

# Memorandum

*Serious drought.  
Help Save Water!*

**To:** GARY JOE  
STRUCTURE DESIGN BRANCH 17  
DIVISION OF ENGINEERING SERVICES

**Date:** March 23, 2016

**File:** 05-SB-101-2.2/3.3  
Linden Casitas  
Retaining Wall D  
Sound Wall B4  
EA 05-4482U1

**From:** DEPARTMENT OF TRANSPORTATION  
DIVISION OF ENGINEERING SERVICES  
GEOTECHNICAL SERVICES

**Subject:** **REVISED RETAINING WALL D and SOUNDWALL B4 FOUNDATION REPORT**

## Scope of Work

A Revised Foundation Report (FR) for Retaining Wall D and Sound Wall B4 is provided for the above referenced project. The project is on State Route 101 in the City of Carpinteria, in southern Santa Barbara County. Improvements are proposed to increase the highway level of service and accessibility, and include replacement of existing bridges and construction of new bridges, retaining walls, sound walls, ramps and frontage roads. Review of published geologic data and previous geotechnical reports, field reconnaissance, and foundation calculations were performed as part of the geotechnical investigation.

The purpose of this report is to document geotechnical conditions and provide foundation recommendations for proposed Retaining Wall D and Sound Wall B4. This report supercedes the Foundation Report issued January 28, 2014.

## Project Description

Route 101 within the project limits is a four-lane divided urban freeway with (2) 12-foot portland cement concrete (PCC) lanes in each direction and asphalt concrete (AC) 5-foot inside shoulders and 8-foot outside shoulders. A landscaped median approximately 40 feet wide with three beam barriers facing each direction of travel provides separation between the northbound and southbound lanes.

The purpose of the Linden Casitas project is to improve access and operations on Route 101, reduce local trips, and provide pedestrian and bicycle connectivity. The project includes construction of (3) mainline bridges on Route 101 to replace existing structures at Linden Avenue, Casitas Pass Road, and Carpinteria Creek. Highway access will be modified and added at Linden Avenue and Casitas Pass Road. Extension of Via Real, a frontage road, will also require construction of a new bridge over Carpinteria Creek. Retaining walls and sound walls are also proposed as part of the project.

Retaining Wall D is proposed for a length of approximately 1598 feet between Via Real and northbound Highway 101 to provide grade separation between northbound 101 and Via Real. The maximum design retained height will be 14 feet. Sound Wall B4 on Type 736 concrete barrier will be constructed top of on Retaining Wall D from “RWD1” Station 2+18.67 to 15+97.67.

### **Pertinent Reports and Investigations**

The following publications were used to assist in the assessment of site conditions:

1. *Preliminary Geotechnical Report*. Finegan, Michael. EA 05-448200. December 21, 2000.
2. *District Preliminary Geotechnical Report*. De Llamas, Zeke. EA 05-448200, July 30, 2008.

### **Field Investigation and Laboratory Testing Program**

Two mud rotary borings were advanced near the retaining wall layout line to determine the subsurface conditions to be used for foundation design. In-situ soil strength parameters were determined using the Standard Penetration Test (SPT) for cohesionless soils. Laboratory tests were used to determine the particle size distribution and corrosion potential of representative samples obtained at depth. Refer to Table 1 for a summary of subsurface investigation information.

**Table 1. Subsurface Exploration Summary**

<i>Boring</i>	<i>Completion Date</i>	<i>Equipment</i>	<i>Hammer Type</i>	<i>Hammer Efficiency (%)</i>	<i>Approximate Ground Elevation (ft)</i>	<i>Depth (ft)</i>
RC-10-005	12-8-2010	CS2000	Auto	93	26.4	152.0
RC-11-010	1-30-2011	CS2000	Auto	93	52.4	172.0

### **Site Geology and Subsurface Conditions**

#### *Physical Setting*

The project is located in the Carpinteria Valley, a sunken area north of the elevated coastal fault block southeast of the City of Carpinteria. Carpinteria valley is a low-lying, flat plain comprised of alluvial deposits. Some low-lying areas in the valley are partly submerged under brackish water of the Carpinteria slough. The plain meets the Pacific Ocean to the southwest, gradually gains elevation to the east as it approaches Rincon and La Granada Mountains, and abuts sharply against the foothills of the Santa Ynez Mountains at its the northern boundary.

A mild coastal climate prevails throughout the year, with marine fog often present in spring and summer months. Nearly all precipitation falls from Pacific storms between October and May, with the majority accumulating in the winter months. Average yearly rainfall is 17.5 inches. The average temperature is 72 degrees Fahrenheit with more than 275 days of sunny weather per year.

*Regional Geology*

The project area is located in the Transverse Ranges Geomorphic Province. State Route 101 is bordered to the north by the Santa Ynez Mountains and to the south by the Pacific Ocean as it traverses the Carpinteria Valley. Geologic maps and field observations indicate that soils in the valley were deposited in an alluvial environment and consist of normally-consolidated deposits of clay, silt, sand, and gravel.

*Groundwater*

Open observation wells were installed in borings RC-10-005 and RC-11-010 to observe fluctuations in groundwater levels and determine if groundwater will influence construction and foundation design. A hand auger boring HA-12-002 was also performed near the retaining wall layout line to further characterize groundwater levels. Results of the groundwater-monitoring program are summarized in Table 2.

**Table 2. Groundwater Elevations**

Boring	Date	Depth to Groundwater (ft)	Groundwater Elevation(ft)
RC-10-005	2-24-2012	7.3	19.1
RC-10-005	4-19-2012	6.7	19.7
RC-11-010	2-9-2011	27.9	24.5
HA-12-001	4-19-2012	12.5	23.2

*Corrosion Evaluation*

The Department considers a site to be potentially corrosive to the foundation elements if the following conditions exist for the representative soil and/or water samples taken at the site: minimum resistivity of 1000 ohm-cm or less and/or PH of 5.5 or less.

Soil and water samples were obtained during the subsurface investigation and tested for corrosion potential at the District Materials Laboratory. The results of the corrosion testing are presented in Table 3. Based on the results, soils are not considered corrosive to foundation elements.

**Table 3. Corrosion Testing Summary**

Boring	Depth (ft)	pH	Resistivity ohm-cm	Chloride ppm	Sulphate ppm	Corrosive
RC-10-005	2.0-4.0	8.4	1260	-	-	NO
RC-10-005	47.0-49.0	8.4	2350	-	-	NO
RC-10-005	87.0-89.0	8.6	3560	-	-	NO

## **Foundation Recommendations**

### *Retaining Wall Type 5SWB: Sound Wall on Retaining Wall on Spread Footing and Standard Plan Retaining Wall Type 5 Case 1*

Masonry block sound walls on concrete barriers on cast-in-place cantilevered retaining walls on spread footings are the recommended structure and foundation types. Details can be found in Bridge Standard Detail Sheets for Retaining Wall Type 5SWB and Revised Standard Plan B3-4A. The depth of foundation embedment shall provide a minimum of 4 feet of horizontal cover from the top of the toe side of the footing to the face of the embankment slope in front of the wall. The net bearing pressure and effective footing width for the service 1 limit state load provided in the Bridge Standard Detail Sheets and Revised Standard Plans were used to evaluate foundation settlement. Extreme limit state bearing stresses were evaluated at a horizontal seismic earth pressure coefficient equal to 0.2. Settlement is expected to be immediate in the cohesionless soils underlying the proposed retaining wall. Calculated differential settlements are within tolerable limits for cast-in-place cantilevered concrete retaining walls. Foundation recommendations are provided in the following table:

Wall Station (ft)	Wall Type	Design Height (ft)	Bottom of Footing Elevation (ft)	Footing Width (ft)	Strength Limit Factored Bearing Resistance (psf) $\Phi_{qN}$ $\Phi=0.45$	Extreme Limit Factored Bearing Resistance (psf) $\Phi_{qN}$ $\Phi=1.0$	Strength Limit Factored Gross Uniform Bearing Stress (psf) $q_0$	Extreme Limit Factored Gross Uniform Bearing Stress (psf) $q_0$	Service Limit State Net Bearing Stress (psf) $q'_0$	Calculated Settlement at Net Bearing Pressure (inches)
0+00 to 0+80	Type 5 Case 1	8.0	38.30	8.50	5200	11,800	3200	2100	2100	2.4
0+80 to 2+18.67	Type 5 Case 1	8.0	37.30	8.50	5200	11,800	3200	2100	2100	2.4
2+18.67 to 2+40	Type 5SWB	8.0	37.55	9.00	5200	11,600	3300	4700	1900	2.4
2+40 to 2+80	Type 5SWB	6.0	37.55	9.00	5200	11,800	2900	3400	1500	2.0
2+80 to 3+80	Type 5SWB	8.0	36.00	9.00	5200	11,600	3300	4700	1900	2.4
3+80 to 5+60	Type 5SWB	8.0	34.00	9.00	5200	11,600	3300	4700	1900	2.4
5+60 to 6+00	Type 5SWB	8.0	32.00	9.00	5200	11,600	3300	4700	1900	2.4
6+00 to 6+60	Type 5SWB	12.0	28.00	10.25	5200	11,800	3400	9200	2500	2.9
6+60 to 6+80	Type 5SWB	14.0	25.75	11.25	5600	13,300	3800	13,300	2800	3.2
6+80 to 7+80	Type 5SWB	12.0	26.00	10.25	5200	11,800	3400	9200	2500	2.9
7+80 to 8+40	Type 5SWB	12.0	25.00	10.25	5200	11,800	3400	9200	2500	2.9
8+40 to 9+20	Type 5SWB	12.0	24.00	10.25	5200	11,800	3400	9200	2500	2.9
9+20 to 9+80	Type 5SWB	10.0	24.00	9.50	5200	11,700	3700	6500	2200	2.6
9+80 to 10+20	Type 5SWB	12.0	22.00	10.25	5200	11,800	3400	9200	2500	2.9
10+20 to 11+40	Type 5SWB	10.0	22.00	9.50	5200	11,700	3700	6500	2200	2.6
11+40 to 11+94.67	Type 5SWB	10.0	21.00	9.50	5200	11,700	3700	6500	2200	2.6
11+94.67 To 12+00	Type 5SWB	10.0	21.00	9.50	5200	11,700	3700	6500	2200	2.6
12+00 to 13+20	Type 5SWB	8.0	21.00	9.00	5200	11,600	3300	4700	1900	2.4
13+20 to 13+65	Type 5SWB	6.0	21.00	9.00	5200	11,800	2900	3400	1500	2.0
13+65 to 15+01	Type 5SWB	8.0	19.22	9.00	5200	11,600	3300	4700	1900	2.4
15.01 to 15+97.67	Type 5SWB	8.0	18.22	9.00	5200	11,600	3300	4700	1900	2.4

### **Construction Considerations**

Loose soils and groundwater may be encountered during foundation excavations. Temporary slopes and/or shoring will be required to support the excavation to construct the retaining wall foundations. Groundwater levels were measured near the bottom of footing excavation.

If groundwater infiltrates footing excavations and the contractor is able to dewater the excavation by pumping, construction of a permeable mattress to bridge soft and wet soils and provide a stable working platform to begin foundation construction is recommended. Over-excavate 18 inches below the bottom of footing elevation and 8 inches beyond the sides of the footing excavation. Replace the excavated material to the bottom of footing elevation with Class III Permeable material fully encapsulated in Class B3 subgrade enhancement geotextile to prevent contamination with fines. Overlap seams in the fabric a minimum of 3 feet. The base layer shall be pumped during forming, placement of concrete, and concrete curing, as required to keep the groundwater elevation below the bottom of footing, providing a dry uniform surface for construction and preventing segregation of the concrete by flowing water prior to curing.

### **Additional Information**

Standard Specification 2-1.6.B, "Supplemental Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the Addressee of this report via electronic mail.

Data and information attached with the project plans are:

- A. Log of Test Borings.

Data and information included in the Information Handout provided to the Bidders and Contractors are:

- A. Revised Foundation Report for the Retaining Wall dated March 23, 2016.

If you have any questions or comments, please contact Ryan Turner at (805) 549-3750.



*Ryan Turner*

RYAN TURNER, P.E., G.E.  
Transportation Engineer Civil  
Geotechnical Design West  
Branch E

c: Job File / Branch E Records  
Structure Construction RE Pending File (email RE\_pending\_file@dot.ca.gov)  
Craig Whitten / DES Office Engineer  
Andrew Tan / PCE  
Eric Karlson/ DME

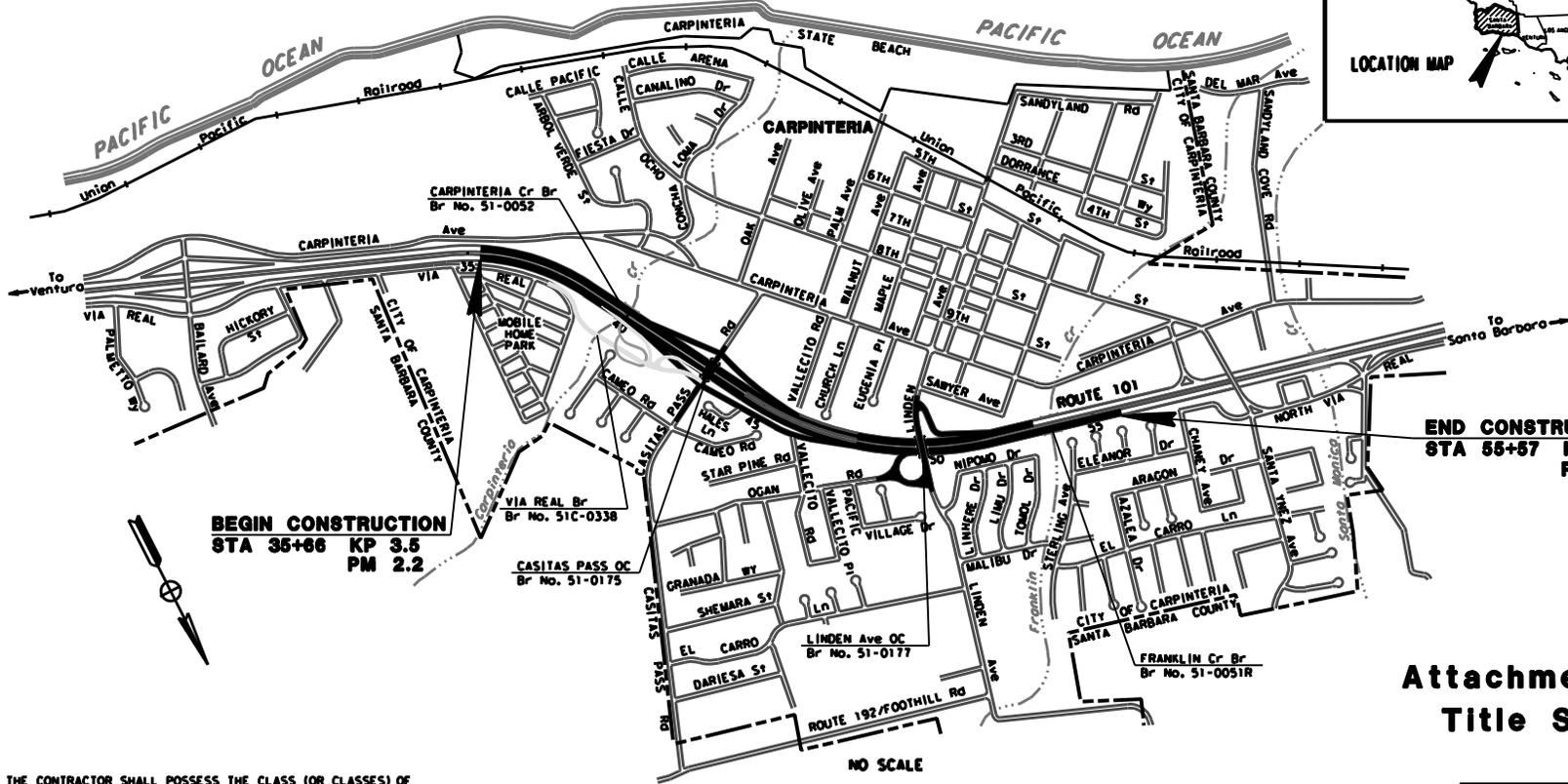
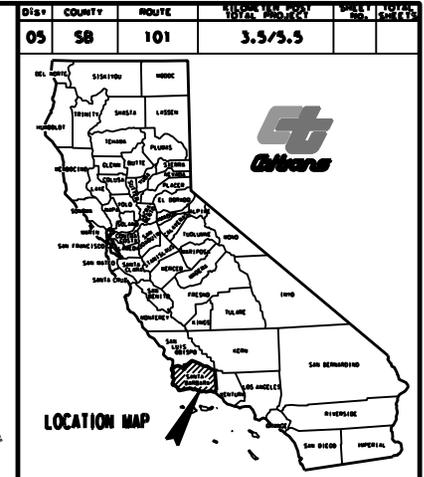
## LIST OF ATTACHMENTS

Vicinity Map	Attachment 1
Geologic Map and Legend	Attachment 2

INDEX OF SHEETS

STATE OF CALIFORNIA  
 DEPARTMENT OF TRANSPORTATION  
 PROJECT PLANS FOR CONSTRUCTION ON  
 STATE HIGHWAY  
 IN SANTA BARBARA COUNTY  
 IN CARPINTERIA  
 FROM 0.4 KM SOUTH OF CARPINTERIA CREEK BRIDGE  
 TO 0.5 KM NORTH OF LINDEN AVENUE OVERCROSSING

TO BE SUPPLEMENTED BY STANDARD PLANS DATED JULY 2004



**BEGIN CONSTRUCTION**  
 STA 35+66 KP 3.5  
 PM 2.2

**END CONSTRUCTION**  
 STA 55+57 KP 5.5  
 PM 3.4

**Attachment 1**  
**Title Sheet**

PROJECT MANAGER  
 DAVID BEARD  
 DESIGN ENGINEER  
 KARI BHANNA

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS."

BORDER LAST REVISED 3/1/2007

CALTRANS WEB SITE IS: [HTTP://WWW.DOT.CA.GOV/](http://www.dot.ca.gov/)

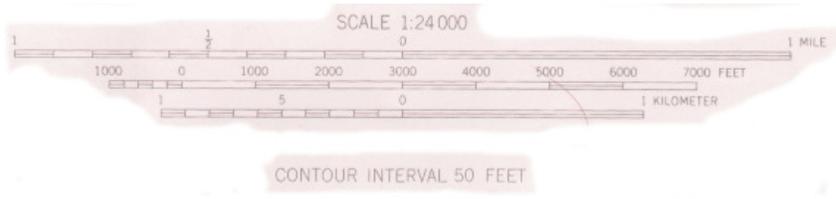
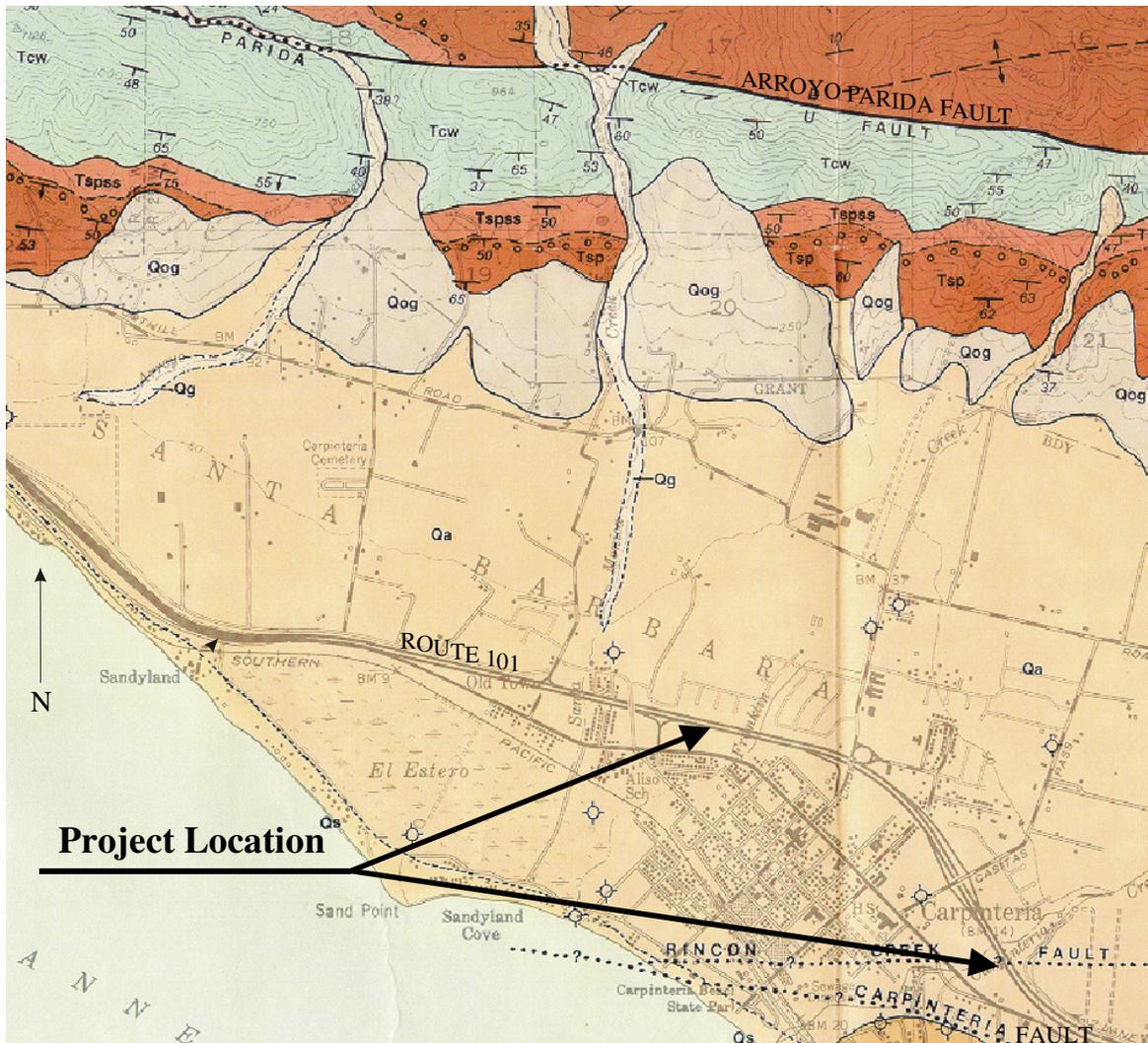
RELATIVE BORDER SCALE IS IN MILLIMETERS



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**CONTRACT No. 05-4482UO**  
 CU 06233 EA 4482UO

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PART OF:  
**GEOLOGIC MAP OF THE  
 CARPINTERIA QUADRANGLE  
 BY THOMAS W. DIBBLEE, JR., 1986**

**Geologic Map**  
**05-SB-101-2.1/3.4**  
**05-448201**  
**Attachment 2**

05-SB-101-2.1/3.4  
05-448201

QUATERNARY

Holocene  
Pleistocene

Miocene

**LEGEND**



**SURFICIAL SEDIMENTS**

Qs beach sand deposits  
Qg stream channel deposits, mostly gravel and sand  
Qa alluvium: unconsolidated flood-plain deposits of silt, sand and gravel



**LANDSLIDE DEBRIS**



**OLDER DISSECTED SURFICIAL SEDIMENTS**

Qoa former alluvial deposits of silt, sand and gravel, in places weakly consolidated; local unconformities at base  
Qog cobble-boulder fan gravel and fanglomerate deposits composed largely of sandstone detritus

**UNCONFORMITY**



**CASITAS FORMATION**  
nonmarine; early to middle(?) Pleistocene age

Qca weakly consolidated alluvial deposits: gray to tan cobble-boulder gravel and gray to reddish sand and clay

**UNCONFORMITY**



**MONTEREY FORMATION**  
marine; early to late Miocene age

Tm upper shale unit: white weathering, thin bedded, hard, platy to brittle siliceous shale; Mohanian Stage  
Tml lower shale unit: white weathering, soft, fissile to powky clay shale with interbeds of hard siliceous shale and thin limestone strata; lower Mohanian to uppermost Saucian Stages



**UNNAMED SANDSTONE (TEMBLOR SANDSTONE OF DIBBLEE, 1966)**  
shallow marine; early Miocene age

Tmss light gray to tan fossiliferous arkosic sandstone and pebble conglomerate; local unconformity(?) at base; exposed north of Santa Ynez fault



**RINCON SHALE**  
marine; early Miocene age

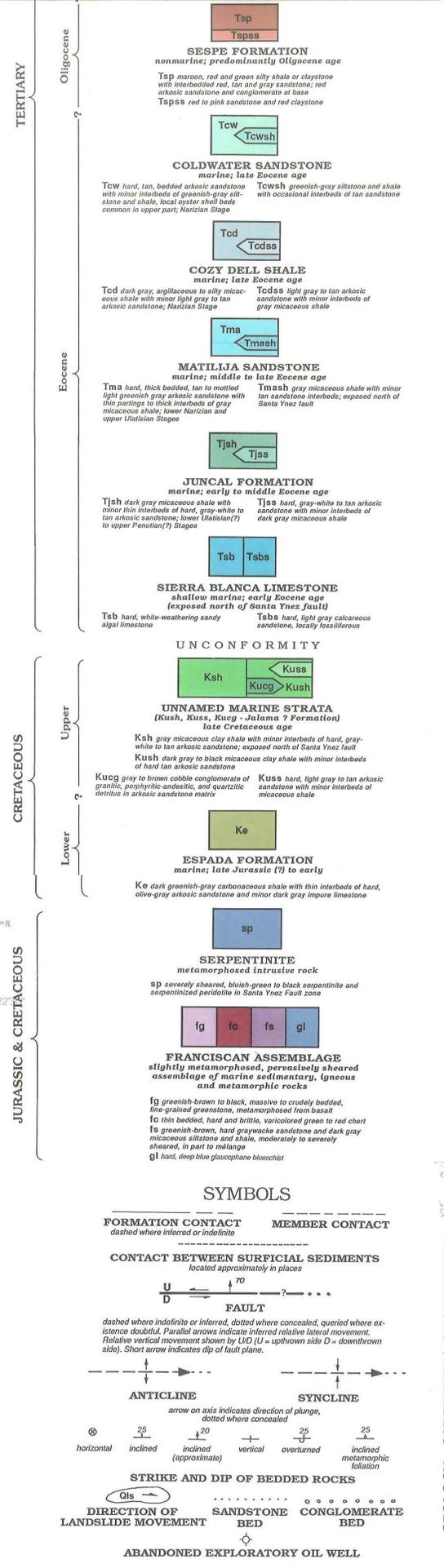
Tr poorly bedded gray clay shale and siltstone, locally concretionary; Saucian and upper Zemorrian Stages



PART OF:

**GEOLOGIC MAP OF THE CARPINTERIA QUADRANGLE BY THOMAS W. DIBBLEE, JR., 1986**

GEOLOGY - CARPINTERIA QUADRANGLE



**Geologic Map - Legend**

**05-SB-101-2.1/3.4**  
**05-448201**  
**Attachment 2**

GEOLOGY - CARPINTERIA QUADRANGLE