FOR CONTRACT NO: 05-0L7014
PROJECT ID: 0500020286

INFORMATION HANDOUT

MATERIALS INFORMATION

FOUNDATION REPORTS RETAINING WALLS

FOUNDATION REPORT SIDEHILL VIADUCT

FOUNDATION REVIEWS

PRELIMINARY SITE INVESTIGATION REPORT

QUICKCHANGE MOVEABLE BARRIER

CRASH CUSHION ABSORB 350

SAFEGUARD LINK SYSTEM

CONSTRUCTION DETAILS-SAFEGUARD LINK

ROUTE: 05-SCr-17-6.0/12.6

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-6.04/6.13
Route 17 Barrier Upgrades
Retaining Wall 1

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a soldier pile retaining wall to support the widened shoulder at Location 1, which lies between approximately post mile 6.04 and post mile 6.13. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 1 is on the northbound side of the highway, approximately 0.6-mile northeast of the Granite Creek Road Overcrossing. Existing outside shoulder widths at the location are typically between 0.5-foot and 1 foot. Metal beam guard railing is in place along the outside shoulder, and a concrete median barrier separates northbound and southbound traffic.

It is proposed to widen outside shoulders to 4 feet and construct concrete barriers with barrier slabs at this location. A soldier pile retaining wall with timber lagging will be constructed between "B1" Station 102+17.58 and "B1" Station 104+58.58 to facilitate the shoulder widening and barrier construction.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

2. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

3. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 1 is in the Carbonera Creek water shed. Carbonera Creek is a tributary of the southward flowing San Lorenzo River, which drains into Monterey Bay.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that upper Miocene aged Santa Cruz Mudstone, geologic unit T_{sc}, and Recent alluvial deposits, geologic unit Q_{al}, underlies Location 1. Brabb describes Santa Cruz Mudstone as medium to thick-bedded and faintly laminated, blocky weathering, pale yellowish-brown siliceous organic mudstone. According to Brabb, the alluvial deposits consist of unconsolidated, heterogeneous, moderately sorted silt and sand containing discontinuous lenses of clay and silty clay.

The highway at Location 1 was constructed as a fill cross section. The embankment slopes are typically inclined at 1.1:1 to 1.6:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling three six-inch auger borings in the northbound #2 traffic lane within the longitudinal limits of the proposed retaining wall. The locations of the borings are shown on the attached RW1-Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Pocket penetrometer measurements of unconfined compressive strength were used to estimate the undrained shear strength of some of the clay samples. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at Location 1 appears to be composed of fill consisting of loose to medium dense silty sand and silty sand with gravel overlying alluvial soils consisting of discontinuous layers of silty sand, sand with silt, sandy clay, and clay. The coarse-grained alluvial soils were determined to be loose to medium dense, and the clays appear to be stiff to very stiff. Siltstone was encountered in boring A-08-040 at a depth of approximately 30 feet, and claystone was encountered in boring A-08-041 at a depth of approximately 38.5 feet. The rock was logged as moderately soft to moderately hard, but was penetrated with carbide-tipped augers with only moderate difficulty.

Ground Water

Ground water was encountered 38.5 feet below the ground surface in boring A-08-002 and 35.0 feet below the ground surface in boring A-08-041. These depths correspond to elevations of 653.26 feet in boring A-08-002 and 652.67 feet in boring A-08-041. Boring A-08-002 is located 8.5 feet left of "B1" Station 104+17. Boring A-08-041 is located 10.3 feet left of "B1" Station 103+28.8.

The ground water elevation during construction may be significantly higher than it was during the subsurface investigation for the project. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
A-08-002	15.9'-19.7'	5.0	2730	N/A	N/A
A-08-040	30.0'-33.5'	Pending	Pending	Pending	Pending
A-08-041	15.0'-20.0'	Pending	Pending	Pending	Pending
Corrosive if		<5.5	<1000	>2000	>500

Based on the results of the corrosion analyses, the site is considered corrosive. Controlling corrosion test parameter results are as follows:

- 5.0 pH

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The Zayante-Vergales Fault is the controlling fault at Location 1. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 1.4 miles from the Zayante-Vergales Fault, the peak bedrock acceleration (PBA) at Location 1 due to an earthquake along the Fault is estimated to be 0.63 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the soldier pile wall are based upon SPT correlations to internal angle of friction in cohesionless soils. The strength parameters of the clay soils were estimated by using a range of values suggested in literature in a slope stability model of the existing embankment to achieve a factor of safety against global failure of 1.1. Retained soils for the proposed soldier pile wall are primarily silty sands of the embankment fill. The soldier piles for the retaining wall will be embedded primarily in embankment material and alluvium.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the soldier pile wall. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B1" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
102+15 to 102+50	0.0-19.0	32	0	120	0.31	3.23
	19.0-40.0	30	0	120	0.33	3.04
	40.0+	37	0	125	0.25	4.25
102+50 to 103+30	0.0-18.0	33	0	120	0.29	3.43
	18.0-28.0	31	0	120	0.32	3.17
	28.0-40.0	25	100	120	0.41	2.53
103+30 to 104+60	0.0-25.0	34	0	120	0.28	3.64
	25.0-35.0	25	100	120	0.41	2.53
	35.0-50.0	27	0	120	0.38	2.76
	50.0+	34	0	120	0.28	3.64

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location 1 between "B1" Station 102+17.58 and "B1" Station 104+58.58. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 1 provided by the structure designer indicates that the lagged height of the wall will range between approximately 3 feet and 7 feet. A reinforced concrete barrier slab, approximately 2 feet thick, will be anchored to the tops of the soldier piles, above the timber lagging.

It is recommended that the lateral earth pressures acting on the retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern for this location. The existing slopes exhibit no sign of instability, and the addition of a soldier pile retaining wall with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The loose density and dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

Ground water may be encountered during drilling for the soldier piles. Depending on the contractor's equipment and methodologies, a significant amount of water may enter the hole before concrete is placed. Temporary casing may be necessary to ensure a dry hole in which to place piles and pour concrete. The appropriate specification language should be included in the contract special provisions to address the possibility of accumulated water in the soldier pile holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 1.

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

- Foundation Report for Retaining Wall No. 1 dated December 31, 2008.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

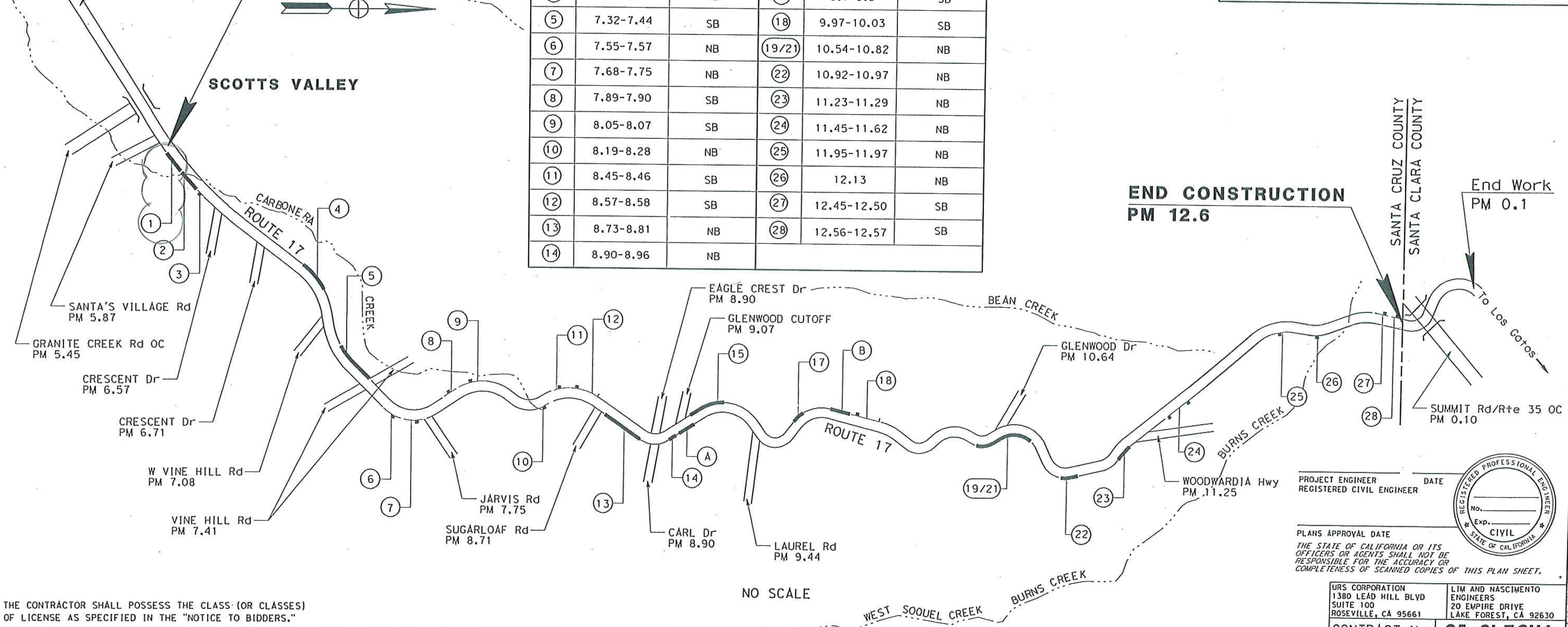
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

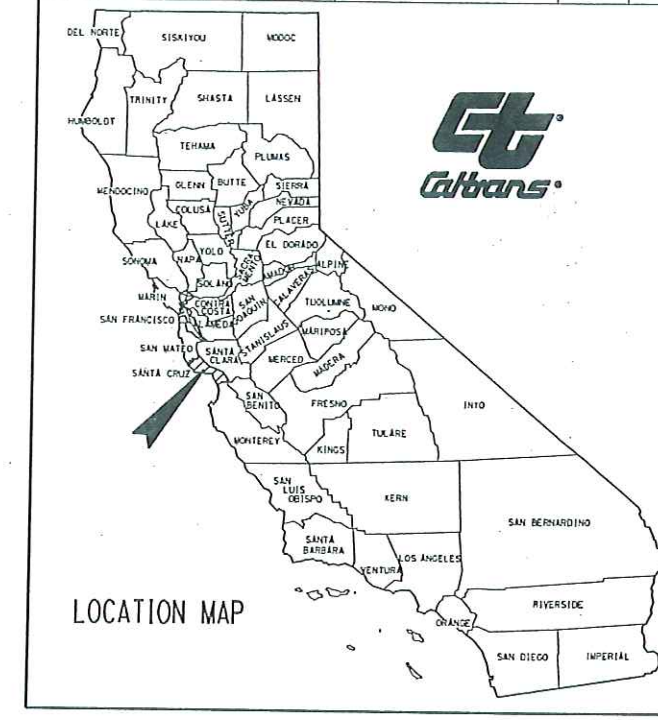
PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			





Caltrans

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER

DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08

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BORDER LAST REVISED 8/1/2008

CALTRANS WEB SITE IS: HTTP://WWW.DOT.CA.GOV/

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => Carlton Allen

CU 06253

EA 0L70U1

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER T. Dudley No. C 039514 Exp. 12/31/09 CIVIL STATE OF CALIFORNIA

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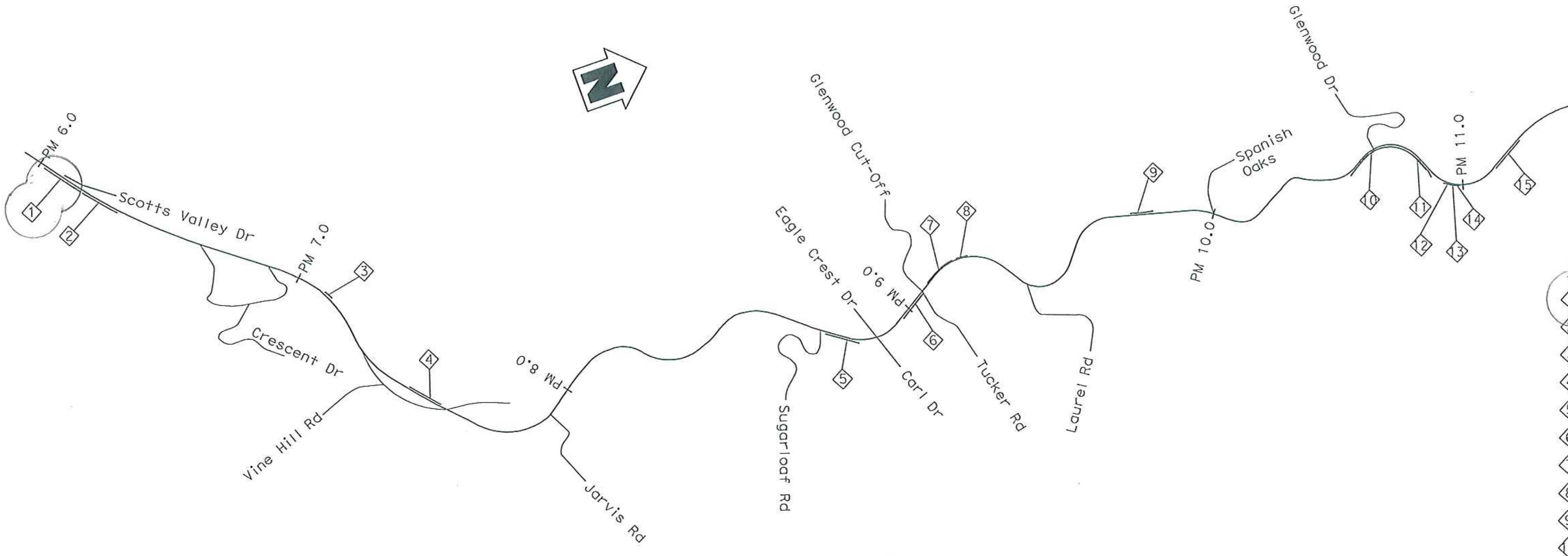
LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



LEGENDS:

- 1 Retaining Wall No. 1
- 2 Retaining Wall No. 2
- 3 Retaining Wall No. 3
- 4 Retaining Wall No. 4
- 5 Retaining Wall No. 5
- 6 Retaining Wall No. 6
- 7 Retaining Wall No. 7
- 8 Retaining Wall No. 8
- 9 Retaining Wall No. 9
- 10 Retaining Wall No. 10
- 11 Retaining Wall No. 11
- 12 Retaining Wall No. 12 *
- 13 Retaining Wall No. 13 *
- 14 Retaining Wall No. 14 *
- 15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

WALL LOCATION KEY MAP

NO SCALE

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN	BY T. Dudley	CHECKED R. Price	
DETAILS	BY C. Lee / Y. Ng	CHECKED R. Price	
QUANTITIES	BY T. Dudley	CHECKED E. Nevarez	

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD

POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

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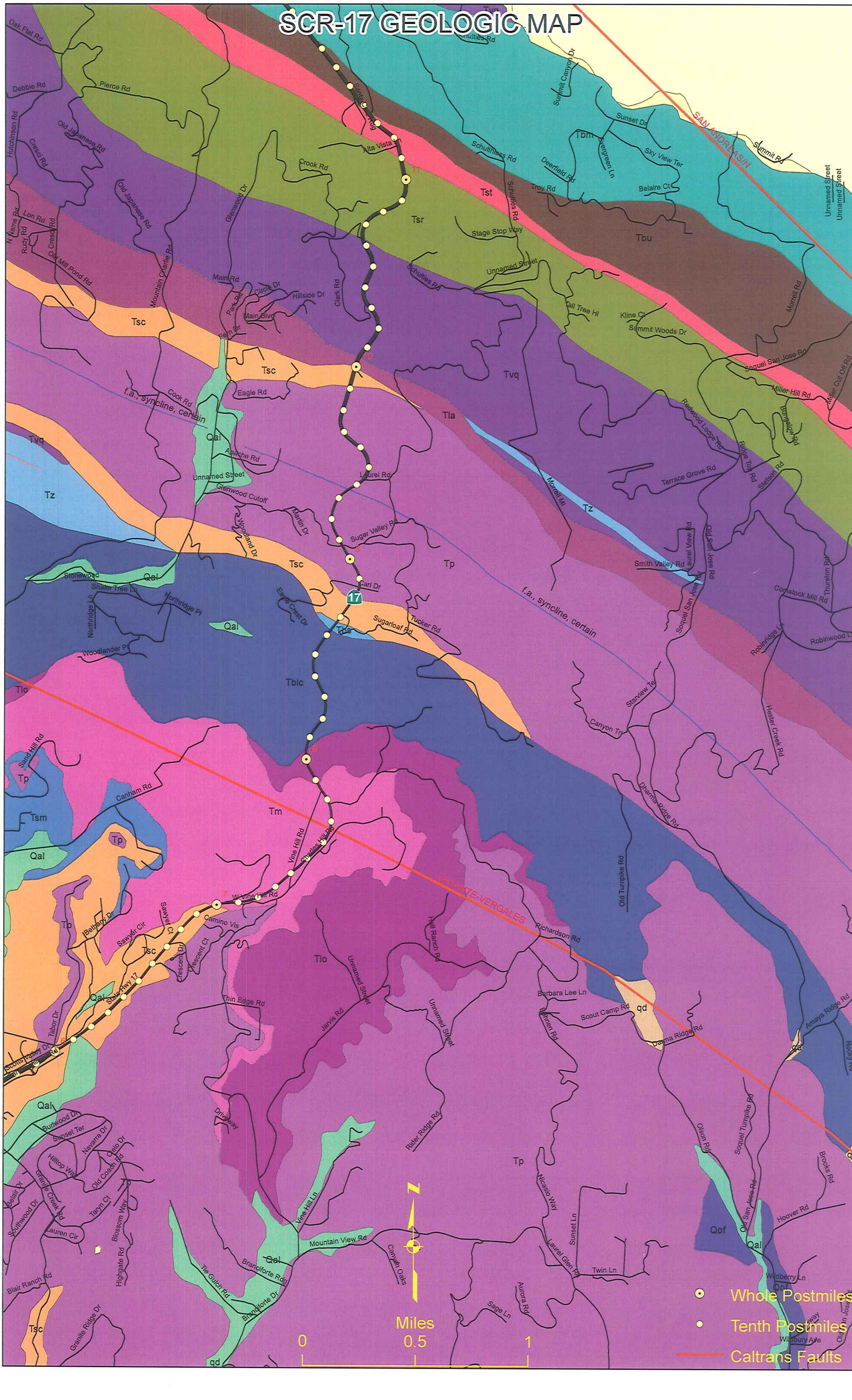
ATTACHMENT 2

GEOLOGIC MAP

SCR-17 GEOLOGIC MAP



ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17			

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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CURVE DATA TABLE

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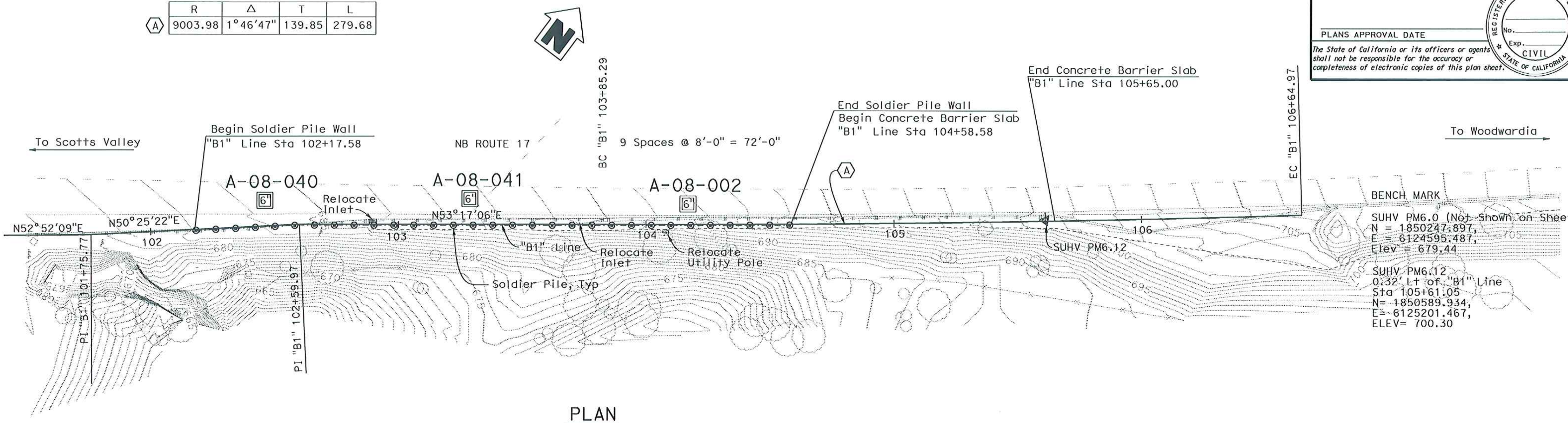

PLAN

1" = 20'

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN	BY	CHECKED
DETAILS	BY	CHECKED
QUANTITIES	BY	CHECKED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO.

POST MILE 6.04

RW1-BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 3 OF

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USERNAME => s108840 DATE PLOTTED => 31-DEC-2008 TIME PLOTTED => 08:03

State of California Business, Transportation and Housing Agency

Department of Transportation

M e m o r a n d u m

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-6.14/6.26
Guard Rail Upgrades
Retaining Wall 2

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

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Location 2 is on the northbound side of the highway, approximately 0.8-mile northeast of the Granite Creek Road Overcrossing. Existing outside shoulder widths at the location are typically less than 1 foot. A temporary concrete barrier is in place along the outside shoulder, and a concrete median barrier separates northbound and southbound traffic.

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The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that upper Miocene aged Santa Cruz Mudstone, geologic unit T_{sc}, underlies Location 2. Brabb describes Santa Cruz Mudstone as medium to thick-bedded and faintly laminated, blocky weathering, pale yellowish-brown siliceous organic mudstone.

The highway at Location 2 was constructed as a fill cross section. The embankment slopes are typically inclined at 1.2:1 to 1.7:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling three six-inch auger borings in the northbound #2 traffic lane within the longitudinal limits of the proposed retaining wall. The locations of the borings are shown on the attached RW 2 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Pocket penetrometer measurements of unconfined compressive strength were used to estimate the undrained shear strength of some of the clay samples. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at Location 2 appears to be composed of fill to a depth of 40 feet or more. The fill consists of loose to dense silty sand with gravel, silty sand, and silt. It is possible that some of the material encountered in the borings was actually soft fine-grained sandstone, but the drilling method did not permit that distinction.

Ground Water

Ground water was not encountered within 46 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
R-08-001	15.0'-20.0'	5.2	700	Pending	Pending
R-08-003	15.0'-20.0'	4.5	970	Pending	Pending
R-08-004	15.9'-19.7'	5.6	1570	N/A	N/A
Corrosive if		<5.5	<1000	>2000	>500

Based on the results of the corrosion analyses, the site is considered corrosive. Controlling corrosion test parameter results are as follows:

- 4.5 pH
- Test results for concentrations of soluble salts were not available at the time of this report. Past experience in the project area, however, suggests that sulfate concentrations will likely be above the 2000-ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The Zayante-Vergales Fault is the controlling fault at Location 2. According to the

Caltrans-adopted Mualchin peak acceleration curves, at a distance of 1.2 miles from the Zayante-Vergales Fault, the peak bedrock acceleration (PBA) at Location 2 due to an earthquake along the Fault is estimated to be 0.64 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high percentage of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the soldier pile wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Retained soils for the proposed soldier pile wall are primarily silty sands of the embankment fill. The soldier piles for the retaining wall will be embedded in embankment material and, possibly, soft fine-grained sandstone.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling. Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the soldier pile wall. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B2" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
209+15 to 204+35	0.0-23.0	33	0	120	0.29	3.43
	23.0-45.0	30	0	120	0.33	3.04
204+35 to 205+00.	0.0-35.0	33	0	120	0.29	3.43
	35.0-45.0	30	0	120	0.33	3.04

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location 2 between "B2" Station 202+19.70 and "B2" Station 205+00.70. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 2 provided by the structure designer indicates that the lagged height of the wall will range between approximately 4 feet and 7 feet. A reinforced concrete barrier slab, approximately 2 feet thick, will be anchored to the tops of the soldier piles, above the timber lagging.

It is recommended that the lateral earth pressures acting on the retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern for this location. The existing slopes exhibit no sign of instability, and the addition of a soldier pile retaining wall with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The loose density and dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the soldier piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered, temporary casing may be necessary to ensure a dry hole in which to place piles and pour concrete. The appropriate specification language should be included in the contract special provisions to address the possibility of accumulated water in the soldier pile holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 2.

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

- Foundation Report for Retaining Wall No. 2 dated December 31, 2008.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1	**LOCATION MAPS**
ATTACHMENT 2	**GEOLOGIC MAP**
ATTACHMENT 3	**BORHOLE LOCATIONS**

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

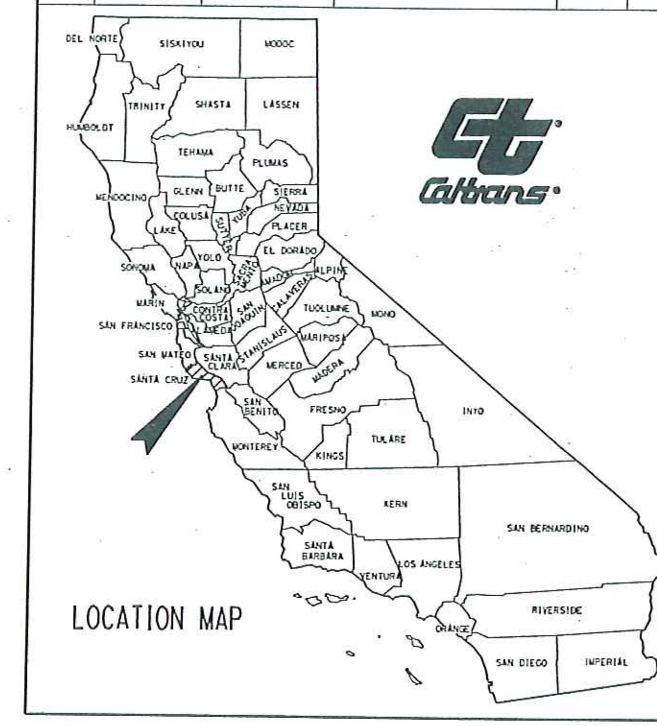
IN SANTA CRUZ COUNTY
IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

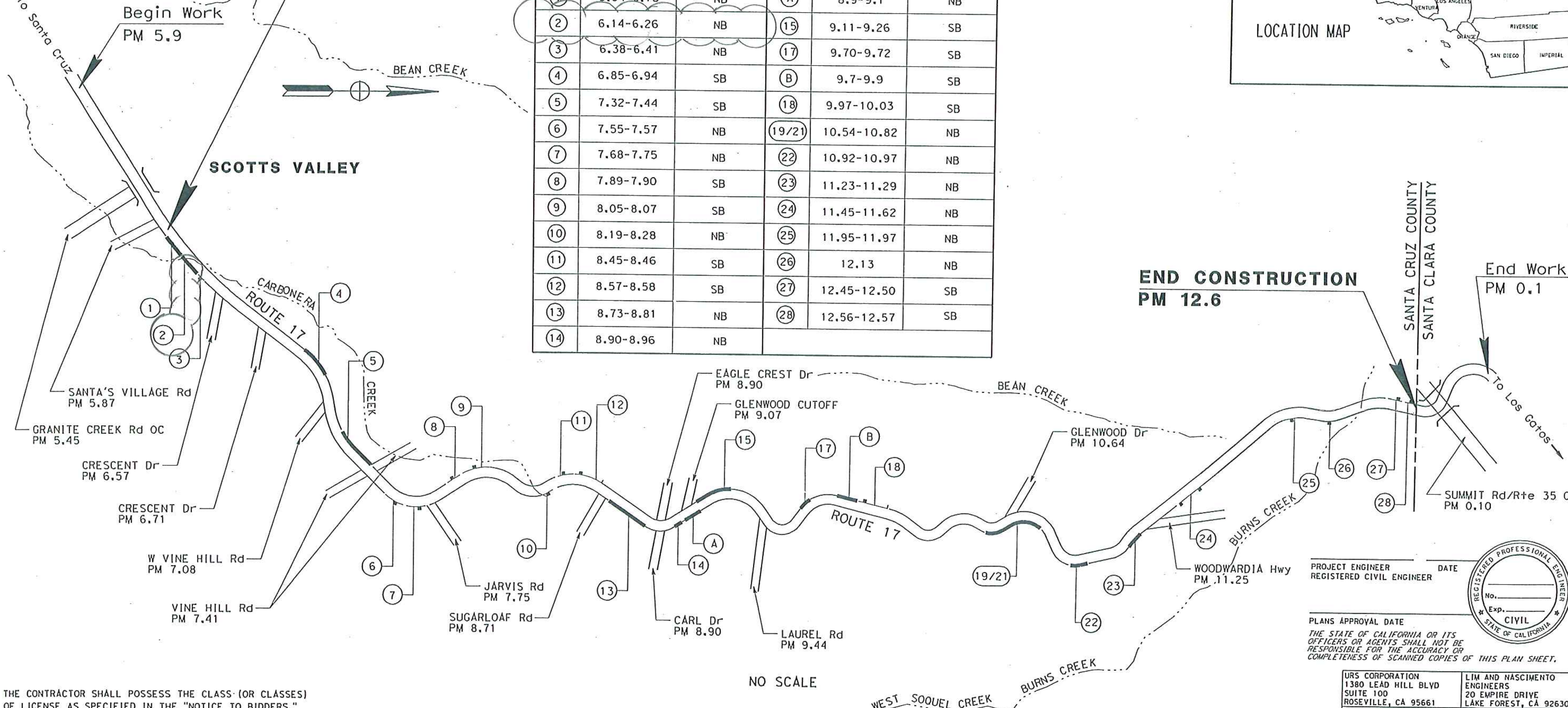
TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			





APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
ROTIMI ADEBAYO	C69102	6/30/2010	

CONSULTANT DESIGN ENGINEER
JAMES A. LABANOWSKI JR.

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

PROJECT ENGINEER
REGISTERED CIVIL ENGINEER
DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08

DATE PLOTTED => 12/5/2008

3:14:25 PM

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

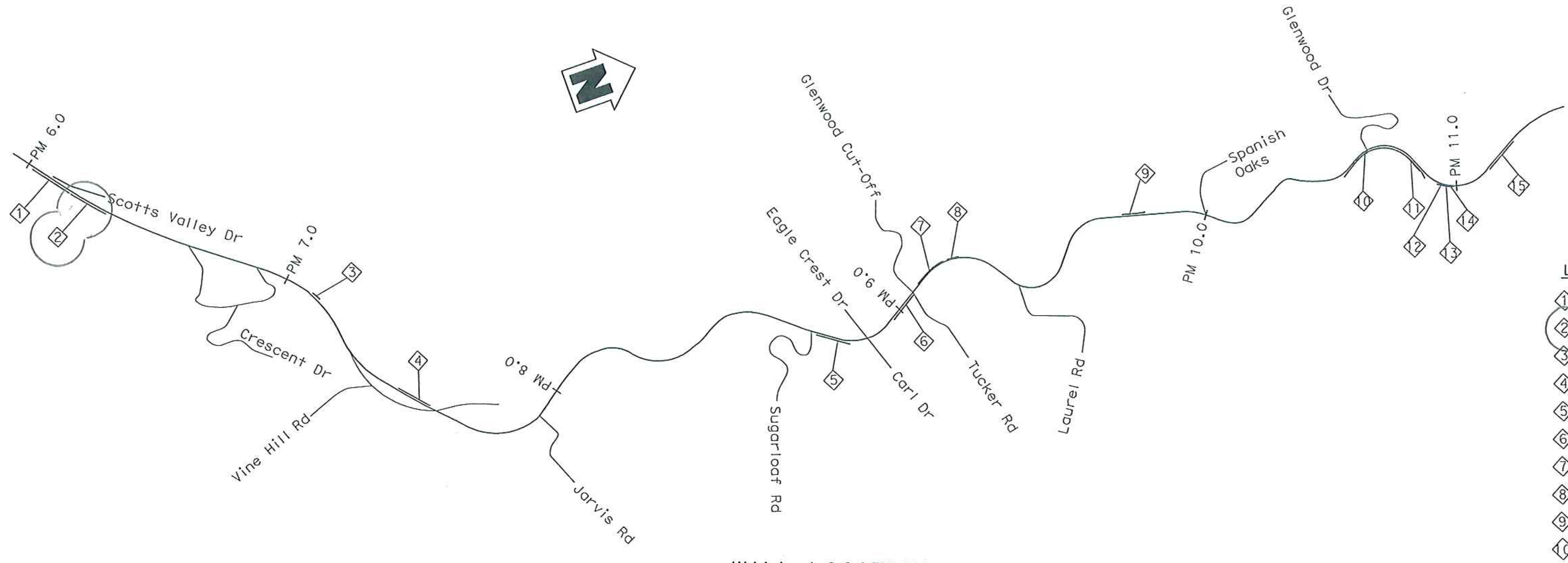
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER T. Dudley No. C 039514 Exp. 12/31/09 CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

1 Retaining Wall No. 1
2 Retaining Wall No. 2
3 Retaining Wall No. 3
4 Retaining Wall No. 4
5 Retaining Wall No. 5
6 Retaining Wall No. 6
7 Retaining Wall No. 7
8 Retaining Wall No. 8
9 Retaining Wall No. 9
10 Retaining Wall No. 10
11 Retaining Wall No. 11
12 Retaining Wall No. 12 *
13 Retaining Wall No. 13 *
14 Retaining Wall No. 14 *
15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

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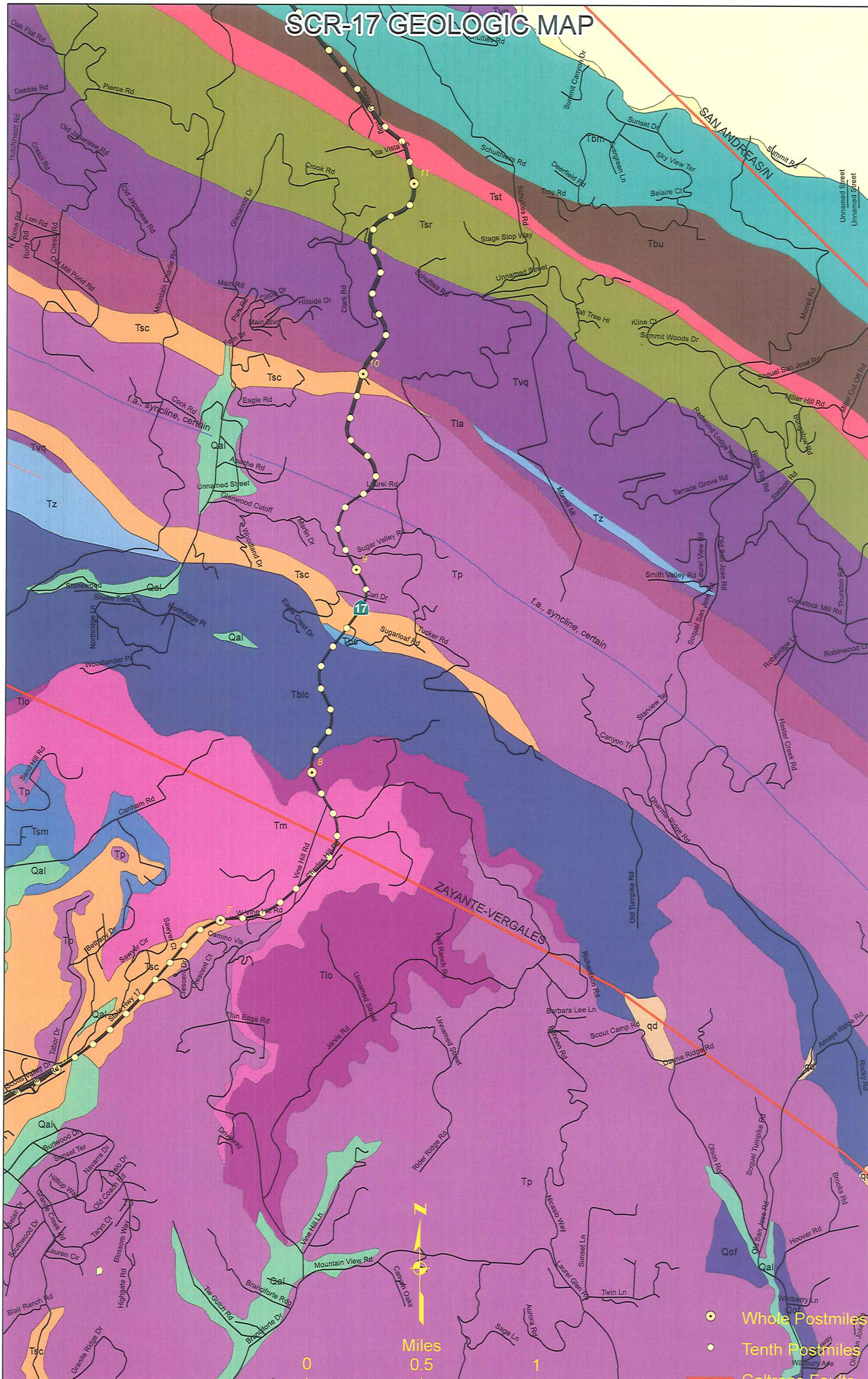
ATTACHMENT 2

GEOLOGIC MAP


SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbm
Tst
Tbu
Tsr
Tvq
Tla
Tz
Tp
Tsc
Qal
Tbs
Tblc
Tlo
Tm
Tsm
Qof
qd
N
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

BENCH MARK

PRHV PM6.261
80.88' Lt of "B2" Line
Sta 206+90.49
N= 1851091.583,
E= 6125667.798,
ELEV= 737.18

SUHV PM6.12
13.33' Lt of "B2" Line
Sta 200+07.66
N= 1850589.9340,
E= 6125201.4670,
ELEV= 700.30

CURVE DATA TABLE

	R	Δ	T	L
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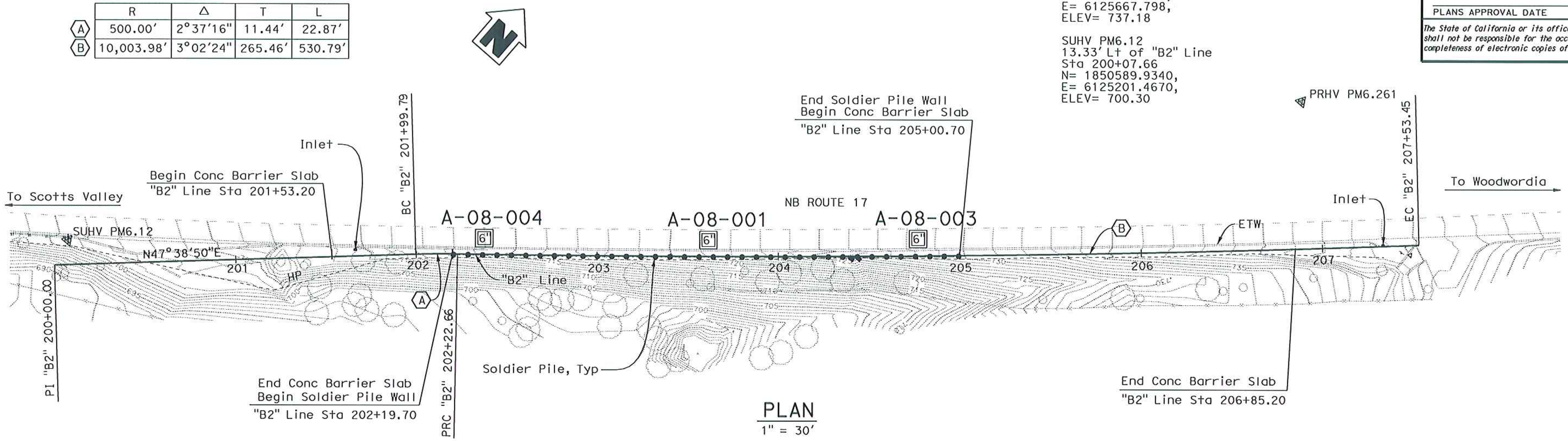
B	10,003.98'	3°02'24"	265.46'	530.79'



PLAN
1" = 30'

DESIGN OVERSIGHT	DESIGN	BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	PROJECT ENGINEER
SIGN OFF DATE	DETAILS	BY	CHECKED		
	QUANTITIES	BY	CHECKED		

BRIDGE NO. TBD

POST MILE 6.20

RW2-BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

FILE => RW2EP.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 7 OF

USERNAME => s108940 DATE PLOTTED => 31-DEC-2008 TIME PLOTTED => 08:04

State of California | Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-6.85/6.94
Guard Rail Upgrades
Retaining Wall 3

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a soldier pile retaining wall to support the widened shoulder at Location 4, which lies between approximately post mile 6.85 and post mile 6.94. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 4 is on the southbound side of the highway, approximately 0.2-mile southwest of the intersection of Route 17 and West Vine Hill Road. Existing outside shoulder widths at the location typically range from less than 1 foot to nearly 2 feet. Metal beam guard railing is currently in place along the outside edge of pavement, and a concrete median barrier separates northbound and southbound traffic along most of the location.

It is proposed to widen outside shoulders to 4 feet and construct concrete barriers with barrier slabs at this location. A soldier pile retaining wall with timber lagging will be constructed between "B4" Station 403+80.00 and "B4" Station 404+29.00 to facilitate the shoulder widening and barrier construction.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

2. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

3. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 4 is in the Carbonera Creek water shed. Carbonera Creek is a tributary of the southward flowing San Lorenzo River, which drains into Monterey Bay.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that upper Miocene aged Santa Cruz Mudstone, geologic unit T_{sc}, underlies Location 4. Brabb describes Santa Cruz Mudstone as medium to thick-bedded and faintly laminated, blocky weathering, pale yellowish-brown siliceous organic mudstone.

The highway at Location 4 was constructed as a cut/fill cross section. The embankment slopes on the southbound side of the roadway are typically inclined at 1.4:1 to 2.1:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling one six-inch auger boring in the southbound #2 traffic lane within the longitudinal limits of the proposed retaining wall. The location of the boring is shown on the attached RW 3 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at Location 4 appears to be composed of medium dense silty sand fill to a depth of approximately 8 feet overlying moderately soft to soft, fine to medium-grained sandstone. The boring was located approximately 8.2 feet right of the retaining wall layout line. Assuming that the interface between the fill and the rock dips at approximately a 1:1 slope, the depth of rock along the retaining wall alignment should be about 16 feet.

Ground Water

Ground water was not encountered within 34.9 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
A-08-020	15.0'-20.0'	5.7	2340	N/A	N/A
Corrosive if		<5.5	<1000	>2000	>500

Based on corrosion test results, and because the project area is not within 1000 feet of salt or brackish water, the site is considered non-corrosive.

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The Zayante-Vergales Fault is the controlling fault at Location 4. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 0.6-mile from the Zayante-Vergales Fault, the peak bedrock acceleration (PBA) at Location 4 due to an earthquake along the Fault is estimated to be 0.67 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained soils in the embankment fills and alluvium, and the shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the soldier pile wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Retained soils for the proposed soldier pile wall are primarily silty sands of the embankment fill. The soldier piles for the retaining wall will be embedded in embankment material and possibly soft fine-grained sandstone.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because the rock that was encountered was relatively soft, it is assumed to behave as a cohesionless soil once disturbed by drilling. Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the soldier pile wall. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B4" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
403+80 to 404+30	0.0-16.0	33	0	120	0.29	3.43
	16.0-40.0	37	0	125	0.25	4.25

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location 4 between "B4" Station 403+80.00 and "B4" Station 404+29.00. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 4 provided by the structure designer indicates that the lagged height of the wall will range between approximately 4 feet and 5 feet. A reinforced concrete barrier slab, approximately 2 feet thick, will be anchored to the tops of the soldier piles, above the timber lagging.

It is recommended that the lateral earth pressures acting on the retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern for this location. The existing slopes exhibit no sign of instability, and the addition of a soldier pile retaining wall with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile holes to prevent caving.

Rock will be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the soldier piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered, temporary casing may be necessary to ensure a dry hole in which to place piles and pour concrete. The appropriate specification language should be included in the contract special provisions to address the possibility of accumulated water in the soldier pile holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 3.

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

- Foundation Report for Retaining Wall No. 3 dated December 31, 2008.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

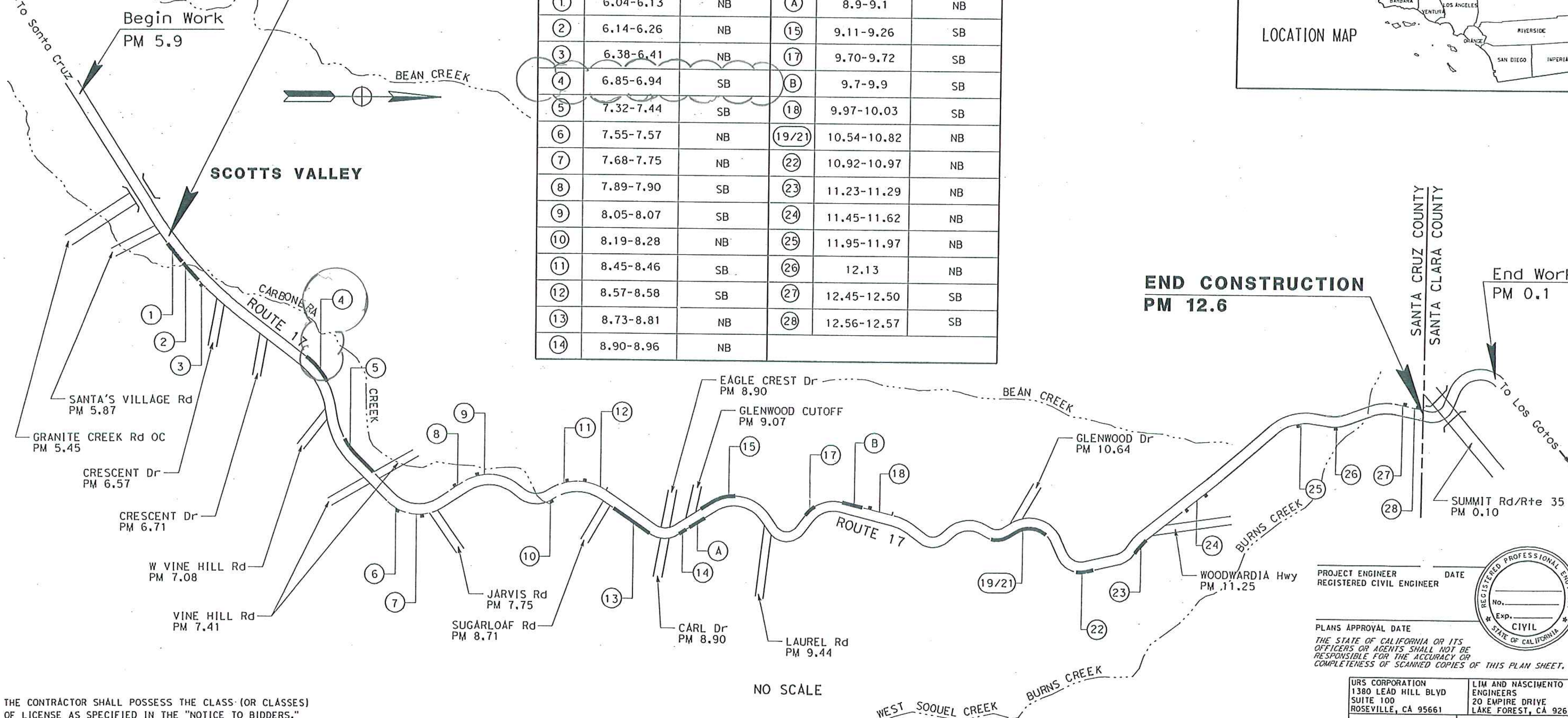
STATE HIGHWAY

IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			



NO SCALE

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

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08

DATE PLOTTED => 12/5/2008 3:14:25 PM

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BORDER LAST REVISED 8/1/2008

CALTRANS WEB SITE IS: HTTP//WWW.DOT.CA.GOV/

RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

USERNAME => Carlton Allen
DGN FILE => ...

CU 06253

EA 0L70U1

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

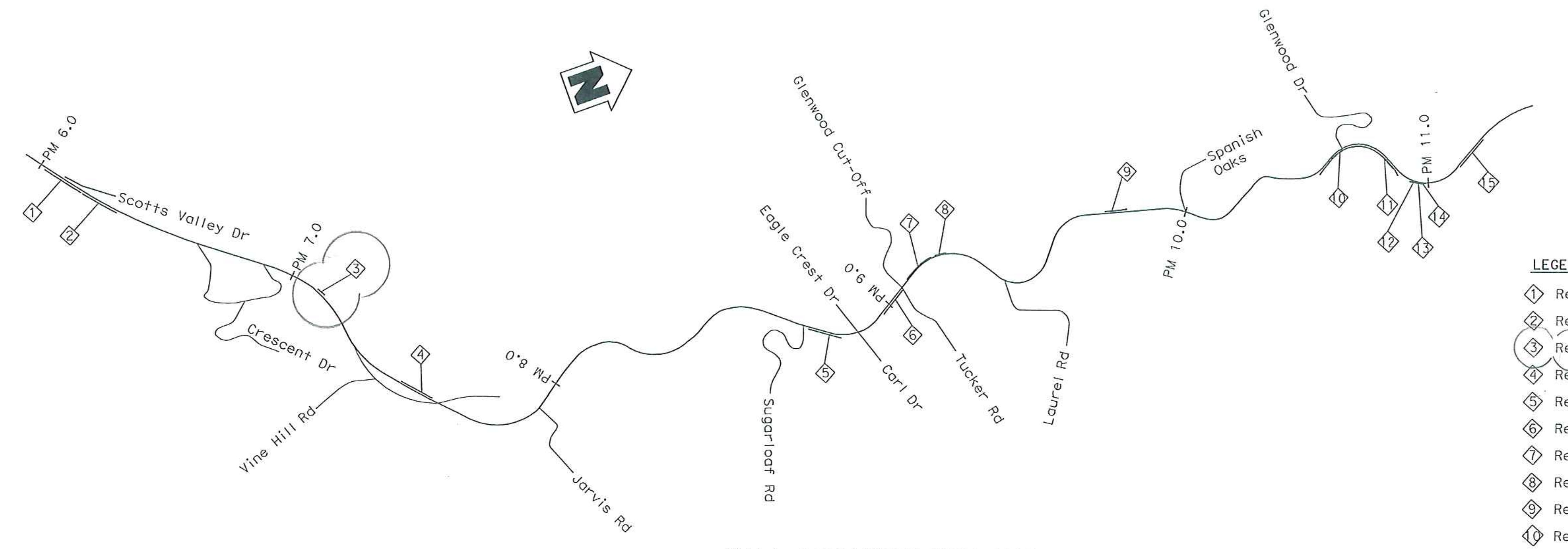
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER
T. Dudley
No. C 039514
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

- 1 Retaining Wall No. 1
- 2 Retaining Wall No. 2
- 3 Retaining Wall No. 3
- 4 Retaining Wall No. 4
- 5 Retaining Wall No. 5
- 6 Retaining Wall No. 6
- 7 Retaining Wall No. 7
- 8 Retaining Wall No. 8
- 9 Retaining Wall No. 9
- 10 Retaining Wall No. 10
- 11 Retaining Wall No. 11
- 12 Retaining Wall No. 12 *
- 13 Retaining Wall No. 13 *
- 14 Retaining Wall No. 14 *
- 15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS INDEX TO PLANS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

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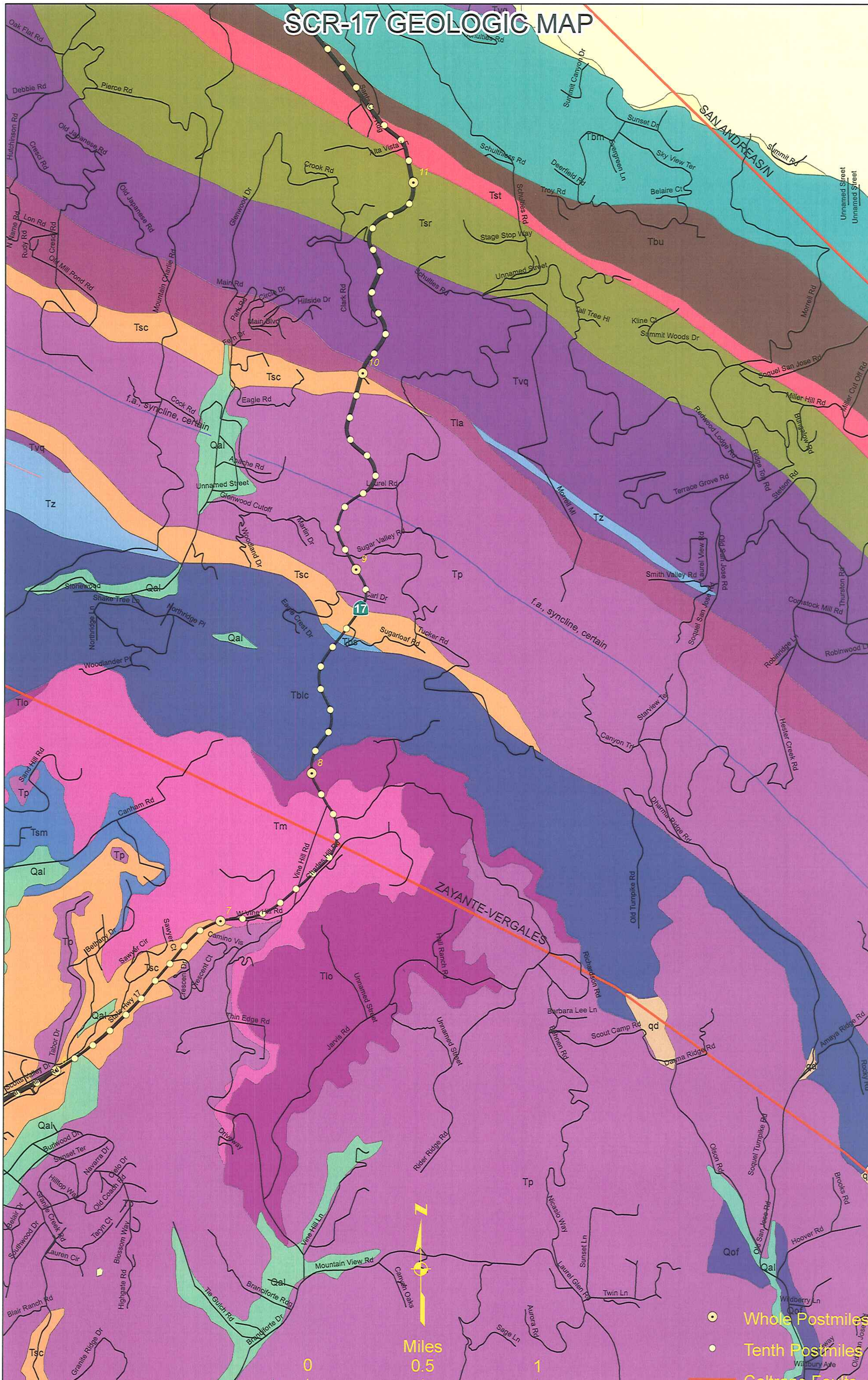
ATTACHMENT 2

GEOLOGIC MAP

SCR-17 GEOLOGIC MAP



ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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BENCH MARK

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E = 6127594.205,
Elev = 919.240

SUHV PM6.99 (Not Shown on Sheet)
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Elev = 962.885

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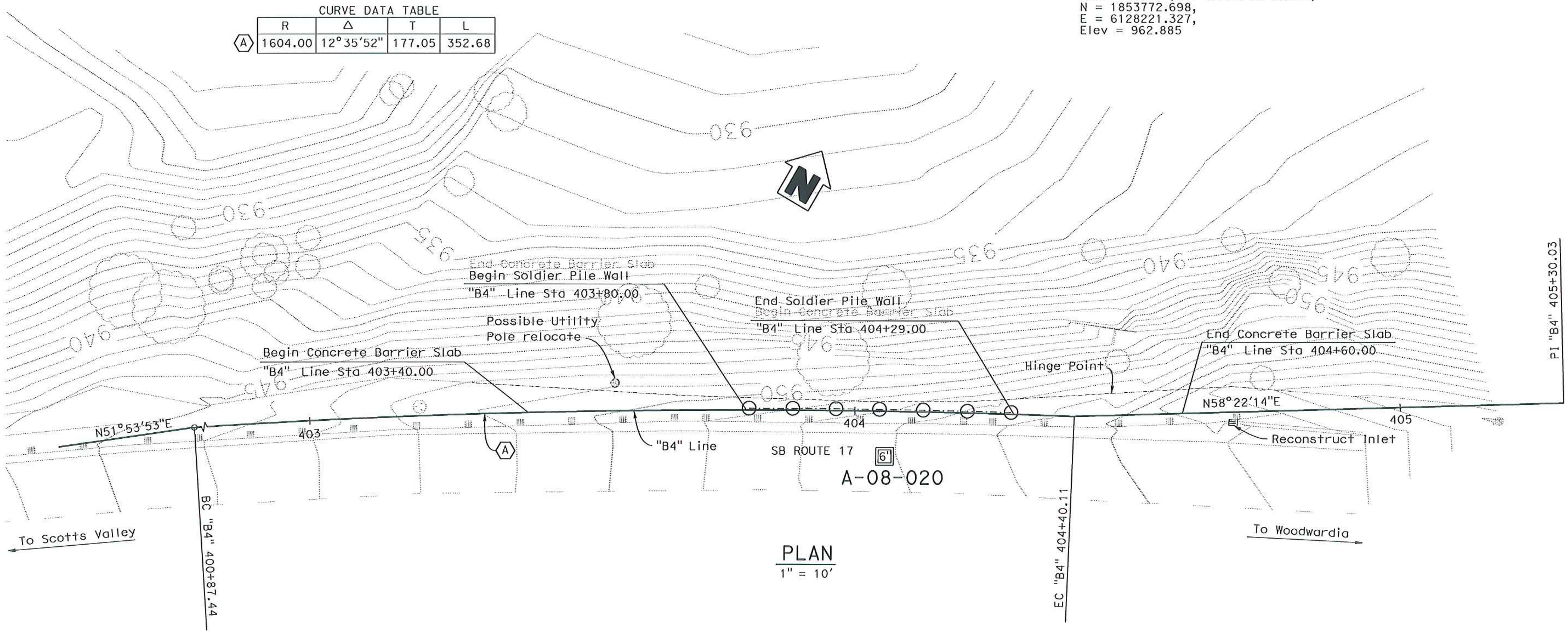


PLAN
1" = 10'

DESIGN OVERSIGHT	DESIGN	BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	DETAILS	BY	CHECKED	
	QUANTITIES	BY	CHECKED	

PROJECT ENGINEER

BRIDGE NO. TBD

POST MILE 6.90

RW3-BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 10 OF

FILE => RW3EP.dgn

USERNAME => s108940 DATE PLOTTED => 31-DEC-2008 TIME PLOTTED => 08:06

State of California Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-7.32/7.44
Guard Rail Upgrades
Retaining Wall 4

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a soldier pile retaining wall to support the widened shoulder at Location 5, which lies between approximately post mile 7.32 and post mile 7.44. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 5 is on the southbound side of the highway, south of the intersection of Route 17 and Vine Hill Road. Existing outside shoulder widths at the location range between 1.3 feet and 3.9 feet, but are typically less than 2 feet. Metal beam guard railing is currently in place along the outside edge of pavement, and a concrete median barrier separates northbound and southbound traffic along much of the location.

It is proposed to widen outside shoulders to 4 feet and construct concrete barriers with barrier slabs at this location. A soldier pile retaining wall with timber lagging will be constructed between "B5" Station 501+00.00 and "B5" Station 506+21.00 to facilitate the shoulder widening and barrier construction.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

2. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

3. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 5 is in the Carbonera Creek water shed. Carbonera Creek is a tributary of the southward flowing San Lorenzo River, which drains into Monterey Bay.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that middle Miocene aged Monterey Formation, geologic unit T_m, underlies Location 5. Brabb describes Monterey Formation as medium- to thick-bedded and laminated olive-gray to light-gray semi siliceous organic mudstone and sandy siltstone. The unit includes a few thick dolomite interbeds.

The highway at Location 5 was constructed as a fill cross section. The embankment slopes are inclined at 1.1:1 to 1.8:1, with most steeper than 1.3:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling four six-inch auger borings in the southbound #2 traffic lane within the longitudinal limits of the proposed retaining wall. The locations of the borings are shown on the attached RW 4 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007)*.

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at Location 5 appears to be comprised mainly of loose to medium dense silty sand with gravel and silty sand fill overlying loose to dense native material consisting of silty sand, sandy silt, and clayey sand. Fine-grained, soft to moderately hard sandstone was encountered at a depth of 32 feet in the northernmost boring. It is possible that some of the material encountered in the other borings was actually fine-grained sandstone, but the drilling method did not permit that distinction.

Ground Water

Ground water was not encountered within 40 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
A-08-019	15.0'-20.0'	4.5	890	Pending	Pending
A-08-021	15.0'-20.0'	4.8	730	Pending	Pending
A-08-022	15.0'-20.0'	5.4	2370	N/A	N/A
A-08-023	15.0'-20.0'	6.4	770	Pending	Pending
Corrosive if		<5.5	<1000	>2000	>500

Based on the results of the corrosion analyses, the site is considered corrosive. Controlling corrosion test parameter results are as follows:

- 4.5 pH
- Test results for concentrations of soluble salts were not available at the time of this report. Past experience in the project area, however, suggests that sulfate concentrations will likely be above the 2000-ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The Zayante-Vergales Fault is the controlling fault at Location 5. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 0.3-mile from the Zayante-Vergales Fault, the peak bedrock acceleration (PBA) at Location 5 due to an earthquake along the Fault is estimated to be 0.67 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the soldier pile wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Retained soils for the proposed soldier pile wall are primarily silty sands of the embankment fill. The soldier piles for the retaining wall will be embedded in embankment material and, possibly, soft fine-grained sandstone.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling. Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the soldier pile wall. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B5" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
501+00 to 502+00	0.0-17.0	33	0	120	0.29	3.43
	17.0-27.0	30	0	120	0.33	3.04
	27.0-40.0	32	0	120	0.31	3.23
502+00 to 503+65	0.0-17.0	33	0	120	0.29	3.43
	17.0-37.0	30	0	120	0.33	3.04
	37.0-40.0	32	0	120	0.31	3.23
503+65 to 506+10	0.0-12.0	31		120	0.32	3.17
	12.0-37.0	30	0	120	0.33	3.04
	37.0-40.0	35	0	120	0.27	3.87
506+10 to 506+21	0.0-12.0	33	0	120	0.29	3.43
	12.0-40.0	35	0	120	0.27	3.87
	40.0+	37	0	125	0.25	4.25

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location 5 between "B5" Station 501+00.00 and "B5" Station 506+21.00. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 4 provided by the structure designer indicates that the lagged height of the wall will range between approximately 3 feet and 8 feet. A reinforced concrete barrier slab, approximately 2 feet thick, will be anchored to the tops of the soldier piles, above the timber lagging.

It is recommended that the lateral earth pressures acting on the retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design

Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern for this location. The existing slopes exhibit no sign of instability, and the addition of a soldier pile retaining wall with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the soldier piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered, temporary casing may be necessary to ensure a dry hole in which to place piles and pour concrete. The appropriate specification language should be included in the contract special provisions to address the possibility of accumulated water in the soldier pile holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 4.

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

- Foundation Report for Retaining Wall No. 4 dated December 31, 2008.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

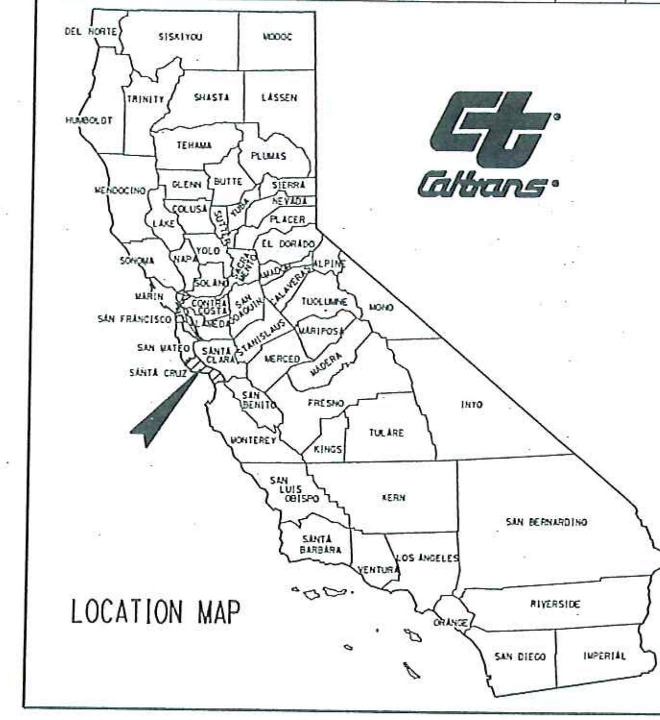
PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

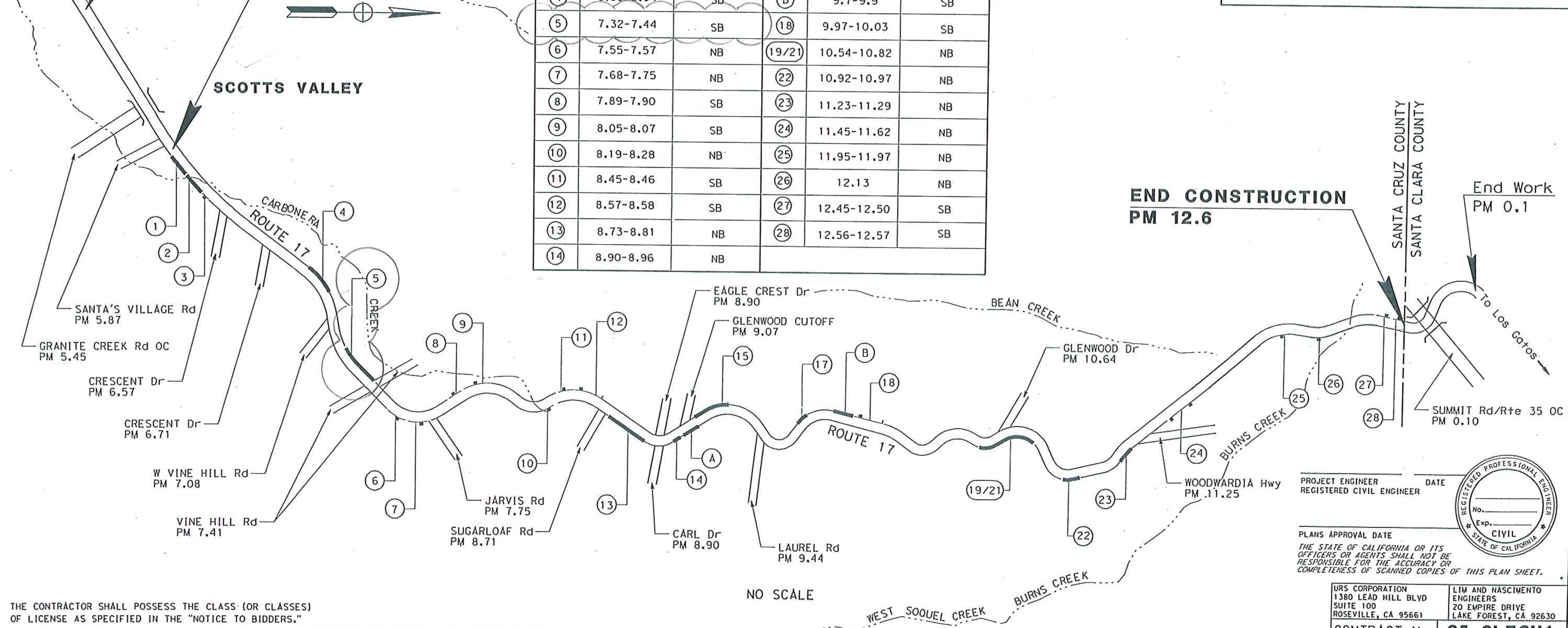
TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		



LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			



NO SCALE

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

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

...\PLANS\50L70Uab001.dgn

DATE PLOTTED => 12/5/2008 3:14:25 PM

LAST REVISION 12-05-08

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

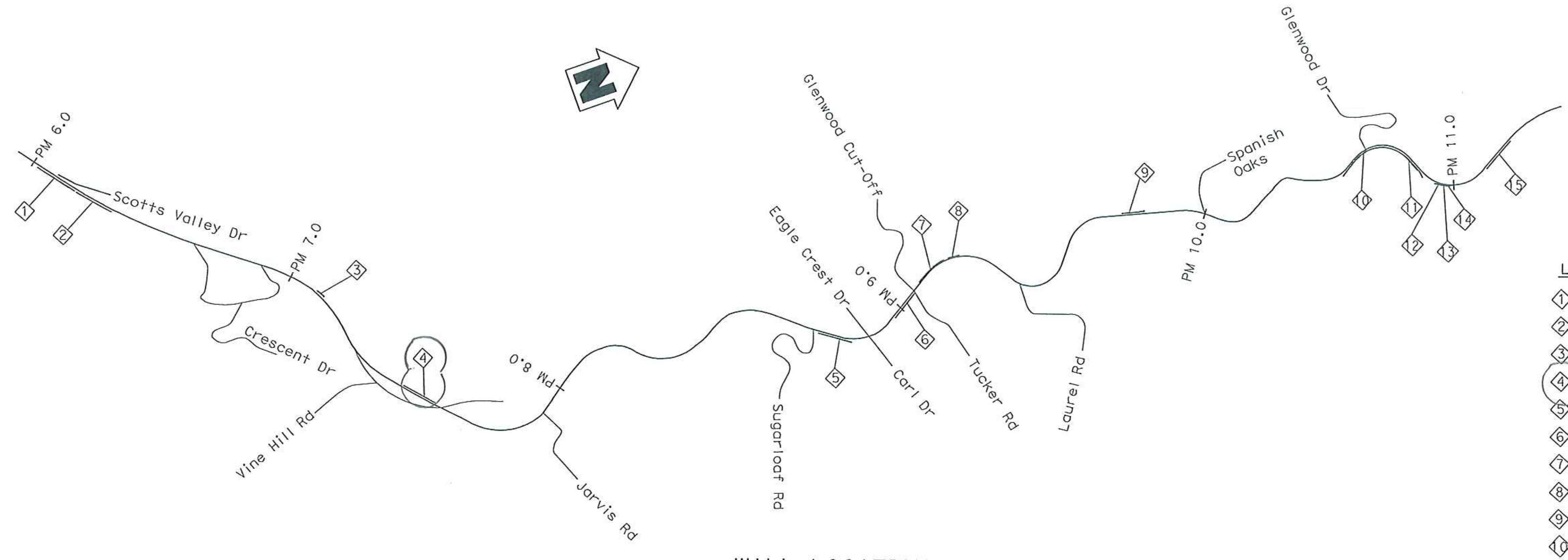
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
T. Dudley
No. C 039514
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

1 Retaining Wall No. 1
2 Retaining Wall No. 2
3 Retaining Wall No. 3
4 Retaining Wall No. 4
5 Retaining Wall No. 5
6 Retaining Wall No. 6
7 Retaining Wall No. 7
8 Retaining Wall No. 8
9 Retaining Wall No. 9
10 Retaining Wall No. 10
11 Retaining Wall No. 11
12 Retaining Wall No. 12 *
13 Retaining Wall No. 13 *
14 Retaining Wall No. 14 *
15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

CU 05
EA 0L7601

RETAINING WALLS
INDEX TO PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

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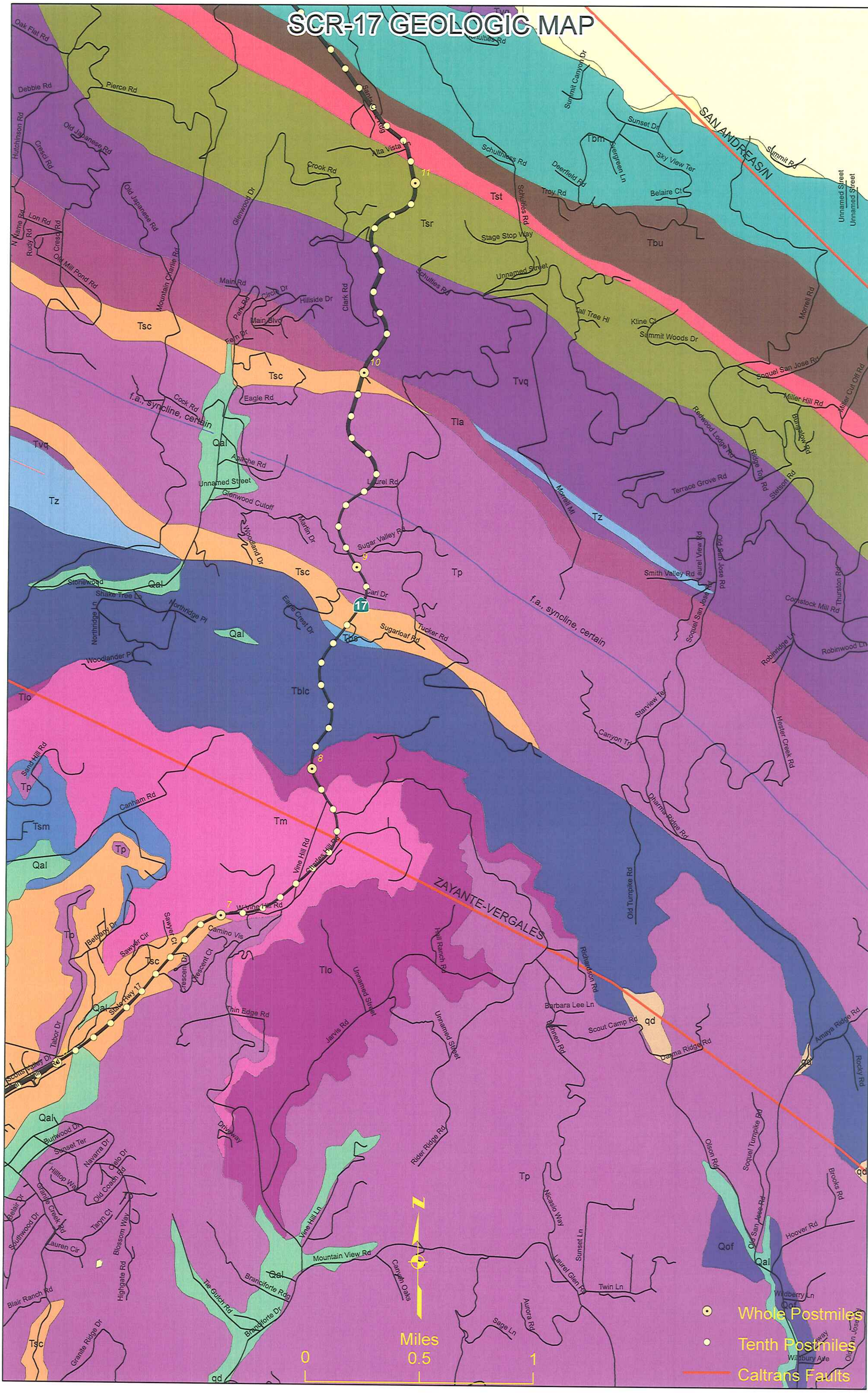
ATTACHMENT 2

GEOLOGIC MAP



SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbu
Tbm
Tst
Tsr
Tvq
Tla
Tz
Tp
Tsc
Tblc
Tm
Tlo
Tsm
Qal
Qof
qd
Whole Postmiles
Tenth Postmiles
Caltrans Faults
Miles
0
0.5
1

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

CURVE DATA TABLE

	R	Δ	T	L
A	2995.99	0°40'59"	17.86	35.72
B	50.00	31°53'32"	14.29	27.83

BENCH MARK
PM7.32
5.79' Lt of "B5" Line
Sta 500+85.27
N= 1854379.824,
E= 6129757.973,
ELEV= 984.122
PM7.43 (Not Shown on Sheet)
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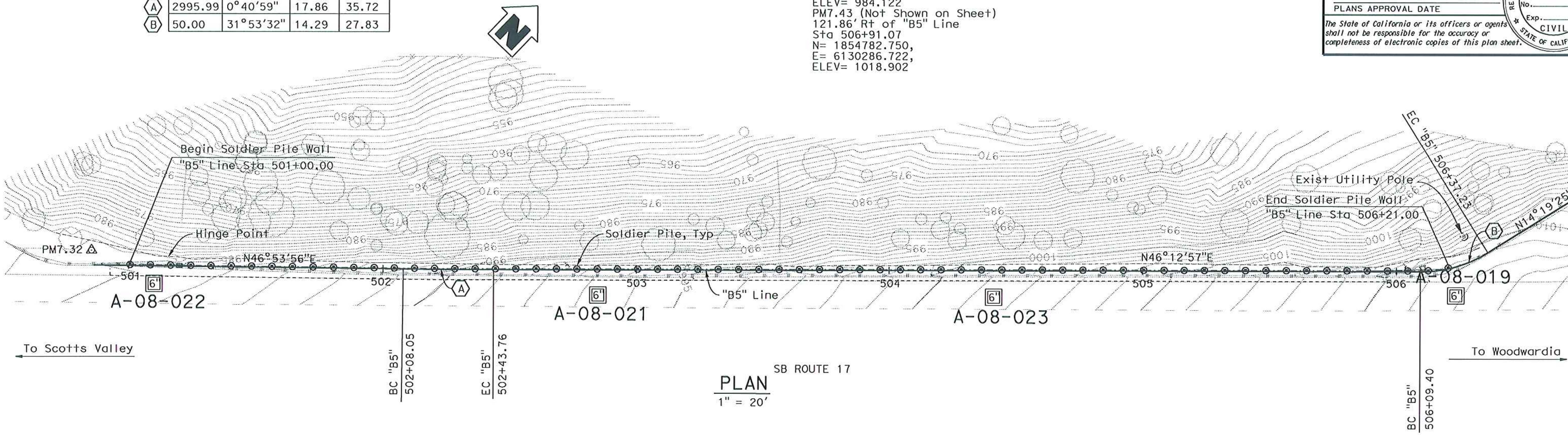
Sta 506+91.07
N= 1854782.750,
E= 6130286.722,
ELEV= 1018.902



SB ROUTE 17

PLAN
1" = 20'

DESIGN OVERSIGHT	DESIGN	BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	DETAILS	BY	CHECKED	PROJECT ENGINEER
	QUANTITIES	BY	CHECKED	

BRIDGE NO. TBD
POST MILE 7.38

RW4-BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 14 OF

FILE => RW4EP.dgn

State of California Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Attn: KEEN YONG POONG
Project Engineer

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-8.9/9.1
Guard Rail Upgrades
Retaining Wall 6

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a soldier pile retaining wall to support the widened shoulder at Location A, which lies between approximately post mile 8.9 and post mile 9.1. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location A is on the northbound side of the highway, south of the intersection of Route 17 and Glenwood Cutoff Road. Existing outside shoulder widths at the location range from less than 1 foot to 3.5 feet, but are typically less than 2 feet. A concrete median barrier separates northbound and southbound traffic except at the Glenwood Cut-Off intersection. Metal beam guard railing and temporary K-rail are currently in place along the northbound outside shoulder.

It is proposed to widen outside shoulders to 8 feet and construct concrete barriers with barrier slabs at this location. A soldier pile retaining wall with timber lagging will be constructed between RWLOL Station 20+26.51 and RWLOL Station 24+46.51 to facilitate the shoulder widening and barrier construction.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.
2. *Preliminary Geotechnical Report*, EA 05-0L700K, Caltrans, Ron Richman, March 17.2005
3. *Preliminary Foundation Report*, EA 05-0L7001, Caltrans, Daniel Appelbaum, June 12, 2008.
4. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages. Location A is in the Bean Creek water shed. Bean Creek is a tributary of the southward flowing San Lorenzo River, which drains into Monterey Bay.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Pliocene and upper Miocene aged Purisima Formation, geologic unit T_p, underlies Location A. Brabb describes Purisima Formation as very thick-bedded yellowish-gray tuffaceous and diatomaceous siltstone containing thick interbeds of bluish-gray, semi friable, fine-grained andesitic sandstone.

The northwest-southeast trending Glenwood Syncline crosses Route 17 north of Location A. The Purisima Formation beds dip 25 degrees to 45 degrees to the north-northeast at Location A.

The "Preliminary Map of Landslide Deposits in Santa Cruz County," compiled by Cooper–Clark & Associates depicts possible landslide features on the slopes below Location A. Field reconnaissance of the site, however, revealed no evidence of recent landslide activity. The impact of landslides on the design, construction, and maintenance of the proposed improvements is not considered significant.

The highway at Location A was constructed as a cut/fill section; with the northbound roadway on a shallow fill. The original ground slopes steeply down from the edge of the roadway, with slope inclinations ranging between 1.25:1 and 1.5:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling three six-inch auger borings in the northbound #2 traffic lane within the longitudinal limits of the proposed retaining wall. The locations of the borings are shown on the attached RW 6 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at Location A appears to be comprised mainly of loose to medium dense silty sand fill overlying medium dense silty sand and sandy silt. Soft, fine-grained sandstone was encountered in two of the borings. The sandstone was encountered at a depth of 18 feet 15.2 feet left of RWLOL Station 20+70.7 and at a depth of 7 feet 14.7 feet left of RWLOL Station 23+57.6.

Ground Water

Ground water was not encountered within 44.5 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
A-08-029	15.0'-20.0'	6.1	1470	N/A	N/A
A-08-030	15.0'-20.0'	6.9	3380	N/A	N/A
A-08-031	18.0'-23.0'	4.6	740	Pending	Pending
Corrosive if		<5.5	<1000	>2000	>500

Based on the results of the corrosion analyses, the site is considered corrosive. Controlling corrosion test parameter results are as follows:

- 4.6 pH
- Test results for concentrations of soluble salts were not available at the time of this report. Past experience in the project area, however, suggests that sulfate concentrations will likely be above the 2000-ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The Zayante-Vergales Fault is the controlling fault at Location A. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 1.1 miles from the Zayante-Vergales Fault, the peak bedrock acceleration (PBA) at Location A due to an earthquake along the Fault is estimated to be 0.65 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high percentage of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the soldier pile wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Retained soils for the proposed soldier pile wall are primarily silty sands of the embankment fill. The soldier piles for the retaining wall will be embedded in embankment material and soft, fine-grained sandstone.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling. Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the soldier pile wall. The given depths are relative to the existing road surface. The interface between soil and rock is assumed to dip to the east at a 1:1 slope, so the depth to sedimentary rock along the retaining wall layout line is substantially deeper than at the borehole locations.

Table 2: Recommended Soil Strength Parameters

Station Limits (RWLOL) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
20+25 to 21+00	0.0'-33.0'	32	0	120	0.31	3.23
	33.0-40.0	37	0	125	0.25	4.25
21+00 to 23+25	0.0-40.0	32	0	120	0.31	3.23
23+25 to 24+50	0.0-23.0	32	0	120	0.31	3.23
	23.0-40.0	37	0	125	0.25	4.25

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location A between RWLOL Station 20+26.51 and RWLOL Station 24+46.51. The wall will be situated to provide room for an 8-foot outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 6 provided by the structure designer indicates that the lagged height of the wall will range between approximately 3 feet and 8 feet. A reinforced concrete barrier slab, approximately 2 feet thick, will be anchored to the tops of the soldier piles, above the timber lagging.

It is recommended that the lateral earth pressures acting on the retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design

Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern for this location. The existing slopes exhibit no sign of instability, and the addition of a soldier pile retaining wall with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

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If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1	**LOCATION MAPS**
ATTACHMENT 2	**GEOLOGIC MAP**
ATTACHMENT 3	**BORHOLE LOCATIONS**

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
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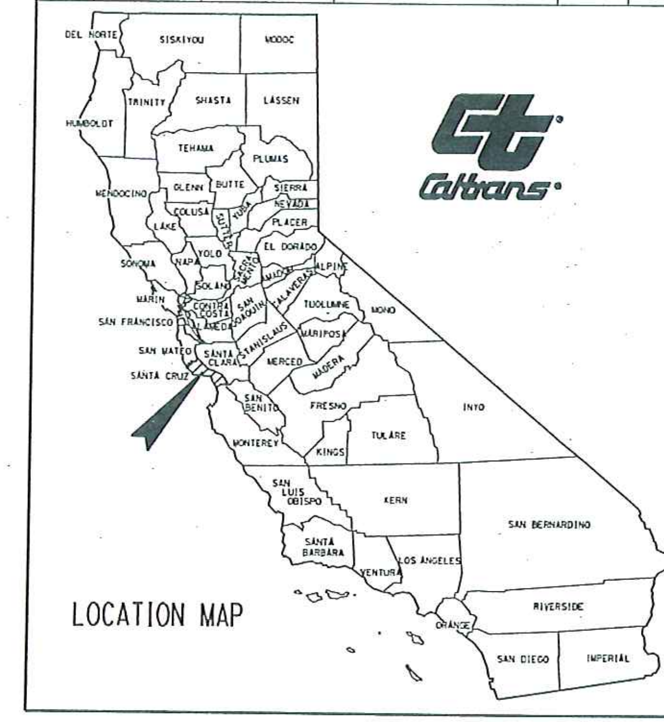
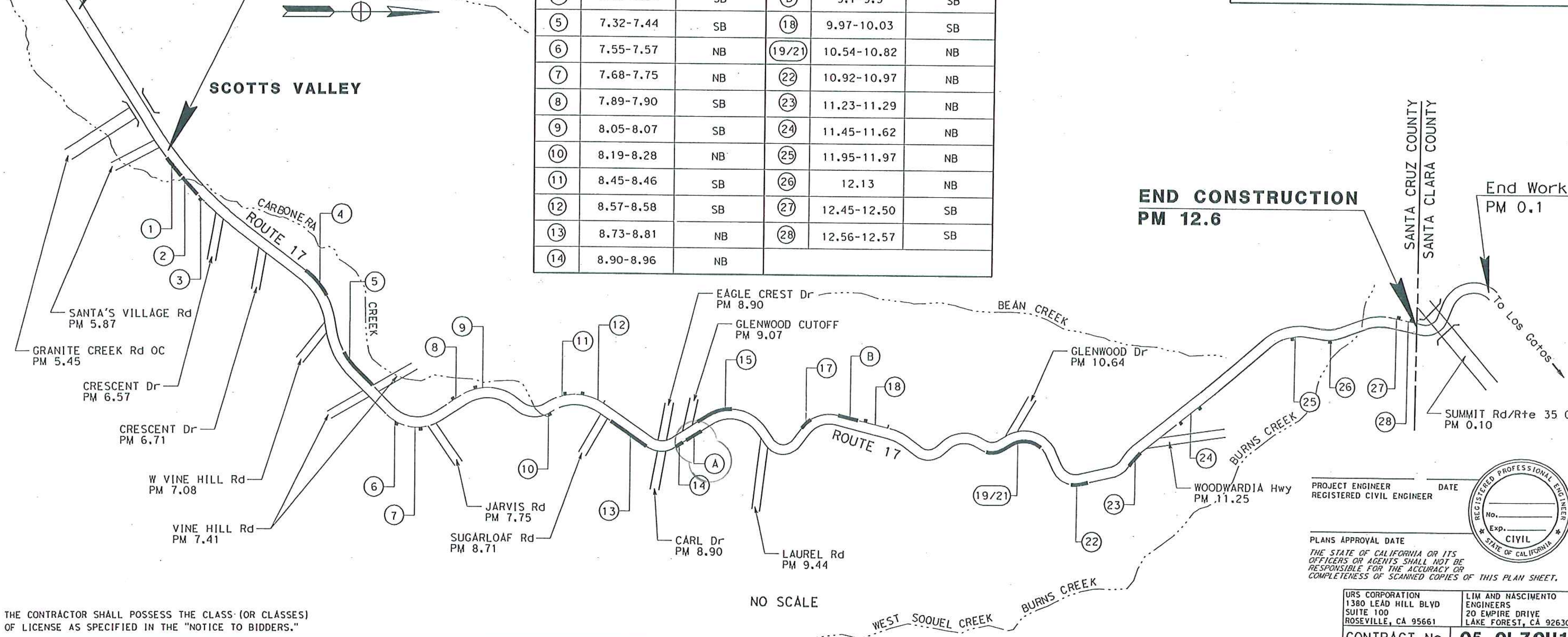
Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			





APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
ROTIMI ADEBAYO	C69102	6/30/2010	

CONSULTANT DESIGN ENGINEER
JAMES A. LABANOWSKI JR.

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

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08

DATE PLOTTED => 12/5/2008 3:14:25 PM

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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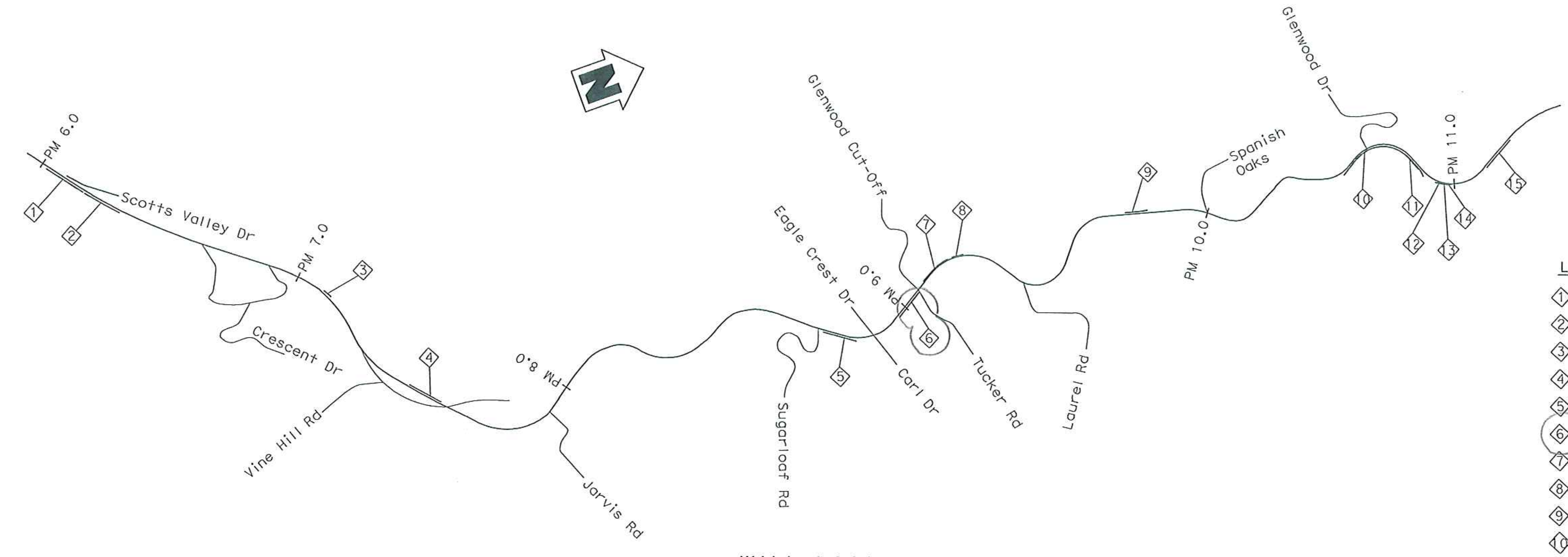
REGISTERED PROFESSIONAL ENGINEER T. Dudley No. C 039514 Exp. 12/31/09 CIVIL STATE OF CALIFORNIA

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

- 1 Retaining Wall No. 1
- 2 Retaining Wall No. 2
- 3 Retaining Wall No. 3
- 4 Retaining Wall No. 4
- 5 Retaining Wall No. 5
- 6 Retaining Wall No. 6
- 7 Retaining Wall No. 7
- 8 Retaining Wall No. 8
- 9 Retaining Wall No. 9
- 10 Retaining Wall No. 10
- 11 Retaining Wall No. 11
- 12 Retaining Wall No. 12 *
- 13 Retaining Wall No. 13 *
- 14 Retaining Wall No. 14 *
- 15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN	BY T. Dudley	CHECKED R. Price	
DETAILS	BY C. Lee / Y. Ng	CHECKED R. Price	
QUANTITIES	BY T. Dudley	CHECKED E. Nevarez	

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

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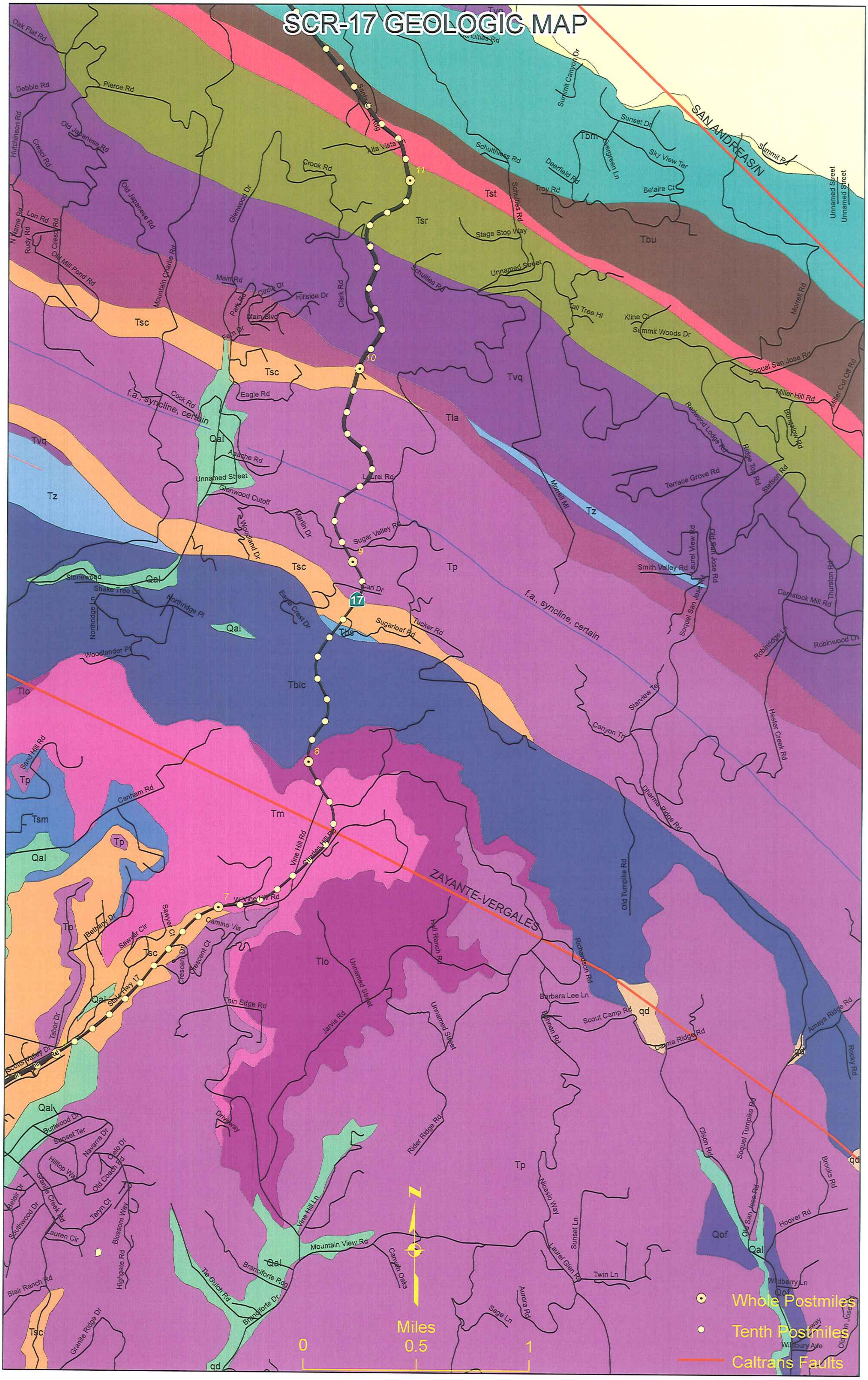
ATTACHMENT 2

GEOLOGIC MAP



SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbm
Tbu
Tst
Tsr
Tvq
Tla
Tz
Tp
Tsc
Qal
Tbs
Tblc
Tm
Tlo
Tsm
Tvq
Qof
qd
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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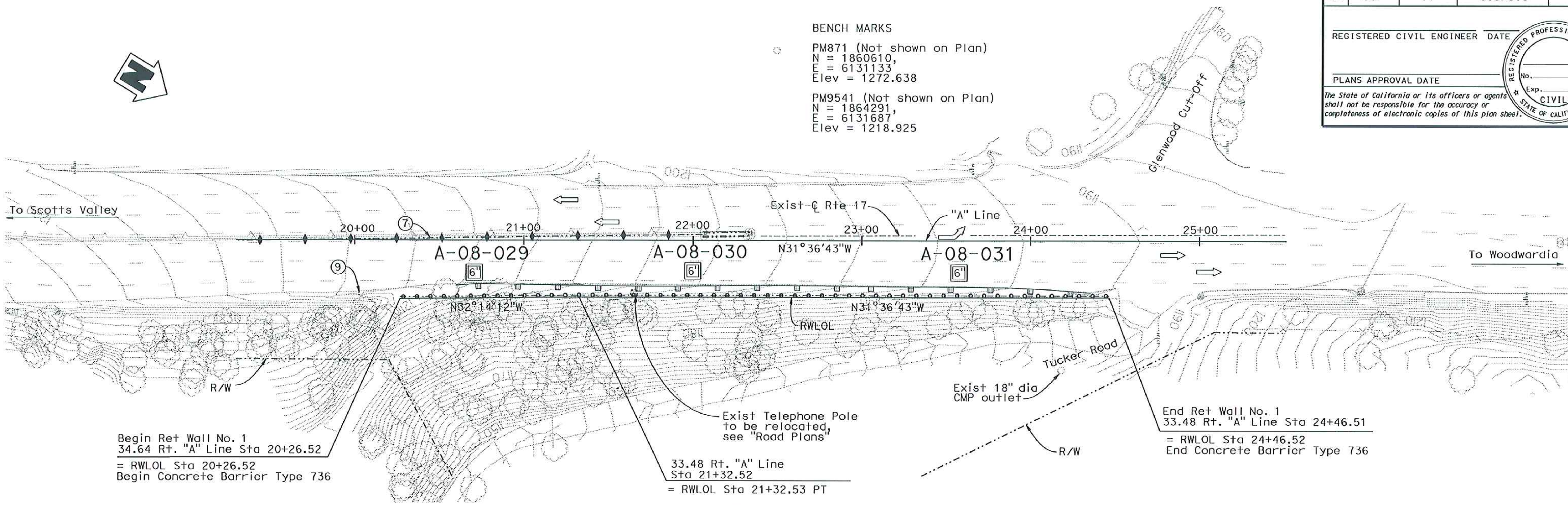


PLAN
1" = 30'

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN	BY	CHECKED
DETAILS	BY	CHECKED
QUANTITIES	BY	CHECKED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO. TBD

POST MILE 8.9

RW 6 - BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L70U1
FILE => RW6EP.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

USERNAME => s108940 DATE PLOTTED => 31-DEC-2008 TIME PLOTTED => 08:06

Memorandum

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-9.11/9.26
Guard Rail Upgrades
Retaining Wall 7

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a soldier pile retaining wall to support the widened shoulder at Location 15, which lies between approximately post mile 9.11 and post mile 9.26. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 15 is on the southbound side of the highway, north of the intersection of Route 17 and Glenwood Cutoff Road. Existing outside shoulder widths at the location range between 1 foot and 3.2 feet, but are typically less than 2 feet. Metal beam guard railing is currently in place along the outside edge of pavement, and a concrete median barrier separates northbound and southbound traffic along much of the location.

It is proposed to widen outside shoulders to 4 feet and construct concrete barriers with barrier slabs at this location. A soldier pile retaining wall with timber lagging will be constructed between "B15" Station 1502+41.50 and "B15" Station 1505+38.50 to facilitate the shoulder widening and barrier construction.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

2. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

3. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 15 is in the Bean Creek water shed. Bean Creek is a tributary of the southward flowing San Lorenzo River, which drains into Monterey Bay.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Pliocene and upper Miocene aged Purisima Formation, geologic unit T_p, underlies Location 15. Brabb describes Purisima Formation as very thick-bedded yellowish-gray tuffaceous and diatomaceous siltstone containing thick interbeds of bluish-gray, semi friable, fine-grained andesitic sandstone.

The highway at Location 15 was constructed as a cut/fill cross section. The embankment slope inclinations range between 0.8:1 and 2.7:1, but are typically about 1.5:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling three six-inch auger borings in the southbound #2 traffic lane within the longitudinal limits of the proposed retaining wall. The locations of the borings are shown on the attached RW 7 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007)*.

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at Location 15 appears to be comprised mainly of loose to medium dense sand and silty sand fill overlying medium dense silty sand and sandy silt. Fine to medium-grained, soft sandstone was encountered in two of the borings. The sandstone was encountered at a depth of 23 feet 9.2 feet right of "B15" Station 1504+16.5 and at a depth of 34.5 feet 9.7 feet right of "B15" Station 1505+20.1.

Ground Water

Ground water was not encountered within 40 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
A-08-026	15.0'-20.0'	6.1	1330	N/A	N/A
A-08-027	15.0'-20.0'	6.6	3770	N/A	N/A
A-08-028	15.0'-20.0'	6.5	2710	N/A	N/A
Corrosive if		<5.5	<1000	>2000	>500

Based on corrosion test results, and because the project area is not within 1000 feet of salt or brackish water, the site is considered non-corrosive.

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 15. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 2.6 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 15 due to an earthquake along the Fault is estimated to be 0.68 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the soldier pile wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Retained soils for the proposed soldier pile wall are primarily sands and silty sands of the embankment fill. The soldier piles for the retaining wall will be embedded in embankment material and, possibly, soft, fine-grained sandstone.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling. Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the soldier pile wall. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B15" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
1502+40 to 1504+00	0.0'-35.0'	30	0	120	0.33	3.04
	35.0-40.0	37	0	125	0.25	4.25
1504+00 to 1504+80	0.0-15.0	33	0	120	0.29	3.43
	15.0-30.0	31	0	120	0.32	3.17
	30.0-40.0	37	0	125	0.25	4.25
1504+80 to 1505+40	0.0-20.0	33		120	0.29	3.43
	20.0-40.0	31	0	120	0.32	3.17
	40.0+	37	0	125	0.25	4.25

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location 15 between "B15" Station 1502+41.50 and "B15" Station 1505+38.50. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 7 provided by the structure designer indicates that the lagged height of the wall will range between approximately 4 feet and 6 feet. A reinforced concrete barrier slab, approximately 2 feet thick, will be anchored to the tops of the soldier piles, above the timber lagging.

It is recommended that the lateral earth pressures acting on the retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height

shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern for this location. The existing slopes exhibit no sign of instability, and the addition of a soldier pile retaining wall with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the soldier piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered, temporary casing may be necessary to ensure a dry hole in which to place piles and pour concrete. The appropriate specification language should be included in the contract special provisions to address the possibility of accumulated water in the soldier pile holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 7.

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

- Foundation Report for Retaining Wall No. 7 dated December 31, 2008.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

LOCATION MAPS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

INDEX OF PLANS

STATE OF CALIFORNIA

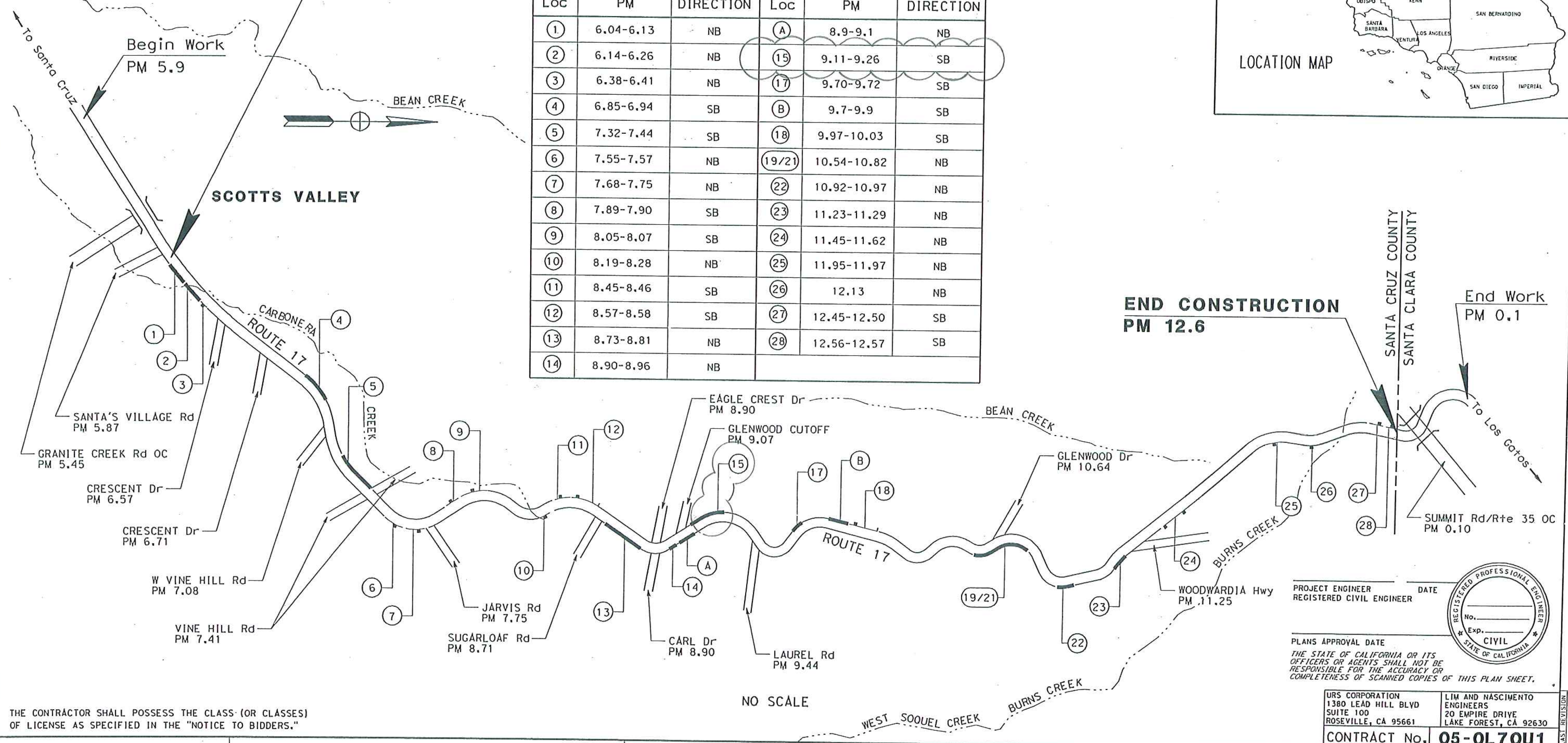
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006



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5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
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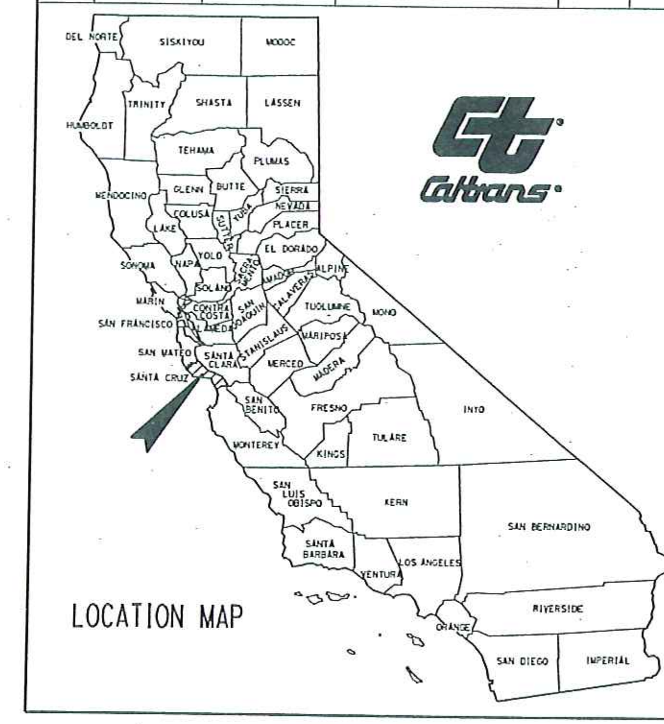

LOCATION MAP

Caltrans

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
C69102	6/30/2010	

CALTRANS DESIGN OVERSIGHT APPROVAL: ROTIMI ADEBAYO

CONSULTANT DESIGN ENGINEER: JAMES A. LABANOWSKI JR.

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

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ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08

DATE PLOTTED => 12/5/2008 3:14:25 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

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T. Dudley
No. C 039514
Exp. 12/31/09
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STATE OF CALIFORNIA

LIM & NASCIMENTO ENGINEERING
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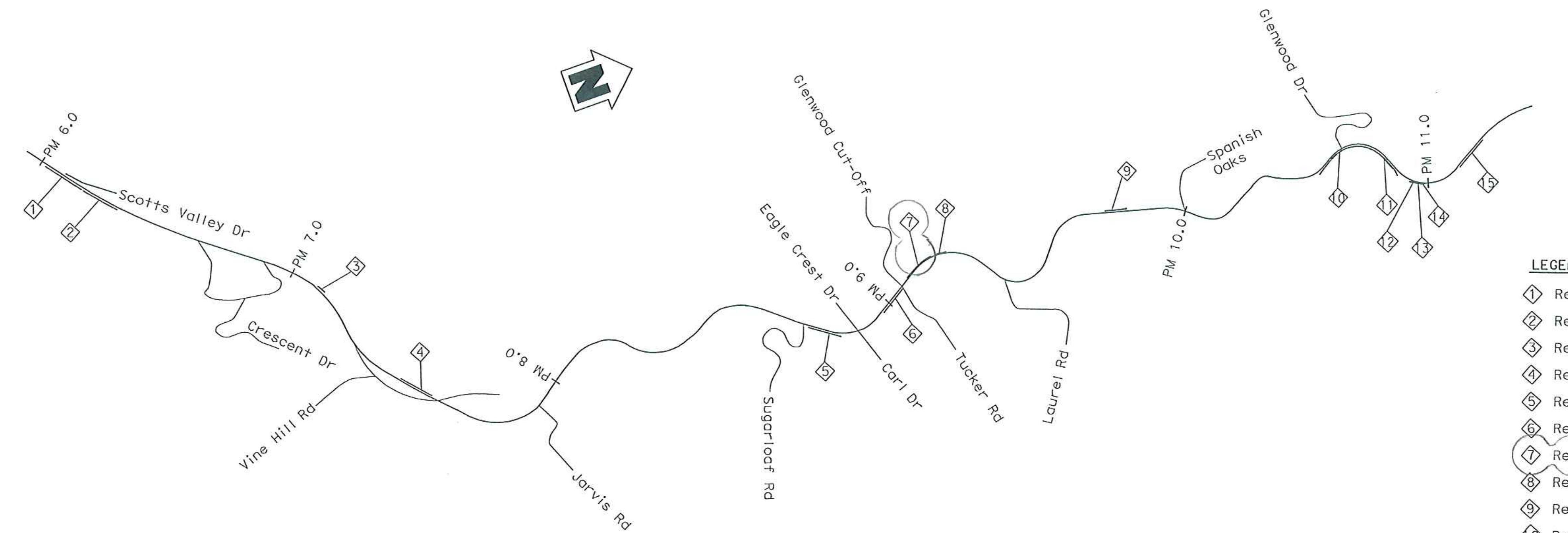
LAKE FOREST, CALIFORNIA 92630



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14 Retaining Wall No. 14 *
15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

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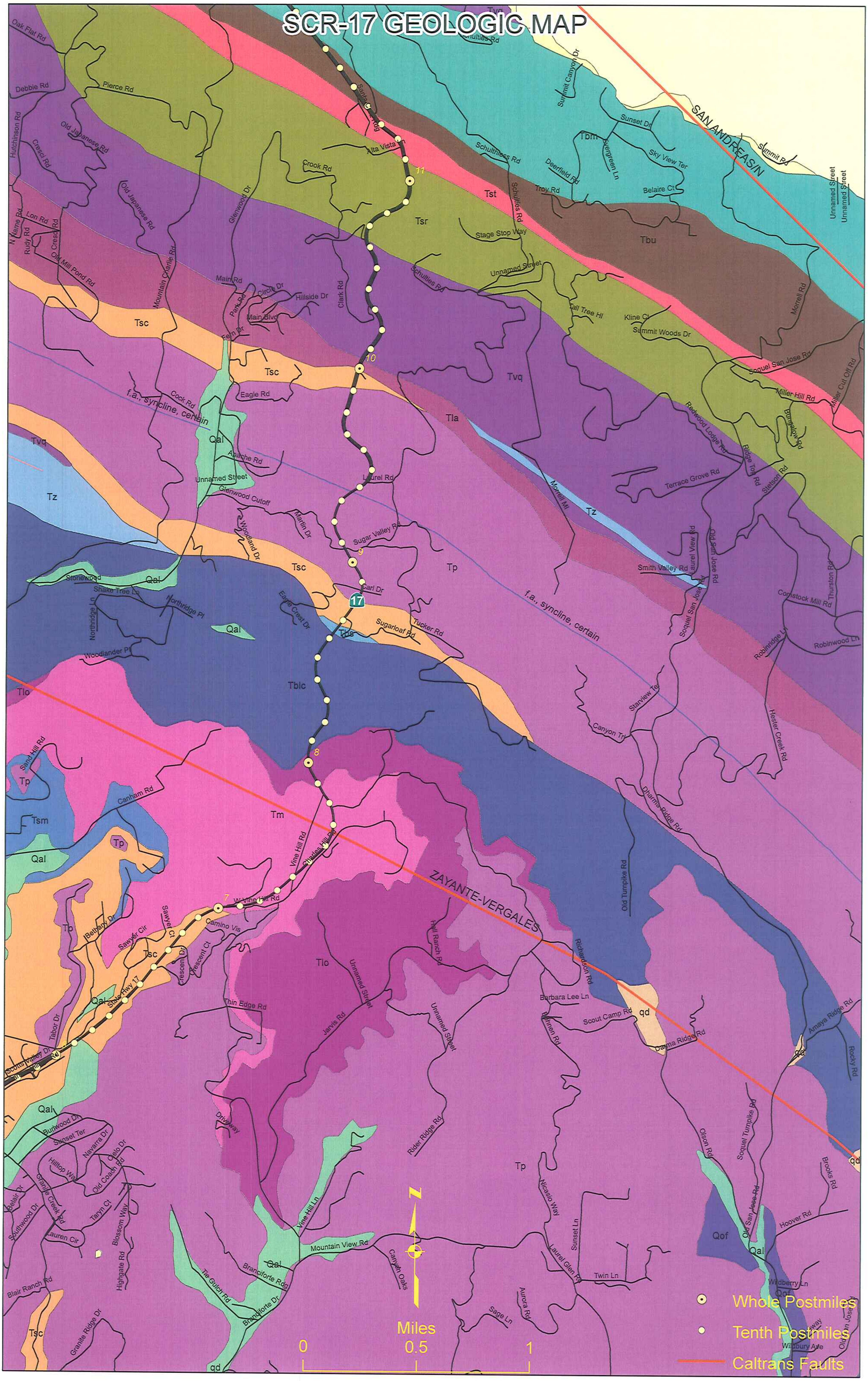
ATTACHMENT 2

GEOLOGIC MAP


SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbm
Tbu
Tst
Tsr
Tvq
Tla
Tz
Tp
Tsc
Qal
Tbs
Tblc
Tlo
Tm
Tsm
Tb
qd
Qof
17
8
9
10
11
N
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

BENCH MARK
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E= 6130976.632,
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E= 6130756.311,
ELEV 1204.003

CURVE DATA TABLE

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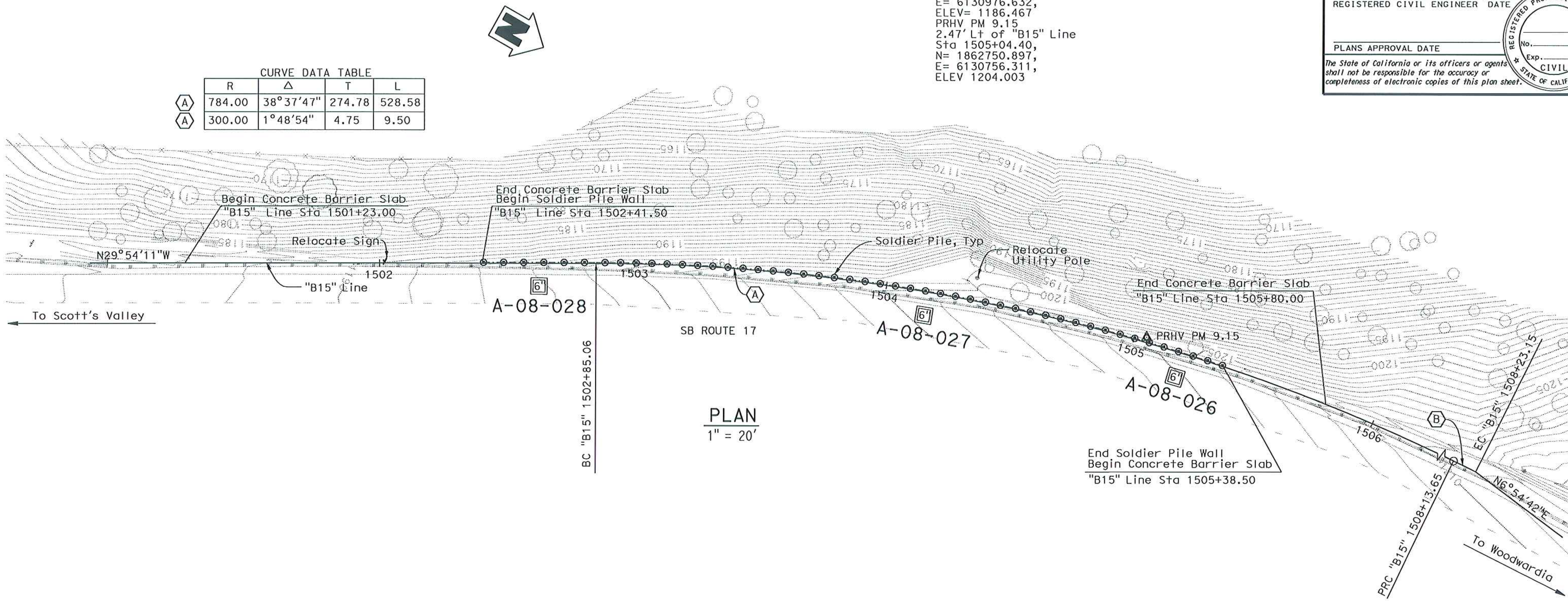
A	300.00	1°48'54"	4.75	9.50



PLAN
1" = 20'

DESIGN	BY	CHECKED	
DETAILS	BY	CHECKED	
QUANTITIES	BY	CHECKED	

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE 9.11

RW7 - BOREHOLE LOCATIONS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

FILE => RW7EP new.dgn

State of California Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-9.11/9.26
Guard Rail Upgrades
Retaining Wall 8

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of two reinforced concrete retaining walls on 24-inch CIDH piles to support the widened shoulder at Location 15, which lies between approximately post mile 9.11 and post mile 9.26. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 15 is on the southbound side of the highway, north of the intersection of Route 17 and Glenwood Cutoff Road. There is an existing retaining wall at the northerly end of the location consisting of 16-inch CIDH piles on approximately 9-foot centers, spanned by timber lagging. Existing outside shoulder widths at this location are typically ±2 feet. Metal beam guard railing is currently in place along the outside edge of pavement, and a concrete median barrier separates northbound and southbound traffic along much of the location.

It is proposed to widen outside shoulders to 4 feet and construct concrete barriers at Location 15. The existing retaining wall will support the widened shoulder through much of the location, but reinforced concrete retaining walls supported by 24-inch CIDH piles will be constructed at both ends of the existing wall to complete the widening. The retaining wall at the southerly end of the existing wall will be 11 feet long, and will extend between "B15" Station 1506+97.13 and "B15" Station 1507+08.13. The retaining wall at the northerly end of the existing wall will be 9.5 feet long, and will span between "B15" Station 1508+15.25 and "B15" Station 1508+24.75.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

2. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

3. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 15 is in the Bean Creek water shed. Bean Creek is a tributary of the southward flowing San Lorenzo River, which drains into Monterey Bay.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Pliocene and upper Miocene aged Purisima Formation, geologic unit T_p, underlies Location 15. Brabb describes Purisima Formation as very thick-bedded yellowish-gray tuffaceous and diatomaceous siltstone containing thick interbeds of bluish-gray, semi friable, fine-grained andesitic sandstone.

The highway at Location 15 was constructed as a cut/fill cross section. The embankment slopes at both ends of the existing retaining wall are inclined steeper than 2:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining walls. The investigation consisted of drilling two six-inch auger borings in the southbound #2 traffic lane, one near the location of each of the walls. The locations of the borings are shown on the attached RW 8 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at the proposed location of the southerly retaining wall consists of approximately 12 feet of very loose to loose silty sand with gravel and silty sand, overlying soft, fine-grained sandstone. The subsurface stratigraphy at the proposed location of the northerly retaining wall consists of approximately 12 feet of dense to very dense silty sand overlying soft, fine-grained sandstone.

Ground Water

Ground water was not encountered within 35 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm

- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
A-08-024	15.0'-20.0'	6.8	1150	N/A	N/A
A-08-025	0.0'-10.0'	7.0	2620	N/A	N/A
Corrosive if		<5.5	<1000	>2000	>500

Based on corrosion test results, and because the project area is not within 1000 feet of salt or brackish water, the site is considered non-corrosive.

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 15. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 2.6 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 15 due to an earthquake along the Fault is estimated to be 0.68 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained material in the embankment fills and native soils, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the retaining walls are based upon SPT correlations to internal angle of friction in cohesionless soils. Retained soils for the proposed walls are primarily silty sands of the embankment fill. The CIDH piles for the retaining walls will be embedded in embankment material and soft, fine-grained sandstone.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the retaining walls. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B15" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
1506+95 to 1507+10	0.0'-21.0	30	0	120	0.33	3.04
	21.0-35.0	37	0	125	0.25	4.25
1508+15 to 1508+25	0.0-21.0	34	0	120	0.28	3.64
	21.0-30.0	37	0	125	0.25	4.25

Foundation Recommendations

Reinforced concrete retaining walls founded on 24-inch CIDH piles are proposed at Location 15 between "B15" Station 1506+97.13 and "B15" Station 1507+08.13, and between "B15" Station 1508+15.25 and "B15" Station 1508+24.75. The walls will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier.

For the purposes of performing a lateral analysis on the proposed 24-inch CIDH piles, foundation soils should be assumed to be cohesionless, with strength parameters as presented in Table 2. The piles should be assumed to derive their axial capacity solely from skin friction. The graphs presented in Attachment 4 can be used to estimate axial capacity for pile lengths up to 35 feet. It is recommended that a factor of safety of 2.0 be assumed in the calculation of allowable capacity.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Slope Stability

Global slope stability is not considered to be a concern at this location. The existing slopes exhibit no sign of instability, and the addition of a retaining wall founded on 24-inch CIDH piles with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The loose density and dry condition of the upper portions of the embankment fill material may require casing the top portions of the CIDH pile holes to prevent caving.

Rock may be encountered during drilling of the holes for the CIDH piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the CIDH piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered during drilling, it may be necessary to pour the concrete for the CIDH piles using "wet" construction methods. The appropriate specification language should be included in the contract special provisions to address the possibility of having to construct the piles in wet holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 8.

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

- Foundation Report for Retaining Wall No. 8 dated December 31, 2008.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

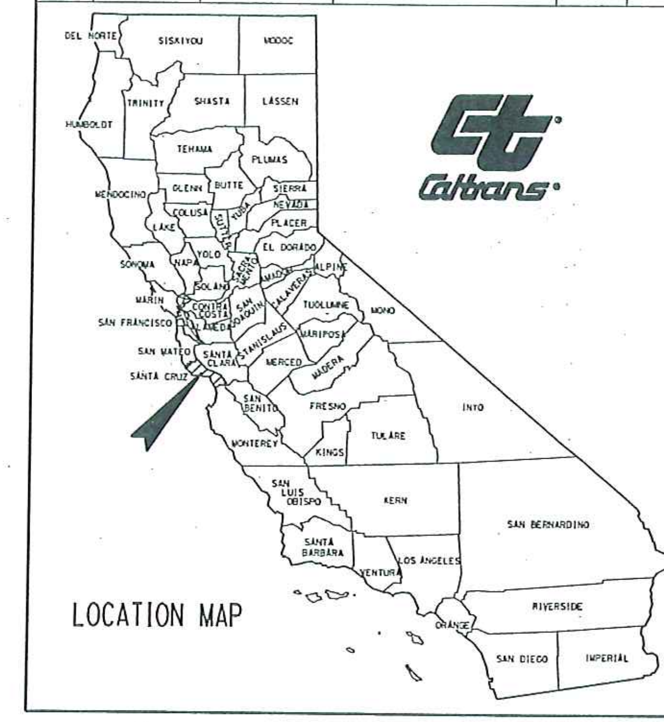
LOCATION MAPS

INDEX OF PLANS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006



LOCATIONS OF CONSTRUCTION

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2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
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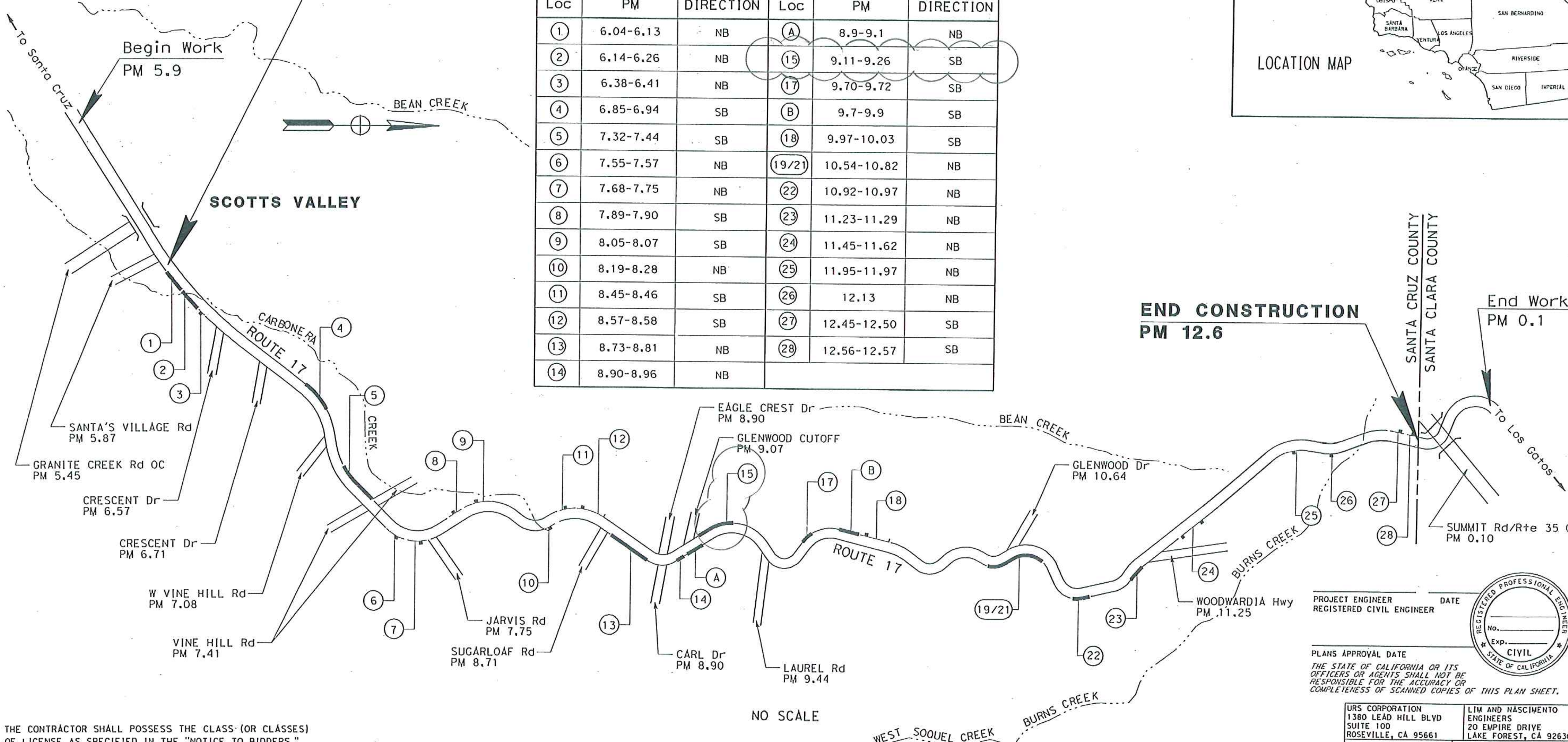

NO SCALE

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

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

...\PLANS\50L70Uab001.dgn

PROJECT ENGINEER REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

DATE PLOTTED => 12/5/2008 3:14:25 PM

LAST REVISION 12-05-08

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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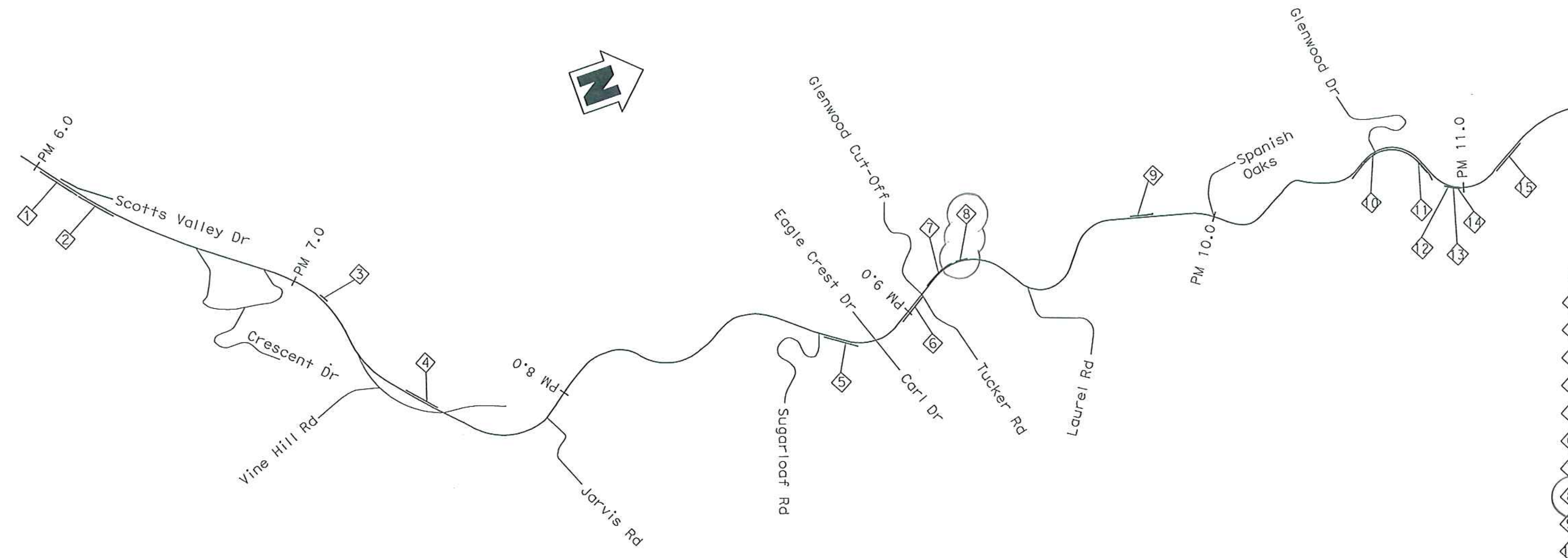
REGISTERED PROFESSIONAL ENGINEER
T. Dudley
No. C 039514
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

- 1 Retaining Wall No. 1
- 2 Retaining Wall No. 2
- 3 Retaining Wall No. 3
- 4 Retaining Wall No. 4
- 5 Retaining Wall No. 5
- 6 Retaining Wall No. 6
- 7 Retaining Wall No. 7
- 8 Retaining Wall No. 8
- 9 Retaining Wall No. 9
- 10 Retaining Wall No. 10
- 11 Retaining Wall No. 11
- 12 Retaining Wall No. 12 *
- 13 Retaining Wall No. 13 *
- 14 Retaining Wall No. 14 *
- 15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

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B0-3	BRIDGE DETAILS
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B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.
DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An
SIGN OFF DATE
DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

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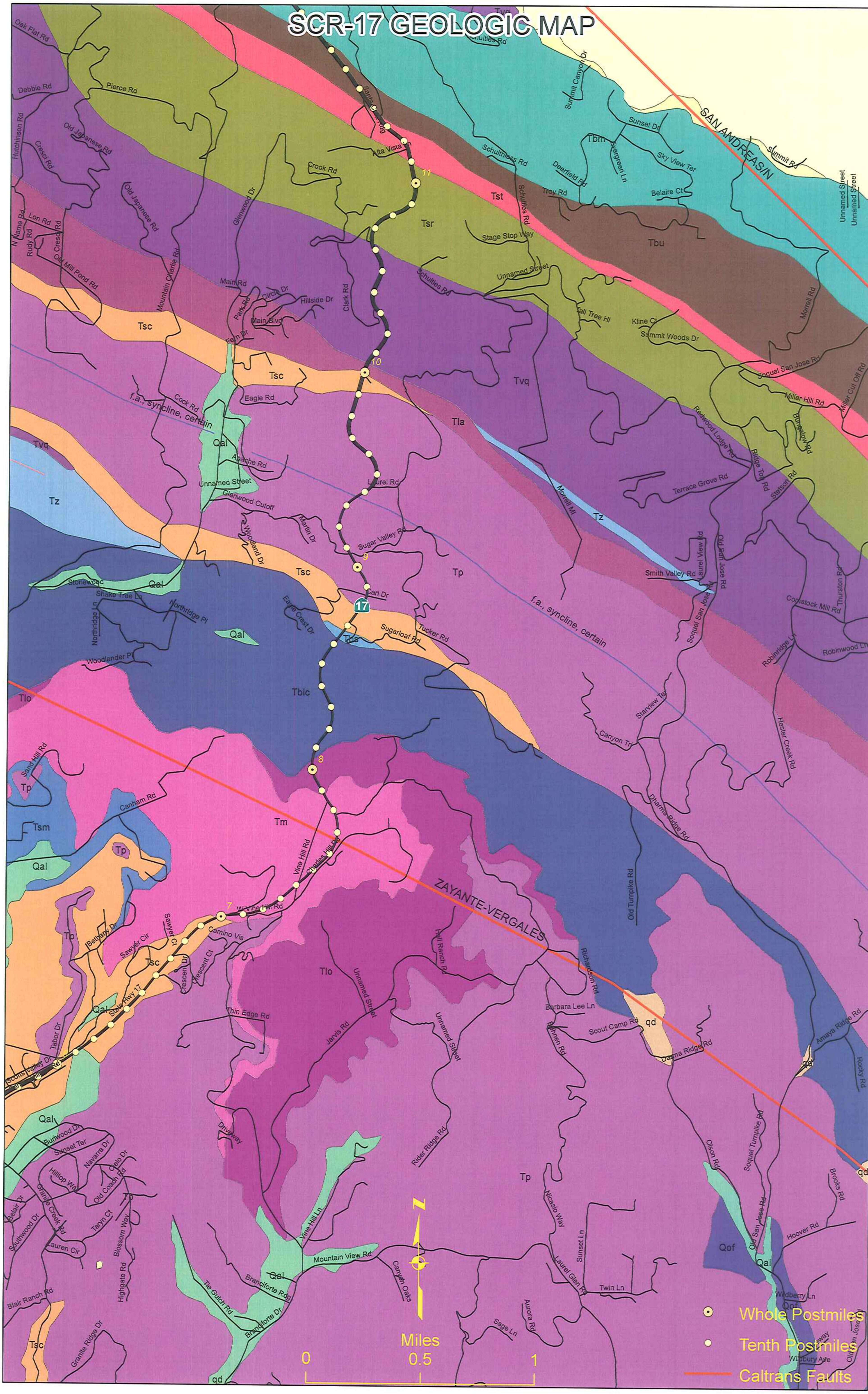
ATTACHMENT 2

GEOLOGIC MAP


SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbm
Tst
Tsr
Tbu
Tvq
Tla
Tz
Tsc
Qal
Tp
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Tblc
Tlo
Tm
Tsm
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Qof
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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E= 6130743.949,
ELEV 1214.099

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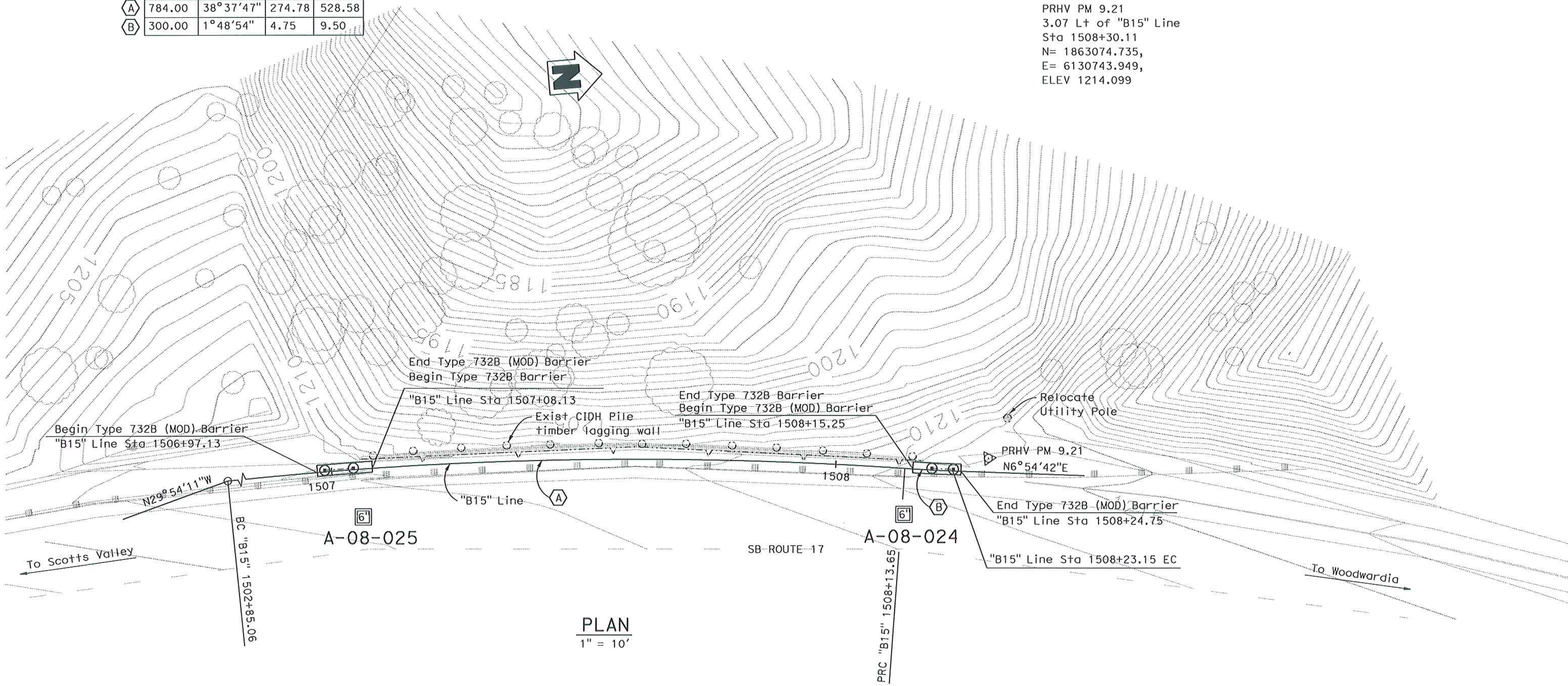

PLAN
1" = 10'

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT	DESIGN BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	DETAILS BY	CHECKED	PROJECT ENGINEER
	QUANTITIES BY	CHECKED	

BRIDGE NO. TBD

POST MILE 9.26

RW8 - BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

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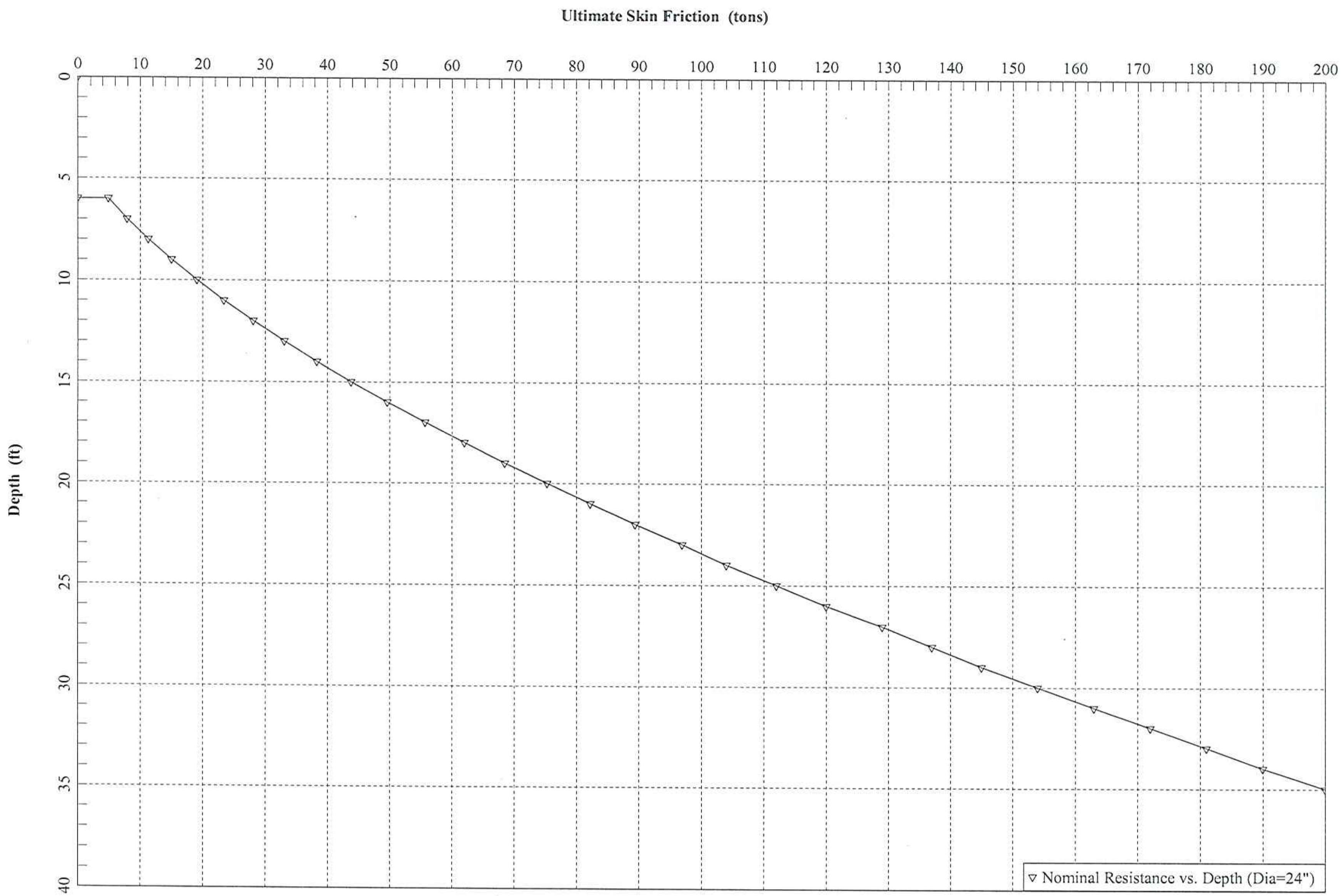
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

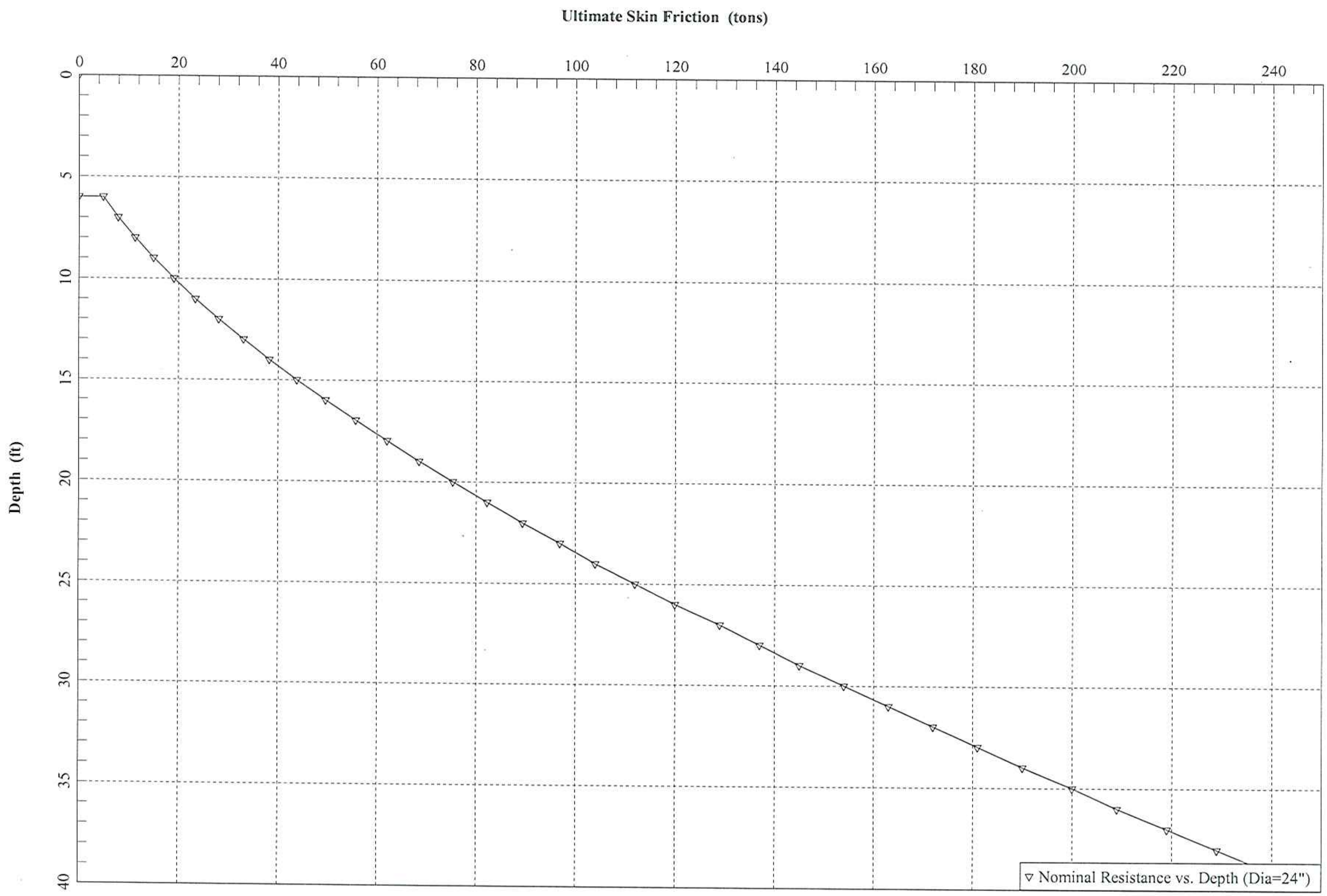
SHEET 20 OF

ATTACHMENT 4

24" CIDH PILE NOMINAL RESISTANCE



EA 05-0L70U1: SCR-17-6.0/12.6 Retaining Wall No. 8A



EA 05-0L70U1: SCR-17-6.0/12.6 Retaining Wall No. 8B

State of California Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: December 31, 2008

File: 05-0L70U1
05-SCR-17-9.7/9.9
Guard Rail Upgrades
Retaining Wall 9

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a soldier pile retaining wall to support the widened shoulder at Location B, which lies between approximately post mile 9.7 and post mile 9.9. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location B is on the southbound side of the highway, approximately 0.7-mile south of the intersection of Route 17 and Glenwood Drive. The existing southbound roadway at the location consists of two 12-foot travel lanes, a 2-foot to 2.6 foot inside shoulder, and a one-foot outside shoulder. The existing outside shoulder along a portion of Location B is supported by a timber-lagged CIDH pile retaining wall. Metal beam guard railing is in place above the existing wall. A concrete median barrier separates northbound and southbound traffic within Location B limits.

It is proposed to widen outside shoulders to 4 feet and construct concrete barriers with barrier slabs at this location. A soldier pile retaining wall with timber lagging will be constructed to the north of the existing retaining wall, between RWLOL Station 65+49.66 and RWLOL Station 68+89.66, to facilitate the shoulder widening and barrier construction.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

2. *Preliminary Geotechnical Report*, EA 05-0L700K, Caltrans, Ron Richman, March 17.2005

3. *Preliminary Foundation Report*, EA 05-0L7001, Caltrans, Daniel Appelbaum, June 12, 2008.

4. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages. Location B is in the Bean Creek water shed. Bean Creek is a tributary of the southward flowing San Lorenzo River, which drains into Monterey Bay.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Pliocene and upper Miocene aged Purisima Formation, geologic unit T_p, underlies Location B. Brabb describes Purisima Formation as very thick-bedded yellowish-gray tuffaceous and diatomaceous siltstone containing thick interbeds of bluish-gray, semi friable, fine-grained andesitic sandstone.

The northwest-southeast trending Glenwood Syncline crosses Route 17 south of Location B. The Purisima Formation beds are vertical to overturned 65 degrees to 75 degrees at Location B.

The highway at Location B was constructed as a cut/fill section. The side slopes in the area where the retaining wall is to be constructed have inclinations ranging between 1.25:1 and 1.4:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling three six-inch auger borings in the southbound #2 traffic lane within the longitudinal limits of the proposed retaining wall. The locations of the borings are shown on the attached RW 9 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at Location B appears to consist of fill composed of medium dense silty sand with gravel overlying medium dense to dense sand, silty sand, sandy silt, and silt. Moderately soft to soft, fine-grained sandstone was encountered at a depth of 39.5 feet in boring A-08-017, 11.7 feet right of RWLOL Station 67+18.6.

Ground Water

Ground water was not encountered within 45.5 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation were tested for corrosion potential. The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm

- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Since resistivity serves as an indicator parameter for the possible presence of soluble salts, tests for sulfate and chloride are usually not performed unless the resistivity of the soil is 1,000 ohm-cm or less.

Table 1: Corrosion Test Results

Boring	Sample Depth	PH	Resistivity (ohm-cm)	Sulfate Content (PPM)	Chloride Content (PPM)
A-08-016	15.0'-20.0'	5.1	900	Pending	Pending
A-08-017	15.0'-20.0'	5.9	1010	N/A	N/A
A-08-018	18.0'-22.0'	5.5	850	Pending	Pending
Corrosive if		<5.5	<1000	>2000	>500

Based on the results of the corrosion analyses, the site is considered corrosive. Controlling corrosion test parameter results are as follows:

- 5.1 pH
- Test results for concentrations of soluble salts were not available at the time of this report. Past experience in the project area, however, suggests that sulfate concentrations will likely be above the 2000-ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w)

of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location B. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 2.1 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location B due to an earthquake along the Fault is estimated to be 0.66 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high percentage of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the soldier pile wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Retained soils for the proposed soldier pile wall are primarily silty sands of the embankment fill. The soldier piles for the retaining wall will be embedded in embankment material and soft, fine-grained sandstone.

Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling. Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the soldier pile wall. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits (RWLOL) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
65+45 to 68+90	0.0'-30.0'	33	0	120	0.29	3.43
	30.0-40.0	30	0	120	0.33	3.04

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location B between RWLOL Station 65+49.66 and RWLOL Station 68+89.66. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 9 provided by the structure designer indicates that the lagged height of the wall will range between approximately 5 feet and 13 feet. A reinforced concrete barrier slab, approximately 2 feet thick, will be anchored to the tops of the soldier piles, above the timber lagging.

It is recommended that the lateral earth pressures acting on the retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern for this location. The existing slopes exhibit no sign of instability, and the addition of a soldier pile retaining wall with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the soldier piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered, temporary casing may be necessary to ensure a dry hole in which to place piles and pour concrete. The appropriate specification language should be included in the contract special provisions to address the possibility of accumulated water in the soldier pile holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 9.

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

- Foundation Report for Retaining Wall No. 9 dated December 31, 2008.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

Daniel L. Appelbaum

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

Michael S. Finegan

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1	**LOCATION MAPS**
ATTACHMENT 2	**GEOLOGIC MAP**
ATTACHMENT 3	**BORHOLE LOCATIONS**

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN SANTA CRUZ COUNTY
IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
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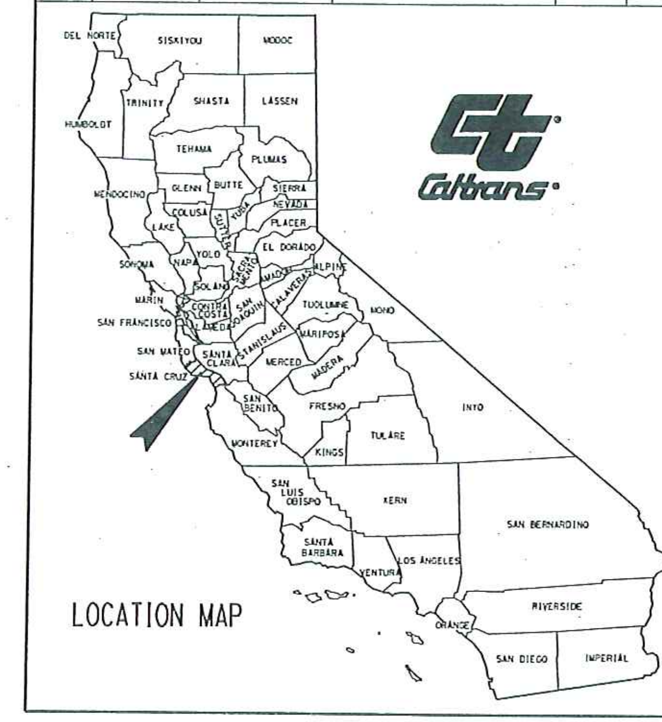

LOCATIONS OF CONSTRUCTION

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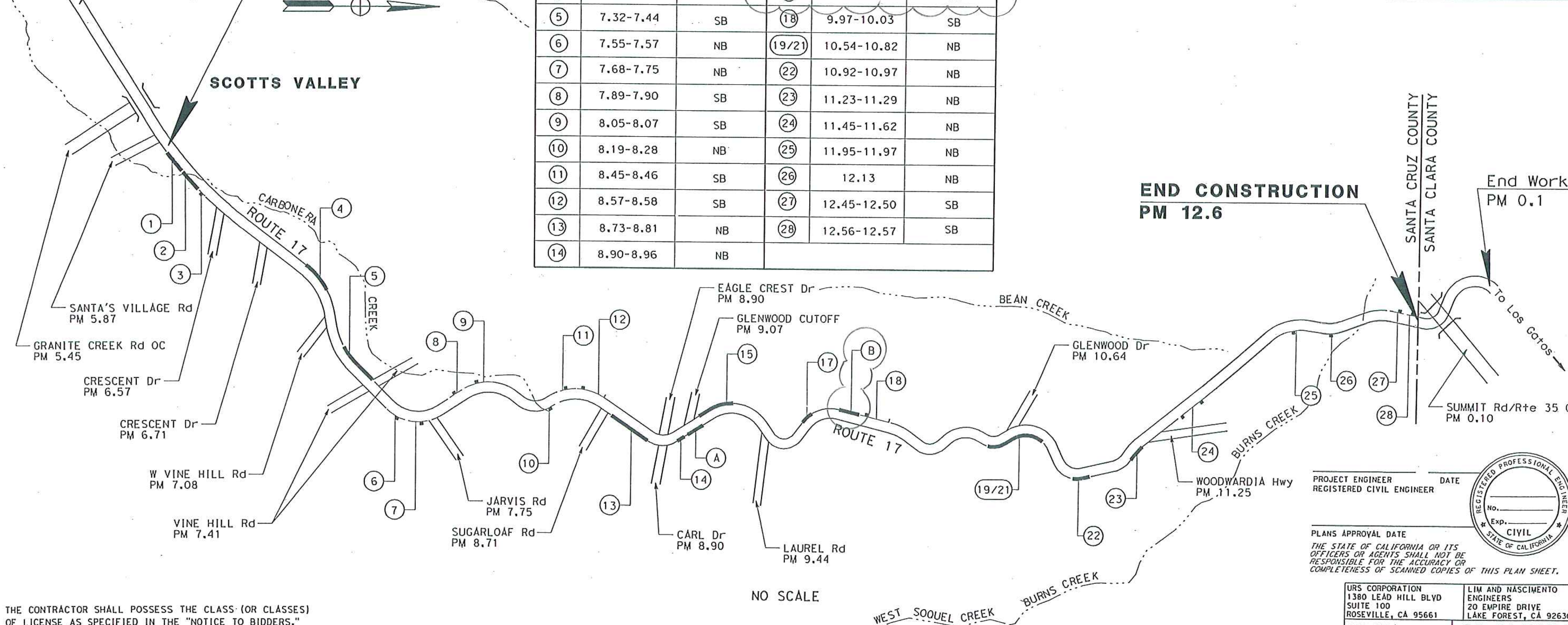
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			



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

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

...\PLANS\50L70Uab001.dgn

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08

DATE PLOTTED => 12/5/2008 3:14:25 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

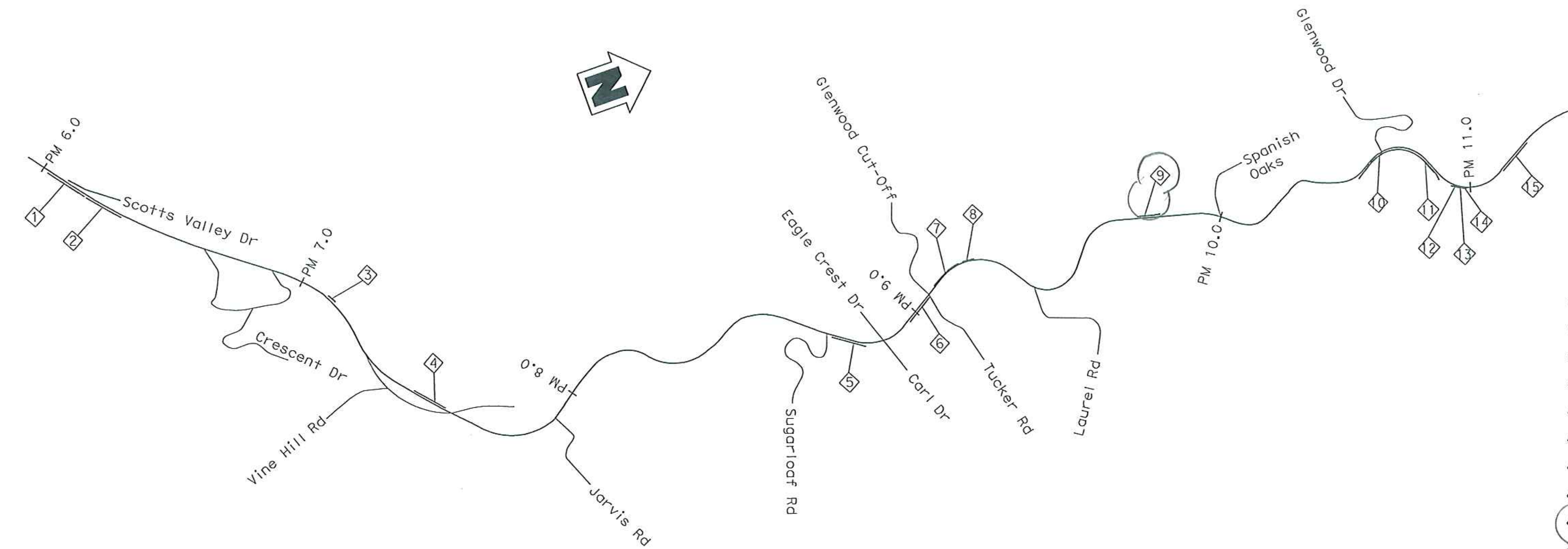
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
T. Dudley
No. C 039514
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

- 1 Retaining Wall No. 1
- 2 Retaining Wall No. 2
- 3 Retaining Wall No. 3
- 4 Retaining Wall No. 4
- 5 Retaining Wall No. 5
- 6 Retaining Wall No. 6
- 7 Retaining Wall No. 7
- 8 Retaining Wall No. 8
- 9 Retaining Wall No. 9
- 10 Retaining Wall No. 10
- 11 Retaining Wall No. 11
- 12 Retaining Wall No. 12 *
- 13 Retaining Wall No. 13 *
- 14 Retaining Wall No. 14 *
- 15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

CU 05
EA 0L7601

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

TIME PLOTTED => 12:29:28 PM
DATE PLOTTED => 12/1/2008
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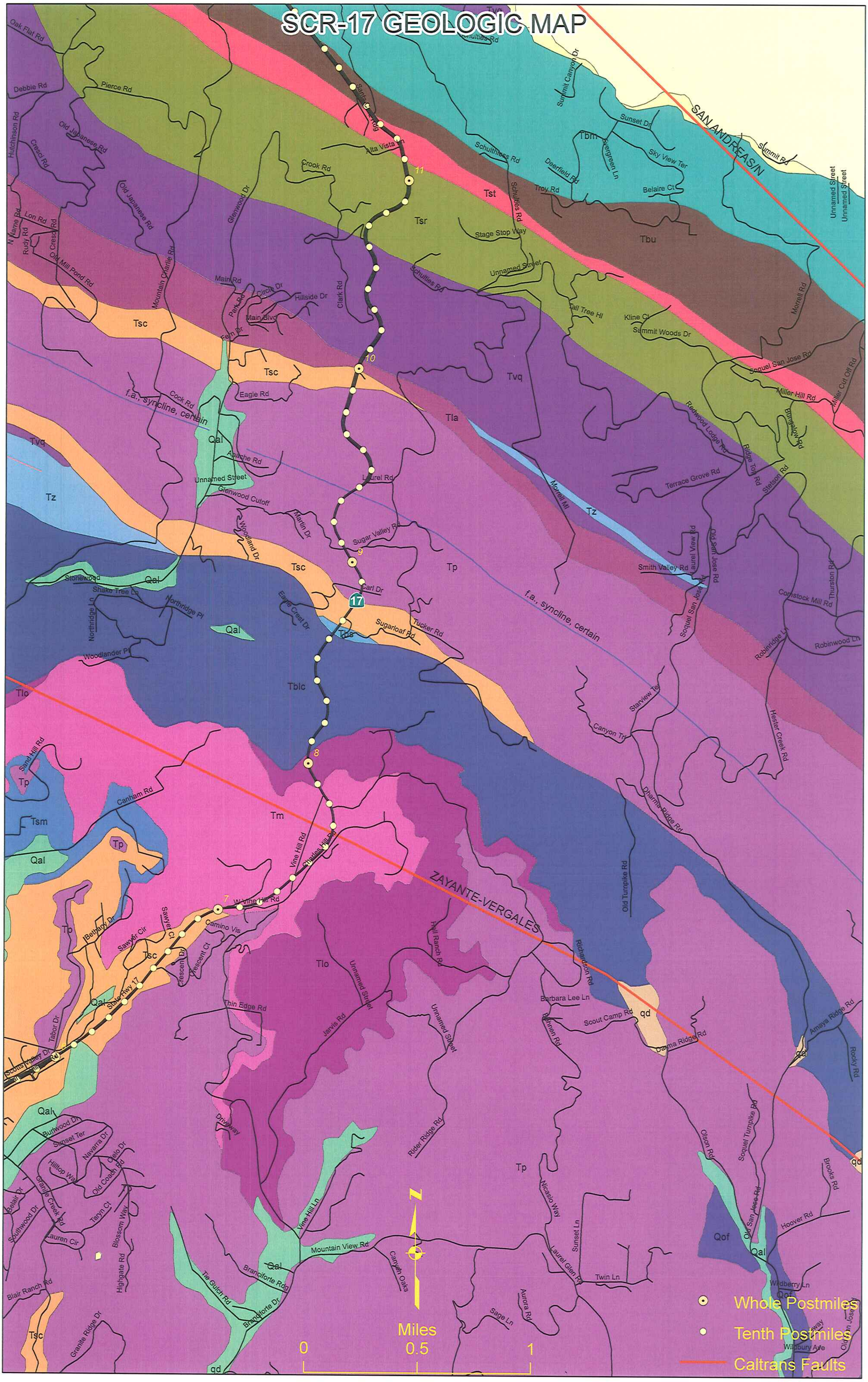
ATTACHMENT 2

GEOLOGIC MAP


SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbu
Tbm
Tst
Tsr
Tvq
Tla
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Tsc
Tds
Tblc
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Tsm
Qal
Qof
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Whole Postmiles
Tenth Postmiles
Caltrans Faults
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ATTACHMENT 3

BOREHOLE LOCATIONS

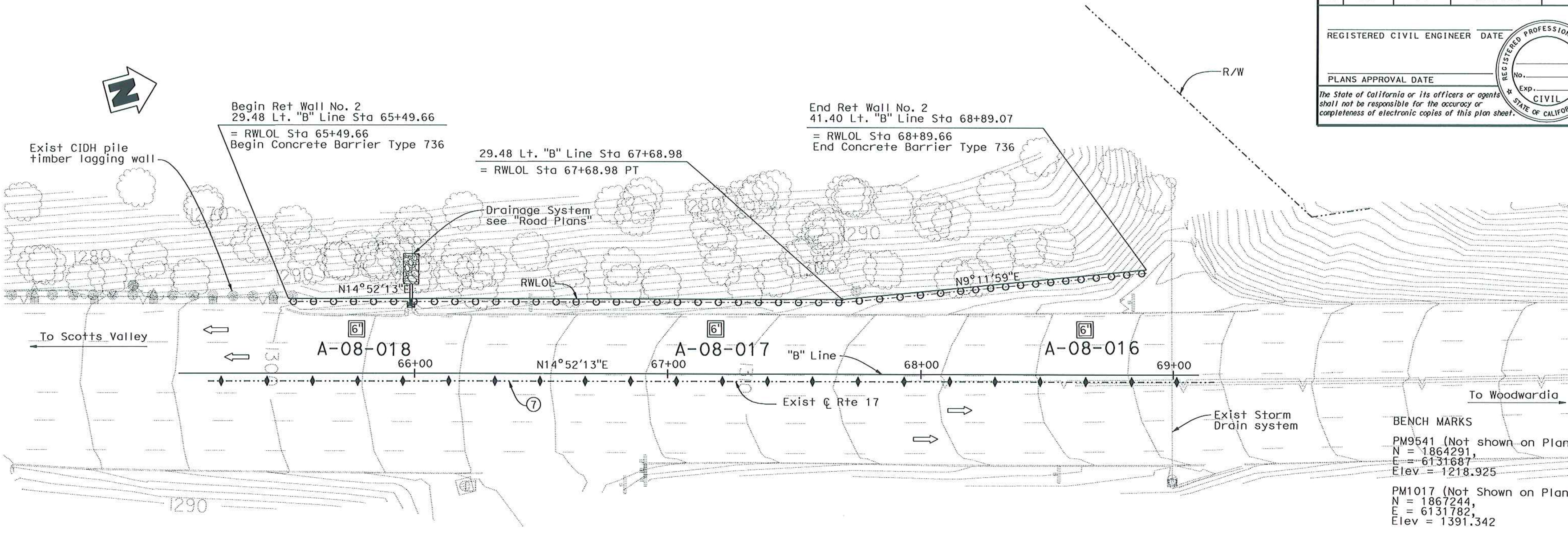
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA



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E = 6131687,
Elev = 1218.925

PM1017 (Not Shown on Plan)
N = 1867244,
E = 6131782,
Elev = 1391.342

PLAN

1" = 20'

DESIGN OVERSIGHT	DESIGN BY	CHECKED
SIGN OFF DATE	DETAILS BY	CHECKED
	QUANTITIES BY	CHECKED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

STEPHEN J. MISLINSKI
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE 9.7

RW 9 - BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L70U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

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USERNAME => s108960 DATE PLOTTED => 31-DEC-2008 TIME PLOTTED => 08:07

State of California Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: January 2, 2009

File: 05-0L70U1
05-SCR-17-10.54/10.82
Guard Rail Upgrades
Retaining Wall 10

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a soldier pile retaining wall and a reinforced concrete retaining wall on 24-inch CIDH piles to support the widened shoulder along a portion of Location 19/21, which extends between approximately post mile 10.54 and post mile 10.82. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 19/21 is on the northbound side of the highway, opposite the intersection of Route 17 and Glenwood Drive. The existing outside shoulder along two segments of Location 19/21 is supported by timber-lagged CIDH pile retaining walls. Metal beam guard railing is in place above both retaining walls and along some of the steeper segments of embankment. A concrete median barrier separates northbound and southbound traffic within Location 19/21 limits, except at the median crossover to Glenwood Drive. Existing northbound outside shoulder widths at the location range from more than 4 feet along the retained embankments, to less than 1 foot along much of the remaining embankment.

It is proposed to widen outside shoulders to a uniform 4 feet and construct concrete barriers at Location 19/21. The shoulder widening will necessitate construction of earth retaining structures along some portions of the embankment where there are no existing walls. Retaining Wall No. 10 encompasses "B19/21" station limits 1900+64.83 to 1908+18.38. A reinforced concrete retaining wall founded on 24-inch CIDH piles will be constructed between "B19/21" Station 1900+64.83 and "B19/21" Station 1900+74.08 to support the widened shoulder at that location. Concrete barrier will be constructed on top of the wall. The section of roadway from "B19/21" Station 1900+74.08 to "B19/21" Station 1903+03.38 is supported by one of the existing timber-lagged CIDH pile retaining walls. Shoulder widths along that segment are adequate, so improvements will be limited to replacing the existing metal beam guard railing with concrete barrier. A soldier pile retaining wall with timber lagging will be constructed to the north of the existing retaining wall, between "B19/21" Station 1903+03.38 and "B19/21" Station 1907+08.38, to facilitate the shoulder widening and barrier construction along that segment of roadway. The concrete barrier will be constructed on a reinforced concrete barrier slab, which will extend from the top of the soldier pile wall to almost 3 feet beyond the existing edge of travel way. From "B19/21" Station 1907+08.38 to "B19/21" Station 1908+18.38 improvements will consist of construction of concrete barrier on a reinforced concrete barrier slab.

Pertinent Reports and Investigations

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

1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

2. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

3. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages. Location 19/21 is in the West Branch Soquel Creek water shed. Soquel Creek drains into Monterey Bay near Capitola.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Oligocene and Eocene aged Rices Mudstone, geologic unit T_{sr}, and lower Miocene and Oligocene aged Vaqueros Sandstone, geologic unit T_{vq}, underlie Location 19/21. Brabb describes Rices Mudstone as olive-gray mudstone and massive, medium light gray, very fine to fine-grained arkosic sandstone. The Vaqueros Sandstone is described as thick-bedded to massive yellowish-gray arkosic sandstone containing interbeds of olive-gray shale and mudstone. Vaqueros Sandstone underlies Retaining Wall No. 10.

The highway at Location 19/21 was constructed as a cut/fill section. The embankment side slopes within the limits of Retaining Wall No. 10 have inclinations ranging between 1.25:1 and 1.55:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling three six-inch auger borings in the northbound #2 traffic lane within the longitudinal limits of the proposed soldier pile retaining wall. The locations of the borings are shown on the attached RW 10 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Pocket penetrometer measurements of unconfined compressive strength were used to estimate the undrained shear strength of some of the clay samples. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007)*.

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at boring A-08-033, located 8.8 feet left of "B19/21" Station 1903+25.0, consisted of 40 feet of medium dense silty sand. The drilling at boring A-08-034, 8.6 feet left of "B19/21" Station 1905+02.8, encountered 29 feet of medium dense silty sand overlying a 4-foot thick layer of stiff to very stiff fat clay, overlying siltstone, at a depth of 33 feet. Boring A-08-035, 9.1 feet left of "B19/21" Station 1906+87.1, encountered 28 feet of stiff sandy fat clay and hard fat clay overlying claystone and siltstone.

Ground Water

Ground water was not encountered within 40 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation are being tested for corrosion potential. Test results were not available at the time of this report. Corrosion test results will be conveyed to you in a separate Corrosion Test Summary Report when they become available.

The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Until corrosion test results become available, the site should be considered to be corrosive to foundation elements. Corrosion test results for a nearby project indicated that that site was corrosive due to a low pH and a sulfate concentration above the 2000 ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude

(M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 19/21. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 2.3 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 19/21 due to an earthquake along the Fault is estimated to be 0.69 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters for the cohesionless soils to be used in the design of the retaining walls are based upon SPT correlations to internal angle of friction. The strength parameters of the clay soils were estimated by using a range of values suggested in literature in a slope stability model of the existing embankment to achieve a factor of safety against global failure of 1.1. Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling. Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design.

Retained soils for the proposed soldier pile wall are primarily silty sands and sandy clays of the embankment fill. The soldier piles for the retaining wall will be embedded in embankment material and native soils consisting of medium dense silty sands, stiff to very stiff sandy clays, and hard clays. No exploratory borings were completed for the design of the proposed reinforced concrete retaining wall at the southerly end of the existing timber-lagged CIDH pile wall because the wall was added to the scope of work after the subsurface investigation for the project had been completed. The values provided for soil strengths and earth pressure coefficients for the design of the reinforced concrete retaining wall are conservative estimates based on soil conditions observed in the project area.

The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the retaining walls. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B19/21") (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
1900+60 to 1900+80	0.0'-40.0'	30	0	120	0.33	3.04
1903+00 to 1904+15	0.0'-17.0'	34	0	120	0.28	3.64
	17.0'-40.0'	33	0	120	0.29	3.43
1904+15 to 1905.65	0.0'-27.0'	33	0	120	0.29	3.43
	27.0'-38.0'	25	150	120	0.41	2.53
	38.0'-40.0'	37	0	125	0.25	4.25
1905+65 to 1907+10	0.0'-17.0'	27	150	120	0.38	2.76
	17.0'-40.0'	25	150	120	0.41	2.53
	40.0'+	37	0	125	0.25	4.25

Foundation Recommendations

A reinforced concrete retaining wall supported on 24-inch CIDH piles is proposed at Location 19/21 between "B19/21" Station 1900+64.83 and "B19/21" Station 1900+74.08. A soldier pile retaining wall with timber lagging is proposed between "B19/21" Station 1903+03.38 and "B19/21" Station 1907+08.38. The walls will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 10 provided by the structure designer indicates that the height of the reinforced concrete retaining wall will be approximately 4 feet. The lagged height of the soldier pile retaining wall will range between 3 feet and 5 feet.

For the purposes of performing a lateral analysis on the 24-inch CIDH piles supporting the reinforced concrete retaining wall, foundation soils should be assumed to be cohesionless, with strength parameters as presented in Table 2. The piles should be assumed to derive their axial capacity solely from skin friction. The graph presented in Attachment 4 can be used to estimate axial capacity for pile lengths up to 35 feet. It is recommended that a factor of safety of 2.0 be used in the calculation of allowable capacity.

It is recommended that the lateral earth pressures acting on the soldier pile retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height

shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern at this location. The existing slopes exhibit no sign of instability, and the addition of the proposed retaining walls with deep foundations and the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The loose density and dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile and CIDH pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles and CIDH piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered while drilling the soldier pile holes, temporary casing may be necessary to ensure a dry hole in which to place piles and pour concrete. If ground water is encountered during drilling for the CIDH piles, it may be necessary to pour the concrete for the piles using "wet" construction methods. The appropriate specification language should be included in the contract special provisions to address the possibility of having to construct piles in wet holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 10.

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

- Foundation Report for Retaining Wall No. 10 dated January 2, 2009.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

LOCATION MAPS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

INDEX OF PLANS

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

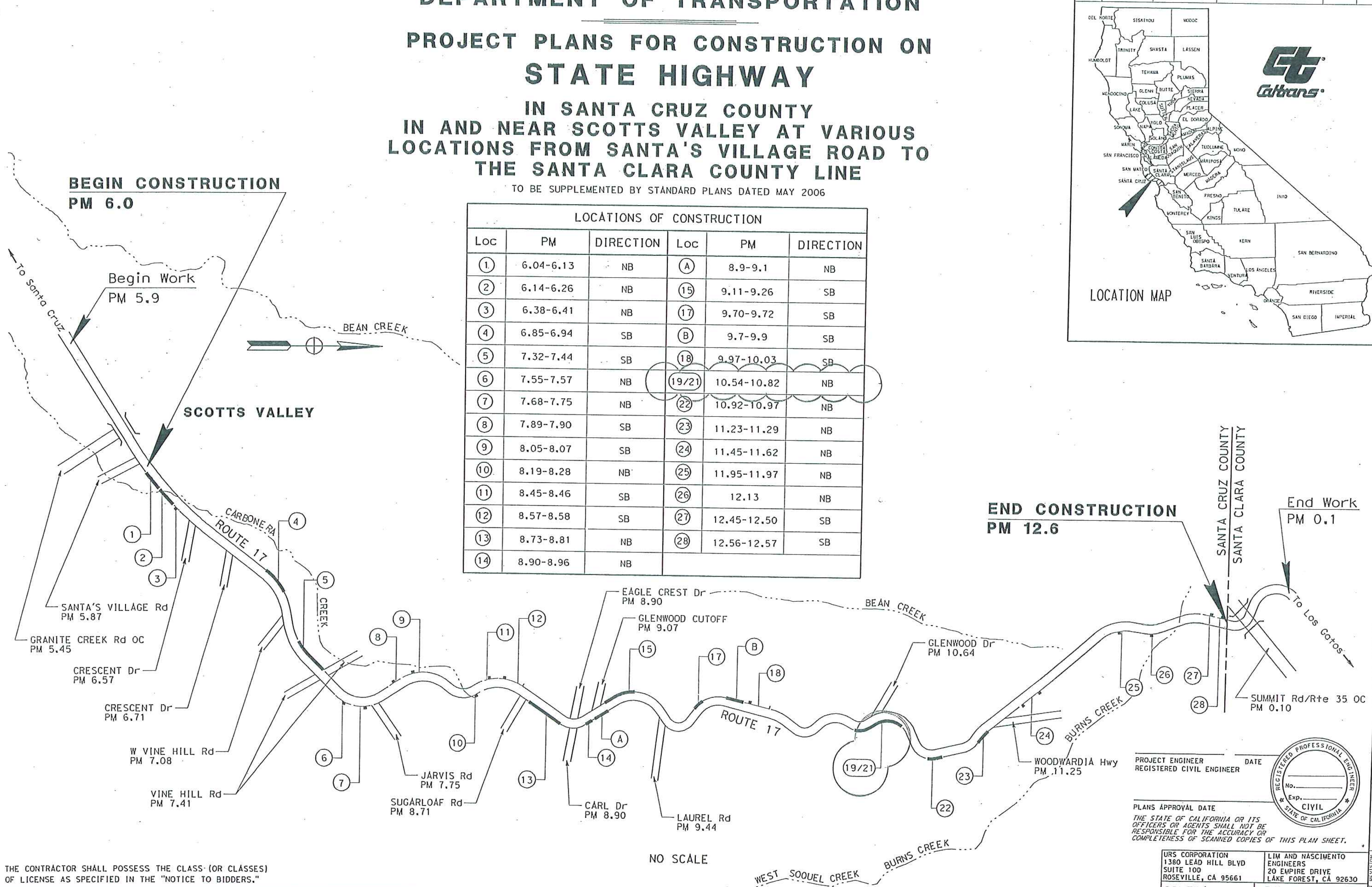
STATE HIGHWAY

IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			



PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

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

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. 05-0L70U1

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

...\PLANS\50L70Uab001.dgn

LAST REVISION 12-05-08 DATE PLOTTED => 12/5/2008 3:14:25 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

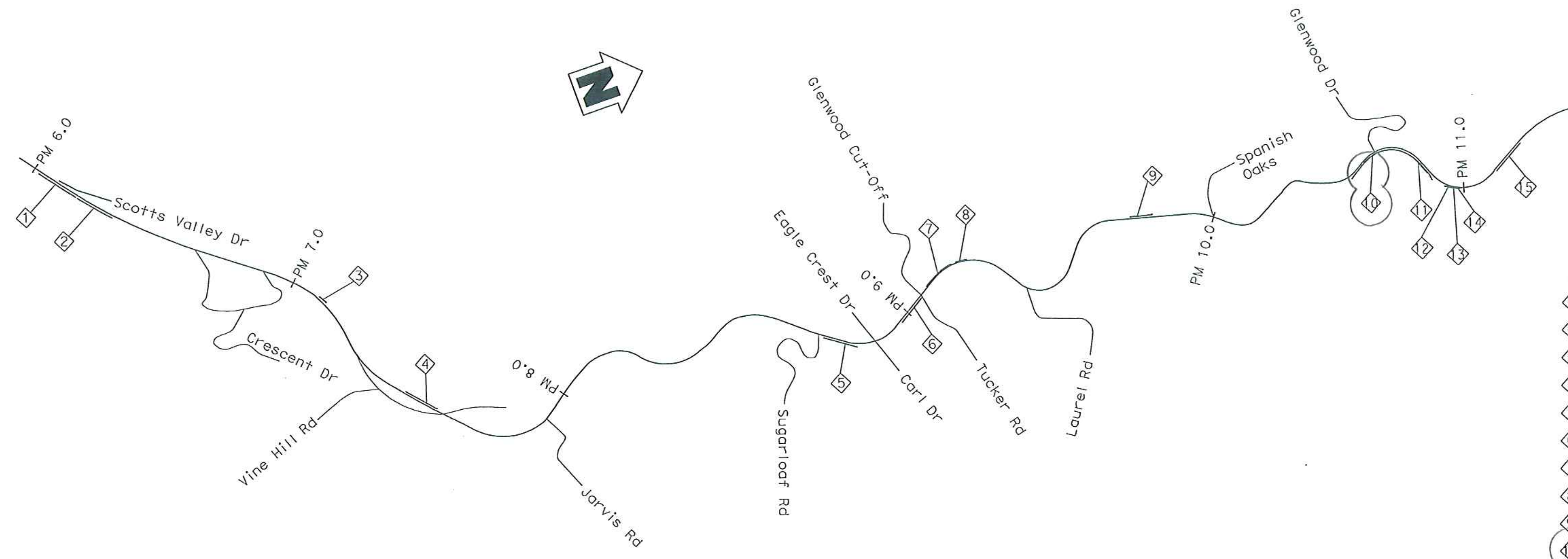
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER T. Dudley No. C 039514 Exp. 12/31/09 CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

1. Retaining Wall No. 1
2. Retaining Wall No. 2
3. Retaining Wall No. 3
4. Retaining Wall No. 4
5. Retaining Wall No. 5
6. Retaining Wall No. 6
7. Retaining Wall No. 7
8. Retaining Wall No. 8
9. Retaining Wall No. 9
10. Retaining Wall No. 10
11. Retaining Wall No. 11
12. Retaining Wall No. 12 *
13. Retaining Wall No. 13 *
14. Retaining Wall No. 14 *
15. Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

CU 05
EA 0L7601

RETAINING WALLS
INDEX TO PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

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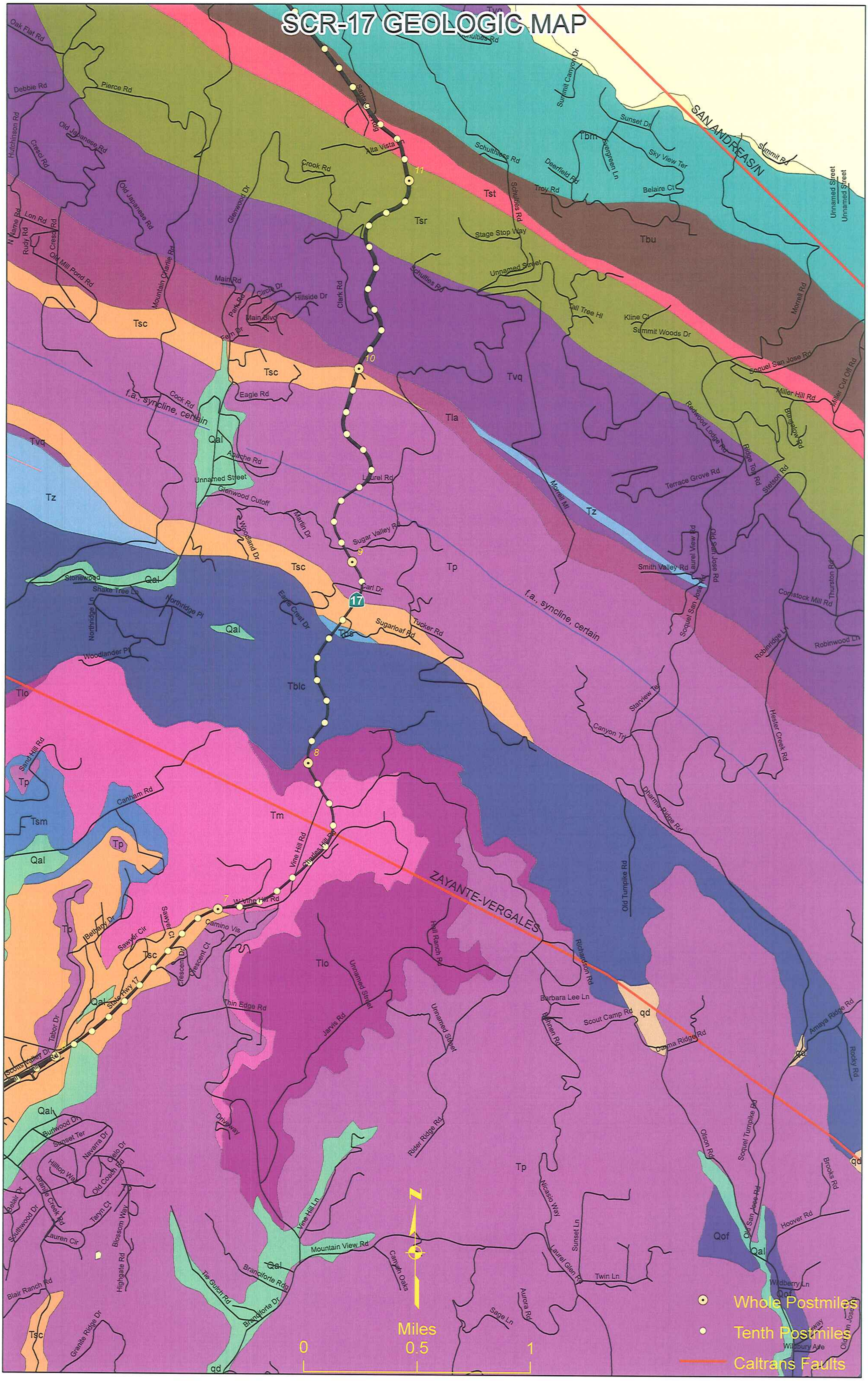
ATTACHMENT 2

GEOLOGIC MAP



SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbm
Tst
Tbu
Tsr
Tvq
Tla
Tz
Tsc
Tp
Qal
Tds
Tblc
Tlo
Tm
Tsm
qd
Qof
11
10
9
8
7
17
N
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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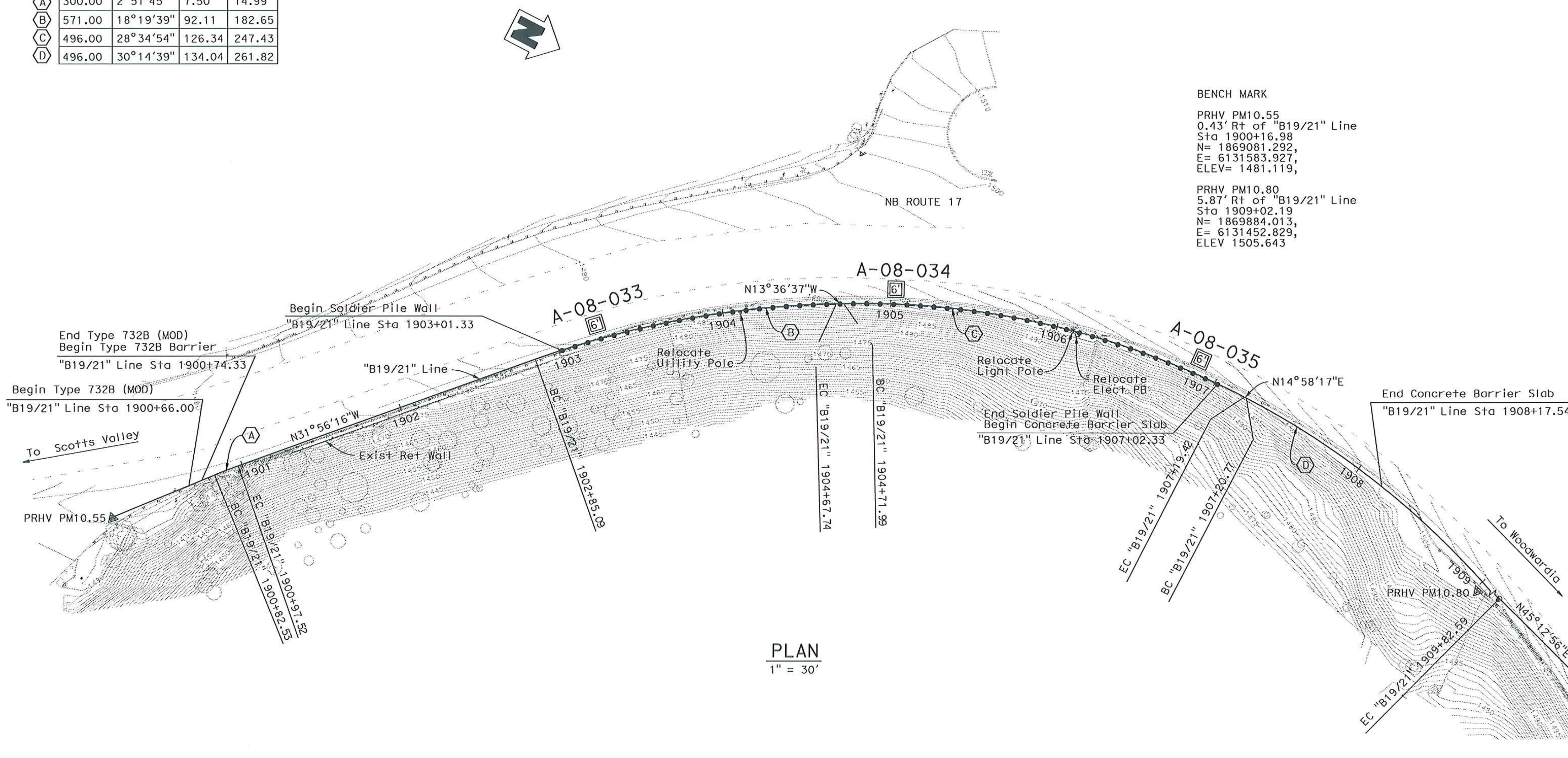
REGISTERED PROFESSIONAL ENGINEER No. ___ Exp. ___ CIVIL STATE OF CALIFORNIA

CURVE DATA TABLE

	R	Δ	T	L
A	300.00	2°51'45"	7.50	14.99
B	571.00	18°19'39"	92.11	182.65
C	496.00	28°34'54"	126.34	247.43
D	496.00	30°14'39"	134.04	261.82



PLAN

1" = 30'

DESIGN OVERSIGHT	DESIGN BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	DETAILS BY	CHECKED	PROJECT ENGINEER
	QUANTITIES BY	CHECKED	

BRIDGE NO. TBD

POST MILE 10.54

RW10 - BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

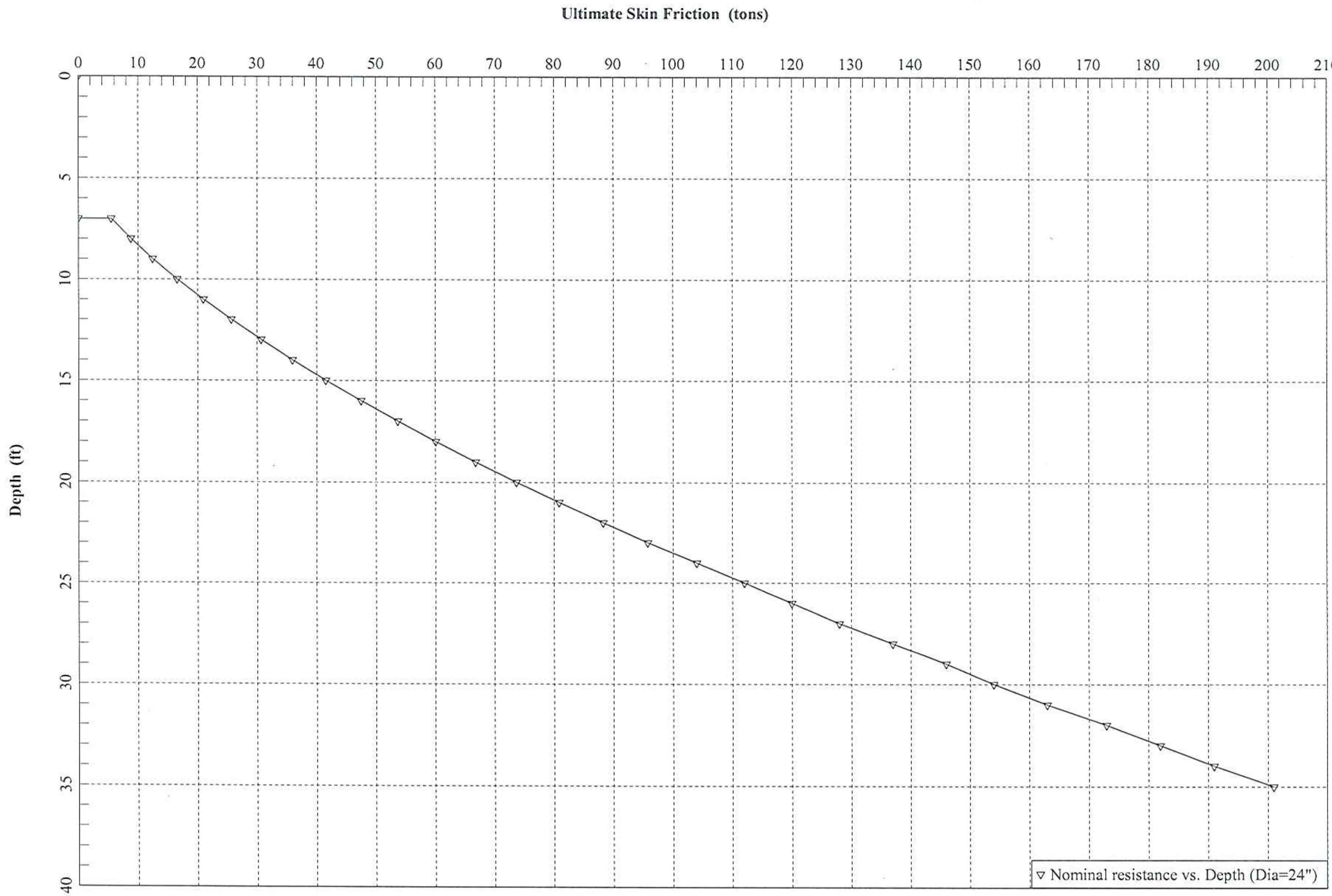
CU 06254
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

ATTACHMENT 4

24" CIDH PILE NOMINAL RESISTANCE



EA 05-0L70U1: SCR-17 PM 10.54 Retaining Wall No. 10

State of California　　　　　　　　Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: January 2, 2009

File: 05-0L70U1
05-SCR-17-10.54/10.82
Guard Rail Upgrades
Retaining Wall 11

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a reinforced concrete retaining wall on 24-inch CIDH piles to support the widened shoulder along a portion of Location 19/21, which extends between approximately post mile 10.54 and post mile 10.82. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 19/21 is on the northbound side of the highway, opposite the intersection of Route 17 and Glenwood Drive. The existing outside shoulder along two segments of Location 19/21 is supported by timber-lagged CIDH pile retaining walls. Metal beam guard railing is in place above both retaining walls and along some of the steeper segments of embankment. A concrete median barrier separates northbound and southbound traffic within Location 19/21 limits, except at the median crossover to Glenwood Drive. Existing northbound outside shoulder widths at the location range from more than 4 feet along the retained embankments to less than 1 foot along much of the remaining embankment.

It is proposed to widen outside shoulders to a uniform 4 feet and construct concrete barriers at Location 19/21. The shoulder widening will necessitate construction of earth retaining structures along some portions of the embankment where there are no existing walls. Retaining Wall No. 11 encompasses "B19/21" Station limits 1909+09.54 to 1914+36.91. A reinforced concrete retaining wall founded on 24-inch CIDH piles will be constructed between "B19/21" Station 1909+09.54 and "B19/21" Station 1909+21.79 to support the widened shoulder at that location. Concrete barrier will be constructed on top of the wall. The section of roadway from "B19/21" Station 1909+21.79 to "B19/21" 1914+36.41 is supported by one of the existing timber-lagged CIDH pile retaining walls. Improvements along that segment will consist of replacing the existing metal beam guard railing with concrete barrier. Construction of a concrete barrier slab is necessary between "B19/21" Station 1910+08.00 and "B19/21" Station 1914+36.91 to accommodate the concrete barrier and a 4-foot outside shoulder.

Pertinent Reports and Investigations

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1. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

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The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Oligocene and Eocene aged Rices Mudstone, geologic unit T_{sr}, and lower Miocene and Oligocene aged Vaqueros Sandstone, geologic unit T_{vq}, underlie Location 19/21. Brabb describes Rices Mudstone as olive-gray mudstone and massive, medium light gray, very fine to fine-grained arkosic sandstone. The Vaqueros Sandstone is described as thick-bedded to massive yellowish-gray arkosic sandstone containing interbeds of olive-gray shale and mudstone. Rices Mudstone underlies Retaining Wall No. 11.

The highway at Location 19/21 was constructed as a cut/fill section. The side slopes within the limits of Retaining Wall No. 11 have inclinations ranging between 1.3:1 and 1.6:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling one six-inch auger boring in the northbound #2 traffic lane in the vicinity of the proposed reinforced concrete retaining wall. The location of the boring is shown on the attached RW 11 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at boring A-08-037, located 7.5 feet left of "B19/21" Station 1908+35.9, consisted of 14 feet of very dense silty sand overlying moderately soft to soft siltstone.

Ground Water

Ground water was not encountered within 40 feet of the ground surface, the maximum depth of the subsurface investigation.

Corrosion

Representative soil samples taken during the foundation investigation are being tested for corrosion potential. Test results were not available at the time of this report. Corrosion test results will be conveyed to you in a separate Corrosion Test Summary Report when they become available.

The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Until corrosion test results become available, the site should be considered to be corrosive to foundation elements. Corrosion test results for a nearby project indicated that that site was corrosive due to a low pH and a sulfate concentration above the 2000 ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 19/21. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 2.3 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 19/21 due to an earthquake along the Fault is estimated to be 0.69 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained soils in the embankment fills and alluvium, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used in the design of the retaining wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling.

Retained soils for the proposed wall are primarily sandy silt of the embankment fill. The CIDH piles for the retaining walls will be embedded in embankment material and moderately soft to soft siltstone. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the retaining walls. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B22" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
1909+09 to 1909+22	0.0'-22.0'	32	0	120	0.31	3.23
	22.0'-35.0	37	0	125	0.25	4.25

Foundation Recommendations

A reinforced concrete retaining wall founded on 24-inch CIDH piles is proposed at Location 19/21 between "B19/21" Station 1909+09.54 and "B19/21" Station 1909+21.79. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier.

For the purposes of performing a lateral analysis on the proposed 24-inch CIDH piles, foundation soils should be assumed to be cohesionless, with strength parameters as presented in Table 2. The piles should be assumed to derive their axial capacity solely from skin friction. The graphs presented in Attachment 4 can be used to estimate axial capacity for pile lengths up to 35 feet. It is recommended that a factor of safety of 2.0 be used in the calculation of allowable capacity.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Slope Stability

Global slope stability is not considered to be a concern at this location. The existing slopes exhibit no sign of instability, and the addition of a retaining wall founded on 24-inch CIDH piles with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

Rock may be encountered during drilling of the holes for the CIDH piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

The dry condition of the upper portions of the embankment fill material may require casing the top portions of the CIDH pile holes to prevent caving.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the CIDH piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered during drilling, it may be necessary to pour the concrete for the CIDH piles using "wet" construction methods. The appropriate specification language should be included in the contract special provisions to address the possibility of having to construct the piles in wet holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish drilling equipment with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 11.

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

- Foundation Report for Retaining Wall No. 11 dated January 2, 2009.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

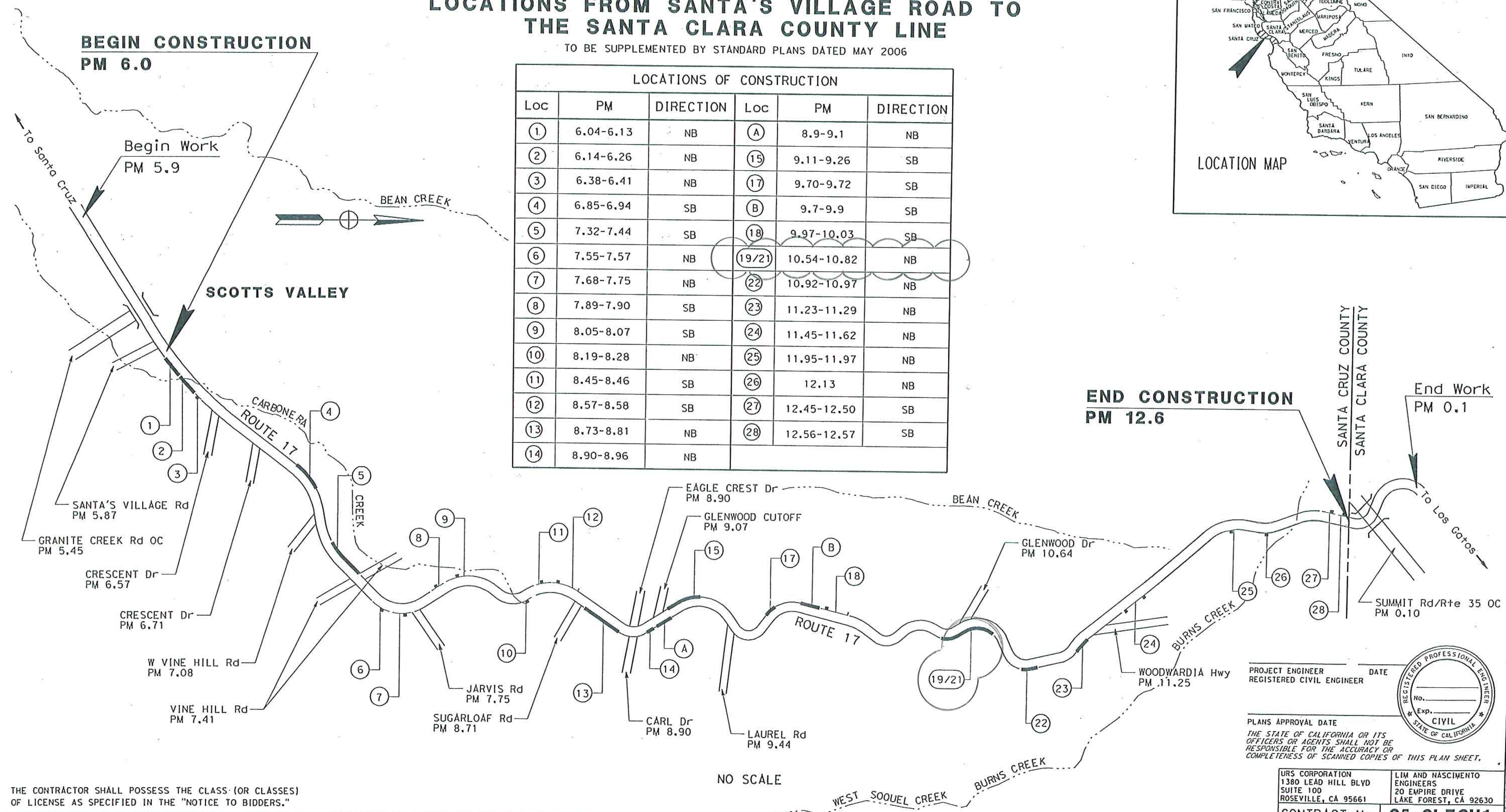
IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			



PROJECT ENGINEER
REGISTERED CIVIL ENGINEER
DATE

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. 05-0L70U1

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

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

...\PLANS\50L70Uab001.dgn

DATE PLOTTED => 12/5/2008 3:14:25 PM

LAST REVISION 12-05-08

BORDER LAST REVISED 8/1/2008

CALTRANS WEB SITE IS: HTTP://WWW.DOT.CA.GOV/

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => Carlton Allen
DGN FILE => 50L70Uab001.dgn

CU 06253

EA 0L70U1

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

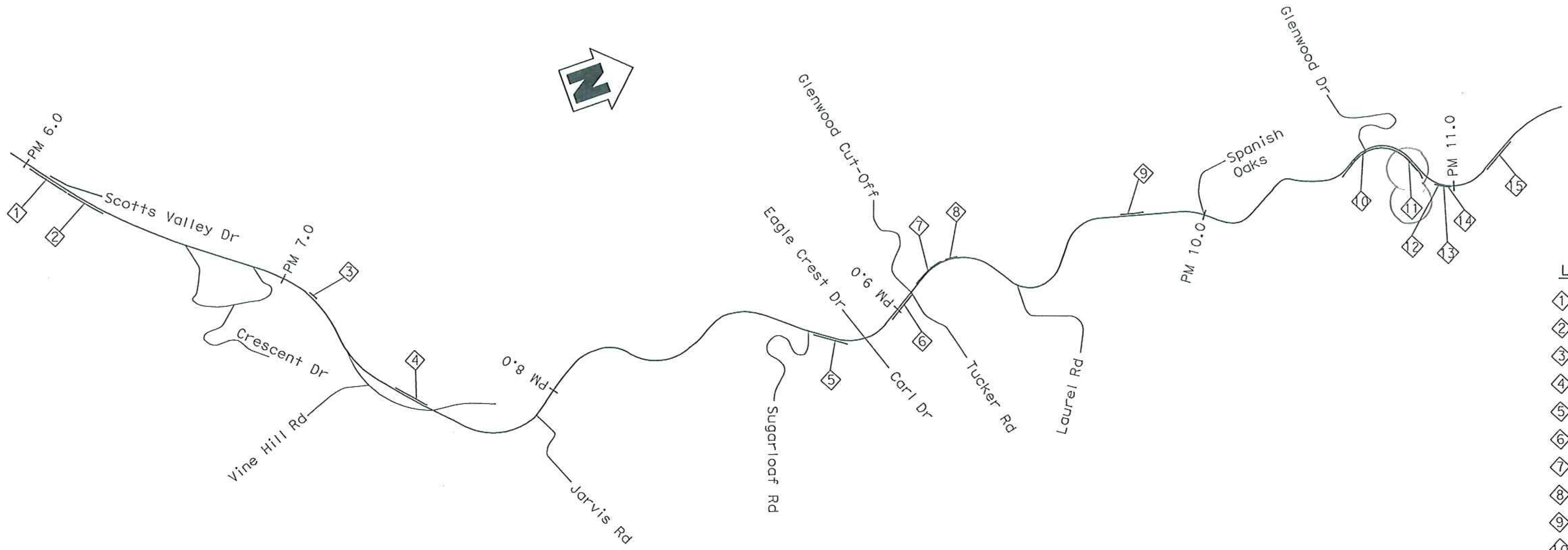
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER T. Dudley No. C 039514 Exp. 12/31/09 CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

1. Retaining Wall No. 1
2. Retaining Wall No. 2
3. Retaining Wall No. 3
4. Retaining Wall No. 4
5. Retaining Wall No. 5
6. Retaining Wall No. 6
7. Retaining Wall No. 7
8. Retaining Wall No. 8
9. Retaining Wall No. 9
10. Retaining Wall No. 10
11. Retaining Wall No. 11
12. Retaining Wall No. 12 *
13. Retaining Wall No. 13 *
14. Retaining Wall No. 14 *
15. Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

CU 05
EA 0L7601

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

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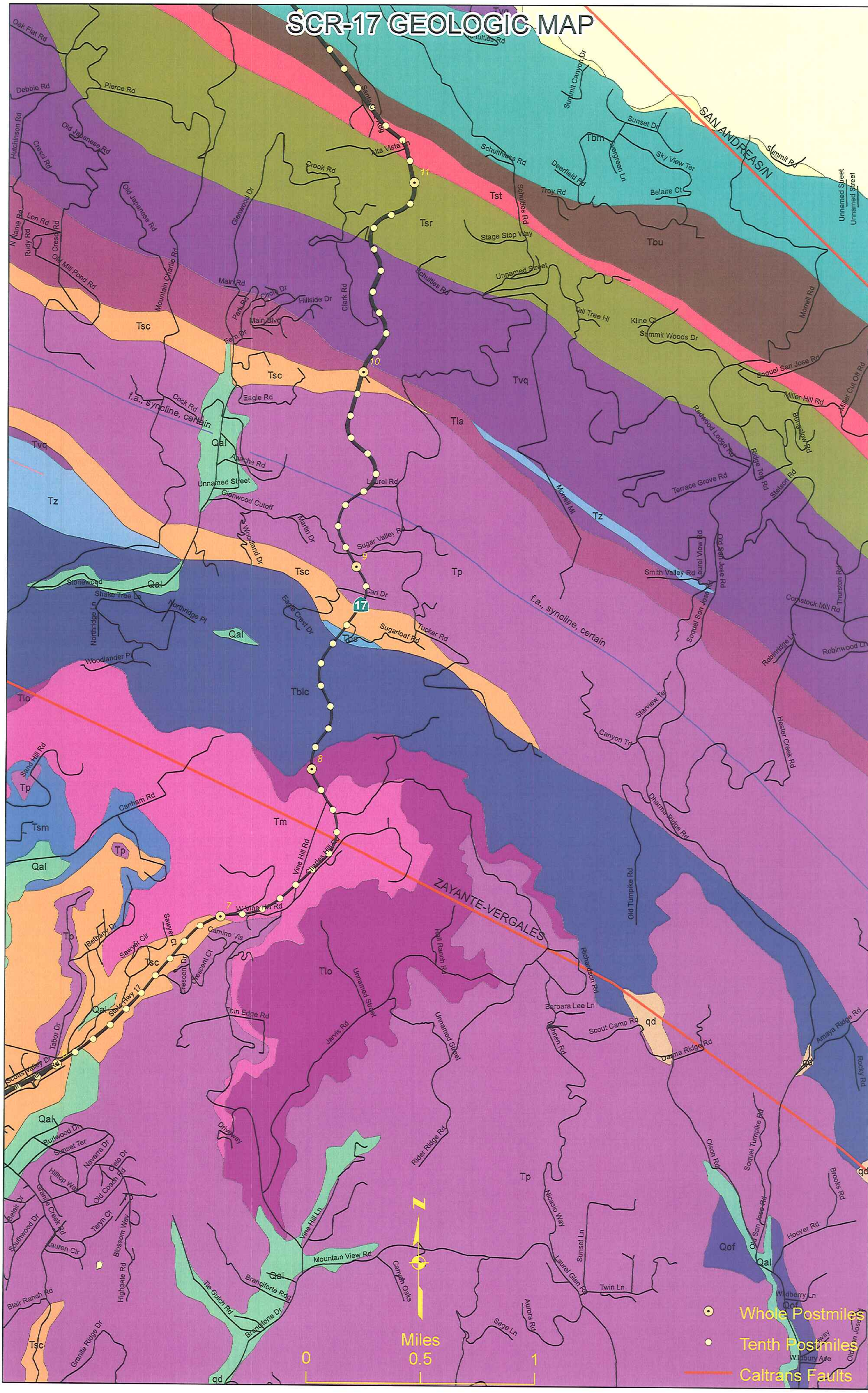
ATTACHMENT 2

GEOLOGIC MAP


SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
f.a., syncline, certain
Tbu
Tst
Tsr
Tbm
Tvq
Tla
Tz
Tp
Tsc
Tbs
Tblc
Tm
Tlo
Tsm
Qal
Qof
qd
17
7
8
9
10
11
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

BENCH MARK
PRHV PM10.80
5.87' Rt of "B19/21" Line
Sta 1909+02.70
N= 1869884.013,
E= 6131452.829,
ELEV= 1505.643
PRHV PM10.89
N= 1870264.357,
E= 6132105.436,
ELEV= 1547.448

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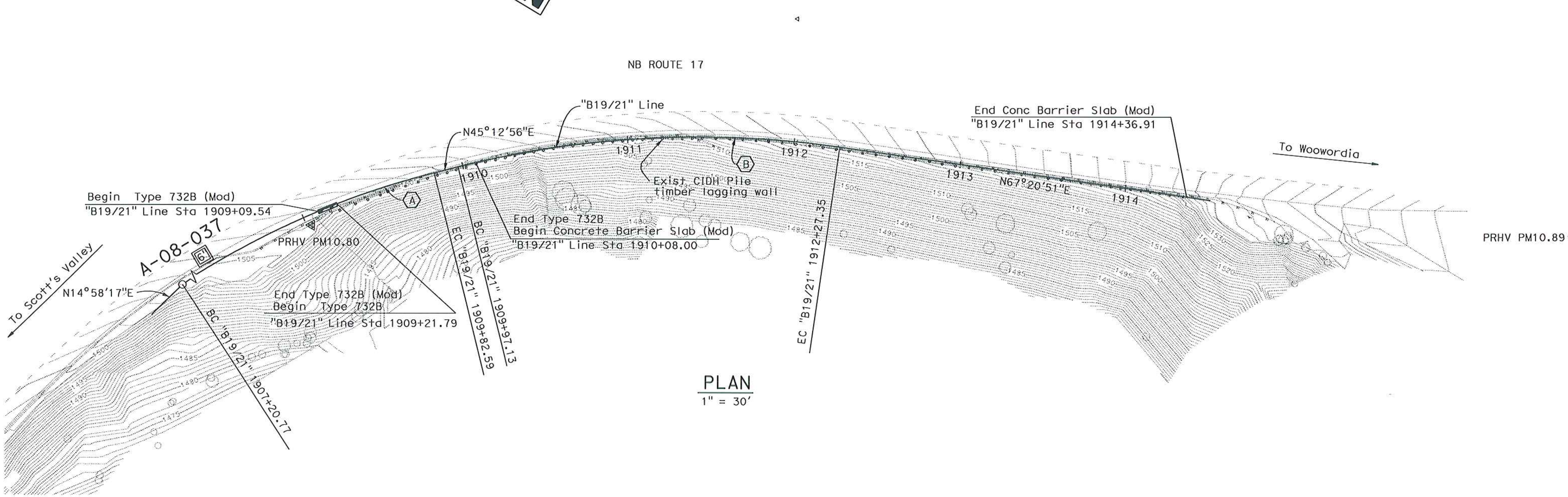

PLAN
1" = 30'

DESIGN OVERSIGHT		DESIGN	BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	STEPHEN J. MISLINSKI PROJECT ENGINEER	BRIDGE NO. TBD	RW11 - BOREHOLE LOCATIONS
SIGN OFF DATE		DETAILS	BY	CHECKED			POST MILE 10.62	
		QUANTITIES	BY	CHECKED				

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601
FILE => RW11EP.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

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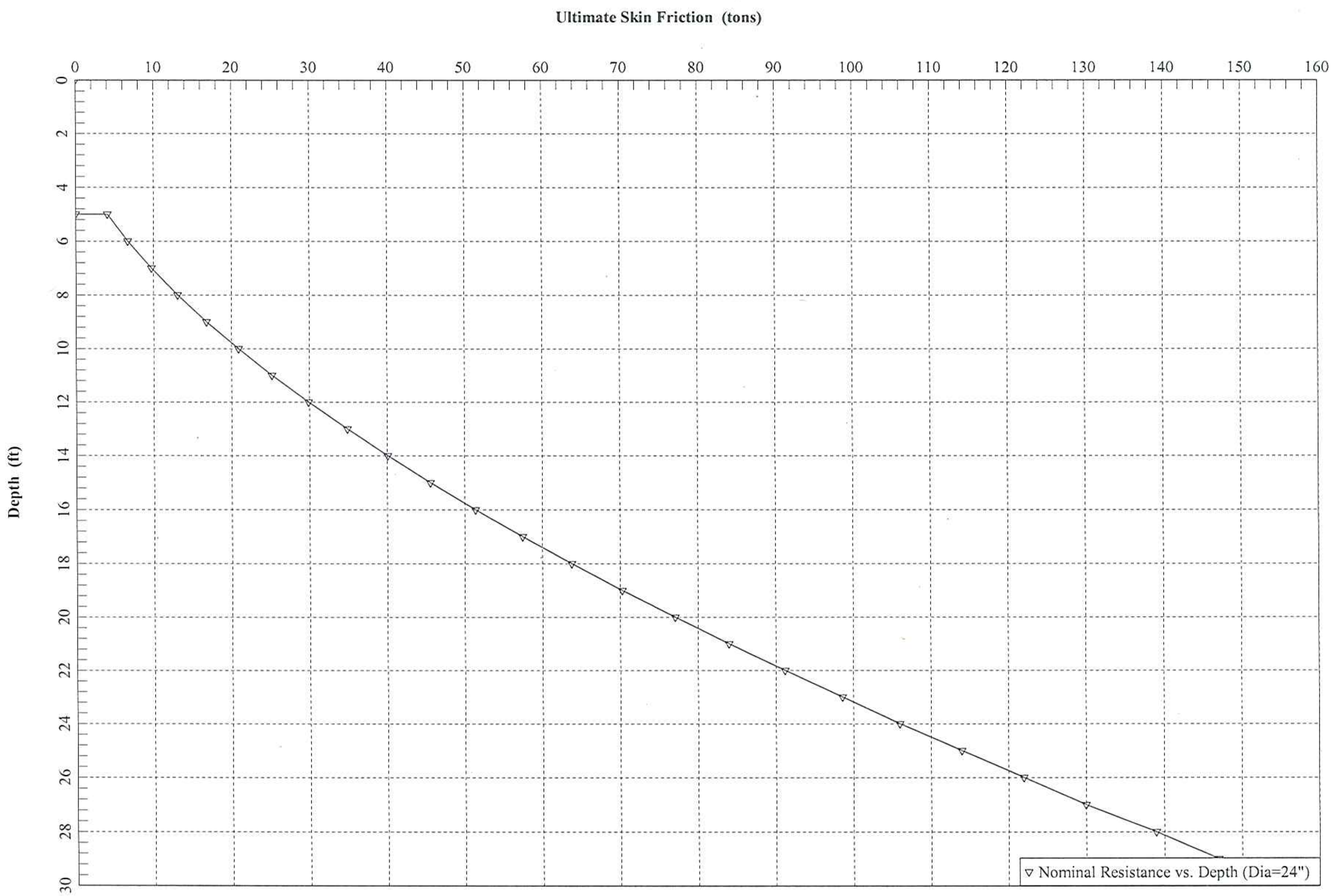
ATTACHMENT 4

24" CIDH PILE NOMINAL RESISTANCE



EA 05-0L70U1: SCR-17 PM 10.62 Retaining Wall No. 11

State of California | Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: January 2, 2009

File: 05-0L70U1
05-SCR-17-10.92/10.97
Guard Rail Upgrades
Retaining Wall 12

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for Retaining Wall No. 12, a combination of a soldier pile retaining wall with timber lagging and a reinforced concrete retaining wall on 24-inch CIDH piles. The retaining wall will support the widened shoulder at Location 22, which lies between approximately post mile 10.92 and post mile 10.97. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 22 is on the northbound side of the highway, approximately 0.3-mile north of the intersection of Route 17 and Glenwood Drive. Existing outside shoulder widths through much of the location are less than 1 foot. The existing outside shoulders are supported by a combination of embankment, a timber-lagged CIDH pile retaining wall, and a Type 1 concrete retaining wall on a pile foundation. A soil nail wall was constructed along a segment of Location 22 in 1998 to repair erosion damage that resulted from a break in an existing culvert. Metal beam guard railing is currently in place along the northbound outside edge of pavement at Location 22, and a concrete median barrier separates northbound and southbound traffic.

It is proposed to widen outside shoulders to 4 feet and replace the existing metal beam guard railing with concrete barriers at Location 22. A combination of a soldier pile retaining wall, a side hill viaduct, and reinforced concrete retaining walls on 24-inch CIDH piles are proposed to facilitate the shoulder widening and barrier construction. This report presents foundation recommendations for Retaining Wall No. 12, a combination of a soldier pile wall with timber lagging and a reinforced concrete wall founded on 24-inch CIDH piles. The limits of the soldier pile wall are from "B22" Station 2200+95.00 to "B22" Station 2201+92.00. The reinforced concrete retaining wall will be 12.75 feet long, and will extend from "B22" Station 2201+92.00 to "B22" Station 2202+04.75.

Pertinent Reports and Investigations

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

1. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

2. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

3. *Completion Report,* EA 05-467903, Caltrans, Kambiz Kouchesfahani, March 27, 1998.

4. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 22 is in the West Branch Soquel Creek water shed. Soquel Creek drains into Monterey Bay near Capitola.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Oligocene and Eocene aged Rices Mudstone, geologic unit T_{sr}, underlies Location 22. Brabb describes Rices Mudstone as olive-gray mudstone and massive, medium light gray, very fine to fine-grained arkosic sandstone

The highway at Location 22 was constructed as a cut/fill section. The embankment side slopes in the area where Retaining Wall No. 12 is to be constructed are inclined at approximately 1.2:1 to 1.6:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling one six-inch auger boring and one 3.7-inch mud rotary boring in the northbound #2 traffic lane within the longitudinal limits of the retaining wall. Boring R-08-036 was drilled to a depth of 61.5 feet, approximately 6.9 feet left of "B22" Station 2202+07.8. Boring A-08-038 was drilled to a depth of 40.0 feet, approximately 8.3 feet left of "B22" Station 2201+20.7. The locations of the borings are shown on the attached RW 12 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Pocket penetrometer measurements of unconfined compressive strength were used to estimate the undrained shear strength of some of the clay samples. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

The subsurface stratigraphy at Boring R-08-036 consists of approximately 15 feet of hard sandy fat clay with gravel, overlying 30 feet of hard fat clay with sand, overlying moderately soft to moderately hard claystone. The subsurface stratigraphy at Boring R-08-038 consists of approximately 29 feet of medium dense to dense silty sand, overlying 4 feet of medium dense clayey sand, overlying soft to very soft siltstone.

Ground Water

Ground water was not encountered in boring A-08-038, and was not measured in boring R-08-036. Water was measured at 38.6 feet below the ground surface in boring R-08-032, located 6.9 feet left of "B22" Station 2202+52.5. That depth equates to a ground water elevation of 1519.0 feet. It is not known with certainty whether the water encountered was actually ground water or residual drilling fluid.

The Completion Report (1998) for the construction of a temporary soil nail wall north of Retaining Wall No. 12 reported that ground water was encountered while drilling the bottom row of soil nails. Taking into account the vertical distance from the roadway surface to the bottom row of nails and the 15-degree declination of the borings, it appears that ground water was encountered roughly 43 feet below the roadway. That equates to an elevation of approximately 1514 feet.

The ground water elevation during construction may be significantly higher than it was during the subsurface investigation for the project. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall.

Corrosion

Representative soil samples taken during the foundation investigation are being tested for corrosion potential. Test results were not available at the time of this report. Corrosion test results will be conveyed to you in a separate Corrosion Test Summary Report when they become available.

The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Until corrosion test results become available, the site should be considered to be corrosive to foundation elements. Corrosion test results for a nearby project indicated that that site was corrosive due to a low pH and a sulfate concentration above the 2000 ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* Since the holes for the steel soldier piles will be backfilled with concrete, the steel piles will be subject to the same mitigation measures as reinforcing steel. The portions of the piles that are in direct contact with corrosive soil will require the application of a protective coating. For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 22. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 1.1 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 22 due to an earthquake along the Fault is estimated to be 0.71 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained material in the embankment fills and native soils, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters of the cohesionless soils to be used in the design of the retaining walls are based upon SPT correlations to internal angle of friction. The strength parameters of the clay soils were estimated by substituting values suggested in literature in a slope stability model of the existing embankment and assuming a factor of safety against global failure of 1.1. Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling.

Modeling the formation as a soil requires application of active earth pressures on the back side of the piles and lower estimations for the values of resisting passive earth pressures, resulting in a more conservative pile tip elevation design.

Retained soils for the proposed retaining walls are primarily silty sands and sandy clays of the embankment fill. The soldier piles and CIDH piles will be embedded in embankment material and native soils consisting of medium dense to dense silty sands, and hard sandy clays. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the walls. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B22") (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
2200+95 to 2201+50	0.0'-15.0'	33	0	120	0.29	3.43
	15.0'-40.0+	30	0	120	0.33	3.04
	40.0'+	37	0	125	0.25	4.25
2201+50 to 2202+10	0.0'-12.0'	27	100	120	0.38	2.76
	12.0'-50.0'	25	300	120	0.41	2.53
	50.0'-61.5'	37	0	125	0.25	4.25

Foundation Recommendations

A soldier pile retaining wall with timber lagging is proposed at Location 22 between "B22" Station 2200+95.00 and "B22" Station 2201+92.00. A reinforced concrete retaining wall supported on 24-inch CIDH piles is proposed between "B22" Station 2201+92.00 and "B22" Station 2202+04.75. The walls will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier. A preliminary copy of the Structure Plan for Retaining Wall No. 12 provided by the structure designer indicates that the lagged height of the soldier pile retaining wall will range between 3 feet and 10 feet. The height of the reinforced concrete retaining wall will be approximately 8.5 feet. .

The soil strength parameters presented in Table 2 should be used for the purposes of performing a lateral analysis on the 24-inch CIDH piles supporting the reinforced concrete retaining wall. The piles should be assumed to derive their axial capacity solely from skin friction. The graph presented in Attachment 4 can be used to estimate axial capacity for pile lengths up to 40 feet. It is recommended that a factor of safety of 2.0 be used in the calculation of allowable capacity.

It is recommended that the lateral earth pressures acting on the soldier pile retaining wall be distributed in accordance with Figure 5.5.5.6-1, "Simplified Lateral Earth Pressure Distribution for Permanent Non-gravity Cantilevered Walls with Vertical Wall Elements Embedded in Granular Soil and Retaining Granular Soil," of Caltrans' Bridge Design Specifications.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Nongravity cantilevered walls shall be dimensioned to ensure stability against passive failure of the embedded vertical elements. The factor of safety against overturning about the bottom of the embedded vertical elements shall be greater than or equal to 1.5 when the simplified lateral earth pressure distributions shown in the Bridge Design Specifications plus any additional surcharge and water pressures are added. For vertical elements embedded in soil, the calculated embedment shall be increased by a factor of 1.1 to determine the embedment to be used.

When timber-lagging members are used for facing, gaps should be provided between lagging members to allow ground water to drain from behind the wall. For lagging members less than 6 inches thick, the gaps should be 3/8-inch; for lagging members 6 inches or greater in thickness, 1/2-inch gaps should be provided.

Where soldier piles are installed in drilled holes backfilled with structural concrete, the width of the vertical wall element is assumed to equal the diameter of the drilled hole. When determining resultant lateral pressures to be applied to the embedded portion of the vertical elements, an effective width of the vertical elements can be used. For timber lagged walls, the effective width shall not exceed 3 times the width of the vertical elements, nor shall it exceed the center-to-center spacing between the vertical elements.

For nongravity-cantilevered walls embedded in soil, the design height shall be established to provide a minimum bench width of 4 feet in front of the wall. The established design height

shall also provide a design grade at least 2 feet below finished grade, measured at the face of the wall.

Slope Stability

Global slope stability is not considered to be a concern at this location. The existing slopes exhibit no sign of instability, and the addition of the proposed retaining wall with a deep foundation and the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

The dry condition of the upper portions of the embankment fill material may require casing the top portions of the soldier pile and CIDH pile holes to prevent caving.

Depending on the needed depth of embedment of the soldier piles and CIDH piles, rock may be encountered during drilling of the holes for the piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

Ground water may be encountered when drilling the holes for the soldier piles and CIDH piles. Depending on the contractor's equipment and methodologies, a significant amount of water may enter the hole before the contractor is able to place the reinforcement cage or soldier pile, and pour concrete. Temporary casing may be necessary to ensure a dry hole in which to place soldier piles and pour concrete. It may be necessary to pour the concrete for the CIDH piles using "wet" construction methods. The appropriate specification language should be included in the contract special provisions to address the possibility of having to construct the piles in wet holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish a drill rig with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 12.

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

- Foundation Report for Retaining Wall No. 12 dated January 2, 2009.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1	**LOCATION MAPS**
ATTACHMENT 2	**GEOLOGIC MAP**
ATTACHMENT 3	**BORHOLE LOCATIONS**
ATTACHMENT 4	**24" CIDH PILE NOMINAL RESISTANCE**

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

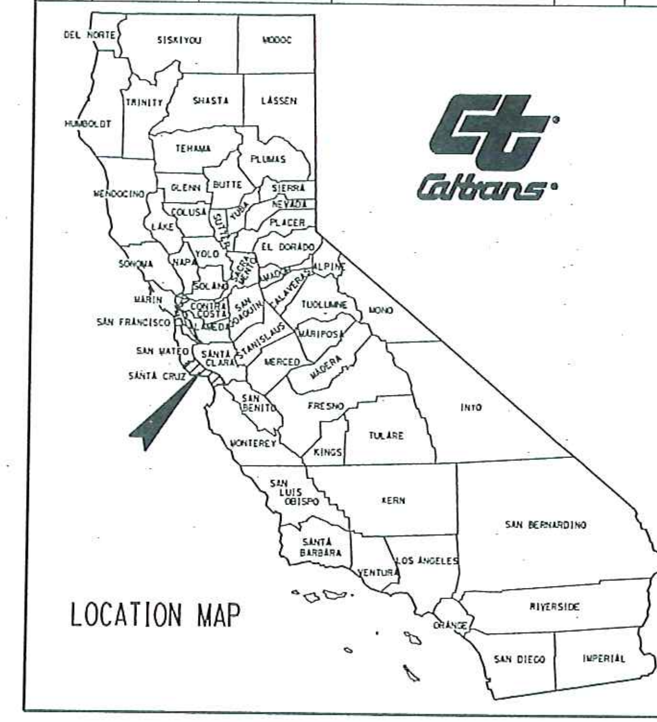
PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

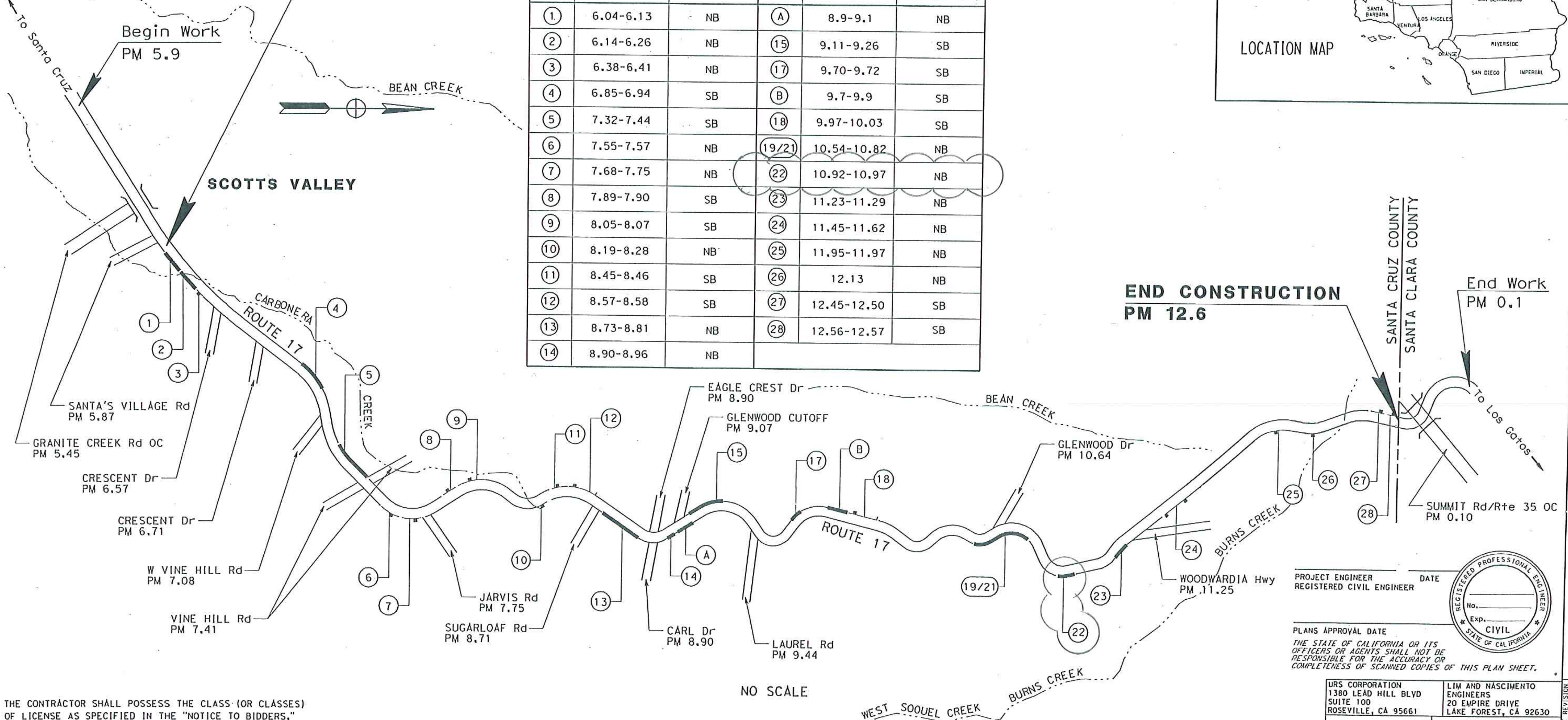
IN SANTA CRUZ COUNTY
IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		



LOCATIONS OF CONSTRUCTION					
Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			



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

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. 05-0L70U1

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

...\PLANS\50L70Ub001.dgn

LAST REVISION 12-05-08

DATE PLOTTED => 12/2/2008 3:14:25 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
T. Dudley
No. C 039514
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

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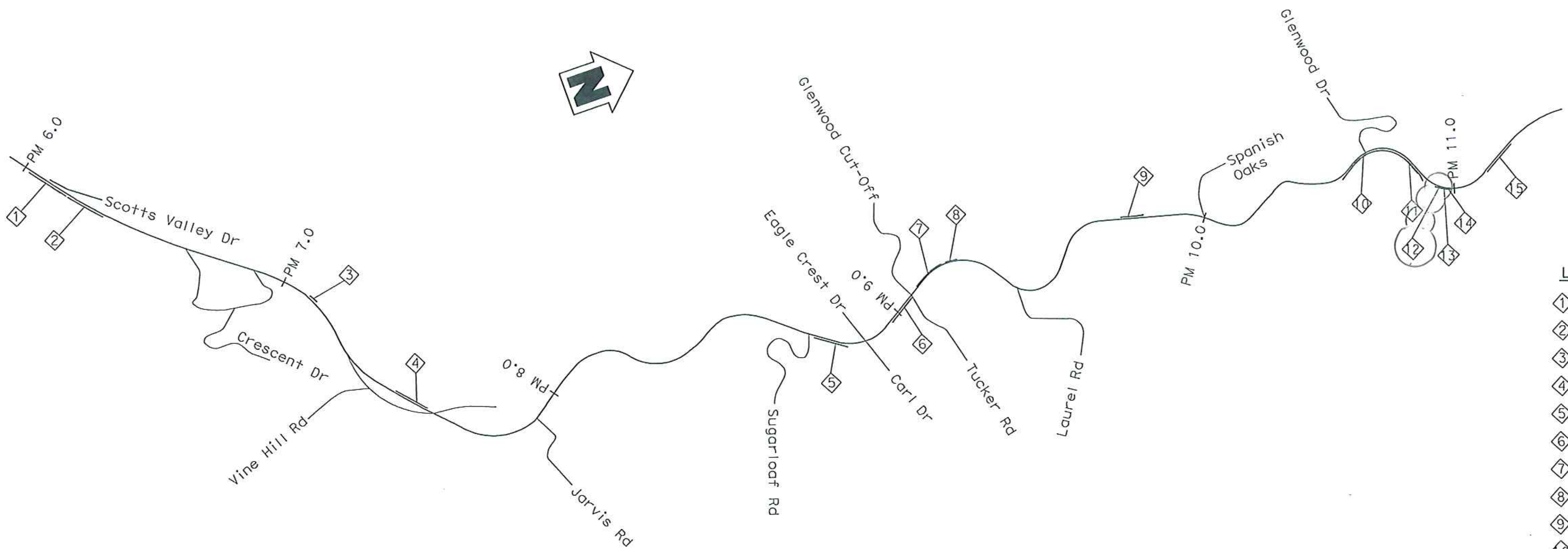
LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

1. Retaining Wall No. 1
2. Retaining Wall No. 2
3. Retaining Wall No. 3
4. Retaining Wall No. 4
5. Retaining Wall No. 5
6. Retaining Wall No. 6
7. Retaining Wall No. 7
8. Retaining Wall No. 8
9. Retaining Wall No. 9
10. Retaining Wall No. 10
11. Retaining Wall No. 11
12. Retaining Wall No. 12 *
13. Retaining Wall No. 13 *
14. Retaining Wall No. 14 *
15. Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
BO-1	BRIDGE DETAILS
BO-3	BRIDGE DETAILS
BO-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.

DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

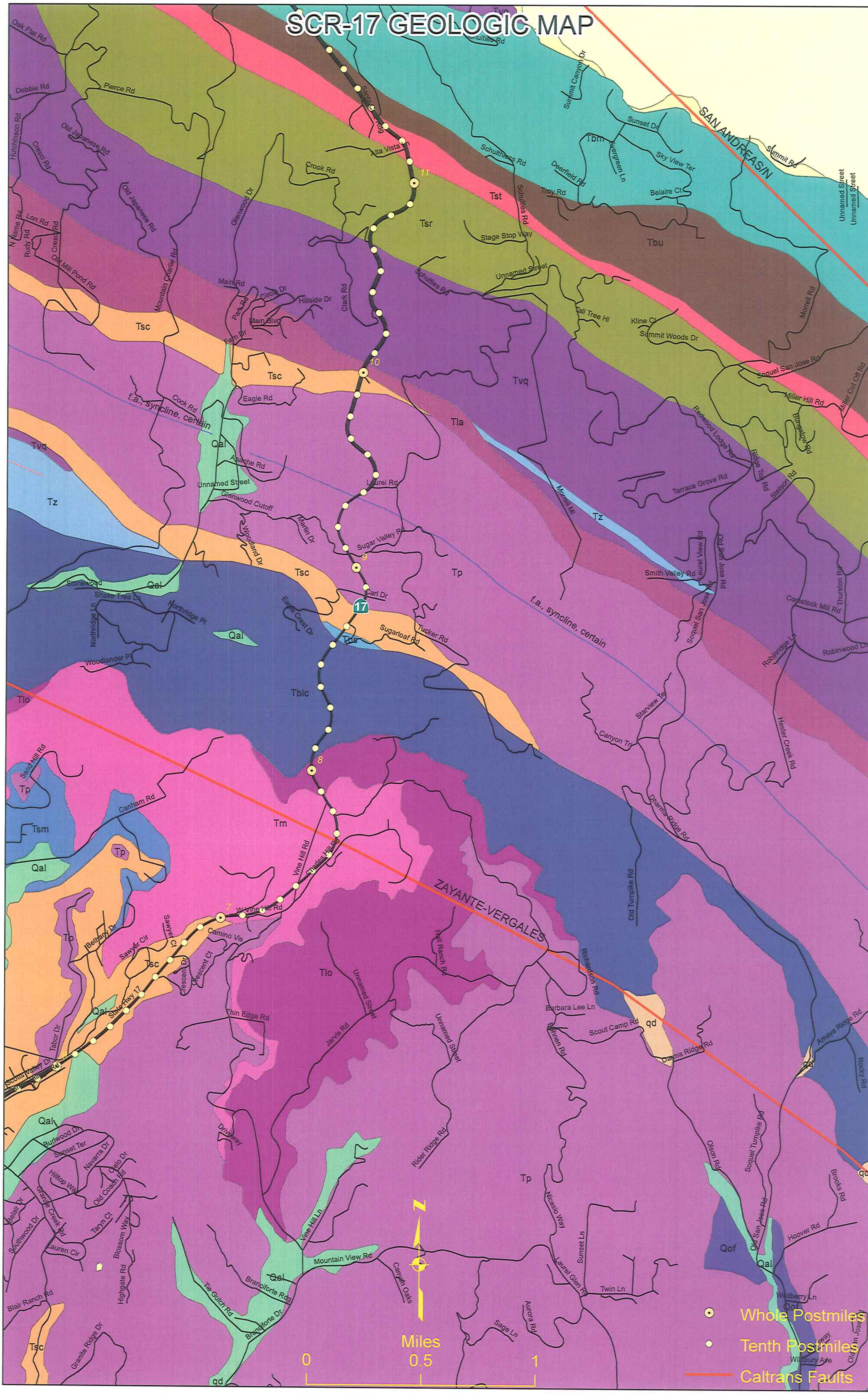
SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

USERNAME => chimon DATE PLOTTED => 12/1/2008 TIME PLOTTED => 12:29:28 PM

ATTACHMENT 2

GEOLOGIC MAP



SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbu
Tst
Tsr
Tbm
Tvq
Tla
Tz
Tp
Tsc
Qal
Tbs
Tblc
Tlo
Tm
Tsm
qd
Qof
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

CURVE DATA TABLE

	R	Δ	T	L
A	124.00	09°16'40"	10.06	20.08
B	594.00	26°24'09"	139.33	273.72

BENCH MARK

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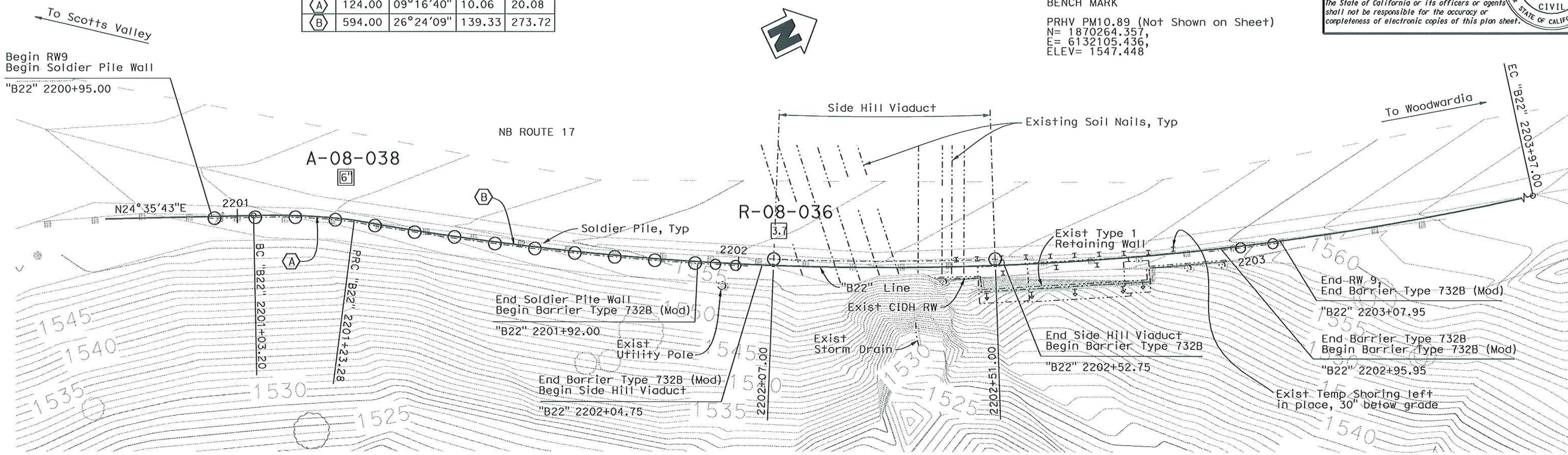
E= 6132105.436,
ELEV= 1547.448



PLAN
1" = 10'

DESIGN OVERSIGHT	DESIGN BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	DETAILS BY	CHECKED	PROJECT ENGINEER
	QUANTITIES BY	CHECKED	

BRIDGE NO. TBD
POST MILE 10.88

RW12 - BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

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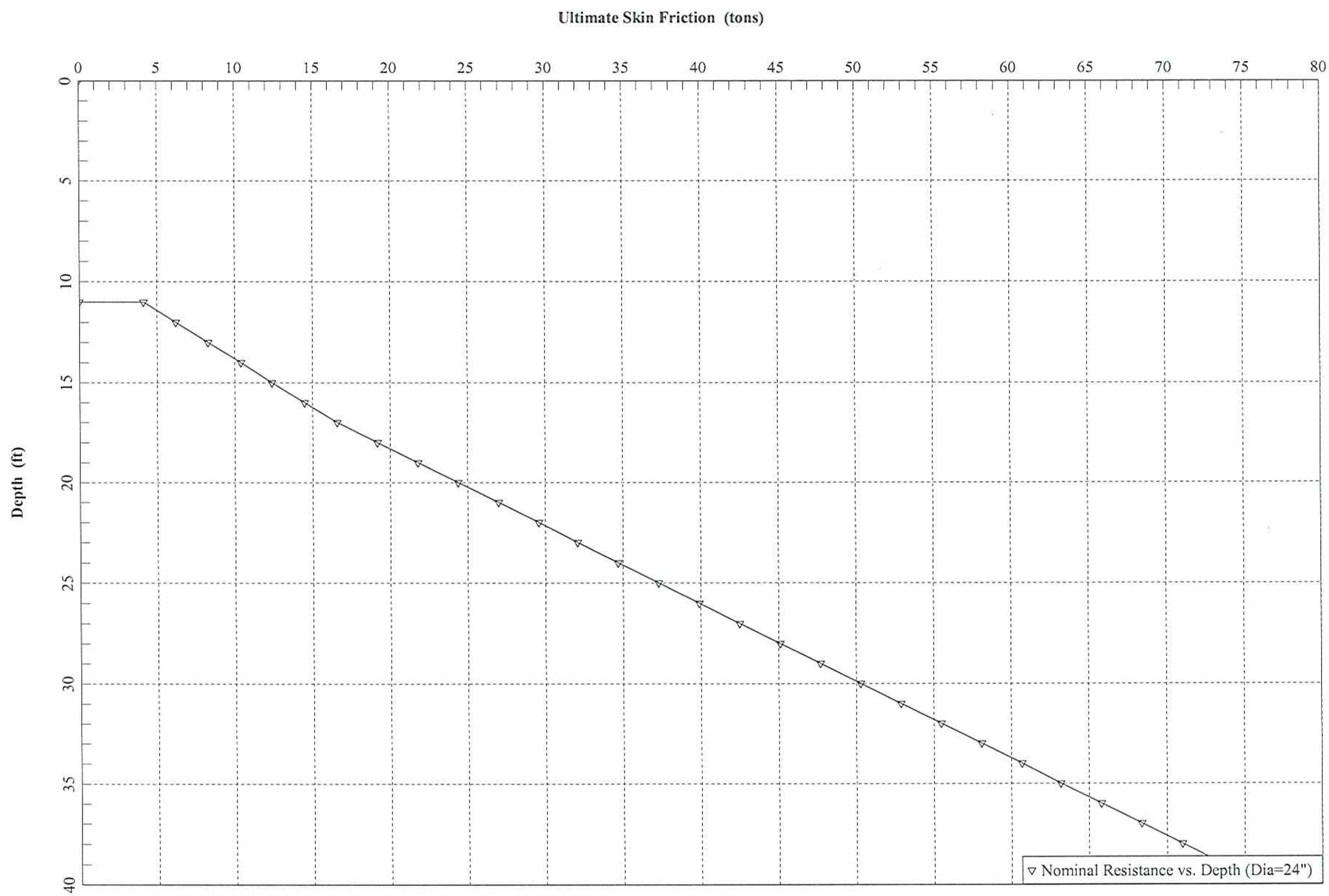
ATTACHMENT 4

24" CIDH PILE NOMINAL RESISTANCE



EA 05-0L70U1: SCR-17 PM 10.95 Retaining Wall No. 12

Memorandum

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: January 2, 2009

File: 05-0L70U1
05-SCR-17-10.92/10.97
Guard Rail Upgrades
Retaining Wall 13

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the reconstruction of a soil nail wall at Location 22, which lies between approximately post mile 10.92 and post mile 10.97. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 22 is on the northbound side of the highway, approximately 0.3-mile north of the intersection of Route 17 and Glenwood Drive. Existing outside shoulder widths through much of the location are less than 1 foot. The existing outside shoulders are supported by a combination of embankment, a timber-lagged CIDH pile retaining wall, and a Type 1 concrete retaining wall on a pile foundation. Metal beam guard railing is currently in place along the northbound outside edge of pavement at Location 22, and a concrete median barrier separates northbound and southbound traffic.

A soil nail wall was constructed in 1998 along a section of roadway at Location 22 to repair erosion damage that resulted from a break in an existing culvert. The wall was built under an emergency contract, under less than favorable conditions. The soil nails that were used were obtained from a nearby project, and were not the diameter or grade of steel that was specified in the plans. The length of the nails was also less than what was specified, so nails were spliced together to obtain the desired length. The wall was constructed without the benefit of verification testing of nail pullout resistance. Because of these circumstances, the soil nail wall was considered to be temporary, with an expected service life of 5 years. Another project to add a truck-climbing lane would have replaced the wall in 2003, but was never constructed. It is necessary to replace the existing soil nail wall as part of the current project to ensure the continued integrity of the roadway. This report presents foundation recommendations for the reconstruction of the wall, denoted Retaining Wall No. 13. The approximate limits of the soil nail wall are from “B22” Station 2202+07 to “B22” Station 2202+51.

Pertinent Reports and Investigations

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

1. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.

2. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.

3. *Office Memo: Temporary Soil Nail Wall,* EA 05-467903, Caltrans, Sara Connor, February 21, 1998.

4. *Completion Report,* EA 05-467903, Caltrans, Kambiz Kouchesfahani, March 27, 1998.

5. *Post Construction Evaluation,* EA 05-467903, Caltrans, Sara Connor, November 16, 1998.

6. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 22 is in the West Branch Soquel Creek water shed. Soquel Creek drains into Monterey Bay near Capitola.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Oligocene and Eocene aged Rices Mudstone, geologic unit T_{sr}, underlies Location 22. Brabb describes Rices Mudstone as olive-gray mudstone and massive, medium light gray, very fine to fine-grained arkosic sandstone

The highway at Location 22 was constructed as a cut/fill section. The existing soil nail wall is inclined at 0.5:1 and flatter.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling two mud rotary borings in the northbound #2 traffic lane. Boring R-08-032 was drilled to a depth of 76.5 feet, approximately 6.9 feet left of "B22" Station 2202+52.5. Boring R-08-036 was drilled to a depth of 61.5 feet, approximately 6.9 feet left of "B22" Station 2202+07.8. The locations of the borings are shown on the attached RW 13 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Pocket penetrometer measurements of unconfined compressive strength were used to estimate the undrained shear strength of some of the clay samples. Soils were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

The subsurface stratigraphy at Boring R-08-032 consists of approximately 15 feet of very loose to dense clayey sand and clayey sand with gravel overlying approximately 5 feet of dense sandy silt with gravel, overlying approximately 20 feet of very stiff sandy lean clay, overlying soft to very soft mudstone. The subsurface stratigraphy at Boring R-08-036 consists of approximately 15 feet of hard sandy fat clay with gravel, overlying 30 feet of hard fat clay with sand, overlying moderately soft to moderately hard claystone.

Ground Water

Boring R-08-032 was left open 24 hours so that ground water elevation could be measured. Water was measured at 38.6 feet below the ground surface. That depth equates to a ground water elevation of 1519.0 feet. It is not known with certainty whether the water encountered was actually ground water or residual drilling fluid.

The Completion Report (1998) for the construction of the temporary soil nail wall reported that ground water was encountered while drilling the bottom row of soil nails. Taking into account the vertical distance from the roadway surface to the bottom row of nails and the 15-degree declination of the borings, it appears that ground water was encountered roughly 43 feet below the roadway. That equates to an elevation of approximately 1514 feet.

The ground water elevation during construction may be significantly higher than it was during the subsurface investigation for this project. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall.

Corrosion

Representative soil samples taken during the foundation investigation are being tested for corrosion potential. Test results were not available at the time of this report. Corrosion test results will be conveyed to you in a separate Corrosion Test Summary Report when they become available.

The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Until corrosion test results become available, the site should be considered to be corrosive to foundation elements. Corrosion test results for a nearby project indicated that that site was corrosive due to a low pH and a sulfate concentration above the 2000 ppm threshold.

For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 22. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 1.1 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 22 due to an earthquake along the Fault is estimated to be 0.71 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g. A horizontal PGA of 0.2g was used for the design of the soil nail wall.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained material in the embankment fills and native soils, and the relatively shallow depth to bedrock.

Design Requirements and Approach

The design of the soil nail wall was performed using GoldNail software, developed by Golder Associates of Redmond, Washington. GoldNail is a slip-surface, limiting-equilibrium, slope-stability model based on satisfying overall limiting equilibrium (translational and rotational) of individual free bodies defined by circular slip surfaces. This design approach is recommended in the FHWA publication *Manual for Design and Construction Monitoring of Soil Nail Walls*, Publication No. FHWA-SA-96-069. The Service Load Design (SLD) method was used. The strength factors and factors of safety recommended in the FHWA manual for Group I and Group VII load combinations were used.

Group I Strength Factors and Factors of Safety		
Nail Head Strength	=	0.67
Nail Tendon Tensile Strength	=	0.55
Ground-Grout Pullout Resistance	=	0.5
Minimum Global Soil Factor of Safety	=	1.35

Group VII Strength Factors and Factors of Safety		
Nail Head Strength	=	0.89
Nail Tendon Tensile Strength	=	0.73
Ground-Grout Pullout Resistance	=	0.67
Minimum Global Soil Factor of Safety	=	1.01

The following design assumptions and approaches have been utilized:

- The maximum contributory area of the soil nail assembly (S_v X S_h) $\leq$ 25 ft^{2,} where S_v is the vertical spacing of the nails and S_h is the horizontal spacing of the nails.

$$S_{v,Max} = 5.0 \text{ feet}$$
$$S_{h,Max} = 5.0 \text{ feet}$$

- The declination angle (θ) of the nails from the horizontal = 15°
- The design strength and nail pullout characteristics of the soil in the nailing zone were assumed as follows:

Unit Weight	=	115 pcf
Cohesion	=	100 psf
Friction Angle	=	25°
Design Nail Pullout Resistance	=	680 lbf/ft (static)
Design Nail Pullout Resistance	=	910 lbf/ft (seismic)

- The top row of nails will be installed parallel the top of the wall, 3 feet below the top of wall. The bottom row of nails will be installed 2.5 feet above the bottom of the wall.

Group I strength factors and factors of safety governed the design of the wall.

Grade 60 #8 steel bars were required in the analysis to achieve stability. The calculated tendon strength for bars this size and grade is 47400 lbf, and the maximum tendon strength needed for stability is 39000 lbf.

The design of the wall facing system is the responsibility of the Structure Designer. Shotcrete finish facing or cast-in-place (CIP) concrete facing may be used for this wall. The stability analysis of the wall assumed a minimum nail head strength of 26300 lbf. Therefore, the wall facing design must provide for a minimum strength of 26300 lbf in facing flexure, facing punching shear, and headed stud tension with appropriate factors of safety.

The following table provides a summary of the structural design elements relevant to the proposed wall:

Station Limits ("B22" Line)	Steel Grade	Bar Size	Nail Embedment Length	Nail Head Strength
2202+05 to 2202+55	60	#8	40 feet	26300 lbf

Grade 60 soil nails shall conform to the requirements in ASTM Designation A615/A615M or A706/A706M. For bar sizes that are unavailable in the designated steel grade, other steel grades with adjusted bar sizes may be used.

Soil Nail Wall Drainage

Construction of a proper drainage system is critical to prevent the build up of hydrostatic pore pressure behind the wall and facing. Two-inch PVC weep holes were placed through the facing of the existing soil nail wall. It is recommended that additional weep holes be installed at a horizontal spacing of approximately 5 feet and a vertical spacing of H/3, where H is the height of the wall.

Soil Nail Pullout Tests

Field verification of the pullout resistance values used in design shall be performed to assure that the nail design loads can be carried without excessive movement, and with an acceptable factor of safety for the service life of the retaining wall. Test nails shall be constructed using the same equipment, methods, and hole diameter as planned for the production nails.

The pullout test shall consist of incrementally loading the test nail assembly until either the maximum test load has been held for the duration specified in the Special Provisions, or a pullout failure has occurred. A pullout failure has occurred when attempts to increase the test load result in movement of the soil nail relative to a fixed reference point without an increase in load. If the test nails fail to meet the requirements stated in the Special

Provisions, Geotechnical Design North shall be contacted immediately for assessment and modification of the wall design.

Stability Testing

The contractor will not be required to perform stability testing on the slope face. The slope is presently in its finished configuration and is stabilized by reinforced shotcrete.

Construction Considerations

The Completion Report for the construction of the existing soil nail wall mentioned that some of the holes for the soil nails had to be cased, presumably because of caving conditions. It was also noted that some of the holes took an excessive amount of grout.

The drilled holes for the bottom row of soil nails may encounter ground water. Clearing the holes of cuttings may be difficult. Furthermore, the sides of the drilled holes may have to be roughened to achieve adequate pullout resistance between the grout and the soil.

Drilling of the soil nail holes will likely need to be done from the roadway, above the existing wall. The drill rig will need to have sufficient reach to drill the bottom row of soil nails, approximately 30 feet below roadway elevation.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 13.

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

- Foundation Report for Retaining Wall No. 13 dated January 2, 2009.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1	**LOCATION MAPS**
ATTACHMENT 2	**GEOLOGIC MAP**
ATTACHMENT 3	**BORHOLE LOCATIONS**

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

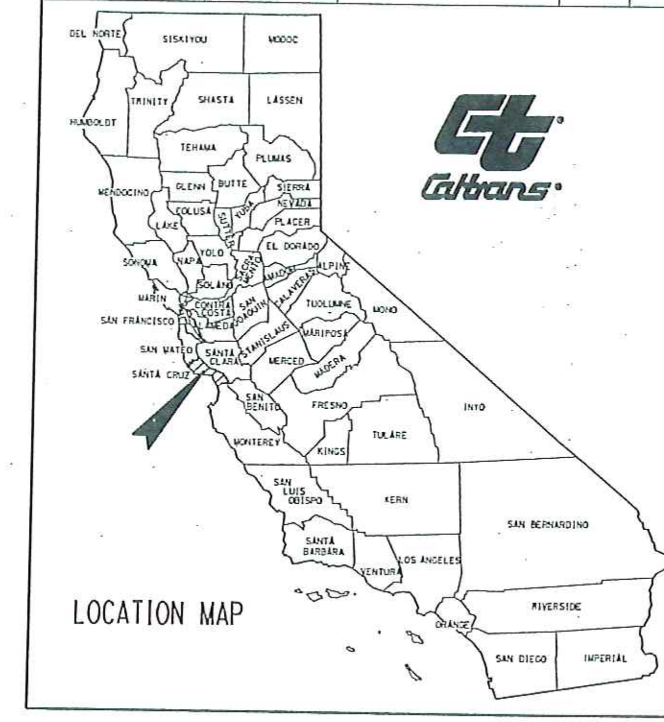
IN SANTA CRUZ COUNTY
IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

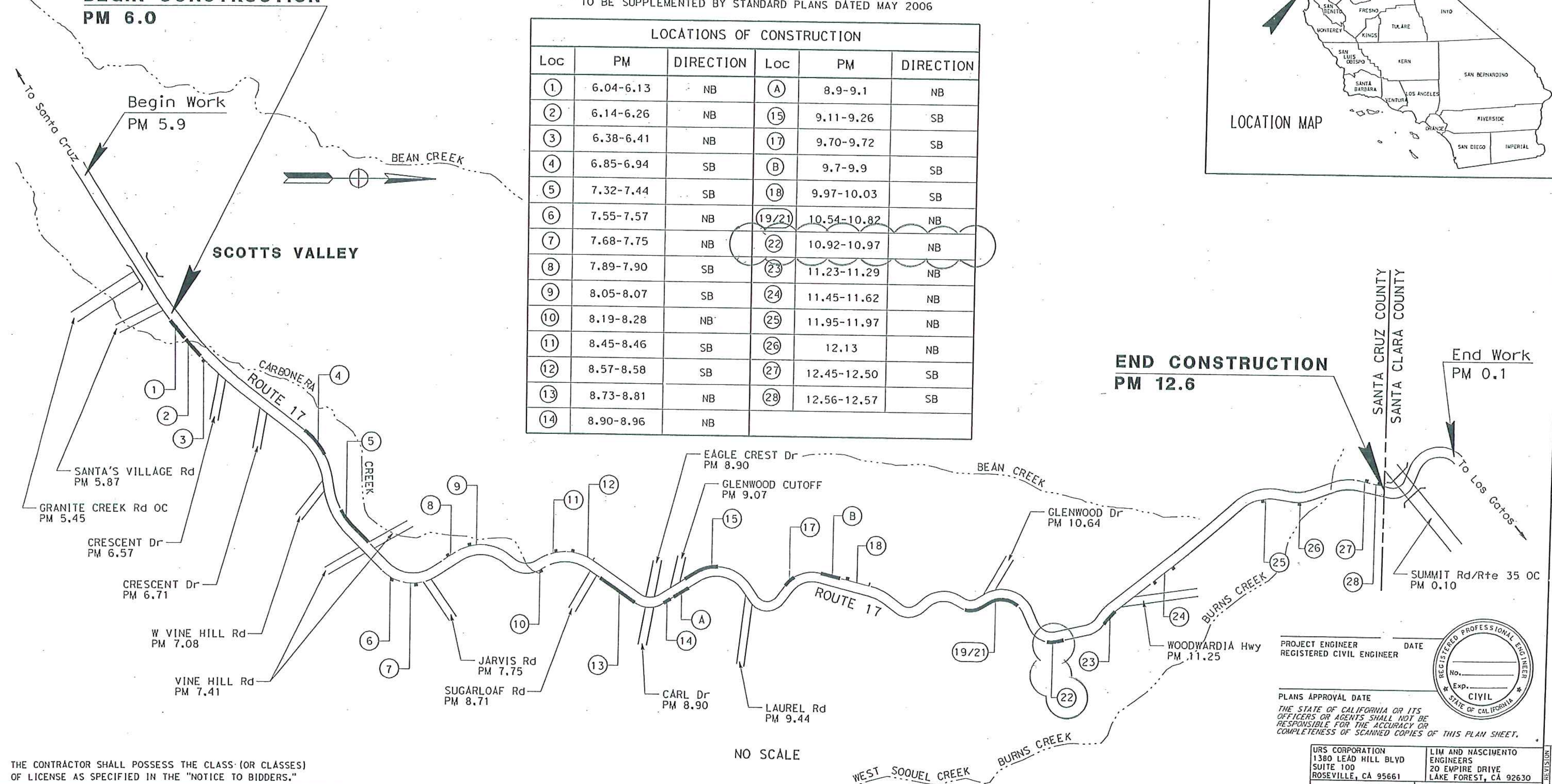
TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			





NO SCALE

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

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

...\PLANS\05OL70Ueb001.dgn

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
No.
Exp.
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08 | DATE PLOTTED => 12/5/2008 | 3:14:25 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

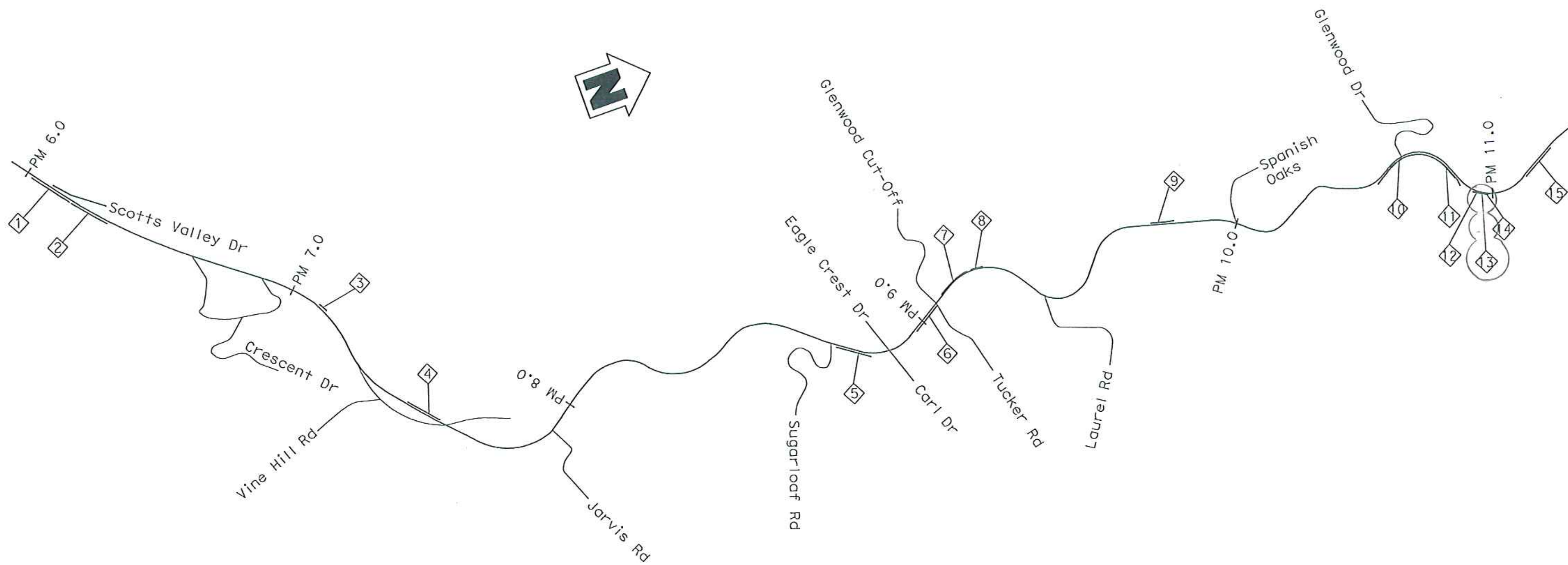
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER T. Dudley No. C 039514 Exp. 12/31/09 CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

- 1 Retaining Wall No. 1
- 2 Retaining Wall No. 2
- 3 Retaining Wall No. 3
- 4 Retaining Wall No. 4
- 5 Retaining Wall No. 5
- 6 Retaining Wall No. 6
- 7 Retaining Wall No. 7
- 8 Retaining Wall No. 8
- 9 Retaining Wall No. 9
- 10 Retaining Wall No. 10
- 11 Retaining Wall No. 11
- 12 Retaining Wall No. 12 *
- 13 Retaining Wall No. 13 *
- 14 Retaining Wall No. 14 *
- 15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.
DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An
SIGN OFF DATE
DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevarez

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 05
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

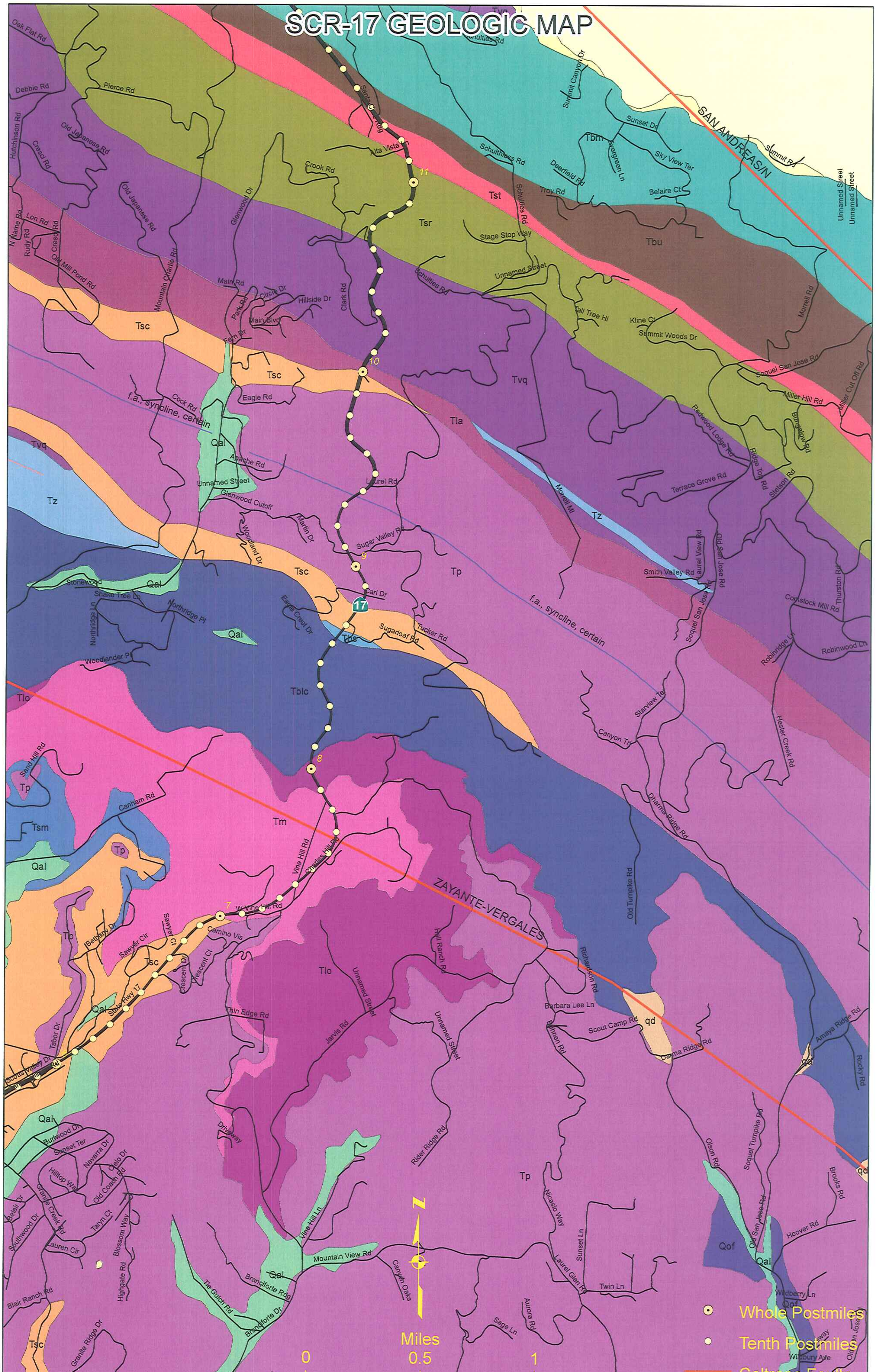
SHEET 1 OF 52

FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-o-itp.dgn

USERNAME => chimon DATE PLOTTED => 12/1/2008 TIME PLOTTED => 12:29:28 PM

ATTACHMENT 2

GEOLOGIC MAP


SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbm
Tst
Tsr
Tbu
Tvq
Tla
Tz
Tp
Tsc
Qal
Tbs
Tblc
Tlo
Tm
Tsm
Tb
qd
Qof
Tvq
11
10
9
8
7
17
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

CURVE DATA TABLE

	R	Δ	T	L
A	124.00	09°16'40"	10.06	20.08
B	594.00	26°24'09"	139.33	273.72

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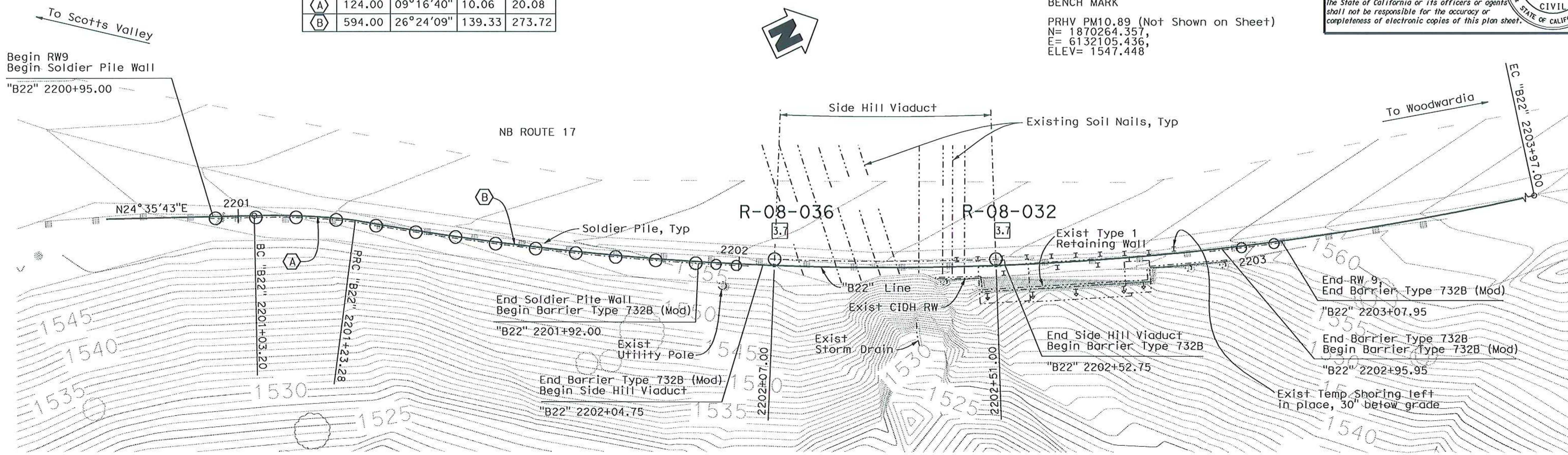
E= 6132105.436,
ELEV= 1547.448



PLAN
1" = 10'

DESIGN OVERSIGHT	DESIGN BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	PROJECT ENGINEER
SIGN OFF DATE	DETAILS BY	CHECKED		
	QUANTITIES BY	CHECKED		

BRIDGE NO. TBD

POST MILE 10.91

RW13 - BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

FILE => RW13FP.dgn

Memorandum

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: January 2, 2009

File: 05-0L70U1
05-SCR-17-10.92/10.97
Guard Rail Upgrades
Retaining Wall 14

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a reinforced concrete retaining wall on 24-inch CIDH piles to support the widened shoulder at Location 22, which lies between approximately post mile 10.92 and post mile 10.97. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 22 is on the northbound side of the highway, approximately 0.3-mile north of the intersection of Route 17 and Glenwood Drive. Existing outside shoulder widths through much of the location are less than 1 foot. The existing outside shoulders are supported by a combination of embankment, a timber-lagged CIDH pile retaining wall, and a Type 1 concrete retaining wall on a pile foundation. A soil nail wall was constructed in 1998 along a section of roadway at Location 22 to repair erosion damage that resulted from a break in an existing culvert. Metal beam guard railing is currently in place along the northbound outside edge of pavement at Location 22, and a concrete median barrier separates northbound and southbound traffic.

It is proposed to widen outside shoulders to 4 feet and replace the existing metal beam guard railing with concrete barriers at Location 22. A combination of a soldier pile retaining wall, a side hill viaduct, and a reinforced concrete retaining wall on 24-inch CIDH piles are proposed to facilitate the shoulder widening and barrier construction. This report presents foundation recommendations for Retaining Wall No. 14, a reinforced concrete wall founded on 24-inch CIDH piles. The wall will be 12 feet long, spanning between "B22" Station 2202+95.95 and "B22" Station 2203+07.95.

Pertinent Reports and Investigations

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

1. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.
2. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.
3. *Completion Report,* EA 05-467903, Caltrans, Kambiz Kouchesfahani, March 27, 1998.
4. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 22 is in the West Branch Soquel Creek water shed. Soquel Creek drains into Monterey Bay near Capitola.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Oligocene and Eocene aged Rices Mudstone, geologic unit T_{sr}, underlies Location 22. Brabb describes Rices Mudstone as olive-gray mudstone and massive, medium light gray, very fine to fine-grained arkosic sandstone

The highway at Location 22 was constructed as a cut/fill section. The embankment side slope in the area where Retaining Wall No. 14 is to be constructed is inclined at approximately 1.7:1.

A subsurface investigation was conducted to assess foundation conditions for the proposed retaining wall. The investigation consisted of drilling one six-inch auger boring in the northbound #2 traffic lane, approximately 8.6 feet left of "B22" Station 2203+06.7. The location of the boring is shown on the attached RW 14 - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Soils obtained from the auger cuttings and from the split spoon sampler were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

Auger drilling was selected over mud-rotary drilling in order to assess potential constructability issues for the proposed retaining wall and to allow direct measurement of ground water elevations during drilling. This method of drilling does not facilitate recovery of undisturbed soil and rock samples, however. The subsurface stratigraphy at the borehole location consists of approximately 27 feet of medium dense sandy silt overlying moderately soft to soft siltstone.

Ground Water

Ground water was not encountered within 40 feet of the ground surface, the maximum depth of the subsurface investigation.

The Completion Report (1998) for the construction of a temporary soil nail wall south of Retaining Wall No. 14 reported that ground water was encountered while drilling the bottom row of soil nails. Taking into account the vertical distance from the roadway surface to the bottom row of nails and the 15-degree declination of the borings, it appears that ground water was encountered roughly 43 feet below the roadway. That equates to an elevation of approximately 1514 feet.

Corrosion

Representative soil samples taken during the foundation investigation are being tested for corrosion potential. Test results were not available at the time of this report. Corrosion test results will be conveyed to you in a separate Corrosion Test Summary Report when they become available.

The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Until corrosion test results become available, the site should be considered to be corrosive to foundation elements. Corrosion test results for a nearby project indicated that that site was corrosive due to a low pH and a sulfate concentration above the 2000 ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 22. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 1.1 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 22 due to an earthquake along the Fault is estimated to be 0.71 g (gravity).

Caltrans *Guidelines for Foundation Investigations and Reports*, dated March 2002, recommends using one-third of the horizontal PGA for the seismic assessment of slopes and retaining systems, with an upper limit of 0.2g.

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained material in the embankment fills and native soils, and the relatively shallow depth to bedrock.

Geotechnical Analysis and Design

Soil strength parameters to be used for the design of the retaining wall are based upon SPT correlations to internal angle of friction in cohesionless soils. Coulomb Theory was used to calculate active lateral earth pressure coefficients for the soil. Passive lateral earth pressure coefficients were calculated using the logarithmic spiral method. Because any rock that may be encountered is expected to be relatively soft, it will be assumed to behave as a cohesionless soil once disturbed by drilling.

Retained soils for the proposed wall are primarily sandy silt of the embankment fill. The CIDH piles for the retaining walls will be embedded in embankment material and, possibly, soft siltstone. The following table presents the soil strength parameters and lateral earth pressure coefficients that are recommended for the design of the retaining wall. The given depths are relative to the existing road surface.

Table 2: Recommended Soil Strength Parameters

Station Limits ("B22" Line) (feet)	Depth (feet)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
2202+95 to 2203+10	0.0'-12.0'	31	0	120	0.32	3.17
	12.0'-36.0'	33	0	120	0.29	3.43
	36.0'-40.0'	37	0	125	0.25	4.25

Foundation Recommendations

A reinforced concrete retaining wall founded on 24-inch CIDH piles is proposed at Location 22 between "B22" Station 2202+95.95 and "B22" Station 2203+07.95. The wall will be situated to provide room for a 4-foot wide outside shoulder and a concrete barrier.

For the purposes of performing a lateral analysis on the proposed 24-inch CIDH piles, foundation soils should be assumed to be cohesionless, with strength parameters as presented in Table 2. The piles should be assumed to derive their axial capacity solely from skin friction. The graphs presented in Attachment 4 can be used to estimate axial capacity for pile lengths up to 40 feet. It is recommended that a factor of safety of 2.0 be used in the calculation of allowable capacity.

The lateral earth pressure due to traffic loads shall be added to the active lateral earth pressure in accordance with Article 5.5.5.10.5, "Live Load Surcharge," of the Bridge Design Specifications. Caltrans' practice is to model highway traffic loads as a 0.240-ksf surcharge.

Slope Stability

Global slope stability is not considered to be a concern at this location. The existing slopes exhibit no sign of instability, and the addition of a retaining wall founded on 24-inch CIDH piles with the associated minimal roadway widening should force potential failure surfaces deeper, improving the factor of safety against global failure.

Construction Considerations

Rock may be encountered during drilling of the holes for the CIDH piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

The loose density and dry condition of the upper portions of the embankment fill material may require casing the top portions of the CIDH pile holes to prevent caving.

While no ground water was encountered during the subsurface investigation at this location, ground water may be encountered when drilling the holes for the CIDH piles. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall. If ground water is encountered during drilling, it may be necessary to pour the concrete for the CIDH piles using "wet" construction methods. The appropriate specification language should be included in the contract special provisions to address the possibility of having to construct the piles in wet holes.

Because both lanes of the traveled way will be needed to convey traffic during the peak traffic hours, the contractor will not be able to grade the roadway to provide access for drilling. The contractor will need to inspect the proposed roadway cross-sections and furnish drilling equipment with sufficient reach to access the drilling locations from the existing roadway.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Retaining Wall No. 14.

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

- Foundation Report for Retaining Wall No. 14 dated January 2, 2009.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1

LOCATION MAPS

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		

INDEX OF PLANS

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

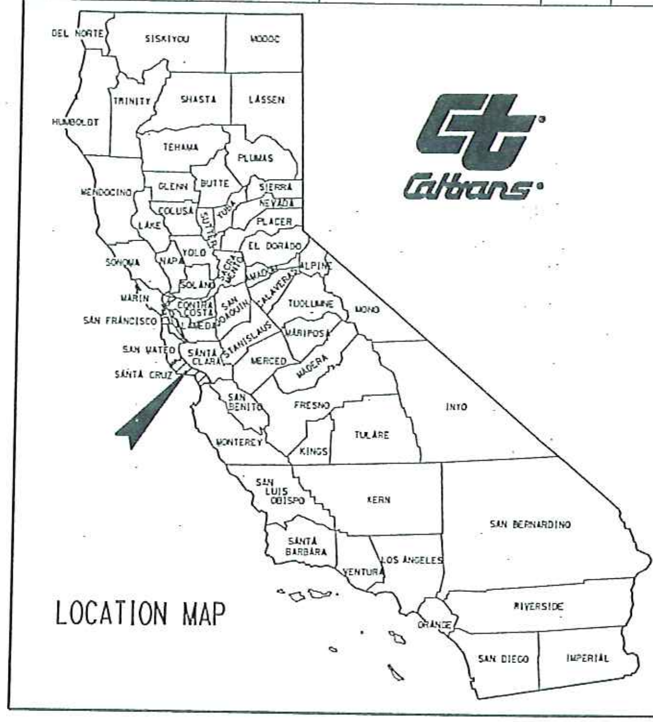
STATE HIGHWAY

IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

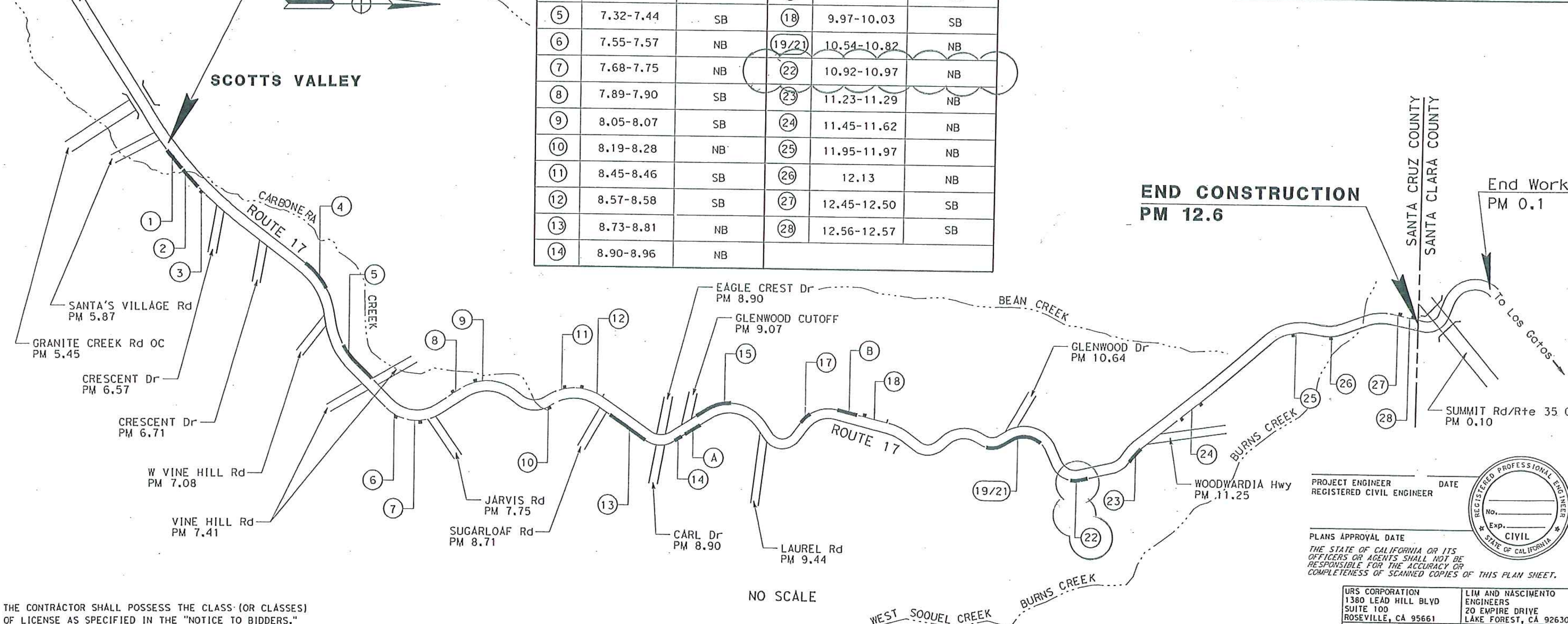
LOCATIONS OF CONSTRUCTION

Loc	PM	DIRECTION	Loc	PM	DIRECTION
1	6.04-6.13	NB	A	8.9-9.1	NB
2	6.14-6.26	NB	15	9.11-9.26	SB
3	6.38-6.41	NB	17	9.70-9.72	SB
4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
13	8.73-8.81	NB	28	12.56-12.57	SB
14	8.90-8.96	NB			



LOCATION MAP

Caltrans



APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
No. ______
Exp. ______
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

CONTRACT No. 05-0L70U1

LAST REVISION 12-05-08

DATE PLOTTED => 12/5/2008 3:14:25 PM

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

..\PLANS\50L70Uab001.dgn

BORDER LAST REVISED 8/1/2008 | CALTRANS WEB SITE IS: HTTP//WWW.DOT.CA.GOV/ | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => Carlton Allen

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	6.10/12.50		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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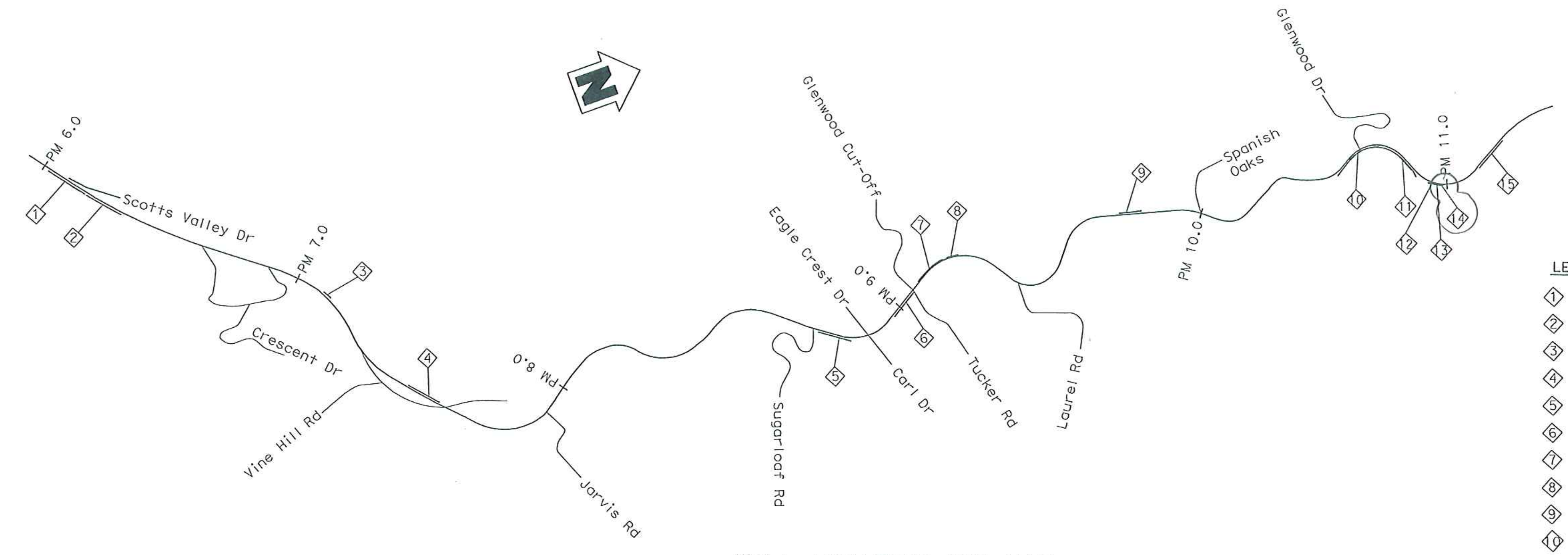
REGISTERED PROFESSIONAL ENGINEER
T. Dudley
No. C 039514
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

LIM & NASCIMENTO ENGINEERING
20 EMPIRE DRIVE
LAKE FOREST, CALIFORNIA 92630



WALL LOCATION KEY MAP

NO SCALE

LEGENDS:

1 Retaining Wall No. 1
2 Retaining Wall No. 2
3 Retaining Wall No. 3
4 Retaining Wall No. 4
5 Retaining Wall No. 5
6 Retaining Wall No. 6
7 Retaining Wall No. 7
8 Retaining Wall No. 8
9 Retaining Wall No. 9
10 Retaining Wall No. 10
11 Retaining Wall No. 11
12 Retaining Wall No. 12 *
13 Retaining Wall No. 13 *
14 Retaining Wall No. 14 *
15 Retaining Wall No. 15

* For Retaining Wall Nos 12, 13 & 14, see "SIDEHILL VIADUCT" plans.

INDEX TO PLANS

STANDARD PLANS DATED MAY 2006

A10A	ACRONYMS AND ABBREVIATIONS (A-L)
A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
A10D	SYMBOLS (SHEET 2 OF 2)
B0-1	BRIDGE DETAILS
B0-3	BRIDGE DETAILS
B0-13	BRIDGE DETAILS
B11-55	CONCRETE BARRIER TYPE 732
B11-56	CONCRETE BARRIER TYPE 736

STANDARD PLAN SHEET NO.
DETAIL NO.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DESIGN OVERSIGHT Wei An

SIGN OFF DATE

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

	BY	CHECKED
DESIGN	T. Dudley	R. Price
DETAILS	C. Lee / Y. Ng	R. Price
QUANTITIES	T. Dudley	E. Nevorez

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Stephen J. Mislinski
PROJECT ENGINEER

CU 05
EA 0L7601

BRIDGE NO. TBD
POST MILE Varies

RETAINING WALLS
INDEX TO PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY) 9/30/08 12/01/08

SHEET 1 OF 52

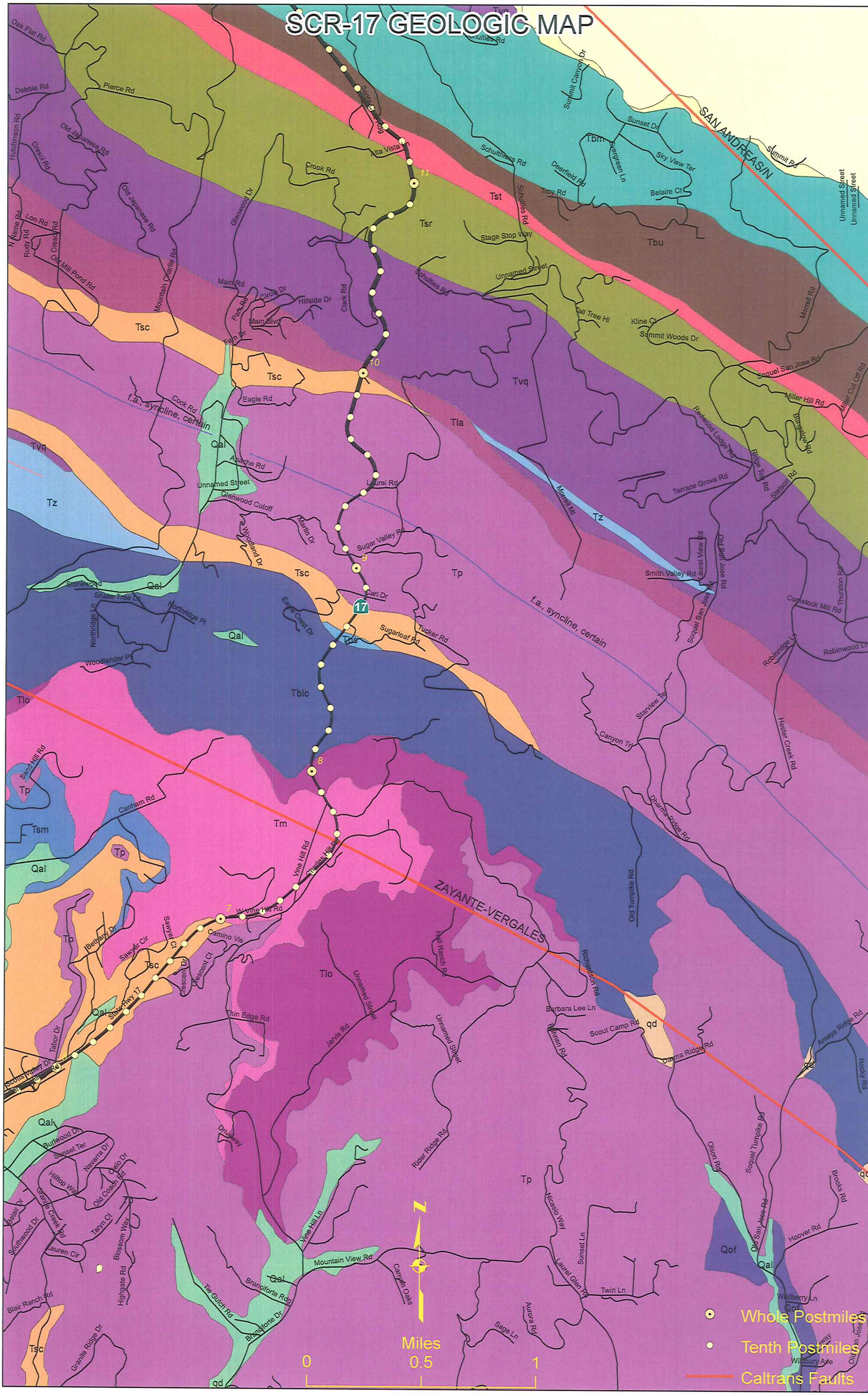
FILE => r:\ct590502_to9 sr 17 - soldier pile walls\plans\rw-groups & sh viaduct\rw-groups\TBDRW0-a-itp.dgn

USERNAME => chimon DATE PLOTTED => 12/1/2008 TIME PLOTTED => 12:29:28 PM

ATTACHMENT 2

GEOLOGIC MAP

SCR-17 GEOLOGIC MAP



ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER No. ____ Exp. ____ CIVIL STATE OF CALIFORNIA

CURVE DATA TABLE

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A	124.00	09°16'40"	10.06	20.08
B	594.00	26°24'09"	139.33	273.72

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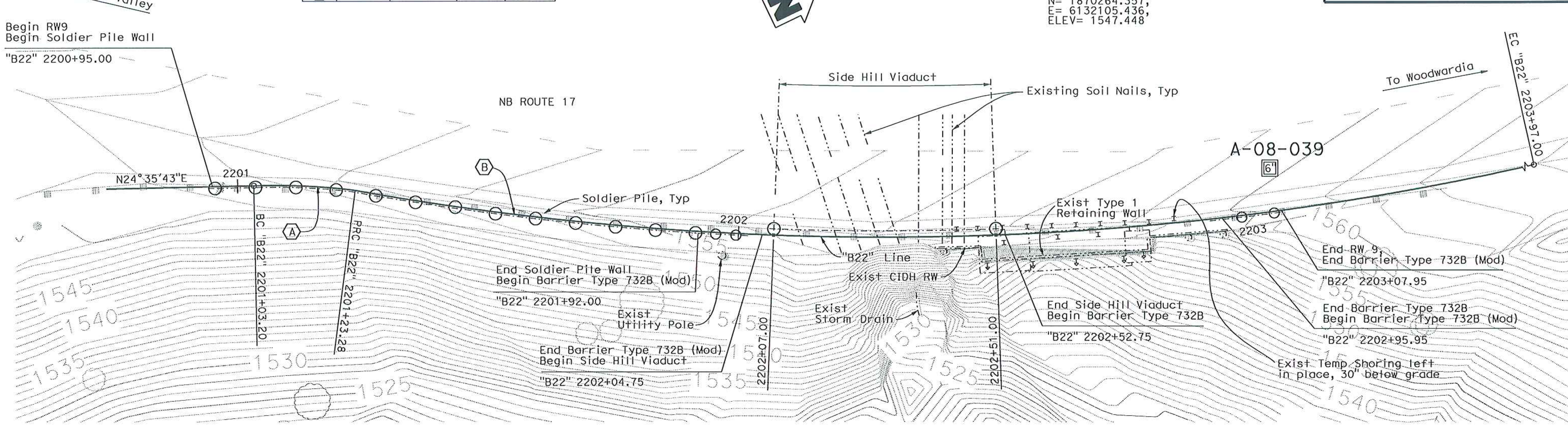
E= 6132105.436,
ELEV= 1547.448



PLAN
1" = 10'

DESIGN OVERSIGHT	DESIGN BY	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	DETAILS BY	CHECKED	PROJECT ENGINEER
	QUANTITIES BY	CHECKED	

BRIDGE NO. TBD

POST MILE 10.92

RW14 - BOREHOLE LOCATIONS

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06254
EA 0L7601

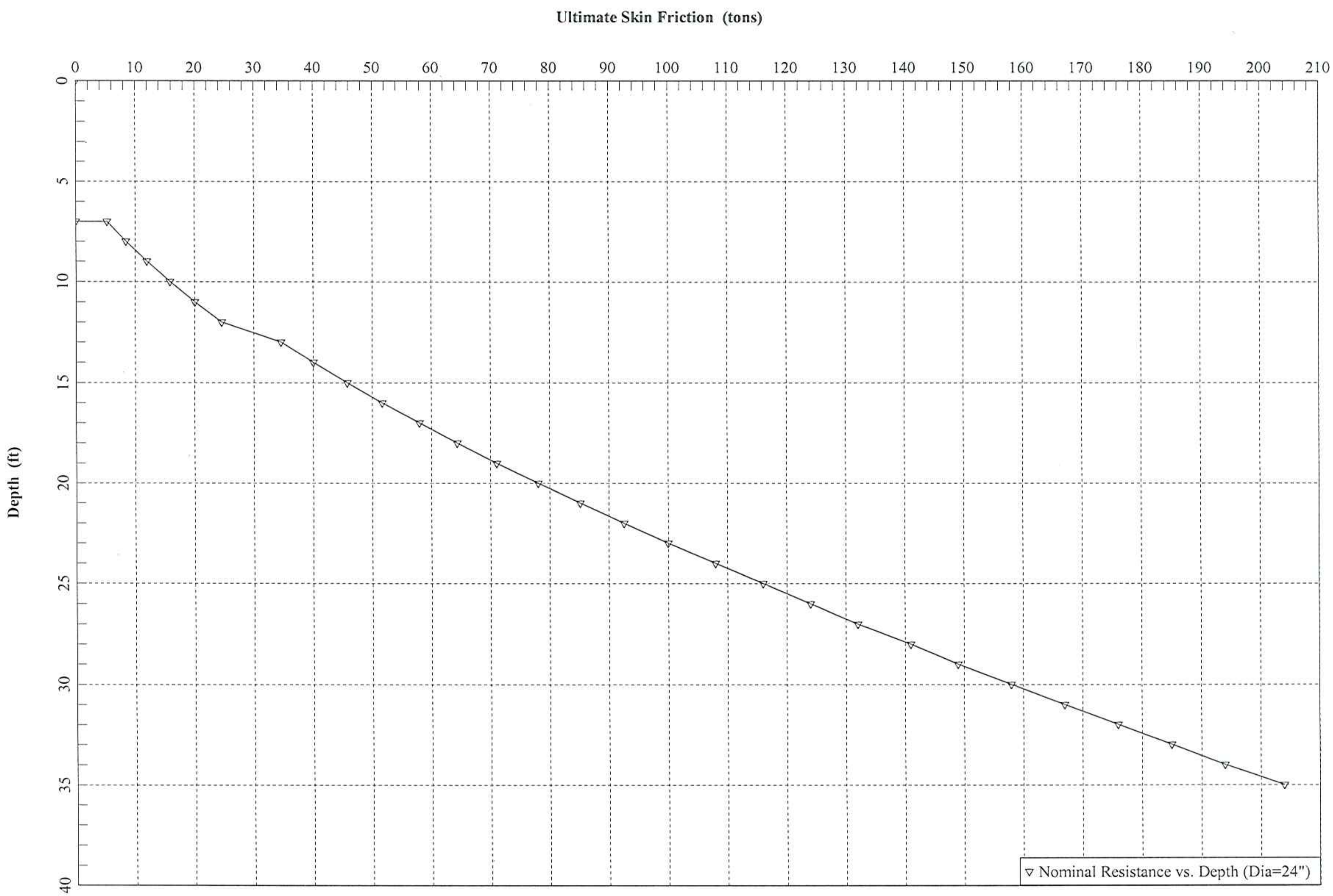
FILE => RW14EP.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

ATTACHMENT 4

24" CIDH PILE NOMINAL RESISTANCE



EA 05-0L70U1: SCR-17 PM 10.95 Retaining Wall No. 14

State of California Business, Transportation and Housing Agency

Department of Transportation

Memorandum

Flex your power!

To: STEVE MISLINSKI
Bridge Design Manager
Lim And Nascimento Engineering Corporation

Date: January 2, 2009

File: 05-0L70U1
05-SCR-17-10.92/10.97
Guard Rail Upgrades
Sidehill Viaduct

Attn: KEEN YONG POONG
Project Engineer

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

Subject: Foundation Report

A Foundation Report (FR) is provided for the above referenced project per your request. The project proposes to widen outside shoulders and construct concrete barriers at several locations on Route 17 in Santa Cruz County to reduce the occurrence and severity of collisions along the segments of highway. Foundation recommendations are presented herein for the construction of a sidehill viaduct to support the widened shoulder at Location 22, which lies between approximately post mile 10.92 and post mile 10.97. These recommendations are based on site investigations, a subsurface investigation conducted during October 2008, and a review of published data and reports.

Existing Facilities and Proposed Improvements

State Route 17 in the project area is a rural four-lane divided conventional highway that crosses the Santa Cruz Mountains. It connects the cities of Santa Cruz and San Jose. The route serves regional and interregional traffic, including motorists who commute daily to job centers in the Silicon Valley. The roadway in the project area includes sharp curves and steep grades.

Location 22 is on the northbound side of the highway, approximately 0.3-mile north of the intersection of Route 17 and Glenwood Drive. Existing outside shoulder widths through much of the location are less than 1 foot. The existing outside shoulders are supported by a combination of embankment, a timber-lagged CIDH pile retaining wall, and a Type 1 concrete retaining wall on a pile foundation. A soil nail wall was constructed in 1998 along a section of roadway at Location 22 to repair erosion damage that resulted from a break in an existing culvert. Metal beam guard railing is currently in place along the northbound outside edge of pavement at Location 22, and a concrete median barrier separates northbound and southbound traffic.

It is proposed to widen outside shoulders to 4 feet and replace the existing metal beam guard railing with concrete barriers at Location 22. A combination of a soldier pile retaining wall, a side hill viaduct, and a reinforced concrete retaining wall on 24-inch CIDH piles are proposed to facilitate the shoulder widening and barrier construction. This report presents foundation recommendations for the sidehill viaduct, a cast-in-place reinforced concrete slab bridge supported by 30-inch CIDH piles. The viaduct will have a single span; the bridge extends between "B22" Station 2202+05.25 and "B22" Station 2202+52.25.

Pertinent Reports and Investigations

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

1. *Geologic Map of Santa Cruz County, California,* Compliled by Earl E. Brabb, 1989.
2. *California Seismic Hazard Map 1996,* Caltrans, Lalliana Mualchin, 1996.
3. *Completion Report,* EA 05-467903, Caltrans, Kambiz Kouchesfahani, March 27, 1998.
4. *Post Construction Evaluation,* EA 05-467903, Caltrans, Sara Connor, November 16, 1998.
5. *Preliminary Foundation Report*, EA 05-0L7601, Caltrans, Daniel Appelbaum, June 23, 2008.

Physical Setting

The project is located in the Santa Cruz Mountains, in the Coast Ranges geomorphic province. Terrain consists of densely vegetated, steep sided mountains with steeply incised drainages.

Location 22 is in the West Branch Soquel Creek water shed. Soquel Creek drains into Monterey Bay near Capitola.

The climate in the Santa Cruz Mountains is Mediterranean with annual rainfall varying locally between 25 inches and 60 inches or more. Most of the rain occurs during the winter months, but summer days are often foggy and wet. Due to these climatic conditions, vegetation is abundant with thick stands of redwood and fir in the valleys and on lower hills; and oak, pine, and chaparral on the higher ground.

Geologic Setting and Soil Conditions

The "Geologic Map of Santa Cruz County, California," compiled by Earl E. Brabb (1989) indicates that Oligocene and Eocene aged Rices Mudstone, geologic unit T_{sr}, underlies Location 22. Brabb describes Rices Mudstone as olive-gray mudstone and massive, medium light gray, very fine to fine-grained arkosic sandstone

The highway at Location 22 was constructed as a cut/fill section. A soil nail wall with a batter of up to 0.5:1 presently supports the section of roadway where the viaduct will be located.

A subsurface investigation was conducted to assess foundation conditions for the proposed viaduct. The investigation consisted of drilling two mud rotary borings in the northbound #2 traffic lane. Boring R-08-032 was drilled to a depth of 76.5 feet, approximately 6.9 feet left of "B22" Station 2202+52.5. Boring R-08-036 was drilled to a depth of 61.5 feet, approximately 6.9 feet left of "B22" Station 2202+07.8. The locations of the borings are shown on the attached Sidehill Viaduct - Borehole Locations drawing. Standard penetration tests (SPT), ASTM test method 1586, were performed at 5-foot depth intervals to estimate soil apparent density. Pocket penetrometer measurements of unconfined compressive strength were used to estimate the undrained shear strength of some of the clay samples. Soils were visually classified in accordance with the Caltrans *Soil and Rock Logging, Classification, and Presentation Manual (June 2007).*

The subsurface stratigraphy at Boring R-08-032 consists of approximately 15 feet of very loose to dense clayey sand and clayey sand with gravel overlying approximately 5 feet of dense sandy silt with gravel, overlying approximately 20 feet of very stiff sandy lean clay, overlying soft to very soft claystone. The subsurface stratigraphy at Boring R-08-036 consists of approximately 15 feet of hard sandy fat clay with gravel, overlying 30 feet of hard fat clay with sand, overlying moderately soft to moderately hard claystone.

Ground Water

Boring R-08-032 was left open 24 hours so that ground water elevation could be measured. Water was measured at 38.6 feet below the ground surface. That depth equates to a ground water elevation of 1519.0 feet. It is not known with certainty whether the water encountered was actually ground water or residual drilling fluid.

The Completion Report for the construction of the temporary soil nail wall at the location of the proposed sidehill viaduct reported that ground water was encountered while drilling the bottom row of soil nails. Taking into account the vertical distance from the roadway surface to the bottom row of nails and the 15-degree declination of the borings, it appears that ground water was encountered roughly 43 feet below the roadway. That equates to an elevation of approximately 1514 feet.

The ground water elevation during construction may be significantly higher than it was during the subsurface investigation for this project. The exploratory drilling was conducted during the dry time of year, after more than a year of below-average rainfall.

Corrosion

Representative soil samples taken during the foundation investigation are being tested for corrosion potential. Test results were not available at the time of this report. Corrosion test results will be conveyed to you in a separate Corrosion Test Summary Report when they become available.

The Department considers a site corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is greater than or equal to 500 ppm
- Sulfate concentration is greater than or equal to 2000 ppm
- The pH is 5.5 or less

Until corrosion test results become available, the site should be considered to be corrosive to foundation elements. Corrosion test results for a nearby project indicated that that site was corrosive due to a low pH and a sulfate concentration above the 2000 ppm threshold.

Reinforced concrete requires corrosion mitigation in accordance with *Bridge Design Specifications, Article 8.22.* For general guidance on mitigating against corrosive environments, refer to the Department's *Corrosion Guidelines, Version 1.0* (September 2003), available at (http:www.dot.ca.gov/hq/esc/ttsb/corrosion/Index.htm).

Seismicity

The proposed project is located within an area of high seismic activity. The Zayante-Vergales Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 7.25, crosses Route 17 between post mile 7.6 and post mile 7.7. The San Andreas North Fault (ST, strike-slip), with a maximum credible earthquake Moment Magnitude (M_w) of 8.0, crosses Route 17 in Santa Clara County, approximately 0.9-mile north of the county line. The San Andreas North Fault is the controlling fault at Location 22. According to the Caltrans-adopted Mualchin peak acceleration curves, at a distance of 1.1 miles from the San Andreas North Fault, the peak bedrock acceleration (PBA) at Location 22 due to an earthquake along the Fault is estimated to be 0.71 g (gravity).

Liquefaction

Liquefaction potential in the project area is expected to be low due to the high proportion of fine-grained material in the embankment fills and native soils, and the relatively shallow depth to bedrock.

Foundation Recommendations

A sidehill viaduct is proposed at Location 22 between "B22" Station 2202+05.25 and "B22" Station 2202+52.25. The bridge width will accommodate a 4-foot wide outside shoulder and a concrete barrier.

30-inch CIDH piles are the recommended foundation type. The CIDH piles will derive their axial support primarily from skin friction. The structure designer will perform analyses of the lateral resistances of the CIDH piles. Design tip elevations for lateral loads have not been provided in the following tables.

Abutments Foundation Design Recommendations								
Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load per Support (kips)		LRFD Service-I Limit State Total Load per Pile (Compression) (kips)	Nominal Resistance (kips)	Design Tip Elevations (ft)	Specified Tip Elevation (ft)
			Total	Permanent				
Abut. 1	30" CIDH	1551.90	140	--	140	280	1497.90 (a), 1501.40 (c)	1497.90
Abut. 2	30" CIDH	1553.73	140	--	140	280	1510.73 (a), 1518.73 (c)	1510.73

Notes:

1) Design tip elevations are controlled by: (a) Compression and (c) Settlement, respectively.

2) The specified tip elevation shall not be raised if controlled by settlement.

Pile Data Table					
Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)
		Compression	Tension		
Abut. 1	30" CIDH	280	0	1497.90 (a), 1501.40 (c)	1497.90
Abut. 2	30" CIDH	280	0	1510.73 (a), 1518.73 (c)	1510.73

Notes:

1) Design tip elevations for Abutments are controlled by: (a) Compression, (c) Settlement, (d) Lateral Load

2) The specified tip elevation shall not be raised above the design tip elevations for lateral load and tolerable settlement.

The following soil parameters should be utilized in performing a lateral analysis on the CIDH piles:

Recommended Soil Strength Parameters for Lateral Analysis						
Location	Depth (feet)	Soil Type	Relative Density/ Consistency	Friction Angle (degrees)	Undrained Shear Strength (psf)	Unit Weight (pcf)
Abutment 1	0.0-15.0	Stiff Clay w/o Free Water	Stiff	N/A	1200	120
	15.0-45.0	Stiff Clay w/o Free Water	Stiff	N/A	1500	125
	45.0-61.5	Stiff Clay w/o Free Water	Very Stiff	N/A	2000	125
Abutment 2	0.0-10.0	Sand Above Water Table	Loose	28	N/A	110
	10.0-15.0	Sand Above Water Table	Medium	32	N/A	120
	15.0-20.0	Silt	Medium	32	100	125
	20.0-40.0	Stiff Clay w/o Free Water	Stiff	N/A	1500	125
	40.0-76.5	Stiff Clay w/o Free Water	Very Stiff	N/A	2000	125

Construction Considerations

Rock will be encountered during drilling of the holes for the CIDH piles. The contractor will need to employ drilling equipment and tooling capable of penetrating weakly to strongly cemented sedimentary rock.

The loose density and dry condition of the upper portions of the embankment fill material may require casing the top portions of the CIDH pile holes to prevent caving.

Ground water may be encountered when drilling the holes for the CIDH piles. Depending on the contractor's equipment and methodologies, a significant amount of water may enter the hole before the contractor is able to place the reinforcement cage and pour concrete. It may be necessary to pour the concrete for the CIDH piles using "wet" construction methods. The appropriate specification language should be included in the contract special provisions to address the possibility of having to construct the piles in wet holes.

Stability of temporary construction slopes is the responsibility of the contractor. The contractor will need to provide working plans and calculations documenting that he can safely construct the proposed improvements. He will need to consider the effects of construction loads on slope stability.

Project Information

Standard Special Provision S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening.

The following is an excerpt from SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the Information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plans are:

- Log of Test Borings for Sidehill Viaduct.

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

- Foundation Report for Sidehill Viaduct dated January 2, 2009.

Project Log of Test Borings have been finalized by this office and are being drafted by the Engineering Graphics Unit. Your office will be notified once they have been completed. For information regarding the status and delivery of the LOTB's, contact Irma Garmarra-Remmen at (916) 227-5510.

If you have any questions or comments, please contact Dan Appelbaum at (805) 549-3745 or Mike Finegan at (805) 549-3194.

Supervised by,

REGISTERED PROFESSIONAL ENGINEER
D.L. Appelbaum
No. C 50001
Exp. 6-30-09
CIVIL
STATE OF CALIFORNIA

DANIEL L. APPELBAUM, PE
Transportation Engineer
Geotechnical Design – North
Branch D

MICHAEL S. FINEGAN, PE, Chief
Geotechnical Design - North
Branch D

c: Roy Bibbens / GDN File
GS File Room
Job File / Branch D Records

LIST OF ATTACHMENTS

ATTACHMENT 1	**LOCATION MAPS**
ATTACHMENT 2	**GEOLOGIC MAP**
ATTACHMENT 3	**BORHOLE LOCATIONS**

ATTACHMENT 1

LOCATION MAPS

INDEX OF PLANS

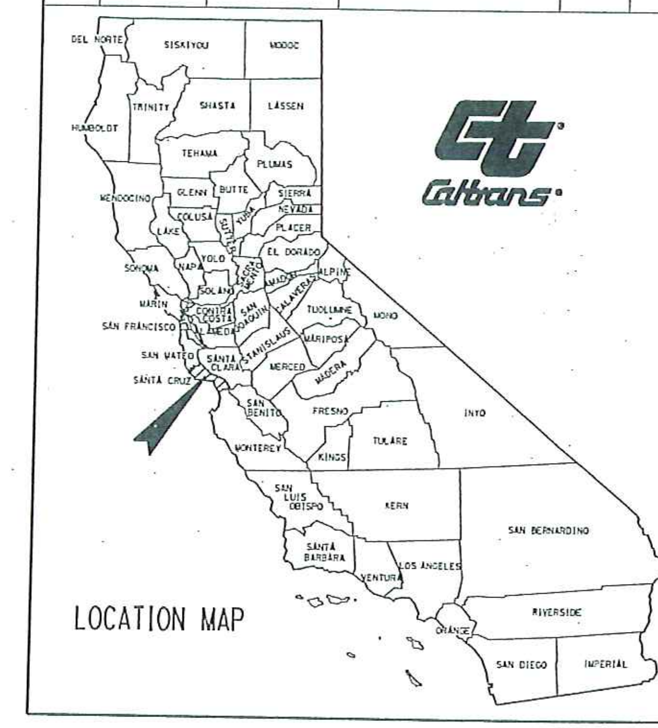
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

IN SANTA CRUZ COUNTY IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS FROM SANTA'S VILLAGE ROAD TO THE SANTA CLARA COUNTY LINE

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
05	SCr	17	6.0/12.6		



LOCATIONS OF CONSTRUCTION

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2	6.14-6.26	NB	15	9.11-9.26	SB
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4	6.85-6.94	SB	B	9.7-9.9	SB
5	7.32-7.44	SB	18	9.97-10.03	SB
6	7.55-7.57	NB	19/21	10.54-10.82	NB
7	7.68-7.75	NB	22	10.92-10.97	NB
8	7.89-7.90	SB	23	11.23-11.29	NB
9	8.05-8.07	SB	24	11.45-11.62	NB
10	8.19-8.28	NB	25	11.95-11.97	NB
11	8.45-8.46	SB	26	12.13	NB
12	8.57-8.58	SB	27	12.45-12.50	SB
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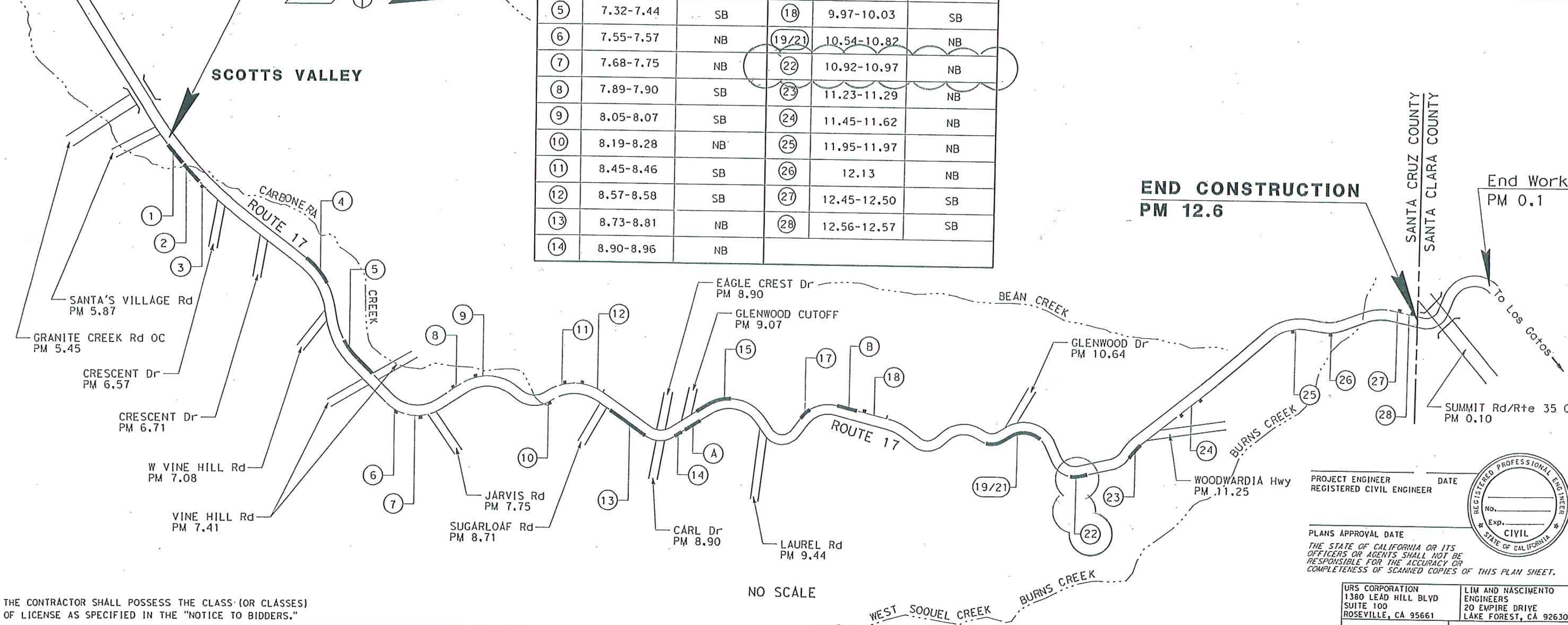
14	8.90-8.96	NB			



APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
JAMES A. LABANOWSKI JR.	ROTIMI ADEBAYO	C69102	6/30/2010	

PROJECT ENGINEER — DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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URS CORPORATION
1380 LEAD HILL BLVD
SUITE 100
ROSEVILLE, CA 95661

LIM AND NASCIMENTO ENGINEERS
20 EMPIRE DRIVE
LAKE FOREST, CA 92630

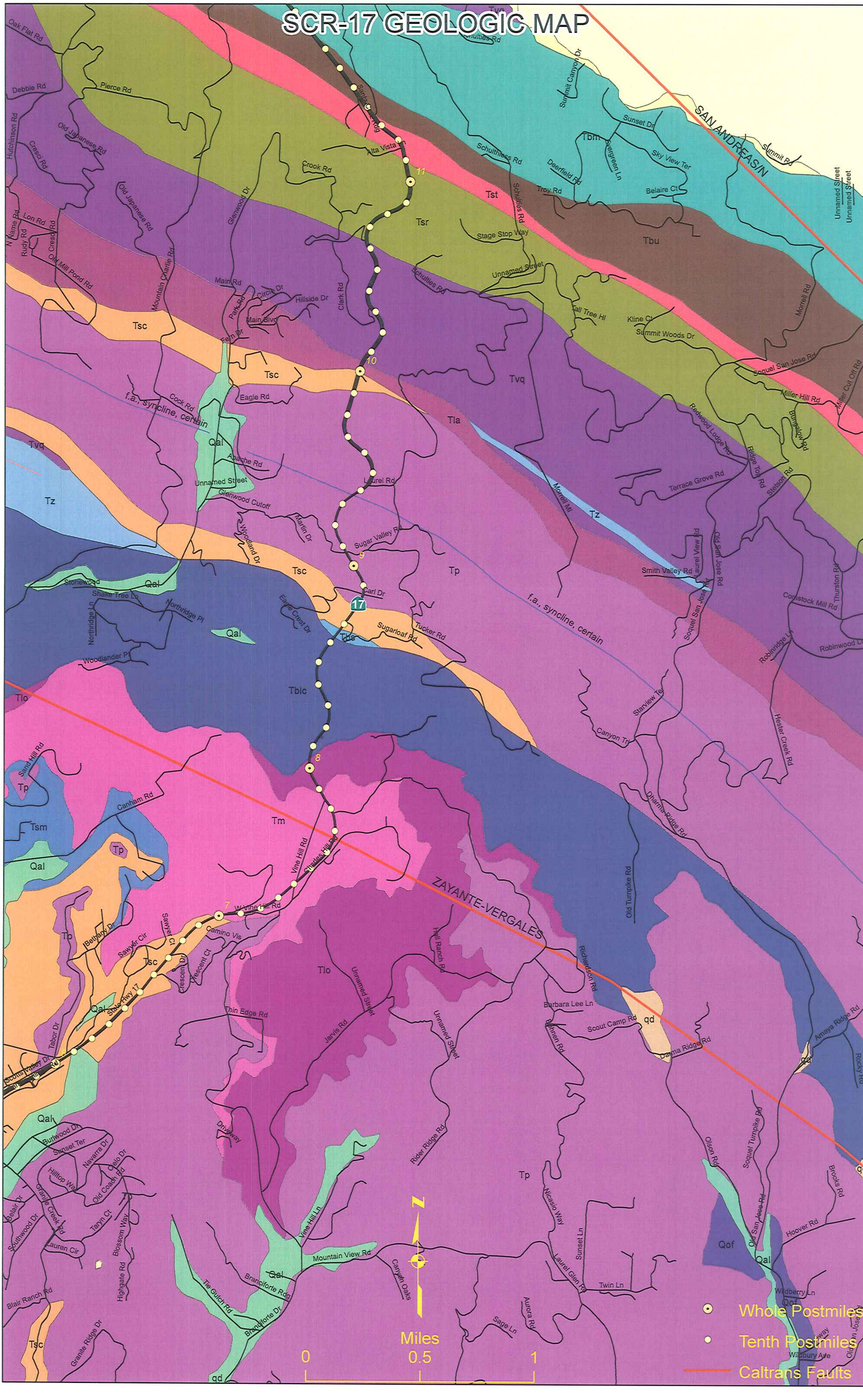
CONTRACT No. **05-0L70U1**

LAST REVISION 12-05-08

DATE PLOTTED => 12/5/2008 3:14:25 PM

ATTACHMENT 2

GEOLOGIC MAP


SCR-17 GEOLOGIC MAP
SAN ANDREAS/N
ZAYANTE-VERGALES
f.a., syncline, certain
Tbm
Tbu
Tst
Tsr
Tvq
Tla
Tz
Tp
Tsc
Qal
Tbs
Tblc
Tm
Tlo
Tsm
qd
Qof
Miles
0
0.5
1
Whole Postmiles
Tenth Postmiles
Caltrans Faults

ATTACHMENT 3

BOREHOLE LOCATIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	SCr	17	8.9/9.9		

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CURVE DATA TABLE

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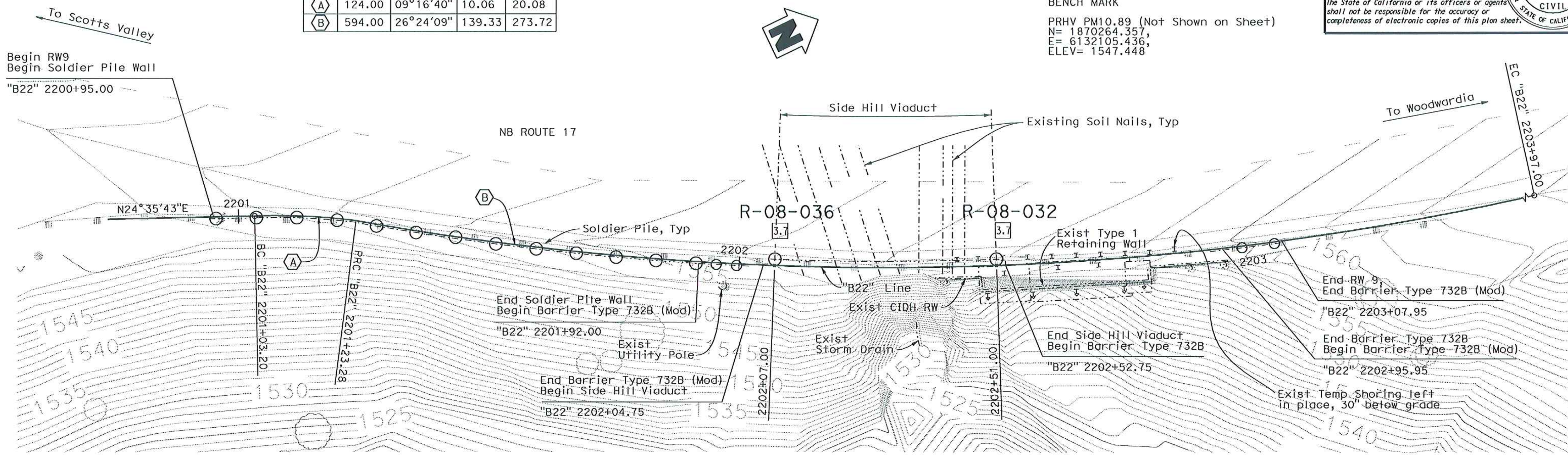
B	594.00	26°24'09"	139.33	273.72



PLAN
1" = 10'

DESIGN OVERSIGHT	DESIGN BY	CHECKED
SIGN OFF DATE	DETAILS BY	CHECKED
	QUANTITIES BY	CHECKED

DESIGN DETAIL SHEET (ENGLISH) (REV. 2/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER

CU 06254
EA 0L7601

BRIDGE NO. TBD
POST MILE 10.91

VIADUCT - BORHOLE LOCATIONS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

FILE => SHViaductFP.dgn

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FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Preliminary Report
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GS (Sacramento)
2. GS

District Project Development
District Project Engineer

Date: March 18, 2009

Sidehills Viaduct
Structure Name

05-SCR-17-6.04/12.50
District County Route Post Mile

05-0L7001 36-0114
E.A. Number Structure Number

Foundation Report By: Daniel Appelbaum Dated: December 31, 2008

Reviewed By: ______ (SD) Daniel Appelbaum (GS)

General Plan Dated: ______ Foundation Plan Dated: 03-16-09

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

✓ Pile Types and Design Loads	✓ Footing Elevations, Design Loads, and Locations	✓ LOTB's
✓ Pile Lengths	✓ Seismic Data	NA Fill Surcharge
NA Predrilling	✓ Location of Adjacent Structures and Utilities	✓ Approach Paving Slabs
NA Pile Load Test	✓ Stability of Cuts or Fills	NA Scour
NA Substitution of H Piles For Concrete Piles ☐ Yes ☐ No	NA Fill Time Delay	✓ Ground Water
	NA Effect of Fills on Abutments and Bents	NA Tremie Seals/Type D Excavation

[signature] Structure Design

LAN ENGINEERING
Branch No.

Daniel R. [signature]
Geotechnical Services

Rev. 11/04

"Caltrans improves mobility across California"

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**

1. Preliminary Report
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services

1. GS (Sacramento)
2. GS

District Project Development
District Project Engineer

Date: March 18, 2009

Retaining Walls
Structure Name

05 - SCR - 17 - 6.04-12.50
District County Route Post Mile

05-0L7001 Various
E.A. Number Structure Number

Foundation Report By: Daniel Appelbaum

Dated: December 31, 2008

Reviewed By: ______________ (SD) Daniel Appelbaum (GS)

General Plan Dated: ______________ Foundation Plan Dated: ~~02-04-09~~ 03-16-09

[X] No changes. [ ] The following changes are necessary.

FOUNDATION CHECKLIST

✓ Pile Types and Design Loads	✓ Footing Elevations, Design Loads, and Locations	✓ LOTB's
✓ Pile Lengths	✓ Seismic Data	NA Fill Surcharge
NA Predrilling	✓ Location of Adjacent Structures and Utilities	NA Approach Paving Slabs
NA Pile Load Test	✓ Stability of Cuts or Fills	NA Scour
NA Substitution of H Piles For	NA Fill Time Delay	✓ Ground Water
Concrete Piles [ ] Yes [ ] No	NA Effect of Fills on Abutments and Bents	NA Tremie Seals/Type D Excavation

[signature] LAN ENGINEERING [signature: Daniel L. Appelbaum]
Structure Design Branch No. Geotechnical Services

Rev. 11/04

PRELIMINARY SITE INVESTIGATION REPORT

SANTA CRUZ 17 GUARDRAIL UPGRADES
SANTA CRUZ COUNTY, CALIFORNIA

PREPARED FOR:
CALIFORNIA DEPARTMENT OF TRANSPORTATION
DISTRICT 5
50 HIGUERA STREET
SAN LUIS OBISPO, CALIFORNIA

PREPARED BY:
GEOCON CONSULTANTS, INC.
6671 BRISA STREET
LIVERMORE, CALIFORNIA

GEOCON PROJECT NO. S9200-06-70
CALTRANS EAs 05-0L7601 and 05-0L7001

APRIL 2009

GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. S9200-06-70
April 29, 2009

Mr. Jim Tkach
California Department of Transportation - District 5
Central Region Environmental Analysis
50 Higuera Street
San Luis Obispo, California 93401

Subject: SANTA CRUZ 17 GUARDRAIL UPGRADES
POST MILES 6.1 TO 12.5
SANTA CRUZ COUNTY, CALIFORNIA
CONTRACT NO. 06A1141, TASK ORDER NO. 70
EAs. 05-0L7601 AND 05-0L7001
PRELIMINARY SITE INVESTIGATION REPORT

Dear Mr. Tkach

In accordance with California Department of Transportation (Caltrans) Contract No. 06A1141, Task Order Number 70, and Expense Authorizations 05-0L7601 and 05-0L7001, Geocon Consultants, Inc. has performed environmental engineering services for the subject project. The project area consists of the unpaved northbound and southbound shoulder areas of Highway 17 between Post Miles (PM) 6.1 and 12.5 in Santa Cruz County, California. The accompanying report summarizes the services performed, including the advancement of hand-auger borings, soil sampling, and laboratory testing.

The contents of this report reflect the views of the author, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Please contact us if there are any questions concerning the contents of this report or if we may be of further service.

Sincerely,

GEOCON CONSULTANTS, INC.

Lauren Vigliotti
Senior Staff Geologist

Richard Day, CEG, CHG
Vice President

PROFESSIONAL GEOLOGIST
RICHARD W. DAY
No. 5479
Exp. 09-30-09
STATE OF CALIFORNIA

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6771 Brisa Street ■ Livermore, California 94550■ Telephone (925) 371-5900 ■ Fax (925) 371-5915

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PRELIMINARY SITE INVESTIGATION REPORT

1.0 INTRODUCTION

This Preliminary Site Investigation Report for the Santa Cruz 17 Guardrail Upgrades project was prepared by Geocon Consultants, Inc. under California Department of Transportation (Caltrans) Contract No. 06A1141, Task Order Number 70 (TO-70), and Expense Authorizations (EAs) 05-0L7601 and 05-0L7001

1.1 Project Description and Proposed Improvements

The project location consists of Caltrans right-of-way (ROW) along portions of the northbound (NB) and southbound (SB) shoulders of SR17 between PM 6.04 and 12.5, in the towns of Scotts Valley and Glenwood, Santa Cruz County, California. The Preliminary Site Investigation (PSI) was conducted prior to proposed roadway and structure excavations at retaining walls that will facilitate widening of the existing highway to improve safety. The approximate project location is depicted on the Vicinity Map, Figure 1.

1.2 General Objectives

The purpose of the scope of services outlined in TO-70 was to evaluate whether impacts due to metals, including aerially deposited lead (ADL), or petroleum hydrocarbon compounds from motor vehicle exhaust exist in the surface and near surface soils within the project boundaries. The investigative results will be used by Caltrans to inform the construction contractor(s) if metals-impacted soil is present within the project boundaries for health, safety, management, and disposal evaluation purposes.

2.0 BACKGROUND

2.1 Potential Lead Soil Impacts

Ongoing testing by Caltrans throughout California has indicated that ADL exists along major freeway routes due to emissions from vehicles powered by leaded gasoline. At sites where soil has not been disturbed, the ADL is generally limited to the upper 2 feet of soil within unpaved shoulder and median areas.

2.2 Hazardous Waste Determination Criteria

Regulatory criteria to classify a waste as "California hazardous" for handling and disposal purposes are contained in the California Code of Regulations (CCR), Title 22, Division 4.5, Chapter 11, Article 3, § 66261.24. Criteria to classify a waste as "Resource, Conservation, and Recovery Act (RCRA) hazardous" are contained in Chapter 40 of the Code of Federal Regulations (40 CFR), Section 261.

For waste containing metals, the waste is classified as California hazardous when: 1) the total metal content exceeds the respective Total Threshold Limit Concentration (TTLC); or 2) the soluble metal content exceeds the respective Soluble Threshold Limit Concentration (STLC) based on the standard Waste Extraction Test (WET). A waste may have the potential of exceeding the STLC when the waste's total metal content is greater than or equal to ten times the respective STLC value, since the WET uses a 1:10 dilution ratio. Hence, when a total metal is detected at a concentration greater than or equal to ten times the respective STLC, and assuming that 100 percent of the total metals are soluble, soluble metal analysis is required. A material is classified as RCRA hazardous, or Federal hazardous, when the soluble metal content exceeds the Federal regulatory level based on the Toxicity Characteristic Leaching Procedure (TCLP). The TTLC value for lead is 1,000 milligrams per kilogram (mg/kg). The STLC and TCLP values for lead are both 5.0 milligrams per liter (mg/l).

The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability and corrosivity; however, for the purposes of this investigation, toxicity (i.e., lead concentrations) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or corrosivity. Waste that is classified as either California hazardous or RCRA hazardous requires management as a hazardous waste.

The Department of Toxic Substances Control (DTSC) regulates and interprets hazardous waste laws in California. DTSC generally considers excavated or transported materials that exhibit "hazardous waste" characteristics to be a "waste" requiring proper management, treatment and disposal. Soil that contains lead above hazardous waste thresholds and is left in-place would not be necessarily classified by DTSC as a "waste." The DTSC has provided site-specific determinations that "movement of wastes within an area of contamination does not constitute "land disposal" and, thus, does not trigger hazardous waste disposal requirements." Therefore, lead-impacted soil that is scarified in-place, moisture-conditioned, and recompacted during roadway improvement activities might not be considered a "waste." DTSC should be consulted to confirm waste classification. It is noted that in addition to DTSC regulations, health and safety requirements and other local agency requirements may also apply to the handling and disposal of lead-impacted soil.

2.3 Environmental Screening Levels

The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) has prepared a technical report entitled *Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater, Interim Final* (November 2007, Revised May 2008), which presents Environmental Screening Levels (ESLs) for soil, groundwater, soil gas, and surface water, to assist in evaluating sites impacted by releases of hazardous chemicals The ESLs are conservative values for more than 100 commonly detected contaminants, which may be used to compare with environmental data collected at a site. ESLs are strictly risk assessment tools and "not regulatory clean up standards." The presence of a chemical at concentrations in excess of an ESL does not necessarily indicate that adverse impacts to human health or the environment are occurring; this simply indicates that a potential for adverse risk may exist and that additional evaluation is or "may be" warranted (SFRWQCB, 2007).

The most restrictive ESL table was used for this characterization: *Table A – Shallow Soil (≤3 meters below ground surface; bgs) – Groundwater is a Current or Potential Source of Drinking Water*. The respective ESLs are listed at the end of Tables 3 and 4 for comparative purposes.

3.0 SCOPE OF SERVICES

We performed the following scope of services as requested by Caltrans in TO-70:

3.1 Pre-field Activities

- Prepared the *Preliminary Site Investigation Workplan*, dated March 5, 2009, which was approved by Caltrans in the field on March 9, 2009.
- Prepared a *Health and Safety Plan* dated March 2009, to provide guidelines on the use of personal protective equipment and the health and safety procedures implemented during the field activities.
- Retained the services of Advanced Technology Laboratories (ATL) to perform the chemical analysis of soil samples.
- Notified Underground Service Alert (USA) at least 48 hours prior to fieldwork.

3.2 Field Activities

Field activities were completed on March 9 to 12, and March 29, 2009, and consisted of collecting a total of 397 soil samples along the unpaved northbound and southbound shoulders of SR17 from 47 hand auger borings (R1B1-B3, R2B1-B5, R3B1-B2, R4B1-B5, R5B1-B4, R6B1-B4, R7B1-B4, R8B1, R9B1-B3, R10B1-B5, R11B1-B5, R12B1-B2, R13B1, R14B1, and R15B1-B3). Soil samples were collected at the following depth intervals, except where refusal was encountered:

0 to 0.5 feet	5.0 to 5.5 feet
1.0 to 1.5 feet	6.0 to 6.5 feet
2.0 to 2.5 feet	7.0 to 7.5 feet
3.0 to 3.5 feet	8.0 to 8.5 feet
4.0 to 4.5 feet	

4.0 INVESTIGATIVE METHODS

4.1 Boring Location Rationale

Soil boring locations were designated by Caltrans. The borings were advanced along the unpaved northbound and southbound SR17 shoulder, between the guardrail and the edge of the slope. Boring coordinates were determined using a differential global positioning system (GPS). The GPS equipment was used to locate the position of each boring with an error of no more than one meter. Boring coordinates are summarized in Table 1 and boring locations are depicted on the Site Plans, Figures 2-1 through 2-14.

4.2 Sampling Procedures

Soil borings were advanced using hand auger methods. Soil samples were collected in polyethylene bags for total lead analyses, and stainless-steel tubes for CAM17 metals and petroleum hydrocarbons analyses. Sample containers were labeled and placed into a chilled cooler for transport to the laboratory. The soil samples were delivered to ATL for analytical testing under chain-of-custody (COC) documentation.

Quality assurance/quality control (QA/QC) procedures performed during the field activities included decontamination of sampling equipment before each boring was advanced. The soil sampling equipment was cleansed between each boring by washing the equipment with an Alconox™ solution followed by a double rinse with deionized water. The borings were backfilled with the soil cuttings generated at each location. The decontamination water was discharged to the ground surface away from surface water bodies or storm drain inlets. The field sampling activities were performed under the supervision of Geocon's field manager.

4.3 Laboratory Analyses

ATL was instructed to homogenize the total lead soil samples prior to analysis in accordance with Contract 06A1141 requirements. The soil samples were analyzed for the following under a 48-hour turn-around-time (TAT):

- 387 soil samples for total lead following United States Environmental Protection Agency (EPA) Test Method 6010B.
- Ten randomly-selected soil samples for the following:
  - Title 22 (CAM17) metals using EPA Test Methods 6010B/7471A
  - Total Petroleum Hydrocarbons (TPH) as gasoline (TPHg), as diesel (TPHd), and as motor oil (TPHmo) using EPA Test Method 8015B(M)
  - Benzene, toluene, ethylbenzene, and xylenes (BTEX) using EPA Test Method 8021B

- Sixty-nine soil samples with total lead concentrations greater than or equal to 50 mg/kg (i.e. ten times the lead STLC of 5.0 mg/l) were further analyzed for soluble WET lead by EPA Test Method 6010B.
- Forty-three soil samples with soluble WET lead concentrations greater than the STLC of 5.0 mg/l and total lead concentrations exceeding 100 mg/kg were further analyzed for soluble TCLP lead using EPA Test Method 1311. This includes one sample (R15B1-0) with a total lead concentration equal to the TTLC of 1,000 mg/kg.
- Forty-two randomly selected soil samples for soil pH by EPA Test Method 9045.

QA/QC procedures were performed for each method of analysis with specificity for each analyte listed in the test method's QA/QC. The laboratory QA/QC procedures included the following:

- One method blank for every ten samples, batch of samples or type of matrix, whichever was more frequent.
- One sample analyzed in duplicate for every ten samples, batch of samples or type of matrix, whichever was more frequent.
- One spiked sample for every ten samples, batch of samples or type of matrix, whichever was more frequent, with the spike made at ten times the detection limit or at the analyte level.

Prior to submitting the soil samples to the laboratory, the COC documentation was reviewed for accuracy and completeness. Reproductions of the laboratory reports and COC documentation are presented in Appendix A.

5.0 FIELD OBSERVATIONS AND INVESTIGATIVE RESULTS

5.1 Site Conditions

Soil encountered during the advancement of borings generally consisted of loamy and silty sand to the maximum depth explored of approximately 8.5 feet. Groundwater was not encountered during the advancement of the soil borings.

5.2 Soil Analytical Results

The soil analytical results are presented in Tables 2 and 3 and are summarized as follows:

- Total lead was reported in the soil samples at concentrations ranging from less than the laboratory reporting limit of 5 (<5) mg/kg to 1,000 mg/kg.
- The following CAM17 metals, other than lead, were reported in the soil samples at concentrations less than ten times their respective STLCs: arsenic, barium, cadmium, chromium, cobalt, copper, molybdenum, nickel, selenium, vanadium, and zinc. Remaining CAM17 metals were not detected above their respective laboratory reporting limits.
- Soluble WET lead was reported in the 69 soil samples analyzed at concentrations ranging from <0.25 to 290 mg/l, with 42 soil samples exceeding the lead STLC of 5.0 mg/l.
- Soluble TCLP lead was reported in the 43 samples analyzed at concentrations ranging from <0.25 to 6.4 mg/l, with one sample exceeding 5.0 mg/l.

- TPHg or BTEX were not detected in the samples above the laboratory reporting limits.
- TPHd was reported in the samples at concentrations ranging from <1.0 to 310 mg/kg; TPHmo was reported at concentrations ranging from <1.0 to 950 mg/kg.
- Soil pH values ranged from 3.8 to 8.3.

5.3 Laboratory Quality Assurance/Quality Control

We reviewed the analytical laboratory QA/QC data provided with the laboratory report. These data show acceptable non-detect results and surrogate recoveries for the method blanks and acceptable recoveries and relative percent differences (RPDs) for the matrix spikes and matrix spike duplicates (MS/MSDs), with some exceptions. The RPDs for several of the analyses were outside criteria, and surrogate recoveries were outside criteria for a number of the method blanks and MS/MSDs. However, the laboratory report indicated that the analytical batches were validated by the Laboratory Control Sample (LCS). Several samples required dilution due to sample matrix.

Based on the laboratory QA/QC results, no additional qualification of the data presented herein is necessary, and the data are of sufficient quality for the purposes of this report.

5.4 Statistical Evaluation for Lead Detected in Soil Samples

Statistical methods were applied to the total lead data to evaluate: 1) the upper confidence limits (UCLs) of the arithmetic means of the total lead concentrations for each sampling depth within the sample populations; and 2) if an acceptable correlation between total and soluble lead concentrations exists that would allow the prediction of soluble lead concentrations based on calculated UCLs. The statistical methods used are discussed in a book entitled *Statistical Methods for Environmental Pollution Monitoring,* by Richard Gilbert (1987); in an EPA *Technology Support Center Issue* document entitled, *The Lognormal Distribution in Environmental Applications,* by Ashok Singh et. al., (December 1997); and in a book entitled *An Introduction to the Bootstrap,* by Bradley Efron and Robert J. Tibshirani (1993).

The lead data for the Site were treated as nine sample populations for statistical evaluation. Sample populations are presented below, referencing retaining wall (RW) number, roadway direction (i.e., NB or SB), and PM location:

A) RW1 borings (R1B1-B3); NB PM 6.04-6.13.
B) RW2 borings (R2B1-B5); NB, PM 6.14-6.26.
C) RW3 and RW4 borings (R3B1, R3B2, and R4B1-B5); SB PM 6.85-6.94/7.32-7.44.
D) RW5 borings (R5B1-B4); NB PM 8.73-8.81.
E) RW6 borings (R6B1-B4); NB PM 8.9-9.1.
F) RW7, RW8, and RW9 borings (R7B1-B4, R8B1, and R9B1-B3); SB PM 9.11-9.26/9.7-9.9.

G) RW10 borings (R10B1-B4); NB PM 10.54-10.82.

H) RW11, RW12, RW13, and RW14 borings (R11B1-B5, R12B1, R12B2, R13B1, and R14B1); NB PM 10.54-10.82/10.92-10.97.

I) RW15 borings (R15B1-B3); NB PM 11.23-11.29.

5.4.1 Calculating the UCLs for the Arithmetic Mean

The upper one-sided 90% and 95% UCLs of the arithmetic mean are defined as the values that, when calculated repeatedly for randomly drawn subsets of site data, equal or exceed the true mean 90% and 95% of the time, respectively. Statistical confidence limits are the classical tool for addressing uncertainties of a distribution mean. The UCLs of the arithmetic mean concentration are used as the mean concentrations because it is not possible to know the true mean due to the essentially infinite number of soil samples that could be collected from a site. The UCLs therefore account for uncertainties due to limited sampling data. As data become less limited at a site, uncertainties decrease, and the UCLs move closer to the true mean.

Due to the number of soil samples collected at certain retaining wall locations, UCLs could not be calculated. A sample set consisting of at least five unique values is required for calculation of UCLs. Therefore, where UCLs were not calculated, we conservatively used the maximum reported total lead concentration to estimate predicted soluble lead values.

Non-parametric bootstrap techniques used to calculate the UCLs are discussed in the previously referenced EPA document and in *An Introduction to the Bootstrap.* For those samples in which total lead was not detected at concentrations exceeding the laboratory reporting limit, a value equal to one-half of the detection limit was used to calculate the total lead mean and establish minimum values. The lead statistics are included in Appendix B and are summarized in the following tables.

Retaining Wall 1 – NB PM 6.04-6.13

SAMPLE INTERVAL (feet)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	12	7.7	17
1.0 to 1.5	88	44	160
2.0 to 2.5	7.3	2.5	17
3.0 to 3.5	4.4	2.5	6.1
4.0 to 4.5	3.7	2.5	6.2
5.0 to 5.5	2.5	2.5	2.5
6.0 to 6.5	2.5	2.5	2.5
7.0 to 7.5	5.7	5.3	6.1
8.0 to 8.5	3.9	2.5	5.3

Retaining Wall 2 – NB PM 6.14-6.26

SAMPLE INTERVAL (feet)	TOTAL LEAD 90%UCL (mg/kg)	TOTAL LEAD 95%UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	76	85	46	13	150
1.0 to 1.5	115	120	99	57	140
2.0 to 2.5	648	708	451	5.8	880
3.0 to 3.5	12	13	8.9	2.5	18
4.0 to 4.5	Not Calculated	Not Calculated	4.0	2.5	7.1
5.0 to 5.5	Not Calculated	Not Calculated	19	2.5	40
6.0 to 6.5	Not Calculated	Not Calculated	42	2.5	160
7.0 to 7.5	Not Calculated	Not Calculated	6.7	2.5	7.1
8.0 to 8.5	Not Calculated	Not Calculated	12.5	2.5	19

Retaining Walls 3 and 4 – SB PM 6.85-6.94/7.32-7.44

SAMPLE INTERVAL (feet)	TOTAL LEAD 90%UCL (mg/kg)	TOTAL LEAD 95%UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	383	406	300	110	650
1.0 to 1.5	156	172	102	61	330
2.0 to 2.5	Not Calculated	Not Calculated	5.7	2.5	18
3.0 to 3.5	Not Calculated	Not Calculated	4.6	2.5	8.5
4.0 to 4.5	Not Calculated	Not Calculated	12	2.5	34
5.0 to 5.5	Not Calculated	Not Calculated	3.3	2.5	5.3
6.0 to 6.5	Not Calculated	Not Calculated	6.0	2.5	23
7.0 to 7.5	Not Calculated	Not Calculated	3.3	2.5	5.4
8.0 to 8.5	Not Calculated	Not Calculated	7.2	2.5	19

Retaining Wall 5 – NB PM 8.73-8.81

SAMPLE INTERVAL (feet)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	231	2.5	600
1.0 to 1.5	15	2.5	39
2.0 to 2.5	4.8	2.5	7.1
3.0 to 3.5	3.3	2.5	5.7
4.0 to 4.5	5.1	2.5	13
5.0 to 5.5	5.9	2.5	6.7
6.0 to 6.5	12	12	12
7.0 to 7.5	2.5	2.5	2.5

Retaining Wall 6 – NB PM 8.9-9.1

SAMPLE INTERVAL (feet)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	56	5.5	160
1.0 to 1.5	199	5.1	450
2.0 to 2.5	29	6.1	56
3.0 to 3.5	21	2.5	70
4.0 to 4.5	26	2.5	89
5.0 to 5.5	3.2	2.5	5.3
6.0 to 6.5	4.9	2.5	12
7.0 to 7.5	8.1	2.5	25
8.0 to 8.5	2.5	2.5	2.5

Retaining Walls 7, 8, and 9 – SB PM 9.11-9.26/9.7-9.9

SAMPLE INTERVAL (feet)	TOTAL LEAD 90%UCL (mg/kg)	TOTAL LEAD 95%UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	206	226	136	25	500
1.0 to 1.5	34	36	24	2.5	73
2.0 to 2.5	47	51	31	2.5	100
3.0 to 3.5	Not Calculated	Not Calculated	6.1	2.5	23
4.0 to 4.5	11	12	7.1	2.5	31
5.0 to 5.5	13	14	9.0	2.5	24
6.0 to 6.5	52	58	31	2.5	150
7.0 to 7.5	17	18	11	2.5	37
8.0 to 8.5	24	27	15	2.5	62

Retaining Wall 10 – NB PM 10.54-10.82

SAMPLE INTERVAL (feet)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	237	11	870
1.0 to 1.5	90	5.7	200
2.0 to 2.5	102	5.2	300
3.0 to 3.5	23	6.3	43
4.0 to 4.5	4.2	2.5	6.1
5.0 to 5.5	2.6	2.5	3.0
6.0 to 6.5	5.3	2.5	7.1
8.0 to 8.5	5.4	5.1	6.0

Retaining Walls 11, 12 13, and 14 – NB PM 10.54-10.82/10.92-10.97

SAMPLE INTERVAL (feet)	TOTAL LEAD 90%UCL (mg/kg)	TOTAL LEAD 95%UCL (mg/kg)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	254	269	199	34	360
1.0 to 1.5	63	68	45	7.8	140
2.0 to 2.5	24	26	19	2.5	51
3.0 to 3.5	12	13	9.7	2.5	19
4.0 to 4.5	15	16	11	2.5	34
5.0 to 5.5	11	12	9.6	2.5	17
6.0 to 6.5	16	18	11	2.5	40
7.0 to 7.5	16	17	11	2.5	39
8.0 to 8.5	13	14	9.4	2.5	26

Retaining Wall 15 – NB PM 11.23-11.29

SAMPLE INTERVAL (feet)	TOTAL LEAD MEAN (mg/kg)	TOTAL LEAD MINIMUM (mg/kg)	TOTAL LEAD MAXIMUM (mg/kg)
0 to 0.5	443	160	1,000
1.0 to 1.5	42	30	60
2.0 to 2.5	128	27	320
3.0 to 3.5	30	2.5	73
4.0 to 4.5	235	2.5	700
5.0 to 5.5	38	2.5	96
6.0 to 6.5	5.0	1.5	11
7.0 to 7.5	32	2.5	88
8.0 to 8.5	5.9	2.5	9.7

5.4.2 Correlation of Total and Soluble Lead

Total and corresponding soluble WET lead concentrations are bivariate data with a linear structure. This linear structure should allow for the prediction of soluble WET lead concentrations based on the maximum total lead concentrations and the UCLs calculated above in Section 5.4.1.

To estimate the degree of interrelation between total and corresponding soluble WET lead values (x and y, respectively), the *correlation coefficient [r]* is used. The correlation coefficient is a ratio that ranges from +1 to –1. A *correlation coefficient* of +1 indicates a perfect direct relationship between two variables; a *correlation coefficient* of –1 indicates that one variable changes inversely with relation to the other. Between the two extremes is a spectrum of less-than-perfect relationships, including zero, which indicates the lack of any sort of linear relationship at all. The *correlation coefficient* was calculated for the 69 (x, y) data points (i.e., soil samples analyzed for both total lead [x] and soluble WET lead [y]). The resulting *coefficient of determination* (r^2) equaled 0.888, which yields a corresponding *correlation coefficient* (r) of 0.943.

For the *correlation coefficient* that indicates a linear relationship between total and soluble WET lead concentrations, it is possible to compute the line of dependence or a best-fit line between the two variables. A least squares method was used to find the equation of a best-fit line (regression line) by forcing the y-intercept equal to zero since that is a known point. The equation of the regression line was determined to be $y = 0.0751(x)$, where x represents total lead concentrations and y represents predicted soluble lead WET concentrations.

This equation was used to estimate the expected WET soluble lead concentrations for the maximum total lead concentrations and the UCLs calculated in for samples collected from the Site (see Section 5.4.1). Regression analysis results and a scatter plot depicting the (x, y) data points along with the regression line are included in Appendix B. The predicted soluble WET lead concentrations for the soil samples collected at the Site are summarized in Tables 5a through 5i.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Waste classifications are evaluated based on the 90% UCL of the lead content for the relevant excavation depths; this has historically been considered sufficient to satisfy a good faith effort by the EPA as discussed in SW-846. Risk assessment characterization is based on the 95% UCL of the lead content in the waste for the relevant depths; this is in accordance with the Risk Assessment Guidance for Superfund (RAGS) Volume 1 Documentation for Exposure Assessment. Per Caltrans, the 90% UCLs are to be used to evaluate onsite reuse and the 95% UCLs are to be used to evaluate offsite disposal.

6.1 Predicted Waste Classifications

Excavation scenarios for the retaining walls are presented in Tables 5a through 5i; summaries of ADL hazardous waste classifications for roadway and structural excavations are presented in Appendix C.

6.1.1 Retaining Wall 1- NB PM 6.04-6.13

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5a.

	Maximum		
Excavation Depth	**Total Lead (mg/kg)**	**Predicted WET Lead (mg/l)**	**Waste Classification**
0 to 2.0 ft	89	**6.6**	**Hazardous**
Underlying soil (2.0 to 8.5 ft)	*6.5*	*0.5*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 2.0 feet would be classified as a California hazardous waste since the maximum-predicted soluble WET lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste

If excavated separately, the top 2.0 feet of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 3.0 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.2 Retaining Wall 2 – NB PM 6.14-6.26

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the calculated UCLs or maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5b.

	90% UCL/Maximum		95% UCL/Maximum		
Excavation Depth	**Total Lead (mg/kg)**	**Predicted WET Lead (mg/l)**	**Total Lead (mg/kg)**	**Predicted WET Lead (mg/l)**	**Waste Classification**
0 to 3.0 ft	280	**21**	304	**23**	**Hazardous**
Underlying soil (3.0 to 8.5 ft)	*41*	*3.1*	*41*	*3.1*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 3.0 feet would be classified as a California hazardous waste since the predicted soluble WET lead concentrations are greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 3.0 feet of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 20 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.3 Retaining Walls 3 and 4 – SB PM 6.85-6.94/7.32-7.44

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the calculated UCLs or maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5c.

	90% UCL		95% UCL		
Excavation Depth	**Total Lead (mg/kg)**	**Predicted WET Lead (mg/l)**	**Total Lead (mg/kg)**	**Predicted WET Lead (mg/l)**	**Waste Classification**
0 to 2.0 ft	270	**20**	289	**22**	**Hazardous**
Underlying soil (2.0 to 8.5 ft)	*16*	*1.2*	*16*	*1.2*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 2.0 feet would be classified as a California hazardous waste since the predicted soluble WET lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 2.0 feet of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 11 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.4 Retaining Wall 5 – NB PM 8.73-8.81

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5d.

	Maximum		
Excavation Depth	**Total Lead (mg/kg)**	**Predicted WET Lead (mg/l)**	**Waste Classification**
0 to 1.0 ft	600	**45**	**Hazardous**
Underlying soil (1.0 to 7.5 ft)	*12*	*0.9*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 1.0 foot would be classified as a California hazardous waste since the maximum-predicted soluble WET lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 1.0 foot of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 11 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.5 Retaining Wall 6 – NB PM 8.9-9.1

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5e.

Excavation Depth	Maximum Total Lead (mg/kg)	Maximum Predicted WET Lead (mg/l)	Waste Classification
0 to 2.0 ft	305	**23**	**Hazardous**
Underlying soil (2.0 to 8.5 ft)	*37*	*2.8*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 2.0 feet would be classified as a California hazardous waste since the maximum-predicted soluble (WET) lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 2.0 feet of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 14 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.6 Retaining Walls 7, 8 and 9 – SB PM 9.11-9.26/9.7-9.9

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the calculated UCLs or maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5f.

	90% UCL		95% UCL		
Excavation Depth	Total Lead (mg/kg)	Predicted WET Lead (mg/l)	Total Lead (mg/kg)	Predicted WET Lead (mg/l)	Waste Classification
0 to 1.0 ft	207	**16**	226	**17**	**Hazardous**
Underlying soil (1.0 to 8.5 ft)	*28*	*2.1*	*30*	*2.3*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 1.0 foot would be classified as a California hazardous waste since the predicted soluble (WET) lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 1.0 foot of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 5 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.7 Retaining Wall 10 – NB PM 10.54-10.82

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5g.

	Maximum		
Excavation Depth	**Total Lead (mg/kg)**	**Predicted WET Lead (mg/l)**	**Waste Classification**
0 to 3.0 ft	457	**34**	**Hazardous**
Underlying soil (3.0 to 8.5 ft)	*12*	*0.9*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 3.0 feet would be classified as a California hazardous waste since the maximum-predicted soluble (WET) lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 3.0 feet of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 23 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.8 Retaining Walls 11, 12, 13, and 14 – NB PM 10.54-10.82/10.92-10.97

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5h.

Excavation Depth	90% UCL		95% UCL		
	Total Lead (mg/kg)	Predicted WET Lead (mg/l)	Total Lead (mg/kg)	Predicted WET Lead (mg/l)	Waste Classification
0 to 1.0 ft	255	**19**	269	**20**	**Hazardous**
Underlying soil (1.0 to 8.5 ft)	*21*	*1.6*	*22*	*1.7*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 1.0 foot would be classified as a California hazardous waste since the maximum-predicted soluble (WET) lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 1.0 foot of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 6 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.1.9 Retaining Wall 15 – NB PM 11.23-11.29

The following table summarizes the predicted soluble WET lead concentrations and the waste classification for excavated soil based on the maximum total lead concentrations and the relationship between total and soluble WET lead for data collected at the Site. The total and soluble WET lead calculations are summarized in Table 5i.

Excavation Depth	Maximum		
	Total Lead (mg/kg)	Predicted WET Lead (mg/l)	Waste Classification
0 to 6.0 ft	375	28	**Hazardous**
Underlying soil (6.0 to 8.5 ft)	*36*	*2.7*	*Non-Hazardous*

Based on the data presented in the table above, soil excavated from the surface to a depth of 6.0 feet would be classified as a California hazardous waste since the maximum-predicted soluble (WET) lead concentration is greater than the lead STLC of 5.0 mg/l. Based on the soluble TCLP lead concentrations, soil will not be classified as a RCRA hazardous waste.

If excavated separately, the top 6.0 feet of soil should be either 1) managed and disposed as a California hazardous waste or 2) stockpiled and resampled to confirm waste classification in accordance with specific disposal facility acceptance criteria.

If soil excavations extend from the ground surface to depths of 40 feet or greater and the soil is managed as a whole, the excavated soil would not be considered a California hazardous waste because the predicted soluble WET lead concentration is less than the STLC of 5.0 mg/l (see Appendix C).

6.2 Other CAM 17 Metals

Based on the total CAM17 metals concentrations, with the exception of lead, soil excavated from the Site would not be considered a hazardous waste.

The CAM17 metals concentrations in soil were compared to ESLs (SFRWQCB, May 2008, Table A) and with published background levels typically found in California soils as presented in *Background Concentrations of Trace and Major Elements in California Soils* (Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California, March 1996). Reported arsenic concentrations were between <1.0 and 4.7 mg/kg, exceeding the residential land use ESL of 0.39 mg/kg and the commercial/industrial land use ESL of 1.6 mg/kg for shallow soil (≤3 meters; SFRWQCB, Table A). Cadmium was reported above the laboratory reporting limit of 1.0 mg/kg in two samples at concentrations of 2.0 and 4.7 mg/kg, which exceeds the residential land use ESL of 1.7 mg/kg. In addition, vanadium was detected in the soil samples at concentrations between 2.7 and 52 mg/kg, exceeding the residential land use ESL of 16 mg/kg for shallow soil.

The average and maximum arsenic, cadmium, and vanadium concentrations, ESLs, and published background concentrations are summarized in the table below:

Metal	Mean	Maximum	Residential ESL	Commercial/ Industrial ESL	PUBLISHED BACKGROUND MEAN[1]	PUBLISHED BACKGROUND RANGE [1]
Arsenic	2.6	4.7	0.39	1.6	3.5	0.6 to 11.0
Cadmium	1.1	4.7	1.7	7.4	0.36	0.05 to 1.70
Vanadium	21	52	16	200	112	39 to 288

Concentrations reported in milligrams per kilogram (mg/kg); [1] Kearney Foundation of Soil Science, March 1996

The mean and maximum reported concentrations of arsenic for soil samples collected at the Site are greater than the ESLs; however are within the published background concentration range. The SFRWQCB *November 2007 Update to Environmental Screening Levels (ESLs) Technical Document* states that ambient background concentrations of arsenic typically exceed risk-based screening levels. In such instances, it may be more appropriate to compare site data to regionally specific established background levels (e.g., Kearney Foundation of Soil Science, 1996).

The maximum concentration of cadmium in the site soil samples is greater than the residential land use ESL and the published background range. However, the calculated mean cadmium concentration is less than the residential land use ESL and within the published background range. The mean and maximum reported vanadium concentrations in the soil samples collected at the Site are greater than the residential land use ESL, however are less than both the commercial/industrial land use ESL and published background mean concentration.

Based on the maximum reported arsenic, cadmium, and vanadium concentrations, and comparisons to ESLs and the published background concentrations, offsite reuse or disposal of soil may be restricted based on metals content, depending on proposed use.

6.3 Petroleum Hydrocarbon Compounds

Two samples had reported concentrations of TPHd and TPHmo greater than their respective ESLs. Specifically, TPHd was reported in samples R2B4-2 and R7B1-0 at concentrations of 140 mg/kg and 310 mg/kg, respectively, exceeding the residential and commercial/industrial land use ESL of 83 mg/kg. TPHmo was reported in samples R2B4-2 and R7B1-0 at concentrations of 570 mg/kg and 950 mg/kg, respectively, exceeding the residential land use ESL of 370 mg/kg. However, reported TPHmo concentrations are below the commercial/industrial land use ESL of 2,500 mg/kg.

Based on the maximum reported TPHd and TPHmo concentrations and comparisons to ESLs, offsite reuse or disposal of soil may be restricted, depending on proposed use.

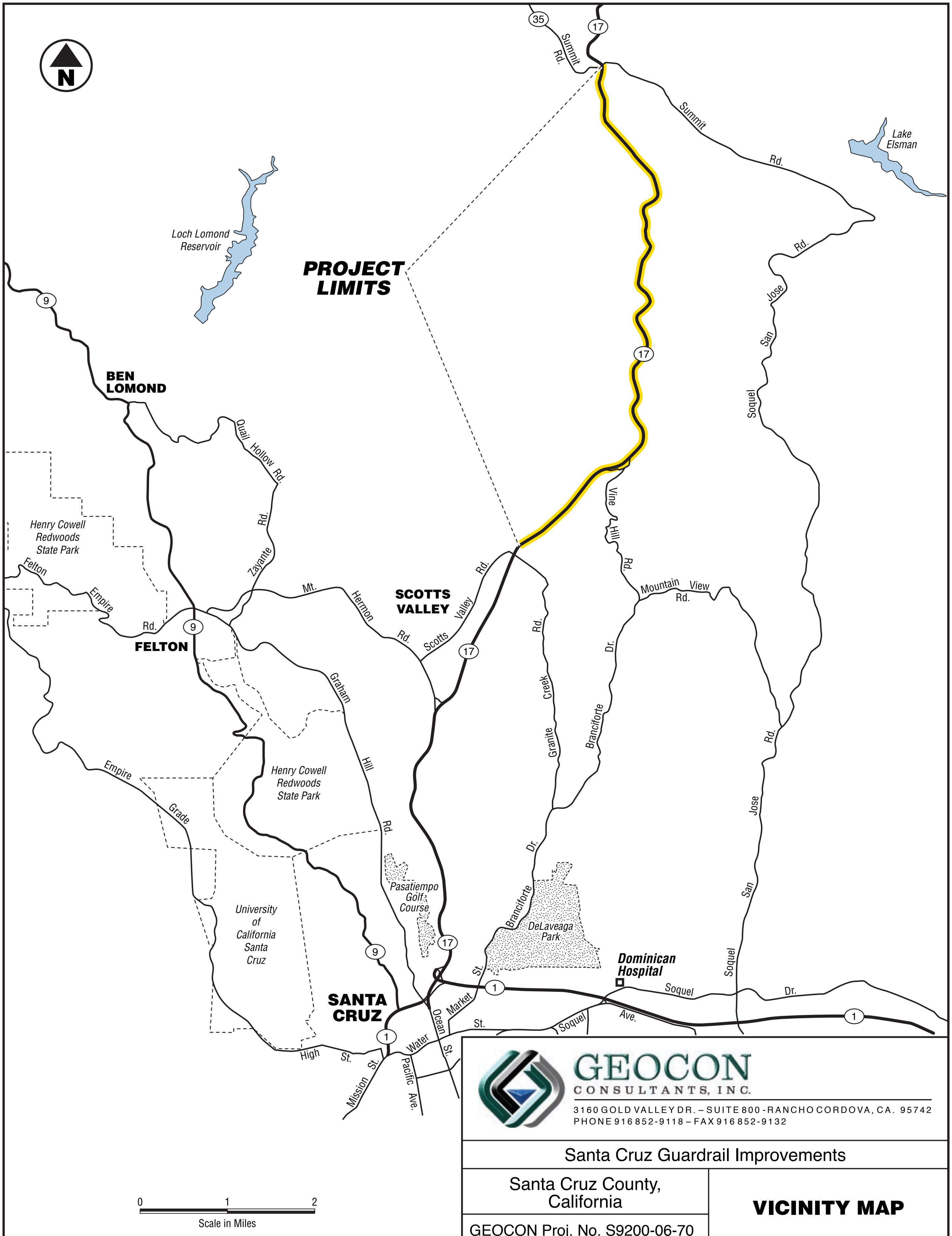
6.4 Worker Protection

Per Caltrans' requirements, the contractor(s) should prepare a project-specific lead compliance plan (CCR Title 8, Section 1532.1, the "Lead in Construction" standard) to minimize worker exposure to lead-impacted soil. The plan should include protocols for environmental and personnel monitoring, requirements for personal protective equipment, and other health and safety protocols and procedures for the handling of lead-impacted soil.

7.0 REPORT LIMITATIONS

This report has been prepared exclusively for Caltrans. The information contained herein is only valid as of the date of the report and will require an update to reflect additional information obtained.

This report is not a comprehensive site characterization and should not be construed as such. The findings as presented in this report are predicated on the results of the limited sampling and laboratory testing performed. In addition, the information obtained is not intended to address potential impacts related to sources other than those specified herein. Therefore, the report should be deemed conclusive with respect to only the information obtained. We make no warranty, express or implied, with respect to the content of this report or any subsequent reports, correspondence or consultation. We strived to perform the services summarized herein in accordance with the local standard of care in the geographic region at the time the services were rendered.



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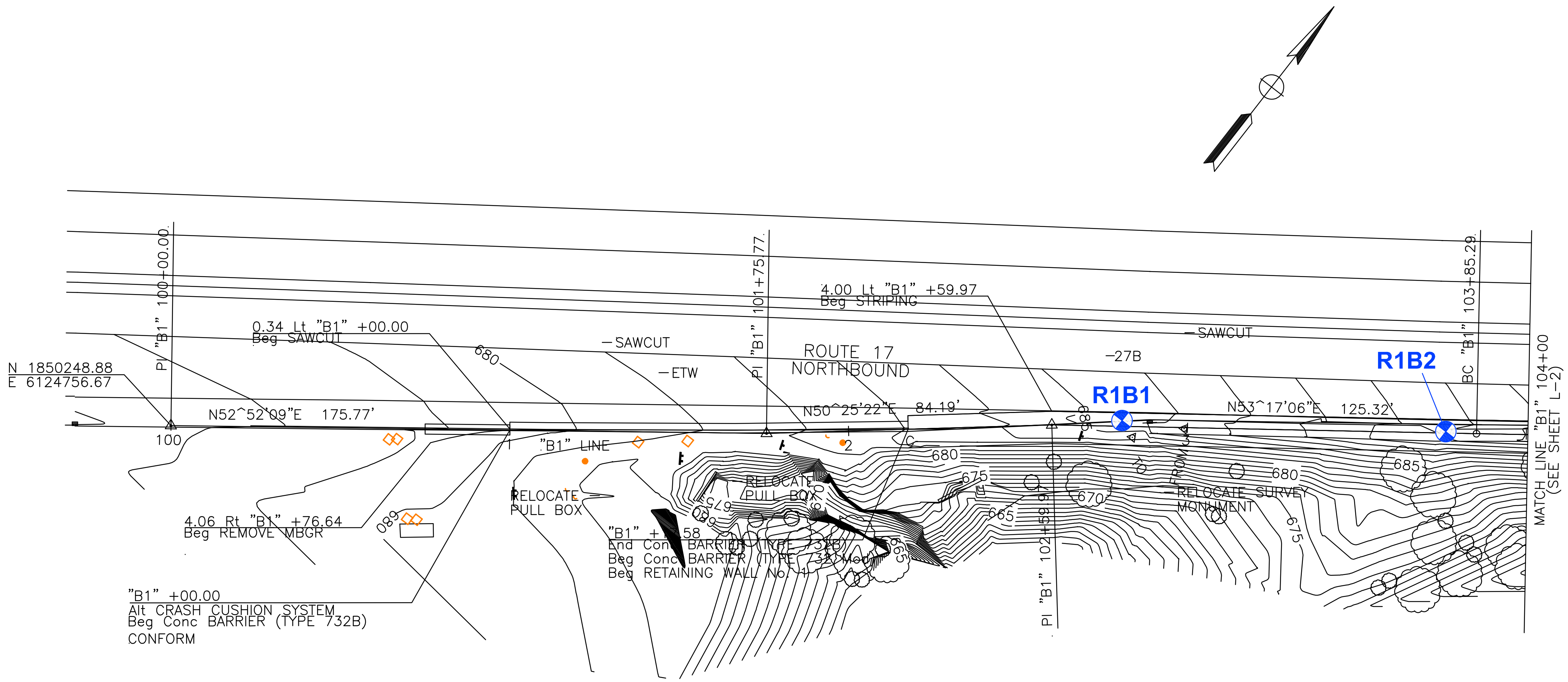
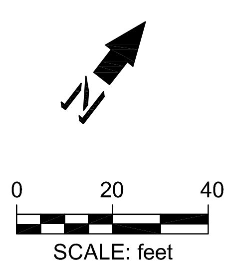
Santa Cruz Guardrail Improvements	
Santa Cruz County, California	**VICINITY MAP**
GEOCON Proj. No. S9200-06-70	
Task Order No. 70	April 2009 — Figure 1

LEGEND:

Boring Location



LOCATION 1
(PM 6.04 TO PM 6.13)



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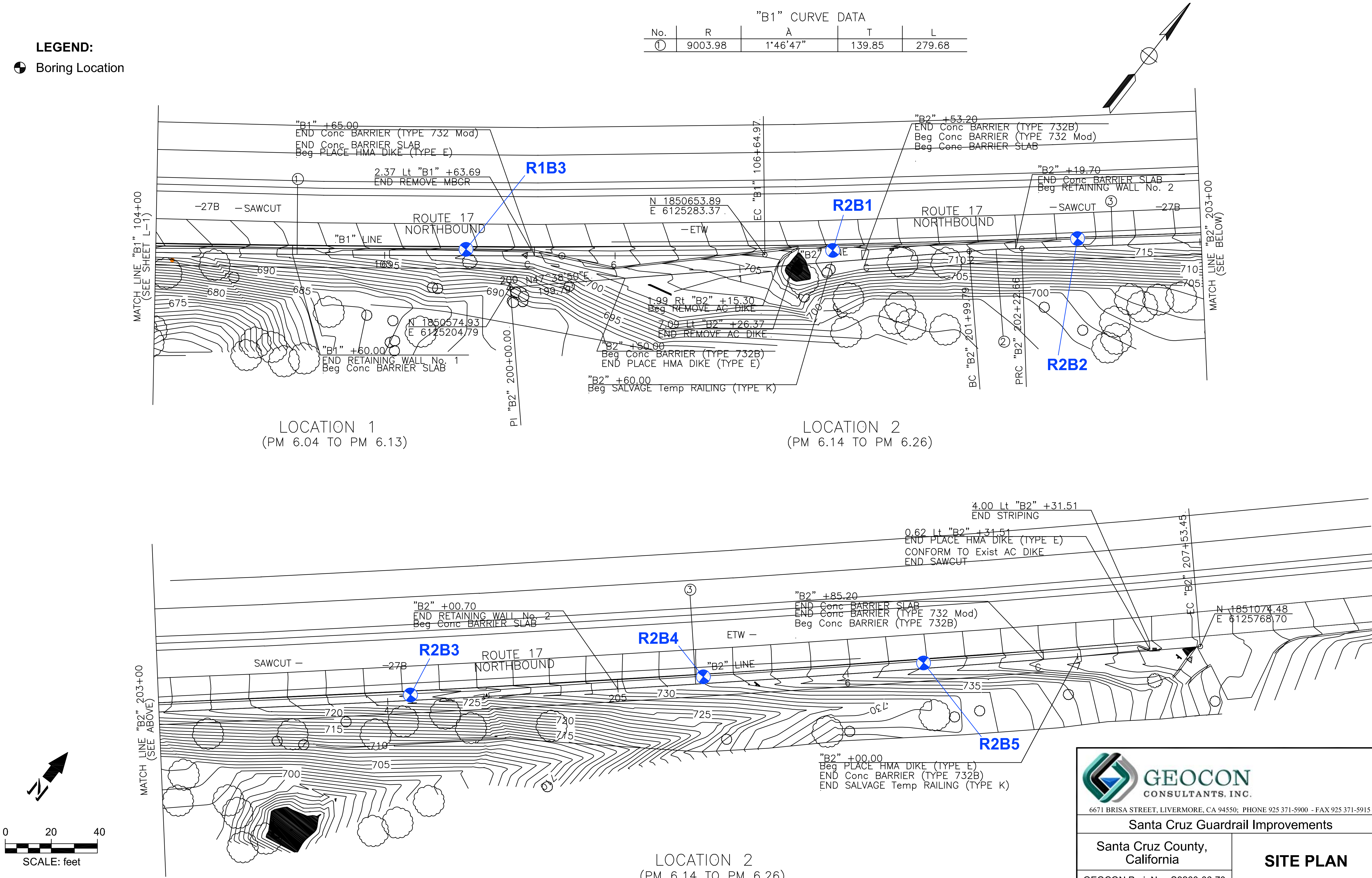
Santa Cruz Guardrail Improvements		
Santa Cruz County, California	**SITE PLAN**	
GEOCON Proj. No. S9200-06-70		
Task Order No. 70	April 2009	Figure 2-1

SITE0309



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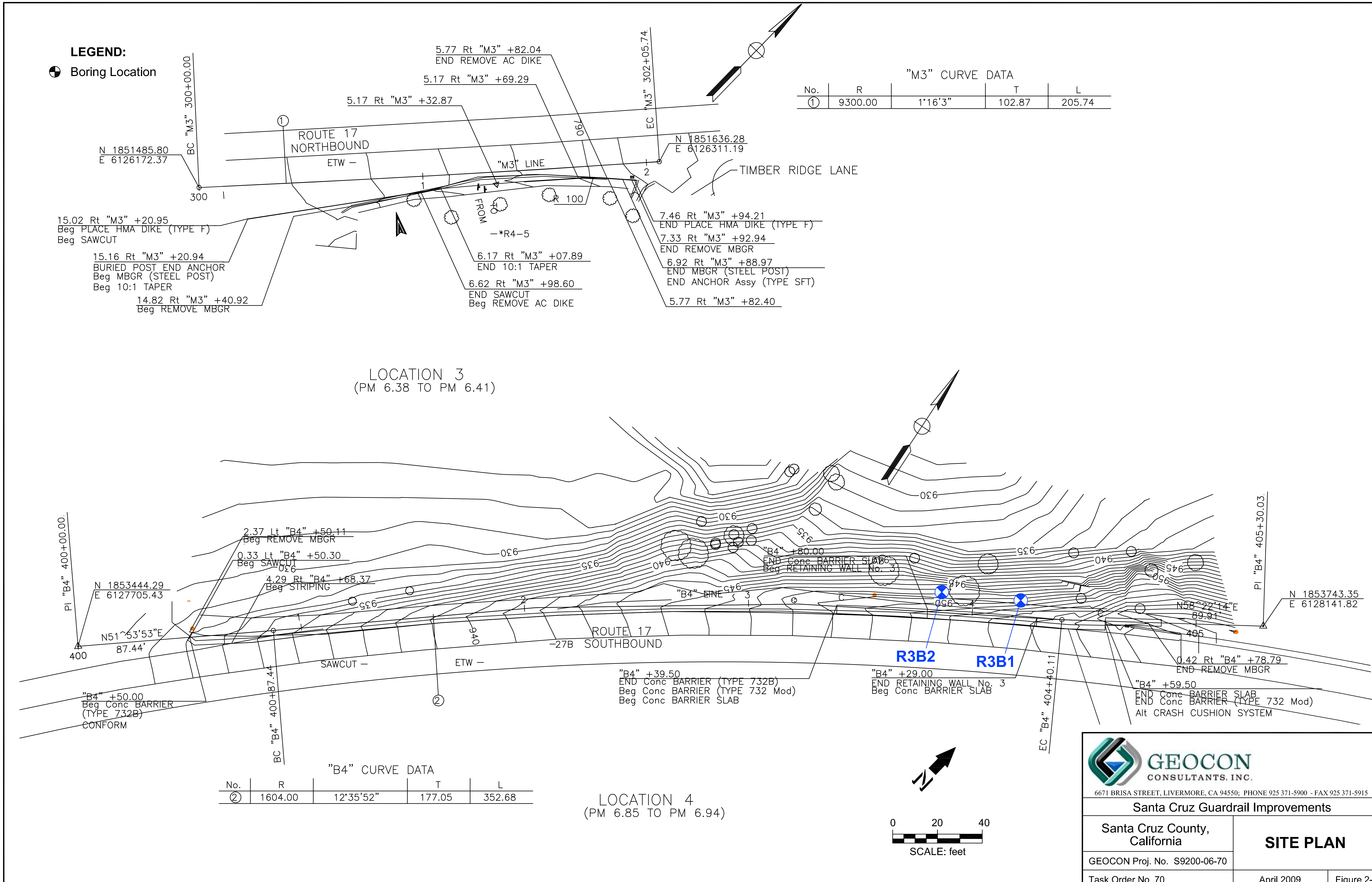
SITE0309


LEGEND:
Boring Location
ROUTE 17 NORTHBOUND
TIMBER RIDGE LANE
"M3" LINE
"M3" CURVE DATA
No. | R | | T | L
1 | 9300.00 | 1°16'3" | 102.87 | 205.74
BC "M3" 300+00.00
EC "M3" 302+05.74
N 1851485.80 E 6126172.37
N 1851636.28 E 6126311.19
5.77 Rt "M3" +82.04 END REMOVE AC DIKE
5.17 Rt "M3" +69.29
5.17 Rt "M3" +32.87
15.02 Rt "M3" +20.95 Beg PLACE HMA DIKE (TYPE F) Beg SAWCUT
15.16 Rt "M3" +20.94 BURIED POST END ANCHOR Beg MBGR (STEEL POST) Beg 10:1 TAPER
14.82 Rt "M3" +40.92 Beg REMOVE MBGR
6.17 Rt "M3" +07.89 END 10:1 TAPER
6.62 Rt "M3" +98.60 END SAWCUT Beg REMOVE AC DIKE
7.46 Rt "M3" +94.21 END PLACE HMA DIKE (TYPE F)
7.33 Rt "M3" +92.94 END REMOVE MBGR
6.92 Rt "M3" +88.97 END MBGR (STEEL POST) END ANCHOR Assy (TYPE SFT)
5.77 Rt "M3" +82.40
LOCATION 3
(PM 6.38 TO PM 6.41)
ROUTE 17 SOUTHBOUND
PI "B4" 400+00.00
N 1853444.29 E 6127705.43
N51°53'53"E 87.44'
2.37 Lt "B4" +50.11 Beg REMOVE MBGR
0.33 Lt "B4" +50.30 Beg SAWCUT
4.29 Rt "B4" +68.37 Beg STRIPING
"B4" +50.00 Beg Conc BARRIER (TYPE 732B) CONFORM
BC "B4" 400+87.44
"B4" +39.50 END Conc BARRIER (TYPE 732B) Beg Conc BARRIER (TYPE 732 Mod) Beg Conc BARRIER SLAB
"B4" +80.00 END Conc BARRIER SLAB Beg RETAINING WALL No. 3
"B4" +29.00 END RETAINING WALL No. 3 Beg Conc BARRIER SLAB
R3B2
R3B1
EC "B4" 404+40.11
PI "B4" 405+30.03
N 1853743.35 E 6128141.82
N58°22'14"E 89.91
0.42 Rt "B4" +78.79 END REMOVE MBGR
"B4" +59.50 END Conc BARRIER SLAB END Conc BARRIER (TYPE 732 Mod) Alt CRASH CUSHION SYSTEM
"B4" CURVE DATA
No. | R | | T | L
2 | 1604.00 | 12°35'52" | 177.05 | 352.68
LOCATION 4
(PM 6.85 TO PM 6.94)
SCALE: feet
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GEOCON Proj. No. S9200-06-70
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April 2009
Figure 2-3

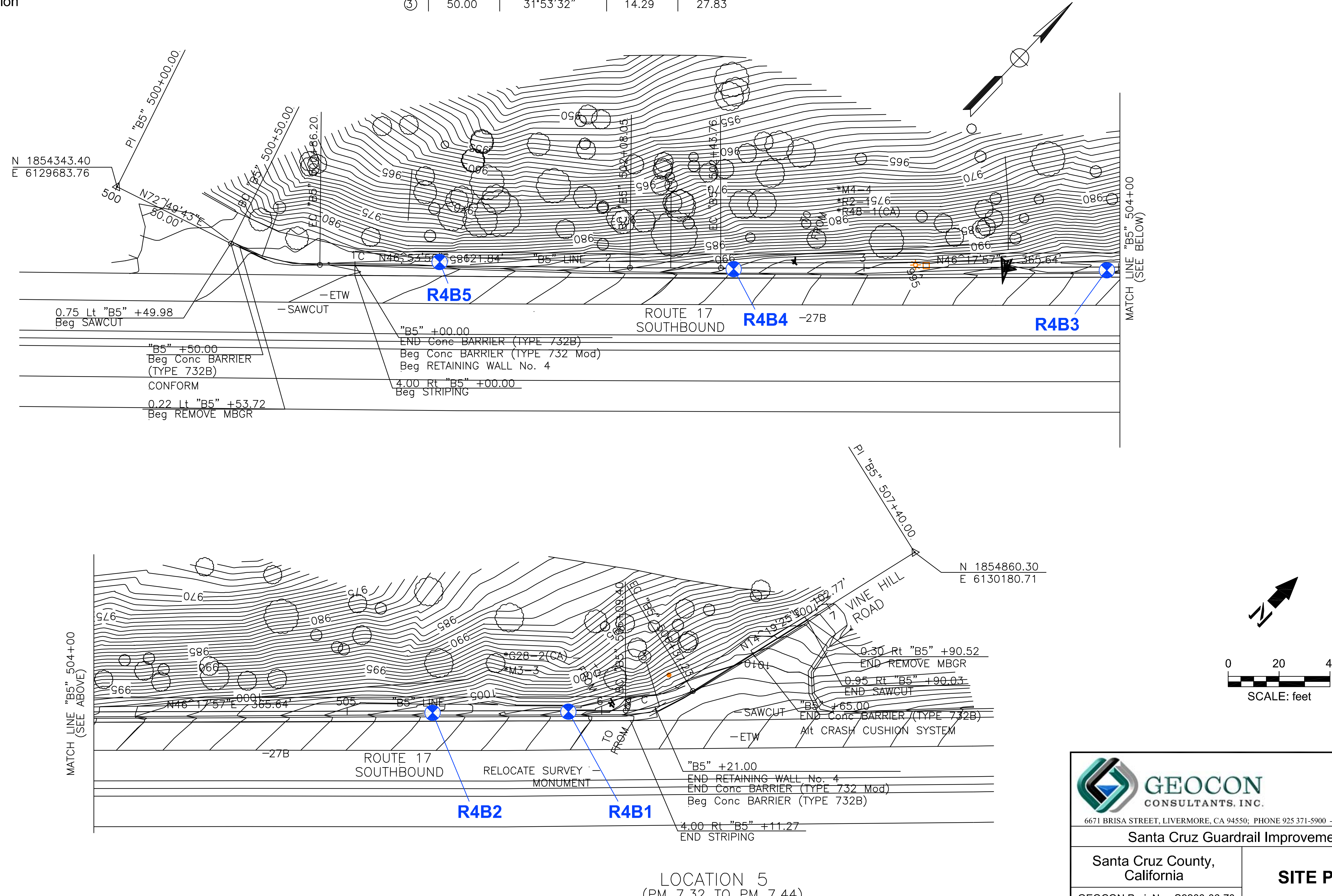
SITE0309

LEGEND:

Boring Location

"B5" CURVE DATA

No.	R	Δ	T	L
1	80.00	25°55'47"	18.42	36.20
2	2995.99	0°40'59"	17.86	35.72
3	50.00	31°53'32"	14.29	27.83



LOCATION 5

(PM 7.32 TO PM 7.44)

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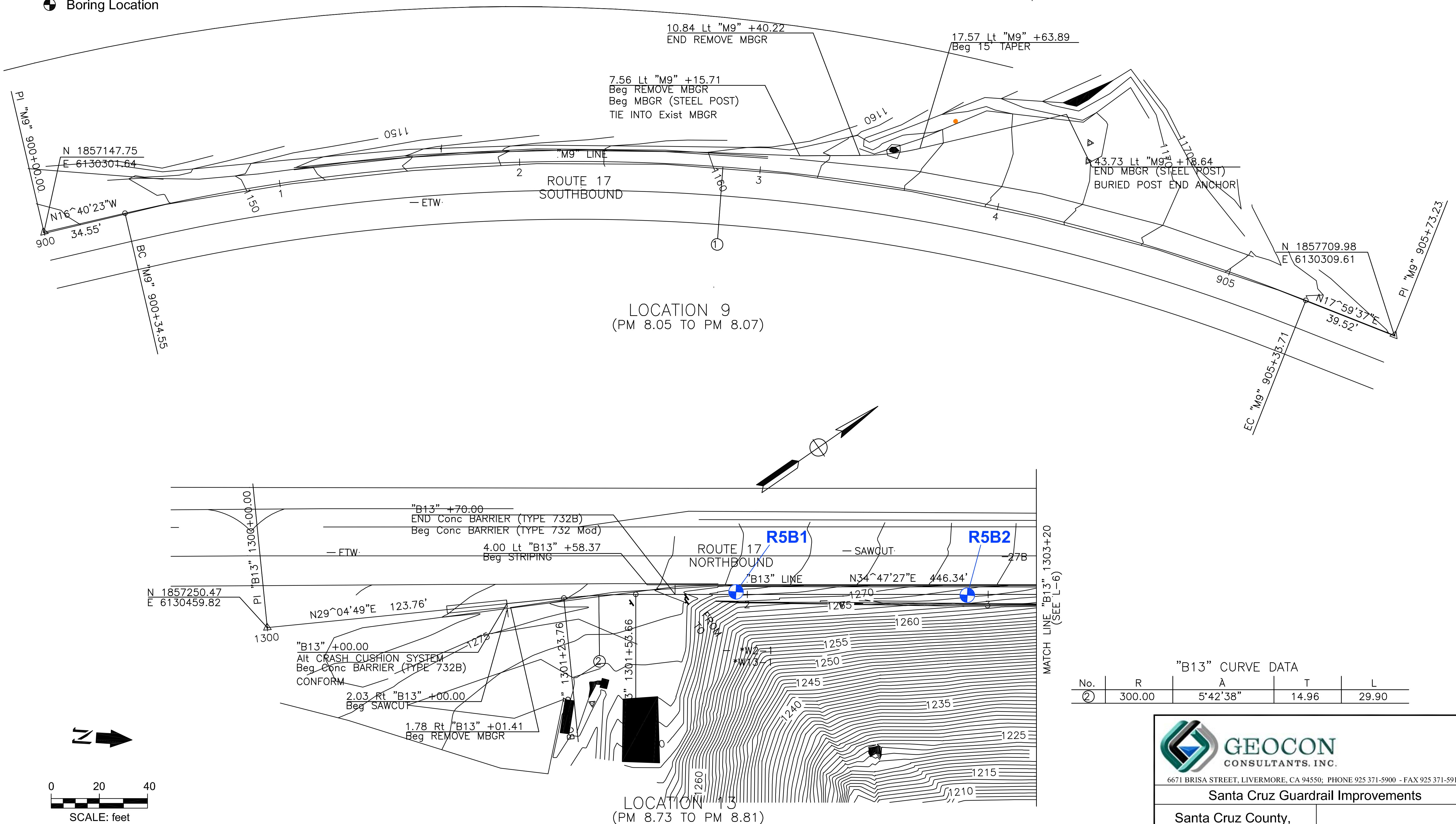
SITE0309

LEGEND:

Boring Location

"M9" CURVE DATA

No.	R	Δ	T	L
1	825.00	34°39'59"	257.48	499.16



"B13" CURVE DATA

No.	R	Δ	T	L
2	300.00	5°42'38"	14.96	29.90

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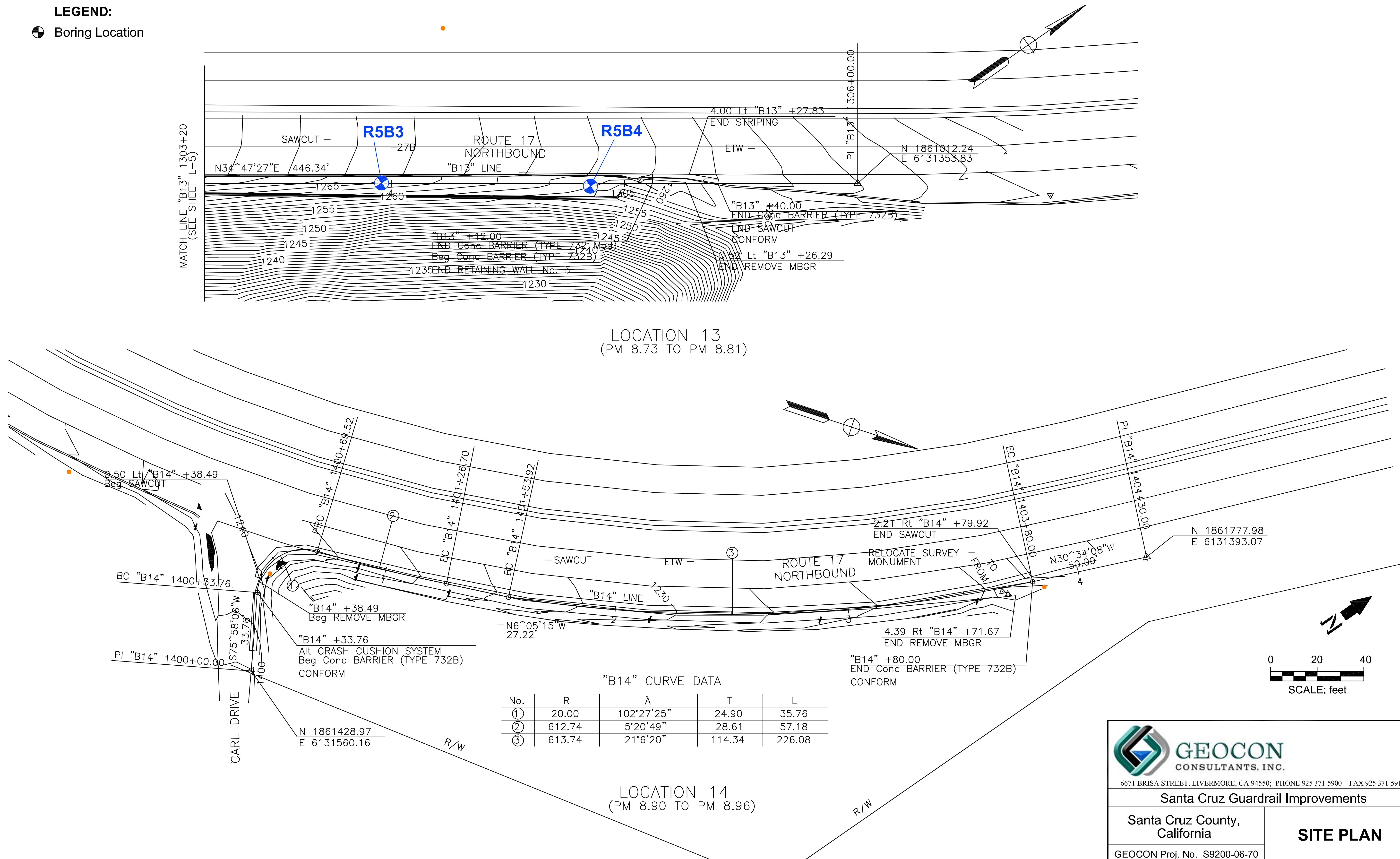
SITE0309



"B14" CURVE DATA

No.	R	Δ	T	L
1	20.00	102°27'25"	24.90	35.76
2	612.74	5°20'49"	28.61	57.18
3	613.74	21°6'20"	114.34	226.08

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SITE PLAN

GEOCON Proj. No. S9200-06-70

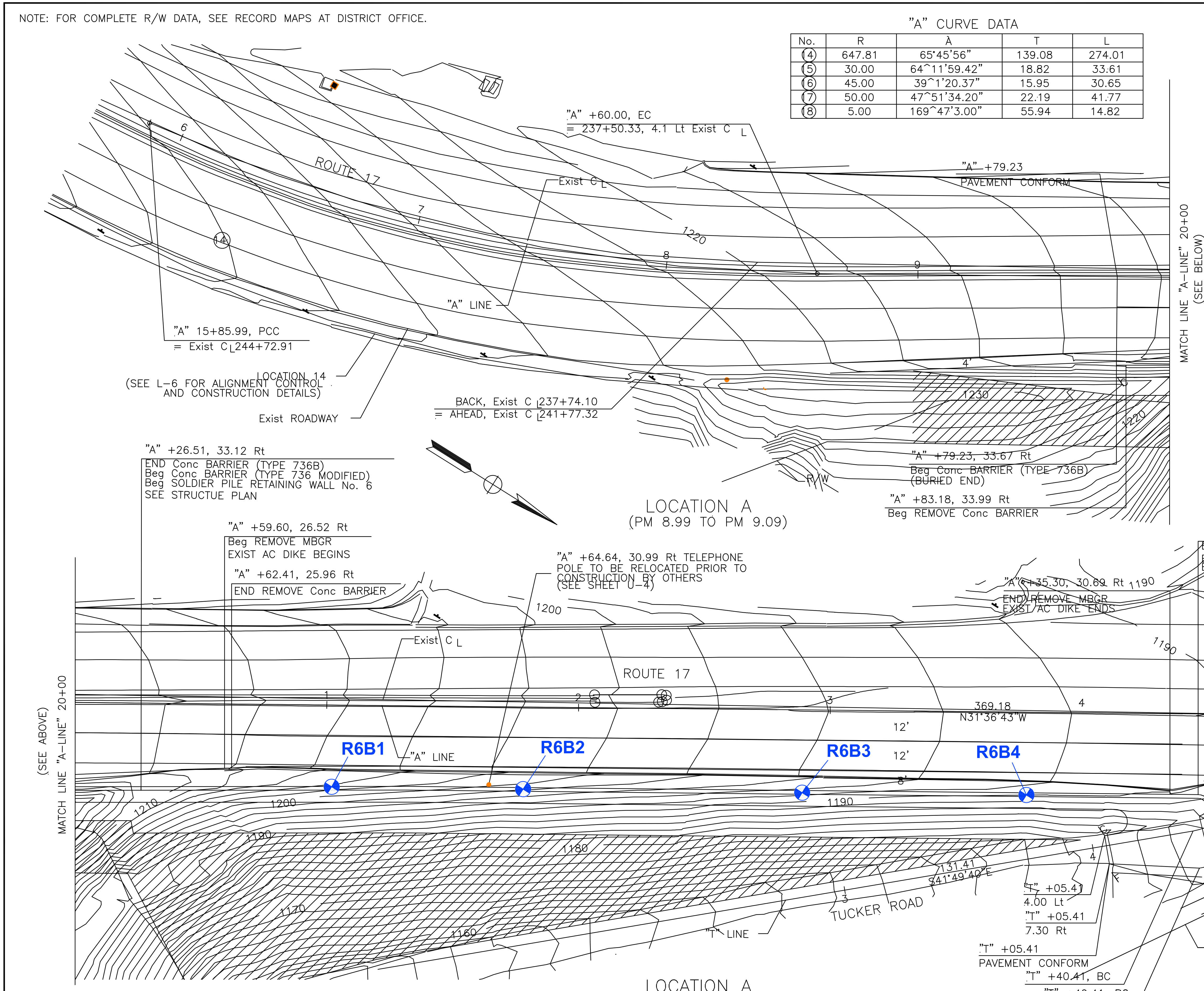
Task Order No. 70 | April 2009 | Figure 2-6

SITE0309

NOTE: FOR COMPLETE R/W DATA, SEE RECORD MAPS AT DISTRICT OFFICE.

"A" CURVE DATA

No.	R	Δ	T	L
14	647.81	65°45'56"	139.08	274.01
15	30.00	64°11'59.42"	18.82	33.61
16	45.00	39°1'20.37"	15.95	30.65
17	50.00	47°51'34.20"	22.19	41.77
18	5.00	169°47'3.00"	55.94	14.82



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Santa Cruz Guardrail Improvements	
Santa Cruz County, California	SITE PLAN
GEOCON Proj. No. S9200-06-70	
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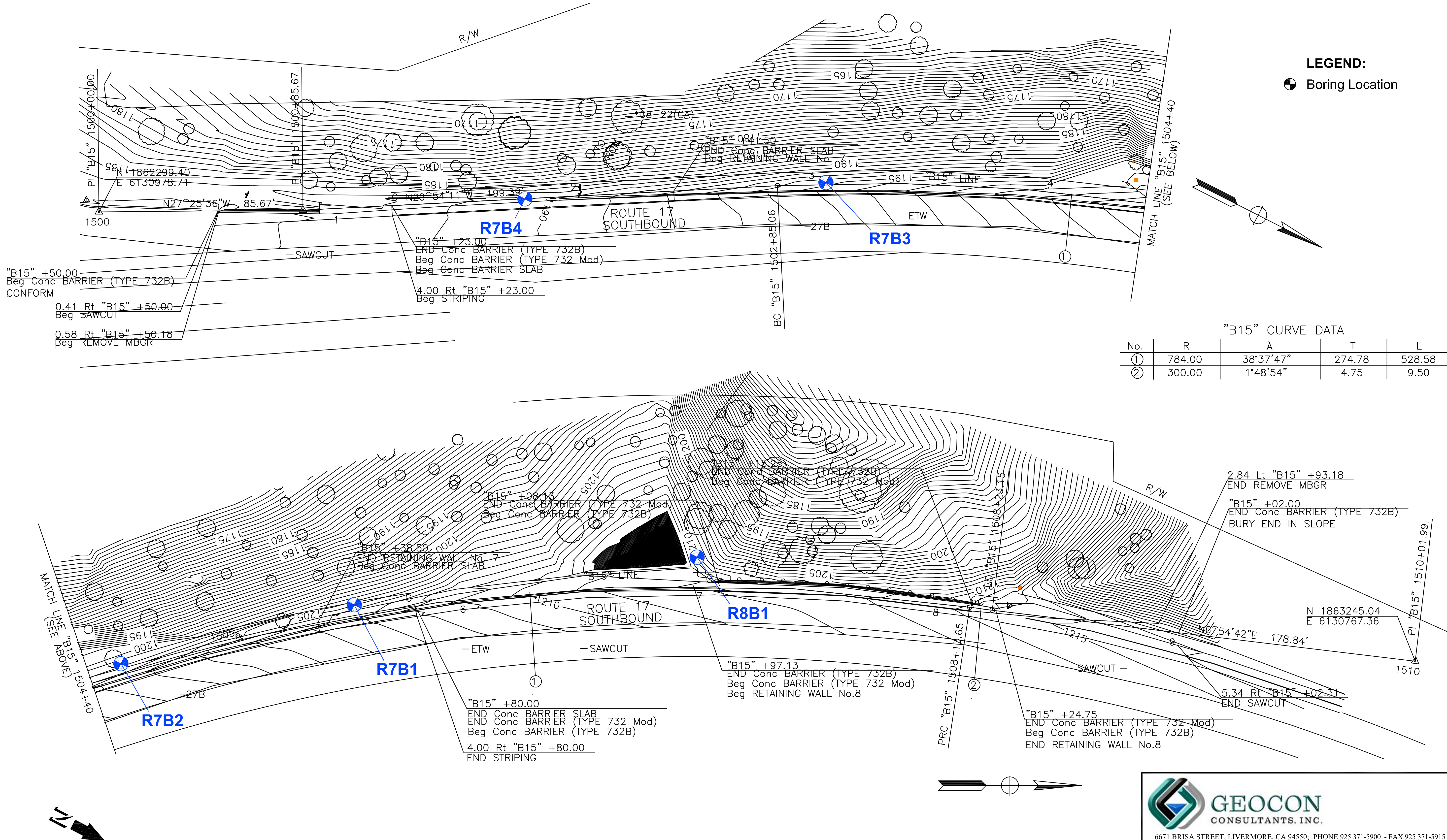
SITE0309



"B15" CURVE DATA

No.	R	Δ	T	L
1	784.00	38°37'47"	274.78	528.58
2	300.00	1°48'54"	4.75	9.50

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Santa Cruz Guardrail Improvements

Santa Cruz County, California

SITE PLAN

GEOCON Proj. No. S9200-06-70

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April 2009

Figure 2-8

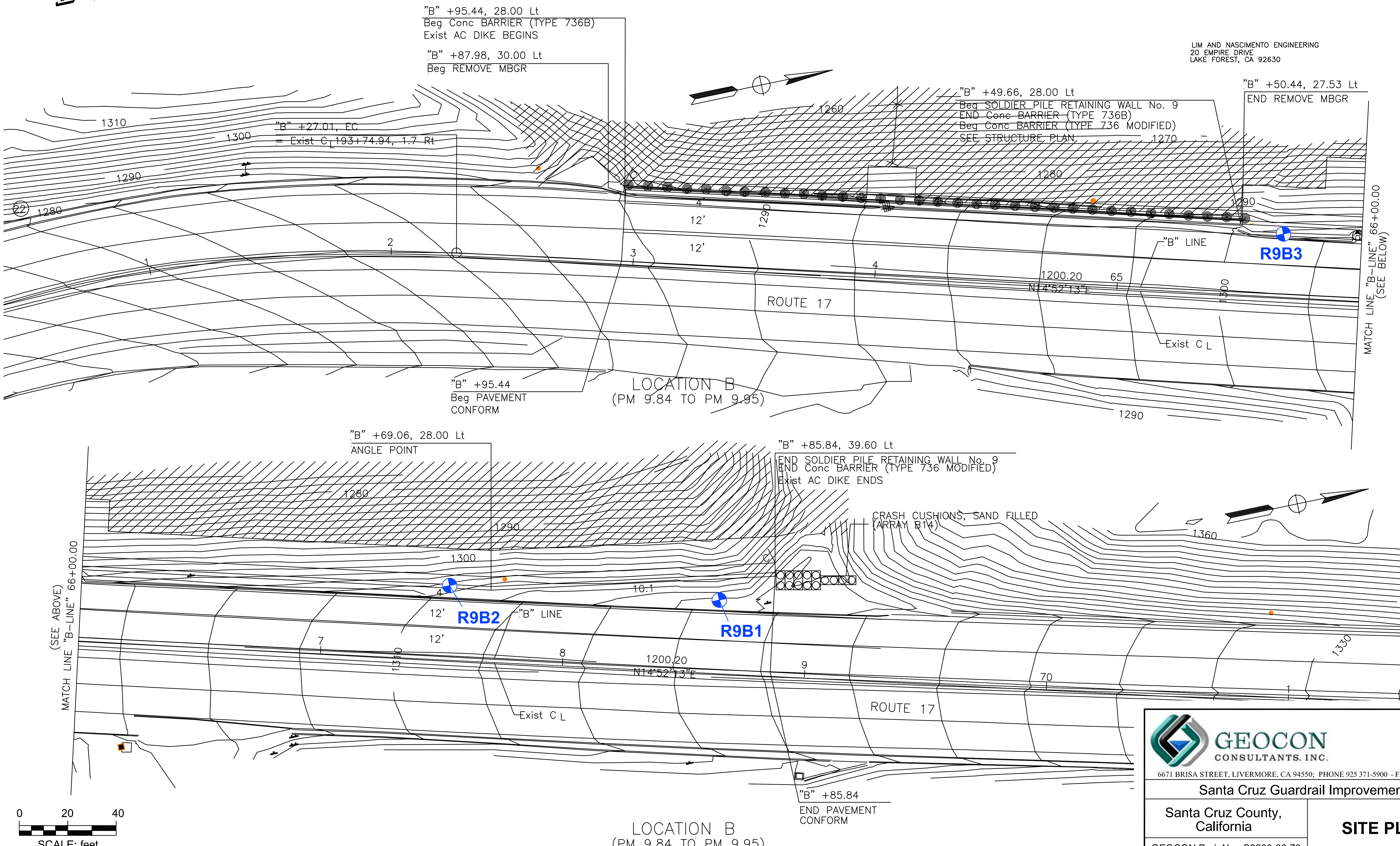
SITE0309

"B" CURVE DATA

No.	R	Δ	T	L
22	575.00	66°34'50"	377.56	668.18

LEGEND:

Boring Location



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Santa Cruz Guardrail Improvements		
Santa Cruz County, California	SITE PLAN	
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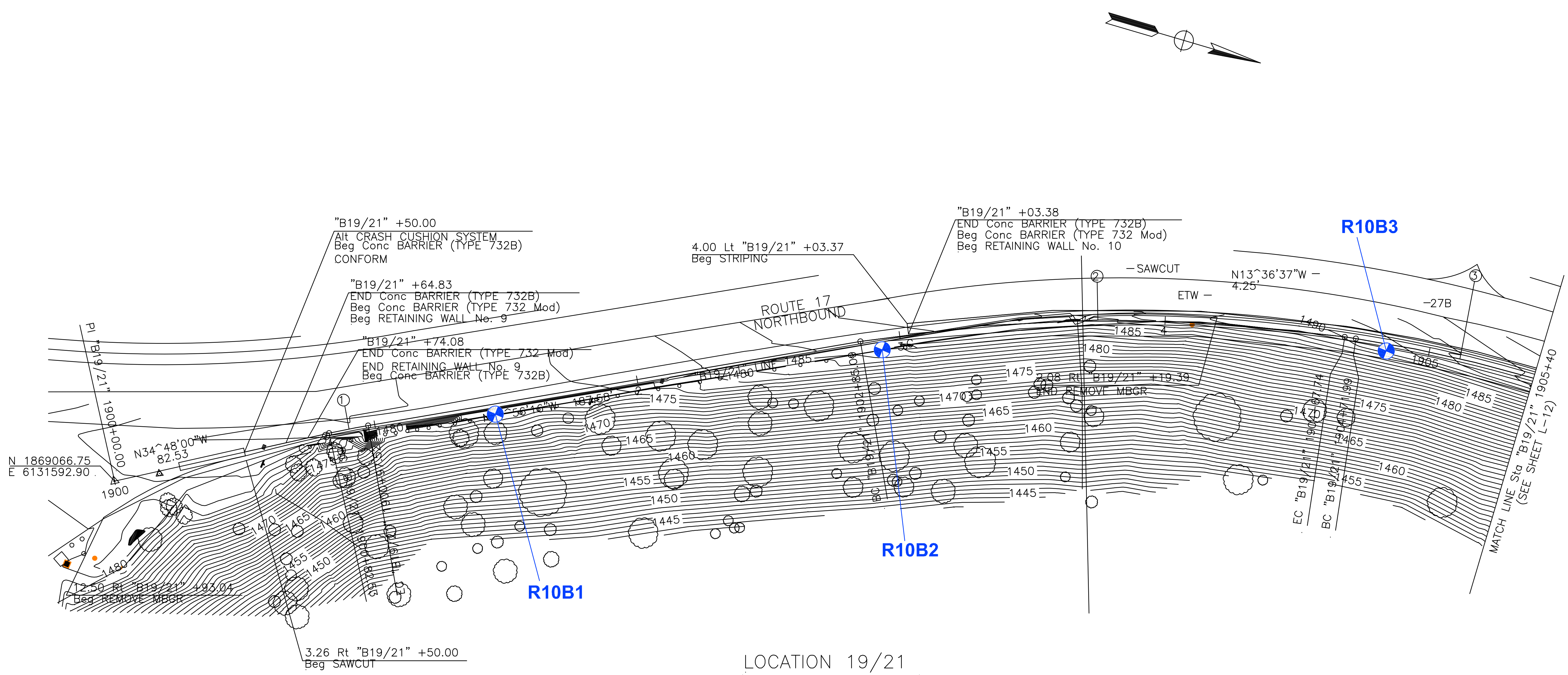
LEGEND:

Boring Location

"B19/21" CURVE DATA

No.	R	Δ	T	L
1	300.00	2°51'45"	7.50	14.99
2	571.00	18°19'39"	92.11	182.65
3	496.00	28°34'54"	126.34	247.43



LOCATION 19/21

(PM 10.54 TO PM 10.82)

0 20 40

SCALE: feet

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Santa Cruz Guardrail Improvements		
Santa Cruz County, California	SITE PLAN	
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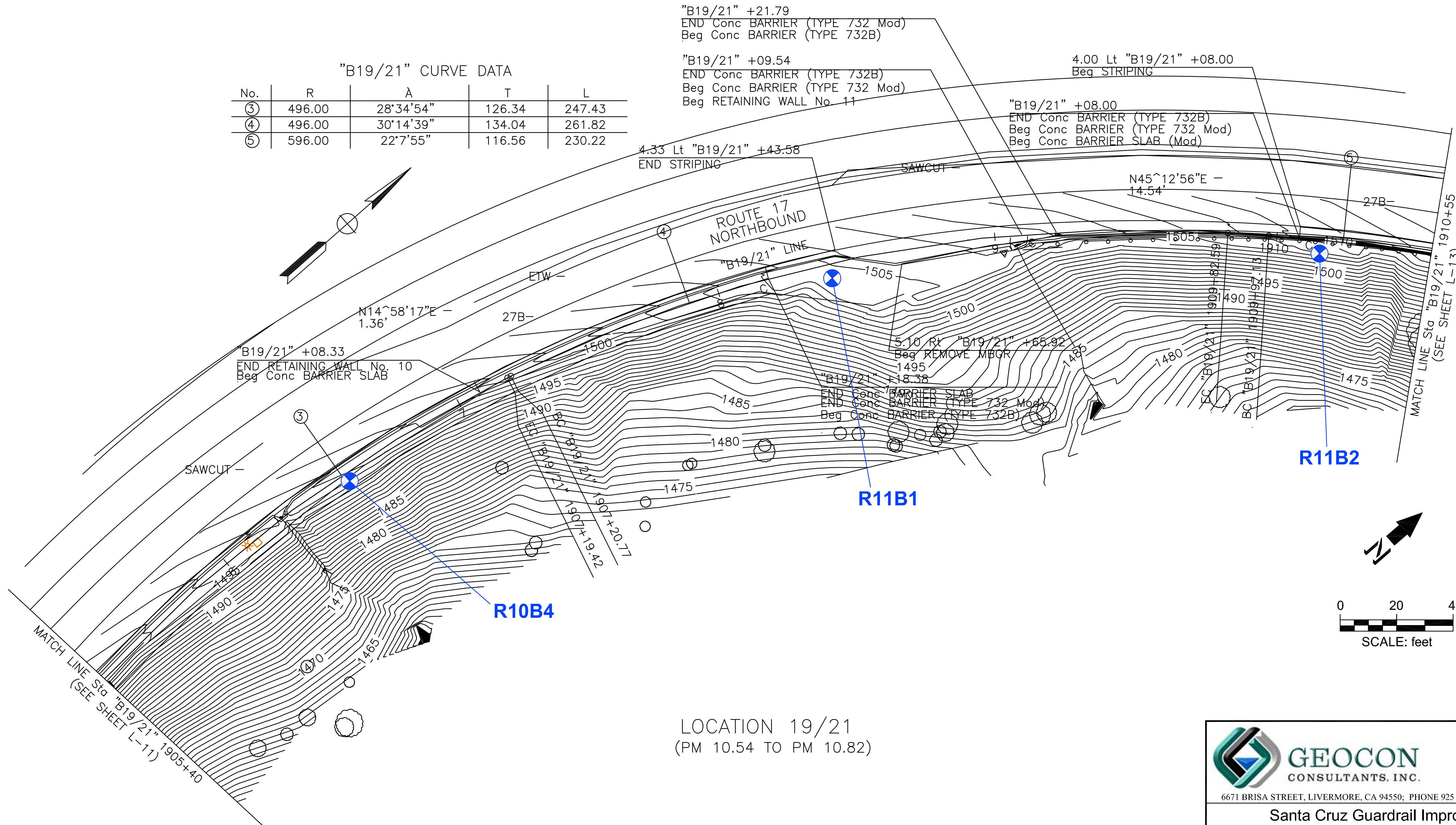
SITE0309

LEGEND:

Boring Location



No.	R	Δ	T	L
3	496.00	28°34'54"	126.34	247.43
4	496.00	30°14'39"	134.04	261.82
5	596.00	22°7'55"	116.56	230.22

LOCATION 19/21
(PM 10.54 TO PM 10.82)

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Santa Cruz Guardrail Improvements

Santa Cruz County, California

SITE PLAN

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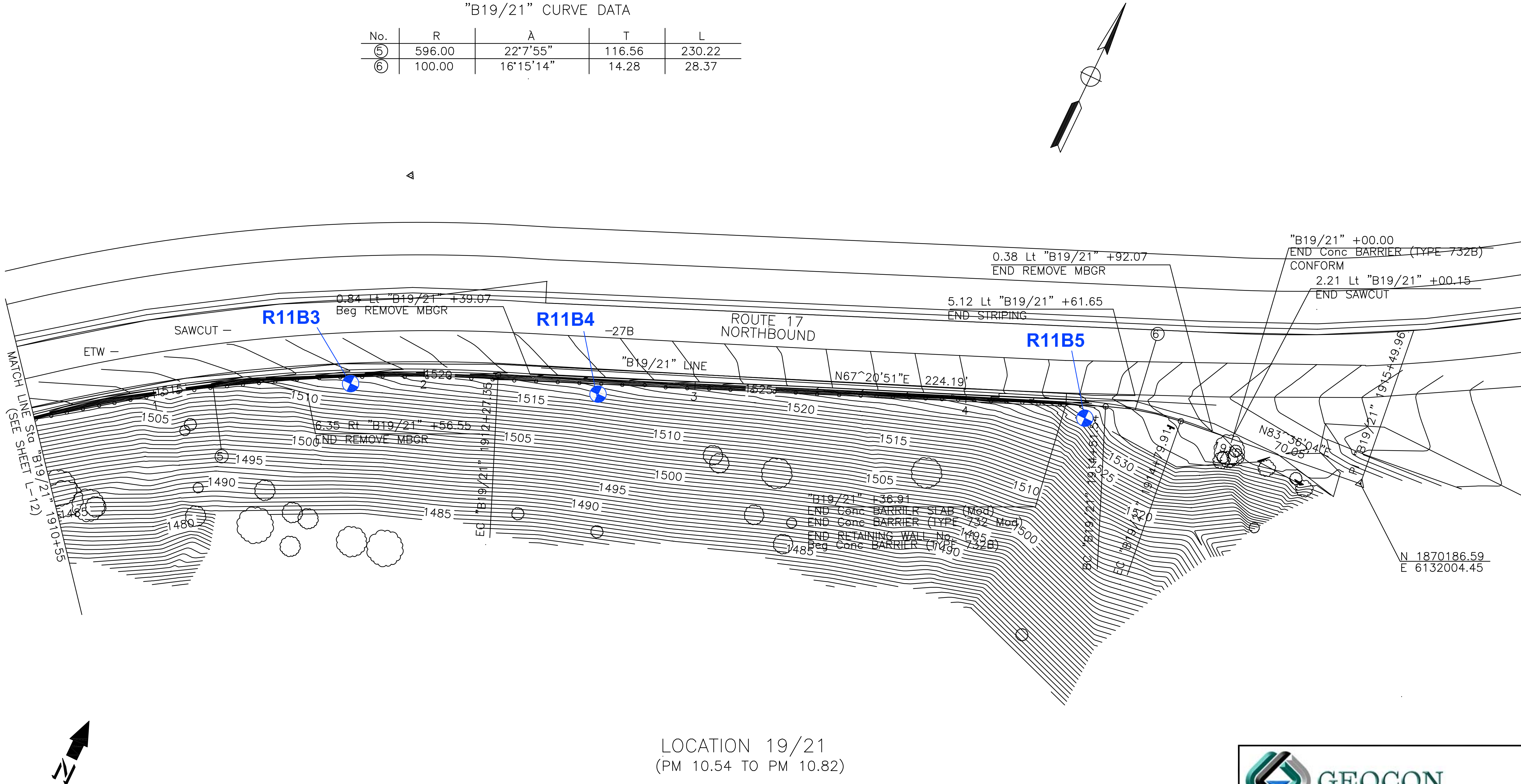
LEGEND:

Boring Location

"B19/21" CURVE DATA

No.	R	Δ	T	L
5	596.00	22°7'55"	116.56	230.22
6	100.00	16°15'14"	14.28	28.37



LOCATION 19/21

(PM 10.54 TO PM 10.82)

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Santa Cruz Guardrail Improvements		
Santa Cruz County, California	SITE PLAN	
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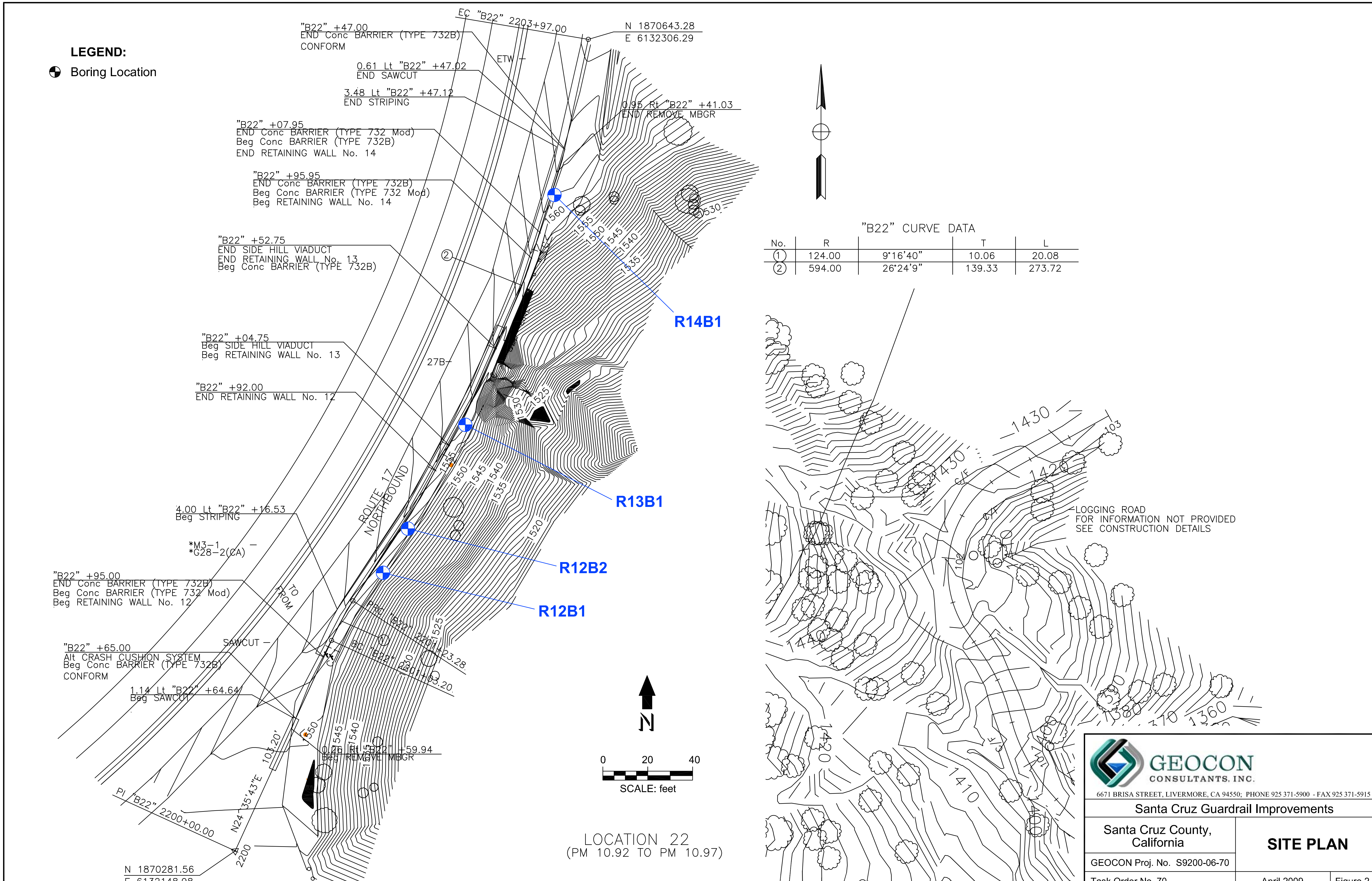
SITE0309



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Santa Cruz Guardrail Improvements

Santa Cruz County, California

SITE PLAN

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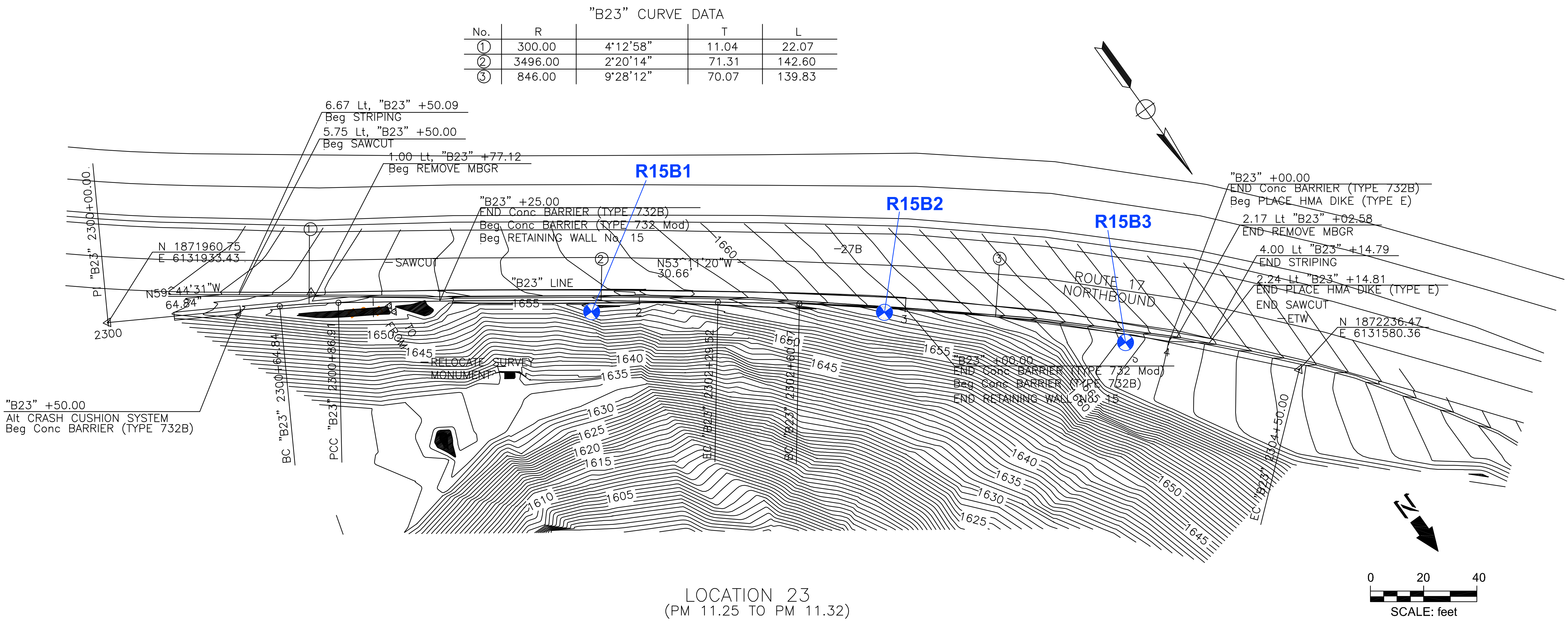
LEGEND:

Boring Location



LOCATION 23
(PM 11.25 TO PM 11.32)

GEOCON CONSULTANTS, INC.

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Santa Cruz Guardrail Improvements

Santa Cruz County, California	**SITE PLAN**
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SITE0309

TABLE 1
Boring Coordinates
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Boring	Easting	Northing
R1B1	6,124,976.892	1,850,422.056
R1B2	6,125,054.316	1,850,478.174
R1B3	6,125,179.562	1,850,576.135
R2B1	6,125,305.444	1,850,673.473
R2B2	6,125,386.166	1,850,742.729
R2B3	6,125,511.038	1,850,847.378
R2B4	6,125,606.530	1,850,931.648
R2B5	6,125,678.260	1,850,995.085
R3B1	6,128,088.519	1,853,706.256
R3B2	6,128,049.695	1,853,685.240
R4B1	6,129,795.874	1,854,409.463
R4B2	6,129,881.405	1,854,487.155
R4B3	6,129,987.835	1,854,587.973
R4B4	6,130,087.153	1,854,683.985
R4B5	6,130,125.449	1,854,721.132
R5B1	6,131,122.062	1,860,680.451
R5B2	6,131,177.997	1,860,758.523
R5B3	6,131,237.168	1,860,844.723
R5B4	6,131,289.397	1,860,917.462
R6B1	6,131,265.171	1,861,956.704
R6B2	6,131,225.412	1,862,021.578
R6B3	6,131,167.505	1,862,116.143
R6B4	6,131,120.825	1,862,192.009
R7B1	6,130,892.803	1,862,456.311
R7B2	6,130,829.396	1,862,565.847
R7B3	6,130,768.063	1,862,701.823
R7B4	6,130,743.500	1,862,799.768
R8B1	6,130,723.692	1,862,943.690
R9B1	6,130,985.194	1,865,646.370
R9B2	6,131,028.396	1,865,825.513
R9B3	6,131,057.460	1,865,933.163
R10B1	6,131,515.508	1,869,189.614
R10B2	6,131,438.157	1,869,314.991
R10B3	6,131,366.912	1,869,490.340
R10B4	6,131,360.385	1,869,656.767
R11B1	6,131,419.387	1,869,832.421
R11B2	6,131,526.875	1,869,967.647
R11B3	6,131,652.853	1,870,058.966
R11B4	6,131,736.780	1,870,094.908
R11B5	6,131,902.423	1,870,164.480
R12B1	6,132,214.865	1,870,405.506
R12B2	6,132,225.983	1,870,425.175
R13B1	6,132,251.520	1,870,471.486
R14B1	6,132,291.232	1,870,573.914
R15B1	6,131,783.518	1,872,063.555
R15B2	6,131,694.325	1,872,128.002
R15B3	6,131,627.421	1,872,190.109

Coordinates shown in feet, NAD 83 (Zone 3)

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R1B1-0	0	7.7	---	---	---
R1B1-1	1	60	4.8	---	---
R1B1-2	2	<5.0	---	---	7.0
R1B1-3	3	<5.0	---	---	---
R1B1-4	4	<5.0	---	---	---
R1B1-5	5	<5.0	---	---	---
R1B1-6	6	<5.0	---	---	---
R1B1-7	7	5.3	---	---	---
R1B1-8	8	5.3	---	---	---
R1B2-0	0	17	---	---	---
R1B2-1	1	44	---	---	---
R1B2-2	2	<5.0	---	---	---
R1B2-3	3	4.5	---	---	---
R1B2-4	4	6.2	---	---	---
R1B3-0	0	11	---	---	---
R1B3-1	1	160	18	0.33	---
R1B3-2	2	17	---	---	7.2
R1B3-3	3	6.1	---	---	---
R1B3-4	4	<5.0	---	---	---
R1B3-5	5	<5.0	---	---	---
R1B3-6	6	<5.0	---	---	---
R1B3-7	7	6.1	---	---	---
R1B3-8	8	<5.0	---	---	---
R2B1-0	0	150	9.1	0.45	---
R2B1-1	1	110	8.6	0.36	---
R2B1-2	2	880	75	2.0	---
R2B1-3	3	18	---	---	---
R2B1-4	4	5.4	---	---	---
R2B1-5	5	23	---	---	---
R2B1-6	6	160	12	0.61	6.6
R2B1-7	7	<5.0	---	---	---
R2B1-8	8	16	---	---	---
R2B2-0	0	20	---	---	---
R2B2-1	1	78	11	---	---
R2B2-2	2	5.8	---	---	---
R2B2-3	3	11	---	---	---
R2B2-4	4	<5.0	---	---	---
R2B2-5	5	<5.0	---	---	---
R2B2-6	6	<5.0	---	---	---
R2B2-7	7	<5.0	---	---	---
R2B2-8	8	<5.0	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R2B3-0	0	22	---	---	7.6
R2B3-1	1	57	5.2	---	---
R2B3-2	2	250	14	1.4	---
R2B3-3	3	7.3	---	---	---
R2B3-4	4	<5.0	---	---	---
R2B3-5	5	40	---	---	---
R2B3-6	6	<5.0	---	---	---
R2B3-7	7	5.3	---	---	---
R2B4-0	0	13	---	---	---
R2B4-1	1	140	9.9	0.59	7.1
R2B4-2	2	850	76	2.3	---
R2B4-3	3	5.7	---	---	---
R2B4-4	4	7.1	---	---	---
R2B4-5	5	15	---	---	---
R2B4-6	6	41	---	---	---
R2B4-7	7	7.1	---	---	---
R2B4-8	8	19	---	---	---
R2B5-0	0	25	---	---	---
R2B5-1	1	110	11	0.46	6.9
R2B5-2	2	270	16	0.83	---
R2B5-3	3	<5.0	---	---	---
R2B5-4	4	<5.0	---	---	---
R2B5-5	5	13	---	---	5.0
R3B1-0	0	130	9.6	<0.25	7.1
R3B1-1	1	29	---	---	---
R3B1-2	2	<5.0	---	---	---
R3B1-3	3	8.5	---	---	---
R3B1-4	4	<5.0	---	---	---
R3B1-5	5	5.2	---	---	---
R3B1-6	6	23	---	---	---
R3B1-7	7	<5.0	---	---	---
R3B1-8	8	<5.0	---	---	---
R3B2-0	0	110	6.8	<0.25	---
R3B2-1	1	61	3.3	---	---
R3B2-2	2	<5.0	---	---	---
R3B2-3	3	<5.0	---	---	---
R3B2-4	4	<5.0	---	---	---
R3B2-5	5	5.3	---	---	6.4
R3B2-6	6	<5.0	---	---	---
R3B2-7	7	5.4	---	---	---
R3B2-8	8	<5.0	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R4B1-0	0	400	30	0.84	---
R4B1-1	1	11	---	---	---
R4B1-2	2	5.5	---	---	---
R4B1-3	3	<5.0	---	---	---
R4B1-4	4	<5.0	---	---	---
R4B1-5	5	<5.0	---	---	---
R4B1-6	6	<5.0	---	---	4.1
R4B1-7	7	<5.0	---	---	---
R4B1-8	8	<5.0	---	---	---
R4B2-0	0	280	29	3.2	---
R4B2-1	1	190	13	0.29	---
R4B2-2	2	<5.0	---	---	---
R4B2-3	3	8.4	---	---	---
R4B2-4	4	28	---	---	---
R4B2-5	5	<5.0	---	---	---
R4B2-6	6	<5.0	---	---	---
R4B2-7	7	<5.0	---	---	5.1
R4B2-8	8	19	---	---	---
R4B3-0	0	650	47	0.64	---
R4B3-1	1	19	---	---	---
R4B3-2	2	<5.0	---	---	---
R4B3-3	3	<5.0	---	---	---
R4B3-4	4	6.6	---	---	---
R4B3-5	5	<5.0	---	---	---
R4B3-6	6	<5.0	---	---	---
R4B3-7	7	<5.0	---	---	---
R4B3-8	8	14	---	---	---
R4B4-0	0	290	28	0.63	6.3
R4B4-1	1	330	8.5	0.36	---
R4B4-2	2	18	---	---	---
R4B4-3	3	<5.0	---	---	---
R4B4-4	4	7.0	---	---	---
R4B4-5	5	<5.0	---	---	---
R4B4-6	6	6.4	---	---	---
R4B4-7	7	<5.0	---	---	---
R4B4-8	8	5.0	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R4B5-0	0	240	19	1.6	6.8
R4B5-1	1	76	4.4	---	---
R4B5-2	2	6.6	---	---	---
R4B5-3	3	5.0	---	---	---
R4B5-4	4	34	---	---	---
R4B5-5	5	<5.0	---	---	---
R4B5-6	6	<5.0	---	---	---
R4B5-7	7	5.1	---	---	---
R4B5-8	8	5.2	---	---	5.8
R5B1-0	0	50	3.3	---	7.3
R5B1-1	1	<5.0	---	---	---
R5B1-2	2	7.1	---	---	---
R5B1-3	3	<5.0	---	---	---
R5B1-4	4	<5.0	---	---	---
R5B1-5	5	<5.0	---	---	---
R5B1-6	6	12	---	---	---
R5B1-7	7	<5.0	---	---	---
R5B2-0	0	<5.0	---	---	---
R5B2-1	1	5.8	---	---	---
R5B2-2	2	<5.0	---	---	---
R5B2-3	3	<5.0	---	---	---
R5B2-4	4	<5.0	---	---	6.4
R5B3-0	0	270	22	0.86	---
R5B3-1	1	39	---	---	---
R5B3-2	2	7.0	---	---	---
R5B3-3	3	5.7	---	---	---
R5B3-4	4	13	---	---	---
R5B3-5	5	<5.0	---	---	---
R5B4-0	0	600	53	1.8	---
R5B4-1	1	13	---	---	---
R5B4-2	2	<5.0	---	---	---
R5B4-3	3	<5.0	---	---	7.0
R5B4-4	4	<5.0	---	---	---
R5B4-5	5	6.7	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R6B1-0	0	41	---	---	---
R6B1-1	1	310	31	1.0	---
R6B1-2	2	56	2.2	---	---
R6B1-3	3	70	5.4	---	---
R6B1-4	4	89	11	---	---
R6B1-5	5	<5.0	---	---	---
R6B1-6	6	12	---	---	---
R6B1-7	7	<5.0	---	---	---
R6B1-8	8	<5.0	---	---	---
R6B2-0	0	17	---	---	5.3
R6B2-1	1	5.1	---	---	---
R6B2-2	2	6.7	---	---	---
R6B2-3	3	<5.0	---	---	---
R6B2-4	4	<5.0	---	---	---
R6B2-5	5	<5.0	---	---	---
R6B2-6	6	<5.0	---	---	---
R6B2-7	7	<5.0	---	---	---
R6B2-8	8	<5.0	---	---	---
R6B3-0	0	160	11	0.55	---
R6B3-1	1	29	---	---	---
R6B3-2	2	6.1	---	---	---
R6B3-3	3	5.9	---	---	6.1
R6B3-4	4	8.0	---	---	---
R6B3-5	5	5.3	---	---	---
R6B3-6	6	<5.0	---	---	---
R6B3-7	7	<5.0	---	---	---
R6B4-0	0	5.5	---	---	---
R6B4-1	1	450	31	1.2	---
R6B4-2	2	47	---	---	5.6
R6B4-3	3	6.5	---	---	---
R6B4-4	4	<5.0	---	---	---
R6B4-5	5	<5.0	---	---	---
R6B4-6	6	<5.0	---	---	---
R6B4-7	7	25	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R7B1-0	0	500	40	0.64	---
R7B1-1	1	35	---	---	---
R7B1-2	2	83	3.4	---	8.3
R7B1-3	3	<5.0	---	---	---
R7B1-4	4	6.4	---	---	---
R7B1-5	5	19	---	---	---
R7B1-6	6	150	13	1.5	---
R7B1-7	7	26	---	---	---
R7B1-8	8	15	---	---	---
R7B2-0	0	210	<0.25	---	---
R7B2-1	1	24	---	---	---
R7B2-2	2	<5.0	---	---	---
R7B2-3	3	<5.0	---	---	7.6
R7B2-4	4	7.2	---	---	---
R7B2-5	5	11	---	---	---
R7B2-6	6	57	2.9	---	---
R7B2-7	7	37	---	---	---
R7B2-8	8	31	---	---	---
R7B3-0	0	45	---	---	---
R7B3-1	1	14	---	---	---
R7B3-2	2	19	---	---	---
R7B3-3	3	<5.0	---	---	---
R7B3-4	4	<5.0	---	---	---
R7B3-5	5	<5.0	---	---	3.8
R7B3-6	6	13	---	---	---
R7B3-7	7	<5.0	---	---	---
R7B3-8	8	62	<0.25	---	---
R7B4-0	0	180	12	0.74	---
R7B4-1	1	26	---	---	---
R7B4-2	2	16	---	---	---
R7B4-3	3	23	---	---	---
R7B4-4	4	31	---	---	---
R7B4-5	5	24	---	---	---
R7B4-6	6	14	---	---	---
R7B4-7	7	16	---	---	---
R7B4-8	8	5.6	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R8B1-0	0	55	2.3	---	5.6
R8B1-1	1	12	---	---	---
R8B1-2	2	<5.0	---	---	---
R8B1-3	3	<5.0	---	---	---
R8B1-4	4	<5.0	---	---	---
R8B1-5	5	<5.0	---	---	---
R8B1-6	6	<5.0	---	---	---
R8B1-7	7	<5.0	---	---	---
R8B1-8	8	<5.0	---	---	---
R9B1-0	0	25	---	---	4.7
R9B1-1	1	73	2.1	---	---
R9B1-2	2	18	---	---	---
R9B1-3	3	11	---	---	---
R9B1-4	4	<5.0	---	---	---
R9B1-5	5	7.9	---	---	---
R9B1-6	6	<5.0	---	---	---
R9B1-7	7	<5.0	---	---	---
R9B1-8	8	<5.0	---	---	---
R9B2-0	0	34	---	---	6.5
R9B2-1	1	4.5	---	---	---
R9B2-2	2	100	9.3	0.99	---
R9B2-3	3	<5.0	---	---	---
R9B2-4	4	<5.0	---	---	---
R9B2-5	5	<5.0	---	---	---
R9B2-6	6	<5.0	---	---	---
R9B2-7	7	<5.0	---	---	---
R9B2-8	8	<5.0	---	---	5.5
R9B3-0	0	35	---	---	---
R9B3-1	1	<5.0	---	---	---
R9B3-2	2	8.1	---	---	---
R9B3-3	3	<5.0	---	---	---
R9B3-4	4	<5.0	---	---	---
R9B3-5	5	<5.0	---	---	---
R9B3-6	6	<5.0	---	---	---
R9B3-7	7	<5.0	---	---	---
R9B3-8	8	<5.0	---	---	5.9
R10B1-0	0	870	290	6.4	---
R10B1-1	1	89	7.1	---	7.0
R10B1-2	2	300	21	0.28	---
R10B1-3	3	43	---	---	---
R10B1-4	4	<5.0	---	---	---
R10B1-5	5	3.0	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R10B2-0	0	22	---	---	---
R10B2-1	1	5.7	---	---	---
R10B2-2	2	89	4.7	---	---
R10B2-3	3	6.3	---	---	---
R10B2-4	4	5.6	---	---	---
R10B2-5	5	<5.0	---	---	---
R10B2-6	6	7.1	---	---	---
R10B2-7	7	9.3	---	---	6.7
R10B2-8	8	5.1	---	---	---
R10B3-0	0	11	---	---	---
R10B3-1	1	65	2.3	---	---
R10B3-2	2	5.2	---	---	---
R10B3-3	3	6.6	---	---	---
R10B3-4	4	<5.0	---	---	---
R10B3-5	5	<5.0	---	---	---
R10B3-6	6	<5.0	---	---	---
R10B3-7	7	5.1	---	---	---
R10B3-8	8	6.0	---	---	---
R10B4-0	0	45	---	---	---
R10B4-1	1	200	26	0.59	---
R10B4-2	2	12	---	---	---
R10B4-3	3	35	---	---	---
R10B4-4	4	6.1	---	---	---
R10B4-5	5	<5.0	---	---	7.1
R10B4-6	6	6.3	---	---	---
R10B4-7	7	<5.0	---	---	---
R10B4-8	8	5.1	---	---	---
R11B1-0	0	34	---	---	---
R11B1-1	1	22	---	---	---
R11B1-2	2	20	---	---	---
R11B1-3	3	8.2	---	---	---
R11B1-4	4	7.3	---	---	---
R11B1-5	5	5.4	---	---	---
R11B1-6	6	6.9	---	---	---
R11B1-7	7	6.8	---	---	---
R11B1-8	8	<5.0	---	---	6.7

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R11B2-0	0	67	6.1	---	---
R11B2-1	1	88	4.2	---	---
R11B2-2	2	<5.0	---	---	---
R11B2-3	3	<5.0	---	---	---
R11B2-4	4	<5.0	---	---	---
R11B2-5	5	<5.0	---	---	---
R11B2-6	6	5.2	---	---	---
R11B2-7	7	39	---	---	---
R11B2-8	8	9.2	---	---	---
R11B3-0	0	360	28	1.9	---
R11B3-1	1	18	---	---	---
R11B3-2	2	24	---	---	---
R11B3-3	3	<5.0	---	---	---
R11B3-4	4	15	---	---	7.7
R11B3-5	5	17	---	---	---
R11B3-6	6	<5.0	---	---	---
R11B3-7	7	6.3	---	---	---
R11B3-8	8	26	---	---	---
R11B4-0	0	54	3.8	---	---
R11B4-1	1	8.3	---	---	---
R11B4-2	2	<5.0	---	---	---
R11B4-3	3	<5.0	---	---	---
R11B4-4	4	<5.0	---	---	---
R11B4-5	5	9.0	---	---	7.7
R11B4-6	6	25	---	---	---
R11B5-0	0	180	9.5	<0.25	---
R11B5-1	1	7.8	---	---	---
R11B5-2	2	20	---	---	---
R11B5-3	3	16	---	---	---
R11B5-4	4	12	---	---	---
R11B5-5	5	5.3	---	---	---
R11B5-6	6	<5.0	---	---	---
R11B5-7	7	<5.0	---	---	---
R11B5-8	8	<5.0	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R12B1-0	0	340	26	1.2	---
R12B1-1	1	24	---	---	6.1
R12B1-2	2	17	---	---	---
R12B1-3	3	16	---	---	---
R12B1-4	4	12	---	---	---
R12B1-5	5	13	---	---	---
R12B1-6	6	40	---	---	---
R12B1-7	7	12	---	---	---
R12B1-8	8	5.9	---	---	---
R12B2-0	0	250	18	1.1	5.4
R12B2-1	1	33	---	---	---
R12B2-2	2	17	---	---	---
R12B2-3	3	19	---	---	---
R12B2-4	4	7.0	---	---	---
R12B2-5	5	10	---	---	---
R12B2-6	6	8.6	---	---	---
R12B2-7	7	9.3	---	---	4.7
R12B2-8	8	6.2	---	---	---
R13B1-0	0	150	8.7	0.50	---
R13B1-1	1	62	1.9	---	---
R13B1-2	2	13	---	---	---
R13B1-3	3	5.2	---	---	---
R13B1-4	4	6.7	---	---	---
R13B1-5	5	12	---	---	---
R13B1-6	6	<5.0	---	---	---
R13B1-7	7	5.0	---	---	---
R13B1-8	8	5.6	---	---	---
				---	---
R14B1-0	0	360	25	1.5	5.9
R14B1-1	1	140	7.5	0.59	---
R14B1-2	2	51	3.6	---	---
R14B1-3	3	15	---	---	---
R14B1-4	4	34	---	---	---
R14B1-5	5	12	---	---	---
R14B1-6	6	6.1	---	---	---
R14B1-7	7	5.2	---	---	6.1
R14B1-8	8	17	---	---	---

TABLE 2
Summary of Lead and pH Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	TCLP Lead (mg/l)	pH
R15B1-0	0	1,000	---	2.2	---
R15B1-1	1	37	---	---	---
R15B1-2	2	320	16	0.98	---
R15B1-3	3	<5.0	---	---	---
R15B1-4	4	<5.0	---	---	---
R15B1-5	5	<5.0	---	---	---
R15B1-6	6	1.5	---	---	---
R15B1-7	7	88	6.5	---	---
R15B1-8	8	<5.0	---	---	---
R15B2-0	0	160	12	1.0	6.0
R15B2-1	1	30	---	---	---
R15B2-2	2	37	---	---	---
R15B2-3	3	73	0.27	---	---
R15B2-4	4	700	34	4.4	---
R15B2-5	5	96	4.9	---	---
R15B2-6	6	<5.0	---	---	---
R15B2-7	7	<5.0	---	---	---
R15B2-8	8	9.7	---	---	---
R15B3-0	0	170	8.6	<0.25	5.6
R15B3-1	1	60	4.5	---	---
R15B3-2	2	27	---	---	---
R15B3-3	3	13	---	---	---
R15B3-4	4	<5.0	---	---	---
R15B3-5	5	16	---	---	---
R15B3-6	6	11	---	---	---
R15B3-7	7	5.1	---	---	---
R15B3-8	8	5.6	---	---	5.8

Notes:
WET = Waste Extraction Test
WET DI = Waste Extraction Test using de-ionized water
TCLP = Toxicity Characteristic Leaching Procedure
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
< = Not detected above the laboratory reporting limit
--- = Not analyzed

TABLE 3
Summary of CAM17 Metals Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
R1B2-3	3	<2.0	4.7	49	<1.0	<1.0	14	2.9	6.5	4.5	1.7	10	1.3	<1.0	<1.0	26	20	<0.10
R2B4-2	2	<2.0	2.5	71	<1.0	2.0	14	4.8	28	850	<1.0	15	1.3	<1.0	<1.0	28	140	<0.10
R4B3-4	4	<2.0	4.7	38	<1.0	4.7	17	2.2	6.8	6.6	5.7	15	1.8	<1.0	<1.0	18	67	<0.10
R5B4-5	5	<2.0	1.4	20	<1.0	<1.0	6.4	1.8	3.2	6.7	<1.0	7.0	<1.0	<1.0	<1.0	13	89	<0.10
R6B3-8	8	<2.0	1.6	170	<1.0	<1.0	25	5.9	7.8	4.3	<1.0	18	<1.0	<1.0	<1.0	52	30	<0.10
R7B1-0	0	<2.0	3.5	83	<1.0	<1.0	30	4.1	34	500	3.4	20	<1.0	<1.0	<1.0	24	350	<0.10
R9B2-1	1	<2.0	4.7	56	<1.0	<1.0	25	10	15	4.5	1.2	28	1.7	<1.0	<1.0	36	46	<0.10
R10B1-5	5	<2.0	<1.0	13	<1.0	<1.0	2.3	<1.0	<1.0	3.0	<1.0	3.1	<1.0	<1.0	<1.0	2.8	8.2	<0.10
R11B3-5	5	<2.0	1.4	11	<1.0	<1.0	4.8	<1.0	3.8	17	<1.0	3.5	<1.0	<1.0	<1.0	4.7	13	<0.10
R15B1-6	6	<2.0	<1.0	5.5	<1.0	<1.0	3.2	<1.0	<1.0	1.5	<1.0	2.8	<1.0	<1.0	<1.0	2.7	11	<0.10
ESLs																		
Shallow Soils (≤3 m bgs)																		
Residential Land Use		6.3	0.39	750	4.0	1.7	750*	40	230	200	40	150	10	20	1.3	16	600	1.3
Comm/Ind Land Use		40	1.6	1,500	8.0	7.4	750*	80	230	750	40	150	10	40	16	200	600	10

Notes:

Results are shown in milligrams per kilogram (mg/kg)

Results in italics are soluble metal concentrations analyzed using the Waste Extraction Test (WET), shown in units of milligrams per liter (mg/l), with the exception of mercury results, which are presented in micrograms per liter (ug/l).

< = Analyte was not detected above the laboratory reporting limit

ESLs = Environmental Screening Levels, Table A Groundwater is Current/Potential Source of Drinking Water, SFRWQCB, Revised May 2008.

* = Value is for Chromium III, no standard for total chromium

TABLE 4
Summary of Petroleum Hydrocarbon Compounds Results
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (ug/kg)
R1B2-3	3	<1.0	1.8	4.2	ND
R2B4-2	2	<1.0	140	570	ND
R4B3-4	4	<1.0	4.0	8.2	ND
R5B4-5	5	<1.0	3.5	6.9	ND
R6B3-8	8	<1.0	2.7	2.9	ND
R7B1-0	0	<1.0	310	950	ND
R9B2-1	1	<1.0	2.5	5.4	ND
R10B1-5	5	<1.0	7.4	11	ND
R11B3-5	5	<1.0	<1.0	<1.0	ND
R15-B1-6	6	<1.0	2.2	3.5	ND
ESLs					
Shallow Soils (≤3 m bgs)					
Residential		83	83	370	---
Commercial/Industrial		83	83	2,500	---

Notes:
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
TPHg = Total Petroleum Hydrocarbons as gasoline
TPHd = Total Petroleum Hydrocarbons as diesel
TPHmo = Total Petroleum Hydrocarbons as motor oil
BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
ND = Not Detected above laboratory reporting limit
--- = Not Analyzed or Not Applicable
< = Not detected above the stated laboratory reporting limit
ESLs = Environmental Screening Levels, Table A, SFRWQCB, Revised May 2008.

TABLE 5a
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Wall 1 (Borings R1B1-B3)

TOTAL LEAD MAXIMUMS

	Total Lead (mg/kg) Maximum
0 to 0.5 ft	17
1 to 1.5 ft	160
2 to 2.5 ft	17
3 to 3.5 ft	6.1
4 to 4.5 ft	6.2
5 to 5.5 ft	2.5
6 to 6.5 ft	2.5
7 to 7.5 ft	6.1
8 to 8.5 ft	5.3

EXCAVATION SCENARIOS

Excavation Depth	Maximum Total Lead (mg/kg)	Maximum Soluble (WET) Lead* (mg/l)
0 to 1.0 ft.	17	1.3
Underlying Soil (1 to 8.5 ft)	*26*	*1.9*
0 to 2.0 ft.	89	6.6
Underlying Soil (2 to 8.5 ft)	*6.5*	*0.5*
0 to 3.0 ft.	65	4.9
Underlying Soil (3 to 8.5 ft)	*4.8*	*0.4*
0 to 4.0 ft.	50	3.8
Underlying Soil (4 to 8.5 ft)	*4.5*	*0.3*
0 to 5.0 ft.	41	3.1
Underlying Soil (5 to 8.5 ft)	*4.1*	*0.3*
0 to 6.0 ft.	35	2.6
Underlying Soil (6 to 8.5 ft)	*4.6*	*0.3*
0 to 7.0 ft.	30	2.3
Underlying Soil (7 to 8.5 ft)	*5.7*	*0.4*
0 to 8.0 ft.	27	2.0
Underlying Soil (8 to 8.5 ft)	*5.3*	*0.4*
0 to 8.5 ft.	25	1.9

Notes:

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y = 0.0751 \; x$

TABLE 5b
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Wall 2 (Borings R2B1-B5)

TOTAL LEAD UCLs and MAXIMUMS

	Total Lead (mg/kg) 90% UCL	95% UCL
0 to 0.5 ft	76.2	84.7
1 to 1.5 ft	115.2	120.4
2 to 2.5 ft	647.8	707.7
3 to 3.5 ft	11.9	12.7

	Maximum
4 to 4.5 ft	7.1
5 to 5.5 ft	40
6 to 6.5 ft	160
7 to 7.5 ft	7.1
8 to 8.5 ft	19

EXCAVATION SCENARIOS

Excavation Depth	90% UCL/Maximum Total Lead (mg/kg)	90% UCL/Maximum Soluble (WET) Lead* (mg/l)	95% UCL/Maximum Total Lead (mg/kg)	95% UCL/Maximum Soluble (WET) Lead* (mg/l)
0 to 1.0 ft.	76	5.7	85	6.4
Underlying Soil (1 to 8.5 ft)	*126*	*9.5*	*134*	*10*
0 to 2.0 ft.	96	7.2	103	7.7
Underlying Soil (2 to 8.5 ft)	*128*	*9.6*	*136*	*10*
0 to 3.0 ft.	280	21	304	23
Underlying Soil (3 to 8.5 ft)	*41*	*3.1*	*41*	*3.1*
0 to 4.0 ft.	213	16	231	17
Underlying Soil (4 to 8.5 ft)	*47*	*3.5*	*47*	*3.5*
0 to 5.0 ft.	172	13	187	14
Underlying Soil (5 to 8.5 ft)	*57*	*4.2*	*57*	*4.2*
0 to 6.0 ft.	150	11	162	12
Underlying Soil (6 to 8.5 ft)	*62*	*4.7*	*62*	*4.7*
0 to 7.0 ft.	151	11	162	12
Underlying Soil (7 to 8.5 ft)	*13*	*1.0*	*13*	*1.0*
0 to 8.0 ft.	133	10	142	11
Underlying Soil (8 to 8.5 ft)	*19*	*1.4*	*19*	*1.4*
0 to 8.5 ft.	120	9.0	*134*	*10.1*

Notes:

UCL = Upper Confidence Limit (90% UCL is applicable for waste classificaltion; 95% UCL applicable for risk assessment)

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y = 0.0751 \; x$

TABLE 5c
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Walls 3 and 4 (Borings R3B1, R3B2, and R4B1-B5)

TOTAL LEAD UCLs and MAXIMUMS

	Total Lead (mg/kg) 90% UCL	Total Lead (mg/kg) 95% UCL
0 to 0.5 ft	383.3	405.7
1 to 1.5 ft	155.7	172.1

	Maximum
2 to 2.5 ft	18
3 to 3.5 ft	8.5
4 to 4.5 ft	34
5 to 5.5 ft	5.3
6 to 6.5 ft	23
7 to 7.5 ft	5.4
8 to 8.5 ft	19

EXCAVATION SCENARIOS

	90% UCL/Maximum		95% UCL/Maximum	
Excavation Depth	Total Lead (mg/kg)	Soluble (WET) Lead* (mg/l)	Total Lead (mg/kg)	Soluble (WET) Lead* (mg/l)
0 to 1.0 ft.	383	29	406	30
Underlying Soil (1 to 8.5 ft)	*34*	*2.5*	*36*	*2.7*
0 to 2.0 ft.	270	20.2	289	22
Underlying Soil (2 to 8.5 ft)	*16*	*1.2*	*16*	*1.2*
0 to 3.0 ft.	186	14	199	15
Underlying Soil (3 to 8.5 ft)	*16*	*1.2*	*16*	*1.2*
0 to 4.0 ft.	141	11	151	11
Underlying Soil (4 to 8.5 ft)	*17*	*1.3*	*17*	*1.3*
0 to 5.0 ft.	120	9.0	128	10
Underlying Soil (5 to 8.5 ft)	*13*	*1.0*	*13*	*1.0*
0 to 6.0 ft.	101	7.6	107	8.1
Underlying Soil (6 to 8.5 ft)	*16*	*1.2*	*16*	*1.2*
0 to 7.0 ft.	90	6.7	95	7.2
Underlying Soil (7 to 8.5 ft)	*12*	*0.9*	*12*	*0.9*
0 to 8.0 ft.	79	5.9	84	6.3
Underlying Soil (8 to 8.5 ft)	*19*	*1.4*	*19*	*1.4*
0 to 8.5 ft.	72	5.4	*77*	*5.8*

Notes:

UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
* = Soluble (WET) lead concentrations are predicted using slope of regression line,
where y = predicted soluble (WET) lead and x = total lead.
Regression Line Slope: $y = 0.0751\ x$

TABLE 5d
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Wall 5 (Borings R5B1-B4)

TOTAL LEAD MAXIMUMS

	Total Lead (mg/kg) Maximum
0 to 0.5 ft	600
1 to 1.5 ft	39
2 to 2.5 ft	7.1
3 to 3.5 ft	5.7
4 to 4.5 ft	13
5 to 5.5 ft	6.7
6 to 6.5 ft	12
7 to 7.5 ft	2.5

EXCAVATION SCENARIOS

Excavation Depth	Maximum Total Lead (mg/kg)	Maximum Soluble (WET) Lead* (mg/l)
0 to 1.0 ft.	600	45
Underlying Soil (1 to 8.5 ft)	*12*	*0.9*
0 to 2.0 ft.	320	24
Underlying Soil (2 to 8.5 ft)	*7.8*	*0.6*
0 to 3.0 ft.	215	16
Underlying Soil (3 to 8.5 ft)	*8.0*	*0.6*
0 to 4.0 ft.	163	12
Underlying Soil (4 to 8.5 ft)	*8.6*	*0.6*
0 to 5.0 ft.	133	10
Underlying Soil (5 to 8.5 ft)	*7.1*	*0.5*
0 to 6.0 ft.	112	8.4
Underlying Soil (6 to 8.5 ft)	*7.3*	*0.5*
0 to 7.0 ft.	98	7.3
Underlying Soil (7 to 8.5 ft)	*2.5*	*0.2*
0 to 7.5 ft.	86	6.4

Notes:

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y = 0.0751\ x$

TABLE 5e
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Wall 6 (Borings R6B1 through R6B4)

TOTAL LEAD MAXIMUMS

	Total Lead (mg/kg) Maximum
0 to 0.5 ft	160
1 to 1.5 ft	450
2 to 2.5 ft	56
3 to 3.5 ft	70
4 to 4.5 ft	89
5 to 5.5 ft	5.3
6 to 6.5 ft	12
7 to 7.5 ft	25
8 to 8.5 ft	2.5

EXCAVATION SCENARIOS

	Maximum	
Excavation Depth	**Total Lead (mg/kg)**	**Soluble (WET) Lead* (mg/l)**
0 to 1.0 ft.	160	12
Underlying Soil (1 to 8.5 ft)	*89*	*6.7*
0 to 2.0 ft.	305	23
Underlying Soil (2 to 8.5 ft)	*37*	*2.8*
0 to 3.0 ft.	222	17
Underlying Soil (3 to 8.5 ft)	*34*	*2.6*
0 to 4.0 ft.	184	14
Underlying Soil (4 to 8.5 ft)	*27*	*2.0*
0 to 5.0 ft.	165	12
Underlying Soil (5 to 8.5 ft)	*11*	*0.8*
0 to 6.0 ft.	138	10
Underlying Soil (6 to 8.5 ft)	*13*	*1.0*
0 to 7.0 ft.	120	9.0
Underlying Soil (7 to 8.5 ft)	*14*	*1.0*
0 to 8.0 ft.	108	8.1
Underlying Soil (8 to 8.5 ft)	*2.5*	*0.2*
0 to 8.5 ft.	97	7.3

Notes:

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y = 0.0751 \quad x$

TABLE 5f
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Walls 7, 8 and 9 (Borings R7B1-B4, R8B1, and R9B1-B3)

TOTAL LEAD UCLs and MAXIMUMS

	Total Lead (mg/kg)	
	90% UCL	95% UCL
0 to 0.5 ft	206.5	225.6
1 to 1.5 ft	33.8	36.4
2 to 2.5 ft	47.5	51.5
4 to 4.5 ft	11.4	12.4
5 to 5.5 ft	12.7	13.7
6 to 6.5 ft	52.1	58.0
7 to 7.5 ft	17.1	18.5
8 to 8.5 ft	24.4	27.1

	Maximum
3 to 3.5 ft	23

EXCAVATION SCENARIOS

Excavation Depth	90% UCL/Maximum Total Lead (mg/kg)	90% UCL/Maximum Soluble (WET) Lead* (mg/l)	95% UCL/Maximum Total Lead (mg/kg)	95% UCL/Maximum Soluble (WET) Lead* (mg/l)
0 to 1.0 ft.	207	16	226	17
Underlying Soil (1 to 8.5 ft)	*28*	*2.1*	*30*	*2.3*
0 to 2.0 ft.	120	9.0	131	9.8
Underlying Soil (2 to 8.5 ft)	*27*	*2.0*	*29*	*2.2*
0 to 3.0 ft.	96	7.2	105	7.8
Underlying Soil (3 to 8.5 ft)	*23*	*1.8*	*25*	*1.9*
0 to 4.0 ft.	78	5.8	84	6.3
Underlying Soil (4 to 8.5 ft)	*24*	*1.8*	*26*	*1.9*
0 to 5.0 ft.	64	4.8	70	5.2
Underlying Soil (5 to 8.5 ft)	*27*	*2.0*	*29*	*2.2*
0 to 6.0 ft.	56	4.2	60	4.5
Underlying Soil (6 to 8.5 ft)	*31*	*2.3*	*35*	*2.6*
0 to 7.0 ft.	55	4.2	60	4.5
Underlying Soil (7 to 8.5 ft)	*21*	*1.6*	*23*	*1.7*
0 to 8.0 ft.	50	3.8	55	4.1
Underlying Soil (8 to 8.5 ft)	*24*	*1.8*	*27*	*2.0*
0 to 8.5 ft.	48	3.6	*52*	*3.9*

Notes:
UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
* = Soluble (WET) lead concentrations are predicted using slope of regression line,
where y = predicted soluble (WET) lead and x = total lead.
Regression Line Slope: $y = 0.0751 \quad x$

TABLE 5g
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Wall 10 (Borings R10B1-B4)

TOTAL LEAD MAXIMUMS

	Total Lead (mg/kg) Maximum
0 to 0.5 ft	870
1 to 1.5 ft	200
2 to 2.5 ft	300
3 to 3.5 ft	43
4 to 4.5 ft	6.1
5 to 5.5 ft	3.0
6 to 6.5 ft	7.1
7 to 7.5 ft	9.3
8 to 8.5 ft	6.0

EXCAVATION SCENARIOS

Excavation Depth	Maximum Total Lead (mg/kg)	Maximum Soluble (WET) Lead* (mg/l)
0 to 1.0 ft.	870	65
Underlying Soil (1 to 8.5 ft)	*72*	*5.4*
0 to 2.0 ft.	535	40
Underlying Soil (2 to 8.5 ft)	*54*	*4.0*
0 to 3.0 ft.	457	34
Underlying Soil (3 to 8.5 ft)	*12*	*0.93*
0 to 4.0 ft.	353	27
Underlying Soil (4 to 8.5 ft)	*6.3*	*0.5*
0 to 5.0 ft.	284	21
Underlying Soil (5 to 8.5 ft)	*6.4*	*0.5*
0 to 6.0 ft.	237	18
Underlying Soil (6 to 8.5 ft)	*7.5*	*0.6*
0 to 7.0 ft.	204	15
Underlying Soil (7 to 8.5 ft)	*7.7*	*0.6*
0 to 8.0 ft.	180	14
Underlying Soil (8 to 8.5 ft)	*6.0*	*0.5*
0 to 8.5 ft.	161	12

Notes:

mg/kg = milligrams per kilogram

mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y = 0.0751 \; x$

TABLE 5h
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Walls 11 through 14
(Borings R11B1-B5, R12B1-B2, R13B1, and R14B1)

TOTAL LEAD UCLs and MAXIMUMS

	Total Lead (mg/kg) 90% UCL	95% UCL
0 to 0.5 ft	254.5	268.6
1 to 1.5 ft	62.9	67.7
2 to 2.5 ft	24.2	26.1
3 to 3.5 ft	12.4	13.1
4 to 4.5 ft	14.9	16.2
5 to 5.5 ft	11.4	11.9
6 to 6.5 ft	16.3	17.7
7 to 7.5 ft	15.7	17.3
8 to 8.5 ft	12.7	13.9

EXCAVATION SCENARIOS

Excavation Depth	90% UCL/Maximum Total Lead (mg/kg)	90% UCL/Maximum Soluble (WET) Lead* (mg/l)	95% UCL/Maximum Total Lead (mg/kg)	95% UCL/Maximum Soluble (WET) Lead* (mg/l)
0 to 1.0 ft.	255	19	269	20
Underlying Soil (1 to 8.5 ft)	*21*	*1.6*	*22*	*1.7*
0 to 2.0 ft.	159	11.9	168	13
Underlying Soil (2 to 8.5 ft)	*15*	*1.2*	*16*	*1.2*
0 to 3.0 ft.	114	8.6	121	9.1
Underlying Soil (3 to 8.5 ft)	*14*	*1.0*	*14*	*1.1*
0 to 4.0 ft.	89	6.6	94	7.1
Underlying Soil (4 to 8.5 ft)	*14*	*1.1*	*14*	*1.1*
0 to 5.0 ft.	74	5.5	78	5.9
Underlying Soil (5 to 8.5 ft)	*14*	*1.1*	*14*	*1.1*
0 to 6.0 ft.	63	4.8	67	5.0
Underlying Soil (6 to 8.5 ft)	*15*	*1.1*	*15*	*1.1*
0 to 7.0 ft.	57	4.3	60	4.5
Underlying Soil (7 to 8.5 ft)	*14*	*1.1*	*14*	*1.1*
0 to 8.0 ft.	52	3.9	54	4.1
Underlying Soil (8 to 8.5 ft)	*13*	*1.0*	*13*	*1.0*
0 to 8.5 ft.	47	3.5	*22*	*1.7*

Notes:

UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
* = Soluble (WET) lead concentrations are predicted using slope of regression line,
where y = predicted soluble (WET) lead and x = total lead.
Regression Line Slope: $y = 0.0751x$

TABLE 5i
SUMMARY OF STATISTICAL ANALYSIS
Santa Cruz 17 Guardrail Upgrades
Santa Cruz, CA

Retaining Wall 15 (Borings R15B1-B3)

TOTAL LEAD MAXIMUMS

	Total Lead (mg/kg) Maximum
0 to 0.5 ft	1,000
1 to 1.5 ft	60
2 to 2.5 ft	320
3 to 3.5 ft	73
4 to 4.5 ft	700
5 to 5.5 ft	96
6 to 6.5 ft	11
7 to 7.5 ft	88
8 to 8.5 ft	9.7

EXCAVATION SCENARIOS

	Maximum	
Excavation Depth	**Total Lead (mg/kg)**	**Soluble (WET) Lead* (mg/l)**
0 to 1.0 ft.	1,000	75
Underlying Soil (1 to 8.5 ft)	*170*	*13*
0 to 2.0 ft.	530	40
Underlying Soil (2 to 8.5 ft)	*185*	*14*
0 to 3.0 ft.	460	35
Underlying Soil (3 to 8.5 ft)	*163*	*12*
0 to 4.0 ft.	363	27
Underlying Soil (4 to 8.5 ft)	*181*	*14*
0 to 5.0 ft.	431	32
Underlying Soil (5 to 8.5 ft)	*51.2*	*3.8*
0 to 6.0 ft.	375	28
Underlying Soil (6 to 8.5 ft)	*36.2*	*2.7*
0 to 7.0 ft.	323	24
Underlying Soil (7 to 8.5 ft)	*48.9*	*3.7*
0 to 8.0 ft.	294	22
Underlying Soil (8 to 8.5 ft)	*9.7*	*0.7*
0 to 8.5 ft.	262	20

Notes:

mg/kg = milligrams per kilogram

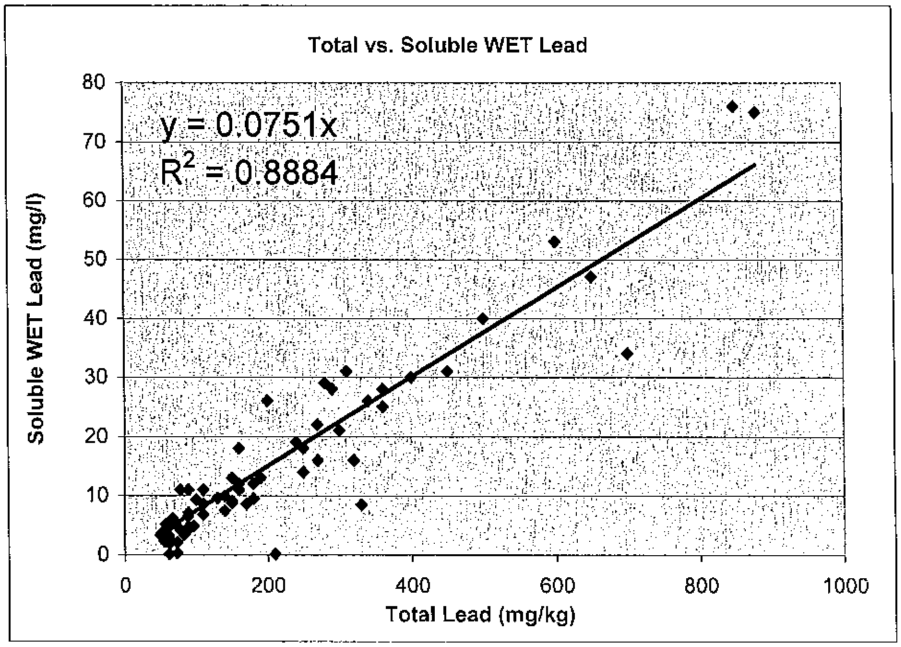
mg/l = milligrams per liter

* = Soluble (WET) lead concentrations are predicted using slope of regression line, where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: $y = 0.0751 \quad x$

APPENDIX B

Sample ID	Total Lead (mg/kg)	WET Lead (mg/l)
R7B2-0	210	0.125
R7B3-8	62	0.125
R9B1-1	73	2.1
R6B1-2	56	2.2
R8B1-0	55	2.3
R7B2-6	57	2.9
R5B1-0	50	3.3
R3B2-1	61	3.3
R7B1-2	83	3.4
R4B5-1	76	4.4
R1B1-1	60	4.8
R2B3-1	57	5.2
R6B1-3	70	5.4
R3B2-0	110	6.8
R4B4-1	330	8.5
R2B1-1	110	8.6
R2B1-0	150	9.1
R9B2-2	100	9.3
R3B1-0	130	9.6
R2B4-1	140	9.9
R6B3-0	160	11
R2B2-1	78	11
R2B5-1	110	11
R6B1-4	89	11
R7B4-0	180	12
R2B1-6	160	12
R4B2-1	190	13
R7B1-6	150	13
R2B3-2	250	14
R2B5-2	270	16
R1B3-1	160	18
R4B5-0	240	19
R5B3-0	270	22
R4B4-0	290	28
R4B2-0	280	29
R4B1-0	400	30
R6B1-1	310	31
R6B4-1	450	31
R7B1-0	500	40
R4B3-0	650	47
R5B4-0	600	53
R2B1-2	880	75
R2B4-2	850	76
R10B1-1	89	7.1
R10B1-2	300	21
R10B2-2	89	4.7
R10B3-1	65	2.3
R10B4-1	200	26
R11B2-0	67	6.1
R11B2-1	88	4.2
R11B3-0	360	28
R11B4-0	54	3.8
R11B5-0	180	9.5
R12B1-0	340	26
R12B2-0	250	18
R13B1-0	150	8.7
R13B1-1	62	1.9
R14B1-0	360	25
R14B1-1	140	7.5
R14B1-2	51	3.6
R15B1-2	320	16
R15B1-7	88	6.5
R15B2-0	160	12
R15B2-3	73	0.27
R15B2-4	700	34
R15B2-5	96	4.9
R15B3-0	170	8.6
R15B3-1	60	4.5

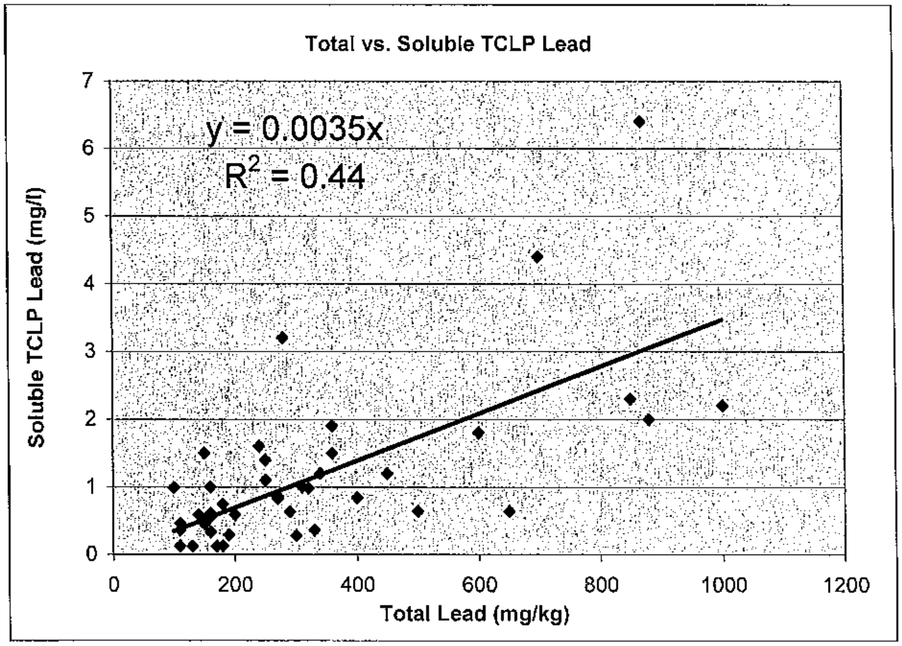


R = 0.943

<u>Not Included</u>

R10B1-0	870	290

Total Lead (mg/kg)	TCLP Lead (mg/l)
300	0.28
190	0.29
160	0.33
110	0.36
330	0.36
150	0.45
110	0.46
150	0.50
160	0.55
140	0.59
200	0.59
140	0.59
160	0.61
290	0.63
650	0.64
500	0.64
180	0.74
270	0.83
400	0.84
270	0.86
320	0.98
100	0.99
310	1.0
160	1.0
250	1.1
450	1.2
340	1.2
250	1.4
150	1.5
360	1.5
240	1.6
600	1.8
360	1.9
880	2.0
1,000	2.2
850	2.3
280	3.2
700	4.4
870	6.4
130	0.125
110	0.125
180	0.125
170	0.125



RW	Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	Total Lead Mean (mg/kg)	Total Lead Maximum (mg/kg)
1	R1B1-0	0	7.7	---	11.9	17
1	R1B2-0	0	17	---		
1	R1B3-0	0	11	---		
1	R1B1-1	1	60	4.8	88	160
1	R1B2-1	1	44	---		
1	R1B3-1	1	160	18		
1	R1B1-2	2	2.5	---	7.3	17
1	R1B2-2	2	2.5	---		
1	R1B3-2	2	17	---		
1	R1B1-3	3	2.5	---	4.4	6.1
1	R1B2-3	3	4.5	---		
1	R1B3-3	3	6.1	---		
1	R1B1-4	4	2.5	---	3.7	6.2
1	R1B2-4	4	6.2	---		
1	R1B3-4	4	2.5	---		
1	R1B1-5	5	2.5	---	2.5	2.5
1	R1B3-5	5	2.5	---		
1	R1B1-6	6	2.5	---	2.5	2.5
1	R1B3-6	6	2.5	---		
1	R1B1-7	7	5.3	---	5.7	6.1
1	R1B3-7	7	6.1	---		
1	R1B1-8	8	5.3	---	3.9	5.3
1	R1B3-8	8	2.5	---		
2	R2B1-0	0	150	9.1	46	150
2	R2B2-0	0	20	---		
2	R2B3-0	0	22	---		
2	R2B4-0	0	13	---		
2	R2B5-0	0	25	---		
2	R2B1-1	1	110	8.6	99	140
2	R2B2-1	1	78	11		
2	R2B3-1	1	57	5.2		
2	R2B4-1	1	140	9.9		
2	R2B5-1	1	110	11		
2	R2B1-2	2	880	75	451	880
2	R2B2-2	2	5.8	---		
2	R2B3-2	2	250	14		
2	R2B4-2	2	850	76		
2	R2B5-2	2	270	16		
2	R2B1-3	3	18	---	8.9	18
2	R2B2-3	3	11	---		
2	R2B3-3	3	7.3	---		
2	R2B4-3	3	5.7	---		
2	R2B5-3	3	2.5	---		
2	R2B1-4	4	5.4	---	4.0	7.1
2	R2B2-4	4	2.5	---		
2	R2B3-4	4	2.5	---		
2	R2B4-4	4	7.1	---		
2	R2B5-4	4	2.5	---		
2	R2B1-5	5	23	---	18.7	40
2	R2B2-5	5	2.5	---		
2	R2B3-5	5	40	---		
2	R2B4-5	5	15	---		
2	R2B5-5	5	13	---		
2	R2B1-6	6	160	12	41.7	160
2	R2B2-6	6	2.5	---		
2	R2B3-6	6	2.5	---		
2	R2B4-6	6	41	---		
2	R2B1-7	7	2.5	---	6.68	7.1
2	R2B2-7	7	2.5	---		
2	R2B3-7	7	5.3	---		
2	R2B4-7	7	7.1	---		
2	R2B1-8	8	16	---	12.5	19
2	R2B2-8	8	2.5	---		
2	R2B4-8	8	19	---		

RW	Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	Total Lead Mean (mg/kg)	Total Lead Maximum (mg/kg)
3	R3B1-0	0	130	9.6	300	650
3	R3B2-0	0	110	6.8		
4	R4B1-0	0	400	30		
4	R4B2-0	0	280	29		
4	R4B3-0	0	650	47		
4	R4B4-0	0	290	28		
4	R4B5-0	0	240	19		
3	R3B1-1	1	29	---	102	330
3	R3B2-1	1	61	3.3		
4	R4B1-1	1	11	---		
4	R4B2-1	1	190	13		
4	R4B3-1	1	19	---		
4	R4B4-1	1	330	8.5		
4	R4B5-1	1	76	4.4		
3	R3B1-2	2	2.5	---	5.7	18
3	R3B2-2	2	2.5	---		
4	R4B1-2	2	5.5	---		
4	R4B2-2	2	2.5	---		
4	R4B3-2	2	2.5	---		
4	R4B4-2	2	18	---		
4	R4B5-2	2	6.6	---		
3	R3B1-3	3	8.5	---	4.6	8.5
3	R3B2-3	3	2.5	---		
4	R4B1-3	3	2.5	---		
4	R4B2-3	3	8.4	---		
4	R4B3-3	3	2.5	---		
4	R4B4-3	3	2.5	---		
4	R4B5-3	3	5.0	---		
3	R3B1-4	4	2.5	---	12	34
3	R3B2-4	4	2.5	---		
4	R4B1-4	4	2.5	---		
4	R4B2-4	4	28	---		
4	R4B3-4	4	6.6	---		
4	R4B4-4	4	7.0	---		
4	R4B5-4	4	34	---		
3	R3B1-5	5	5.2	---	3.3	5.3
3	R3B2-5	5	5.3	---		
4	R4B1-5	5	2.5	---		
4	R4B2-5	5	2.5	---		
4	R4B3-5	5	2.5	---		
4	R4B4-5	5	2.5	---		
4	R4B5-5	5	2.5	---		
3	R3B1-6	6	23	---	6.0	23
3	R3B2-6	6	2.5	---		
4	R4B1-6	6	2.5	---		
4	R4B2-6	6	2.5	---		
4	R4B3-6	6	2.5	---		
4	R4B4-6	6	6.4	---		
4	R4B5-6	6	2.5	---		
3	R3B1-7	7	2.5	---	3.3	5.4
3	R3B2-7	7	5.4	---		
4	R4B1-7	7	2.5	---		
4	R4B2-7	7	2.5	---		
4	R4B3-7	7	2.5	---		
4	R4B4-7	7	2.5	---		
4	R4B5-7	7	5.1	---		
3	R3B1-8	8	2.5	---	7.2	19
3	R3B2-8	8	2.5	---		
4	R4B1-8	8	2.5	---		
4	R4B2-8	8	19	---		
4	R4B3-8	8	14	---		
4	R4B4-8	8	5.0	---		
4	R4B5-8	8	5.2	---		

RW	Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	Total Lead Mean (mg/kg)	Total Lead Maximum (mg/kg)
5	R5B1-0	0	50	3.3	231	600
5	R5B2-0	0	2.5	---		
5	R5B3-0	0	270	22		
5	R5B4-0	0	600	53		
5	R5B1-1	1	2.5	---	15	39
5	R5B2-1	1	5.8	---		
5	R5B3-1	1	39	---		
5	R5B4-1	1	13	---		
5	R5B1-2	2	7.1	---	4.8	7.1
5	R5B2-2	2	2.5	---		
5	R5B3-2	2	7.0	---		
5	R5B4-2	2	2.5	---		
5	R5B1-3	3	2.5	---	3.3	5.7
5	R5B2-3	3	2.5	---		
5	R5B3-3	3	5.7	---		
5	R5B4-3	3	2.5	---		
5	R5B1-4	4	2.5	---	5.1	13
5	R5B2-4	4	2.5	---		
5	R5B3-4	4	13	---		
5	R5B4-4	4	2.5	---		
5	R5B1-5	5	2.5	---	5.9	12
5	R5B3-5	5	2.5	---		
5	R5B4-5	5	6.7	---		
5	R5B1-6	6	12	---	12	12
5	R5B1-7	7	2.5	---	2.5	2.5
6	R6B1-0	0	41	---	55.9	160
6	R6B2-0	0	17	---		
6	R6B3-0	0	160	11		
6	R6B4-0	0	5.5	---		
6	R6B1-1	1	310	31	199	450
6	R6B2-1	1	5.1	---		
6	R6B3-1	1	29	---		
6	R6B4-1	1	450	31		
6	R6B1-2	2	56	2.2	29	56
6	R6B2-2	2	6.7	---		
6	R6B3-2	2	6.1	---		
6	R6B4-2	2	47	---		
6	R6B1-3	3	70	5.4	21.2	70
6	R6B2-3	3	2.5	---		
6	R6B3-3	3	5.9	---		
6	R6B4-3	3	6.5	---		
6	R6B1-4	4	89	11	25.5	89
6	R6B2-4	4	2.5	---		
6	R6B3-4	4	8.0	---		
6	R6B4-4	4	2.5	---		
6	R6B1-5	5	2.5	---	3.2	5.3
6	R6B2-5	5	2.5	---		
6	R6B3-5	5	5.3	---		
6	R6B4-5	5	2.5	---		
6	R6B1-6	6	12	---	4.9	12
6	R6B2-6	6	2.5	---		
6	R6B3-6	6	2.5	---		
6	R6B4-6	6	2.5	---		
6	R6B1-7	7	2.5	---	8.1	25
6	R6B2-7	7	2.5	---		
6	R6B3-7	7	2.5	---		
6	R6B4-7	7	25	---		
6	R6B1-8	8	2.5	---	2.5	2.5
6	R6B2-8	8	2.5	---		

RW	Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	Total Lead Mean (mg/kg)	Total Lead Maximum (mg/kg)
7	R7B1-0	0	500	40	233.8	500
7	R7B2-0	0	210	0.125		
7	R7B3-0	0	45	---		
7	R7B4-0	0	180	12		
8	R8B1-0	0	55	2.3		
9	R9B1-0	0	25	---		
9	R9B2-0	0	34	---		
9	R9B3-0	0	35	---		
7	R7B1-1	1	35	---	24.8	73
7	R7B2-1	1	24	---		
7	R7B3-1	1	14	---		
7	R7B4-1	1	26	---		
8	R8B1-1	1	12	---		
9	R9B1-1	1	73	2.1		
9	R9B2-1	1	4.5	---		
9	R9B3-1	1	2.5	---		
7	R7B1-2	2	83	3.4	30.1	100
7	R7B2-2	2	2.5	---		
7	R7B3-2	2	19	---		
7	R7B4-2	2	16	---		
8	R8B1-2	2	2.5	---		
9	R9B1-2	2	18	---		
9	R9B2-2	2	100	9.3		
9	R9B3-2	2	8.1	---		
7	R7B1-3	3	2.5	---	7.6	23
7	R7B2-3	3	2.5	---		
7	R7B3-3	3	2.5	---		
7	R7B4-3	3	23	---		
8	R8B1-3	3	2.5	---	2.5	
9	R9B1-3	3	11	---	5.3	
9	R9B2-3	3	2.5	---		
9	R9B3-3	3	2.5	---		
7	R7B1-4	4	6.4	---	11.8	31
7	R7B2-4	4	7.2	---		
7	R7B3-4	4	2.5	---		
7	R7B4-4	4	31	---		
8	R8B1-4	4	2.5	---	2.5	
9	R9B1-4	4	2.5	---	2.5	
9	R9B2-4	4	2.5	---		
9	R9B3-4	4	2.5	---		
7	R7B1-5	5	19	---	14.1	24
7	R7B2-5	5	11	---		
7	R7B3-5	5	2.5	---		
7	R7B4-5	5	24	---		
8	R8B1-5	5	2.5	---	2.5	
9	R9B1-5	5	7.9	---	4.3	
9	R9B2-5	5	2.5	---		
9	R9B3-5	5	2.5	---		
7	R7B1-6	6	150	13	58.5	150
7	R7B2-6	6	57	2.9		
7	R7B3-6	6	13	---		
7	R7B4-6	6	14	---		
8	R8B1-6	6	2.5	---		
9	R9B1-6	6	2.5	---		
9	R9B2-6	6	2.5	---		
9	R9B3-6	6	2.5	---		
7	R7B1-7	7	26	---	20.4	37
7	R7B2-7	7	37	---		
7	R7B3-7	7	2.5	---		
7	R7B4-7	7	16	---		
8	R8B1-7	7	2.5	---		
9	R9B1-7	7	2.5	---		
9	R9B2-7	7	2.5	---		
9	R9B3-7	7	2.5	---		

RW	Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	Total Lead Mean (mg/kg)	Total Lead Maximum (mg/kg)
7	R7B1-8	8	15	---	28.4	62
7	R7B2-8	8	31	---		
7	R7B3-8	8	62	0.125		
7	R7B4-8	8	5.6	---		
8	R8B1-8	8	2.5	---		
9	R9B1-8	8	2.5	---		
9	R9B2-8	8	2.5	---		
9	R9B3-8	8	2.5	---		
10	R10B1-0	0	870		237	870
10	R10B2-0	0	22	---		
10	R10B3-0	0	11	---		
10	R10B4-0	0	45	---		
10	R10B1-1	1	89		89.9	200
10	R10B2-1	1	5.7	---		
10	R10B3-1	1	65			
10	R10B4-1	1	200			
10	R10B1-2	2	300		102	300
10	R10B2-2	2	89			
10	R10B3-2	2	5.2	---		
10	R10B4-2	2	12	---		
10	R10B1-3	3	43	---	22.7	43
10	R10B2-3	3	6.3			
10	R10B3-3	3	6.6	---		
10	R10B4-3	3	35	---		
10	R10B1-4	4	2.5	---	4.2	6.1
10	R10B2-4	4	5.6	---		
10	R10B3-4	4	2.5	---		
10	R10B4-4	4	6.1	---		
10	R10B1-5	5	3.0	---	2.6	3.0
10	R10B2-5	5	2.5	---		
10	R10B3-5	5	2.5	---		
10	R10B4-5	5	2.5	---		
10	R10B2-6	6	7.1	---	5.3	7.1
10	R10B3-6	6	2.5	---		
10	R10B4-6	6	6.3	---		
10	R10B2-7	7	9.3	---	5.6	9.3
10	R10B3-7	7	5.1	---		
10	R10B4-7	7	2.5	---		
10	R10B2-8	8	5.1	---	5.4	6.0
10	R10B3-8	8	6.0	---		
10	R10B4-8	8	5.1	---		
11	R11B1-0	0	34	---	139	360
11	R11B2-0	0	67			
11	R11B3-0	0	360			
11	R11B4-0	0	54			
11	R11B5-0	0	180			
12	R12B1-0	0	340			
12	R12B2-0	0	250			
13	R13B1-0	0	150			
14	R14B1-0	0	360			
11	R11B1-1	1	22	---	28.8	140
11	R11B2-1	1	88			
11	R11B3-1	1	18	---		
11	R11B4-1	1	8.3	---		
11	R11B5-1	1	7.8	---		
12	R12B1-1	1	24	---		
12	R12B2-1	1	33	---		
13	R13B1-1	1	62			
14	R14B1-1	1	140			
11	R11B1-2	2	20	---	13.8	51
11	R11B2-2	2	2.5	---		
11	R11B3-2	2	24	---		
11	R11B4-2	2	2.5	---		
11	R11B5-2	2	20	---		
12	R12B1-2	2	17	---		
12	R12B2-2	2	17	---		
13	R13B1-2	2	13	---		
14	R14B1-2	2	51			

RW	Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	Total Lead Mean (mg/kg)	Total Lead Maximum (mg/kg)
11	R11B1-3	3	8.2	---	6.3	19
11	R11B2-3	3	2.5	---		
11	R11B3-3	3	2.5	---		
11	R11B4-3	3	2.5	---		
11	R11B5-3	3	16	---		
12	R12B1-3	3	16	---		
12	R12B2-3	3	19	---		
13	R13B1-3	3	5.2	---		
14	R14B1-3	3	15	---		
11	R11B1-4	4	7.3	---	7.9	34
11	R11B2-4	4	2.5	---		
11	R11B3-4	4	15	---		
11	R11B4-4	4	2.5	---		
11	R11B5-4	4	12	---		
12	R12B1-4	4	12	---		
12	R12B2-4	4	7.0	---		
13	R13B1-4	4	6.7	---		
14	R14B1-4	4	34	---		
11	R11B1-5	5	5.4	---	7.8	17
11	R11B2-5	5	2.5	---		
11	R11B3-5	5	17	---		
11	R11B4-5	5	9.0	---		
11	R11B5-5	5	5.3	---		
12	R12B1-5	5	13	---		
12	R12B2-5	5	10	---		
13	R13B1-5	5	12	---		
14	R14B1-5	5	12	---		
11	R11B1-6	6	6.9	---	8.4	40
11	R11B2-6	6	5.2	---		
11	R11B3-6	6	2.5	---		
11	R11B4-6	6	25	---		
11	R11B5-6	6	2.5	---		
12	R12B1-6	6	40	---		
12	R12B2-6	6	8.6	---		
13	R13B1-6	6	2.5	---		
14	R14B1-6	6	6.1	---		
11	R11B1-7	7	6.8	---	13.7	39
11	R11B2-7	7	39	---		
11	R11B3-7	7	6.3	---		
11	R11B5-7	7	2.5	---		
12	R12B1-7	7	12	---		
12	R12B2-7	7	9.3	---		
13	R13B1-7	7	5.0	---		
14	R14B1-7	7	5.2	---		
11	R11B1-8	8	2.5	---	10.1	26
11	R11B2-8	8	9.2	---		
11	R11B3-8	8	26	---		
11	R11B5-8	8	2.5	---		
12	R12B1-8	8	5.9	---		
13	R12B2-8	8	6.2	---		
13	R13B1-8	8	5.6	---		
14	R14B1-8	8	17	---		

APPENDIX B - LEAD STATISTICS

RW	Sample ID	Sample Depth (ft)	Total Lead (mg/kg)	WET Lead (mg/l)	Total Lead Mean (mg/kg)	Total Lead Maximum (mg/kg)
15	R15B1-0	0	1,000		443	1000
15	R15B2-0	0	160			
15	R15B3-0	0	170			
15	R15B1-1	1	37	---	42.3	60
15	R15B2-1	1	30	---		
15	R15B3-1	1	60			
15	R15B1-2	2	320		128	320
15	R15B2-2	2	37	---		
15	R15B3-2	2	27	---		
15	R15B1-3	3	2.5	---	29.5	73
15	R15B2-3	3	73			
15	R15B3-3	3	13	---		
15	R15B1-4	4	2.5	---	235	700
15	R15B2-4	4	700			
15	R15B3-4	4	2.5	---		
15	R15B1-5	5	2.5	---	38.2	96
15	R15B2-5	5	96			
15	R15B3-5	5	16	---		
15	R15B1-6	6	1.5	---	5.0	11
15	R15B2-6	6	2.5	---		
15	R15B3-6	6	11	---		
15	R15B1-7	7	88		31.9	88
15	R15B2-7	7	2.5	---		
15	R15B3-7	7	5.1	---		
15	R15B1-8	8	2.5	---	5.9	10
15	R15B2-8	8	9.7	---		
15	R15B3-8	8	5.6	---		

b0

Number of Valid Observations	5
Number of Distinct Observations	5
Minimum	13
Maximum	150
Mean	46
Median	22
SD	58.31
Variance	3400
Coefficient of Variation	1.268
Skewness	2.204
Mean of log data	3.376
SD of log data	0.946
90% Standard Bootstrap UCL	76.21
95% Standard Bootstrap UCL	84.66

b1

Number of Valid Observations	5
Number of Distinct Observations	4
Minimum	57
Maximum	140
Mean	99
Median	110
SD	32.12
Variance	1032
Coefficient of Variation	0.324
Skewness	-0.148
Mean of log data	4.548
SD of log data	0.351
90% Standard Bootstrap UCL	115.2
95% Standard Bootstrap UCL	120.4

b2

Number of Valid Observations	5
Number of Distinct Observations	5
Minimum	5.8
Maximum	880
Mean	451.2
Median	270
SD	392
Variance	153652
Coefficient of Variation	0.869
Skewness	0.276
Mean of log data	5.281
SD of log data	2.059
90% Standard Bootstrap UCL	647.8
95% Standard Bootstrap UCL	707.7

b3

Number of Valid Observations	5
Number of Distinct Observations	5
Minimum	2.5
Maximum	18
Mean	8.9
Median	7.3
SD	5.937
Variance	35.25

Coefficient of Variation	0.667
Skewness	0.924
Mean of log data	1.987
SD of log data	0.74
90% Standard Bootstrap UCL	11.89
95% Standard Bootstrap UCL	12.72

c0

Number of Valid Observations	7
Number of Distinct Observations	7
Minimum	110
Maximum	650
Mean	300
Median	280
SD	183.3
Variance	33600
Coefficient of Variation	0.611
Skewness	1.208
Mean of log data	5.546
SD of log data	0.615
90% Standard Bootstrap UCL	383.3
95% Standard Bootstrap UCL	405.7

c1

Number of Valid Observations	7
Number of Distinct Observations	7
Minimum	11
Maximum	330
Mean	102.3
Median	61
SD	117.3
Variance	13764
Coefficient of Variation	1.147
Skewness	1.541
Mean of log data	4.028
SD of log data	1.224
90% Standard Bootstrap UCL	155.7
95% Standard Bootstrap UCL	172.1

f0

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	25
Maximum	500
Mean	135.5
Median	50
SD	163.7
Variance	26811
Coefficient of Variation	1.208
Skewness	1.92
Mean of log data	4.359
SD of log data	1.081
90% Standard Bootstrap UCL	206.5
95% Standard Bootstrap UCL	225.6

f1

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	2.5
Maximum	73
Mean	23.88
Median	19
SD	22.72
Variance	516.1
Coefficient of Variation	0.951
Skewness	1.629
Mean of log data	2.728
SD of log data	1.099
90% Standard Bootstrap UCL	33.76
95% Standard Bootstrap UCL	36.44

f2

Number of Valid Observations	8
Number of Distinct Observations	7
Minimum	2.5
Maximum	100
Mean	31.14
Median	17
SD	38.08
Variance	1450
Coefficient of Variation	1.223
Skewness	1.377
Mean of log data	2.694
SD of log data	1.385
90% Standard Bootstrap UCL	47.47
95% Standard Bootstrap UCL	51.52

f3

Number of Valid Observations	8
Number of Distinct Observations	3
Minimum	2.5
Maximum	23
Mean	6.125
Median	2.5
SD	7.439
Variance	55.34
Coefficient of Variation	1.215
Skewness	2.145
Mean of log data	1.379
SD of log data	0.879

f4

Number of Valid Observations	8
Number of Distinct Observations	4
Minimum	2.5
Maximum	31
Mean	7.138
Median	2.5
SD	9.838
Variance	96.79
Coefficient of Variation	1.378
Skewness	2.618
Mean of log data	1.481
SD of log data	0.91

90% Standard Bootstrap UCL	11.4
95% Standard Bootstrap UCL	12.38

f5

Number of Valid Observations	8
Number of Distinct Observations	5
Minimum	2.5
Maximum	24
Mean	8.988
Median	5.2
SD	8.445
Variance	71.32
Coefficient of Variation	0.94
Skewness	1.044
Mean of log data	1.782
SD of log data	0.983
90% Standard Bootstrap UCL	12.65
95% Standard Bootstrap UCL	13.67

f6

Number of Valid Observations	8
Number of Distinct Observations	5
Minimum	2.5
Maximum	150
Mean	30.5
Median	7.75
SD	51.68
Variance	2671
Coefficient of Variation	1.694
Skewness	2.246
Mean of log data	2.24
SD of log data	1.612
90% Standard Bootstrap UCL	52.11
95% Standard Bootstrap UCL	58.04

f7

Number of Valid Observations	8
Number of Distinct Observations	4
Minimum	2.5
Maximum	37
Mean	11.44
Median	2.5
SD	13.55
Variance	183.7
Coefficient of Variation	1.185
Skewness	1.249
Mean of log data	1.778
SD of log data	1.21
90% Standard Bootstrap UCL	17.1
95% Standard Bootstrap UCL	18.49

f8

Number of Valid Observations	8
Number of Distinct Observations	5
Minimum	2.5

Maximum	62
Mean	15.45
Median	4.05
SD	21.3
Variance	453.8
Coefficient of Variation	1.379
Skewness	1.871
Mean of log data	1.957
SD of log data	1.301
90% Standard Bootstrap UCL	24.39
95% Standard Bootstrap UCL	27.1

h0

Number of Valid Observations	9
Number of Distinct Observations	8
Minimum	34
Maximum	360
Mean	199.4
Median	180
SD	133.6
Variance	17845
Coefficient of Variation	0.67
Skewness	0.076
Mean of log data	5.005
SD of log data	0.894
90% Standard Bootstrap UCL	254.5
95% Standard Bootstrap UCL	268.6

h1

Number of Valid Observations	9
Number of Distinct Observations	9
Minimum	7.8
Maximum	140
Mean	44.79
Median	24
SD	44.35
Variance	1967
Coefficient of Variation	0.99
Skewness	1.489
Mean of log data	3.375
SD of log data	0.996
90% Standard Bootstrap UCL	62.91
95% Standard Bootstrap UCL	67.74

h2

Number of Valid Observations	9
Number of Distinct Observations	6
Minimum	2.5
Maximum	51
Mean	18.56
Median	17
SD	14.31
Variance	204.7
Coefficient of Variation	0.771
Skewness	1.419
Mean of log data	2.574
SD of log data	1.012

90% Standard Bootstrap UCL	24.21
95% Standard Bootstrap UCL	26.09

h3

Number of Valid Observations	9
Number of Distinct Observations	6
Minimum	2.5
Maximum	19
Mean	9.656
Median	8.2
SD	6.819
Variance	46.5
Coefficient of Variation	0.706
Skewness	0.146
Mean of log data	1.967
SD of log data	0.883
90% Standard Bootstrap UCL	12.43
95% Standard Bootstrap UCL	13.12

h4

Number of Valid Observations	9
Number of Distinct Observations	7
Minimum	2.5
Maximum	34
Mean	11
Median	7.3
SD	9.616
Variance	92.46
Coefficient of Variation	0.874
Skewness	1.954
Mean of log data	2.097
SD of log data	0.835
90% Standard Bootstrap UCL	14.9
95% Standard Bootstrap UCL	16.16

h5

Number of Valid Observations	9
Number of Distinct Observations	8
Minimum	2.5
Maximum	17
Mean	9.578
Median	10
SD	4.54
Variance	20.61
Coefficient of Variation	0.474
Skewness	-0.0489
Mean of log data	2.126
SD of log data	0.597
90% Standard Bootstrap UCL	11.43
95% Standard Bootstrap UCL	11.91

h6

Number of Valid Observations	9
Number of Distinct Observations	7
Minimum	2.5
Maximum	40

Mean	11.03
Median	6.1
SD	12.91
Variance	166.7
Coefficient of Variation	1.17
Skewness	1.848
Mean of log data	1.911
SD of log data	0.999
90% Standard Bootstrap UCL	16.29
95% Standard Bootstrap UCL	17.71

h7

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	2.5
Maximum	39
Mean	10.76
Median	6.55
SD	11.77
Variance	138.4
Coefficient of Variation	1.093
Skewness	2.507
Mean of log data	2.039
SD of log data	0.804
90% Standard Bootstrap UCL	15.74
95% Standard Bootstrap UCL	17.25

h8

Number of Valid Observations	8
Number of Distinct Observations	7
Minimum	2.5
Maximum	26
Mean	9.363
Median	6.05
SD	8.155
Variance	66.5
Coefficient of Variation	0.871
Skewness	1.503
Mean of log data	1.933
SD of log data	0.828
90% Standard Bootstrap UCL	12.73
95% Standard Bootstrap UCL	13.92

APPENDIX B - ARSENIC, CADMIUM AND VANADIUM STATISTICS

Sample ID	Sample Depth (ft)	Arsenic	Cadmium	Vanadium
R10B1-5	5	0.5	0.5	2.8
R11B3-5	5	1.4	0.5	4.7
R15-B1-6	6	0.5	0.5	2.7
R1B2-3	3	4.7	0.5	26
R2B4-2	2	2.5	2.0	28
R4B3-4	4	4.7	4.7	18
R5B4-5	5	1.4	0.5	13
R6B3-8	8	1.6	0.5	52
R7B1-0	0	3.5	0.5	24
R9B2-1	1	4.7	0.5	36
	Minimum	0.5	0.5	2.7
	Maximum	4.7	4.7	52
	Mean	2.6	1.1	20.7
	ESLs			
Shallow Soils (≤3 m bgs)				
Residential Land Use		0.39	1.7	16
Comm/Ind Land Use		1.6	7.4	200

Notes:

One half the detection limit value was used to calculate the mean.

Values are shown in units of milligrams per kilogram

APPENDIX C

APPENDIX C

Roadway Excavation - Hazardous Waste Classification
SR17 Retaining Walls

RW:	1	2	3, 4	5	6	7, 8, 9	10	11, 12, 13, 14	15
0 to 1	17	76	383	600	160	206	870	254	1000
1 to 2	160	115	156	39	450	34	200	63	60
2 to 3	17	648	18	7.1	56	47	300	24	320
3 to 4	6.1	12	8.5	5.7	70	23	43	12	73
4 to 5	6.2	7.1	34	13	89	11	6.1	15	700
5 to 6	2.5	40	5.3	6.7	5.3	13	3.0	11	96
6 to 7	2.5	160	23	12	12	52	7.1	16	11
7 to 8	6.1	7.1	5.4	2.5	25	17	*7.1*	16	88
8 to 9	5.3	19	19		2.5	24	6.0	13	9.7

California Hazardous

Non-Hazardous

APPENDIX C

Structural Excavation Depths to Achieve Non-Hazardous Waste Classification
SR17 Retaining Walls

RW:	1	2	3, 4	5	6	7, 8, 9	10	11, 12, 13, 14	15
0 to 1	17	76	383	600	160	206	870	254	1000
1 to 2	160	115	156	39	450	34	200	63	60
2 to 3	17	648	18	7.1	56	47	300	24	320
3 to 4	6.1	12	8.5	5.7	70	23	43	12	73
4 to 5	6.2	7.1	34	13	89	11	6.1	15	700
5 to 6	2.5	40	5.3	6.7	5.3	13	3.0	11	96
6 to 7	2.5	160	23	12	12	52	7.1	16	11
7 to 8	6.1	7.1	5.4	2.5	25	17	7.1	16	88
8 to 9	5.3	19	19	2.5	2.5	24	6.0	13	9.7
9 to 10		*19*	*19*	*2.5*	*2.5*		*6.0*		*9.7*
10 to 11		*19*	*19*	*2.5*	*2.5*		*6.0*		*9.7*
11 to 12		*19*			*2.5*		*6.0*		*9.7*
12 to 13		*19*			*2.5*		*6.0*		*9.7*
13 to 14		*19*			*2.5*		*6.0*		*9.7*
14 to 15		*19*					*6.0*		*9.7*
15 to 16		*19*					*6.0*		*9.7*
16 to 17		*19*					*6.0*		*9.7*
17 to 18		*19*					*6.0*		*9.7*
18 to 19		*19*					*6.0*		*9.7*
19 to 20		*19*					*6.0*		*9.7*
20 to 21							*6.0*		*9.7*
21 to 22							*6.0*		*9.7*
22 to 23							*6.0*		*9.7*
23 to 24									*9.7*
24 to 25									*9.7*
25 to 26									*9.7*
26 to 27									*9.7*
27 to 28									*9.7*
28 to 29									*9.7*
29 to 30									*9.7*
30 to 31									*9.7*
31 to 32									*9.7*
32 to 33									*9.7*
33 to 34									*9.7*
34 to 35									*9.7*
35 to 36									*9.7*
36 to 37									*9.7*
37 to 38									*9.7*
38 to 39									*9.7*
39 to 40									*9.7*

APPENDIX C

Summary of ADL Hazardous Waste Classifications
SR17 Retaining Walls

RW	Location	Finding
1	NB PM 6.04-6.13	Top 2' is hazardous Underlying (>2') is non-hazardous - or - Non-hazardous if excavations are 3' or greater
2	NB PM 6.14-6.26	Top 3' is hazardous Underlying (>3') is non-hazardous - or - Non-hazardous if excavations are 20' or greater
3 4	SB PM 6.85-6.94 SB PM 7.32-7.44	Top 2' is hazardous Underlying (>2') is non-hazardous - or - Non-hazardous if excavations are 11' or greater
5	NB PM 8.73-8.81	Top 1' is hazardous Underlying (>1') is non-hazardous - or - Non-hazardous if excavations are 11' or greater
6	NB PM 8.9-9.1	Top 2' is hazardous Underlying (>2') is non-hazardous - or - Non-hazardous if excavations are 14' or greater
7, 8 9	SB PM 9.11-9.26 SB PM 9.7-9.9	Top 1' is hazardous Underlying (>1') is non-hazardous - or - Non-hazardous if excavations are 5' or greater
10	NB PM 10.54-10.82	Top 3' is hazardous Underlying (>3') is non-hazardous - or - Non-hazardous if excavations are 23' or greater
11 12, 13, 14	NB PM 10.54-10.82 NB PM 10.92-10.97	Top 1' is hazardous Underlying (>1') is non-hazardous - or - Non-hazardous if excavations are 6' or greater
15	NB PM 11.23-11.29	Top 6' is hazardous Underlying (>6') is non-hazardous - or - Non-hazardous if excavations are 40' or greater

INFORMATION HANDOUT

FOR

Quickchange Moveable Barrier

***

Crash Cushion Absorb 350

***

SafeGuard Link System

FOR CONSTRUCTION ON STATE HIGHWAY

IN SANTA CRUZ COUNTY
IN AND NEAR SCOTTS VALLEY AT VARIOUS LOCATIONS
FROM SANTA'S VILLAGE ROAD TO
THE SANTA CRUZ / SANTA CLARA COUNTY LINE

DISTRICT 05, ROUTE 17

CONTRACT NO. 05-0L70U1

05-SCr-17-6.0/12.6

Product Description:

SafeGuard Link System

The SafeGuard® Link System is designed for construction zones where safety and barrier portability are paramount. The freestanding barriers come in 28 ft (8.5 m) sections and can be quickly interlocked to form a 200' to 300' portable barrier wall in about 30 minutes. This portable, crashworthy barrier can be moved and reconfigured as staging progresses, with controlled access for vehicles and equipment.

The ABSORB 350

ABSORB 350 is a non-redirective, gating crash cushion that offers maintenance workers and contractors a reliable and easy method to protect the ends of concrete barriers. At two feet wide, it is ideally suited for narrow areas where road and workspace are limited. The ABSORB 350 is easier to restore after an impact than other non-redirective, gating crash cushions.

Quickchange Moveable Barrier

The QMB system is designed to create a positive traffic barrier between opposing lanes of traffic and between motorists and construction work areas. The Barrier Transfer Machine (BTM) laterally transfers the barrier wall, one lane or more, at speeds of up to 7 mph (11 km/h). This allows the roadway to be reconfigured to maximize the number of traffic lanes in the peak traffic direction and to make the road system operate more efficiently. The Reactive Tension System Quickchange® Moveable Barrier (RTS-QMB) is used in both permanent and construction applications. RTS-QMB creates managed lanes that cost effectively increase highway capacity and reduce congestion by making more efficient use of new or existing roadways. These applications include high volume highways were additional right-of-way may not be available, where environmental concerns may exist, or where the lack of funding may slow or inhibit support for new construction. Moveable barrier provides a "fast-build" solution for improving highway capacity without having to wait for time consuming study reviews. For construction applications, RTS-QMB is designed to accelerate construction, improve traffic flow and safeguard work crews and motorists by positively separating the work area and traffic. RTS-QMB reduces work zone congestion by enabling more lanes to be open during peak hour traffic. The work zone can be expanded during off peak periods, providing greater access for work crews which speeds construction.

Quotations (for estimating purpose only) :

	3 Mo.	6 Mo.	9 Mo.	1 Year
ArmorGuard (Safeguard Link System)	$30,000	$ 60,000	$ 90,000	$120,000
Construction Barrier Transfer Machine		$147,000	$167,200	$187,000
Construction Quickchange Moveable Barrier		$42 per foot	$48 per foot	$55 per foot

	TL-2	TL-3
Absorb-350 Crash Cushion sale cost	$5,000	$7,400

Absorb-350 Crash Cushion rental cost: Contact Statewide Safety
522 Inga Road
Nipomo, CA 93444
800-559-7080

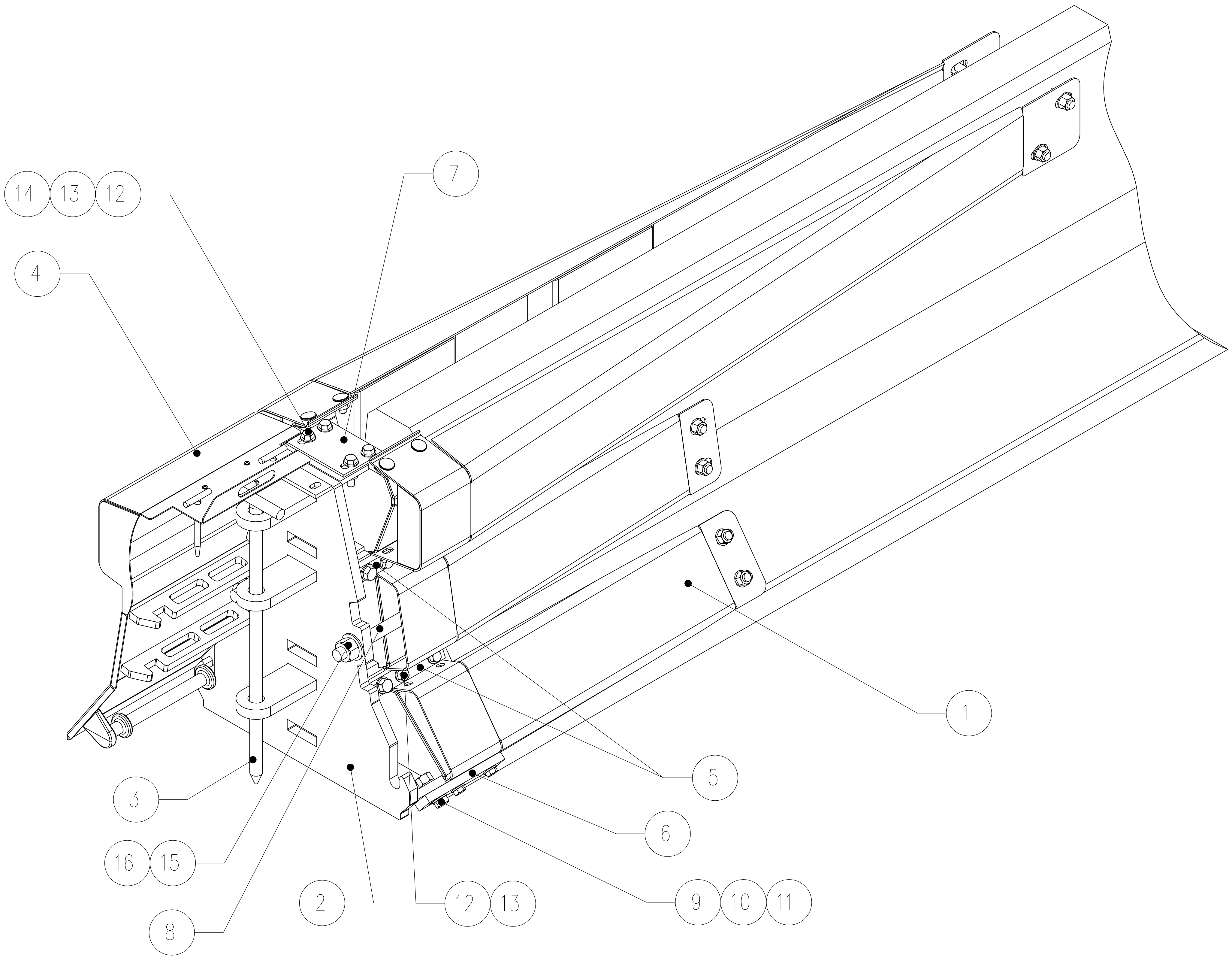
Quotation provided by:

Byron F. West Jr.
Western States Regional Manager
Office: 541-899-0888
Fax: 541-899-0999
Mobile: 209-483-3049

Corporate Office Contact Info

BARRIER SYSTEMS INC

Barrier Systems
3333 Vaca Valley Pkwy
Vacaville, CA 95688
Phone: (707) 374-6800
Fax.: (707) 374-6801
Email: info@barriersystemsinc.com



ITEM	QTY / DWG	PART DESCRIPTION	SPECIFICATION	DWG #
1	1	TRANSITION	NA	B021002
2	1	STATIONARY SIDE HINGE	NA	C010206
3	1	MASTER PIN	NA	A021116
4	1	HINGE COVER ASSY, STEEL, SAFEGUARD	NA	B040647
5	4	HINGE MOUNT STRAP	NA	B020514
6	2	HINGE MOUNT STRAP, LOWER	NA	B020515
7	1	SHEAR PLATE	NA	B011229
8	2	THREADED CONNECTING ROD	NA	B020226
9	6	HEX BOLT	3/4"-10 HX HD X 2 1/2", A325, GALV.	2001398
10	6	HEX NUT	3/4"-10, GR2, GALV.	2001399
11	12	FLAT WASHER	3/4" FLAT RD, GALV.	2001380
12	12	HEX BOLT	5/8"-11 HX HD X 2.0", GR2, GALV.	2001205
13	16	FLAT WASHER	5/8" FLAT RD, GALV.	2000118
14	4	HEX NUT, 5/8"	5/8-11, GR2, GALV	2000134
15	4	HEX NUT	1 1/8" UNC, OVERSIZED , GR2,	2001404
16	4	WASHER	1 1/8" FLAT ROUND, GALV.	2001405

REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
	SEE ECO #			1	NA	1

SCALE: 1:10

	DATE	INIT.
DRAWN BY	06/20/03	GAD
		JSM

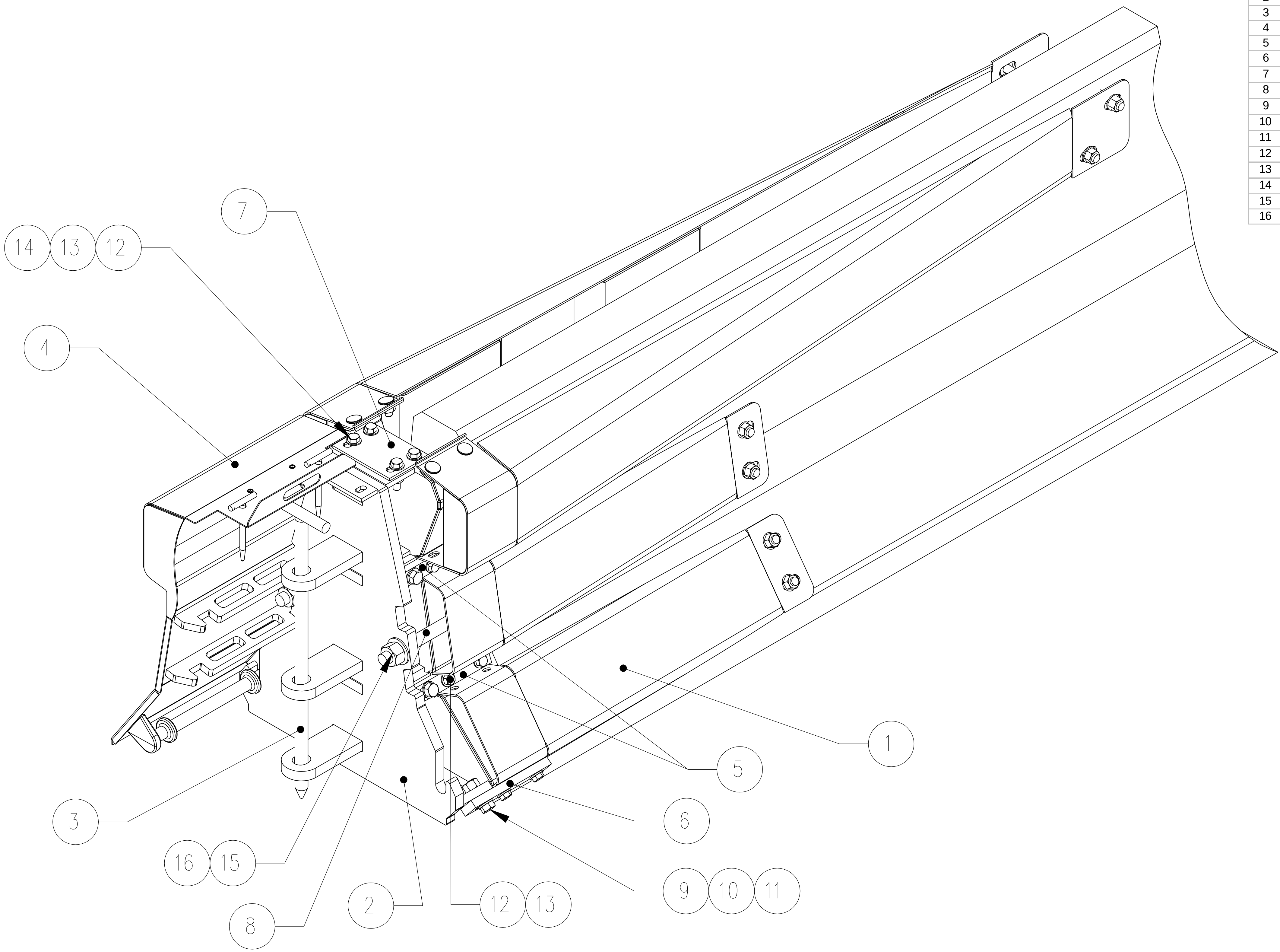
Standard Tolerance
Angular +/- 1/2 Deg.
Fractional +/- 1/16
Dec. XXX= +/- .010
Dec. .XX= +/- .030

TITLE: SAFEGUARD LINK TRANSITION TO NEW JERSEY SHAPED P.C.B. ASSEBMLY, STATIONARY SIDE

MODEL	DRAWING NUMBER	REV
	B030658	A

B030658.DXF 5/20/2009 10:07:37 AM

ITEM	QTY / DWG	PART DESCRIPTION	SPECIFICATION	DWG #
1	1	TRANSITION	NA	B021002
2	1	GATE SIDE HINGE	NA	C010207
3	1	MASTER PIN	NA	A021116
4	1	HINGE COVER ASSY, STEEL, SAFEGAURD	NA	B040647
5	4	HINGE MOUNT STRAP	NA	B020514
6	2	HINGE MOUNT STRAP, LOWER	NA	B020515
7	1	SHEAR PLATE	NA	B011229
8	2	THREADED CONNECTING ROD	NA	B020226
9	6	HEX BOLT	3/4"-10 HX HD X 2 1/2", A325, GALV.	2001398
10	6	HEX NUT	3/4"-10, GR2, GALV.	2001399
11	12	FLAT WASHER	3/4" FLAT RD, GALV.	2001380
12	12	HEX BOLT	5/8"-11 HX HD X 2.0", GR2, GALV.	2001205
13	16	FLAT WASHER	5/8" FLAT RD, GALV.	2000118
14	4	HEX NUT, 5/8"	5/8-11, GR2, GALV	2000134
15	4	HEX NUT	1 1/8" UNC, OVERSIZED , GR2,	2001404
16	4	WASHER	1 1/8" FLAT ROUND, GALV.	2001405



REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
	SEE ECO #			1	NA	1

SCALE: 1:10

	DATE	INIT.
DRAWN BY	06/20/03	GAD
		JSM

Standard Tolerance
Angular +/- 1/2 Deg.
Fractional +/- 1/16
Dec. .XXX= +/- .010
Dec. .XX= +/- .030

TITLE: SAFEGUARD LINK TRANSITION TO NEW JERSEY SHAPED P.C.B. ASSEMBLY, GATE SIDE

MODEL	DRAWING NUMBER	REV
	B030659	A