GEOLOGIC HAZARDS REPORT
SAN LUIS OBISPO COUNTY FIRE STATION 43
HIGHWAY 229 AT IRONGATE ROAD
CRESTON, CALIFORNIA

May 1, 2009

Prepared for

Ms. Kathy MacNeill
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Prepared by

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May 1, 2009

File No.: SL-15969-GA

Ms. Kathy MacNeill
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PROJECT: SAN LUIS OBISPO COUNTY FIRE STATION 43
HIGHWAY 229 AT IRONGATE ROAD
CRESTON, CALIFORNIA

SUBJECT: Geologic Hazards Report

CONTRACT REF.: Purchase Order 25005062 for a Soils Engineering Investigation for San Luis Obispo County Fire Station 43, Highway 229, Creston, California, by San Luis Obispo County, dated April 1, 2009

Dear Ms. MacNeill:

In accordance with the terms of the referenced purchase order, this geologic hazards report has been prepared for use in the development of plans and specifications for the San Luis Obispo County Fire Station 43 facility in Creston, California. This report is based upon our review of geologic and geotechnical maps and literature, a site reconnaissance, and a subsurface field exploration. In it we describe the general site geologic characteristics, identify potential geologic hazards, and provide guidance for site development. Three hard copies and one electronic copy of this report are being furnished for your use.

Our soils engineering report has been submitted under separate cover.

We appreciate the opportunity to have provided geological services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

Richard T. Gorman, C.E.G.

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Doc. No.: 0905-004.RPT/jml

TABLE OF CONTENTS

Appendices

1.0 INTRODUCTION

Planned Development

The proposed San Luis Obispo County Fire Station 43 will be on Highway 229 in Creston, California (see Vicinity Map in Appendix A). The site will be improved an apparatus bay structure, and a separate administration/living quarters structure. The total footprint of the two structures is expected to be approximately 6,000 square feet, and they are to be constructed in the center of the site. The two-bay, high-roof apparatus structure will be a single-story, and designed to accommodate a possible expansion for a third bay. The administration/living quarters may be one or two-story. Both structures are anticipated to be of steel and/or wood frame, and possible masonry, construction. Conventional continuous and spread foundations, with concrete slabs-on-grade, have been planned. The project is expected to include exterior flatwork and possibly landscaping improvements between and around the structures. Retaining walls for sitework, or connected to or forming part of a structure, and a maximum of 5 feet tall, may also be constructed. To accommodate local flood conditions finish floor elevation of the structures may be 3 to 4 feet above existing grades. The site will be served by the existing utility systems in the area; an on-site well and drainage retention/detention basins may be located on the south side of the building area, and an on-site effluent disposal system is anticipated for the north side of the building area. Driveways and parking area improvements composed of either asphalt concrete (AC) or Portland cement concrete (PCC) over aggregate base (AB) are planned for the site, as are typical frontage improvements along Highway 229.

Purpose and Scope of Work

This study has been conducted to evaluate and define the geologic/seismic conditions and potential geologic/seismic hazards associated with the proposed development of this site. The scope of our work is intended to satisfy the requirements of California Geological Survey Note 48 (2007); California Code of Regulations, Title 24; and the 2007 California Building Code (CBC).

It is our intent that this report be used exclusively by the client to form the geologic/seismic basis of the design of the proposed project and in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk.

This report does not address issues in the domain of the contractor such as, but not limited to, site safety, subsidence of the site due to compaction, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, shoring, temporary slope angles, construction means and methods, etc. Analyses of the soil for radioisotopes, man-made asbestos, mold potential, hydrocarbons, corrosivity or chemical properties are beyond the scope of this investigation. Ancillary features such as temporary access roads, fences, signs, flag poles, and nonstructural fills are also not within our scope and are not addressed. Soils engineering issues have been addressed in a separate report by this firm (Earth Systems Pacific [ESP], 2009).

In the event that any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report verified or modified in writing. The criteria presented in this report are considered preliminary until such time as any peer review or review by any jurisdiction has been completed, conditions are observed by the geologist in the field during construction, and the conclusion have been verified as appropriate, or modified in writing.

Description of Site

The site is on the east side of Highway 229, approximately ½-mile north of the community of Creston (see Vicinity Map in Appendix A). Irongate Road extends to the west off Highway 229 near the north property line of the site. The site is flat, and slopes to the north at 1 percent or less. The surrounding properties are large acreage parcels that are utilized for hay, row crops or livestock grazing. The Huer Huero Creek, a seasonal drainage, is approximately 560 feet east of the site. At the time of our field investigation, the site was planted with a winter cover crop, and the perimeters had been disced. Aerial power and buried telephone lines are present along the Highway 229 frontage. The locations of other utility lines on the site are unknown.

2.0 FIELD INVESTIGATION AND LABORATORY TESTING

Geologic Site Reconnaissance

A geologic reconnaissance of the site and its immediate vicinity was performed on April 3, 2009. The purpose of the reconnaissance was to observe exposures of on-site soils and bedrock at or near the site, and to identify geologic features indicative of the possible presence of a fault, landslide, or other existing or potential geological hazards.

Subsurface Exploration

On April 3, 2009, seven exploratory borings were drilled on the site for the soils engineering report using a Mobile Drill Model B-53 truck-mounted rig, equipped with an 8-inch outside diameter hollow stem auger. The approximate locations of the borings are shown on the Boring

Location Map in Appendix A. As the borings were drilled, standard penetration tests (SPT) were performed (ASTM D 1586-99), and soil samples were obtained using a ring-lined barrel sampler (ASTM D 3550-01, reapproved 07, with shoe similar to ASTM D 2937-04). The samplers were driven with an automatic trip hammer. Bulk soil samples were obtained from the auger cuttings.

Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-06. Logs of the borings and a Boring Log Legend are also presented in Appendix A. In reviewing the boring logs and legend, the reader should recognize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, the presence of cementation, variations in soil moisture, the presence of groundwater, and other factors. Consequently, the logger must exercise judgment in interpreting soil characteristics, possibly resulting in soil descriptions that vary somewhat from the legend.

Laboratory Testing

For the soils engineering report (ESP, 2009), selected ring samples were tested for unit weight and moisture (ASTM D 2937-04), and for one-dimensional consolidation (ASTM D 2435-04). Bulk samples were tested for maximum density and optimum moisture (ASTM D 1557-07), expansion index (ASTM D 4829-07), angle of shearing resistance and cohesion (ASTM D 3080-04, remolded to 90 percent of maximum dry density), and R-value (ASTM D 2844-07). An SPT sample was tested for particle size distribution (ASTM D 1140-06, D422-63,-07). The laboratory test results are presented in the soils engineering report (ESP, 2009).

3.0 SUBSURFACE GEOLOGIC PROFILE

The subsurface geologic profile encountered consisted of interlayered clayey sand and well graded sand alluvium (see Cross Section A-A' in Appendix B). In all seven borings, the upper soil encountered was alluvium consisting of loose, moist clayey sand. At 14 to 15.5 feet in Borings 1 through 3, loose to medium dense, moist to wet, well graded sand was found. The well graded sand contained a trace of coarse gravel below 15.5 feet in Boring 1, between 30 and 35 feet in Boring 2, and below 14 feet in Boring 3. Thin layers of fine grained clayey sand were found below 15.5 feet in Boring 3. The well graded sand continued to the boring termination depths of 16.5 feet in Boring 1, 51.5 feet in Boring 2, and 21.5 feet in Boring 3. The upper clayey sand was encountered for the entire depth (5 feet) of Borings 4 through 7. Subsurface water was found in Boring 2 at 25 feet. Subsurface water was not encountered in the other six borings.

4.0 GEOLOGY

Geologic Setting

The site lies within the southern Salinas Valley, in the Coast Ranges geomorphic province. The Salinas Valley is bounded to the east by the Temblor Range, to the northeast by the Cholame Hills and to the southwest by the Santa Lucia Range. Locally, the site lies on flat, flood plain of the Huer Huero Creek, which is approximately 560 feet east. The Geologic Map of the Creston & Shedd Canyon quadrangles (Dibblee, 2004) indicates the site building area is predominantly underlain by alluvial sand and gravel, which was also encountered during the subsurface investigation (see Geologic Map in Appendix B).

Faulting

Significant Faults

The Rinconada, San Andreas, Los Osos, and Hosgri-San Simeon faults are the most significant regional *active* faults within a 65-mile radius of the site, which could affect the proposed development during its anticipated lifespan. The closest fault to the site is the Quaternary age La Panza fault located approximately 1.5 miles east of the site. Regional faults and locations of historic earthquake events are depicted on the Historical Earthquake/Fault Map in Appendix B.

Rinconada Fault

The Rinconada Fault, located approximately 6 miles west, is the closest mapped *active* fault to the site. Southeast of Santa Margarita, the Rinconada fault merges with the Nacimiento fault and continues across the Cuyama River Gorge to the San Rafael Mountains where it intersects the Big Pine fault. Northwestward, the Rinconada fault passes through Paso Robles and then branches into high-angle faults, locally called the San Marcos and Jolon faults (Burch and Durham, 1970). These faults are mapped as part of the Rinconada fault zone.

Although no ground rupture has been mapped in Holocene time on the Rinconada fault, small to moderate earthquakes (< 5.9 magnitude) have been recorded in the vicinity of the fault during the last 200 years, indicating that the fault is active. It is possible that the shock waves produced by these earthquakes did not have enough energy to break the ground surface or cause any ground surface displacement.

San Andreas Fault

The San Andreas fault is considered to be the most active fault in the general region. The Parkfield segment of the San Andreas fault lies 20 miles to the east of the site. The last major quake (magnitude 8.0 or greater) was on the south end of the fault in 1857. In the immediate vicinity of Parkfield, there is a 20-mile segment that is locked, generating an earthquake every 20 years or so on average. Dated quakes on this segment are 1881, 1901, 1922, 1934, and 1966, and are usually in the magnitude 5.5 to 6.0 range (Bakun, 1988). Most recently, a 6.0 magnitude earthquake occurred on this fault segment on September 28, 2004 (Holzer and others, 2004). The epicenter to this earthquake was in the general area of the 1934 earthquake, which occurred approximately 21 miles east of the site.

Los Osos Fault

The Los Osos fault, at its closest point to the site, is approximately 20 miles to the southwest. It consists of four distinct segments. From northwest to southeast these are: Estero Bay, Irish Hills, Lopez Reservoir, and Newsome Ridge segments. PG&E (1988) suggests that the Irish Hills segment displays the best expressed geomorphic features, displacing late Pleistocene and Holocene deposits. The Irish Hills segment starts in the vicinity of Los Osos and extends to just past San Luis Obispo Creek. A two-mile long segment west of Laguna Lake is considered to be active (Treiman, 1989) and is zoned as a State Earthquake Fault Zone under the Alquist-Priolo Act (Hart, 1997). This active segment also lies about 20 miles to the southwest of the site. The Los Osos fault comprises a northwest-trending series of high- and low-angle faults that exhibit a complex history of both strike-slip and reverse displacement. However, during late Quaternary, movement appears to have been primarily reverse displacement (PG&E, 1988).

Hosgri-San Simeon Fault System

The Hosgri-San Simeon Fault System lies approximately 29 miles to the west of the site. A northwest-trending strike-slip fault, the San Simeon fault extends from offshore of Ragged Point to just offshore of San Simeon Point, where it joins the northern end of the Hosgri fault. From this point the Hosgri fault extends to an ocean shelf 2 miles west of Point Buchon, and then trends toward the Point Sal area. The fault system is considered active by the 2004 United States Geologic Survey (USGS, 2008), based on Hall's claims of recent offset terrace deposits along San Simeon Cove, and also by a relocation of the 1927 "Lompoc Earthquake" onto the southern end of the Hosgri fault (Hall, 1975, 1976, 1977).

On December 22, 2003, a 6.5 magnitude earthquake occurred approximately 6 miles northeast of San Simeon, California and approximately 26.5 miles north of the subject site. Analysis by the USGS and the University of California at Berkeley indicates that the event had a thrust (reverse-faulting) mechanism (Goel, 2004). The earthquake occurred in the vicinity of the northern end of the Hosgri-San Simeon fault.

5.0 ANALYSIS AND CONCLUSIONS

General

It is our opinion that the existing local and regional geologic conditions would not preclude development at the site.

Slope Stability

The site is essentially flat with no geologically significant slopes on or immediately adjacent to it.

Flooding

According to the Flood Insurance Rate Map (Community-Panel 06079C0650F) for the San Luis Obispo County, the site is located in a Zone A flood zone (no base elevations determined) a 100-year flood zone (see FIRM Flood Zone Map in Appendix B).

Earthquake History

The historic seismicity in the site region was researched using EQSEARCH (Blake, 2007) and the Boore and Joyner (1997) method of analysis for Site Class E soil profile. EQSEARCH is a computer program that performs automated searches of a custom catalog of historical Central California earthquakes. As the program searches the catalog, it computes the epicentral distance from the selected site to each of the earthquakes within the specified search area. The epicentral distances should be considered estimates, particularly for earthquake data that dates prior to 1932, when instruments were first used to record earthquake data. The parameters used for the search consisted of earthquake Richter magnitudes ranging from 5.0 to 9.0, which occurred within a 65-mile radius from the site, from 1800 to 2007.

The results of the search indicate that within the search parameters, 55 earthquakes have occurred (see Historical Earthquake/Fault Map and Data Output in Appendix B). The closest earthquake to the site had a magnitude of 5.0, and can be attributed to the Rinconada fault. This earthquake occurred in 1830, was located approximately 5 miles west of the site, and was the event with the highest peak horizontal ground acceleration estimated to have occurred at the site at 0.17g. The largest magnitude earthquake to affect the site was the "1857 Earthquake" on the San Andreas Fault. It had a magnitude of 7.9 and occurred approximately 52 miles northeast of the site. The September 2004 earthquake along the Parkfield segment occurred approximately 27.5 miles northeast of the project site. It had a magnitude of 6.0 and produced a peak horizontal ground acceleration of 0.09g.

Site Specific Earthquake Ground Motion Analysis

General

The site is in a region of generally high seismicity and has the potential to experience strong ground shaking from earthquakes on regional or local causative faults. Based on the information presented in 2007 CBC Section 1614.1.2, the building site lies approximately 10 km from the active Rinconada fault; therefore, a site-specific response analysis is required. The site-specific response analysis is intended to be in conformance with ASCE Standard 7-05, Chapter 21, Site-Specific Ground Motion Procedures for Seismic Design, Sections 21.2.1 through 21.2.4. This chapter requires that the following site-specific seismic information be developed: 1) the Probabilistic Maximum Considered Earthquake (MCE) response curve; 2) the Site-Specific Deterministic MCE response curve; 3) the Site Design response curve (2/3 of the Site-Specific Deterministic MCE); and 4) Design Acceleration Parameters. The MCE is defined as having a 2 percent chance of exceedance in 50 years, with a return period of approximately 2,475 years. The deterministic and probabilistic ground motions were calculated using the Next Generation Attenuations (NGA) that were obtained from the computer software program EZ-FRISK (ver. 7.32) by Rick Engineering, Inc. The NGAs used for this ground motion analysis were as follows: Campell & Bozorgnia, 2008; Boore & Atkinson, 2008; and Chiou & Young, 2008. The average spectral curve of these three NGAs was used as the Probabilistic MCE and Deterministic MCE.

Probabilistic MCE

To develop the probabilistic MCE spectrum for the site, the EZ-FRISK computer program was used. Nineteen significant mapped faults within a 65-mile radius of the site were selected from the program database. The peak horizontal ground acceleration and spectral accelerations, at 5 percent damped for a CBC soil Site Class E, were estimated using the NGAs mentioned above. The soil class was derived from the subsurface investigation performed at the site. The average of these three curves was used as the probabilistic MCE response spectrum (see Average NGA Probabilistic MCE Response Spectrum in Appendix C).

Deterministic MCE

A deterministic analysis using NGAs was performed in accordance with DSA Bulletin 09-01 (2009) which generally requires that the 84^{th} percentile of the deterministic ground motion be used in lieu of using 150 percent of the median value. The parameters used in this analysis included the following: a soil Site Class E; the Rinconada fault, which is the closest active fault to the site; and a maximum magnitude of 7.5 for this fault (Peterson and others, 2008). Values for the three spectral NGA curves were computed from the EZ-FRISK computer program. The values were then averaged and used as the basis for calculating the Average 84^{th} percentile Deterministic Response Spectrum (see the Average NGA 84^{th} Percentile Deterministic Response Spectrum in Appendix C).

The ordinates of the 84^{th} percentile Deterministic spectrum are lower than the corresponding ordinates of the response spectrum (Deterministic MCE Lower Limit) calculated in accordance with Fig. 21.2.1 in ASCE Standard 7-05 (see the Site-Specific Design Response Spectrum in Appendix C). The Deterministic MCE Lower Limit was calculated using $F_a = 0.9$ and $F_v = 2.4$, and is also plotted on the Site-Specific Design Response Spectrum graph in Appendix C. As the Deterministic MCE Lower Limit is higher than the 84^{th} percentile Deterministic MCE spectrum, it is our opinion that the Deterministic MCE Lower Limit should be used as the Site Deterministic MCE curve.

Site-Specific MCE

The Site Specific MCE is defined by ASCE 7-05, Section 21.2.3 as the lesser of the Probabilistic MCE and the Site Deterministic MCE (Deterministic MCE Lower Limit). Review of the plots on the site specific design response spectrum graph indicates that the Probabilistic MCE is the lesser of the two curves; therefore, it should be used as the Site Specific MCE.

Site-Specific Design Response Spectrum

Per ASCE 7-05 Section 21.3, the Site Design Response Spectrum is obtained by taking 2/3 of the Site Specific MCE (Probabilistic MCE); this information is also plotted on the Site Design Response Spectrum in Appendix C. The Site Design Response Spectrum accelerations for 2/3 of the Site Specific MCE were higher than the accelerations from the 80 percent of the general procedure Design Response Curve as shown on the Site-Specific Design Response Spectrum graph in Appendix C. *Therefore, it is recommended that Site-Specific Design Response Spectrum curve be used for design.*

Design Acceleration Parameters

The following design acceleration parameters are based on the site specific procedure used to determine the site-specific design ground motion values. Note that ASCE 7-05 requires that the parameter S_{D1} shall be taken as the greater of the spectral acceleration, S_a, at a period of 1 second (0.593g), or two times the spectral acceleration, S_a, at a period of 2 seconds (0.474g). In this case, the value at two times the spectral acceleration S_a, at a period of 2 seconds, was higher (0.948g).

SUMMARY OF DESIGN RESPONSE ACCELERATION PARAMETERS

Mapped Acceleration Values for Site Class B		**2007 CBC Site Coefficients and General Procedure Adjusted MCE Spectral Response Acceleration Parameters For Site Class E**					
Seismic Parameter	Value (g)	Site Coefficients	Value	Seismic Parameter	Value (g)	Seismic Parameter	Value (g)
S_S	1.114	F_a	0.9	S_{MS}	1.002	S_{DS}	0.668
S_1	0.537	F_v	2.4	S_{M1}	1.289	S_{D1}	0.860

80% of the General Procedure Design Response Spectrum Acceleration Values for Site Class E				**Site-Specific Design Response Spectrum Acceleration Values for Site Class E**			
Seismic Parameter	Value (g)	Seismic Parameter	Value (g)	Seismic Parameter	Value (g)	Seismic Parameter	Value (g)
S_{MS}	0.801	S_{DS}	0.534	S_{MS}	1.078	S_{DS}	0.719
S_{M1}	1.031	S_{D1}	0.688	S_{M1}	1.422	S_{D1}	0.948

Seismic Design Category

Section 1613.5.6 of the 2007 California Building Code indicates that structures will be assigned to Category D unless $S_1 \geq 0.75$. The S_1 calculated for the site is 0.493g; therefore, the site would be a Category D.

Surface Ground Rupture

Surface ground rupture generally occurs at sites that are traversed by, or that lie very near, a causative fault. The site is not in a State Earthquake Fault Zone, and there are no mapped faults crossing or adjacent to the site. Therefore, the potential for surface ground rupture to occur within the site is considered to be low.

Liquefaction

The term "liquefaction" refers to the liquefied condition and subsequent loss of soil strength that can occur in soils when they are subjected to a sudden shock, such as that generated during an earthquake. Studies of areas where liquefaction has occurred have led to the general conclusion that saturated soil conditions, low soil density, grain sizes within a certain range, and a sufficiently strong earthquake are factors that, in combination, create a potential for liquefaction. During liquefaction, the energy from the earthquake causes the water pressure within the pores of the soil to increase. The increase in water pressure decreases the friction between the soil grains, allowing the soil grains to move relative to one another. During this state, the soil will behave as a viscous liquid, temporarily losing its ability to support foundations and other improvements. The high-pressure water will flow along the path of least resistance, which may be to the ground surface. As it flows, the water carries sand and silt in suspension, often releasing these materials on the surface in cone-shaped deposits called "sand boils."

To assess the potential for liquefaction, soil and SPT data from Boring 2 were used as input for a computer generated analysis. Groundwater was encountered at a depth of 25 feet in this boring. A potential rise in the groundwater to a depth of 14.5 feet below the existing ground surface, the gradational contact between clayey sand and well graded sand, was used in the liquefaction analysis. Based upon the surrounding topography and the distance that the Huer Huero Creek is from the site, a groundwater surface shallower than 14.5 feet was considered unlikely.

The analysis also requires both the earthquake magnitude and the Peak Ground Acceleration (PGA). The PGA value of 0.33g was taken from the Site-Specific Design Response Spectrum. The seismicity of nearby faults was then deaggregated to determine the statistical mean and modal earthquake magnitudes that contributed to the site PGA of 0.33g. These magnitudes were estimated by performing a probabilistic seismic hazard deaggregation using the United States Geologic Survey Website (USGS, 2008). The mean and the modal magnitudes were then compared and the higher of the two was used in the analysis. In this case, the modal magnitude was higher than the mean magnitude; this value was a maximum moment magnitude of 7.78.

Using the developed seismic values, liquefaction potential at the site was analyzed following the guidelines of Special Publication 117 (CGS, 1997, revised 2008), and the recommended procedures for analyzing liquefaction potential (Martin and others, 1999) using the "Simplified Procedure" as presented at the NCEER workshop and summarized by Youd and others (2001). The analysis also considered recent information presented by Seed and others (2003) and Idriss and others (2004).

The analyses indicated that there is a potential for liquefaction at the site in all of the soils below the groundwater table, with maximum dynamic settlement that would occur under the parameters analyzed on the order of 8.2 to 8.5 inches (see Liquefaction Analysis spreadsheets in Appendix C). It should be noted that the methods of analysis available to date are largely thought to overestimate the magnitude of dynamic settlement that would actually occur. Our judgment is that the maximum dynamic settlement at the site due to a future earthquake would be on the order of 4 to 6 inches with maximum differential settlement of up to 4 inches. Recommendations for mitigation of this dynamic settlement are presented in the soils engineering report (ESP, 2009).

Lateral Spreading

Lateral spreading can occur as a consequence of liquefaction. This phenomenon is confined to areas where the terrain is sloping, or when the liquefied zone extends below sloping terrain, and generally affects slopes along creeks, bays, or other water features bordered by slopes. Liquefaction of the soil induces instability of the soils on the slopes, resulting in the "spreading" of the soil into the inundated zone. As the site is essentially flat and is not bordered by slopes along a creek or other water features, the potential for lateral spreading to occur on the site is nil. The closest creek to the site building area is the Huer Huero Creek located approximately 560 feet east, which should not impact the site with respect to lateral spreading.

Seismically Induced Settlement

Seismically induced settlement of sufficient magnitude to cause structural damage is normally associated with poorly consolidated, predominantly sandy soils, or variable consolidation characteristics within the building areas. Seismically induced settlement on the order of 4 to 6 inches with maximum differential settlement of up to 4 inches was estimated for this site. Recommendations for mitigation of this dynamic settlement are presented in the soils engineering report (ESP, 2009).

Naturally Occurring Asbestos

There are no naturally occurring asbestos bearing rock formations (serpentinite or ultramafic rock) on site. The site is underlain by alluvial deposits, which are not asbestos-bearing geologic units.

6.0 CLOSURE

This report is valid for conditions as they exist at this time for the type of project described herein. Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use of the client and the client's architect/engineer as discussed in the "Purpose and Scope of Work" section of this report. Application beyond the stated intent is strictly at the user's risk.

If changes with respect to project type or location become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report shall comply with the California Building Code.

The conclusions of this soils report are based upon geologic conditions encountered at the site, and may be augmented by additional requirements of the architect/engineer, or by additional recommendations provided by this firm based on conditions exposed during construction.

This document, the data, and conclusions contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of text.

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APPENDIX A

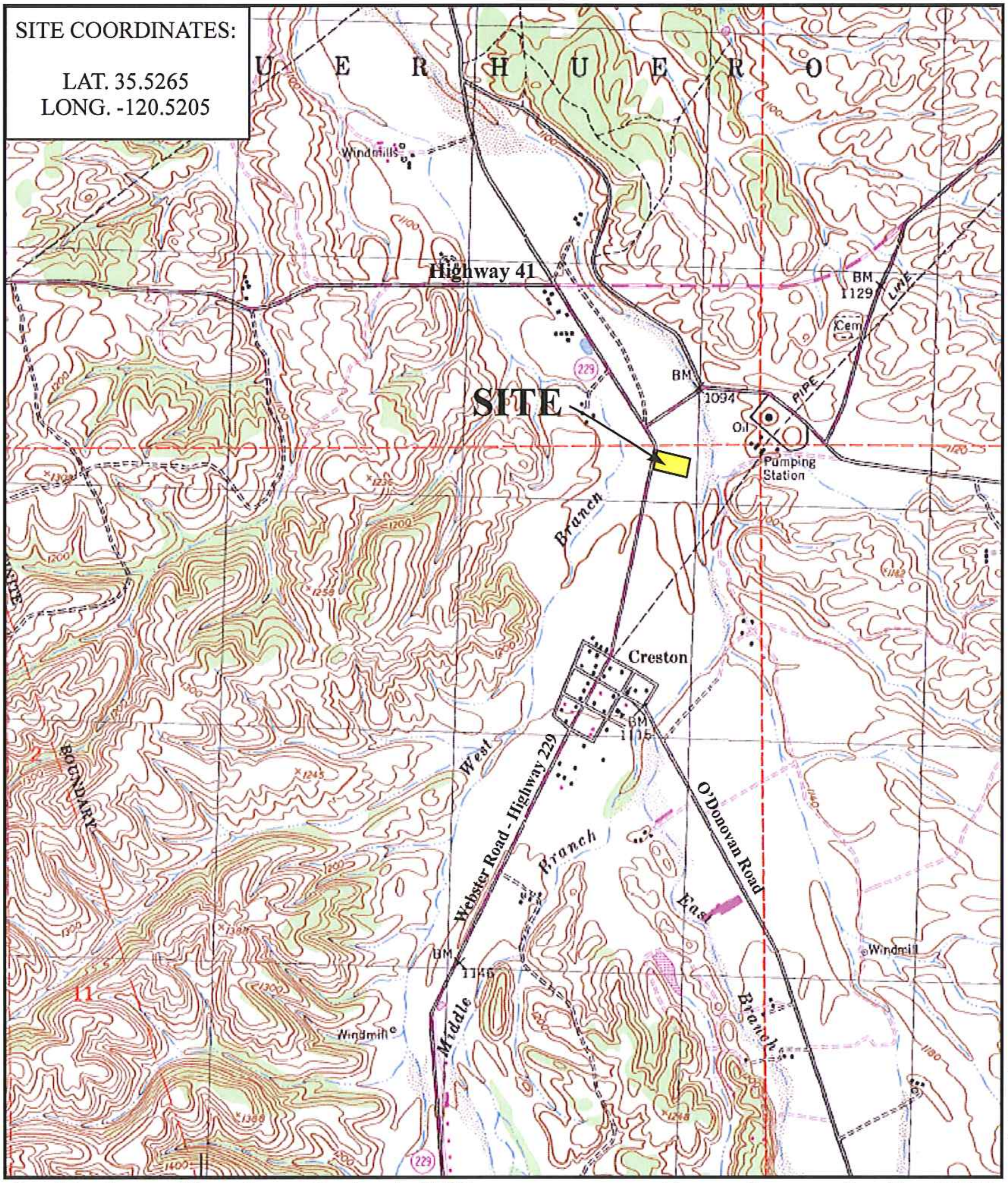
Vicinity Map
Boring Location Map
Boring Log Legend
Boring Logs

VICINITY MAP

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

SITE COORDINATES:

LAT. 35.5265
LONG. -120.5205



Base Map Extracted from: Creston Quadrangle, USGS

(Approximate scale: 1" = 1500')

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April 2009

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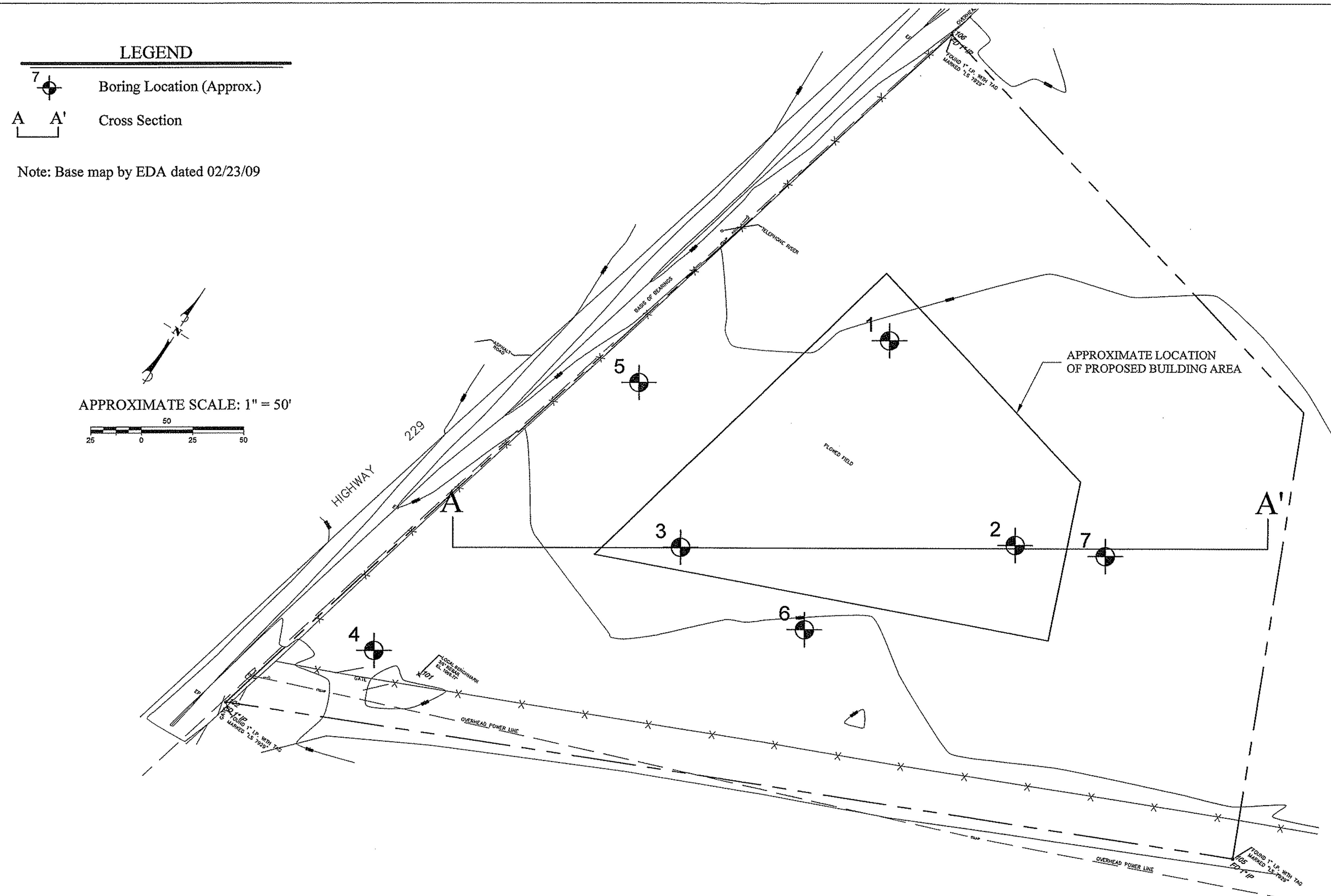


BORING LOCATION MAP

SAN LUIS OBISPO COUNTY FIRE STATION 43

Highway 229 at Iron Gate Road
Creston, California

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401-8116
(805) 544-3276 • FAX (805) 544-1786
E-mail: esc@earthsys.com

April 30, 2009 RLW SL-15969-SA

SAN LUIS OBISPO COUNTY FIRE STATION 43-050109sitemap.dwg

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	■
STANDARD PENETRATION TEST (SPT)	●
SHELBY TUBE	▭
BULK	○
SUBSURFACE WATER DURING DRILLING	▼
SUBSURFACE WATER AFTER DRILLING	▽

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	MORE THAN HALF OF MATERIAL IS TESTED OR JUDGED TO BE LARGER THAN #200 SIEVE SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS	HALF OR MORE OF MATERIAL IS TESTED OR JUDGED TO BE SMALLER THAN #200 SIEVE SIZE	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY, CLAYEY FINE SANDS, CLAYEY SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY, SILTY SOILS, ELASTIC SILTS
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET
LITTLE/NO MOISTURE	JUDGED BELOW OPTIMUM	JUDGED ABOUT OPTIMUM	JUDGED OVER OPTIMUM	SATURATED

TYPICAL CONSISTENCY

COARSE GRAINED SOILS

BLOWS/FOOT SPT	BLOWS/FOOT CA SAMPLER	DESCRIPTIVE TERM
0-10	0-16	LOOSE
11-30	17-50	MEDIUM DENSE
31-50	51-83	DENSE
OVER 50	OVER 83	VERY DENSE

FINE GRAINED SOILS

BLOWS/FOOT SPT	BLOWS/FOOT CA SAMPLER	DESCRIPTIVE TERM
0-2	0-3	VERY SOFT
3-4	4-7	SOFT
5-8	8-13	MEDIUM STIFF
9-15	14-25	STIFF
16-30	26-50	VERY STIFF
OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL ROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL ROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
FRESH	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM; SOME FRACTURES PRESENT; FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY"; FELDSPAR CRYSTALS ARE "CLOUDY"
INTENSELY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend091608.dwg

Earth Systems Pacific

Boring No. 1

PAGE 1 OF 1
JOB NO.: SL-15969-SA
DATE: 4/3/09

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SC		CLAYEY SAND: dark brown, loose, moist (alluvium)					
3				3.0–4.5	Ring Sample			1 3 5
5				5.0–6.5	Ring Sample			2 7 8
7			brown					
10				10.0–11.5	SPT			2 2 3
15				15.0–16.5	SPT			3 6 5
16	SW		WELL GRADED SAND: light brown, medium dense, moist, trace coarse gravel					
16.5			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: Ring Sample; Grab Sample; Shelby Tube Sample; SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

PAGE 1 OF 2
JOB NO.: SL-15969-SA
DATE: 4/3/09

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SC	CLAYEY SAND: dark brown, loose, moist (alluvium)	1.0–2.5	Ring Sample			3 6 8
5			5.0–6.5	SPT			2 4 5
8		brown					
10			10.0–11.5	SPT			2 3 5
14.5	SW	WELL GRADED SAND: light brown, medium dense, moist	15.0–16.5	SPT			4 6 8
20			20.0–21.5	SPT			4 6 7
25		wet (groundwater ▼)	25.0–26.5	SPT			3 7 7

LEGEND: Ring Sample, Grab Sample, Shelby Tube Sample, SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

JOB NO.: SL-15969-SA
DATE: 4/3/09

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
27	SW		WELL GRADED SAND: as above					
30			loose, 5 to 15% coarse gravel	30.0–31.5	SPT			2 2 6
35			medium dense	35.0–36.5	SPT			1 4 7
40				40.0–41.5	SPT			FLOW SANDS
45				45.0–46.5	SPT			3 6 15
50				50.0–51.5	SPT			2 3 11
51.5			End of Boring @ 51.5' Subsurface water encountered @ 25.0'					

LEGEND: Ring Sample; Grab Sample; Shelby Tube Sample; SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3

PAGE 1 OF 1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

JOB NO.: SL-15969-SA
DATE: 4/3/09

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SC		CLAYEY SAND: dark brown, loose, moist (alluvium)					
2				2.0-3.5	Ring Sample			4 7 9
5				5.0-6.5	Ring Sample			3 3 5
9			brown					
10				10.0-11.5	Ring Sample			4 7 9
14	SW		WELL GRADED SAND: light brown, loose, moist, trace coarse gravel					
15				15.0-16.5	SPT			2 2 3
15.5			thin layers of fine grained clayey sand					
20			medium dense	20.0-21.5	SPT			5 9 10
21.5			End of Boring @ 21.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

JOB NO.: SL-15969-SA
DATE: 4/3/09

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0–5	SC		CLAYEY SAND: dark brown, loose, moist (alluvium)	1.0–2.5	Ring Sample			4 7 9
				3.5–5.0	SPT			1 1 2
				3.0–5.0	Grab Sample			
5			End of Boring @ 5.0' No subsurface water encountered					

LEGEND: Ring Sample, Grab Sample, Shelby Tube Sample, SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 5

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

JOB NO.: SL-15969-SA
DATE: 4/3/09

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0–5	SC		CLAYEY SAND: dark brown, loose, moist (alluvium)	2.0–3.5	Ring Sample			3, 7, 6
				3.5–5.0	SPT			1, 2, 4
5			End of Boring @ 5.0' No subsurface water encountered					

LEGEND: Ring Sample; Grab Sample; Shelby Tube Sample; SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 6

PAGE 1 OF 1
JOB NO.: SL-15969-SA
DATE: 4/3/09

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0–3	SC		CLAYEY SAND: dark brown, medium dense, moist (alluvium)	1.0–2.5	Ring Sample			6 / 10 / 10
3–5			loose	3.5–5.0	SPT			5 / 6 / 6
5			End of Boring @ 5.0' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 7

PAGE 1 OF 1
JOB NO.: SL-15969-SA
DATE: 4/3/09

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53
AUGER TYPE: 8" Hollow Stem

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0–5	SC		CLAYEY SAND: dark brown, loose, moist (alluvium)	1.5–3.0	Ring Sample			3, 4, 4
				0.0–3.0	Grab Sample			
				3.5–5.0	SPT			2, 4, 6
5			End of Boring @ 5.0' No subsurface water encountered					

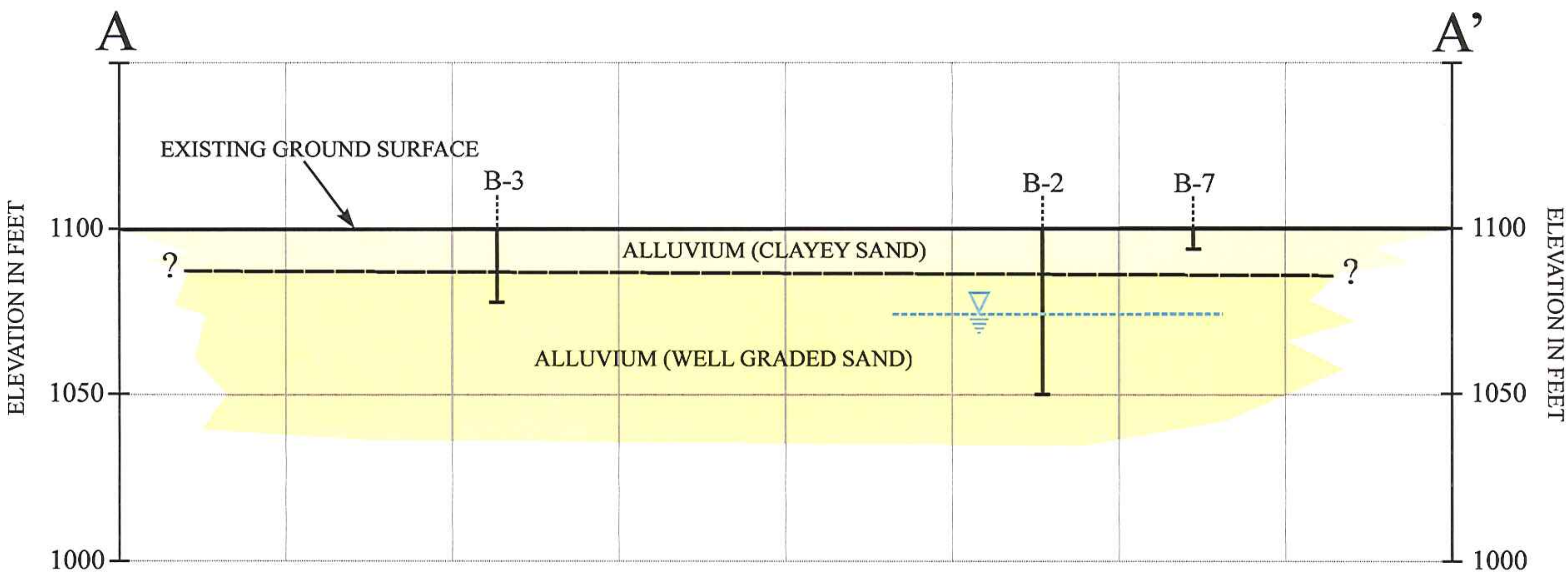
LEGEND: ■ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Cross Section A-A'
Geologic Map
Historical Earthquake/Fault Map
EQ Search Output
FIRM Flood Zone Map

CROSS SECTION A-A'
SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California



APPROXIMATE SCALE: 1" = 50'

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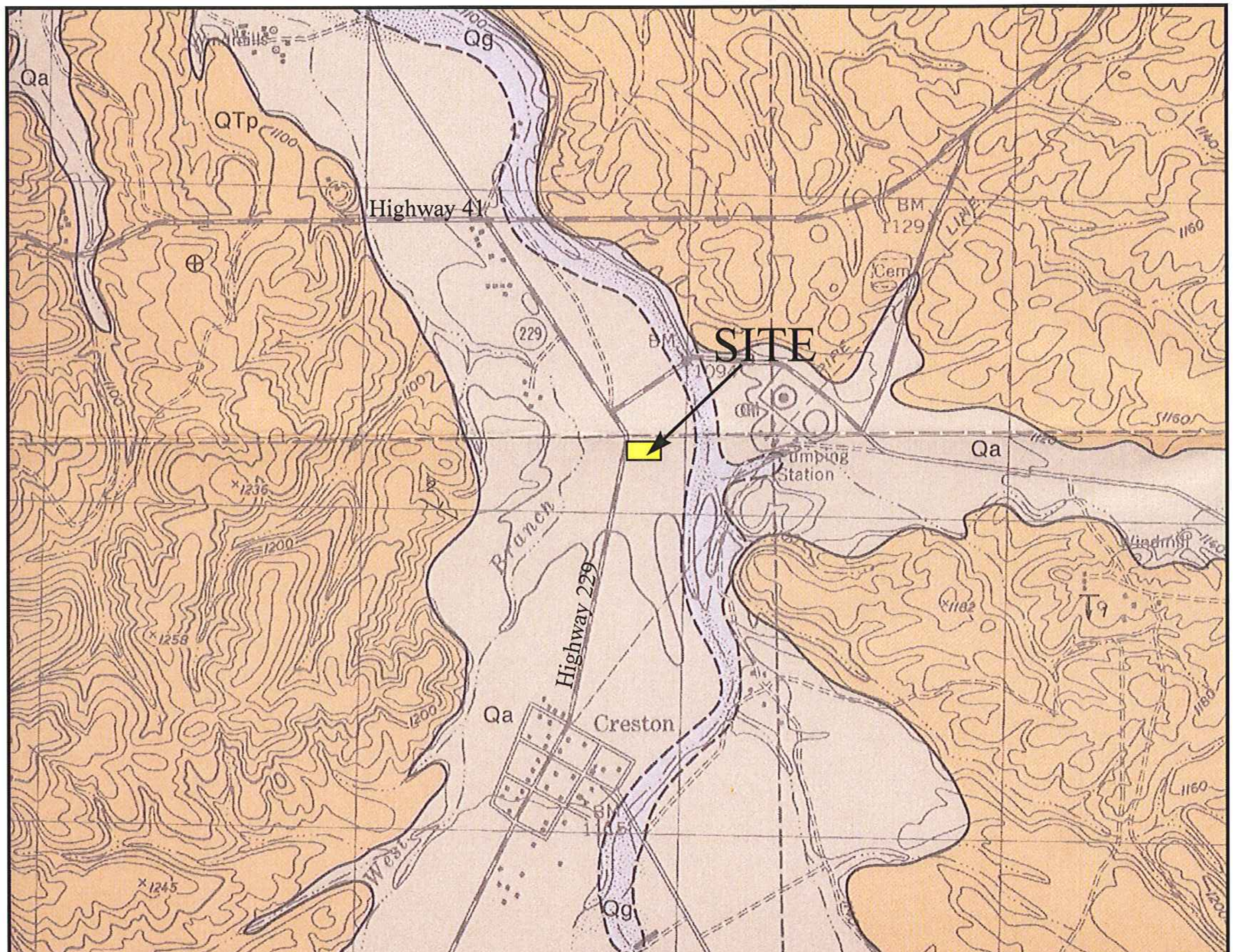
CRESTON FIRE STATION-043009cross section.cdr

GEOLOGIC MAP

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California



Extract from: Geologic Map of the Creston and Shedd Canyon Quadrangles, San Luis Obispo County, California: by T.W. Dibblee, Jr., 2004.

EXPLANATION

Geologic Units

Qg

Surficial Sediments
-gravel & sand of stream channels

Qa

Surficial Sediments
-alluvial gravel & sand of valley areas

QTp

Paso Robles formation
- pebble, gravel sand and clay, sandstone and claystone, light medium gray, Pleistocene age

Geologic Symbols

Contact
Dashed where approximately located or inferred

High-angle fault
Dashed where approximately located or inferred; dotted where concealed

Thrust or reverse fault
Dashed where approximately located or inferred; dotted where concealed. Saw-teeth on upper plate. Dip of fault plane between 30° and 80°

Anticline
Showing axis at surface. Dashed where approximately located; dotted where concealed

Syncline
Showing axis at surface. Dashed where approximately located; dotted where concealed

30 90

Horizontal Inclined Vertical
Strike and dip of beds

N

Approx. Scale: 1" = 2000'

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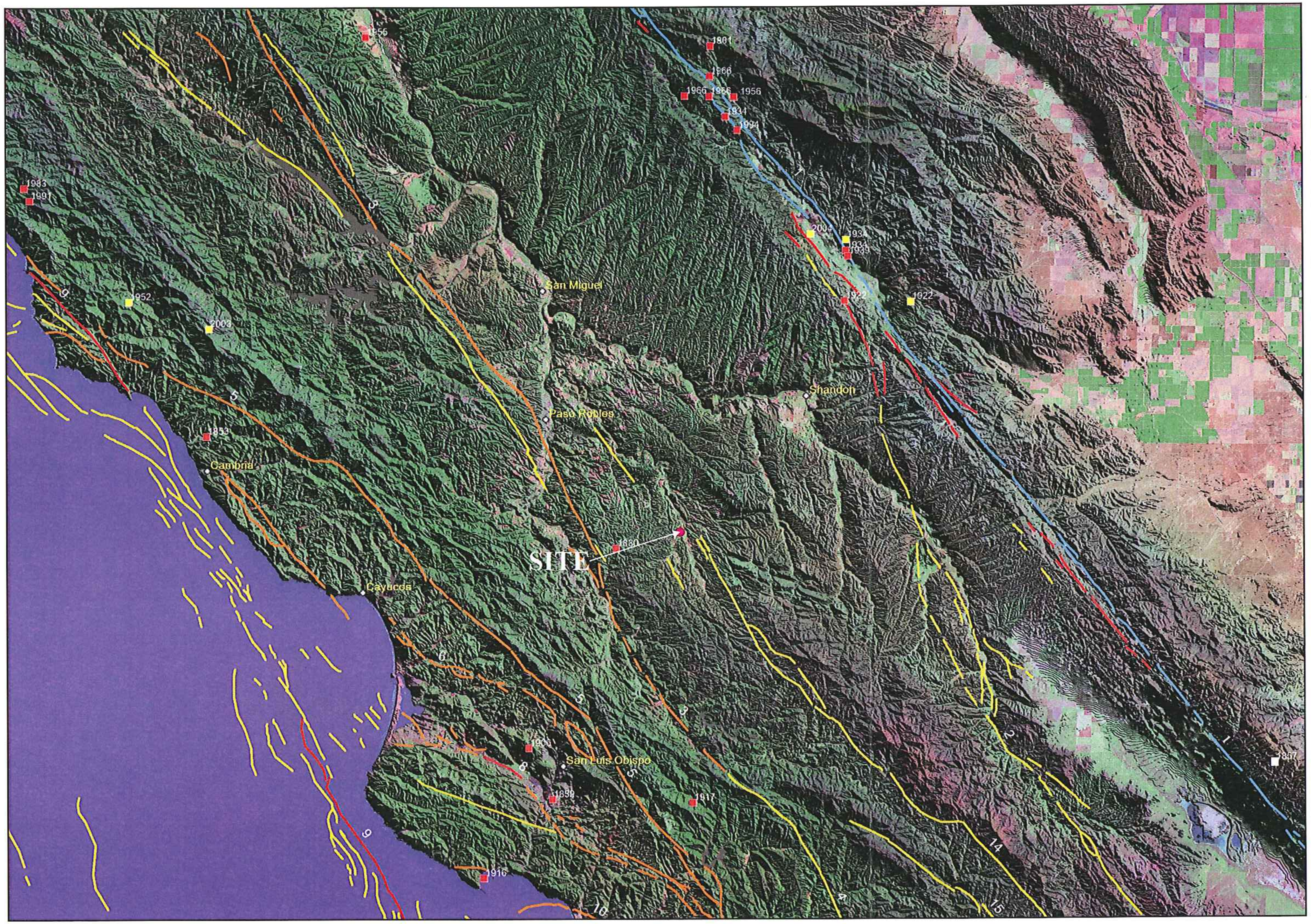
CRESTON FIRE STATION-042009geology map.cdr

HISTORICAL EARTHQUAKE/ FAULT MAP

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California



LEGEND

- Historic rupture (<200 years)
- Holocene fault (<10,000 years)
- Late Quaternary (<700,000 years)
- Quaternary fault (<1.6 million)

HISTORICAL EARTHQUAKE MAGNITUDE

5.0 to 5.9   6.0 to 6.9   7.0 to 7.9

FAULTS

1	San Andreas	11	Casmalia
2	San Juan	12	Lions Head
3	Rinconada	13	Oceano
4	East Huasna	14	La Panza
5	Oceanic	15	South Cuyama
6	Cambria		
7	West Huasna		
8	Los Osos		
9	Hosgri-San Simeon		
10	San Luis Range		

REFERENCES

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Jennings, C.W, 1994

N

(Approximate Scale: 1" = 6 miles)

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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: 0042-0000

DATE: 04-16-2009

JOB NAME: Test Run

EARTHQUAKE-CATALOG-FILE NAME: ALLQUAKE.DAT

SITE COORDINATES:
SITE LATITUDE: 35.5265
SITE LONGITUDE: 120.5205

SEARCH DATES:
START DATE: 1800
END DATE: 2007

SEARCH RADIUS:
65.0 mi
104.6 km

ATTENUATION RELATION: 1) Boore et al. (1997) Horiz. - Vs = 150 m/s
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
ASSUMED SOURCE TYPE: SS [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

Page 1

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]
MGI	35.5000	120.6000	01/01/1830	0 0 0.0	0.0	5.00	0.171	VIII	4.8(7.8)
MGI	35.3000	120.7000	12/07/1906	640 0.0	0.0	5.90	0.111	VII	18.6(30.0)
DMG	35.7500	120.3300	08/18/1922	512 0.0	0.0	5.00	0.069	VI	18.8(30.2)
MGI	35.2500	120.5000	07/10/1917	043 0.0	0.0	5.30	0.079	VII	19.1(30.8)
MGI	35.2500	120.5000	07/10/1917	045 0.0	0.0	5.30	0.079	VII	19.1(30.8)
MGI	35.2500	120.5000	07/09/1917	2238 0.0	0.0	5.30	0.079	VII	19.1(30.8)
MGI	35.2500	120.5000	07/09/1917	2222 0.0	0.0	5.00	0.068	VI	19.1(30.8)
T-A	35.2500	120.6700	00/00/1830	0 0 0.0	0.0	5.70	0.092	VII	20.9(33.6)

T-A	35.2500	120.6700	12/17/1852	0 0 0.0	0.0	5.70	0.092	VII	20.9(33.6)
DMG	35.7500	120.2500	03/10/1922	112120.0	0.0	6.50	0.136	VIII	21.6(34.8)
DMG	35.8000	120.3300	06/08/1934	430 0.0	0.0	5.00	0.062	VI	21.7(34.9)
DMG	35.8000	120.3300	12/28/1939	121538.0	0.0	5.00	0.062	VI	21.7(34.9)
DMG	35.8000	120.3300	06/05/1934	2148 0.0	0.0	5.00	0.062	VI	21.7(34.9)
DMG	35.8000	120.3300	06/08/1934	447 0.0	0.0	6.00	0.104	VII	21.7(34.9)
GSB	35.8190	120.3640	09/28/2004	171524.2	8.0	6.00	0.103	VII	22.0(35.4)
GSB	35.9170	120.4650	12/20/1994	102747.2	8.0	5.00	0.052	VI	27.1(43.7)
MGI	35.1700	120.7500	12/01/1916	2253 0.0	0.0	5.70	0.074	VII	27.8(44.7)
DMG	35.9300	120.4800	12/24/1934	1626 0.0	0.0	5.00	0.051	VI	27.9(45.0)
DMG	35.9500	120.5300	06/29/1966	195325.9	0.0	5.00	0.049	VI	29.2(47.1)
DMG	35.9500	120.5000	06/28/1966	42613.4	0.0	5.50	0.064	VI	29.3(47.1)
DMG	35.9500	120.4700	11/16/1956	323 9.0	0.0	5.00	0.049	VI	29.4(47.3)
GSB	35.9530	120.5020	09/29/2004	171004.0	11.0	5.10	0.051	VI	29.5(47.4)
DMG	35.9700	120.5000	06/28/1966	4 856.2	0.0	5.10	0.050	VI	30.6(49.3)
DMG	36.0000	120.5000	03/03/1901	745 0.0	0.0	5.50	0.059	VI	32.7(52.6)
DMG	36.0000	120.5000	02/02/1881	011 0.0	0.0	5.60	0.062	VI	32.7(52.6)
MGI	35.6000	121.1000	02/01/1853	21 0 0.0	0.0	5.00	0.045	VI	32.9(53.0)
GSG	35.7060	121.1020	12/22/2003	191556.0	7.0	6.40	0.090	VII	34.9(56.2)
MGI	35.0000	120.5000	11/19/1927	332 0.0	0.0	5.00	0.042	V	36.4(58.5)
DMG	36.0000	120.9200	11/02/1955	1940 6.0	0.0	5.20	0.043	VI	39.6(63.8)
DMG	35.7300	121.2000	11/22/1952	74637.0	0.0	6.00	0.065	VI	40.6(65.4)
DMG	36.0000	121.0000	02/26/1932	1658 0.0	0.0	5.00	0.037	V	42.3(68.1)
DMG	35.3000	119.8000	01/09/1857	16 0 0.0	0.0	7.90	0.167	VIII	43.5(69.9)
MGI	34.9000	120.4000	03/29/1928	625 0.0	0.0	5.30	0.042	VI	43.8(70.5)
DMG	34.9000	120.7000	11/04/1927	135053.0	0.0	7.50	0.133	VIII	44.4(71.5)
DMG	36.1700	120.3200	12/27/1926	919 0.0	0.0	5.00	0.035	V	45.8(73.7)
BRK	36.2000	120.4000	07/22/1983	343 2.0	0.0	5.00	0.034	V	47.0(75.6)
PAS	36.1820	120.2680	02/14/1987	72650.8	6.0	5.10	0.036	V	47.4(76.3)
BRK	36.2100	120.3800	07/25/1983	223140.0	0.0	5.10	0.035	V	47.8(77.0)
BRK	36.2200	120.4000	07/22/1983	23955.0	0.0	6.00	0.056	VI	48.4(77.8)
DMG	36.2300	120.6500	02/05/1947	614 0.0	0.0	5.00	0.033	V	49.1(79.0)
BRK	36.2200	120.2900	05/02/1983	2346 6.0	0.0	5.60	0.045	VI	49.6(79.8)
BRK	36.2200	120.2900	05/02/1983	234239.0	0.0	6.70	0.080	VII	49.6(79.8)
GSB	35.8280	121.3230	09/17/1991	211029.3	8.0	5.10	0.034	V	49.6(79.8)
BRK	36.2500	120.4700	06/11/1983	3 954.0	0.0	5.10	0.034	V	50.0(80.5)
BRK	36.2200	120.2600	09/09/1983	91614.0	0.0	5.40	0.040	V	50.0(80.5)
BRK	35.8400	121.3300	08/29/1983	101031.0	0.0	5.20	0.036	V	50.3(80.9)
PAS	36.1510	120.0490	08/04/1985	12 156.0	6.0	5.80	0.049	VI	50.5(81.3)
MGI	34.8000	120.4000	12/12/1902	0 0 0.0	0.0	5.70	0.046	VI	50.6(81.5)
BRK	36.2400	120.2900	05/09/1983	24912.0	0.0	5.20	0.036	V	50.9(81.9)
BRK	36.2600	120.4000	07/09/1983	74052.0	0.0	5.30	0.037	V	51.1(82.2)
PAS	36.2860	120.4130	10/25/1982	2226 4.0	6.0	5.60	0.043	VI	52.8(84.9)
DMG	34.7000	120.3000	01/12/1915	431 0.0	0.0	5.50	0.037	V	58.4(94.0)
DMG	34.7000	120.3000	07/31/1902	920 0.0	0.0	5.50	0.037	V	58.4(94.0)

EARTHQUAKE SEARCH RESULTS

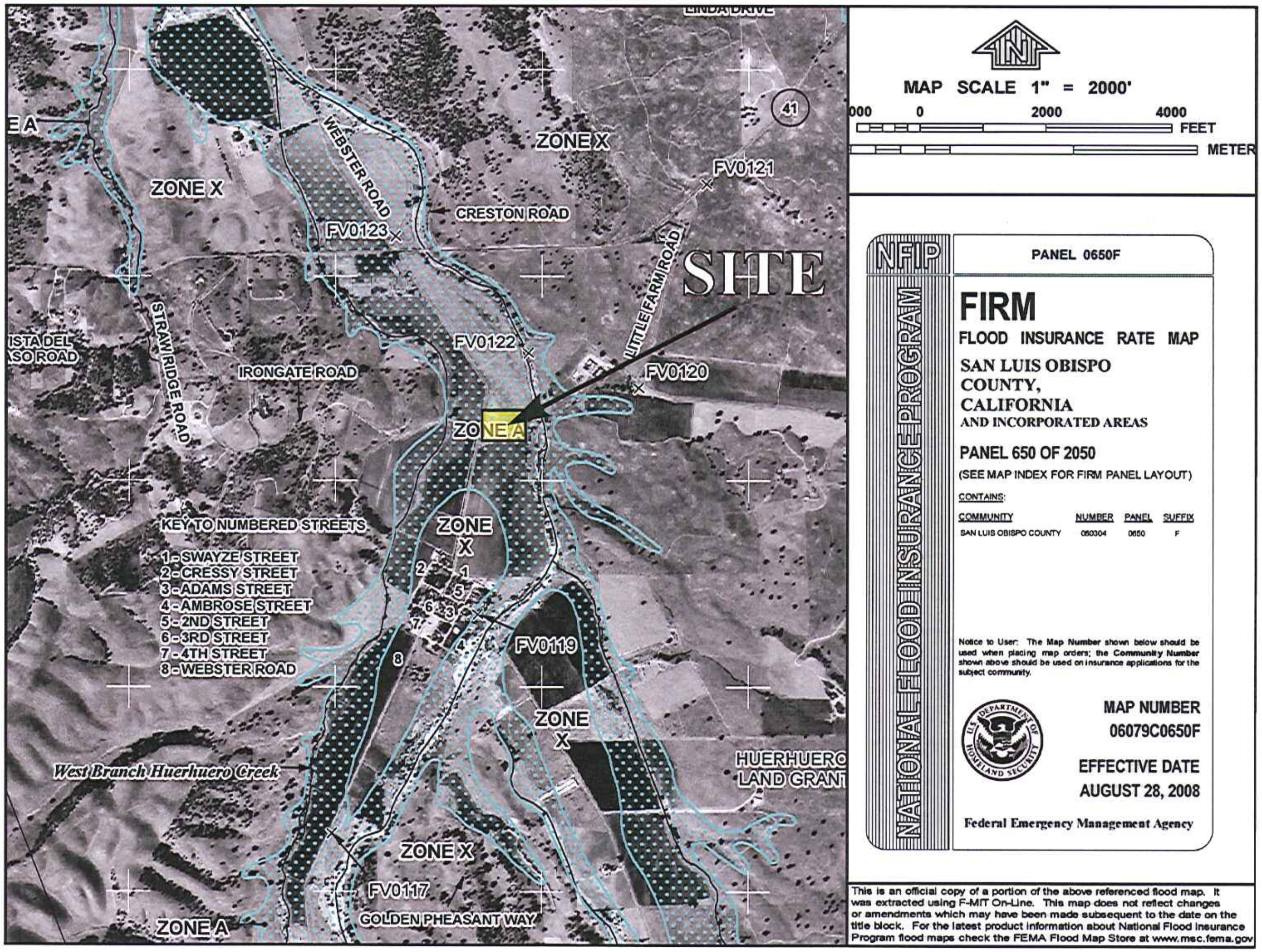
Page 2

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]
MGI	34.6000	120.4000	08/01/1902	330 0.0	0.0	6.30	0.053	VI	64.3(103.5)
MGI	34.6000	120.4000	07/28/1902	657 0.0	0.0	6.30	0.053	VI	64.3(103.5)

****

FIRM FLOOD ZONE MAP

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California



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April 2009

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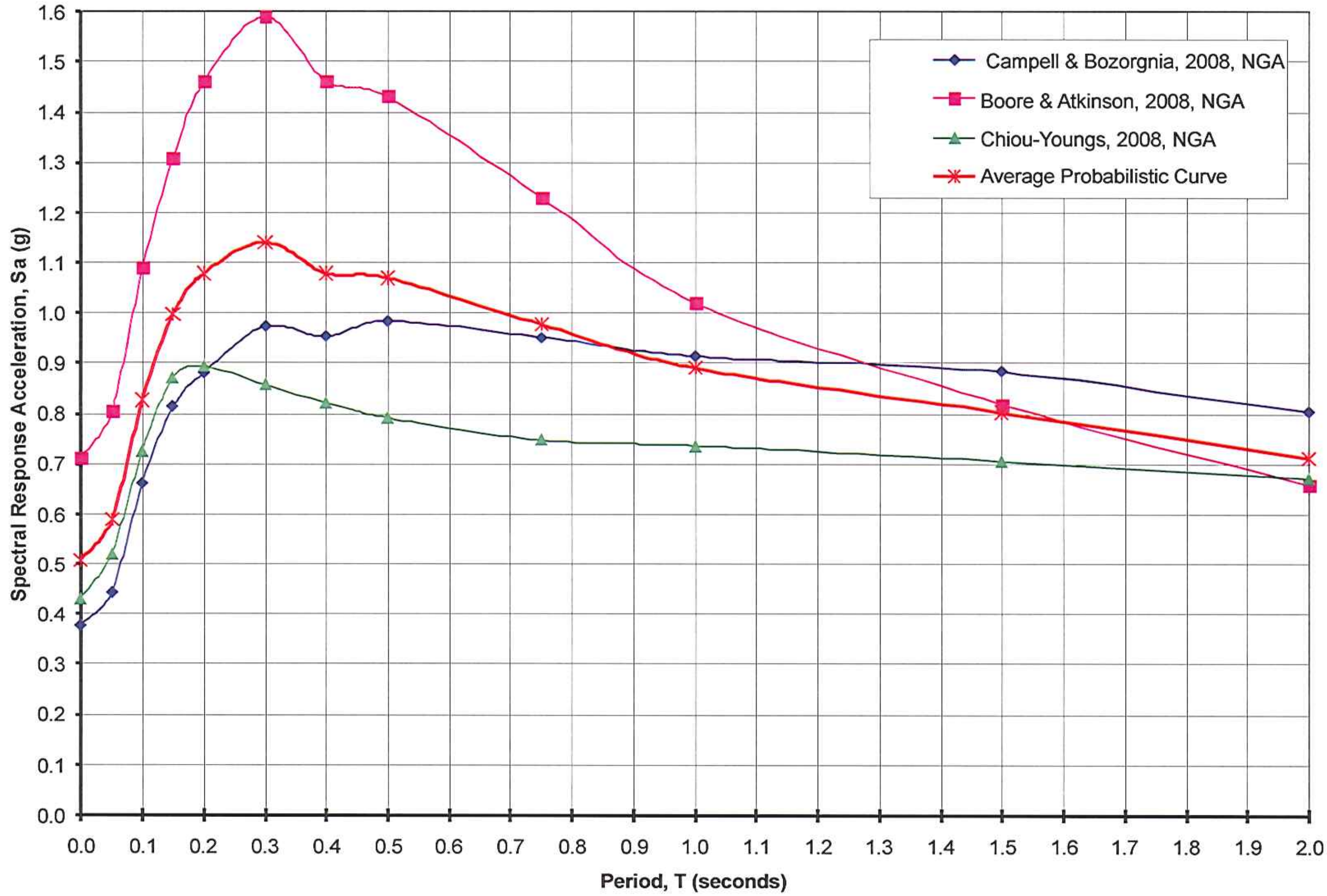
CRESTON FIRE STATION-042009flood map.cdr

APPENDIX C

Average NGA Probabilistic MCE Response Spectrum
Average NGA 84% Deterministic Response Spectrum
Site Specific Design Response Spectrum
Liquefaction Analysis, Boring 2, Groundwater at 25 Feet
Liquefaction Analysis, Boring 2, Groundwater at 14.5 Feet

AVERAGE NGA PROBABILISTIC MCE RESPONSE SPECTRUM

SAN LUIS OBISPO COUNTY
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California



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AVERAGE NGA 84% DETERMINISITIC RESPONSE SPECTRUM

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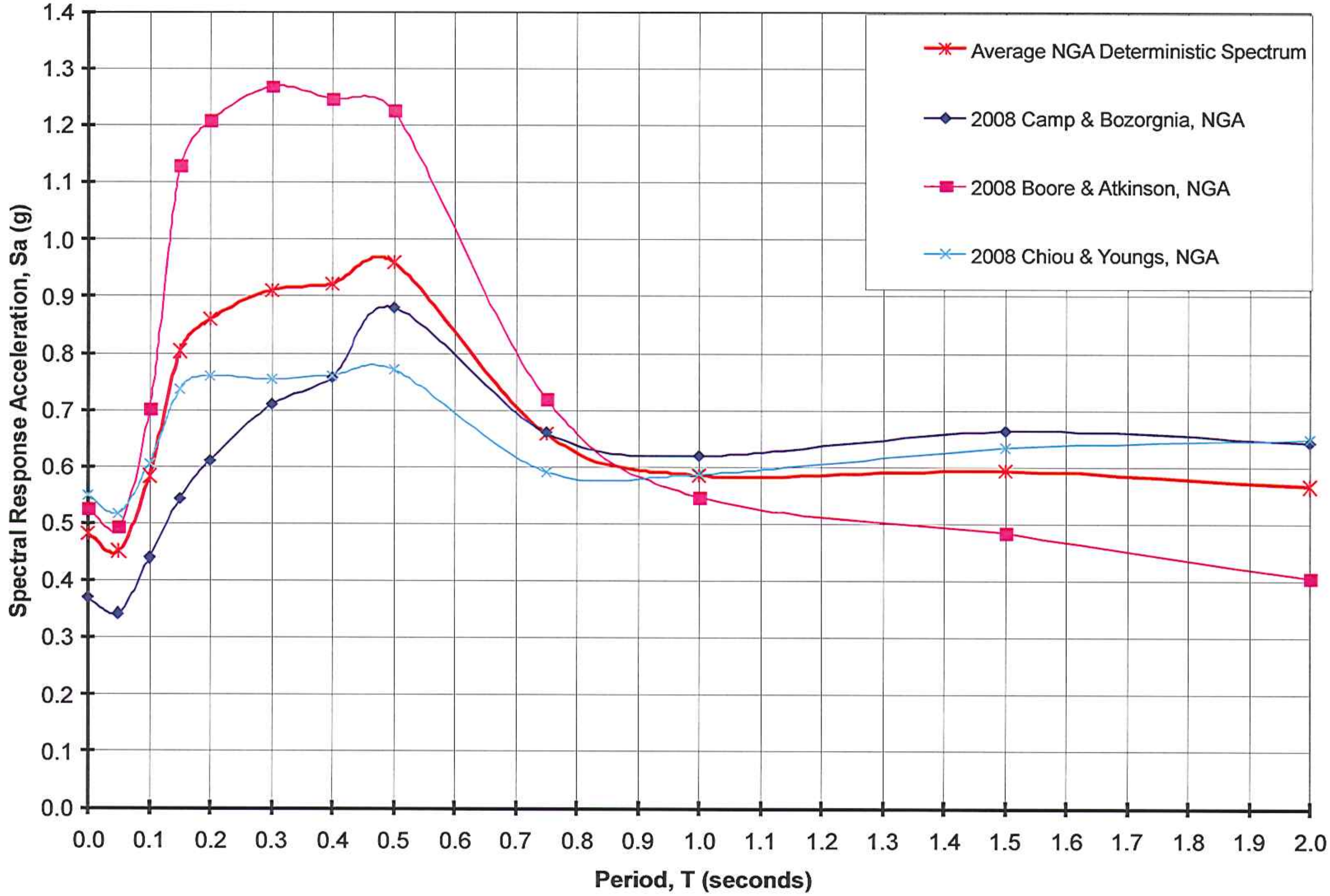
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California



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SITE SPECIFIC DESIGN RESPONSE SPECTRUM

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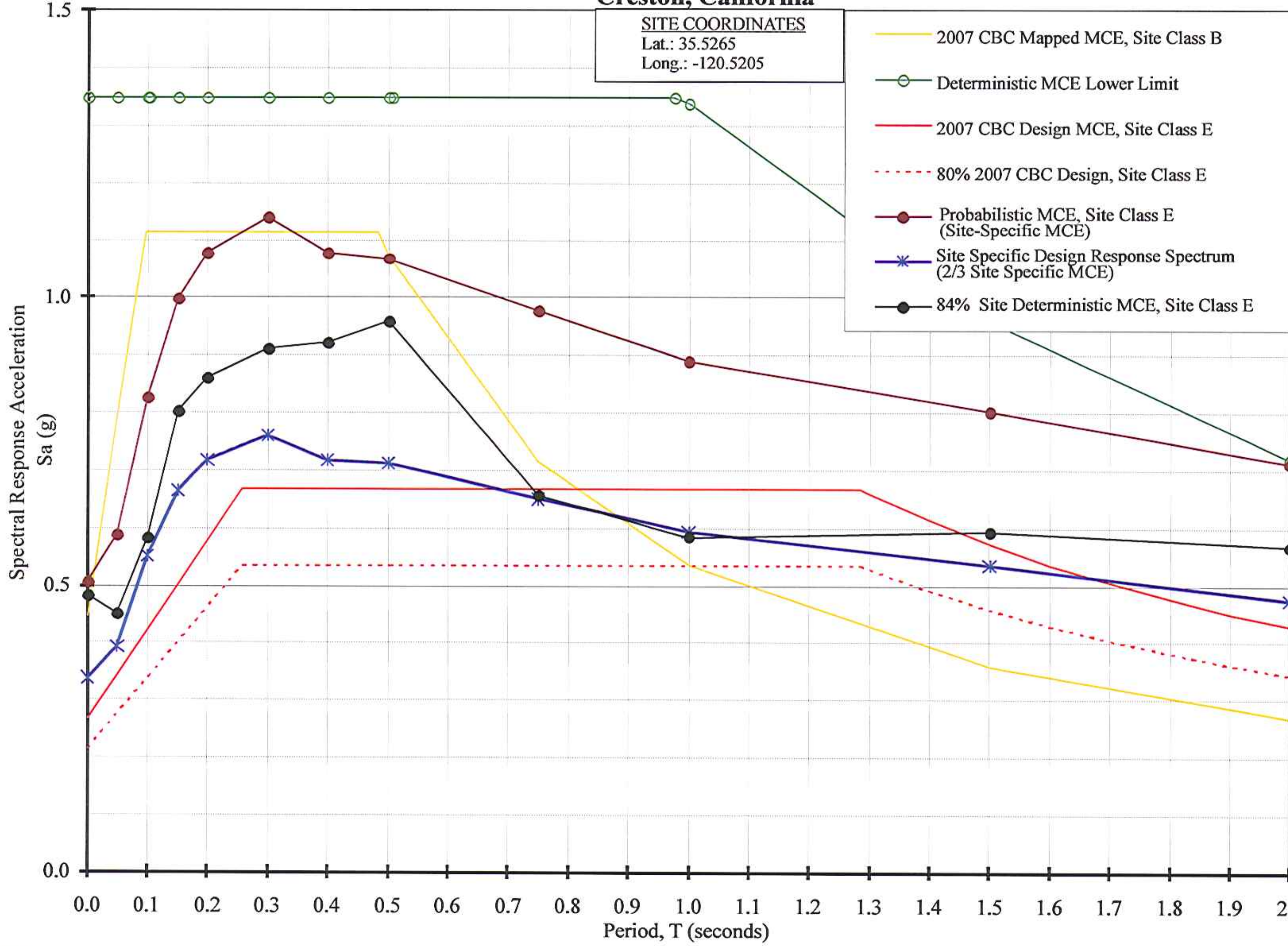
FIRE STATION 43
Highway 229 at Irongate Road
Creston, California



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SL-15969-GA

Project: SLO County Fire Station 43, Creston, CA
Job No: SL-15969-SA
Date: 4/27/2009
Boring: B-2 Data Set: 1

Methods: **Liquefaction Analysis using 1996 & 1998 NCEER workshop method (Youd & Idriss, editors)**
Journal of Geotechnical and Enviromental Engineering (JGEE), October 2001, Vol 127, No. 10, ASCE
Settlement Analysis from Tokimatsu and Seed (1987), JGEE,Vol 113, No.8, ASCE
Modified by Pradel, JGEE, Vol 124, No. 4, ASCE

EARTHQUAKE INFORMATION:

Magnitude: 7.78 7.5
PGA, g: 0.33 0.36
MSF: 0.91
GWT: 25.0 feet
Calc GWT: 25.0 feet
Remediate to: 0.0 feet

SPT N VALUE CORRECTIONS:

Energy Correction to N60 (C_E): 1.25
Drive Rod Corr. (C_R): 1 Default
Rod Length above ground (feet): 3.0
Borehole Dia. Corr. (C_B): 1.15
Sampler Liner Correction for SPT?: 1 Yes
Cal Mod/ SPT Ratio: 0.63

Total (ft) Liquefied Thickness	Total (in.) Induced Subsidence
26.5	8.2

Threshold Acceler., g: 0.06
Required SF: 1.30
Minimum Calculated SF: 0.19

Base Depth (feet)	Cal Mod N	SPT N	Liquef. Suscept. (0 or 1)	Total Unit Wt. (pcf)	Fines Content (%)	Depth of SPT (feet)	Rod Length (feet)	Tot.Stress at SPT po (tsf)	Eff.Stress at SPT p'o (tsf)	rd	C_N	C_R	C_S	$N_{1(60)}$	Rel. Dens. Dr (%)	Trigger FC Adj. $\Delta N_{1(60)}$	Equiv. Sand $N_{1(60)CS}$	K_σ	M = 7.5 Available CRR	M = 7.5 Induced CSR*	Liquefac. Safety Factor	Post FC Adj. $\Delta N_{1(60)}$	$N_{1(60)CS}$	Volumetric Strain (%)	Induced Subsidence (in.)
								0.000																	
2.5	14	9	1	115	20	1.5	4.5	0.086	0.086	1.00	1.70	0.75	1.00	16.2	48	4.9	21.1	1.00	0.229	0.235	Non-Liq.	4.9	21.1	0.02	0.01
7.5		9	1	115	20	5.5	8.5	0.316	0.316	0.99	1.70	0.75	1.20	19.8	53	5.2	24.9	1.00	0.282	0.233	Non-Liq.	5.2	24.9	0.03	0.02
14.5		8	1	115	20	10.5	13.5	0.604	0.604	0.98	1.32	0.77	1.14	13.4	44	4.7	18.1	1.00	0.195	0.231	Non-Liq.	4.7	18.1	0.07	0.06
17.5		14	1	115	5	15.5	18.5	0.891	0.891	0.97	1.09	0.87	1.23	23.5	58	0.0	23.5	1.00	0.260	0.228	Non-Liq.	0.0	23.5	0.05	0.02
25.0		13	1	115	5	20.5	23.5	1.179	1.179	0.96	0.95	0.94	1.20	19.9	53	0.0	19.9	0.97	0.216	0.233	Non-Liq.	0.0	19.9	0.08	0.07
27.5		14	1	115	5	25.5	28.5	1.466	1.451	0.94	0.85	0.99	1.20	20.4	54	0.0	20.4	0.91	0.221	0.246	0.90	0.0	20.4	1.15	0.34
32.5		8	1	115	5	30.5	33.5	1.754	1.582	0.92	0.82	1.00	1.11	10.5	39	0.0	10.5	0.92	0.113	0.260	0.44	0.0	10.5	2.53	1.52
37.5		11	1	115	5	35.5	38.5	2.041	1.714	0.89	0.79	1.00	1.15	14.3	45	0.0	14.3	0.91	0.155	0.274	0.56	0.0	14.3	1.97	1.18
42.5		2	1	115	5	40.5	43.5	2.329	1.845	0.85	0.76	1.00	1.10	2.4	18	0.0	2.4	0.89	0.053	0.281	0.19	0.0	2.4	6.89	4.13
47.5		21	1	115	5	45.5	48.5	2.616	1.977	0.80	0.73	1.00	1.27	27.9	63	0.0	27.9	0.83	0.341	0.301	1.14	0.0	27.9	0.10	0.06
51.5		14	1	115	5	50.5	53.5	2.904	2.108	0.75	0.71	1.00	1.17	16.7	49	0.0	16.7	0.87	0.180	0.279	0.65	0.0	16.7	1.71	0.82

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April 27, 2009 KM SL-15969-GA

LIQUEFACTION ANALYSIS - BORING 2 GROUNDWATER AT 25.0'

SAN LUIS OBISPO COUNTY FIRE STATION 43
Highway 229 at Irongate Road
Creston, California

Project: SLO County Fire Station 43, Creston, CA
Job No: SL-15969-SA
Date: 4/27/2009
Boring: B-2 Data Set: 1

Methods: Liquefaction Analysis using 1996 & 1998 NCEER workshop method (Youd & Idriss, editors)
Journal of Geotechnical and Enviromental Engineering (JGEE), October 2001, Vol 127, No. 10, ASCE
Settlement Analysis from Tokimatsu and Seed (1987), JGEE, Vol 113, No.8, ASCE
Modified by Pradel, JGEE, Vol 124, No. 4, ASCE

EARTHQUAKE INFORMATION:

Magnitude: 7.78 7.5
PGA, g: 0.33 0.36
MSF: 0.91
GWT: 14.5 feet
Calc GWT: 14.5 feet
Remediate to: 0.0 feet

SPT N VALUE CORRECTIONS:

Energy Correction to N60 (C_E): 1.25
Drive Rod Corr. (C_R): 1 Default
Rod Length above ground (feet): 3.0
Borehole Dia. Corr. (C_B): 1.15
Sampler Liner Correction for SPT?: 1 Yes
Cal Mod/ SPT Ratio: 0.63

Threshold Acceler., g: 0.05

Total (ft) Liquefied Thickness	Total (in.) Induced Subsidence
32	8.5

Required SF: 1.30
Minimum Calculated SF: 0.16

Base Depth (feet)	Cal Mod N	SPT N	Liquef. Suscept. (0 or 1)	Total Unit Wt. (pcf)	Fines Content (%)	Depth of SPT (feet)	Rod Length (feet)	Tot. Stress at SPT po (tsf)	Eff. Stress at SPT p'o (tsf)	rd	C_N	C_R	C_S	$N_{1(60)}$	Rel. Dens. Dr (%)	Trigger FC Adj. $\Delta N_{1(60)}$	Equiv. Sand $N_{1(60)CS}$	K_σ	M = 7.5 Available CRR	M = 7.5 Induced CSR*	Liquefac. Safety Factor	Post FC Adj. $\Delta N_{1(60)}$	$N_{1(60)CS}$	Volumetric Strain (%)	Induced Subsidence (in.)
								0.000																	
2.5	14	9	1	115	20	1.5	4.5	0.086	0.086	1.00	1.70	0.75	1.00	16.2	48	4.9	21.1	1.00	0.229	0.235	Non-Liq.	4.9	21.1	0.02	0.01
7.5		9	1	115	20	5.5	8.5	0.316	0.316	0.99	1.70	0.75	1.20	19.8	53	5.2	24.9	1.00	0.282	0.233	Non-Liq.	5.2	24.9	0.03	0.02
14.5		8	1	115	20	10.5	13.5	0.604	0.604	0.98	1.32	0.77	1.14	13.4	44	4.7	18.1	1.00	0.195	0.231	Non-Liq.	4.7	18.1	0.07	0.06
17.5		14	1	115	5	15.5	18.5	0.891	0.860	0.97	1.11	0.87	1.23	24.0	59	0.0	24.0	1.00	0.268	0.236	1.13	0.0	24.0	0.14	0.05
25.0		13	1	115	5	20.5	23.5	1.179	0.992	0.96	1.03	0.94	1.22	22.1	56	0.0	22.1	1.00	0.241	0.268	0.90	0.0	22.1	1.09	0.98
27.5		14	1	115	5	25.5	28.5	1.466	1.123	0.94	0.97	0.99	1.23	23.8	58	0.0	23.8	0.98	0.264	0.294	0.90	0.0	23.8	1.04	0.31
32.5		8	1	115	5	30.5	33.5	1.754	1.255	0.92	0.92	1.00	1.13	11.9	41	0.0	11.9	0.97	0.129	0.313	0.41	0.0	11.9	2.32	1.39
37.5		11	1	115	5	35.5	38.5	2.041	1.386	0.89	0.87	1.00	1.17	16.1	48	0.0	16.1	0.95	0.174	0.325	0.54	0.0	16.1	1.82	1.09
42.5		2	1	115	5	40.5	43.5	2.329	1.518	0.85	0.83	1.00	1.10	2.6	19	0.0	2.6	0.93	0.054	0.329	0.16	0.0	2.6	6.34	3.80
47.5		21	1	115	5	45.5	48.5	2.616	1.649	0.80	0.80	1.00	1.29	31.2	67	0.0	31.2	0.88	1.200	0.341	3.52	0.0	31.2	0.00	0.00
51.5		14	1	115	5	50.5	53.5	2.904	1.781	0.75	0.77	1.00	1.19	18.4	51	0.0	18.4	0.86	0.199	0.336	0.59	0.0	18.4	1.63	0.78

LIQUEFACTION ANALYSIS - BORING 2
GROUNDWATER AT 14.5'

SAN LUIS OBISPO COUNTY FIRE STATION 43

Highway 229 at Irongate Road
Creston, California

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April 27, 2009 KM SL-15969-GA