Appendix E:
Geologic Hazards Report

LIMITED GEOLOGIC HAZARDS SUMMARY
FULTON CORRIDOR SPECIFIC PLAN AREA
FRESNO, CALIFORNIA

PROJECT NO. 014-10022B
SEPTEMBER 21, 2011

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1.0 INTRODUCTION

Krazan & Associates, Inc. (Krazan), has conducted this Limited Geologic Hazards Summary research for the referenced City of Fresno Fulton Corridor Specific Plan project subject site area (refer to Vicinity Map, Figure 1, and Topographic Site Map, Figure 2). Discussions regarding regional and site geologic/seismic conditions are presented herein, together with conclusions pertaining to potential geologic hazards. Based upon the geographical size of the Fulton Corridor Specific Plan project area and the relative consistency of geologic characteristics of the project areas, no soil sample collection and laboratory analysis were conducted in conjunction with this summary research and no site-specific geological investigations were conducted.

2.0 PURPOSE AND SCOPE

The information presented herein is intended to be utilized as a discussion of issues related to Geology/Soils in support of preparation of environmental review in conjunction with the referenced Specific Plan Area . The scope of work included the following:

- A site reconnaissance to observe the surface conditions at the Fulton Corridor Specific Plan subject site area.
- A review of geologic and seismologic literature pertinent to the area of the site.
- Evaluation of potential geologic hazards.
- Preparation of a summary of conditions, conclusions and recommendations.

3.0 SITE LOCATION

The Fulton Corridor Specific Plan project subject site area is located in Fresno County within the eastern portion of the San Joaquin Valley in California (refer to Vicinity Map, Figure 1).

- The Fulton Corridor area comprises approximately 400-567+/- acres encompassing approximately one square mile of land that focuses around the “Fulton Corridor” extending from Divisadero Street to the north, State Route (SR) 41 to the south, roughly M Street to the east, and the Union Pacific Railroad tracks or SR 99 to the west. The Fulton Corridor area is

surrounded by residential neighborhoods to the north, east, south and west, with areas of industrial and commercial development to the southeast and northwest.

The subject site is located in the northeast portion of USGS 7.5-minute Quadrangle Fresno South, dated 1963, photorevised 1981. A review of the Fresno South map indicates that surface elevations over the area of the subject site range from approximately 280 to 295 feet above mean sea level (Figure 2). A major surface watercourse identified as the San Joaquin River is located approximately 5.6 miles north of the northernmost point of the subject site.

4.0 GEOLOGIC SETTING

4.1 General

The Fulton Corridor Specific Plan subject site area is located along the east margin of the southern San Joaquin Valley portion of the Great Valley Geomorphic Province of California. The San Joaquin Valley is bordered to the north by the Sacramento Valley portion of the Great Valley, to the east by the Sierra Nevada, to the west by the Coast Ranges, and to the south by the Transverse Ranges. The San Joaquin sedimentary basin is separated from the Sacramento basin to the north by the buried Stockton arch and associated Stockton Fault. The 450-mile long Great Valley is an asymmetric structural trough that has been filled with a prism of Mesozoic and Cenozoic sediments up to 5 miles thick.

The Sierra Nevada, located east of the San Joaquin Valley, is gently southwesterly tilted fault block comprised of igneous and metamorphic rocks of pre-Tertiary age that comprise the basement beneath the San Joaquin Valley. The Coast Ranges, located west of the San Joaquin Valley, are comprised of folded and faulted sedimentary and metasedimentary rocks of Mesozoic and Cenozoic age.

The San Joaquin River and the Kings River are the principal rivers in the area. Alluvial fans formed by these rivers are the predominant geomorphic features in the Fresno area. The area of the subject site is characterized by low alluvial fans and plains, which constitute a belt of coalescing alluvial fans of low relief between the dissected uplands, adjacent to the Sierra Nevada and the valley trough. According to the map entitled "Geomorphic Features of the Fresno Area, San Joaquin Valley, California" (Page and Leblanc, 1969), the site is located in the "Compound Alluvial Fan of Intermittent Streams North of the Kings River Geomorphic Area." Recent alluvial fan deposits from streams emerging from highlands surrounding the Great Valley and Pleistocene non-marine sedimentary deposits (Riverbank Formation) composed of older alluvium and dissected fan deposits underlie the subject site area (See Regional Geologic Map, Figures 3 and 3.1, and Regional Geologic Cross-Section showing the San Joaquin Valley, Figure 4).

4.2 Structure and Faults

The general area of the subject site is underlain by a homoclinal series of Cenozoic deposits dipping 4 to 6 degrees to the southwest toward the center of the San Joaquin Valley. The contact between the Cenozoic and basement rocks dips nearly 8 degrees southwest, or at a slightly greater inclination than does the on-lapping homoclinal Cenozoic sequence.

The Sierra Nevada and Coast Ranges are geologically young mountain ranges that possess active and potentially active fault zones. Major active faults and fault zones occur at some distance to the east, west, and south of the project site (see the Regional Fault Map, Figure 5 and Fault Map Explanation, Figure 5.1). Table I is a listing of significant active faults within 100 miles of the subject site.

Numerous active faults are present within the central Coast Ranges west of the site including the San Andreas Fault (located approximately 65 miles west of the subject site). One of the nearest seismotectonic sources is the Great Valley Fault zone (Coast Ranges-Central Valley boundary zone), located approximately 40 miles west of the site. The Great Valley Fault zone is the geomorphic boundary of the Coast Ranges and the Central Valley and is underlain by a 300-mile long seismically active fold and thrust belt that has been the source of recent earthquakes, such as the 1983 magnitude 6.5 Coalinga and the 1985 magnitude 6.1 Kettleman Hills earthquakes. Nearly the entire thrust system is concealed or "blind." The basal detachment of this thrust system dips at a shallow angle to the west. East-directed thrusting over ramps in the detachment and west-directed thrusting on backthrusts are responsible for the uplift along the eastern range front of the Coast Ranges. Based on earthquake focal mechanisms, movement on the thrust zone is generally perpendicular to the strike of the geomorphic boundary and trend of the San Andreas Fault system. Shortening along the geomorphic boundary is driven by a component of the Pacific-North American Plate motion that is normal to the plate boundary. The Great Valley Fault zone is considered the dominant seismic feature with potential for affecting the subject site.

Regional structure within the Western Sierra Nevada north of the subject site is complex and generally consists of blocks separated by steeply eastward-dipping, north and northwest striking reverse faults of the Foothills Fault System. The Foothills Fault system is located approximately 40 miles north of the subject site. Based on mapping and historical seismicity, the seismicity of the Sierra Nevada foothills has been generally considered low by the scientific community. However, on August 1, 1975, a 5.7 Richter magnitude earthquake occurred near Oroville within the northern Sierra Nevada. Surface rupture along the Cleveland Hill Fault (part of the Foothills Fault System) was associated with 1975 Oroville earthquake. As a result of this event, numerous studies were undertaken to further evaluate the seismicity of the Sierra Nevada foothills. Of particular note are the geologic and seismicity studies conducted by Woodward-Clyde Consultants (WCC) to evaluate the proposed Auburn Dam site. Based on these studies, WCC concluded that seismic events in the Sierra Nevada foothills are associated with very small, geologically infrequent, incremental displacements having minor geomorphic surface expression.

In addition, the eastern border of the southern San Joaquin Valley is cut by a series of en-eschelon range-front faults. These faults are mainly northwest-trending normal faults, down dropped to the west and with a near vertical dip. One of the range-front faults, the Clovis Fault, is mapped approximately 13 miles northeast of the subject site. These range-front faults have generally been considered inactive; however, a September 1973 magnitude 4.4 earthquake that occurred approximately 4.3 miles north of the subject site may be related to this fault system.

The Sierra Nevada and Owens Valley Fault Zones bound the eastern edge of the Sierra Nevada block nearly 88 miles east of the site.

Tensional forces resulting in normal faults are reported to be related to crustal stress relief in the southeast portion of the San Joaquin Valley. Numerous relatively short, normal faults traverse this region. Creep activity is the prominent mode of slip on those faults in this region that are active. These movements have continued on an intermittent basis from the early Miocene to Recent time. This faulting is directly related to and controls the accumulation of oil in several oil fields within the easterly portion of the valley. Most authors agree that current creep movements can be ascribed to subsidence promoted by extensive withdrawal of petroleum, and in some cases, groundwater. Those faults considered to be active in the southern valley are Kern Front and Pond Faults located at least 90 miles south of the subject site.

White Wolf Fault (responsible for a 1952 earthquake that caused extensive damage in the Bakersfield area) is located in the tectonically active Tehachapi Mountains at the southerly terminus of the valley, over 100 miles south of the subject site.

5.0 SITE DESCRIPTION

5.1 General/Surface Features

Site reconnaissance was performed in July and August 2011 resulting in the following observations:

- The Fulton Corridor subject site area was observed to be virtually entirely developed land consistent with the characteristics of an urban center. Single and multi-story buildings were spread throughout the subject site. One-, two- and three-story buildings appear to be concentrated in the northern and western areas of the subject site, while much taller buildings of four to twenty-one stories (Fresno Pacific Towers/Security Bank Building) occupied the central area surrounding the Fulton Mall and vicinity. Areas not developed with structures generally contained paved streets, sidewalks, parking lots, parks, and landscaped areas.

No evidence of surface faulting was observed on the subject sites during our reconnaissance. The subject site and surrounding properties are relatively flat. No evidence of slope failures or instabilities was observed on the subject property or adjoining properties.

6.0 GEOLOGIC HAZARDS

6.1 Fault Rupture Hazard Zones in California

The Alquist-Priolo Geologic Hazards Zones Act went into affect in March, 1973. Since that time, the act has been amended 10 times (Hart, 1994). The purpose of the Act, as provided in DMG Special Publication 42 (SP 42), is to prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." The act was renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1994, and at that time, the originally designated "Special Studies Zones" was renamed the "Earthquake Fault Zones."

As indicated by SP 42, "the State Geologist is required to delineate "earthquake fault zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. The State Mining and Geology Board provide additional regulations (Policies and Criteria) to guide the cities and counties in their implementation of the law (CCR, Title 14, Division 2)."

Special Publication 42 also provides definitions of certain terms, which are important to the evaluation of seismic hazards. These include the definitions for a fault and a fault trace. They also include the following:

Active Fault: One which has had surface displacement within Holocene time (about the last 11,000 years), hence constituting a potential hazard to structures that might be located across it.

Potentially Active Fault: Initially, faults were defined as *potentially active*, and were zoned, if they showed evidence of surface displacement during Quaternary time (last 1.6 million years). The term "recently active" was not defined, as it was considered to be covered by the term "potentially active."...the term "potentially active" continued to be used as a descriptive term on map explanations on EFZ maps until 1988.

Sufficiently Active and Well-Defined: There are so many potentially active faults in the State that it would be meaningless to zone all of them. The State Geologist made a policy decision to zone only those potentially active faults that have a relatively high potential for ground rupture. To facilitate this, the terms "sufficiently active" and "well-defined," were defined for zoning faults other than the 4 named in the Act. These two terms constitute the present criteria used by the State Geologist in determining if a given fault should be zoned under the Alquist-Priolo Act.

Sufficiently active: A fault is deemed sufficiently active if there is evidence of Holocene surface displacement along one or more of its segments or branches. Holocene surface displacement may be directly observable or inferred.

Well-defined: A fault is considered well-defined if its trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The fault may be identified by direct observation or by indirect methods. The critical consideration is that the fault, or some part of it, can be located in the field with sufficient precision and confidence to indicate that the required site-specific investigations would meet with some success.

The Fulton Corridor Specific Plan subject site area does not lie on a Fault Rupture Hazard Zones Map, and accordingly, the site is not within a Fault-Rupture Hazard Zone. The nearest zoned fault is a portion of the Ortigalita Fault located approximately 61 miles west of the subject site.

6.2 Seismic Hazard Zones in California

In 1990, the California State Legislature passed the Seismic Hazard Mapping Act to protect public safety from the effects of strong shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. The Act is codified in the Public Resources Code as Division 2, Chapter 7.8, Sections 2690-2699.6 and became operative on April 1, 1991. The program and actions mandated by the Seismic Hazards Mapping Act closely resemble those of the Alquist-Priolo Earthquake Fault Hazards Zones Act (described above in Section 7.1). The Act requires that the State Geologist delineate various seismic hazards zones on Seismic Hazards Zones Maps. Specifically, the maps identify areas where soil liquefaction and earthquake-induced landslides are most likely to occur. The Act directs cities, counties, and state agencies to use the maps in their land use planning and permitting processes. A site-specific geotechnical evaluation is required prior to permitting most urban developments within the mapped zones. The Act also requires sellers of real property within the zones to disclose this fact to potential buyers.

Due to the relatively recent promulgation of the Act, a limited number of Seismic Hazard Zone Maps have been prepared as of this writing. Areas covered by the preliminary maps released to date include portions of the immediate San Francisco Bay area and several areas in Los Angeles, Orange, and Ventura Counties. The area of the subject site is not included on any of the maps released to date.

6.3 Historic Seismicity/Earthquake Epicenter Distribution

The Fresno area has historically experienced a low to moderate degree of seismicity. A listing of historic earthquakes with magnitudes greater than 4.0 within approximately 50 miles (80 kilometers) of the subject site was obtained from the comprehensive California Geological Survey computerized earthquake catalog for the State of California, the Townley and Allen (1939) catalog and the U.S. Geological Survey Earthquake Data Base System. In addition, a listing of historic earthquakes with magnitudes greater than 5.0 within approximately 100 miles of the subject site was obtained. The listings include the date, time, location, depth, magnitude, and intensity all recorded events within the search radius between 1800 and 2005. A review of the literature for pre-1900 earthquakes (Toppozada, 1991) does not reveal any significant recorded seismic events in the vicinity of the subject site prior to the period covered by the above noted listings.

The historic earthquake listings are included in Appendix A. A plot of epicenters associated with historic earthquakes in the region of the site with magnitudes greater than or equal to 5.0 is shown on Figure 6, Regional Earthquake Epicenter Map.

The earthquake data indicated that 88 events with magnitudes greater than 4.0 occurred within 50 miles of the subject site between 1800 and 2011. The data indicates that 134 events exceeded magnitudes 5.0 within 100 miles of the subject site. The nearest listed event occurred approximately 2.4 miles north of the site in 1864 with a magnitude of 4.3. The 1864 event may have occurred on a system of range-front faults which trend along the easterly margin of the San Joaquin Valley (described in Section 5.3 of this report). None of the listed earthquakes with magnitudes greater than 4.6 occurred within 24 miles of the site. Numerous earthquakes are listed with magnitudes between 5.0 and 6.0 beyond about 40 miles of the site. No events were recorded with magnitudes greater than 6.0 within 45 miles of the site.

The geologic literature indicates that groundshaking of VII intensity (Modified Mercalli Scale) was felt in Fresno from the 1872 Owens Valley Earthquake. This is the largest known earthquake event to have affected the Fresno area. The most recent earthquake significant to the Fresno area was the Coalinga seismic event which occurred on May 2, 1983 within the Coast Ranges-Sierran Block Boundary Seismotectonic structure. The Coalinga seismic event had a magnitude of M_w 6.5. The initial shock had a Modified Mercalli Intensity of V in the Fresno area. This earthquake and aftershocks had a substantial affect on Coalinga area but no damage, either architectural or structural, was reported in the area of the subject site.

6.4 Geologic Subgrade

Information obtained from the geologic literature indicates the general soil profile at the site consists predominately of silty sands, sandy silts and clayey sands. With the exception of a limited occurrence of near-surface loose soils, penetration resistance and laboratory testing indicate that these materials are at least medium dense. The Site Class per Table 1613.5.2 of the 2010 California Building Code is based upon the site soil conditions. It is our opinion that Site Class D is most consistent with the subject site soil conditions.

6.5 Soil Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs in soils such as sand in which the strength is purely friction. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic event.

To evaluate the liquefaction potential of a site, the following items are evaluated: 1) Groundwater depth; 2) Soil type; 3) Relative density; 4) Initial confining pressure; 5) Intensity and duration of groundshaking.

The soils anticipated to be encountered within a depth of approximately 50 feet on the subject site predominately consist of loose to very dense sandy silts, silty sands, sands, and sandy clayey silts. Moderate cohesion strength is associated with the clayey soils. Available groundwater depth mapping, as well as Krazan's experience in the area, indicates that historically groundwater has been located at depths on the order of 73 to 121 feet below site grade. Based on these findings, it appears that the potential for soil liquefaction within the project site is very low due to the type of soils anticipated to be within the upper layer, the relatively low levels of expected groundshaking at the site, and the lack of groundwater. Therefore, mitigation measures to mitigate seismic-induce liquefaction do not appear to be warranted.

6.6 Seismic Settlement and Lateral Spread

One of the most common phenomena during seismic shaking accompanying any earthquake is the induced settlement of loose unconsolidated soils. Based on the nature of the subsurface materials, the relatively level site conditions, and the relatively low to moderate seismicity of the region, it is not anticipated that seismic settlement or lateral spread would represent a significant geologic hazard to the site.

6.7 Subsidence Due to Fluid Withdrawal

Portions of the San Joaquin Valley have been subject to land subsidence due to fluid withdrawal (groundwater and petroleum). However, the area of the subject site is not known to be subject to such subsidence hazards.

6.8 Expansive Soils

The surface and near-surface soils observed on the site surface consist of sandy silts, silty sands, sandy silt or silty sand with trace clay, and sands. These materials are considered to have a very low to moderate expansion potential.

6.9 Tsunamis and Seiches

A tsunami is a series of ocean waves generated by an impulsive disturbance. Due to the inland location of the subject site, tsunamis are not considered a threat to the site. Seiches are standing waves in a body of water such as a lake or reservoir. Because such a body of water is not located near the site, seiches are not anticipated to affect the subject site.

6.10 Slope Stability and Potential for Slope Failure

Due to the generally flat-lying nature of the site and surrounding areas, problems from landslides are not anticipated to affect this site.

6.11 Volcanic Hazards

The subject site is not within an area known to be affected by volcanic hazards (Miller, 1989, USGS Bulletin, 1847).

6.12 County Seismic Safety Element

Documentation and mapping included in the Seismic Safety Element of the Fresno County General Plan, dated 2000 and Draft 2025 Fresno General Plan dated 2002 were reviewed. In addition, we reviewed the seismic safety supplement to the safety element (dated 1974) and the Draft Safety Element dated 2002. The seismic information contained within the Seismic Safety Element is somewhat dated and/or generalized and is superseded by more recent information and analyses described herein. The referenced documents generally indicate that the site area is subject to relatively low to moderate seismicity and related hazards.

7.0 CONCLUSIONS

Based upon our vicinity project history and review of available data, no evidence has been found that would indicate that a fault or other geologic hazard exists on the Fulton Corridor Specific Plan project subject site, which would represent the potential for a significant impact. Since the subject site area is underlain by deep alluvial basin, the area may be affected by strong seismic ground shaking; however, the seismicity of the region is considered relatively low to moderate. According to the 2025 Fresno General Plan Draft EIR, construction activities will require excavation and compaction of soils under the direction of a registered civil engineer or registered geologist. The Fresno metropolitan area is not prone to earthquakes or other geological hazards.

The City requires, as a standard building practice, the submittal of geotechnical reports. The design and construction of projects are required to comply with the recommendations of said reports. Therefore, it is recommended that a geotechnical investigation be conducted by the developer of any project within the Specific Plan subject site areas and submitted to the City for review and approval prior to issuance of site-specific building and grading permits. Conformance with the City's standard practice and procedures and the objectives and policies in the 2025 Fresno General Plan are mitigation measures which will reduce effects related to geology and geologic hazards to a level of less-than-significant. Provided that the proposed future developments conform to current design criteria and the recommendations of current and future Geotechnical Engineering Investigation(s), there appears to be no geologic reason to discourage the development and redevelopment of the subject site Specific Plan areas.

A list of references cited is provided in Appendix B.

8.0 LIMITATIONS

The above conclusions are based on conditions observed and geologic information available as of the date of this report. If future seismic occurrences show nearby fault activity other than that described above, if future events show geologic conditions differing from those indicated above, or if present state-of-the-art geologic information should change materially, then the conclusions of this report should be reviewed by a Certified Engineering Geologist, and the conclusions modified or approved in writing.

This report is applicable only to the subject site property as described herein, and should not be utilized for any other site.

If there are any questions or if we can be of further assistance, please do not hesitate to contact our office at (559) 348-2200.

Respectfully submitted,
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REFERENCES AND BACKGROUND SOURCES
014-10022B

Association of Engineering Geologists, 2001, *Engineering Geology Practice in Northern California,* Special Publication 12 and California Geological Survey Bulletin 210.

Bartow, J.A., 1991, *The Cenozoic Evolution of the San Joaquin Valley, California,* U.S. Geological Survey Professional Paper 1501, 40p.

Bennett, J.H., and Sherbrune, R.W., editors, 1983, *The Coalinga, California Earthquakes*, Special Publication 66, California Division of Mines and Geology.

California Building Standards Commission, 2007, California Code of Regulations, Title, 24, *California Building Code, 2007 edition*, Whittier, California

California Geological Survey, Note 48, *Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*, October 2007.

California Division of Mines and Geology (CGS), 2008, *Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117,* 102p.

California Geological Survey, *California Fault Parameters*, Internet Site
http://www.consrv.ca.gov/dmg/shezp/fltindex.html

Cao, Tianquing, Bryant, William A., Rowshandel, B., Branum, David, and Wills, Christopher J., 2003, *The Revised 2002 California Probabilistic Seismic Hazards Maps*: California Geological Survey, CGS website, June 2003.

City of Fresno, Planning and Development Department, Advance Planning, 2002, *2025 Fresno General Plan, Chapter I: Safety*, February 1, 2002.

Eaton, J.P., 1986, *Tectonic Environment of the Vacaville/Winters Earthquake, and the Potential for Large Earthquake Along the Western Edge of the Sacramento Valley,* U.S. Geological Survey, Open-File Report 86-370.

Hart, E.W. and Bryant, W.A., Revised 1997, *Fault-Rupture Hazard Zones in California: Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps, with Supplements 1 and 2 added 1999,* California Division of Mines and Geology, Special Publication 42, 38p.

Federal Emergency Management Agency, 2008, *FIRM Flood Insurance Rate Map, Madera, Madera County, California, County and incorporated Areas,* Community Panel Number 06039C1160E, effective date: September 22, 2008.

REFERENCES AND BACKGROUND SOURCES (CONT.)
014-10022B

Fresno County General Plan, 2000. *Background Report, Chapter 9*: *Safety*, Adopted October 3, 2000.

Jennings, C.W. and Bryant, W.A., 2010, *Fault Activity Map of California*, California Geological Survey, California Geologic Data Map No. 6.

Hill, Mary. 2006. *Geology of the Sierra Nevada*, California Natural History Guides, University of CA Press.

Marchand, D.E., 1976, *Preliminary Geological Maps Showing Quaternary Deposits of the Madera Area (Madera 7.5 Minute Quadrangle) Eastern San Joaquin Valley, Madera and Fresno Counties, California*, scale 1:24,000.

Matthews, R.A. and Burnet, J.L., 1965, *Geologic Map of California – Fresno Sheet*, 1:250,000.

Miller, C. Dan, 1989. *Potential Hazards from Future Volcanic Eruptions in California*, USGS Bulletin 1947.

Page, R.W. 1986, *Geology of the Fresh Ground-Water Basin of the Central Valley, California*, U.S. Geological Survey Professional Paper 1404-C, 54p.

Rymer, M.J., and Ellsworth, W.L., editors, 1990, *The Coalinga, California, Earthquake of May 2, 1983*, U.S. Geological Survey Professional Paper 1487.

Southern California Earthquake Center, University of Southern California 1999, *Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigation Liquefaction in California.*

Tokimatsu, K., and Seed, H. Bolton, 1987, *Evaluation of Settlements in Sands Due to Earthquake Shaking*, ASCE Journal of Geotechnical Engineering, vol. 113, no. GT8, p. 861-878.

Toppozada, T., Branum, D., Peterson, M., Hallstrom, C. Cramer, C., Reichle, M., *2000 Epicenters of and Areas Damaged by M>5 California Earthquakes 1800-1999*, California Geological Survey, Map Sheet 49.

Toppozada, T.R., 1987. *The 1892 Vacaville-Winters Earthquake and 1983 Coalinga Earthquake*, California Geology, December 1987 Volume 40, No. 12.

Toppozada, T.R., Real, C.R., and Parke, D.L., 1991. *Preparation of Isoseismal Maps and Summaries of Reported Effects for Pre-1900 California Earthquakes*, California Division of Mines and Geology, Open-File Report 81-11.

REFERENCES AND BACKGROUND SOURCES (CONT.)
014-10022B

Townley, S. D., and M. W. Allen, 1939. Descriptive Catalog of Earthquakes of Pacific Coast of the United States, 1769-1928. *Bulletin of the Seismological Society of America* 29 (1), 1-297.

Unruh, J.R., and Moores, E.M., 1992, *Quaternary Blind Thrusting in the Southwestern Sacramento Valley:* Tectonics, Vol. 11.

Wagner, D.L., Bortugno, E.J., and McJunkin, R.D., 1990, *Geologic Map of the San Francisco – San Jose Quadrangle, California, Scale 1:250,000,* California Department of Conservation, Division of Mines and Geology, Regional Geologic Map Series.

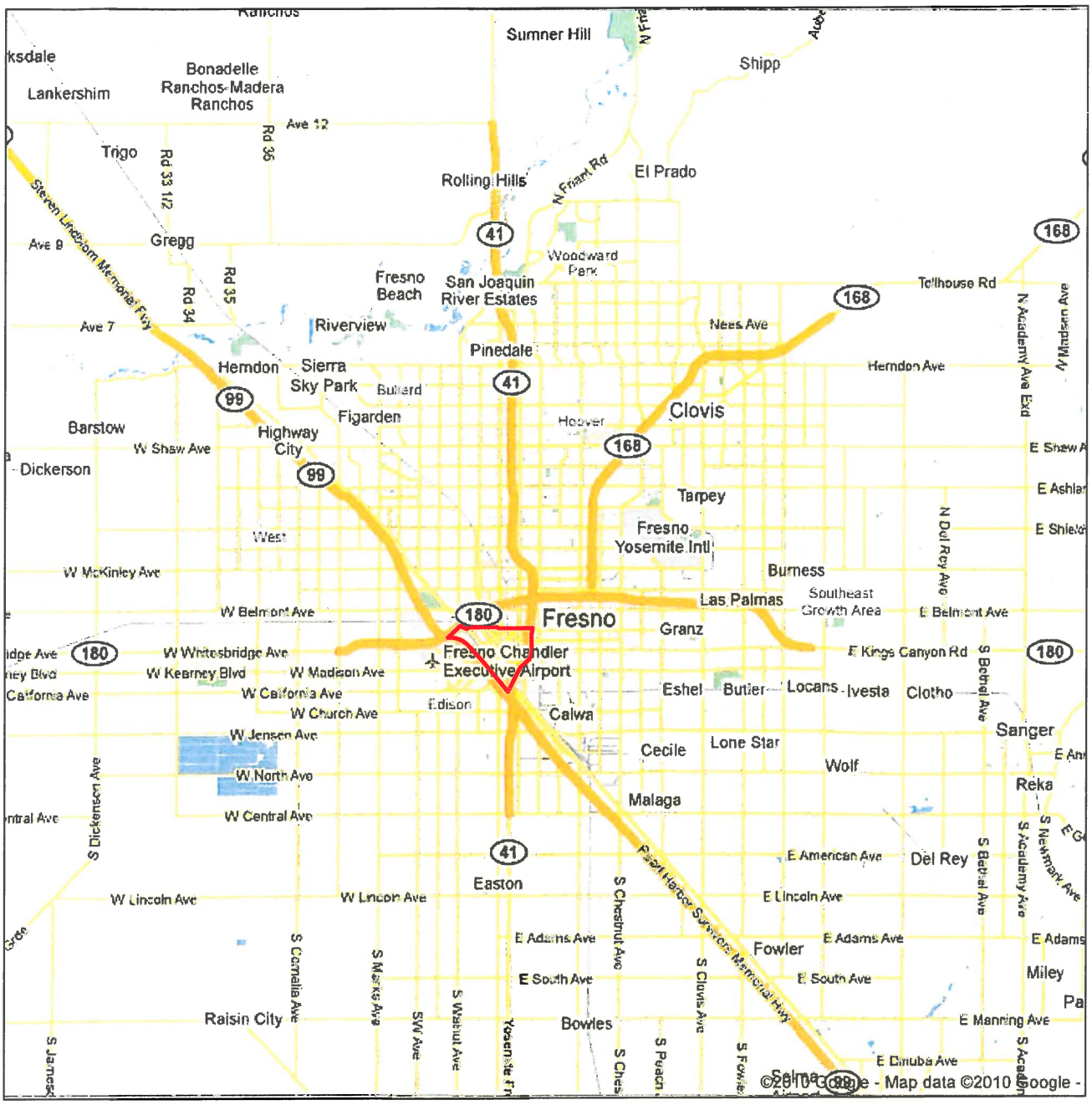
Youd, T. Leslie., Hansen, Corbett M., and Bartlett, Steven F., 2002, *Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement*, ASCE Journal of Geotechnical and Geoenvironmental Engineering, vol. 128, no. 12, December 2002 issue, p. 1007-1017.

Table I

SEISMIC SOURCES
FULTON CORRIDOR SPECIFIC PLAN AREA
FRESNO, CALIFORNIA

ABBREVIATED FAULT NAMES*	CLOSEST DISTANCE TO PROJECTION OF RUPTURE AREA ALONG FAULT (MILES)	MAXIMUM EARTHQUAKE MAG. (Mw)	EST. SITE INTENSITY MOD. MERC.
FOOTHILLS FAULT SYSTEM 1	40.0	6.5	VII
GREAT VALLEY 11	40.1	6.4	VII
GREAT VALLEY 12	40.1	6.3	VII
GREAT VALLEY 13	41.9	6.5	VII
FOOTHILLS FAULT SYSTEM 2	42.6	6.5	VII
GREAT VALLEY 14	46.2	6.4	VI
FOOTHILLS FAULT SYSTEM 3	46.6	6.5	VII
GREAT VALLEY 10	48.0	6.4	VII
GREAT VALLEY 9	53.4	6.6	VII
ORTIGALITA	61.3	7.1	VI
SAN ANDREAS (Creeping)	65.4	6.2	V
SAN ANDREAS - Parkfield	66.3	6.5	VI
GREAT VALLEY 8	70.8	6.6	VI
SAN ANDREAS - 1857 Rupture M-2a	73.6	7.8	VII
SAN ANDREAS - Cholame M-1c-1	73.6	7.3	VI
SAN ANDREAS - Cho-Moj M-1b-1	73.6	7.8	VII
SAN ANDREAS - Whole M-1a	73.6	8.0	VII
ROUND VALLEY	73.8	7.0	VI
HARTLEY SPRINGS	76.3	6.6	VI
HILTON CREEK	77.2	6.7	VI
SAN JUAN	78.2	7.1	VI
QUIEN SABE	78.9	6.4	V
BIRCH CREEK	80.2	6.4	VI
INDEPENDENCE	81.6	7.1	VI
FISH SLOUGH	84.6	6.6	VI
RINCONADA	86.6	7.5	V
OWENS VALLEY	87.7	7.6	VI
CALAVERAS (CS+CC)	89.2	6.4	V
CALAVERAS (CS+CC FLOATING)	89.2	6.2	V
CALAVERAS (FLOATING)	89.2	6.2	V
CALAVERAS (CS)	89.2	5.8	VI
CALAVERAS (CS+CC+CN)	89.2	6.9	VI
GREAT VALLEY 7	90.8	6.7	VI
MONO LAKE	91.1	6.6	VI
WHITE MOUNTAINS	91.6	7.4	VI
ZAYANTE-VERGELES	92.8	7.0	VI
SAN ANDREAS (SAS)	93.8	7.0	VI
SAN ANDREAS (SAS+SAP+SAN+SAO)	93.8	7.9	VII
SAN ANDREAS (SAS+SAP+SAN)	93.8	7.8	VII
SAN ANDREAS (SAS+SAP)	93.8	7.4	VI
SAN ANDREAS (FLOATING)	93.8	6.9	VI
WESTERN NEVADA ZONE 1	94.3	7.3	VI
CALAVERAS (CC)	94.6	6.2	V
CALAVERAS (CC+CN)	94.6	6.2	V
SAN ANDREAS - Carrizo M-1c-2	98.3	7.4	VI
MONTEREY BAY-TULARECITOS	99.4	7.3	VI
DEEP SPRINGS	99.5	6.6	VI
WESTERN NEVADA ZONE 2	99.9	7.3	VI

*These faults are used in seismic hazard analysis in accordance with the California Geological Survey.

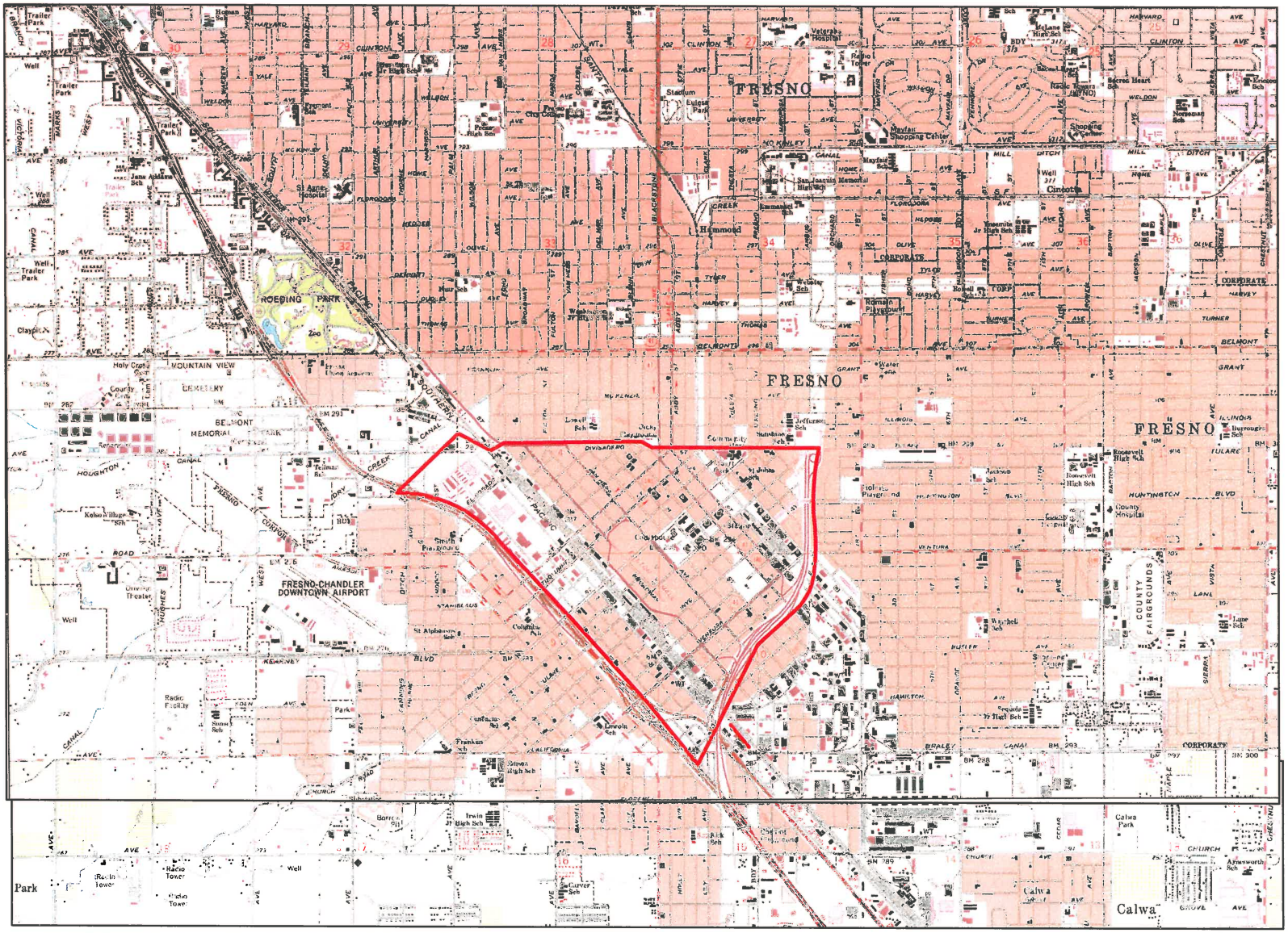


EXPLANATION

SUBJECT SITE BOUNDARY (APPROXIMATE)

*ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE

VICINITY MAP	Scale: NTS	Date: 8/11	Krazan SITE DEVELOPMENT ENGINEERS Conducting Assessments Nationwide
FULTON CORRIDOR SPECIFIC PLAN AREAS GEOLOGIC HAZARDS ANALYSIS	Drawn by: S. A.	Approved by: M. B.	
	Project No. 014-10022B	Figure No. 1	



MAP SOURCE: (4) USGS 7.5-minute Quadrangles as follows: Fresno North (dated 1965, photo revised 1981) Fresno South (dated 1963, photo revised 1981), Malaga (dated 1964, photo revised 1981) and Clovis (dated 1964, photo revised 1981).

EXPLANATION

SUBJECT SITE BOUNDARY (APPROXIMATE)

N

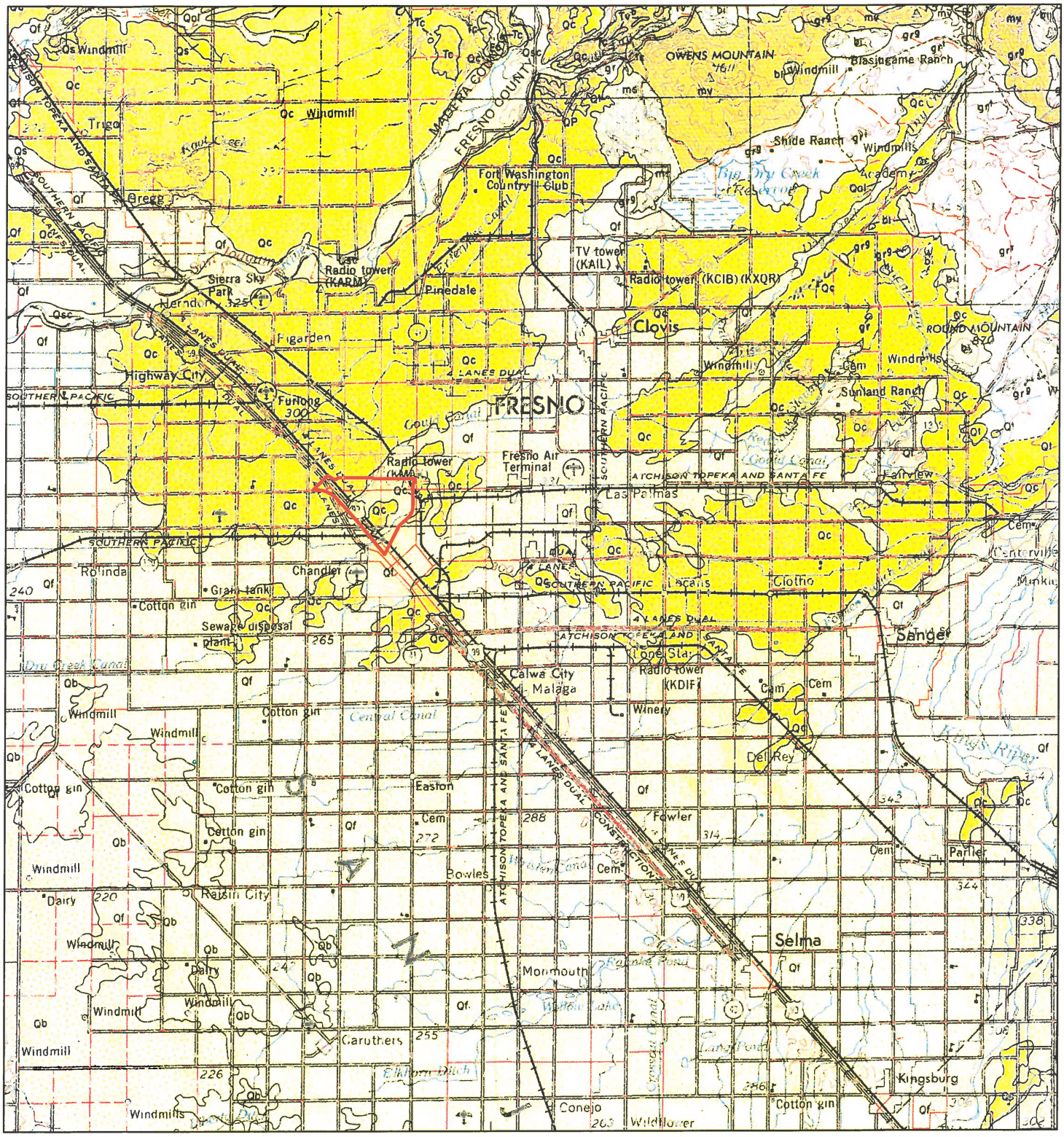
TOPOGRAPIC SITE MAP

FULTON CORRIDOR SPECIFIC PLAN AREAS
GEOLOGIC HAZARDS ANALYSIS

Scale: NTS	Date: 8/11
Drawn by: S. A.	Approved by: M. B.
Project No. 014-10022B	Figure No. 2

Krazan

SITE DEVELOPMENT ENGINEERS
Conducting Assessments Nationwide



EXPLANATION

SUBJECT SITE BOUNDARY (APPROXIMATE)

*MAP SOURCE:
GEOLOGIC MAP OF CALIFORNIA
OLAF P. JENKINS EDITION
FRESNO SHEET 1965

REGIONAL GEOLOGIC MAP	Scale: NTS	Date: 8/11	Krazan
FULTON CORRIDOR SPECIFIC PLAN AREAS GEOLOGIC HAZARDS ANALYSIS	Drawn by: S. A.	Approved by: M. B.	SITE DEVELOPMENT ENGINEERS Conducting Assessments Nationwide
	Project No. 014-10022B	Figure No. 3	

Qs RECENT DUNE SAND

Loose sand desposits very low in organic matter, northwest of Fresno and near Dinuba (Delhi soil series).

Qal RECENT ALLUVIUM

Stream alluvium including some dissected fans on the margins of the Great Valley. Corase granitic fanglomerate along the eastern front of the Sierra Nevada. Talus and slope wash. Alluvial fill in upland meadows. Recent calcareous tufa deposits in Kern Peak and Camp Nelson quadrangles.

Qsc RECENT RIVER AND MAJOR STREAM CHANNEL DEPOSITS IN THE GREAT VALLEY

Sediments along river channels and major streams including adjacent natural levees.

Qf RECENT ALLUVIAL FAN DEPOSITS IN THE GREAT VALLEY

Sediments deposits from streams emerging from highlands surrounding the Great Valley. Modesto Formation-*granitic sand and silt.*

Qb RECENT BASIN DEPOSITS IN THE GREAT VALLEY

Sediments deposited during flood stages of major streams in the area between natural stream levees and fans.

Qt QUATERNARY NONMARINE TERRACE DEPOSITS

Stream terraces of unconsolidated sand, silt , clay and gravel.

Qc PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS

Riverbank Formation-*granitic sand, silt and clay* . Older alluvium and dissected fan deposits in the San Joaquin Valley. So-called sand dune in Sand Meadows (southwest of Mineral King) composed of stream deposited sand, gravel, and cobbles.

Qp PLIOCENE-PLISTOCENE NONMARINE SIDIMENTARY DEPOSITS

Turlock Lake Formation-granitic sand, silt, clay, and cobbles.
Tulare Formation-continental beds of poorly consolidated sandstone, siltstone, and conglomerate.

Tc TERTIARY NONMARINE SEDIMENTARY ROCKS

Tuffaceous "sand and gravel" of Janda (Lanes Bridge and Friant quadrangles).

grg MESOZOIC GRANITIC ROCKS (GRANODIORITE)

Granodiorite, including hornblende biotite grandiorite. Tinemaha Granodiorite- *includes some quartz monzonite*; granodiorite in the Independence and Mount Pinchot quadrangles. Isabella Granodiorite-*ranging to quartz diorite* (Kern River Basin). Tokapah Porphyritic Granodiorite. Clover Creek Granodiorite, Cow Creek Granodiorite (Sequoia and Kings Canyon area). Lamarck Granodiorite (Mount Pinchot area).

grt MESOZOIC GRANITIC ROCKS (TONALITE) (QUARTZ DIORITE) AND DIORITE

Quartz diorite, pyroxene quartz diorite (near Academy). and hornblende diorite. Sacatar Quartz Diorite-*ranges from gabbro to grandiorite* (Kern River Basin). Potwisha Quartz Diorite (Sequoia area).

MESOZOIC BASIC INTRUSIVE ROCKS

Hornblende gabbro, pyroxene-hornblende gabbro, clinopyroxene anorthosite (Mount Pinchot quadrangle); and other mafic plutonic rocks including some diorite. Summit Gabbro-*hornblende gabbro* (Kern River Basin). Elk Creek Gabbro (Sequoia area). Olivine gabbro near Orosi.

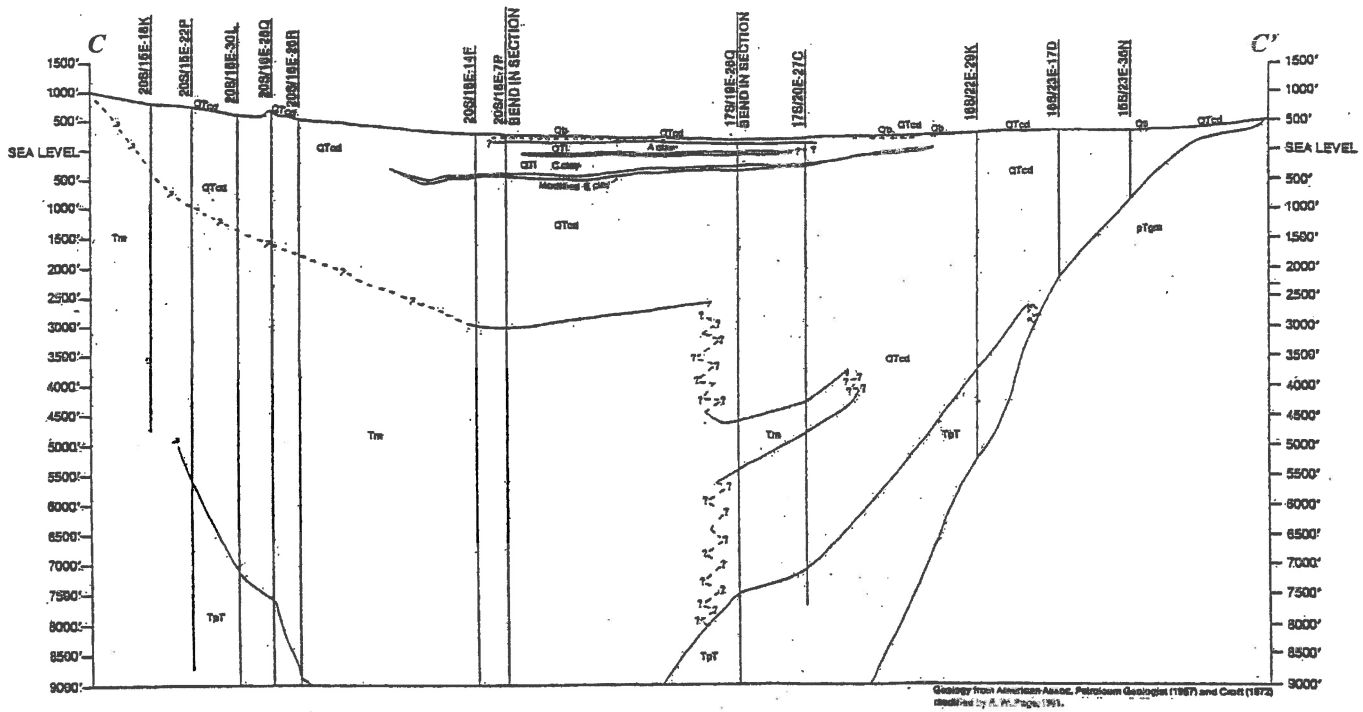
ms PRE-CRETACEOUS METASEDIMENTARY ROCKS

Unnamed metamorphic rocks composed predominantly of schist, metachert, phyllite, quarzite, hornfels, tactite slate, and marble .

mv PRE-CRETACEOUS METAVOLCANIC ROCKS

Unnamed amphibolite, mica schist, metarhyolite, and other metamorhposed tuffs and flows.

REGIONAL GEOLOGIC MAP EXPLANATION	Scale: AS SHOWN	Date: 8/11	Krazan
FULTON CORRIDOR SPECIFIC PLAN AREAS GEOLOGIC HAZARDS ANALYSIS	Drawn by: S. A.	Approved by: M. B.	SITE DEVELOPMENT ENGINEERS Conducting Assessments Nationwide
	Project No. 014-10022B	Figure No. 3.1	



EXPLANATION

Qs	*SAN DUNES (HOLOCENE) (HOLOCENE)*
Qb	*FLOOD BASIN DEPOSITS (HOLOCENE)*
QTl	*LACUSTRINE & MARSH DEPOSITS (PLIOCENE TO HOLOCENE)*
Qtcd	*CONTINENTAL ROCKS & DEPOSITS (OLIGOCENE TO HOLOCENE)*
Tm	*MARINE ROCKS & DEPOSITS (EOCENE, OLIGOCENE, MIOCENE, & PLIOCENE)*
TpT	*CONTINENTAL & MARINE ROCKS & DEPOSITS (PRE-TERTIARY TO OLIGOCENE)*
pTgm	*GRANITE & METAMORPHIC ROCKS (PRE-TERTIARY)*
~	*STRATIGRAPHIC UNIT CONTACT APPROXIMATELY LOCATED; QUERIED WHERE DATA ARE INCONCLUSIVE*

NOTE:

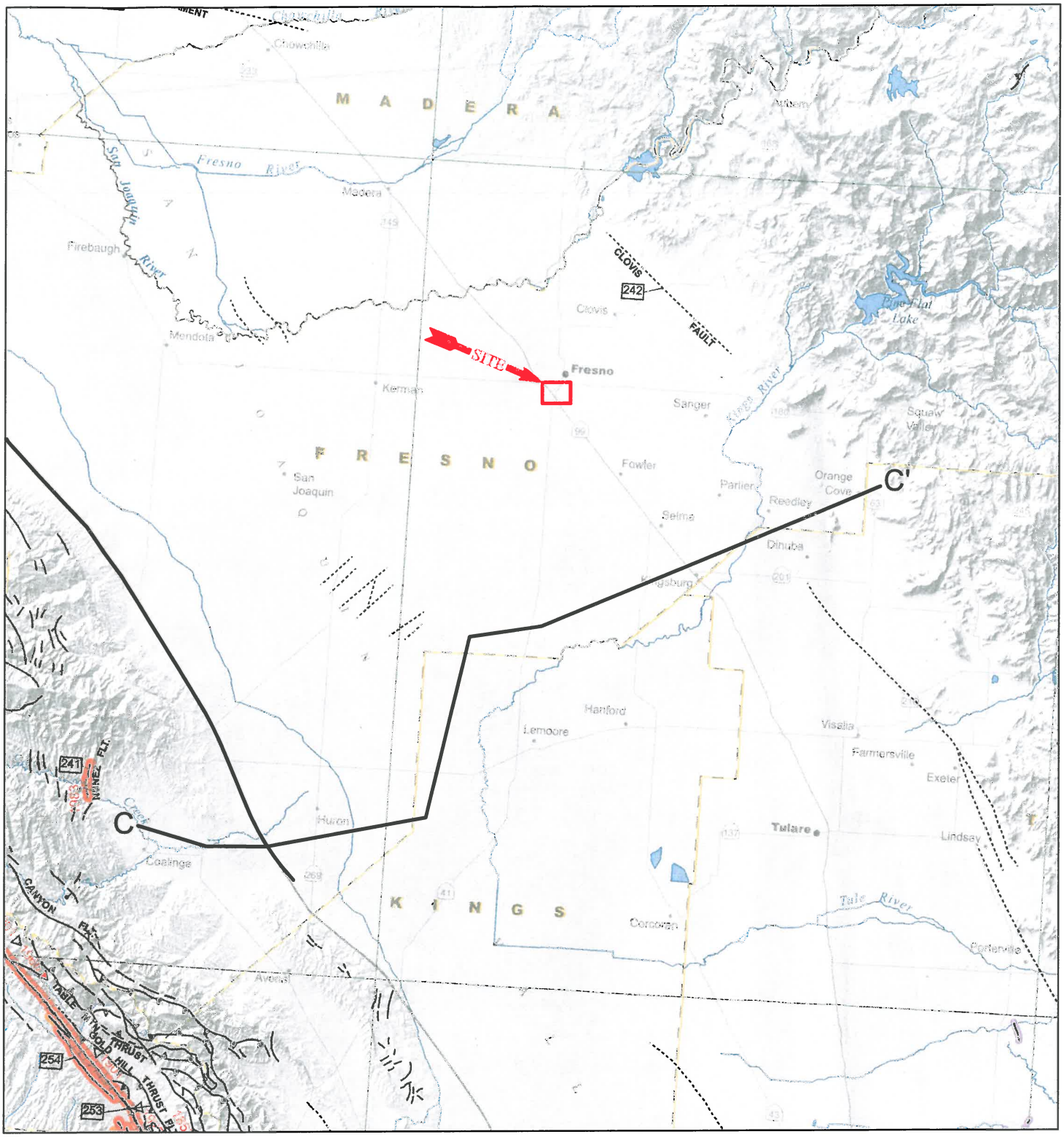
SEE FAULT MAP FOR LOCATION OF GEOLOGIC CROSS SECTION

REGIONAL GEOLOGIC CROSS-SECTION SHOWING THE SAN JOAQUIN VALLEY

(SEE FIGURE 5 FOR LINE OF CROSS-SECTION)

N

CROSS-SECTION	Scale: NTS	Date: 8/11	Krazan
FULTON CORRIDOR SPECIFIC PLAN AREAS GEOLOGIC HAZARDS ANALYSIS	Drawn by: S. A.	Approved by: M. B.	SITE DEVELOPMENT ENGINEERS Conducting Assessments Nationwide
	Project No. 014-10022B	Figure No. 4	



EXPLANATION

C——C' LINE OF REGIONAL GEOLOGIC CROSS SECTION

*MAP SOURCE:
C. G. S "FAULT ACTIVITY MAP OF CALIFORNIA
JENNINGS AND BRYANT, 2010

FAULT TRACES ON LAND ARE INDICATED BY SOLID LINES WHERE WELL LOCATED, BY DASHED LINES WHERE CONCEALED BY YOUNGER ROCKS OR BY LAKES OR BAYS, FAULT TRACES ARE QUERIED WHERE CONTINUATION OR EXISTENCE IS UNCERTAIN.

N

0 12 24

SCALE IN MILES(±)
*ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE

REGIONAL FAULT MAP	Scale: AS SHOWN	Date: 8/11	Krazan
FULTON CORRIDOR SPECIFIC PLAN AREAS GEOLOGIC HAZARDS ANALYSIS	Drawn by: S. A.	Approved by: M. B.	SITE DEVELOPMENT ENGINEERS Conducting Assessments Nationwide
	Project No. 014-10022B	Figure No. 5	

Fault along which historic (last 200 years) displacement has occurred and is associated with one or more of the following:

(a) a recorded earthquake with surface rupture. (Also included are some well-defined surface breaks caused by ground shaking during earthquakes, e.g. extensive ground breakage, not on the White Wolf fault, caused by the Arvin-Tehachapi earthquake of 1952). The date of the associated earthquake is indicated. Where repeated surface ruptures on the same fault have occurred, only the date of the latest movement may be indicated, especially if earlier reports are not well documented as to location of ground breaks.

(b) fault creep slippage - slow ground displacement usually without accompanying earthquakes.

(c) displaced survey lines.

A triangle to the right or left of the date indicates termination point of observed surface displacement. Solid red triangle indicates known location of rupture termination point. Open black triangle indicates uncertain or estimated location of rupture termination point.

Date bracketed by triangles indicates local fault break.

No triangle by date indicates an intermediate point along fault break.

Fault that exhibits fault creep slippage. Hachures indicate linear extent of fault creep. Annotation (creep with leader) indicates representative locations where fault creep has been observed and recorded.

Square on fault indicates where fault creep slippage has occured that has been triggered by an earthquake on some other fault. Date of causative earthquake indicated. Squares to right and left of date indicate terminal points between which triggered creep slippage has occurred (creep either continuous or intermittent between these end points).

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

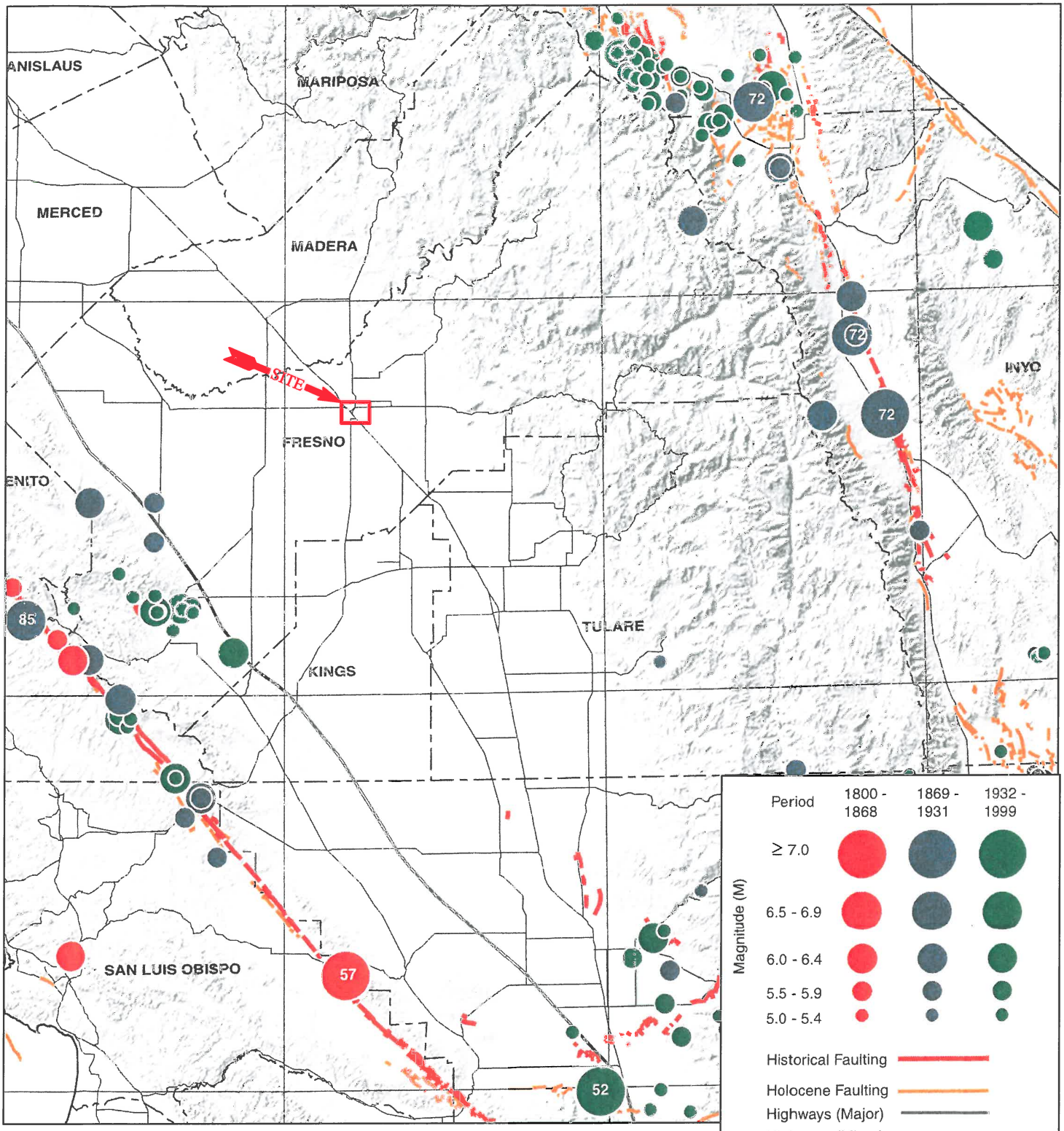
NOTES:

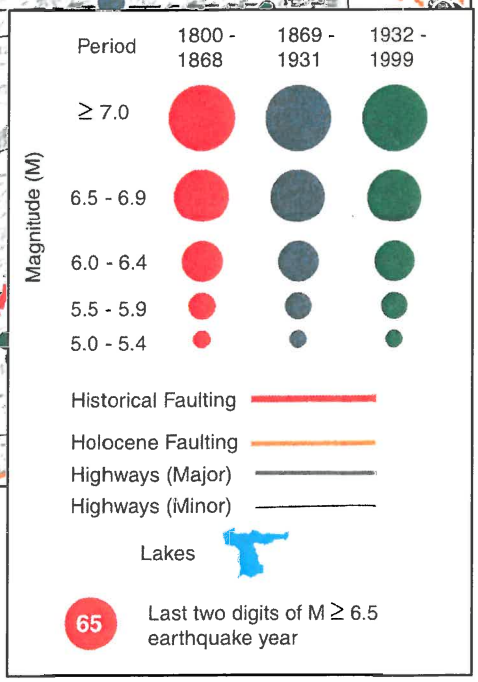
PREPARED FROM THE C.G.S. "FAULT ACTIVITY MAP OF CALIFORNIA" JENNINGS AND BRYANT, 2010

FAULT TRACES ON LAND ARE INDICATED BY SOLID LINES WHERE WELL LOCATED, BY DASHED LINES WHERE CONCEALED BY YOUNGER ROCKS OR BY LAKES OR BAYS. FAULT TRACES ARE QUERIED WHERE CONTINUATION OR EXISTENCE IS UNCERTAIN.

FAULT MAP
EXPLANATION

FAULT MAP EXPLANATION	Scale: AS SHOWN	Date: 8/11	Krazan SITE DEVELOPMENT ENGINEERS Conducting Assessments Nationwide
FULTON CORRIDOR SPECIFIC PLAN AREAS GEOLOGIC HAZARDS ANALYSIS	Drawn by: S. A.	Approved by: M. B.	
	Project No. 014-10022B	Figure No. 5.1	





*MAP SOURCE:
CGS MAP SHEET 49 EPICENTERS OF
AND AREAS DAMAGED BY M > 5 CALIFORNIA
EARTHQUAKES 1800-1989 BY TOPPOZADA, BRANUM, PETERSEN
HALLSTROM, CRAMER & REICHLE, 2000

0 40 80

SCALE IN KILOMETERS (±)
*ALL LOCATIONS AND DIMENSIONS
ARE APPROXIMATE

EPICENTER MAP LEGEND

REGIONAL EARTHQUAKE EPICENTER MAP	Scale: AS SHOWN	Date: 8/11	Krazan SITE DEVELOPMENT ENGINEERS Conducting Assessments Nationwide
FULTON CORRIDOR SPECIFIC PLAN AREAS GEOLOGIC HAZARDS ANALYSIS	Drawn by: S. A.	Approved by: M. B.	
	Project No.	Figure No. 6	

Appendix A

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*                       *
*    E Q S E A R C H    *
*                       *
*     Version 3.00      *
*                       *
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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 01411022a

DATE: 08-30-2011

JOB NAME: 01411022a

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

MAGNITUDE RANGE:
MINIMUM MAGNITUDE: 4.00
MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
SITE LATITUDE: 36.7359
SITE LONGITUDE: 119.7894

SEARCH DATES:
START DATE: 1800
END DATE: 2011

SEARCH RADIUS:
50.0 mi
80.5 km

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
ASSUMED SOURCE TYPE: DS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
SCOND: 0 Depth Source: A
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 0.0

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
T-A	36.7500	119.7500	08/16/1864	553 0.0	0.0	4.30	0.155	VIII	2.4(3.8)
MGI	37.0000	120.0700	09/12/1928	120 0.0	0.0	4.60	0.047	VI	23.9(38.5)
T-A	37.0000	119.5000	07/14/1894	450 0.0	0.0	4.30	0.039	V	24.2(39.0)
DMG	36.6020	119.3750	09/15/1973	1 315.4	8.0	4.40	0.041	V	24.7(39.8)
DMG	36.5830	120.3330	11/30/1963	225548.0	0.0	4.50	0.036	V	31.9(51.3)
BRK	36.4600	120.3400	08/03/1975	63516.0	0.0	4.90	0.040	V	36.0(57.9)
BRK	36.4600	120.3400	08/03/1975	638 0.0	0.0	4.40	0.031	V	36.0(57.9)
BRK	36.4700	120.3500	08/03/1975	55717.0	0.0	4.00	0.025	V	36.1(58.1)
BRK	36.5000	120.4000	08/15/1975	222751.0	0.0	4.60	0.033	V	37.5(60.4)
PAS	36.2200	120.1360	09/24/1980	8 839.1	6.7	4.40	0.028	V	40.5(65.1)
BRK	36.3000	120.3100	05/03/1983	93947.0	0.0	4.00	0.022	IV	41.7(67.1)
PAS	36.2600	120.2590	05/03/1983	142656.0	1.2	4.10	0.023	IV	41.9(67.5)
PAS	36.2050	120.1760	05/03/1983	0 022.1	9.0	4.00	0.022	IV	42.5(68.4)
BRK	36.1800	120.1200	08/12/1983	22 236.0	0.0	4.00	0.022	IV	42.5(68.5)
PAS	36.2500	120.2670	05/03/1983	01629.1	9.0	4.50	0.028	V	42.8(68.8)
PAS	36.1510	120.0490	08/04/1985	12 156.0	6.0	5.80	0.056	VI	42.9(69.0)
BRK	36.2500	120.2800	05/03/1983	018 1.0	0.0	4.40	0.027	V	43.2(69.5)
PAS	36.1450	120.0520	08/04/1985	112915.4	6.0	4.30	0.025	V	43.3(69.7)
PAS	36.1310	119.9970	08/05/1985	144538.3	6.0	4.30	0.025	V	43.3(69.7)
BRK	36.2500	120.2900	05/03/1983	154142.0	0.0	4.80	0.033	V	43.6(70.1)
BRK	36.2400	120.2800	05/03/1983	05034.0	0.0	4.00	0.021	IV	43.7(70.4)
PAS	36.2740	120.3310	02/19/1984	94310.6	7.4	4.40	0.026	V	43.8(70.5)
BRK	36.2800	120.3400	05/04/1983	161120.0	0.0	4.30	0.025	V	43.9(70.6)
USG	36.2300	120.2710	05/19/1983	11 530.1	12.9	4.16	0.023	IV	44.0(70.8)
BRK	36.2700	120.3300	05/03/1983	05745.0	0.0	4.80	0.032	V	44.0(70.8)
PAS	36.1190	119.9890	08/04/1985	12 841.8	6.0	4.10	0.022	IV	44.0(70.8)
USG	36.2380	120.2850	05/03/1983	21514.9	8.8	4.08	0.022	IV	44.0(70.9)
BRK	36.2400	120.2900	05/09/1983	24912.0	0.0	5.20	0.040	V	44.1(71.0)
PAS	36.1770	120.1750	05/03/1983	635 3.1	5.0	4.00	0.021	IV	44.1(71.0)
BRK	36.2200	120.2600	09/09/1983	91614.0	0.0	5.40	0.044	VI	44.2(71.1)
BRK	36.2500	120.3100	05/24/1983	9 219.0	0.0	4.60	0.029	V	44.3(71.2)
BRK	36.2300	120.2800	09/09/1983	92133.0	0.0	4.00	0.021	IV	44.3(71.3)
PAS	36.2190	120.2640	05/08/1984	192113.1	15.3	4.20	0.024	IV	44.4(71.4)
BRK	36.2600	120.3300	05/04/1983	72840.0	0.0	4.70	0.031	V	44.5(71.6)
BRK	36.2600	120.3300	05/03/1983	43233.0	0.0	4.30	0.025	V	44.5(71.6)
PAS	36.3130	120.3960	10/25/1982	231217.8	6.0	4.30	0.025	V	44.6(71.7)
BRK	36.2800	120.3600	05/05/1983	102045.0	0.0	4.60	0.029	V	44.6(71.8)
USG	36.2320	120.2990	05/03/1983	15546.4	6.9	4.00	0.021	IV	44.8(72.2)
UNR	37.3730	119.9560	08/10/1975	51640.5	5.5	4.40	0.026	V	44.9(72.3)
PAS	36.3210	120.4160	10/25/1982	231554.2	6.0	4.00	0.021	IV	45.0(72.5)
BRK	36.2200	120.2900	05/02/1983	234239.0	0.0	6.70	0.087	VII	45.2(72.7)
BRK	36.2200	120.2900	05/02/1983	2346 6.0	0.0	5.60	0.048	VI	45.2(72.7)
BRK	36.2200	120.3000	05/09/1983	32638.0	0.0	4.40	0.026	V	45.5(73.3)
DMG	36.2300	120.3200	08/13/1940	22 729.0	0.0	4.00	0.021	IV	45.7(73.5)
USG	36.2910	120.4010	08/12/1983	11441.1	9.8	4.04	0.021	IV	45.8(73.7)
BRK	36.2900	120.4100	08/14/1983	124337.0	0.0	4.20	0.023	IV	46.2(74.3)
USG	36.1800	120.2600	05/03/1983	13 914.6	12.5	4.04	0.021	IV	46.4(74.7)
GSB	36.3000	120.4270	04/21/1994	163715.3	10.0	4.50	0.027	V	46.4(74.7)
PAS	36.2860	120.4130	10/25/1982	2226 4.0	6.0	5.60	0.047	VI	46.5(74.8)
PAS	36.1820	120.2680	02/14/1987	72650.8	6.0	5.10	0.036	V	46.6(74.9)
DMG	36.2200	120.3300	10/22/1955	7 413.0	0.0	4.20	0.023	IV	46.6(75.0)
BRK	36.1400	120.1900	05/22/1983	83923.0	0.0	4.00	0.020	IV	46.8(75.3)
GSB	36.1920	120.2930	02/02/1997	022020.3	9.0	4.10	0.021	IV	46.8(75.3)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
T-A	36.1700	119.3200	07/25/1868	230 0.0	0.0	5.00	0.034	V	47.0(75.6)
USG	36.1800	120.2800	07/18/1983	1928 5.4	10.9	4.16	0.022	IV	47.1(75.7)
USG	36.1540	120.2320	05/02/1983	235529.1	8.6	4.24	0.023	IV	47.1(75.8)
BRK	36.2600	120.4000	07/09/1983	74052.0	0.0	5.30	0.040	V	47.2(76.0)
BRK	36.1400	120.2100	06/07/1983	51839.0	0.0	4.00	0.020	IV	47.3(76.1)
BRK	36.1300	120.1900	05/03/1983	14147.0	0.0	4.50	0.026	V	47.4(76.2)
USG	36.1340	120.2040	05/05/1983	43748.6	11.2	4.01	0.020	IV	47.5(76.5)
BRK	36.2500	120.4000	05/03/1983	6 447.0	0.0	4.30	0.023	IV	47.7(76.7)
GSP	36.1810	120.3010	03/31/1994	195959.7	10.0	4.40	0.025	V	47.7(76.8)
GSB	36.1720	120.2880	03/31/1994	200229.7	9.0	4.20	0.022	IV	47.8(76.9)
PAS	36.2400	120.3900	07/22/1983	24910.7	8.7	4.20	0.022	IV	47.8(76.9)
PAS	36.2400	120.3900	07/22/1983	24910.7	8.7	4.20	0.022	IV	47.8(76.9)
GSB	36.1740	120.2920	12/16/2006	061405.0	9.0	4.20	0.022	IV	47.8(76.9)
BRK	36.2100	120.3500	05/03/1983	03947.0	0.0	4.20	0.022	IV	47.8(77.0)
BRK	36.1500	120.2500	05/12/1983	1341 8.0	0.0	4.50	0.026	V	47.9(77.0)
BRK	36.1100	120.1600	01/14/1976	214359.0	0.0	4.90	0.032	V	47.9(77.0)
BRK	36.2300	120.3800	09/11/1983	1148 7.0	0.0	4.30	0.023	IV	47.9(77.1)
GSB	36.1630	120.2870	04/24/1984	045251.5	10.0	4.00	0.020	IV	48.2(77.6)
GSB	36.1580	120.2800	05/11/1985	085923.8	5.0	4.00	0.020	IV	48.3(77.7)
PAS	36.0520	119.9780	08/04/1985	151539.5	6.0	4.40	0.024	V	48.4(77.8)
PAS	36.1760	120.3220	01/03/1985	112228.0	7.8	4.30	0.023	IV	48.7(78.3)
BRK	36.3000	120.4800	08/26/1983	32118.0	0.0	4.00	0.020	IV	48.7(78.4)
BRK	36.2100	120.3800	07/25/1983	223140.0	0.0	5.10	0.035	V	48.9(78.7)
DMG	36.1700	120.3200	12/27/1926	919 0.0	0.0	5.00	0.033	V	48.9(78.7)
BRK	36.1000	120.1800	05/03/1983	01557.0	0.0	4.00	0.020	IV	49.0(78.8)
BRK	36.1000	120.1800	05/03/1983	01537.0	0.0	4.20	0.022	IV	49.0(78.8)
BRK	36.1300	120.2500	05/03/1983	855 3.0	0.0	4.50	0.025	V	49.0(78.9)
PAS	36.2450	120.4310	07/22/1983	329 2.3	3.0	4.10	0.021	IV	49.2(79.1)
PAS	36.2450	120.4310	07/22/1983	329 2.3	3.0	4.10	0.021	IV	49.2(79.1)
BRK	36.2200	120.4000	07/22/1983	23955.0	0.0	6.00	0.056	VI	49.2(79.1)
PAS	36.1760	120.3370	01/03/1985	104522.8	6.0	4.10	0.021	IV	49.2(79.1)
BRK	36.1400	120.2800	05/03/1983	0 924.0	0.0	4.00	0.019	IV	49.3(79.4)
DMG	37.0700	120.5800	11/01/1954	64240.0	0.0	4.00	0.019	IV	49.4(79.4)
DMG	36.3000	120.5000	11/30/1943	215718.0	0.0	4.00	0.019	IV	49.6(79.8)
GSG	36.0460	120.0420	01/28/2005	130326.3	10.0	4.00	0.019	IV	49.7(79.9)

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-END OF SEARCH- 88 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2011

LENGTH OF SEARCH TIME: 212 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 2.4 MILES (3.8 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 6.7

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.155 g

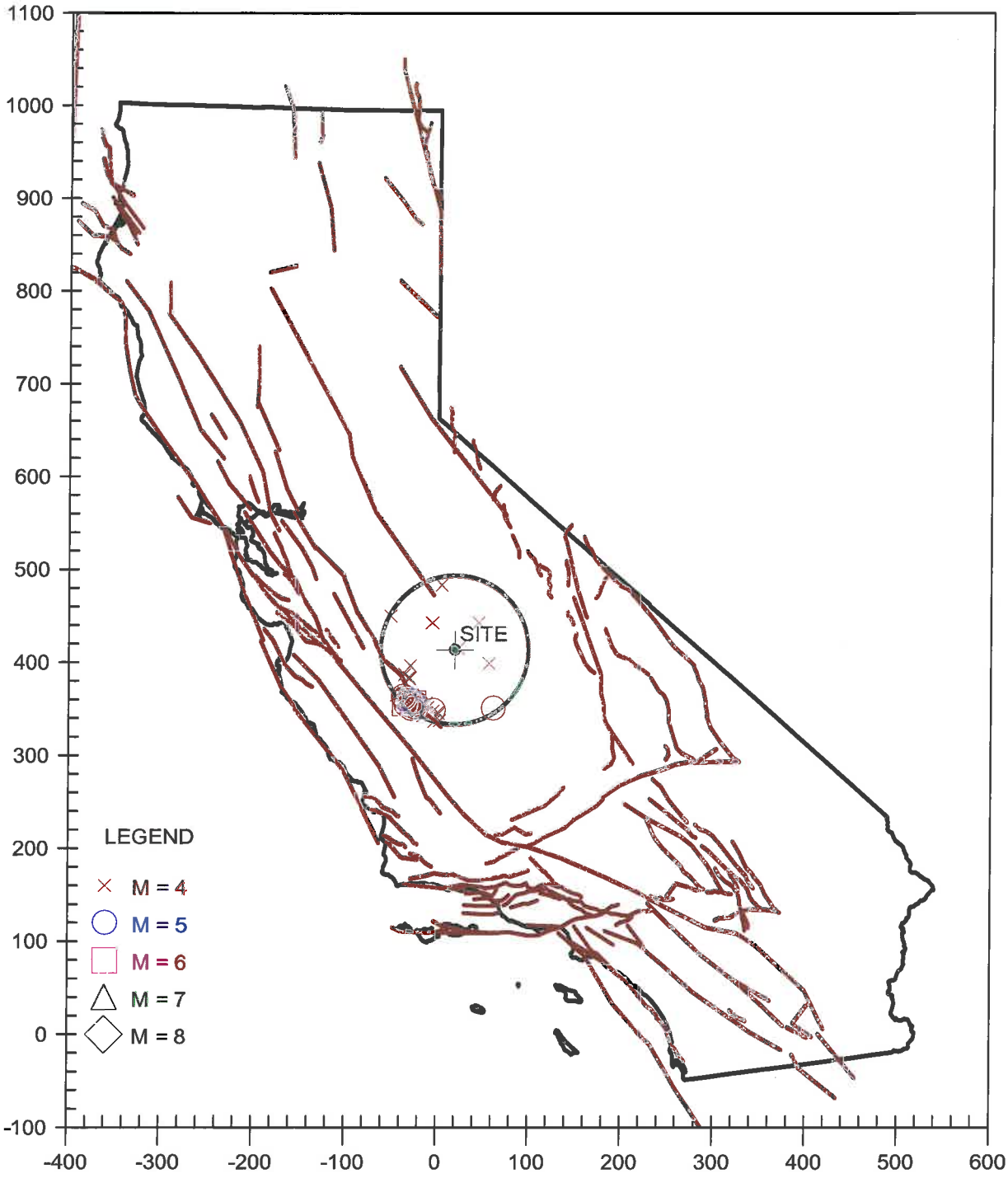
COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
a-value= 2.784
b-value= 0.804
beta-value= 1.851

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	88	0.41706
4.5	27	0.12796
5.0	12	0.05687
5.5	5	0.02370
6.0	2	0.00948
6.5	1	0.00474

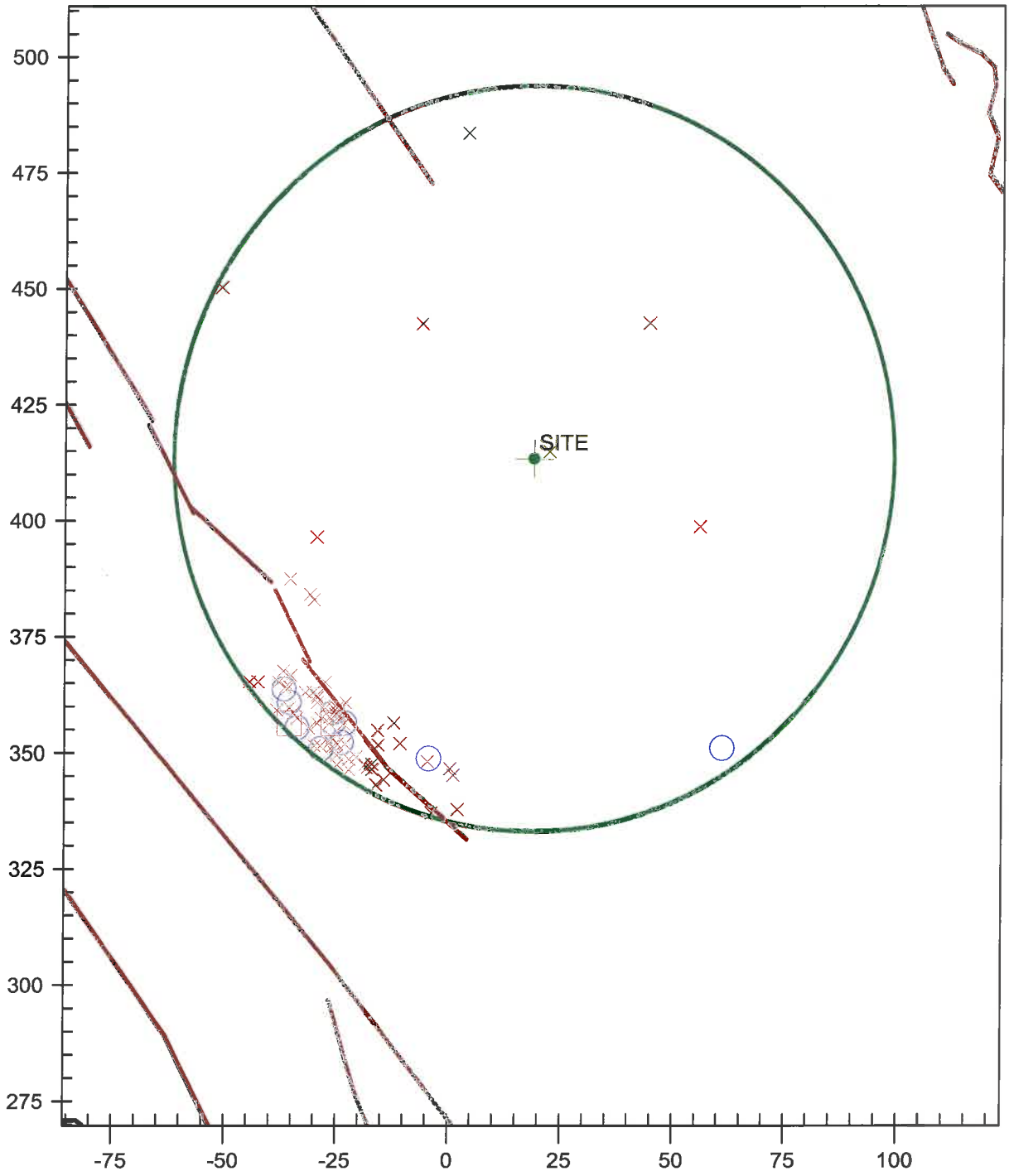
EARTHQUAKE EPICENTER MAP

01411022a



EARTHQUAKE EPICENTER MAP

01411022a



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*                       *
*    E Q S E A R C H    *
*                       *
*     Version 3.00      *
*                       *
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ESTIMATION OF
PEAK ACCELERATION FROM
CALIFORNIA EARTHQUAKE CATALOGS

JOB NUMBER: 01411022a

DATE: 08-30-2011

JOB NAME: 01411022a

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

MAGNITUDE RANGE:
MINIMUM MAGNITUDE: 5.00
MAXIMUM MAGNITUDE: 9.00

SITE COORDINATES:
SITE LATITUDE: 36.7359
SITE LONGITUDE: 119.7894

SEARCH DATES:
START DATE: 1800
END DATE: 2011

SEARCH RADIUS:
100.0 mi
160.9 km

ATTENUATION RELATION: 3) Boore et al. (1997) Horiz. - NEHRP D (250)
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
ASSUMED SOURCE TYPE: DS [SS=Strike-slip, DS=Reverse-slip, BT=Blind-thrust]
SCOND: 0 Depth Source: A
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

MINIMUM DEPTH VALUE (km): 0.0

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
PAS	36.1510	120.0490	08/04/1985	12 156.0	6.0	5.80	0.056	VI	42.9(69.0)
BRK	36.2400	120.2900	05/09/1983	24912.0	0.0	5.20	0.040	V	44.1(71.0)
BRK	36.2200	120.2600	09/09/1983	91614.0	0.0	5.40	0.044	VI	44.2(71.1)
BRK	36.2200	120.2900	05/02/1983	2346 6.0	0.0	5.60	0.048	VI	45.2(72.7)
BRK	36.2200	120.2900	05/02/1983	234239.0	0.0	6.70	0.087	VII	45.2(72.7)
PAS	36.2860	120.4130	10/25/1982	2226 4.0	6.0	5.60	0.047	VI	46.5(74.8)
PAS	36.1820	120.2680	02/14/1987	72650.8	6.0	5.10	0.036	V	46.6(74.9)
T-A	36.1700	119.3200	07/25/1868	230 0.0	0.0	5.00	0.034	V	47.0(75.6)
BRK	36.2600	120.4000	07/09/1983	74052.0	0.0	5.30	0.040	V	47.2(76.0)
BRK	36.2100	120.3800	07/25/1983	223140.0	0.0	5.10	0.035	V	48.9(78.7)
DMG	36.1700	120.3200	12/27/1926	919 0.0	0.0	5.00	0.033	V	48.9(78.7)
BRK	36.2200	120.4000	07/22/1983	23955.0	0.0	6.00	0.056	VI	49.2(79.1)
BRK	36.2000	120.4000	07/22/1983	343 2.0	0.0	5.00	0.033	V	50.2(80.8)
BRK	36.2500	120.4700	06/11/1983	3 954.0	0.0	5.10	0.034	V	50.5(81.3)
DMG	36.6000	120.8000	07/25/1926	175749.0	15.0	5.00	0.030	V	56.7(91.3)
DMG	36.2300	120.6500	02/05/1947	614 0.0	0.0	5.00	0.029	V	59.2(95.2)
DMG	36.0000	120.5000	02/02/1881	011 0.0	0.0	5.60	0.037	V	64.4(103.6)
DMG	36.0000	120.5000	03/03/1901	745 0.0	0.0	5.50	0.035	V	64.4(103.6)
DMG	35.9700	120.5000	06/28/1966	4 856.2	0.0	5.10	0.028	V	66.0(106.2)
DMG	35.9500	120.4700	11/16/1956	323 9.0	0.0	5.00	0.026	V	66.2(106.5)
GSB	35.9530	120.5020	09/29/2004	171004.0	11.0	5.10	0.027	V	67.0(107.9)
DMG	35.9500	120.5000	06/28/1966	42613.4	0.0	5.50	0.034	V	67.1(108.0)
PAS	37.5090	119.0430	06/11/1980	441 1.1	14.1	5.00	0.026	V	67.4(108.4)
DMG	35.9300	120.4800	12/24/1934	1626 0.0	0.0	5.00	0.026	V	67.6(108.8)
GSB	35.9170	120.4650	12/20/1994	102747.2	8.0	5.00	0.026	V	67.9(109.2)
DMG	37.2000	118.7000	09/30/1889	520 0.0	0.0	5.60	0.035	V	68.1(109.6)
DMG	35.9500	120.5300	06/29/1966	195325.9	0.0	5.00	0.026	V	68.1(109.6)
DMG	36.0800	118.8200	05/29/1915	646 0.0	0.0	5.00	0.025	V	70.4(113.2)
GSB	35.8190	120.3640	09/28/2004	171524.2	8.0	6.00	0.042	VI	70.9(114.1)
DMG	36.4000	121.0000	04/12/1885	4 5 0.0	0.0	6.20	0.047	VI	71.0(114.3)
DMG	35.8000	120.3300	12/28/1939	121538.0	0.0	5.00	0.025	V	71.3(114.7)
DMG	35.8000	120.3300	06/08/1934	430 0.0	0.0	5.00	0.025	V	71.3(114.7)
DMG	35.8000	120.3300	06/05/1934	2148 0.0	0.0	5.00	0.025	V	71.3(114.7)
DMG	35.8000	120.3300	06/08/1934	447 0.0	0.0	6.00	0.042	VI	71.3(114.7)
DMG	35.7500	120.2500	03/10/1922	112120.0	0.0	6.50	0.054	VI	72.7(117.1)
PAS	37.4640	118.8230	05/27/1980	145057.1	2.4	6.30	0.048	VI	73.2(117.8)
USG	37.4980	118.8380	06/06/1980	141817.2	2.0	5.27	0.028	V	74.2(119.5)
DMG	35.7500	120.3300	08/18/1922	512 0.0	0.0	5.00	0.024	V	74.4(119.8)
UNR	37.5580	118.9110	06/19/1980	71931.5	0.4	5.00	0.024	V	74.6(120.0)
USG	37.5420	118.8830	06/05/1980	20 452.3	1.6	5.05	0.025	V	74.7(120.3)
PAS	37.5540	118.8970	08/01/1980	163856.3	4.7	5.40	0.029	V	74.8(120.5)
UNR	37.5160	118.8370	06/18/1980	185537.7	6.3	5.30	0.028	V	75.2(121.0)
UNR	37.5360	118.8510	06/20/1980	152459.6	8.7	5.30	0.028	V	75.6(121.7)
PAS	37.4860	118.7830	05/25/1980	164930.3	4.7	5.80	0.036	V	75.8(122.1)
USG	37.5610	118.8740	08/01/1980	164745.9	1.9	5.15	0.026	V	76.0(122.4)
GSG	37.5290	118.8170	05/15/1999	132210.7	5.0	5.60	0.032	V	76.6(123.2)
PAS	37.6640	119.0080	01/07/1983	32419.1	5.0	5.60	0.032	V	77.2(124.2)
MGI	36.6000	118.4000	09/04/1868	0 0 0.0	0.0	5.00	0.023	IV	77.5(124.7)
DMG	37.4170	118.6670	02/02/1961	0 742.0	0.0	5.10	0.024	V	77.7(125.0)
DMG	36.5800	121.1800	07/29/1951	105345.0	0.0	5.00	0.023	IV	77.8(125.1)
DMG	37.5000	118.7500	09/18/1927	2 7 7.0	0.0	6.00	0.039	V	77.8(125.2)
GSB	36.6030	121.2010	04/23/1995	084136.6	7.0	5.00	0.023	IV	78.7(126.7)
USG	37.5270	118.7590	06/08/1980	61139.6	1.3	5.12	0.024	V	78.7(126.7)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
GSG	37.5640	118.8050	07/15/1998	045319.2	6.0	5.10	0.024	V	78.8(126.7)
DMG	36.9000	121.2000	03/06/1882	2145 0.0	0.0	5.70	0.033	V	78.8(126.8)
PAS	37.5560	118.7910	05/25/1980	194452.2	6.4	6.50	0.051	VI	78.9(127.0)
PAS	37.5170	118.7430	05/26/1980	122427.3	2.0	5.20	0.025	V	78.9(127.0)
PAS	37.6220	118.8810	09/30/1981	115327.0	6.0	5.80	0.035	V	79.0(127.1)
PAS	37.6560	118.9290	01/07/1983	13810.6	5.7	5.70	0.033	V	79.2(127.5)
DMG	37.5170	118.7330	06/05/1960	747 7.0	0.0	5.20	0.025	V	79.3(127.6)
DMG	36.5780	121.2090	02/24/1972	155651.0	7.5	5.10	0.024	V	79.4(127.7)
PAS	37.4490	118.6530	11/26/1984	162141.4	6.0	5.50	0.030	V	79.6(128.1)
DMG	37.3500	118.5500	08/04/1959	73659.0	0.0	5.20	0.025	V	80.4(129.4)
GSB	37.5890	118.7950	06/09/1998	052440.2	6.0	5.20	0.025	V	80.4(129.4)
PAS	37.6080	118.8210	05/25/1980	163344.8	3.7	6.40	0.047	VI	80.4(129.4)
PAS	37.4230	118.6080	11/23/1984	191235.3	6.0	5.40	0.028	V	80.5(129.6)
DMG	37.4500	118.6330	02/02/1961	0 416.0	0.0	5.30	0.026	V	80.5(129.6)
DMG	36.0000	120.9200	11/02/1955	1940 6.0	0.0	5.20	0.025	V	80.8(130.1)
UNR	37.6360	118.8470	06/19/1980	14430.2	8.3	5.20	0.025	V	80.9(130.2)
DMG	36.6700	121.2500	08/06/1916	1938 0.0	0.0	5.50	0.029	V	81.0(130.3)
T-A	36.6700	121.2500	04/01/1857	1135 0.0	0.0	5.00	0.022	IV	81.0(130.3)
PAS	37.5370	118.7130	05/25/1980	203551.0	5.0	5.50	0.029	V	81.0(130.4)
PAS	37.5140	118.6830	10/04/1978	164248.7	5.6	5.80	0.034	V	81.2(130.7)
DMG	37.5670	118.7330	09/14/1941	164331.8	0.0	5.80	0.034	V	81.7(131.4)
DMG	37.5670	118.7330	12/31/1941	64844.0	0.0	5.40	0.028	V	81.7(131.4)
DMG	37.5670	118.7330	09/14/1941	182118.7	0.0	5.50	0.029	V	81.7(131.4)
DMG	37.5670	118.7330	09/14/1941	2116 1.0	0.0	5.00	0.022	IV	81.7(131.4)
DMG	37.5670	118.7330	09/14/1941	183911.9	0.0	6.00	0.038	V	81.7(131.4)
DMG	37.4530	118.6040	12/03/1938	174252.6	10.0	5.70	0.032	V	81.9(131.8)
PAS	37.6040	118.7700	05/27/1980	19 1 8.3	3.8	5.00	0.022	IV	82.1(132.1)
GSB	36.8100	121.2750	01/26/1986	192051.2	7.0	5.50	0.029	V	82.3(132.5)
DMG	36.7000	118.3000	08/17/1896	1130 0.0	0.0	5.90	0.036	V	82.5(132.7)
PAS	37.5380	118.6750	10/04/1978	1739 3.3	6.3	5.30	0.026	V	82.6(133.0)
PAS	37.4700	118.5970	11/23/1984	18 825.6	6.0	6.20	0.042	V	82.9(133.5)
DMG	36.4500	121.2500	09/27/1938	1223 0.0	0.0	5.00	0.022	IV	83.3(134.1)
DMG	36.7000	121.3000	04/09/1961	72541.0	0.0	5.50	0.029	V	83.6(134.6)
DMG	36.7000	121.3000	03/31/1885	756 0.0	0.0	5.50	0.029	V	83.6(134.6)
DMG	36.6800	121.3000	04/09/1961	72316.0	0.0	5.60	0.030	V	83.7(134.7)
GSB	36.8030	121.3020	02/20/1988	083957.5	9.0	5.30	0.026	V	83.8(134.8)
DMG	36.0000	121.0000	02/26/1932	1658 0.0	0.0	5.00	0.022	IV	84.3(135.7)
PAS	37.4480	118.5450	03/25/1985	16 513.6	6.0	5.00	0.022	IV	84.3(135.7)
DMG	37.3300	118.4200	01/05/1912	354 0.0	0.0	5.50	0.028	V	85.9(138.2)
DMG	37.3300	118.4200	05/06/1910	1640 0.0	0.0	5.50	0.028	V	85.9(138.2)
DMG	37.5670	118.5830	12/28/1951	24927.0	0.0	5.20	0.023	IV	87.7(141.2)
DMG	37.5000	118.5000	04/11/1872	19 0 0.0	0.0	6.60	0.049	VI	88.4(142.3)
DMG	36.9000	118.2000	03/26/1872	14 6 0.0	0.0	6.50	0.046	VI	88.6(142.5)
DMG	36.9000	118.1900	11/28/1929	1949 0.0	0.0	5.50	0.027	V	89.1(143.4)
DMG	36.8000	121.4000	04/02/1885	1525 0.0	0.0	5.40	0.026	V	89.2(143.5)
DMG	37.0000	118.2000	04/03/1872	1215 0.0	0.0	6.10	0.037	V	89.7(144.3)
T-A	36.8300	118.1700	02/28/1895	825 0.0	0.0	5.00	0.021	IV	89.8(144.5)
T-A	36.8300	118.1700	07/12/1871	330 0.0	0.0	5.00	0.021	IV	89.8(144.5)
DMG	36.8300	121.4200	12/31/1910	1211 0.0	0.0	5.00	0.021	IV	90.4(145.5)
DMG	36.7800	121.4300	01/20/1960	32553.0	0.0	5.00	0.021	IV	90.8(146.1)
T-A	38.0000	120.2500	04/11/1872	12 0 0.0	0.0	5.00	0.021	IV	90.9(146.2)
MGI	37.0000	118.1700	12/02/1929	7 0 0.0	0.0	5.30	0.024	V	91.3(146.9)
MGI	37.0000	118.1700	12/08/1929	1245 0.0	0.0	5.30	0.024	V	91.3(146.9)

EARTHQUAKE SEARCH RESULTS

FILE CODE	LAT. NORTH	LONG. WEST	DATE	TIME (UTC) H M Sec	DEPTH (km)	QUAKE MAG.	SITE ACC. g	SITE MM INT.	APPROX. DISTANCE mi [km]
DMG	36.8000	121.4500	06/24/1939	13 2 0.0	0.0	5.50	0.026	V	91.9(148.0)
PAS	37.5420	118.4440	07/21/1986	144226.7	6.0	5.90	0.033	V	92.6(149.1)
GSB	36.7550	121.4640	08/12/1998	141025.1	8.0	5.40	0.025	V	92.7(149.1)
PAS	37.4730	118.3720	07/31/1986	72240.5	6.0	5.90	0.032	V	93.2(149.9)
DMG	36.7000	118.1000	03/26/1872	1030 0.0	0.0	7.80	0.088	VII	93.5(150.5)
MGI	36.6000	118.1000	05/17/1872	21 0 0.0	0.0	5.00	0.020	IV	94.0(151.3)
PAS	37.5830	118.4500	07/20/1986	142946.3	6.0	5.90	0.032	V	94.1(151.4)
DMG	36.9100	121.4800	11/28/1974	23 124.7	0.0	5.20	0.022	IV	94.2(151.6)
GSB	37.0250	121.4580	01/16/1993	062934.9	5.0	5.30	0.023	IV	94.3(151.7)
DMG	36.8000	121.5000	11/13/1892	1245 0.0	0.0	5.60	0.027	V	94.7(152.4)
PAS	37.6470	118.5020	07/21/1986	22 718.7	6.0	5.40	0.025	V	94.7(152.4)
MGI	36.5800	118.0800	07/06/1917	11 1 0.0	0.0	5.70	0.029	V	95.3(153.3)
DMG	37.0200	121.4800	03/09/1949	122839.0	0.0	5.20	0.022	IV	95.4(153.5)
T-A	36.5800	118.0700	08/13/1882	0 0 0.0	0.0	5.00	0.020	IV	95.8(154.2)
T-A	36.5800	118.0700	04/18/1872	0 0 0.0	0.0	5.00	0.020	IV	95.8(154.2)
DMG	35.6000	118.8000	06/30/1926	1331 0.0	0.0	5.00	0.020	IV	95.9(154.3)
DMG	37.0000	121.5000	06/20/1897	2014 0.0	0.0	6.20	0.037	V	96.2(154.9)
MGI	35.5000	120.6000	01/01/1830	0 0 0.0	0.0	5.00	0.020	IV	96.6(155.4)
GSB	38.0470	119.1570	10/24/1990	061520.7	12.0	5.70	0.028	V	96.9(156.0)
BRK	37.1000	121.5000	08/06/1979	17 522.0	0.0	5.80	0.030	V	97.7(157.2)
PAS	37.6200	118.3980	07/22/1986	134859.0	6.0	5.20	0.022	IV	97.9(157.5)
DMG	37.5000	121.3000	07/15/1866	630 0.0	0.0	5.80	0.029	V	98.5(158.5)
T-A	36.8300	121.5700	10/18/1800	0 0 0.0	0.0	7.00	0.055	VI	98.7(158.8)
PAS	37.6270	118.3860	07/22/1986	133358.9	6.0	5.00	0.019	IV	98.7(158.9)
DMG	37.6100	118.3680	05/10/1936	174013.2	10.0	5.00	0.019	IV	98.8(159.0)
DMG	35.3000	119.8000	01/09/1857	16 0 0.0	0.0	7.90	0.089	VII	99.1(159.5)
DMG	37.2000	121.5000	07/06/1899	2010 0.0	0.0	5.80	0.029	V	99.7(160.4)
DMG	37.4000	121.4000	04/10/1881	10 0 0.0	0.0	5.90	0.031	V	99.9(160.7)

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-END OF SEARCH- 134 EARTHQUAKES FOUND WITHIN THE SPECIFIED SEARCH AREA.

TIME PERIOD OF SEARCH: 1800 TO 2011

LENGTH OF SEARCH TIME: 212 years

THE EARTHQUAKE CLOSEST TO THE SITE IS ABOUT 42.9 MILES (69.0 km) AWAY.

LARGEST EARTHQUAKE MAGNITUDE FOUND IN THE SEARCH RADIUS: 7.9

LARGEST EARTHQUAKE SITE ACCELERATION FROM THIS SEARCH: 0.089 g

COEFFICIENTS FOR GUTENBERG & RICHTER RECURRENCE RELATION:
a-value= 1.619
b-value= 0.412
beta-value= 0.949

TABLE OF MAGNITUDES AND EXCEEDANCES:

Earthquake Magnitude	Number of Times Exceeded	Cumulative No. / Year
4.0	134	0.63507
4.5	134	0.63507
5.0	134	0.63507
5.5	58	0.27488
6.0	19	0.09005
6.5	8	0.03791
7.0	3	0.01422
7.5	2	0.00948

EARTHQUAKE EPICENTER MAP

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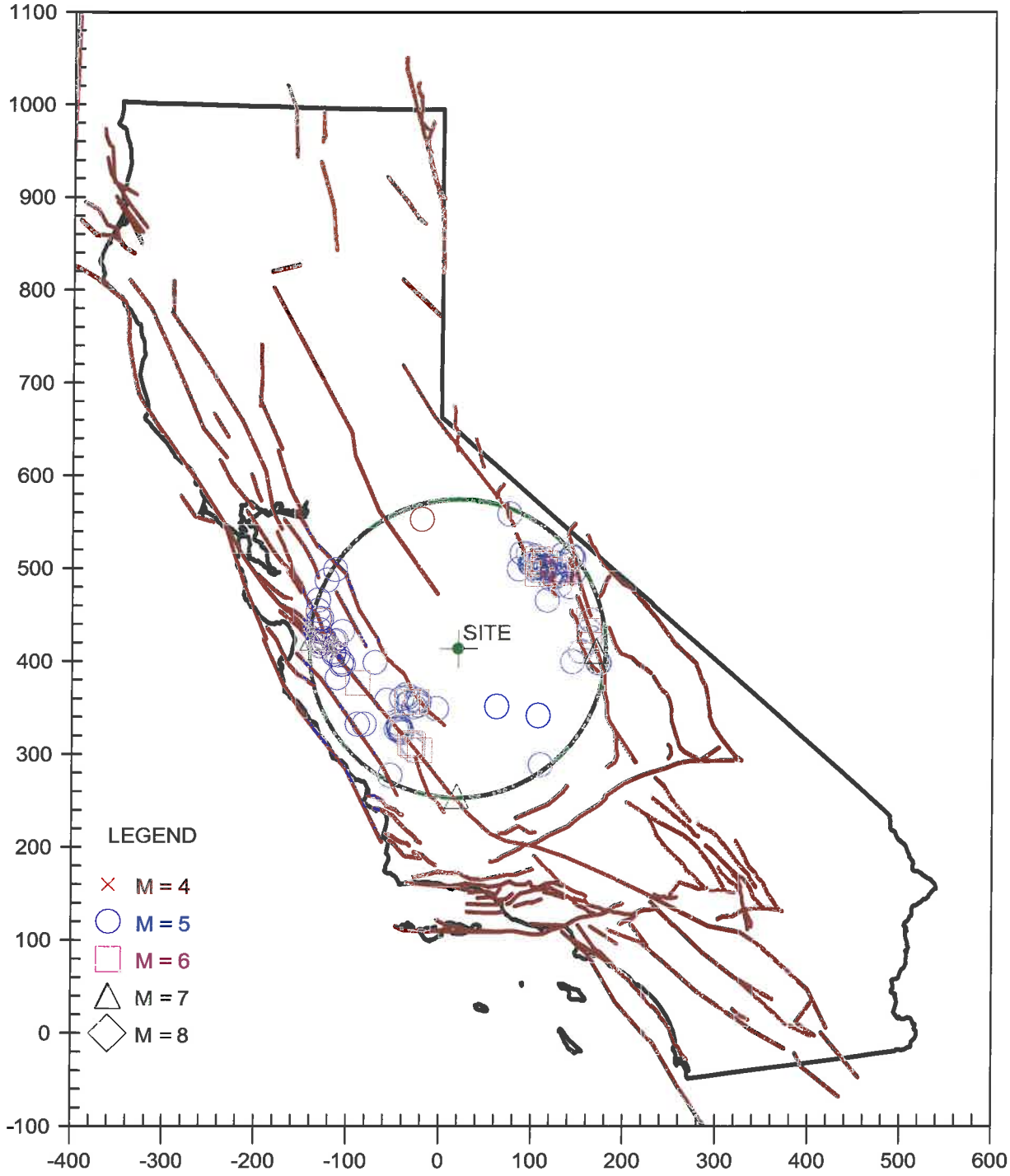
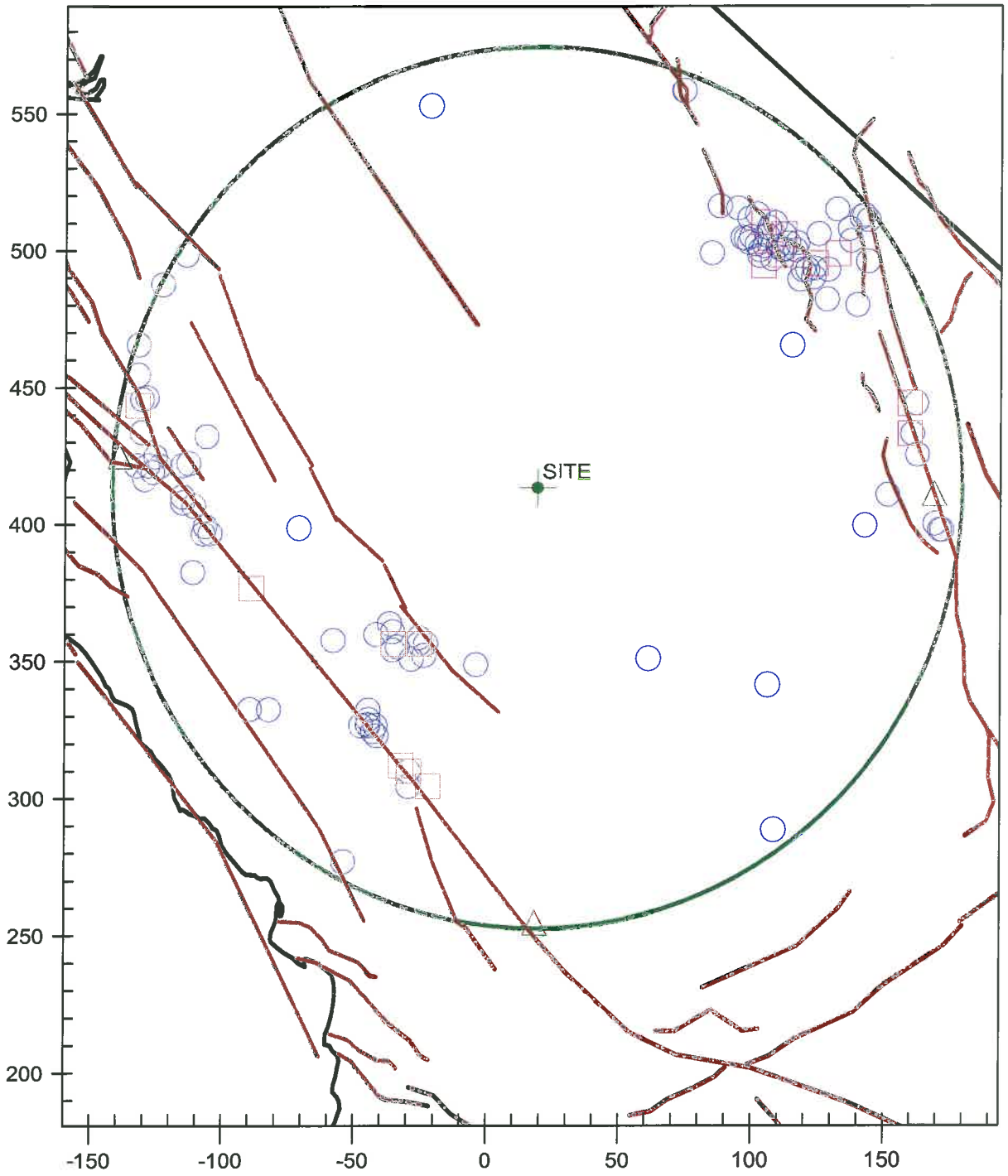


EARTHQUAKE EPICENTER MAP

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