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July 22, 2011

Monterey Peninsula Water Management District
 Attn: Henrietta Stern
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Subject: *September Ranch Subdivision Project, APN: 015-171-010, -012 & 015-361-013, -014*

As per the request of Monterey Peninsula Water Management District and September Ranch Partners (SRP), Bierman Hydrogeologic (BHgl) has prepared a brief summary of the September Ranch Aquifer (SRA) Depositional Environment.

It should be noted that the geology of the Carmel Valley was first described in Lawson (1893) which demonstrated the influence of faulting on the topography of the area. Beal (1915) and Galliher (1930) described the regional stratigraphy and bedrock geologic structure of the Monterey area¹. Tertiary stratigraphy and lithology presented in this summary of the SRA Depositional Environment are referenced from previous geologic characterization and mapping from Bowen (1965, 1969a, 1969b) and Brown (1962). Clark (1974) completed additional geologic mapping which suggested that several faults in Carmel Valley were potentially active. Quaternary mapping by Dupre' (1980 to 1985 and 1990b), unpublished mapping by Clark (1984-1995), Rosenberg (1993), Clark and Rosenberg (1994), and Clark, Dupre', Rosenberg (1997²) indicate that Holocene and Pleistocene strike-slip faulting and thrust faulting in Carmel Valley has occurred, including the Hatton Canyon fault that crosses September Ranch¹.

In addition, since numerous geologic and hydrogeologic investigations have been completed for the September Ranch Property since the early 1990s³, this summary of SRA Depositional Environment is based on the conclusions of the previous reports/data and is herein interpreted and summarized by BHgl.

Site Geology:

Geologic Map (Figure 1) shows the wells associated with the SRA and an overview of the regional geology. Although the Geologic Map shows the September Ranch to be underlain by Quaternary Terrace (Qt) deposits, for this summary, the Terrace deposits have been divided into, subunits consisting of colluvium - Qcol (Todd, 1992; Geoconsultants 1996; Kleinfelder, 2003), an older, primary water bearing alluvium unit; -Qoa₁ and an older, lower permeability alluvium unit; - Qoa₂ (Todd, 1997). All of these units overlie the Monterey Shale (Tm) and are shown as Qt on the attached geologic cross sections (A-A', B-B', C-C', D-D', E-E' and Site Geologic Map showing lines of section, Kleinfelder, 2003). Although these geologic cross-section groups the units as Quaternary Terrace deposits, Geologic Cross Section C-C' from Todd (1996-attached)

¹ Kleinfelder, 2003.

² Monterey and Seaside 7.5-minute Quadrangle, Monterey, CA, a digital database, Clark, Dupre', Rosenberg, 1997

³ Geoconsultants, Inc (1981, 1995), Todd (1985, 1993, 1995, 1996), Terratech, Inc (1995), Kleinfelder, Inc. (2003), and Kennedy/Jenks Consultants (2004, 2006).

shows each of the units described above (Qcol, Qoa₁, Qoa₂, Tm) their approximate thicknesses and their hydrogeologic relation to each other. A summary of how these units were deposited is discussed below.

September Ranch Depositional Environment:

Monterey Formation: The Monterey Formation generally consists of three sedimentary units consisting of mudstone and siltstone interbeds that were deposited from middle to late Miocene Period (24 million years ago) in a deep marine to a shallowing marine environment. The lower two units of the Monterey Formation (based on microscopic lifeforms of forams/diatoms) were deposited in a deep sea marine environment, while the sediments in the upper unit were generally deposited in a shallowing marine environment as a result of tectonic uplifting and sea level regression.

As sea level dropped and tectonic activity and continental uplift continued through Pliocene to Pleistocene (5 million to 10,000 years ago), the Areas Mountains were formed along with mass landslides associated with the formation of tributaries, streams and rivers. As tectonic activity and weathering continued these tributaries and streams formed the Carmel River, which started cutting through, and forming channels (as depicted on attached Geologic Cross Section C-C' from Todd, 1996) in the Monterey Formation as the river meandered across the valley floor to the Pacific Ocean.

Quaternary Terrace Deposits (Qt), herein referenced as Older Alluvium Deposits (Qoa₁/Qoa₂): During the end of the Pleistocene and the beginning of the Holocene (10,000 years ago) it is interpreted⁴ a large landslide on the south side of Carmel Valley (Geologic Map, Figure 1) closed off the valley floor and Carmel River for a period of time. During this period of closure, while sea level regression and tectonic activity continued, the Carmel River likely rose and meandered behind the landslide which created the undifferentiated Terrace deposits (Qt) further east of September Ranch. Eventually the Carmel River breached the landslide (likely at the toe of the landslide) and a new meandering channel between the "Monterey Formation Knoll" west of September Ranch, and the Monterey Formation "Bank" on the northeastern side of September Ranch was formed (Geologic Map, Figure 1). During the period the Carmel River was flowing in this orientation, fluvial sediments (Qoa₁, Qoa₂) were deposited in this channel carried from further up-gradient sources.

These sediments consists of weakly consolidated to semiconsolidated, weakly to moderately cemented, moderately to poorly sorted, fine-to-coarse grained silty sand with pebble and cobble gravels to depths of 175-feet below ground surface (bgs)⁵. These sediments are the Qoa₁ and Qoa₂ units that make-up the SRA. Although the upper and lower units are comprised mainly of the same sediments, the lower unit (Qoa₂) contains slightly more finely grained material and is more compressed/cemented resulting in a less permeable unit than that of the upper Qoa₁ unit. The difference in permeability is perhaps due to a lower energy fluvial environment during the deposition of Qoa₂, and/or, a relic of landslide deposits which were never completely eroded after the river breached the landslide.

Colluvium (Qcol): With time, and continued faulting, the Carmel River meandered south, south westward around the south side of the Monterey Formation "Knoll" to its current position and formed the Carmel Valley Alluvial Aquifer (CVAA) and the September Ranch channel was

⁴ Todd, 1992 as noted in Kleinfelder, 2003 Report.

⁵ Todd, 1996

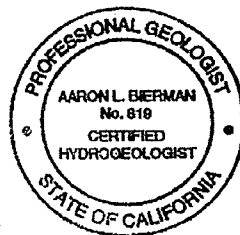
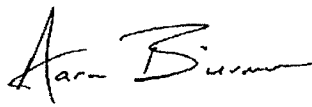
abandoned. However, the SRA continued to receive deposition of sediments in the form of colluviums which is loose, heterogeneous mixture of silt, sand, and angular to subangular gravel fragments deposited by small landslides or slope failure at the base of steep slopes or cliffs. These sediments comprise approximately the upper 55 feet of the SRA (Todd, 1992, 1997) and are generally an unsaturated, non-water-bearing unit.

Conclusion:

The September Ranch Aquifer has been reported to be bounded on the north and northeast by the outcropping of the Monterey Shale which was uplifted by the Hatton Canyon Fault (Kleinfelder, 2003; Kennedy Jenks Consultants, 2006) with subsequent fluvial erosion. The September Ranch is bounded on the south and southwest by the outcropping of the Monterey Formation "Knoll" and its associated subsurface ridge as delineated by Vertical Electrical Soundings (VES)⁶. This subsurface ridge is interpreted to be the former western fluvial channel bank caused by uplift and fluvial erosion. The September Ranch is bounded on the east by additional Monterey Shale outcrops as a result of the historical meandering river. There is no evidence currently known to suggest that the Hatton Canyon Fault serves as a hydraulic barrier or contributor to groundwater flow, or, to influence groundwater resources in the SRA, or, influence the SRAs hydrogeologic connectivity with the CVAA (Kleinfelder, 2003).

Based on review of all data and reports associated with September Ranch, it is BHgl interpretation that the subsurface ridge of Monterey Shale and the SRA as delineated by VES data, geologic mapping and subsurface investigations, is a product of both faulting and fluvial erosion. Such that, the SRA was down-dropped relative to its north and south sides, while, concurrently, mass landslides and fluvial sedimentation was occurring, thereby creating a semi-isolated barrier between the SRA and the CVAA.

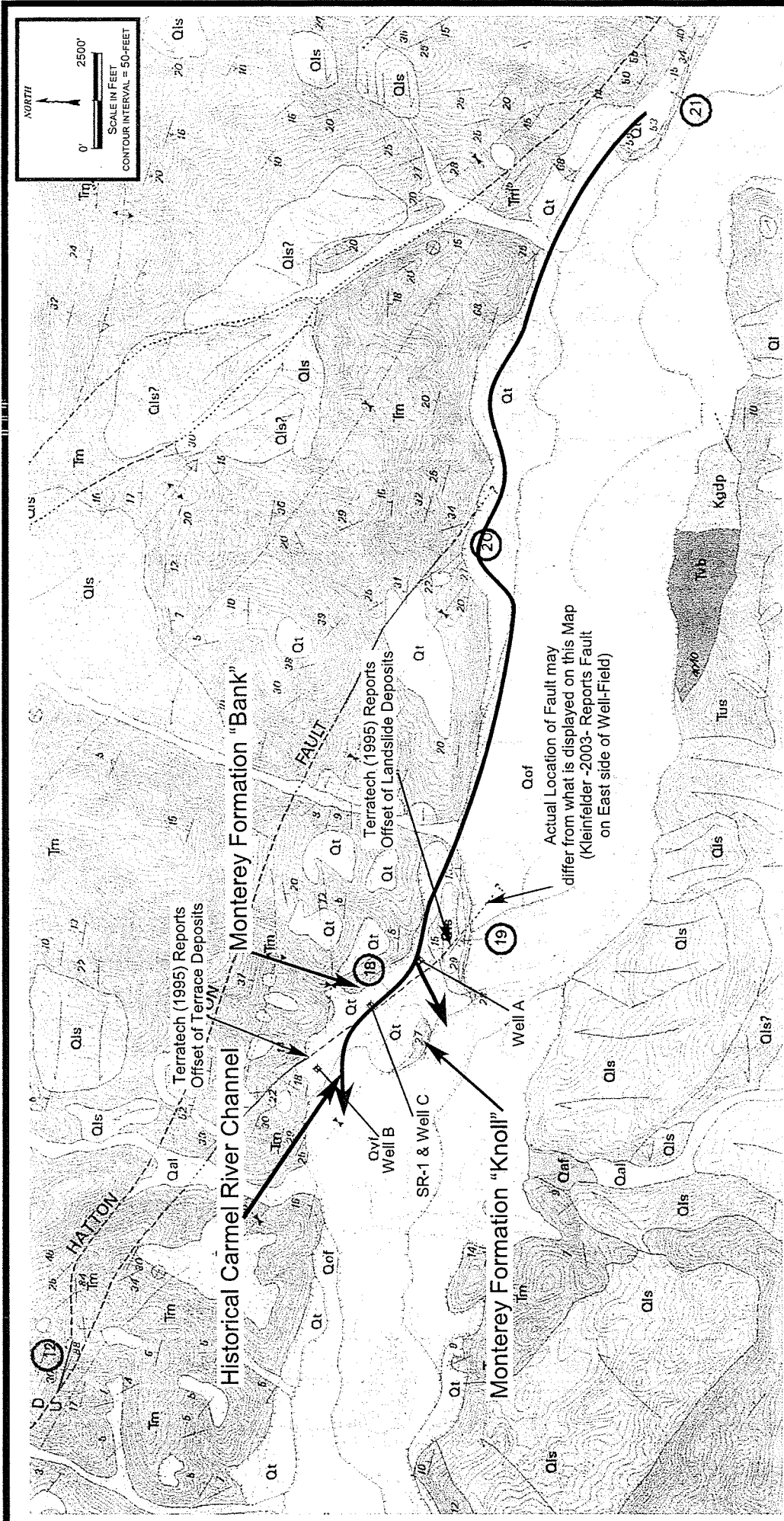
In summary, due to historic tectonic activity and geomorphology of Carmel Valley, the SRA has been determined to be semi-isolated from that of CVAA, and therefore, less than significant impacts to the CVAA have been determined⁷. This concludes our summary of the depositional environment for the SRA.



Aaron Bierman
Certified Hydrogeologist #819

⁶ Todd, 1997.

⁷ Monterey County Board of Supervisors, Resolution No. 10-312, November 9, 2010.



NOTES:
 Base Map from Geologic Map of the Monterey and Seaside 7.5 Minute Quadrangle, Monterey County, California: A Digital Database
 Compiled by: Joseph C. Clark, William R. Dupre and Lewis I. Rosenberg, 1997



GEOLOGIC MAP
 September Ranch Subdivision
 APNs: 015-171-010, 012 & 015-361-013, -014
 Monterey County, California

FIGURE
1
 By: A. Birman, 7/11/11
 Sept.Ranch\Figure1\GeologicMap.cvx



Source: Compiled on U.S. Geologic Survey topographic quadrangle from Clark and others (1997), Terratech, Inc. (December 2002), and Kleinfelder field reconnaissance.

Well Id. Nos

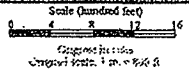
- 1b Well B (Todd, May 1993)
- 2c Old Hazton well (Todd, May 1993)
- 2a Well C (Todd, May 1993)
- 3a Well A (Todd, May 1993)
- 4 Stein well
- 5 Taranino well
- 6 Campisi well
- 7 Hahn well
- 8 Chaplin well
- 9 Ash well
- 10 Avila well
- 11 Stewart well

Geologic Units

Qal	Alluvial deposits (Holocene)
Qt	Young Terrace deposits (Quaternary)
Qt	Older Terrace deposits (Quaternary)
Qls	Landslide deposits (Quaternary)
Tm	Monterey Formation (Miocene)

Map Symbols

- September Ranch Property Line
- Line of Cross Section (Shown on Plate x)
- Geologic contact, approximately located
- Fault, dashed where approximate, dotted beneath younger unbroken material, queried where uncertain, U on upthrown side, D on downthrown side
- Anticline, approximately located, dotted beneath younger unfolded material
- Syncline, approximately located, dotted beneath younger unfolded material
- Direction of landslide movement
- Landslide escarpment



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Site Geologic Map PLATE 3

September Ranch
 Carmel Valley, California

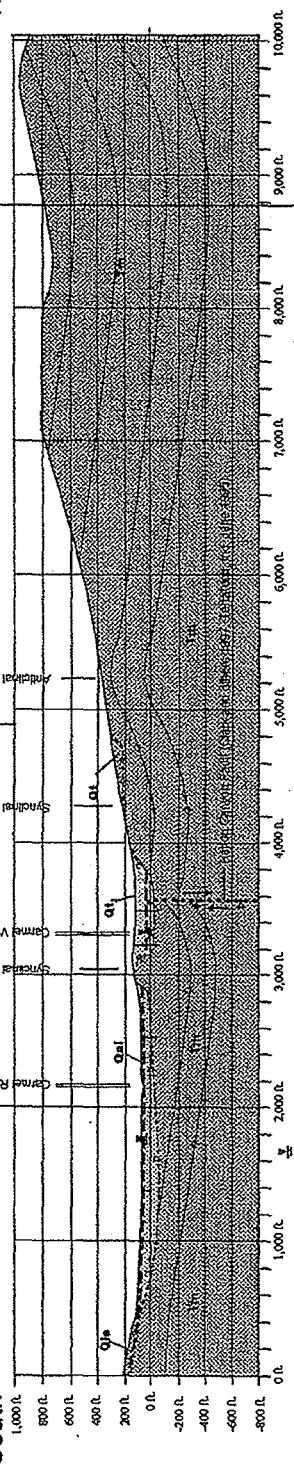
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September Ranch

A' North

A South



Explanation
 ▽ Water table
 Alb Albuvian (Holocene)
 Qls Landslide (Quaternary)
 Qt Terrace deposit (Quaternary)
 Tm Monterey Formation (Miocene)

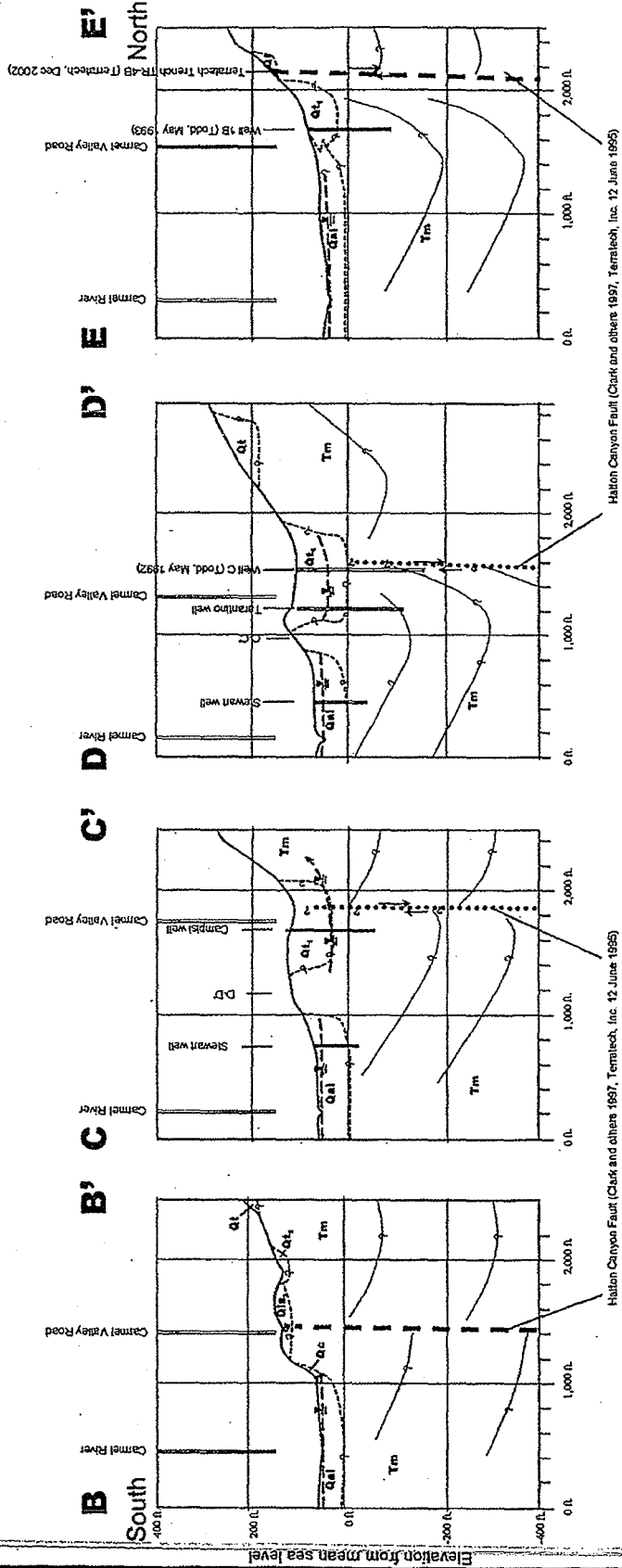
PLATE 6

Geologic Cross Section
 September Ranch
 Carmel Valley, California

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Distance in feet from south end of section line

4 X vertical exaggeration.

Explanation	
	Water table
	Colluvium (Holocene)
	Alluvium deposits (Holocene)
	September Ranch terrace (Quaternary)
	Lelandito deposit (Quaternary)
	Terrace deposits (Quaternary)
	Monterey (Miocene)

Haton Canyon Fault (Clark and others 1957, Tembleck, Inc. 12 June 1955)

Haton Canyon Fault (Clark and others 1957, Tembleck, Inc. 12 June 1955)

PLATE
7

Geologic Cross Sections
(with vertical exaggeration)
September Ranch
Carmel Valley, California

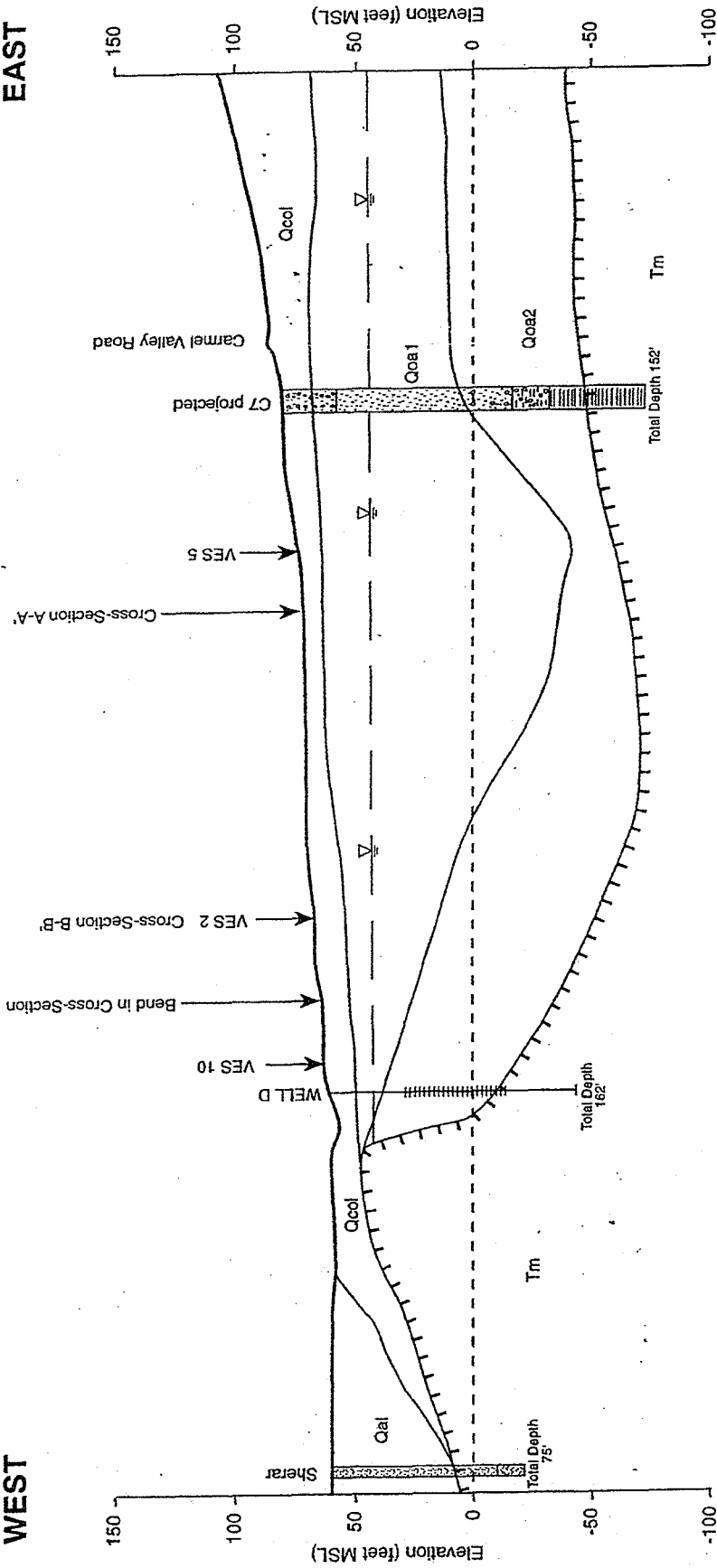
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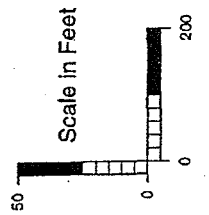
C WEST

C' EAST



LEGEND

- Qal Recent Alluvium
- Qcol Colluvium
- Qoa1 Older Alluvium 1
- Qoa2 Older Alluvium 2
- Tm Monterey Formation



November 1996

TODD ENGINEERS
Emeryville, California

Figure 5
West - East
Cross Section C - C'