MATERIALS REPORT

SR 32 Widening Project

03-But-32
From SR 99 to Yosemite Drive
MP 10.14/12.65
EA: 1E-4900

Prepared by:

BLACKBURN CONSULTING
11521 Blocker Drive, Suite 110
Auburn, CA 95603
(530) 887-1494

October 29, 2010

Prepared for:

Mark Thomas & Company, Inc.
7300 Folsom Boulevard, Suite 203
Sacramento, CA 95826

Auburn Office:
11521 Blocker Drive, Suite 110 ▪ Auburn, CA 95603
(530) 887-1494 ▪ Fax (530) 887-1495

blackburn consulting

Modesto Office: (209) 522-6273
West Sacramento Office: (916) 375-8706

Geotechnical ▪ Construction Services ▪ Forensics

File No. 1202.3
October 29, 2010

Mr. Matt Brogan
Mark Thomas & Company, Inc.
7300 Folsom Boulevard, Suite 203
Sacramento, CA 95826

Subject: **MATERIALS REPORT**
SR 32 Widening Project, 03-But-32
SR 99 to Yosemite Drive, MP 10.14/12.65
EA: 1E-4900
Chico, California

Dear Mr. Brogan,

Blackburn Consulting (BCI) is pleased to submit this Materials Report for the SR 32 Widening Project in Chico, California. BCI prepared this report in accordance with our June 5, 2009 agreement. This report contains our laboratory test results, conclusions and recommendations regarding culvert design and structural pavement sections for the new widening segment.

Thank you for selecting BCI to be on your design team. Please call if you have questions or require additional information.

Sincerely;

BLACKBURN CONSULTING,

Robert Pickard, C.E.G.
Project Engineering Geologist

Rick Sowers, P.E.
Principal

MATERIALS REPORT
SR 32 Widening Project, 03-But-32
SR 99 to Yosemite Drive, MP 10.14/12.65
EA: 1E-4900
Chico, California

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Scope of Services

To prepare this report, BCI:

- Reviewed preliminary project plans provided by Mark Thomas & Company, Inc. (MTCo).
- Observed and logged the subsurface conditions in nine exploratory borings for the Materials Report.
- Performed R-value and soil corrosivity and density tests on samples obtained from the exploratory borings.
- Performed engineering analysis and calculations to support the conclusions in this report.

Further sampling and testing was conducted to provide project earthwork and bridge foundation recommendations. These are contained in the Geotechnical Design Report (GDR) and the Dead Horse Slough Bridge Foundation Report, submitted separately.

1.2 Project Description

The project will widen about 2.5 miles of State Route 32, located in Chico, California. The project begins at the SR99/SR32 interchange (PM 10.14, approximate Station 92) and extends east along SR32 to about 1,400 ft east of Yosemite Drive (PM 12.65, approximate Station 224). We show the project area on Figure 1.

The City proposes to widen a section of SR32 from two lanes to four lanes primarily on the north side, with local shoulder widening along the south side. Improvement plans include widening the north and south-bound off-ramps from SR99 from 2-lanes to 3-lanes. The existing 2-lane section of SR32 beneath the SR99 overpass will be modified and re-striped to accommodate 3-lanes of traffic. MTCo indicates the design Traffic Indices for this project range from 5.0-8.0 along side streets adjacent to SR 32, to 10.0 along the SR32 mainline, and 12.5 at the SR99 off-ramps.

New roadway grades will generally match existing, with cuts and fills at less than 5 ft in height. Sources for project borrow have not been identified. We assume that new roadway fill will be similar to the native materials, however, these must be tested for acceptable R-value and soil corrosivity prior to site use.

The existing SR 32 roadway will be rehabilitated based on deflection studies by others. The project also includes approximately 7,000 lf of new soundwall; recommendations for these walls are included in the project GDR.

Extensions of existing culverts are proposed at the locations listed in Table 1.

Table 1: Planned Culvert Extension Locations

Culvert Station Location (Approximate Station)	**Culvert Size and Type**
129+32	24" CMP
152+86	24" CMP
157+50	24" CMP
161+25	30" CMP
177+30	6'x8' RCB
183+60	36" CMP

The culvert extensions will be constructed within shallow native soils and/or within engineered embankment fill.

2 LABORATORY TESTING

BCI obtained soil samples within the upper five feet from ground surface at selected locations throughout the project. Refer to Figure 2 for the boring locations and Appendix A for the detailed boring logs. The laboratory test reports are included in Appendix B.

2.1 Resistance Value (R-value) Test Results

Table 2 summarizes our R-value test results.

Table 2: R-value Test Results (CTM 301)

Sample Location	**Sample Depth (feet)**	**Soil Description**	**R-value**
A-10-B3	1-5	Lean Clay	22
A-10-B11	0.5-5	Lean Clay	27
A-10-B16	0-5	Lean Clay	22
A-10-B18	0-4	Silty Gravel with Cobbles	29
A-10-B22	1-5	Sandy Silt with Cobbles	19
A-10-B26	1-4.5	Silt with Sand	27

2.2 Soil Corrosion Test Results

Table 3 summarizes our soil corrosion test results.

Table 3: Corrosion Test Results (CTM 417, 422, 643)

Boring/Sample	Description	pH	Min. Resistivity (ohm-cm)	Sulfate (ppm)	Chloride (ppm)
A-10-B8, Bag J	Lean Clay with Sand	7.0	3750	18.4	5.9
A-10-B14, Bag M	Lean Clay with Gravel	6.1	8310	0.4	10.7
A-10-B24, Bag C	Sandy Silt with Cobbles	6.8	4290	4.9	6.7

3 GEOLOGIC AND SOIL SURVEY MAPPING

3.1 Geologic Setting

Geologic mapping by Helly and Harwood[1] shows the western half of the project (from SR99 to just east of El Monte Avenue) to be underlain by sediments of the Pleistocene-age Modesto formation, which is comprised primarily of alluvial sand, silt and clay. Older Pleistocene age sediments of the Red Bluff formation, including coarse red gravels, are mapped from about El Monte Avenue to Bruce Road. East of Bruce Road to the end of the project, bedrock of the Tuscan formation is mapped and is comprised of Pliocene age volcanic mudflows (lahars) with interbedded volcanic conglomerate and sandstone. We present a Geologic Map as Figure 3.

3.2 Soil Survey

BCI reviewed the United States Department of Agriculture's "Soil Survey of Butte County" issued October, 1992. Table 4 shows the soil units mapped within the limits of this project.

Table 4: Soil Survey Units

Soil Name	Soil Unit No. & Description	General Location within Project Limits
Vina Fine Sandy Loam	425 Sandy loam	SR99 and SR32 Interchange area
Almendra Loam	418 Sandy loam	East of SR99 to El Monte Ave.
Redtough-Redswale Complex	302 Gravelly and cobbly loam	El Monte Ave. to Bruce Rd.
Doemill-Jokerst Complex	615 Gravelly/Cobbly loam and bedrock	Bruce Rd. to east end of project

[1] Helley, E.J. and Harwood, D.S., 1985, *Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley*, U.S. Geological Survey, Map MF-1790.

Figure 4 shows the approximate soil boundaries within the project area. Soil Engineering Properties, as described in the Soil Survey, are included with Appendix B.

4 STRUCTURAL PAVEMENT SECTIONS

4.1 Pavement Section Recommendations

The results of the R-value tests range from 19 to 29. We recommend a design R-value of 19 for new pavement structural sections. Table 5 presents the recommended pavement sections for Traffic Indices (TI) ranging from 5.0 to 12.5, with basement R-value of 19, in accordance with Caltrans Flexible Pavement Design Methods (Highway Design Manual, Chapter 600).

Table 5: New Flexible Pavement Sections (R-value = 19)

Pavement Section	TI					
	5.0	**6.0**	**7.0**	**8.0**	**10.5**	**12.5**
HMA-A (ft)	0.25	0.30	0.35	0.40	0.55	0.65
AB (ft)	0.60	0.80	1.00	1.15	1.60	1.95
Full Depth AC (ft)	0.55	0.65	0.80	0.90	1.25	1.50

Our pavement section calculations are included in Appendix C. Subgrade preparation and compaction recommendations are presented in the GDR. Any import fill material should have a minimum R-value of 19 for use of these sections.

4.2 Pavement Materials

Hot Mix Asphalt (HMA) shall be Type A, ¾-inch maximum and conform to the provision of Caltrans Standard Specifications, Section 39.

Open Graded Friction Course (OGFC) shall be 3/8-inch maximum and conform to the provision of Caltrans Standard Specifications, Section 39.

Asphaltic Emulsion (Paint Binder) shall conform to the provisions of Caltrans Standard Specifications, Sections 39-4.02 and 94.

Aggregate Base (AB) shall be Caltrans Class 2, ¾-inch maximum grading and shall conform to provisions in Section 26 of the Caltrans Standard Specifications.

5 CULVERT CORROSION

For structural elements, Caltrans[2] considers a site corrosive if one or more of the following conditions exist for the representative soil and/or water samples taken at a site:

- Chloride concentration is 500 parts per million (ppm) or greater,
- Sulfate concentration is 2000 ppm or greater,
- pH is 5.5 or less.

The maximum chloride and sulfate concentrations we obtained range from 0.4 to 18 ppm. The minimum pH we measured is 6.1, and the minimum resistivity is 3,750 ohm-cm. Based on our testing, the site soils are considered non-corrosive.

In accordance with the Caltrans Highway Design Manual (2009), we provide the approximate life of a 0.052 inch thick (18 gage) corrugated steel pipe (CSP), in years, for each sample location in Table 6 below.

Table 6: Life of 18 Gage (0.052 inch) CSP - CTM 643

Boring/ Test Location	Sample No.	Sample/ Test Depth (feet)	PH	Resistivity (ohm-cm)	Approx. Years to Perforation
A-10-B8	Bag J	1-5	7.0	3,750	25
A-10-B14	Bag M	0-5	6.1	8,310	22
A-10-B24	Bag C	1-5	6.8	4,290	23

Based on Figure 855.3A from the Caltrans Highway Design Manual for a 50-year service life with respect to soil corrosivity, the recommended thickness of CSP is 0.138 inch (10 Gage) for Galvanized Steel metal. 16-gage aluminum pipes or aluminized steel pipes are acceptable alternatives.

Based on our pH, sulfate and chloride testing, and Table 855.4A of the CHDM, there are no restrictions on cementious materials with respect to soil corrosivity. However, water content restrictions do apply; use a maximum water-to-cementious material ratio of 0.45.

The above minimum thicknesses do not take pipe abrasion resistance and overfill height into consideration. We provide culvert foundation and backfill recommendations in our Geotechnical Design Report for the project.

[2] Caltrans Corrosion Guidelines, Version 1.0, September 2003

6 LIMITATIONS

BCI performed services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. Where referenced, we used ASTM or Caltrans standards as a general (not strict) *guideline* only. We do not warranty our services.

BCI based this report on the current site conditions. We assume the soil and ground water conditions encountered in our borings are representative of the subsurface conditions across the site. Actual conditions between our borings could be different.

Our scope did not include evaluation of on-site hazardous material, flood potential, or biological pollutants. Please contact BCI if you would like an evaluation of one or more of these issues.

Modern designs and construction are complex, with many regulatory sources/restrictions, involved parties, construction alternatives, etc. It is common to experience changes and delays. The owner should set aside a reasonable contingency fund based on complexities and cost estimates to cover changes and delays.

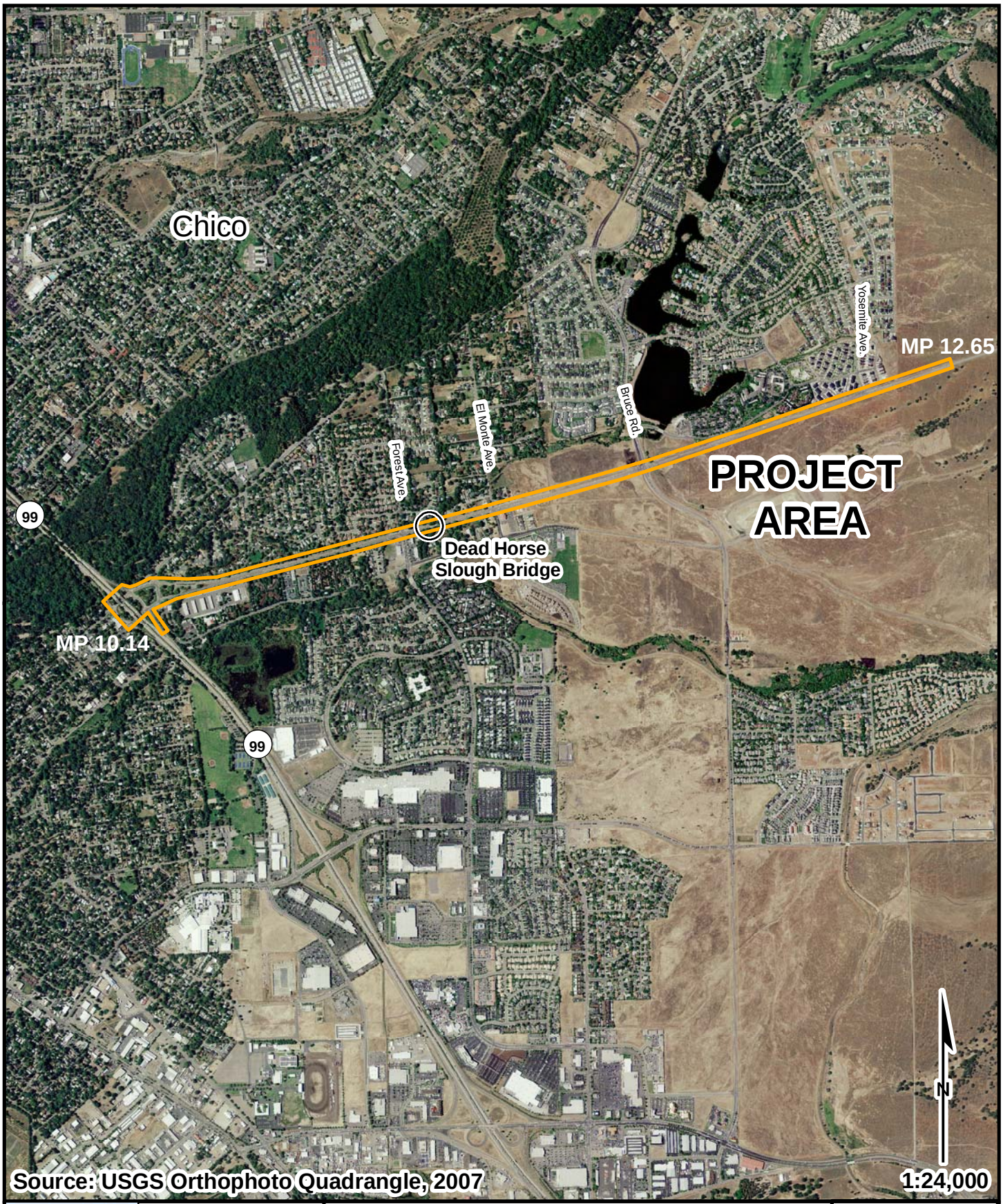
FIGURES

Figure 1: Vicinity Map

Figure 2: Boring Location Map (9 Sheets)

Figure 3: Geologic Map

Figure 4: Soil Survey Map



blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495-Fax
www.blackburnconsulting.com

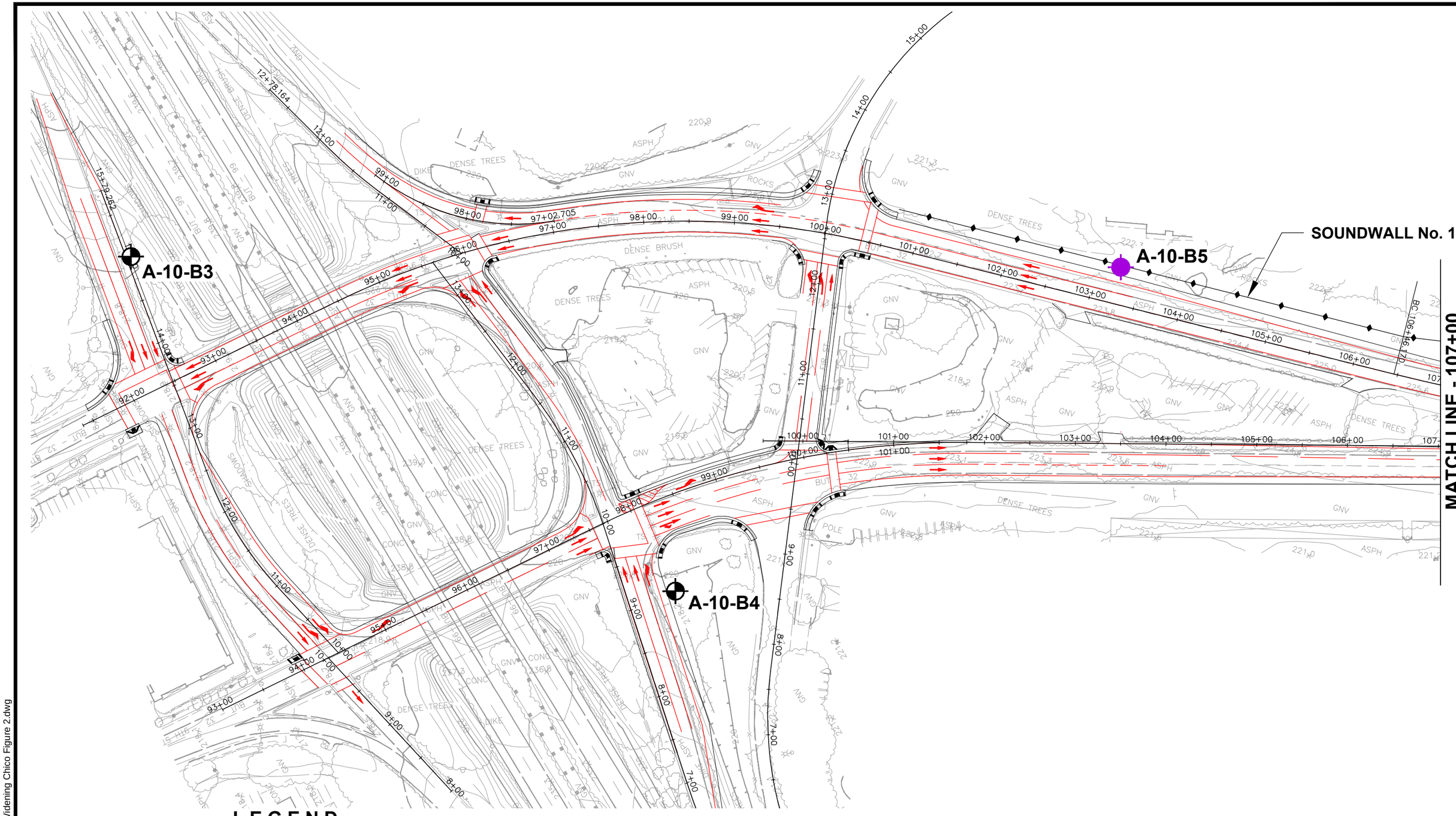
VICINITY MAP

SR 32 Widening Project, 03-But-32
SR 99 to Yosemite Drive, MP 10.14/12.65
Chico, California

File No. 1202.3

October 2010

Figure 1



LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

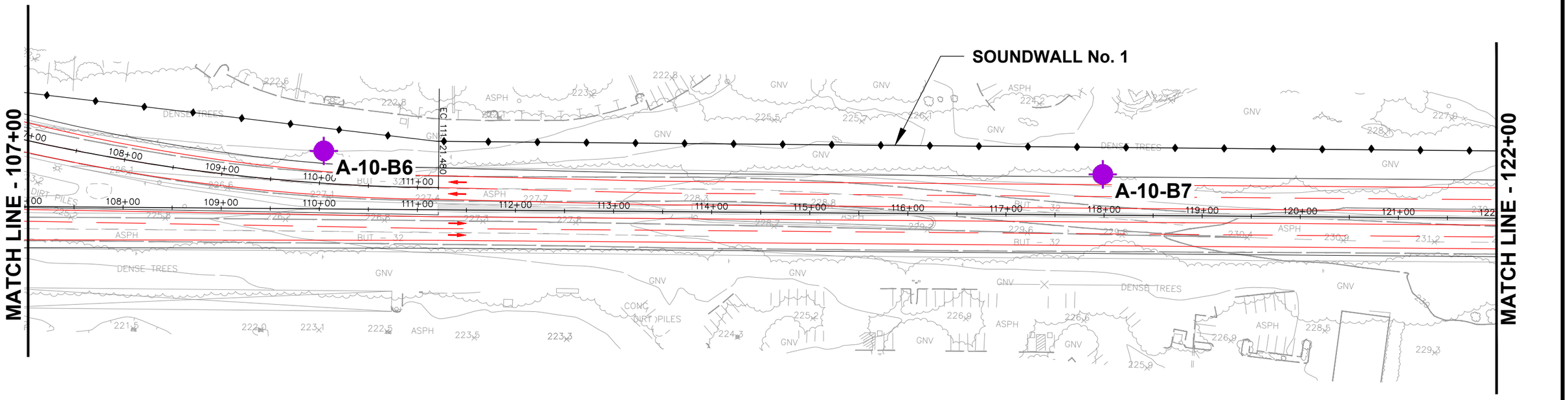
SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 1 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg



LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

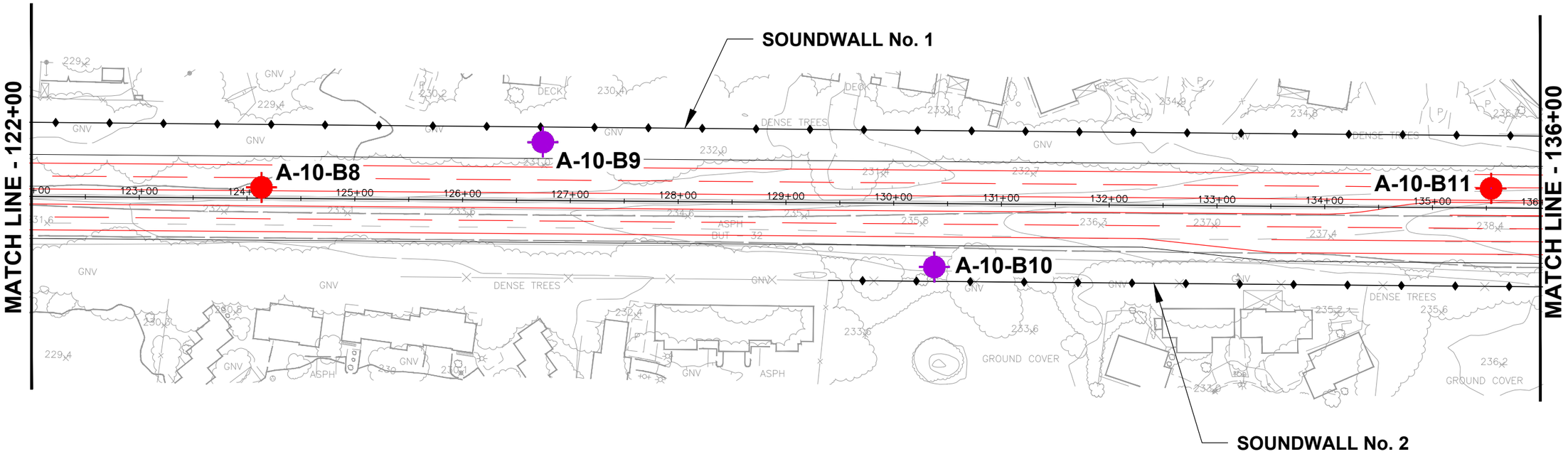
SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 2 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg



LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

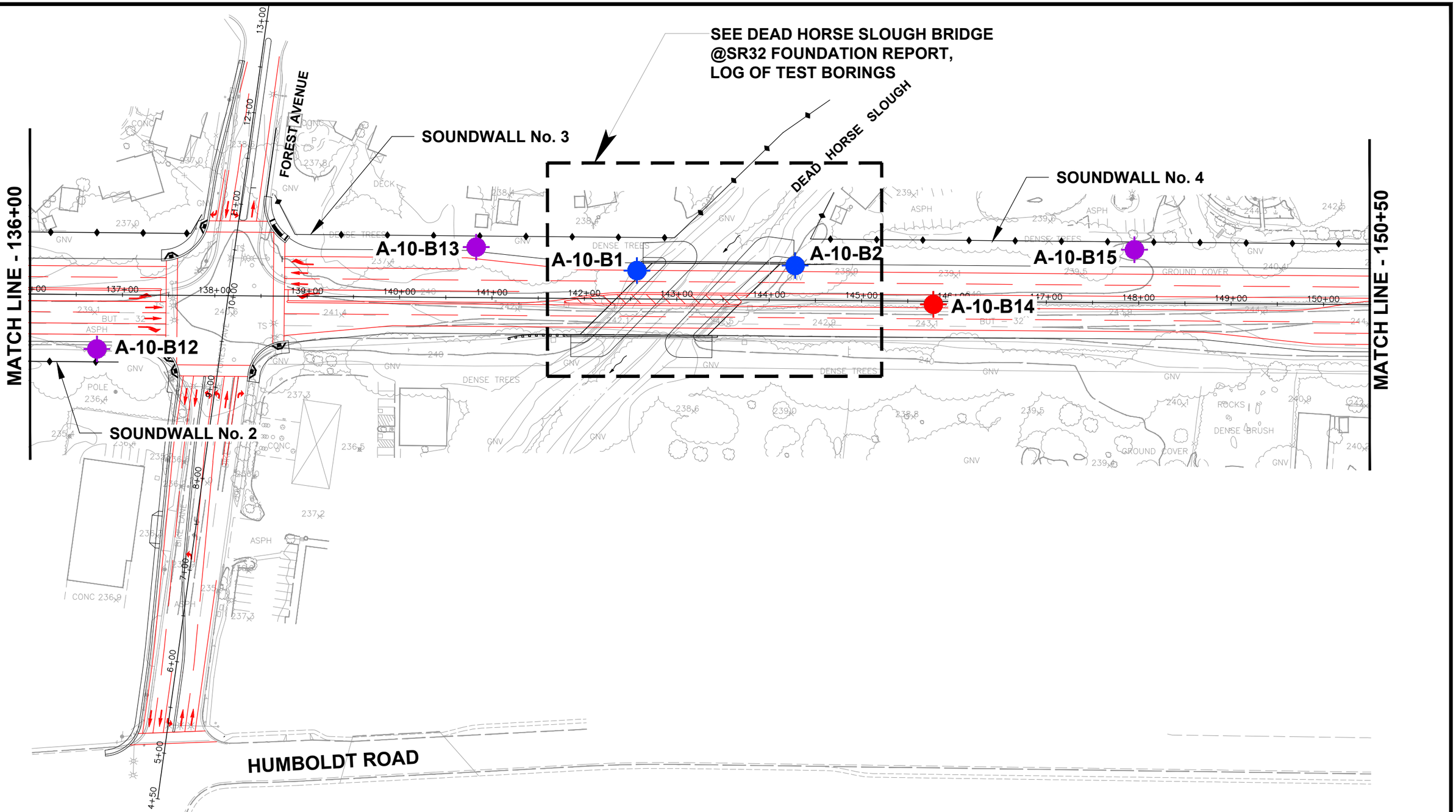
SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 3 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg



LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

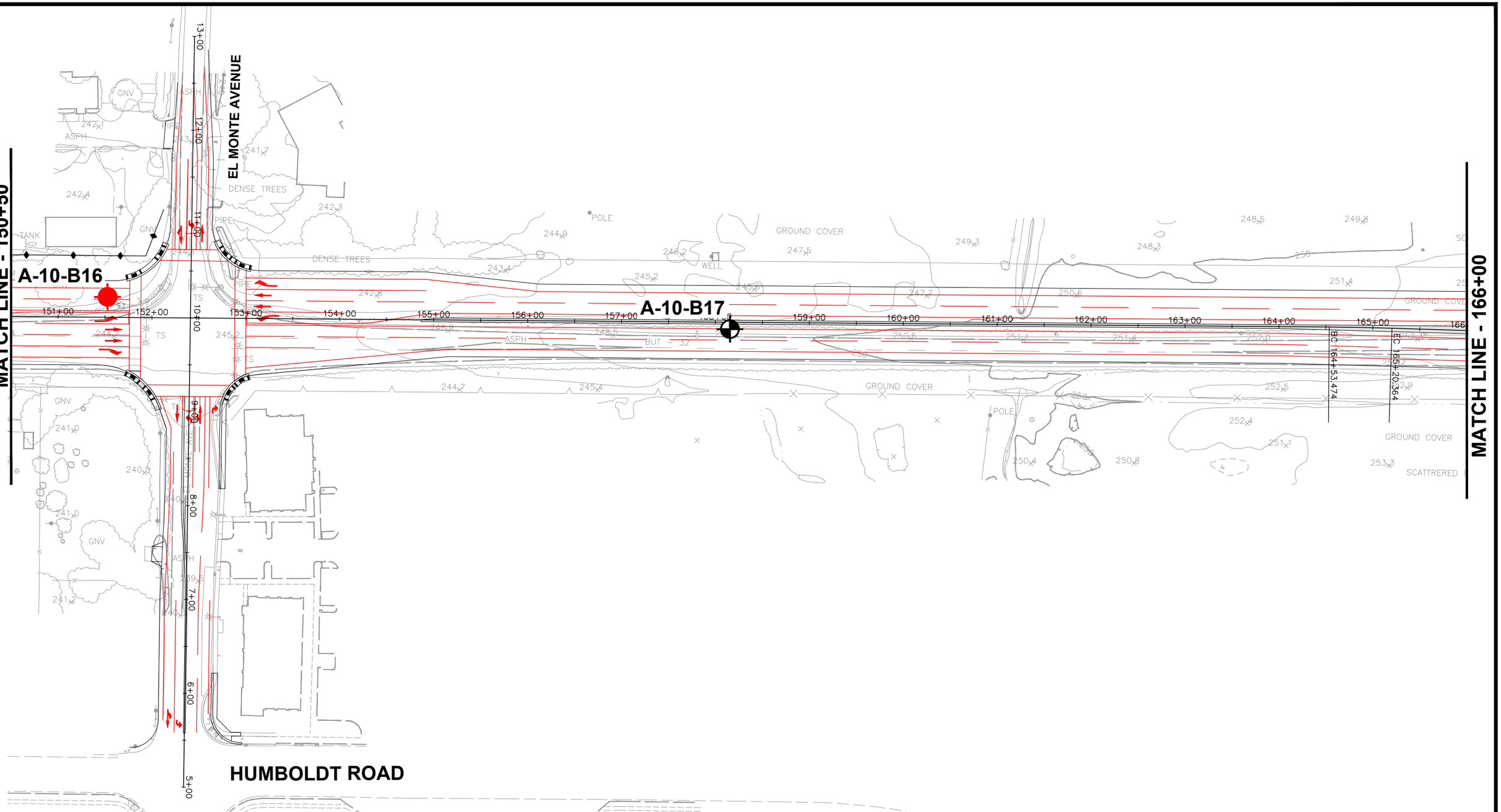
SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 4 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg



LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 5 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg

MATCH LINE - 166+00

MATCH LINE - 181+50

A-10-B18

A-10-B19

BRUCE ROAD

DEAD HORSE SLOUGH SOUTH FORK

BC 169+91.712

EC 170+58.602

BC 172+79.138

EC 178+73.256

LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 6 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg

MATCH LINE - 181+50

MATCH LINE - 197+00

SOUNDWALL No. 5

SIERRA SUNRISE TERRACE

A-10-B20

A-10-B21

A-10-B22

A-10-B23

LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting

11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

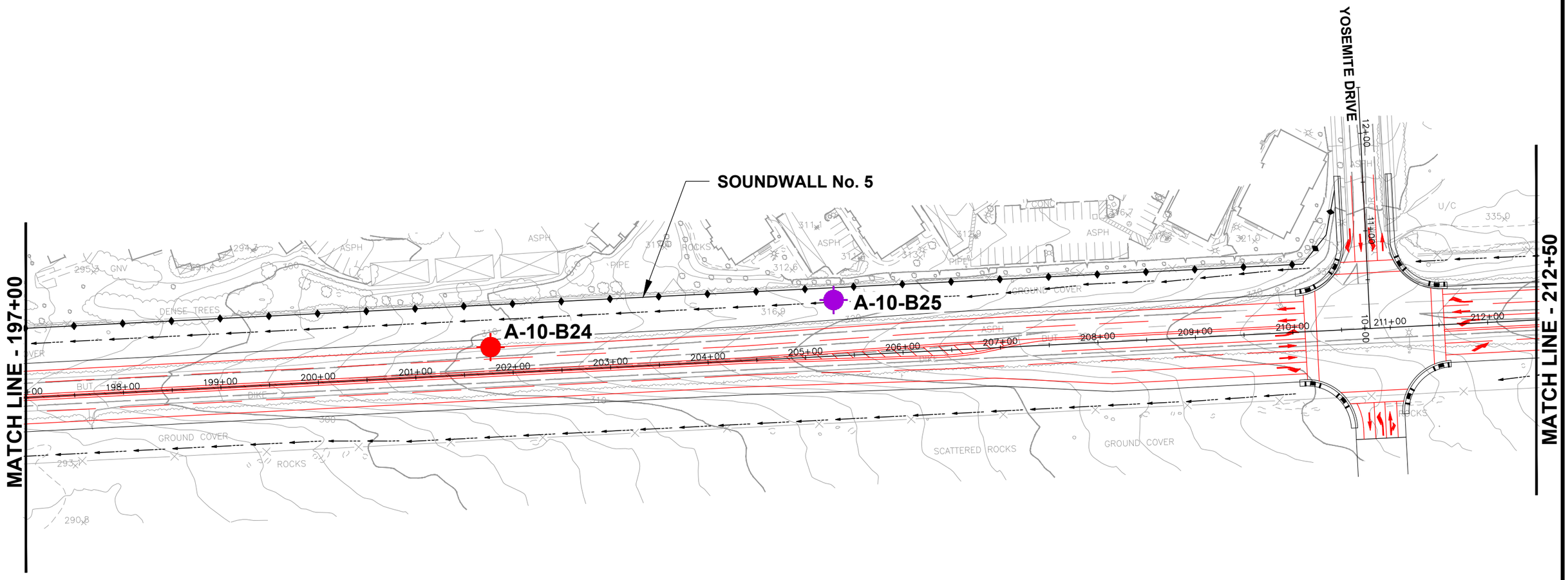
SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 7 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg



LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

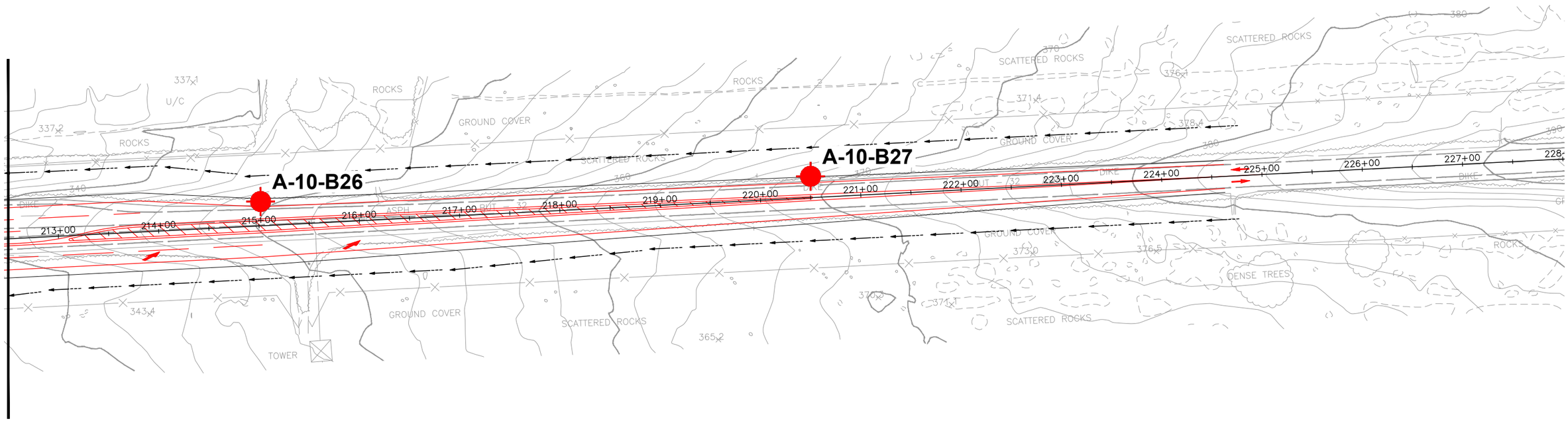
SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 8 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg



LEGEND

- Geotechnical Roadway Boring
- Bridge Foundation Boring
- Proposed Soundwall
- Soundwall Boring
- Pavement (Materials) Boring

SCALE: 1"=100'

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

BORING LOCATION MAP

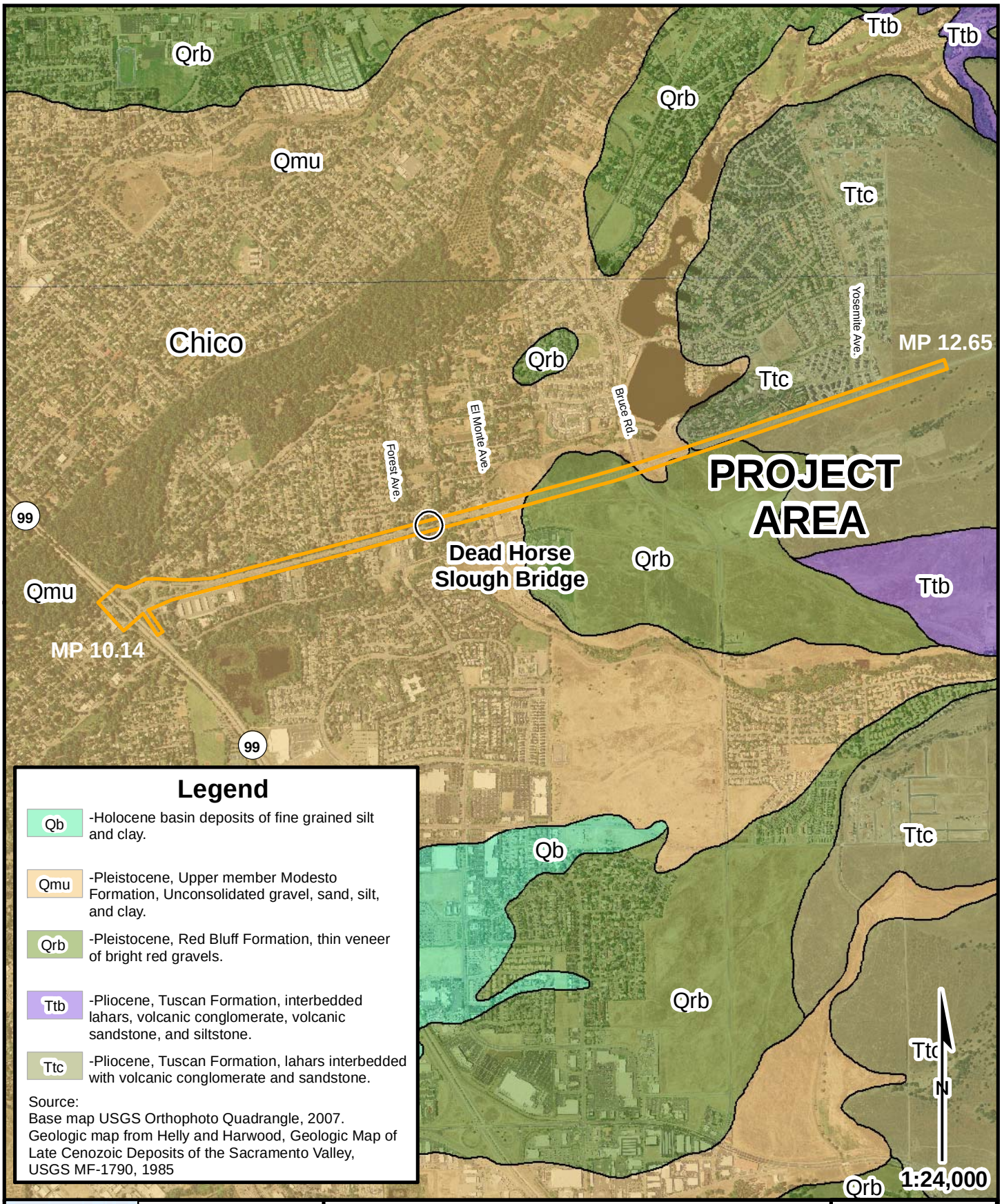
SR32 Widening
PM 10.14 to 12.65
Chico, California

File No. 1202.3

October 2010

Figure 2
Page 9 of 9

10/28/2010 1202.2 SR32 Widening Chico Figure 2.dwg



Legend

- Qb -Holocene basin deposits of fine grained silt and clay.
- Qmu -Pleistocene, Upper member Modesto Formation, Unconsolidated gravel, sand, silt, and clay.
- Qrb -Pleistocene, Red Bluff Formation, thin veneer of bright red gravels.
- Ttb -Pliocene, Tuscan Formation, interbedded lahars, volcanic conglomerate, volcanic sandstone, and siltstone.
- Ttc -Pliocene, Tuscan Formation, lahars interbedded with volcanic conglomerate and sandstone.

Source:
Base map USGS Orthophoto Quadrangle, 2007.
Geologic map from Helly and Harwood, Geologic Map of Late Cenozoic Deposits of the Sacramento Valley, USGS MF-1790, 1985

blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495-Fax
www.blackburnconsulting.com

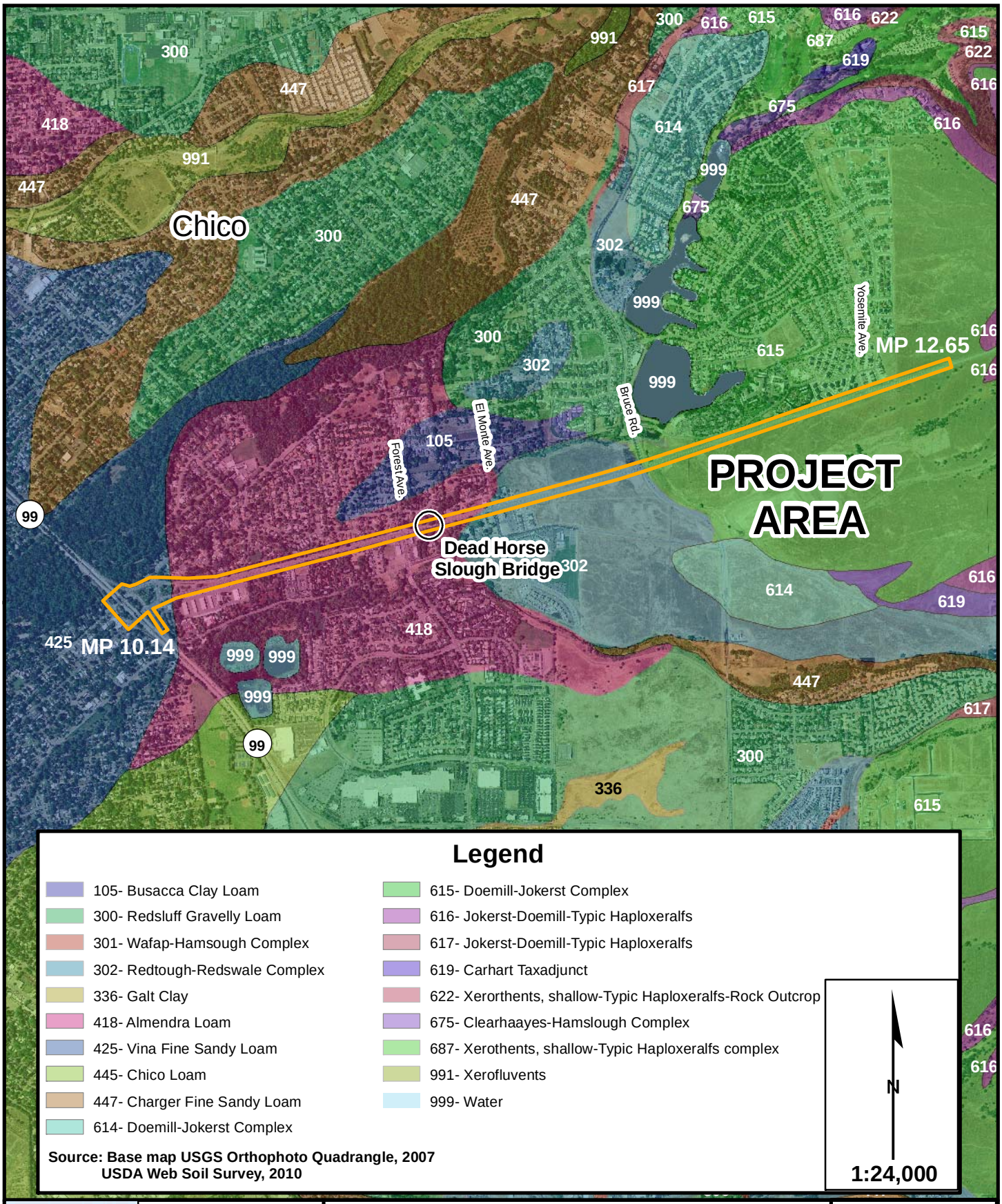
GEOLOGIC MAP

SR 32 Widening Project, 03-But-32
SR 99 to Yosemite Drive, MP 10.14/12.65
Chico, California

File No. 1202.3

October 2010

Figure 3



blackburn consulting
11521 Blocker Drive, Ste 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495-Fax
www.blackburnconsulting.com

SOIL SURVEY MAP

SR 32 Widening Project, 03-But-32
SR 99 to Yosemite Drive, MP 10.14/12.65
Chico, California

File No. 1202.3

October 2010

Figure 4

APPENDIX A

Boring Logs

Boring Legend

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-7-10	4-7-10	39° 44' 21.33" / 121° 48' 20.71" NAD83	A-10-B11
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~20.00' Lt Sta ~135+50	~235.9 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2.5")			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY GRAVEL (GM); loose to medium dense; brown; moist; mostly coarse to fine GRAVEL; little fines [FILL].												
	1				Bag I										R
233.90	2		Lean CLAY (CL); stiff; reddish black; moist; few fine SAND; mostly fines.		1	4 4	12	67				PP = 1.75			
	3					8				26	96				UC
231.90	4														
	5		Bottom of borehole at 5.0 ft bgs												
229.90	6														
	7														
227.90	8														
	9														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B11
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-8-10	4-8-10	39° 44' 23.87" / 121° 48' 7.24" NAD83	A-10-B14
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~10.00' Rt Sta ~145+75	~239.0 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2.5")			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	6.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY with GRAVEL (CL); stiff; very dark brown; moist; little coarse to fine GRAVEL; mostly fines.		Bag M,N										CP, CR
237.00	2														
235.00	4														
	5				1	5	14	50				PP = 1.75			
						6									
233.00	6					8									
			Bottom of borehole at 6.5 ft bgs												
231.00	8														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B14
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-8-10	4-8-10	39° 44' 25.49" / 121° 48' 0.82" NAD83	A-10-B16
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~20.00' Lt Sta ~151+45	~241.9 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2.5")			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	6.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY (CL); stiff; very dark brown; moist; few coarse to fine GRAVEL; mostly fines.		Bag K,L										R
239.90	2														
237.90	4														
	5				1	5 8 10	18	50				PP = 2.25			
235.90	6		Bottom of borehole at 6.5 ft bgs												
233.90	8														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B16
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-6-10	4-6-10	39° 44' 29.26" / 121° 47' 40.66" NAD83	A-10-B18
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~20.00' Lt Sta ~167+70	~253.1 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	4.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY GRAVEL with COBBLES (GM); medium dense to dense; olive brown; moist; about 5 to 10% COBBLES; mostly coarse to fine GRAVEL; few coarse to medium SAND; little fines; COBBLES consist of Andesite, moderately to slightly weathered, hard, subrounded.		Bag G										R
251.10	2														
249.10	4		Bottom of borehole at 4.0 ft bgs												
247.10	6														
245.10	8														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B18
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-6-10	4-6-10	39° 44' 36.55" / 121° 47' 9.71" NAD83	A-10-B22
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~25.00' Lt Sta ~193+00	~286.0 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT with COBBLES (ML); stiff; brown; moist; about 5 to 10% COBBLES; few coarse to fine GRAVEL; some fine SAND; mostly fines; COBBLES consist of Andesite, moderately to slightly weathered, hard to very hard, subangular to subrounded [FILL].												
	1				Bag D										R
284.00	2														
	3		SANDY SILT with COBBLES (ML); stiff; brown; about 5 to 10% COBBLES; few coarse to fine GRAVEL; some fine SAND; mostly fines; COBBLES consist of Andesite, moderately to slightly weathered, hard to very hard, subangular to subrounded.												
282.00	4														
	5		Bottom of borehole at 5.0 ft bgs												
280.00	6														
	7														
278.00	8														
	9														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B22
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	**4-6-10**	**4-6-10**	**39° 44' 39.21" / 121° 46' 59.12" NAD83**	**A-10-B24**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**~25.00' Lt Sta ~201+80**	**~310.8 ft MSL**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 55 (track)**	**6 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2.5")			**Automatic Hammer**	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			**GW not encountered**	**5.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Poorly graded GRAVEL with SILT (GP-GM); loose to medium dense; brown; moist; mostly coarse to fine GRAVEL; few medium SAND; few fines [FILL].												
			SANDY SILT with COBBLES (ML); stiff; brown; moist to wet; about 5 to 10% COBBLES; few coarse to fine GRAVEL; some medium to fine SAND; mostly fines; COBBLES consist of Andesite, slightly weathered to fresh, hard to very hard [FILL].												
	1				Bag C										CP, CR
308.80	2				1	16	50/5	4							M, UW
						50/5"									
	3		SANDY SILT with COBBLES (ML); stiff; brown; moist to wet; about 5 to 10% COBBLES; few coarse to fine GRAVEL; some medium to fine SAND; mostly fines; COBBLES consist of Andesite, slightly weathered to fresh, hard to very hard.												
306.80	4														
	5		Bottom of borehole at 5.0 ft bgs												
304.80	6														
	7														
302.80	8														
	9														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				**A-10-B24**
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	**BUT**	**32**		**03-1202.1**
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			**1 of 1**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-6-10	4-6-10	39° 44' 43.18" / 121° 46' 42.98" NAD83	A-10-B26
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~25.00' Lt Sta ~215+05	~349.0 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Poorly graded GRAVEL (GP); loose to medium dense; brown; moist; coarse to fine GRAVEL; little medium SAND; few fines [FILL].												
	1		SILT with SAND (ML); stiff; brown; moist to wet; little medium to fine SAND; mostly fines [FILL].		Bag B										R
347.00	2														
	3														
345.00	4														
	5		IGNEOUS ROCK (BRECCIA), very fine sand to boulder, massive, olive gray, moderately weathered, moderately soft to moderately hard [BEDROCK].												
			Bottom of borehole at 5.0 ft bgs												
343.00	6														
	7														
341.00	8														
	9														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B26
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-6-10	4-6-10	39° 44' 44.69" / 121° 46' 36.64" NAD83	A-10-B27
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~20.00' Lt Sta ~223+50	~368.0 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILT (ML); soft; brown; moist; few medium to fine SAND; mostly fines [FILL].												
	1				Bag A										CP
366.00	2														
	3		IGNEOUS ROCK (BRECCIA), very fine sand to boulder, massive, olive gray, moderately weathered, moderately soft to moderately hard [BEDROCK].												
364.00	4														
	5		Bottom of borehole at 5.0 ft bgs												
362.00	6														
	7														
360.00	8														
	9														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B27
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	**4-14-10**	**4-14-10**	**39° 44' 12.2814" / 121° 49' 14.052" NAD83**	**A-10-B3**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			**~10.00' Lt Sta ~15+00**	**~221.0 ft MSL**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 55 (track)**	**6 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2.5")			**Automatic Hammer**	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE) / TOTAL DEPTH OF BORING
Backfilled with native cuttings			**12.2 ft**	**12.2 ft on4-14-10** / **15.1 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Lean CLAY (CL); stiff; dark reddish brown; moist; few GRAVEL; few SAND; mostly fines.												
	1				Bag O			100							PA, R PI
219.00	2				1	12	33	33				PP = 1.5			
						16									
	3					17				25	87				M, UW
217.00	4														
	5				2	7	10	83				PP = 1.25			
						5									
215.00	6					5				27	92				UC
	7														
213.00	8														
	9														
	10														

(continued)

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				**A-10-B3**
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	**BUT**	**32**		**03-1202.1**
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			**1 of 2**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	10		Lean CLAY (CL) *(continued)*.		3	3	33	83							
						10									
			CLAYEY GRAVEL (GC); medium dense; reddish brown; moist; mostly GRAVEL; little fines.			23				17	121				M, PA, UW PA
209.00	12														
			Poorly graded GRAVEL (GP); dense to very dense; dark reddish brown; wet; about 10% COBBLES; mostly GRAVEL; some SAND.												
	13														
207.00	14														
	15				4	50/1"	REF	0							
			Bottom of borehole at 15.1 ft bgs												
205.00	16														
	17														
203.00	18														
	19														
201.00	20														
	21														
	22														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				**A-10-B3**
DIST. **03**	COUNTY **BUT**	ROUTE **32**	POSTMILE	EA **03-1202.1**
PROJECT OR BRIDGE NAME **State Route 32 Widening**				
BRIDGE NUMBER	PREPARED BY **RCP**		DATE	SHEET **2 of 2**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
RCP	4-7-10	4-7-10	39° 44' 18.4" / 121° 48' 35.1" NAD83	A-10-B8
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Taber			~10.00' Lt Sta ~124+15	~230.1 ft MSL
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			CME 55 (track)	6 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk			Automatic Hammer	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Backfilled with native cuttings			GW not encountered	5.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SILTY GRAVEL (GM); loose; brown; dry to moist; mostly coarse to fine GRAVEL; little fines [FILL].												
	1				Bag J										
228.10	2		Lean CLAY with SAND (CL); stiff; reddish black; moist; little SAND; mostly fines.												CP, CR
	3														
226.10	4														
	5		Bottom of borehole at 5.0 ft bgs												
224.10	6														
	7														
222.10	8														
	9														
	10														

5 BR - STANDARD 1202LOGS.GPJ CALTRANS_LIBRARY_DEC09.GLB 5/14/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE				HOLE ID
BORING RECORD				A-10-B8
DIST.	COUNTY	ROUTE	POSTMILE	EA
03	BUT	32		03-1202.1
PROJECT OR BRIDGE NAME				
State Route 32 Widening				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	RCP			1 of 1

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - Support

REPORT TITLE
BORING RECORD LEGEND

DIST.	COUNTY	ROUTE	POSTMILE	EA
03	**Butte**	**32**		**03-1202.1**

PROJECT OR BRIDGE NAME
State Route 32 Widening

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
			1 of 2

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

NOTE: This legend sheet provides descriptors and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (July 2007), Section 2, for tables of additional soil description components and discussion of soil description and identification.

APPENDIX B

Soil Engineering Properties

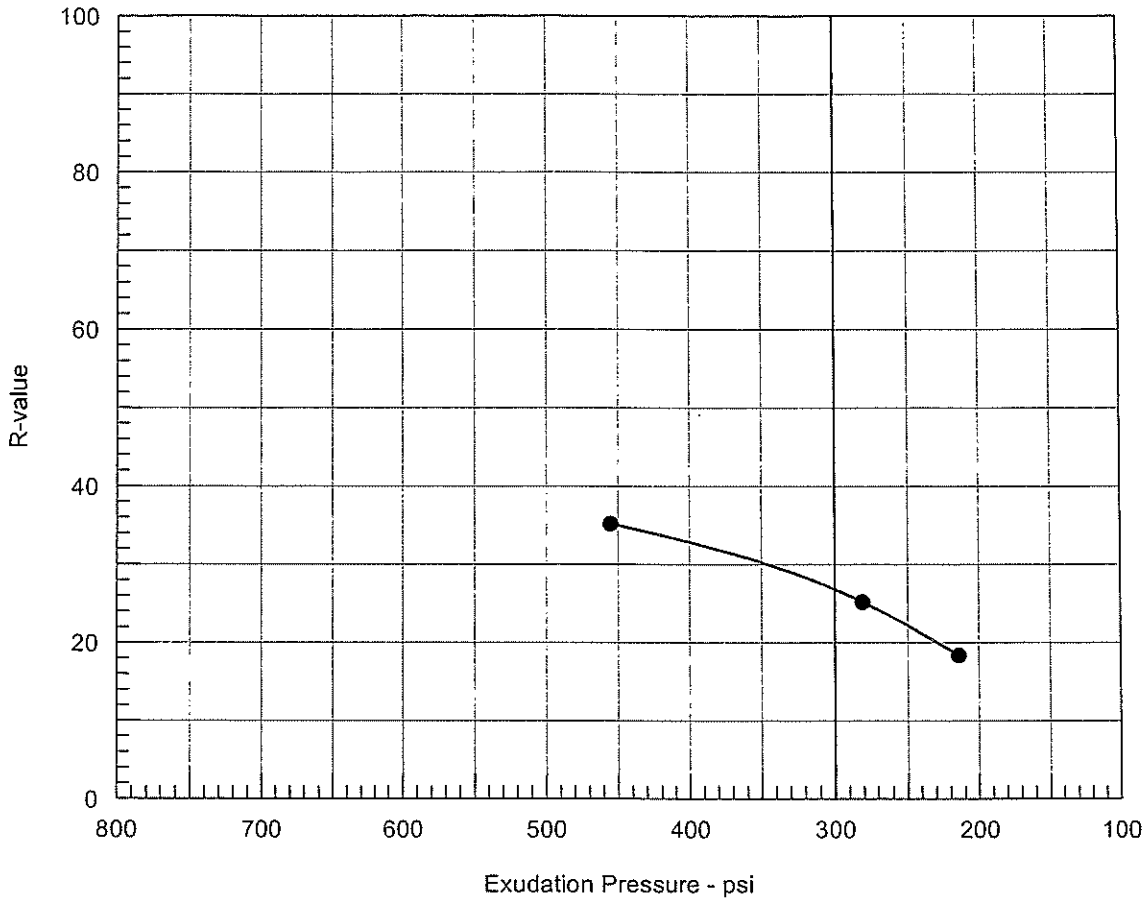
Laboratory Test Results

Soil Engineering Properties[1]

Soil Name	Depth (in.)	Soil Texture	USCS[2]	Percent Passing Sieve No.				Liquid Limit	Plastic Limit
				4	10	40	200		
Vina Fine Sandy Loam (425)	0-3	Fine sandy loam, Loam	ML	95-100	90-100	65-95	35-75	27-40	7-13
	3-11	Fine sandy loam, Loam	CL	95-100	90-100	65-95	35-75	27-40	7-13
	11-23	Sandy loam, Loam	SC	95-100	90-100	55-95	25-75	22-33	6-12
	23-37	Sandy loam, Loam	SC-SM	95-100	90-100	55-95	25-75	22-33	6-12
	37-80	Sandy loam, Loam, Coarse sand, Loamy sand	SM	95-100	90-100	45-95	5-75	0-27	NP-9
Almendra Loam (418)	0-4	Loam, Fine sandy loam	ML	95-100	90-100	65-95	35-75	30-47	9-18
	4-14	Loam, Fine sandy loam	CL	95-100	90-100	65-95	35-75	30-47	9-18
	14-40	Loam, Fine sandy loam	CL	95-100	90-100	65-95	35-75	29-42	11-19
	40-52	Loam, Fine sandy loam	CL	95-100	90-100	65-95	35-75	36-39	9-19
	52-86	Sandy loam, Loam,	CL	95-100	90-100	55-95	55-95	25-75	7-17
Redtough-Redswale Complex (302)	0-1	Loam, Gravely loam, Cobbly loam	ML	55-110	50-100	40-95	30-75	29-42	9-15
	1-7	Gravelly loam, Loam, Cobbly loam	CL	50-100	45-90	40-85	30-70	29-41	12-19
	7-13	Cobbly Loam, Loam, Gravelly loam	CL	50-100	45-90	40-85	30-70	29-39	12-19
	>13	Cemented very gravelly material	---	---	---	---	---	---	---
Doemill-Jokerst Complex (615)	0-1	Gravelly loam, Loam, Very cobbly loam	ML	80-100	75-98	60-93	45-74	32-47	9-16+
	1-14	Gravelly loam, Cobbly loam, Gravelly clay loam, Loam	CL	75-100	70-96	60-96	40-76	29-42	12-21
	>14	Bedrock	---	---	---	---	---	---	---

[1] United States Department of Agriculture, 1992, “Soil Survey of Butte County”.
[2] Unified Soil Classification System

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	144	117.8	14.5	0.00	91	2.52	455	35	35
2	104	115.9	15.7	0.00	106	2.57	281	24	25
3	74	114.1	16.8	0.00	112	2.39	214	20	18

Test Results	Material Description
R-value at 300 psi exudation pressure = 27	SANDY lean CLAY with GRAVEL, dark brown

Project No.: 1202.3
Project: SR 32 Widening
Source of Sample: A-10-B11 **Depth:** 0.5-5.0'
Sample Number: Bag I
Date: 4/26/2010

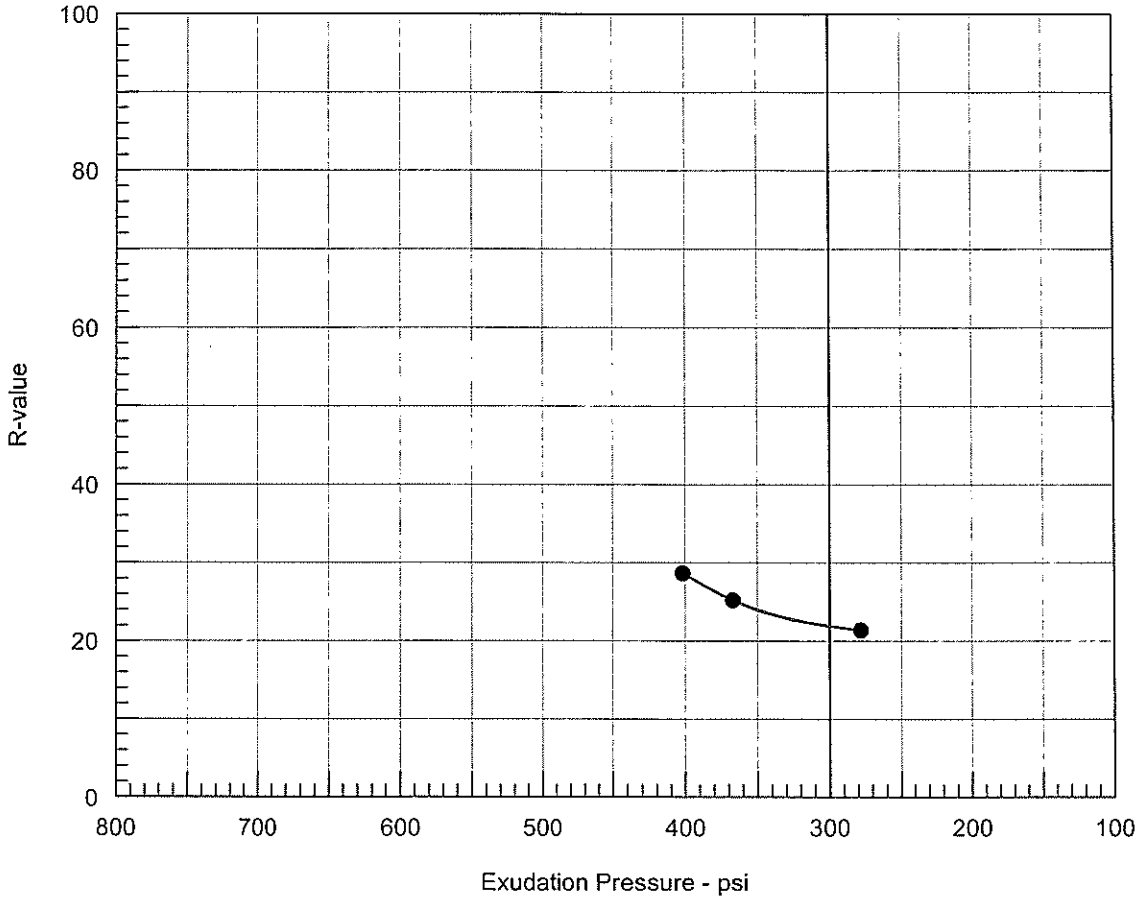
Tested by: KAC
Checked by: MDR
Remarks:
24.1% retained on No. 4, sample batched.

R-VALUE TEST REPORT

Blackburn Consulting

Figure _____

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	84	119.0	14.5	0	98	2.44	402	30	29
2	74	118.0	15.0	0	104	2.48	367	25	25
3	54	116.4	15.6	0	109	2.51	278	21	21

Test Results	Material Description
R-value at 300 psi exudation pressure = 22	CLAYEY SAND with GRAVEL, Very dark brown

Project No.: 1202.3
Project: SR 32 Widening
Source of Sample: A-10-B16 **Depth:** 0.0-5.0'
Sample Number: Composite:Bags K & L
Date: 4/26/2010

Tested by: MAR
Checked by: MDR

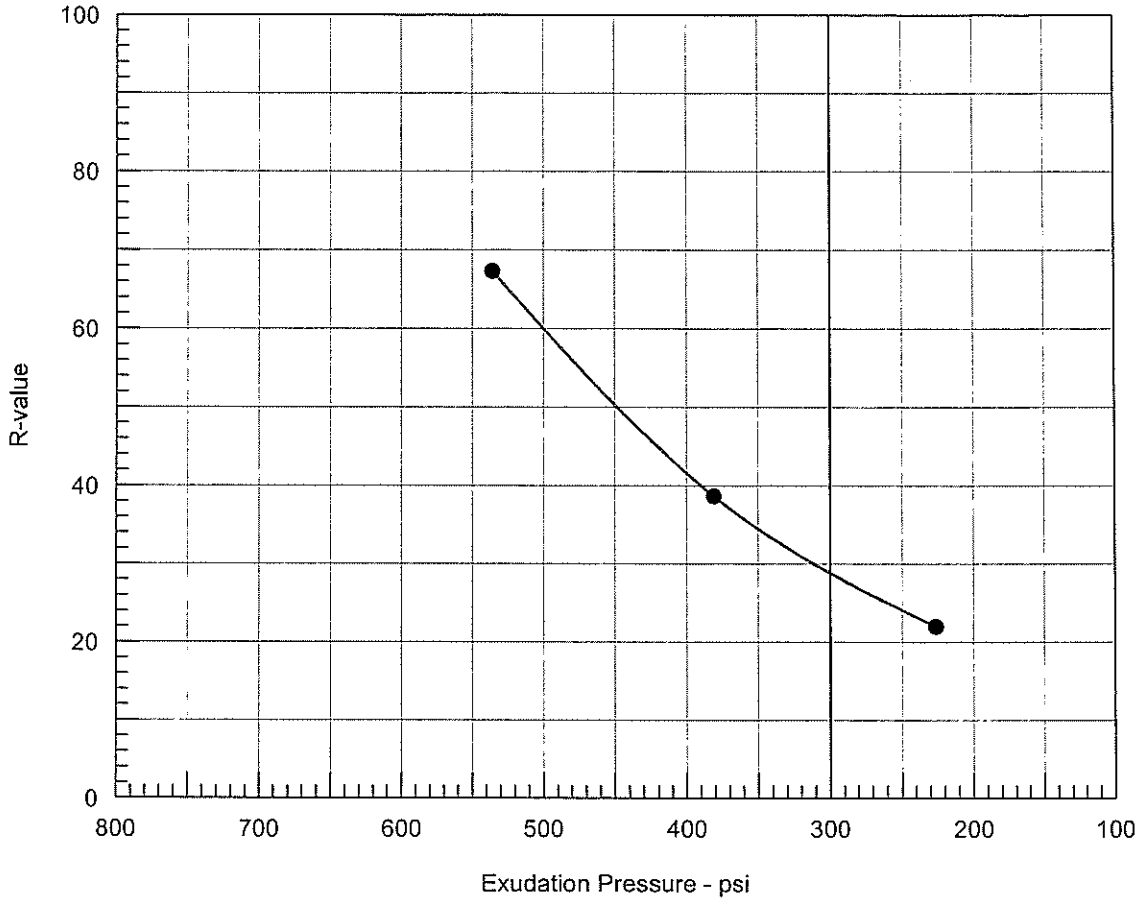
Remarks:
28.0% retained on No. 4 sieve. Sample batched.

R-VALUE TEST REPORT

Blackburn Consulting

Figure _____

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	304	132.7	10.4	0.00	42	2.48	536	67	67
2	164	129.9	11.4	0.00	83	2.47	381	39	39
3	44	127.4	12.5	0.00	108	2.45	226	22	22

Test Results	Material Description
R-value at 300 psi exudation pressure = 29	CLAYEY GRAVEL with SAND, dark brown

Project No.: 1202.3
Project: SR 32 Widening
Source of Sample: A-10-B18 **Depth:** 0.0-4.0'
Sample Number: Bag G
Date: 4/26/2010

Tested by: MDR
Checked by:

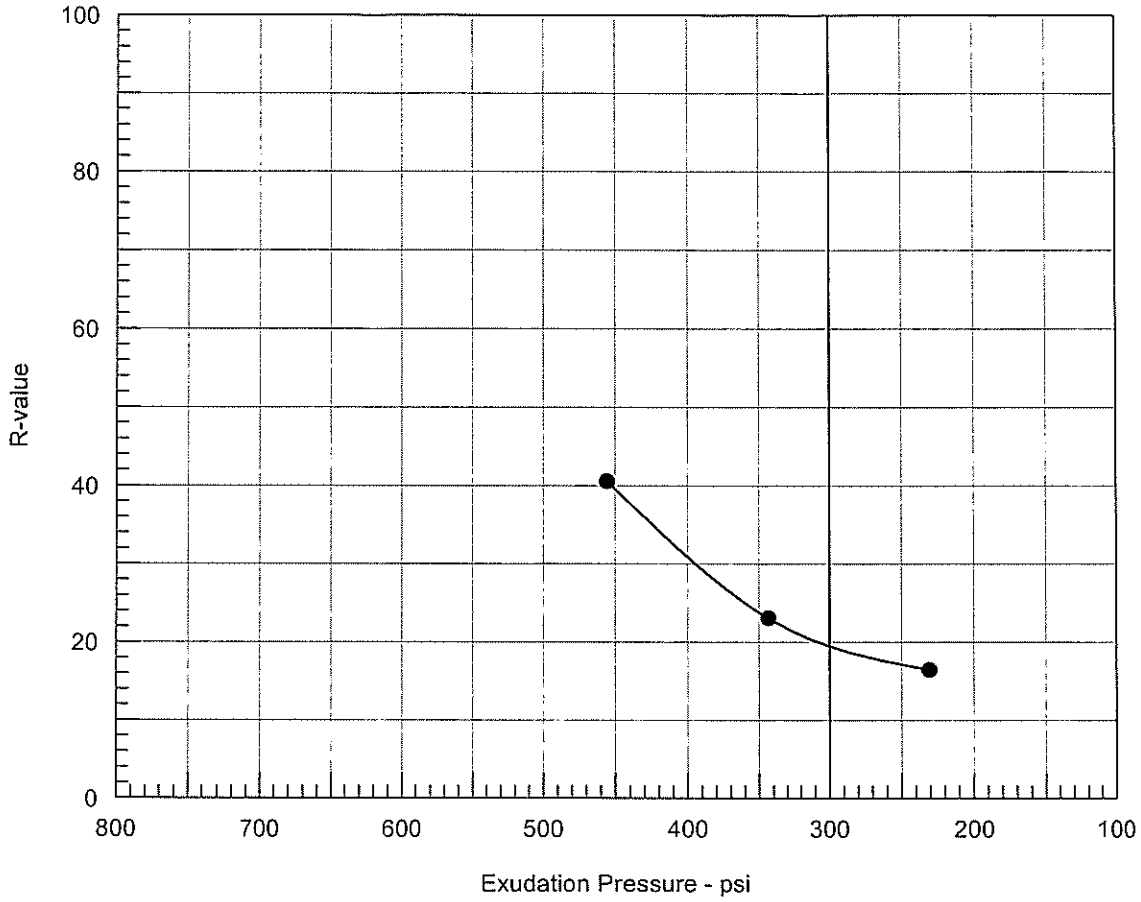
Remarks:
52.8% retained on No. 4, sample batched.

R-VALUE TEST REPORT

Blackburn Consulting

Figure ____

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	224	119.5	14.4	0.00	80	2.47	456	41	41
2	124	116.5	15.5	0.00	105	2.48	344	23	23
3	44	114.6	16.6	0.00	115	2.54	231	16	16

Test Results	Material Description
R-value at 300 psi exudation pressure = 19	SANDY lean CLAY with GRAVEL, dark reddish brown

Project No.: 1202.3
Project: SR 32 Widening
Source of Sample: A-10-B22 **Depth:** 1.0-5.0'
Sample Number: Bag D
Date: 4/26/2010

Tested by: MDR
Checked by:

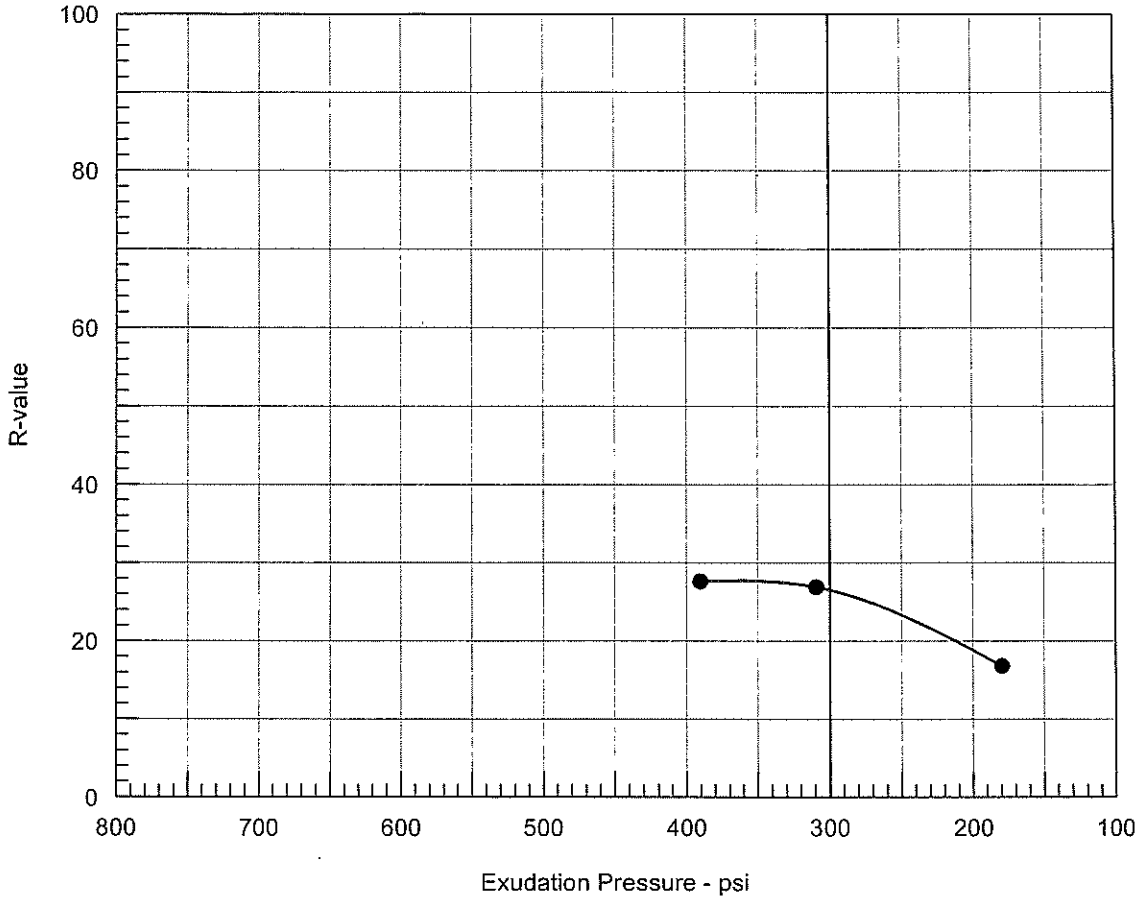
Remarks:
27.8% retained on No. 4, sample batched.

R-VALUE TEST REPORT

Blackburn Consulting

Figure _____

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	144	120.9	13.7	0.00	100	2.50	390	28	28
2	104	120.4	14.1	0.00	102	2.63	309	25	27
3	64	116.6	15.5	0.00	114	2.55	180	17	17

Test Results	Material Description
R-value at 300 psi exudation pressure = 27	SANDY lean CLAY with GRAVEL, dark reddish brown

Project No.: 1202.3
Project: SR 32 Widening
Source of Sample: A-10-B26 **Depth:** 1.0-4.5'
Sample Number: Bag B
Date: 4/26/2010

Tested by: MDR
Checked by:

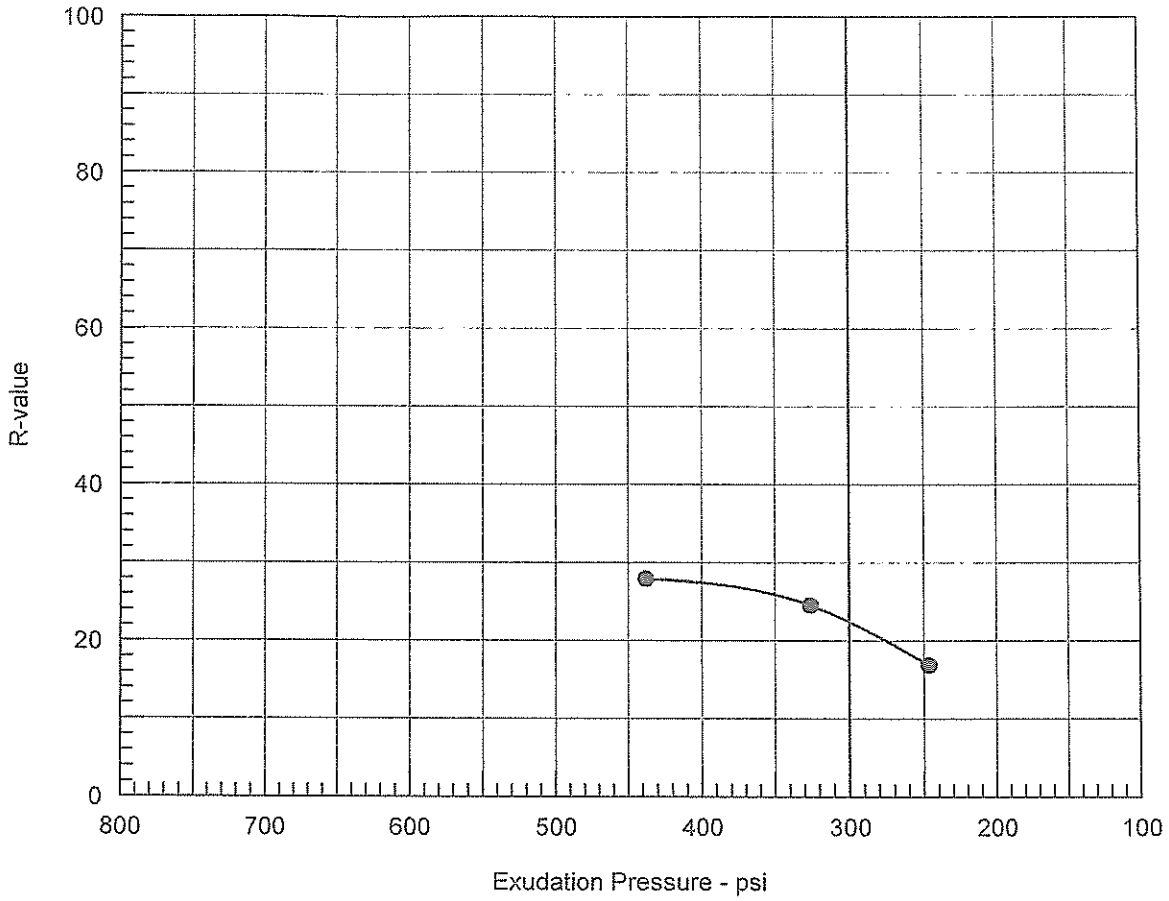
Remarks:
20.4% retained on No. 4, sample batched.

R-VALUE TEST REPORT

Blackburn Consulting

Figure ____

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	124	107.6	19.0	0.00	105	2.46	438	28	28
2	84	105.5	20.4	0.00	109	2.59	326	23	25
3	64	102.7	21.6	0.00	115	2.53	246	17	17

Test Results	Material Description
R-value at 300 psi exudation pressure = 22	Lean CLAY, very dark brown

Project No.: 1202.1
Project: SR 32 Widening
Source of Sample: A-10-B3 **Depth:** 1.0-5.0'
Sample Number: Bag O
Date: 5/13/2010

Tested by: KAC
Checked by: MDR

Remarks:
10.9% retained on No. 4, sample batched.

R-VALUE TEST REPORT

Blackburn Consulting

Figure _____

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 04/14/2010
Date Submitted 04/09/2010

To: Ken Colburn
Blackburn Consulting
11521 Blocker Dr. Ste. 110
Auburn, CA 95603

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 1202.1/SR 32 WIDENIG Site ID : [redacted] BAG J.
Your purchase order number is 1202.1. A-10-03
Thank you for your business.

* For future reference to this analysis please use SUN # 57685-117004.

EVALUATION FOR SOIL CORROSION

Soil pH	6.98		
Minimum Resistivity	3.75 ohm-cm (x1000)		
Chloride	5.9 ppm	00.00059	%
Sulfate	18.4 ppm	00.00184	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 04/23/2010
Date Submitted 04/20/2010

To: Ken Colburn
Blackburn Consulting
11521 Blocker Dr. Ste. 110
Auburn, CA 95603

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 1202.1/SR 32 WDENING Site ID : [redacted] BAG M.
Your purchase order number is 1202.1. A-10-814
Thank you for your business.

* For future reference to this analysis please use SUN # 57764-117182.

EVALUATION FOR SOIL CORROSION

Soil pH	6.13		
Minimum Resistivity	8.31 ohm-cm (x1000)		
Chloride	10.7 ppm	00.00107	%
Sulfate	0.4 ppm	00.00004	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 04/14/2010
Date Submitted 04/09/2010

To: Ken Colburn
Blackburn Consulting
11521 Blocker Dr. Ste. 110
Auburn, CA 95603

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 1202.1/SR 32 WIDENIG Site ID : [illegible] BAG C.
Your purchase order number is 1202.1. A-10-624
Thank you for your business.

* For future reference to this analysis please use SUN # 57685-117002.

EVALUATION FOR SOIL CORROSION

Soil pH	6.78		
Minimum Resistivity	4.29 ohm-cm (x1000)		
Chloride	6.7 ppm	00.00067	%
Sulfate	4.9 ppm	00.00049	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX C

Pavement Section Calculations

Project: SR32 Widening
BCI No.: 1202.X
Date: 04/22/10
Calc. By: WEN

ASPHALT PAVEMENT DESIGN CALCULATIONS

(Caltrans Highway Design Manual)

Design Resistance Value: 19

	TI	5	6	7	8	10.5	12.5
a	Gf (AC)	2.54	2.31	2.14	2.00	1.75	1.7
b	SECTION GE Required (.0032)(100-R)(TI)	1.296	1.555	1.814	2.074	2.722	3.240
c	AC: GE Required [(.0032)(100-78)(TI)] + 0.2	0.552	0.622	0.693	0.763	0.939	1.080
	AC: Thickness Required (c/a)	*0.218*	*0.269*	*0.323*	*0.381*	*0.537*	*0.635*
d	***AC: Thickness Used (feet)**	**0.25**	**0.30**	**0.35**	**0.40**	**0.55**	**0.65**
e	AC: GE Used (dxa)	0.63393	0.69443	0.75007	0.8018591	0.9625	1.105
f	AB: GE Required (b-e)	0.662	0.861	1.064	1.272	1.759	2.135
	AB: Thickness Required (f/1.1)	*0.602*	*0.783*	*0.968*	*1.156*	*1.599*	*1.941*
g	***AB: Thickness Used**	**0.6**	**0.8**	**1.00**	**1.15**	**1.6**	**1.95**
h	AB: GE Used (1.1xg)	0.660	0.880	1.100	1.265	1.760	2.145
	Total Section GE Used (e+h)	**1.294**	**1.574**	**1.850**	**2.067**	**2.723**	**3.250**
	Required Section GE	1.296	1.555	1.814	2.074	2.722	3.240
	****Section Check (Total - Required Section GE)**	*-0.002*	*0.019*	*0.036*	*-0.007*	*0.001*	*0.010*

*To nearest .05' (round up for AC layer)
**Should be within +/- 0.25 ft