APPENDIX F.
GEOTECHNICAL REPORT

This page intentionally left blank

GEOTECHNICAL/GEOLOGIC FEASIBILITY STUDY, CASA BLANCA RANCH PROJECT, NORTH OF OAK GLEN ROAD, CITY OF YUCAIPA, SAN BERNARDINO COUNTY, CALIFORNIA

MERIDIAN LAND DEVELOPMENT

SEPTEMBER 26, 2012
J.N. 291-12

PETRA

past + present + future
it's in our science

Riverside County / Environmental

40880-R County Center Drive
Temecula, CA 92591
T: 951.600.9271 F: 951.719.1499

PETRA

past + present + future
it's in our science

Engineers, Geologists
Environmental Scientists

September 26, 2012
J.N. 291-12

Mr. Jonathan Weldy
MERIDIAN LAND DEVELOPMENT
19153 Town Center Drive, 106
Apple Valley, California 92308

Subject: Geotechnical/Geologic Feasibility Study, *Casa Blanca Ranch Project*, North of Oak Glen Road, City of Yucaipa, San Bernardino County, California

Dear Mr. Weldy:

Petra Geotechnical, Inc. (Petra) is pleased to submit herewith our feasibility-level geotechnical/geologic constraints study for the proposed Casa Blanca Ranch project, located north of Oak Glen Road and east of Jefferson Street in the City of Yucaipa, California (Figure 1). This work was performed in accordance with the scope of work outlined in our revised Proposal No. 1254-12 dated August 28, 2012. The purposes of our study were to obtain available geotechnical and geologic information on the nature of the previous land usage and current site conditions, to evaluate the potential geologic constraints that may affect development of the property, and to provide geologic and geotechnical mitigation recommendations for submittal with a proposed Environmental Impact Report (EIR).

This investigation included a preliminary site reconnaissance and a general review of published and unpublished literature, aerial photographs, and geologic maps pertaining to geologic and geotechnical hazards which may have an impact on the proposed development. This report presents the findings and opinions regarding the feasibility of the proposed project with respect to the geologic and geotechnical factors that may impact site development.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

Grayson R. Walker, GE
Vice President

TABLE OF CONTENTS

GEOTECHNICAL/GEOLOGIC FEASIBILITY STUDY
CASA BLANCA RANCH PROJECT, NORTH OF OAK GLEN ROAD
CITY OF YUCAIPA, SAN BERNARDINO COUNTY, CALIFORNIA

Purpose and Scope of Services

The purpose of this study was to obtain preliminary information on the general geologic and geotechnical conditions within the project area in order to provide conclusions and recommendations for the feasibility of the proposed project to support an associated Environmental Impact Report (EIR).

The scope of our evaluation consisted of the following:

- Preliminary reconnaissance of the site to evaluate the general site conditions.
- Research and review of readily available published and unpublished geologic data, maps and geotechnical reports concerning geologic and soil conditions within and adjacent to the site which could have an impact on the proposed development.
- Review available sequential stereo-paired aerial photographs of the site and surrounding area.
- Preparation of this feasibility report, presenting the results of our evaluation and recommendations for the proposed development.

Location and Site Description

As we understand the project site consists of an essentially rectangular shaped property constituting approximately 238 acres of land that is bounded by Oak Glen Road to the south and by Jefferson Street/Cherry Croft Drive to the west. Vacant undeveloped land bounds the site to the north and east. The project consists of four separate parcels, APN's 321-082-15, 321-101-02, 321-101-12 and 321-101-20, and the general location is shown on the attached Site Location Map, Figure 1. Approximately two acres of the site, located at the end of James Birch Road, is leased by the San Bernardino Valley Municipal Water District and is presumed to be excluded from the proposed project. Additionally, several building structures located in the southwest corner of the site are understood to remain intact and will not be subject to the proposed development.

At the time of our investigation, the site was a vacant ranch with plateaus and canyons used for agriculture. The subject site has a gentle to moderate gradient descending from the eastern to the western portion of the site. Steeper gradients were observed within the canyon areas and some gradients approached near vertical (bluff) at the main bend in Wilson Creek. The main branch of Wilson Creek emanates from the northeast corner of the subject site and extends through the west-central portion of the site where it enters a stone culvert under Jefferson Street. The highest elevations within the property form gently sloping plateaus with tributary canyons which dissect the ridge lines and flow to Wilson Creek. Vegetation throughout the site consisted of a variety of grasses, shrubs and small stands of trees. A thicker stand of trees was observed along the southern boundary of the site in the vicinity of Oak Glen Road.

Several buildings are located within the southwest portion of the site which is the operation center of the ranch. The operation center includes the ranch house and mobile home, garage, caretaker's house, workshop with attached storage shed, and packing building. South and east of the main residence are groves adjacent to Oak Glenn Road. A large, dry pond area was observed within the groves below the workshop area. A small pond is east-northeast of the main residence close to the grove. A second grove area with adjacent smaller dry pond was observed just north of the packing building. The remainder of the site is agricultural fields and natural land with farm and household trash and debris periodically observed throughout the site. Several dirt paths provide general access throughout the site and minor areas of loose fill soils were periodically observed adjacent to the pathways.

A large water reservoir, owned and operated by the San Bernardino Valley Municipal Water District, is located at the end of James Birch Road within the southern central portion of the property. We understand that one water well (inactive) and two water tunnels exist on the site, however the well and tunnels were not observed during our site reconnaissance (Petra, 2011).

GEOTECHNICAL EVALUATION

Site Reconnaissance

An engineering geologist with Petra conducted a cursory reconnaissance of the subject site on September 17, 2012. The purpose of the reconnaissance was to observe and document the current conditions of the site.

Literature Review

Petra researched and reviewed available published and unpublished geologic data pertaining to regional geology, faulting and geologic hazards that may affect the site. The results of this review are included within the Findings section of this report.

Aerial Photo Analysis

Sequential black and white stereo, and individual-frame, aerial photographs (1938 to 1995) covering the site and surrounding area were obtained and reviewed by Petra. These photographs, obtained from Continental Aerial Photo, were at approximate scales ranging from 1 inch equals 2,000 feet to 1 inch equals 4,000 feet. Additionally, we reviewed aerial imagery from Google Earth from 1995 to 2011.

FINDINGS

Previous Site Land Use

Based on information obtained during this investigation, the site appears to have been predominantly a farm used for agriculture from at least the early 1900's until present. From approximately 1938 through present different portions of the land were brought into cultivation and planted with groves and fields for agriculture. Notable observations within some aerial photographs are as follows:

1938

In the 1938 photograph, the main residence and garage are in the southwest portion of the site. One large building is located within the present day operation center located northeast of the main residence. South and east of the main residence are groves adjacent to Oak Glenn Road. A small pond is east-northeast of the main residence close to the grove. Wilson Creek is visible crossing the site from the northeast toward the west-central portion of the site with tributaries extending from the east. Dirt access roads are visible throughout the site. The remainder of the site is agricultural land with canyon areas left natural.

1953

In the 1953 photograph, the small pond east-northeast of the main residence is barely visible and another small pond is located north of the large building in the operation center. Three new small buildings have been constructed within the operation center. The remainder of the site appears basically the same as observed in the 1938 photograph.

1966

In the 1966 photograph, both small ponds appear to be dry and the remainder of the site is agricultural land with canyon areas left natural.

1976

In the 1976 photos the existing water reservoir has been constructed within the south central portion of the property and James Birch Road has also been completed.

1980

In the 1980 photograph, the small pond located north of the large building in the operation center has reappeared and a large pond is observed east-northeast of the main residence within the groves. The remainder of the site is agricultural land with canyon areas left natural.

1990

In the 1990 photograph, another building has been placed just south of the main residence and the southern most building within the operation center has been removed. Groves have been planted between the main residence and Wilson Creek just west of the operation center. The small pond located north of the operation center appears to be dry and not visible. The remainder of the site is agricultural land with canyon areas left natural.

1995

In the 1995 photograph, the large pond observed east-northeast of the main residence within the groves appears to be dry and the groves south of the pond appear to be reduced in size. The groves between the main residence and Wilson Creek have been reduced in size to just an area north-northeast of the operation center. The remainder of the site is agricultural land with canyon areas left natural.

2005

In the 2005 photograph, the small pond located north of the operation center appears to be in use again. Farming equipment is visible along the northeast portion of the operation center. What appear to be crates of some sort are visible within the Wilson Creek flood plain adjacent a dirt access road. Overall the site and vicinity appear similar to that observed during Petra's site inspection.

Regional Geologic Setting

The subject property is situated within the San Gabriel Mountains Block (upper plate of the San Vincent thrust) within the northern part of the Peninsular Ranges Geomorphic Province. The San Gabriel Mountains Block is underlain by granitic and metamorphic crystalline rock that are Cretaceous in age or older. The block is bounded on the east-northeast by the San Andreas fault zone and the San Bernardino Mountains, and on the south-southwest by the Banning Fault and on the north-northwest by the Vincent Thrust. In closer proximity, the subject site is located just east of an area of northeast trending thrust faulting associated with the Vincent Thrust and the Crafton Hills Fault Zone. The site lies less than half a mile north of the Yucaipa Ridge, just under 1 mile southwest of the San Bernardino Mountains, and approximately 2 miles east of the Crafton Hills.

The site is located on the southern portion of a narrow alluvial valley located between the San Bernardino Mountains and Yucaipa Ridge emanating from Potato Canyon to the east. These Quaternary alluvial deposits extend southwest into the Yucaipa basin from the flanks of the San Bernardino Mountains, Yucaipa Ridge and Crafton Hills. The active alluvial drainage Wilson Creek, intersect at the northeast corner of the property and exists at the west central portion of the stie. Oak Glen Creek generally flows westward just south of the project site.

Local Geology and Subsurface Soil Conditions

Surficial earth materials observed during our reconnaissance and on published geologic maps generally consists of man-made undocumented fill, active alluvial wash deposits, young alluvium and colluvium (middle to late Holocene), and older alluvium (middle to late Pleistocene). The younger alluvial and colluvial units are present with the active drainages and incised tributary canyon areas and the older alluvium comprises the elevated plateaus.

Groundwater

Groundwater depth is anticipated to vary within the general area due to water being pumped from nearby wells. Flow direction beneath the subject site is toward the southwest and the Yucaipa basin. Several groundwater wells located within or adjacent to the subject site on the CDWR website indicated that groundwater level levels were between 40 and 67 feet below ground surface in 1968 to 1971 (CDWR, 2010). Although Wilson Creek stream bed was dry during our site investigation, periodic surface water flow will be present within the stream.

Faulting

The geologic structure of the southern California area is dominated mainly by northwest-trending faults associated with the San Andreas Fault system. Based on our review of published and unpublished geologic maps and literature pertaining to the site and regional geology, the site does not lie within the boundaries of an Earthquake Fault zone as defined by the State of California Alquist-Priolo Earthquake Fault Zoning Act. The closest AP zoned active faults to the site include the South Branch of the San Andreas Fault Zone – San Bernardino Mountain Section approximately 0.5 miles to the north and the Crafton Hills Fault Zone – Western Hills Fault, approximately 1.8 miles to the west/northwest. Other principal potentially active faults in the general area include the Crafton Hills Fault Zone – Chicken Hills Fault, approximately 1,700 feet northwest; the San Gorgonio Pass fault approximately 4.2 miles to the south and the San Jacinto Fault Zone – San Jacinto Valley Section located approximately 9.5 miles to the southwest.

However, two relatively short north trending fault segments are mapped within the central portion of the project site as depicted on the attached Figure 2 (City of Yucaipa, 2000, Matti et. al., 2003). These faults are mapped as having Late Quaternary displacement but Holocene activity has not been ruled out; meaning they are at least considered potentially active. Based on our review of stero-paired aerial photographs, a break in topography coincides with the two mapped fault traces.

Landslides

Although no landslides have been mapped within or adjacent to the site, several of the steeper canyon slope areas have been mapped as having a moderate to high potential for developing small shallow landslides i.e. debris flow type surficial failures during periods of prolonged precipitation (Morton, 2003). Based on our site reconnaissance evidence of slope creep, erosion and very shallow surficial failures along the flanks of the canyons were periodically observed within the site. In addition some of the tributary canyons have been incised enough to create overstepped slope conditions with the most notable being the near vertical bluff along the bend in Wilson Creek in the northwest quadrant of the property.

CONCLUSIONS

General Feasibility

Based on our research and review of pertinent geologic literature development of the project site is considered feasible from a geotechnical standpoint, however from a geologic standpoint, the presence of two potentially active fault strands is considered a potentially significant constraint. A detailed fault investigation should be conducted by a qualified professional geologist prior to the design phase of the project if structures for human occupancy are proposed in the vicinity of the mapped faults. In addition, there are a number of geologic/geotechnical constraints inherent to the property that should be considered during the design process. These constraints and other preliminary design considerations should be more thoroughly investigated at the design-level of planning and are discussed further below.

Geologic and Geotechnical Constraints

Fault Surface Rupture

The site is not located within a currently designated State of California Alquist-Priolo Earthquake Fault Zone (Hart, 1999). However, two potentially active fault strands, have been mapped as projecting through the site and are depicted on Figure 2. Based on the limited information available, the southern fault strand starts about 210 feet northeast of the existing water tank and about 200 feet west of the property line between APN 321-101-02 and 321-101-20. These fault strands do not appear to consist of a wide zone but rather would be a single fault that is limited in width, i.e. several 10's of feet. The southern mapped fault strand is on the order of 400 feet in length and the northern strand is on the order of 600 feet in length. *Subsurface fault trenching may be required prior to the design level phase of planning where these mapped faults are suspected, depending on the design concept of the project. If the project design does not propose structures for human occupancy, i.e. residential dwellings or commercial structures etc., in the immediate vicinity of the suspected faults then a fault investigation would not be required.*

If these faults are located but proven to be inactive, or if there is no evidence of faulting, then the proposed development will not be constrained by a fault surface rupture hazard. If active fault strands are discovered then appropriate fault setbacks, will be required for structures for human occupancy. Typical setbacks are on the order of 50 feet on either side of the fault, however the setback distance also depends on the quality of the data and the type or complexity of the fault(s). Evidence of active faults does not preclude other forms of development such as roadways, landscaping areas, graded slopes etc. Further evaluation will be warranted based on the project design.

Seismic Shaking

The site is located within an active tectonic area of southern California with several significant faults capable of producing moderate to strong earthquakes. The San Andreas, Crafton Hills, Banning and San Jacinto fault zones are all in close proximity of the site and capable of producing strong ground motions. The site will likely be subjected to very strong seismically related ground shaking during the anticipated life span of the project and structures within the site should therefore be designed and constructed to resist the effects of strong ground motion in accordance with the most current edition of the California Building Code (CBC).

Liquefaction and Seismically Induced Settlement

Liquefaction of soils can be caused by strong vibratory motion due to earthquakes. When solid particles in a saturated soil consolidate into a tighter package as a result of vibration due to an earthquake, the non-compressible pore water between the particles will be squeezed out. If the soil has a high permeability, a sufficient amount of water will drain out of the pores to maintain inter-granular stresses and, thereby, the soil's shear strength. However, if the permeability is relatively low, then the water will not drain away quickly enough and pore water pressures will build as a result. If the pore water pressure rises to a level such that the shear strength of the soil becomes zero, then liquefaction is said to have occurred. Factors known to influence liquefaction potential include soil type and depth, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

Based on a review of the San Bernardino County Geologic Hazard Overlays the site does not lie within zone that is susceptible to liquefaction. Based on the our review of the prevalent soils types, the potential for liquefaction induced settlement is considered very low due to the absence of a shallow groundwater table and an assumed relative high density of the coarse grained alluvial soils underlying the site.

Landslides and Secondary Effects of Seismic Activity

No landslides have been mapped within or near the subject site and based on a review of the San Bernardino County Geologic Hazard Overlays the site does not lay within zone that is susceptible to landsliding. However several canyon slope areas within the site have been mapped as having moderate to high potential for surficial failures leading to minor debris flows (Morton, 2003). In addition we observed evidence of oversteepened and eroded slope areas periodically within the project site. Other secondary effects of seismic activity normally considered as possible hazards to a site include several types of ground failure. Various general types of ground failures, which might occur as a consequence of severe ground shaking at the site, include ground subsidence, ground lurching, lateral spreading and earthquake-induced landsliding. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, subsoils and groundwater conditions, in addition to other factors. Based on the site conditions, ground subsidence and ground lurching are considered unlikely at the site, however there is a potential from lateral spreading and/or shallow earthquake-induced landsliding to occur along the steeper canyon slope or bluff areas.

Tsunamis and Seiches

Inundation of the site due to tsunamis is considered negligible because the site is over 55 miles from the Pacific Ocean at an elevation over 2,700 feet msl. Furthermore, the site is not located in proximity to enclosed bodies of water; therefore, inundation of the site due to seiches during an earthquake event is also considered nil.

Groundwater

Adverse effects on the proposed development resulting from the presence of shallow groundwater are not anticipated. However portions of the site lies within the drainage course of Wilson Creek and a flood plain review will likely be required. Local drainage considerations relative to the proposed development should be addressed by the project civil engineer.

Areal Subsidence

The subject site is not known to be located in an area with potential for ground subsidence due to withdrawal of fluids.

Slope Stability

Based on our observations, the exposed soils and natural slopes are considered to have favorable geologic structure and no evidence of deep seated landsliding or gross instability was encountered. However, based on preliminary mapping some canyon slope areas may be subject to erosion, slope creep and localized surficial instability. Further evaluation within specific areas of the site may be necessary during the design phase geotechnical investigation of the project depending of the proposed grading concept with regards to proposed cut and/or fill slopes and/or proposed improvements near the tops of the existing canyon slope areas.

Compressible Soils and Remedial Grading

The undocumented fill and near-surface alluvial soils are surficially loose and inconsistent due to the uncompacted and variable nature of the fills and shallow underlying natural alluvial deposits. Accordingly, remedial grading of the near-surface compressible soils will be necessary for support of lightly loaded shallow foundations and engineered fills. While subject to near-surface remedial grading, the site is generally suitable for the support of shallow, lightly to moderately loaded foundations. We recommend that a detailed geotechnical investigation be conducted when site the grading and foundation plans are developed to prepare site specific grading and foundation recommendations that are appropriate for the proposed construction.

Erosion

Site soils are generally granular in nature, are occasionally oversteepened and are subject to erosion. During and following site development the erosion potential on graded slopes will require erosion control measures.

Expansive Soils

Based on the predominant soils types encountered at the site, granular sand to silty sands with gravels, the expansion potential is anticipated to be in the very low category, i.e. an expansion index between 0 and 20. Preliminary expansion index results should be provided in the design level geotechnical investigation and the final soil expansion potential should be determined at the completion of site grading for foundation design considerations.

Suitability of On-Site Materials for Use as Engineered Fill

Based on our surficial observations at the subject site and assumed soil conditions at depth, the vast majority of soil materials would be suitable for use as engineered fill. Oversize rock may be encountered during site development that may require special recommendations and/or handling. As with most remedial grading, the majority of soils exposed at or near the surface would require moisture conditioning to near optimum moisture for use as engineered fill.

RECOMMENDATIONS

Mitigation of Geologic /Geotechnical Constraints

Active Faulting

Subsurface fault trenching should be performed during the Tentative Map phase of planning in all areas where structures for human occupancy, as well as structures sensitive to ground rupture, are proposed and active faults are mapped or are suspected. The areas of mapped potentially active faulting are currently limited to the central portion of the site as shown on Figure 2. If these faults are located but proven to be inactive, or if there is no evidence of faulting, then the proposed development will not be constrained by a fault surface rupture hazard. If active fault strands are discovered, then appropriate fault setbacks will be required for structures for human occupancy. Evidence of active faults do not preclude other forms of development such as roadways, park sites, graded slopes etc.

Landslides and Potential Slope Instability

Deep-seated landslides are not considered a constraint to the project, however, areas that have been mapped as being susceptible to surfical slope failure and/or oversteepend slope areas that may also be susceptible to surfical slope failure should be fully investigated and analyzed during the Tentative Map phase of planning within areas of development. Depending on their orientation, proposed cut slopes excavated in site materials will require additional mapping and/or large-diameter bucket auger borings may also be recommended in proposed cut slope areas to evaluate the subsurface geologic structure. Analysis of the geologic structure and the shear strength of the soil materials will determine the gross (global) and surficial stability of the proposed slopes.

Where instability is anticipated, the cut slope may be reconstructed as either a buttress fill or stabilization fill slope depending on the nature of the instability. Proposed cut slopes excavated in existing undocumented artificial fill materials or low density alluvial soils may be grossly unstable and should be reconstructed as engineered fill slopes. If development is planned near the new vertical bluff on the north bank of Wilson Creek in the northwest quadrant of the site a setback zone could be established as a potential mitigation measure.

Bluff Setbacks

Structural setbacks will be required from the tops of the existing bluffs to avoid encroachment into building areas in the event of future bluff instability. The setbacks may be determined by projecting an imaginary plane at a 1.5:1 (h:v) inclination from the toe of the bluff to the ground surface above. In view of the relatively low height of the bluffs, this criteria satisfies the foundation setback criteria presented in Section 1808.7.2, Foundation Setback from Descending Slope Surface, in the 2010 CBC.

Compressible Soils

Compressible soils are anticipated throughout the property and are expected to be comprised of undocumented fill and recent alluvium or colluvium. Any compressible soils that exist within proposed structural fill areas, or any that remain in-place at finish grade in proposed cut areas, should be removed to underlying competent older alluvium and then replaced as compacted fill. Subsurface exploration combined with sampling and laboratory testing of the onsite soils should be performed to determine the horizontal limits and the depths of remedial grading that will likely be required.

Strong Ground Motions

Since the subject property is located within a seismically active area of southern California, moderate to strong ground shaking can be expected within the site during the life of the project. Therefore, structures should be designed the resist the effects of seismic ground motions as provided in the applicable building codes at the time the site is developed. Seismic design parameters and peak ground accelerations will be provided as part of future site specific geotechnical investigations.

Suitability of On-Site Materials for Use as Engineered Fill

On-site soil materials that are free of hard rock greater than 12 inches in maximum dimension, and any trash, organics or similar deleterious materials will be suitable for use as engineered fill. Rock greater than 12 inches in maximum dimension may be buried in deep fill areas utilizing special grading techniques such as placing the rock in windrows or as rock blankets. Specific recommendations and grading techniques for burying oversize rock would be provided as part of future site specific geotechnical investigations.

On-Site Structures

In the event the well and water tunnels are not intended for future use, it is recommended that they be abandoned in accordance with the California Well Standards as published by the California Department of Water Resources (Bulletin 74-81 and 74-90), with oversight provided by the appropriate agencies. It is suspected that septic tanks and leach fields may existing on the site and during development, it is recommended that they be removed in accordance with current regulations. It is also recommended that all organics, trash and debris observed on the site within the proposed areas to be developed should be removed and disposed in accordance with current regulations. This would also apply to any man-made structures encountered within the areas to be developed.

RECOMENDATIONS FOR ADDITIONAL STUDY

The findings and conclusions presented in this feasibility evaluation are based on the research performed by Petra to support the Casa Blanca Ranch EIR. When Tentative Tract and Final maps have been developed, additional studies, including preliminary subsurface investigations, detailed geologic mapping and geotechnical testing and analysis, will be necessary to provide detailed recommendations that are appropriate for the proposed construction. The following is a synopsis of the typical types of studies that may be performed during the subsequent development phases.

Tentative Tract Map Phase

- Subsurface fault investigations in areas of mapped faults which includes clearing areas of potential ground surface rupture hazards and/or establishing fault setback zones.
- Detailed geologic mapping within areas of proposed development.
- Drilling of geotechnical hollow-stem auger borings and or excavating test pits in areas of compressible soils (fill and natural alluvium) to determine the depths to competent materials.
- Excavating large-diameter bucket auger borings for down-hole geologic logging and subsequent slope stability analysis in both natural slope areas to remain as well as proposed large cut slopes.
- Evaluation of groundwater, if encountered within our borings, with respect to the grading design concept.

Final Tract Map Phase

- Comparison review with the previous Tentative Tract map for design changes.
- Site specific 40 grading plan reviews.
- Grading specific recommendations, including but not limited to areas for disposal of oversize rock, slope buttressing or stabilization etc.
- Site specific supplemental geotechnical investigations which may include additional subsurface borings, test pits, and/or other methods depending on the location of the proposed structures and/or changes to the grading concept.
- Preliminary foundation design recommendations.

LIMITATIONS

This report is based on the project site, as we understand, and our geologic and geotechnical research of available maps and data. As stated, when site plans have been developed, detailed subsurface investigation and geotechnical testing and analysis, will be necessary.

The conclusions and opinions contained in this report are based on the results of the described geotechnical evaluations and represent our professional judgment. This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and in the same time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

It has been a pleasure to be of service to you on this project. Should you have questions regarding the contents of this report or should you require additional information, please contact this office.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

Douglass Johnston, CEG
Associate Geologist
CEG 2477

PROFESSIONAL GEOLOGIST
DOUGLASS L. JOHNSTON
NO. 2477
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Grayson R. Walker, GE
Principal Engineer
GE 871

REGISTERED PROFESSIONAL ENGINEER
GRAYSON R. WALKER
GE 871
GEOTECHNICAL
STATE OF CALIFORNIA

DLJ/GRW/jma

Distribution: (3) Addressee

REFERENCES

California Department of Water Resources, 2010, Historic Water Level Database, http://www.water.ca.gov/.

California Division of Mines and Geology, Special Studies Zone, Yucaipa Quadrangle, Revised Official Map, effective January 1, 1979.

California Geological Survey, 2002, *Probabilistic Seismic Hazard Assessment for the State of California*, Open-File Report 96-08, Revised 2002 California Seismic Shaking Analysis, , Appendix A.

______, 2011, California Geological Survey Website: http//www.consrv.gov/CGS/rghm/Pshamap/pshamain.html

City of Yucaipa, 2000, Fault-Rupture Hazard Zones, fault traces complied by D. Scott Magorien, CEG, dated August 14.

Hart, Earl W., and Bryant, William A., 2003, Fault-Rupture Hazards Zones in California, CDMG Special Publication 42, revised 1997, Supplements 1 and 2 added 1999, Supplement 3 added 2003.

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

Jennings, C.W, 2010, *Geologic Map of California*: California Geological Survey, Geologic Data Map No. 2.

Matti et. al., 2003, Geologic Map of the Yucaipa 7.5' Quadrangle, San Bernardino and Riverside Counties, California, U.S.G.S Open-File Report 03-301.

_______, 2003, Summary Pamphlet, Geologic Map and Digital Database of the Yucaipa 7.5' Quadrangle, San Bernardino and Riverside Counties, California, Version 1.0, U.S.G.S Open-File Report 03-301.

Morton, D. M. et. al.,2003, Preliminary Soil-Slip Susceptibility Map for the South Half of the San Bernardino 30' 60' Quadraugle, Southern California, Plate 3, U.S.G.S. Open-File Report 03-17

Petra Geotechnical, Inc., 2011, Phase I Environmental Site Assessment, 36104 Oak Glen Road, 240 Acres (APN Numbers 0321-082-15; 0321-101-02; -12; and -20), *Casa Blanca Ranch*, City of Yucaipa, San Bernardino County, California, prepared for ELBERTA, LLC & SOCAL CASA BLANCA, LP, Petra J.N. 361-11, dated December 19.

Rodgers, T. H., 1965, Geologic Map of California, Santa Ana Sheet: California Division of Mines and Geology, 1:250,000 scale.

San Bernardino County, Official Land Use Plan, Geologic Hazard Overlay, Yucaipa Quadrangle, FH32C, 1:24,000 Scale.

Aerial-Photographs Reviewed

Agency	Date	Flight - Photo Number	Approximate Scale 1 inch = --- feet
Continental Aerial Photo	5/25/49	AXL 11F: 78, 79	2,000
Continental Aerial Photo	8/11/68	AXL 9JJ: 56,57	2,000
Continental Aerial Photo	1/15/76	PC11: 47, 48	4,000
Continental Aerial Photo	Jan 1980	SBD 15: 37, 39	4,000
Continental Aerial Photo	12/30/86	F: 86, 87	3,000
Continental Aerial Photo	5/25/90	C81: 9-3, 9-4	4,000
Continental Aerial Photo	7/11/95	C115-27: 94, 95	2,000
Google Earth Imagery	10/1/95	N/A	-
Google Earth Imagery	5/28/02	N/A	-
Google Earth Imagery	10/5/05	N/A	-
Google Earth Imagery	4/12/07	N/A	-
Google Earth Imagery	6/19/09	N/A	-
Google Earth Imagery	3/9/11	N/A	-

FIGURES

PETRA

Reference: Bing Maps

PETRA GEOTECHNICAL, INC.

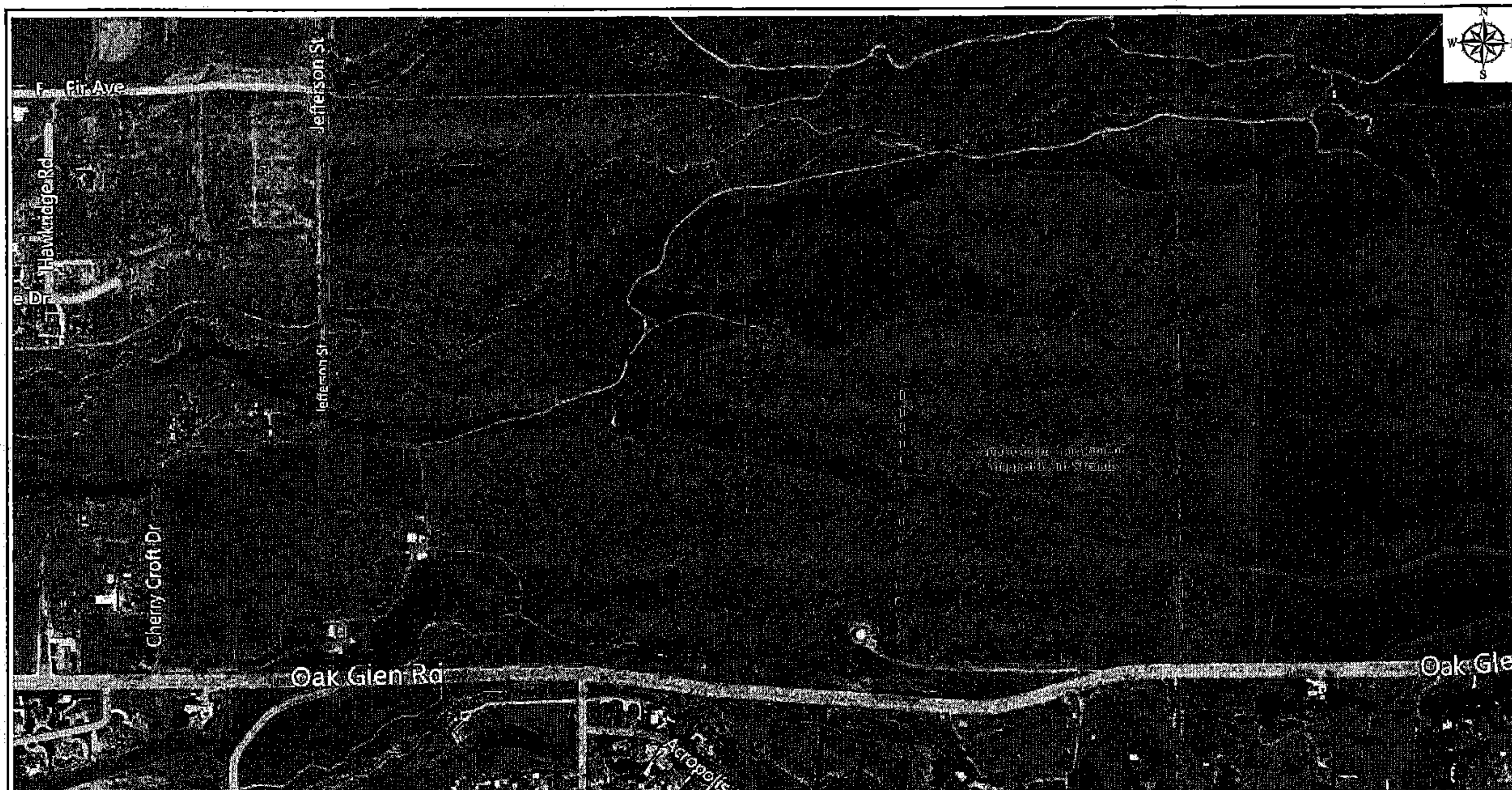
40880 County Center Drive, Suite R
Temecula, California 92591
PHONE: (951) 600-9271

COSTA MESA TEMECULA PALM DESERT SAN DIEGO SANTA CLARITA

SITE LOCATION MAP

Casa Blanca Ranch Project
Oak Glen Road and Jefferson Street
City of Yucaipa, California

DATE: Sept. 2012	J.N.: 291-12	Figure 1
DWG BY: JC	SCALE: None	



EXPLANATION

Approximate Location of Site Boundry

Reference: Bing Maps

PETRA GEOTECHNICAL, INC.			
COSTA MESA TEMECULA PALM DESERT SAN DIEGO SANTA CLARITA			
SITE PLAN			
Casa Blanca Ranch Project Oak Glen Road and Jefferson Street City of Yucaipa, California			
DATE: Sept. 2012	J.N.: 291-12	Figure 2	
DWG BY: DLJ	SCALE: N/A		

FAULT RUPTURE HAZARD INVESTIGATION, CASA BLANCA RANCH PROJECT, NORTH OF OAK GLEN ROAD, CITY OF YUCAIPA, SAN BERNARDINO COUNTY, CALIFORNIA

MERIDIAN LAND DEVELOPMENT

JUNE 27, 2013
J.N. 12-291

Riverside County

40880 County Center Drive, Suite R
Temecula, California 92591
T: 951-600-9271

June 27, 2013
J.N. 12-291

Mr. Jonathan Weldy
MERIDIAN LAND DEVELOPMENT
19153 Town Center Drive, 106
Apple Valley, California 92308

Subject: **Fault Rupture Hazard Investigation, *Casa Blanca Ranch Project*, North of Oak Glen Road, City of Yucaipa, San Bernardino County, California**

Dear Mr. Weldy:

This report presents the results of our fault investigation within a portion of the Casa Blanca Ranch project site, located north of Oak Glen Road and east of Jefferson Street in the City of Yucaipa, California (Figure 1). The purposes of this investigation were to assess potential fault rupture within the site, and to recommend appropriate setback zones for habitable structures if necessary. The overall project site is approximately 238 acres of land; however the subject fault investigation was located in the southern portion of the site approximately 1,300 feet west of the eastern property line (Figure 2). This work was performed in accordance with the scope of work outlined in our supplemental proposal dated April 17, 2003.

The site is not located within the boundaries of a State of California Alquist-Priolo Earthquake Fault Zone (APEFZ), however two escarpments are mapped as faults within the project site and are delineated on the City of Yucaipa Fault Rupture Hazards Zones plan. As such these mapped fault traces are considered "potentially" active and required further geologic study which was conducted in the spirit of an APEFZ study. The APEFZ requires that buildings for human occupancy not be built over known active faults. Within an APEFZ, geologic studies are conducted prior to construction of habitable or other critical structures to avoid placing such development over faults that may potentially produce ground rupture. Additionally, habitable structures are "set back" a reasonable distance from active fault traces, consistent with the level of site-specific investigations.

SCOPE OF WORK

This investigation specifically assess both the presence or absence of faulting and assesses the risk of ground surface rupture across the mapped escarpments within the subject portion of the property. The conclusions and recommendations in this report are used to determine project feasibility and final design, so that structures for human occupancy are not constructed over active faults. The State of California currently defines an "active fault" as one that has had surface displacement within Holocene time, about the last 11,500 years (Bryant and Hart, 2007). This investigation followed the California Geological Survey guidelines for evaluating the hazards of surface fault rupture (CGS, 2002).

The scope of services for this investigation included the following:

- Reviewing pertinent technical literature, geologic maps and stereographic aerial photographs relative to the site geology and potential location of faults (see References).
- Surface reconnaissance and observation of the general site geology and geomorphologic features particularly expressive of potential active faults. The fault trenches limits were also delineated in the field such that the existing grain crops in the area could be harvested by the current farmer.
- Excavating, cleaning and geologic logging of two exploratory fault trenches totaling approximately 655 linear feet to document fault presence or absence, estimated age and the continuity of unbroken sediments. The trenches were logged and interpreted under the direction of the undersigned geologist. The trenches were also observed by the Independent Peer Reviewer, Dr. Miles Kenney, as well as the City of Yucaipa Reviewer Mr. Scott Magorien.
- Loosely backfilled the trenches with the excavated soil cuttings.
- Organizing and interpreting appropriate geologic data.
- Preparing this Fault Rupture Hazard Investigation report and related figures and trench logs.

CEQA Significance Thresholds

Appendix G of Title 14 of the California Code of Regulations (the CEQA Guidelines) specifies nine possible environmental impacts to consider when evaluating geology and soils impacts. These include an assessment of how the proposed project could be affected by geology hazards:

a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
   i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (Refer to CGS Special Publication 42-Bryant and Hart, 2007).
   ii) Strong seismic ground shaking.

iii) Seismic-related ground failure, including liquefaction.
iv) Landslides.

b. Result in substantial soil erosion or the loss of topsoil
c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.
e. Having soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

It should be noted that this investigation addresses only item a.i) above. Subsequent engineering geologic and geotechnical investigations to be performed during the design stage of the project will address the remaining items.

SITE DESCRIPTION

The overall Casa Blanca Ranch project site consists of an essentially rectangular shaped property constituting approximately 238-acres of land that is bounded by Oak Glen Road to the south and by Jefferson Street to the west. The fault investigation took place on the southern side of the property just north and east of an existing San Bernardino Valley Municipal Water District reservoir. Based on aerial photograph interpretation a relatively weak tonal lineament was observed in the area of two mapped fault strands (Matti, et. al., 2003). The site location and approximate locations of the mapped escarpments are shown on the attached Site Location Map, Figure 1 and the surveyed location of the fault trenches within the property boundary are shown on Figure 3.

Vacant undeveloped land bounds the site to the north and east. The overall 238-acre site consists of four separate parcels, APN's 321-082-15, 321-101-02, 321-101-12 and 321-101-20. The site is a predominately vacant ranchland with plateaus and canyons used for active dry farming. The subject site has a gentle to moderate gradient descending from the eastern to the western portion of the site. Steeper gradients were observed within the canyon areas and some gradients approached near vertical (bluff) at the main bend in Wilson Creek. The main branch of Wilson Creek emanates from the northeast corner of the subject site and extends through the west-central portion of the site where it enters a stone culvert under Jefferson Street. The highest elevations within the property form gently sloping plateaus with tributary canyons which dissect the ridge lines and flow to Wilson Creek. Vegetation throughout the site consisted of a variety of grasses, shrubs and small stands of trees as well as grain crops within the plateau areas. Thicker stands of trees were observed along the southern boundary of the site in the vicinity of Oak Glen Road.

PROPOSED DEVELOPMENT

Based on preliminary lotting studies by AEI-CASC, the proposed development on the southern and western portions of the property (plateau areas) will consist of a slightly terraced single-family residential development which will include manufactured slopes and various infrastructure, i.e. underground utilities, drainage facilities and streets. All building structures and site improvements will be constructed in accordance with applicable building codes.

SITE INVESTIGATION

Although the mapped escarpments within the project site were anticipated to be of Pleistocene age, i.e. older than recent or Holocene time, they were considered to be potentially active. In accordance with current geologic standards of practice, an independent fault trenching program and fault analysis was specially developed for this site. This investigation took place between May 13 and 30, 2013.

After review of pertinent literature and interpretation of aerial photographs and topographic maps, two exploratory trenches were strategically placed across a suspected escarpment mapped as two relative short fault segments (Matti, et. al., 2003). A small westward flowing incised drainage channel bisects the two mapped escarpments. The total trench length totaled about 655 linear feet with depths up to approximately 10 to 10.5 feet below existing grades. A five foot wide, mid-height bench was established within both sides of each trench. Trench T-1 is approximately 330 feet long and was placed across the southern mapped escarpment approximately 200 to 300 feet north of the existing water reservoir. Trench T-2 is approximately 325 feet long and was placed across the northern mapped escarpment approximately 550 feet north of T-1. The trenches were oriented approximately perpendicular to the general mapped escarpment and topographic break in the area. The trench locations were surveyed by Hess Development Inc. during the course of our fieldwork as shown on Figure 3.

The walls of the trenches were cleaned of loose or smeared soil and a graphic log was compiled on the northern trench walls that illustrates the locations and orientations of the pertinent soil deposits observed. Colors described in the logs are based on the Munsell Soil Color notation. The trench logs are included as Plates 1 through 8 of this report. Dr. Miles Kenney (of Kenney Geoscience), who is not associated with Petra Geotechnical, Inc., visited the trenches following our initial logging to provide independent quality assurance and generalized age dating of the exposed stratigraphy. Additionally Mr. Scott Magorien, geologic reviewer for the City of Yucaipa visited the site on May 22, 2013 to observe and inspect the trenches. Both trenches were loosely backfilled following the completion of geologic fieldwork.

REGIONAL GEOLOGIC AND TECTONIC SETTING

Regional and Local Geology

The subject property is situated within the San Gabriel Mountains Block (upper plate of the Vincent thrust) within the northern part of the Peninsular Ranges Geomorphic Province. The upper plate of the San Gabriel Mountains Block is underlain by plutonic granitic crystalline rock (granodiorites, diorites and tonalities) that is Cretaceous in age or older. The subject block is bounded on the east-northeast by the San Andreas fault zone and the San Bernardino Mountains, on the south-southwest by the Banning Fault and on the north-northwest by the Vincent Thrust.

In closer proximity, the Casa Blanca Ranch site is located just east/sontheast of an area of northeast trending thrust faulting associated with the Vincent Thrust and the Crafton Hills Fault Zone (Yucaipa Graben Complex). The site lies near the boundary between the upper and lower San Gabriel Mountains Blocks which are separated by the Vincent Thrust and the Yucaipa Grabben Complex. The site lies less than half a mile north of the flanks of the Yucaipa Ridge, just under one mile south-southwest of the San Bernardino Mountains, and approximately two miles east of the Crafton Hills.

The subject site is situated on the southern portion of a relatively narrow alluvial valley located between the San Bernardino Mountains and Yucaipa Ridge emanating from Potato Canyon to the east. Recent Quaternary alluvial deposits within this valley extend southwest into the Yucaipa basin from the flanks of the nearby San Bernardino Mountains, Yucaipa Ridge and Crafton Hills. The active alluvial drainage Wilson Creek enters the project site at the northeast corner of the property and exits the site at the west central portion boundary. Oak Glen Creek generally flows to the west/southwest immediately south of the project site. The attached Figure 2 depicts the general area geology as mapped by Matti et. al (2003).

The current fault investigation, located in the south-central portion of the project site (Figure 3), lies on an abandoned alluvial fan surface (terrace) that has been deeply incised to the north and south by Wilson and Oak Glen Creeks respectively to create local mesas. The generally north-south trending escarpment areas express a subtle break in the mesa's topography which was interpreted by Matti et. al. as two very short normal fault strands with the eastern block downdropped relative to the west.

The subject mesa (geomorphic surface) is mapped by Matti et. al. as old axial-valley deposits (Unit Qoa_2) consisting of terrestrial interstratified sand and gravel that are on the order of 30 feet thick which rest unconformably over unit Qoa_1. However, axial-valley deposits are similar in composition and characteristics to alluvial fan deposits, therefore based on our mapping and subsurface exposures within the fault trenches, the sediments contain appreciable cobbles and boulders which we interpret as more characteristic of alluvial fan and debris flow type deposits than finer grained axial steam flow deposits. Matti et. al. discuss their Qoa units as ranging in age from 50,000 to 500,000 years old and have postulated that these alluvial units may have emanated from the San Gorgonio River drainage during mid- to late-Pleistocene time and have been subsequently repositioned as a result of about 3 kilometers of right lateral slip along the nearby San Andreas Fault (San Bernardino strand).

Local Faults

The geologic structure of the southern California area is dominated mainly by northwest-trending major faults associated with the San Andreas Fault system. Based on our review of published and unpublished geologic maps and literature pertaining to the site and regional geology, the site does not lie within the boundaries of an Earthquake Fault zone as defined by the State of California Alquist-Priolo Earthquake Fault Zoning Act (Bryant and Hart, 2007). The closest AP zoned active faults to the site include the South Branch of the San Andreas Fault Zone – San Bernardino Mountain Section approximately 0.9 miles to the north and the Crafton Hills Fault Zone – Western Hills Fault, approximately 1.8 miles to the west/northwest. Other principal active faults in the general area include the Crafton Hills Fault Zone – Chicken Hill Fault, approximately 1,700 feet to the northwest; the San Gorgonio Pass fault approximately 4.2 miles to the south and the San Jacinto Fault Zone – San Jacinto Valley Section located approximately 9.5 miles to the southwest.

The San Andreas Fault Zone (SAFZ) is the most prominent active geologic structure in the area (Jennings and Bryant, 2010). It is primarily a right-lateral, strike-slip fault that trends northwest and is near vertical. However, local complexities between the SAFZ and the San Jacinto fault zone are postulated as having contributed toward local extensional faulting to the west. This deformation has formed a series of normal dip-slip faults which is locally referred to as the Crafton Hills horst-and-grabben complex which has uplifted the nearby Crafton Hills and downdropped the Yucaipa Valley. The Crafton Hills fault essentially terminates at a series of normal faults referred to as the Yucaipa Grabben Complex which extends east-northeast of the Crafton Hills and generally located to the north and northwest of the overall project site. The postulated extension of the Chicken Hill Fault lies between the subject site and the Yucaipa Grabben Complex to the west/northwest and is believed to eventually connect with the Yucaipa Grabben Complex north of the site. The southwestern portion of the Chicken Hill Fault is an AP zoned active fault approximately 3.5 miles to the southwest of the site and the Crafton Hills horst-and-grabben complex to the north of the site is believed to have late Holocene displacements within younger fan deposits (Matti et. al.).

The two relatively short, north-south trending escarpments (possible fault segments) that are mapped within the central portion of the project site that are the subject of this study, are approximately depicted on the attached Figures 1 and 2 (City of Yucaipa, 2000, Matti et. al., 2003). These faults are mapped as having possible late Quaternary (Pleistocene) displacement but Holocene activity has not been ruled out; meaning they were considered at least potentially active. Based on our review of historic stero-paired aerial photographs, a tonal lineament and subtle break in topography coincides with the two mapped escarpments.

SITE-SPECIFIC FINDINGS

Aerial Photograph Analysis

Stereo-paired aerial photographs were reviewed to assess the recent geomorphology and potentially fault-related lineaments. Based on the aerial photos reviewed, see references, a relative weak lineament was observed principally as a tonal contrasts on the stereoscopic view of aerial photographs. The subtle break in topography was suspicious enough that is was mapped as a fault-related geomorphic feature by others.

Reconnaissance

Several visits were made to the subject site area during April and May, 2013 for the purpose of surface geologic mapping and reconnaissance in preparation of the fault study. Based on our field mapping, the center of the two fault trenches were strategically placed perpendicular to the gentle break in topography (mapped escarpment) and extended approximately 160 feet in either direction.

Fault Trench Findings

Based on trench exposures and as documented on the logs (Plates 1 through 8), the site is underlain by three main units of older alluvium and/or alluvial fan deposits; however the lower units (Qoa_2 and especially within unit Qoa_3) had various sub-units or soil debris flow packages that established minor stratigraphy. These sub-units were not specifically logged but were occasionally mapped where the contact could be traced for 10 feet or longer.

The uppermost unit (Qoa_1) mantles the site with depths ranging from approximately 1.5 to 4 feet, and consists of a cumulic soil horizon characterized by dark brown to dark grayish brown (10 YR 3/2 to 5/4) silty fine sands with clay and abundant organic accumulations. This soil horizon has been highly disturbed in the upper 1 to 2 feet by recent and historical tilling. A cumulic soil horizon forms by slow incremental deposition that approximates rate of soil development and is typically structureless and highly bioturbated as was observed within the trench exposures. Minor pedogenic development was also observed within this surficial unit indicating an early to mid-Holocene soil development profile (Kenney, 2013). Also documented on the trench logs is a minor amount of artificial fill related to the establishing the access ramps into the trenches and a buried concrete drainage pipe encountered in T-1. This unit was continuous and unbroken across the fault trench exposure, although it thickened slightly near the center of the trench.

Unit Qoa_2 which directly underlies Ooa_1 in the eastern half of each trench (the unit terminates near Station 150 in both trenches) consists of fine-grained alluvial fan type deposits that is considerably coarser grained than Qoa_1, fine to medium sands with silt and scattered gravels, that was also friable and observed as brown to reddish brown (7.5 YR 3/3 to 5/4). This unit is generally massive, lacked any notable cobble or boulder inclusions and rested uncomfortably with the overlying Qoa_1 and underlying Qoa_3 units. This unit was also continuous and unbroken across the eastern half of the fault trench exposures and based on its stratigraphic relationship and degree of weathering is considered late Pleistocene in age (Kenney, 2013).

Unit Qoa_3 is the lowermost major member from our fault trench exposures and generally consists of gravelley sand to sandy gravel matrix within a cobble and boulder rich debris flow type deposits. The matrix is generally reddish yellow, yellowish brown to brownish yellow (7.5 YR 6/6, 10 YR 6/8 and 10 YR 3/6). The cobble and boulder component are most typically very strongly grussified diorites with minor accumulations of weathered granodiorites and trace amounts of schist. The boulder clasts exposed reached dimensions up to 6 feet in diameter but were more commonly on the order of 2 to 3 feet in diameter. Faint relic bedding could be occasionally traced into the bottom of the trench identifying individual debris flow contacts which appear to be slightly tilted to the east at a very low angle. Based on the high degree of weathering in this unit, the age of these sediments could be conservatively stated as 50,000 years. This unit was also continuous and unbroken across the fault trench exposures.

The disappearance of unit Qoa_2 near the center of the trenches, which coincides closely with the escarpment trace, and the relationship of the exposed geology has led us to postulate that the finer grained Qoa_2 materials were considerable more erodible than the underlying more erosion resistant boulder-rich debris flow type deposits of unit Qoa_3 and that differential weathering and fluvial processes (i.e. inset drainages) across the abandoned terrace created the localized topographic break. This could be easily interpreted as the appearance of a downdropped block due to tectonic movement on a normal fault based on surface field mapping or aerial photo interpretation. The thickening of the younger unit Qoa_2 near Station 180 in the trenches is also nearly in-line with the axial drainages leading to the existing incised westerly-trending channel bisecting the two mapped escarpments.

CONCLUSIONS AND RECOMMENDATIONS

Based the exposed stratigraphy within two fault trenches excavated across the mapped escarpment, continuous unbroken older alluvium and alluvial fan sediments (Qoa) of at least late Pleistocene age, and probably older, were observed. These sediments, therefore, have not been subjected to ground rupture during Holocene time (~11,500 years). The deeper unbroken site sediments (Qoa_3) are at least 50 ka, as the abandoned alluvial fan terrace surface is approximately ~30 feet above the adjacent modern floodplains (Wilson and Oak Glen Creeks), and are more likely on the order of 100 to 120 ka old (Kenney, 2013). This age estimate is also supported by the moderately to strongly developed cumulic soil profile that caps these sediment (Qoa_1) and the highly grussified nature of the dirotie cobbles and boulders which are at least late Pleistocene in age. Therefore, these sediments have likely experienced many major seismic events over the preceding 11,500 years without experiencing ground rupture. Based on regional geomorphic expression and on site-specific exposures observed in the fault trenches, the potential for fault related ground rupture is very low.

Recommendations

1. Design and construct the project in accordance with all applicable building codes, including the current edition California Building Code (CBC), and any relevant amendments adopted by the City of Yucaipa.

2. Further geotechnical investigations should be conducted to characterize the geotechnical characteristics of the site and to insure that all building plans are designed in compliance with the geotechnical engineer.

3. The geotechnical inspection and testing should continue through the construction phase of the project to insure that construction complies with the geotechnical recommendations.

Concluding Statement

Based on our fault evaluation study, no known active faults have been identified within the site. While fault rupture would most likely occur along established fault traces, fault rupture could occur at other locations. The potential for significant impact from fault surface rupture is anticipated to be very low. Based on our findings provided above, the project site is considered appropriate for the proposed residential development with regards to active fault hazards.

CLOSURE

The conclusions and opinions contained in this report are based on the results of the described geologic evaluations and represent our professional judgment. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty. The findings, conclusions and opinions contained in this report are to be considered tentative only and subject to confirmation by the undersigned during the construction process. Without this confirmation, this report is to be considered incomplete and Petra or the undersigned professionals assume no responsibility for its use.

The professional opinions contained herein have been derived in accordance with current geologic standards of practice and no warranty is expressed or implied. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

This opportunity to be of service is greatly appreciated. Should you have any questions regarding this report, please do not hesitate to contact us.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

PROFESSIONAL GEOLOGIST
DOUGLASS L. JOHNSTON
NO. 2477
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Douglass L. Johnston, CEG
Associate Geologist

DLJ/jma

Attachments: References
Figure 1 – Site Location Map
Figure 2 – Geologic Map
Figure 3 – Fault Trench Location Map
Plates 1 through 4 – Fault Trench Logs (T-1)
Plates 5 through 8 – Fault Trench Logs (T-2)

Distribution: (3) Addressee

REFERENCES CITED

Bryant W.A. and Hart, E.W., Interim Revision 2007, *Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with index to Earthquake Fault Zone Maps*: California Geological Survey Special Publication 42, 42 p.

California Division of Mines and Geology, Special Studies Zone, Yucaipa Quadrangle, Revised Official Map, effective January 1, 1979.

California Geological Survey, 2002a, *Probabilistic Seismic Hazard Assessment for the State of California*, Open-File Report 96-08, Revised 2002 California Seismic Shaking Analysis, Appendix A.

_______, 2002b rev., *Guidelines for Evaluating the Hazard of Surface Fault Rupture*: California Geological Survey Note 49, 4 p.

City of Yucaipa, 2000, Fault-Rupture Hazard Zones, RBF Consulting, fault traces complied by D. Scott Magorien, CEG, dated August 14.

Hart, Earl W., and Bryant, William A., 2003, Fault-Rupture Hazards Zones in California, CDMG Special Publication 42, revised 1997, Supplements 1 and 2 added 1999, Supplement 3 added 2003.

Gutierrez, C., Bryant, W., Saucedo, G. and Wills, C., compilers, 2010, *Geologic Map of California*: California Geological Survey Geologic Data Map No. 2, scale 1:750,000.

Jennings, C.W. and Bryant, W.A., compilers, 2010, *Fault Activity Map of California*: California Geological Survey Geologic Data Map No. 6, scale 1:750,000.

Kenney GeoScience, 2013, Preliminary Evaluation of the Age and Stratigraphy of the Alluvial Terrace Located South of Oak Glen Creek and North of Yucaipa Creek, California, dated May 26.

Matti et. al., 2003, Geologic Map of the Yucaipa 7.5' Quadrangle, San Bernardino and Riverside Counties, California, U.S.G.S Open-File Report 03-301.

_______, 2003, Summary Pamphlet, Geologic Map and Digital Database of the Yucaipa 7.5' Quadrangle, San Bernardino and Riverside Counties, California, Version 1.0, U.S.G.S Open-File Report 03-301.

Morton, D. M. et. al.,2003, Preliminary Soil-Slip Susceptibility Map for the South Half of the San Bernardino 30' 60' Quadrangle, Southern California, Plate 3, U.S.G.S. Open-File Report 03-17

Petra Geotechnical, Inc., 2012, Geotechnical/Geologic Feasibility Study, *Casa Blanca Ranch Project*, North of Oak Glen Road, City of Yucaipa, San Bernardino County, California, dated September 26.

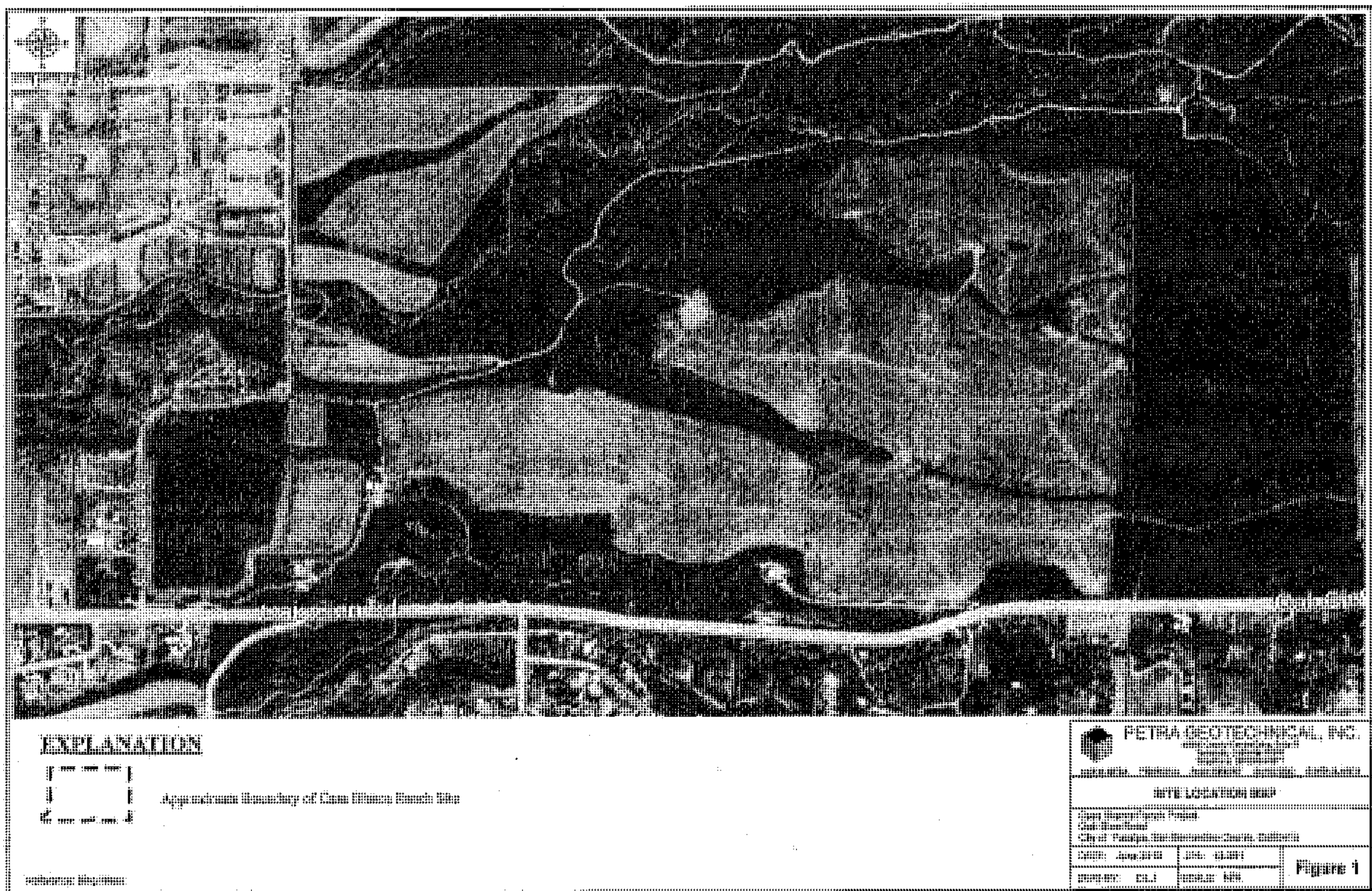
Rodgers, T. H., 1965, Geologic Map of California, Santa Ana Sheet: California Division of Mines and Geology, 1:250,000 scale.

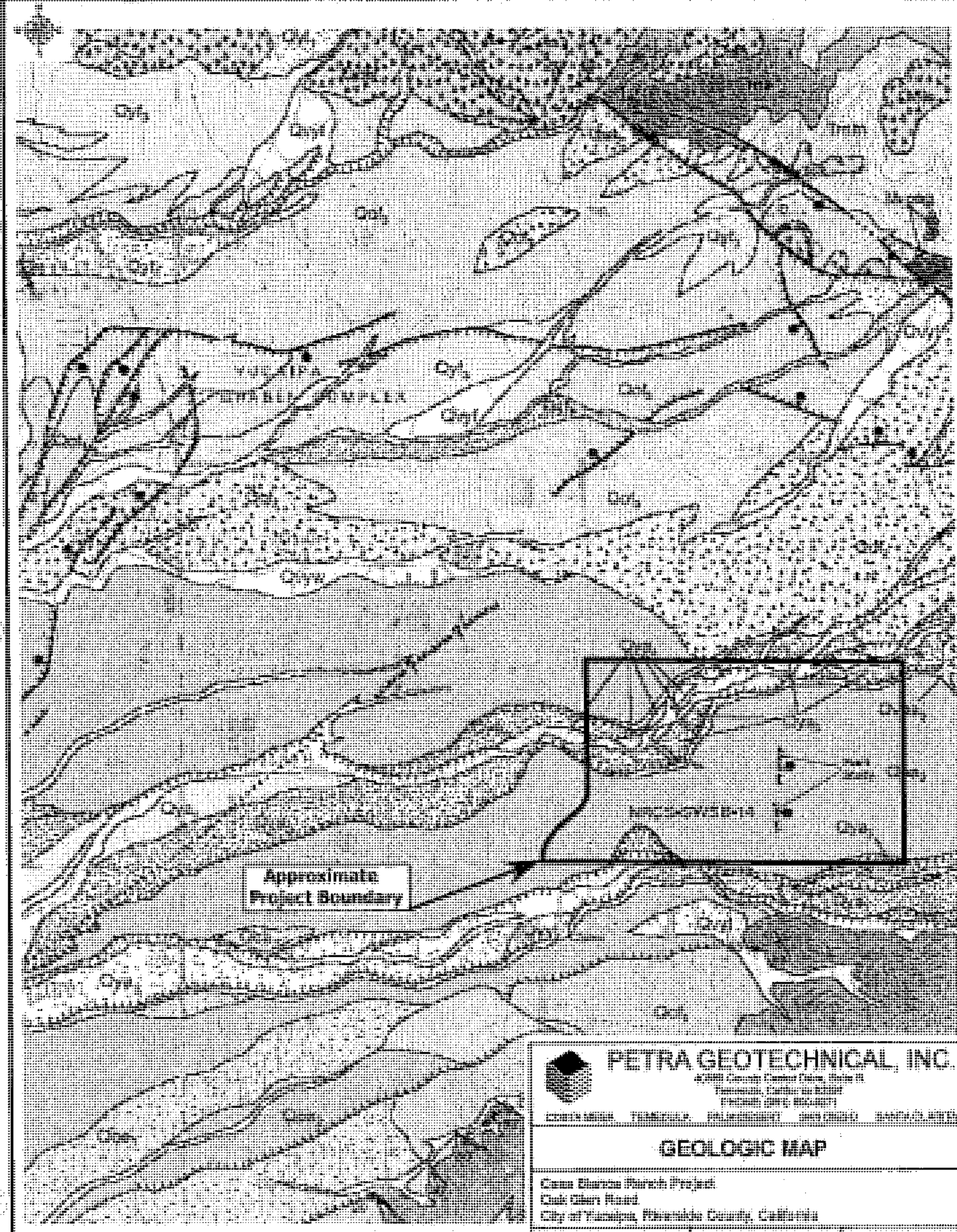
San Bernardino County, Official Land Use Plan, Geologic Hazard Overlay, Yucaipa Quadrangle, FH32C, 1:24,000 Scale.

Aerial Photographs Reviewed

Source/Agency	Date	Flight No.	Frame(s)
Continental Aerial Photo	5/25/49	AXL 11F	78, 79
Continental Aerial Photo	8/11/68	AXL 9JJ	56,57
Continental Aerial Photo	1/15/76	PC11	47, 48
Continental Aerial Photo	Jan 1980	SBD 15	37, 39
Continental Aerial Photo	12/30/86	F	86, 87
Continental Aerial Photo	5/25/90	C 81	9-3, 9-4
Continental Aerial Photo	7/11/95	C 115-27	94, 95
UC Santa Barbara	8/10/38	AXL-1938	79-95, 79-96
UC Santa Barbara	2/16/53	AXL-1953B	43k-32, 43k-31
UC Santa Barbara	8/11/68	AXL-1968	9JJ-46, 9JJ-47
Google Earth Imagery	10/1/95	N/A	N/A
Google Earth Imagery	5/28/02	N/A	N/A
Google Earth Imagery	10/5/05	N/A	N/A
Google Earth Imagery	4/12/07	N/A	N/A
Google Earth Imagery	6/19/09	N/A	N/A
Google Earth Imagery	3/9/11	N/A	N/A

FIGURES


EXPLANATION
PETRA GEOTECHNICAL, INC.
SITE LOCATION MAP
Figure 1

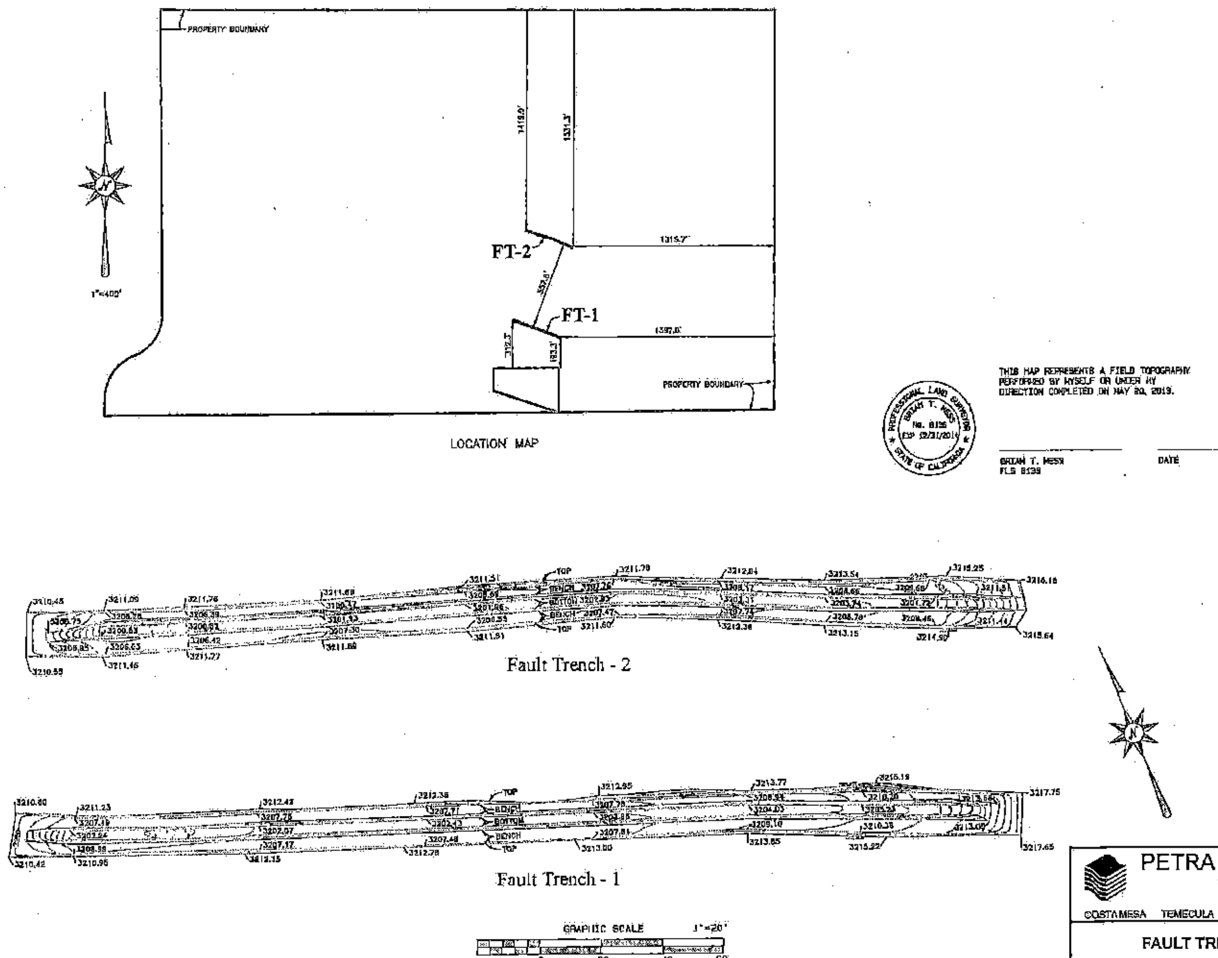


PETRA GEOTECHNICAL, INC.

GEOLOGIC MAP

Casa Blanca Ranch Project
Oak Glen Road
City of Yucaipa, Riverside County, California

DATE: June 2013	J.N.: 13-391	**Figure 2**
DWG BY: DLJ	SCALE: None	



PETRA GEOTECHNICAL, INC.
40880 County Center Drive, Suite R
Temecula, California 92591
Telephone: (951) 600-9271
COSTA MESA TEMECULA PALM DESERT SAN DIEGO SANTA CLARITA

FAULT TRENCH LOCATION MAP

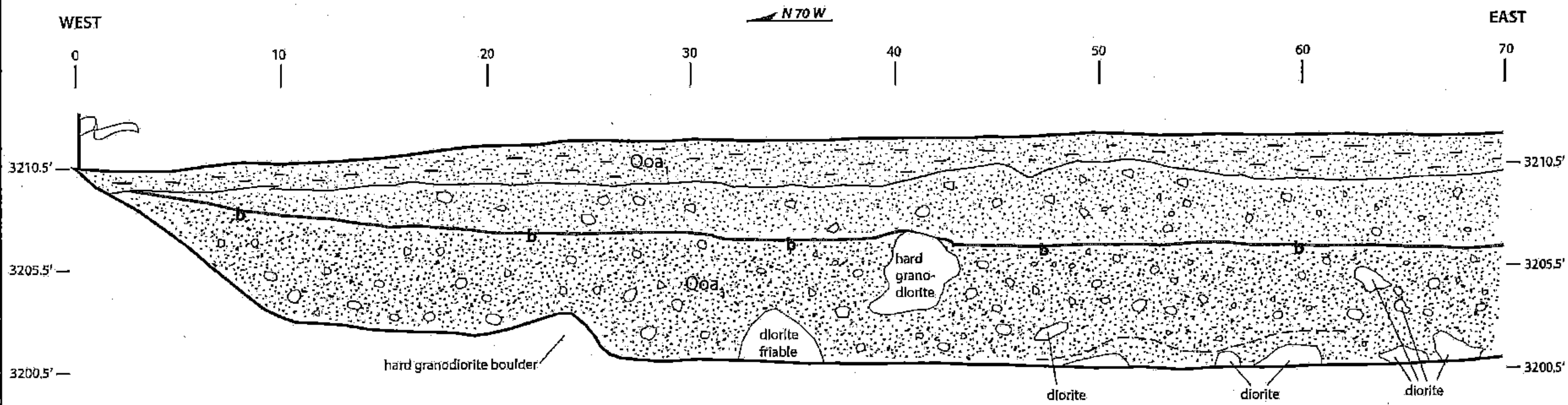
Casa Blanca Ranch Project
Oak Glen Road
City of Yucaipa, San Bernardino County, California

DATE: June 2013	J.N.: 12-291	**Figure 3**
DWG BY: DLJ	SCALE: N/A	

Reference: HDI, 2013, Casa Blanca Fault Trench Map

PLATES

PETRA



Horizontal and Vertical Scale: 1" = 5'

- - - Approximate debris flow contact.

b Bench

Afu - Pipe backfill, from locally reworked Qoa_1.

Qoa_1 - Silty, very fine Sand with Clay, dark brown (10YR 3/2), bioturbated, organics present, porous, minor ped development. Disturbed heavily in upper 1-foot and locally to 3 feet below surface. Loose and easily excavated.

Qoa_2 - Silty medium to fine Sand with scattered gravels, red brown (7.5YR 5/4), slightly porous, more dense than Qoa_1.

Qoa_3 - Sandy Gravel to gravelly Sand Matrix, yellow brown (10YR 6/3 - upper matrix to 7.5YR 6/6 - lower matrix), mostly matrix supported but locally clast supported. Primary debris flow units (fanglomerate). Areas where matrix supported show bituminous secondary laminate. Pockets of Alluvium. Show locally continuous "bedding". Clast supported areas contain more boulders and are massive.

NOTE: Individual boulders are mostly well-grussified diorites and weathered granodiorites. Boulders > 1' diameter are logged, whereas cobbles < 1' diameter are schmetically portrayed.

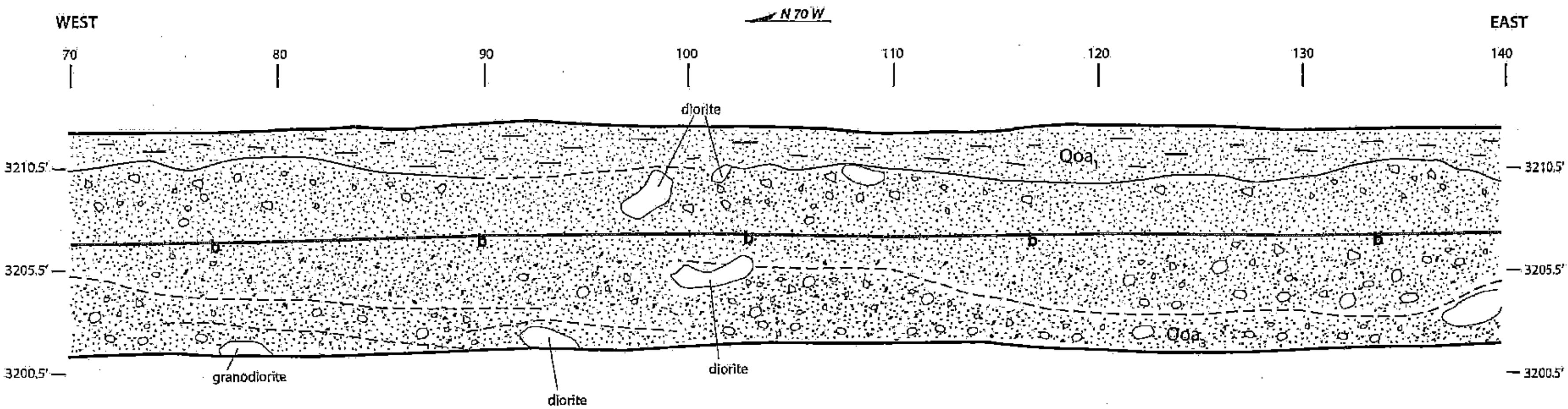
FAULT TRENCH 1

PETRA GEOTECHNICAL, INC.

JN 12-291 JUNE, 2013

Casa Blanca Ranch
City of Yucaipa

PLATE 1



Horizontal and Vertical Scale: 1"=5'

See Plate 1 for Explanation

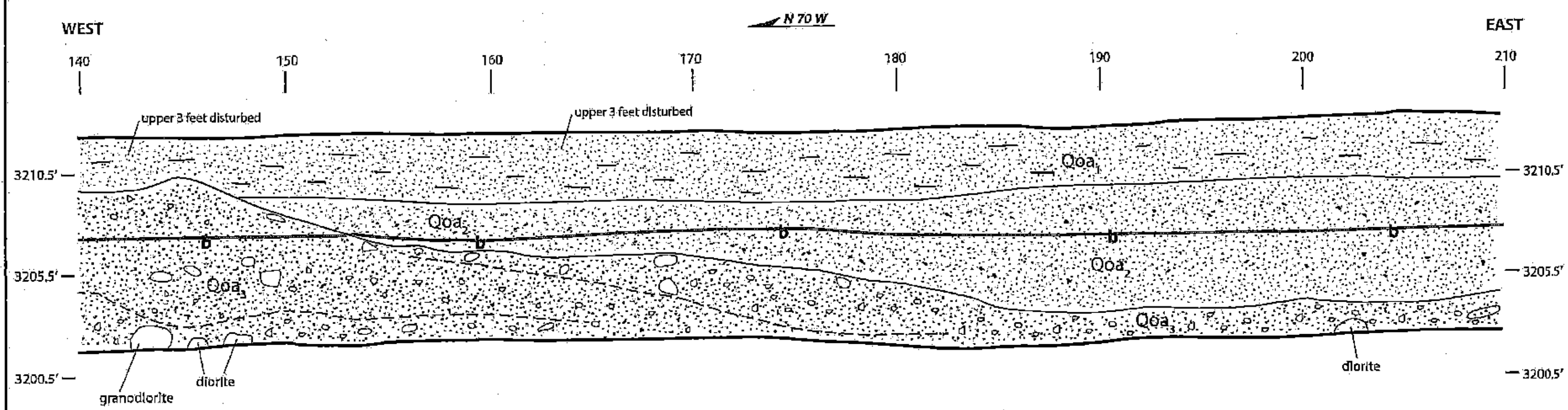
FAULT TRENCH 1

PETRA GEOTECHNICAL, INC.

JN 12-291 JUNE, 2013

Casa Blanca Ranch
City of Yucalpa

PLATE 2



Horizontal and Vertical Scale: 1" = 5'

See Plate 1 for Explanation

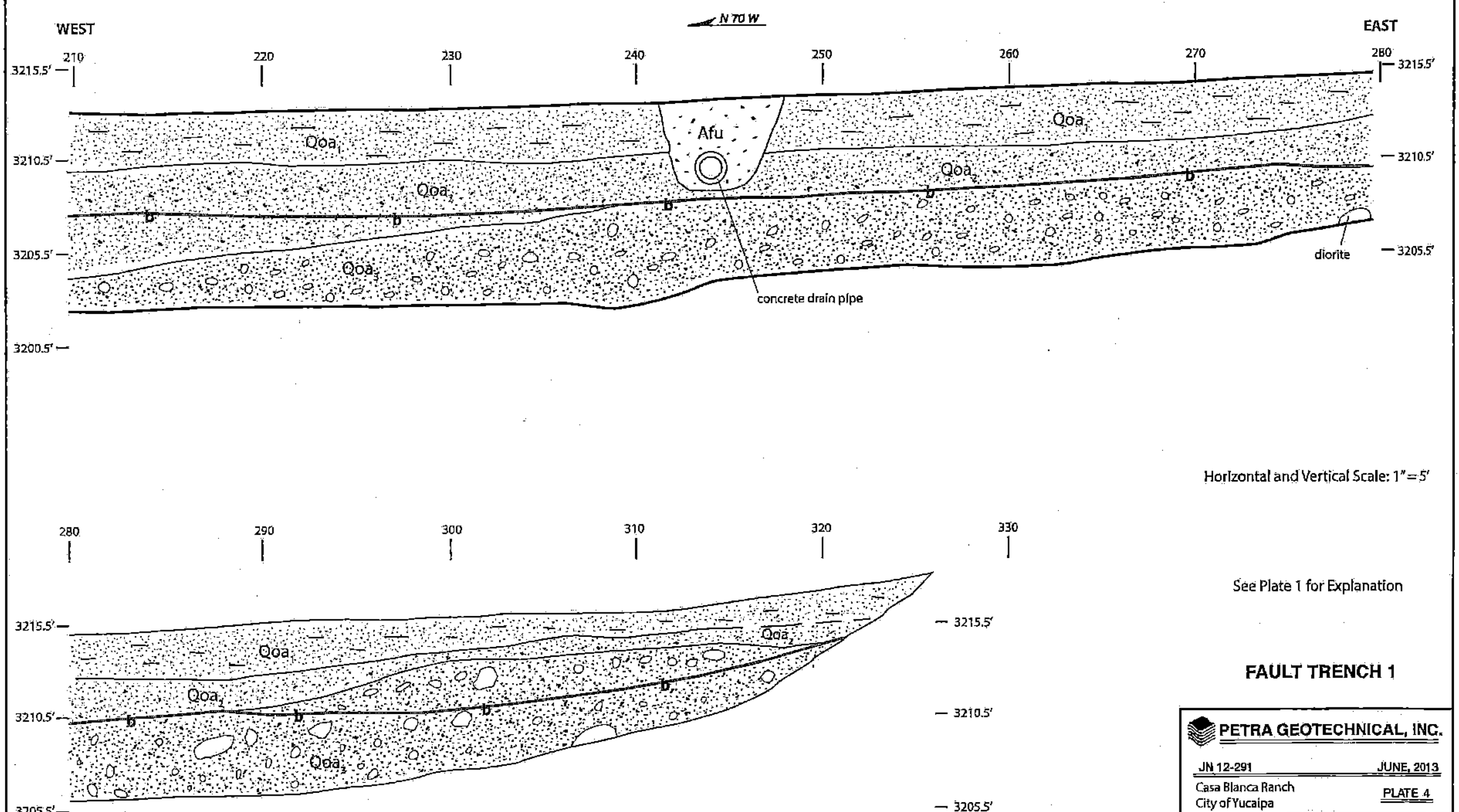
FAULT TRENCH 1

PETRA GEOTECHNICAL, INC.

JN 12-291 JUNE, 2013

Casa Blanca Ranch
City of Yucalpa

PLATE 3



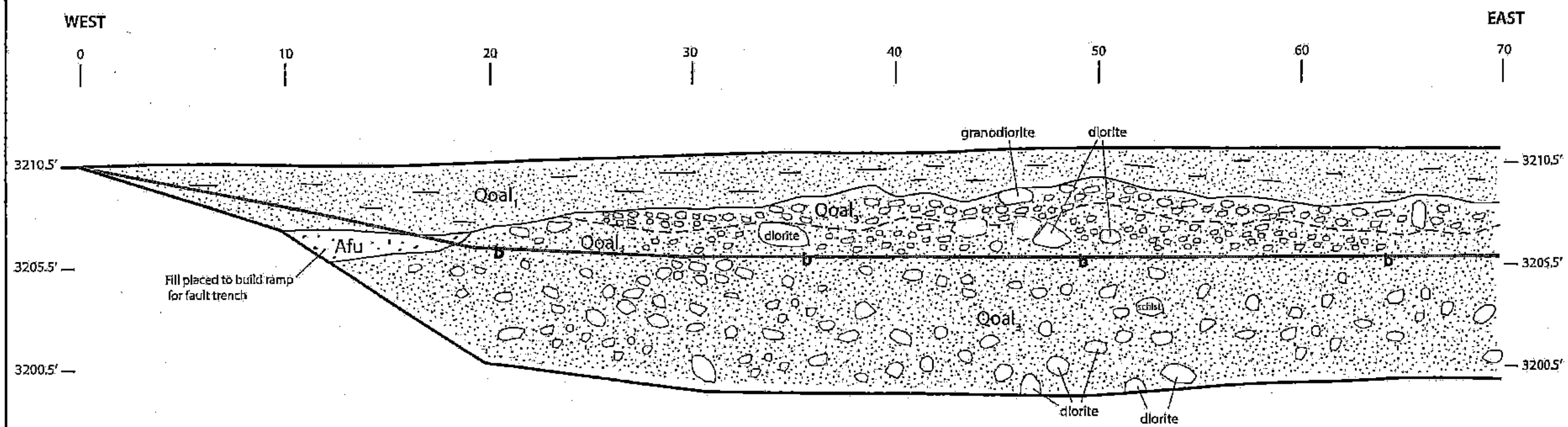
Horizontal and Vertical Scale: 1" = 5'

See Plate 1 for Explanation

FAULT TRENCH 1

PETRA GEOTECHNICAL, INC.

JN 12-291 JUNE, 2013
Casa Blanca Ranch
City of Yucaipa
PLATE 4



Horizontal and Vertical Scale: 1" = 5'

Approximate debris flow contact

b Bench

Afu - Ramp fill

$Qoal_1$ - Silty Sand with Clay and some Gravel. Dark grayish brown (10YR 5/4) to yellowish brown (10YR 3/2). Ocassional roots down to 4 feet. Porous and dry. Friable. Very coarse to no ped development.

$Qoal_2$ - Clayey Silty Sand, some Gravel, softer than Unit 1, more clay. Reddish brown (light) 7.5YR 5/4 to brown (7.5YR 3/3). No roots, porous, friable, softer than Unit 1. Dry, less porous than Unit 1.

$Qoal_3$ - Gravelly Sand, trace Silts. Secondary lamina structure (tiger strips). Softer than Unit 3, friable. Upper matrix (10YR 6/8) to brownish yellow (10YR 3/6). Lower matrix (7.5YR 6/6) to Reddish yellow (7.5YR 4/4). Cobble and boulder rich - large boulders 4'-6'. Debris flow origin.

NOTE: Individual boulders are mostly well-grussified diorites and weathered granodiorites. Boulders > 1' diameter are logged, whereas cobbles < 1' diameter are schmetically portrayed.

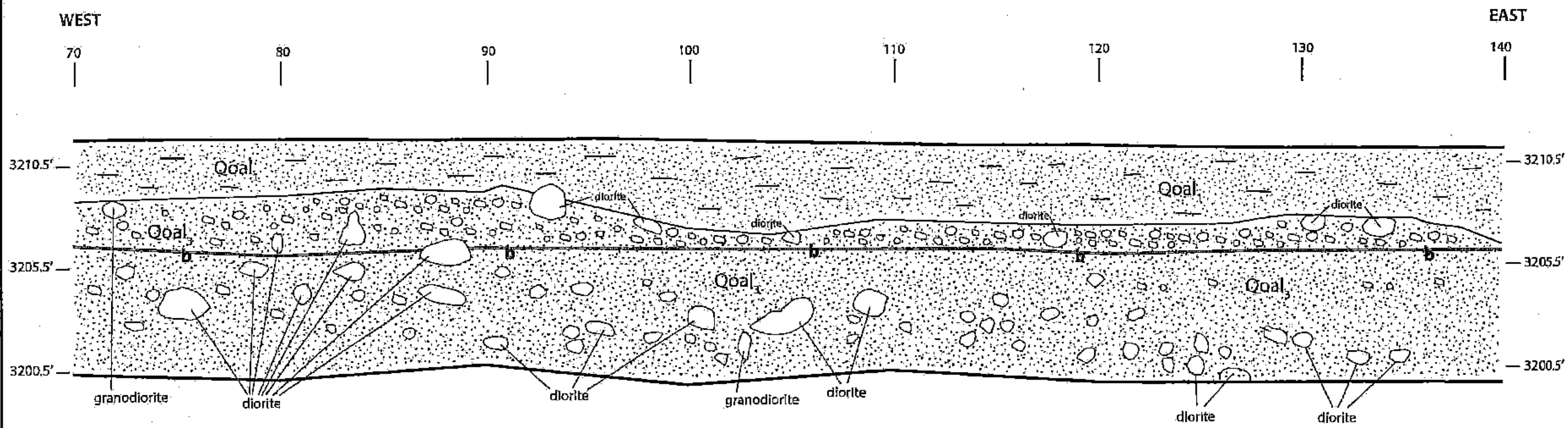
FAULT TRENCH 2

PETRA GEOTECHNICAL, INC.

JN 12-291 — JUNE, 2013

Casa Blanca Ranch
City of Yucaipa

PLATE 5



Horizontal and Vertical Scale: 1" = 5'

See Plate 5 for Explanation

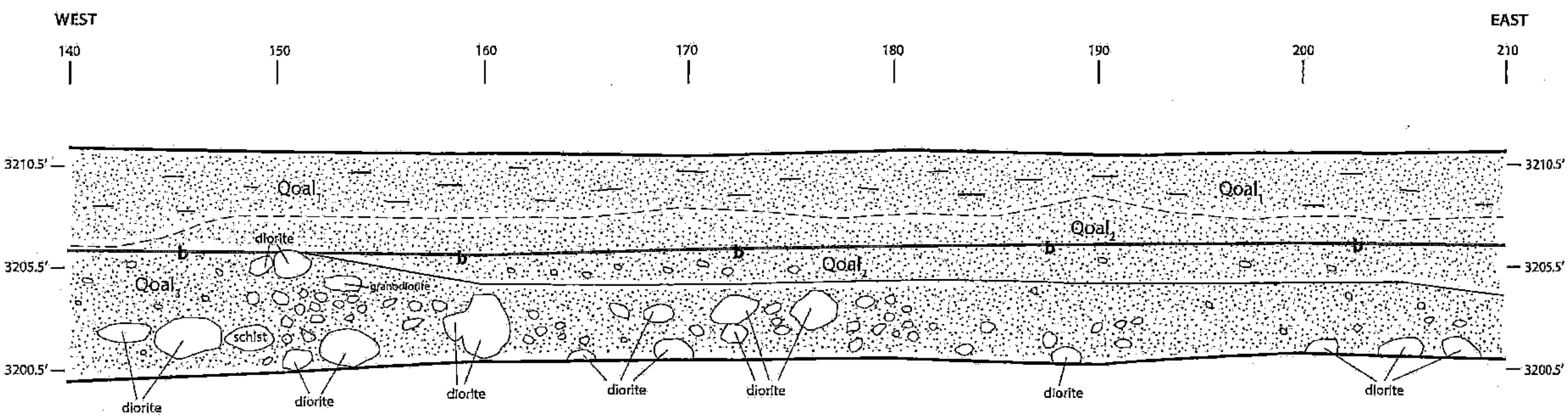
FAULT TRENCH 2

PETRA GEOTECHNICAL, INC.

JN 12-291 JUNE, 2013

Casa Blanca Ranch
City of Yucalpa

PLATE 6



Horizontal and Vertical Scale: 1″ = 5′

See Plate 5 for Explanation

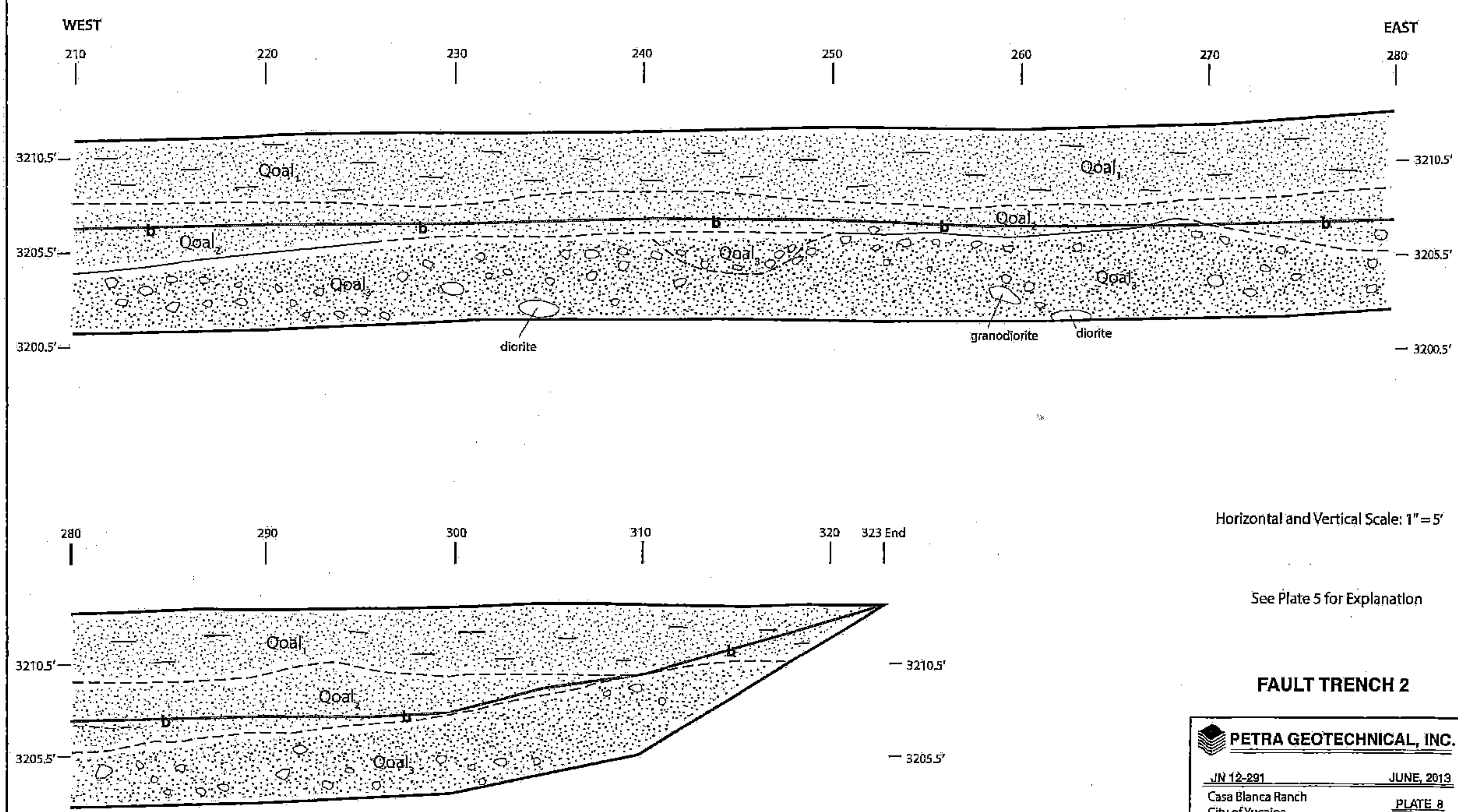
FAULT TRENCH 2

PETRA GEOTECHNICAL, INC.

JN 12-291 JUNE, 2013

Casa Blanca Ranch
City of Yucaipa

PLATE 7



Horizontal and Vertical Scale: 1" = 5'

See Plate 5 for Explanation

FAULT TRENCH 2

PETRA GEOTECHNICAL, INC.

JN 12-291 JUNE, 2013

Casa Blanca Ranch
City of Yucaipa

PLATE 8