Appendix E-4

2023 Re-evaluation of the Portion of the Cherry Valley Fault

City of Calimesa
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"Preserving and enhancing the open space atmosphere and quality of life in Calimesa"

October 2, 2023

Petra Geosciences, Inc.
42-240 Green Way Suite E
Palm Desert, CA 92211
Attn: Alan Pace, Senior Associate Geologist

RE: Tentative Tract Map 33931, Mesa Verde Development – Re-evaluation of the Cherry Valley Fault

Dear Mr. Alan Pace:

The City's Engineering Department has reviewed the provided Cherry Valley Fault Re-Evaluation Study dated March 9, 2023 for the Mesa Verde Project. Based on the City's review, there are no comments and the City accepts the recommendations presented in the report.

This completes the review for the subject project. Please contact Travis Bradshaw at tbradshaw@cityofcalimesa.net or (909) 795-9801 for questions or clarifications.

Sincerely,
Travis Bradshaw

Travis Bradshaw
Associate Engineer

March 9, 2023
J.N. 21-303

MESA VERDE OWNER, LLC
18565 Jamboree Road, Suite 200
Irvine, California 92612

Attention: Mr. David Graves

Subject: Re-evaluation of the Portion of the Cherry Valley Fault, Currently Identified as a Potentially Active Fault, Traversing the Revised Tentative Tract Map 33931, *Mesa Verde Project,* Located Adjacent and South of the San Bernardino/Riverside County Line, Approximately One Mile North of San Timoteo Road, City of Calimesa, Riverside County, California

Reference: Fault Investigation, Oak Valley at Calimesa, Riverside County, California; report prepared by Petra Geotechnical, Inc. and Hushmand Associates, Inc., J.N. 04-238 dated October 20, 2004.

Dear Mr. Graves:

Petra Geosciences, Inc. (Petra) is submitting this report presenting the results of our re-evaluation of potential active faulting within the Mesa Verde project in the city of Calimesa.

Mesa Verde Project Fault Evaluation Overview

General

The Cherry Valley Fault has been identified by the County of Riverside as being potentially active and, therefore, the presence and/or absence of active faulting must be evaluated by a State of California Professional Geologist (PG).

Site-Specific Evaluation

A part of the Mesa Verde project lies within a zone of potentially active faulting associated with the Cherry Valley Fault. Following a site-specific evaluation for the subject site, the referenced Petra/Hushmand report states:

> "*Early Holocene faulting for the eastern portion of the site cannot be ruled out because slightly older sediments with ages closer to the Holocene/Pleistocene boundary are not present. Therefore, setbacks for habitable structures were recommended*".

<u>Additional Evaluations and Recent Activities</u>

Based on our review of recently available investigation reports, completed either concurrently or after the Petra/Hushmand 2004 report, we have found new information on segments of the Cherry Valley Fault. Based on this data, the segments of Cherry Valley Fault to the east of the Mesa Verde project that previously considered potentially active, have been determined to be inactive, please see Literature Reviewed, attached.

Petra summarized this new data in a report for submittal to the City of Calimesa for a project east of Mesa Verde project. The City has accepted our report and the conclusion that the Cherry Valley Fault can be considered inactive for that location.

<u>Current Re-evaluation</u>

This report presents a narrative that the potentially active fault within the Mesa Verde project can also be considered inactive and building setback for habitable structure are not necessary.

Petra has prepared this report presenting a summary of the existing data. The existing data is contained in 4 consultants' reports, reports by the California Geologic Survey and reports by geologic researchers. As such, our evaluation consisted of the following scope of work:

- Collection and review of readily available and previous geotechnical reports, literature and plans concerning soil and geologic conditions existing within the site. All reports reviewed are provided herein, as Attachments to this report.
- Performing a detailed review of available aerial photographs for analysis of faulting.
- Attending a meeting with the City Geologic Reviewer, if necessary.
- Preparing this report and presenting the results of our evaluation.

DATA REVIEW

<u>Craig Smith, Engineering and Geology 1988 Report</u>

Craig Smith (Smith, 1988) investigated the project now known as the Heights at Calimesa. Below, in italics, are excerpts from the Craig Smith (Smith, 1988) report:

> *Based on the trenching program and field observations, major movement along these faults occurred during deposition of the Pleistocene Sediments but before deposition of the younger Holocene deposits. Faulting in the younger beds has not been observed in this study nor reported by others. The trace of the ENE trending Banning fault is well defined and is located about 3000*

feet northeast of the project. Earthquake activity on the fault has occurred during recorded history east of the City of Banning. However, no activity has been reported on the portion West of Banning. Matti, et al in their study of the Banning fault have concluded that the westerly segment of it, near the site is now inactive. Inasmuch as the Cherry Valley Faults are en-echelon to the Banning fault, are minor features as compared to the Banning fault, and their past activity has probably been an integral portion of the movement of the Banning fault, it is concluded that these faults are inactive.

One fault system was found in Trench 6A and is believed to be the southerly en-echelon fault shown on sheet 98 of the seismic element map. Based on the observed data and findings of others, it is our opinion that the fault is inactive and that building set back limits are not required.

Leighton Consulting Inc. August 3, 2004, Report

In 2004, Leighton Consulting Group (Leighton, 2004) conducted a subsurface investigation to determine the activity of the Cherry Hills fault at the Sunny Cal Egg Ranch property, located south of Cherry Valley Boulevard, north of Brookside Avenue, and the Danny Thomas Ranch property, located north of Cherry Valley Boulevard. Figure 1 shows the relation of the Sunny Cal and Danny Thomas properties in relation to the Heights at Calimesa Project. The investigation included mapping, trenching and soil-age dating. The soil age dating was accomplished by Ms. Tania Gonzalez of Earth Consultants International (ECI). The Leighton report with the ECI report is included in Attachment A of this report.

Below, in italics, are excerpts from the Leighton Consulting Inc. (Leighton, 2004) report:

No evidence of active faulting was observed within the entire lengths of Trenches T-3, T-4, T-6, T-7, or T-8. These trenches exposed Plio-Pleistocene aged San Timoteo Formation Bedrock and Pleistocene aged older alluvial sediments that have been indirectly aged to be older than 11,000 years old.

A fault was observed within Trenches T-1, T-2, and T-5 at approximate Stations 0+60, 0+25, and 0+90, respectively. Within Trenches T-1 and T-2, the fault was observed at the very near subsurface, buried by a minimal amount of Holocene aged sediment. The fault was not observed to penetrate this sediment. The same fault was encountered within Trench T-5 and was observed to be buried by approximately 9 feet of Holocene and Pre-Holocene aged sediment (estimated to be in excess of 20,000 years old). The fault was not observed to penetrate soils younger than 11,000 years old and as such is considered inactive. In addition, there is little geomorphic evidence to suggest the fault is active. It appears the fault transects the hill to the west of Trench T-5 and is buried by older alluvium east of T-1 (see Plate 1). Based on the findings summarized within this *report, no fault related structural setback or other remedial measures related to surficial ground rupture due to faulting are required for construction within the subject site.*

<u>C.H.J. Inc. August 3, 2005, and September 15, 2006, Reports</u>

In August of 2005, C.H.J. Inc. (CHJ, 2005) submitted a report of active faulting for Tentative Tract No. 30545, located north of Cherry Valley Boulevard, partly in the city of Calimesa. The location of the CHJ investigation is shown on Figure 1. Below, in italics, is an excerpt from the C.H.J. Inc. (CHJ, 2005) report:

The site is traversed by a Fault Hazard Management Zone designated by-the County of Riverside to include traces of suspected active faulting associated with the Cherry Valley fault. Geologic mapping and subsurface investigations conducted by this firm identified traces of two fault splays associated with the Cherry Valley fault zone trending northwest/southeast across the site. Based on our subsurface investigation, we conclude that the southern of the two faults is inactive. The age of activity of the northern splay (North Branch) could not be determined based on the geologic conditions at the site.

After the CHJ 2005 report had been completed they issued an update to the 2005 report utilizing new off-site subsurface information regarding the northerly fault (Cherry Valley Fault - North Branch) located at the site (CHJ, 2006). The new information was the Leighton's (Leighton, 2004) report. The updated report superseded the previous recommendations about the Recommended Restricted Use Zone (RRUZ) in the northeast portion of the site. Below, in italics, is an excerpt from the C.H.J. Inc. (CHJ, 2006) report:

Based on the evidence from Leighton's investigation, we conclude that the fault (Fault B) mapped by Leighton (2006) and the Cherry Valley - North Branch mapped by this firm are the same geologic feature. Additionally, based on the soil age estimates of the alluvial soils reported by Leighton of unruptured soils across the fault trace, we conclude that the Cherry Valley Fault - North Branch mapped at the subject site is considered inactive as defined by the State of California and are recommending that the RRUZ associated with the Cherry Valley fault - North Branch be removed.

<u>Petra Geotechnical, Inc. /Hushmand &Associates 2004) Report (Referenced)</u>

In October of 2004, the Petra/Hushmand team investigated a project referred to as Oak Valley at Calimesa for Fiesta Development. The project is currently referred to as the Mesa Verde project and is being planned by Shopoff Group.

Our investigation found the fault exhibits evidence of Quaternary activity. The western portion of the fault investigated during this study was not found to be active in the Holocene time (about the last 11,000 years). However, soil age dating found unfaulted material with an age about 5,000 years before the present. Soils greater than 11,000 years old was not found within the eastern section and therefore the fault was considered to be potentially active and recommendations for structural setbacks for habitable structures within the eastern portion of the site were recommended.

CONCLUSION

Activity has been attributed to sections of the Cherry Valley fault due to lack of observable unfaulted soils on the order of or older than 11,000 years. Where Holocene age soils have been observed they demonstrate inactivity. Accordingly, some sections of the Cherry Valley fault have been deemed potentially active and some sections have been deemed inactive. It is our opinion that the soil age dating adjacent to the Height at Calimesa Project and the Mesa Verde Project is representative of the inactivity of the Cherry Valley fault. Accordingly, structural setbacks for habitable structures are not recommended.

Should you have questions regarding the contents of this report or should you require additional information, please contact this office.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

PROFESSIONAL GEOLOGIST
NO. EG1952
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Alan Pace
Senior Associate Geologist
CEG 1952

AP/EL/JC/SJ/lv

Attachments: Literature Reviewed
Leighton Consulting Inc. August 3, 2004 Report
C.H.J. Inc. August 3, 2005 Report
C.H.J. Inc. September 15, 2006 Report
Petra Geotechnical, Inc. October 20, 2004 Report

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LITERATURE REVIEWED

C.H.J, Inc., 2005, Subsurface Investigation of Faulting Cherry Valley Gateway Project, Tentative Tract No. 30545, Northeast Of Cherry Valley Boulevard and Interstate 10, Cherry Valley Area Riverside County, California; prepared for TSG Cherry Valley, L.P., Job No. 04806-8, dated August 3.

_______, 2006, Update to Subsurface Investigation of Faulting, Cherry Valley Gateway Project, 244± Acres Northeast of Cherry Valley Boulevard and Interstate 10, Cherry Valley Area, Riverside County, California, dated September 15.

Leighton Consulting, Inc., 2004, Fault Investigation Report, Danny Thomas Ranch Portion of the Sunny-Cal Egg Ranch Project, North of Cherry Valley Boulevard, East of Interstate 10, Cherry Valley Area of Unincorporated Riverside County, California, dated August 3.

ATTACHMENTS

ATTACHMENT

LEIGHTON CONSULTING INC. AUGUST 3, 2004 REPORT

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

August 3, 2004

Project No. 600390-002

To: Ms. Kathi Berman
37251 Cherry Valley Boulevard
Cherry Valley, California 92223

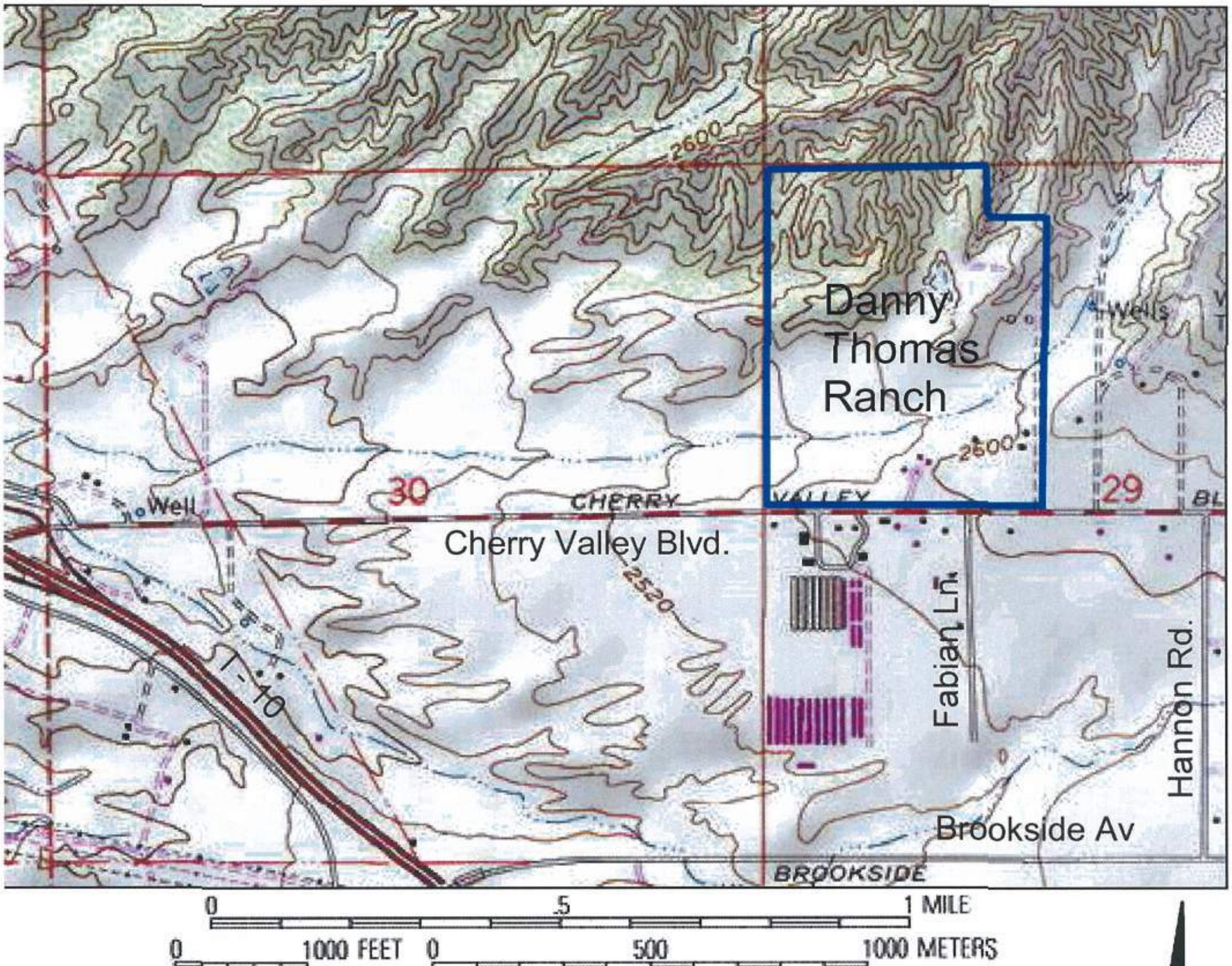
Subject: Fault Investigation Report, Danny Thomas Ranch Portion of the Sunny-Cal Egg Ranch Project, North of Cherry Valley Boulevard, East of Interstate 10, Cherry Valley Area of Unincorporated Riverside County, California

Introduction

In accordance with your authorization, Leighton Consulting, Inc. has conducted an investigation on the conditions of faulting at the Danny Thomas Ranch portion of the Sunny-Cal Egg Ranch project, located north of Cherry Valley Boulevard, and east of Interstate 10 in the Cherry Valley Area of unincorporated Riverside County, California. The purpose of the investigation was to identify if faulting is present within the Riverside County designated Earthquake Fault Zone onsite, and if so, to determine the approximate age of faulting. This report and its conclusions are intended to assist you with the proposed conceptual development plans for the site. A draft report addressing the general geologic and soils engineering aspects of the site has been previously submitted (Leighton, 2004b).

Site Location and Description

The project site is approximately 123-acres in area and is located north of Cherry Valley Boulevard and west of Hannon Road in the Cherry Valley area of unincorporated Riverside County, California (see Figure 1, Site Location Map). The Cities of Calimesa and Beaumont are located northwest and southeast of the site respectively. The majority of the northern half of the Ranch is in a natural state, occupied by mountainous badlands-type topography typical of this area of Riverside County. A utility easement is present near the toe of the slope of these hills, transecting the site from east to west. Vegetation in this mountainous portion of the site



Map created with TOPO!® ©2003 National Geographic (www.nationalgeographic.com/topo)

Danny Thomas Ranch Portion of the Sunny-Cal Egg Ranch Project. North of Cherry Valley Blvd., East of Interstate 10, Unincorporated Riverside County, California	SITE LOCATION MAP	PROJECT NO. 600390-002 DATE August, 2004	Figure No. 1

generally consists of shrubs and grasses. A large west draining valley transects the southern portion of the site with the badlands topography located to the north and an elevated older alluvial terrace to the south of the valley. Vegetation south of the mountainous portion of the site is disturbed due to present and past grazing and agricultural activities, and generally consists of mustard weeds and grasses.

Based on our aerial photograph review and site visits, it appears that the east-central portion of the site, north of the valley area was graded sometime between 1962 and 1974 for livestock and agricultural purposes. Aerial photographs also indicate that a low bedrock ridge, north of the Danny Thomas House on the north side of the valley, was excavated and portions of the valley had been filled. An earthen dam was constructed in the central portion of the site, across the larger southwest trending gully that descends from the hillside towards the main west-trending valley. Numerous structures are present onsite, and include the Danny Thomas house, located in the south-central potion of the site, a residence located within the southeastern portion of the site, barns and corrals for livestock in the east central portion of the site, and a water well and pump house within the southwestern portion of the site. The approximate limits of the undocumented fill and existing structures onsite are shown on the Geologic Map (Plate 1, In Pocket).

Topographic relief across the site is variable, ranging from moderately steep (locally steeper than 2:1 horizontal to vertical), 150-foot tall slopes within the bedrock areas onsite, to gently sloping alluvial drainages. The site generally drains to the south and west.

Previous Geologic/Geotechnical Work

Previous regional geologic studies including the general site area have been conducted by Morton (2004), Greenwood and Morton (1991), and Dibblee (1982). In addition, we have recently completed a summary letter of significant geotechnical constraints (Leighton, 2004a), and have prepared a draft report of the geotechnical portion of the Environmental Impact Report (EIR) for the Sunny-Cal Egg Ranch Project (Leighton, 2004b). Documents including maps, aerial photographs, and other sources used during the investigation are referenced in Appendix A.

Purpose and Project Scope

Roughly the southern half of the Danny Thomas Ranch property has been designated as an Earthquake Fault Zone on the 1999 County of Riverside Environmental Hazards Map, and the subsequent 2003 County of Riverside General Plan Earthquake Fault Study Zones Map (County of Riverside, 1999 and 2003). The approximate limits of the County designated fault study zone are shown on the Geologic Map (Plate 1). Based on our conversation with Mr. Wayne Harrison, the former Chief Engineering Geologist with the County of Riverside, the County designated fault zone is to be treated in accordance with the State of California, Alquist-Priolo Earthquake Fault Zoning Act of 1972 (Hart and Bryant, 1999). The purpose of this Act is to mitigate the hazard of fault rupture by prohibiting the construction of structures intended for human occupancy across active faults. Because recent activity is believed to be an indicator of future movement, an active fault is one in which movement has occurred sometime within the past 11,000 years. The Act requires that fault investigations be conducted for development projects within an Earthquake Fault Zone to evaluate the conditions of faulting, determine if any active traces of the fault exist in the project area and if so, to recommend appropriate mitigation. Typical mitigation includes locating or setting back the development away from the trace of the active fault. This fault investigation was intended to identify the presence of active faults traversing the County of Riverside Earthquake Fault Zone, and evaluate their possible impact on the proposed development. The scope of our investigation included:

- Review of readily available reports and maps pertinent to the site. The references are listed in Appendix A.

- Review, of vertical, sequential, stereo aerial photographs taken in the site area between 1948 and 1984. The aerial photos were reviewed in an attempt to identify any continuous lineaments or geomorphic evidence of active faulting across the site. A listing of aerial photographs reviewed is included in Appendix A.

- A meeting and other discussions with Mr. Douglas Morton, geologist with the United States Geologic Survey (USGS). Mr. Morton has conducted geologic mapping and other geologic studies in the region including the project area for many years.

- Coordination with Underground Service Alert (USA) and Sunny-Cal Egg Ranch representatives familiar with the Danny Thomas Ranch property to have underground services and/or utility easements located prior to the beginning of our field investigation.

- Excavation and geologic logging of eight fault trenches, T-1 through T-8 (totaling approximately 1,870 lineal feet) within the Riverside County Earthquake Fault Zone, between May 18, 2004 through June 11, 2004. The trenches generally ranged in depth from 10 to 20 feet and were benched in accordance with Cal-OSHA guidelines. The trenches were backfilled without the use of any compaction standards. The trench locations are shown on the Geologic Map, Plate 1 (In Pocket). Drafted copies of the trench logs are included as Plates 2, 3 and 4 (In Pocket).

- Soil stratigraphic age estimates were performed by Earth Consultant International (ECI), acting as our subconsultant. Soils present within the exposed deposits were analyzed and compared to dated soils from the region to estimate the age of the deposits. Their report is included as Appendix B. ECI's soil profile locations are shown on the trench logs, Plates 2, 3 and 4 (In Pocket).

- Two charcoal samples obtained from representative areas within Trench, T-1 were sent to Beta Analytic Inc., in Miami, Florida for radiocarbon dating. The sample locations are shown on the log of Trench T-1 (Plate 2). The results of the radiocarbon tests are provided in Appendix C.

- Field meeting to review the fault trenches and our interpretations with Mr. David Jones, geologist for the County of Riverside on June 11, 2004.

- The locations and limits of each trench, and the locations of the fault (where encountered within the trenches), were surveyed by representatives of The Keith Companies (TKC) on June 11, 2004. The locations and limits of the trenches and the location of the fault are shown on Plate 1.

- Preparation of this report summarizing the findings and conclusions.

FINDINGS

Geologic Setting

The site is located in the northern end of the San Gorgonio Pass area of Southern California near the intersection of the San Bernardino Mountains of the Transverse Range Geomorphic Province, and the San Jacinto Mountains of the Peninsular Ranges Geomorphic Province. The Peninsular Ranges province extends approximately 900 miles southward from the Santa Monica Mountains to the tip of Baja California (Yerkes, et al., 1965). The province is characterized by elongate northwest-trending mountain ridges separated by intervening, sediment-floored valleys. However, the most dominant structural features of the province are the northwest trending fault zones, most of which either die out, merge with, or are terminated by the steep reverse faults at the southern margin of the Transverse Ranges province. The major northwest trending fault zones include the San Jacinto, Whittier-Elsinore, and Newport-Inglewood. The Transverse Ranges province extends approximately 310 miles westward from the Mojave Desert to the Pacific Ocean. Uplift and shortening of the Transverse Ranges began approximately 3.5 million years ago (mid-Pliocene Epoch) and is continuing today (Stille, 1936; Woodford et al., 1954; Wright, 1991). The San Fernando Valley, and the Santa Monica, San Gabriel and San Bernardino Mountains are the most prominent topographical features which comprise the Transverse Ranges.

The dominant structural feature within this region which bounds the two provinces is the active San Andreas transform system that consists of several major northwest trending, right lateral strike slip faults. The San Andreas Fault Zone (SAFZ) is located approximately 6 miles northeast of the site. The active Banning Fault Zone, considered a branch of the SAFZ, is located approximately 4,000 feet north of the northern end of the site, and the San Jacinto Fault Zone is located approximately 7 miles southwest of the site. This area of Southern California has, and is continuously experiencing major crustal disturbance as the SAFZ marks the boundary between the Pacific and North American Plates. The Peninsular Ranges geomorphic province, located on the Pacific Plate is moving northwesterly relative to the Transverse Ranges Geomorphic Province, located within the North American Plate. The bulk of the generally right-lateral transform movement between the plates is occurs along the SAFZ and its associated faults. The San Gorgonio Pass is an area which is continually being contorted between the SAFZ and the San Bernardino Mountains to the north, and the San Jacinto Fault Zone and San Jacinto Mountains to the south. Numerous thrust faults have been mapped in this general site vicinity, due to the ongoing regional tectonic activity in the area. The Regional Fault Map (Figure 2) presents a generalized depiction of the major faults in this area of Southern California. The location of major historical earthquakes in the region is shown on the Regional Seismicity Map (Figure 3).

The present landscape onsite is the result of this tectonic activity, erosion and previous grading activities.

Earth Units

Surficial soil deposits (including undocumented artificial fill, alluvium, and older alluvium) and San Timoteo Formation bedrock underlie the project area. The approximate limits of the earth units as presented on our Geologic Map (Plate 1), and Trench Logs (Plates 2, 3, and 4) are based on regional mapping by others (Morton, 2004 and unpublished mapping), our aerial photograph interpretation, and the findings of our field investigation. Descriptions of the individual units (Plate 2) are based on the units as observed during our field investigation.

Undocumented Artificial Fill (Map Symbol: Afu)

We have mapped undocumented artificial fill in various areas of the project area. Fill has been mapped in the vicinity of the main residence onsite (the Danny Thomas House), and is probably related to initial grading for the house. Undocumented fill is also present as an earthen dam across one of the main, southwest draining gullies within the central portion of the property. Undocumented fill is also expected in the central portion of the north side of the east-west trending valley, adjacent to the bedrock ridge which has been graded in the past. Uncontrolled fill is likely to be present in other areas of the site as a result of past agricultural uses, and previous structures built onsite. To the best of our knowledge, the fill is undocumented and was placed without significant compaction effort. Undocumented artificial fill was not observed within the trenches excavated during this investigation. The approximate limits of the fill is shown on Plate 1.

Alluvium and Older Alluvium (Map Symbols: Qal and Qalo)

The low lying areas of the site have been mapped as being blanketed by younger (Holocene aged) alluvial deposits, deposited on valley floors (Morton, 2004). The younger alluvium consists of predominately poorly consolidated silty fine sand with scattered channels of sand and gravel. A detailed description of the unit is provided on Plate 2. The limits of the unit is shown on the Geologic Map (Plate 1), and the accompanying trench logs (Plates 2, 3 and 4).

The elevated terrace, located immediately north of Cherry Valley Boulevard, has been mapped as middle Pleistocene aged, older alluvium (Morton, 2004). Older alluvium was also observed at an average depth of 4 to 5-feet below the younger alluvial soil in the large east-west trending valley onsite. The older alluvium consists of poorly to moderately indurated, silty, fine to medium grained sand with gravel, with interfingered channels of fine to coarse-grained sand with gravel and cobbles. The unit is moderately bedded within the sloped portion of Trench T-3, and the beds are generally subhorizontal. Numerous areas within Trench T-1 exposed faint to well developed soil horizons within the unit. A detailed description of the older alluvium is provided on Plate 2. The approximate limits of the older alluvium, is shown on the Geologic Map (Plate 1), and the accompanying trench logs (Plates 2, 3 and 4).

Both alluvium and older alluvium were observed in each of the trenches excavated during this investigation.

San Timoteo Bedrock-Middle Member (Map Symbol: Tstm)

Bedrock of the terrestrially deposited, middle member of the Plio-Pleistocene aged, San Timoteo Formation has been mapped in the northern, rugged portion of the Danny Thomas Ranch (Morton, 2004). Where observed, the San Timoteo Formation consisted of moderately to poorly bedded sandstone and conglomerate with cobbles to a maximum dimension of about 18 inches. The clasts within the unit have been derived from the adjacent mountains of the Transverse Ranges Geomorphic Province (Morton, 2004), and were typically observed to be highly weathered to decomposed. The unit has been dated as Plio-Pleistocene based on vertebrate fauna observed within the unit (Morton, 2004). Bedding orientations within the bedrock were observed to be highly variable, ranging from subhorizontal to near vertical, and the bedrock slightly to highly fractured and faulted in the areas investigated. Beds were generally 6 inches to over 4 feet in thickness. This unit was observed during this investigation within the northern ends of Trenches T-1, T-2, T-5, T-6 and T-7. A detailed description of the bedrock is provided on Plate 2. The limits of the San Timoteo Formation is shown on the Geologic Map (Plate 1) and the accompanying trench logs (Plates 2, 3 and 4).

Although not observed during the investigation, the San Timoteo Formation bedrock is expected to be underlain at depth by the fluvial-lacustrine deposited, Miocene to Pliocene aged Mount Eden Formation (Morton, 2004).

Groundwater

The depth to groundwater beneath the Sunny-Cal Egg Ranch site is currently on the order of 300 feet, based on information from onsite wells provided by the owner. No historic groundwater data for the area was available for our review.

Groundwater or seepage was not encountered in any of the trenches excavated for this investigation or during any of the explorations during our previous investigation of the site (Leighton, 2004b).

Geologic Map Review

The site is not located within a State of California Alquist-Priolo Earthquake Fault Zone (CGS, 2000) however, the majority of the southern portion of the site has been designated as an Earthquake Fault Zone on the 1999 County of Riverside Environmental Hazards Map, and the subsequent 2003 County of Riverside General Plan, Earthquake Fault Study Zones Map (County of Riverside, 1999 and 2003). The approximate limits of the county designated zone are shown on the Geologic Map (Plate 1). The limits of the zone are approximate due to the differences in scale between the County of Riverside Fault Study Zones Map, and the base map used for the project.

As a part of the investigation, we have reviewed the regional geologic maps for the general site vicinity prepared by Dibblee Jr., Morton, and Greenwood and Morton. A summary of this previous mapping with respect to the conditions of faulting onsite is provided below:

Mapping by Dibblee, (1982)

Regional mapping of the area conducted by Dibblee notes similar geologic units on the site as described previously and in the general location as mapped by others (Morton, and Greenwood and Morton, see below). However, Dibblee maps the contact between the San Timoteo Formation bedrock and the recent and older alluvium as depositional and not a fault contact. He does not note the presence of a fault on the site.

Mapping by Morton (2004, and unpublished mapping), and Greenwood and Morton (1991)

Regional mapping by Greenwood and Morton in 1991 indicated the presence of two faults within the central and southern portions of the site. The southern fault, as mapped, was located within the Riverside County designated Earthquake Fault Zone while the central fault was not. Regional mapping by Morton in 2004 indicated the presence of a fault located in the southern portion of the site. We met with Mr. Morton, of the USGS to discuss the faults mapped through the site. Mr. Morton participated in much of the regional geologic mapping previously conducted in the site area (Morton, 2004, and unpublished mapping, and Greenwood and Morton, 1991). Mr. Morton indicated that the 2004 Geologic Map superceded the 1991 Geologic Map for the subject area. Based on our meeting with Mr. Morton, and our review of updated geologic maps (Morton, 2004 and unpublished mapping), and aerial photographs (see below) the central fault is not believed to be present onsite as previously mapped (Greenwood and Morton, 1991). The southern fault as mapped by Morton (unpublished mapping) was depicted as a thrust fault, juxtaposing Plio-Pleistocene aged San Timoteo Formation bedrock against middle Quaternary aged alluvial (stream/riverbed) deposits. The fault was mapped as buried by the young (Holocene aged) alluvium within the large east-west trending valley which transects the southern portion of the site.

The trenching program was designed to address the issue of active faulting onsite with regard to the entire Riverside County designated Earthquake Fault Zone and the southern fault as mapped by Morton and as interpreted by us from the aerial photograph review (see below).

Aerial Photograph Review

A review of vertical, sequential, stereo aerial photograph pairs was conducted in an attempt to identify possible geomorphic evidence of faulting. Various photos taken between 1948 and 1984 were reviewed, a listing of which is presented at the end of Appendix A.

Based on the aerial photograph review, west of the project site, strong geomorphic expression in the form of a sharp lineation is located in the area of the southern fault as mapped by Morton (2004). This lineation displays a roughly N60W orientation within the San Timoteo Formation derived hills, west of the site. This lineation trends toward the central portion of the large east-west trending valley onsite. No geomorphic expression was observed in the younger or older alluvial soils located within or south of the valley in the photographs we reviewed. However, it appears that just west of the project area, the fault curves to an approximate orientation of N80W to east-west, roughly bordering the existing toe of slope on the northwestern portion of the valley (see Plate 1). The fault trenches excavated during this investigation crossed the possible projections of this lineament along the toe of natural slope and across the large, west draining trending valley.

The location of the central fault as mapped by Greenwood and Morton (1991) coincides with a small, east-west trending gully onsite, north of the larger east west trending valley. No other significant lineations were observed in the site area.

The active Banning Fault Zone is also visible within the aerial photographs reviewed, and is located offsite, approximately 4,000 feet north of the northern end of the site. The Banning Fault Zone is observed as a very strong lineation, trending roughly N70W.

Soil Age Estimates

The younger alluvial deposits (Qal) onsite have been mapped as being Holocene in age (Morton, 2004). The older alluvial deposits (Qalo) onsite have been mapped as being middle Pleistocene in age (Morton, 2004). Based on the State of California, Alquist-Priolo Earthquake Fault Zoning

Act of 1972 (Hart and Bryant, 1999), an active fault is one in which movement has occurred along the fault sometime within the past 11,000 years. As such, if a fault is present at a site, and is observed to be buried by soils that are directly or indirectly aged to be older than 11,000 years, the fault is deemed inactive and no mitigation measures are required. To constrain the age of the onsite soils excavated during the investigation, age estimates of the onsite soils were made using both soil stratigraphic age estimates, and radio carbon dating.

Soil-Stratigraphic Age Estimate

Age estimates of the earth units encountered were made utilizing soil-stratigraphic techniques, prepared by Earth Consultants International (ECI) acting as our subconsultant. Age estimates where determined for two locations (profiles) within Trench T-1 and one profile within Trench T-5 (see Plates 2, 3, and 4 for the profile locations). The soil horizons exposed within the profiles were analyzed and compared to dated soils from the region to estimate the age of the deposits. The ages of the dated horizons were added to one another in order to estimate the age of the entire profile. The soils analyzed were representative of the soils encountered throughout the trenches excavated during this investigation.

The profiles analyzed within Trench T-1 indicated that the soils trenched at depth were pre-Holocene in age. Specifically, the soil profiles were dated to have a minimum age of approximately 34,000 years before the present. However, due to the variable depositional environment on site, it is likely that the ages of the soil exposed within the trenches onsite are more likely on the order of 100,000 to 400,000 years old.

The thickness of the analyzed soil profile located above the fault as encountered within Trench T-5 was considerably less than that of the profiles within Trench T-1, as such the age of the soil was estimated to be considerably younger. However, the minimum age of the soil overlying the fault encountered within Trench T-5 was also determined to be pre-Holocene in age. Specifically the overlying soil is estimated to have a minimum age of approximately 20,000 years before the present. However, due to the variable depositional environment on site, it is likely that the ages of the soil exposed within the trenches onsite are more likely on the order of 60,000 years old.

The complete ECI report is included as Appendix B.

Radio Carbon Dating Age Estimate:

Two small detrital charcoal samples collected from Trench T-1 were dated in an attempt to constrain the age of the older alluvial soil encountered throughout the trenches. The older alluvial soils observed during the investigation contained scattered charcoal detritus, likely *deposited during past storms in which charcoal was washed into the channel along with soil from* a source upstream of the site. The charcoal samples were collected using a pocket knife and foil paper with no direct human contact being made during the collection process. The samples were then carefully wrapped in foil paper and overnighted to Beta Analytic, Inc. located in Miami, Florida.

The two samples dated were obtained from Trench T-1 within the older alluvial soils. The first sample (Sample T-1@Sta435) was collected at Station 4+35, from 3-feet above the bottom of the trench. The second sample (Sample T-1@Sta525) was collected at Station 5+25, from 1.5-feet above the top of the first (lower) bench. The approximate sample locations are depicted on the Log of Trench T-1 (see Plates 2 and 3).

The samples where dated using carbon dating, which is based on the radioactive decay of the carbon atom. The samples were tested by Beta Analytic Inc. using the Accelerator Mass Spectrometry (AMS) method. AMS dating involves the conversion of minute amounts of carbon and reducing this carbon to graphite. Carbon-14 (C^{14}) ions are then detected within the graphite using an accelerator-mass-spectrometer. The age estimate is produced based on the amount of C^{14} within the sample compared to the amount of decayed carbon in the sample. Test results indicated the following age estimates for the two samples tested:

Sample Name	Location (Station Number)	Approximate Depth (Below Existing Ground Surface)	Estimated Age (Years Before Present)
T-1@Sta435	4+35	12-feet	3000 +/- 40
T-1@Sta525	5+25	6.5-feet	510 +/- 40

Numerous factors have led us to believe that these findings are anomalous. The results of ECI's soil-stratigraphic age estimates indicate that the age of stratigraphic horizons overlying the depths of the subject samples to be at a minimum, tens of thousands of years old. ECI noted numerous buried soil horizons within the older alluvium onsite, each of which requires thousands of years to develop. We have discussed the findings of the radio carbon age estimates with ECI and they have stated their utmost confidence in the age estimates provided within their report (Appendix B). Considering that the climate and environment of the subject site (and all of Southern California) has not substantially changed within the last 3,000 years, it is arduous to believe that a 12-foot thick section of sediment could have accumulated in such an environment within such a relatively short period of time. Although radio carbon age estimates have proven accurate in studies similar to the subject project, problems do arise while dating carbon collected from buried soil horizons. In this case, we believe it is likely the carbon samples dated were contaminated via bioturbation of the soil. As such, the reported radio carbon age estimates are not considered representative for the ages of the subject soils encountered onsite.

The results of the radiocarbon tests are provided in Appendix C.

Field Investigation

A total of eight fault Trenches (T-1 through T-8) were excavated between May 18, 2004 and June 11, 2004, totaling approximately 1,870 linear feet. The trenches were excavated using a subcontracted John Deere "JD450" track mounted excavator with a 5-foot wide bucket. The trenches generally ranged in depth from 10 to 20 feet and were benched in accordance with Cal-OSHA guidelines, at approximately 5-foot vertical intervals. After excavation, the lowest and mid bench of the east wall of each trench was cleaned to allow a clear view of the soils exposed. A level line was hung on the lowest bench along the length of each trench using nylon string, nails and a pocket level. The trenches were logged at a scale of 1-inch equal to 5 feet. The locations and limits of the trenches, and the fault (as encountered in Trenches T-1, T-2, and T-5) were surveyed by representatives of The Keith Companies on June 11, 2004.

Trenches T-1 and T-3 were excavated to evaluate if active faulting was present within the Riverside County designated Earthquake Fault Zone, as depicted on Plate 1. Faulting was observed within northernmost portion of Trench T-1 (at approximate Station 0+60). Faulting was not observed in Trench T-1 south of Station 0+60, or within the entire length of Trench T-3.

During our investigation, faulting was observed within Trenches T-1, T-2, and T-5. In each trench, the main fault was observed as a 2 to 6-inch thick, yellowish red (5YR 4/6), clay to sandy clay gouge zone that was hard and dry and appeared highly weathered. The fault was generally observed to be tight with local rootlet growth. In general, the fault was oriented N60W to East-West, dipping to the north at a moderate 25 to 40 degrees. The main fault appeared to be a thrust fault, juxtaposing San Timoteo Formation bedrock on the north (hanging wall) with either a different unit of the San Timoteo Formation bedrock, and/or older alluvial soils on the south (footwall). Minor offset along beds within the San Timoteo Formation bedrock was also noted, particularly in the near vicinity of the fault. Trenches T-1 and T-2 were the initial trenches excavated to locate the fault and evaluate the recent activity of the fault. Within Trenches T-1 and T-2 (at approximate Stations 0+60 and 0+25, respectively) the gouge zone was massive, lacking significant striations and/or planar surfaces. However, faintly polished lineations roughly parallel to the direction of faulting were observed within the gouge fault zone in Trench T-5 (at approximate Station 0+90). Faulting was not observed within any of the other trenches excavated onsite.

The fault extended to within 4 feet of the surface in Trench T-1 and within 2 feet of the surface in Trench T-2. The soil above the fault in these trenches was composed of Holocene-aged alluvial soil. The soil above the fault in Trench T-2 was disturbed due to past tilling. The fault as observed within Trenches T-1 and T-2 juxtaposed moderately bedded sandstone on the hanging wall with massively bedded silty sandstone to conglomerate on the footwall. Approximately 30 lateral feet of bedrock was observed on the footwalls, becoming buried by increasingly deeper older alluvial soils to the south. The bedrock south of the fault was observed to be very similar in composition to the older alluvial soils, and the contact was based primarily on the weathering of the clasts within the units. Clasts within the bedrock were observed to be highly weathered and easily friable while clasts within the older alluvium were moderately weathered. The contact between the bedrock and older alluvium was interpreted to be a faint, southerly dipping stone line (see Plates 2, 3, and 4).

The fault as exposed in Trenches T-1 and T-2 was only observed within the Plio-Pleistocene aged bedrock unit, however, because it extended to within a few feet of the surface and was overlain only by Holocene age alluvial soil, recent activity along the fault could not be ruled out. As such, additional trenching was performed to further evaluate the conditions of faulting onsite. This included excavation of Trenches T-4 through T-8, which were excavated at or near the toe of the natural slope where the fault was expected to be encountered based on our findings within Trenches T-1 and T-2. The trenches were excavated across the toe of the natural slope where the geomorphology and aerial photo review suggest the fault would be found. However, with the exception of Trench T-5, no evidence of faulting was observed within the entire lengths of these trenches.

Within Trench T-5, the fault was observed juxtaposing generally massive, conglomeratic San Timoteo Formation bedrock on the hanging wall with older alluvial soils on the footwall. The fault was not observed to penetrate the approximately 9-foot thick section of alluvium and older alluvium overlying the fault (see Plate 4). It was in this area that ECI performed a soil profile to evaluate the age of the soil above the fault. Their analysis indicated the soil above the fault to be at least 20,000 years old (ECI Profile 3, Appendix B). As such the fault is considered to be inactive.

Trenches T-1, T-2, T-5, T-6 and T-7 all exposed the toe of slope of the southerly facing hills onsite to be composed of San Timoteo Formation bedrock. However, in the area of Trench T-4 older alluvial soil was exposed at the toe of the slope. Based on this, and the location of the fault as encountered within Trench T-5, we believe the fault transects the ridge in the northwestern corner of the site, as depicted on Plate 1. In addition, field mapping of a road cut west of the site revealed a set of fractures oriented similarly to the fault as encountered in Trenches T-1, T-2, and

T-5. Although the materials observed in the road cut were highly weathered, it is likely that the fracture set is the same fault, juxtaposing bedrock and older alluvial soils.

East of Trench T-1 none of the trenches excavated encountered the subject fault. T-6 and T-7 exposed a depositional contact between bedrock and older alluvial soils, becoming increasingly deeper to the south (see Plate 4). T-8 exposed only older alluvial material as the trench was located within a small draw, south of the toe of slope. Due to the existence of the relatively large southwesterly draining channel in the central portion of the site, we believe that the fault, east of T-1 becomes increasingly buried by older alluvium and likely trends slightly to the southeast, towards the previously graded bedrock ridge onsite (see Plate 1).

The fault trenches where reviewed by Mr. David Jones, a geologist with the County of Riverside on June 11, 2004. Mr. Jones generally concurred with our interpretations regarding onsite faulting, as encountered within the trenches.

The trenches where backfilled using the excavated soils between June 17, 2004 and June 30, 2004. No compactive effort was used during backfilling and the backfill will require complete removal and replacement with compacted fill during grading of the site. Locations and limits of the trenches as surveyed, are shown on the Geologic Map, Plate 1. Computer drafted copies of the trench logs are included as Plates 2, 3, and 4.

CONCLUSIONS

No evidence of acting faulting was observed within the entire lengths of Trenches T-3, T-4, T-6, T-7, or T-8. These trenches exposed Plio-Pleistocene aged San Timoteo Formation Bedrock and Pleistocene aged older alluvial sediments that have been indirectly aged to be older than 11,000 years old.

A fault was observed within Trenches T-1, T-2, and T-5 at approximate Stations 0+60, 0+25, and 0+90 respectively. Within Trenches T-1 and T-2, the fault was observed at the very near subsurface, buried by a minimal amount of Holocene aged sediment. The fault was not observed to penetrate this sediment. The same fault was encountered within Trench T-5 and was observed to be buried by approximately 9 feet of Holocene and Pre-Holocene aged sediment (estimated to in excess of 20,000 years old). The fault was not observed to penetrate soils younger than 11,000 years old and as such is considered inactive. In addition, there is little geomorphic evidence to suggest the fault is active. It appears the fault transects the hill to the west of Trench T-5 and is buried by older alluvium east of T-1 (see Plate 1).

Based on the findings summarized within this report, no fault related structural setback or other remedial measures related to surficial ground rupture due to faulting are required for construction within the subject site.

The trenches excavated during the investigation where backfilled without compaction effort. The backfill will require complete removal and replacement with compacted fill during grading of the site. The surveyed limits of the trenched areas are shown on the Geologic Map, Plate 1.

If you have any questions regarding this report, please do not hesitate to contact us. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

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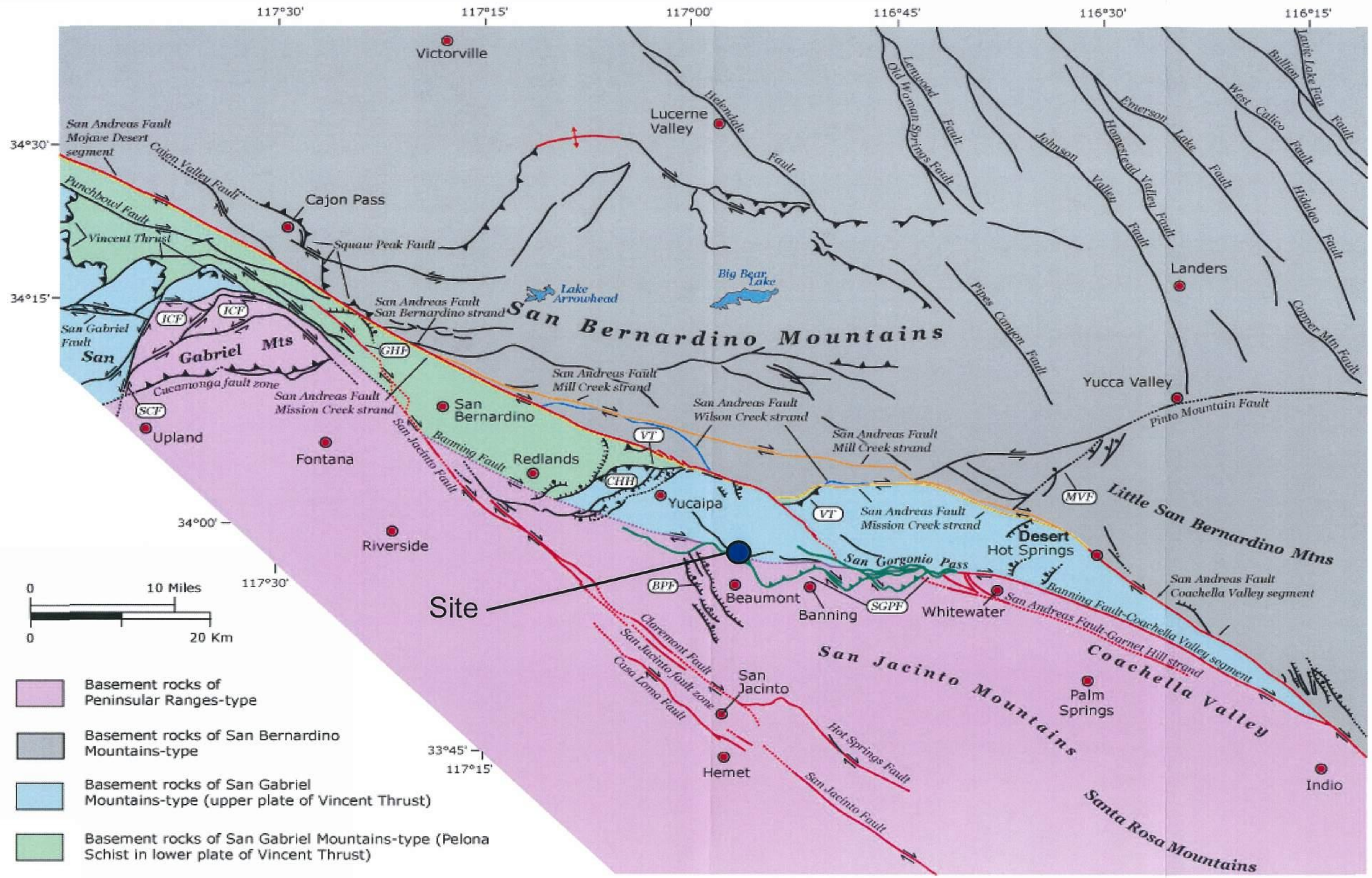
Senior Staff Geologist

DPJ/PB/rsh

Attachments: Figure 1 - Site Location Map - Page 2
Figure 2 - Regional Fault Map - Rear of Text
Figure 3 - Regional Seismicity Map - Rear of Text
Appendix A - References
Appendix B - Soil Stratigraphic Study
Appendix C - Radio Carbon Dating Results
Plate 1 - Geologic Map - In Pocket
Plates 2, 3 and 4 - Fault Trench Logs - In Pocket

Distribution: (1) Addressee
(1) Michael Brandman Associates
Attention: Ms. Christine Jacobs-Donoghue
(1) The Keith Companies
Attention: Mr. Mike Hamilton
(1) Best Best & Krieger LLP
Attention: Ms. Michelle Ouellette



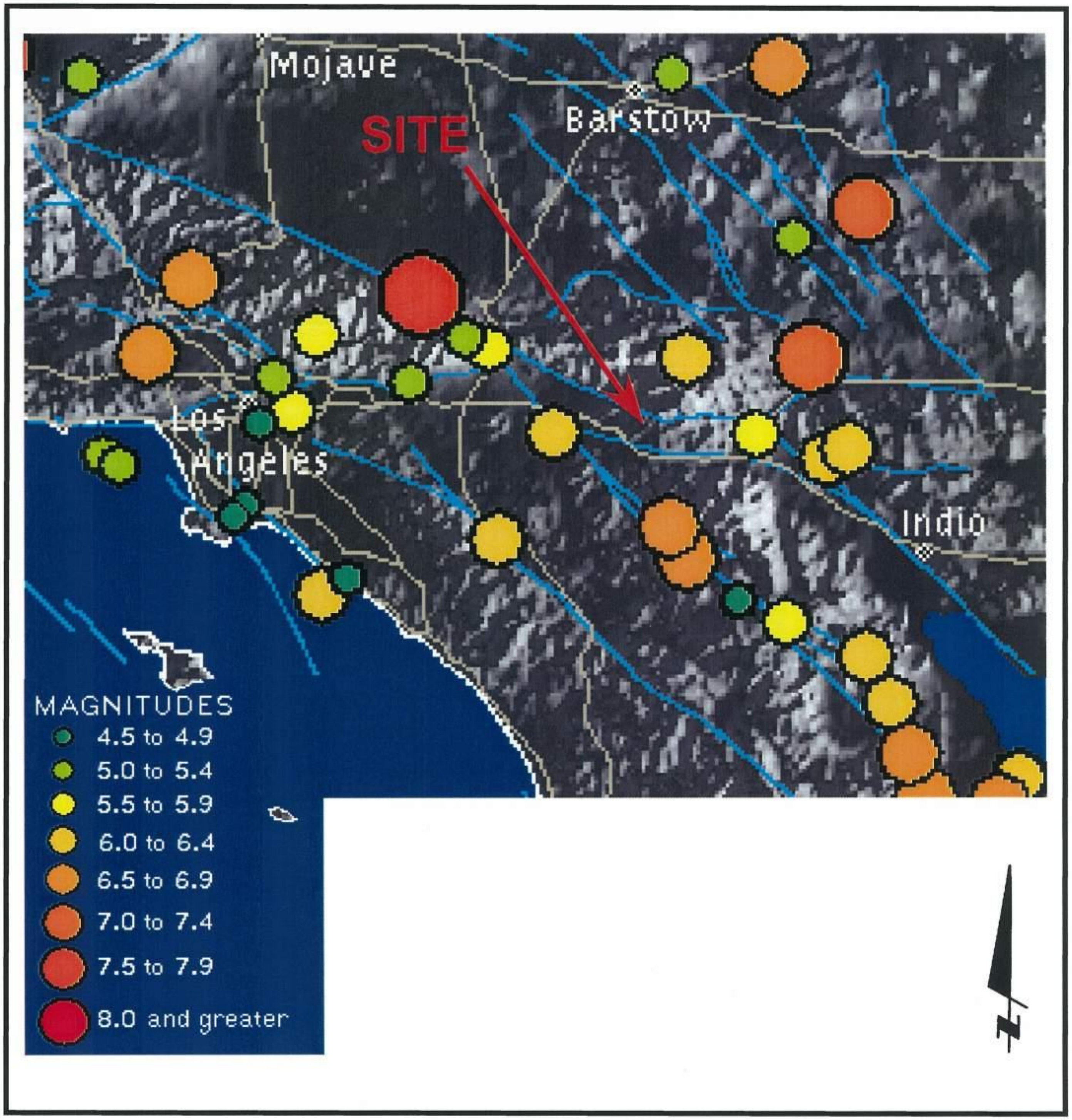
SOURCE: USGS website:
http://wrgis.wr.usgs.gov/docs/wgmt/scamp/graphic/indmap_ie.jpg

REGIONAL FAULT MAP

Danny Thomas Ranch Portion of the Sunny-Cal Egg Ranch Project, North of Cherry Valley Blvd, East of I-10, Cherry Valley Area of Unincorporated Riverside County, California

Project No.: 600390-002
Scale: As Shown
Date: August, 2004

Figure No. 2



MAP OF SIGNIFICANT SOUTHERN CALIFORNIA EARTHQUAKES, 1812 TO PRESENT
FROM SOUTHERN CALIFORNIA EARTHQUAKE CENTER (SCEC) WEB SITE
WWW.DATA.SCEC.ORG/CLICKMAP.HTML

DANNY THOMAS RANCH PORTION OF THE SUNNY-CAL EGG RANCH PROJECT CHERRY VALLEY AREA OF UNINCORPORATED RIVERSIDE COUNTY, CALIFORNIA	REGIONAL SEISMICITY MAP	PROJECT NO. 600390-002 DATE August, 2004 FIGURE NO. 3

APPENDIX A

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Aerial Photos Reviewed:

Date:	Flight No.	Frame(s):	Scale:	Agency:
3-4-1948	USAF-1	51	1:31,500	USAF
1-15-1957	R11557	5-10	1:12,000	RCFCD
1-29-1962	RCFC 62	2-219 and 220	1:24,000	RCFCD
5-24-1974	RCFC 74	102 and 103	1:24,000	RCFCD
1-23-1980	RCFC 80	103 and 104	1:24,000	RCFCD
2-23-1984	RCFC 83	1645 and 1646	1:19,200	RCFCD

Earth Consultants International

Project No. 2411
July 8, 2004

To: **LEIGHTON AND ASSOCIATES, INC.**
10532 Acacia Street, Suite B-6
Rancho Cucamonga, CA 91730

Attention: **Mr. Philip Buchiarelli**

Subject: **Report, Age Estimates of the Near-Surface Deposits in Support of a Fault Trenching Study Conducted by Leighton and Associates in Cherry Valley, Near Beaumont, California**
Leighton and Associates, Inc. Project No. 600390-02

Dear Mr. Buchiarelli,

Earth Consultants International, Inc. (ECI) is pleased to submit this report summarizing the results of a soil-stratigraphic study that we conducted at your request at the Danny Thomas Ranch property off of Cherry Valley Road, near Beaumont, California. The purpose of our study was to estimate the age of the sediments exposed in trenches that Leighton and Associates (L&A) excavated to determine whether or not the site is underlain by active faults. To that end, we provided assistance at the beginning of the study to advise you of a trenching depth that exposed sediments more than 11,000 years old (pre-Holocene). As the trenching study progressed, we prepared soil descriptions to quantify the age of the sediments, and also assisted you with a determination of the age of the faults exposed in some of the trenches. Finally, we assisted you with the verbal presentation of findings to the Riverside County geological reviewer. Specifics about the tasks we conducted, the methodology that we used, and the results of our study are provided in the sections that follow.

SCOPE OF WORK

As briefly discussed above, the tasks that we completed for this study include:

- Conducted a total of five site visits to observed the depth of excavation, collect soil samples and make soil descriptions, and review the fault exposures.
- Described three soil profiles representative of the soils exposed through the length of the trenches; the profiles extended from the ground surface down to the bottom of the excavations.
- Compared the soil descriptions made at the site to those of soils from other areas in southern California with similar parent material and climate that have been dated using

absolute dating methods. This allowed us to estimate the approximate age of the soils, and therefore, the minimum age of the sediments exposed in the trenches.

- Attended a field meeting with the County of Riverside geological reviewer to present our preliminary findings regarding the age of the soils and faults exposed.
- Prepared this report.

BACKGROUND and METHODOLOGY

The term soil as used herein refers to a natural body consisting of layers (or horizons) of mineral and/or organic material that are different from the underlying geologic material in their "morphological, physical, chemical and mineralogical properties and their biological characteristics" (Birkeland, 1984). These differences are the result of weathering and the effects of five main soil-forming factors: parent material, climate, slope or topography, organisms, and time (Jenny, 1941). Time is an important factor because the longer a geologic deposit is exposed to the effects of weathering and soil formation, the better developed the soil characteristics become. We take advantage of this factor when using soils to estimate the age of the deposits.

Soil development occurs on stable geomorphic surfaces (a stable surface is one that is not being impacted by deposition or erosion). Soil development typically starts to occur as soon as a surface stops being eroded or deposited on. Therefore, in some environments, such an alluvial plain or alluvial fan, it is not uncommon to find several weak to moderately well developed buried soils that rest one upon the other, sometimes separated by unaltered sediments (the parent material). The soils represent periods of sub-aerial weathering and soil formation that occurred in between periods of alluvial erosion and deposition. In these environments, the age of the underlying primary deposits is best estimated by summing the age of the individual overlying buried soils. Soil age estimates provide a <u>minimum</u> age for the deposits that the soils formed into, especially in depositional environments such as this one, where short periods of soil formation occur only infrequently, in between erosional and depositional events. Furthermore, portions of soil horizons, and sometimes even entire soil horizons may be removed (truncated) from the area by erosion during floods, further limiting the reliability of soils as indicators of the age of the geological deposits that the soils formed into. Nevertheless, if these limitations are recognized and taken into account, soils developed in active fluvial or alluvial fan environments can still provide useful information. In areas where suitable datable materials such as charcoal are not available, soil-age estimations are particularly useful.

We made three soil profile descriptions for this study. Two of the soil profiles were made in Trench 1 (Profile No. 1 at Station 336, and Profile No. 2 at Station 86), whereas the third profile was made in Trench 5 (at Station 96). The profiles described are representative of the soils we observed elsewhere in the trenches. We described the soil profiles according to the characteristics and nomenclature set forth by the Soil Survey Staff (1975, 1992) and Birkeland (1984, 1999). Colors of the soil horizons and parent materials were recorded using a Munsell Soil Color Chart. We looked for, among other characteristics, the amount and thickness of translocated clay and silt, the presence of clay films or stains on soil ped faces and clasts and in between sand grains (referred to as bridges), the color (reddening) of the soils, and the looseness or induration of the sediments. We also noted the degree of weathering of the cobbles and boulders. We used these characteristics to evaluate whether the near-surface soils are Holocene (less than about 11,000 years old) or pre-Holocene (more than about 11,000 years old). The soil profile descriptions are provided at the end of this report, in Appendix A.

Soil development index (SDI) values were calculated for the soil profiles based on the field descriptions using a modified version of the Harden (1982) index, and the maximum horizon index (MHI) of Ponti (1985). Both SDI and MHI values have been shown to be useful relative indicators of age when comparing soils developed in similar parent materials under similar climatic conditions (Bornyasz and Rockwell, 1997; Rockwell et al., 1984; Harden, 1982). Minimum age estimates for the deposits were made by comparing the SDI and MHI values obtained at the site with those of dated regional soils developed under similar conditions (see Charts 1 and 2 in Appendix A).

More general estimates of the age of the deposits were also made using the degree of weathering of cobbles exposed in the trenches. Tinsley and others (1982) defined cobble-weathering stages that can be used to estimate the approximate age of the deposits containing the cobbles. Simply put, older sediments have more weathered clasts. The clast weathering stages defined by Tinsley and others (1982) are described below. Observations regarding the degree of weathering of the clasts are included in the soil profile descriptions.

<u>Stage 1</u>: Unweathered bedrock, rings sharply to blow of hammer.

<u>Stage 2</u>: Slightly weathered bedrock, incipient to moderate surface pitting, fractured, with oxidation rinds greater than 1-2 mm in thickness, yields moderate ring to blow of hammer.

<u>Stage 3</u>: Substantially weathered bedrock, surface highly pitted, strongly fractured, mafic minerals and feldspars may be strongly altered, clasts can be broken with difficulty by hand, dull sound to blow of hammer.

<u>Stage 4</u>: Very strongly weathered bedrock, easily disaggregated by hand into grus; very dull sound when struck with hammer.

FINDINGS

Geologic Units

The soils we observed in the trenches have developed within a stratified sequence of coarse-grained fluvial and alluvial fan deposits. Basically, the sediments exposed in the trenches can be grouped into three main types: fluvial sediments characterized by a series of nested channels; poorly sorted alluvial fan and colluvial sediments shed off the hillsides to the north and south of the main study area; and "bedrock" of the San Timoteo Formation. Each of these deposits is described further below.

The fluvial deposits consist of unweathered, gray sand and gravel sediments infilling channels cut into the surrounding alluvial fan deposits. The channels are typically narrow in cross-section, approximately between 1 and 10 feet wide and 1 to 2 feet thick, with a layer (lag) of gravel or cobbles at the bottom. Bedding within these deposits is poor, although some channels include fining-upward sequences that indicate these sediments were deposited in a single storm event. Fine-grained overbank deposits were observed locally, such in Profile 1, at a depth of about 2 meters. These deposits occur in the flat portion of the site.

The alluvial fan deposits consist of poorly sorted, massive sandy to bouldery sediments that have been deposited onto the valley floor. Soils have developed in these sediments, forming laterally extensive surfaces that can be followed along the length of the trenches, often across the fluvial channels described above. We used these soil horizons as marker beds when looking for potential faults in the sediments. The older layers of alluvium overlying the bedrock are compositionally very similar to the bedrock, making it difficult to differentiate the contact between the two units. However, the clasts in the bedrock are characteristically very strongly weathered, breaking easily into grus, whereas those in the alluvial fan deposits are not. Locally, the contact is also marked by a line of cobbles referred to as a stoneline.

The San Timoteo Formation is a Quaternary-age (probably about 1 million year old or oder) alluvial fan deposit that consists of poorly indurated to loose, poorly sorted sandstone to gravelly sandstone with abundant cobbles and boulders. These sediments are locally well bedded, sometimes with thin interbeds of siltstone or claystone. These beds are typically relatively horizontal or dipping at shallow angles, but bedding adjacent to the fault zone dips steeply.

Soils

Soil formation within the fluvial and alluvial fan sequence is represented by a stacked series of weak to moderately well developed soils that rest one upon the other, sometimes separated by unaltered or very slightly altered alluvial fan or fluvial sediments (the parent material). The soils represent periods of sub-aerial weathering and soil formation that occurred in between periods of alluvial erosion and deposition. Table 1 shows the Soil Development Index (SDI) and Maximum Horizon Index (MHI) values for each of the profiles. We regressed the SDI and MHI values against those for similar dated soils from the region (see Charts 1 and 2 in Appendix A).

There is some inherent variability in the soil profiles described at the site that reflect the degree of incision and filling in that has occurred over time in the area. For example, in Soil Profile No. 1, we exposed multiple alluvial units with several discrete soil profiles. The upper profile, developed in the uppermost, 1.5 m -thick alluvial unit, is a relatively weak soil with an incipient argillic horizon between about 76 and 114 cm. The argillic horizon has a dark yellowish brown (10YR 4/4d) color, a sandy loam texture, weak to moderately developed subangular blocky soil structure and common, thin clay films in pores and as clast coatings. These characteristics are typical of early to middle Holocene soils in alluvial deposits along the southern slopes of the central and eastern Transverse Ranges (McFadden and Weldon, 1987; McFadden, 1988; Harden et al., 1983; Harrison et al., 1990). Consequently, we assign an early to middle Holocene age for the upper 1.5 m of alluvium at this site. Using Soil Development Index (SDI) values, this surface soil has an SDI of 43.63. Comparison with similar soils that have been dated indicates that this soil is approximately 10,800 years old, although it could be as young as 4,400 years old (see Table 1 and Chart 1 in Appendix A). This estimate is consistent with the early to middle Holocene age given above.

Below the Holocene soil and deposit, a sequence of alluvial units with their respective soils was exposed. The uppermost of these buried deposits (Buried Soils 1 and 2 of Profile 1 in Table 1) has an argillic horizon with substantially stronger development than the surface soil. The color is also brown (10YR 4/3) but the clay films are redder at 7.5YR 3/3. Furthermore, the soil has moderately developed, angular blocky structure and common to many moderately thick clay films coatings clasts and ped faces. Downward, this argillic horizon grades to a yellowish brown (10YR 5/4) Cox horizon with some traslocated clay developed in probable overbank deposits. These soil qualities compare well with dated late Pleistocene soils along the southern margins of the central and eastern Transverse Ranges (McFadden and Weldon, 1987; McFadden, 1988; Harden et al., 1983; Harrison, 1990). Using SDIs, the soil is at a minimum 8,000 years old. However, since an unknown amount of material has been removed from this soil above the argillic horizon, this age estimate is thought to be underestimated. The maximum age estimate using SDIs of approximately 20,000 years is therefore preferred. The Maximum Horizon Index (MHI) value, which is based on the characteristics of the more developed horizon in the entire profile, and is therefore not dependent on the thickness of the soil, yields an approximate age for this buried soil of between 13,600 (minimum) and 41,700 (mean) years. Given that this deposit has been buried since the early to middle Holocene, the actual age of this deposit may be even older. At any rate, this buried deposit is at a minimum late Pleistocene in age.

There are four additional partial or complete buried soil profiles below the two described above. These soils range from weak (A horizon over Cox horizon) to moderately developed, with one showing better color expression (7.5YR 4/6m) than the upper buried soil. These observations demonstrate that the oldest of these deposits must be Pleistocene and may in fact be many tens of thousands of years in age. Age estimates for each of the buried horizons, and the overall profile as a whole, are given in Table 1.

In Profiles 2 and 3 we observed a similar stacking of a weakly developed surface soil overlying partial buried soils. The surface soils in both of these profiles are Holocene to late Pleistocene in age (6,700 to 16,000 years old for the soil in Profile 2; 3,000 to 7,700 years old for the soil in Profile 3). The estimated ages of the buried soils underlying this surface soil are listed in Table 1. Given that these buried soils have been truncated, we have listed the mean and maximum ages estimated using SDIs, and the minimum and mean age estimates using MHIs.

In these two profiles, the deepest buried soils were developed in the San Timoteo Formation rather than in older alluvium. The soils developed in the bedrock are poorly developed, characterized by weak argillic horizons with 7.5YR colors, weak to moderate blocky soil structure, and thin to moderately thick clay films on ped faces. These characteristics alone do not make these soils significantly older than the overlying deposits (see Table 1), except that the clasts contained in these horizons are extensively weathered, and can be easily broken apart by hand. Therefore, although the degree of soil development of the overlying section suggest that these soils are approximately 34,000 to 140,000 years old (cumulative age obtained by adding the estimated ages of the overlying soils), their clast weathering suggests they are 100,000 to 400,000 years old (S3 soil stage designation of Tinsley et al., 1982, based on soil color and cobble weathering stages of 3 to 4).

The minimum cumulative ages for each of the three soil profiles described in the trenches are summarized in Table 1, and in Charts 1 and 2. Using SDIs, the estimated ages of these profiles vary between about 34,000 and 58,000 years using the mean values, and between 85,000 and 141,000 years using the maximum values allowed by the statistical envelope at the 95th percentile (see Chart 1). Using MHIs, the estimated ages for these profiles vary between 34,000 and 69,000 years using the minimum values, and between 105,000 and 213,000 years using the mean values. The age estimates based on the different index techniques (MHI vs. SDI) are within close agreement given the natural variability of the soils across the site. Because several of these soils have been modified by erosion, resulting in truncated soil profiles that do not represent the full degree of soil development that these units have experienced, it is our opinion that the SDI values (which are thickness-dependent measures of soil development) are not very good indicators of the age of these deposits, and that the MHI values should be given more credence.

Table 1: Summary of Estimated Ages Using Mean Horizon Indices (MHI) and Soil Development Index (SDI) Values

Profile 1	MHI	Min -Mean Age	Profile 2	MHI	Min -Mean Age	Profile 3	MHI	Min -Mean Age
Surface Soil	0.42	6,139 - 19,535	Surface Soil	0.58	13,415 - 41,137	Surface Soil	0.29	3,246 - 10,916
Buried Soil 1	058	13,588 - 41,656	Buried Soil 1	0.46	7,504 – 23,569	Buried Soil 1	0.53	10,635 - 32,839
Buried Soil 2	0.48	8,399 - 26,215	Buried Soil 2	0.60	14,668 – 44,904	Buried Soil 2	0.42	6,392 - 20,283
Buried Soil 3	0.26	2,863 - 9,753	Buried Soil 3	0.62	15,828 - 48,406	Buried Soil 3	0.58	13,415 - 41,137
Buried Soil 4	0.38	5,219 - 16,811	Buried Soil 4	0.64	17,951 - 54,860			
Buried Soil 5	0.63	16,859 - 51,532						
Cumulative Age:		**53,067 – 165,502**	**Cumulative Age:**		**69,366 – 212,876**	**Cumulative Age:**		**33,688 - 105,175**

Profile 1	SDI	Mean-Max Age	Profile 2	SDI	Mean-Max Age	Profile 3	SDI	Mean-Max Age
Surface Soil	43.63	10,804 – 26,383	Surface Soil	63.70	15,988 – 38,152	Surface Soil	26.16	7,680 – 19,219
Buried Soil 1	28.71	8,072 – 20,125	Buried Soil 1	72.72	19,067 – 45,177	Buried Soil 1	54.13	13,263 – 31,978
Buried Soil 2	39.94	10,052 – 24,667	Buried Soil 2	36.30	9,363- 23,088	Buried Soil 2	18.64	6,631 – 16,791
Buried Soil 3	12.13	5,839 – 14,945	Buried Soil 3	24.80	7,479 – 18,756	Buried Soil 3	18.00	6,548 – 16,599
Buried Soil 4	12.92	5,930 – 15,157	Buried Soil 4	14.63	6,132 – 15,629			
Buried Soil 5	13.24	5,968 – 15,245						
Cumulative Age:		**46,665 – 116,522**	**Cumulative Age:**		**58,029 – 140,742**	**Cumulative Age:**		**34,122 – 84,587**

Faults

A fault zone was exposed near the north end of both trenches discussed in this report, within bedrock of the San Timoteo Formation. In Trench 1, the main fault trace could be traced upward to within approximately one foot of the ground surface, where it was overlain by a thin mantle of soil consisting primarily of an A horizon. The soil has been modified, either by plowing, or as a result of grading for the unpaved road that extends through that portion of the site. Given the youthful and modified character of the overlying soil, the recency of activity of the fault in Trench 1 could not be evaluated.

In Trench 5, however, the fault extended upward to the contact between the San Timoteo Formation and the overlying alluvial fan/colluvial deposits. The contact between these two units is defined to some extent by the presence of a line of cobbles (stoneline) at or near the contact, and by differences in the degree of weathering of the clasts contained within each of the two deposits (Stage 1 in the alluvium, Stage 3-4 in the San Timoteo Formation). The fault did not extend upwards into the overlying soil (buried soil 2 of Profile 3 in Table 1), which is estimated to be at least 20,000 years old (based on the minimum ages estimated using the MHI method), but is probably more than 60,000 years old (based on the maximum age estimates using the SDI method, and the mean age estimates using the MHI method). Since there could have been several periods of erosion and deposition since the fault last moved, these age estimates are considered minimums. Given the data presented above, the fault is Pleistocene in age, and is therefore considered not active.

SUMMARY

At your request, ECI has conducted a study to estimate the age of the soils exposed in a series of trenches that L&A excavated in the Cherry Valley area, near Beaumont, California. The trenches were excavated to depths of between 10 and 15 feet to ensure that Pleistocene sediments were exposed at depth. Our analysis of the soil profiles exposed indicate that the surface soil, which extends to a depth of between 0.82 to 1.52 meters (2.7 to 5.0 feet), is Holocene in age, whereas the underlying buried soils are indeed Pleistocene in age. Using a variety of soil stratigraphic age estimation methods, including clast weathering stages, we conclude that the sediments exposed near the bottom of the trenches are at least 34,000 years old, but most likely as much as 100,000 to 400,000 years old.

Furthermore, the fault zone exposed in some of these trenches was shown not to extend upwards into alluvial fan deposits that given their degree of soil development are estimated to be at a minimum 20,000 years old, but most likely at least 60,000 years old. The fault was also shown not to have geomorphic expression. For these reasons, the fault is deemed to have last moved in the Pleistocene, and therefore is considered not active.

We trust that the information presented above provides you the information you need at this time. We appreciate the opportunity to be of service on this project.

Respectfully submitted,

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Project Consultant

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APPENDIX A: SOIL DESCRIPTIONS AND AGE ESTIMATES

Cherry Valley Trenches
Leighton and Associates, Inc.

Profile No. 1 – Trench 1 @ Station 336

Ap Soil Horizon (0 to 26 cm): LOAMY fine to coarse SAND, brown to dark brown (10YR 4.5/3) when dry, very dark grayish brown (10YR 3/2.5) when moist; strong very thick platy and moderate medium angular blocky breaking to single grained; soft when dry, friable to very friable when moist, non-sticky and non-plastic when wet, slightly fragic (shatters under pressure); no clay films observed; abundant roots and rootlets; abrupt to clear, wavy lower boundary.

A1 Soil Horizon (26 to 53 cm): Fine to medium SANDY LOAM, dark brown to brown (10YR 4/3) when dry, dark brown (10YR 3/3) when moist; weak fine to medium angular blocky soil structure; soft when dry, very friable when moist, slightly sticky and non-plastic when wet; no clay films observed; abundant roots and rootlets; clear wavy lower boundary.

A2/Bw Soil Horizon (53 to 76 cm): LOAM to fine SANDY LOAM, dark yellowish brown to yellowish brown (10YR 4.5/4) when dry, very dark grayish brown to dark brown (10YR 3/2.5) when moist; weak fine to medium angular blocky soil structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; no clay films observed; scattered gravel; clear wavy lower boundary.

Btj1 Soil Horizon (76 to 91 cm): Fine to medium SANDY LOAM, dark yellowish brown (10YR 4/4) when dry, dark brown to dark yellowish brown (10YR 3/3.5) when moist; moderate to strong medium angular blocky soil structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; common thin clay coatings on clasts, common thin clay films filling in pores, common to many thin clay films bridging grains; many rootlets, abundant pinhole pores; clear to gradual, wavy boundary.

Btj2 Soil Horizon (91 to 114 cm): Fine to coarse SANDY LOAM, dark brown to dark yellowish brown (10YR 4/3.5) when dry, dark brown (10YR 3/3) when moist; moderate to strong coarse angular blocky soil structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; common to many thin clay films lining pores; abundant pores to 2.5 mm diameter; abrupt to clear, wavy lower boundary.

BC Soil Horizon (114 to 152 cm): SANDY LOAM to LOAMY SAND, fine to medium grained, brown (10YR 5/3) when dry, dark brown (10YR 3/3) when moist; weak fine to medium angular blocky soil structure breaking to single grained; slightly hard when dry, friable to very friable when moist; slightly sticky and non-plastic when wet; few to common thin clay films coating clasts; common rootlets and pinhole pores; abrupt wavy lower boundary.

2Btb Soil Horizon (152 to 197 cm): Fine to coarse SANDY LOAM, dark brown (10YR 4/3 with 7.5YR 3/3 clay) when dry, dark brown (7.5YR 3/2) when moist; moderate coarse angular blocky breaking to strong fine angular blocky soil structure; slightly hard to hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common to many moderately thick clay films coating clasts, common moderately thick clay films on ped faces, common thin clay films bridging grains; many fine rootlets and pinhole pores; abrupt wavy lower boundary.

3Cox Soil Horizon (197 to 210 cm): LOAM to SANDY CLAY LOAM, very fine to fine sand with scattered fine gravel, yellowish brown (10YR 5/4) when dry, dark brown to brown (10YR 4/3) when moist; coarse fine to medium subangular blocky soil structure; extremely hard when dry, very friable when moist, sticky and plastic when wet; common thin to very thin clay films on ped faces, common thin clay films filling pores; micaceous; abundant pores; possible overbank deposits; abrupt wavy lower boundary.

4Bwb Soil Horizon (210 to 235 cm): LOAMY fine SAND with scattered medium to coarse sand grains, dark yellowish brown (10YR 3.5/4) with brown 7.5YR 5/4) clay when dry, dark brown (10YR 3/3) when moist; weak to moderate medium angular blocky soil structure; slightly hard when dry, friable when moist; non-sticky and non-plastic when wet; few thin clay films coating clasts and as stains; gradual wavy lower boundary.

4Btjb1 Soil Horizon (235 to 262 cm): LOAMY SAND, fine to medium sand grains, yellowish brown (10YR 5/4) when dry, dark brown (10YR 3/3) when moist; weak fine subangular blocky soil structure; soft when dry, friable when moist, slightly sticky and non-plastic when wet; common thin clay films on ped faces, common thin to moderately thick clay films coating clasts; few rootlets, abundant pinhole pores; clear wavy boundary.

5Btjb2 Soil Horizon (262 to 299 cm): Fine SANDY LOAM, yellowish brown to light yellowish brown (10YR 5/4 to 6/4) when dry, dark brown to dark yellowish brown (10YR 4/3.5 with 7.5YR 4/4) when moist; strong coarse angular blocky soil structure; slightly hard when dry, friable when moist, sticky and slightly plastic when wet; common thin clay films on ped faces, common clay films filling in pores; abundant pores; micaceous; boundary not observed, in bench of trench.

6Cox Soil Horizon (299 to 323 cm): LOAMY fine to coarse SAND, light yellowish brown (10YR 6/4) with brown (7.5YR 5/3) clay when dry, dark brown to dark yellowish brown (10YR 4/3.5) with brown (7.5YR 5/4) clay when moist; moderate medium to coarse angular blocky soil structure; soft to slightly hard when dry, friable when moist, non-sticky and non-plastic when wet; common thin clay films coating clasts, common thin clay films filling pores; abundant gravel predominantly 2 to 3 cm in diameter, subrounded; clear wavy lower boundary.

7Ab Soil Horizon (323 to 335 cm): Fine to coarse SAND, dark brown to dark yellowish brown (10YR 4.5/3) when dry, dark yellowish brown (10YR 3/4) when moist; massive breaking to weak fine angular blocky soil structure; soft when dry, friable to very friable when moist, non-sticky and non-plastic when wet; many to continuous thin clay films coating clasts, few thin clay films on ped faces; abundant gravel; few pinhole pores; possible overprinted buried A horizon; clear wavy boundary.

7Cox Soil Horizon (335 to 372 cm): LOAMY fine to coarse SAND, yellowish brown (10YR 5/4) when dry, dark brown to dark yellowish brown (10YR 4/3.5) with reddish yellow (7.5YR 6/6) clay when moist; massive breaking to weak to moderate medium angular blocky soil structure; loose to soft when dry, loose to very friable when moist, non-sticky and non-plastic when wet; few to common thin clay films coating clasts; abundant angular to subrounded gravel, coarsens downward; abrupt smooth lower boundary.

8Bwb1 Soil Horizon (372 to 386 cm): LOAMY SAND to SAND with gravel, yellowish brown (10YR 5.5/4) when dry, dark brown to brown (10YR 4/3) with strong brown (7.5YR 4/6) clay when moist; massive breaking to moderate fine angular blocky soil structure; loose to soft when dry, very friable when moist, non-sticky and non-plastic when wet; no clay films observed; abrupt to clear, wavy lower boundary.

8Bwb2 Soil Horizon (386 to 408 cm): Gravelly fine SANDY LOAM, yellowish brown (10YR 5/4.5) with brown (7.5YR 5/4) clay when dry, dark yellowish brown (10YR 3/4) with strong brown (7.5YR 4/6) clay when moist; weak to moderate fine angular blocky soil structure; loose to soft when dry, friable when moist, slightly sticky and slightly plastic when wet; common thin clay films coating clasts; coarser grained than horizon above; clear, wavy to irregular lower boundary.

9Cox Soil Horizon (408 to 427 cm): Fine to coarse SAND, yellowish brown to light yellowish brown (10YR 5.5/4 to 6.5/4) when dry, dark yellowish brown (10YR 4/4) when moist; single grained and weak fine to medium angular blocky soil structure; loose to soft when dry, loose to very friable when moist, non-sticky and non-plastic when moist; no clay films observed; abundant subangular to subrounded gravel; abrupt, wavy to irregular lower boundary.

10Btb Soil Horizon (427 to 448 cm): Fine to coarse SANDY CLAY, yellowish brown (10YR 5/4 & 6/4) with light brown (7.5YR 6/4) clay when dry, dark brown to brown (7.5YR 4.5/4) when moist; strong coarse angular blocky soil structure; slightly hard to hard when dry, friable when moist, sticky and plastic to very plastic when wet; common thin clay films on ped faces, common thin clay films as stains; lower boundary not observed.

Profile No. 2 – Trench 1 @ Station 86

Ap Soil Horizon (0 to 18 cm): LOAM to SANDY LOAM, brown (10YR 4.5/3) when dry, very dark brown (10YR 2/2.5) when moist; strong very coarse platy breaking to strong coarse subangular blocky soil structure; soft to slightly hard when dry; friable when moist; slightly sticky and non-plastic when wet; no clay films observed; hydrophobic, abundant organics; abundant roots; clear, wavy to irregular boundary.

A1 Soil Horizon (18 to 43 cm): Fine to medium SANDY LOAM, dark brown to dark yellowish brown (10YR 4.5/3) when dry, dark brown (10YR 3/3) when moist; weak coarse angular blocky breaking to moderate fine to medium angular blocky soil structure; soft when dry, very friable when moist, non-sticky to slightly sticky and non-plastic when wet; no clay films observed; abundant rootlets; scattered gravel to 3 cm in diameter; clear wavy lower boundary.

A2/C Soil Horizon (43 to 82 cm): LOAMY fine to medium SAND, brown to yellowish brown (10YR 5/3.5) when dry, dark brown (10YR 3/3) when moist; single-grained to weak fine to medium subangular blocky soil structure; loose to soft when dry, loose to very friable when moist, non-sticky and non-plastic when wet; no clay films observed; abundant roots and rootlets, extensively bioturbated; with fine angular gravel to 0.5 cm in diameter; abrupt wavy lower boundary.

2Btb1 Soil Horizon (82 to 107 cm): LOAM to SANDY CLAY LOAM, dark brown to dark yellowish brown (10YR 4/3.5) with brown to strong brown (7.5YR 5/5) clay when dry, dark brown (7.5YR 3/2) when moist; moderate medium subangular blocky grading downward to strong coarse angular blocky soil structure; slightly hard when dry, friable when moist, sticky and slightly plastic when wet; common to many thin clay films coating clasts, common thin clay films on ped faces, many moderately thick clay films bridging grains; micaceous; many rootlets and pinhole pores; clear wavy lower boundary.

2Btb2 Soil Horizon (107 to 140 cm): SANDY LOAM to SANDY CLAY LOAM, dark brown (7.5YR 4/3 and 4/4) when dry, dark brown (7.5YR 3/2.5) when moist; weak to moderate coarse angular blocky soil structure; soft to slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many moderately thick clay films filling pores, common to many thin clay films on ped faces, few to common thin clay films bridging grains, many thin to moderately thick clay films coating clasts; less clay than horizon above; with gravel to 4 cm in diameter; clear to gradual, wavy boundary.

2BCb1 Soil Horizon (140 to 192 cm): SANDY LOAM to LOAMY SAND, fine to coarse sand grains, light yellowish brown (10YR 6/4) with reddish yellow (7.5YR 6/6) clay when dry, dark yellowish brown (10YR 4/4) with strong brown (7.5YR 4/6) clay when moist; moderate coarse to very coarse angular blocky soil structure; soft to slightly hard when dry, very friable when moist, non-sticky and non-plastic when wet; common thin clay films on ped faces, common thin clay films coating clasts, common thin clay films bridging grains; gradual wavy lower boundary.

2BCb2 Soil Horizon (192 to 226 cm): Fine to medium SANDY LOAM, dark yellowish brown (10YR 4/4) with strong brown (7.5YR 4/6) clay when dry, dark brown (10YR 3/3) with dark brown (7.5YR 4/3) clay when moist; moderate medium angular blocky soil structure; soft to slightly hard when dry, friable to very friable when moist, non-sticky and non-plastic when wet; few moderately thick and common thin clay films on ped faces, many thin clay films lining pores, many thin clay films as stains; few scattered coarse sand grains and fine gravel; many rootlets and pinhole pores; abrupt to clear, wavy lower boundary.

3Cox Soil Horizon (226 to 277 cm): Gravelly fine to coarse SAND to LOAMY SAND, dark yellowish brown (10YR 4/4) with reddish yellow (7.5YR 6/6) clay when dry, dark yellowish brown (10YR 3/4) with strong brown (7.5YR 4/6) clay when moist; weak medium angular blocky soil structure breaking to single-grained; loose when dry and moist, non-sticky and non-plastic when wet; common thin clay stains on grains and few thin clay stains coating clasts; channel deposit with gravel to 15+ cm in diameter; abrupt wavy to irregular lower boundary.

4Btb1 Soil Horizon (277 to 302 cm): SANDY CLAY LOAM, yellowish brown (10YR 5/6) with reddish yellow (7.5YR 6/6) clay when dry, dark brown (7.5YR 3/4) when moist; moderate medium angular blocky soil structure; slightly hard when dry, friable when moist, sticky and slightly plastic when wet; many thin clay films on ped faces, common to many thin clay films bridging grains, many to continuous moderately thick clay films filling pores, many to continuous thin clay films coating clasts; common pinhole pores; gradual wavy lower boundary.

4Btb2 Soil Horizon (302 to 338 cm): SANDY CLAY LOAM to SANDY CLAY, yellowish brown (10YR 5/6) with reddish yellow (7.5YR 6/6) clay when dry, dark yellowish brown (10YR 4/4) with strong brown (7.5YR 4/6) clay when moist; moderate medium subangular blocky soil structure; slightly hard when dry, friable when moist, sticky and slightly plastic to plastic when wet; common to many thin clay films on ped faces and coating grains, many thin clay films bridging grains, continuous moderately thick clay films filling pores; fine to medium sand grains, well sorted; clear to gradual, wavy lower boundary.

5Btb3 Soil Horizon (338 to 354 cm): SANDY CLAY LOAM, strong brown (7.5YR 5/6) with dark brown (7.5YR 4/2) clay on clasts when dry, dark brown to dark yellowish brown (10YR 3.5/4) with dark brown (7.5YR 4/4) clay when moist; moderate to strong coarse angular blocky soil structure; slightly hard to hard when dry, friable when moist, sticky and slightly plastic when wet; common thin clay films on ped faces, many to continuous thin clay films bridging grains, continuous moderately thick clay films coating clasts; fine to medium sand grains, well sorted, less clay than horizon above; clasts are slightly weathered; clear to gradual, wavy lower boundary (soil developed in Qoa).

5Btb4 Soil Horizon (354 to 378 cm): SANDY CLAY LOAM to SANDY CLAY, dark yellowish brown to yellowish brown (10YR 4.5/6) with strong brown (7.5YR 5/8) clay on clasts when dry, dark yellowish brown (10YR 3/4) with strong brown (7.5YR 4/6) clay on clasts when moist; weak to moderate medium angular blocky soil structure; slightly hard when dry, friable when moist, sticky and plastic when wet; continuous moderately thick clay films coating clasts, many to continuous moderately thick clay films bridging grains, common moderately thick and many thin clay films on ped faces; angular to subangular gravels to 4 cm in diameter, more gravel than horizon above, clasts are slightly weathered; gradual to wavy lower boundary (soil developed in Qoa).

6Btb5 Soil Horizon (378 to 387 cm): SANDY CLAY, yellowish brown (10YR 5/6) with reddish yellow (7.5YR 6/6) clay when dry, strong brown (7.5YR 4/6) when moist; strong medium to coarse angular blocky soil structure; slightly hard to hard when dry, friable when moist, sticky and plastic when wet; common moderate thick and many to continuous thin clay films on ped faces, many to continuous moderately thick clay films bridging grains; very weathered (grussified) clasts; gradual wavy lower boundary (soil developed in Qst).

6Btb6 Soil Horizon (387 to 402+ cm): SANDY CLAY LOAM, yellowish brown (10YR 5/6) with reddish yellow (7.5YR 6/6) clay on clasts when dry, dark yellowish brown (10YR 3/4) with strong brown (7.5YR 4/6) clay when moist; weak to moderate fine subangular blocky soil structure breaking to single-grained; slightly hard to hard when dry, friable when moist, sticky and slightly plastic when wet; many to continuous moderately thick clay films on ped faces, continuous moderately thick to thick clay films bridging grains, common to many thin clay films coating clasts; very weathered (grussified) clasts; lower boundary not observed (soil developed in Qst).

Profile No. 3 – Trench 5 @ Station 96

Ap Soil Horizon (0 to 18 cm): SANDY LOAM, dark yellowish brown (10YR 4/4) when dry, very dark brown (10YR 2/3) when moist; weak to moderate coarse granular soil structure breaking to single grained; soft to loose when dry, very friable to loose when moist, non-sticky to slightly sticky and non-plastic when wet; no clay films observed except for stains on clasts that are probably reworked; abundant organics, hydrophobic; abrupt wavy lower boundary.

A1 Soil Horizon (18 to 60 cm): SANDY LOAM to LOAM, dark yellowish brown (10YR 4/4) when dry, very dark brown (10YR 2/3) when moist; massive breaking to weak medium to coarse subangular blocky soil structure; soft to loose when dry, very friable to loose when moist, non-sticky to slightly sticky and non-plastic when wet; no clay films observed except for many thin to very thin stains on clasts (probably reworked); abundant scattered angular gravel predominantly less than 1 cm in diameter, few to 4 cm in diameter; abundant organics and humus, many rootlets and worm casts; clear wavy lower boundary.

A2/Bw Soil Horizon (60 to 104 cm): SANDY LOAM, dark yellowish brown (10YR 4/3) when damp, very dark brown (7.5YR 2/3) when moist; massive breaking to weak medium to coarse subangular blocky soil structure; soft to loose when dry, very friable to loose when moist, slightly sticky and non-plastic when wet; common to many thin clay films on ped faces, common thin clay films filling pores, common to many thin to very thin stains on clasts; abundant rootlets and worm casts; clear to gradual, wavy lower boundary.

2Btb1 Soil Horizon (104 to 140 cm): SANDY LOAM, dark yellowish brown (10YR 4/4) with brown (7.5YR 5/4) clay when dry, dark brown (7.5YR 3/3 to 2.5/3) when moist; moderate to strong medium subangular blocky soil structure; soft when dry, friable when moist, non-sticky to slightly sticky and non-plastic when wet; many moderately thick clay films on ped faces, many thin clay films bridging grains, many to continuous thin clay stains on clasts; gradual wavy lower boundary.

2Btb2 Soil Horizon (140 to 180 cm): SANDY LOAM, dark yellowish brown (10YR 4/4) with brown (7.5YR 5/4) clay when dry, dark brown (7.5YR 3/2) with dark brown to brown (7.5YR 4/4) clay when moist; moderate to strong coarse angular blocky soil structure; soft when dry, friable when moist, non-sticky and non-plastic when wet; many to continuous moderately thick clay films coating clasts, many thin and common moderately thick clay films bridging grains, common moderately thick clay films on ped faces; abundant angular to subrounded gravels 0.5 to 10 cm in diameter; clear wavy lower boundary.

2Btb3 Soil Horizon (180 to 206 cm): SANDY LOAM, dark brown (7.5YR 5/4) with light brown (7.5YR 6/4) stains on clasts when dry, dark brown (7.5YR 3/3) with dark brown to brown (7.5YR 4/4) clay on clasts when moist; strong coarse to very coarse angular blocky soil structure; hard to very hard when dry, friable to firm when moist, slightly sticky and non-plastic when wet; many moderately thick to thick clay films bridging grains, many thin to moderately thick clay films on ped faces, common to many thin clay films coating clasts; abundant roots and pinhole pores; clear wavy lower boundary.

2BCb1 Soil Horizon (206 to 233 cm): LOAMY fine to medium SAND, yellowish brown and brown (10YR 5/4 and 7.5YR 5/4) when dry, dark brown (7.5YR 3/2.5) when moist; weak to moderate medium subangular blocky soil structure breaking to single grained; soft to slightly hard when dry, friable when moist, non-sticky to slightly sticky and non-plastic when wet; common thin to moderately thick clay films bridging grains, common thin clay films on ped faces, many to continuous thin clay films filling pores; abrupt wavy lower boundary.

3BCb2 Soil Horizon (233 to 277 cm): Gravelly SANDY LOAM, strong brown and brown (7.5YR 4/6 & 5/4) when dry, dark brown to brown (7.5YR 4/3 and 3/2) when moist; massive breaking to weak to moderate fine subangular blocky soil structure; slightly hard when dry, friable when moist, slightly sticky and non-plastic when wet; many moderately thick to thick clay films on ped faces, continuous thin clay films filling pores, many to continuous moderately thick clay films bridging grains; clear wavy lower boundary (soil developed on Qst).

4BCb3/Cox Soil Horizon (277 to 308+ cm): SANDY LOAM to SANDY CLAY LOAM, brownish yellow (10YR 6/6) with brown (7.5YR 5/4) clay on ped faces when dry, dark yellowish brown (10YR4/4) with dark brown to brown (7.5YR 4/4) clay on ped faces when moist; moderate medium to coarse angular blocky soil structure; hard to very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common thin clay films on ped faces, common to many thin clay films filling pores, common moderately thick and many thin clay films bridging grains; clasts are very weathered (grussified); lower boundary not observed (soil developed in Qst).

Table A: Soil Descriptions
Cherry Valley Trenches, California

PEDON
ID Profile 1 - Trench 1 @ Station 336
Class
P.M. alluvium/colluvium over QTs

Veg. Grasses / Pasture
Logged by: TKG/5-28-04
Age of Soil See Chart

HORIZON	DEPTH (cm)	COLOR (dry, moist)	TEXTURE	STRUCTURE	CONSISTENCE (dry, moist; wet)	CLAY FILMS	BOUNDARY	H.I.	SDI	NOTES
Ap	0-26	10YR4.5/3d, 3/2.5m	LS	3vkpl&2mabk	so, fr-vfr; so, po	n.o.	a-c, w			Abundant roots and rootlets; fragic
	26	0.08	0.20	0.67	0.20	0.00		0.19	4.95	
A1	26-53	10YR4/3d, 3/3m	SL	1f-mabk	so, vfr; ss, po	n.o.	c, w			Abundant roots and rootlets
	27	0.10	0.40	0.50	0.37	0.00		0.23	6.15	
A2/Bw	53-76	10YR4.5/4d, 3/2.5m	L-SL	1f-mabk	so, fr; ss, ps	n.o.	c, w			Scattered gravel
	23	0.13	0.50	0.50	0.53	0.00		0.28	6.36	
Btj1	76-91	10YR4/4d, 3/3.5m	SL	2-3mabk	so, fr; ss, ps	2ncl, 2npo, 2-3nbr	c-g, w			Juvenile argillic; many roots; abundant pinhole pores
	15	0.18	0.40	0.75	0.53	0.63		0.42	6.23	
Btj2	91-114	10YR4/3.5d, 3/3m	SL	2-3cabk	so, fr; ss, ps	2-3npo	a-c, w			Abundant pores to 2.5mm diameter
	23	0.13	0.40	0.75	0.53	0.37		0.36	8.34	
BC	114-152	10YR5/3d, 3/3m	SL-LS	1f-mabk	sh, fr-vfr; ss, po	1-2ncl	a, w			Common rootlets and pinhole pores
	38	0.10	0.30	0.50	0.57	0.37		0.31	11.61	Surface soil 43.63
2Btb	152-197	10YR4/3 & 7.5YR3/3d, 7.5YR3/2m	SL	2cabk-3fabk	sh-h, fr; ss, ps	2-3mkcl, 2mkpf, 3nbr	a, w			Many fine rootlets and pinhole pores
	45	0.15	0.40	0.75	0.83	0.68		0.47	21.13	
3Cox	197-210	10YR5/4d, 4/3m	L-SCL	3f-msbk	eh, vfr; s, p	2n-vnpf, 2npo	a, w			Possible overbank deposits; micaceous; abundant pores.
	13	0.10	0.60	0.67	1.67	0.47		0.58	7.58	Buried soil 1 28.71
4Bwb	210-235	10YR3.5/4 & 7.5YR5/4d, 10YR3/3m	LfS	1-2mabk	sh, fr; so, po	1ncl & st	g, w			Scattered medium to coarse sand
	25	0.20	0.20	0.58	0.40	0.37		0.29	7.29	
4Btjb1	235-262	10YR5/4d, 3/3m	LS	1fsbk	so, fr; ss, po	2npf, 2n-mkcl	c, w			Few rootlets, abundant pinhole pores
	27	0.10	0.20	0.33	0.37	0.53		0.26	6.90	
5Btjb2	262-299	10YR5/4 to 6/5d, 10YR4/3.5&7.5YR4/4m	fSL	3cabk	sh, fr; s, ps	2npf, 2npo	n.o.			Micaceous, abundant pores.
	37	0.25	0.40	0.83	0.90	0.50		0.48	17.78	
6Cox	299-323	10YR6/4 & 7.5YR5/4d, 10YR4/3.5 & 7.5YR5/4	LS	2m-cabk	so-sh, fr; so, po	2ncl, 2npo	c, w			Abundant subrounded gravel 2-3 cm diameter
	24	0.33	0.20	0.67	0.30	0.50		0.33	7.97	Buried soil 2 39.94
7Ab	323-335	10YR4.5/3d, 3/4m	S	m- 1fabk	so, fr-vfr; so, po	3-4ncl, 1npf	c, w			Abundant gravel, few pinhole pores; possibly overprinted buried A horizon
	12	0.05	0.00	0.42	0.20	0.57		0.21	2.47	
7Cox	335-372	10YR5/4d, 4/3.5 w/ 7.5YR6/6m	LS	m- 1-2mabk	lo-so, lo-vfr; so, po	1-2ncl	a, s			Abundant angular to subrounded gravel, coarsens downward
	37	0.40	0.20	0.50	0.10	0.37		0.26	9.66	Buried soil 3 12.13
8Bwb1	372-386	10YR5.5/4d, 4/3 w/ 7.5YR4/6m	LS-S	m - 2fabk	lo-so, vfr; so, po	n.o.	a-c, w			
	14	0.38	0.10	0.50	0.10	0.00		0.18	2.51	
8Bwb2	386-408	10YR5/4.5d w/ 7.5YR5/4d, 10YR3/4 w/ 7.5YR4/6m	gSL	1-2fabk	lo-so, fr; ss, ps	2ncl	c, w-i			Coarser grained that horizon above.
	22	0.48	0.40	0.58	0.43	0.40		0.38	8.40	
9Cox	408-427	10YR5.5/4 to 6.5/4d, 4/4m	S	sg & 1f-mabk	lo-so, lo-vfr; so, po	n.o.	a, w-i			Abundant subangular to subrounded gravel
	19	0.20	0.00	0.33	0.10	0.00		0.11	2.01	Buried soil 4 12.92
10Btb	427-448+	10YR5/4&6/4 w/ 7.5YR6/4d, 7.5YR4.5/4m	SC	3cabk	sh-h, fr; s, p-vp	2npf, 2nst	n.o.			
	21	0.40	0.80	0.83	1.25	0.50		0.63	13.24	Buried soil 5 13.24
								SDI@448+cm	150.57	

Key to Soil Notation
Color: Standard Munsell Soil Color Chart Notation
Texture: g-Gravel, S-sand, LS-Loamy Sand, SL-Sandy Loam, SCL-Sandy Clay Loam, L-Loam, SC-Sandy Clay, C-Clay
Structure: 1-Weak, 2-Moderate, 3-Strong; f-Fine, m-Medium, c-Coarse; s.g.-Single grain, m-massive, sbk-Subangular Blocky, abk-Angular Blocky, pr-Prismatic, pl -Platy
Consistence: (dry) lo-Loose, so-Soft, sh-Slightly hard, h-Hard, vh-Very hard, eh-Extremely hard; (moist) lo-loose; vfr-very friable, fr-friable; fi-firm, vfi- very firm; (wet) so-Nonsticky, ss-Slight sticky, s-Sticky, vs-Very sticky, po-Nonplastic,
Clay Films: st-Stains, n-Thin, mk-Moderatly thick, k-Thick; v1-Very few, 1-Few, 2-Common, 3-Many, 4-Continuous; po-In pores, br-Bridging grains, pf-On ped faces, cl-Coating clasts, gr-Coating grains
Horizon Boundaries: a-Abrupt, c-Clear, g-Gradual, d-Diffuse; s-Smooth, w-Wavy, i-Irregular

Table A: Soil Descriptions
Cherry Valley Trenches, California

PEDON
ID Profile 2 - Trench 1 @ Station 86
Class
P.M. Alluvium/colluvium over QTs

Veg. Grasses/Pasture
Logged by: TKG/5-28-04
Age of Soil See Chart

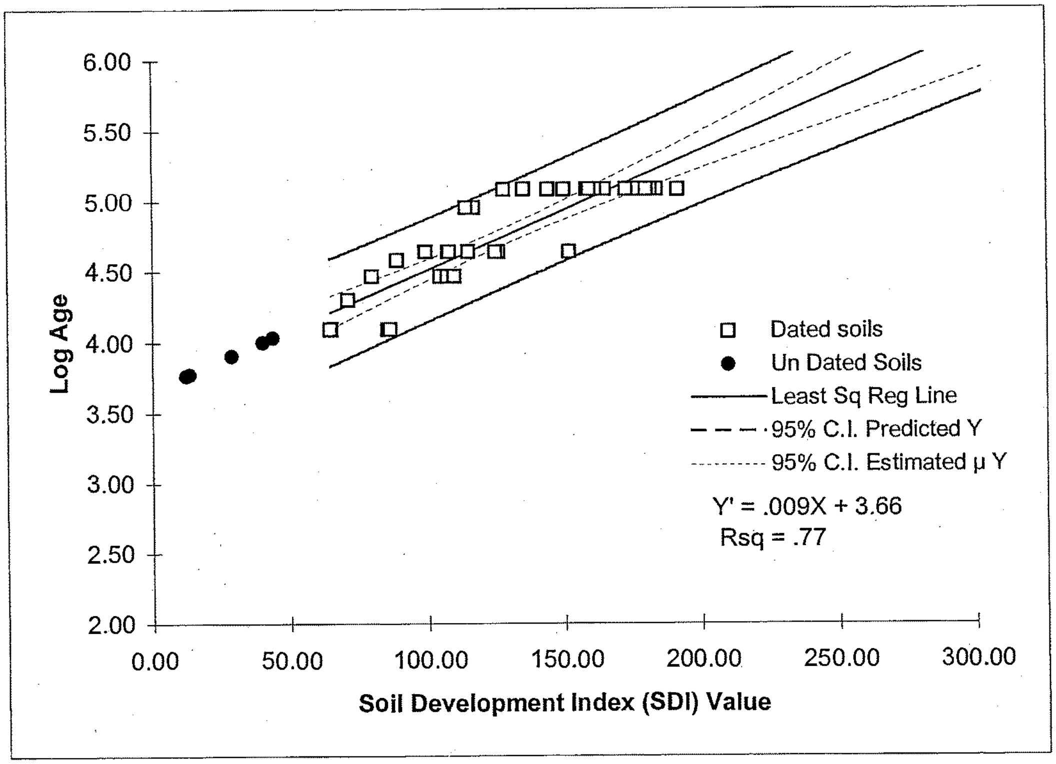
HORIZON	DEPTH (cm)	COLOR (dry, moist)	TEXTURE	STRUCTURE	CONSISTENCE (dry, moist; wet)	CLAY FILMS	BOUNDARY	H.I.	SDI	NOTES
Ap	0-18	10YR4.5/3d, 2/2.5m	L-SL	3vcpl - 3csbk	so-sh, fr; ss, po	n.o.	c, w-l			Hydrophobic, abundant organics, abundant roots.
	18	0.08	0.50	0.67	0.47	0.00		0.50	15.91	
A1	18-43	10YR4.5/3d, 3/3m	SL	1cabk - 2f-mabk	so, vfr; so-ss, po	n.o.	c, w			Abundant rootlets; scattered gravel to 3cm diameter.
	25	0.10	0.40	0.58	0.28	0.00		0.58	25.54	
A2/C	43-82	10YR5/3.5d,3/3m	LS	sg - 1f-msbk	lo-so, lo-vfr; so, po	n.o.	a, w			Abundant roots and rootlets, extensively bioturbated; fine gravel to 0.5cm diameter
	39	0.13	0.20	0.25	0.10	0.00		0.44	22.24	Surface soil 63.70
2Btb1	82-107	10YR4/3.5 & 7.5YR5/5d, 7.5YR3/2m	L-SCL	2msbk-3cabk	sh, fr; s, ps	2-3ncl, 2npf, 3mkbr	c, w			Micaceous; many rootlets and pinhole pores.
	25	0.33	0.60	0.75	0.90	0.75		0.24	8.07	
2Btb2	107-140	7.5YR4/3&4/4d, 3/2.5m	SL-SCL	1-2cabk	so-sh, fr; ss, ps	nkpo, 2-3npf, 1-2nbr, 3n-mk	c-g, w			Less clay than above, with gravel to 4cm in diameter
	33	0.28	0.50	0.58	0.63	0.75		0.46	15.08	
2BCb1	140-192	10YR6/4 & 7.5YR6/6d, 10YR4/4 & 7.5YR4/6m	SL-LS	2c-vcabk	so-sh, vfr; so, po	2npf, 2ncl, 2nbr	g, w			
	52	0.60	0.30	0.67	0.30	0.60		0.41	21.38	
2BCb2	192-226	10YR4/4d & 7.5YR4/6, 10YR3/3 & 7.5YR4/3m	SL	2mabk	so-sh, fr-vfr; so, po	2mk&3npf, 3npo, 3nst	a-c, w			Few scattered coarse sand grains and fine gravel; many rootlets and pinhole pores.
	34	0.50	0.40	0.67	0.30	0.73		0.43	14.73	
3Cox	226-277	10YR4/4 w/ 7.5YR 6/6d, 10YR3/4 w/ 7.5YR4/6m	gS-gLS	1mabk - sg	lo, lo; so, po	2ngr, 1ncl	a, w-l			Channel deposit with gravel to >15 cm diameter
	51	0.60	0.10	0.42	0.00	0.47		0.26	13.46	Buried soil 1 72.72
4Btb1	277-302	10YR5/6 & 7.5YR6/6d, 7.5YR3/4m	SCL	2mabk	sh, fr; s, ps	3npf, 2-3nbr, 3-4 mkpo, 3-4	g, w			Common pinhole pores
	25	0.60	0.60	0.67	0.90	0.83		0.60	15.00	
4Btb2	302-338	10YR5/6 & 7.5YR6/6d, 10YR4/4 & 7.5YR4/6m	SCL-SC	2msbk	sh, fr; s, ps	2-3npf&gr, 3nbr, 4mkpo	a, w			Well sorted fine-medium sand
	36	0.70	0.70	0.50	0.90	0.75		0.59	21.30	Buried soil 2 36.30
5Btb3	338-354	7.5YR5/6 & 4/2d, 10YR3.5/4 & 7.5YR4/4m	SCL	2-3cabk	sh-h, fr; s, ps	2npf, 3-4nbr, 4mkcl	g, w			Fine to medium sand; well sorted, less clay than above; clasts are slightly weathered.
	16	0.50	0.60	0.75	1.00	0.85		0.62	9.87	
5Btb4	354-378	10YR4.5/6 & 7.5YR5/8d, 10YR3/4 & 7.5YR4/6m	SCL-SC	1-2mabk	sh, fr; s,p	4mkcl, 3-4mkgr, 2mk&3npf	g, w			Angular to subangular gravel to 4cm diameter; more gravel thanabove; clasts are slightly weathered.
	24	0.85	0.70	0.58	0.73	0.87		0.62	14.93	Buried soil 3 24.80
6Btb5	378-387	10YR5/6 & 7.5YR6/6d, 7.5YR4/6m	SC	3m-cabk	sh-h, fr; s, p	2mk&3-4npf, 3-4mkbr	g,w			Grussified clasts - developed in bedrock of QTs
	9	0.70	0.80	0.83	0.83	0.70		0.64	5.80	
6Btb6	387-402+	10YR5/6 & 7.5YR6/6d, 10YR3/4 & 7.5YR4/6m	SCL	1-2fsbk- sg	sh-h, fr; s, ps	3-4mkpf, 4mk-kbr, 2-3ncl	n.o.			Grussified clasts - developed in bedrock of QTs
	15	0.70	0.60	0.33	1.00	0.90		0.59	8.83	Buried soil 4 14.63
								SDI@402+cm	212.15	

ID Profile 3 - T-S, Station 0+96
Class
P.M. coarse alluvium over QTs

Veg. Grasses
Logged by TKG / 6/7/04
Age of Soil See Chart

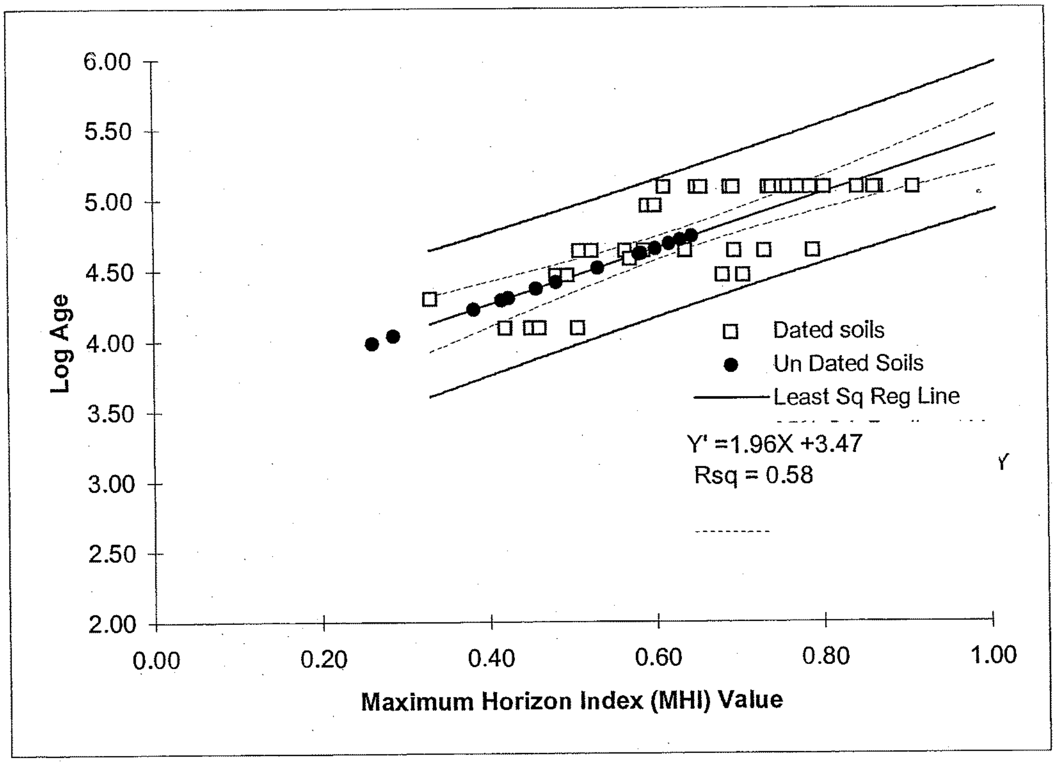
HORIZON	DEPTH (cm)	COLOR (dry, moist)	TEXTURE	STRUCTURE	CONSISTENCE (dry, moist; wet)	CLAY FILMS	BOUNDARY	H.I.	SDI	NOTES
Ap	0-18	10YR4/4d, 2/3m	SL	1-2cgr - sg	so-lo, vfr-lo; so-ss, po	n.o.	a, w			Abundant organics, hydrophobic; with stains on clasts that are probably reworked
	18	0.15	0.40	0.25	0.18	0.00		0.16	2.95	
A1	18-60	10YR4/4d, 2/3m	SL-L	m - 1m-csbk	so-lo, vfr-lo; so-ss, po	3n-vncl	c,w			Abundant scattered angular gravel <1cm diameter, few to 4cm diameter; abundant organics and humus, many rootlets and worm casts; probably reworked clasts.
	42	0.15	0.50	0.25	0.18	0.43		0.25	10.62	
A2/Bw	60-104	10YR4/3damp, 7.5YR2/3m	SL	m - 1m-csbk	so-lo, vfr-lo; ss, po	2-3npf, 2npo, 2-3n-vnst	c-g, w			Abundant rootlets and worm casts
	44	0.15	0.40	0.25	0.27	0.65		0.29	12.59	Surface soil 26.16
2Btb1	104-140	10YR4/4 & 7.5YR5/4d, 7.5YR3/3&2.5/3m	SL	2-3msbk	so, fr; so-ss, po	3mkpf, 3nbr, 3-4ncl	g, w			
	36	0.40	0.40	0.58	0.28	0.82		0.41	14.90	
2Btb2	140-180	10YR4/4 & 7.5YR5/4d, 7.5YR3/2&4/4m	SL	2-3cabk	so, fr; so, po	3-4mkcl, 3n&2mkbr, 2mkpf	c, w			Abundant angular to subrounded gravels 0.5-10cm diameter.
	40	0.40	0.40	0.75	0.20	0.80		0.43	17.00	
2Btb3	180-206	7.5YR5/4&6/4d, 3/3&4/4m	SL	3c-vcabk	h-vh, fr-fi; ss, po	3mk-kbr, 3n-mkpf, 2-3ncl	c, w			Abundant roots and pinhole pores.
	26	0.30	0.40	0.83	0.87	0.78		0.53	13.79	
2BCb1	206-233	10YR5/4&7.5YR5/4d, 7.5YR3/2.5m	LS	1-2msbk - sg	so-sh, fr; so-ss, po	2n-mkbr, 2npf, 3-4npo	a, w			
	27	0.33	0.20	0.33	0.38	0.63		0.31	8.44	Buried soil 1 54.13
3BCb2	233-277	7.5YR4/6 & 5/4d, 4/3 & 3/2m	gSL	m - 1-2fsbk	sh, fr; ss, po	3mk-kpf, 4npo, 3-4mkbr	c, w			
	44	0.38	0.40	0.33	0.57	0.87		0.42	18.64	Buried soil 2 18.64
4BCb3/Cox	277-308+	10YR6/6& 7.5YR5/4d, 10YR4/4 & 7.5YR4/4m	SL-SCL	2m-cabk	h-vh, fr; ss, ps	2npf, 2-3npo, 2mk&3nbr	n.o.			Clasts are very grussified.
	31	0.60	0.50	0.67	1.03	0.68		0.58	18.00	Buried soil 3 18.00
								SDI@307+cm	116.92	

Chart 1: Soil Development Indices, Cherry Valley Trenches, California



	SDI	Log Age	Age (yrs)	95% Predicted Age C.I. Max	Min
Profile 1 - Trench 1 @ Station 336					
Surface soil	43.63	4.03	10,804	26,383	4,424
Buried soil 1	28.71	3.91	8,072	20,125	3,238
Buried soil 2	39.94	4.00	10,052	24,667	4,097
Buried soil 3	12.13	3.77	5,839	14,945	2,281
Buried soil 4	12.92	3.77	5,930	15,157	2,320
Buried soil 5	13.24	3.78	5,968	15,245	2,336
Profile 2 - Trench 1 @ Station 86					
Surface soil	63.70	4.20	15,988	38,152	6,700
Buried soil 1	72.72	4.28	19,067	45,117	8,058
Buried soil 2	36.30	3.97	9,363	23,088	3,797
Buried soil 3	24.80	3.87	7,479	18,756	2,982
Buried soil 4	14.63	3.79	6,132	15,629	2,406
Profile 3 - T-5, Station 0+96					
Surface soil	26.16	3.89	7,680	19,219	3,069
Buried soil 1	54.13	4.12	13,263	31,978	5,501
Buried soil 2	18.64	3.82	6,631	16,791	2,619
Buried soil 3	18.00	3.82	6,548	16,599	2,583

Chart 2: Soil Development Indices, Cherry Valley Trenches, California



		MHI	Log Age	Age (yrs)	95% Predicted Age C.I. Max	Min
Profile 1 - Trench 1 @ Station 336						
	Surface soil	0.42	4.29	19,535	62,164	6,139
	Buried soil 1	0.58	4.62	41,656	127,702	13,588
	Buried soil 2	0.48	4.42	26,215	81,821	8,399
	Buried soil 3	0.26	3.99	9,753	33,229	2,863
	Buried soil 4	0.38	4.23	16,811	54,149	5,219
	Buried soil 5	0.63	4.71	51,532	157,521	16,859
Profile 2 - Trench 1 @ Station 86						
	Surface soil	0.58	4.61	41,137	126,148	13,415
	Buried soil 1	0.46	4.37	23,569	74,029	7,504
	Buried soil 2	0.60	4.65	44,904	137,466	14,668
	Buried soil 3	0.62	4.68	48,406	148,040	15,828
	Buried soil 4	0.64	4.74	54,860	167,659	17,951
Profile 3 - T-5, Station 0+96						
	Surface soil	0.29	4.04	10,916	36,707	3,246
	Buried soil 1	0.53	4.52	32,839	101,407	10,635
	Buried soil 2	0.42	4.31	20,283	64,361	6,392
	Buried soil 3	0.58	4.61	41,137	126,148	13,415

BETA

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REPORT OF RADIOCARBON DATING ANALYSES

Mr. Daniel Jankly — Report Date: 7/13/2004

Leighton Consulting, Inc. — Material Received: 6/17/2004

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 193209	2990 +/- 40 BP	-24.6 o/oo	3000 +/- 40 BP
Beta - 193210	510 +/- 40 BP	-24.9 o/oo	510 +/- 40 BP

Beta - 193209
SAMPLE : T-1@STA435
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 1380 to 1110 (Cal BP 3330 to 3060)

Beta - 193210
SAMPLE : T-1@STA525
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1400 to 1450 (Cal BP 550 to 500)

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.6:lab. mult=1)

Laboratory number: **Beta-193209**

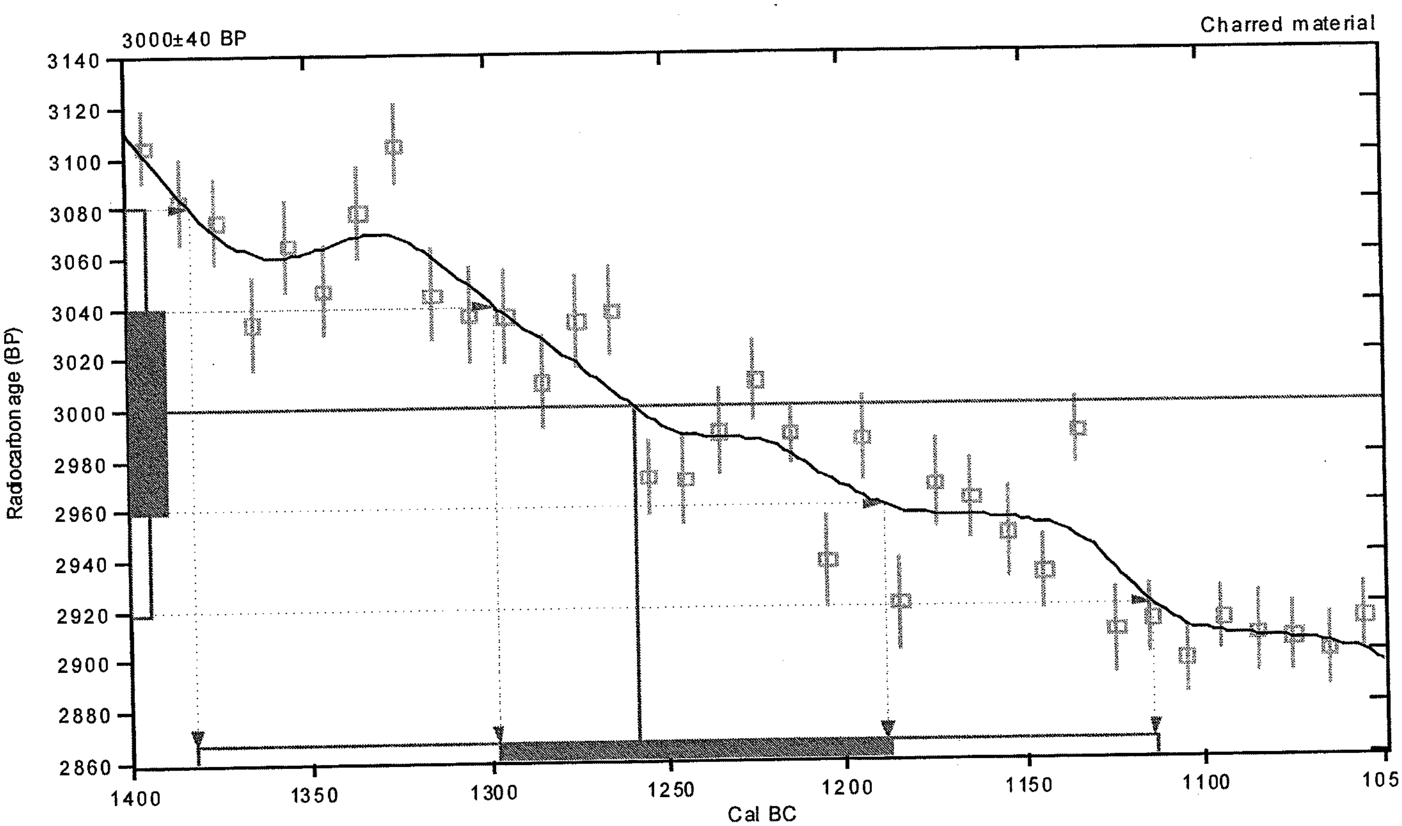
Conventional radiocarbon age: **3000±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 1380 to 1110 (Cal BP 3330 to 3060)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 1260 (Cal BP 3210)

1 Sigma calibrated result: (68% probability) Cal BC 1300 to 1190 (Cal BP 3250 to 3140)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii

INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.9:lab. mult=1)

Laboratory number: **Beta-193210**

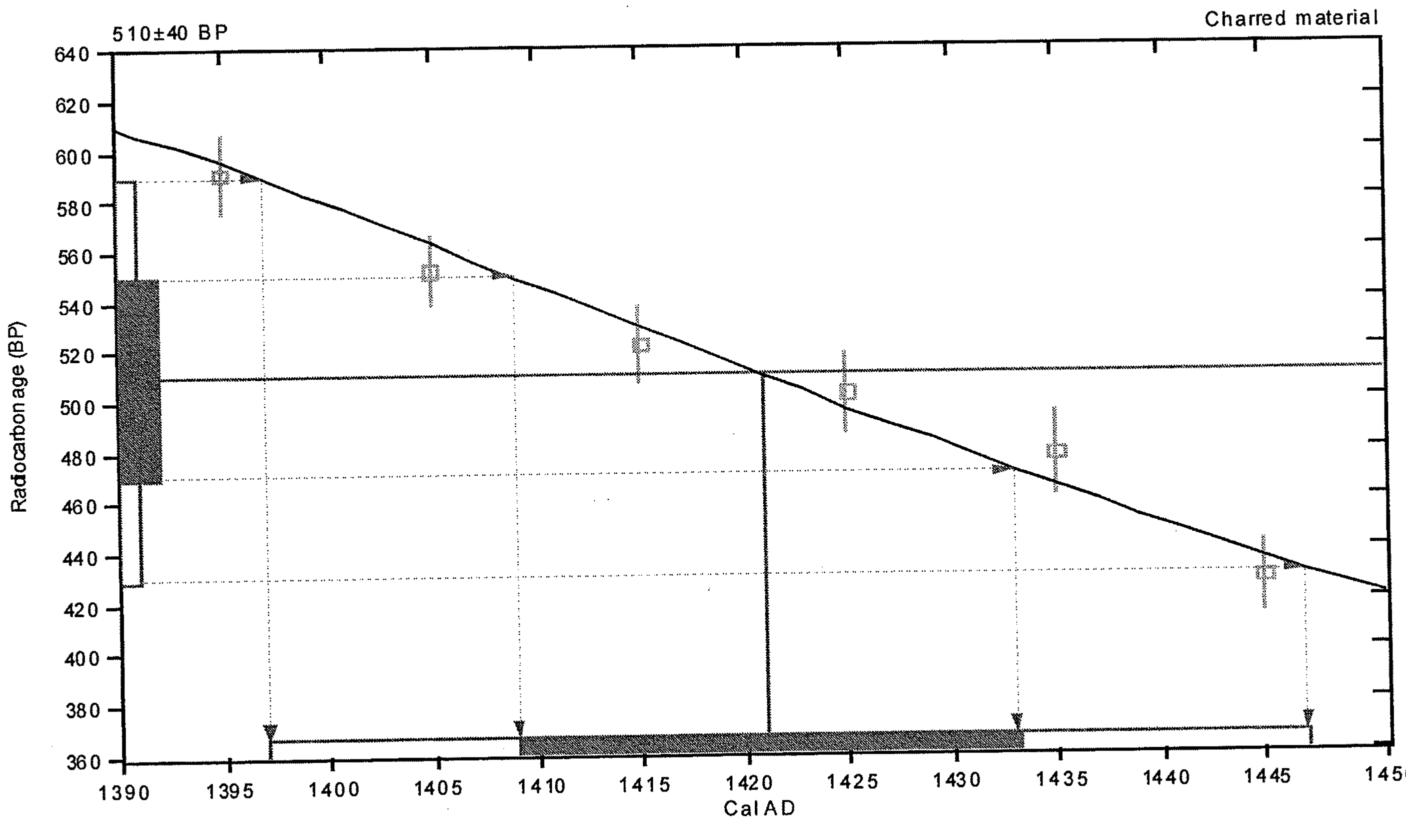
Conventional radiocarbon age: **510±40 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 1400 to 1450 (Cal BP 550 to 500)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1420 (Cal BP 530)

1 Sigma calibrated result: (68% probability) Cal AD 1410 to 1430 (Cal BP 540 to 520)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii

INTCAL98 Radiocarbon Age Calibration

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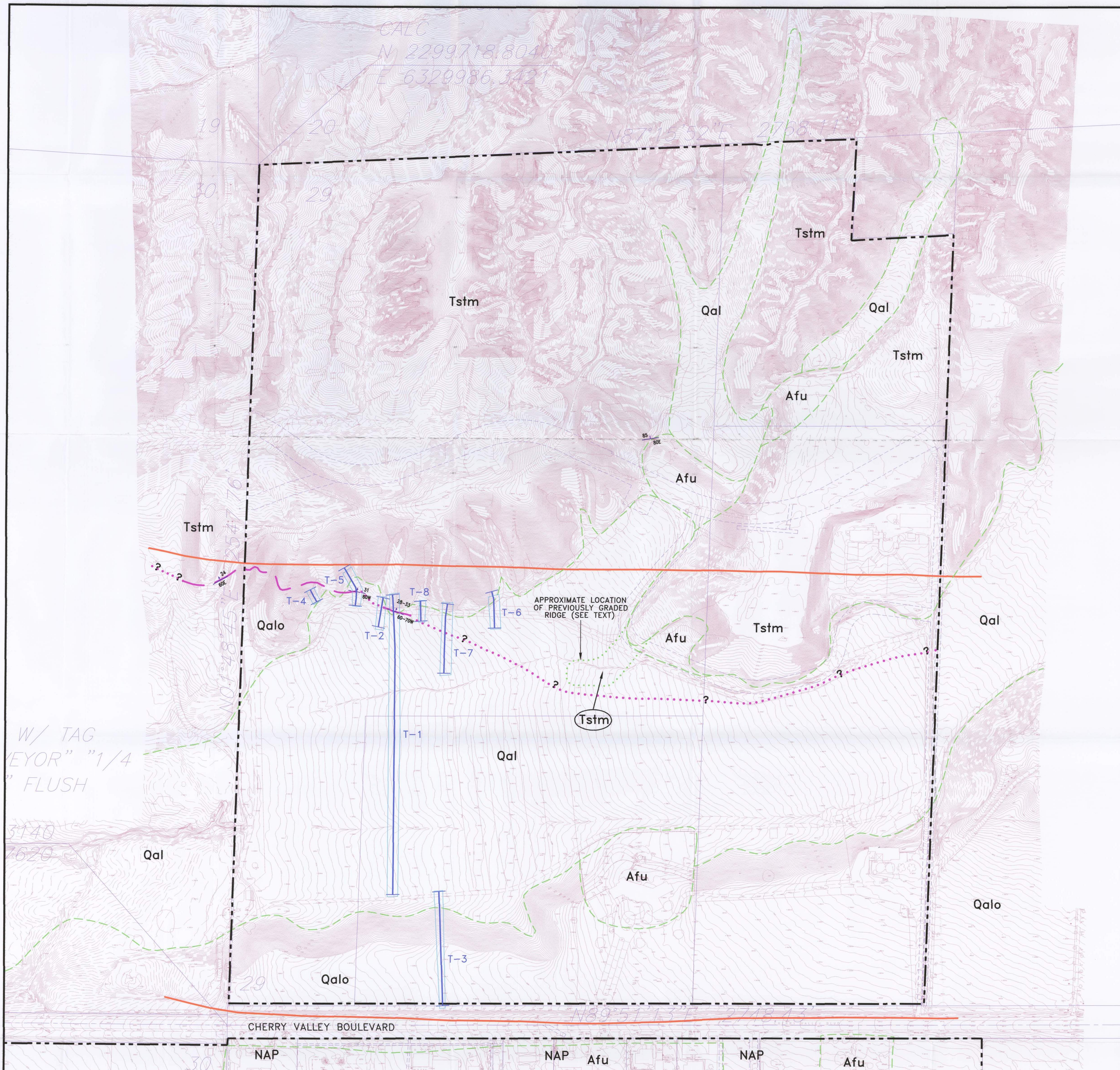


LEGEND

SYMBOLS

T-8 — FAULT TRENCH LOCATION, SURVEYED BY THE KEITH COMPANIES (TKC) ON 6-11-04

APPROXIMATE LIMITS OF UNCOMPACTED FAULT TRENCH BACKFILL (AREA TO BE REMOVED AND REPLACED WITH COMPACTED FILL, SEE TRENCH LOGS FOR DEPTHS)

LIMITS OF THIS INVESTIGATION

APPROXIMATE LOCATION OF RIVERSIDE COUNTY DESIGNATED EARTHQUAKE FAULT ZONE (RIVERSIDE COUNTY GENERAL PLAN, 2003)

APPROXIMATE LOCATION OF FAULT, DOTTED WHERE BURIED, (SEE TEXT), SURVEYED BY TKC ON 6-11-04 WHERE ENCOUNTERED (T-1, 2 AND 5)

APPROXIMATE LOCATION OF GEOLOGIC CONTACT, DOTTED WHERE BURIED

38 / 45E — APPROXIMATE LOCATION OF BEDDING ATTITUDE, DASHED WHERE SUBSURFACE

30 / 45E — APPROXIMATE LOCATION OF FAULT ATTITUDE, DASHED WHERE SUBSURFACE

UNITS

Afu	UNDOCUMENTED ARTIFICIAL FILL
Qal	ALLUVIUM
Qalo	OLDER ALLUVIUM
Tstm	SAN TIMOTEO FORMATION BEDROCK

N

0 100 200
SCALE FEET

PLATE 1

GEOLOGIC MAP August 3, 2004

FAULT INVESTIGATION REPORT, DANNY THOMAS RANCH PORTION OF THE SUNNY-CAL EGG RANCH PROJECT, CHERRY VALLEY AREA OF UNINCORPORATED RIVERSIDE COUNTY, CALIFORNIA

Leighton			
	Proj: 600390-002	Scale: 1"=100'	Date: 8/04
	Geol: PB/DPJ	Drafted By: BQT	CP By: BQT

P:\DRAFTING\600390\002\OF_04-06-21\PLATE1.DWG (03-03-08 10:32:11AM) Plotted by: btran

GE001306 C

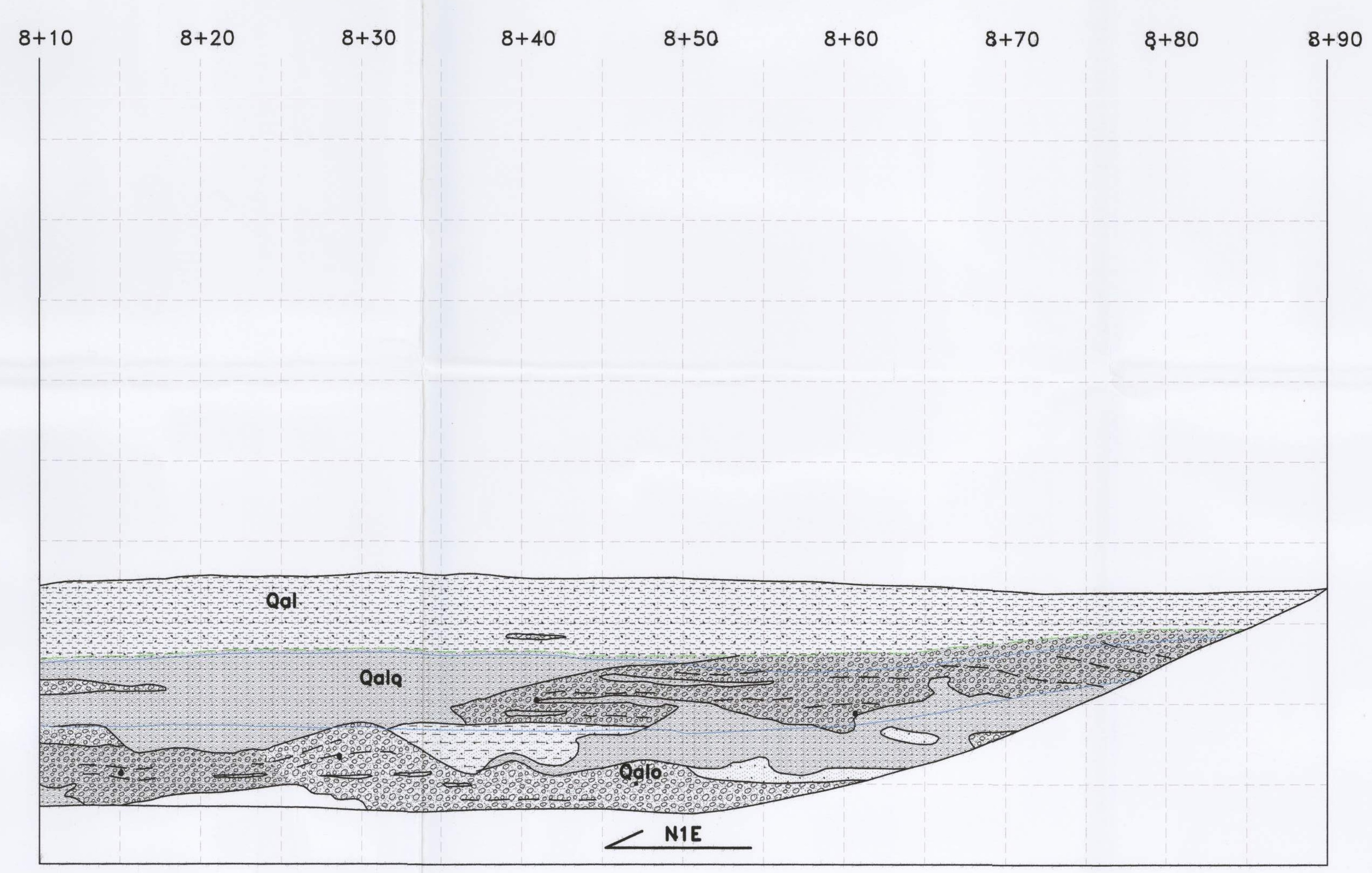


PLATE 3

LOG OF TRENCH T-1 (EAST WALLS)
DANNY THOMAS RANCH PORTION OF THE SUNNY-CAL EGG RANCH PROJECT,
CHERRY VALLEY AREA OF UNINCORPORATED
RIVERSIDE COUNTY, CALIFORNIA

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Proj: 600390-002	Scale: 1"=5'	Date: 8/04
Geol: PB/DPJ	Drafted By: JDS	CP By: JDS

P:\DRAFTING\600390\002\OF_6-21-04\PLATE3.DWG (11-21-05 1:29:11PM) Plotted by: VNGUYEN

GE001306 D

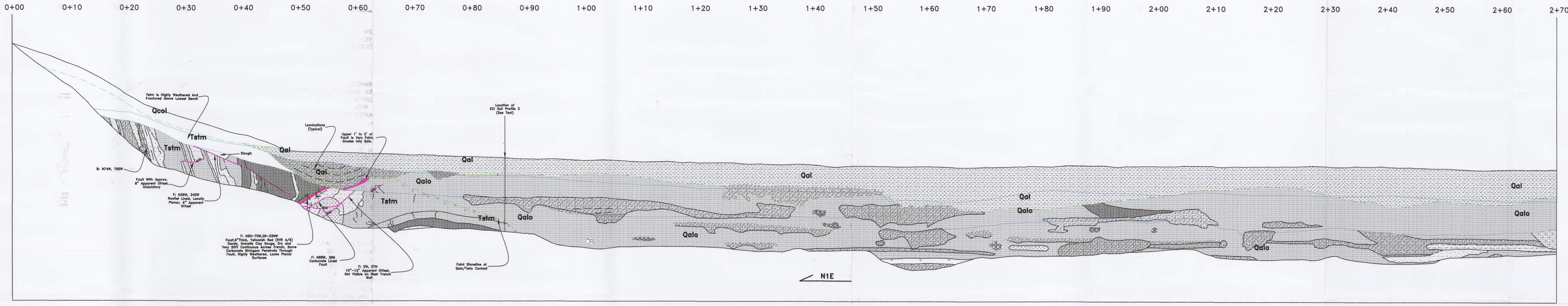
LEGEND

Qcol – COLLUVIUM: SILTY TO GRAVELY SAND, YELLOW (2.5Y 7/6) TO STRONG BROWN (7.5 YR 4/6), DRY TO SLIGHTLY MOIST, MEDIUM DENSE. SAND IS FINE TO COARSE GRAINED. SCATTERED ROOTLETS, GRADATIONAL CONTACT WITH Qal/Qalo/Tstm.

Qal – ALLUVIUM: SILTY SAND (FINE TO MEDIUM GRAINED) TO FINE SANDY SILT. BROWN (7.5YR 4/4) TO DARK YELLOWISH BROWN (10YR 3/6), DRY TO SLIGHTLY MOIST, MEDIUM DENSE/SLIGHTLY STIFF, LOCAL GRAVEL TO 2"DIA. LOCAL INSIZED CHANNELS WITH SAND/GRAVEL/COBBLE INFILL, LOCALLY LAMINATED AS DEPICTED. GRADATIONAL CONTACT WITH Qcol/Qalo/Tstm.

Qalo – OLDER ALLUVIUM: SILTY FINE SAND, WITH SCATTERED GRAVEL TO SAND (FINE TO VERY COARSE GRAINED), WITH SCATTERED GRAVEL. REDDISH BROWN (5YR 4/4) TO BROWN (7.5 YR 4/4) TO YELLOWISH BROWN (10YR 4/6). LOCAL WELL DEVELOPED SOIL HORIZONS, LOCAL INSIZED CHANNELS WITH SAND/GRAVEL/COBBLE INFILL, LOCALLY LAMINATED. SOIL HORIZONS & CHANNEL LAMINATIONS ARE GENERALLY SUBHORIZONTAL WITH GRADATIONAL CONTACTS. SOIL HORIZONS ARE LOCALLY CHAOTICALLY SCOURED BY INSIZED CHANNELS. CLASTS ARE GENERALLY MODERATELY WEATHERED, SUB ANGULAR TO SUB ROUNDED, OF VARIABLE COMPOSITION AND UP TO 8" DIA.

Tstm – SAN TIMOTEO FORMATION BEDROCK: INTERBEDDED SANDSTONE (VERY FINE TO COARSE GRAINED); SILTY SANDSTONE (FINE GRAINED); CONGLOMERATE (SILTY FINE TO COARSE SAND MATRIX); AND SCARCE SILTSTONE. LIGHT YELLOWISH BROWN (2.5YR 6/4) TO OLIVE YELLOW (2.5YR 6/6)TO VERY PALE BROWN (10YR 7/3). SLIGHTLY MOIST, MEDIUM DENSE, LOCALLY MICACEOUS. CLASTS UP TO 18"DIA., DECOMPOSED TO HIGHLY WEATHERED, EASILY FRIABLE, AND SUBANGULAR TO SUBROUNDED. CLASTS ARE HIGHLY VARIABLE IN COMPOSITION. SOME SOFT SEDIMENT DEFORMATION, BEDS ARE MASSIVE TO 6"THICK, LOCALLY FRACTURED AND FAULTED.



SYMBOLS/GRAPHICS

SAND

GRAVEL

COBBLES

SILT

GEOLOGIC CONTACT

FAULT WITH ARROWS INDICATING RELATIVE OFFSET DIRECTION (IF KNOWN)

LOCATION OF BENCH

KROTOVINA

B,F,J BEDDING, FAULT OR JOINT/FRACTURE ATTITUDES

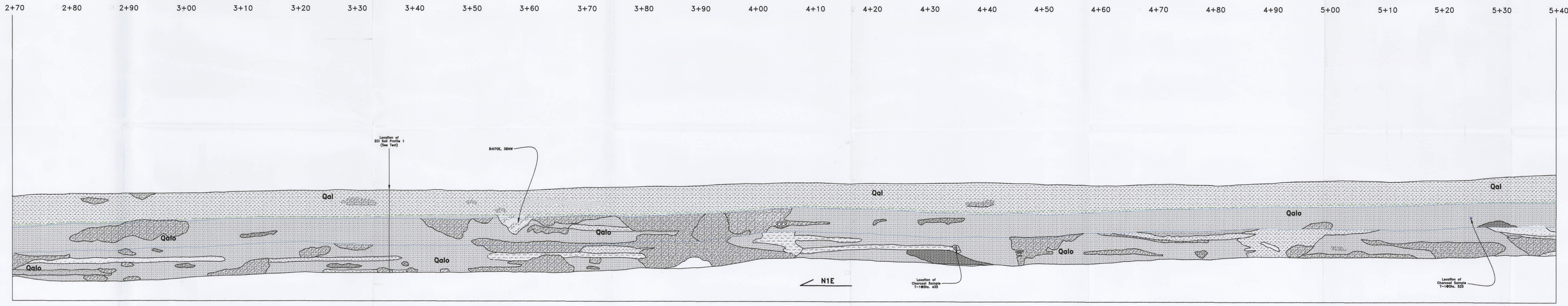


PLATE 2

LOG OF TRENCH T-1 (EAST WALLS)
DANNY THOMAS RANCH PORTION OF THE SUNNY-CAL EGG RANCH PROJECT,
CHERRY VALLEY AREA OF UNINCORPORATED
RIVERSIDE COUNTY, CALIFORNIA

Leighton Consulting, Inc. A LEIGHTON GROUP COMPANY	Proj: 600390-002	Scale: 1"=5'	Date: 8/04
	Geol: PB/DPJ	Drafted By: JDS	CP By: BQT

P:\DRAFTING\600390\002\OF_6-21-04\PLATE2.DWG (11-21-05 1:24:27PM) Plotted by: VNGUYEN

GE001306 E

PLATE 4

LOG OF TRENCH T-2 THROUGH T-8 (EAST WALLS)
DANNY THOMAS RANCH PORTION OF THE SUNNY-CAL EGG RANCH PROJECT,
CHERRY VALLEY AREA OF UNINCORPORATED
RIVERSIDE COUNTY, CALIFORNIA

Leighton Consulting, Inc. A LEIGHTON GROUP COMPANY	Proj: 600390-002	Scale: 1"=5'	Date: 8/04
	Geol: PB/DPJ	Drafted By: JDS	CP By: JDS
	P:\DRAFTING\600390\002\OF_6-21-04\PLATE4.DWG (11-21-05 1:33:16PM) Plotted by: VNGUYEN		

ATTACHMENT

C.H.J. INC. AUGUST 3, 2005 REPORT

SUBSURFACE INVESTIGATION OF FAULTING
CHERRY VALLEY GATEWAY PROJECT
TENTATIVE TRACT NO. 30545
NORTHEAST OF
CHERRY VALLEY BOULEVARD
AND INTERSTATE 10
CHERRY VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA
PREPARED FOR
TSG CHERRY VALLEY, L.P.
JOB NO. 04806-8

C.H.J. Incorporated

SUBSURFACE INVESTIGATION OF FAULTING
CHERRY VALLEY GATEWAY PROJECT
TENTATIVE TRACT NO. 30545
NORTHEAST OF
CHERRY VALLEY BOULEVARD
AND INTERSTATE 10
CHERRY VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA
PREPARED FOR
TSG CHERRY VALLEY, L.P.
JOB NO. 04806-8

C.H.J. Incorporated
1355 E. Cooley Drive, Colton, CA 92324 ◆ Phone (909) 824-7210 ◆ Fax (909) 824-7209
15345 Anacapa Road, Suite D, Victorville, CA 92392 ◆ Phone (760) 243-0506 ◆ Fax (760) 243-1225

August 3, 2005

TSG Cherry Valley, LP
c/o The Shopoff Group
114 Pacifica, Suite 245
Irvine, California 92618-3321
Attention: Mr. James Welsh

Job No. 04806-8

Dear Mr. Welsh:

Attached herewith is the report of Subsurface Investigation of Faulting prepared for the Cherry Valley Gateway Project, Tentative Tract No. 30545, located north of Cherry Valley Boulevard in the City of Calimesa, California.

This report was based upon a scope of services generally outlined in our proposals dated December 21, 2004 and January 10, 2005, and other written and verbal communications.

We appreciate this opportunity to provide engineering geologic services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
C.H.J., INCORPORATED

Jay J. Martin, E.G.
Vice President

JJM/RJJ:sra

Distribution: TSG Cherry Valley, LP (6)

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SUBSURFACE INVESTIGATION OF FAULTING
CHERRY VALLEY GATEWAY PROJECT
TENTATIVE TRACT NO. 30545
NORTHEAST OF CHERRY VALLEY BOULEVARD
AND INTERSTATE 10
CHERRY VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA
PREPARED FOR
TSG CHERRY VALLEY, LP
JOB NO. 04806-8

INTRODUCTION

During February through July of 2005, a subsurface investigation of faulting was performed by this firm for Tentative Tract No. 30545, located north of Cherry Valley Boulevard, partly in the City of Calimesa and partly in an unincorporated area of Riverside County, California. The purpose of this investigation was to explore and evaluate the engineering geologic conditions at the subject site, particularly as to the potential hazard of ground rupture due to active faulting, and to provide appropriate engineering geologic recommendations for design of the proposed development. The approximate location of the site is shown on the attached Index Map (Enclosure "A-1").

The site is traversed by a Fault Hazard Management Zone designated by the County of Riverside to include traces of suspected active faulting associated with the Cherry Valley fault. The approximate location of the site and the boundaries of the Fault Hazard Management Zone are shown on the attached Fault Hazard Zone Map (Enclosure "A-2").

To orient our investigation, we were provided with a Conceptual Design Plan showing the locations of the proposed building areas and a Topographic Survey, prepared by Lung and Associates, dated April 26, 2004. We utilized information from the subsequent survey by Hunsaker & Associates, Incorporated in preparation of the final report.

An engineering geologic investigation was conducted by this firm and the results presented in a report dated August 26, 2004 (C.H.J. Incorporated, Job No. 04806-3). Pertinent information from that investigation has been utilized in the preparation of this report which supercedes our prior report.

The results of our current investigation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this subsurface investigation of faulting included the following:

- Review of published and unpublished literature and maps, including previous investigations conducted by this firm and others
- Review and analysis of stereoscopic aerial photographs flown in 1960, 1962, 1974, 1980, 1984, 1990, 1995, 2000, 2002, and 2004
- A geologic field reconnaissance of the site and surrounding area
- Geologic mapping of the site at a scale of 1 inch equals 100 feet
- Continuous geologic trenching and bulldozer slope cuts across suspected faults and previously identified lineaments to provide subsurface coverage for the proposed building areas with respect to ground rupture hazards due to faulting
- Evaluation of the geologic data to develop site-specific recommendations for mitigation of geologic hazards and concerns to the site.

PROJECT CONSIDERATIONS

It is proposed to develop the 244-acre site as a residential area including open space use. Information furnished this office indicates that approximately 140 acres of the southern and northwestern portions of the subject tract will be developed with single-family residential structures. These are expected to be one- to two-story wood frame and stucco buildings or similar type construction. The remaining approximately 100 acres, located primarily in the northeastern portion of the site, will be used as open space. The area of this investigation includes all of the proposed development area and locations of interest within the open space area.

The project grading plan was not available at the time of our investigation. Based on client-provided information, the site is to be developed into lots ranging from 5,000 square feet and greater in size. Observation of site topography and of adjacent developments indicates that grading of this site will entail cuts and fills to a maximum of about 30 feet. The final project grading plan should be reviewed by the geotechnical engineer.

SITE DESCRIPTION

The site is located within the San Timoteo Badlands area of Calimesa. Entrance to the site is via unpaved graded roads accessed from Cherry Valley Boulevard at the west and east portions of the site. The southern portion of the site consists of a relatively flat, southwest-sloping drainage bordered by topographic benches on the south near Cherry Valley Boulevard and on the north by southwest-trending ridges and canyons. The northern portion of the site is characterized by badlands topography with steep-walled canyons separated by narrow ridges. The majority of the proposed development is planned within the lowland and canyon areas of the site.

At the time of our investigation, the site was covered by annual grasses and weeds. Scattered scrub oak trees were located in the canyon areas and adjacent to the slope along Cherry Valley Boulevard. Typical sage scrub was present primarily on the upland areas of the site. The lowland and canyon bottom areas of the site appear to have been previously disced.

Several utility vaults are located within the northern portion of the site and are associated with a water line and fiber optic cable that traverse the site within an east-west trending canyon from the northeastern boundary to the central portion of the site and continue to the northwestern boundary on a general northwest trend. Fill and road construction are associated with the trend of the pipeline. Developed properties that include residences are located on ridges and in canyon bottoms along the northern boundary of the site. Prior grading of ridges within the southern portion of the site was observed on historic aerial photographs that include the area of the site. Fill associated with the prior grading activities was observed locally within our explorations.

The main trace of the Cherry Valley fault zone is defined in the field and on aerial photographs by a prominent geomorphic escarpment and forms the contact between older alluvium on the southwest and Plio-Pleistocene sediments (San Timoteo formation) on the northeast. Across the western portion of the site, the escarpment exhibits prominent linear topographic expression between ridgelines with incision and removal of the feature in intervening drainages. In the eastern portion of the site, the trend of the escarpment swings toward the northeast but is still identifiable as a distinct topographic feature in aerial photographs and existing topography. The scarp morphology is well preserved at locations to the northwest of the subject site.

PREVIOUS INVESTIGATIONS

The potential hazard of surface fault rupture at the site was identified during our prior engineering geologic investigation summarized in our report, dated August 26, 2004. We identified several mapped strands of the Cherry Valley fault that trend through the Calimesa area, including the area of the site, and concluded that a site-specific investigation to address the potential for fault rupture hazard associated with these faults is necessary for the proposed development.

The Cherry Valley fault was mapped as two subparallel northwest-trending strands in the Calimesa area by Shuler (1953) and Matti and others (1992). Bloyd (1971) mapped a concealed fault trace based on groundwater data north of and trending parallel to the traces mapped by Shuler (1953) and Matti (1992). Smith (1988) observed several Pleistocene age faults in trenches located about 1,000 feet north of the site near the northerly of the two previously mapped fault splays. ICG (1990) located a fault in the northeastern portion of the site in the San Timoteo Formation as a colluvium-filled fissure. The locations of these faults are shown on Enclosure "A-3", Detail of FER-235, Plate Ia.

Matti and others (1992) suggest that the Cherry Valley fault zone may represent the westerly extent of the San Gorgonio Pass fault complex - a series of Quaternary reverse, thrust, and wrench faults that extends eastward to the Whitewater area - and suggest that the most recent activity along faults in the western portion of the complex (the area of the site) is latest Pleistocene in age.

The County of Riverside (1990) depicts three strands of the Cherry Valley fault in the northeast portion of the site. Two major strands mapped by the County are approximately coincident with the two faults mapped by Shuler (1953) and Matti and others (1992). A third more northwesterly-trending strand appears to coincide with the fault mapped by ICG (1990).

A fault rupture hazard investigation conducted by Leighton & Associates, dated August 3, 2004, for the parcel adjacent to the eastern boundary of the subject site included subsurface exposures excavated across the eastern extension of the southern of the two fault zones evaluated herein. Leighton & Associates encountered thrust faulting in three trenches that juxtapose San Timoteo bedrock over relatively younger soils. Based on stratigraphic evidence and soils ages, they concluded that the faults are "inactive".

We performed a fault rupture hazard investigation of the Cherry Valley fault zone for a site located northwest of the subject site (CHJ, 2002). During our prior investigation, we observed a north-dipping, low-angle reverse fault. The results of that investigation concluded that the Cherry Valley fault was inactive based on the presence of greater than 10 feet of unruptured older alluvium of up to middle Pleistocene age overlying the fault.

GEOLOGIC SETTING

The site is located in the northern portion of the Peninsular Ranges Geomorphic Province. The Peninsular Ranges are characterized by northwest-trending mountains and basins bounded by northwest-trending faults. The Peninsular Ranges province includes numerous distinctive landforms consisting of elevated erosional surfaces (geomorphic surfaces). The geomorphic surfaces are relatively planar, stable highland areas that have been uplifted and are now being incised by modern drainages.

The site is located in the eastern portion of a series of low hills that extend from Redlands to the base of the San Jacinto mountains. These hills are known as the "badlands" and are characterized by relatively steep-walled incised drainages separated by narrow ridge lines. The badlands represent a block of land that has been uplifted along the northeast side of the San Jacinto fault. This uplifted block is primarily comprised of the Plio-Pleistocene-age San Timoteo formation and its equivalents overlying metamorphic and igneous bedrock. Geologic mapping conducted as part of this investigation revealed the presence of moderately to steeply south-dipping sedimentary beds of the San Timoteo formation in the northern portion of the site. Similar bedding was observed during our prior investigation for a project located adjacent to the northwestern corner of the subject site. In addition, mapping during the prior investigation to the northwest revealed the presence of an anticline (folded sedimentary units) with a northwest-trending hingeline located in the northeastern-most portion of that site. The anticline structure is defined by steeply dipping to possibly overturned beds on its southern limb and gently dipping beds on its northern limb. The local geology of the site is shown on Enclosure "A-4", Geologic Map and Site Plan. The general geology of the region is presented on Enclosure "A-5", Geologic Index Map (Dibblee, 1982).

SITE GEOMORPHOLOGY

The geomorphology (landforms) of the site is characterized by series of southwest-trending ridges and intervening drainages in the northern portion of the site that drain into an east-west trending drainage located in the southern portion of the site. A west-northwest trending lineament/escarpment visible in aerial photographs and on topographic maps bisects the site and separates planar, dissected topographic bench surfaces from steeper, sharper ridges on the north in the upland areas of the site. Based on aerial photograph review, the bench features described above continue to the northwest as a series of benches adjacent to and south of the Cherry Valley fault zone and is equivalent to a planar and more continuous surface traversed by Cherry Valley Boulevard along the southern boundary of the site. This surface likely represents a former terrace that is abandoned due to regional uplift and incision. Based on review of aerial photographs, it is evident that discing and/or grading has occurred in some areas of the site. In the 1960 photos, areas of the bench feature in the southern one-half of the site appear to have been plowed or disced as well as the majority of lowland and drainage areas of the site. Modification by lowering and flattening of a ridge between the location of Trench Nos. T-2 and T-3 is evident in the 1974 photographs. Similar but less pronounced modification of ridges located south of and parallel to the previously described location is evident in the 1980 photographs. Significant modifications of the land forms within the site were not noted in the 1990, 1995, and 2000 photographs.

CRITERIA FOR FAULT ACTIVITY DESIGNATIONS

In general, the state of activity of a fault is determined by establishing the age of the youngest materials displaced by the fault. If datable material is present, an absolute age can sometimes be established. If no datable material exists, then only a relative age can be assigned to movement on the fault.

Treiman (1994) concluded that the previously mapped strands of the Cherry Valley fault trending from Calimesa to Cherry Valley do not exhibit the necessary characteristics of active faulting to warrant inclusion within an Alquist-Priolo Earthquake Fault Zone. However, the County of Riverside (1990) has established a Fault Hazard Management Zone for portions of the Cherry Valley fault for planning purposes. The fault traces identified on the County of Riverside map and lineations identified in aerial photographs as possible locations of the Cherry Valley fault zone located within the conceptual plan area of the subject site were investigated during this study.

SUBSURFACE AND FIELD INVESTIGATION

Our field program included excavation of five trenches and four slope cuts to investigate the areas of potential fault strands identified in our preliminary study and in the field. A total of approximately 2,215 lineal feet of trench and approximately 2,600 lineal feet of slope cut was excavated. The trenches ranged in maximum depth from 15 to 21 feet and were oriented roughly perpendicular to the northwest-southeast trend of the Cherry Valley fault. The trenches were excavated with a Caterpillar 320 excavator utilizing a 48-inch wide bucket. Trench sidewall stability considerations necessitated the inclusion of benches in the excavations. The slope cuts were excavated with a Caterpillar D6 bulldozer. The trench walls and slope cuts were cleaned to expose the soil/rock substrate, examined for geologic features, including lithology, soil horizons, and indications of possible fault-related features. A horizontal reference datum and lateral stationing were established along the exposures. The trenches and cut slopes were logged at a scale of 1 inch equal to 5 feet. The trench logs and slope cut logs are included in Appendix "B".

Mr. David Jones of the County of Riverside Department of Building and Safety visited the site on March 24, 2005 to observe the work in progress and observe the trench and slope cut exposures. Dr. Katherine Kendrick and Dr. Douglas Morton of the United States Geological Survey (USGS) also visited the site and generally concurred with the conclusions made in this report.

Upon completion of the field investigation, the trenches were backfilled and track rolled with a bulldozer. No other compactive effort was applied. The trench backfill should be considered as undocumented fill. Structures should not be placed on or immediately adjacent to any undocumented fill. The trench locations were surveyed by Hunsaker & Associates on May 18, 2005 to facilitate accuracy of their location and recovery of the trench margins during future site work when the trench backfill is removed and replaced as engineered fill, if necessary. Undocumented fill is associated with the cut slopes created during this investigation. Rebar was placed to document the locations where the North Cherry Valley fault was exposed. These rebar locations were surveyed by Hunsaker & Associates, Incorporated during May and June of 2005, and are plotted on Enclosure "A-4".

As part of our previous investigation, the geologic conditions at the site were mapped at a scale of 1 inch equals 200 feet utilizing a Topographic Map prepared by Lung and Associates, dated April 26, 2004. Based upon information gained during this investigation, the mapping from our previous report has been revised. The mapped geologic units and their characteristics are described below. The Geologic Map and Site Plan is included as Enclosure "A-4".

GEOLOGIC MATERIALS

As observed in our current explorations and in outcrop exposures, the geologic materials at the site include siltstone, sandstone, and conglomerate of Plio-Pleistocene age San Timoteo formation in fault contact with older alluvium of late to middle Pleistocene age. These materials are mantled by younger

Holocene-age fluvial sediments within active drainages. Colluvium locally mantles San Timoteo formation materials on slopes and in swales formed in the hillside areas of the site. Fill derived from local materials was encountered in limited areas of the site. The geologic units mapped at the site as part of this investigation (Enclosure "A-3") are discussed below in order from youngest to oldest. We have utilized recognized nomenclature for the geologic units. Some units indicated on the trench and slope cut logs are not shown on the Geologic Map. Argillic soils were not mapped as separate units nor was colluvium differentiated on the Geologic Map. In general, these are units that have developed on underlying geologic units and are generally found only within the upper 2 to 3 feet of the surface. However, the slopes on the site may locally have considerable depths of loose colluvial materials.

Fill (f):

Fill material composed of silty sand with gravel was observed in the hilltop area of Trench No. T-1B near a former road alignment. Fill material consisting of silty and clayey sand with some gravel was observed in the southern portion of Trench No. T-4 as a "wedge" extending downslope from Station 0+90. It is inferred from our discussions with personnel of State of California Department of Water Resources and San Gorgonio Valley Water District that the installation of the water line and associated fiber optic cable generated significant amounts of fill within the utility alignment. It is unknown if the fill was compacted or if any compaction testing was conducted during placement of the water line. Only the larger accumulations of fill are shown on the Geologic Map. Minor amounts of fill are likely present in unexplored portions of the site and in proximity to road alignments.

Younger Alluvium (Qya):

Younger alluvium of Holocene age was observed within the active drainages at the site and is composed of gray to brown silty sand with gravel and cobbles. These materials are typically unconsolidated and may have a significant potential for settlement. With the exception of the south end of Trench No. 4, we did not encounter these materials in our explorations.

Colluvium (Qcol):

Colluvium (materials deposited on slopes by gravity) locally mantles older materials in slope areas. These materials generally form a loose, bioturbated layer ranging from about 12 inches to 18 inches thick on the slopes with thicker layers occurring in swales. These deposits are not delineated on the Geologic Map; however, they are depicted on the Trench and Slope Cut Logs at some locations.

Older Alluvium (Qoa):
Older alluvium of probable Pleistocene age, composed of silty and clayey fine- to coarse-grained sand with gravel, was observed within the bench areas in the southern portion of the site. The older alluvium includes clayey (argillic) soil horizons developed in an alternating sequence of fine-grained and coarse-grained sandy fluvial sediments. The argillic soils have a distinctive reddish-brown (5YR) color. The development of argillic soil horizons such as those observed on the older alluvium require an extended period of subaerial exposure, typically at least 15,000 years. The older alluvium is in fault contact (Cherry Valley fault) with the San Timoteo formation.

San Timoteo Formation (QTst):
Interbedded sandstone and cobble-boulder conglomerate of the San Timoteo formation was observed north of the Cherry Valley fault zone at the site and is generally exposed on the steeper ridges and in road cuts at the site. As observed in our explorations and in road cut and natural exposures at the site, the San Timoteo conglomerate is massive to thickly bedded with some areas of thin sand laminae locally between cobble and boulder clasts. Zones of fine- to medium-grained sandstone were observed in several exposures and are interpreted to be interbeds within the conglomerate units. The San Timoteo material is moderately to well cemented, forms relatively steep slopes, and varies from light grey in fresh exposures to brownish grey where deeply weathered.

The San Timoteo formation described above was previously mapped by Dibblee (1982) as gray fanglomerate; however, based on our interpretations of exposures at the previously explored adjacent site located to the northwest, the unit is more appropriately mapped as Plio-Pleistocene age San Timoteo formation. Preliminary mapping of the El Casco quadrangle conducted by representatives of the USGS (Matti, 2003) agreed with the local geologic mapping conducted by this firm. The San Timoteo formation is a sequence of interbedded silts, sands, and gravels derived from uplift and erosion of the San Jacinto and San Bernardino mountains (Shuler, 1953). Gravel generally becomes more common higher in the section; therefore, the San Timoteo formation can be described as a coarsening-upward sequence. Bedding within the San Timoteo formation is regionally inclined at a slight angle toward the northeast to northwest; however, bedding observed in the San Timoteo formation at the site varied from steeply south-dipping to relatively flat lying.

AGE OF THE GEOLOGIC UNITS

During cleaning, observation, and logging of the trench walls, a careful search was made for charcoal samples that could potentially provide radiometric ages via Carbon-14 analysis; however, no such materials were encountered. The only soils observed in the exposures with a sufficient concentration of carbon for bulk radiometric analysis were present at the modern ground surface and would not yield useful information. Therefore, we utilized pedogenic soil development, published and unpublished geologic literature and reports, and geomorphic relationships as an indicator of age for the geologic materials encountered during this investigation.

In general, the degree of soil development reflects the time a particular geomorphic surface has been exposed to the physical, chemical, and biological effects of weathering. In the absence of radiometric age control and assuming similar soil-forming conditions, the numerical age estimates can be established for the site by comparison with a sequence of radiometrically dated soils. Such sequences have been prepared for the Cajon Pass (McFadden and Weldon, 1987), Anza (Rockwell and others, 1990) and most importantly for Yucaipa (Harden and Matti, 1989) and the San Timoteo Badlands (Kendrick, 1999).

Time and budget constraints on this investigation did not permit detailed descriptions of soil profiles exposed in trenches. Field examination and classification of soil profiles was conducted by this firm and confirmed informally in the field with Dr. Katherine Kendrick of the USGS for the current investigation and our prior investigation located at the northwest boundary of the subject site and conducted in a similar geologic setting and materials. In addition, we considered soils age data presented for the adjacent parcel to the east (Leighton Consulting, Inc., 2004) which is equivalent to the subject site from a geologic standpoint.

The San Timoteo formation (QTst) exposed at the site is comparable to Unit 3 described by Albright (1999) and is Plio-Pleistocene in age; as such, it is up to 2.5 million years old. Sedimentary rocks of the San Timoteo formation were exposed in portions of all trenches and slope cuts except Trench No. 1A and Trench No. 3.

Older alluvium (Qoa) was exposed in portions of all of the trench and slope cut explorations. Argillic soil horizons ranging from about 1 to 5 feet thick were observed as subsurface horizons developed within and locally scoured by fluvial and alluvial sediments and locally at the surface overlying the San Timoteo formation. Similar soils were encountered during our prior investigation for the adjacent project located to the northwest of the subject site and are interpreted to be equivalent in age based on geomorphic and geologic relationships (topographic continuity of a dissected bench surface located south of the Cherry

Valley fault zone). Based on comparison with Carbon-14 dated soils from the Cajon Pass area, Kendrick (1999) estimated the age of similar argillic soils in the San Timoteo Badlands area to be approximately 20,000 to 30,000 years old. The argillic soils observed in Trench Nos. 1B through 4 for this investigation exhibit characteristics like those of the soils described by Kendrick (1999) and are expected to range from 20,000 to 50,000 years old (late Pleistocene age) to latest Pleistocene in age. Based on our interpretation of the aerial photographs reviewed for the site, it should be noted that the surficial materials, including the upper soil horizon in the area of Trench Nos. 1A, 2, 3, and 4, have likely been disturbed or stripped during prior grading/borrow activities at the site. However, the existing soil horizons and stratigraphic profiles are similar between all trench exposures at the site. In addition, the geomorphic surface located south of and adjacent to the Cherry Valley fault containing this soil and stratigraphic sequence is equivalent. Therefore, we interpret that an argillic soil of late Pleistocene age overlies or previously overlaid the Cherry Valley fault zone at the location of our trench exposures.

The younger alluvium (Qya) and stream deposits (Qs) are considered to be less than 11,000 years old (Holocene age).

FAULT RUPTURE HAZARD

The site is not located within an Alquist-Priolo Zone designated by the State of California to include traces of suspected active faulting. However, the northern portion of the site is included within a Fault Hazard Management Zone established by County of Riverside to include traces of suspected active faulting associated with the Cherry Valley fault zone. The boundary of the Fault Hazard Management Zone is shown on Enclosure "A-2".

PHOTOLINEAMENTS:

Two photolineaments consisting of aligned slope breaks, saddles, and tonal contacts were observed to traverse the northern portion of the site on aerial photographs. These lineaments are approximately coincident with previously mapped fault traces within the site and suggest a possible fault-related origin.

Photolineament 1

Photolineament 1 is defined by a distinct narrowing and apparent right-lateral offset of a series of southwest-trending ridges and anomalous topography - including beheaded drainages - that forms a west-northwest trending lineament. These features extend southeasterly across the site from an area northwest of the site and are absent or obscured within the northeast portion of the site. The location of this lineament is coincident with the northern of the two subparallel faults mapped by Shuler (1953) and Matti (1992).

Trench No. 1B and Slope Cuts 2 and 4 are located across the trace of this feature. At the north end of Trench No. 1B, we exposed a high-angle fault within the San Timoteo formation that includes a zone with up to 18 inches of clayey gouge and sheared material near the location of Photolineament 1. This fault places reddish brown, fine- to medium-grained sandstone on the north against light gray cobble/boulder conglomerate on the south. Several low-angle north-dipping faults were observed south of this high-angle fault within a distance of 30 feet. In Slope Cut 2, we encountered a similar high-angle fault at three locations due to the sinuosity of the cut. These faults have similar features to those of the fault observed in Trench No. 1B, including dissimilar rock types in contact across the fault; however, associated low-angle faults were not observed. These fault exposures are located near the trend of Photolineament 1 and define a fault zone oriented N63W as measured along strike between the three locations. Based on an eastward projection of the fault to the next ridge, we located a road cut exposure of the same high-angle fault that juxtaposes similar materials as observed at the locations in Slope Cut 2. In Slope Cut 4, we located the fault as a 10-foot wide zone of subparallel shears with individual orientations ranging from N70W to N89E. Based on a horizontal exposure formed at the base of the slope cut, these shears converge locally and form a trend fault zone with an easterly trend.

We conclude that Photolineament 1 is related to and defines the location of a high-angle fault referred to herein as the Cherry Valley Fault - North Branch. This fault zone is defined in aerial photographs by topographic linearity, apparent right lateral offset of ridgelines crossing the fault trend, and the linearity of a canyon along strike with the fault. A similarity of shear zone width and character in the fault zone, juxtaposition of dissimilar rock types across the zone, and fault geometry define this fault zone in the field. Topographic anomalies including a beheaded drainage (located off site) and apparent right-lateral offset of ridges within the site along trend define the location of this fault. We interpret this fault zone to exhibit an apparent component of right lateral, strike-slip motion and/or dip-slip separation. The geologic materials exposed at the surface across this fault zone are pre-Holocene in age; therefore, we cannot determine the status of activity of this fault zone based on the faulted geologic materials. It is possible that subsequent investigation of the North Branch Cherry Valley fault may provide evidence that this fault is not active.

Photolineament 2

Photolineament 2 is located about 300 to 400 feet south of and subparallel to Photolineament 1 and is defined by a series of south-facing escarpments and slope breaks. It can be traced along a southeasterly trend from the western site boundary to the east central portion of the site where it assumes a more easterly trend and converges toward Photolineament 1. It is approximately coincident with the southern of the two subparallel faults mapped by Shuler (1953) and Matti (1992).

Trench Nos. 1B through 4 and Slope Cut Nos. 1 through 3 were placed across the trace of this feature. A road cut located at the eastern boundary of the site also exposes this feature. In all of these exposures, we encountered a low angle (less than 20 degree) north-dipping fault or faults as described on the enclosed Trench and Slope Cut Logs. These faults place San Timoteo formation conglomerate of Plio-Pleistocene age in the hanging wall over older alluvial deposits of Pleistocene to latest-Pleistocene age in the foot wall and define a low-angle thrust (reverse) fault. This reverse fault was observed in eight exposures within the site boundaries, at two locations within an adjacent area located to the northwest, and is described by Leighton Consulting (2004) within the adjacent parcel to the east. Therefore, Photolineament 2 is related to and defines the location of a fault zone referred to herein as Cherry Valley Fault - South Branch.

Relationship of North Branch and South Branch Faults

The eastward projection of the North Branch fault trends along the north wall of an east-west oriented canyon (possibly fault controlled) and toward the vicinity of an apparent bend in the low-angle South Branch fault zone observed in Trench No. 4. The South Branch fault zone in Trench No. 4 strikes northwesterly near this projected junction, suggesting a structural connection between the North and South Branch faults. We did not find evidence of the high-angle North Branch fault in the area of our prior study located northwest of the subject site. Leighton Consulting (2004) did not find evidence for a high-angle fault within the study area to the east; however, their explorations did not extend across the eastward projection of the North Branch fault. A review of aerial photographs along the eastward projection of the North Branch fault suggests its expression as the east trending drainage located north of Trench No. 2, 3, and 4. A structural connection between the North and South Branch segments of the Cherry Valley fault zone is possible and has been indicated on geologic maps; however, this relationship was not directly observed during this study. If a structural connection exists between the fault zones evaluated during our field investigation, it is possible that branching of the Cherry Valley fault zone occurs near the north end of Trench No. 3 (note the northwest trend of faults measured in this exposure) and is related to partitioning of strain along the fault into strike slip and dip slip components accommodated by separate but sub-parallel splays. This interpretation is possible based on the complex regional tectonic history of the area that includes extensional, compressional, and lateral slip fault zones located between the San Jacinto and San Andreas faults. The Banning fault, which accommodated significant strike slip motion during a prior tectonic regime and trends subparallel to the Cherry Valley fault zone, is located about 0.7 mile north of the site. Its proximity and past slip history indicate that a significant component of lateral stress affected the area of the site. This lateral slip history, together with the documented compressional faulting in the area, supports the presence of a localized, structurally coupled, subparallel fault system comprised of a low-angle thrust fault and high-angle strike-slip fault accommodating different components of regional strain (strain partitioning).

Activity of the Cherry Valley Fault Zone

We infer the age of latest activity on the Cherry Valley fault zone based on the relationships observed in Trench No. 1B, evidence from our prior investigation of the Cherry Valley fault to the northwest, and data obtained by Leighton Consulting (2004) in the adjacent property to the east. In several exposures within the subject site, South Branch faults were traced into the active rooting zone, equivalent to the existing ground surface. This surface is formed in Pleistocene materials and is interpreted to represent a Pleistocene-age feature. In Trench No. 1B from Station 1+00 to 1+50, we observed a well-developed argillic soil with 2.5YR color hues extending to the existing ground surface and mantling the fault zone. We did not find evidence of the fault extending to the surface through this zone. We observed a similar relationship of Pleistocene-age soil mantling the northwest extension of this fault during our prior investigation located northwest of the site. The upper portion of the natural materials has apparently been removed by grading/borrow activities at the other trench locations within the site so that one must assume that the fault reaches the surface at these locations. Leighton Consulting (2004) encountered the eastern extension of the low-angle fault in three trench exposures, one of which allowed the determination that the fault rupture did not extend to the surface of Pleistocene age materials. At the other two locations the fault was overlain by unruptured Holocene materials. Therefore, based on the lack of observed offset of Pleistocene age older alluvium at Trench No. 1B within the subject site and similar evidence from exposures of this fault located northwest and immediately east of the site, the Cherry Valley Fault - South Branch within the site boundaries is considered to be inactive and Restricted Use Zones are not recommended.

Holocene-age activity on the northern splay (North Branch) could not be precluded based on the geologic conditions at the site. The fault exposures show rupture to the ground surface in Tertiary age San

Timoteo formation materials. Prior mapping of these faults shows branching (connection) of the North Branch and South Branch faults, implying that they have similar states of activity. However, this condition was not observed directly and can only be implied by the strike of faults in Trench No. 4.

REGIONAL TECTONIC SETTING

The tectonics of the Southern California area are dominated by the interaction of the North American Plate and the Pacific Plate, which are apparently sliding past each other in a translational manner. Although some of the motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson, 1996), the San Andreas fault zone is thought to represent the major surface expression of the tectonic boundary and to be accommodating most of the translational motion between the Pacific Plate and the North American Plate. However, some of the plate motion is apparently also partitioned out to the other northwest-trending strike-slip faults that are thought to be related to the San Andreas system, such as the San Jacinto fault and the Elsinore fault. Local compressional or extensional strain resulting from the translational motion along this boundary is accommodated by left-lateral, reverse, and normal faults, such as the Cucamonga fault, the Crafton Hills fault zone, and the blind thrust faults of the Los Angeles Basin (Matti and others, 1992; Morton and Matti, 1993).

SAN ANDREAS FAULT:

The San Andreas fault zone is located along the southwest margin of the San Bernardino Mountains, approximately 6 miles northeast of the site. The toe of the mountain front from the San Bernardino area to San Gorgonio Pass roughly demarcates the presently active trace of the San Andreas fault, which is characterized by youthful fault scarps, vegetational lineaments, springs, and offset drainages. The Working Group on California Earthquake Probabilities (1995) tentatively assigned a 28 percent (±13 percent) probability to a major earthquake occurring on the San Bernardino Mountains segment of the San Andreas fault between 1994 and 2024.

The San Andreas fault is thought to represent the major surface expression of the tectonic boundary between the Pacific Plate and the North American Plate. The Working Group on California Earthquake Probabilities (1995) tentatively assigned a 28 percent (±13 percent) probability to a major earthquake occurring on the San Bernardino segment of the San Andreas fault between 1994 and 2024.

San Bernardino Segment

The main trace of the San Andreas fault as it traverses the San Bernardino Valley, known as the San Bernardino segment, is located along the southwest side of Yucaipa Ridge. This fault is apparently a westerly continuation of the active Banning branch of the San Andreas fault in the northern end of the Salton Trough, although the connection between the two faults is not known in detail. The Banning fault ruptured the ground surface during the 1986 Palm Springs earthquake. The toe of the mountain front in the San Bernardino area roughly demarcates the known, presently active, south branch of the San Andreas fault, which is characterized by youthful fault scarps, vegetational lineaments, aligned springs, and offset drainages.

The State of California has designated an Alquist-Priolo Earthquake Fault Zone to include traces of potentially active (Quaternary) faulting associated with the San Bernardino Segment of the San Andreas fault zone.

Banning Fault

A splay of the Banning fault is located approximately 3,700 feet north of the site. The Banning fault places granitic and metamorphic bedrock over Plio-Pleistocene age sediments. The Banning fault is an ancient structure that was abandoned in early Pliocene time (Matti and others, 1985). East of Cabazon, the structure referred to as the Banning fault represents a branch of the Coachella Valley segment of the San Andreas fault and is considered active. The Banning fault north of the site is included within an Alquist Priolo Zone designated by the State of California and a Fault Hazard Management Zone by Riverside County to include traces of active faulting. Fault trenching conducted by Woodward Clyde (April, 1993) concluded that there was evidence for Holocene displacement along the splay of the Banning fault north of the site.

Mill Creek Branch

The Mill Creek branch of the San Andreas fault, formerly known as the "North Branch" of the San Andreas fault (Dibblee, 1964), is a major structural boundary with respect to the basement rock type at the site and in the San Bernardino Valley. In Mill Creek, the fault juxtaposes predominantly granitic rocks along the northeast side against predominantly gneissic rocks and Tertiary-age sediments against the southwest side. The Mill Creek fault is located approximately 9 miles north of the site. Mill Creek is structurally controlled by the Mill Creek branch of the San Andreas fault. The State of California has designated an Alquist-Priolo Earthquake Fault Zone to include traces of potentially active (Quaternary) faulting associated with the Mill Creek branch.

The state of activity of the Mill Creek fault is not known with certainty. This fault connects the active Mission Creek branch of the San Andreas fault in the upper Salton Trough with the potentially active "North Branch" in the San Bernardino Valley.

Wilson Creek Fault

The Wilson Creek fault is an older, inactive branch of the San Andreas fault located approximately 7 mile northeast of the site. The Wilson Creek fault is the oldest known branch of the San Andreas fault and has been truncated and rotated along the San Andreas fault zone (Matti and others, 1985).

OTHER FAULTS:

The "main" trace of the San Jacinto fault is located approximately 6 miles southwest of the site. The San Jacinto fault zone is a system of northwest-trending, right-lateral, strike-slip faults. The San Jacinto fault is the closest known active fault to the site and is considered to be the most important fault to the site with respect to the hazard of seismic shaking and ground rupture. More large historic earthquakes have occurred on the San Jacinto fault than any other fault in Southern California (Working Group on California Earthquake Probabilities, 1988). Based on the data of Matti and others (1992), the San Bernardino Valley segment of the San Jacinto fault may be accommodating much of the motion between the Pacific Plate and the North American Plate in this area. Matti and others (1992) suggest this motion is transferred to the San Andreas fault in the Cajon Pass region by "stepping over" to parallel fault strands which include the Glen Helen fault. The Working Group on California Earthquake Probabilities (1995) tentatively assigned a 37 percent (±17 percent) probability of a major earthquake on the San Bernardino Valley segment of the San Jacinto fault for the 30 year interval from 1994 to 2024.

The Crafton Hills are formed by a system of normal dip-slip faults that trends from the Live Oak canyon to the San Andreas fault to the northeast (Matti and others, 1992). The Reservoir Canyon (Crafton) fault which forms the northwest boundary is located approximately 6 miles northwest of the site as mapped by Matti and others (1992). The Western Heights fault forms the southeast boundary and is located approximately 5 miles feet northwest of the site as indicated on the Alquist-Priolo Map. The Chicken Hill fault is located approximately 4 miles northwest of the site. Both the Western Heights fault and the Chicken Hill fault are included with Alquist-Priolo zones to include traces of suspected active faulting.

The Pinto Mountain fault is present approximately 19 miles east of the site. The Pinto Mountain fault is an east-west trending left-lateral fault that apparently terminates against the Mission Creek fault (Matti and others, 1992). Until the 1992 Landers earthquake, it was thought that the Pinto Mountain fault truncated the right-lateral faults of the East Mojave shear zone (Reynolds and others, 1992). However, north-south trending ruptures aligned across the Pinto Mountain fault occurred during the 1992 Landers event (Treiman, 1992).

HISTORICAL SEISMICITY

A map of recorded earthquake epicenters archived in a computer database that includes events from 1977 to 2005 for earthquakes of magnitude 4 or greater within a radius of 100 kilometers/miles of the site is included as Enclosure "A-5" (Epi Software, 2004).

No large earthquakes have occurred on the San Bernardino segment of the San Andreas fault within the regional historical time frame. Using dendrochronological evidence, Jacoby and others (1987) inferred that a great earthquake ruptured the northern reaches of this segment on December 8, 1812. Trenching studies have revealed evidence that rupture on the San Andreas fault at Wrightwood occurred within this time frame (Fumal and others, 1993). Comparison of rupture events at the Wrightwood and Pallett Creek sites and analysis of reported intensities at the coastal missions led Fumal and others (1993) to conclude that the December 8, 1812 event ruptured the San Bernardino Mountains segment of the San Andreas fault largely to the southeast of Wrightwood, possibly extending into the San Bernardino Valley.

Surface rupture occurred on the Mojave segment of the San Andreas fault in the great 1857 Fort Tejon earthquake. The Coachella Valley segment of the San Andreas fault was responsible for the 1948 **M** 6.5 earthquake in the Desert Hot Springs area and for the 1986 **M** 5.6 earthquake in the North Palm Springs area. The 1986 quake ruptured the ground surface along the Banning fault at the northwest end of the Coachella Valley.

The Working Group on California Earthquake Probabilities (1988) lists seven **M** 6.0 or greater earthquakes that have occurred on the San Jacinto fault since 1899, although they acknowledge that several of these earlier episodes may have occurred on other nearby faults. Two of these earthquakes took place in the San Bernardino Valley. A **M** 6.5 event in 1899 near Lytle Creek and a **M** 6.2 event in 1923 near Loma Linda may have occurred on the San Jacinto fault. However, Fife and others (1976) and Matti and Carson (1991) suggest that the 1923 event took place on an unnamed fault parallel to and east of the San Jacinto fault.

No large historical earthquakes have been attributed with certainty to the Cherry Valley, Pinto Mountain, or Crafton Hills faults.

SEISMIC ANALYSIS

The precise relationship between magnitude and recurrence interval of large earthquakes for a given fault is not known due to the relatively short time span of recorded seismic activity. As a result, a number of assumptions must be made to quantify the ground shaking hazard at a particular site. Seismic hazard evaluations can be conducted from both a probabilistic and a deterministic standpoint. The probabilistic method is prescribed by current codes and was utilized to estimate the seismic hazard to the site during this investigation.

PROBABILISTIC HAZARD ANALYSIS:

The probabilistic analysis of seismic hazard is a statistical analysis of seismicity of all known regional faults and seismic sources attenuated to a particular geographic location. The results of a probabilistic seismic hazard analysis (PSHA) are presented as the annual probability of exceedance of a given strong motion parameter for a particular exposure time (Johnson and others, 1992).

For this report, the seismic hazard analysis computer program EZFRISK, version 7.11 (Risk Engineering, 2005) was used to analyze the location of the site under the criteria for a "soil" site type with an average shear wave velocity of 270 m/s in the upper 30 meters (100 feet). The estimated value for the peak ground acceleration (PGA) was calculated as the average of the accelerations computed using the attenuation relations of Boore et al. (1997), Sadigh et al. (1997), and Abrahamson and Silva (1997) in relation to seismogenic faults within a 93-mile (150-km) radius of the site. The EZFRISK program considers seismicity from mappable seismogenic faults and background sources (those earthquakes not associated with a mapped fault source) and assumes that the occurrence rate of earthquakes on a fault is proportional to the estimated slip rate of that fault. Potential earthquake magnitudes are correlated to expected seismic sources and the resultant maximum ground acceleration at the site is computed.

Based on the site-specific PSHA performed for the site, the estimated peak horizontal ground acceleration with a 10 percent probability of exceedance in 50 years (statistical return period of 475 years) is 0.60g. This corresponds to the Design Basis Earthquake as defined in the 2001 CBC.

SEISMIC ZONE:

The site is included within Seismic Zone 4. Table 16-I of the 2001 CBC assigns a Seismic Zone Factor "Z" of 0.4 to Seismic Zone 4.

NEAR-SOURCE EFFECTS:

The seismic hazard to this site is dominated by the San Bernardino segment of the San Andreas fault. The San Bernardino segment of the San Andreas fault is classified as a Type "A" fault by the State of California (Cao and others, 2003). The applicable near-source acceleration factor N_A, is 1.00, and the near-source velocity factor N_V is 1.20.

SOIL PROFILE TYPE:

The preliminary soil profile type as defined by the 2001 CBC is S_D, stiff soil, for all materials at the site except the unweathered portions of the San Timoteo formation. For the unweathered San Timoteo formation, the preliminary soil profile type based on the shear wave velocity data of Woodward-Clyde (1993) is S_C, very dense soil and soft rock. The soil profile classifications should be verified during the recommended geotechnical investigation.

SLOPE STABILITY

The term "deep-seated landslide" as used in this report refers to slope failures greater than approximately 10 feet in depth. Deep-seated landslides extend through the upper surficial soils into the underlying bedrock material. They are typically related to the underlying geologic structures, such as bedding planes, foliation, jointing, or faulting. In contrast, surficial failures occur within the upper soil horizon and are typically unrelated to the underlying geologic structure. Both types of failures are common in the fanglomerate due to the steep natural slopes, the geologic structure, and the close proximity of faults capable of generating strong seismic shaking.

Evidence for large deep-seated landslide or large surficial failures was not observed on the site. However, evidence for surficial failures in these materials is quickly obscured by erosion. It is our opinion that all steep slopes (steeper than approximately 2 horizontal [h] to 1 vertical [v]) in the older alluvium and the San Timoteo formation should be considered to have a potential for surficial failure and the generation of debris flows downslope of them. Areas of extensive erosion are indicated on the Geologic Map and Site Plan (Enclosure "A-4").

The critical factors affecting the stability of cut slopes are: 1) the presence or absence of existing shallow or deep-seated landslides in the proposed cut slopes; and 2) the underlying structure of the native materials, particularly the degree of bedding developed in the fanglomerate. Cut slopes that expose adverse bedding components (components that dip out of slope) may require remedial measures, such as flattening, buttressing, or re-design, due to the potential for triggering a landslide along bedding. Cut slopes in the San Timoteo formation that face in a southerly direction can be expected to have adverse bedding components.

A slope stability investigation would be required if proposed finished cuts slopes exceed 30 feet in vertical height. This condition should be evaluated when grading plans are available.

GROUNDWATER AND LIQUEFACTION

No evidence for springs or perched groundwater conditions was observed on the site during the geologic field reconnaissance, the geologic mapping, or on the aerial photographs reviewed.

According to information available from the Western Municipal Water District (2001), a well located north of the site (State Well No. T2S/R1W-19N01S) showed a minimum depth to groundwater of 189± feet bgs on May 9, 1991. The groundwater data covcred the period between 1991 and 1997. Groundwater measurements taken from the same well available from the USGS indicate a shallowest depth of 96 feet bgs on January 27, 1992. The data available from the USGS covers the years 1992 to 2001.

State Well No. T2S/R1W-30E03 is located in the southwestern portion of the site. Groundwater level data was available for the period April 1963 through June 1998. The highest groundwater level for this well occurred at the beginning of the period and was measured as 150 feet bgs on April 3, 1963. The most recent groundwater level in this well was 174.4 feet bgs as measured on June 8, 1998. This well is monitored by the San Gorgonio Pass Water Agency (SGPWA).

State Well No. T2S/R1W-30C01 is located in the western portion of the site. Groundwater level data was available for the period June 1963 through October 2004. The highest groundwater level for this well occurred at the beginning of the period and was measured as 175.9 feet bgs on June 7, 1963. The most recent groundwater level in this well was 207.9 feet bgs as measured on October 25, 2004. This well is monitored by the SGPWA.

The current depth to groundwater beneath the site is expected to be greater than 50 feet bgs.

Liquefaction is a process in which strong ground shaking causes saturated soils to lose their strength and behave as a fluid (Matti and Carson, 1991). Ground failure associated with liquefaction can result in severe damage to structures. The geologic conditions for increased susceptibility to liquefaction are: 1) shallow depth to groundwater (i.e., less than 50 feet), 2) presence of unconsolidated sandy alluvium, typically Holocene in age, and 3) strong ground shaking. All three of these conditions must be present for liquefaction to occur. Based upon the data reviewed during this investigation, only one of the three geologic conditions for increased liquefaction susceptibility (strong ground shaking) are expected to exist on the site. Due to the depth to groundwater, liquefaction is not considered to be a significant hazard, and further evaluation of the liquefaction potential of the site is not warranted.

At exposed interfaces, such as fill over cut slopes, a potential exists for springs or seeps to develop, especially when considering landscape irrigation. The seeps may result in minor nuisances or, in extreme cases, may lead to slope failure. Such contacts will need to be evaluated on a case-by-case basis as part of the geologic in-grading observation, and remedial measures may be necessary. Potential mitigation methods include construction of a stabilization fill with a back drain system. Such stabilization fills could also provide cosmetic improvement of slopes.

Subdrains are expected to be recommended where canyons are filled. Final subdrain locations and design should be determined by the engineering geologist during grading.

FLOODING AND EROSION

No evidence for recent significant flooding of the site was observed during our field reconnaissance, geologic field mapping, or on the aerial photographs used for this investigation. An evaluation of the flood potential of the site and the design of adequate drainage falls under the purview of others.

The on-site soils are moderately to highly susceptible to erosion by running water. Water should not be allowed to flow over graded areas or slope faces so as to cause erosion.

CONCLUSIONS

On the basis of our investigation, it is the opinion of this firm that the proposed development is feasible from an engineering geologic standpoint, provided the recommendations contained in this report are implemented during grading and construction.

The site is traversed by a Fault Hazard Management Zone designated by the County of Riverside to include traces of suspected active faulting associated with the Cherry Valley fault. Geologic mapping and subsurface investigations conducted by this firm identified traces of two fault splays associated with the Cherry Valley fault zone trending northwest/southeast across the site. Based on our subsurface investigation, we conclude that the southern of the two faults is inactive. The age of activity of the northern splay (North Branch) could not be determined based on the geologic conditions at the site.

Severe seismic shaking of the site can be expected during the lifetime of the proposed development.

No evidence for deep-seated landslides or large surficial failures was observed on the site. However, a slope stability investigation may be required when plans are available to evaluate proposed cut slopes planned within the areas mapped as San Timoteo formation. The County of Riverside requires slope stability evaluations for cuts and/or fills greater than 30 feet in height.

The depth to groundwater is expected to be greater than 50 feet. The hazard posed by liquefaction is considered to be low. However, final liquefaction susceptibility should be evaluated during the recommended geotechnical investigation when exploratory borings are available to provide additional groundwater data.

Some potential for future shallow, perched groundwater exists at the site, particularly associated with landscape irrigation. The potential for perched groundwater is considered to be highest at contacts in fill over cut slopes and in filled drainages. A mild to medium potential for hydroconsolidation exists in the stream channel deposits and younger alluvium if these soils are saturated by the perched groundwater.

No evidence for recent significant flooding of the site was observed during our field reconnaissance, geologic mapping, or on the aerial photographs used for this investigation. An evaluation of the flood potential of the site and the design of adequate drainage falls under the purview of others.

The on-site soils are generally granular and are considered to be non-critically expansive. Further evaluation of on-site soils should be performed in the subsequent geotechnical investigation(s).

RECOMMENDATIONS

RECOMMENDED RESTRICTED USE ZONE:

Several postulated fault traces were previously mapped by others within the site boundaries and two potential fault trends were identified in aerial photographs during our investigation. Evidence of faulting was found associated with two of these features described herein as the North Branch and South Branch of the Cherry Valley fault zone. The South Branch fault was found to be inactive; therefore, a restricted use zone is not required to mitigate potential for surface rupture along this fault.

The age of activity of the northern splay (North Branch) could not be determined based on the geologic conditions at the site. For the North Branch fault and northeastern portion of the site beyond the areas covered by the explorations, we recommend a Restricted Use Zone to mitigate the potential for surface rupture associated with the North Branch fault. The location of the Recommended Restricted Use Zone (RRUZ) is indicated on Enclosure "A-4". The southwest boundary of the RRUZ is located 50 feet south-west of the surface trace of the North Branch fault where encountered in our exploratory excavations. Since the southeasterly reach of the fault was not encountered in our exploratory excavations, the RRUZ in that area is defined by a 50-foot setback from the northeast ends of our trenches (T-3 and T-4). It should be noted that the establishment of the RRUZ includes areas where subsurface investigation has not been performed to evaluate the potential for faulting. If desired, subsurface investigation may be performed within the RRUZ for future projects proposed to be located within the unevaluated portions of the RRUZ. If active faulting is precluded by evidence obtained from additional investigation, the RRUZ designation for that portion of the RRUZ may be modified. Also, if appropriate, this evidence could result in reclassification of North Branch fault as inactive. Subsequent investigation of the North Branch fault off site (if located), may also result in reclassification of the activity of the North Branch fault.

Dissimilar foundation conditions are not expected to exist along the South Branch trace of the Cherry Valley fault, and no setbacks associated with differential ground response are recommended.

GEOTECHNICAL INVESTIGATION:

A final geotechnical investigation of the site should be conducted. Geotechnical issues to this site and the proposed development include the presence of compressible/collapsible soils in drainage areas, stability of fill and cut slopes, and the presence of expansive soils.

SEISMIC DESIGN CONSIDERATIONS:

Severe seismic shaking of the site can be expected during the lifetime of the proposed structures. Therefore, the proposed structures should be designed accordingly.

The site is subject to near-source effects of strong motion. The applicable near-source acceleration factor N_A, as defined in the 2001 CBC, is 1.00, and the near-source velocity factor N_V is 1.20.

The preliminary soil profile type as defined by the 2001 CBC is S_D, stiff soil, for all materials at the site except the San Timoteo formation. For the San Timoteo formation, the preliminary soil profile type based on the shear wave velocity data of Woodward-Clyde (1993) is S_C, very dense soil and soft rock. The soil profile classifications should be verified during the recommended geotechnical investigation.

The 2001 CBC places the site within Seismic Zone 4. A Seismic Zone Factor "Z" of 0.40 is assigned to Seismic Zone 4.

PROTECTION OF STRUCTURES:

Structures are proposed in several box canyons and/or adjacent to hillsides with steep natural slopes. Surficial failures that could occur on these slopes could jeopardize structures on these lots. Structures that could be jeopardized by surficial failures should be protected by one or more of the following measures: 1) removal of unstable soils on hillsides to expose competent native materials; 2) placement of debris walls with adequate provisions for cleanout adjacent to the hillsides; 3) removal and replacement of unstable slopes (buttressing); and 4) adequate horizontal setbacks of structures from slopes, with provisions for drainage of debris and runoff. It is our opinion that minimum 6-foot high debris walls with provisions for cleanout would be adequate protection for the proposed improvements. Regardless of the mitigation chosen, it is critical that adequate drainage for debris-laden runoff be provided for structures to be located in canyons.

CUT SLOPE CONSTRUCTION:

Provided that no adverse geologic structures are exposed during grading, cut slopes in the San Timoteo formation and older alluvium should be grossly and surficially stable at inclinations of 2(h) to 1(v) to maximum height of 60 feet. The stability of all cut and fill slopes to be greater than 30 feet height will need to evaluated with a slope stability investigation.

Cut slopes should be provided with terraces and interceptor drains in accordance with the 2001 CBC.

SUBSURFACE DRAINAGE:

At exposed interfaces, such as fill over cut slopes, a potential exists for springs or seeps to develop, especially when considering landscape irrigation. The seeps may result in minor nuisances or, in extreme cases, may lead to slope failure. Such contacts will need to be evaluated on a case-by-case basis as part of the geologic in-grading observation, and remedial measures may be necessary. Potential mitigation methods include construction of a stabilization fill with a back drain system. Such stabilization fills could also provide cosmetic improvement of slopes.

Subdrains may be recommended where canyons are filled. Subdrain locations and design should be determined by the engineering geologist during grading plan review and grading.

SLOPE PROTECTION:

Inasmuch as the native materials are susceptible to erosion by running water, it is our recommendation that the slopes at the project be planted as soon as possible after completion. The use of succulent ground covers, such as iceplant or sedum, is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the water system and to prevent over watering.

Measures should be provided to prevent surface water from flowing over slope faces.

GRADING PLAN REVIEW:

The final project grading plan should be reviewed by the engineering geologist.

LIMITATIONS

C.H.J., Incorporated has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable engineering geologists practicing under similar circumstances. No other representation, express or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the conditions of the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application, or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of C.H.J., Incorporated. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions be encountered in the field, by the client or any firm performing services for the client or the client's assign, that appear different than those described herein, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,
C.H.J., INCORPORATED

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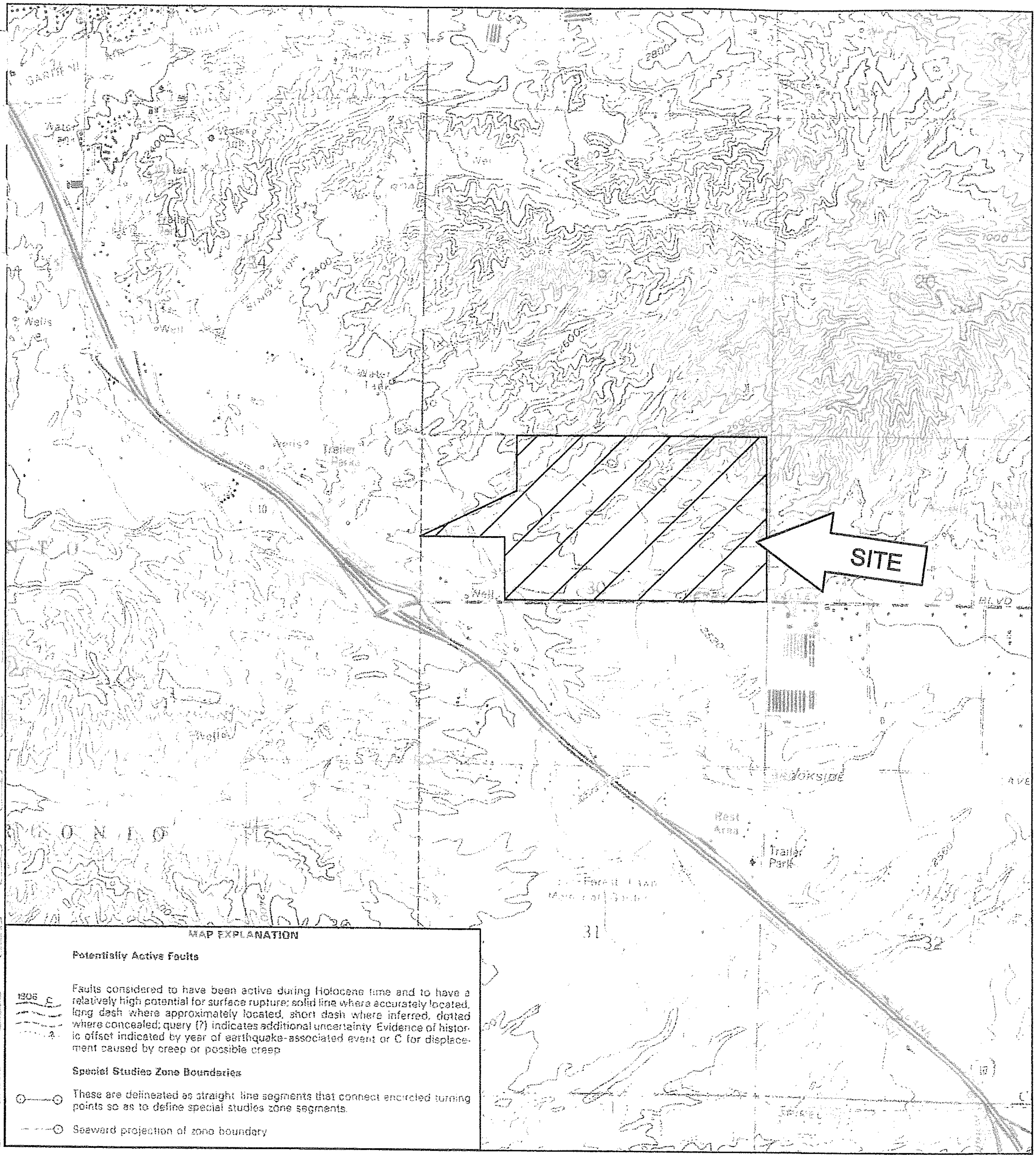
APPENDIX "A"

GEOLOGIC MAPS



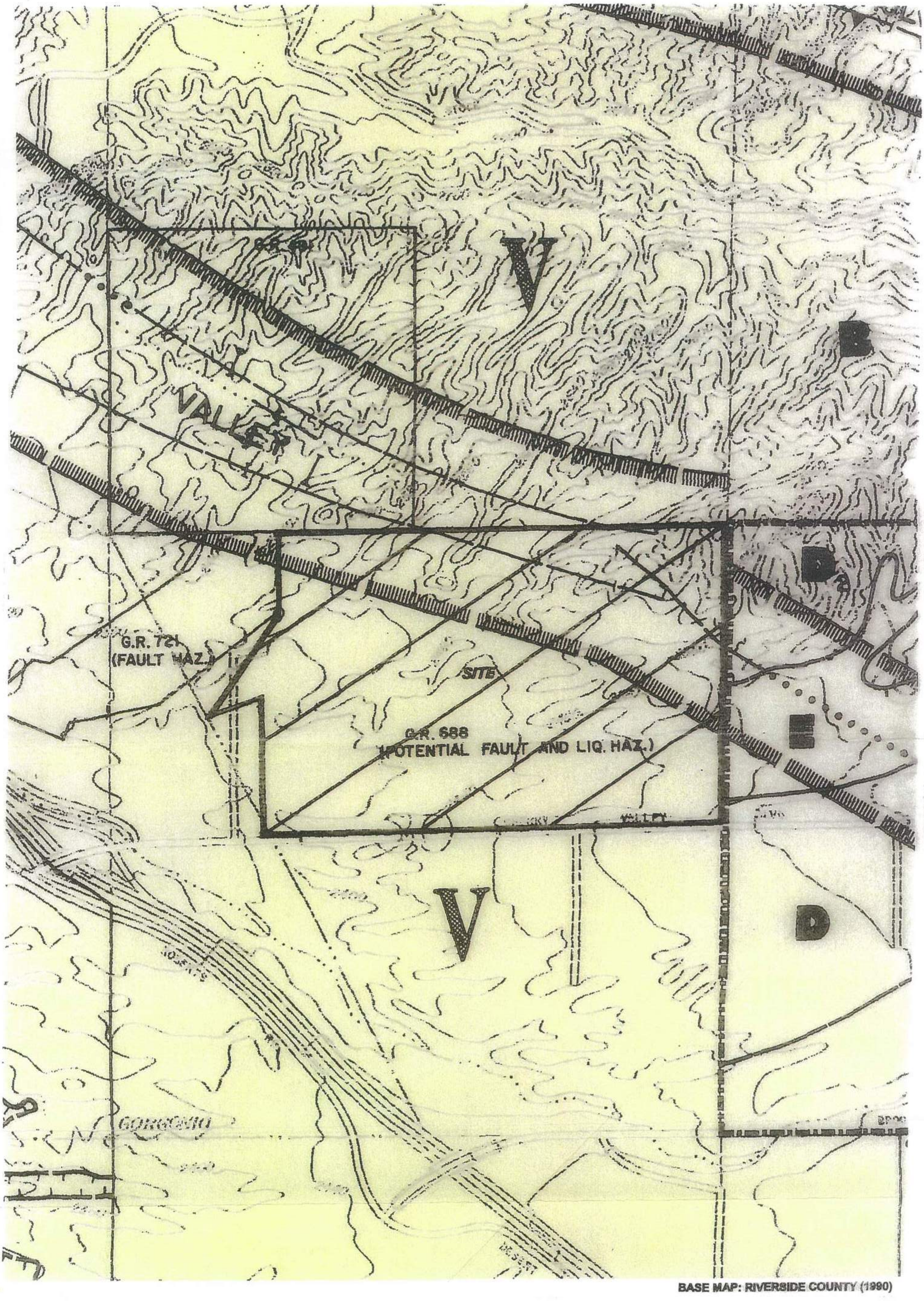
-N-

SCALE: 1"= 2,000'

INDEX MAP

FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-1"
DATE: JULY 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED



FAULT HAZARD ZONE MAP		
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-2"
DATE: JULY 2005		JOB NUMBER 04806-8
		C.H.J., INCORPORATED

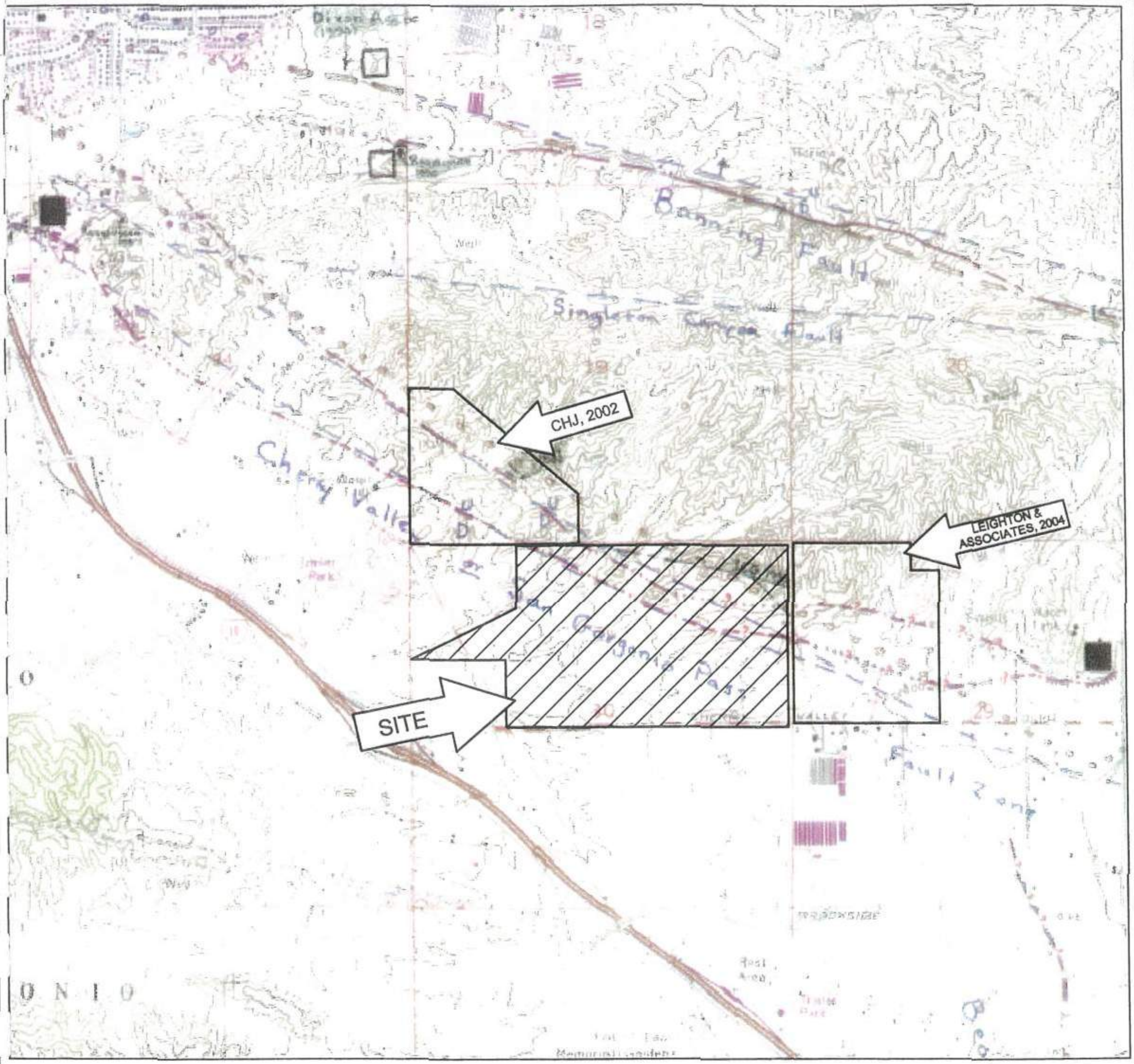


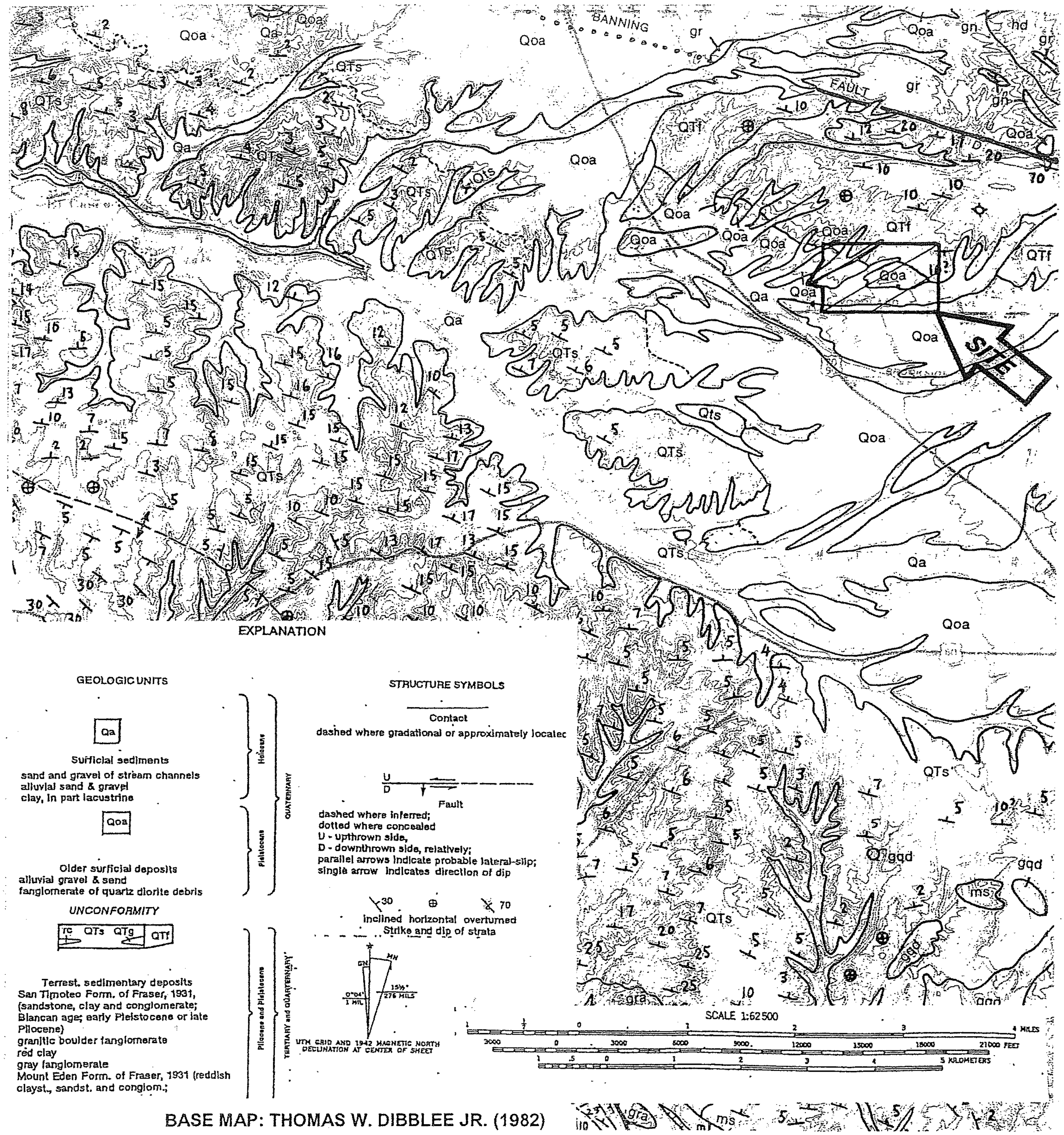
Plate Ia (FER-235) - Faults mapped by others on the northeast half of the El Casco 7.5-minute quadrangle (dotted line indicates concealed or inferred fault)

- Bloyd (1971)
- Dibblee (1981a) *(only where not duplicated by others)*
- Matti and Morton (1974-91)
- Shuler (1953)
- various consultants as noted
- trenches by Dames and Moore (1987)

DETAIL OF FER-235 PLATE IA.		
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-3"
DATE: AUGUST 2005		JOB NUMBER 04806-8
	C.H.J. INCORPORATED	

-N-

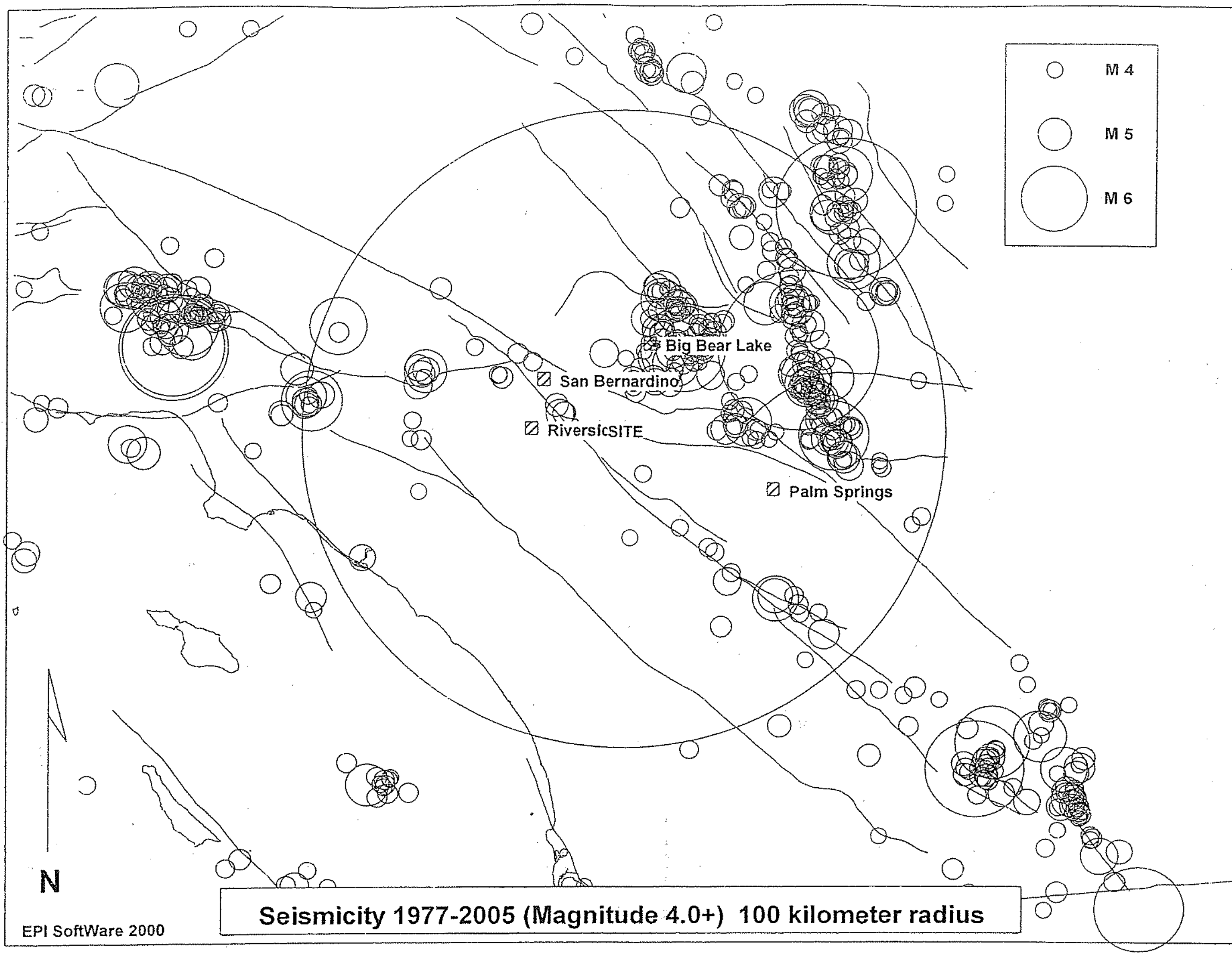
SCALE: 1"= 2,000'



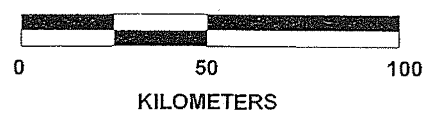
BASE MAP: THOMAS W. DIBBLEE JR. (1982)

GEOLOGIC INDEX MAP		
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-5"
DATE: JULY 2005		JOB NUMBER 04806-8

C.H.J. INCORPORATED



SITE LOCATION: 33.9712 LAT. -117.0243 LONG.



MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 574

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 306

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

4.0- 4.9 : 272
5.0- 5.9 : 30
6.0- 6.9 : 2
7.0- 7.9 : 2
8.0- 8.9 : 0

CLOSEST EVENT: 4.4 ON TUESDAY, JUNE 30, 1992 LOCATED APPROX. 13 KILOMETERS NORTH OF THE SITE

LARGEST 5 EVENTS:

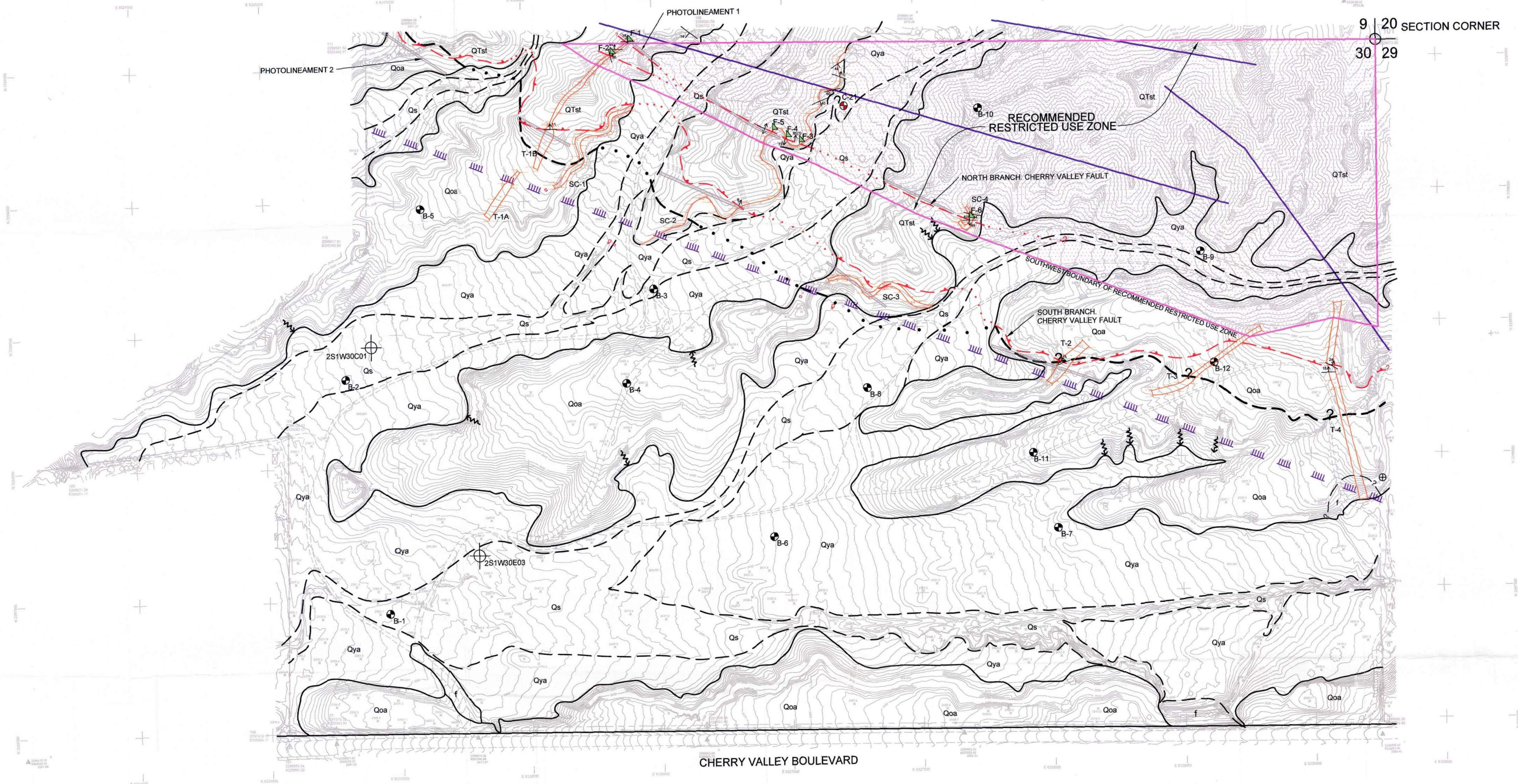
7.3 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 59 KILOMETERS NORTHEAST OF THE SITE
7.1 ON SATURDAY, OCTOBER 16, 1999 LOCATED APPROX. 97 KILOMETERS NORTHEAST OF THE SITE
6.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 31 KILOMETERS NORTHEAST OF THE SITE
6.1 ON THURSDAY, APRIL 23, 1992 LOCATED APPROX. 65 KILOMETERS EAST OF THE SITE
5.9 ON THURSDAY, OCTOBER 01, 1987 LOCATED APPROX. 97 KILOMETERS WEST OF THE SITE

EARTHQUAKE EPICENTER MAP		
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-6"
DATE: JULY 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED

APPENDIX "B"

TRENCH AND SLOPE CUT LOGS



LEGEND:

f: fill

Qs: stream channel deposits (recent - Holocene)

Qya: younger alluvium (Holocene)

Qoa: older alluvium (Pleistocene)

QTst: San Timoteo formation, upper member (Plio-Pleistocene)

approximate location of well

exploratory boring location

rebar indicating fault location

geologic contact (dashed where approximately located)

fault (dashed where approximately located, dotted where concealed, teeth indicate upper plate of thrust fault, this investigation)

strike and dip of bedding

horizontal bedding

area of erosion

strike and dip of fault

trench and slope cut locations

location of photolineament

postulated fault (Riverside County, 1990)

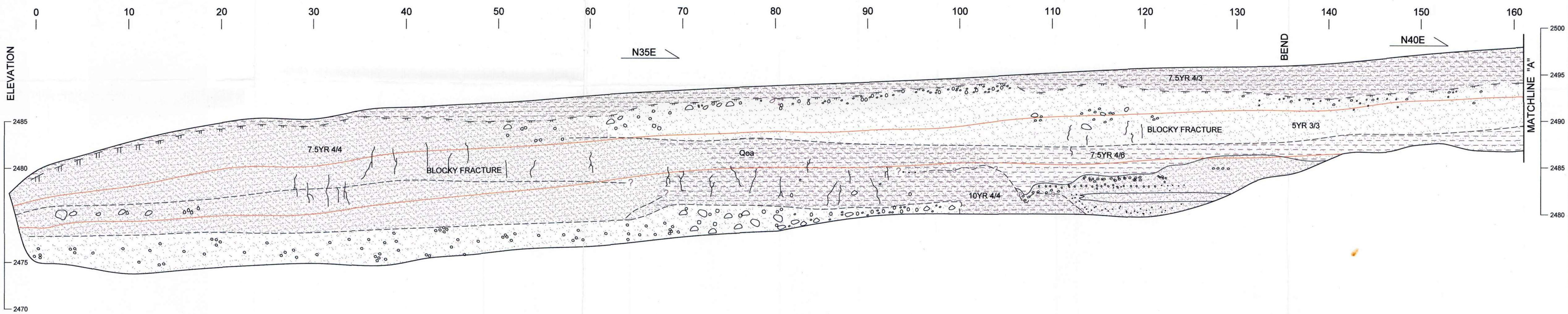
Earthquake Hazard Zone (Riverside County, 1990) southern boundary

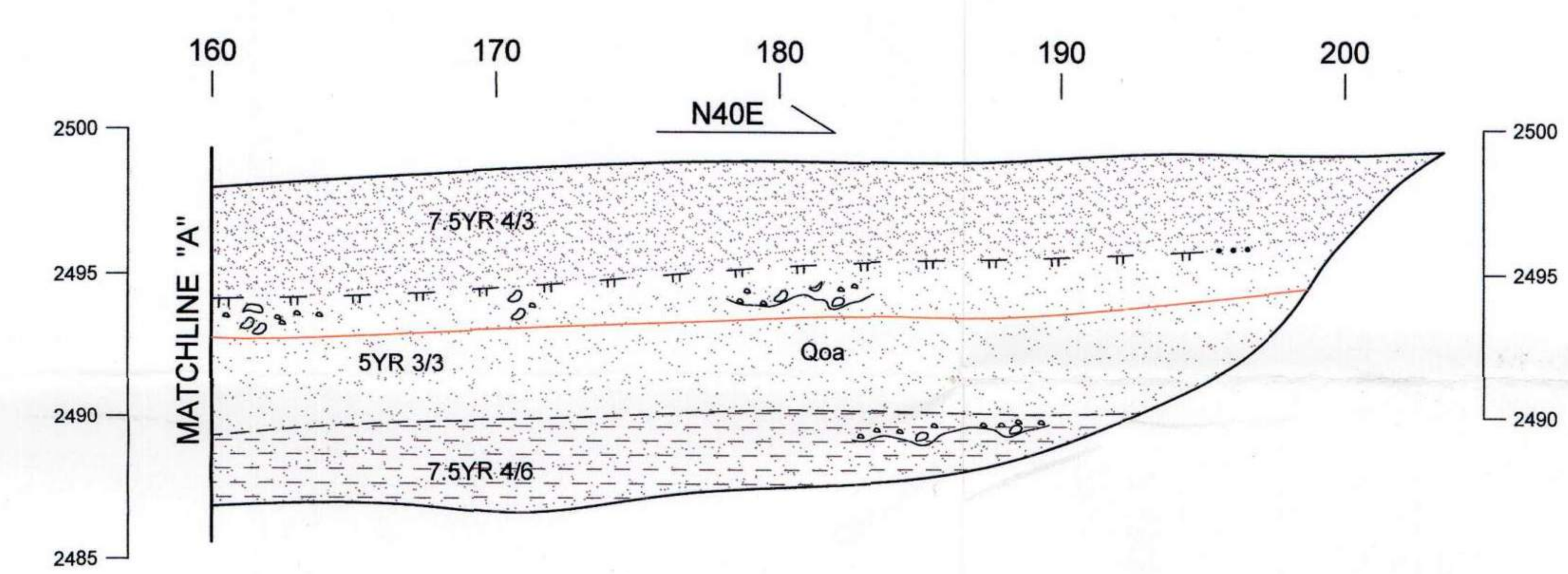
Limit of Recommended Restricted Use Zone

-N-

SCALE: 1"= 200'

GEOLOGIC MAP AND SITE PLAN		
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "A-4"
DATE: AUGUST 2005		JOB NUMBER 04806-8
		C.H.J. INCORPORATED





LEGEND:

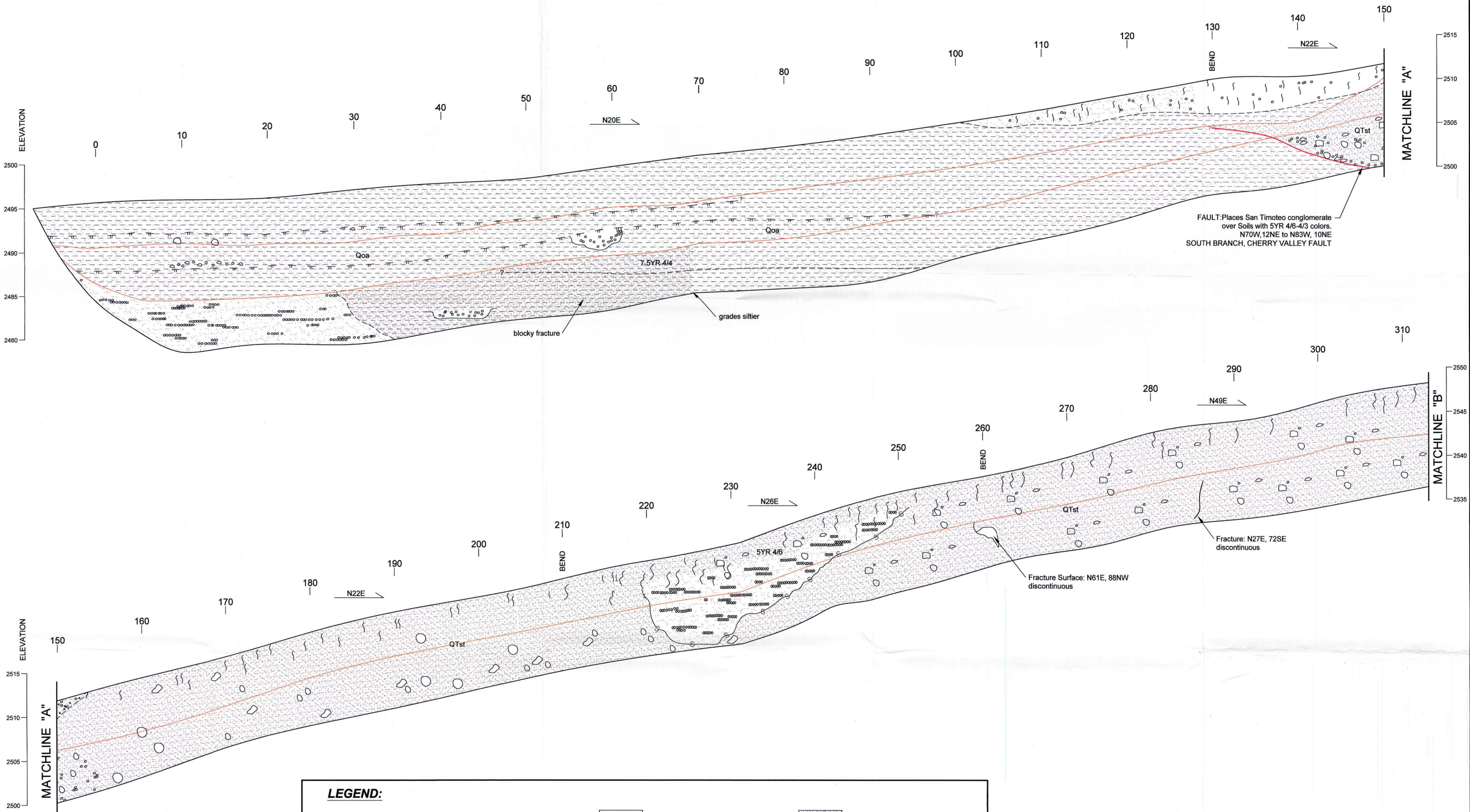
- — — —S— · · · ? Geologic contact, dotted where inferred queried where uncertain, "S"= scoured
- soil developed on San Timoteo Fm. and Qoa.
- soil horizon, "S" = scoured
- Fault, dotted where inferred
- location of bench
- Sand - fine to coarse-grained, stratified, to massive, few gravel
- Sand - fine to medium-grained, massive
- Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
- Sand and Silt, fine to medium-grained, massive
- Silt with fine-grained sand
- fluvial channel deposits - coarse-grained sand and gravel, locally stratified

SCALE: 1"=5' H=V

T-1A

TRENCH 1A	WEST WALL-VIEW WEST	
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545	ENCLOSURE "B-1"
DATE: AUGUST 2005	CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	JOB NUMBER 04806-8

C.H.J., INCORPORATED



SCALE: 1"=5' H=V

LEGEND:

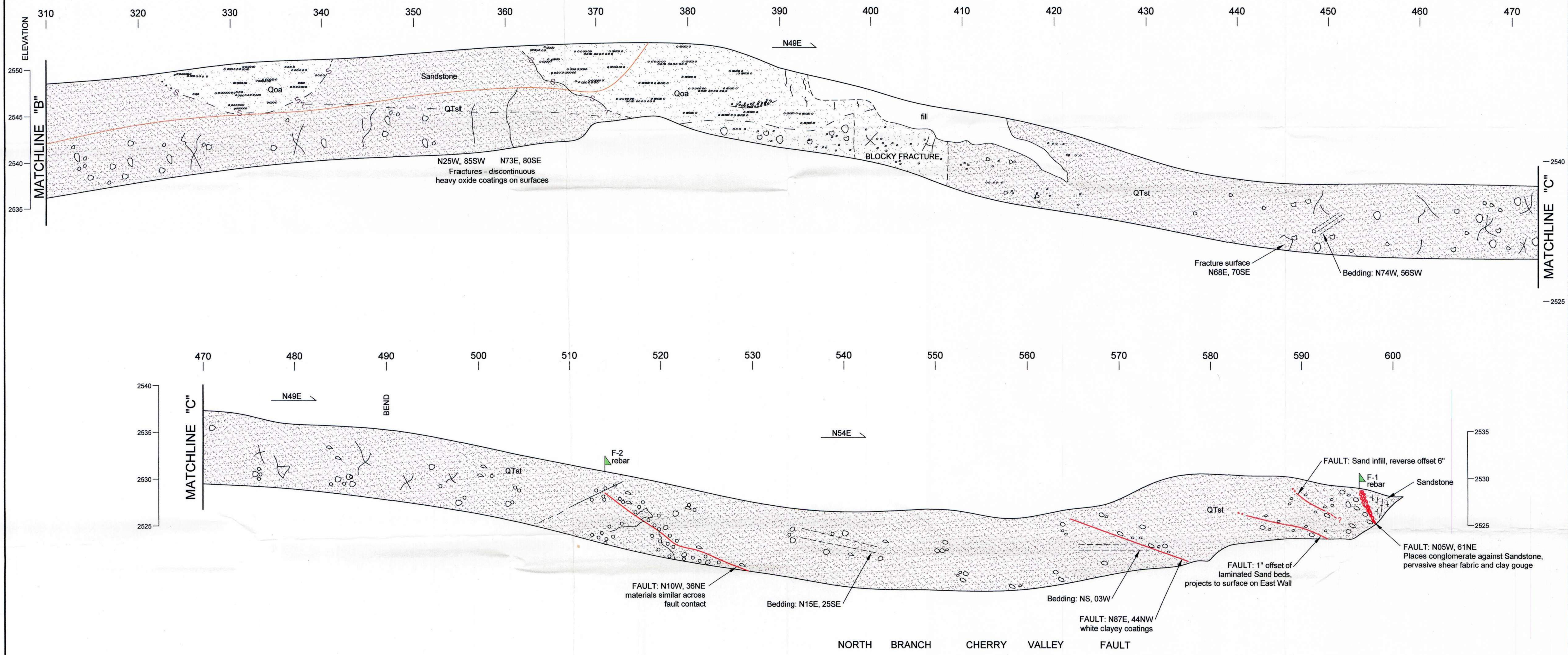
— — —S— · · · ?	Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
{ {	soil developed on San Timoteo Fm. and Qoa.
— ┬┬ ┬┬ ┬┬ S ┬┬ —	soil horizon, "S" = scoured
(red line)	Fault, dotted where inferred
(orange line)	location of bench
(pattern)	Sand - fine to coarse-grained, stratified, to massive, few gravel
(pattern)	Sand - fine to medium-grained, massive
(pattern)	Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
(pattern)	Sand and Silt, fine to medium-grained, massive
(pattern)	Silt with fine-grained sand
(pattern)	fluvial channel deposits - coarse-grained sand and gravel, locally stratified

T-1B

PG. 1 OF 2

TRENCH 1B	WEST WALL-VIEW WEST	
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-2.1"
DATE: AUGUST 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED



NORTH BRANCH CHERRY VALLEY FAULT

LEGEND:

— — —S— · · · ?	Geologic contact, dotted where inferred queried where uncertain, "S"= scoured		Sand - fine to coarse-grained, stratified, to massive, few gravel		Sand and Silt, fine to medium-grained, massive
⌇ ⌇	soil developed on San Timoteo Fm. and Qoa.		Sand - fine to medium-grained, massive		Silt with fine-grained sand
— ┬┬ ┬┬ ┬┬ S ┬┬ —	soil horizon, "S" = scoured		Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally		fluvial channel deposits - coarse-grained sand and gravel, locally stratified
	Fault, dotted where inferred				
	location of bench				

SCALE: 1"=5' H=V

T-1B

PG. 2 OF 2

TRENCH 1B	WEST WALL-VIEW WEST	
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-2.2"
DATE: AUGUST 2005		JOB NUMBER 04806-8
		C.H.J., INCORPORATED

LEGEND:

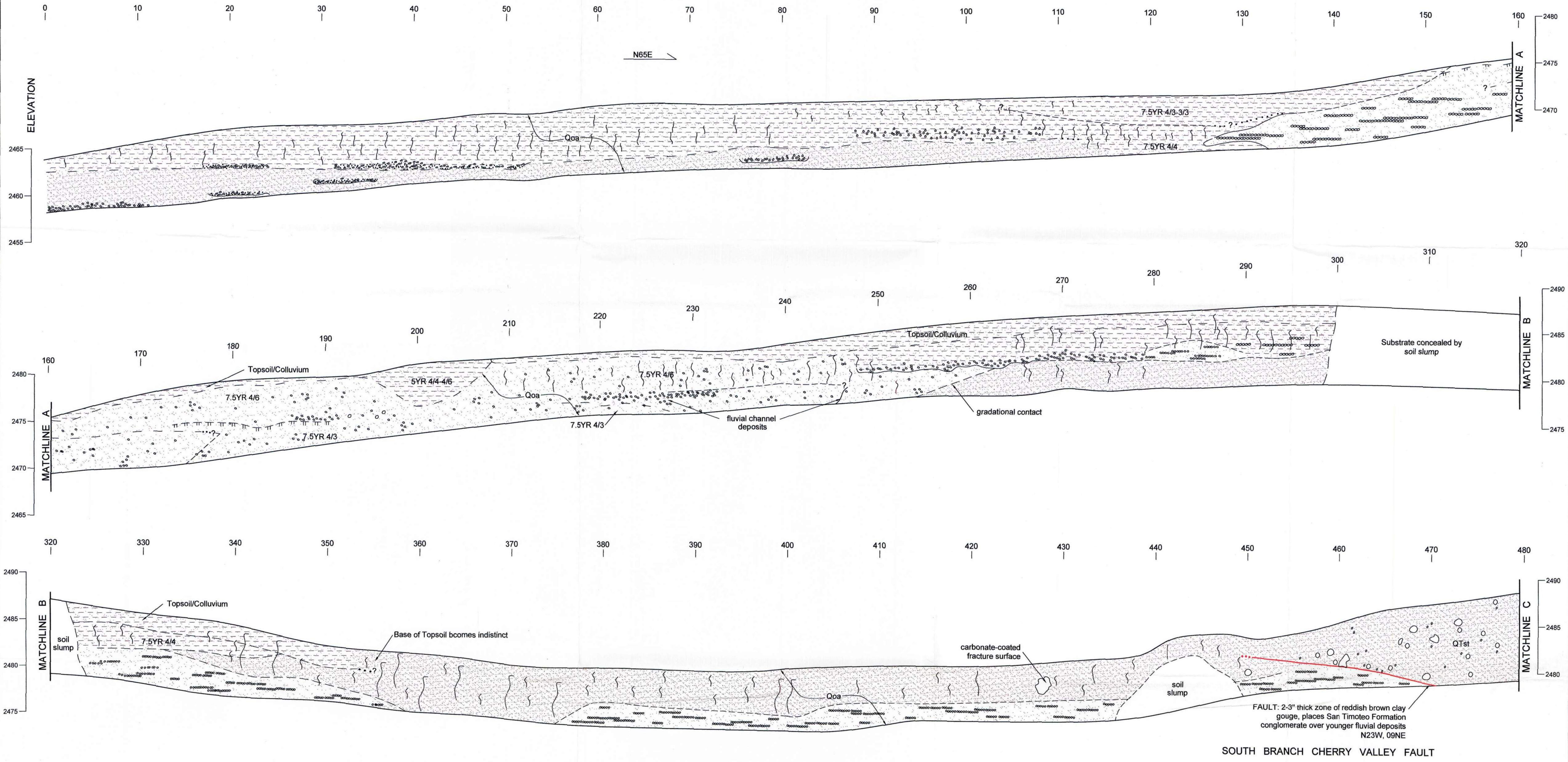
- Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
- soil developed on San Timoteo Fm. and Qoa.
- soil horizon, "S" = scoured
- Fault, dotted where inferred
- location of bench
- Sand - fine to coarse-grained, stratified, to massive, few gravel
- Sand - fine to medium-grained, massive
- Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
- Sand and Silt, fine to medium-grained, massive
- Silt with fine-grained sand
- fluvial channel deposits - coarse-grained sand and gravel, locally stratified

SCALE: 1"=5' H=V

SLOPE CUT NO. 1

FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-6"
DATE: AUGUST 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED



LEGEND:

- Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
- soil developed on San Timoteo Fm. and Qoa.
- soil horizon, "S" = scoured
- Fault, dotted where inferred
- location of bench
- Sand - fine to coarse-grained, stratified, to massive, few gravel
- Sand - fine to medium-grained, massive
- Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
- Sand and Silt, fine to medium-grained, massive
- Silt with fine-grained sand
- fluvial channel deposits - coarse-grained sand and gravel, locally stratified

SCALE: 1"=5' H=V

SLOPE CUT NO.2

FOR: TSG CHERRY VALLEY, LP

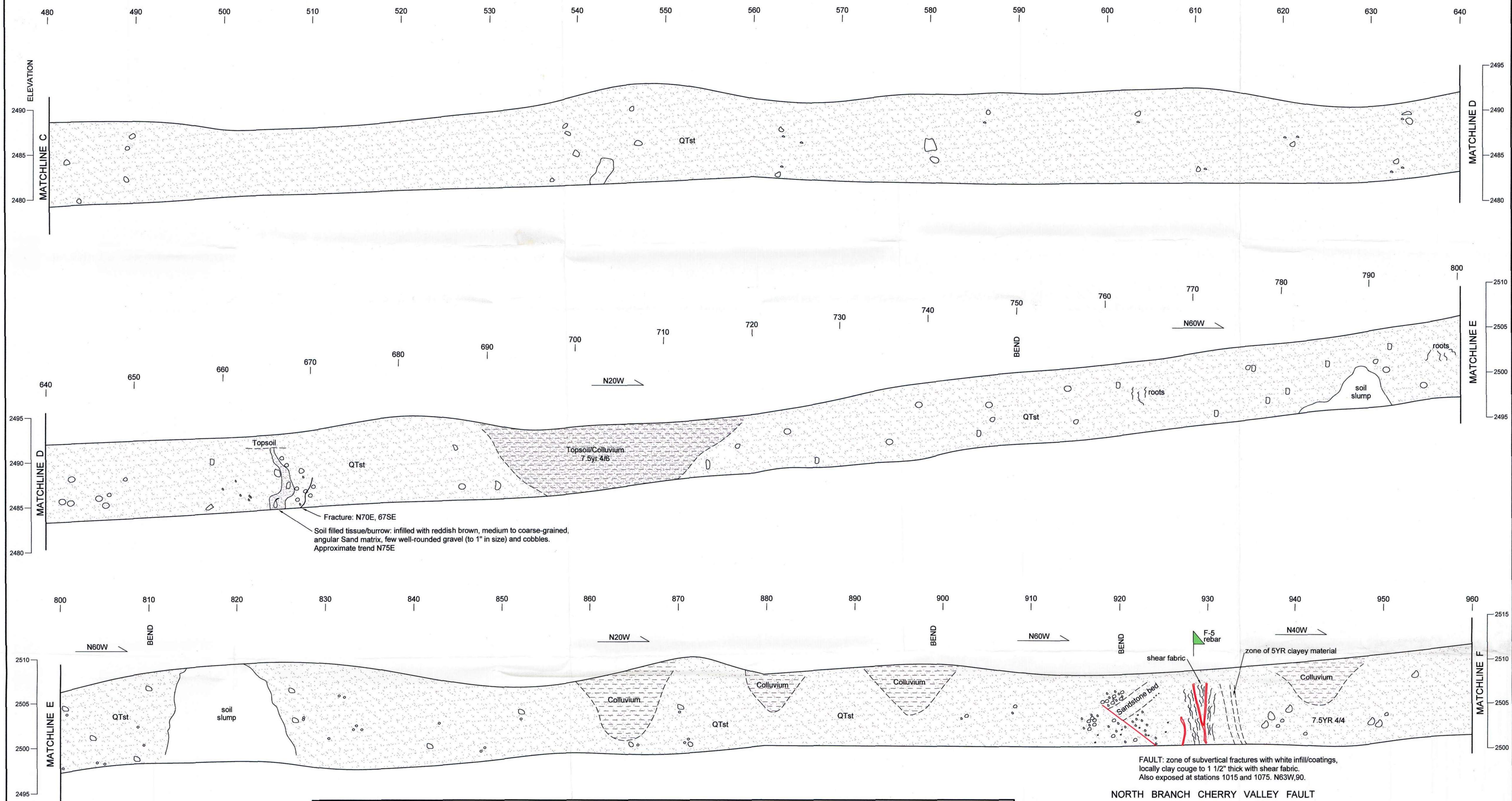
DATE: AUGUST 2005

CHERRY VALLEY GATEWAY PROJECT
TENTATIVE TRACT NO. 30545
CHERRY VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

ENCLOSURE "B-7.1"

JOB NUMBER 04806-8

C.H.J., INCORPORATED



LEGEND:

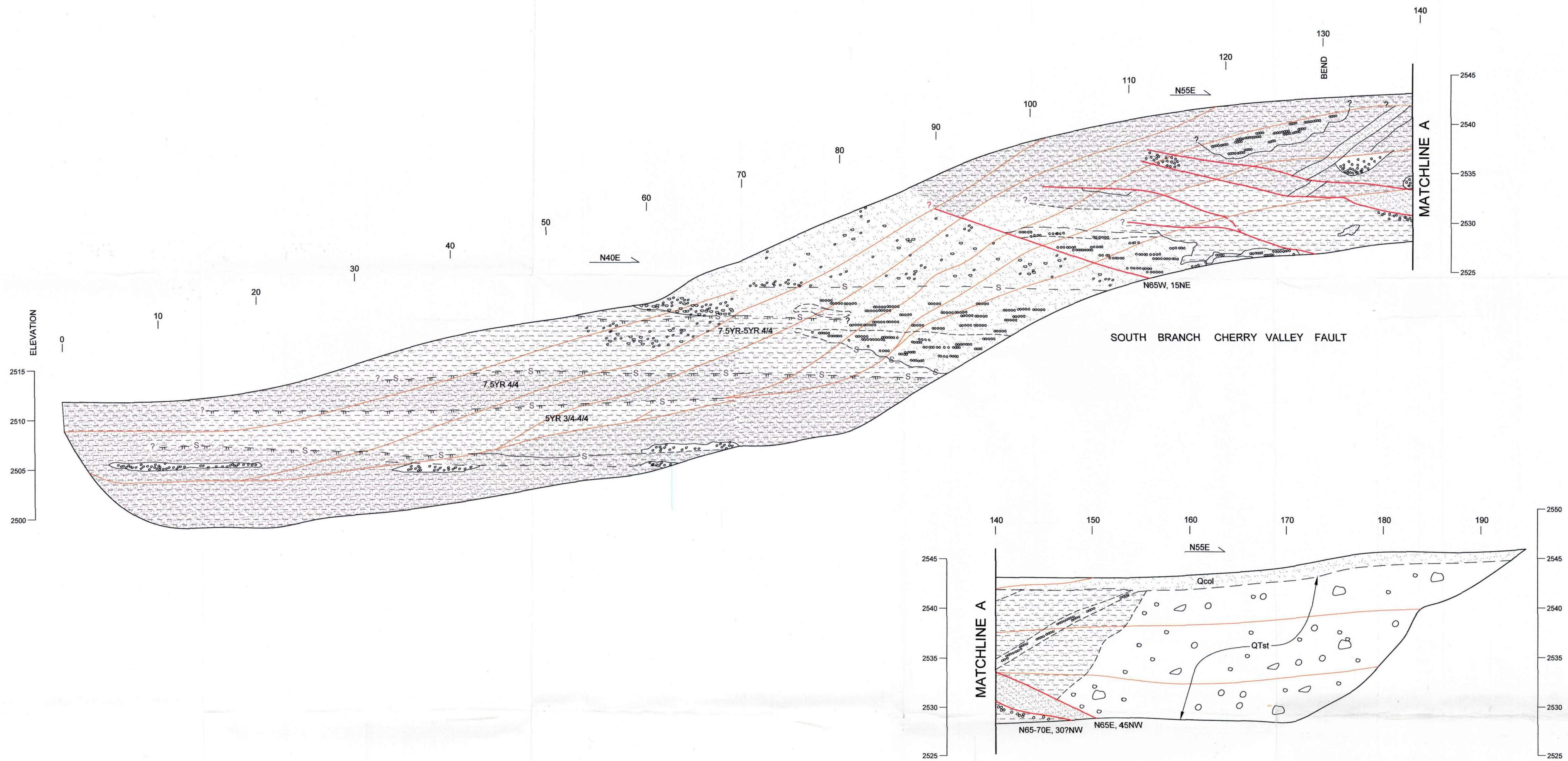
- Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
- soil developed on San Timoteo Fm. and Qoa.
- soil horizon, "S" = scoured
- Fault, dotted where inferred
- location of bench
- Sand - fine to coarse-grained, stratified, to massive, few gravel
- Sand - fine to medium-grained, massive
- Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
- Sand and Silt, fine to medium-grained, massive
- Silt with fine-grained sand
- fluvial channel deposits - coarse-grained sand and gravel, locally stratified

SCALE: 1"=5' H=V

SLOPE CUT NO.2

FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-7.2"
DATE: AUGUST 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED



LEGEND:

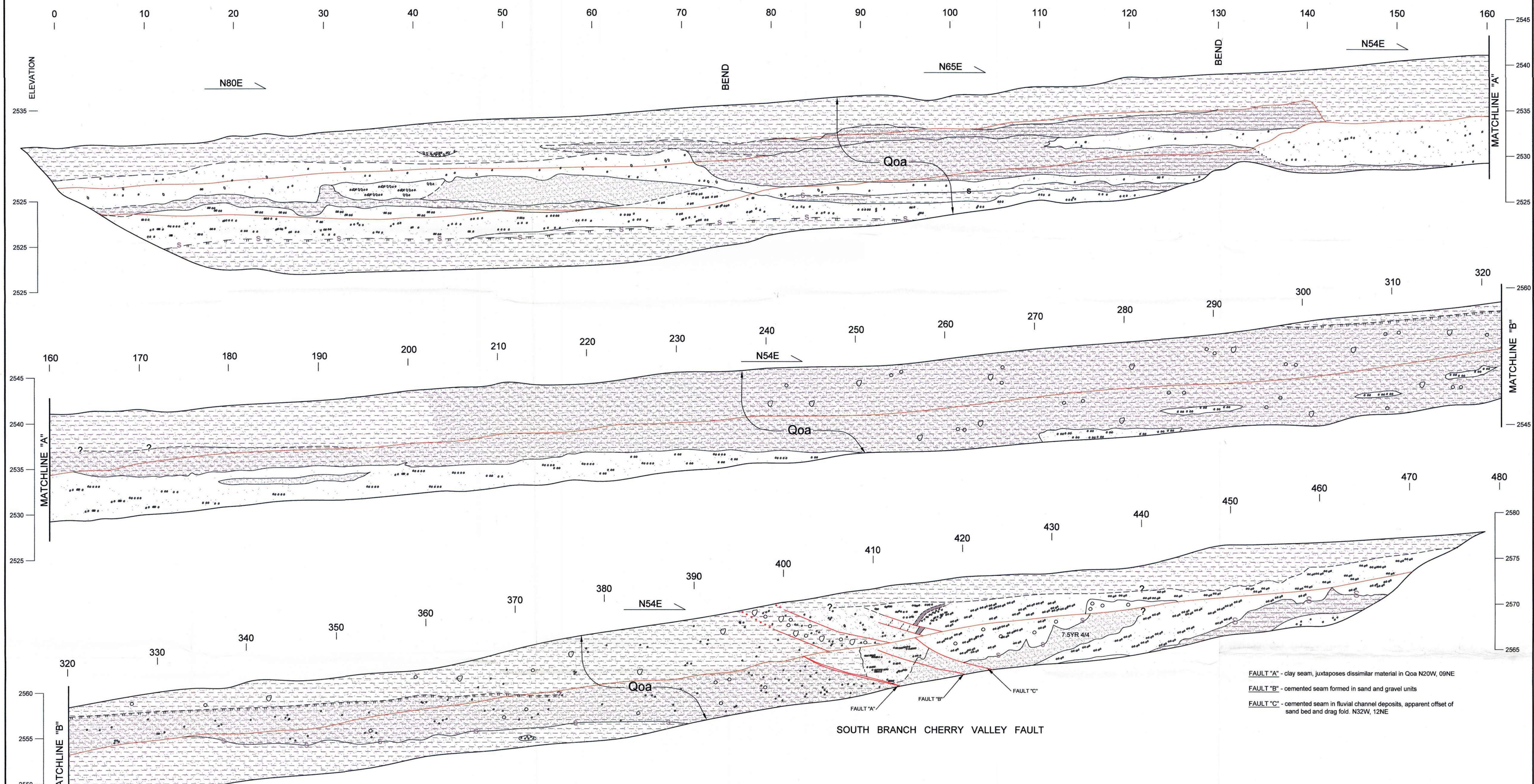
— — —S— · · · ?	Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
	soil developed on San Timoteo Fm. and Qoa.
— ┬┬ ┬┬ ┬┬ S ┬┬ —	soil horizon, "S" = scoured
	Fault, dotted where inferred
	location of bench
	Sand - fine to coarse-grained, stratified, to massive, few gravel
	Sand - fine to medium-grained, massive
	Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
	Sand and Silt, fine to medium-grained, massive
	Silt with fine-grained sand
	fluvial channel deposits - coarse-grained sand and gravel, locally stratified

SCALE: 1"=5' H=V

T-2

TRENCH 2	WEST WALL-VIEW WEST	
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-3"
DATE: AUGUST 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED



FAULT "A" - clay seam, juxtaposes dissimilar material in Qoa N20W, 09NE

FAULT "B" - cemented seam formed in sand and gravel units

FAULT "C" - cemented seam in fluvial channel deposits, apparent offset of sand bed and drag fold. N32W, 12NE

LEGEND:

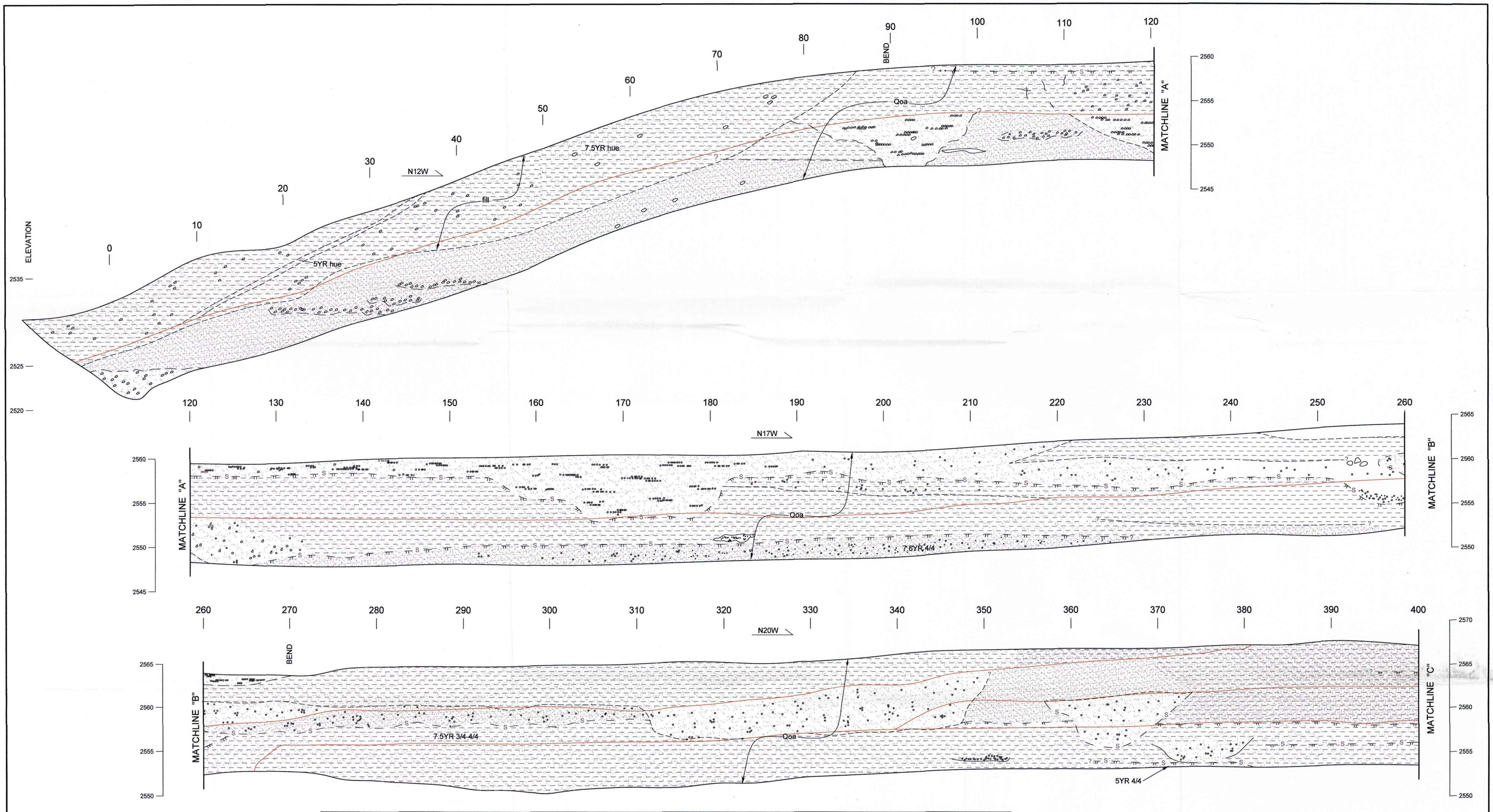
- — — —S— · · · ? Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
- soil developed on San Timoteo Fm. and Qoa.
- soil horizon, "S" = scoured
- Fault, dotted where inferred
- location of bench
- Sand - fine to coarse-grained, stratified, to massive, few gravel
- Sand - fine to medium-grained, massive
- Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
- Sand and Silt, fine to medium-grained, massive
- Silt with fine-grained sand
- fluvial channel deposits - coarse-grained sand and gravel, locally stratified

SCALE: 1"=5' H=V

T-3

TRENCH 3	WEST WALL-VIEW WEST	
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545	ENCLOSURE "B-4"
DATE: AUGUST 2005	CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	JOB NUMBER 04806-8

C.H.J., INCORPORATED



LEGEND:

— — —S— · · · ? Geologic contact, dotted where inferred queried where uncertain, "S" = scoured

soil developed on San Timoteo Fm. and Qoa.

- ╥ ╥ ╥ S ╥ - soil horizon, "S" = scoured

Fault, dotted where inferred

location of bench

Sand - fine to coarse-grained, stratified, to massive, few gravel

Sand - fine to medium-grained, massive

Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally

Sand and Silt, fine to medium-grained, massive

Silt with fine-grained sand

fluvial channel deposits - coarse-grained sand and gravel, locally stratified

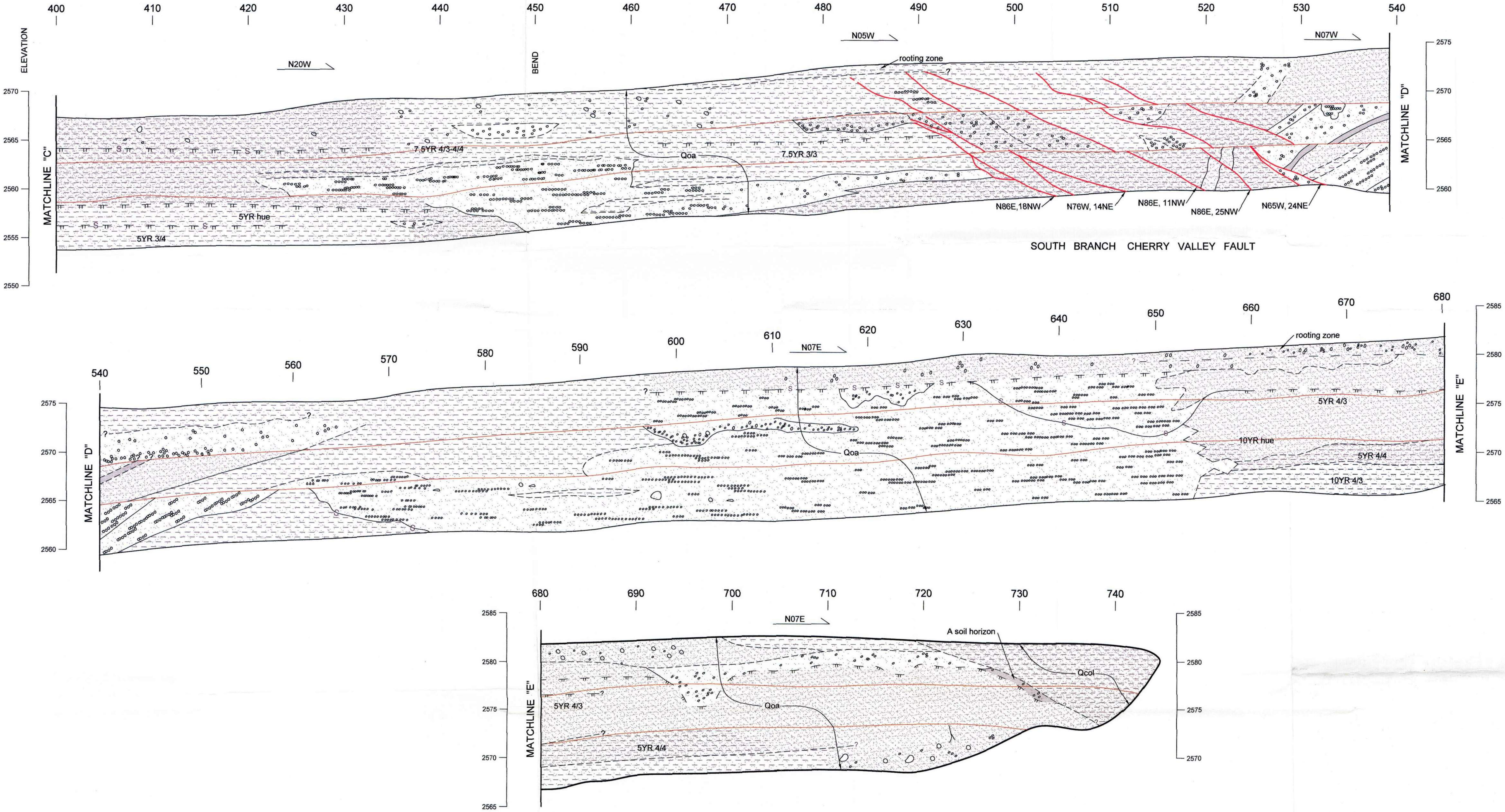
SCALE: 1"=5' H=V

T-4

PG. 1 OF 2

TRENCH 4	WEST WALL-VIEW WEST	
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-5.1" JOB NUMBER 04806-8
DATE: AUGUST 2005		

C. H. J. INCORPORATED



LEGEND:

— — —S— · · · ? Geologic contact, dotted where inferred queried where uncertain, "S" = scoured

soil developed on San Timoteo Fm. and Qoa.

— ┬┬ ┬┬ ┬┬ S ┬┬ — soil horizon, "S" = scoured

Fault, dotted where inferred

location of bench

Sand - fine to coarse-grained, stratified, to massive, few gravel

Sand - fine to medium-grained, massive

Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally

Sand and Silt, fine to medium-grained, massive

Silt with fine-grained sand

fluvial channel deposits - coarse-grained sand and gravel, locally stratified

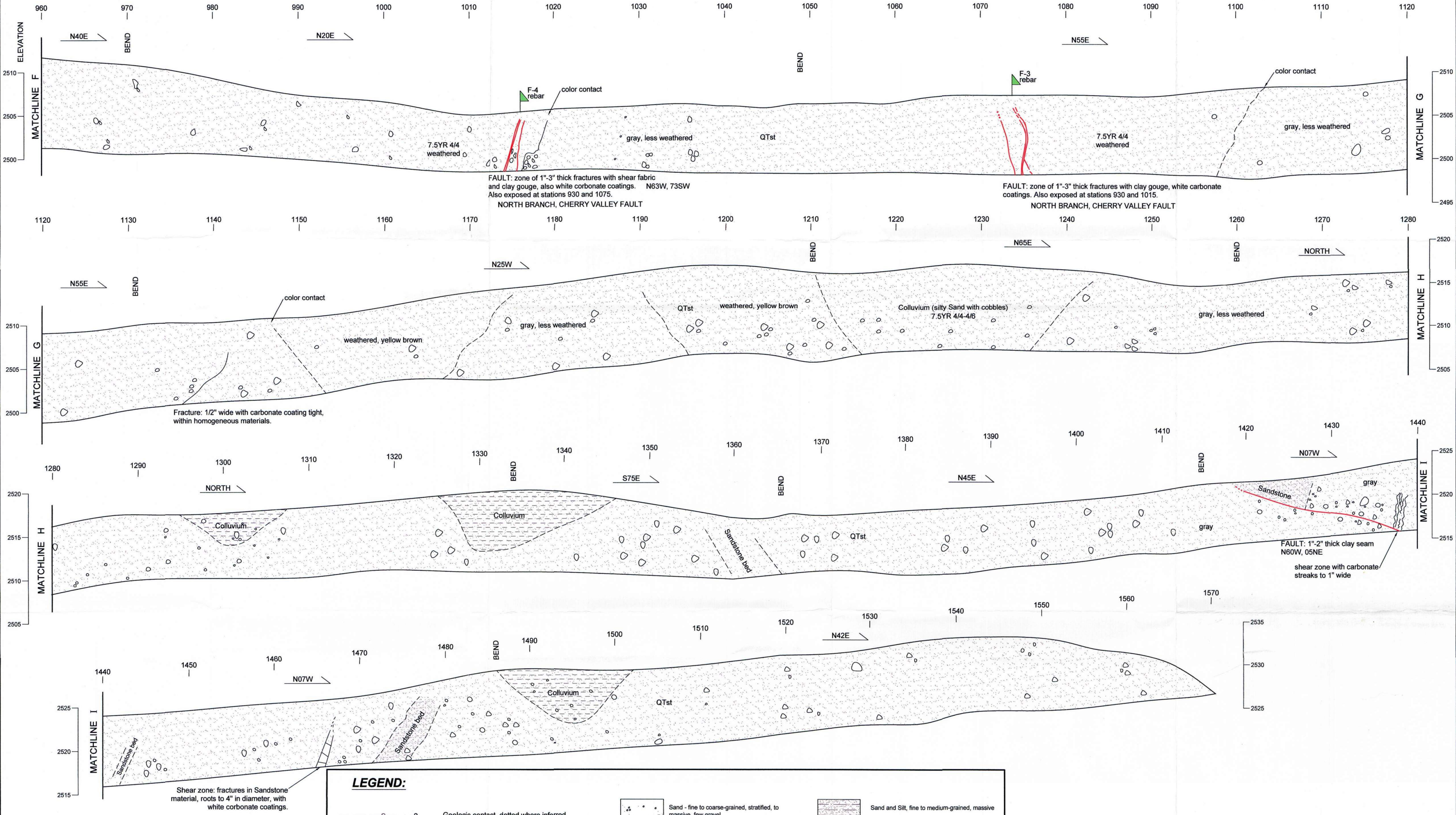
SCALE: 1"=5' H=V

T-4

PG. 2 OF 2

TRENCH 4	WEST WALL-VIEW WEST	
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-5.2"
DATE: AUGUST 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED



LEGEND:

— — —S— · · · ?	Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
{ {	soil developed on San Timoteo Fm. and Qoa.
— ᅮ ᅮ ᅮS ᅮ —	soil horizon, "S" = scoured
(red line)	Fault, dotted where inferred
(red line)	location of bench

	Sand - fine to coarse-grained, stratified, to massive, few gravel
	Sand - fine to medium-grained, massive
	Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
	Sand and Silt, fine to medium-grained, massive
	Silt with fine-grained sand
	fluvial channel deposits - coarse-grained sand and gravel, locally stratified

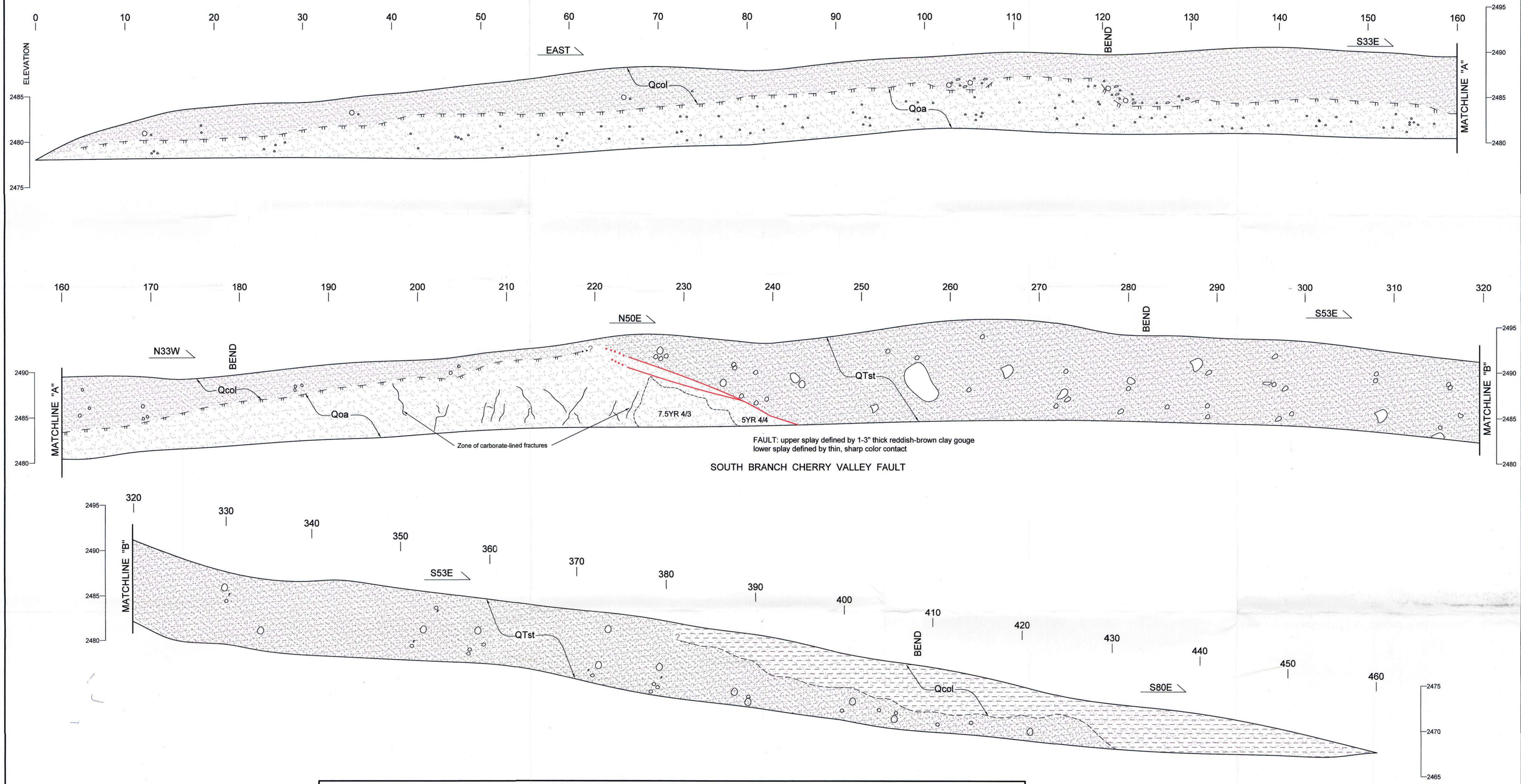
SCALE: 1"=5' H=V

PG 3 OF 3

SLOPE CUT NO.2

FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-7.3"
DATE: AUGUST 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED



LEGEND:

- Geologic contact, dotted where inferred queried where uncertain, "S" = scoured
- soil developed on San Timoteo Fm. and Qoa.
- soil horizon, "S" = scoured
- Fault, dotted where inferred
- location of bench
- Sand - fine to coarse-grained, stratified, to massive, few gravel
- Sand - fine to medium-grained, massive
- Silty Sand - fine to medium-grained, massive, few gravel and cobbles locally
- Sand and Silt, fine to medium-grained, massive
- Silt with fine-grained sand
- fluvial channel deposits - coarse-grained sand and gravel, locally stratified

SCALE: 1"=5' H=V

SLOPE CUT NO. 3		
FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT TENTATIVE TRACT NO. 30545 CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE "B-8"
DATE: AUGUST 2005		JOB NUMBER 04806-8

C.H.J., INCORPORATED

ATTACHMENT

C.H.J. INC. SEPTEMBER 15, 2005 REPORT

C.H.J. Incorporated
1355 E. Cooley Drive, Colton, CA 92324 ◆ Phone (909) 824-7210 ◆ Fax (909) 824-7209
15345 Anacapa Road, Suite D, Victorville, CA 92392 ◆ Phone (760) 243-0506 ◆ Fax (760) 243-1225

September 15, 2006

TSG Cherry Valley, LP
c/o The Shopoff Group
114 Pacifica, Suite 245
Irvine, California 92618-3321
Attention: Mr. James Welsh

Job No. 04806-8

Subject: Update to Subsurface Investigation of Faulting
Cherry Valley Gateway Project
244± Acres Northeast of Cherry Valley Boulevard and Interstate 10
Cherry Valley Area
Riverside County, California

References: See attached Reference sheet

Dear Mr. Welsh:

As requested we have performed an update to the referenced Subsurface Investigation of Faulting report (C.H.J., Incorporated, 2005). This update has been prepared utilizing new off-site subsurface information regarding the northerly fault (Cherry Valley Fault - North Branch) located at the site. This update is intended to supercede our previous recommendations with regard to the Recommended Restricted Use Zone (RRUZ) in the northeast portion of the site.

As you are aware, the site is traversed by a Fault Hazard Management Zone designated by Riverside County (1990) to include traces of suspected active faulting associated with the Cherry Valley fault zone. Two traces of the Cherry Valley fault zone were mapped by this firm on the site at the locations indicated on the attached Geologic Map (Enclosure 1). Based on the available data at the time, an RRUZ was established for the northern fault referred to as the Cherry Valley Fault - North Branch. The southerly fault was concluded to be inactive, and no RRUZ was recommended. Prior to and after our investigation, Leighton and Associates, Inc. and Leighton Consulting, Inc. (Leighton) in 2004 and 2006 performed a fault investigation on these same two faults at the adjacent Danny Thomas Property east of the subject site. The reports prepared by Leighton concluded the northerly and the southerly faults were inactive.

The locations of the Cherry Valley fault zone as shown on the Riverside County Fault Hazard Management (RCFHM) map are indicated on the attached Geologic Map (Enclosure 1). The location of these faults generally coincide with the faults mapped by Shuler (1953). The difference in our locations and the locations shown on the RCFHM is likely due to errors made while transferring from small to large scale mapping. No lineaments or other topographic features indicative of faulting were observed in the field or on the aerial photographs reviewed that coincided with the fault locations shown on the RRCFHM. Our mapped traces of faulting also coincide directly with the faults mapped by Leighton (2006). Additionally, Cut SC-2 was excavated across the mapped trace of the southerly faulting. No evidence of faulting was observed in the exposed geologic materials in SC-2. Based on the lack of faulting exposed in SC-2 the lack of geomorphic evidence observed in the aerial photographs and our geologic mapping of the site, we conclude that the faults shown on the RCFHM are located too far north and the "ground truth" faulting is as shown on the attached Geologic Map (Enclosure 1). No RRUZ is recommended for the faults as shown on the RCFHM.

CHERRY VALLEY FAULT - NORTH BRANCH:

The Cherry Valley Fault - North Branch is defined by a distinct narrowing and apparent right-lateral offset of a series of southwest-trending ridges and anomalous topography, including beheaded drainages, that form a west-northwest trending lineament. These features extend southeasterly across the site from an area northwest of the site and are absent or obscured within the northeast portion of the site.

At the north end of the site, we exposed a high-angle fault within the San Timoteo formation that includes a zone with up to 18 inches of clayey gouge and sheared material. This fault places reddish brown, fine- to medium-grained sandstone on the north against light gray cobble/boulder conglomerate on the south. Several low-angle north-dipping faults were observed south of this high-angle fault within a distance of 30 feet. The fault exposures define a fault zone oriented N63W to an almost east-west trend in the eastern portion of the site.

This fault zone is defined in aerial photographs by topographic linearity, apparent right lateral offset of ridgelines crossing the fault trend, and the linearity of a canyon along strike with the fault. A similarity of shear zone width and character in the fault zone, juxtaposition of dissimilar rock types across the zone, and fault geometry define this fault zone in the field. Topographic anomalies including a beheaded drainage (located off site) and apparent right-lateral offset of ridges within the site along trend define the location of this fault. We interpret this fault zone to exhibit an apparent component of right lateral, strike-slip motion and/or dip-slip separation. The geologic materials exposed at the surface across this fault zone are pre-Holocene in age; therefore, we could determine the status of activity of this fault zone based on the faulted geologic materials at this site.

The Cherry Valley Fault - North Branch was investigated by Leighton (2006). In Leighton's report, they refer to it as Fault B. Leighton shows the fault as an east-west trending reverse thrust fault. They conclude that the fault is inactive due to the lack of geomorphic evidence and unfaulted alluvial soils considered to be very early Holocene to late Pleistocene in age.

The fault trenches excavated by Leighton (2006) were located in the eastern portion of the adjacent site. They did not conduct trenching in the western portion of the site due to the steep terrain. They mapped the western portion of the fault based on the geomorphic expression of the fault as a linear ridgeline. In the eastern portion of the subject site the fault is buried beneath younger alluvium within a fault controlled canyon. The geomorphic expression provides strong evidence for continuity of the fault (Fault B) as mapped by Leighton (2006), and the fault mapped by this firm (Cherry Valley Fault - North Branch). Leighton mapped the fault as extending along the same trend and in a similar location to the fault mapped by this firm along the eastern boundary of the subject site.

Based on the evidence from Leighton's investigation, we conclude that the fault (Fault B) mapped by Leighton (2006) and the Cherry Valley - North Branch mapped by this firm are the same geologic feature. Additionally, based on the soil age estimates of the alluvial soils reported by Leighton of unruptured soils across the fault trace, we conclude that the Cherry Valley Fault - North Branch mapped at the subject site is considered inactive as defined by the State of California and are recommending that the RRUZ associated with the Cherry Valley fault - North Branch be removed. We have provided a revised Geologic Map (Enclosure 1) that supercedes the previous Geologic Map included with the referenced Subsurface Investigation of Faulting report (C.H.J., Incorporated, 2005).

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,
C.H.J., INCORPORATED

Terrance A. Davis, E.G. 2393
Project Geologist

Jay J. Martin, E.G. 1529
Vice President

Allen D. Evans, G.E. 2060
Vice President

REGISTERED GEOLOGIST TERRANCE A. DAVIS No. 2393 CERTIFIED ENGINEERING GEOLOGIST Exp. 12-31-07 STATE OF CALIFORNIA
9-15-06

REGISTERED PROFESSIONAL ENGINEER ALLEN D. EVANS No. 2060 Exp. 3-31-2007 GEOTECHNICAL STATE OF CALIFORNIA
9-15-06

REGISTERED GEOLOGIST JAY J. MARTIN No. 1529 CERTIFIED ENGINEERING GEOLOGIST Exp. 8-31-08 STATE OF CALIFORNIA
9-15-06

TAD/JJM/ADE:sra

Enclosure: 1 - Geologic Map

REFERENCES

C.H.J., Incorporated, Subsurface Investigation of Faulting, Tentative Tract No. 30545, Cherry Valley Acquisition Parcel, 244± Acres Northeast of Cherry Valley Boulevard and Interstate 10, Cherry Valley Area, Riverside County, California, Dated August 3, 2005, Job No. 04806-8.

Leighton Consulting, Inc., Fault Investigation Report, Danny Thomas Ranch Portion of Sunny-Cal Egg Ranch Project, North of Cherry Valley Boulevard, East of Interstate 10, Cherry Valley Area of Unincorporated Riverside County, California, Dated August 3, 2004, Project No. 600390-001.

Leighton and Associates, Inc., Supplemental Fault Investigation Report, Proposed Residential Development, 122-Acre Site, 37300 and 37356 Cherry Valley Boulevard, Calimesa Area of Unincorporated Riverside County, California, Dated August 4, 2006, Project No. 021836-011.

Riverside County, 1990, Fault Hazard Management Zone Map, Sheet No. 98. Scale: 1 inch equals 800 feet.

Shuler, E.H., 1953. Geology of a portion of the San Timoteo Canyon Badlands near Beaumont, California: Master of Science Thesis, University of Southern California.

LEGEND:

f: fill

Qs: stream channel deposits (recent - Holocene)

Qya: younger alluvium (Holocene)

Qoa: older alluvium (Pleistocene)

QTst: San Timoteo formation, upper member (Plio-Pleistocene)

approximate location of well

B-12 exploratory boring location

F-6 rebar indicating fault location

geologic contact (dashed where approximately located)

fault (dashed where approximately located, dotted where concealed, teeth indicate upper plate of thrust fault, this investigation)

85 strike and dip of bedding

horizontal bedding

area of erosion

15 strike and dip of fault

trench and slope cut locations

location of photolineament

postulated fault (Riverside County, 1990)

Earthquake Hazard Zone (Riverside County, 1990) southern boundary

-N-

SCALE: 1"= 200'

GEOLOGIC MAP AND SITE PLAN

FOR: TSG CHERRY VALLEY, LP	CHERRY VALLEY GATEWAY PROJECT CHERRY VALLEY AREA RIVERSIDE COUNTY, CALIFORNIA	ENCLOSURE 1
DATE: SEPTEMBER 2006		JOB NUMBER 04806-8

C.H.J. Incorporated

ATTACHMENT

PETRA GEOTECHNICAL, INC. OCTOBER 20, 2004 REPORT

FAULT INVESTIGATION, OAK VALLEY AT CALIMESA, RIVERSIDE COUNTY, CALIFORNIA.

Prepared for:

FIESTA DEVELOPMENT, INC.

Prepared by:
PETRA GEOTECHNICAL, INC.
and
HUSHMAND AND ASSOCIATES, INC.

October 20, 2004
J.N. 238-04

October 20, 2004
J.N. 238-04

Mr. Saied Naaseh
FIESTA DEVELOPMENT, INC.
470 E. Harrison Street
Corona, California 92879

Subject: Fault Investigation, Oak Valley at Calimesa, Riverside County, California.

Dear Mr. Naaseh:

Petra Geotechnical, Inc. (Petra) and Hushmand and Associates, Inc. are pleased to submit our Fault Investigation for the subject project. The results of our investigation indicate the site is traversed by the Cherry Valley fault, which extends westward from the San Gorgonio fault zone. The fault exhibits evidence of Quaternary activity, which decreases along its surface trace from east to west within the boundaries of the site. Accordingly, the following report provides recommen-dations for structural setbacks for habitable structures within the eastern portion of the fault within the site. The western portion of the fault investigated during this study was not found to be active in the Holocene time period (last 10,000yrs). Therefore, setbacks for residential structures within this portion of the property are not recommended, however, setbacks for public buildings such as schools, fire stations, etc. are recommended.

Petra appreciates the opportunity to be of service to Fiesta Development, Inc. Should you need additional information or any clarifications please call one of the undersigned.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

Original Copy Signed by:

Robert Ruff
Senior Vice President

RWR/nls

FAULT INVESTIGATION, OAK VALLEY AT CALIMESA, RIVERSIDE COUNTY, CALIFORNIA

INTRODUCTION

Project Description

The Oak Valley project was adopted by the County of Riverside in 1990 as Specific Plan Numbers 216 and 216A. The development was a golf/recreation-oriented, master-planned community of mixed residential, commercial, recreational, and community uses. The amended plan calls for a mixed-use master planned community providing for about 2996 residential dwelling units along with supportive land uses including neighborhood commercial, recreation center, mixed use, schools, parks, and open space. A major component of the original plan, a golf course, is no longer being proposed.

Site Description

The site comprises about 1539 acres, the location of which is shown on Figure 1. This area comprises the northern part of the larger Oak Valley project as described in EIR 229 by Michael Brandman Associates (MBA, 1988) and which constituted about 6725 acres primarily between the I-10 freeway and San Timoteo Canyon Road, and from the San Bernardino/Riverside county line on the north near Yucaipa to the Beaumont area on the south. This area was previously referred to as the Phase 1 area of the Oak Valley project as described in the EIR (MBA, 1988). Access to the site is primarily from County Line Road and Sandalwood Drive exits from the I-10 Freeway.

Scope of Work

In accordance with our scope of work discussed in our original proposal and amendments (dated March 18, 2004, May 19, 2004, and June 28, 2004) the scope of work for our geotechnical fault investigation consisted of:

- Collection and review of readily available literature and maps pertaining to geologic conditions within and adjacent to the site,

- Review of development plans available at the time of our investigation,

- Obtaining and reviewing historical aerial photographs to better define fault features within and adjacent to the site,

- Excavation of 20 exploratory trenches to depths ranging from approximately 6 to 18 feet to evaluate the location and degree of activity of the Cherry Valley fault between Interstate 10 on the east and Covington Canyon on the west, a distance of approximately 1.75 miles.

- Detailed Logging of the trenches at a scale of 1” = 5’.

- Preparing a site plan and fault map depicting the location of the exploratory trenches and the Cherry Valley fault.

- Preparation of this report summarizing the conclusions of the study and providing recommendations for siting proposed structures in the vicinity of the fault.

BACKGROUND INFORMATION

Previous Investigations

Geological investigations in the region have been performed since the 1920s (e.g., Frick, 1921); these studies are summarized in the EIR (MBA, 1988). There is little published information available on the specific project area. Of particular importance were the investigations by Dames & Moore (1987) and by Rasmussen Associates (1984, 1988) both of who conducted fault-trenching investigations. Also important is research conducted since the EIR was prepared; specifically, the work of Albright (1999) and Kendrick et al (2002) and fault mapping performed for the April, 2004 geotechnical report by Hushmand and Associates, Inc., and Petra Geotechnical, Inc.

Current Study-Method Investigation

Preliminary investigations included review of published geological literature and project reports. Pertinent reports are referenced within later sections of this report. Stereoscopic aerial photographs were analyzed to characterize the geologic setting of the site and to assist in locating the exploratory trenches. Several vintages of photos (scale of about 1:24,000) taken between 1979 and 1995 were reviewed.

For this report we utilized a reconnaissance level geological/geotechnical map prepared for our previous study conducted in April 2004 by a senior California-licensed, Engineering Geologist, aided by previous maps prepared by others (e.g., Dames & Moore, 1987; Rasmussen Associates, 1984, 1988) and aerial photographs. A revised fault map based on the results of this current study is presented as Plate 1.

Twenty exploratory fault trenches were excavated in two phases during July and August of 2004 using a track-mounted excavator with a 36- to 48- inch- wide bucket. The trenches were logged by a senior engineering geologist at a scale of 1" = 5' with the exception of trench FT-8, which was logged at a scale of 1" = 2'. The trench locations were selected to provide data on the structural characteristics of the fault, fault-zone width, and to provide information related to the age of faulting (Plate 1).

SITE PHYSIOGRAPHY

The Oak Valley project area lies along the western edge of the Beaumont Plain and near the eastern edge of a region referred to as the San Timoteo Badlands. The site is generally a well-vegetated grassland and somewhat more similar to a savanna or wooded savanna than to true badlands which are characterized by little vegetation. The locally rugged relief within portions of the site is probably mainly a result of the area being capped by a hard, erosion-resistant, impermeable, ancient soil with a well-developed carbonate horizon. This hard surface protects the area from erosion, but once the cap is breached, the underlying uncemented materials are susceptible to erosion and formation of steep-sided canyons.

The site is characterized by flat mesas and ridges transected by northerly, westerly and southwesterly draining valleys and canyons. The mesas and ridges lie at approximately the same elevation and represent a formerly flat to undulatory, gently southwest-sloping surface collectively referred to informally as the Calimesa surface. Elevations of the Calimesa surface are highest within the northern parts of the site where the ridge tops range from approximately 2200 to 2300 feet above sea level. Elevations of the Calimesa surface gradually decrease toward the southwest providing an elevation difference across the site of about 100 feet.

The valleys in the northern part of the property drain toward the north and are tributaries of Yucaipa Creek. Valleys in the east, west, and south drain primarily southwesterly and are tributaries of San Timoteo Creek. The two major valleys within the site are Covington Canyon, which drains southwesterly from the northeast corner of the site to the south-central part of the site, and Burns Canyon, which traverses the southeast corner of the site and drains southwesterly subparallel to Covington Canyon. Maximum relief between canyons and the adjacent ridge tops of the Calimesa surface is commonly in the 100 to 130 foot range with a maximum of about 180 feet in Covington Canyon near the southern property line. Valley profiles range from sharp and V-shaped in the smaller valleys to somewhat broad and U-shaped across the larger valleys. Although commonly steep, the valley walls are generally covered with thin deposits of slopewash and colluvium.

REGIONAL GEOLOGY AND STRUCTURE

The subject property is within a very complex geologic area of San Gorgonio Pass (Allen, 1957), which is an area of relatively low topographic relief between two high-standing mountain ranges. These ranges include the San Bernardino Mountains to the north, and the San Jacinto Mountains toward the south, both of which contain peaks over 10,000 feet in elevation. In general, sediments occupy the relatively low-lying area in San Gorgonio Pass, and crystalline bedrock comprises the mountainous areas (Matti et. al., 1992b). Numerous active faults associated with the San Andreas fault system (Powell, 1993; Treiman, 1994) exist in the region, which produce abundant microseismicity (Nicholson et. al., 1986; Seeber and Armbruster, 1995; Magistrale and Sanders, 1996) and surface rupture events (For example, see Sieh and Yule, 1999; Yule, 2000).

Oak Valley is located on the northeastern limb of a regional asymmetric, northwest-trending anticline in the San Timoteo Formation. The axis of this fold is located west and southwest of the project boundaries and parallels the San Jacinto fault. Bedding planes and member contacts in the San Timoteo Formation on the west limb of the fold typically dip 15 to 50 degrees southwest. On the east limb, including the area beneath Oak Valley, bedding planes and member contacts typically strike northwesterly to northeasterly and generally exhibit gentle dips ranging from nearly horizontal to about 5 degrees to the north, with local increases in dip to about 15 degrees.

Locally, steeper dips typically occur in association with deformation along the north side, or hanging wall, of the Cherry Valley fault. These dips range from greater than 15 degrees to vertical and, in some places, bedding is overturned directly above the fault zone. A gentle anticline and syncline are also exposed in the arroyo walls of Covington Canyon north of the subject fault in the western part of the site. Our previous field reconnaissance performed in April 2006 by this office also identified two small northeasterly dipping faults in the walls of the arroyo near these folds. Toward the east, the late-Pleistocene erosional geomorphic surface north of the subject fault exhibits an open-fold that likely developed as a result of deformation associated with activity across this fault.

Regional Faulting

The site lies between three major active fault zones of the San Andreas fault system (Powell, 1993). These include, the northwest-trending San Andreas fault zone toward the northeast, the northwest trending San Jacinto fault zone toward the southwest, and the east-west trending San Gorgonio Pass-Banning fault zone to the east. More specifically, the subject site is located at the westernmost end of the San Gorgonio Pass fault zone.

Most faults associated with the San Andreas and San Jacinto fault zones are strike-slip which are faults dominated by horizontal movement of rocks across the faults. Faults within the San Gorgonio-Banning fault zone are a combination of strike-slip and reverse/thrust faults, which accommodate vertical and horizontal motion due to regional compression associated with a left bend in the San Andreas fault in the San Gorgonio Pass region. The Banning fault lies just northeast of the site and is not believed to be active west of Banning (Rasmussen, 1982). Southwest of the Banning fault is the San Gorgonio Pass fault zone, which represents a complex system of northerly dipping oblique-reverse faults. A western strand of the San Gorgonio Pass fault zone, the Cherry Valley fault, extends onto the site from the east, and “dies out” toward the west within the property. The Cherry Valley fault is a thrust fault with a low to moderate northerly dip. Repeated motion across this fault in the late Pleistocene time has offset and deformed units of the San Timoteo Formation within the property.

Regional Geologic Rock & Soil Units

The region surrounding the property consists of late Tertiary- and Quaternary-aged sediments and sedimentary rocks overlying ancient crystalline basement rocks. The basement rocks typically consist of Mesozoic plutonic rocks (e.g. granites, diorites) and Mesozoic through Precambrian-aged metamorphic rocks (e.g. gneiss; Powell, 1993; Matti, et.al., 1982; Matti, et.al. 1983; Dibblee. 1964).

Sedimentary rocks in the region consist of Miocene- to Pleistocene-age conglomerate, sandstone, siltstone, and shale of fluvial (river) origin and local clay beds of possible lacustrine (lake) origin. In the San Timoteo Badlands, the oldest sedimentary rocks are the late Miocene-Pliocene age Mount Eden Formation overlain by the Pleistocene San Timoteo Formation (Shuler, 1953;

Dibblee, 1981; Morton and Matti, 1993). Both of these units were deposited in a basin that extended westward and southward from the then highstanding San Bernardino Basin and adjacent mountains (Morton and Matti, 1993). The regional geology of the area around the site is shown on Figure 2. The valleys in the region are filled with late-Quaternary-age sediments (mostly Holocene) consisting of alluvium, slopewash, and alluvial-fan deposits. Descriptions of the geologic units encountered during our study are provided in the Local Geology section below.

LOCAL GEOLOGY

Numerous geologic units were encountered during our field investigation, which was primarily focused in the eastern portion of the property along the Cherry Valley fault. A description of the units encountered in the exploratory trenches is provided below.

Site Stratigraphy

The geologic units described in this report consist of the Pleistocene San Timoteo Formation and relatively younger valley alluvium, in addition to important soil profiles that developed within these two formations. The distribution of these sediments is shown on Plate 1 of the Limited Geotechnical Investigation report prepared by Hushmand Associates, Inc. and Petra Geotechnical, dated June 2004. These units, from oldest to youngest, are described further below.

San Timoteo Formation

The San Timoteo Formation is Pleistocene in age or 1.5 to 1.3 million years old (Morton and Matti, 1993). The formation is divided into three members (Shuler, 1953). The formation onsite represents the upper member, whereas the middle and lower members are present in the deep subsurface. The entire formation along with probable older sediments, reach a total thickness of over 5,000 feet beneath parts of the Oak Valley development.

The San Timoteo Formation is chiefly of fluvial (river) origin with local lacustrine (lake) deposits and is composed of beds of siltstone, sandstone, silty sandstone, claystone, and poorly sorted gravelly to bouldery sandstone and conglomerate. Gravels in the unit are composed of quartz, plutonic (e.g., granite, diorite), meta-sedimentary, meta-igneous, and meta-volcanic rock types. The rock fragments are subangular to subrounded indicating short transport distance. These deposits were principally derived from rocks to the north and northeast in the San Gabriel and San Bernardino Mountains (Albright, 1999). The sediments in outcrop are generally friable to moderately indurated, and easily to moderately erodible. Bedding varies from thin to thick, and well-defined to poorly developed beds with gradational contacts.

Alluvium

The canyons and valleys within the site contain young alluvium of Holocene age. A pedogenic analysis of the alluvium in Trench FT-4 that is typical of most of the thicker valley alluvium within the eastern portion of the site, suggests a maximum approximate age of 5000 years (mid-Holocene; Bornyasz, Appendix B). This alluvium is primarily locally derived from upstream outcrops of the San Timoteo Formation. The material is generally composed of dark-reddish-brown and dark brown, loosely indurated, sand to silty sand with minor amounts of gravelly sand with occasional boulders. The alluvium is massive to poorly bedded.

The young alluvium is relatively thin in small tributary canyons and thicker in the larger drainages and at the canyon mouths. The arroyos in the narrower parts of smaller valleys indicate thicknesses of only about 5 feet to as much as 20 feet.

Pedogenic Soils

Pedogenic soils form by weathering processes on the San Timoteo Formation and other younger valley-fill sediments. Pedogenic soil characteristics typically change as the soil develops over time, and thus, can provide an estimate of the age of the surface on which the soil developed. These soils exhibit ages varying from late Pleistocene, on the order of 100,000 years to only a few thousand years in age. Because of their relatively young age, they are extremely useful in determining the activity of faulting. Soils can be divided into several recognizable layers or horizons; their degree of development in terms of their physical, chemical and mineralogical properties are indicative of their age. The soil profile consists of the vertical arrangement of all the soil horizons from the surface to the parent material. The principal soils and soil horizons exposed during the investigation are described below. A summary of the characteristics of each horizon is also provided on the Trench Logs (Plates 2 through 9).

A horizon: The A horizon is a thin surficial unit consisting of an accumulation of organic matter mixed with a more dominant loosely consolidated mineral fraction. This horizon, because of its surface position is the youngest soil horizon and is estimated to be late-Holocene in age.

Bt horizon: The Bt or argillic horizon is present in most of the trenches and may or may not be overlain by a thin A-horizon. This soil unit consists of hard, dark-brown, sandy clay and clay in the form of blocks and prisms, and moderately to well-developed clay films on ped surfaces. Soils with a well-developed thick Bt horizon generally may be assigned a minimum age of latest Pleistocene. Bt Horizon soils of Trench FT-20 were determined by Bornyasz (Appendix B) to have an age of approximately 100,000 yrs. based on statistical comparison of the soil development on site with dated regional soils developed under similar conditions.

Btk horizon: The Btk horizon is a clay-rich horizon with later accumulation of carbonate in the form of thin filaments, small flecks, or as thin linings on ped surfaces.

K horizon: The K soil horizon is characterized by abundant calcium carbonate in the soil profile. In this horizon most mineral grains are coated or engulfed with carbonate to form a white to light gray unit in outcrop. In some trenches the K horizon is laminated.

CBk horizon: This horizon is transitional between slightly weathered parent material (hard, blocky siltstone of trench FT-6) and the more-weathered Btk horizons. In trench FT-6 the CBk horizon grades laterally to a white K horizon.

CK horizon: The CK horizon represents a transitional zone between relatively unweathered parent material and the K horizon. Calcium Carbonate occurs, but the parent material is prominent and recognizable.

Artificial Fill

There are a few local areas within the site with artificial fill. Generally these are small berms or dams built to retain water for livestock. The only area with significant fill is the valley just south of the trailer park in the central part of the site near Trench FT-5. This area served as an equipment storage area and has been a borrow area. These activities have resulted in dirt, brush, and trash having been disturbed and pushed into the arroyo. Several other areas along the creeks also have local accumulations of trash and generally are not significant to the project.

ON-SITE FAULTING AND DEFORMATION

The Cherry Valley Fault and Style of Fault Related Deformation

The Cherry Valley fault extends into the southeast corner of the property (Figure 2 and Plate 1) from offsite to the east (Matti et al, 1985, 1992; Dames and Moore, 1987; Rasmussen and Associates, 1984, 1988). According to mapping by Matti and others, (1992), this fault represents the westernmost extension of the San Gorgonio Pass fault zone that apparently dies out south of a series of northeast trending faults in the Crafton Hills area (Figure 2). According to Matti and others (1992) all faults of the San Gorgonio Pass fault zone are at least late-Quaternary in age and the faults within the eastern portion of the zone between Beaumont and Whitewater exhibit evidence of Holocene activity.

Motion across the Cherry Valley fault is primarily reverse (rocks on the north side of the fault move upwards) with a relatively minor component of strike-slip (horizontal motion). The fault generally dips towards the north approximately 30 degrees across the site. Repeated surface rupturing earthquakes across this fault in the late Pleistocene within the property has “pushed” San Timoteo formation up and over itself. Within the eastern portion of the fault on the site, surface rupture across the Cherry Valley fault displaced a surficial late Pleistocene soil. Considerable secondary folding and faulting has occurred in the rocks above the main fault zone (rocks north of the fault), which in places has tilted the sediments of the San Timoteo Formation toward the south to vertical or even overturned. In contrast, rocks south of the main fault zone shown on Plate 1 are relatively undeformed and typically exhibit regional dips of the San Timoteo Formation and minor secondary faulting.

Based on our evaluation of the data acquired during our field investigation, the Cherry Valley fault within the property has been subdivided into two sections based on recency of activity along the fault. These two sections are called the Western and Eastern fault zones, and are shown on Plate 1.

Age of Faulting

Our investigation revealed that the Cherry Valley fault can be recognized in the eastern portion of the site by an eroded and degraded scarp associated with folding and displaced strata of the San Timoteo Formation. The scarp in the southeast corner of the site is 70 to 80 feet high and the mesa surface north of the fault in this area, which represents a late Pleistocene erosion surface, appears to be warped upward and tilted slightly to the north as a result of faulting. To the west, the scarp height steadily diminishes from approximately 80 feet near trenches FT-9 through FT-12 to approximately 10 feet at trench FT-16. West of trench FT-16 the fault has no geomorphic expression where it rises onto the surface of a nearly level mesa.

Field investigations of the Cherry Valley fault by Dames & Moore (1987) were inconclusive regarding the recency of its activity. They considered it to be potentially active since it displaces Pleistocene sediments. Furthermore, this evaluation was also based on the work of Matti, et.al. (1985) where it was indicated that the San Gorgonio fault displaces Holocene deposits east of the site. Accordingly, they recommended a restricted-building zone or setback zone. Subsequent work onsite by Rasmussen Associates (1988) suggested that the fault is overlain by the unfaulted mature soil. They, therefore, concluded the fault should not be considered active.

Neither of the above two studies were sufficiently extensive to provide conclusive data that would allow a more-definitive age classification. The purpose of our recent study, which included 20 trenches located between the eastern limits of the site near I-10 and Covington Canyon on the west, was to investigate the fault in a sufficient number of localities to determine its degree of activity in more detail. Observations of the faulted and unfaulted relationships of pedogenic soils along the fault trace enabled a reclassification and further definition of the age of most-recent faulting.

It is our professional opinion, based on our analysis of fault data acquired during our study, that in the western portion of the site (Western fault zone) the fault was inactive during the Holocene. Additionally, in the eastern portion of the property, (Eastern Fault Zone) the age of most recent faulting is either indeterminate or geologic evidence is suggestive of possible Holocene activity. The boundary between these two fault classifications (located west of trench FT-5 and east of trench FT-13; Plate 1) is relatively well-defined and is based on the following observations. Evaluation of the data collected during our study is discussed below for the Western and Eastern fault zones.

Age Criteria for Activity on the Western Fault Zone

The Cherry Valley fault between Covington Canyon and the prominent drainage just east of trench FT-13 does not displace well developed Bt and K horizon soils of trenches FT-13 through FT-16 and FT-18 through FT-20 estimated to have an age of approximately 100,000 years (see data in Appendix B by M. Bornyasz). The fact that the fault is also not expressed in the topography on the extensive late Pleistocene erosional mesa surface in the area of trenches FT-19 and FT-20 is also strong evidence that the fault has not had Holocene activity in this area. Trench FT-7 located in Covington Canyon exposed the contact between the San Timoteo Formation and alluvium. The fault at this location terminates in San Timoteo sediments and does not extend upward into the alluvium. The alluvial contact slopes to the south and may be either tilted by fault activity or, alternatively, the sloping contact may be the result of erosion.

The age of the alluvium at this locality is estimated to be no younger than latest Pleistocene near the bottom of the channel based on the presence of a well-developed soil profile near the ground surface.

<u>Age Criteria for Activity on the Eastern Fault Zone</u>

From the prominent drainage east of trench FT-13 eastward to the property boundary near trench FT-12 the fault lies at or near the base of a scarp that increases in height from approximately 30 feet to over 70 feet. The fault in this area tends to be located near the base of the highly eroded fault scarp or at prominent mid-scarp topographic benches. Older soil horizons (well-developed Bt and K horizons) that, based on their degree of development, are late-Pleistocene in age, exhibit significant disruption by faulting. In particular, the strong Bt and BCk horizons of trenches FT-1, FT-3a, FT-6, FT-6a, and FT-8 are either overridden by San Timoteo sediments or displaced by as much as 5 feet. The origin and relationship of the strong argillic soil horizons that have been disrupted by faulting in the eastern portion of the site have similar characteristics to the unfaulted argillic soils at trenches FT-19 and FT-20, but are significantly thinner. It is possible that these two soils are similar in age and that the faulted soils of the Eastern Fault Zone developed on the same geomorphic surface or older paleo-slope as the unfaulted soils occupying the mesa surface in the area of trenches FT-19 and FT-20 in the Western Fault Zone.

The contact between younger valley alluvium (estimated minimum age of approximately 5000 years (Bornyasz, Appendix B) and San Timoteo Formation present in trenches FT-4 and FT-6 is not displaced indicating that the fault has not been active since at least mid-Holocene. Early Holocene faulting, however, cannot be ruled out because slightly older sediments with ages closer to the Holocene/Pleistocene boundary are not present. Therefore, setbacks for habitable structures are recommended.

STRUCTURAL FAULT SETBACKS

Recommended Structural Fault Setbacks

The location of the fault as shown on Plate 1 is based on surveying performed by Van Dell and Associates, Inc. Trench and fault locations were surveyed. This survey data was used in conjunction with all geologic data collected to provide a relatively accurate location of the fault throughout the site. Based on our evaluation of the existing fault data collected within the site, it is our professional opinion that structural fault setbacks are prudent for the Cherry Valley fault within the property. We are recommending special setback criteria for the Eastern and Western fault zones based on our assessment regarding the variation of activity along the fault. Our recommended setback criteria for each of these zones are discussed in the following two sections.

We recommended that the setback zone on the hanging wall (north side of the fault) be at least 150 feet wide and the setback on the footwall (area on the south side of the fault) be a minimum of 75 feet. These setbacks should be measured from the location of the mapped trace of the main strand of the fault shown on Figures 4 through 7. However, please see the section below called "Movement of Structural Setbacks Due to Grading" regarding how the recommended setbacks will shift due to grading across the site (i.e. cuts and fills).

The reason for our recommended variance in setback width north and south of the main fault is that the sediments of the San Timoteo formation north of the main fault are generally highly disturbed by faulting and likely to contain secondary faults. In contrast, the sediments of the San Timoteo Formation on the south side of the fault are much less affected by faulting (generally exhibit regional dips) and do not typically exhibit minor faults.

Recommended Structural Setbacks for the Western Fault Zone

No structural setbacks are recommended for residential structures along the western portion of the fault as shown on Figures 4 through 7, and Plate 1. However, faults setbacks as discussed in previous section "Recommended Structural Fault Setbacks" will apply for schools and other public buildings (fire station, post office, etc) along this portion of the fault.

Recommended Structural Setbacks for the Eastern Fault Zone

Structural fault setbacks are recommended for all habitable structures for the Eastern Fault Zone as shown on Figures 4 through 7 and Plate 1. Fault setback dimensions as measured from the main fault will follow the guidelines discussed in the previous section called "Recommended Structural Fault Setbacks." The final location of the fault setbacks, which will shift during grading, will follow the general guidelines discussed in the next section.

Movement of Structural Setbacks Due to Grading.

A graphic example of the recommended setbacks is depicted on Figure 3. From this figure it can be observed that because the fault plane is tilted toward the north, the final as-graded location of the fault will vary depending on the elevation of finish grades. In general, cutting or lowering the grade over the fault will result in the fault location (and setbacks) migrating toward the north at a ratio of approximately 2:1 (i.e., the fault location will move northward approximately 2 feet for each foot of cut.). In a similar manner, in areas to be filled, the fault's projected location at finish grade will be located south of its location in the underlying bedrock depicted on Figures 4-7. The fault setback should also satisfy the criteria that the original surface fault location as currently shown on Figures 4-7 should exist within 25 feet of the final fault setback. For example, if local grading cuts "move" the fault toward the north approximately 75 feet in the horizontal, then, the fault setback along the southern side of the fault would need to be widened by approximately 25 feet. In this example, cuts would need to be approximately 130 feet deep (assuming a dip angle of 30 degrees for the fault).

CLOSURE

This report has been prepared exclusively for Fiesta Development, Inc. and represents our best professional judgment regarding the location and activity of the Cherry Valley Fault that traverses through the site. It should be realized that the Cherry Valley Fault probably extends a short distance to the west before it dies out. This extension is shown as a dotted line based on weak geomorphic evidence and geologic mapping. In the event that schools or other public buildings are planned in the near vicinity of this fault projection, our firm should be contacted to perform additional services.

We hope that this information meets with your needs at this time. Please feel free to contact the undersigned should you have any questions.

Respectfully submitted,

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APPENDIX A

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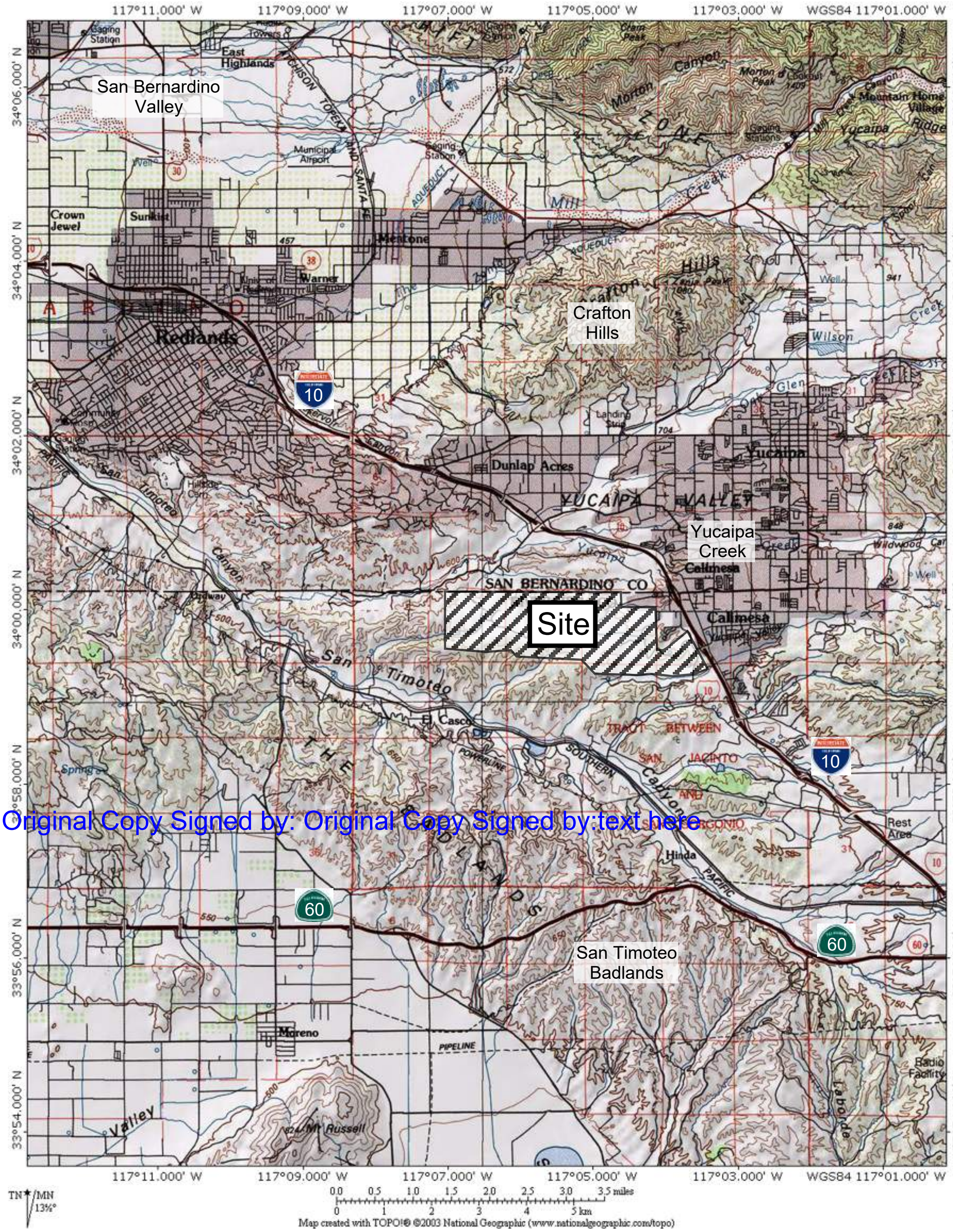

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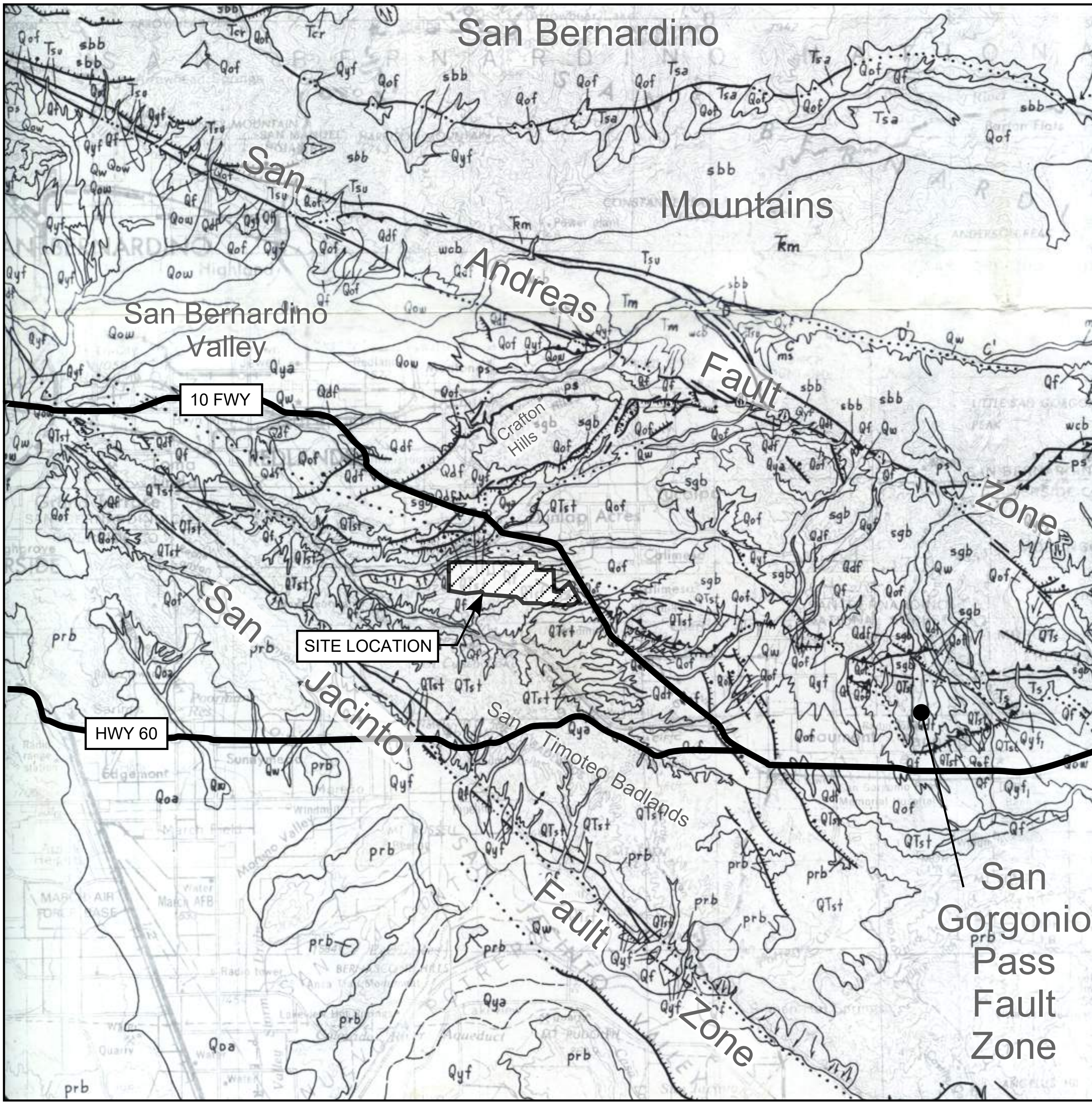
SAN DIEGO MURRIETA LOS ANGELES COSTA MESA

SITE LOCATION MAP

Fiesta Development
Calimesa, CA

DATE:	10/2004	J.N.:	238-04	FIGURE 1
DWG. BY:	DBS	SCALE:	1" = 2 miles	



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EXPLANATION

Qf — Modern Alluvial Fan Deposits - Quaternary

QTst — San Timoteo Badlands Deposits - Pleistocene to Pliocene

Thrust Fault

0 — 4 mi

GRAPHIC SCALE (in feet)

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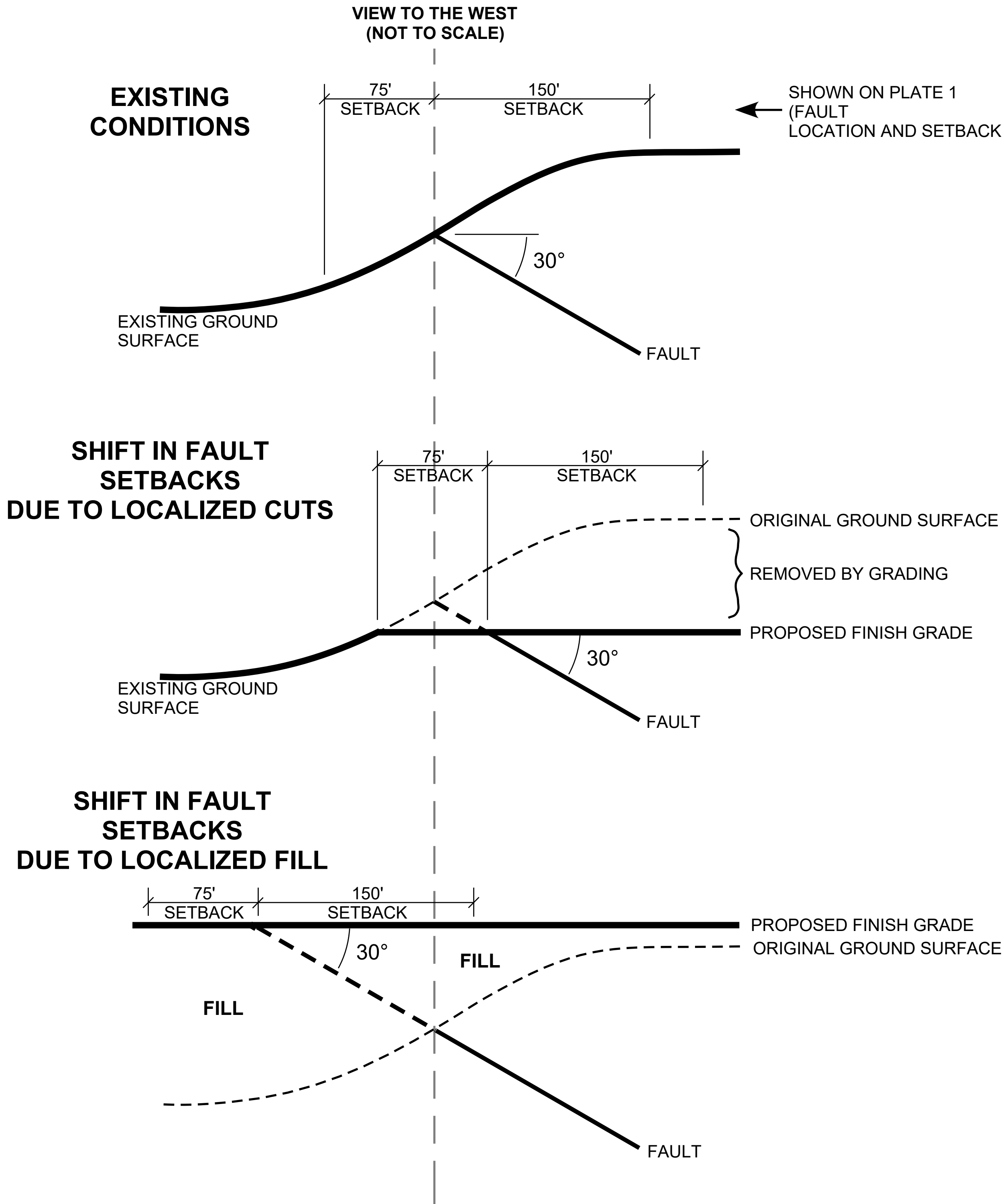
REGIONAL GEOLOGIC MAP

Fiesta Development
Calimesa, CA

DATE:	10/2004	J.N.:	238-04	FIGURE 2
DWG. BY:	DBS	SCALE:	1" = 4 miles	



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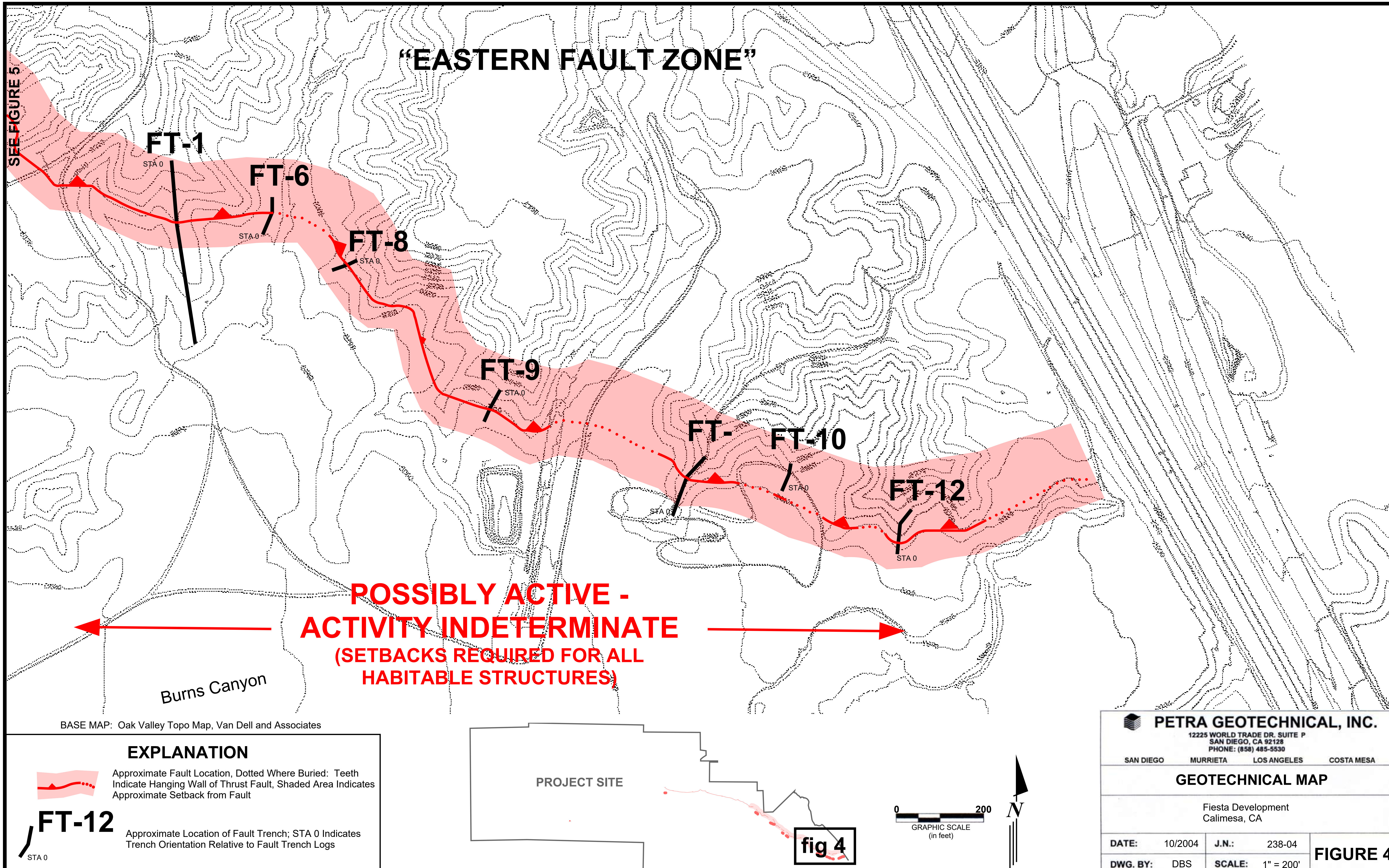
SAN DIEGO MURRIETA LOS ANGELES COSTA MESA

SHIFT OF FAULT SETBACKS DUE TO GRADING

Fiesta Development
Calimesa, CA

DATE:	10/2004	J.N.:	238-04	FIGURE 3
DWG. BY:	DBS	SCALE:	NO SCALE	



"EASTERN FAULT ZONE"
SEE FIGURE 5
FT-1
STA 0
FT-6
STA 0
FT-8
STA 0
FT-9
STA 0
FT-
STA 0
FT-10
STA 0
FT-12
STA 0
POSSIBLY ACTIVE -
ACTIVITY INDETERMINATE
(SETBACKS REQUIRED FOR ALL
HABITABLE STRUCTURES)
Burns Canyon
BASE MAP: Oak Valley Topo Map, Van Dell and Associates
EXPLANATION
Approximate Fault Location, Dotted Where Buried: Teeth Indicate Hanging Wall of Thrust Fault, Shaded Area Indicates Approximate Setback from Fault
FT-12
STA 0
Approximate Location of Fault Trench; STA 0 Indicates Trench Orientation Relative to Fault Trench Logs
PROJECT SITE
fig 4
0
200
GRAPHIC SCALE
(in feet)
N
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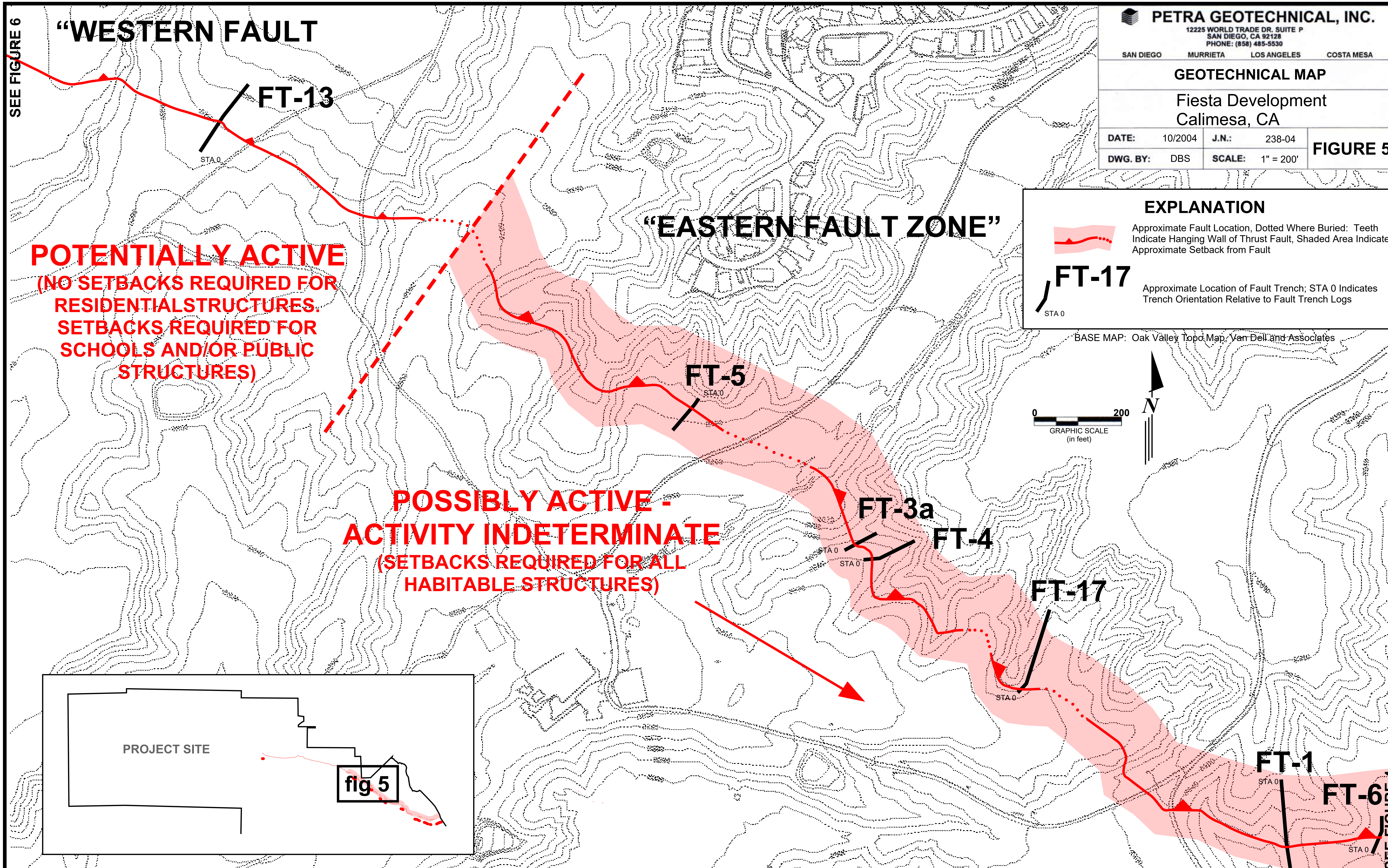
PHONE: (858) 485-5530
SAN DIEGO
MURRIETA
LOS ANGELES
COSTA MESA
GEOTECHNICAL MAP
Fiesta Development
Calimesa, CA
DATE: 10/2004
J.N.: 238-04
DWG. BY: DBS
SCALE: 1" = 200'
FIGURE 4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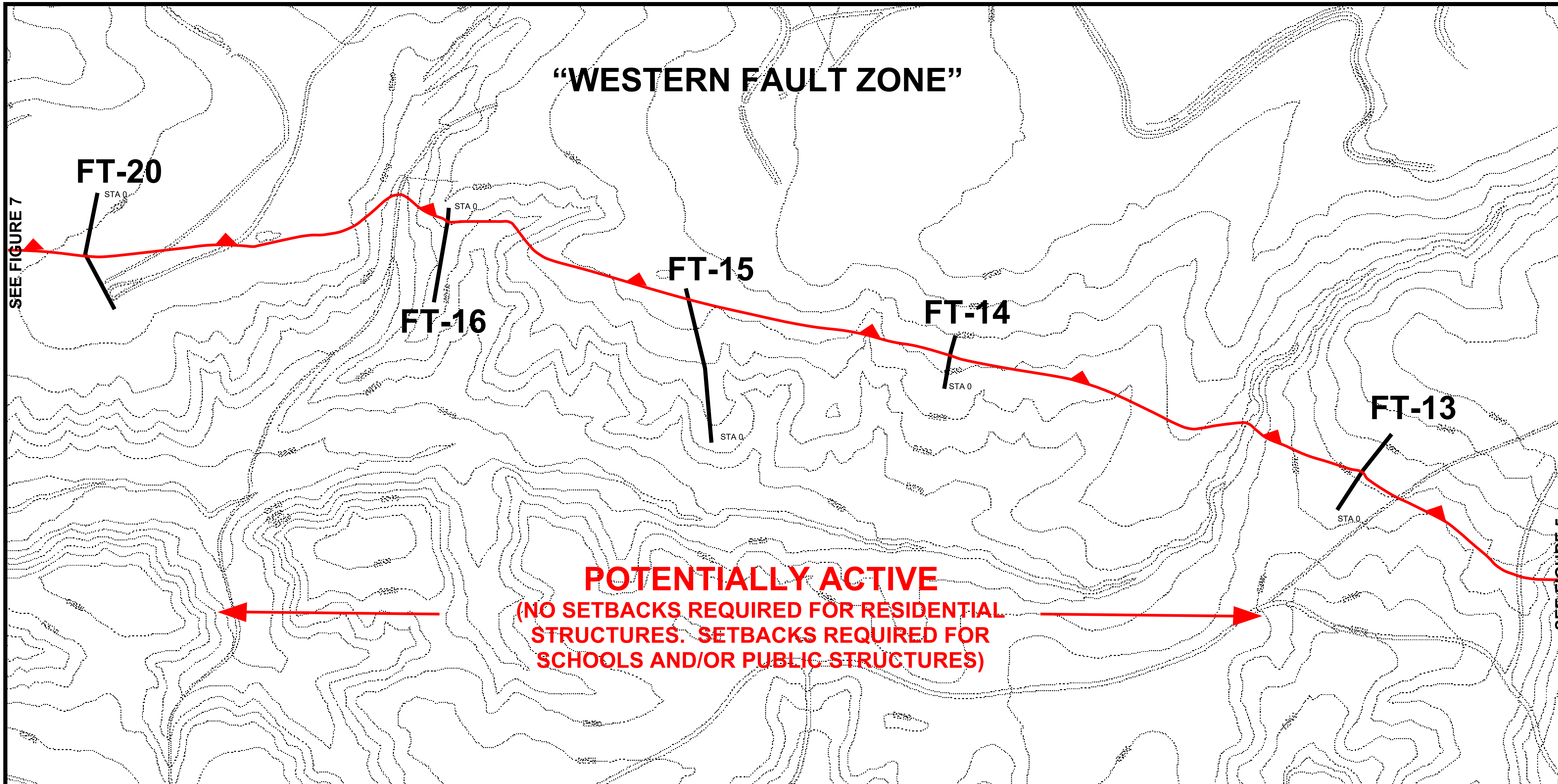
PHONE: (858) 485-5530
SAN DIEGO
MURRIETA
LOS ANGELES
COSTA MESA
GEOTECHNICAL MAP
Fiesta Development
Calimesa, CA
DATE: 10/2004
J.N.: 238-04
DWG. BY: DBS
SCALE: 1" = 200'
FIGURE 5
EXPLANATION
Approximate Fault Location, Dotted Where Buried: Teeth Indicate Hanging Wall of Thrust Fault, Shaded Area Indicates Approximate Setback from Fault
FT-17
STA 0
Approximate Location of Fault Trench; STA 0 Indicates Trench Orientation Relative to Fault Trench Logs
BASE MAP: Oak Valley Topo Map, Van Dell and Associates
0
200
GRAPHIC SCALE
(in feet)
N
SEE FIGURE 6
"WESTERN FAULT
FT-13
STA 0
"EASTERN FAULT ZONE"
POTENTIALLY ACTIVE
(NO SETBACKS REQUIRED FOR RESIDENTIALSTRUCTURES. SETBACKS REQUIRED FOR SCHOOLS AND/OR PUBLIC STRUCTURES)
FT-5
STA 0
POSSIBLY ACTIVE -
ACTIVITY INDETERMINATE
(SETBACKS REQUIRED FOR ALL HABITABLE STRUCTURES)
FT-3a
FT-4
STA 0
STA 0
FT-17
STA 0
FT-1
STA 0
FT-6
STA 0
SEE FIGURE 4
PROJECT SITE
fig 5

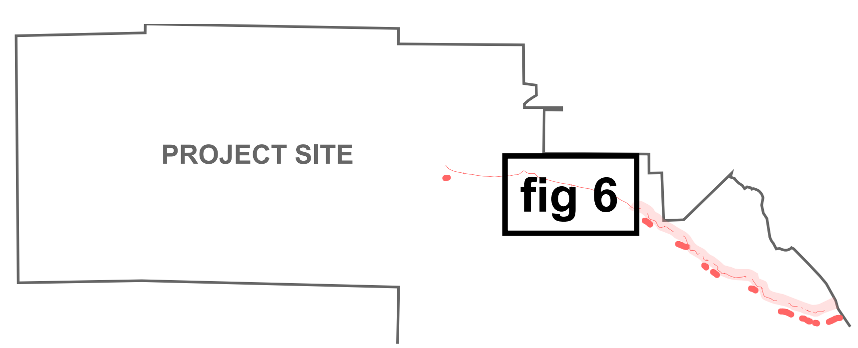


BASE MAP: Oak Valley Topo Map, Van Dell and Associates

EXPLANATION

Approximate Fault Location, Dotted Where Buried, Queried Where Uncertain: Teeth Indicate Hanging Wall of Thrust Fault, Shaded Area Indicates Approximate Setback from Fault

FT-20 (STA 0) Approximate Location of Fault Trench; STA 0 Indicates Trench Orientation Relative to Fault Trench Logs



0 200
GRAPHIC SCALE
(in feet)

N

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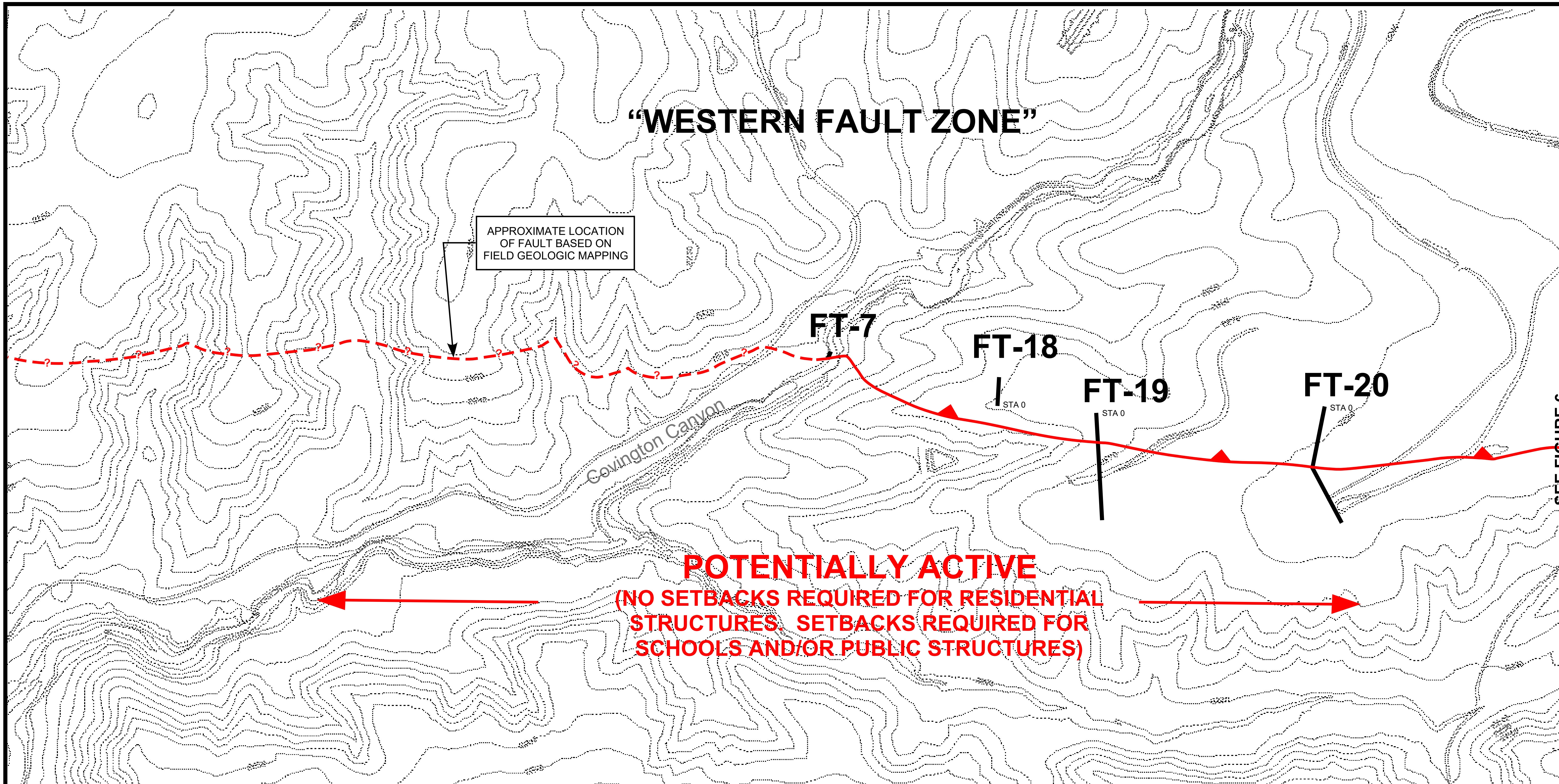
GEOTECHNICAL MAP

Fiesta Development
Calimesa, CA

DATE:	10/2004	J.N.:	238-04	**FIGURE 6**
DWG. BY:	DBS	SCALE:	1" = 200'	

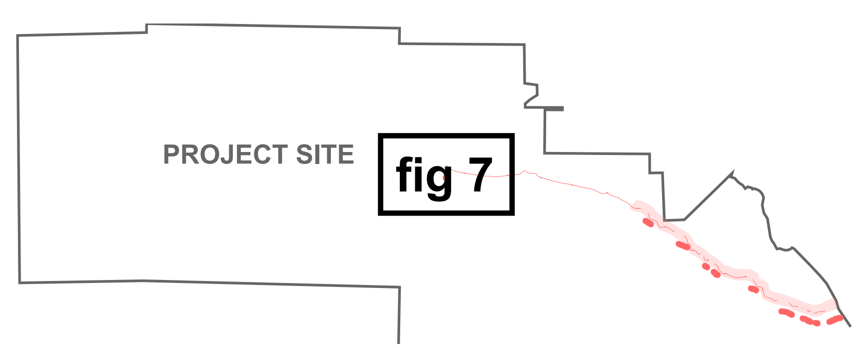


BASE MAP: Oak Valley Topo Map, Van Dell and Associates

EXPLANATION

Approximate Fault Location, Dotted Where Buried, Queried Where Uncertain: Teeth Indicate Hanging Wall of Thrust Fault, Shaded Area Indicates Approximate Setback from Fault

FT-20 (STA 0) Approximate Location of Fault Trench; STA 0 Indicates Trench Orientation Relative to Fault Trench Logs



0 200 GRAPHIC SCALE (in feet)

N

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GEOTECHNICAL MAP

Fiesta Development
Calimesa, CA

DATE:	10/2004	J.N.:	238-04	FIGURE 7
DWG. BY:	DBS	SCALE:	1" = 200'	

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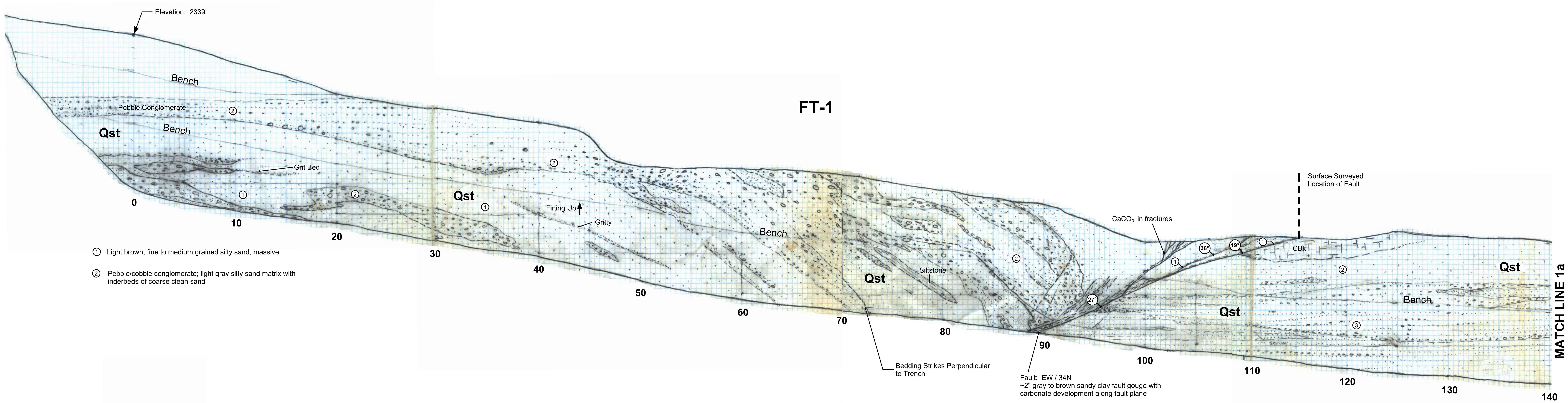
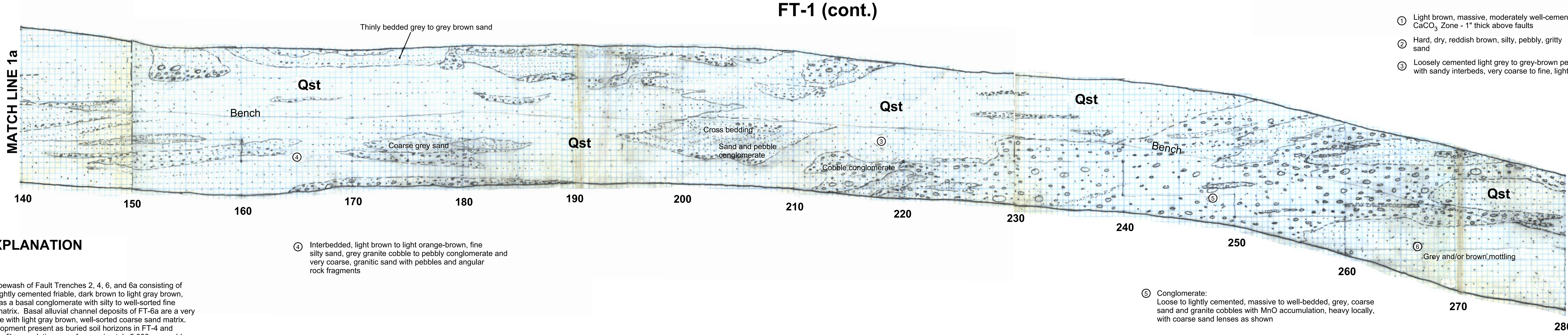
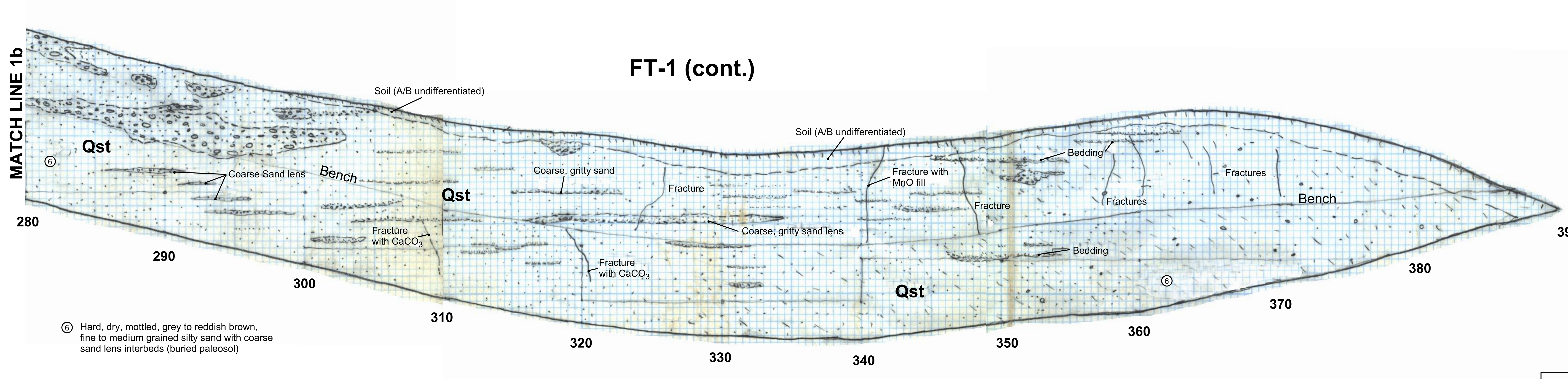
GEOTECHNICAL MAP		
Fiesta Development Calimesa, CA		
DATE 10/2004	J.N. 238-04	**PLATE 1**
DWG BY: DBS	SCALE: 1" = 400'	







EXPLANATION

HOLOCENE VALLEY ALLUVIUM

Qal_{S1} Younger alluvium and slopewash of Fault Trenches 2, 4, 6, and 6a consisting of undifferentiated loose to lightly cemented friable, dark brown to light gray brown, silty fine sand. Typically has a basal conglomerate with silty to well-sorted fine to medium grained sand matrix. Basal alluvial channel deposits of FT-6a are a very loose pebble conglomerate with light gray brown, well-sorted coarse sand matrix. Some immature soil development present as buried soil horizons in FT-4 and FT-6 with estimated soil profile cumulative age of approximately 5,000 years old based on the statistical comparison of soil development between the soils at the subject site and dated regional soils developed under similar conditions.

Qal_{S2} Older alluvium of Fault Trench 7 (FT-7). Undifferentiated alluvium and slopewash with moderately well-developed soil profile at ground surface. Consists generally of dark brown clayey fine- to medium-grained sand and sandy clay.

Qc Colluvium; very stiff, dry to damp, dark brown clay and sandy clay with grit and few pebbles.

Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

LATE PLEISTOCENE PEDOGENIC SOILS

A — A horizon; loose, dry, gray brown silty organic

Bt — Argillic horizon; hard, dark brown sandy clay and clay with blocky to prismatic peds with moderately to well-developed clay films on ped surfaces. See logs for estimated age determination of soil.

Btk — Argillic horizon with later accumulation of Stage I and II carbonate. Present as thin filaments, small flecks, or thin linings on ped surfaces.

Bk — Accumulation of Stage I and II carbonate, generally below well developed argillic horizon, parent material locally recognizable.

K — The K horizon represents domination of carbonates with Stage III or higher carbonate development. Most grains are coated with carbonate creating an essentially white outcrop.

CBk — This horizon is transitional between slightly weathered parent material and more weathered Btk horizons. In FT-6 the CBk horizon grades laterally to a white K horizon.

CK — Transitional horizon between relatively unweathered parent material and K horizon. Generally has Stage I $CaCO_3$ development, parent material prominent and recognizable.

Kr — Krotovina (filled animal burrows).

PLEISTOCENE BEDROCK

Qst San Timoteo Formation: Early to Mid-Pleistocene sediments consisting of poorly to moderately consolidated or cemented fluvial silts, sands, gravels, and cobble conglomerates with local paleosols. Sandstones vary in lithology from well-sorted, coarse grained, cohesionless sands to moderately cemented, poorly sorted silty, clayey fine sands. Sandstones are generally thinly bedded and characterized by color and textural changes. Conglomerates are generally thin, on the order of several feet thick and coarsely bedded.

0 — 5
GRAPHIC SCALE
(in feet)
HORIZONTAL =

FT-1

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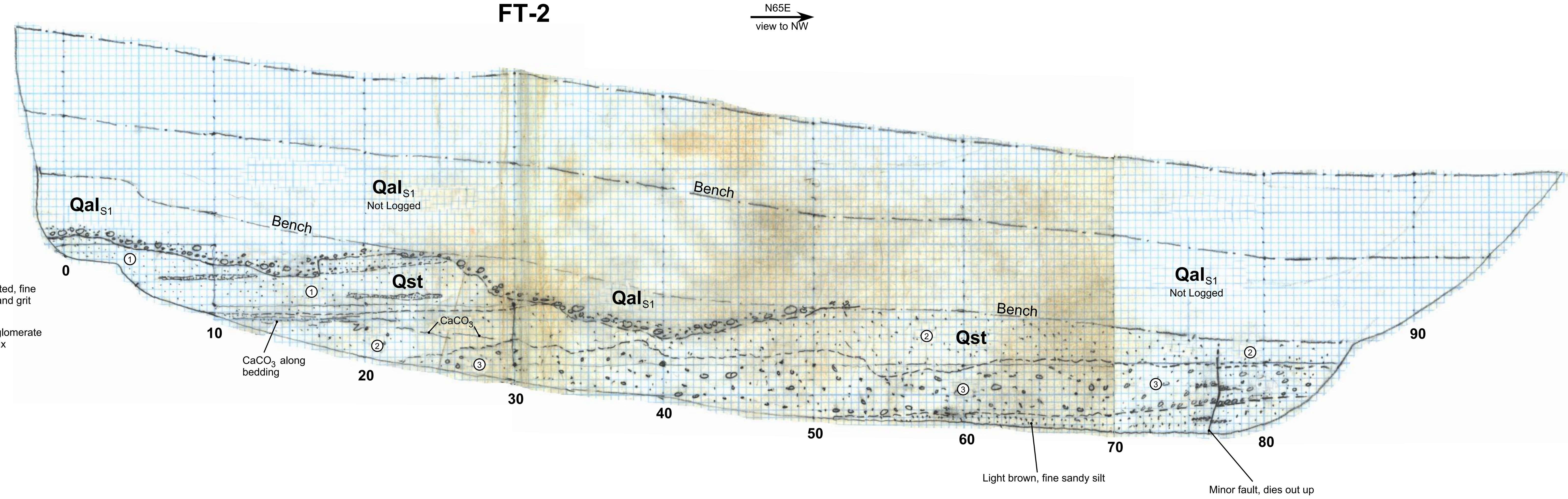
FAULT TRENCH EXPLORATION

Fiesta Development
Calimesa, CA

DATE	10/2004	J.N.	238-04	PLATE 2
DWG BY:	DBS	SCALE:	1" = 5'	

FT-2



① Slightly cemented, light brown very fine silty sand, massive

② Light brown, moderately well-cemented, fine grained silty sand with few pebbles and grit

③ Dense, dry, ltght brown pebble conglomerate with medium grained silty sand matrix

EXPLANATION

HOLOCENE VALLEY ALLUVIUM

Qal$_{S1}$ Younger alluvium and slopewash of Fault Trenches 2, 4, 6, and 6a consisting of undifferentiated loose to lightly cemented friable, dark brown to light gray brown, silty fine sand. Typically has a basal conglomerate with silty to well-sorted fine to medium grained sand matrix. Basal alluvial channel deposits of FT-6a are a very loose pebble conglomerate with light gray brown, well-sorted coarse sand matrix. Some immature soil development present as buried soil horizons in FT-4 and FT-6 with estimated soil profile cumulative age of approximately 5,000 years old based on the statistical comparison of soil development between the soils at the subject site and dated regional soils developed under similar conditions.

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Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

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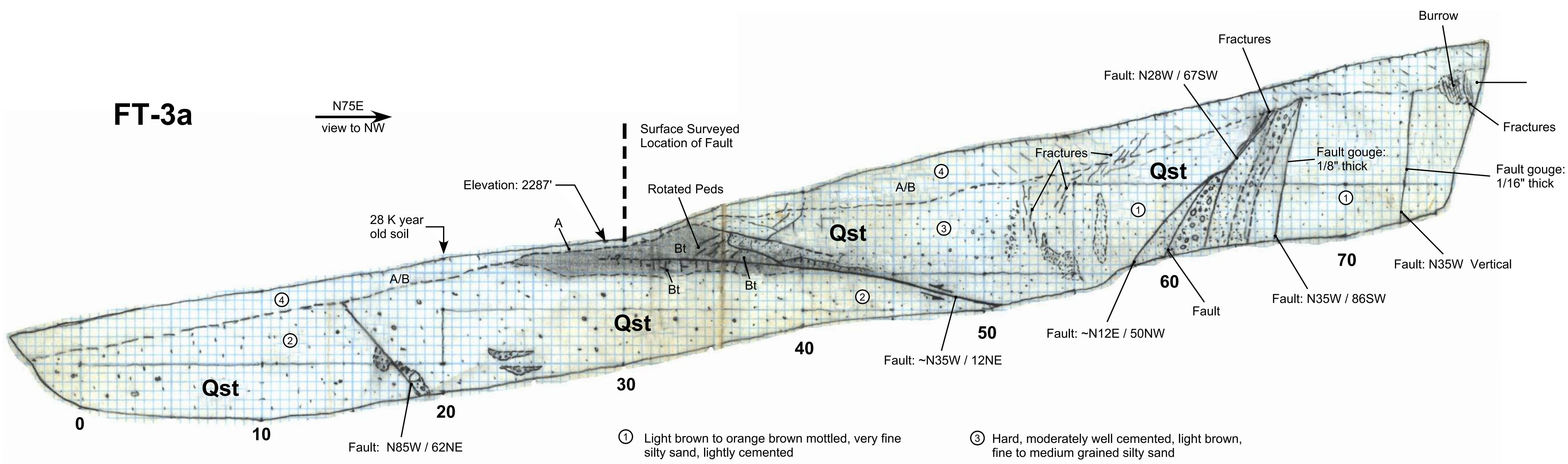
Kr — Krotovina (filled animal burrows).

PLEISTOCENE BEDROCK

Qst San Timoteo Formation: Early to Mid-Pleistocene sediments consisting of poorly to moderately consolidated or cemented fluvial silts, sands, gravels, and cobble conglomerates with interbedded paleosols. Sandstones vary in lithology from well-sorted, coarse grained, cohesionless sands to moderately cemented, poorly sorted silty, clayey fine sands. Sandstones are generally thinly bedded and manifested by color and textural changes. Conglomerates are generally thin, on the order of several feet thick and coarsely bedded.

FT-3a



① Light brown to orange brown mottled, very fine silty sand, lightly cemented

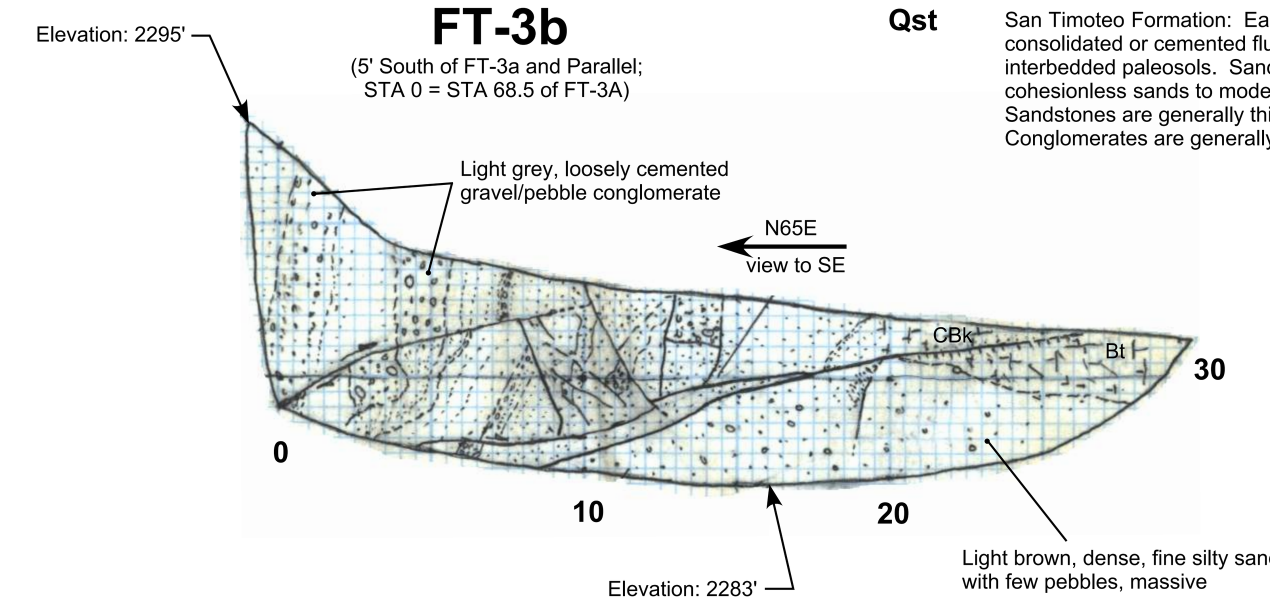
② Light brown to reddish brown, dense, fine silty sand with few pebbles, massive, with few gravel lenses

③ Hard, moderately well cemented, light brown, fine to medium grained silty sand

④ Undifferentiated "modern" soils consisting of A horizon and weak to moderately developed B horizons of probable Holocene age

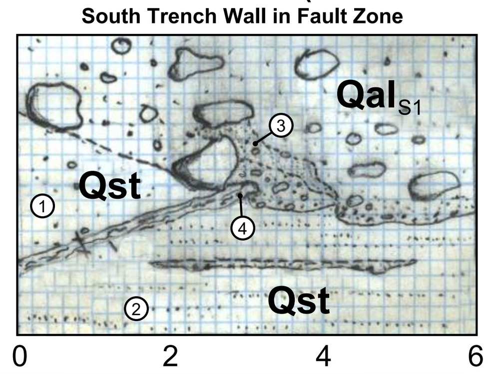
FT-3b

(5' South of FT-3a and Parallel; STA 0 = STA 68.5 of FT-3A)



FT-4

DETAIL of FT-4 (1" =
South Trench Wall in Fault Zone

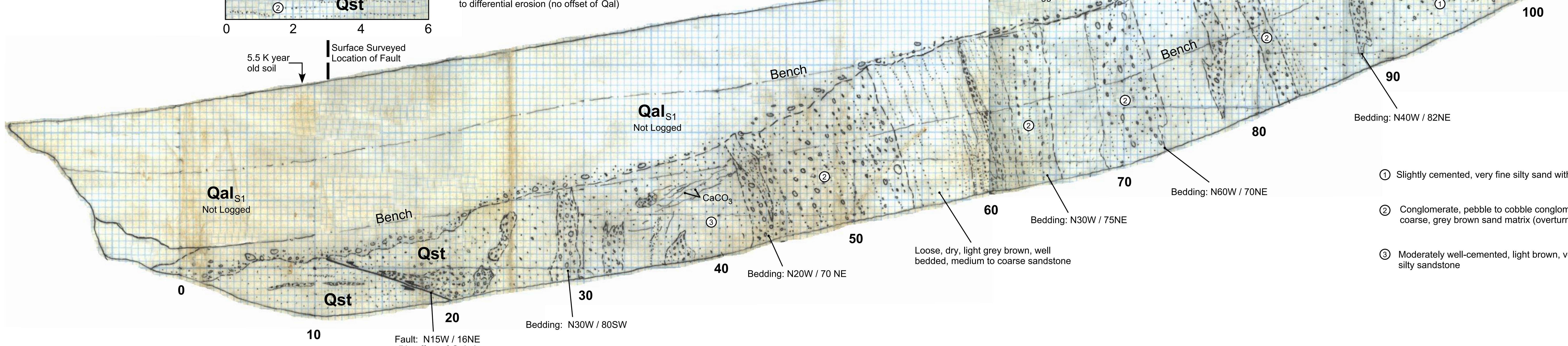


① Moderately cemented, light reddish brown, fine to medium grained silty sand with pebbles

② Slightly cemented, light brown, fine sand with lenses of coarse, gritty sandstone

③ Zone of moderately well-cemented clayey sand with **no fault offset**

④ Shear Zone, very hard, cemented and sheared sand/clayey sand, erosionally resistant, overhang at Qal contact is due to differential erosion (no offset of Qal)



① Slightly cemented, very fine silty sand with few pebbles and grit

② Conglomerate, pebble to cobble conglomerate with coarse, grey brown sand matrix (overturned throughout trench)

③ Moderately well-cemented, light brown, very fine silty sandstone

0 5
GRAPHIC SCALE
(in feet)
HORIZONTAL = VERTICAL

FT-2 thru FT-			
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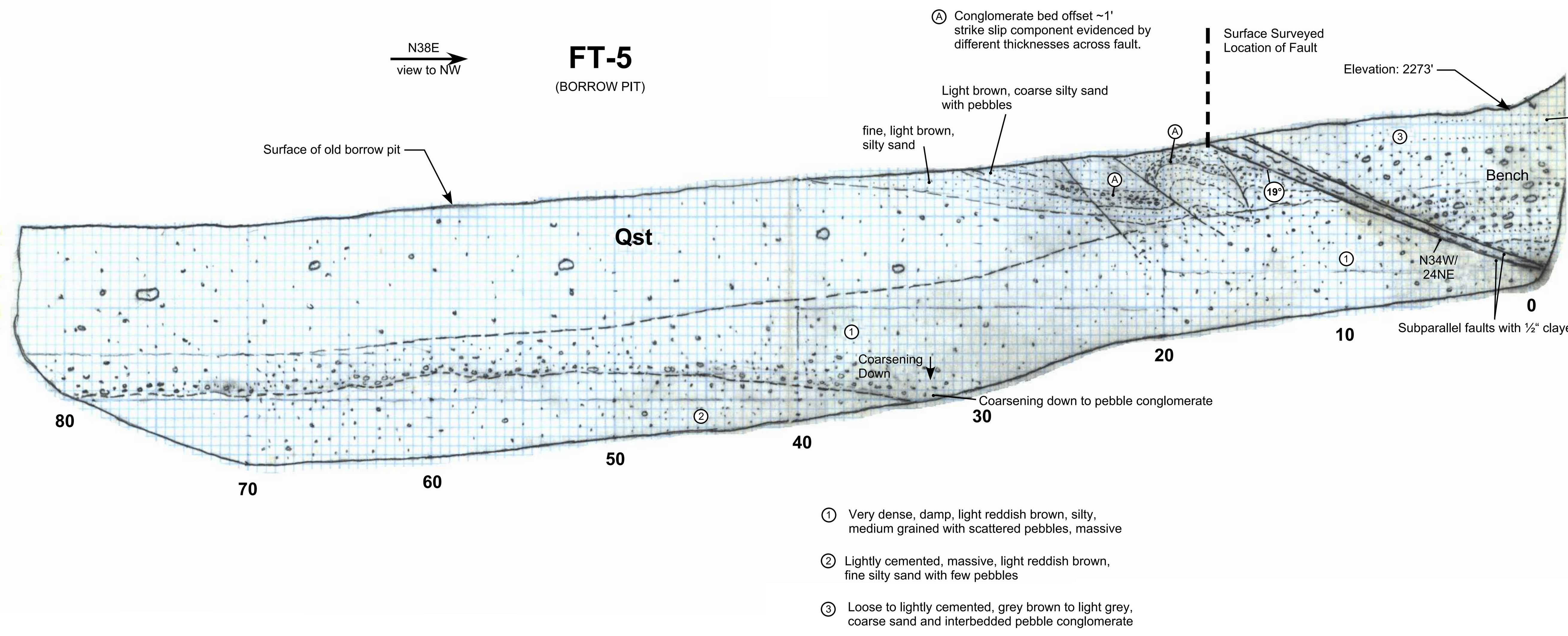
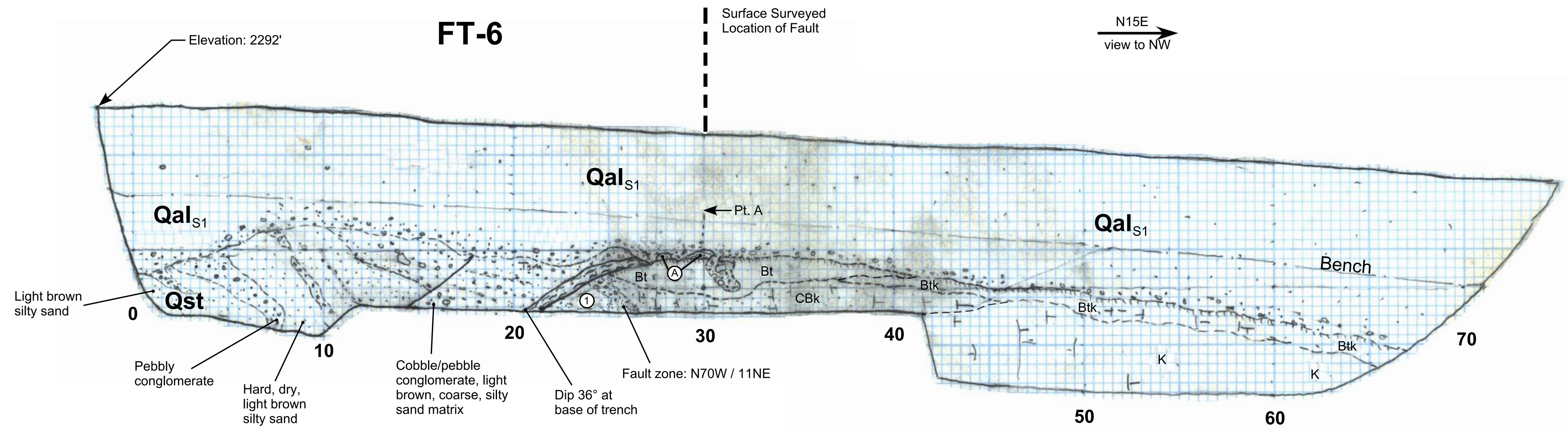
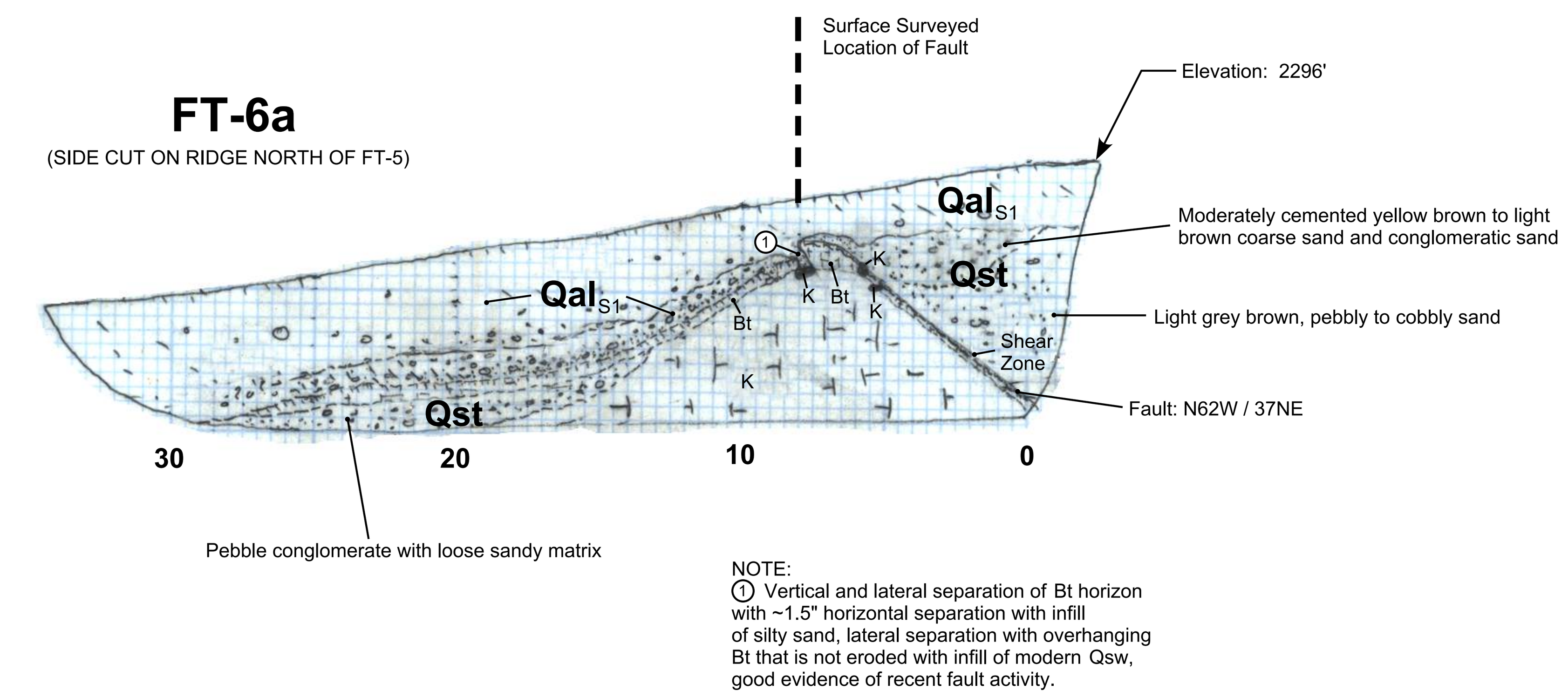
FAULT TRENCH EXPLORATION LOGS			
Fiesta Development Calimesa, CA			
DATE 10/2004	J.N. 238-04	**PLATE 3**	
DWG BY: DBS	SCALE: 1" = 5'		







EXPLANATION

HOLOCENE VALLEY ALLUVIUM

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Qal$_{S2}$ Older alluvium of Fault Trench 7 (FT-7). Undifferentiated alluvium and slopewash with moderately well-developed soil profile at ground surface. Consists generally of dark brown clayey fine to medium-grained sand and sandy clay.

Qc Colluvium; very stiff, dry to damp, dark brown clay and sandy clay with grit and few pebbles.

Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

LATE PLEISTOCENE PEDOGENIC SOILS

A — A horizon; loose, dry, gray brown silty organic sand

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Kr — Krotovina (filled animal burrows).

PLEISTOCENE BEDROCK

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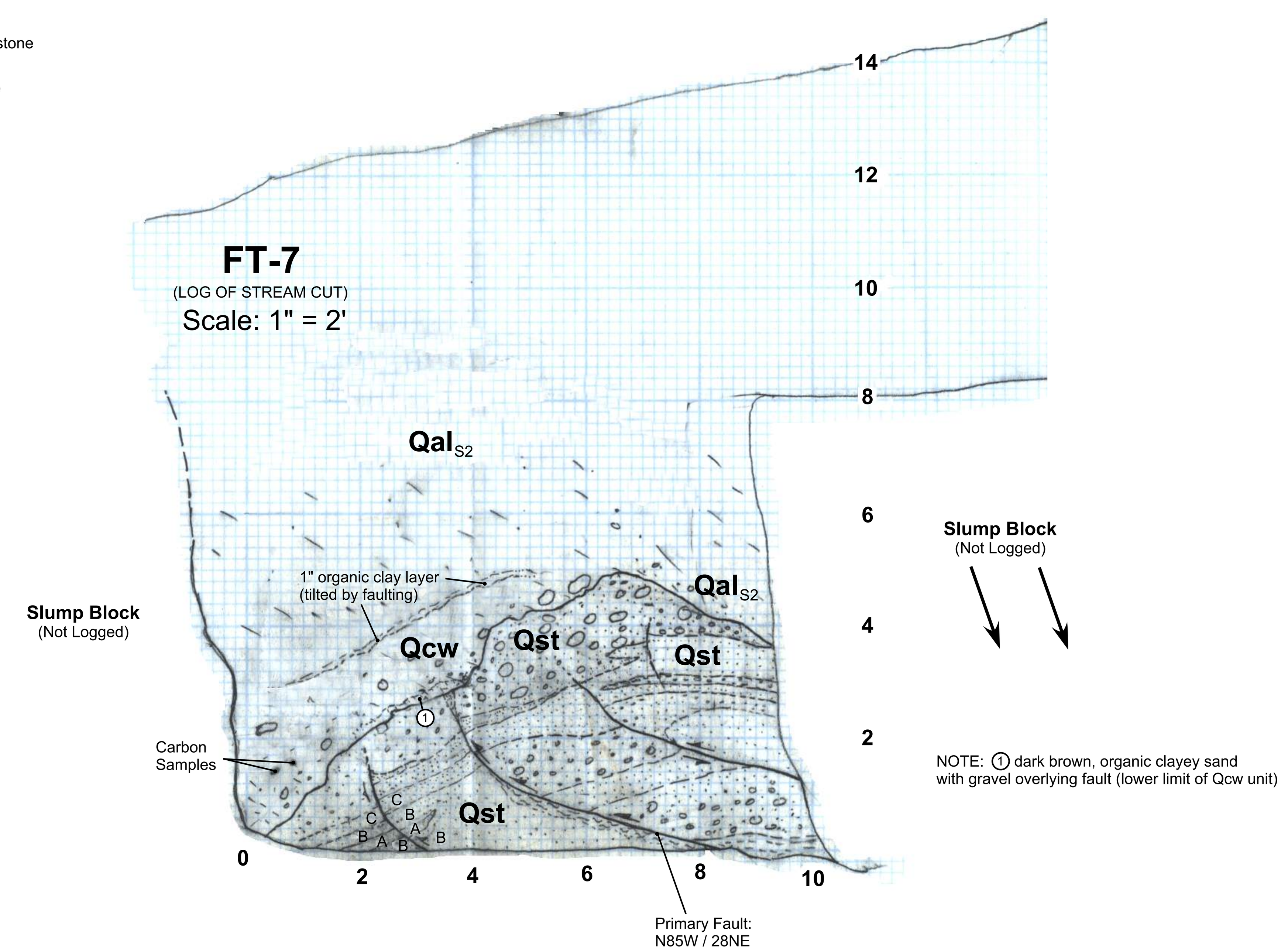
Bk
Hard, white carbonate horizon, locally stage II, average stage V ±, developed in hard, brown siltstone, massive

Bt, argillic horizon,
Blocky to prismatic peds with moderately developed clay films

Qal$_{S1}$
loose, dry, light grey brown, fine silty sand, few pebbles and grit, with cobble/pebble conglomerate at base

① Hard, dry, light brown sandy siltstone

NOTE: Ⓐ remnant fault shear zone cut by Qal



NOTE: ① dark brown, organic clayey sand with gravel overlying fault (lower limit of Qcw unit)

GRAPHIC SCALE (in feet) 0 5
HORIZONTAL = VERTICAL

FT-5 thru FT-			
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FAULT TRENCH EXPLORATION LOGS			
Fiesta Development Calimesa, CA			
DATE 10/2004	J.N. 238-04		PLATE 4
DWG BY: DBS	SCALE: 1" = 5'		

① Conglomeratic sand, subrounded pebbles, moderate MnO_2 stain

② Fine sand with bedding, moderate MnO_2 staining parallel to bedding

③ Silty fine sand, massive, slightly red but mostly tan, similar to unit ⑥

④ Pebbly conglomerate pebbles are subrounded and dominated by leucocratic plutonic clasts with minor gneiss and metamorphic clasts, moderately bedded particularly in lower (North) 4" of unit, gray areas indicate regions with strong MnO_2 staining that coat the grains

⑤ Very fine silty sand (SP), light olive brown, massive, some rounded pebbles, same pebble composition as unit ④, moderate FeO_3 staining - penetrative, no MnO_2, no $CaCO_3$

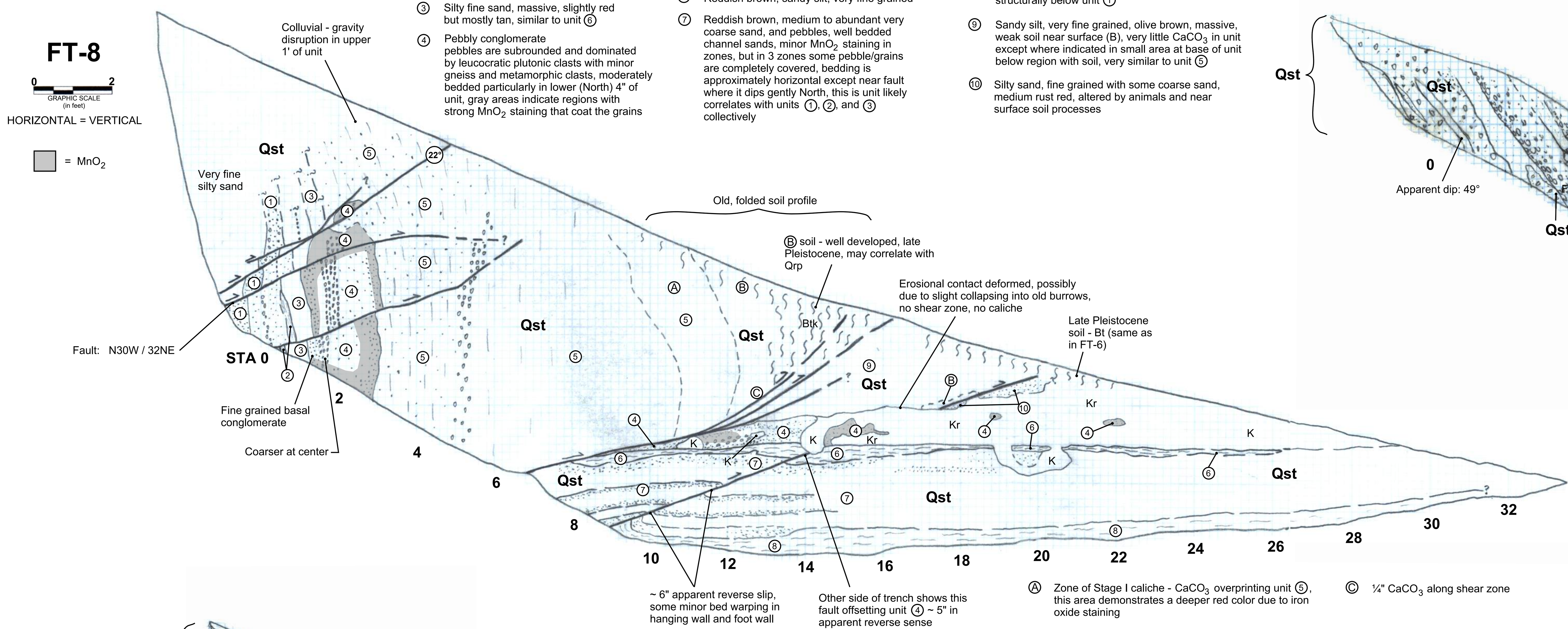
⑥ Reddish brown, sandy silt, very fine grained

⑦ Reddish brown, medium to abundant very coarse sand, and pebbles, well bedded channel sands, minor MnO_2 staining in zones, but in 3 zones some pebble/grains are completely covered, bedding is approximately horizontal except near fault where it dips gently North, this is unit likely correlates with units ①, ②, and ③ collectively

⑧ Sandy silt to silty very fine sand, reddish brown in upper 6" of unit, grades to olive brown at depth, bedded, compositional layers are 1 - 3" thick (variations of silt and sand), this unit likely correlates with very fine silty sand member structurally below unit ①

⑨ Sandy silt, very fine grained, olive brown, massive, weak soil near surface (B), very little $CaCO_3$ in unit except where indicated in small area at base of unit below region with soil, very similar to unit ⑤

⑩ Silty sand, fine grained with some coarse sand, medium rust red, altered by animals and near surface soil processes

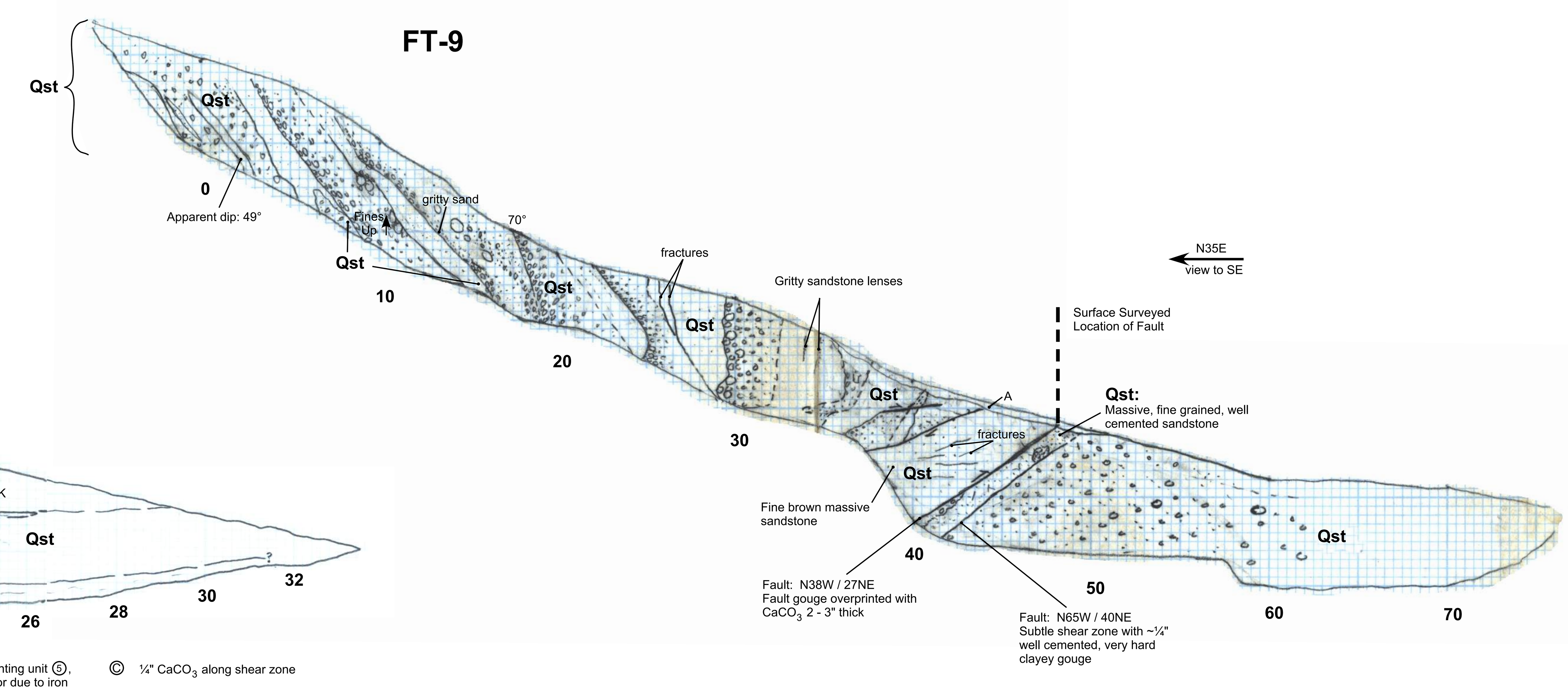


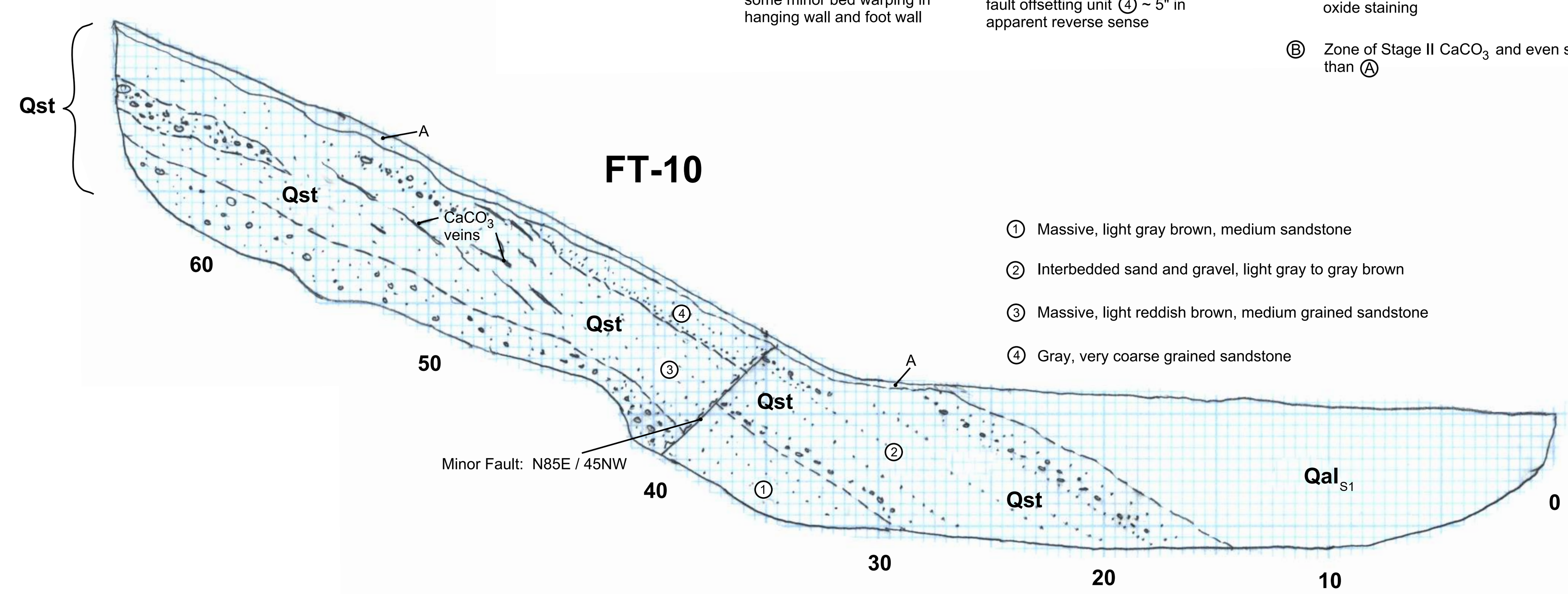
Ⓐ Zone of Stage I caliche - $CaCO_3$ overprinting unit ⑤, this area demonstrates a deeper red color due to iron oxide staining

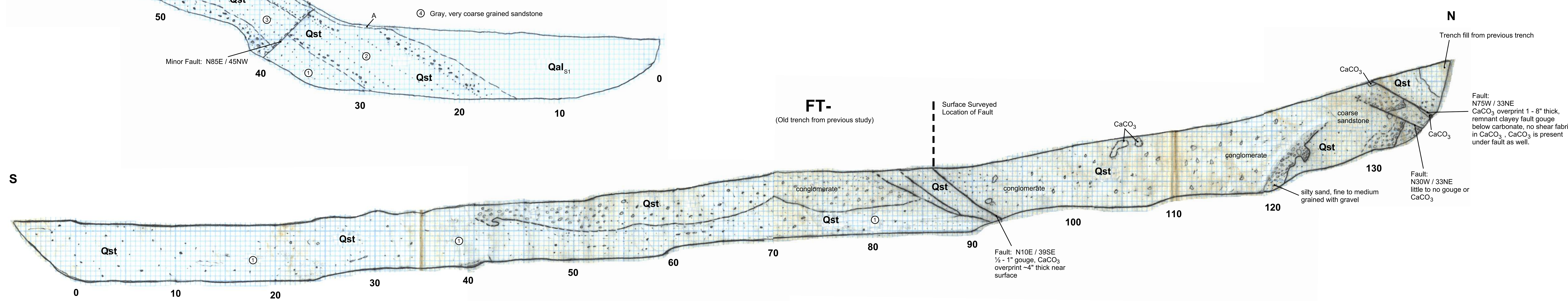
Ⓑ Zone of Stage II $CaCO_3$ and even stronger red color than Ⓐ

Ⓒ ¼" $CaCO_3$ along shear zone

K Krotovinas (in-filled animal burrows), areas that have been strongly bioturbated and reworked







① Dense, moderately cemented, reddish brown, silty sand with few gravels, massive bedding

EXPLANATION

HOLOCENE VALLEY ALLUVIUM

Qal_{S1} Younger alluvium and slopewash of Fault Trenches 2, 4, 6, and 6a consisting of undifferentiated loose to lightly cemented friable, dark brown to light gray brown, silty fine sand. Typically has a basal conglomerate with silty to well-sorted fine to medium grained sand matrix. Basal alluvial channel deposits of FT-6a are a very loose pebble conglomerate with light gray brown, well-sorted coarse sand matrix. Some immature soil development present as buried soil horizons in FT-4 and FT-6 with estimated soil profile cumulative age of approximately 5,000 years old based on the statistical comparison of soil development between the soils at the subject site and dated regional soils developed under similar conditions.

Qal_{S2} Older alluvium of Fault Trench 7 (FT-7). Undifferentiated alluvium and slopewash with moderately well-developed soil profile at ground surface. Consists generally of dark brown clayey fine to medium-grained sand and sandy clay.

Qc Colluvium; very stiff, dry to damp, dark brown clay and sandy clay with grit and few pebbles.

Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

LATE PLEISTOCENE PEDOGENIC SOILS

A A horizon; loose, dry, gray brown silty organic sand

Bt Argillic horizon; hard, dark brown sandy clay and clay with blocky to prismatic peds with moderately to well-developed clay films on ped surfaces. See logs for estimated age determination of soil.

Btk Argillic horizon with later accumulation of Stage I and II carbonate. Present as thin filaments, small flecks, or thin linings on ped surfaces.

Bk Accumulation of Stage I and II carbonate, generally below well developed argillic horizon, parent material locally recognizable.

K The K horizon represents domination of carbonates with Stage III or higher carbonate development. Most grains are coated with carbonate creating an essentially white outcrop.

CBk This horizon is transitional between slightly weathered parent material and more weathered Btk horizons. In FT-6 the CBk horizon grades laterally to a white K horizon.

CK Transitional horizon between relatively unweathered parent material and K horizon. Generally has Stage I $CaCO_3$ development, parent material prominent and recognizable.

Kr Krotovina (filled animal burrows).

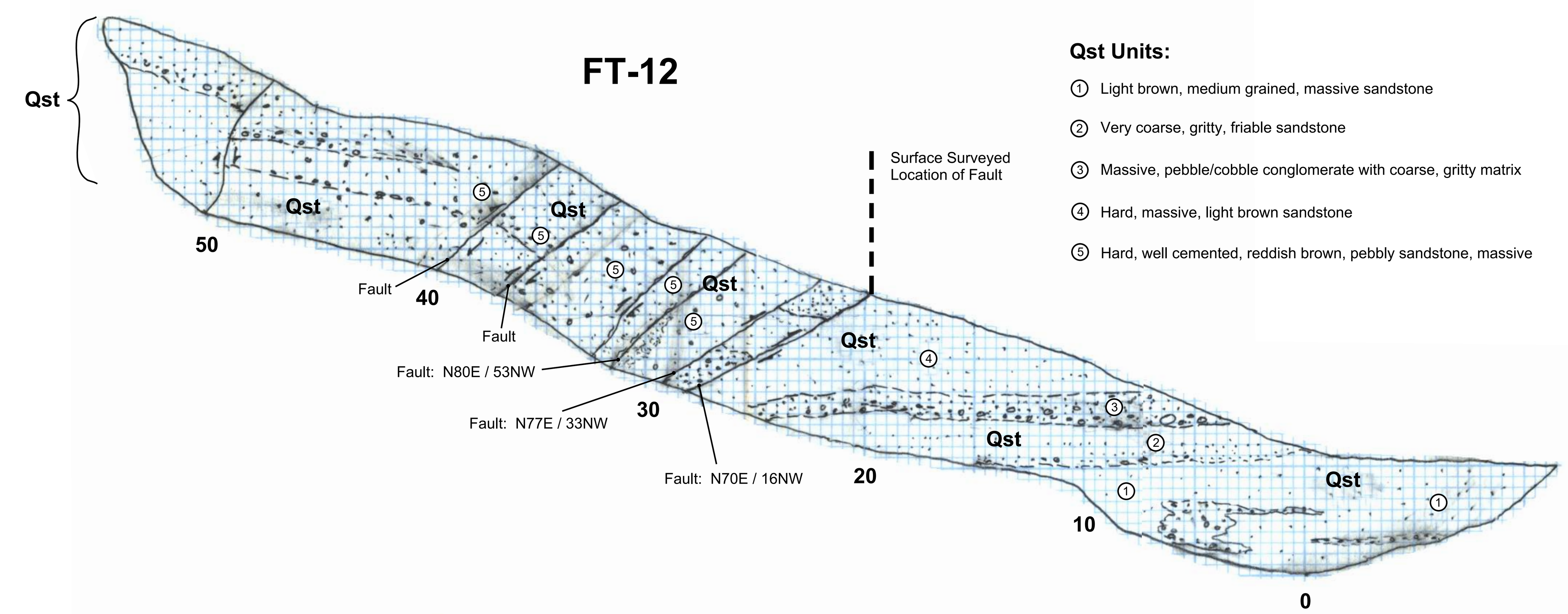
PLEISTOCENE BEDROCK

Qst San Timoteo Formation: Early to Mid-Pleistocene sediments consisting of poorly to moderately consolidated or cemented fluvial silts, sands, gravels, and cobble conglomerates with interbedded paleosols. Sandstones vary in lithology from well-sorted, coarse grained, cohesionless sands to moderately cemented, poorly sorted silty, clayey fine sands. Sandstones are generally thinly bedded and manifested by color and textural changes. Conglomerates are generally thin, on the order of several feet thick and coarsely bedded.

0 5
GRAPHIC SCALE (in feet)
HORIZONTAL = VERTICAL

FT-8 thru FT-		
PETRA GEOTECHNICAL, INC. 12225 WORLD TRADE DRIVE, SUITE P SAN DIEGO, CALIFORNIA 92128 PHONE: (858) 485-5530 SAN DIEGO MURIETTA LOS ANGELES COSTA MESA		
FAULT TRENCH EXPLORATION		
Fiesta Development Calimesa, CA		
DATE 10/2004	J.N. 238-04	PLATE 5
DWG BY: DBS	SCALE: 1" = 5'	

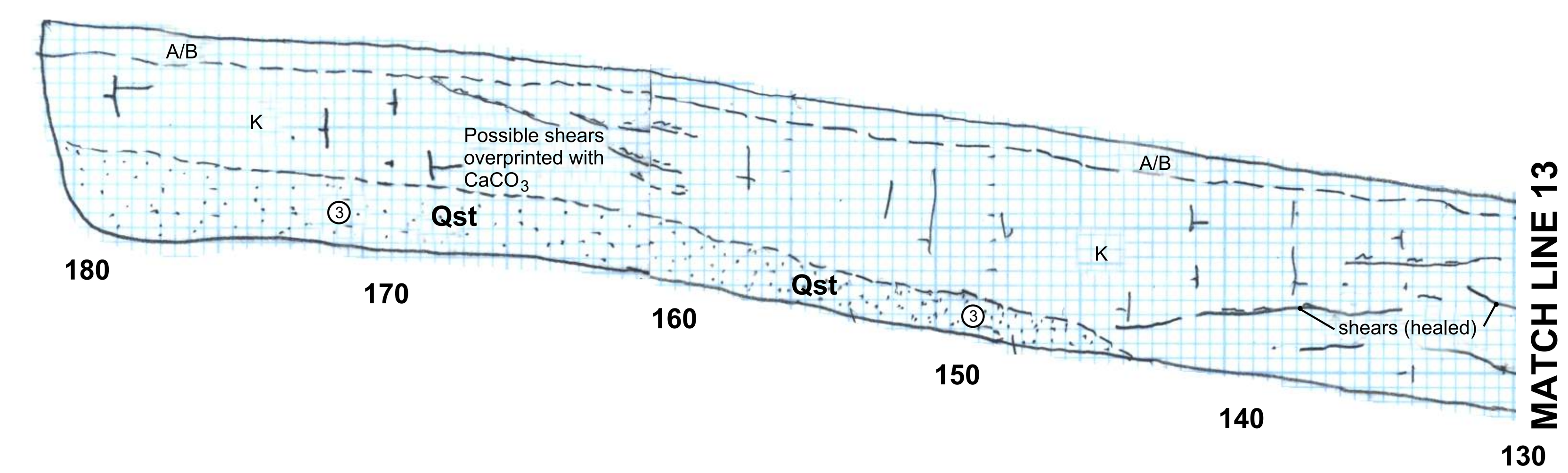
FT-12



Qst Units:

1. Light brown, medium grained, massive sandstone
2. Very coarse, gritty, friable sandstone
3. Massive, pebble/cobble conglomerate with coarse, gritty matrix
4. Hard, massive, light brown sandstone
5. Hard, well cemented, reddish brown, pebbly sandstone, massive

FT-13

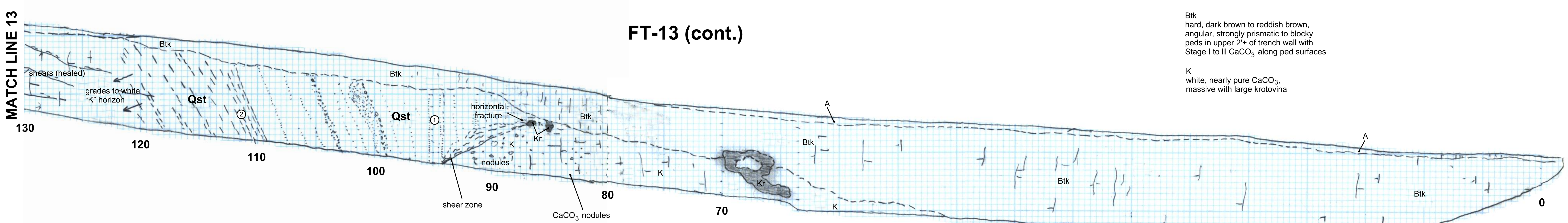


1. Vertical bedding in coarse, gritty, red brown sandstone and pebble conglomerate
2. Hard, gray brown siltstone with Stage I and II $CaCO_3$
3. Moderately well cemented, hard, light brown to mottled with orange brown, fine silty sand, in part gritty, massive

Btk
hard, dark brown to reddish brown, angular, strongly prismatic to blocky peds in upper 2'+ of trench wall with Stage I to II $CaCO_3$ along ped surfaces

K
white, nearly pure $CaCO_3$, massive with large krotovina

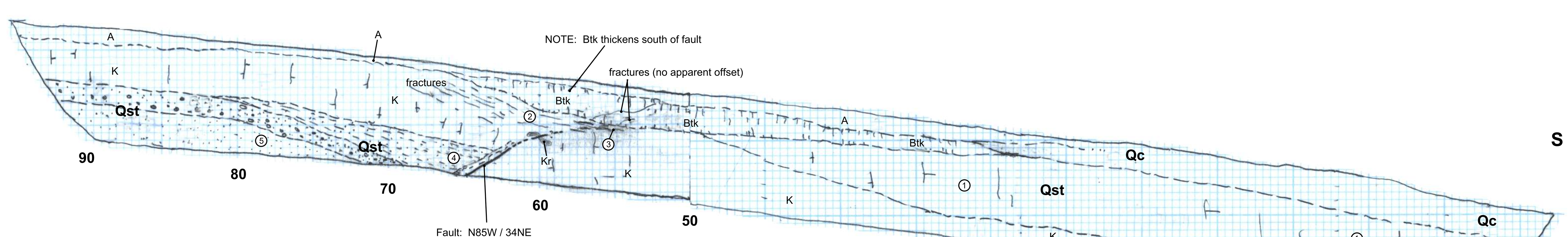
FT-13 (cont.)



Fault not visible in Btk horizon. Manifested in lower part of trench by subtle color lineation and truncation of vertical bedding.

FT-14

N



S

2. Fractures/joints in K horizon. Fault not visible in upper part of trench, shear zone manifested by faint lineations, color change, and contact with K horizon and Unit 3.
3. Burrows along subhorizontal joints in K horizon
4. Hard, well cemented, light brown, massive, very fine sandstone, locally Stages I and II $CaCO_3$
5. Well cemented, massive, light brown, fine to medium grained, silty sandstone

1. Paleosol, reddish brown, hard, gritty, pebbly, massive, clay present, blocky to prismatic structure, Stage I and II $CaCO_3$

EXPLANATION

HOLOCENE VALLEY ALLUVIUM

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Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

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Kr — Krotovina (filled animal burrows).

PLEISTOCENE BEDROCK

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0 5
GRAPHIC SCALE
(in feet)
HORIZONTAL = VERTICAL

FT-12 thru FT-

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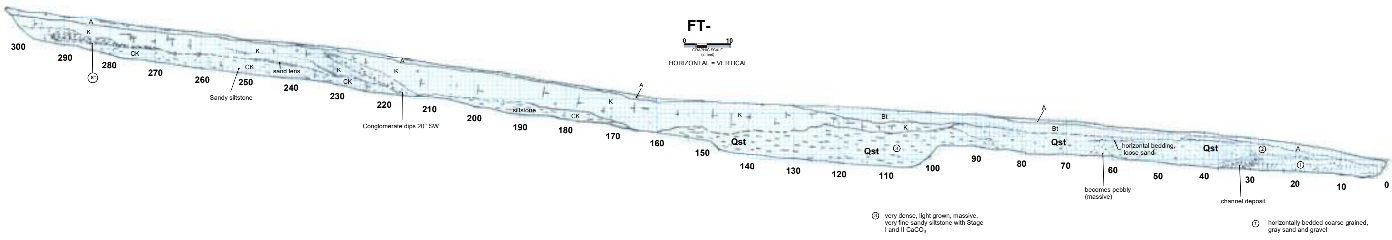
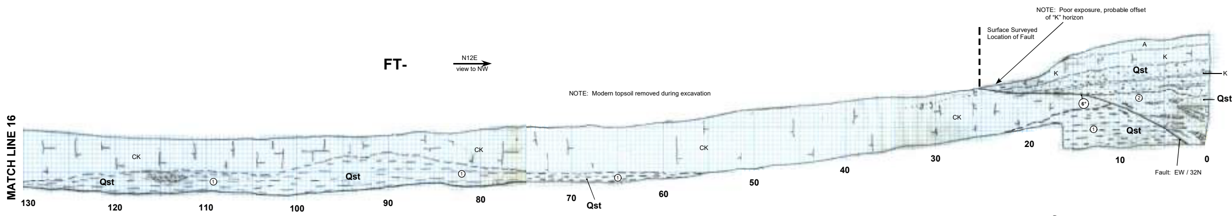
SAN DIEGO MURIETTA LOS ANGELES COSTA MESA

FAULT TRENCH EXPLORATION

Fiesta Development
Calimesa, CA

DATE	10/2004	J.N.	238-04	PLATE 6
DWG BY:	DBS	SCALE:	1" = 5'	





① Brown, medium dense, massive siltstone with veins and filaments of $CaCO_3$ (Stage I)

② Interbedded fine to coarse grained sand, pebble/cobble conglomerate, light gray, very friable with MnO staining along bedding

CK
Light brown, massive, gritty siltstone with Stage III $CaCO_3$, outcrop essentially white, parent siltstone visible on fresh breaks, numerous $CaCO_3$ veins and nodules, moderately well cemented, blocky, locally grades to "K" horizon

EXPLANATION

HOLOCENE VALLEY ALLUVIUM

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Qal_{S2} Older alluvium of Fault Trench 7 (FT-7). Undifferentiated alluvium and slopewash with moderately well-developed soil profile at ground surface. Consists generally

Qc Colluvium; very stiff, dry to damp, dark brown clay and sandy clay with grit and few pebbles.

Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

LATE PLEISTOCENE PEDOGENIC SOILS

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PLEISTOCENE BEDROCK

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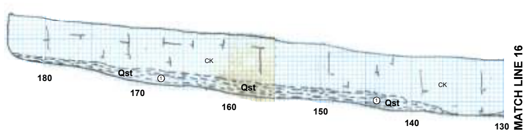
FT-16 (cont.)



0 — 5
GRAPHIC SCALE (in feet)
HORIZONTAL = VERTICAL

FT-15 thru FT-

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12225 WORLD TRADE DRIVE, SUITE P
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PHONE: (858) 485-5530
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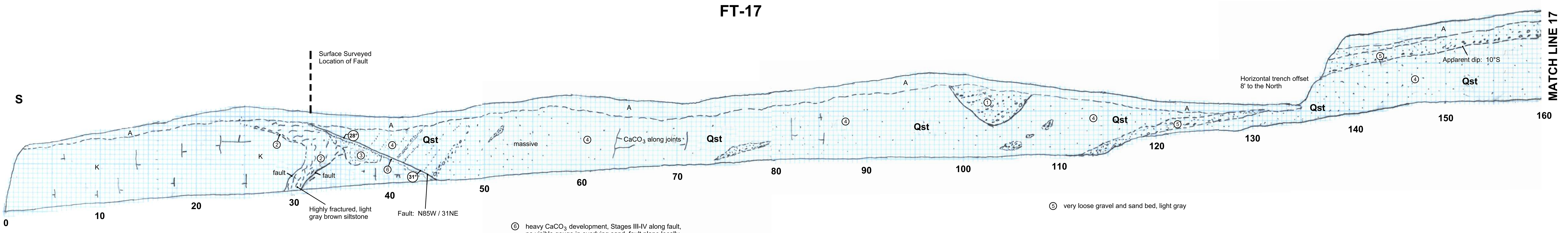
FAULT TRENCH EXPLORATION

Fiesta Development
Calimesa, CA

DATE	10/2004	J.N.	238-04	PLATE 7
DWG BY:	DBS	SCALE:	(SEE ABOVE)	

FT-17



① conglomerate filled Holocene channel

② zone of intense fracturing

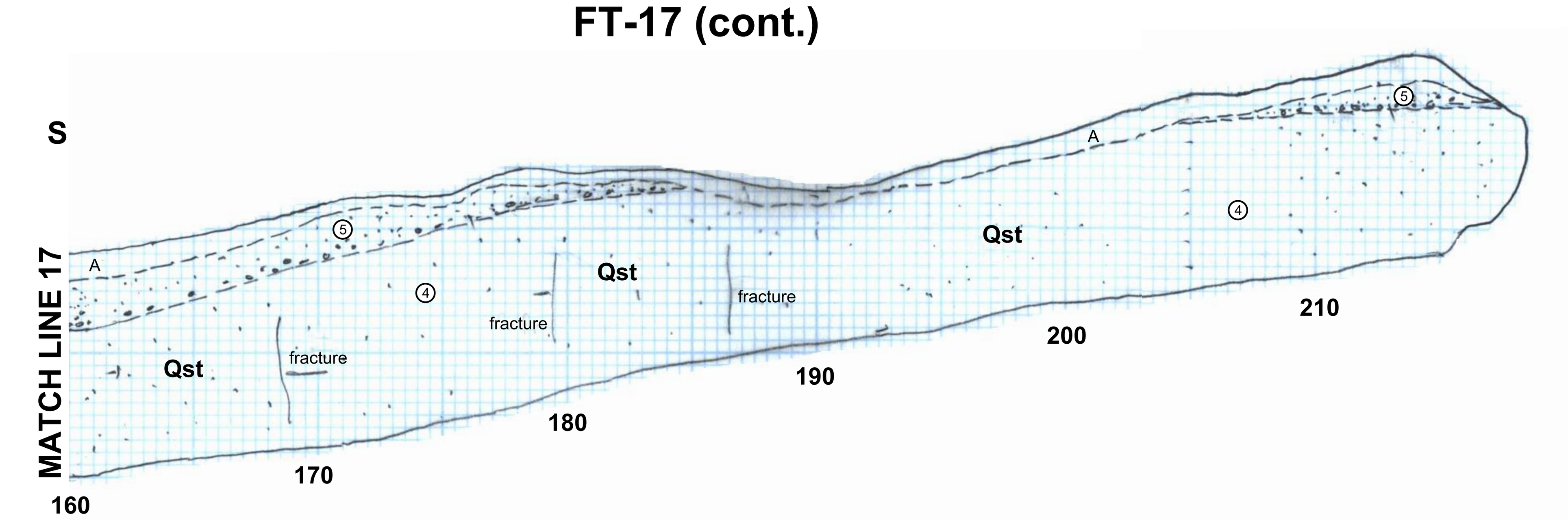
③ light reddish brown, massive, clayey sandstone with few pebbles

④ dense, dry, thickly bedded fine sandstone with few cobble conglomerate beds, massive, fine grained, light reddish brown sandstone with $CaCO_3$ along fractures

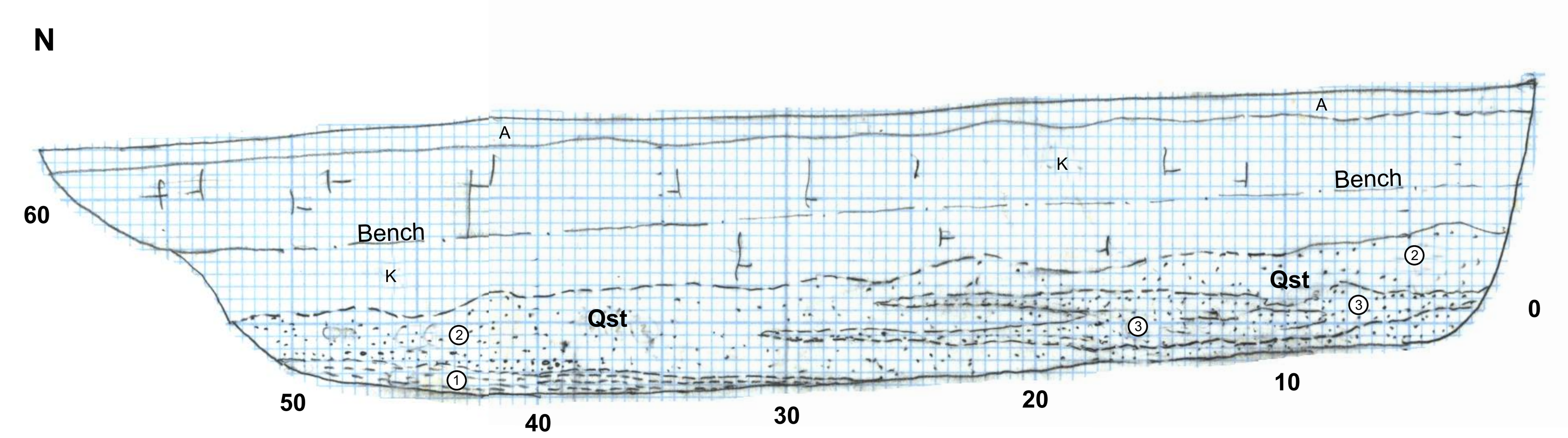
⑤ very loose gravel and sand bed, light gray

⑥ heavy $CaCO_3$ development, Stages III-IV along fault, no visible gouge in overlying sand, fault plane locally well developed in sandstone, very faint slicken sides parallel to dip of plane (possible replacement of gouge by $CaCO_3$ below fault surface)

FT-17 (cont.)



FT-18



① light brown, lightly cemented, massive, very fine grained sandy siltstone

② interbedded, very coarse grained, orange brown sand and pebble conglomerate and moderately cemented, light gray brown fine sand

③ loosely cemented, very coarse, gritty sand, orange brown to reddish brown

A horizon
very loose (tilled?), light gray brown silty to clayey sand with 1/8" rootlets, numerous krotovina

K
loose to moderately cemented, white to light gray, silty, developed in dark brown clay, highly fractured with ½"+ thick veins and nodules of $CaCO_3$

EXPLANATION

HOLOCENE VALLEY ALLUVIUM

Qal_{S1} Younger alluvium and slopewash of Fault Trenches 2, 4, 6, and 6a consisting of undifferentiated loose to lightly cemented friable, dark brown to light gray brown, silty fine sand. Typically has a basal conglomerate with silty to well-sorted fine to medium grained sand matrix. Basal alluvial channel deposits of FT-6a are a very loose pebble conglomerate with light gray brown, well-sorted coarse sand matrix. Some immature soil development present as buried soil horizons in FT-4 and FT-6 with estimated soil profile cumulative age of approximately 5,000 years old based on the statistical comparison of soil development between the soils at the subject site and dated regional soils developed under similar conditions.

Qal_{S2} Older alluvium of Fault Trench 7 (FT-7). Undifferentiated alluvium and slopewash with moderately well-developed soil profile at ground surface. Consists generally of dark brown clayey fine to medium-grained sand and sandy clay.

Qc Colluvium; very stiff, dry to damp, dark brown clay and sandy clay with grit and few pebbles.

Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

LATE PLEISTOCENE PEDOGENIC SOILS

A A horizon; loose, dry, gray brown silty organic sand

Bt Argillic horizon; hard, dark brown sandy clay and clay with blocky to prismatic peds with moderately to well-developed clay films on ped surfaces. See logs for estimated age determination of soil.

Btk Argillic horizon with later accumulation of Stage I and II carbonate. Present as thin filaments, small flecks, or thin linings on ped surfaces.

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Kr Krotovina (filled animal burrows).

PLEISTOCENE BEDROCK

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0 5
GRAPHIC SCALE
(in feet)
HORIZONTAL = VERTICAL

FT-17 thru FT-

PETRA GEOTECHNICAL, INC.
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SAN DIEGO MURIETTA LOS ANGELES COSTA MESA

FAULT TRENCH EXPLORATION

Fiesta Development
Calimesa, CA

DATE 10/2004	J.N. 238-04	PLATE 8
DWG BY: DBS	SCALE: 1" = 5'	

FT-19

① light brown, massive siltstone

② light gray, coarse grained, cohesionless gritty sand

③ loosely cemented, gray brown, coarse sand and silty sandstone

④ orange brown, coarse grained, massive sandstone along fault with $CaCO_3$ veins parallel to fault

⑤ interbedded gray brown sandstone and orange brown siltstone with Stage I and II $CaCO_3$, numerous $CaCO_3$ veins and nodules

Fault: N80W / 40NE
manifested in lower part of trench by sharp lithologic change, no gouge, very subtle zone of shearing, numerous $CaCO_3$ fragments <1/8" in fault zone, no discrete fault plane apparent

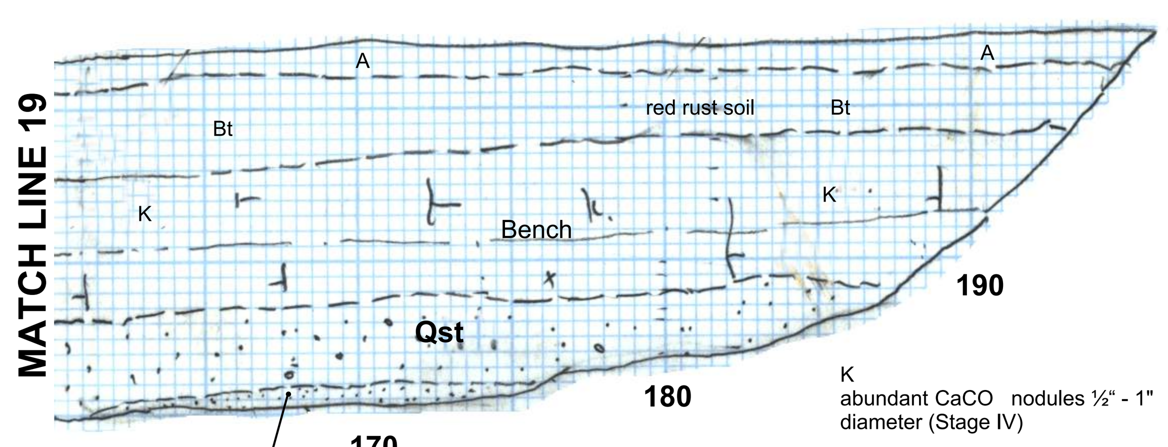
Bt
very well developed angular, blocky peds

Bk - K
gradual at base with siltstone at N end of trench, white with ¼" - ½" nodules and thick $CaCO_3$ veins to solid $CaCO_3$, this trench does expose a true "K" horizon in places where no parent material is visible and unit is nearly all $CaCO_3$ (Stage IV)

NOTE: In comparing FT-19 to FT-20 soil profiles, FT-19 in the footwall rocks has a more developed Bk - K soil profile and thinner Bt horizon likely due to coarse grained soils near the surface.

In FT-19, the soil profile in the hanging wall rocks is similar to FT-20 due to finer grained soils exposed near the surface (parent material).

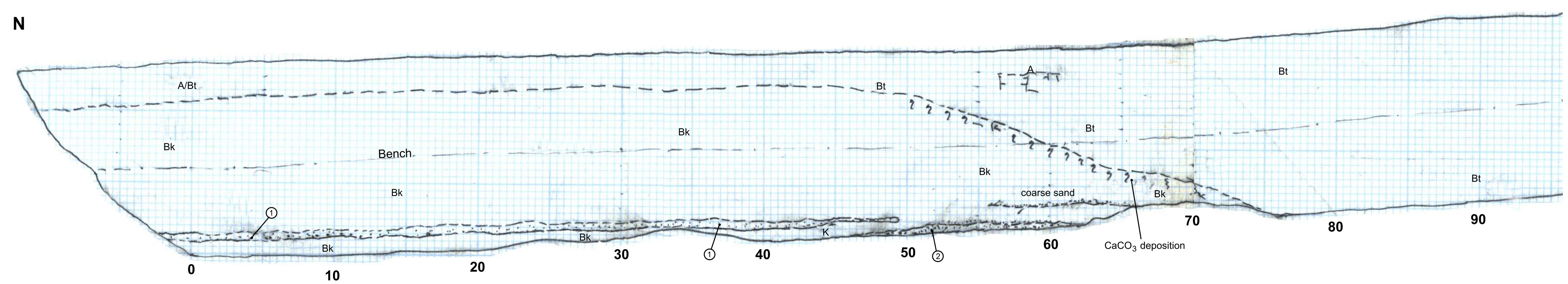
FT-19 (cont.)



K
abundant CaCO nodules ½" - 1" diameter (Stage IV)

Bt
thickens toward South, likely due to finer grained parent material

FT-20



① loose, very coarse, gritty sand bed within "K" horizon with heavy $CaCO_3$ development

② lightly cemented, light brown, massive silty sand

A/Bt
undifferentiated "A" and Bt horizons. Dark brown with very well developed small, blocky (1" - 2") peds, with well developed clay films, strong reddish hue near fault (5YR)

EXPLANATION

HOLOCENE VALLEY ALLUVIUM

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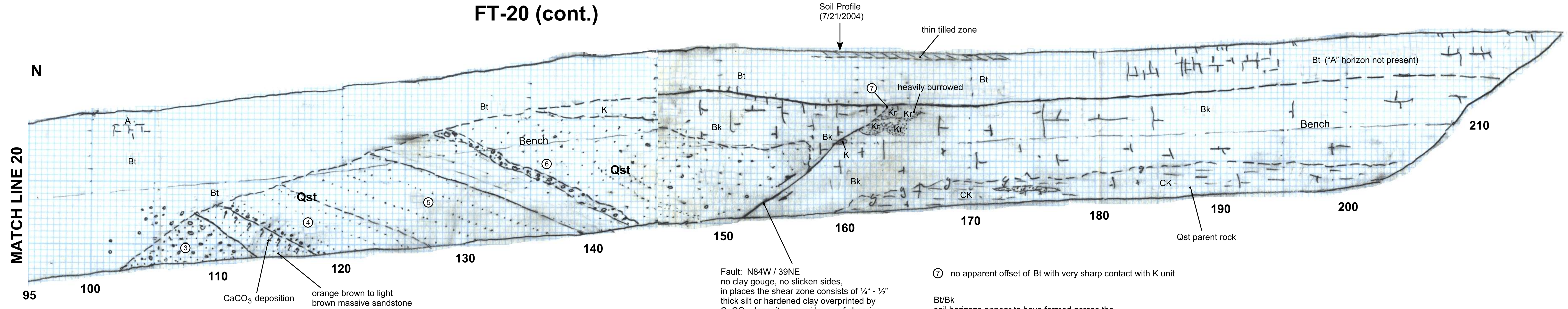
FT-20 (cont.)



Fault: N84W / 39NE
no clay gouge, no slicken sides, in places the shear zone consists of ¼" - ½" thick silt or hardened clay overprinted by $CaCO_3$ deposits, no evidence of shearing, shear zone appears overprinted with $CaCO_3$ (healed)

⑦ no apparent offset of Bt with very sharp contact with K unit

Bt/Bk
soil horizons appear to have formed across the exposed fault, base of Bt is relatively sharp (well defined) and is undisturbed by faulting

③ pebble conglomerate with light brown to gray brown medium grained silty sand matrix

④ fining upward bed of pebble conglomerate (basal) and sandstone

⑤ moderately well cemented reddish brown massive silty fine sand

⑥ massive, moderately cemented, light brown to reddish brown silty sandstone with Stage I $CaCO_3$ development, few pebbles present

0 — 5
GRAPHIC SCALE (in feet)

FT-19 thru FT-

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FAULT TRENCH EXPLORATION

Fiesta Development
Calimesa, CA

DATE	10/2004	J.N.	238-04	PLATE 9
DWG BY:	DBS	SCALE:	1" = 5'	

APPENDIX B

Soil Analysis Data
By Mitch Bornyasz

PETRA

PEDON

ID T-4 SP-1 Sta. 0+09'
Class
P.M. Qal&Qcol shed from Qsti

Landform: Axis of small drainage off side of promeent geomorphic surface
Veg.: Sparse brush and grasses
Source: MSB
Age of development: ~5,500yrs. Ave. Cumulative

HORIZON	DEPTH (ft)	thickness (cm)	COLOR (dry,moist)	TEXTURE	STRUCTURE	CONSIS (dry or moist; wet)	CLAY FILMS	BOUNDARY	H.I.	SDI	NOTES
A	0-2.9		10YR4/4d; 3.5/3m	SL	m-2msbk	so; so, po	n.o.	g, w			Qcol
	2.9	88.4	0.15	0.40	0.25	0.20	0.00		0.14	12.63	
BC	2.9-5.0		10YR5/6d; 4/4m	SL-SCL	m-1-2mabk	so; so, po-ps	n.o.	c, w			Qcol
	2.1	64.0	0.30	0.45	0.29	0.28	0.00		0.19	12.12	*24.74*
2Ab	5.0-6.9		10YR4/6d; 4/4m	SCL	m-2msbk	sh; so, ps	n.o.	a-c, w			Coarse Qal
	1.9	57.9	0.30	0.50	0.25	0.57	0.00		0.23	13.37	
3Bwb	6.9-10.0		10YR5/6d; 4/4m	SL	m-2m-fsbk	so; so, po	n.o.	c, w			Fineer Qcol/Qal
	3.1	94.5	0.30	0.40	0.25	0.20	0.00		0.16	15.52	*28.90*
4ABb2	10.0-11.7		10YR5/6d; 4/4m	SL	m-2msbk-abk	sh; so, po	n.o.	c, w-l			Fine Qcol
	1.7	51.8	0.30	0.40	0.29	0.40	0.00		0.20	10.30	
5BCb2	11.7-13.7		7.5YR4/6d; 4/4m	SCL	m-1-2fsbk&s.g.	sh-lo; so, po	*	a, w			Coarse Qal & Reworked Paleosol
	2	61.0	0.35	0.50	0.17	0.20	-		0.17	10.60	* stgr & 1-2ncl clay from eroded paleosol P.M.
6Cr	13.7+		10YR5/6d; 5/4m	S-SCL	bedded 2-3fabk	h, so, po	stgr, 1-2nbr, 1ncl	n.o.			Upper member of San Timoteo Fm.
	-		n/a	n/a	n/a	n/a	n/a				
	total	417.6							SDI Total	74.54	
									SDI @ 250	44.69	

PEDON

ID T-3a SP-2 Sta. 0+20'
Class
P.M. Qsti Bedrock

Landform: Side of small drainage off side of promeent geomorphic surface
Veg.: Sparse brush and grasses
Source: MSB
Age of development: ~28Kyrs. Ave Minumum

HORIZON	DEPTH (ft)	DEPTH (cm)	COLOR (dry,moist)	TEXTURE	STRUCTURE	CONSIS (dry or moist; wet)	CLAY FILMS	BOUNDARY	H.I.	SDI	NOTES
A	0-0.3		10YR5/4d; 4/3m	SCL	3m-fsbk&gr	sh-h; ss, ps	n.o.	c, s-w			
	0.3	9.1	0.15	0.60	0.67	0.83	0.00		0.32	2.94	Eroding surface/
Bt	0.3-1.0		10YR-7.5YR4/5d; 4/4m	SL-SCL	3fabk-pr	h-vh; so-ss, ps	2vnbr, stpf & 1-2npo	c, s-w			minimum soil age
	0.7	21.3	0.28	0.50	0.92	0.95	0.50		0.45	9.58	
BC	1.0-2.5		10YR4/5d; 4/4m	SL-SCL	3fabk	h-vh; so-ss, ps	stgr	g, s			
	1.5	45.7	0.25	0.50	0.83	0.95	0.17		0.39	17.63	
Cox	2.5-6.5		10YR4/5d; 4/4m	fS	bedded-3fabk	h; so, po	n.o.	g, s			
	4	121.9	0.25	0.00	0.42	0.60	0.00		0.18	22.06	
Cr	6.5+		10YR7/6-6/6d	fS	bedded 2-3fabk	h; so, po	n.o.	n.o.			
	-	-	n/a	n/a	n/a	n/a	n/a	n/a	-		
	total	198.1							SDI Total	52.21	
									SDI@ 250	61.26	

	PEDON				
			Landform	Stable elevated geomorphic surface	
ID	T-20 SP-3	Sta.1+60"	Veg.	Sparse brush and grasses	
Class			Source	MSB	
P.M.	Qsti Bedrock		Age of development		

HORIZON	DEPTH (ft)	DEPTH (cm)	COLOR (dry,moist)	TEXTURE	STRUCTURE	CONSIS (dry or moist; wet)	CLAY FILMS	BOUNDARY	H.I.	SDI	NOTES
Bt1	0-0.4	0-12	10YR4/4d, 7.5-10YR3/4m	SC-CL	2m-cabk	vh; s, p	3kbr, 2-3mkpf, 2mkpo	c, s			
	0.4	12	0.23	0.80	0.67	1.47	0.80		0.57	6.89	
Bt2	0.4-2.3	12-70	7.5YR3.5/6-3/4d, 3/4m	C	3cabk-pr	vh-eh; vs, vp	3-4kbr, 3mkpf, 2kpo	c, s			
	1.9	58	0.35	1.00	0.92	1.90	0.87		0.72	41.64	
Bt3	2.3-3.2	70-128	7.5YR4/4d, 3/4m	SC-CL	3fabk-pr	vh; vs,vp	3kbr, 3mkpf, 1kpo	c, s			
	0.9	27	0.30	0.80	0.92	1.80	0.80		0.66	18.09	
Btk	3.2-4.1	128-155	7.5YR4/6d, 4/4m	SC-CL	2mabk-sbk	h; s, p	2-3mkbr, 2npf	a-c, w			Stage I Carbonate
	0.9	27	0.40	0.80	0.58	1.27	0.60		0.52	14.30	
Bk1	4.1-6.0	155-183	10YR7/3.5d, 4/6m	fSL	m-2f-msbk	h; ss, ps	n.o.	c, w			Stage III+ Carbonate
	1.9	58	0.28	0.40	0.50	0.93	0.00		0.30	17.44	
Bk2	6.0-7.8	183-241	10YR7/3.5d, 4/6m	fSL	m-2fsbk	sh; so, po	n.o.	c, w			Stage II Carbonate
	1.8	55	0.28	0.40	0.50	0.40	0.00		0.23	12.34	
Ck	7.8-9.7	241-296	10YR6/4d, 4/5m	fSL	2fabk-sbk	sh; so, po	n.o.	g, s-w			Stage I Carbonate
	1.9	58	0.25	0.40	0.58	0.40	0.00		0.23	13.51	
C	9.7-12.6+	296-384	10YR6/4d, 4/5m	fS-LS	m-2fabk-sbk	sh; so, po	n.o.				
	2.9	88	0.25	0.10	0.58	0.00	0.00		0.13	11.73	
									SDI @ 300cm	124.23	

KEY

Color: Standard Munsell Soil Color Chart Notation

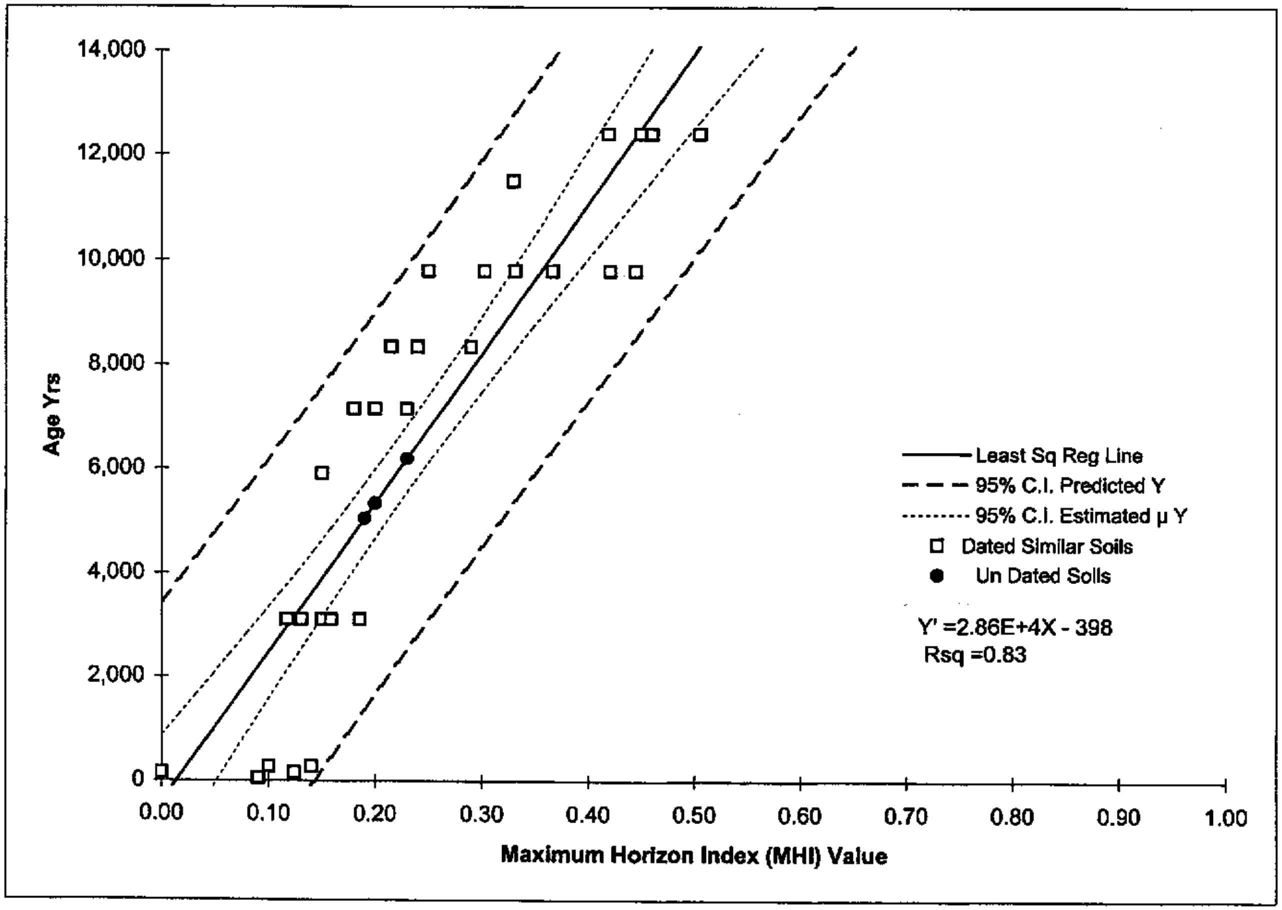
Texture: g-Gravel, S-sand, LS-Loamy Sand, SL-Sandy Loam, SCL-Sandy Clay Loam, SC-Sandy Clay, C-Clay

Structure: 1-Weak, 2-Moderate, 3-Strong; f-Fine, m-Medium, c-Coarse; s.g.-Single grain, m-massive, sbk-Subangular Blocky, abk-Angular Blocky, pr-Prismatic

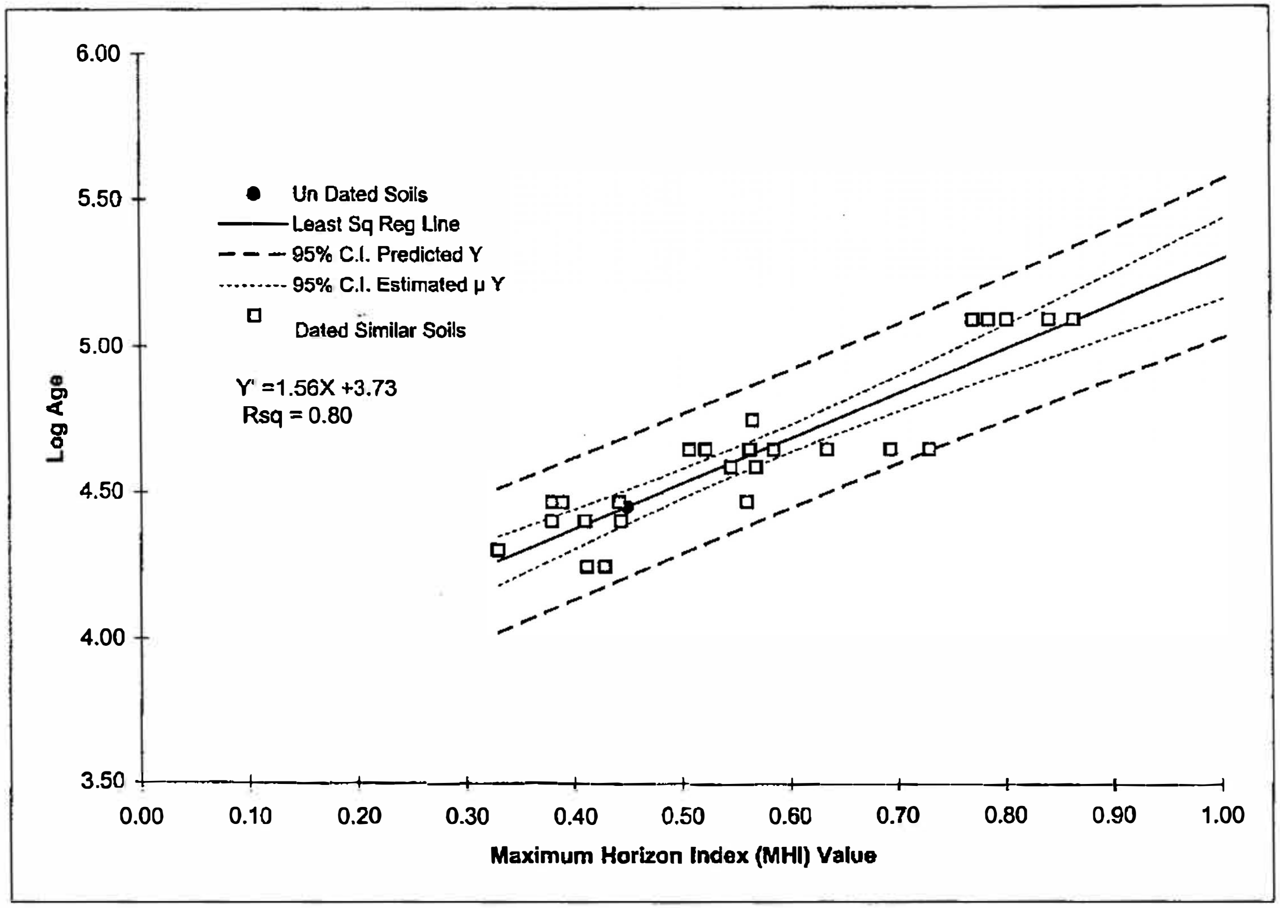
Consistence: (dry) lo-Loose, so-Soft, sh-Slightly hard, h-Hard, vh-Very hard, eh-Extremely hard; (wet) so-Nonsticky, ss-Slighlt sticky, s-Sticky, vs-Very sticky, po-Nonplastic,

Clay Films: n-Thin, mk-Moderatly thick, k-Thick; v1-Very few, 1-Few, 2-Common, 3-Many, 4-Continuous; po-In pores, br-Bridging grains, pf-On ped faces, cl-Coating clasts

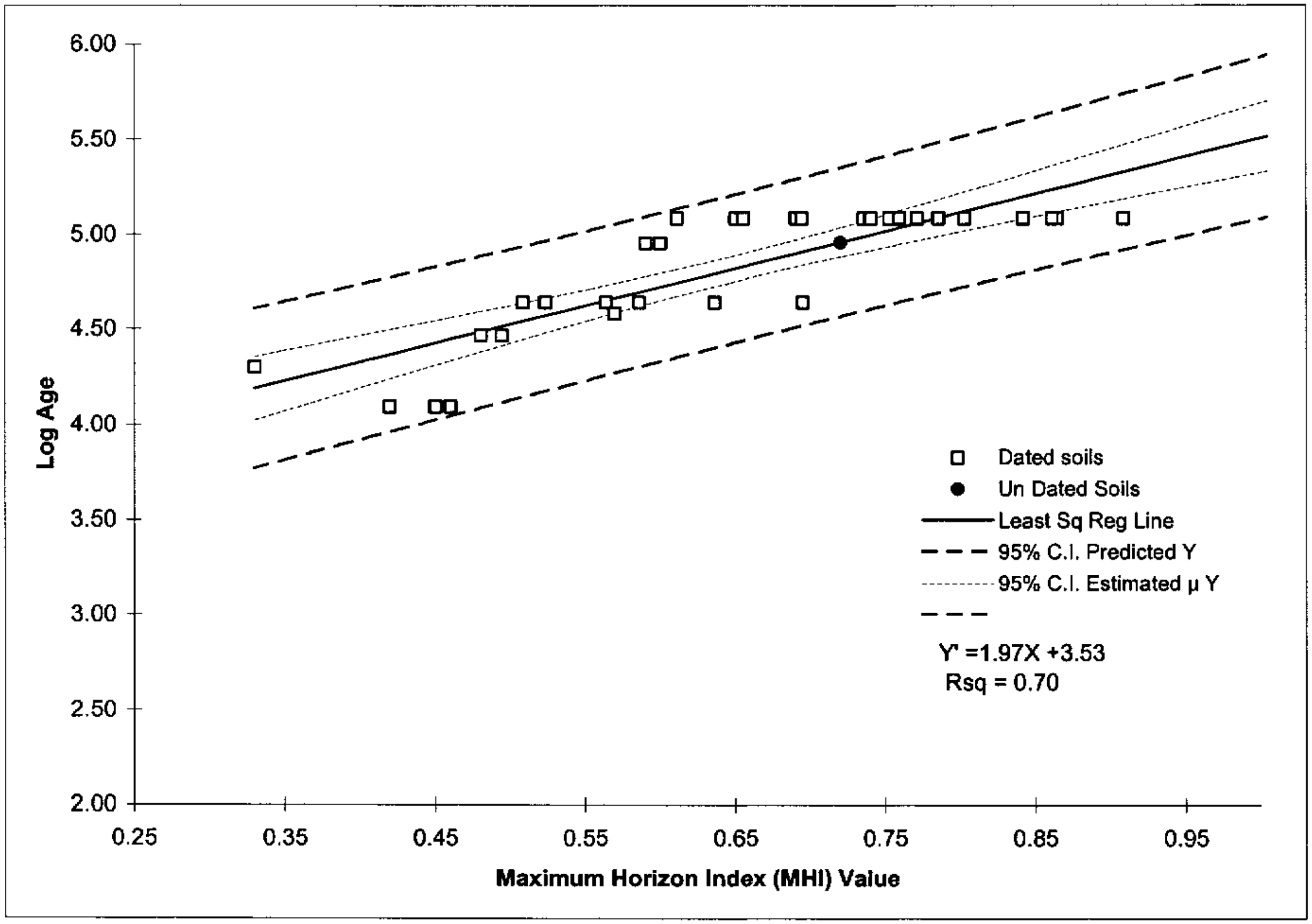
Horizon Boundaries: a-Abrupt, c-Clear, g-Gradual, d-Diffuse; s-Smooth, w-Wavy, i-Irregular



Profile	MHI	Age	Max Error in μ of Y	Min Error in μ of Y	95% Predicted Age C.I. Max	95% Predicted Age C.I. Min
SP-1 upper	0.19	5,044	5,711	4,377	8,724	1,365
SP-1 mid	0.23	6,190	6,830	5,550	9,865	2,516
SP-1 lower	0.20	5,331	5,986	4,675	9,008	1,653



Profile	MHI	Log Age	Max Error in μ of Y	Min Error in μ of Y	Max Error in Y pop	Min Error in Y pop	Age (yrs)	95% Predicted Age C.I. Max	95% Predicted Age C.I. Min
SP-2	0.45	4.45	4.50	4.39	4.68	4.21	27,935	48,367	16,135



Profile	MHI	Log Age	Max Error in µ of Y	Min Error in Y pop.	Age (yrs)	95% Predicted Age C.I. Max	95% Predicted Age C.I. Min
T-20 SP-3	0.72	4.96	5.03	4.57	90,597	223,328	36,753

Methods

The soils exposed were described according to the characteristics and nomenclature set forth by the Soil Survey Staff (1975, 1992) and Birkeland (1984). The profile descriptions (Table I) were used to calculate the degree of development for the soils exposed in each of the deposits. Soil development index values were calculated for these soils based on a modified version of the maximum horizon index (MHI) of Ponti (1985). Age estimates for the deposits are based on the statistical comparison of soil development between the soils at the subject site and dated regional soils developed under similar conditions.

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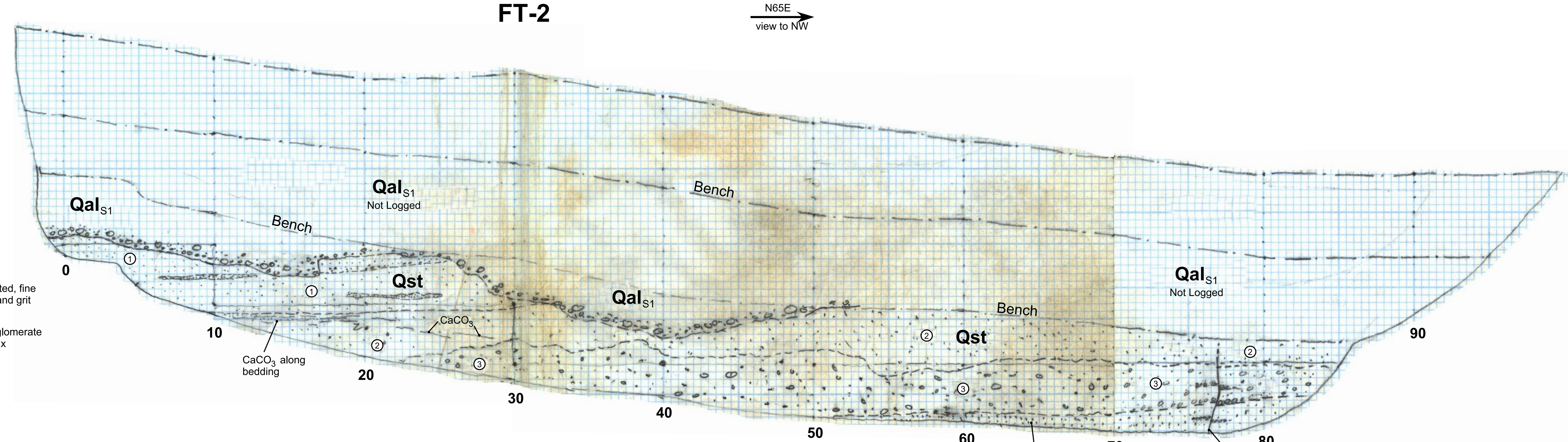
FT-2

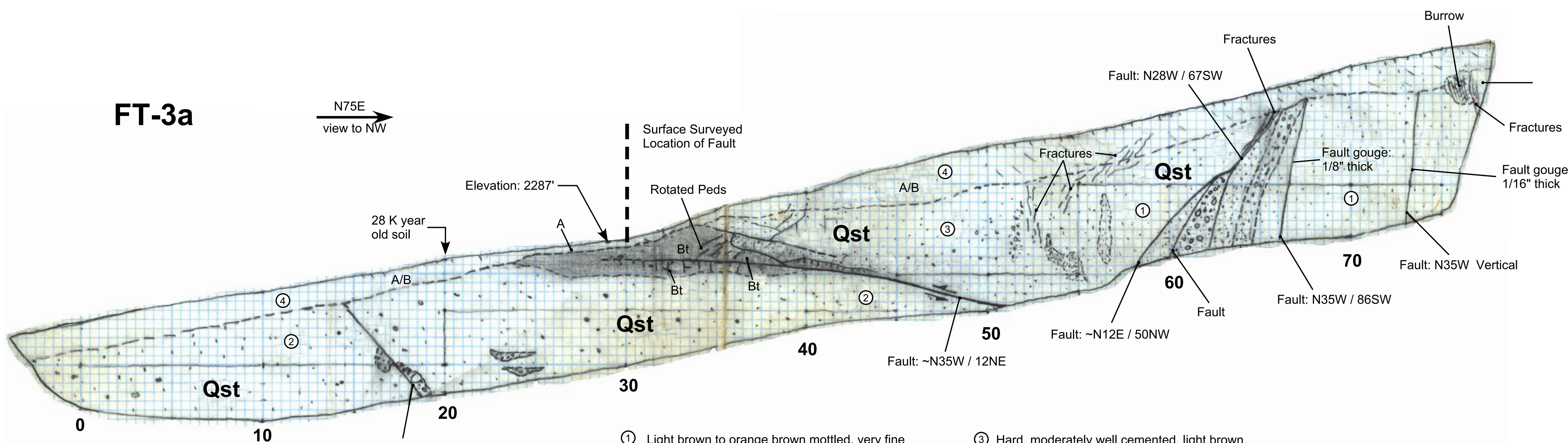


① Slightly cemented, light brown very fine silty sand, massive

② Light brown, moderately well-cemented, fine grained silty sand with few pebbles and grit

③ Dense, dry, litght brown pebble conglomerate with medium grained silty sand matrix

FT-3a



① Light brown to orange brown mottled, very fine silty sand, lightly cemented

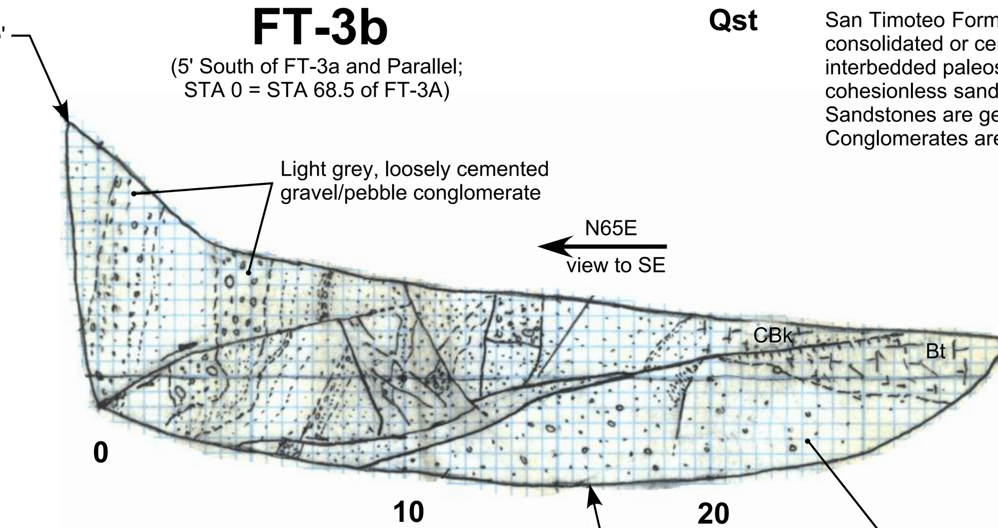
② Light brown to reddish brown, dense, fine silty sand with few pebbles, massive, with few gravel lenses

③ Hard, moderately well cemented, light brown, fine to medium grained silty sand

④ Undifferentiated "modern" soils consisting of A horizon and weak to moderately developed B horizons of probable Holocene age

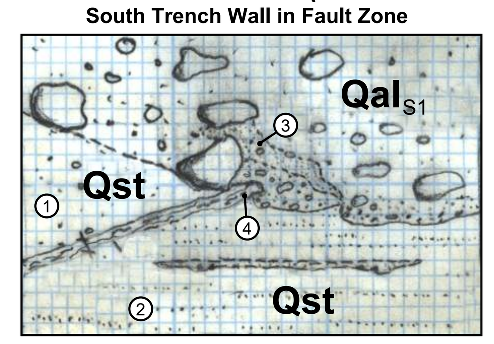
FT-3b

(5' South of FT-3a and Parallel; STA 0 = STA 68.5 of FT-3A)



FT-4

DETAIL of FT-4 (1" =
South Trench Wall in Fault Zone

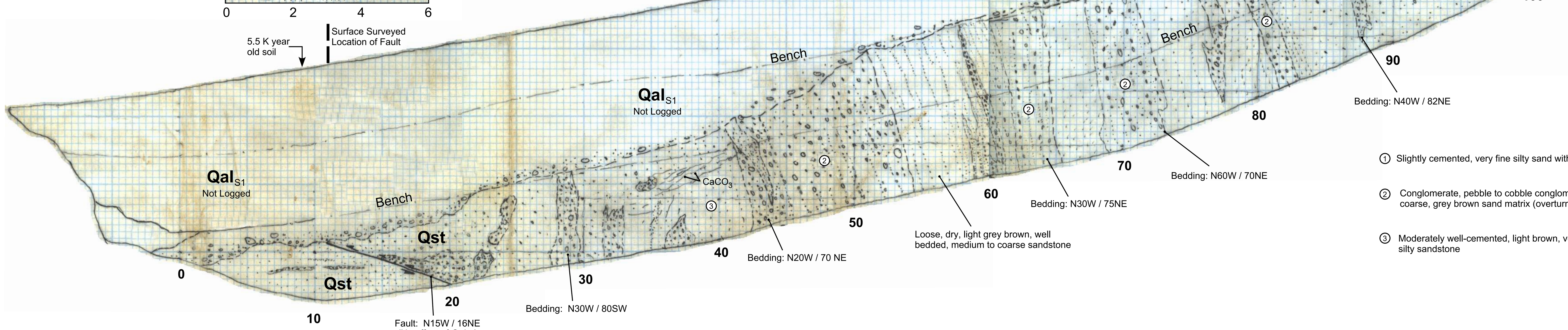


① Moderately cemented, light reddish brown, fine to medium grained silty sand with pebbles

② Slightly cemented, light brown, fine sand with lenses of coarse, gritty sandstone

③ Zone of moderately well-cemented clayey sand with **no fault offset**

④ Shear Zone, very hard, cemented and sheared sand/clayey sand, erosionally resistant, overhang at Qal contact is due to differential erosion (no offset of Qal)



① Slightly cemented, very fine silty sand with few pebbles and grit

② Conglomerate, pebble to cobble conglomerate with coarse, grey brown sand matrix (overturned throughout trench)

③ Moderately well-cemented, light brown, very fine silty sandstone

EXPLANATION

HOLOCENE VALLEY ALLUVIUM

Qal_{S1} Younger alluvium and slopewash of Fault Trenches 2, 4, 6, and 6a consisting of undifferentiated loose to lightly cemented friable, dark brown to light gray brown, silty fine sand. Typically has a basal conglomerate with silty to well-sorted fine to medium grained sand matrix. Basal alluvial channel deposits of FT-6a are a very loose pebble conglomerate with light gray brown, well-sorted coarse sand matrix. Some immature soil development present as buried soil horizons in FT-4 and FT-6 with estimated soil profile cumulative age of approximately 5,000 years old based on the statistical comparison of soil development between the soils at the subject site and dated regional soils developed under similar conditions.

Qal_{S2} Older alluvium of Fault Trench 7 (FT-7). Undifferentiated alluvium and slopewash with moderately well-developed soil profile at ground surface. Consists generally of dark brown clayey fine to medium-grained sand and sandy clay.

Qc Colluvium; very stiff, dry to damp, dark brown clay and sandy clay with grit and few pebbles.

Qcw Colluvial wedge in fault zone of FT-7 consisting of mixture of organic brown silty sand and conglomeratic debris from fault scarp overlain by 1" thick black organic clay.

LATE PLEISTOCENE PEDOGENIC SOILS

A — A horizon; loose, dry, gray brown silty organic sand

Bt — Argillic horizon; hard, dark brown sandy clay and clay with blocky to prismatic peds with moderately to well-developed clay films on ped surfaces. See logs for estimated age determination of soil.

Btk — Argillic horizon with later accumulation of Stage I and II carbonate. Present as thin filaments, small flecks, or thin linings on ped surfaces.

Bk — Accumulation of Stage I and II carbonate, generally below well developed argillic horizon, parent material locally recognizable.

K — The K horizon represents domination of carbonates with Stage III or higher carbonate development. Most grains are coated with carbonate creating an essentially white outcrop.

CBk — This horizon is transitional between slightly weathered parent material and more weathered Btk horizons. In FT-6 the CBk horizon grades laterally to a white K horizon.

CK — Transitional horizon between relatively unweathered parent material and K horizon. Generally has Stage I $CaCO_3$ development, parent material prominent and recognizable.

Kr — Krotovina (filled animal burrows).

PLEISTOCENE BEDROCK

Qst San Timoteo Formation: Early to Mid-Pleistocene sediments consisting of poorly to moderately consolidated or cemented fluvial silts, sands, gravels, and cobble conglomerates with interbedded paleosols. Sandstones vary in lithology from well-sorted, coarse grained, cohesionless sands to moderately cemented, poorly sorted silty, clayey fine sands. Sandstones are generally thinly bedded and manifested by color and textural changes. Conglomerates are generally thin, on the order of several feet thick and coarsely bedded.

0 — 5
GRAPHIC SCALE (in feet)
HORIZONTAL = VERTICAL

FT-2 thru FT-

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FAULT TRENCH EXPLORATION LOGS
Fiesta Development
Calimesa, CA

DATE	10/2004	J.N.	238-04	PLATE 3
DWG BY:	DBS	SCALE:	1" = 5'	