GEOLOGIC REPORT
PROPOSED RESIDENTIAL INCLUSIONARY HOUSING DEVELOPMENT

Congress Road, Pebble Beach
Monterey County, California

29 April 2013

Project No. M10473

PEBBLE BEACH COMPANY
c/o Ms. Cheryl Burrell
P.O. Box 1767
Pebble Beach, California 93953

SUBJECT: Geologic Report

REFERENCE: Proposed Inclusionary Housing Development, Congress Road, Pebble Beach, Monterey County, CA. APN 008-041-009

Dear Ms. Burrell:

The following geologic report presents the results of our investigation of the site of a proposed Inclusionary Housing Development. This study was performed concurrently with a geotechnical report also prepared by Haro, Kasunich and Associates, Inc. for this project. The geologic and geotechnical reports should be reviewed in conjunction with one another.

Our report describes the geology of the site and its surrounding area, evaluates potential geologic hazards, and provides recommendations for mitigation of potential geologic hazards. We based our evaluation on a draft site plan for this project dated February 26, 2013 that was prepared by L and S Engineering and Surveying, Inc.

The chief findings of significance to the proposed Inclusionary Housing Development were the presence of minor gullying, cutslopes adjacent to Congress Road, and perched groundwater on portions of the property proposed for development.

Other than these issues, which can be mitigated, we see no geologic constraints which would preclude construction of the Inclusionary Housing Development provided that the recommendations contained in this report and in the

accompanying geotechnical engineering report being prepared by Haro, Kasunich and Associates are incorporated in the final plans, implemented during construction, and maintained for the lifetime of the proposed structures.

Sincerely,

Haro, Kasunich and Associates Inc.

Mark Foxx
Certified Engineering Geologist No. 1493

MF/mf
Attachments
Copies: 6 to Addressee
Pdf List : BurrellC@pebblebeach.com
Jeff Lorentz [Jeff@LandSengineers.com]

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INTRODUCTION

This report presents the results of our Geologic Investigation of a Proposed Inclusionary Housing Development in Pebble Beach, Monterey County, California. The site is located along the east side of Congress Road just north of SFB Morse Drive, just inside the SFB Morse Gate on Highway 68 (Figure 1). The Proposed Inclusionary Housing Development is located on gently sloping ground and is bordered by Sawmill Gulch to the south, Congress Drive to the west, and existing residential housing to the east.

The Proposed equestrian center will consist of 24 residences in four buildings and 12 detached carport/garage parking structures. Some of these structures may require short retaining walls.

The purpose of our investigation was to evaluate geologic conditions at the site, identify potential geologic hazards relative to the property, and provide recommendations for mitigation measures relative to potential geologic hazards.

This investigation consisted of: 1) a review of pertinent published and unpublished geologic literature including prior geologic reports from the vicinity that were prepared by Foxx, Nielsen and Associates and Haro Kasunich and Associates Inc., 2) field examination of the property in March 2013, 3) observation and geologic interpretation of exploratory borings drilled for this study in the area of the proposed structures, 4) discussions with the project geotechnical engineer, 5) preparation of a site geologic map, and 6) preparation of this report.

SITE CONDITIONS

The proposed Inclusionary Housing Development is located east of Congress Road just north of SFB Morse Drive near the SFB Morse Gate on Highway 68 (Figure 1). The site appears to be in a relatively natural state. Cutslopes 1 to 6 feet high exist along the edge of Congress Road. Sawmill Gulch is just south of the property.

The buildings, roads and parking areas for the proposed Inclusionary Housing Development will occupy a portion of the parcel roughly 140 by 600 feet in size (Plate 1). The land is gently sloping. There are moderately steep slopes adjacent to the west edge of the property within the Congress Road right of way parcel that were created by excavation during construction of Congress Road.

The property is lightly to moderately vegetated, chiefly with pine and oak trees. Unpaved paths or trails traverse the area. In places these trails have been rilled by surface water flow.

The erodible nature of the near surface earth materials makes good drainage control and erosion mitigation measures important. Development of the Inclusionary Housing should include implementation and maintenance of an erosion control plan.

SITE GEOLOGY

The proposed Inclusionary Housing Development site is situated in a relatively uncomplicated area relative to earth materials and structural geology according to the geologic maps of this area (Clark, Dupre and Rosenberg, 1997) and the subsurface work we conducted

A 1997 geologic map shows the distribution of Quaternary geologic units in the vicinity, predominantly dune deposits and terrace deposits of various age. The 1997 map by Clark, Dupre and Rosenberg shows older dune (Pleistocene age) deposits at the property. These consist of moderately well sorted silt and sand deposits which overly bedrock. This is consistent with our field observations.

A 1974 geologic map of the area shows the area of the proposed Inclusionary Housing Development underlain by Tertiary age Unnamed Sandstone (Clark and others, 1974). Our exploratory borings revealed that the site is underlain by granitic bedrock, mapped nearby as granodiorite by Clark and others. Granitic bedrock was found in two of our deeper exploratory borings that penetrated the sand cover. The sand ranges in color from orange-gray to white and is compositionally a coarse-grained silty sand. It is recognized by rounding of composite grains since it has a similar appearance to that of the weathered granitic rock.

The granitic basement rock is typically moderately to highly weathered so that it contains an appreciable amount of clay. The weathering has significantly weakened the rock and created an appearance and hardness similar to the local sandstone. Structurally, granodiorite bedrock probably underlies the entire site at some depth since it is basement rock. Granodiorite was encountered at a depth of 8 to 12 feet in the four borings where it was found. Perched groundwater was found overlying the granodiorite at depths from 5 to 13 feet.

LANDSLIDES AND GENERAL SLOPE STABILITY

The published geologic maps of this area do not show any landslides mapped on or near the property, and the natural slopes of the property are mostly gentle to moderately steep and densely vegetated. Our review of aerial photographs

dating back to 1945 did not reveal any indication of active landslides on the slopes at and around the area of the proposed development.

In our opinion, slope instability is a low potential geologic hazard at the site.

FAULTS and EARTHQUAKE HAZARDS

The property lies in a highly seismically-active region of California. A broad system of inter-related northwest-southeast trending strike-slip faults represents the boundary between the Pacific and North American crustal plates. For the past 15 million years (mid-Miocene) the Pacific plate has been slipping northwestward with respect to the North American plate (Atwater, 1970; Graham, 1978). The majority of movement has been taken up by the San Andreas fault itself, however, there are other faults within this broad system that have also experienced movement at one time or another.

The large faults of significance to the property include, but are not limited to, the San Gregorio-Sur-Hosgri fault zone, the San Andreas fault, and the Monterey Bay fault zone and its onland extensions that include the Tularcitos-Navy fault and the King City-Rinconada fault (Figure 3). These faults are either active or considered potentially active (see Buchanan-Banks and others, 1978; Jennings, 1975; Greene, 1977; Hall and others, 1974; Burkland and Assoc., 1975; Rosenberg and Clark, 1994). In addition, there are smaller active and potentially active faults near the property.

The chief fault of concern near the property is the active San Gregorio-Sur-Hosgri fault, the closest active fault to the property capable of generating a large magnitude earthquake. This active fault is located about 5 ½ miles offshore west of the property. The fault is recognized as one of the dominant faults in the coastal fault system along the Central California Coast. It probably generated the 1927-1928 earthquakes that occurred near Monterey (Mitchell, 1928). The sizes of these earthquakes were estimated at greater than Magnitude 6, and the ground shaking from them caused extensive damage to buildings in the Monterey Bay Area. The San Gregorio fault is considered capable of generating a Moment Magnitude earthquake on the order of 7.3 with a recurrence interval on the order of 400 years (Frankel and others, 1996). Such an earthquake would cause severe ground shaking at the subject property.

The Cypress Point fault is a northwest-trending oblique-slip fault that has been traced over four miles onland and extends northwestward beneath Monterey Bay (Clark, et. al., 1974). The submerged segment probably joins with the active San Gregorio fault zone which lies offshore and skirts the coastline. The mapped trace of the fault is located about 3000 feet southwest of the property (Figure 4). The fault is exposed on both the north and south sides of the Monterey Peninsula. The northern exposure is only a couple hundred feet west of Fan Shell Beach on Seventeen Mile Drive where it is wholly within granitic rock but

has broken and sheared the rock into a soft fault gouge 15 to 20 feet wide. The Cypress Point fault is probably capable of generating earthquakes in the 4-5 Magnitude range based on the short length of the fault (Burkland and Associates, 1975). Such earthquakes have a low potential for generating ground rupture but a high potential for generating severe ground shaking at close distances.

Rosenberg and others (1994) mapped several faults on the eastern side of the Monterey Peninsula, notably the Sylvan Thrust and the Hatton Canyon faults (Figure 5). They found evidence of Holocene age (past 11,000 years) movement, and therefore, classified these faults as active. These faults appear to have developed from compressional forces directed from south to north resulting in basement rock being thrust up and over the geologically younger Monterey Formation. They found no evidence that the faults continue to the northwest towards the property; however, they infer the projection of the dominant fault in this series of faults, the Hatton Canyon fault, to the northwest towards a fault identified by geophysical methods offshore (Greene, 1977) as shown in Figure 5. This inferred projection passes slightly south of the property. There is no existing geologic evidence to suggest a concern with faults passing through the property, and we saw evidence at the property that faults transect the property.

The San Andreas fault is one of the most active faults in the world; however at its closest point it is located about 29 miles northeast of the property. The San Andreas fault is divided into segments, each of which act differently in terms of the size of earthquakes that they generate (Sykes and Nishenko, 1984). The 95-mile long "Creeping Segment" of the fault is the closest to the property. This fault segment is not considered capable of generating large magnitude earthquakes because it is constantly "creeping" and releasing energy in small (Magnitude 1 to 3) earthquakes. The Southern Santa Cruz Mountains Segment is considered capable of generating Magnitude 7 earthquakes such as the Lorna Prieta Earthquake of 1989. However, this earthquake generated only minor to moderate ground shaking in the Monterey area. In general, the San Andreas does not appear to pose a significant threat of ground shaking at the property.

The Monterey Bay fault zone is six to nine miles wide and about 25 miles long. The fault zone extends into Monterey Bay where it probably melds with the San Gregorio fault. The fault zone intersects the coast in the vicinity of Seaside and Ford Ord. Several of the pertinent onshore faults are, from west to east, the Tularcitos-Navy, Chupines, and the King-City faults; the King City Fault probably represents the eastern extent of the Monterey Bay fault zone. This fault zone is recognized as potentially active. It is considered capable of generating Moment Magnitude earthquakes on the order of 7.1 to 7.3 with recurrence intervals ranging from 1700 to 2800 years. Although the recurrence interval seems very long, there is no information about when the last large magnitude earthquake

occurred on this fault zone. An earthquake on any of these faults could generate severe ground shaking at the property.

The foregoing discussion is intended to describe the significant faults and seismic sources near the property. It is also intended to illustrate the high potential for severe ground shaking from a future earthquake at the property. With respect to ground shaking at the property from an earthquake, it is our opinion that the most likely fault to generate such shaking in the lifetime of the dwelling is the San Gregorio fault located offshore. Ground motions at the property associated with an earthquake on this fault can be estimated by the geotechnical engineer as needed.

An additional potential seismically related hazard is liquefaction or settlement of the surficial soils on the property. The lower portion of the soils overlying the granite are saturated at times of the year, but have moderate density. If the geotechnical engineer determines it is necessary, this potential hazard can be mitigated by construction of foundations designed to mitigate damage in the event of liquefaction or settlement.

DRAINAGE AND EROSION HAZARDS

Erosion caused by concentrated runoff is a potential hazard at the property. The erosive force of flowing surface water is directly related to the volume and velocity of flow.

Erosion and gullying are a potential hazard due to the cohesionless nature of the surficial soils and the sparse density of trees and a lack of other vegetation, probably due to a lack of nutrients in the soil. Because of the erodible nature of the earth materials, good drainage control and erosion mitigation measures should be incorporated in the project plans. Development of the site should include implementation and maintenance of an erosion control and landscaping plan.

On-site drainage courses should be lined or surfaced with erosion resistant material to mitigate erosion. A detailed drainage and erosion control plan should be developed for the proposed development. We recommend that an engineering geologist review the plan prior to its finalization.

CONCLUSIONS

1. The proposed Inclusionary Housing Development site is located near the intersection of SFB Morse Drive and Congress Road in Pebble Beach.

2. Granitic basement rock is the bedrock underlying the property, and a thin layer of older dune sand overlies the bedrock and is exposed at the ground surface.

The granitic bedrock (granodiorite) is highly weathered below the dune sands. A perched water table exists on top of the granodiorite.

3. The near surface earth materials are erodible, and so good drainage and erosion control is appropriate to mitigate erosion hazards.

4. There are no landslides on the property, and there does not appear to be a significant landslide hazard at the property.

5. There are several active and potentially active faults within 30 miles of the property. The property will experience moderate to severe ground shaking during the next 30 years as the result of a large magnitude earthquake on the San Andreas fault, the San Gregorio fault, or one of the other active faults near the property.

6. Based upon the results of this study, there is low liquefaction potential in the soils on the property due to their composition and density.

RECOMMENDATIONS

1. A registered geotechnical engineer must conduct an analysis of the earth materials underlying the proposed building sites and provide foundation criteria.

2. Installation of subdrains may be required to reduce soil saturation and perched groundwater levels. Subdrains may be installed in advance of construction to avoid delays during project grading.

3. A detailed drainage and erosion control plan must be developed for the proposed project. Development of the site should include implementation and maintenance of the erosion control and landscaping plan. An engineering geologist should review the drainage plan prior to its finalization.

4. The buildings proposed for the proposed Inclusionary Housing Development should be designed to withstand significant seismic shaking in the event of a large magnitude earthquake on the San Gregorio-Sur-Hosgri fault zone. It is likely that the site will experience severe ground shaking in the next 30 years.

5. All areas where vegetation is stripped during construction should be re-vegetated with appropriate erosion resistant vegetation prior to the following rainy season.

6. We recommend that we be provided the opportunity for a general review of final design specifications and the drainage and erosion control plan. If we are not accorded the privilege of making the recommended reviews we can assume no responsibility for misinterpretation of our recommendations.

7. If any unexpected variations in soil conditions, or if any unanticipated geologic conditions are encountered during construction, or if the proposed project will differ from that discussed or illustrated in this report, we require that we be notified so supplemental recommendations can be given.

INVESTIGATION LIMITATIONS

1. The conclusions and recommendation noted in this report are based on probability and in no way imply the site will not possibly be subjected to ground failure or seismic shaking so intense that structures will be severely damaged or destroyed.

2. This report is issued with the understanding that it is the duty and responsibility of the owner(s), or their representatives or agents, to ensure that the recommendations contained in this report are brought to the attention of the architect and engineer for the project, incorporated into the plans and specifications, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. If any unexpected variations in soil conditions, or if any undesirable conditions are encountered during construction, or if the proposed construction will differ from that planned at the present time, Haro Kasunich and Associates Inc. should be notified so that supplemental recommendations can be given.

4. We recommend that our firm be provided the opportunity for a general review of the final design and specifications in order that our recommendations may be properly interpreted and implemented in the design and specification. If our firm is not accorded the privilege of making the recommended review, we can assume no responsibility for misinterpretation of our recommendations.

5. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or partially, by changes outside our control. Therefore, this report should not be relied upon after a period of three years without being reviewed by an engineering geologist.

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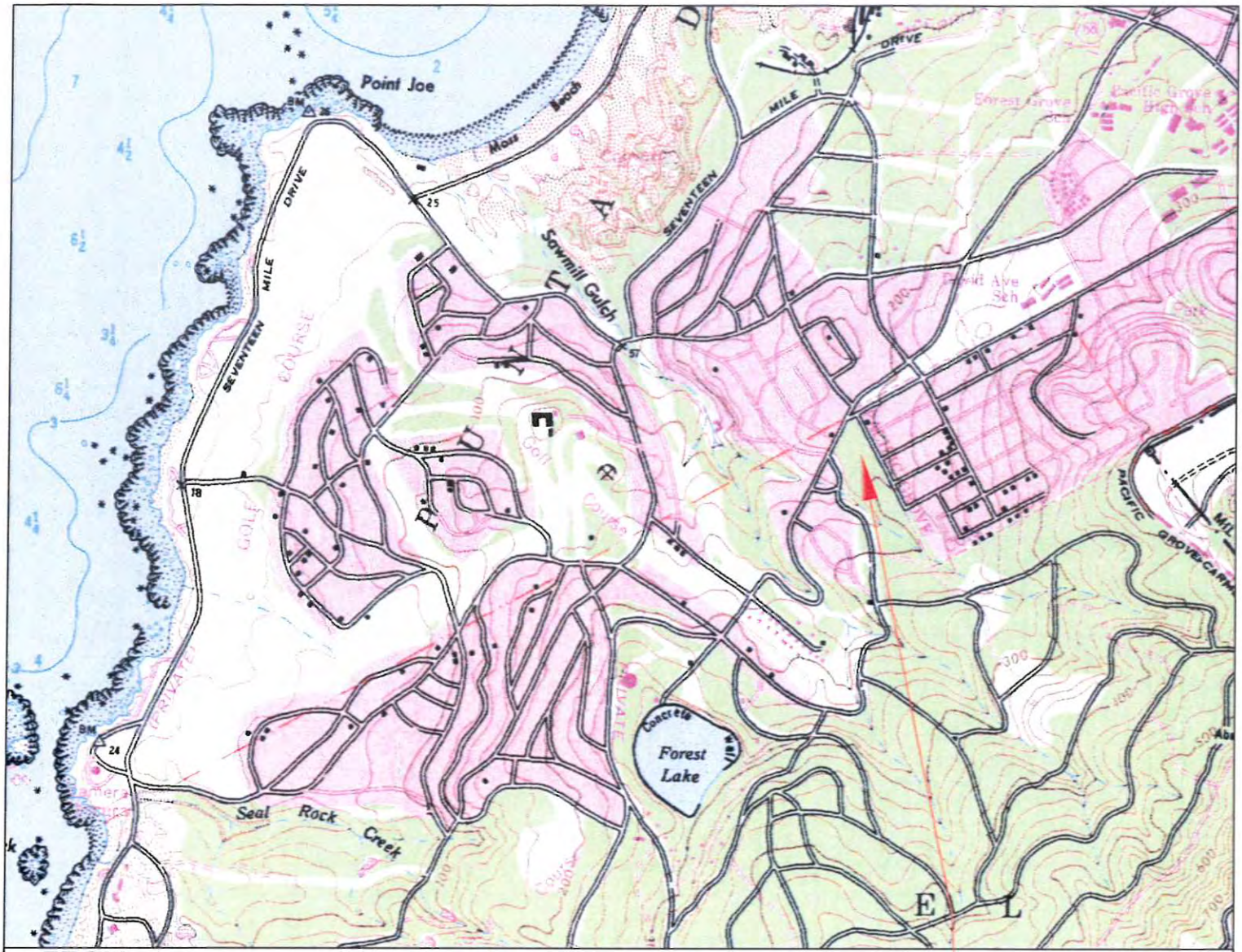


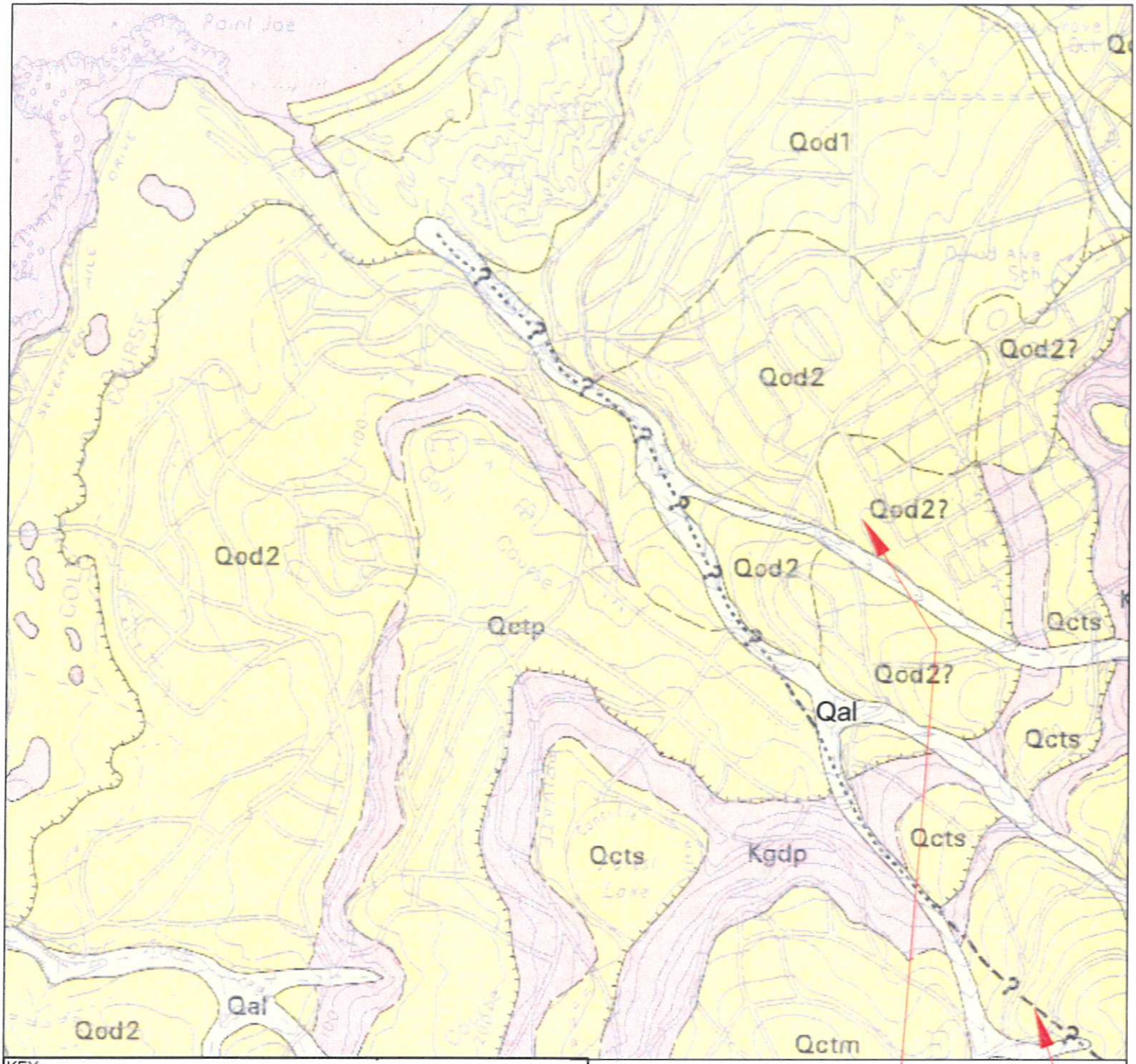
FROM:
USGS Monterey Topographic Quadrangle
40 ft. contour interval

SITE VICINITY MAP
Area D Subdivision
Pebble Beach, California

SCALE: 1:24,000 (1" = 2,000')	
DRAWN BY: JD	
DATE: April 2013	HARO, KASUNICH & ASSOCIATES, INC.
REVISED:	GEOTECHNICAL AND COASTAL ENGINEERS
JOB NO. M10473	116 E. LAKE AVENUE, WATSONVILLE, CA 95076
	(831) 722-4175

FIGURE NO. 1

SHEET NO.



KEY:

Qod **Older coastal dunes (Pleistocene)**—Weakly consolidated, well-sorted, fine-to medium-grained sand. Some geologic deposits are covered with a thin veneer of eolian deposits. In some areas, this is indicated by a subscript (e) following the symbol for the geologic unit overlain by the eolian deposits. Locally divided into:

Qod_1 **Younger dune deposits (Pleistocene)**—Weakly consolidated, well-sorted, fine- to medium-grained sand deposited in an extensive coastal dune field. Age of unit is middle(?) Wisconsinan

Qod_2 **Older dune deposits (Pleistocene)**—Weakly to moderately consolidated, moderately well-sorted silt and sand deposited in extensive coastal dune fields. Age of unit is early(?) Wisconsinan

Qct **Coastal terrace deposits, undivided (Pleistocene)**—Semiconsolidated, moderately well-sorted marine sand containing thin, discontinuous gravel-rich layers. Locally divided into:

Qcto **Ocean View coastal terrace (Pleistocene)**

Qctl **Lighthouse coastal terrace (Pleistocene)**

Qctp **Peninsula College coastal terrace (Pleistocene)**

Qcts **Sylvan coastal terrace (Pleistocene)**

Qal **Alluvial deposits, undivided (Holocene)**—Unconsolidated, heterogeneous, moderately sorted silt and sand with discontinuous lenses of clay and silty clay

Kgdp **Porphyritic granodiorite of Monterey of Ross (1976) (Cretaceous)**

FROM:
GEOLOGIC MAP OF THE MONTEREY AND SEASIDE 7.5-MINUTE QUADRANGLES, MONTEREY COUNTY, CALIFORNIA: A DIGITAL DATABASE

By

Joseph C. Clark, William R. Dupre', and Lewis I. Rosenberg

1997

REGIONAL GEOLOGIC MAP
Area D Subdivision
Pebble Beach, California

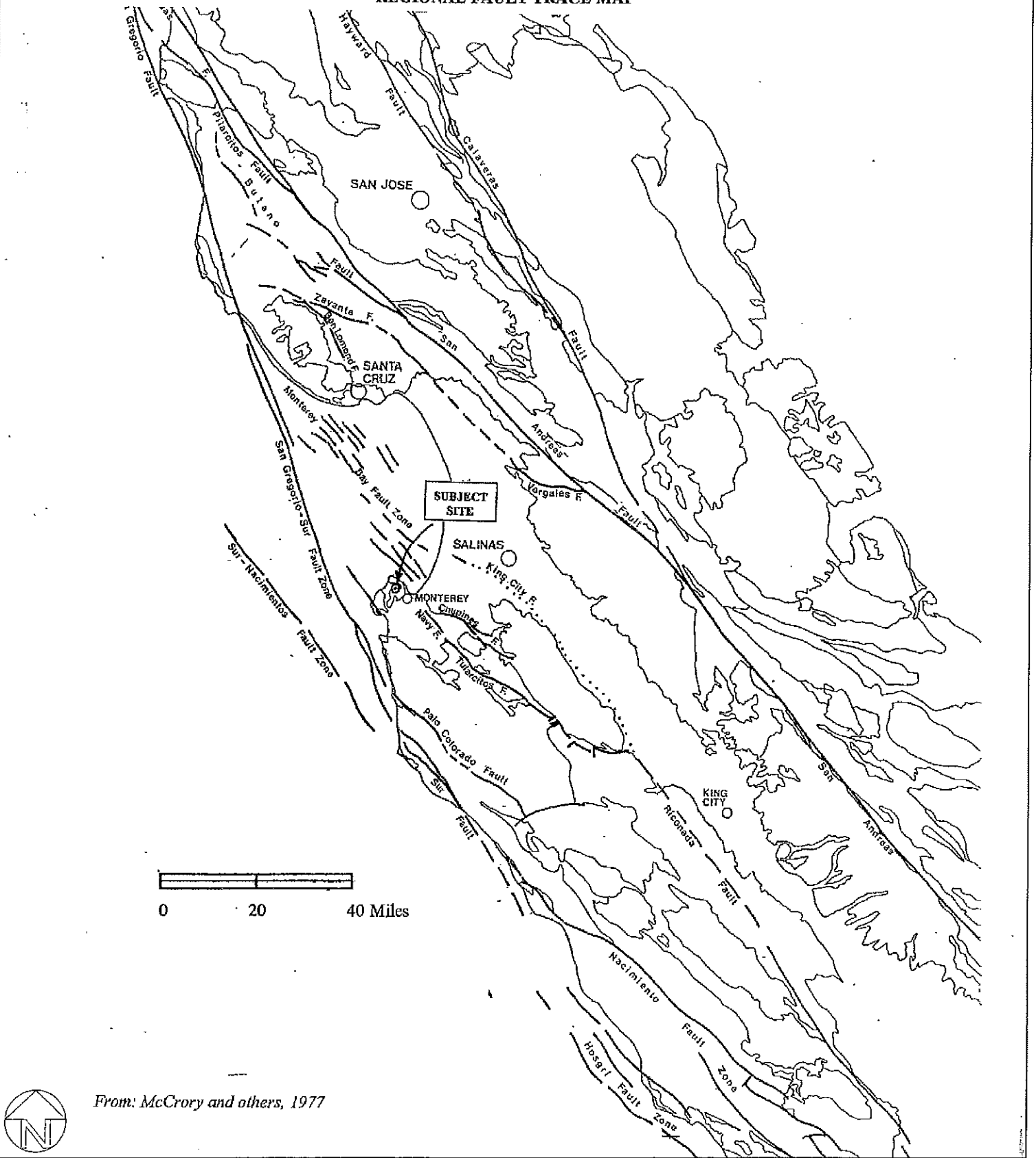
SCALE:	NOT TO SCALE
DRAWN BY:	JD
DATE:	April 2013
REVISED:	
JOB NO.	M10473

HARO, KASUNICH & ASSOCIATES, INC.
GEOTECHNICAL AND COASTAL ENGINEERS
116 E. LAKE AVENUE, WATSONVILLE, CA 95076
(831) 722-4175

FIGURE NO. 2

SHEET NO.

REGIONAL FAULT TRACE MAP



From: McCrory and others, 1977

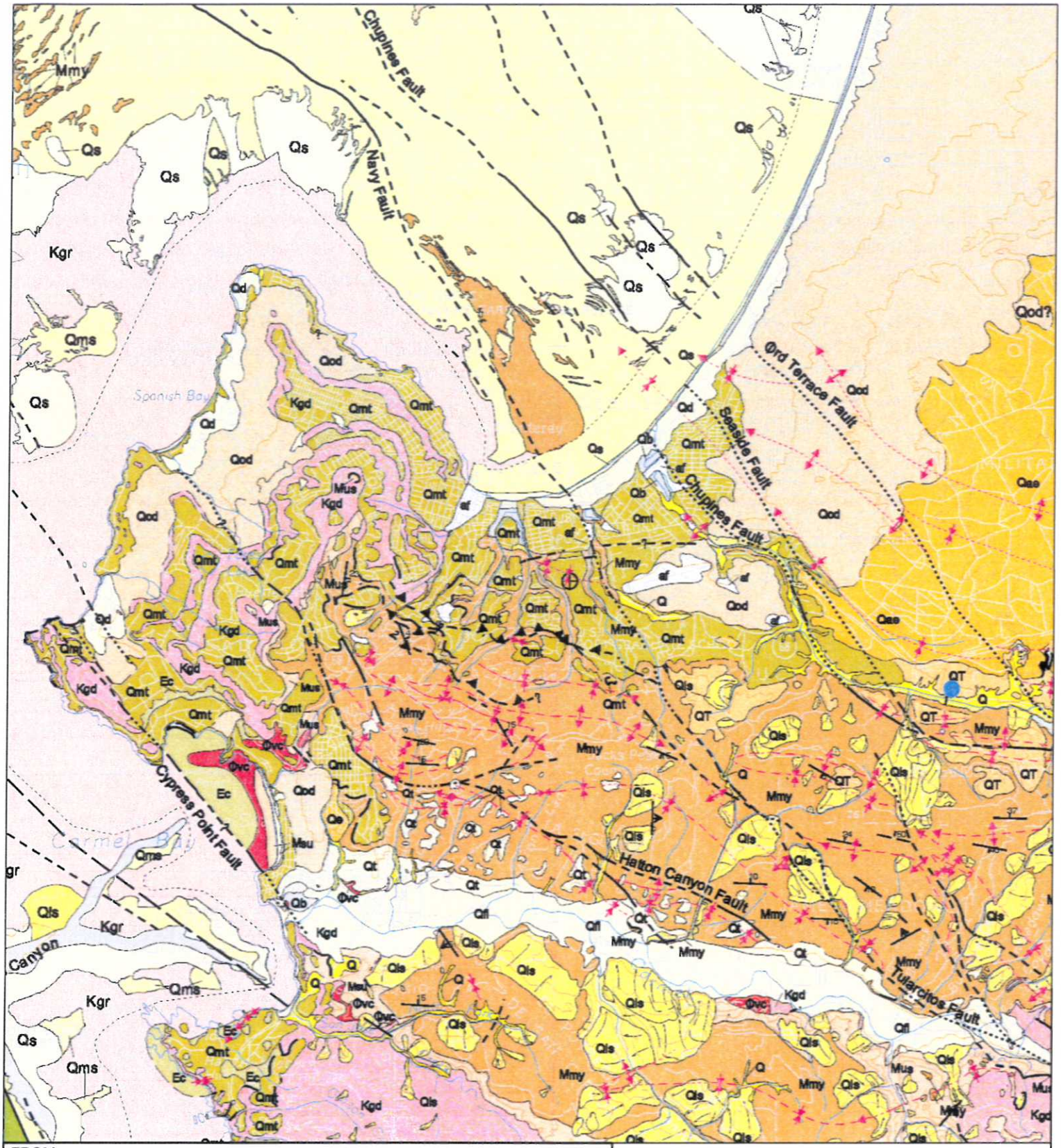
REGIONAL FAULT TRACE MAP

Area D Subdivision
Pebble Beach, California

SCALE: AS SHOWN	
DRAWN BY: JD	
DATE: April 2013	HARO, KASUNICH & ASSOCIATES, INC.
REVISED:	GEOTECHNICAL AND COASTAL ENGINEERS
JOB NO. M10473	116 E. LAKE AVENUE, WATSONVILLE, CA 95076 (831) 722-4175

FIGURE NO. 3

SHEET NO.



FROM:

GEOLOGIC MAP OF THE MONTEREY 30'x60' QUADRANGLE AND ADJACENT AREAS, CALIFORNIA

Compiled by

David L. Wagner[1], H. Gary Greene[2], George J. Saucedo[1] and Cynthia L. Pridmore[1]

2002

Digitized by

Sarah E. Watkins[1], Jason D. Little[1], and Joseph J. Bizzarro[2]

1. Department of Conservation, California Geological Survey
2. Moss Landing Marine Laboratories and Monterey Bay Aquarium Research Institute

REGIONAL FAULT MAP

Area D Subdivision

Pebble Beach, California

SCALE:	NOT TO SCALE
DRAWN BY:	JD
DATE:	April 2013
REVISED:	
JOB NO.	M10473

HARO, KASUNICH & ASSOCIATES, INC.

GEOTECHNICAL AND COASTAL ENGINEERS

116 E. LAKE AVENUE, WATSONVILLE, CA 95076

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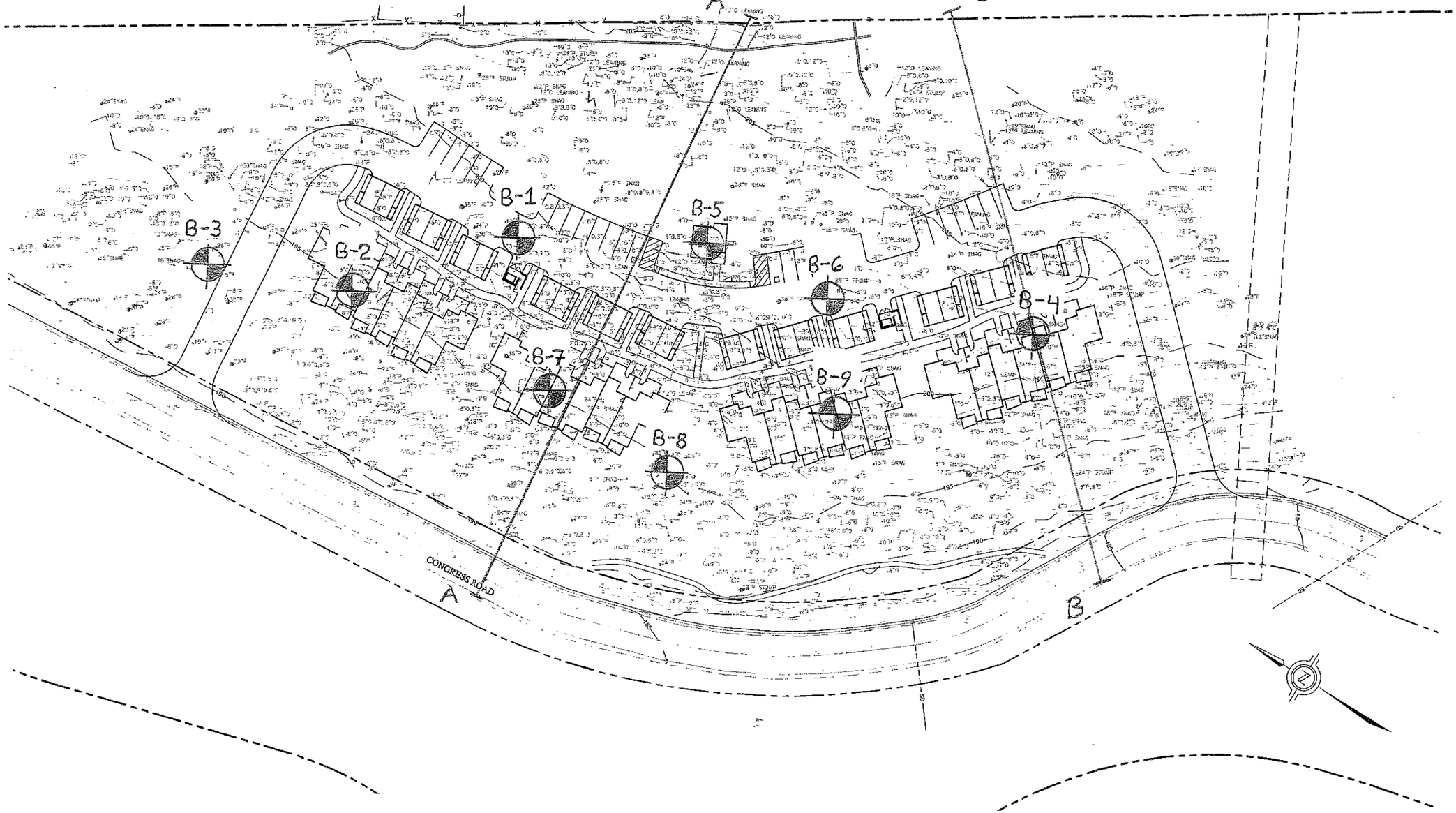
FIGURE NO. 4

SHEET NO.

GEOLOGIC
CROSS SECTIONS



NOTES:

B-1 EXPLORATORY BORING LOCATION

BASE MAP BY L&S ENGINEERING AND SURVEYING INC. DATED 2-26-13

BORING SITE PLAN
Area D - Del Monte Forest Plan
Congress Road
Pebble Beach, Monterey County, California

SCALE: 1"=70' (approximate)	APN 008-041-009
DRAWN BY: BILL S.	
DATE: 4-3-13	HARO, KASUNICH & ASSOCIATES, INC.
REVISED:	GEOTECHNICAL AND COASTAL ENGINEERS
JOB NO: M10473	116 E. LAKE AVENUE, WATSONVILLE, CA 95076 (831) 722-4175

PLATE 1

PLATE 2

GEOLOGIC CROSS SECTION A

1" = 30 FT.

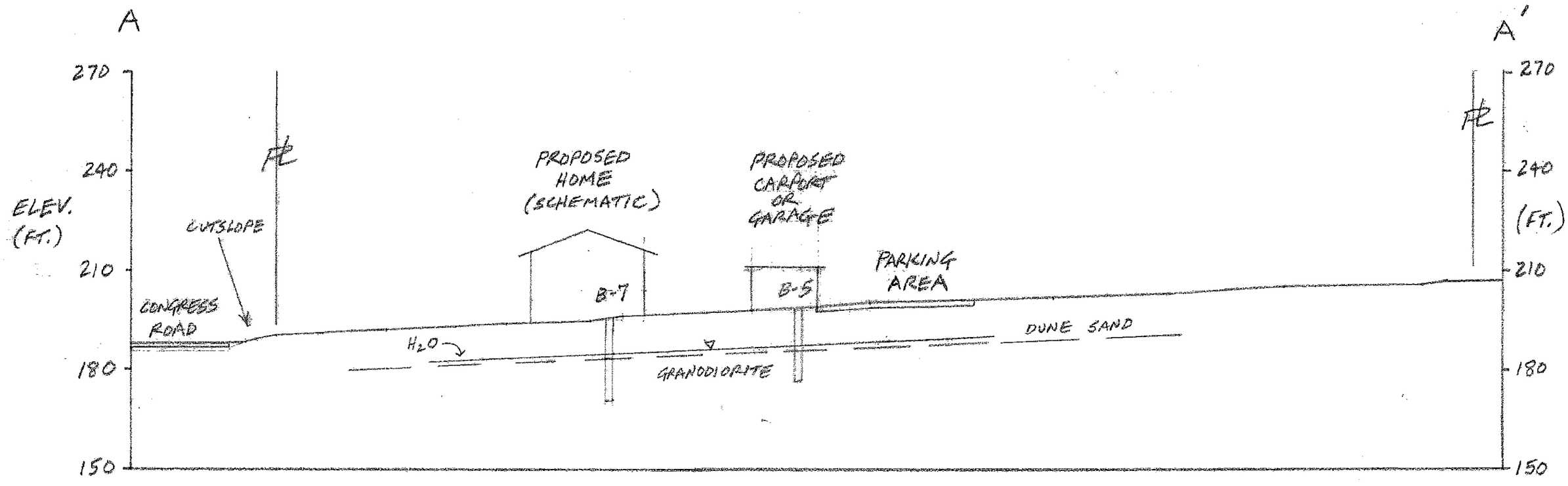


PLATE 3

GEOLOGIC CROSS SECTION B

1" = 30 FT.