesa Drive.
			Trench, 14 to 16 feet deep, between strands of San Andreas fault (CDMG, 1974oo), no faulting in late Pleistocene older alluvium.			
(San Bernardino)	(37*)	561	Harrison Mtn.	12/12/77	G.A. Clopine	Vic. of 1900 Mesa Verde Drive
			Trench, average depth 13 feet, between strands of San Andreas fault (CDMG, 1974oo), faulting in "older alluvium" overlain by unfaulted "younger alluvium".			
(San Bernardino)	(38*)	1493	Harrison Mtn.	3/28/77	G.A. Clopine	Lot 35, Tract 5659
			Trench, 11 feet deep, north of South Branch San Andreas fault (CDMG, 1974oo), no faulting in older alluvium.			
(San Bernardino)	(39*)	1085	Harrison Mtn.	8/7/78	Gary S. Rasmussen and Associates	Project #1387
			Trenches, average depth 10 feet, across North Branch San Andreas fault (CDMG, 1974oo), late Pleistocene terrace deposits faulted against Holocene alluvium.			
(San Bernardino)	(40*)	635	Harrison Mtn.	6/10/77	G.A. Clopine	Hemlock and Willow Drive
			Two trenches, average depth 8 feet, across South Branch San Andreas fault (CDMG, 1974oo), late Pleistocene older alluvium faulted against Holocene alluvium.			
(San Bernardino)	(41*)	217	Harrison Mtn.	9/21/74	G.A. Clopine	Tract 8545
			Trenches, 9 to 16 feet deep, southwest of San Andreas fault (CDMG, 1974oo), no faulting in Holocene alluvium.			
(San Bernardino)	(42*)	869	Harrison Mtn.	5/20/78	Geo-Sec, Horne, Chance and Associates	Project #331
			Trenches, average depth 10 feet, directly southwest of South Branch San Andreas fault (CDMG, 1974oo), no faulting in Holocene alluvium.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, San Bernardino County (Figs. 10-14)						
(San Bernardino)	(43*)	650	Harrison Mtn.	04/8/77 6/20/77	Gary S. Rasmussen and Associates	Project #1185
			Trenches, average depth 11 feet, southwest of San Andreas fault (CDMG, 1974oo), no faulting in Holocene alluvium.			
(San Bernardino)	(44*)	868	Harrison Mtn.	10/12/78	Gary S. Rasmussen and Associates	Project #1403
			Trenches, average depth 11 feet, across South Branch San Andreas fault (CDMG, 1974oo), faulting in Holocene alluvium.			
(San Bernardino)	(45*)	653	Harrison Mtn.	8/2/77	Gary S. Rasmussen and Associates	Project #1109-3
			Trenches, average depth 12 feet, across South Branch San Andreas fault (CDMG, 1974oo), two major traces, approximately 120 feet apart, rupture older alluvium to within 6 inches of surface. "Carbon 14 sample" indicated in "wet organic clay" 9 feet below surface adjacent to fault zone. No data on sample in report.			
(San Bernardino)	(46*)	646	Harrison Mtn.	10/77	C. Price	Area No. 409 713-1
			Trenches, 10 to 15 feet deep, south of San Andreas fault (CDMG, 1974oo), no faulting in Pleistocene alluvium.			
(San Bernardino)	(47*)	221	Harrison Mtn.	1/21/75	Gary S. Rasmussen and Associates	Project #1083
			Trenches, average depth 10 feet, southwest of San Andreas fault (CDMG, 1974oo), no faulting in Holocene alluvium.			
(San Bernardino)	(48*)	528	Harrison Mtn.	2/18/77	Gary S. Rasmussen and Associates	Project #1176
			Trenches, 10 to 15 feet deep, across strand of San Andreas fault (CDMG, 1974oo), faulting in sandstone and conglomerate of Potatoe Formation.			
(San Bernardino)	(49*)	524	Harrison Mtn.	3/19/74 9/10/76	Gary S. Rasmussen and Associates	Project #1016-3
			Trenches northeast of San Andreas fault (CDMG, 1974oo), no active traces in alluvium, terrace deposits, and conglomerate of Potatoe Formation.			
(San Bernardino)	(50*)	1495	Harrison Mtn.	7/17/80	Geological Systems Evaluation Co.	Project #334
			Trenches, 4 feet deep, across South Branch San Andreas fault (CDMG, 1974oo), faulting in alluvium.			

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San Andreas Fault, San Bernardino County (Figs. 10-14)						
(San Bernardino)	(51*)	222	Harrison Mtn.	06/24/75 10/20/77	Leighton and Associates	Project #G4256-2
			Trenches between strands of San Andreas fault (CDMG, 1974oo), no evidence of recent faulting in conglomerate of Potatoe Formation, "less prominent fault in Potatoe Formation."			
(San Bernardino)	(52*)	651	Harrison Mtn.	7/22/77	Leighton and Associates	Project #77219-1
			Trench directly southwest of South Branch San Andreas fault (CDMG, 1974oo), no faulting in Pleistocene alluvium.			
San Bernardino	(53)	891	Harrison Mtn.	8/30/78	Gary S. Rasmussen and Associates	Project #1388
			Trenches, minimum depth 10 feet, between strands of San Andreas fault (CDMG, 1974oo), no faulting in older alluvium.			
San Bernardino	(54)	90	Harrison Mtn.	2/3/75	G.A. Clopine	Lot 47, Tract 5299
			Two trenches, maximum depth 12 feet, between strands of San Andreas fault (CDMG, 1974oo), no faulting in "late Pleistocene older alluvium".			
San Bernardino	(55)	709	Harrison Mtn.	4/14/78	Gary S. Rasmussen and Associates	Project #1318
			Trenches, minimum depth 11 feet, across South Branch San Andreas fault (CDMG, 1974oo), faulting in Holocene alluvium.			
San Bernardino	(56)	668	Harrison Mtn.	12/19/77	Gary S. Rasmussen and Associates	Project #1082-2
			Trenches, minimum depth 11 feet, across South Branch San Andreas fault (CDMG, 1974oo); faulting in Holocene alluvium and sag pond deposits.			
San Bernardino	(57)	601	Harrison Mtn.	12/21/77	Gary S. Rasmussen and Associates	Project #1280
			Trenches, minimum depth 11 feet, across South Branch San Andreas fault (CDMG, 1974oo), and "additional buried and inactive faults"; fault displacement in Holocene alluvium and mid-late Pleistocene terrace deposits.			
(San Bernardino)	(58*)	862	Harrison Mtn	2/8/78	Gary S. Rasmussen and Associates	Project #1301-2
			Trenches, minimum depth 11 feet, across North and South Branches San Andreas fault (CDMG, 1974oo), faulting in late Pleistocene terrace deposits resting on Potatoe sandstone and metamorphic rocks.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Andreas Fault, San Bernardino County (Figs. 10-14)						
San Bernardino	(59)	625	Harrison Mtn., Redlands	1/10/78	Gary S. Rasmussen and Associates	Project #1281
			Trenches, minimum depth 11 feet, across South Branch San Andreas fault (CDMG, 1974oo), and "buried inactive fault"; faulting in Holocene alluvium and sag pond deposits.			
San Bernardino	(60)	634	Harrison Mtn., Redlands	1/24/78	Gary S. Rasmussen and Associates	Project #1295
			Trench, 11 feet minimum depth, southwest of South Branch San Andreas fault (CDMG, 1974oo), no faulting in Holocene alluvium.			
San Bernardino	(61)	890	Yucaipa	12/11/78	Gary S. Rasmussen and Associates	Project #1063-3
			Trenches, 10 to 15 feet deep, across South Branch San Andreas fault and associated thrust faults (CDMG, 1979ss), 110 feet wide fault zone across San Andreas fault and other faults in Holocene alluvium.			
San Bernardino	(62)	660	Yucaipa	2/3/78 2/14/78	Gary S. Rasmussen and Associates	Project #1239-2
			Trenches, average depth 10 feet, southwest of South Branch San Andreas fault (CDMG, 1979ss), faulting in Holocene alluvium.			
San Bernardino	(63)	930	Yucaipa	10/20/78	Gary S. Rasmussen and Associates	Project #1400
			Trenches, average depth 10 feet, southwest of South Branch San Andreas fault (CDMG, 1979ss), no faulting in Holocene alluvium.			
San Bernardino	(64)	53	Yucaipa	10/27/74 9/17/77 1/18/78	Lewis S. Lohr	Job #2-74-10 Job #36-77-9
			Trenches, average depth 6 feet, directly between strands of South Branch San Andreas fault (CDMG, 1979ss), no faulting in Holocene alluvium.			
San Bernardino	(65)	1448	SW1/4 San Gorgonio Mtn.	4/19/82	Leighton and Associates	Project #6810707-01
			Trenches, 11 to 13 feet deep, northeast of strand of South Branch San Andreas fault (CDMG, 1974pp), no faulting in Holocene alluvium.			
San Bernardino	(66)	987	SW1/4 San Gorgonio Mtn.	6/26/78	Gary S. Rasmussen and Associates	Project #1365
			Trench, 10 to 12 feet deep, northeast of strand of South Branch San Andreas fault (CDMG, 1974pp), no faulting in Holocene alluvium.			

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San Andreas Fault, San Bernardino County (Figs. 10-14)						
San Bernardino	(67)	624	SW1/4 San Gorgonio Mtn.	1/30/76	Lewis S. Lohr	Oak Glen Pines Camp
			Trench, average depth 10 feet, southwest of South Branch San Andreas fault (CDMG, 1974pp), no faulting in Holocene alluvium.			
San Bernardino	(68)	374	SE1/4 Morongo Valley	6/17/75 12/10/76	Converse-Davis-Dixon Associates	Project #75-102-28
			Two trenches up to 12 feet northwest of Morongo Valley fault (CDMG, 1974q), no faulting in Holocene alluvium.			

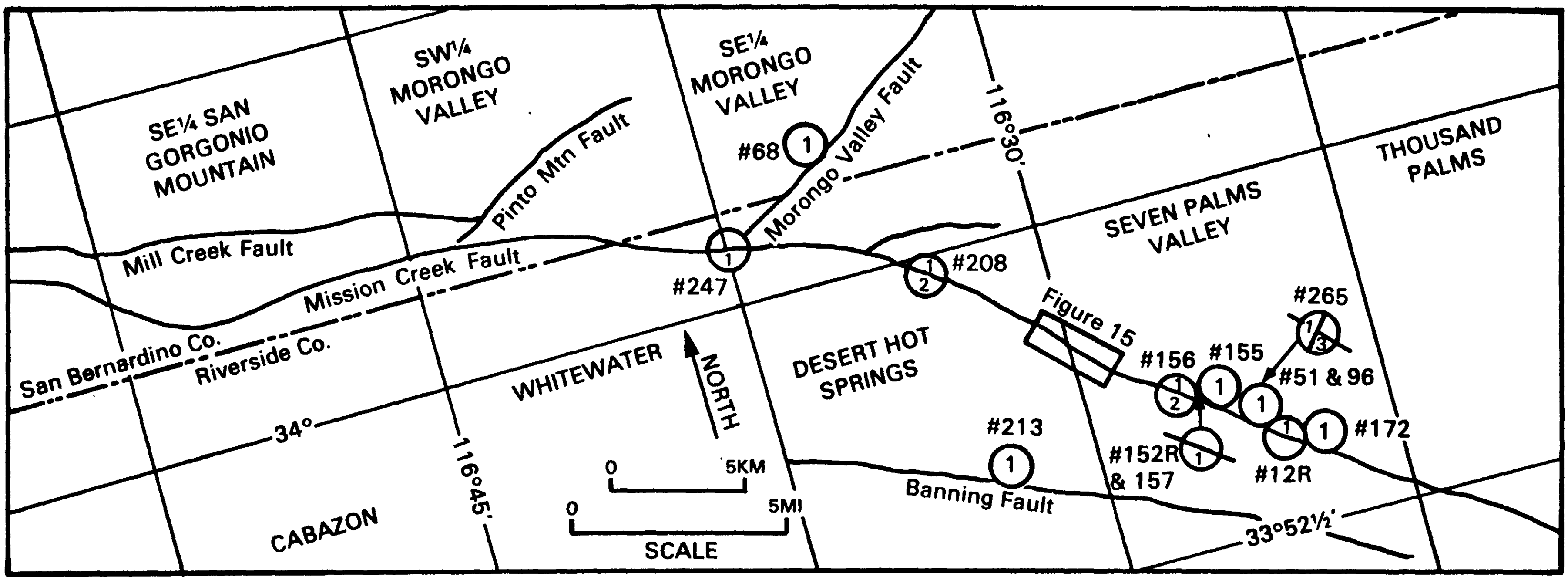

Fig. 14 - Locations of engineering geology reports along Mission Creek and Morongo Valley faults between San Gorgonio Mountain and Seven Palms Valley areas by San Bernardino and Riverside County numbers. See Fig. 1 for location and Fig. 2 for explanation of symbols.

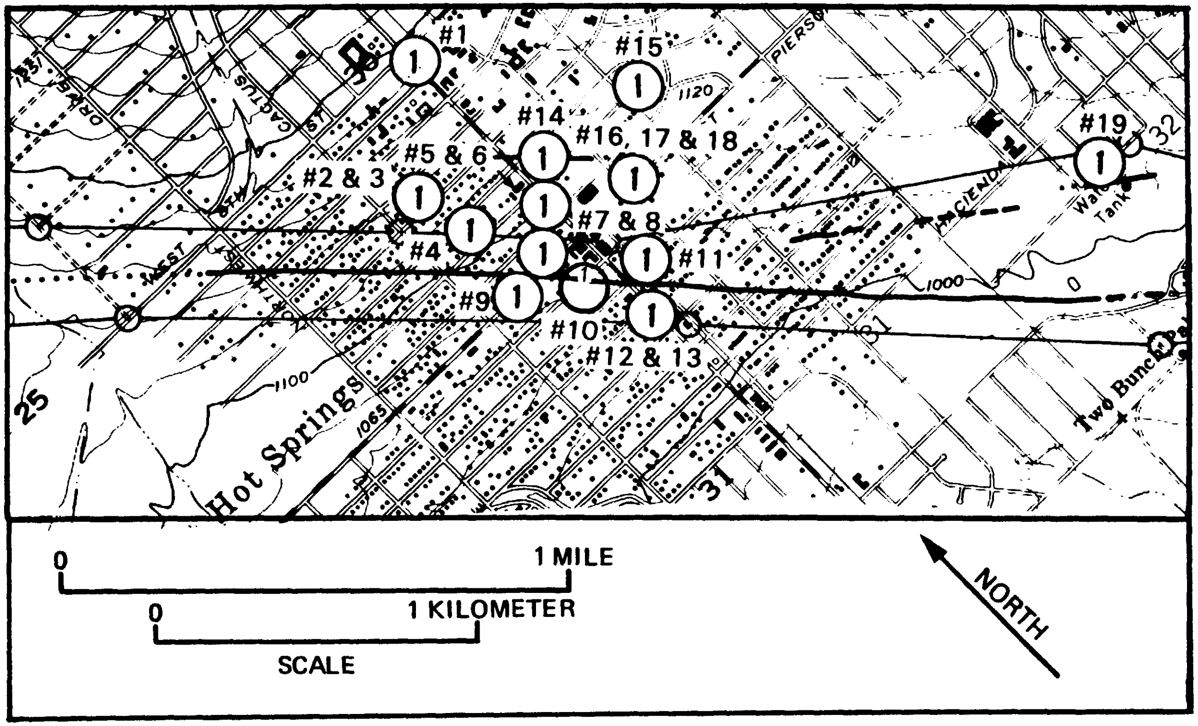

Fig. 15 - Locations of engineering geology reports along Mission Creek fault by City of Desert Hot Springs number. See Fig. 14 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Mission Creek and Associated Faults, Riverside County (Figs. 14 and 15):						
Riverside	12 R	626	Seven Palms Valley	11/21/77	Gary S. Rasmussen and Associates	Project #1255
			Six trenches, 10-11 feet deep, across and southwest of Mission Creek fault (CDMG, 1980n). Trenches 1,3,4: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	51	271	Seven Palms Valley	6/29/76	Lewis S. Lohr	Job #12-76-6
			One trench, 10-12 feet deep, northeast of Mission Creek fault (CDMG, 1974n). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	96	599	Seven Palms Valley	10/16/77	Lewis S. Lohr	Job #40-77-10
			One trench, 10-12 feet deep, northeast of Mission Creek fault (CDMG, 1974n). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	152-R	980	Seven Palms Valley	4/17/79	Gary S. Rasmussen and Associates	Project #1473
			Five trenches, 10-12 feet deep, across and northeast of Mission Creek fault (CDMG, 1980n). Trenches 1,2,5: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	155	916	Seven Palms Valley	1/12/79	Gary S. Rasmussen and Associates	Project #1432
			Two trenches, 10-12 feet deep, northeast of Mission Creek fault (CDMG, 1974n). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	156	922	Seven Palms Valley	1/18/79	Gary S. Rasmussen and Associates	Project #1430
			Three trenches, 10-12 feet deep, across Mission Creek fault (CDMG, 1980n). Trenches 1,3: faulting in Holocene alluvium (Qal of Rogers, 1965). Trench 2: faulting in late Pleistocene units and Holocene alluvium (Qc and Qal of Rogers, 1965).			
Riverside	157	921	Seven Palms Valley	1/15/79	Gary S. Rasmussen and Associates	Project #1412-2
			One trench, 10-12 feet deep, across Mission Creek fault (CDMG, 1980n). Faulting, with 1 inch vertical offset, in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	172	979	Seven Palms Valley	4/24/79	Gary S. Rasmussen and Associates	Project #1466
			One trench, 10-12 feet deep, northeast of Mission Creek fault (CDMG, 1974n). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Mission Creek and Associated Faults, Riverside County (Figs. 14 and 15):						
Riverside	208	1161	Desert Hot Springs	2/2/80	Lewis S. Lohr	Job #81-80-4
			Three trenches, 10 feet deep, across Mission Creek and White House Canyon faults (CDMG, 1980o). Trench 1: Fault with maximum displacement of 2.0 feet for White House Canyon fault and 2.8 feet for Mission Creek fault in Pleistocene fanglomerate and Holocene alluvium. Trench 2: Mission Creek fault displaces Pleistocene fanglomerate and Holocene alluvium. Trench 3: Mission Creek fault displaces Pleistocene fanglomerate (Qc and Qal of Rogers, 1965).			
Riverside	213	1265	Desert Hot Springs	1/11/80	Buena Engineers, Inc.	Job #B-10857-P1
			Two trenches, 10 feet deep, northeast of San Andreas (Banning) fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	247	1408	Morongo Valley SE 1/4 and SW 1/4	5/22/81	Leighton and Associates, Inc.	Project #6790444-05
			Twenty-two trenches, 5-15 feet deep, across Mission Creek fault (CDMG, 1974q,r). Trenches 1,3,4,5,6,7,25,26,27,28,30,31,32,33,35,36,37: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	265	1467	Seven Palms Valley	12/14/81	Southern California Soil and Testing, Inc.	Job #19423
			One trench, 10 feet deep, northwest of Fun Valley fault (CDMG, 1980n). Possible faulting in Ocotillo conglomerate, but no faulting in overlying Holocene alluvial and aeolian deposits (Qc (?) and Qal of Rogers, 1965).			
Desert Hot Springs	(1)	95	Desert Hot Springs	4/30/75	Gary S. Rasmussen and Associates	Project #1099
			Two trenches, 8 feet deep, northeast of Mission Creek fault (CDMG, 1980o). No faulting in Holocene fan deposits (Qal of Rogers, 1965).			
Desert Hot Springs	(2)	711	Desert Hot Springs	1/13/78	Buena Engineers, Inc.	Job #B-9105-P1
			One trench, 12 feet deep, northeast of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(3)	999	Desert Hot Springs	6/25/79	Gary S. Rasmussen and Associates	Project #1502
			One trench, maximum depth 13 feet, northeast of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Mission Creek and Associated Faults, Riverside County (Figs. 14 and 15):						
Desert Hot Springs	(4)	1098	Desert Hot Springs	1/28/80	Gary S. Rasmussen and Associates	Project #1540
			One trench, 11 to 15 feet deep, northeast of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(5)	1099	Desert Hot Springs	5/22/70	Southern California Soil and Testing, Inc.	Job #18954
			One trench, average depth 10 feet, northeast of Mission Creek fault (CDMG, 1980o). Fracturing, but no faulting in Holocene alluvium and aeolian deposits (Qal of Rogers, 1965).			
Desert Hot Springs	(6)	835	Desert Hot Springs	2/2/78	Gary S. Rasmussen and Associates	Project #1289
			Two trenches, maximum depth 12 feet, northeast of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(7)	998	Desert Hot Springs	7/2/79	Gary S. Rasmussen and Associates	Project #1493
			Six trenches, average depth 13 feet, northeast of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(8)	141	Desert Hot Springs	4/24/75	Gary S. Rasmussen and Associates	Project #1100
			One trench, maximum depth 10 feet, northeast of Mission Creek fault (CDGM, 1980o). No faulting in Holocene alluvial fan deposits (Qal of Rogers, 1965).			
Desert Hot Springs	(9)	834	Desert Hot Springs	8/31/78	Gary S. Rasmussen and Associates	Project #1393
			One trench, 11 feet deep, southwest of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(10)	597	Desert Hot Springs	8/16/77	Gary S. Rasmussen and Associates	Project #1230
			Two trenches, average depth 10 feet, across Mission Creek fault (CDMG, 1980o). Trench 2: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(11)	1001	Desert Hot Springs	8/6/79	Gary S. Rasmussen and Associates	Project #1523
			One trench, 10 to 12 feet deep, northeast of Mission Creek fault (CDMG, 1980o). Fracturing, but no faulting in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Mission Creek and Associated Faults, Riverside County (Figs. 14 and 15):						
Desert Hot Springs	(12)	881	Desert Hot Springs	9/8/78	Gary S. Rasmussen and Associates	Project #1391
			Two trenches, maximum depth 12 feet, southwest of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(13)	572	Desert Hot Springs	3/31/77	Gary S. Rasmussen and Associates	Project #1186
			One trench, average depth 10 feet, southwest of Mission Creek fault (CDMG, 1980o). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(14)	188	Seven Palms Valley	1/29/76	Gary S. Rasmussen and Associates	Project #1125
			Four trenches, average depth 10 feet, across Miracle Hill fault (CDMG, 1980n). No faulting in Holocene fan deposits (Qal of Rogers, 1965).			
Desert Hot Springs	(15)	833	Seven Palms Valley	8/24/78	Gary S. Rasmussen and Associates	Project #1383
			Two trenches, maximum depth 12 feet, northeast of Miracle Hill fault (CDMG, 1980n). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(16)	623	Seven Palms Valley	7/26/76	Gary S. Rasmussen and Associates	Project #1152
			Two trenches, 10 to 11 feet deep, northeast of Mission Creek fault (CDMG, 1980n). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Desert Hot Springs	(17)	571	Seven Palms Valley	12/10/75	Gary S. Rasmussen and Associates	Project #1120
			Two trenches, average depth 10 feet, northeast of Mission Hill fault (CDMG, 1980n). No faulting in Holocene fan deposits (Qal of Rogers, 1965).			
Desert Hot Springs	(18)	923	Seven Palms Valley	6/15/76	Gary S. Rasmussen and Associates	Project #1129
			Two trenches, maximum depth 11 feet, northeast of Mission Hill fault (CDMG, 1980n). No faulting in Holocene fan deposits (Qal of Rogers, 1965).			
Desert Hot Springs	(19)	908	Seven Palms Valley	11/2/77	Gary S. Rasmussen and Associates	Project #1263
			One trench, maximum depth 12 feet, northeast of Miracle Hill fault (CDMG, 1980n). Caliche-filled fractures but no faulting in Holocene alluvium (Qal of Rogers, 1965).			

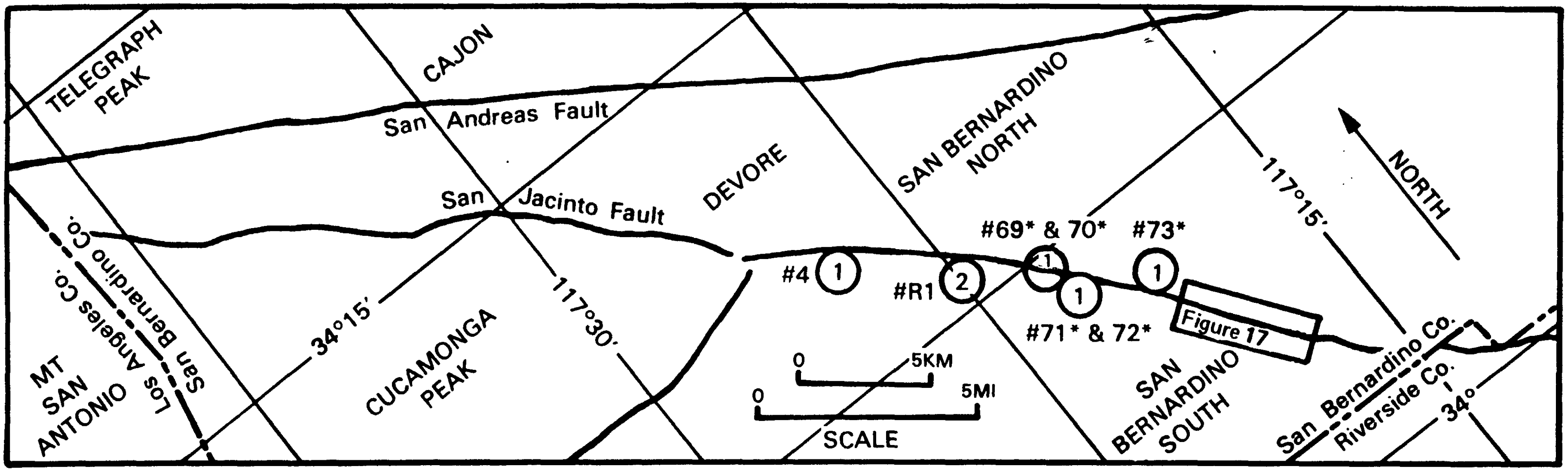

Fig. 16 - Locations of engineering geology reports along San Jacinto fault zone between Telegraph Peak and San Bernardino areas by San Bernardino County, City (*) and City of Rialto (R) numbers. See Fig. 1 for location and Fig. 2 for explanation of symbols.

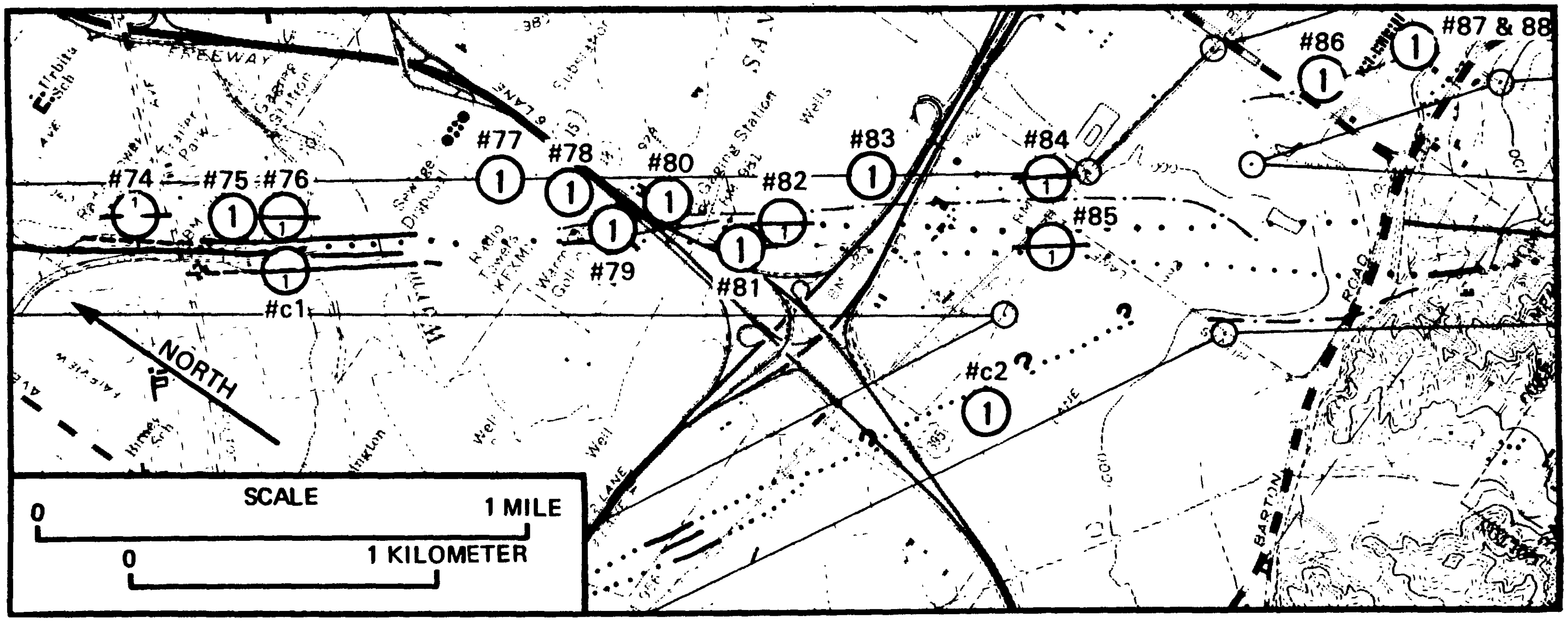

Fig. 17 - Locations of engineering geology reports along San Jacinto fault zone in Colton area by San Bernardino County and City of Colton (C) number. See Fig. 16 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, San Bernardino County (Figs. 16 and 17)						
(Rialto)	(1)	198	San Bernardino North	08/24/72 12/12/75 03/10/76	Leighton and Associates	Project #'s 2173, 75368-1, 75368-2
			Two trenches to a maximum depth of 10 feet in old alluvial terrace deposits estimated to be "as old or older than 11,000 years (Holocene) and may be as old as Pleistocene (11,000 - 3,000,000 ± years) located directly southwest of San Jacinto fault (CDMG, 1974nn), no faulting.			
San Bernardino	(4)	488	Devore	6/20/77	Gary S. Rasmussen and Associates	Project #1213
			Trench, average depth 11 feet, southwest of covered traces San Jacinto fault (CDMG, 1974mm), no faulting in Holocene alluvium.			
(San Bernardino)	(69)	1093	San Bernardino South	11/13/79	G.A. Clopine	Baseline Ave. and Martin Road
			Trenches up to 8 feet deep across concealed traces of San Jacinto fault (CDMG, 1977tt), zone of deformed Holocene aluvium in fault zone, 5 feet wide, extends to within 2 feet of surface.			
(San Bernardino)	(70)	1494	San Bernardino South	6/23/80	G.A Clopine	North of Baseline Ave.
			Trenches, 9 to 10 feet deep, across concealed traces of San Jacinto fault (CDMG, 1977tt), fault in Holocene alluvium.			
(San Bernardino)	(71)	636	San Bernardino South	7/28/77	Gary S. Rasmussen and Associates	Project #1229
			Trench and test pits southwest of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(72)	1502	San Bernardino South	10/27/81	G.A. Clopine	2010 West Foothill Blvd.
			Trench, average depth 10 feet, southwest of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(73)	1092	San Bernardino South	10/29/79 12/07/79	Woodward-Clyde Consultants	Project #41158F/0009
			Trenches, 7-11 feet deep, across "aerial photo lineament" and northeast of Claremont fault (CDMG, 1977tt), no faulting in Holocene alluvium.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, San Bernardino County (Figs. 16 and 17)						
(San Bernardino)	(74)	1491	San Bernardino South	1/22/80 4/30/80	Medall, Aragon, Worswick and Associates	Project #R1662A
			Trenches 8-10 feet deep, directly northeast of principal trace of San Jacinto fault (CDMG, 1977tt), 5 to 25 feet wide zone of fractures forming fault zone in Holocene alluvium.			
(San Bernardino)	(75)	1501	San Bernardino South	4/23/79	G.A. Clopine	Scenic Drive area
			Three trenches up to 15 feet deep, northeast of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(76)	1504	San Bernardino South	10/29/81	Gary S. Rasmussen and Associates	Project #1768
			Three trenches, 6 to 12 feet deep, northeast of San Jacinto fault (CDMG, 1977tt), fault with 5 feet wide zone of bedding deformation and 2 feet of vertical displacement in Holocene alluvium.			
(Colton)	(1)	237	San Bernardino South	5/7/76	F.A. Fleming	Colton Ave. and Harbor Industrial Drive
			Trenches up to 11 feet deep, across strands of San Jacinto fault zone (CDMG, 1977tt), faulting in Holocene alluvium.			
(San Bernardino)	(77)	1499	San Bernardino South	10/10/80	Gary S. Rasmussen and Associates	Project #1662
			Trenches, 10-16 feet deep, northeast of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(78)	639	San Bernardino South	12/5/77	Gary S. Rasmussen and Associates	Project #1278
			Trench 9-11 feet deep, northeast of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium. "Sand boil" probably caused by shaking during earthquakes of Richter magnitude 6-1/2 or greater.			
(San Bernardino)	(79)	1496	San Bernardino South	6/24/80	Geological Systems Evaluation Co.	Project #333
			Trenches, maximum depth 12 feet across San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(80)	1492	San Bernardino South	4/29/80	G.A. Clopine	South "E" St., and Fairway Drive
			Trench, average depth 9 feet, northeast of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, San Bernardino County (Figs. 16 and 17)						
(San Bernardino)	(81)	1018	San Bernardino South	5/75	W.A. Wahler and Associates	Project #0827
			Trenches, average depth 11 feet, across "concealed" trace of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(82)	1091	San Bernardino South	7/19/79	Pioneer Consultants	Job #3249-001
			Trenches up to 11 feet deep, across concealed strand of San Jacinto fault (CDMG, 1977tt), 20 foot wide fault zone in Holocene alluvium.			
(San Bernardino)	(83)	863	San Bernardino South	7/25/78	Gary S. Rasmussen and Associates	Project #1371
			Trench, 9-11 feet deep, northeast of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(Colton)	(2)	752	San Bernardino South	6/6/78	Leighton and Associates	Project #678178-01
			Trenches to 11 feet deep, southwest of San Jacinto fault (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(84)	1503	San Bernardino South	5/20/80	Gary S. Rasmussen and Associates	Parcel No. 5656, NE of Southern Pacific & Hunts Ln.
			Trenches, average depth 10 feet, directly northeast of San Jacinto fault (CDMG, 1977tt), sand dikes and boils and fault in Holocene alluvium.			
(San Bernardino)	(85)	1140	San Bernardino South	2/08/80 2/25/80	Leighton and Associates	Project #678302-05 678302-04
			Several trenches, 11 to 12 feet deep, across concealed traces of San Jacinto fault and "aerial photo lineaments" (CDMG, 1977tt), faulting, syncline, and sand blows in Holocene alluvium. Square headed nails in offset sediment possibly indicate faulting since 1800's. Fault indicated by differences in groundwater levels.			
(San Bernardino)	(86)	867	San Bernardino South	4/78	C. Price	Area No. 403 717
			Trenches up to 9 feet deep, across "aerial photo lineament" (CDMG, 1977tt), no faulting in Holocene alluvium.			
(San Bernardino)	(87)	525	San Bernardino South	4/25/77	Gary S. Rasmussen and Associates	Project #1199
			Trenches up to 11 feet deep, across "aerial photo lineament" (CDMG, 1977tt), no faulting in Holocene alluvium.			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, San Bernardino County (Figs. 16 and 17)						
(San Bernardino)	(88)	652	San Bernardino South	7/22/77	Gary S. Rasmussen and Associates	Project #1226
			Trench up to 11 feet deep, across "aerial photo lineament" (CDMG, 1977tt), no faulting in Holocene alluvium.			

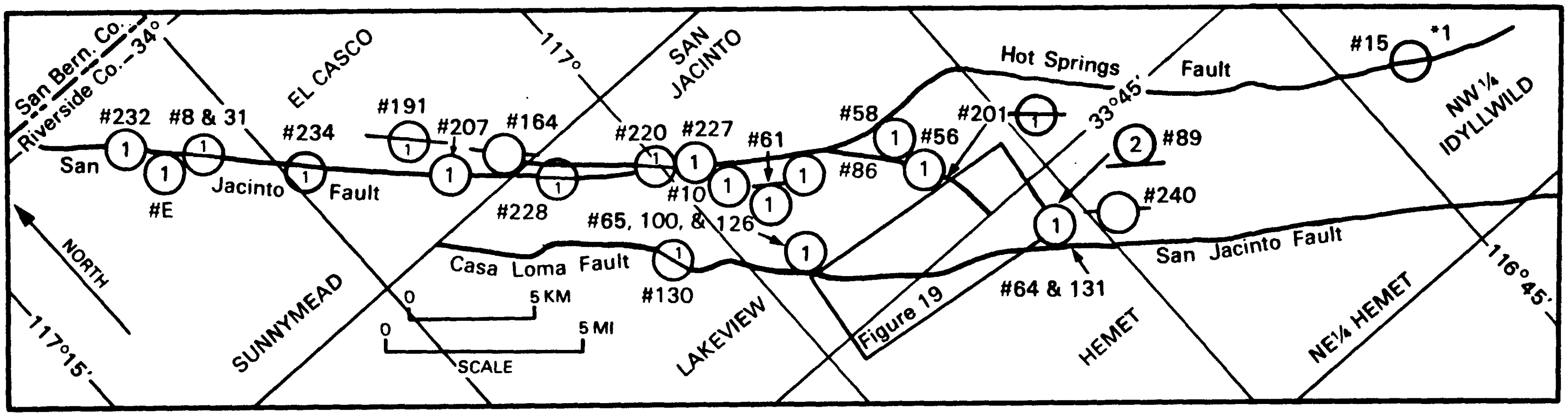

Fig. 18 - Locations of engineering geology reports along San Jacinto fault zone between Sunnymead and Idyllwild by Riverside County number. See Fig. 1 for location and Fig. 2 for explanation of symbols.

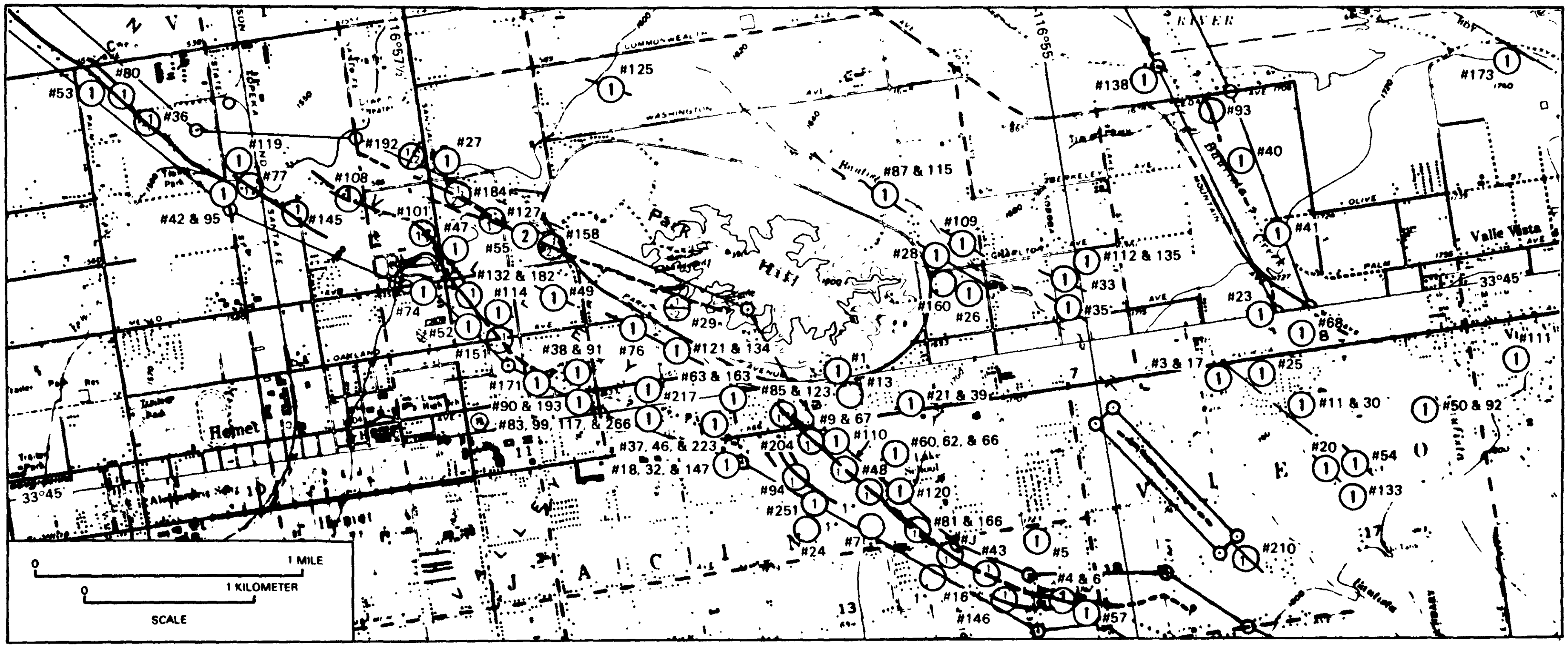

Fig. 19 - Locations of engineering geology reports along San Jacinto fault zone in Hemet area by Riverside County number. See Fig. 18 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	E	-	Sunnymead	11/30/72	Gallaher and Bovey	Tract No. 4616
			One trench, average depth 10 feet, southwest of San Jacinto fault (CDMG, 1974k). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	J	-	Hemet	2/19/74	Gary S. Rasmussen and Associates	Project #1033-0
			Four trenches, 12-15 feet deep, across Casa Loma fault (CDMG, 1980j). Trenches 1-4: faulting with vertical offsets up to 5.5 feet in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	1	-	Hemet	11/11/74	Gary S. Rasmussen and Associates	Project #1055-2
			Four trenches, 11-12 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	3	7	Hemet	9/18/74	Gary S. Rasmussen and Associates	Project #1060
			One trench, 10-12 feet deep, southwest of San Jacinto fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	4	851	Hemet	9/18/74	Gary S. Rasmussen and Associates	Project #1056
			Three trenches, 11-12 feet deep, across and southwest of Casa Loma fault (CDMG, 1980j). Trenches 1 and 2: normal faulting with offsets up to 3 feet in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	5	6	Hemet	9/24/74	Gary S. Rasmussen and Associates	Project #1058
			One trench, 8-12 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	6	8	Hemet	9/24/74	Gary S. Rasmussen and Associates	Project #1057
			Two trenches, average depth 11 feet, across Casa Loma fault (CDMG, 1980j). Trenches 1 and 2: two normal faults, with combined total offset of 4 feet, in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	7	-	Hemet	10/15/74	Gary S. Rasmussen and Associates	Project #1070
			No trenching southwest of Casa Loma fault (CDMG, 1980j). Fault located 250 feet northeast of site by prominent scarp in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	8	-	Sunnymead	10/21/74 Revised 3/4/75	Lewis S. Lohr	Parcel Map 6286
			Two trenches, maximum depth 11 feet, across San Jacinto fault (CDMG, 1974k). Southeasterly trench: right-lateral faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	9	11	Hemet	10/8/74	Gary S. Rasmussen and Associates	Project #1062
			One trench, 11-12 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	10	80	San Jacinto	10/23/74	Pioneer Consultants	Job #1954-001
			Trench, maximum depth 14 feet, southwest of San Jacinto fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	11	12	Hemet	10/25/74	Gary S. Rasmussen and Associates	Project #1073
			Two trenches and one pit, 10-11 feet deep, northeast of San Jacinto fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	13	45	Hemet	9/24/74	Gary S. Rasmussen and Associates	Project #1059
			No trenching northeast of Casa Loma fault (CDMG, 1980j). Presence of fault a few hundred feet to the southwest determined by projection of a lineation on aerial photos and previous trenching in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	15	79	NW-1/4 Idyllwild	11/12/74 Revised 12/74	Lewis S. Lohr	Baldy Mountain Recreational Vehicle Park
			No trenching on Hot Springs fault (CDMG, 1974p). Fault location based on topographic expression in colluvial deposits of Pleistocene age (Qc of Rogers, 1965).			
Riverside	16	33	Hemet	10/15/74	Gary S. Rasmussen and Associates	Project #1068
			No trenching southwest of Casa Loma fault (CDMG, 1980j). Fault located by prominent scarp 65 feet northeast of site in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	17	44	Hemet	11/26/74	Gary S. Rasmussen and Associates	Project #1076
			Two trenches, 10-12 feet deep, southwest of San Jacinto fault (CDMG, 1974j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	18	43	Hemet	10/25/74	Gary S. Rasmussen and Associates	Project #1075
			One trench, 11 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	20	146	Hemet	7/23/75	Earth Science Laboratories, Inc.	Job #337-S
			Two trenches, average depth 11-12 feet, across San Jacinto fault (CDMG, 1974j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	21	46	Hemet	12/23/74	Gary S. Rasmussen and Associates	Project #1080
			One trench, 11-13 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	23	517	San Jacinto Hemet	2/12/75	Gary S. Rasmussen and Associates	Project #1086
			Five trenches, 10 feet deep, southwest of San Jacinto fault (CDMG, 1980i,j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	24	42	Hemet	2/14/75	Gary S. Rasmussen and Associates	Project #1088
			No trenching southwest of Casa Loma fault (CDMG, 1980j). Presence of fault 1000+ feet to the northeast determined by scarp in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	25	3	Hemet	3/4/75	Gary S. Rasmussen and Associates	Project #1090
			One trench, average depth 9 feet, northeast of San Jacinto fault (CDMG, 1974j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	26	71	San Jacinto	3/10/75	Lewis S. Lohr	Job #4-75-3
			One trench, 10 feet deep, southwest of Park Hill fault (Sharp, 1972). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	27	2	San Jacinto	3/24/75	Gary S. Rasmussen and Associates	Project #1093
			One trench, 81/2 feet deep, northeast of Bautista Creek fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	28	88	San Jacinto	3/20/75	Lewis S. Lohr	Job # 5-75-3
			One trench, 10 feet deep, across Park Hill fault (Sharp, 1972). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	29	89	San Jacinto	4/4/75	Gary S. Rasmussen and Associates	Project #1096
			One trench, 10 1/2 to 11 feet deep, southwest of Bautista Creek fault (CDMG, 1980i). No faulting in Bautista Formation or Holocene alluvium (Qc and Qal of Rogers, 1965).			
Riverside	30	75	Hemet	4/10/75	Lewis S. Lohr	Job #6-75-4
			Two trenches, maximum depth 10 feet, northeast of San Jacinto fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	31	126	Sunnymead	5/21/75	Gary S. Rasmussen and Associates	Project #1101
			Three trenches, approximately 10 feet deep, across San Jacinto fault (CDMG, 1974k). Trenches 1-3: reverse faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	32	130	Hemet	3/3/75	Gary S. Rasmussen and Associates	Project #1087
			No trenching southwest of Casa Loma fault (CDMG, 1980j). Fault located 2100 feet east of site by prominent fault scarp in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	33	125	San Jacinto	5/24/75	Lewis S. Lohr	Job # 7-75-5
			One trench, 10 feet deep, across trace of hidden fault in Park Hill fault zone (CDMG, 1974i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	35	145	San Jacinto	6/30/75	Lewis S. Lohr	Job # 8-75-6
			One trench, 10 feet deep, across trace of Park Hill fault (Sharp, 1972). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	36	140	San Jacinto	6/16/75	Gary S. Rasmussen and Associates	Project #1104
			Four trenches, averaging 10 feet deep, across Casa Loma fault (CDMG, 1980i). Trenches 1 to 4: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	37	142	Hemet	4/5/75	Gary S. Rasmussen and Associates	Project #1092
			Three trenches, minimum depth 11 feet, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	38	158	San Jacinto	10/29/75	Gary S. Rasmussen and Associates	Project #1118
			Three trenches, minimum depth 11 feet, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	39	169	Hemet	11/21/75	Gary S. Rasmussen and Associates	Project #1121
			Two trenches, averaging 11 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	40	174	San Jacinto	12/10/75	F. Allen Fleming	Tentative Tract #6970 (4460)
			Two trenches, 10 feet deep, east of San Jacinto fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	41	213	San Jacinto	12/29/75	F. Allen Fleming	
			Three trenches, 11 feet deep, east of southwest branch of San Jacinto fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	42	211	San Jacinto	3/30/76	Irvine Soils Engineering and Testing Laboratory	Job #1019-00
			One trench and 5 pits, approximately 8 feet deep, southwest of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	43	190	Hemet	1/19/76	Gary S. Rasmussen and Associates	Project #1124
			Three trenches, 10-13 feet deep, across and northeast of Casa Loma fault (CDMG, 1980j). Trench 1-A: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	46	207	Hemet	3/5/76	Lewis S. Lohr	
			One trench, 10-12 feet deep, southwest of unnamed fault in Casa Loma fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	47	210	San Jacinto	3/22/76	Charles Price	Job #346-757
			One trench, 9-10 feet deep, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	48	227	Hemet	2/25/76	Gary S. Rasmussen and Associates	Project #1128
			Two trenches, 10-12 feet deep, northeast of and across Casa Loma fault (CDMG, 1980j). Trench 2: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	49	244	San Jacinto	6/3/76	Lewis S. Lohr	
			One trench, 10-12 feet deep, across trace of unnamed fault in Casa Loma-Bautista Creek fault zone (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	50	-	Hemet	12/26/74	Gary S. Rasmussen and Associates	Project #1079
			One trench, averaging 10 feet deep, northeast of unnamed fault in San Jacinto fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	52	315	San Jacinto	7/29/76	Lewis S. Lohr	Job #13-76-7
			One trench, 10-12 feet deep, southwest of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	53	321	San Jacinto	8/23/76	Lewis S. Lohr	Job #14-76-8
			One trench, 10-11 feet deep, southwest of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	54	332	Hemet	9/9/76	Stickel and Associates	Project #1829-001
			One trench, average depth 10 feet, across unnamed fault in San Jacinto fault zone (CDMG, 1974j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	55	330	San Jacinto	10/13/76	Lewis S. Lohr	Job #15-76-10
			One trench, maximum depth 11 feet, across unnamed (Bautista Creek) fault in San Jacinto fault zone (CDMG, 1980i). No faulting in "Pleistocene Bautista Formation (?)" (Qc of Rogers, 1965).			
Riverside	56	334	San Jacinto	10/21/76	Envicom Corporation	Job #CV 1864-W
			Four trenches, 10 feet deep, across San Jacinto and Claremont faults (CDMG, 1980l). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	57	354	Hemet	8/5/76	Gary S. Rasmussen and Associates	Project #1151
			One trench, 10-11 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	58	353	San Jacinto	10/4/76	Envicom Corporation	Tentative Tract 8072
			Three trenches, averaging 10 feet deep, northeast of San Jacinto fault and east of the Hot Springs fault (CDMG, 1980i). No faulting in Holocene alluvium or fan deposits (Qal of Rogers, 1965).			
Riverside	60	356	Hemet	9/1/76	Pioneer Consultants	Job #2429-001
			Three trenches, 10-12 feet deep, northeast of unnamed fault in Casa Loma fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	61	355	San Jacinto	11/1/76	Lewis S. Lohr	Job #17-76-10
			One trench, 8-14 feet deep, southwest of San Jacinto fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	62	364	Hemet	11/24/76	Lewis S. Lohr	Job #18-76-11
			One trench, 10-11 feet deep, northeast of unnamed fault in Casa Loma-Bautista Creek fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	63	382	San Jacinto	12/20/76	Lewis S. Lohr	Job #19-76-12
			One trench, 10-12 feet deep, southwest of unnamed fault in Casa Loma-Bautista Creek fault zone (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	64	407	Hemet	1/25/77	Lewis S. Lohr	Job #20-77-1
			One trench, 10-11 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	65	412	San Jacinto	1/24/77	Gary S. Rasmussen and Associates	Project #1172
			One trench, 10-13 feet deep, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	66	424	Hemet	2/19/77	Lewis S. Lohr	Job #22-77-2
			One trench, 10 feet deep, northeast of unnamed fault in Casa Loma fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	67	422	Hemet	2/15/77	Lewis S. Lohr	Job #21-77-2
			One trench, 10 feet deep, across unnamed fault in Casa Loma fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	68	-	Hemet	1/11/77	Gary S. Rasmussen and Associates	Project #1169
			One trench and a pit, 11-12 feet deep, northeast of San Jacinto fault (CDMG, 1974j). No faulting in late Holocene alluvium (Qal of Rogers, 1965).			
Riverside	74	580	San Jacinto	3/21/77	Gary S. Rasmussen and Associates	Project #1158
			One trench, 11-12 feet deep, southwest of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	76	475	San Jacinto	5/7/77	Lewis S. Lohr	Job #25-77-5
			One trench, maximum depth 11 feet, across unnamed fault in Casa Loma-Bautista Creek fault zone (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	77	708	San Jacinto	11/17/75	Gary S. Rasmussen and Associates	Project #1119
			Two trenches, minimum depth 11 feet, across Casa Loma and related en echelon faults (CDMG, 1980i). Trenches 1,2: normal and right-lateral faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	80	485	San Jacinto	5/17/77	Lewis S. Lohr	Job #27-77-5
			Three trenches, maximum depth 13 feet, across Casa Loma fault (CDMG, 1980i). Trench 1: series of faults in Holocene alluvium with displacements varying between .5 and 7 feet. Trench A: numerous stepped normal faults in Holocene alluvium. Trench B: numerous, small, stepped normal faults and one prominent fault with gouge in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	81	480	Hemet	4/5/76	Gary S. Rasmussen and Associates	Project #1132
			Five trenches, 10-12 feet deep, across and northeast of Casa Loma fault (CDMG, 1980j). Trenches 2,A,B,C: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	83	483	Hemet	6/5/77	Lewis S. Lohr	Job #29-77-6
			One trench, 10 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	85	518	Hemet	7/15/77	Lewis S. Lohr	Job #32-77-7
			Two trenches, 10 feet deep, across unnamed fault (Casa Loma fault ?) (CDMG, 1980j). Normal faulting in both trenches in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	86	-	San Jacinto	7/5/77	Gary S. Rasmussen and Associates	Project #1210
			Trench, averaging 11 feet deep, southwest of Claremont fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	87	534	San Jacinto	8/15/77	Lewis S. Lohr	Job #33-77-8
			One trench, maximum depth 12 feet, across hidden fault northeast of Park Hill fault (CDMG, 1974i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	89	549	Hemet	8/29/77	Lewis S. Lohr	Job #35-77-8
			One trench, 10 feet deep, northeast of unnamed fault in San Jacinto fault zone (CDMG, 1974j). No faulting in Pleistocene fanglomerates (Qc of Rogers, 1965).			
Riverside	90	1252	San Jacinto, Hemet	5/10/77	Gary S. Rasmussen and Associates	Project #1192
			Three trenches, maximum depth 20 feet, southwest of Casa Loma fault (CDMG, 1980i,j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	91	574	San Jacinto	5/10/77	Gary S. Rasmussen and Associates	Project #1192
			Three trenches, maximum depth 17 feet, northeast of inferred trace of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	92	583	Hemet	10/6/77	Stickel and Associates	Tentative Tract #9567
			One trench, average depth 10 feet, northeast of unnamed fault in San Jacinto fault zone (CDMG, 1974j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	93	573	San Jacinto	9/27/77	Lewis S. Lohr	Job #37-77-9
			Two trenches, maximum depth 12 feet, across San Jacinto fault (CDMG, 1980i). Trench 1: maximum displacement of 2.4 feet by reverse and right-lateral (?) displacement. Trench 2: several faults exposed which exhibited normal or reverse displacements from 1-6 inches. Faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	94	584	Hemet	10/4/77	Lewis S. Lohr	Job #38-77-10
			Seven trenches, 10 feet deep, across Casa Loma fault (CDMG, 1980j). Trenches 1-7: faulting in Holocene alluvium (Qal of Rogers, 1965) with "three displacement events" with offsets up to 1 foot.			
Riverside	95	596	San Jacinto	6/12/77	Lewis S. Lohr	Job #30-77-6
			One trench, maximum depth 13 feet, southwest of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	99	616	Hemet	11/1/77	Lewis S. Lohr	Job #41-77-11
			Two trenches, 6-15 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	100	630	San Jacinto	11/21/77	Gary S. Rasmussen and Associates	Project #1248
			One trench, 10-15 feet deep, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	101	632	San Jacinto	12/9/77	Lewis S. Lohr	Job #42-77-12
			Four trenches, maximum depth 14 feet, across trace of unnamed fault in Casa Loma-Bautista Creek fault zone (CDMG, 1980i). All four trenches exposed evidence of normal faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	108	659	San Jacinto	12/16/77	Lewis S. Lohr	Job #43-77-12
			Two trenches, maximum depth 12 feet, across Casa Loma and Bautista Creek faults (CDMG, 1980i). Trenches 1,2: faulting in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	109	658	San Jacinto	1/6/78	Lewis S. Lohr	Job #45-78-1
			One trench, 12 feet deep, across trace of hidden fault in Park Hill fault zone (CDMG, 1974i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	110	670	Hemet	12/28/77	Lewis S. Lohr	Job #44-77-12
			Two trenches, 10-14 feet deep, across Casa Loma fault (CDMG, 1980j). Trenches 1 and 2: normal faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	111	633	Hemet	1/9/78	Lewis S. Lohr	Job #46-78-1
			One trench, approximately 10 feet deep, northeast of unnamed fault in San Jacinto fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	112	669	San Jacinto	1/30/78	Lewis S. Lohr	Job #48-78-1
			One trench, 10 feet deep, northeast of hidden fault in Park Hill fault zone (CDMG, 1974i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	114	676	San Jacinto	2/15/78	Gary S. Rasmussen and Associates	Project #1292
			One trench, 11-12 feet deep, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	115	684	San Jacinto	2/22/78	Lewis S. Lohr	Job #50-78-2
			Three trenches, maximum depth 12 feet, across trace of hidden fault in Park Hill fault zone (CDMG, 1974i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	117	683	Hemet	11/23/77	Gary S. Rasmussen and Associates	Project #1270
			One trench 11-13 feet deep southwest of Casa Loma fault (CDMG 1980j). Fractures present but no faulting in Holocene alluvium (Qal of Rogers 1965).			
Riverside	119	745	San Jacinto	3/29/78	Gary S. Rasmussen and Associates	Project #1286
			Two trenches, averaging 10 feet deep, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	120	725	Hemet	2/9/78	Lewis S. Lohr	Job #49-78-2
			One trench, 10-11 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	121	739	San Jacinto	3/13/78	Lewis S. Lohr	Job #51-78-3
			Five trenches, averaging 10 feet deep, across trace of unnamed fault in Casa Loma-Bautista Creek fault zone (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	123	754	Hemet	1/21/78	Lewis S. Lohr	Job #47-78-1
			Four trenches, maximum 16 feet deep, across Casa Loma fault (CDMG, 1980j). Trenches 1-4: Normal faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	125	-	San Jacinto	4/7/78	Gary S. Rasmussen and Associates	Project #1307
			Four trenches, averaging 10 feet deep, across, east and west of Park Hill fault (CDMG, 1974l). Trench 2: northeast trending offset observed in Holocene alluvium (Qal of Rogers, 1965) but was attributed to "secondary effects of strong ground motion" such as "hydroconsolidation of subsurface soils" or "liquefaction."			
Riverside	126	753	San Jacinto	5/16/78	Lewis S. Lohr	Job #60-78-5
			One trench, 10 feet deep, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	127	756	San Jacinto	4/22/78	Lewis S. Lohr	Job #57-78-4
			Five trenches, maximum depth 14 feet, across trace of unnamed fault and Casa Loma or related fault in San Jacinto fault zone (CDMG, 1980i). Displacement observed in trenches 1 and 4 across Casa Loma or related fault in Holocene stream deposits (Qal of Rogers, 1965). Trench 5: clay filled fractures and 2 inch vertical displacement attributed to settlement on unnamed fault in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	130	778	Lakeview	6/3/78	Lewis S. Lohr	Job #61-78-6
			Two trenches, approximately 10 feet deep, across and west of Casa Loma fault (CDMG, 1974l). Trench 1: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	131	779	Hemet	6/30/78	Lewis S. Lohr	Job #63-78-6
			One trench, approximately 10 feet deep, northeast of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	132	789	San Jacinto	4/28/78	Lewis S. Lohr	Job #58-78-4
			One trench, maximum depth 14 feet, across Casa Loma fault (CDMG, 1980i). Normal faulting in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	133	788	Hemet	6/16/78	Gary S. Rasmussen and Associates	Project #1359
			Two trenches, 10-11 feet deep, across and southwest of San Jacinto fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	134	786	San Jacinto	3/28/78	Lewis S. Lohr	Job #53-78-3
			One trench, maximum depth 13 feet, across unnamed fault in San Jacinto fault zone (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	135	787	San Jacinto	5/3/78	Lewis S. Lohr	Job #59-78-5
			One trench, 10 feet deep, northeast of Park Hill fault and hidden fault (CDMG, 1974i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	138	810	San Jacinto	7/8/78	Lewis S. Lohr	Job #64-78-7
			Two trenches, maximum depth 14 feet, west of San Jacinto fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	145	993	San Jacinto	02/77 10/78	Irvine Soils Engineering	Job #1039-00 and 1575-00
			Five trenches, maximum depth 12 feet, across Casa Loma fault (CDMG, 1980i). Trenches 3,4, and 5: offsets attributable to faulting in bedded clayey silt layer in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	146	948	Hemet	5/4/78	Gary S. Rasmussen and Associates	Project #1308
			Six trenches, 10-12 feet deep, across Casa Loma fault (CDMG, 1980j). Trenches 1,2,3,4,5,: faulting with vertical offsets up to 1 foot in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	147	860	Hemet	8/31/78	Lewis S. Lohr	Job #67-78-8
			Three trenches, 10 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	151	880	San Jacinto	4/23/77	Lewis S. Lohr and Associates	Job #24-77-4
			Six trenches, averaging 10 feet deep, across and southwest of Casa Loma fault (CDMG, 1980i). Vertical displacements up to 24 inches in northerly diagonal trench and in two short trenches in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	158	-	San Jacinto	1/16/79	Gary S. Rasmussen and Associates	Project #1428
			Seven trenches, 10-12 feet deep, across Bautista Creek fault and related faults (CDMG, 1980i). Three fault zones identified from offset observed in trenches 1,4,5,6 and 7. Fault zone 1: faulting in late Pleistocene Bautista Formation (Qc of Rogers, 1965). Fault zone 2: late Pleistocene Bautista beds faulted against Holocene (?) alluvium (Qc and Qal of Rogers, 1965). Fault zone 3: faulting in Bautista Formation, no faulting in overlying Holocene alluvium (Qc and Qal of Rogers, 1965).			
Riverside	160	926	San Jacinto	10/16/74	Lewis S. Lohr	Parcel Map 13825
			No trenching in Park Hill fault zone (CDMG, 1974i). No physiographic evidence for faulting found.			
Riverside	163	927	Hemet	2/2/79	Lewis S. Lohr	Job #71-79-2
			One trench, 10 feet deep, southwest of unnamed fault in Casa Loma-Bautista Creek fault zone (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	164	945	El Casco	2/10/79	Lewis S. Lohr	Job #72-79-2
			No trenching in San Jacinto fault zone (CDMG, 1974m). Location of fault based on shear and fracture zone in Pliocene non-marine rocks (Pc of Rogers, 1965).			
Riverside	166	956	Hemet	3/5/79	Gary S. Rasmussen and Associates	Project #1446
			Three trenches, 10-12 feet deep, across Casa Loma fault (CDMG, 1980j). Fracturing and offset bedding with minimum vertical displacements of 5 feet in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	171	1205	San Jacinto	1/31/79	Gary S. Rasmussen and Associates	Project #1443
			One trench, 10-12 feet deep, southwest of Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	173	969	San Jacinto	1/3/79	Gary S. Rasmussen and Associates	Project #1424
			Two trenches, 10-12 feet deep, southwest of Claremont fault (CDMG, 1974i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	182	996	San Jacinto	5/30/79	Lewis S. Lohr	Job #77-79-5
			One trench, averaging 10 feet deep, across Casa Loma fault (CDMG, 1980i). Faulting, with displacements of up to 6 inches, in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	184	1035	San Jacinto	6/5/79	Lewis S. Lohr	Job #78-79-6
			Five trenches, maximum depth 14 feet, across Bautista Creek and unnamed fault (CDMG, 1980i). Faulting in all five trenches with displacements of up to 6.8 feet in Pleistocene Bautista Formation and Holocene alluvium (Qc and Qal of Rogers, 1965).			
Riverside	191	-	El Casco	10/1/79	Pioneer Consultants	Job #3213-007
			Thirteen trenches, 5-13 feet deep, across three unnamed faults northeast and parallel to San Jacinto fault (CDMG, 1974m). Trenches 1,5,5a,11: offsetting in Holocene alluvium (Qal of Rogers, 1965) along fault 2. Trenches 2,7,10: offsetting in Pliocene San Timoteo Formation (Pc of Rogers, 1965) and questionable evidence for offset in Holocene deposits along fault 3. Trenches 3,4: offsetting in San Timoteo Formation, no faulting in Holocene alluvium along fault 4.			
Riverside	192	1066	San Jacinto	3/9/79	Lewis S. Lohr	Job #75-79-3
			Two trenches, averaging 10 feet deep, northeast of Casa Loma fault (CDMG, 1980i). No faulting in Pleistocene "sediments" (?) or Holocene alluvium (Qc (?) and Qal of Rogers, 1965).			
Riverside	193	1275	San Jacinto	5/10/77	Gary S. Rasmussen and Associates	Project #1196
			Two trenches, maximum depth 20 feet, southwest of the Casa Loma fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	201	1135	San Jacinto	5/9/79	GeoSoils, Inc.	W.O. 596-602-00
			Twenty-three trenches and pits, 8-15 feet deep, across San Jacinto fault (CDMG, 1980i). Trenches 3,4,5,8, and 15: displacement of alluvial layers ranging from 3-18 inches in Holocene alluvium (Qal of Rogers, 1965). Trench 13: 4-6 inches of displacement in Holocene alluvium.			
Riverside	204	1130	Hemet	3/14/80	Lewis S. Lohr	Job #80-80-3
			One trench, 10-11 feet deep, across Casa Loma fault (CDMG, 1980j). Two separate zones of faulting with 1.5 feet and 2.8 feet vertical displacement in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	207	1151	El Casco	4/25/80	Lewis S. Lohr	Job #82-80-4
			One trench, 10 feet deep, across trace of Claremont (?) fault (CDMG, 1974m). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	210	1198	Hemet	4/21/80	Gary S. Rasmussen and Associates	Project #1608
			Five trenches, 10-12 feet deep, across and southwest of Lake Street fault (CDMG, 1980j). Trenches 1A, 1B, 2, 3B: faulting with vertical offsets of up to 18 inches in Holocene alluvium (Qal of Rogers, 1965).			

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San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	217	1212	San Jacinto	6/2/80	Lewis S. Lohr	Job #83-80-6
			One trench, maximum depth 13 feet, northeast of Casa Loma fault (CDMG, 1980i) No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	220	1237	San Jacinto Lakeview	4/10/80	Pioneer Consultants	Job #3397-001
			Three trenches, 10-13 feet deep, across and southwest of unnamed faults in San Jacinto fault zone (CDMG, 1980i, 1974l). Trench 1: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	223	1227	Hemet	8/8/80	Lewis S. Lohr	Job #84-80-9
			One trench, 10 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	227	1308	San Jacinto	4/23/81	Irvine Soils Engineering, Inc.	Job #2023-00
			Twelve trenches, 3-11 feet deep, across San Jacinto fault (CDMG, 1980i). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	228	1251	Lakeview	9/26/80	Lewis S. Lohr	Job #85-80-9
			Two trenches, averaging 10 feet deep, across unnamed faults in San Jacinto fault zone (CDMG, 1974l). Trenches 1 and 2: faulting, with vertical displacements up to 5 feet in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	232	1274	Sunnymead	10/22/80	Lewis S. Lohr	Job #86-80-10
			One trench, approximately 10 feet deep, across San Jacinto fault (CDMG, 1974k). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	234	1300	El Casco	12/16/80	Lewis S. Lohr	Job #87-80-12
			Eighteen trenches, maximum depth 11 feet, across San Jacinto and related faults (CDMG, 1974m). Trenches 1-6,7-17: faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	240	1315	Hemet	12/4/80	Leighton and Associates	Project #680899-01
			No trenching in "Park Hill" fault zone (San Jacinto fault of Rogers, 1965). No physiographic or magnetic evidence for faulting in Pleistocene Bautista Formation (Qt of Rogers, 1965).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Jacinto Fault Zone, Riverside County (Figs. 18 and 19)						
Riverside	251	1368	Hemet	6/18/81	Lewis S. Lohr	Job #88-81-6
			One trench, 10 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			
Riverside	266	1469	Hemet	5/20/82	Lewis S. Lohr	Job #95-32-05
			One trench, 10 feet deep, southwest of Casa Loma fault (CDMG, 1980j). No faulting in Holocene alluvium (Qal of Rogers, 1965).			

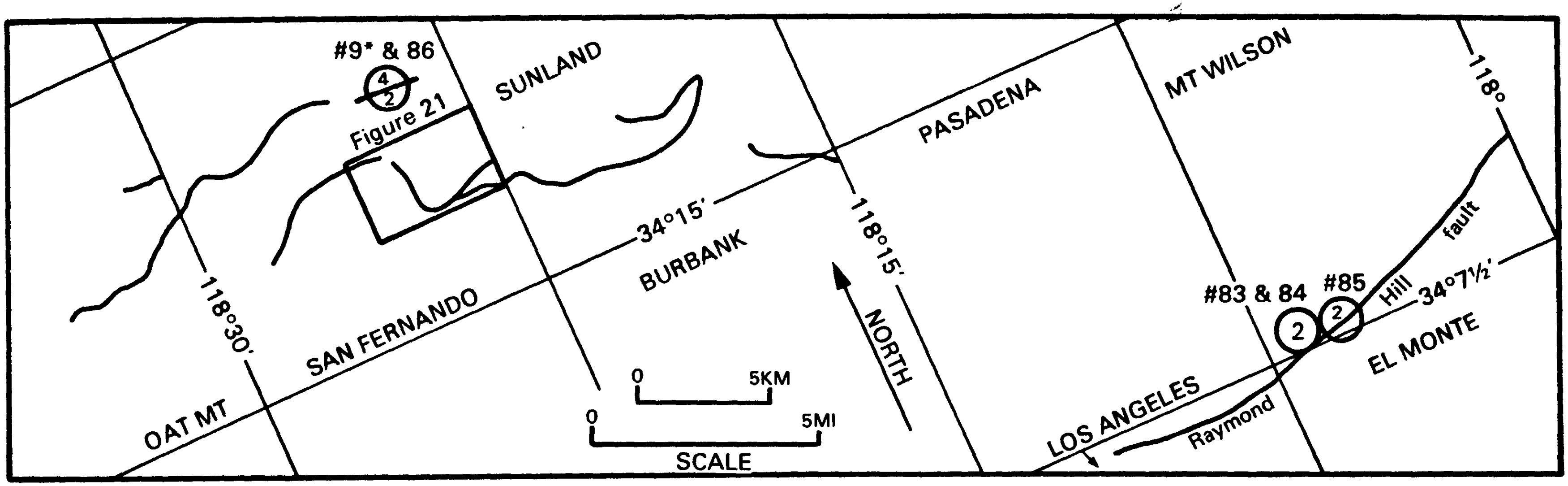

Fig. 20 - Locations of engineering geology reports along faults in San Fernando area and Raymond Hill fault by Los Angeles County and City (*) numbers. See Fig. 1 for location and Fig. 2 for explanation of symbols.

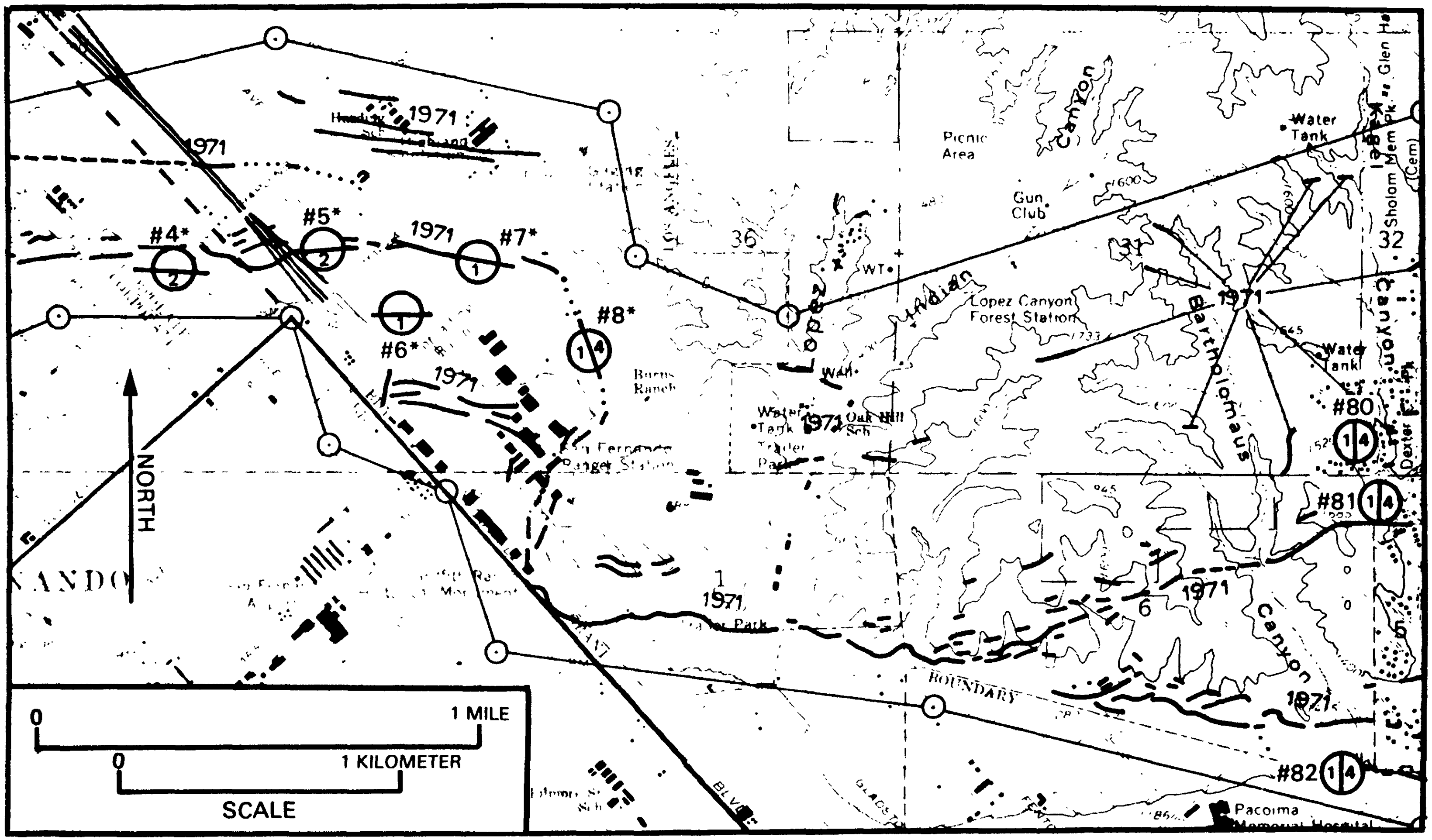

Fig. 21 - Locations of engineering geology reports along faults in San Fernando area by Los Angeles County and City (*) numbers. See Fig. 20 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Fernando Area Faults, Los Angeles County (Figs. 20 and 21)						
(Los Angeles)	(4)	384	San Fernando	6/19/76	John D. Merrill	Project #63408
			Two trenches, 8 feet deep, across Sylmar fault (CDMG, 1979v). Trench 1: faulting attributable to February 9, 1971 earthquake in older alluvium (Qos of Barrows, et al., 1974).			
(Los Angeles)	(5)	393	San Fernando	10/21/76	The Earth Group, Inc.	W.O. #P-6021
			One trench, unspecified depth, across trace of Sylmar fault (CDMG, 1979v). Loose sand zone and truncation of alluvial stratification cited as evidence for faulting in older alluvial deposits (Qos of Barrows, et al., 1974).			
(Los Angeles)	(6)	858	San Fernando	4/7/78	Ralph Ernest Smith and Associates	12924 Chippewa St., Sylmar
			One trench, 5 feet deep, south of Sylmar fault (CDMG, 1979v). Faulting, confirmed by seismic profile analysis, in "fill material" (Qaf and Qsc (?) of Barrows, et al., 1974).			
(Los Angeles)	(7)	1250	San Fernando	1/28/80	GeoSoils, Inc.	W.O. #1067-VN
			Three trenches, 5 feet deep, across Sylmar fault (CDMG, 1979v). Trench 1: faulting in Holocene alluvium (Qsc of Barrows, et al., 1974).			
(Los Angeles)	(8)	955	San Fernando	1/16/79	Foundation Engineering Co., Inc.	Tentative Tract No. 36183
			Ten trenches, average depth 5 feet, across trace of Sylmar fault (CDMG, 1979v). Trench 8: faulting in Townsley, Pico Formation bedrock. Trenches 4,10: sand-stone bedrock of Townsley, Pico Formation thrust over Holocene alluvium (Ttp and Qsc of Barrows, et al., 1974).			
(Los Angeles)	(9)	307	San Fernando	3/1/71	F. Beach Leighton and Associates, Inc.	Project #1267
			Five borings, 22 to 30 feet deep, and 2 pits 8 feet deep, across Veterans fault (CDMG, 1979v). Boring 5 and pit 2: faulting in claystone-siltstone and terrace gravel beds (Tqs and Qof of Barrows, et al., 1974).			
Los Angeles	(80)	1376	San Fernando	9/1/81	Geoplan, Inc.	Project #15580, Tentative Parcel Map 8075, 12489 N. Blue Sage Road, Kagel Canyon District
			Two trenches, maximum depth 17 feet, north of Kagel fault (CDMG, 1979v). No faulting in Pliocene Pico Formation, older alluvium or residual soil (Ttp, Qoa and Qal of Barrows, et al., 1974).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
San Fernando Area Faults, Los Angeles County (Figs. 20 and 21)						
Los Angeles	(81)	1322	San Fernando	3/23/80	Brian A. Robinson and Associates, Inc.	J.O. No. 0336, 12271 Forest Trail, Kagel Canyon
			Two trenches, maximum depth 8 feet and log of steep road cut, north of Kagel fault (CDMG, 1979v). Trenches 1,2: no faulting in Miocene Modelo Formation shale and conglomerate or Holocene alluvium (Tm and Qal of Barrows, et al., 1974). Road cut: No faulting in Pliocene Pico Formation sandstone or Holocene alluvium (Ttp and Qal of Barrows, et al., 1974).			
Los Angeles	(82)	1174	San Fernando	1/17/80	Geoplan, Inc.	Project #84637, 12003 N. Kagel Canyon Road, Lakeview Terrace District
			Five trenches, 8-15 feet deep, west of Lakeview fault (CDMG, 1979v). Trench 4: slight fracturing, but no faulting in Miocene Modelo Formation. No fracturing or faulting in overlying stream terrace deposits or residual soil (Tm, Qt and Qal (?) of Barrows, et al., 1974).			
Los Angeles	(86)	-	San Fernando	2/3/81	California Geo-Systems, Inc.	Job #GS80-1123. Tentative Tract No. 40605. Sylmar.
			Three trenches, maximum depth 10 feet, across trace of Veterans fault (CDMG, 1979v). Trench 3: faulting and fracturing in lower Pleistocene Pacoima Formation (?) and terrace deposits (TQs and Qof of Barrows, et al., 1974).			
Raymond Hill Fault, Los Angeles County (Fig. 20)						
Los Angeles	(83)	1428	Mt. Wilson	2/18/82	California Geo-Systems, Inc.	Job # GS82-210. Proposed PM 14975, Arcadia.
			One trench, 13 feet deep, northwest of Raymond Hill fault (CDMG, 1977w). No faulting in pre-Holocene alluvium (Qc of Jennings and Strand, 1969).			
Los Angeles	(84)	1226	Mt. Wilson	9/17/80	Bob Dickey Geotechnical, Inc.	Job # 0-176. Tentative PM 12913, 1040 San Gabriel Blvd.
			Two trenches, maximum depth 7 feet, northwest of Raymond Hill fault (CDMG, 1977w). No faulting in alluvium (Qc of Jennings and Strand, 1969).			
Los Angeles	(85)	-	Mt. Wilson	10/9/73	Leighton-Yen and Associates, Inc.	Project #73220-1. Tentative Tract 32041, San Marino.
			Three trenches, maximum depth 10 feet, across Raymond Hill fault (CDMG, 1977w). Trenches 1,3: Fracturing, shearing and faulting in older alluvium (Qc of Jennings and Strand, 1969).			

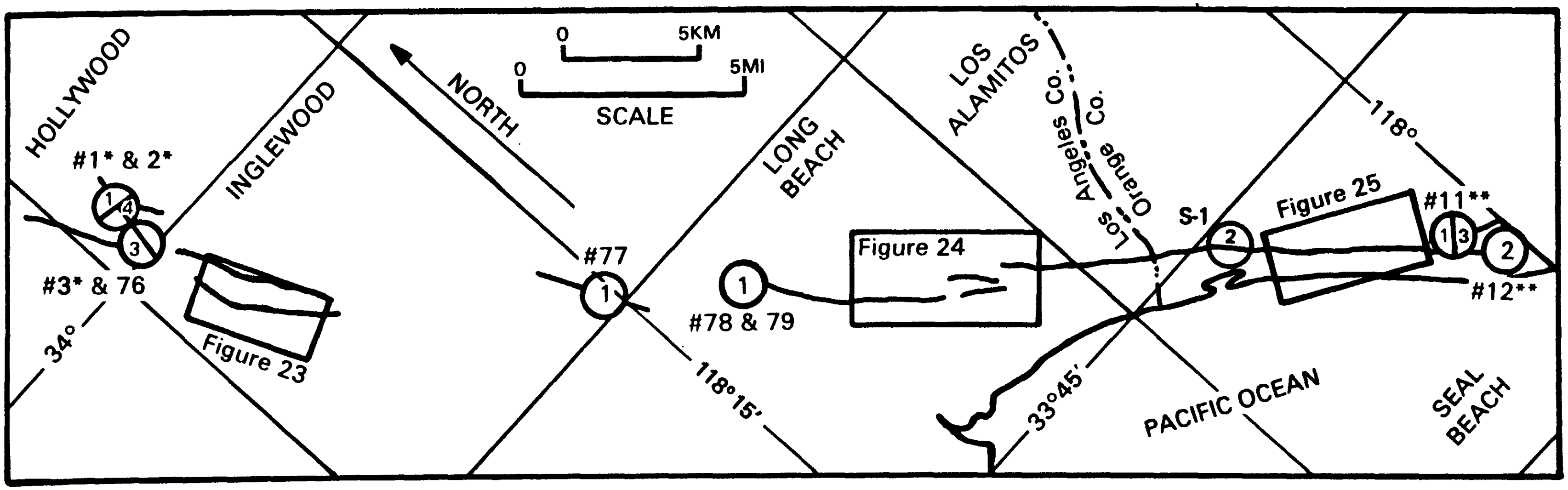

Fig. 22 - Locations of engineering geology reports along Inglewood-Newport fault zone in Inglewood and Seal Beach areas by Los Angeles County, City (*), Huntington Beach (**) and Seal Beach (S) numbers. See Fig. 1 for location and Fig. 2 for explanation of symbols.

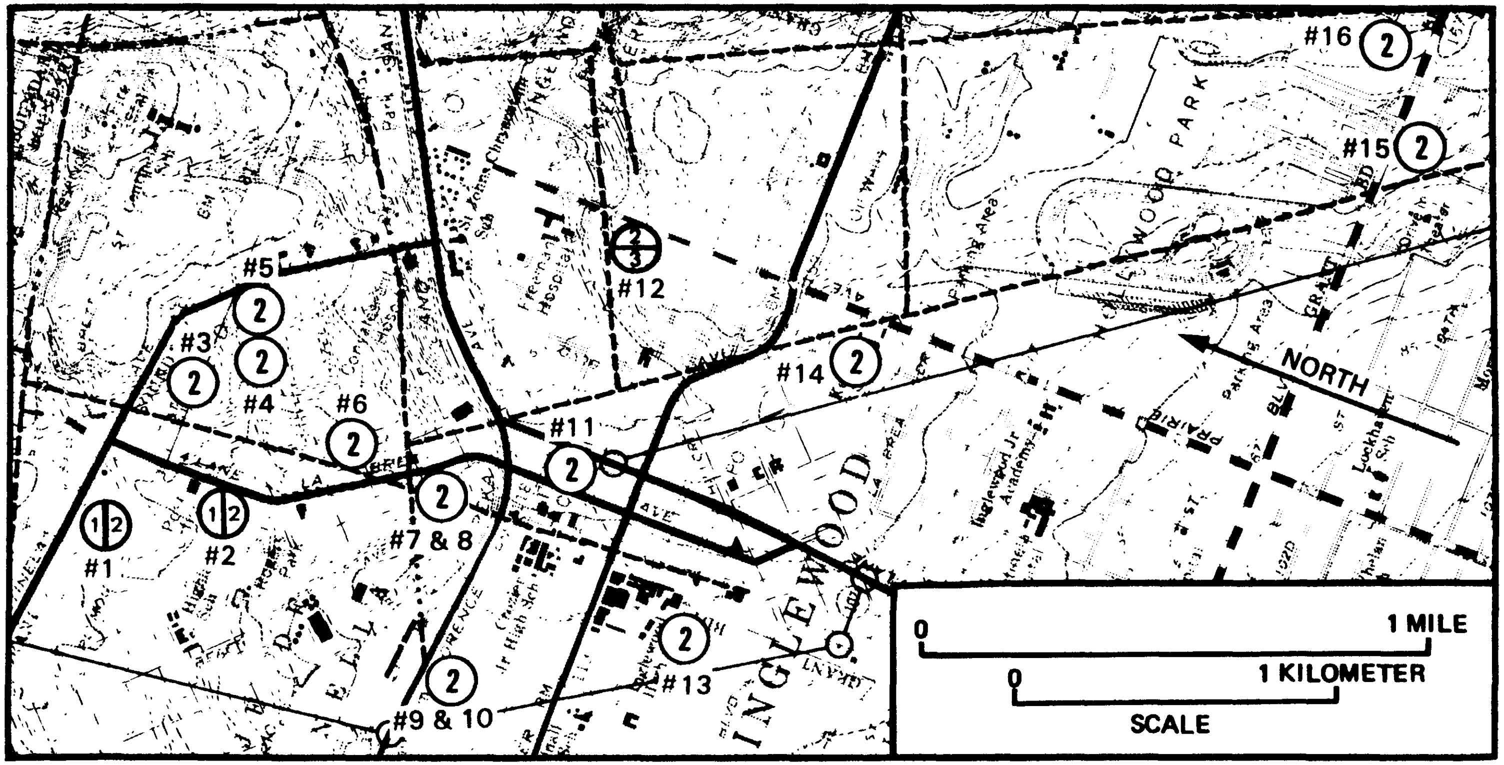

Fig. 23 - Locations of engineering geology reports along faults in Inglewood area by Inglewood City number. See Fig. 22 for location and Fig. 2 for explanation of symbols.

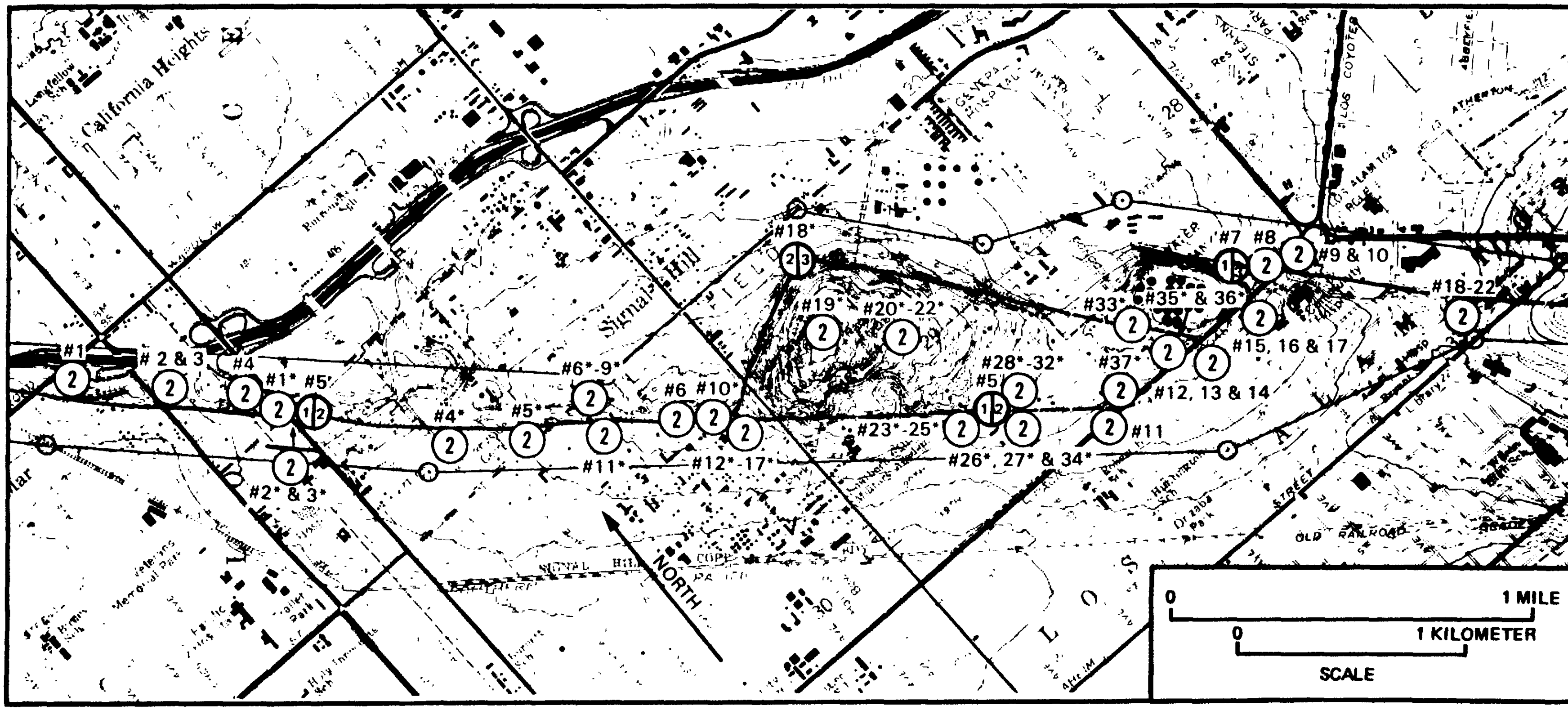

Fig. 24 - Locations of engineering geology reports along Inglewood-Newport fault zone by City of Long Beach and Signal Hill (*) numbers. See Fig. 22 for location and Fig. 2 for explanation of symbols.

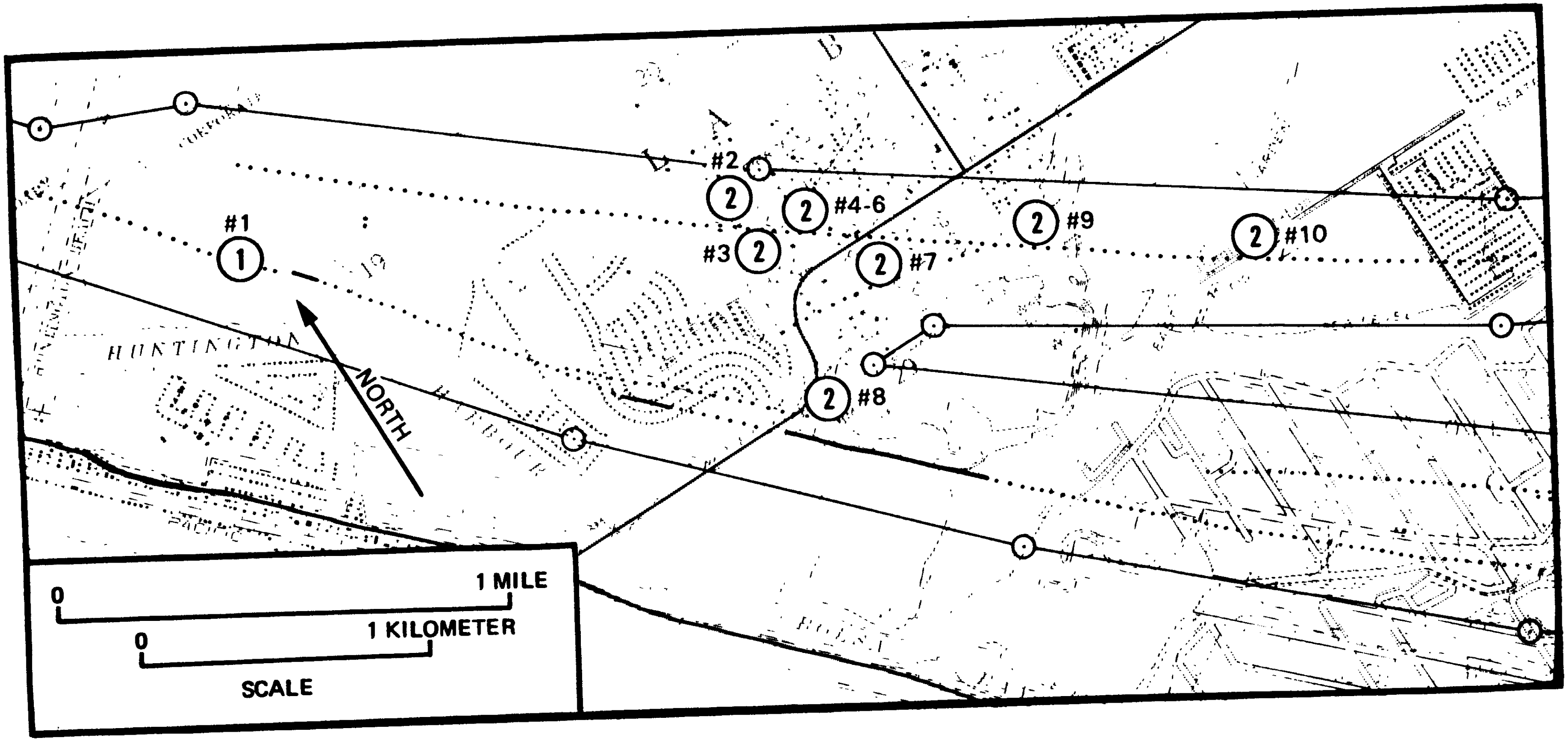

Fig. 25 - Locations of engineering geology reports along Inglewood-Newport fault zone by City of Huntington Beach number. See Fig. 22 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
(Los Angeles)	(1)	844	Hollywood	5/2/78	John D. Merrill	Project #84393
			Two trenches, maximum depth 6-1/2 feet, in Inglewood-Newport fault zone (CDMG, 1976hh). Trench 1: faulting in "early Pleistocene Inglewood Formation", but no faulting in overlying "Holocene soil profile" (Pu of Jennings and Strand, 1969).			
(Los Angeles)	(2)	1262	Hollywood	1/5/81	William R. Munson	4000 Don Alegre Place, Baldwin Hills
			One trench, 6.2 feet deep, across trace of Inglewood-Newport fault (CDMG, 1976hh). Normal faulting with .5 to 2.0 feet displacement in Tertiary-early Quaternary "A Formation" bedrock, but no faulting in Holocene slopewash deposits (Pu of Jennings and Strand, 1969).			
(Los Angeles)	(3)	1206	Hollywood	5/7/80	Thomas Clements Associates	Job #3-80-112
			Two trenches, 5 feet deep, across trace of Inglewood-Newport fault (CDMG, 1976hh). Trenches 1,2: "cracking or faulting" reported, but no lithological description or formation name given. (Qm (?) of Jennings and Strand, 1969).			
Los Angeles	(76)	-	Hollywood	4/23/79	HRC Geotechnical Consultants, Inc.	Tentative Tract #33172. Stocker St. near Valley Ridge.
			Two trenches and 26 test pits, maximum depth 15 feet, across Inglewood-Newport fault (CDMG, 1976hh). Trench T-13 and test pits T-8, T-9: "sheared and intensely fractured fault zone containing many soil-filled cracks, calcareous filled fractures, and fault breccia" in Pleistocene San Pedro Formation bedrock (Qm of Jennings and Strand, 1969).			
Los Angeles	(77)	-	Inglewood	5/15/70	Glenn A. Brown and Associates	Project #69138-A. Tract No. 28634, Carson.
			One trench, 12 feet deep, across Avalon-Compton fault (CDMG, 1976ii). No faulting in Holocene alluvium (Qal of Jennings, 1962).			
Los Angeles	(78)	252	Long Beach	3/23/76	Pacific Soils Engineering, Inc.	W.O. #200637. Carol Cable Bldg., 2665 Del Amo Blvd.
			Three trenches, maximum depth 11 feet, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in Holocene alluvium (Qal of Jennings, 1962).			
Los Angeles	(79)	401	Long Beach	2/10/77	LeRoy Crandall and Associates	Job #E-77024. Vicinity of Dominguez St. and Long Beach Freeway.
			No trenching across Cherry Hill fault (CDMG, 1976gg). Subsurface section across projected trace of fault constructed from logs of exploration borings drilled by firm in 1967. Sandy layers in borings appear to be continuous across projected trace of fault indicating that Holocene deposits to a depth of at least 40 feet have not been disrupted. (Qal of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Inglewood	(1)	1285	Inglewood	12/22/80	C. Michael Scullin	Project #80168. Southerly 65 ft. of lot 246, tentative Tract No. 401633, 924 Enterprise Avenue.
			One trench, maximum depth 9 feet, west of segment of Inglewood-Newport fault (CDMG, 1976ii). No faulting in colluvium or upper Pleistocene coastal plain deposits of Lakewood Formation (Qal and Qt of Jennings, 1962).			
Inglewood	(2)	1224	Inglewood	9/4/79	Geo. Systems, Inc.	Job #G59-307. Proposed Condominium Complex, 744-748 N. Eucalyptus Avenue.
			One trench, 4 1/2 to 11 feet deep, west of Inglewood-Newport fault (CDMG, 1976ii). No faulting in alluvium or underlying bedrock (Qal and Qt of Jennings, 1962).			
Inglewood	(3)	1117	Inglewood	1/10/80	Harley Tucker, Inc.	Project #384-79. Lot 690, Tract 1453, 323 East Plymouth St.
			One trench, maximum depth 6 1/2 feet, east of segment of Inglewood-Newport fault (CDMG, 1976ii). No faulting in upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Inglewood	(4)	1122	Inglewood	3/7/80	Lockwood-Singh and Associates	Project Ref. #1759-92. Proposed Eleven-unit Condominium, lot 63, Tract 4242, 530-540 Hazel St.
			Two trenches, 6 feet deep, east of segment of Inglewood-Newport fault (CDMG, 1976ii). Trenches 1,2: No faulting in terrace deposits (Qt of Jennings, 1962).			
Inglewood	(5)	1202	Inglewood	4/21/80	Lockwood-Singh and Associates	Project Ref. #1727-92. Proposed Eight-unit Condominium lot 615, Tract 1453, Book 20, 415 Exton Ave.
			Three trenches, maximum depth 7 1/2 feet, between segments of Inglewood-Newport fault (CDMG, 1976ii). Trenches 1-3: No faulting in terrace deposits (Qt of Jennings, 1962).			
Inglewood	(6)	1203	Inglewood	8/18/80	Lockwood-Singh and Associates	Project Ref. #2092-02. Proposed 20-unit Condominium, 529 Market St.
			Five trenches, maximum depth 8 feet, east of segment of Inglewood-Newport fault (CDMG, 1976ii). Trenches 2-5: No faulting in Pleistocene terrace deposits (Qt of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Inglewood	(7)	1282	Inglewood	8/25/80	Thomas Clements Associates and Baseline Consultants, Inc.	Project #8-80-123. Portion of lot 3, Tract 511, property at the southeast corner of Ivy Ave. and Beach Avenue.
			Three trenches, 5 feet deep, across segment of Inglewood-Newport fault (CDMG, 1976ii). Trenches 1-3: No faulting in fill material.			
Inglewood	(8)	-	Inglewood	10/28/80	Baseline Consultants, Inc.	Project #670-100. Applebee project, 240 Ivy Avenue.
			Two trenches, maximum depth 11 feet, across segment of Inglewood-Newport fault (CDMG, 1976ii). Trenches 1,2: No faulting in Pleistocene sand deposits (Qt of Jennings, 1962).			
Inglewood	(9)	1193	Inglewood	6/30/80	Harley Tucker, Inc.	Project #519-80. Lot 3, block 207, Tract No. 697, 223 Inglewood Ave.
			Two trenches, 5 feet deep, southeast of Centinela fault (CDMG, 1976ii). Trenches 1,2: No faulting in upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Inglewood	(10)	1190	Inglewood	4/15/80	Geosoils, Inc.	W.O. 1179-VN. Proposed 22-unit Condominium, 340 West Regent St.
			Two trenches, maximum depth 4 feet, southeast of segment of Inglewood-Newport fault (CDMG, 1976ii). Trenches 1,2: No faulting in "older alluvium" (Qt of Jennings, 1962).			
Inglewood	(11)	1129	Inglewood	2/21/79	LeRoy Crandall and Associates	Job #AE-78400. Proposed Clinic Bldg. and Parking Structure, La Brea Avenue and Queen St.
			One trench, 10 feet deep, east of segment of Inglewcod-Newport fault (CDMG, 1976ii). No faulting in upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Inglewood	(12)	1201	Inglewood	3/2/77	LeRoy Crandall and Associates	Job #AE-76103. Proposed Medical Office Bldg., Prairie Avenue and Howland Drive.
			Six borings, 45 to 60 feet deep, south of Inglewood Park Cemetery fault (CDMG, 1976ii). "Soils encountered show uniform stratification with no apparent discontinuities or offsets" in upper Pleistocene Lakewood Formation and lower Pleistocene San Pedro Formation (Qt and Qm of Jennings, 1962).			
Inglewood	(13)	-	Inglewood	11/17/79	Baseline Consultants, Inc.	Project #439-119. Kelso St. Property, 122 Kelso St.
			One trench, maximum depth 7 1/2 feet, west of segment of Inglewood-Newport fault (CDMG, 1976ii). No faulting in Quaternary terrace deposits (Qt of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Inglewood	(14)	1223	Inglewood	7/21/80	Hu Associates	Project #HA-1070-4. Proposed condominium complex, 741 Nutwood St.
			One trench, 7 feet deep, southwest of segment of Inglewood-Newport fault (CDMG, 1976ii). No faulting in Pleistocene terrace deposits (Qt of Jennings, 1962).			
Inglewood	(15)	1144	Inglewood	1/27/80	C. Michael Scullin	Project #80108. 3400 to 3500 Century Blvd.
			One trench, maximum depth 8 feet, northeast of segment of Inglewood-Newport fault (CDMG, 1976ii). No faulting in upper Pleistocene coastal plain deposits of Lakewood Formation (Qt of Jennings, 1962).			
Inglewood	(16)	1145	Inglewood	2/11/80	Triad Foundation Engineering, Inc.	Job #80-30. Proposed Commercial Bldg., 3249 West Century Blvd.
			One trench, 6 to 7 feet deep, southwest of segment of Inglewood-Newport fault (CDMG, 1976ii). No faulting in "soil deposits" (Qt of Jennings, 1962).			
Long Beach	(1)	276	Long Beach	7/20/76	C. Michael Scullin	Project #G76160. Lots 24 and 25, Vista Del Mar Tract, 3354 and 3364 Pine Avenue, Long Beach.
			One trench, maximum depth 11 feet, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Long Beach	(2)	277	Long Beach	7/21/76	Evans, Goffman and McCormick	Job #76-85. Lot 34 and portion of lot 33, Tract 2901, Long Beach.
			Two trenches, maximum depth 9 feet, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in Pleistocene terrace deposits (Qt of Jennings, 1962).			
Long Beach	(3)	-	Long Beach	3/13/78	Bob Dickey Geotechnical Inc.	Proposed residential subdivision, lots 1 to 16 of block B and lots 4,6 to 9, and 18 of block C, Tract No. 2901 (M.B. 36-63), on Elm Avenue and Pasadena Avenue between Wardlow and 33rd Sts., Long Beach.
			One trench, maximum depth 8 feet, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene sands (Qt of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Long Beach	(4)	723	Long Beach	4/14/78	Action Engineering Consultants	W.O. 138901. Tract 35131, NW corner of Atlantic Avenue and 31st St., Long Beach.
			One trench, maximum depth 6 feet, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in Pleistocene terrace deposits (Qm and Qt of Jennings, 1962).			
Long Beach	(5)	-	Long Beach	2/21/77	Evans, Goffman and McCormick	Job #76-04. Significance of Alquist-Priolo Special Studies Zone within Signal Hill.
			Two trenches, maximum depth 11 feet, across Cherry Hill fault (CDMG, 1976gg). Trenches 1,2: No faulting in older alluvium or "Holocene alluvium and colluvium" (Qm and Qt of Jennings, 1962).			
Long Beach	(6)	-	Long Beach	5/6/77	Dennis R. Allen	South 1/4, lots 4 and 5, Crescent Heights Tract, Signal Hill.
			Three trenches, 8 feet deep, across Cherry Hill fault (CDMG, 1976gg). Trenches 1-3: No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Long Beach	(7)	707	Long Beach	8/24/77	John D. Merrill	Project #74021. 4+ Acre Parcel, NW corner, Termino Avenue and Pacific Coast Highway, Long Beach.
			One trench, maximum depth 21 feet, across Reservoir Hill fault (CDMG, 1976gg). Faulting in Pleistocene San Pedro Formation, but no faulting in overlying Holocene deposits (Qt and Qal (?) of Jennings, 1962).			
Long Beach	(8)	451	Long Beach	10/29/75	LeRoy Crandall and Associates	Job #E-75197. Proposed Cinema Complex between Pacific Coast Highway, Termino Avenue, Mendez St., and Outer Circle, Long Beach.
			Two trenches, maximum depth 10 feet, across the Reservoir Hill fault (CDMG, 1976gg). Trenches 1,2: No faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Long Beach	(9)	-	Long Beach	3/10/77	C. Michael Scullin	Project #77126. Parcel 2, PM 8002, Hathaway Avenue and Outer Circle Drive, Long Beach.
			One trench, maximum depth 6 feet, northeast of Reservoir Hill-Seal Beach fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Long Beach	(10)	419	Long Beach	3/10/77	C. Michael Scullin	Project #77127. Parcel 4, PM 8002, between Lakewood Blvd. and Outer Traffic Circle Drive, Long Beach.
			Two trenches, maximum depth 7 feet, northeast of the Reservoir Hill-Seal Beach fault (CDMG, 1976gg). Trenches 1,2: No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Long Beach	(11)	589	Long Beach	6/2/77	Evans, Goffman and McCormick	Job #77-71. Southwest corner, Pacific Coast Highway and Obispo St., Long Beach.
			Two trenches, maximum depth 15 feet, southwest of Cherry Hill fault (CDMG, 1976gg). Trenches 1,2: No faulting in "pre-Holocene older alluvium" (Qt of Jennings, 1962).			
Long Beach	(12)	252	Long Beach	3/23/76	C. Michael Scullin	Project #G76123. Lot 9, Cerritos Heights Tract, 1725 Loma Avenue and 1720 Newport Avenue, Long Beach.
			Two trenches, maximum depth 6 feet, south of Northeast Flank fault (CDMG, 1976gg). Trenches 1,2: No faulting in terrace deposits (Qt of Jennings, 1962).			
Long Beach	(13)	195	Long Beach	3/30/76	C. Michael Scullin	Project #G76112A. Lots 7 and 9, Allen and Rheas Signal Hill Tract, 3630-3642 Wilton St., Long Beach.
			One trench, maximum depth 7 feet, south of Northeast Flank fault (CDMG, 1976gg). No faulting in terrace deposits (Qt of Jennings, 1962).			
Long Beach	(14)	326	Long Beach	7/28/76	C. Michael Scullin	Project #G76162. Lots 29 and 30, Bonnie Brae Tract, 3506 and 3512 Wilton St., Long Beach.
			One trench, maximum depth 7 1/2 feet, south of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Long Beach	(15)	389	Long Beach	11/8/76	C. Michael Scullin	Project #G76202. Lot 5, 3626 Pacific Coast Highway, westerly 1/2 of lot 6, 3720 Pacific Coast Highway, Overlook Park Track, Long Beach.
			One trench, maximum depth 9 feet, southwest of Reservoir Hill-Seal Beach fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Long Beach	(16)	378	Long Beach	3/23/76	C. Michael Scullin	Project #G76126. North 1/4 of Farm lot 38, Alamitos Tract, 1740 Grand Avenue, Long Beach.
			One trench, maximum depth 7 feet, south of trace of Northeast Flank fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Long Beach	(17)	-	Long Beach	7/16/81	Kenneth G. Osborne and Associates	Job #3327-1. Community Professional Bldg., Pacific Coast Hwy. and Termino Avenue, Long Beach.
			One trench, maximum depth 10 feet, southwest of Reservoir Hill fault (CDMG, 1976gg). No faulting in pre-Holocene "slope wash" (Qt of Jennings, 1962).			
Long Beach	(18)	-	Long Beach	2/26/76	C. Michael Scullin	Project #676115. Lot 9, Tract 6399, 1349 Bennett, Long Beach.
			One trench, 6 feet deep, southwest of Seal Beach fault (CDMG, 1976gg). No faulting in terrace deposits (Qt of Jennings, 1962).			
Long Beach	(19)	327	Long Beach	9/15/76	C. Michael Scullin	Project #G76177. Lot 25, Tract 6359, 1356 Ximeno Avenue, Long Beach.
			One trench, 6 feet deep, southwest of Reservoir Hill-Seal Beach fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Long Beach	(20)	552	Long Beach	8/11/77	C. Michael Scullin	Project #77182. 4515 E. Anaheim St., Long Beach.
			One trench, maximum depth 7 feet, southwest of the Reservoir Hill-Seal Beach fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Long Beach	(21)	504	Long Beach	6/21/77	A. A. Carrey	Lot No. 3, Tract No. 4324, Long Beach.
			One trench, 8 to 10 feet deep, southwest of Seal Beach fault (CDMG, 1976gg). No faulting in Pleistocene San Pedro Formation (Qt of Jennings, 1962).			
Long Beach	(22)	644	Long Beach	1/11/78	C. Michael Scullin	Project #78102. Portion of Farm lot 62, Alamitos Tract, 4729 E. Anaheim St., Long Beach
			One trench, maximum depth 7 feet, southwest of Seal Beach fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Signal Hill	(1)	-	Long Beach	1/28/79	C. Michael Scullin	Project #79106. Lots 1-48, block 1, lots 7-24, 31-48, block 2, Windermere tract, southeasterly of Atlantic Ave. and Spring St.
			Eight trenches, maximum depth 13 feet, across Cherry Hill fault (CDMG, 1976gg). Trenches 1,2,6: jointing, shearing and calcite filled fractures, but no faulting, in Palos Verdes sand or the upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(2)	-	Long Beach	11/12/80	LeRoy Crandall and Associates	Job #AE-80322
			Two trenches, maximum depth 9 feet, southwest of Cherry Hill fault (CDMG, 1976gg). Trenches 1-2: No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(3)	-	Long Beach	4/1/79	C. Michael Scullin	Project #79122. Lots 1-8, American Colony Tract, 2800 Atlantic Avenue.
			One trench, 6 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(4)	-	Long Beach	8/17/79	C. Michael Scullin	Project #79158. 2699 California Avenue.
			One trench, 6 1/2 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(5)	-	Long Beach	5/11/79	C. Michael Scullin	Project #79131. Southerly lot 38, lot 40, northerly 1/2 lot 42, Burnett Villa Tract, 1100 Willow Avenue.
			One trench, 7 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(6)	-	Long Beach	1/9/81	Kenneth G. Osborne and Associates	Job #2663-11. Industrial Bldg. Site, westerly side of Gundry Avenue between Willow and 27th Sts.
			One trench, maximum depth 13 feet, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in brown sandy silts or orange brown sands (Qt of Jennings, 1962).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Signal Hill	(7)	-	Long Beach	6/25/79	C. Michael Scullin	Project #79141. 1400 Willow St. southeasterly corner Willow St. and Gundry Avenue
			One trench, maximum depth 7 feet, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(8)	-	Long Beach	6/1/78	Baseline Consultants, Inc.	Project #99-058. Southwest corner of Willow St. and Walnut Avenue.
			Three trenches, maximum depth 10 feet, northeast of Cherry Hill fault (CDMG, 1976gg). Trenches 1-3: No faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Signal Hill	(9)	-	Long Beach	7/14/78	Baseline Consultants	Project #137-078. Gill property, Cherry Avenue and 25th St.
			One trench, 8 to 17 feet deep, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Signal Hill	(10)	-	Long Beach	6/16/78	H. V. Lawmaster and Co., Inc.	File No. 584G. Proposed apartment complex, southeasterly of intersection of Burnett St. and Gaviota Ave.
			Two trenches, maximum depth 20 1/2 feet, across Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits and Palos Verde sand of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(11)	-	Long Beach	1/31/80	Baseline Consultants, Inc.	Project #468-010. Wong Property, 2542 Brayton Avenue.
			One trench, 8 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Signal Hill	(12)	-	Long Beach	1/25/78	C. Michael Scullin	Project #78105. Portion of lot 102, American Colony Tract, 2286 Gaviota Avenue.
			One trench, 6 1/2 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			

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Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Signal Hill	(13)	-	Long Beach	3/26/79	C. Michael Scullin	Project #79120. Portion of lot 102, American Colony Tract, 2160 - 2258 Gaviota Avenue (Tract 36087).
			Two trenches, maximum depth 8 feet, southwest of Cherry Hill fault (CDMG, 1976gg). Trenches 1-2: No faulting in terrace deposits of upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(14)	-	Long Beach	8/1/79	C. Michael Scullin	Project #79155. Lots "B", 5 and 6, Tract 3593, 2298 Rose Avenue.
			One trench, maximum depth 9 feet, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(15)	-	Long Beach	5/21/78	Baseline Consultants, Inc.	Project #95-058. B and B Property, Cherry Avenue and Hill Street.
			One trench, unspecified depth, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Signal Hill	(16)	-	Long Beach	10/18/79	C. Michael Scullin	Project #79171. Tentative Tract 36810, 2001 21st St.
			Two trenches, maximum depth 7 feet, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(17)	-	Long Beach	9/7/79	C. Michael Scullin	Project #79163. Tentative Tract 37297, 2121 Hill St.
			One trench, maximum depth 12 feet, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(18)	-	Long Beach	7/27/77	H. V. Lawmaster and Co., Inc.	File No. 77-515G. 15+ Acre site located southerly of Willow St. and easterly of Junipero Avenue.
			Eight trenches, 3 to 5 feet deep, across Pickler and Northeast Flank faults (CDMG, 1976gg). Trenches 1-8: No faulting in upper Pleistocene Lakewood Formation or the underlying lower Pleistocene San Pedro Formation (Qt and Qm of Jennings, 1962).			

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Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Signal Hill	(19)	-	Long Beach	7/27/79	Baseline Consultants	Project #348-079. Proposed Development, 2330 Junipero Avenue.
			One trench, 8 feet deep, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in Pleistocene sandstones (Qm or Qt of Jennings, 1962).			
Signal Hill	(20)	-	Long Beach	7/6/79	Harley Tucker, Inc.	Project #287-79. Lot 14, Tract 27021, Molino Avenue.
			Four trenches, maximum depth 15 feet, northeast of Cherry Hill fault (CDMG, 1976gg). Trenches 1-4: No faulting in lower Pleistocene San Pedro Formation (Qm of Jennings, 1962).			
Signal Hill	(21)	-	Long Beach	9/4/81	Baseline Consultants, Inc.	Project #855-081. Papadakis property, 2735 Hill St.
			One trench, 6 1/2 feet deep, southwest of Northeast Flank fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits (Qm or Qt of Jennings, 1962).			
Signal Hill	(22)	-	Long Beach	6/20/80	Baseline Consultants, Inc.	Project #562-060. Hugh Seed Property, Ohio Avenue, south of Hill Street.
			One trench, 6 feet deep, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in terrace sands of Lakewood Formation (Qm or Qt of Jennings, 1962).			
Signal Hill	(23)	-	Long Beach	7/7/80	C. Michael Scullin	2070 Stanley Avenue
			One trench, 6 1/2 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(24)	-	Long Beach	3/7/79	Converse Ward Davis Dixon	Project #79-2107-01. Lots 63 and 64 of lot 5, (off) Terrace Drive.
			Three trenches, 5 to 10 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). Trenches 1-3: No faulting in terrace deposits (Qt or Qm of Jennings, 1962).			
Signal Hill	(25)	-	Long Beach	9/7/79	C. Michael Scullin	Project #79162. 1995 Molino Avenue.
			One trench, maximum depth 12 feet, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			

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Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Signal Hill	(26)	-	Long Beach	7/25/78	Baseline Consultants	Project #140-078. Band B property, 20th St.
			One trench, maximum depth 14 1/2 feet, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Signal Hill	(27)	-	Long Beach	4/25/79	Robert Stone and Associates	Job #1392-00. Proposed Signal Hills Condominiums, Portion of Tract No. 35227, 1903 Temple St.
			One trench, unspecified depth, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in sedimentary deposits of upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(28)	-	Long Beach	8/12/80	William R. Munson	Portion of lots 4 and 5, Catalina Street Tract, 2099 Temple St.
			One trench, 6 to 7 1/2 feet deep, northeast of Cherry Hill fault (CDMG, 1976gg). Steeply dipping fractures, but no faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Signal Hill	(29)	-	Long Beach	4/1/78	John D. Merrill	Project #84444. Lots 1,2 and 3, Price Peterson Tract, Temple Avenue - 20th St.
			One trench, 6 to 15 feet deep, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(30)	-	Long Beach	12/28/79	C. Michael Scullin	Project #79179. Lot 9, Signal Hill Tract, 2051 Orizaba Avenue.
			Two trenches, maximum depth 8 1/2 feet, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(31)	-	Long Beach	12/20/78	Baseline Consultants	Project #228-128. Hill and Hall property, N.E.C. 20th St. and Orizaba Avenue.
			One trench, 10 feet deep, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits (Qt of Jennings, 1962).			
Signal Hill	(32)	-	Long Beach	10/15/80	Baseline Consultants, Inc.	Project #656-090. T.W.C. Project, 1980 Obispo Ave.
			One trench, maximum depth 14 feet, southwest of Northeast Flank fault (CDMG, 1976gg). No faulting in Quaternary terrace deposits (Qt of Jennings, 1962).			

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Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Signal Hill	(33)	-	Long Beach	3/7/79	C. Michael Scullin	Project #79110. Lots 10-14, Ellis Tract, 3399 19th St.
			One trench, maximum depth 9 feet, across Northeast Flank fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(34)	-	Long Beach	5/4/79	Baseline Consultants, Inc.	Project #300-049. Hammond and Seed Property, 19th St., east of Temple Avenue.
			One trench, 8 to 10 feet deep, southwest of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene sands (Qt of Jennings, 1962).			
Signal Hill	(35)	-	Long Beach	11/29/78	C. Michael Scullin	Project #78182. Lot 11, Hunt Villa Tract, 3300 19th St.
			Two trenches, maximum depth 7 feet, southwest of Northeast Flank fault (CDMG, 1976gg). No faulting in terrace deposits of upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(36)	191	Long Beach	9/14/78	C. Michael Scullin	Project #78158. Lots 8-13 and westerly 30 feet of lots 14-16, Therberts Tract, 1830 Redondo Avenue.
			Two trenches, maximum 7 feet deep, southwest of Northeast Flank fault (CDMG, 1976gg). No faulting in terrace deposits of upper Pleistocene Lakewood Formation (Qt of Jennings, 1962).			
Signal Hill	(37)	-	Long Beach	12/12/77	C. Michael Scullin	Project #77224. Portion of lot 24B, Hunt Villa Tract, 19th St. and Obispo Avenue.
			One trench, 6 to 7 feet deep, northeast of Cherry Hill fault (CDMG, 1976gg). No faulting in upper Pleistocene terrace deposits of Lakewood Formation (Qt of Jennings, 1962).			
Huntington Beach	(1)	400	Seal Beach	1/24/77	John D. Merrill	Project #63475. Unit 1, Tract 9168, Huntington Harbour.
			One trench, 19 feet deep, across South Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in Holocene deposits (Qal of Jennings, 1962). Seismic profiling showed the fault to disrupt sediments 60 feet beneath the site.			
Huntington Beach	(2)	379	Seal Beach	12/10/76	Earth Research Associates, Inc.	Job #324-76. Parcel 4, Block 182, 16692 Dolores Street.
			One trench, maximum depth 13 feet, northeast of North Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in Pleistocene terrace deposits (Qm of Jennings, 1962).			

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Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Huntington Beach	(3)	209	Seal Beach	4/7/76	H.V. Lawmaster and Company, Inc.	File No. 76-379G-A. Proposed Apartment Complex, 16672 Algonquin Street.
			One trench, maximum depth 9 1/2 feet, southwest of North Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in silty sands, silty clays or buff marl (Qm of Jennings, 1962).			
Huntington Beach	(4)	314	Seal Beach	7/28/76	H.V. Lawmaster and Company, Inc.	File No. 76-414G. Site of proposed Apartment Buildings, 16841 and 16851 Lynn Street.
			One trench, 11 feet deep, northeast of North Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in late Pleistocene Lakewood Formation (Qm of Jennings, 1962).			
Huntington Beach	(5)	-	Seal Beach	7/29/76	H.V. Lawmaster and Company, Inc.	File No. 76-416G. Proposed Apartment Building, 16834 Blanton Street.
			One trench, 15 feet deep, northeast of North Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in late Pleistocene Lakewood Formtion (Qm of Jennings, 1962).			
Huntington Beach	(6)	208	Seal Beach	4/7/76	H.V. Lawmaster and Company, Inc.	File No. 76-378G-A. Proposed Apartment Complex, 16822 Sims Street.
			One trench, maximum depth 12 1/2 feet, northeast of North Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in silty clays, silty sands or greenish brown marly siltstones (Qm of Jennings, 1962).			
Huntington Beach	(7)	-	Seal Beach	8/10/79	Baseline Consultants	Project #357-079. Curtis Development Project, Warner Avenue.
			One trench, maximum depth 15 feet, northeast of Bolsa-Fairview fault (CDMG, 1976qq). No faulting in Pleistocene Lakewood Formation (Qm of Jennings, 1962).			
Huntington Beach	(8)	399	Seal Beach	10/15/76	Terratech, Inc.	Project #1883. Unit 1, Tract 8636, Huntington Harbour.
			One trench, 19 feet deep, northeast of South Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in "Holocene deposits" (Qm of Jennings, 1962).			
Huntington Beach	(9)	394	Seal Beach	10/28/76	Earth Research Associates, Inc.	Job #274-76. Proposed Apartment Complex, Bolsa Chica Rd. South of Warner Street.
			Three trenches, 10 to 12 feet deep, northeast of North Branch of Inglewood-Newport fault (CDMG, 1976qq). Trenches 1-3: No faulting in Pleistocene terrace deposits (Qm of Jennings, 1962).			

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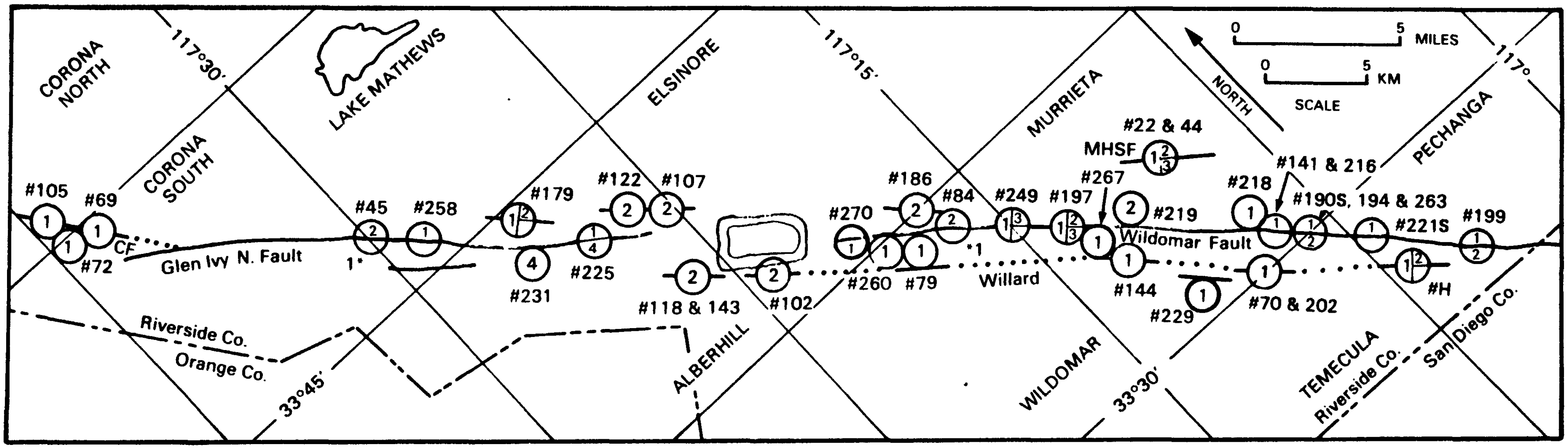
Inglewood-Newport Fault Zone, Los Angeles and Orange Counties (Figs. 22-25)						
Huntington Beach	(10)	247	Seal Beach	4/2/76 Supplement 6/25/76	Irvine Soils Engineering and Testing Laboratory	Job #1024-94. Tracts 8630, 8893 and 8894, Graham Street and Slater Avenue.
			One trench, unspecified depth, northeast of North Branch of Inglewood-Newport fault (CDMG, 1976qq). No faulting in "Holocene alluvium" (Qt of Jennings, 1962).			
Huntington Beach	(11)	250	Seal Beach	6/22/76	H.V. Lawmaster and Company, Inc.	File No. 76-404G. Tract No. 7635: Lot Nos. 32,33,34,35 and 37, near Talbert Avenue and Edwards Street.
			Three trenches, 15 feet deep, across North Branch of Inglewood-Newport fault (CDMG, 1976qq). Trenches 1-3: No faulting in "lower Pleistocene San Pedro Formation" or Holocene alluvium (Qt and Qal of Rogers, 1965).			
Huntington Beach	(12)	-	Seal Beach	9/20/74	Dames and Moore	Job #6192-001-02. Seacliff Village, Huntington Beach Company.
			One trench, 10 feet deep, across projected trace of Inglewood-Newport fault (CDMG, 1976qq). No faulting in upper Pleistocene Lakewood Formation (Qt of Rogers, 1965).			
Seal Beach	(1)	-	Seal Beach	4/30/80 revised 12/14/81	Medall, Aragon, Worswick & Assoc.	Project #S1753C
			Trenches across 20 ft. wide zone of discontinuous strata along Seal Beach fault. Silt greater than 125,000 years old displaced at least a few feet; 35,000-50,000 year old paleosol displaced a few inches. Modern solum probably younger than 15,000 to 20,000 years old contains a few small cracks.			



CF: Chino Fault: MHSF: Murrieta Hot Springs Fault

Fig. 26 - Locations of engineering geology reports along strands of Elsinore fault zone by Riverside County number. See Fig. 1 for location and Fig. 2 for explanation of symbols.

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Elsinore Fault Zone, Riverside County (Fig. 26)						
Riverside	H	-	Temecula, Pechanga	7/10/73	F. Beach Leighton and Associates	Job #73222
			Trenches, 8-13 feet deep, across strands of Wolf Valley fault zone (Kennedy, 1977; CDMG, 1980f,a) and Willard fault zone (Envicom, 1976). Near vertical joints with no offset in alluvium (Qal, Kennedy, 1977) across strand of Wolf Valley fault in southernmost trenches. Fault cuts old terrace deposits (Pauba Formation, Qps, Kennedy, 1977) and does not displace alluvium along possible northern extension of Wolf Valley fault or strand of Willard fault (Envicom, 1976).			
Riverside	22	-	Murrieta	11/29/74 rev. 7/12/75	Murphy, M.A. and Associates	Revised specific plan 103-C/W
			Trenches, average depth 5-7 feet, across Murrieta Hot Springs fault (Kennedy, "Fractures" in "Temecula Arkose" (Qus and Qps, Kennedy, 1977); no faulting in floodplain sediments (Qal, Kennedy, 1977).			
Riverside	44	-	Murrieta	2/13/76	Earth Research Associates, Inc.	
			Trenches, depth 7-14 feet, across Murrieta Hot Springs fault (Kennedy, 1977). Gouge zones, in unnamed pre-Pauba Formation (Qus, Kennedy, 1977); no faulting in alluvium (Qal, Kennedy, 1977).			
Riverside	45	-	Corona South, Lake Mathews	2/13/76	Pioneer Consultants	Job #2316-001
			Trenches to a depth of 12 feet across strands of Glen Ivy North fault (Weber, 1977; CDMG, 1980c,g.) Fault gouge and slickensides reported in older fan deposits (Qof, Weber, 1977). "Rift valley" (30 ft. deep, 100 ft. wide); water line in vicinity of Hunt Road requires annual repair; may be caused by continuous creep; parallel cracks in asphalt of Lawson Road.			
Riverside	69	-	Corona South	3/22/77	Pioneer Consultants	Job #2466-001
			Trenches up to 10 feet deep across Chino fault (Weber, 1977; CDMG, 1980c). Consultant reported that Chino fault cuts alluvium (Qsc or Qof, Weber, 1977) in three trenches. The structures observed were dismissed as sedimentary features by Tony Brown (Riverside County geologist) upon examination of trenches in neighboring sites GR-72 and 105.			
Riverside	70	-	Temecula	3/21/75	Pioneer Consultants	Job #1208-095
			Trenches, depth 12-14 feet, across strand of Willard fault (Kennedy, 1977). No faulting in alluvium (Qal, Kennedy, 1977).			

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Elsinore Fault Zone, Riverside County (Fig. 26)						
Riverside	72	-	Corona South	3/15/77	C. Michael Scullin	Project #77129 Trenches up to 10 feet deep west of Chino fault (Weber, 1977; CDMG, 1980c); no faulting in old alluvium (Qsc and Qof, Weber, 1977).
Riverside	79	-	Wildomar	5/20/77	LeRoy E. Rand	Parcel Map No. 9070 Trench average depth 7 feet, northeast of Willard fault (Kennedy, 1977). No faulting in alluvial fan debris (Qal, Kennedy, 1977).
Riverside	84	-	Wildomar	6/29/77	Lewis S. Lohr	Job #31-77-6 Three trenches, average depth 9 feet, across three strands of Wildomar fault zone (Kennedy, 1977; CDMG, 1980h). No faulting in Pauba Formation (Quc and Qps, Kennedy, 1977) northernmost trench. "North Branch" of Wildomar fault displaces Pauba Formation within three feet of surface in middle trench. South Branch of Wildomar fault displaces Pauba Formation within one foot of surface in southernmost trench. Property is located directly southeast of closed topographic depression within Wildomar fault zone.
Riverside	102	-	Elsinore	11/14/77	J.F. Stickel & Assoc.	Job #1877-001 Trench, average depth 12 feet, in Willard fault zone (Weber, 1977). No faulting in alluvium (Qiv and Qif, Weber, 1977).
Riverside	105	-	Corona North	12/17/77	C. Michael Scullin	Project #77217 Trenches up to 9 feet across Chino fault (Weber, 1977); no faulting in colluvim and old alluvium (Qsc and Qof, Weber, 1977).
Riverside	107	-	Alberhill, Elsinore	12/1/77	J.F. Stickel & Assoc.	Job #1918-001 Trenches, average depth 13 feet, across strand of Glen Ivy North fault (Weber, 1977; CDMG, 1980e,b). No faulting in alluvium (Qiv, Weber, 1977).
Riverside	118	-	Alberhill	4/11/78	Lewis S. Lohr	Job #52-78-3 Trench, average depth 10 feet, across strand of Willard fault (Weber, 1977); no faulting in floodplain and valley fill (Qiv, Weber, 1977).
Riverside	122	-	Alberhill	5/25/78	Lewis S. Lohr	Job #54-78-3 Trenches, average depth 9 feet, across possible strand of Glen Ivy North fault (Weber, 1977; CDMG, 1980e); no faulting in Pauba Formation and floodplain and valley fill (Qp and Qov, Weber, 1977).

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Elsinore Fault Zone, Riverside County (Fig. 26)						
Riverside	141	1148	Murrieta	4/22/80	F. Beach Leighton and Associates	Job #67837-03
			Trenches, depths 7-11 feet, across trace of Wildomar fault (Kennedy, 1977; CDMG, 1980d). Possible fault in alluvium (Qal, Kennedy, 1977). Evidence presented for slightly different location than that shown by Kennedy.			
Riverside	143	-	Alberhill	8/22/78	Lewis S. Lohr	Job #66-78-8
			Trench, average depth 9 feet, across strand of Willard fault (Weber, 1977). No faulting in alluvium (Qiv, Weber, 1977).			
Riverside	144	-	Murrieta	9/6/78	Lewis S. Lohr	Job #68-78-9
			Trench, average depth 10 feet, across possible strand of Willard fault (Envicom, 1976). No faulting in alluvium (Qal, Kennedy, 1977).			
Riverside	179	-	Alberhill	4/25/79	C. Michael Scullin	Job #79125
			Trenches up to 12 feet deep across trace of unnamed fault (Weber, 1977) parallel to and about one-half mile north of Glen Ivy North fault. Fault gouge reported in older alluvium (Qov, Weber, 1977); alluvial fan (Qfi) and stream channel deposits (Qsct) not faulted.			
Riverside	186	-	Wildomar	7/8/79	Lewis S. Lohr	Job #79-79-7
			Trench, average depth 9 feet, across branch of Wildomar fault (Kennedy, 1977; CDMG, 1980h). No faulting in Pauba Formation (Qps, Kennedy, 177).			
Riverside	190-S	-	Murrieta	3/7/78	F. Beach Leighton and Associates	Job #678043-01
			Trenches, 5-8 feet deep, across Wildomar fault (Kennedy, 1977; CDMG, 1980d). Alluvium faulted against Pauba Formation (Qal and Qps, Kennedy, 1977).			
Riverside	194	1150	Temecula	2/7/80	Kenneth G. Osborne & Assoc.	Job #2888-1,5,11
			Trenches, depth 5-13 feet, across Wildomar fault (Kennedy, 1977; CDMG, 1980f). Fault separates Pauba Formation and alluvium (Qps and Qal, Kennedy, 1977). Pavement along Ynez Road (west of site) disturbed along alignment of Wildomar fault.			
Riverside	197	-	Murrieta	12/14/79	James P. McGoldrick, Con. Eng.	Parcel Map No.13648
			Seven trenches, maximum depth 15 feet, northeast and across Wildomar fault (Kennedy, 1977; CDMG, 1980d). Trench 1: well-developed, iron-stained reverse fault plane offsetting Temecula (?) and possibly Pauba (?) Formations (Qt and Qp, Kennedy, 1977). No faulting in overlying alluvium (Qal, Kennedy, 1977).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Elsinore Fault Zone, Riverside County (Fig. 26)						
Riverside	199	1192	Pechanga	6/13/80	Pioneer Consultants	Job #1208-159
			Nineteen trenches across Wildomar fault zone (Kennedy, 1977; CDMG, 1980a). Trenches 1,7,8,11,12,13,14: faulted alluvium (Qal, Kennedy, 1977). Trench 4: faulting in Pauba Formation but no offset in Recent colluvial topsoil (Qp and Qal, Kennedy, 1977). Trench 15: faulting in Pauba Formation and overlying alluvium (Qp and Qal, Kennedy, 1977). Trench 6: Pauba (?) Formation extensively faulted but displayed lack of shear zones and gouge formation (Qp, Kennedy, 1977).			
Riverside	202	1232	Murrieta	1/19/79	Pioneer Consultants	Job #1208-156,157, 158,159
			Two trenches, 12-15 feet deep, across strands of Willard fault (Envicom, 1976). No faulting in alluvium (Qal, Kennedy, 1977).			
Riverside	216	1247	Murrieta	7/79	Fugro, Inc.	Project #79-233-01
			Four trenches averaging 10 feet deep across Wildomar fault (Kennedy, 1977; CDMG, 1980d). Trench 3: fault "abruptly terminating and offsetting a sand/silt, iron-stained contact in alluvium" (Qal, Kennedy, 1977).			
Riverside	218	1269	Murrieta	7/79	Fugro, Inc.	Project #79-233-00
			Trenches 10-12 feet deep northeast of Wildomar fault (Kennedy, 1977; CDMG, 1980d); no faulting in alluvial overbank and floodplain deposits (Qal, Kennedy, 1977).			
Riverside	219	1216	Murrieta	8/1/80	F. Beach Leighton and Associates	Project #680073-01
			Trench, average depth 6 feet, northeast of Wildomar fault (Kennedy, 1977); no faulting in Pauba sandstone (Qps, Kennedy, 1977).			
Riverside	221-S	1232	Pechanga	10/1/79	Pioneer Consultants	Job #3234-001
			Trench 5-10 feet deep across concealed trace of Wildomar fault (Kennedy, 1977; CDMG, 1980a). Down-dragging and offsetting of a throughgoing clay layer in alluvium interpreted as resulting from a high-angle reverse fault (Qal, Kennedy, 1977).			
Riverside	225	1244	Alberhill	7/21/80	C. Michael Scullin	Project #80139
			Twelve trenches, 5-15 feet deep, across Glen Ivy North fault (Weber, 1977; CDMG, 1980e). Reverse faulting in trenches 1-3 thrusts older granodiorite over younger dark fan deposits (Kgr and Qof of Weber, 1977). Fault marked by 3-6 inch wide zone of crushed gouge "offset by shears". In trench 2, unfaulted white fan deposits (Qof, Weber, 1977) overlies the fault.			
Riverside	229	1270	Murrieta	10/7/80	G.A. Nicoll and Associates, Inc.	Project #R 2310
			One trench, average depth 10 feet, southwest of Wildomar fault (CDMG, 1980d). No faulting in Holocene alluvium (Qal of Kennedy, 1977).			

County (City) of Jurisdiction	County (City) File Number	CDMG AP File Number	7-1/2 Minute Quadrangle(s)	Date of Report(s) (Mo/da/yr)	Investigating Firm or Geologist	Identification Number and Site Description Where no City or County Number
Elsinore Fault Zone, Riverside County (Fig. 26)						
Riverside	231	1292	Alberhill	11/80	Richard D. Merker	Tentative PM 16615
			"Shallow trench" southwest of Glen Ivy North fault (Weber, 1977; CDMG, 1980e) No fault in extremely deformed and gouged metamorphosed shale bedrock (Jb, Weber, 1977)			
Riverside	249	-	Wildomar	7/21/81	G.A. Nicoll and Assoc., Inc.	Project #R2467
			Four trenches, 6 to 12 1/2 feet deep, across trace of Wildomar fault (Kennedy, 1977; CDMG, 1980h). Fault displacement and carbonate-filled fractures in two of the trenches in sandstone (Qus, Kennedy, 1977) unit. Alluvial cover did not appear to contain any fault breaks			
Riverside	258	1445	Lake Mathews	1/13/82	Geo-Ekta Laboratories	Tract No. 7240
			Trench, to a maximum depth of 11 feet, across trace of Glen Ivy fault (Weber, 1977; CDMG, 1980g). Fault location determined by the presence of a three-foot zone stained dark red in brownish-gray alluvial deposits (Qv, Weber, 1977). Slickensides and inclined cobbles reported in fault zone.			
Riverside	260	1329	Wildomar	11/27/81	Lewis S. Lohr	Job #93-81-11
			Trench, maximum depth 71/2 feet, southwest of Wildomar fault zone (Kennedy, 1977; CDMG, 1980h). No faulting in alluvium (Qal, Kennedy, 1977).			
Riverside	263	1460	Murrieta, Temecula	3/17/82	Leighton and Associates, Inc.	Project #6820059-01
			Five trenches, 6-7 feet deep, across and northeast of Wildomar fault (CDMG, 1980d,f). Trenches T-1 and T-4: faulting in Pleistocene Pauba Formation (Qps of Kennedy, 1977).			
Riverside	267	1483	Murrieta	8/8/81	Lewis S. Lohr	Job #89-81-07
			Two trenches, maximum depth 10 feet, southwest of Wildomar fault (CDMG, 1980d). No faulting in Holocene alluvium (Qal of Kennedy, 1977).			
Riverside	270	1514	Elsinore	10/31/82	California GeoTek, Inc.	Project #654W20-01
			Four trenches, maximum depth 10 feet, across subsidiary of Wildomar fault (CDMG, 1980b). Trenches 1,4: faulting in Holocene alluvium (Ql of Weber, 1977).			

REFERENCES

State of California Special Studies Zones 7-1/2 minute quadrangles:

CDMG (1974i)	San Jacinto
CDMG (1974j)	Hemet
CDMG (1974k)	Sunnymead
CDMG (1974l)	Lakeview
CDMG (1974m)	El Casco
CDMG (1974n)	Seven Palms Valley
CDMG (1974p)	Idyllwild
CDMG (1974q)	SE 1/4 Morongo Valley
CDMG (1974r)	SW 1/4 Morongo Valley
CDMG (1974s)	Valyermo
CDMG (1974t)	Lebec
CDMG (1974u)	La Liebre Ranch
CDMG (1974x)	Lake Hughes
CDMG (1974cc)	Juniper Hills
CDMG (1974dd)	Mescal Creek
CDMG (1974ee)	Mount San Antonio
CDMG (1974ff)	Littlerock
CDMG (1974jj)	Cuddy Valley
CDMG (1974kk)	Frazier Mountain
CDMG (1974ll)	Sawmill Mountain
CDMG (1974mm)	Devore
CDMG (1974nn)	San Bernardino North
CDMG (1974oo)	Harrison Mountain
CDMG (1974pp)	SW 1/4 San Gorgonio Mountain
CDMG (1976gg)	Long Beach
CDMG (1976hh)	Hollywood
CDMG (1976ii)	Inglewood
CDMG (1976qq)	Seal Beach
CDMG (1976vv)	SW 1/4 Breckenridge Mountain
CDMG (1976ww)	Rio Bravo Ranch
CDMG (1977w)	Mount Wilson
CDMG (1977rr)	Redlands
CDMG (1977tt)	San Bernardino South
CDMG (1979v)	San Fernando
CDMG (1979y)	Del Sur
CDMG (1979z)	Sleepy Valley
CDMG (1979aa)	Ritter Ridge
CDMG (1979bb)	Palmdale
CDMG (1979ss)	Yucaipa
CDMG (1980a)	Pechanga
CDMG (1980b)	Elsinore
CDMG (1980c)	Corona South
CDMG (1980d)	Murrieta
CDMG (1980e)	Alberhill
CDMG (1980f)	Temecula
CDMG (1980g)	Lake Mathews
CDMG (1980h)	Wildomar
CDMG (1980i)	San Jacinto
CDMG (1980j)	Hemet

CDMG (1980n) Seven Palms Valley
CDMG (1980o) Desert Hot Springs

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