INFORMATION HANDOUT

For Contract No. 03-1A8434
NEAR SOUTH LAKE TAHOE
FROM CASCADE ROAD TO UPPER EMERALD BAY ROAD

Identified by
Project ID 03000002244

PERMITS

TAHOE REGIONAL PLANNING AGENCY PERMIT

UNITED STATE ARMY CORP OF ENGINEERS

STATE OF CALIFORNIA, DEPARTMENT OF PARKS AND RECREATION, RIGHT OF ENTRY PERMIT

WATER QUALITY

LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD

BOARD ORDER No. RT-2014-0037

AGREEMENTS

CALIFORNIA DEPARTMENT OF FISH AND WILDLIF, FINAL STREAMBED ALTERATION AGREEMENT

Notification No. 1600-2014-0057-R2

USDA, LETTER OF CONSENT, EXHIBIT 01

ADDITIONAL INFORMATION

NATINA ESTIMATE FOR STEEL ITEMS TO BE STAINED

MATERIALS INFORMATION

AERIALLY DEPOSITED LEAD SITE INVESTIGATION REPORT

GEOTECHNICAL INFORMATION

Geotechnical Design Report, July 25, 2012.

Ground Penetrating Radar Survey, Emerald bay Rubble Wall, October 7, 2004.

Preliminary Geotechnical Report, October 29, 2003

GEOTECHNICAL INFORMATION

Geotechnical Design Report, July 25, 2012.

Ground Penetrating Radar Survey, Emerald bay Rubble Wall, October 7, 2004.

Preliminary Geotechnical Report, October 29, 2003

Memorandum

Flex your power!
Be energy efficient!

To: MR. FERMIN BARRIGA
BRANCH CHIEF,
DESIGN M2

ATTN: MR. JASON MILLER

Date: July 25, 2012

File: 03-ED-89-
PM13.8/18.0
EA 03-1A843
EFIS 0300000224
EMERALD BAY
TAHOE EIP

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: **Geotechnical Design Report**

Introduction

Per the request of District 3 Design Branch M3, a Geotechnical Design Report has been prepared for the Emerald Bay Environmental Improvement Project (EA 03-1A843). The purposes of this project are for storm water quality improvements, adding dikes and retention basins, widening, and Rock Slope Protection (RSP) placement for slope stabilization and protection. This report mainly addresses the slope stabilization and protection issues.

Existing Facilities and Proposed Improvements

Within the project limits, Route 89 is roughly oriented north-to-south and is composed of an asphalt concrete-paved, two-lane roadway on the slope above Emerald Bay (see Plate No. 1). This section of Route 89 has variable shoulder width. Cut slopes varying between 1.5:1 H:V to 1:1 and extending up to a height of 90 ft in the glacial till and granite bedrock materials. Boulders were noted adjacent to the road way that ranged from 3 to 8 feet in diameter (see Plate No. 2a).

The proposed storm water quality improvements include drainage work with rock-lined ditches, infiltration basins, and placing rock energy dissipaters around existing sandtraps. The proposed slope stabilization and protection improvements include placing new RSP and revegetation for various slope stabilization locations. Also, RSP placements around the outlets of the culverts, and at the back of the (E) wingwall of the Cascade Creek Bridge are proposed. At this point in time plans and typical cross sections for the slope stabilization work are not available to the Office of Geotechnical Design. The proposed fills and slope gradings which appears to be less than 10 feet high are next to the proposed concrete curbs and gutters (see attached Plan No. X-2 "Typical Cross Sections", dated 1/24/2011).

An infiltration basin report, "Field Work Report Tahoe Environmental Improvement Project", (03-ED-PM14.21/17.28, attached as Appendix A) was completed in 2008 by Kleinfelder for improvements previously proposed in the current project limits. At that time there were 10 potential infiltration basin sites and infiltration testing was performed at 5 of the potential basin sites. As a convenience, the locations of borings performed for the 2008 work (where provided) were plotted on the map of Plate No. 4.

According to the "Preliminary Rockfall Observations and Recommendations" report (attached as Appendix B), dated 2003, there is an area with potential rock fall next to the Emerald Bay Landslide. According to Greg Slocum, Caltrans Structure Design, recommendations from this report were not implemented. It is our understanding that mitigation of the rock fall potential is not part of the current project scope.

Pertinent Reports and Investigations

The following maps and other sources of published information were utilized in the preparation of this report:

- "Geologic Map of The Lake Tahoe Basin", Regional Geologic Map No. 4, Scale 1:100000, Published by California Geologic Survey, 2005
- "Caltrans District 3 Areas Likely to Contain Naturally Occurring Asbestos", Caltrans, 2005
- Western Regional Climate Data Center website: http://www.wrcc.dri.edu/
- Caltrans ARS Online (v1.0.4) http://dap3.dot.ca.gov/shake_stable/
- "Preliminary Rockfall Observations and Recommendations", EA 03-442703, 03-ED-89-PM 16.5, Caltrans, OGDN, dated July 10, 2003
- "Preliminary Geotechnical Report", EA 03-1A840K, 03-ED-89-PM 0.0/27.4,

Caltrans, OGDN, dated October 29, 2003

- "Ground Penetrating Radar Survey, Emerald Bay Rubble Wall", EA 03-4C2500, 03-ED-89-PM 16.5/16.6, Caltrans, OGS, dated October 7, 2004

- "Field Work Report Tahoe Environmental Improvement Project", EA 03-1A8430, 03-ED-89-PM 14.21/17.28, Kleinfelder, dated July 18, 2008

Physical Setting

Climate

According to the Western Regional Climate Center website, the closest operating weather station to the project site is in the City of South Lake Tahoe, about 6 miles southeast. Data maintained at this station for the period from 1981 to 2010 indicates an average total precipitation of 14.37. The average maximum and minimum temperatures are 81° F to 15° F, respectively. The South Lake Tahoe Station does not have snow fall data.

According to the Western Regional Climate Center website Tahoe City Station (about 17 miles to the north of the project site), the period from 1903 to May 2012 indicates an average total snow fall of 2.4 inches for October and 45.9 inches for January.

Topography

The project section of the highway runs roughly parallel to the western shoreline of Emerald Bay. It climbs moderate to steep sloping hillside topography. The highway elevation climbs from the south end at elevation about 6400 feet to the north end of elevation about 6800 feet.

Regional Geology, Faults and Seismicity

According to the "Geologic Map of The Lake Tahoe Basin", Regional Geologic Map No. 4, 2005, the site is in an area of Pleistocene aged glacial till deposits (Qti) and landslide deposits (Qls) (see Plate No. 3a).

Surface rupture, ground shaking, subsidence and liquefaction are seismically induced hazards that may result from moderate to major earthquake events. According to Caltrans ARS Online (v2.0), the nearest active fault is the West Tahoe – Dollar Point Fault, with the surface trace located approximately 1.7 miles easterly of the project site (see Plate No. 3a). ARS Online considers this fault as the controlling fault, and assigns a MMax of 7.0 with a resulting peak ground acceleration of approximately 0.4g at the site (for a "soft rock" condition V_{S30} of 760 m/s). No known active or inactive faults traverse the project limits. Based on our findings, the potential for damage or collapse associated with fault surface rupturing, seismically induced ground subsidence, or liquefaction is considered low.

Naturally Occurring Asbestos (NOA)

According to the Caltrans District 3 "Areas Likely to Contain Naturally Occurring Asbestos" map, the project site is at least 15 miles from the closest area depicting naturally occurring asbestos.

Field Investigation

A site reconnaissance was performed on May 16, 2012. No subsurface exploration, sampling, or testing was performed. During the site reconnaissance, most of the slopes appeared generally to be in good condition and repair. Soil loss appears to have occurred at the ends of retaining walls, most likely due to erosion (see Plate No. 2b).

Geotechnical Recommendations

The proposed fill slopes and slope gradings with a slope ratio of 1.5H:1V or flatter is acceptable. The slope ratio for the proposed RSP at the back of the (E) wingwall of Cascade Creek Bridge should not be steeper than 1:1. The use of on-site materials is acceptable for constructing fill slopes at no steeper than 1.5H:1V.

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 included in the Information Handout provided to the bidders and Contractors are:

Data and Information available for inspection at the District Office:

A. None

Data and Information included in the Information Handout provided to the bidders and

Contractors are:

A. "Geotechnical Design Report", 03-ED-89-PM 13.8/18.0, dated July 25, 2012.

Data and Information available for inspection at the District Office:

A. None

Data and Information available for inspection at the Transportation Laboratory are:

A. None

The recommendations provided are based on specific project information regarding site location, proposed slope ratios and site conditions. If any conceptual changes are made and or if the site and subsurface conditions have changed from those described in this report, the Office of Geotechnical Design-North should review those changes and determine if the recommendations provided herein are still applicable.

Any questions should be directed to the attention of Luke Leong (916) 227-1081 of the Office of Geotechnical Design – North.

LUKE LEONG, P.E.
Transportation Engineer – Civil
Geotechnical Design – North

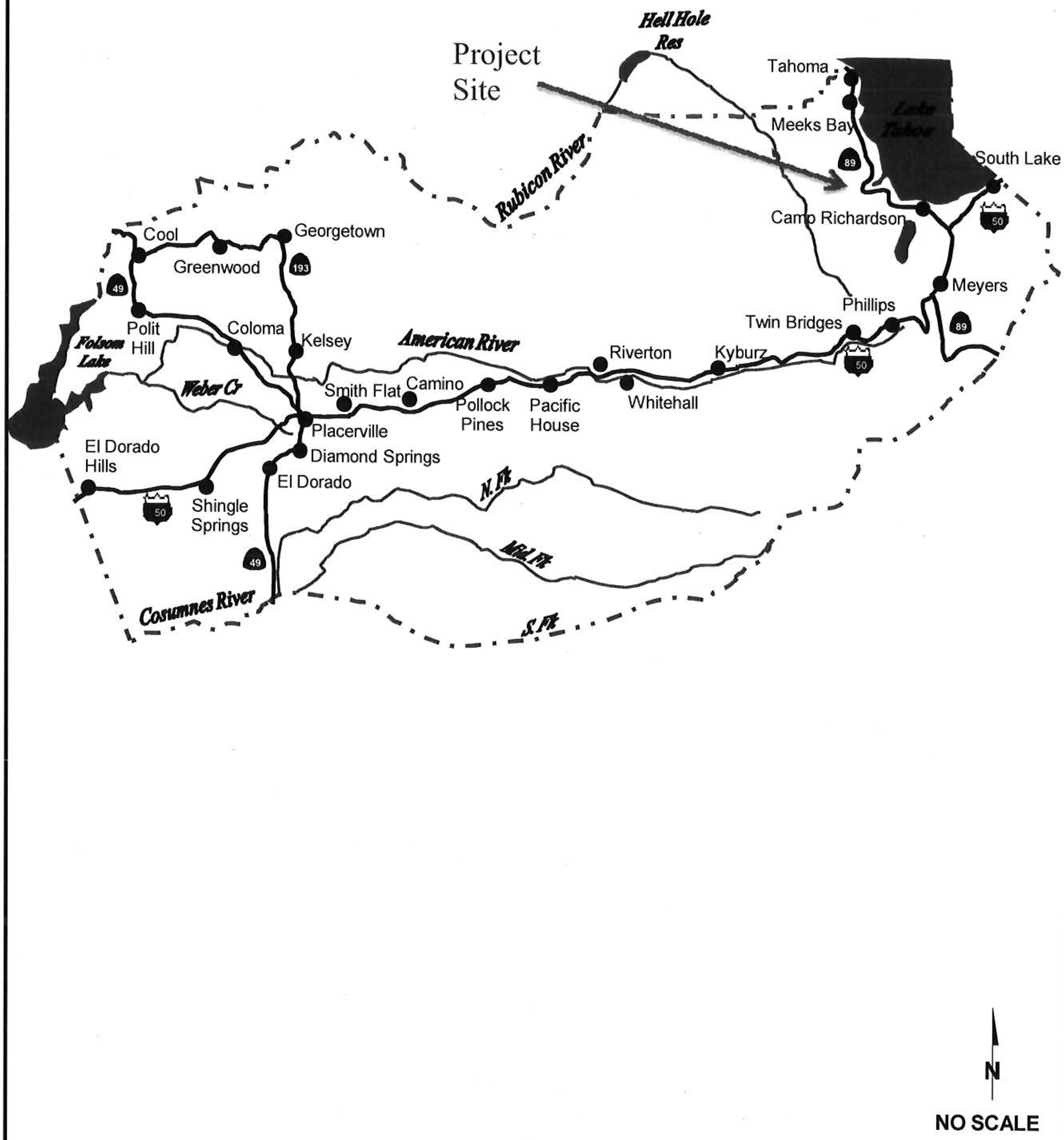
Attachments:
Plate 1. Vicinity Map
Plate 2a. Photograph
Plate 2b. Photograph
Plate 3a. Geologic Map
Plate 3b – 3d. Geologic Map Legend
Plate 4. Infiltration Borehole Locations
District 3 Plans No. 1 – 4. Typical Cross Sections

Appendices:

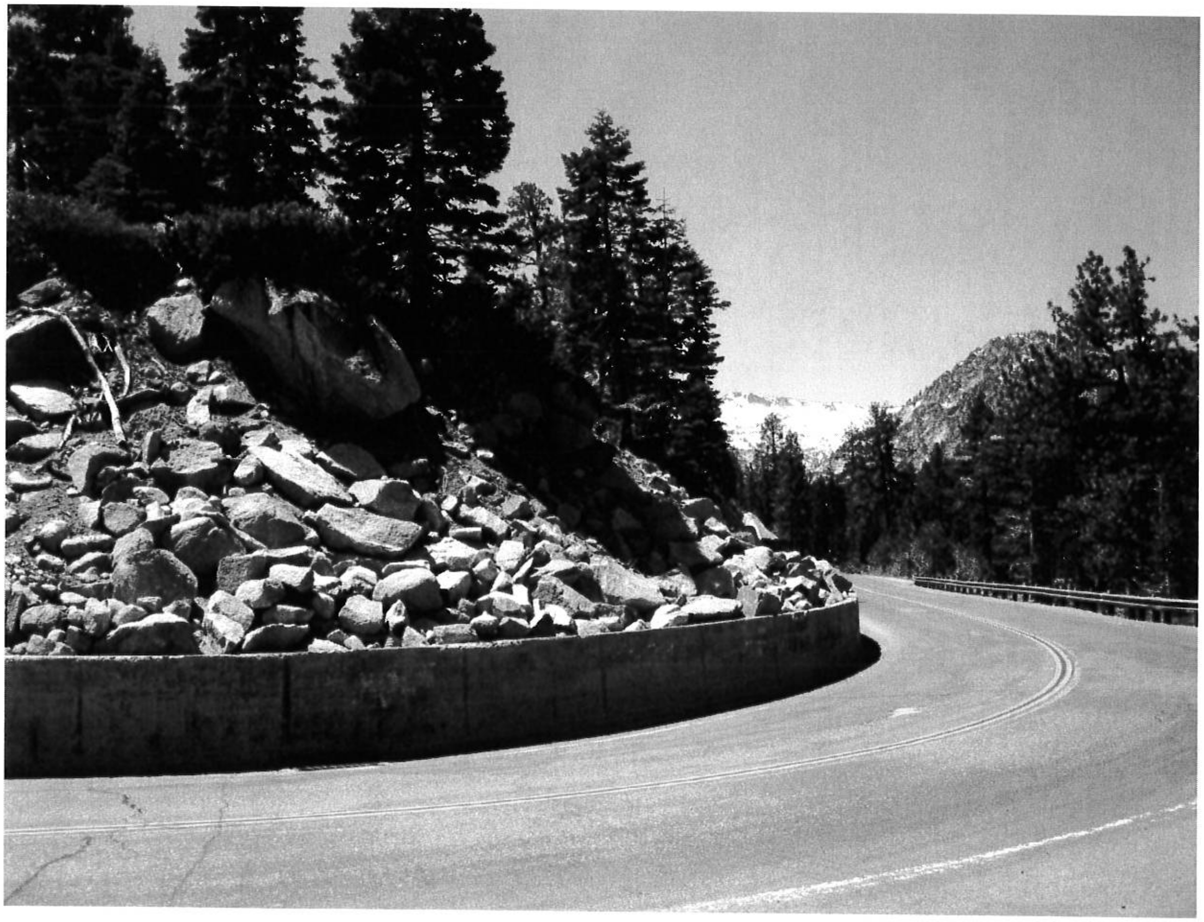
A. "Preliminary Rockfall Observations and Recommendations"

B. "Field Work Report Tahoe Environmental Improvement Project"

c: MarkHagy, (OGDN)
GDN File
DME - Dan Ferchaud
PM – Mike Bartlett

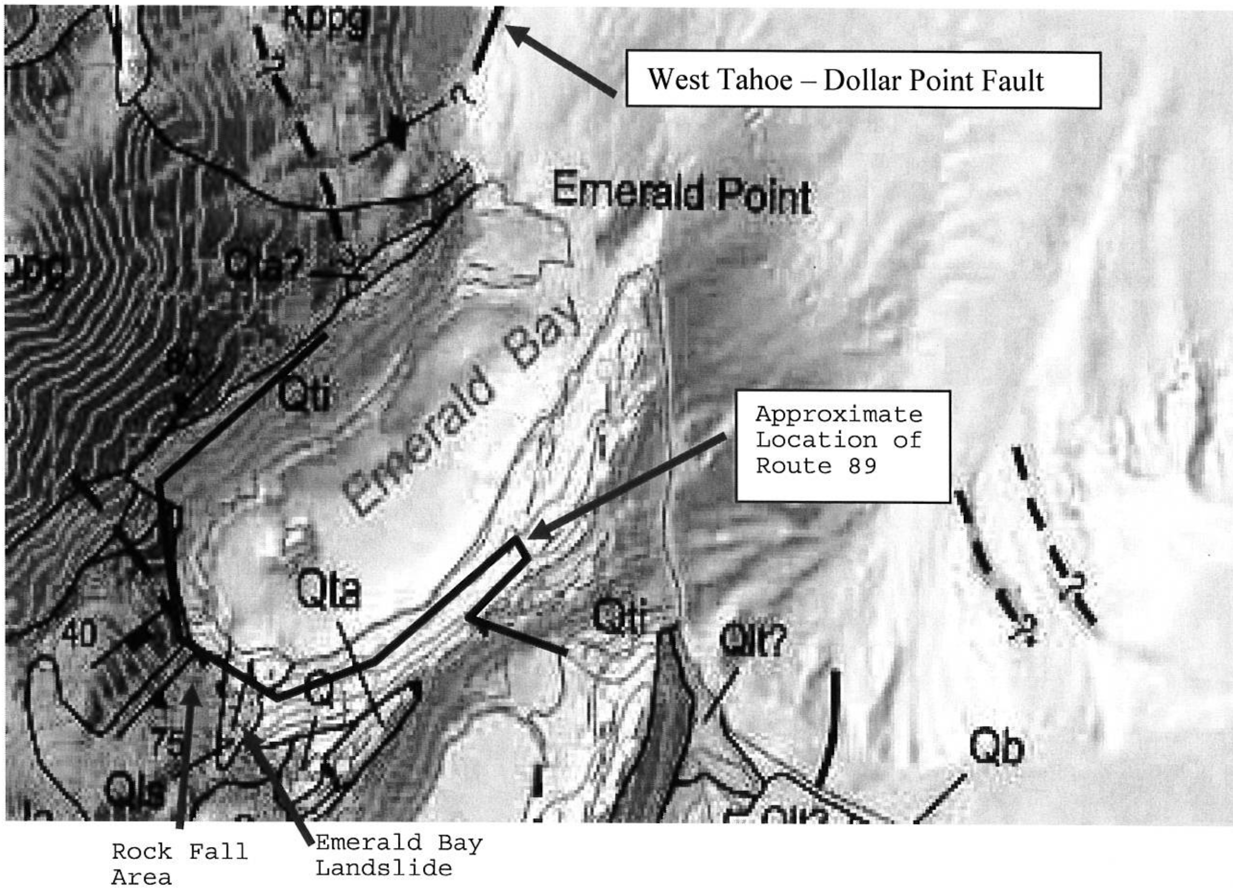


CALTRANS Engineering Services Office of Geotechnical Services Geotechnical Design Branch - North	EA:	03-1A843	**VICINITY MAP**	
	Date:	06/01/12		
	03-ED-89-PM 13.8/18.0			PLATE NO.
	Geotechnical Design Report			**1**



Looking north west at "A" Line approximately STA 205+50.

Looking north at "A" Line approximately STA 291+00.



"Geologic Map of The Lake Tahoe Basin", Regional Geologic Map No. 4

See Plates 3b, 3c, 3d For Legend

North
No Scale

CALTRANS Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North	EA: 03-1A843 Date: 6/1/2012	Geologic Map
	03-ED-50-PM 13.8/18.0 **Geotechnical Design Report**	Plate No. 3a

DESCRIPTION OF MAP UNITS

(See pamphlet for more detailed unit descriptions)

- af — Artificial fill (late Holocene)
- Qb — Beach deposits (Holocene)
- Qfp — Flood-plain deposits (Holocene)
- Qt — Talus deposits (Holocene)
- Ql — Lake deposits (Holocene)
- Qyg — Younger glacial deposits (Holocene)
- Qc — Colluvium (Holocene)
- Qls — Landslide deposits (Holocene and Pleistocene)
- Q — Alluvium (Holocene and Pleistocene)
- Qf — Alluvial fan deposits (Holocene and Pleistocene)
- Qm — Mudflow deposits (Holocene and (or) Pleistocene)
- Qob — Older beach deposits (Pleistocene)
- Qol — Older lake deposits (Pleistocene)
- Qlt — Lacustrine terrace deposits (Pleistocene)

Tioga glacial deposits (Pleistocene)

- Qti — Till
- Qtio — Outwash deposits

Tahoe glacial deposits (Pleistocene)

- Qta — Till
- Qtao — Outwash deposits

Tahoe and Tioga glacial deposits - undivided (Pleistocene)

- Qgt — Till

Older glacial deposits - pre-Tahoe deposits (Pleistocene)

Granitic rocks

- ap — Aplite and pegmatite dikes (Cretaceous)
- Kelg — Echo Lake granodiorite (Cretaceous)
- Kppg — Phipps Pass granodiorite (Cretaceous)
- Kbmg — Bryan Meadow granodiorite (Cretaceous)
- Kllg — Lovers Leap granodiorite (Cretaceous)
- Kgag — Glen Alpine granodiorite (Cretaceous)
- Ktlg — Tyler Lake granodiorite (Cretaceous)
- Kwlg — Wrights Lake granodiorite (Cretaceous)
- Kdlg — Dicks Lake granodiorite (Cretaceous)
- Krpa — Alaskite at Rubicon Point (Cretaceous)
- Krvg — Rockbound Valley granodiorite (Cretaceous)
- Kwpg — Granodiorite of Waterhouse Peak (Cretaceous)
- Kgqd — Quartz diorite of Grass Lake (Cretaceous)
- Kkgg — Granodiorite of Kingsbury Grade (Cretaceous)
- Kwpt — Tonalite West of Waterhouse Peak (Cretaceous)
- Keg — Granodiorite of East Peak (Cretaceous)
- Ksgr — Monzogranite of Spooner Summit of Grose (1985) (Cretaceous)
- Ktcg — Granodiorite of Thornburg Canyon (Cretaceous)
- Kcvg — Granodiorite of Charity Valley (Cretaceous)
- Kcld — Diorite of Caples Lake (Cretaceous)

Tahoe and Tioga glacial deposits - undivided (Pleistocene)

- Qgt — Till

Older glacial deposits - pre-Tahoe deposits (Pleistocene)

- Qog — Till
- Qogo — Outwash deposits

Glacial deposits undivided (Pleistocene and Holocene?)

- Qg — Till
- Qgo — Outwash deposits
- Qvbm — Bald Mountain olivine latite of Birkeland (1961) (Pleistocene) Qvbmcc - cinder cone deposits
- Qjf — Juniper Flat alluvium of Birkeland (1961) (Pleistocene)
- Qpc — Prosser Creek alluvium of Birkeland (1961) (Pleistocene)
- Qvh — Hirschdale olivine latite of Birkeland (1961) (Pleistocene) Qvhcc - cinder cone deposits; Qvht - basaltic tuff
- QPot — Older talus deposits (Pliocene and (or) Pleistocene)
- QPvd — Dry Lake volcanic flows of Birkeland (1961); Wise and Sylvester (2004) (Pliocene and (or) Pleistocene) - QPvd1 - QPvd4 (oldest to youngest)
- QPvbc — Big Chief basalt of Birkeland (1961) (Pliocene and (or) Pleistocene)
- QPvpm — Page Meadow basalt of Wise and Sylvester (2004) (Pliocene and (or) Pleistocene)
- QPs — Unnamed gravels, sand and alluvium (Pliocene and (or) Pleistocene)
- QPvbu — Burton Creek basalt of Wise and Sylvester (2004) (Pliocene and (or) Pleistocene)
- QPvlf — Lake Forest basalt of Wise and Sylvester (2004) (Pliocene and (or) Pleistocene)

Unnamed volcanic and intrusive rocks (Pliocene and (or) Pleistocene)

- QPvb — Basalt flows, flow breccia and basaltic ash
- QPi — QPia - intrusive andesite and latite; QPib - intrusive basalt
- Pvta — Tahoe City trachyandesite of Wise and Sylvester (2004) (Pliocene) Pvtcc - cinder cone deposits
- Pvtb — Tahoe City basalt of Wise and Sylvester (2004) (Pliocene)
- Pvp — Polaris olivine latite of Birkeland (1961) (Pliocene) Pvpt - latite tuff and tuff breccia
- Pvah — Alder Hill basalt of Birkeland (1961) (Pliocene) Pvahcc - cinder cone deposits
- Ps — Fluvial and lacustrine deposits (Pliocene)

Unnamed volcanic and intrusive rocks (Pliocene)

- Pva — Andesite and basaltic andesite flows
- Pval — Andesite lahars
- Pvb — Basalt flows - includes Boca Ridge flows of Latham (1985)
- Pi — Dikes and intrusives - Pia - andesite; Pib - basalt

Unnamed volcanic and intrusive rocks (Miocene)

- Mva — Undivided andesitic and dacitic lahars, flows, breccia and volcaniclastic sediments
- Mvaf — Andesite and dacite flows
- Mvbf — Basalt flows
- Mvs — Fluvial deposits
- Intrusive rocks - Mia - andesite, basaltic andesite and latite; Mib - basalt; Mir - rhyolite
- Mvg — Glenbrook volcanic center (Miocene) Mvgi - latite intrusions; Mvgt - vitric-crystal tuff; Mvgf - trachyte flows and vent fill

Upper lahar sequence of Harwood and Fisher (2002) (Miocene)

- Mvul — Andesitic lahars
- Mvula — Andesite flows

- Kcvg — Granodiorite of Charity Valley (Cretaceous)
- Kcld — Diorite of Caples Lake (Cretaceous)
- Kclg — Granodiorite of Caples Lake (Cretaceous)
- Kfpg — Freel Peak granodiorite (Cretaceous)
- Kbla — Burnside Lake adamellite of Parker (1961) (Cretaceous)
- Kdpg — Granodiorite of Daggett Pass (Cretaceous)
- Kcpt — Carson Pass tonalite of Parker (1961) (Cretaceous)
- Kfvg — Granodiorite of Faith Valley (Cretaceous)
- Kepg — Ebbetts Pass granodiorite of Wilshire (1957) (Cretaceous)
- Kklg — Granodiorite of Kinney Lakes (Cretaceous)
- bd — Basalt dikes (Cretaceous)
- Kdqd — Quartz monzodiorite north of Daggett Pass (Cretaceous?)
- Kbp — Breccia pipe (Cretaceous?)
- Kcfg — Camper Flat granodiorite (Cretaceous or Jurassic?)
- Kdvg — Desolation Valley granodiorite (Cretaceous or Jurassic?)
- Kkqm — Keiths Dome quartz monzonite (Cretaceous or Jurassic?)

Unnamed granitic rocks of the Sierra Nevada batholith

- Kgr — Granite and granodiorite, undivided (Cretaceous)
- Kqd — Quartz diorite and diorite (Cretaceous)
- Kdg — Diorite and gabbro (Cretaceous)
- KJgr — Granite (Cretaceous and (or) Jurassic)
- KJgd — Granodiorite (Cretaceous and (or) Jurassic)
- KJdg — Diorite and gabbro (Cretaceous and (or) Jurassic)

Jurassic intrusive rocks:

- Jaqd — Quartz diorite at Azure Lake (Late? and Middle Jurassic)
- Jpgr — Pyramid Peak granite (Jurassic)
- Jdi — Diorite (Jurassic?)
- Jdg — Diorite and gabbro (Late? and Middle Jurassic)
- Jmd — Microdiorite dikes (Jurassic)
- Jmib — Mafic intrusive breccia (Late? and Middle Jurassic)
- Ja — Anorthosite (Late? and Middle Jurassic)

Metamporhic rocks

Tuttle Lake Formation of Harwood (1992) (Late? and Middle Jurassic)

- Jtlf — Lava flows
- Jtlb — Volcanic breccia
- Jtls — Tuffaceous sandstone and conglomerate
- Jtld — Diamictite
- Jsc — Sailor Canyon Formation (Middle and Early Jurassic)
- JTrm — Metamorphic rocks undivided (Jurassic and (or) Triassic)

Upper lahar sequence of Harwood and Fisher (2002) (Miocene)

- Mvul — Andesitic lahars
- Mvula — Andesite flows
- Mvulp — Pumiceous tuff
- Mvulr — Rockslide-avalanche deposits

Lower lahar sequence of Harwood and Fisher (2002) (Miocene)

- Mvll — Andesitic lahars
- Mvlla — Andesite flows

Unnamed volcanic and sedimentary rocks

- ΦMvr — Rhyolite tuff (Oligocene and Miocene?)
- Φc — Conglomerate and breccia (Oligocene and (or) older Tertiary)

- Jsc — Sailor Canyon Formation (Middle and Early Jurassic)
- JTrm — Metamorphic rocks undivided (Jurassic and (or) Triassic)
- JTrms — Metasedimentary rocks (Jurassic and (or) Triassic)
- JTrmv — Metavolcanic rocks (Jurassic and (or) Triassic)
- Trls — Limestone (Late Triassic?)

Lake Tahoe Sequence of Harwood (1992)

- Jlp — Pelite unit (Jurassic?)
- Jle — Ellis Peak Formation (Jurassic)
- Jlb — Blackwood Creek Formation (Jurassic)
- Mls — Serena Creek Formation (Mississippian? or younger)

MAP SYMBOLS

Contact - solid where well or approximately located; dashed where inferred or gradational.

Fault - solid where well located; dashed where approximately located; short dash where inferred; dotted where concealed; queried where continuation or existence is uncertain. Ball and bar on downthrown side. *(The age and location of the faults in the lake bottom and cutting Quaternary deposits should be considered preliminary interpretations.)*

Thrust fault - solid where well located; dashed where approximately located.

Anticlinal fold - arrow indicates plunge direction.

Synclinal fold - arrow indicates plunge direction.

Glacial moraine crest.

Dikes - andesite, latite, basalt and mafic dikes; dashed where approximately located.

Arrows on landslides indicate direction of movement.

Maar at Lake Forest on the Kings Beach Quadrangle.

Strike and dip of stratified rocks. Number indicates dip angle in degrees when known.

- 25 — Inclined beds
- 40 — Inclined beds - ball indicates top direction known
- Vertical beds
- 80 — Overturned beds

Strike and dip of metamorphic and igneous foliation and cleavage.

- 45 — Foliation or cleavage
- Vertical foliation or cleavage
- 60 — Cleavage parallel to bedding
- 55 — Cleavage parallel to bedding - ball indicates top direction known

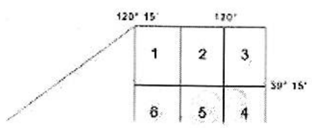
Strike and dip of joints.

- 70 — Joint
- Vertical joint

ABBREVIATED INDEX TO GEOLOGIC SOURCE DATA

(Primary compilation sources shown in bold type)

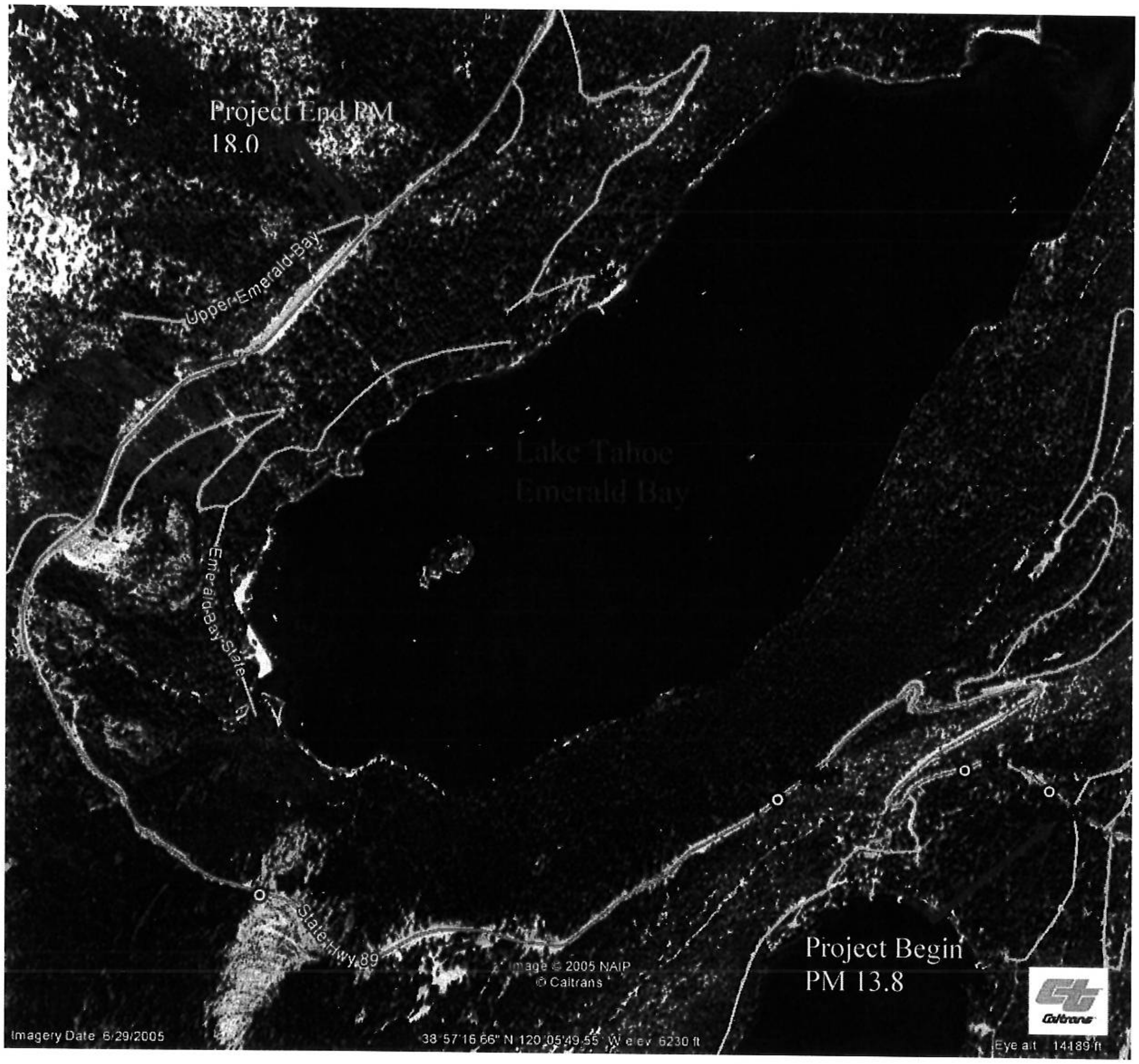
7°30'



1. Truckee Quadrangle*
   Birkeland, P.W, 1961; Burnett, J.L., 1982; Franks, A.L., 1980; Gates, W.C.B., 1994; **Harwood, D.S. and Fisher, G.R., 2002**; Hawkins, F.F., LaForge, R. and Hansen, R.A., 1986; Latham, T.S., Jr., 1985; **Wise, W.S. and Sylvester, A.G., 2004**.
2. Martis Peak Quadrangle*
   Birkeland, P.W, 1961; Burnett, J.L., 1982; Franks, A.L., 1980; Gates, W.C.B., 1994; **Latham, T.S., Jr., 1985**; Matthews, R.A., 1968; **Wise, W.S. and Sylvester, A.G., 2004**.
3. Mount Rose Quadrangle*
   Lewis, R.L., 1988; Stewart, J.H., 1999.
4. Marlette Lake Quadrangle*
   Grose, T.L.T., 1986; Stewart, J.H., 1999.
5. Kings Beach Quadrangle*
   Burnett, J.L., 1982; Franks, A.L., 1980; **Wise, W.S. and Sylvester, A.G., 2004**.

11. Emerald Bay Quadrangle*
    Burnett, J.L., 1982; **Fisher, G.R., 1989**; Loomis, A.A., 1983; **McCaughey, J.W., 2003**; U.S. Department of Agriculture, 1974.
12. Rockbound Valley Quadrangle
    Fisher, G.R., 1989; **Loomis, A.A., 1983**; **Sabine, C., 1992**.
13. Pyramid Peak Quadrangle
    Connelly, S.F., 1988; John, D.A., Armin, R.A. and Moore, W.J., 1981; **Loomis, A.A., 1983**; **Sabine, C., 1992**; Wagner, D.L. and Spittler, T.E., 1997.
14. Echo Lake Quadrangle*
    Burnett, J.L., 1982; Connelly, S.F., 1988; Fisher, G.R., 1989; **John, D.A., Armin, R.A. and Moore, W.J., 1981**; **Loomis, A.A., 1983**; **McCaughey, J.W., 2003**.
15. Freel Peak Quadrangle*
    Armin, R.A. and John, D.A., 1983; John, D.A., Armin, R.A. and Moore, W.J., 1981.

CALTRANS Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North	EA: 03-1A843 Date: 6/1/2012	Geologic Map Legend	
	03-ED-50-PM 13.8/18.0 **Geotechnical Design Report**		Plate No. 3d



Legend:

● Borehole Locations

Note: Locations of BH 89-67-MW1 & BH 89-65-MW1 are very close to each other as a result they show up as one dot.

North
No Scale

CALTRANS Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North	EA: 03-1A843 Date: 6/1/2012	Infiltration Borehole Locations
	03-ED-50-PM 13.8/18.0 **Geotechnical Design Report**	Plate No. 4

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	89	13.8/18.0		

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 J. MILLER No. 67128 Exp 9-30-10 CIVIL STATE OF CALIFORNIA

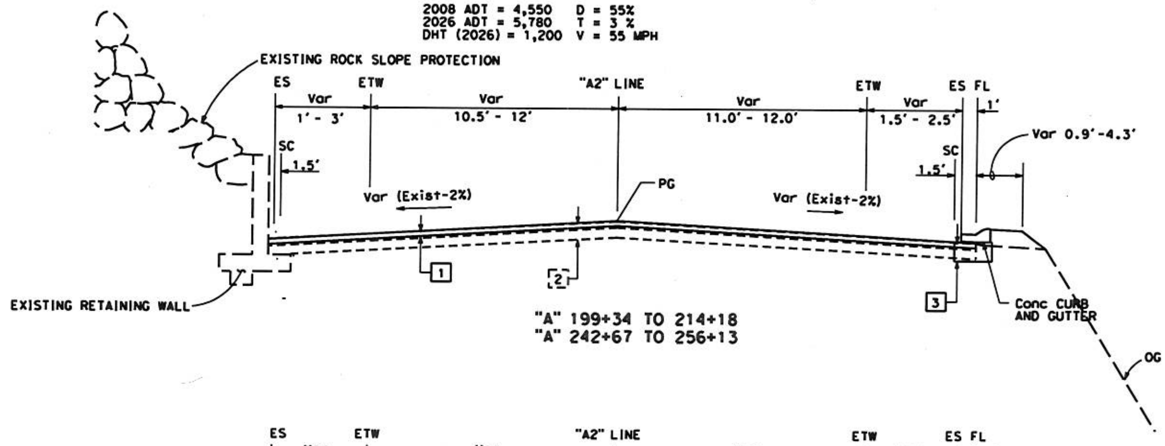
NOTES

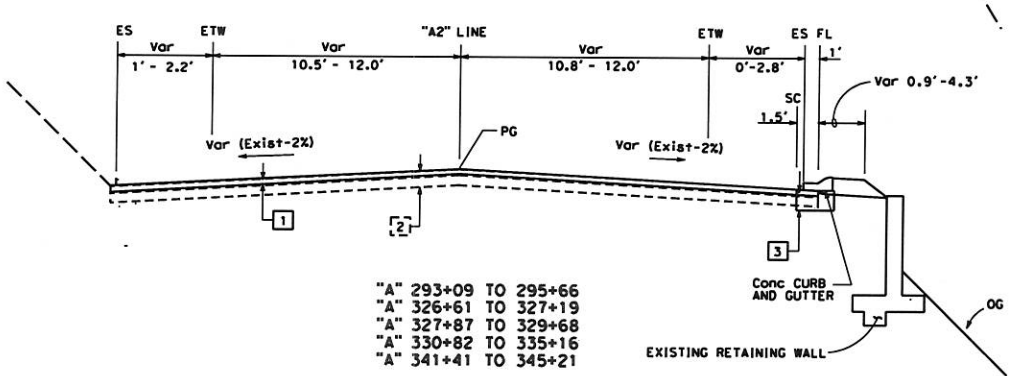
1. DIMENSIONS OF THE PAVEMENT STRUCTURES (STRUCTURAL SECTIONS) ARE SUBJECT TO TOLERANCES SPECIFIED IN THE STANDARD SPECIFICATIONS.
2. SUPERELEVATION AS SHOWN OR AS DIRECTED BY THE ENGINEER.
3. FOR PLACEMENT OF PCC CURB, PLEASE REFER TO ESL MAPPING.

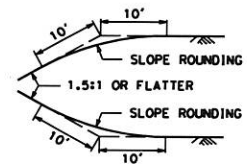
Typical Section Notes:
(1) Denotes 0.25' Overlay & 0.20' Cold Plane- Whole project
(2) Denotes Existing Turnouts (Rt/Lt)
(3) Denotes Proposed Maintenance Vehicle Turnouts (MVP's) and Proposed Turnouts (Rt/Lt)
(4) Denotes Overlaying Existing Driveways (Rt/Lt)
(5) Denotes Regrading Existing Parking Lots
(6) Denotes Digouts (Rt/Lt)

DESIGN DESIGNATION (ROUTE 89, PM 13.80/18.00)

2008 ADT = 4,550 D = 55%
2026 ADT = 5,780 T = 3 %
DHT (2026) = 1,200 V = 55 MPH







SLOPE ROUNDING DETAIL (Typ)

STRUCTURAL SECTION

1. COLD PLANE AC PAVEMENT (0.25' Max) OVERLAY 0.20' HMA
2. Exist PAVEMENT 0.60' AC 0.50' Cl 2 AB
3. SHOULDER WIDENING OR TURNOUTS 0.50' HMA 1.00' Cl 2 AB
4. PCC CURB 0.5' PCC 1.0' AB (CLASS 2)

ROUTE 89

TYPICAL CROSS SECTIONS

NO SCALE

X-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	FUNCTIONAL SUPERVISOR	CALCULATED-DESIGNED BY	REVISED BY	DATE REVISED
NORTH REGION PROJECT DEVELOPMENT DESIGN BRANCH N-2	F. BARRIGA	CHECKED BY J. MILLER	J. MILLER	01/24/11

Caltrans

BORDER LAST REVISED 3/1/2007 | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => USER DGN FILE => REQUEST | CU 03224 | EA 1A8430

LAST REVISION 1/24/11 DATE PLOTTED => DATE TIME PLOTTED => TIME

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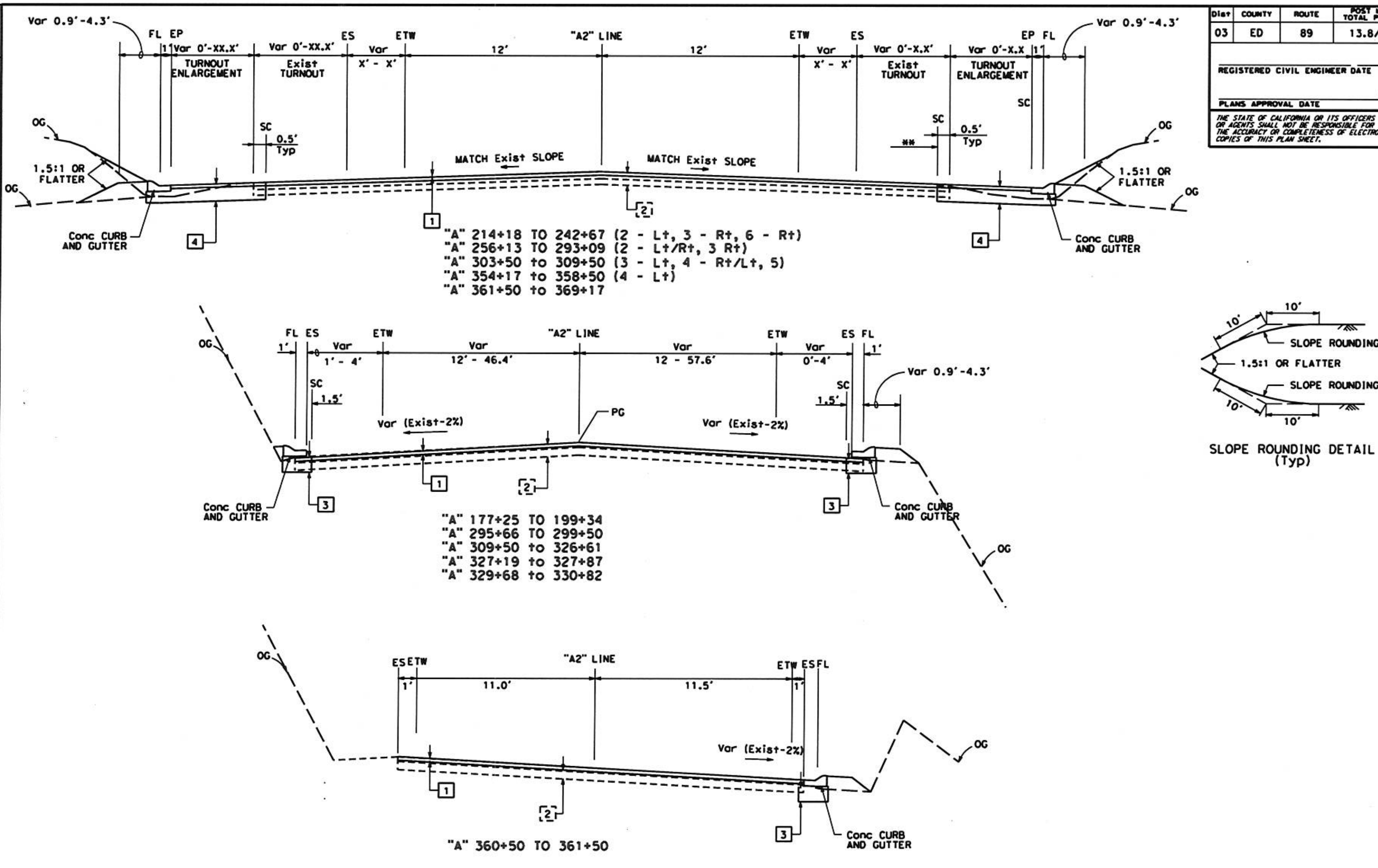
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
03	ED	89	13.8/18.0		

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 — J. MILLER — No. 67128 — Exp. 9-30-10 — CIVIL — STATE OF CALIFORNIA



TYPICAL CROSS SECTIONS

NO SCALE

X-2

ROUTE 89

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

NORTH REGION PROJECT DEVELOPMENT DESIGN BRANCH M-2

FUNCTIONAL SUPERVISOR: F. BARRIGA

CALCULATED-DESIGNED BY / CHECKED BY: J. MILLER

REVISED BY: J. MILLER — DATE REVISED: 01/24/11

LAST REVISION: 1/24/11 — DATE PLOTTED => @DATE — TIME PLOTTED => @TIME

BORDER LAST REVISED 3/1/2007

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CU 0324 — EA 1A8430

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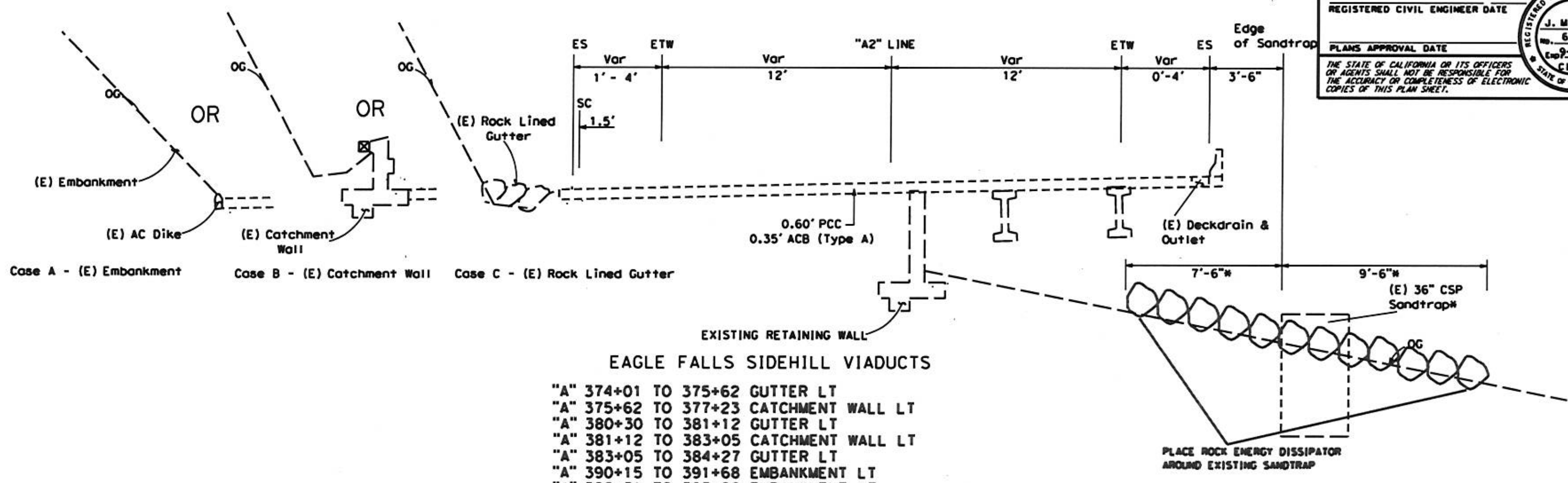
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	89	13.8/18.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

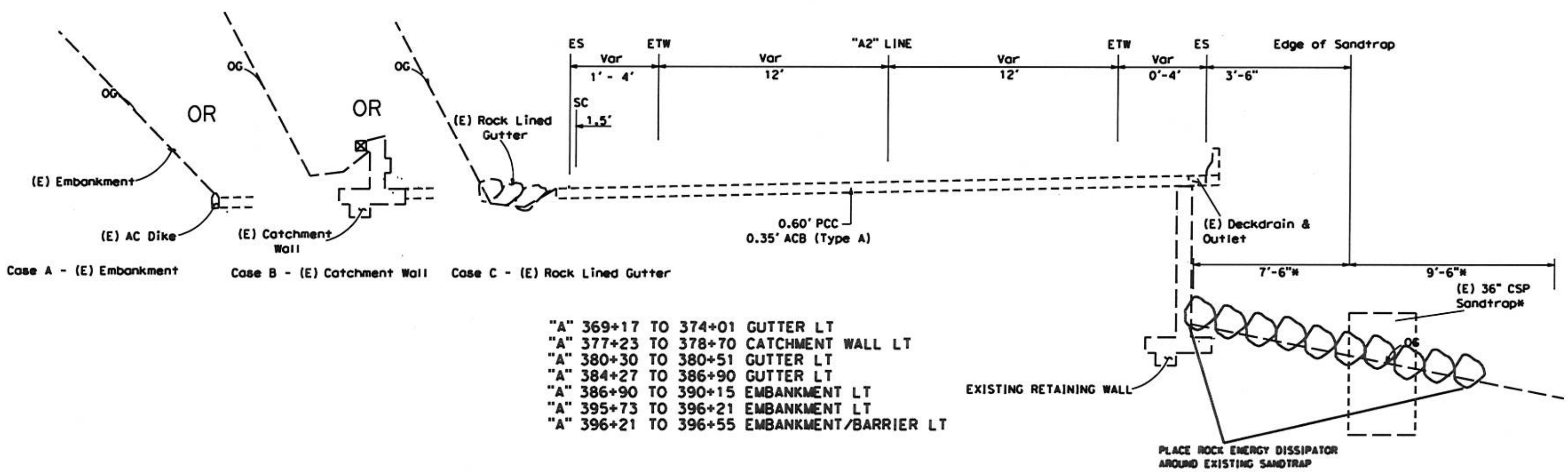
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER J. MILLER No. 67128 Exp. 9-30-10 CIVIL STATE OF CALIFORNIA



EAGLE FALLS SIDEHILL VIADUCTS

"A" 374+01 TO 375+62 GUTTER LT
"A" 375+62 TO 377+23 CATCHMENT WALL LT
"A" 380+30 TO 381+12 GUTTER LT
"A" 381+12 TO 383+05 CATCHMENT WALL LT
"A" 383+05 TO 384+27 GUTTER LT
"A" 390+15 TO 391+68 EMBANKMENT LT
"A" 392+31 TO 393+96 EMBANKMENT LT



"A" 369+17 TO 374+01 GUTTER LT
"A" 377+23 TO 378+70 CATCHMENT WALL LT
"A" 380+30 TO 380+51 GUTTER LT
"A" 384+27 TO 386+90 GUTTER LT
"A" 386+90 TO 390+15 EMBANKMENT LT
"A" 395+73 TO 396+21 EMBANKMENT LT
"A" 396+21 TO 396+55 EMBANKMENT/BARRIER LT

ROUTE 89

TYPICAL CROSS SECTIONS

NO SCALE

X-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
NORTH REGION
PROJECT DEVELOPMENT
DESIGN BRANCH M-2

FUNCTIONAL SUPERVISOR: F. BARRIGA
CALCULATED-DESIGNED BY: J. MILLER
CHECKED BY
REVISED BY: J. MILLER
DATE REVISED: 01/24/11

LAST REVISION 1/24/11
DATE PLOTTED => @DATE
TIME PLOTTED => @TIME

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BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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CU 03224

EA 1A8430

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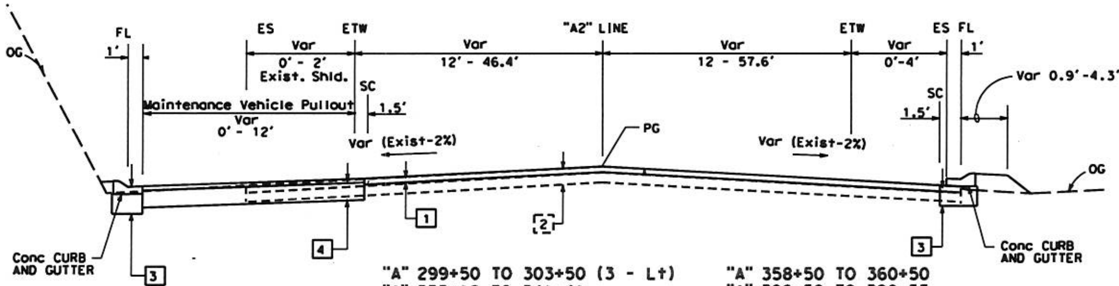
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
03	ED	89	13.8/18.0		

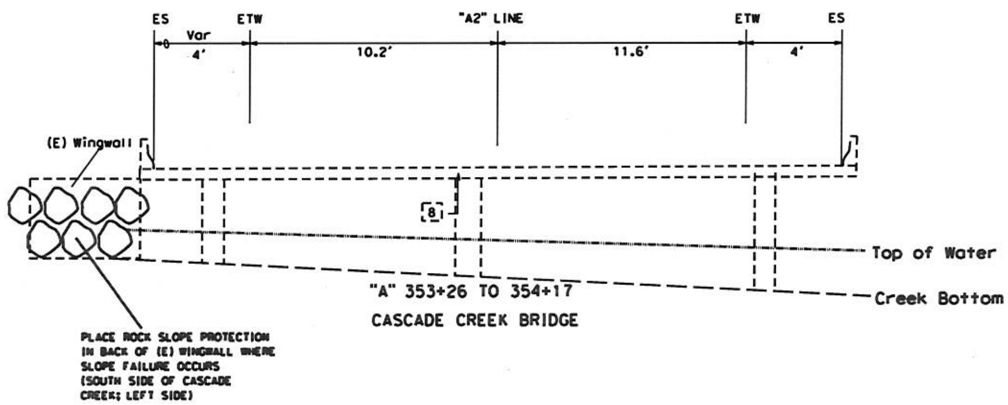
REGISTERED CIVIL ENGINEER DATE

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 J. MILLER No. 67128 Exp. 9-30-10 CIVIL STATE OF CALIFORNIA





* = R.E.D. DIMENSIONS SAME AS EA: 03-292101 (D-16, SECTION D-D)

ROUTE 89

TYPICAL CROSS SECTIONS

NO SCALE

X-4

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
NORTH REGION
PROJECT DEVELOPMENT
DESIGN BRANCH N-2

FUNCTIONAL SUPERVISOR: F. BARRIGA

CALCULATED-DESIGNED BY:
CHECKED BY: J. MILLER

REVISED BY: J. MILLER
DATE REVISED: 01/24/11

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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CU 03224

EA 1A8430

LAST REVISION 1/24/11
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Appendix A

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Mr. Greg Slocum, Project Engineer
Structures Design

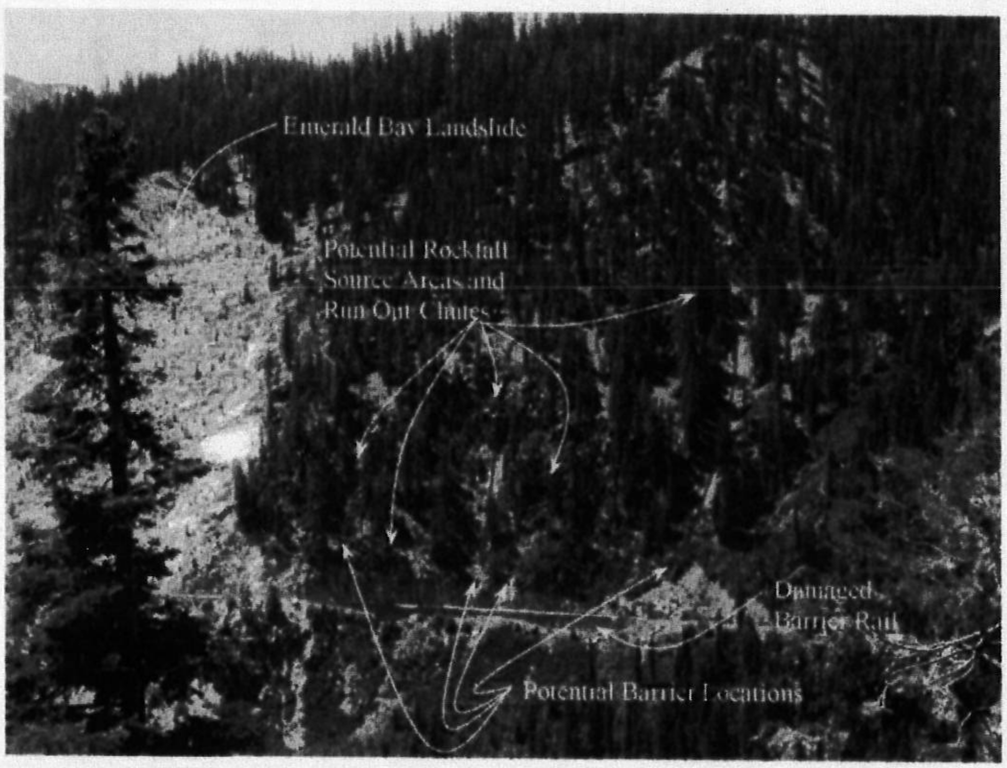
Date: July 10, 2003

File: 03-ED-89-KP 26.6
01-442703 PM 16.5

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS #5

Subject: Preliminary Rockfall Observations and Recommendations

Greg Slocum, Structures Design, is preparing an Advanced Planning Study for the repair/replacement of a rock-type barrier rail along Highway 89 in El Dorado at Kilometer Post 26.6. The existing barrier has been severely damaged by rockfall. Mr. Slocum asked the Office of Geotechnical Design - North (OGDN) to recommend appropriate rockfall mitigation measures for this site. This section of the highway is located on the slope above the western end of Emerald Bay, Lake Tahoe. It is located next to the Emerald Bay landslide (see Photograph 1 below).



Photograph 1. A photograph taken looking southwest toward of the slope above the damaged barrier and the Emerald Bay landslide.

DAS–OBM–125

INITIALS/DATE				
7/21/03	7/21/03	7/21/03		

The highway was constructed on a sidehill cut and fill. The highway has little or no shoulder and the lanes are narrow. The cut, near vertical and up to 18 meters in height, was excavated in granitic rock.

Mr. Timothy Beck of the OGDN reviewed the site on July 1, 2003. The terrain at this location is steep and rugged from the lake to the ridgeline. Four potential rockfall source areas and run out chutes were identified at this site (See Photograph 1). The damaged portions of the barrier rail are located just below the run out chutes. A portion of the cut has failed and also contributes rockfall to the site.

There are a number of rockfall mitigation measures that would be appropriate for this site. Widening the highway with a larger cut could be used to create a rockfall catchment ditch. The catchment ditch would require periodic cleaning and it would probably be difficult to get the permitting agencies to approve a larger cut. Relocating the highway on a viaduct would create a rockfall catchment ditch or allow rock to pass under the roadway. A viaduct would be expensive, require maintenance, and it would probably be difficult to get the permitting agencies approvals. A rockshed could be built to allow the rockfall to pass over the roadway. The rockshed would be expensive, require maintenance, and it would probably be difficult to get the permitting agencies approvals. Erecting cable net barriers across the run out chutes above the highway would greatly reduce or eliminate rockfall from reaching the highway. The net barriers could be "powder coated" to blend into their surrounding and they would probably cost an order of magnitude less than a cut or a structure. The barriers would require periodic rock removal, repairs, and are relatively unknown to permitting agencies. Finally, the source areas could be stabilized with rock bolts, pinned wire mesh, rock trimming or a combination of the three. Stabilizing the source areas would probably comparable in cost to cable net barriers and maintenance free. The source areas are not in the highway right-of-way and it might be difficult get permission to do slope modifications. Stabilizing the source areas is the recommended rockfall mitigation method in spite of its negatives.

All of these rockfall mitigation methods would require further studies. The OGDN could assist in those further studies. If you have any additional questions, please call Tim Beck at (916) 227-7184.

TIMOTHY J. BECK
Senior Engineering Geologist
Geotechnical Design - North

c: RoyBibbens, SteveMahnke, JohnDuffy, KowBannerman, OGDN.03

Appendix B

State of California

Business, Transportation and Housing Agency

Memorandum

To: Tim Beck
Geotechnical Design North

Date: October 7, 2004
File: 03-ED-89-KP 26.6/26.8
EA: 03-4C2500

Attention: Tim Beck

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5

Subject: Ground Penetrating Radar Survey, Emerald Bay Rubble Wall

Introduction

This report documents results of a ground penetrating radar (GPR) survey of an area adjacent to the Emerald Bay rubble wall along State Route 89 in El Dorado County, KP 26.6/26.8. The survey was conducted in an attempt to identify boulders and in-place rock in the area of the proposed barrier slab excavation.

Ground Penetrating Radar Data Acquisition and Processing

A ground penetrating radar (GPR) survey was conducted in order to obtain subsurface reflection data in the area of a proposed barrier slab excavation. Figure 1 is an aerial photo of State Route 89 in the vicinity of the rubble wall. A Sensors and Software PulseEKKO acquisition system, using 450 and 225 MHz antennas, was used to collect the GPR data. Data were collected along transects oriented parallel to the wall. Figure 2 is a map showing the location of the GPR profiles with respect to the existing wall. A total of 8 profiles were surveyed. Four transects were collected using the 450 MHz antennas and four transects were collected using the 225 MHz antennas. Only the profiles collected with the 450 MHz antennas are discussed in the report. The other records can be made available upon request. Records collected using the 225 MHz antennas are minimally diagnostic. Win Ekko Pro a commercially available software package, was used to process the GPR data and generate the GPR profiles presented in this report.

Results of Ground Penetrating Radar Survey

The investigation depth of the GPR profiles presented in this report is approximately 1.0 meter. Most reflections observed in the upper 0.46 m, the proposed depth of the of the barrier slab, are related to the roadway structural section. Reflections within this zone are typically high amplitude, flat lying and laterally continuous. Locally, reflections representative of in-place rock exist as shallow as 0.25 m (Figure 3). Reflections characteristic of reinforcing steel dowels are also present in the upper 0.46 m, which could potentially impact construction. The reflections are located between approximately 27 m and 30 m along Profiles 2, 3, and 4 (Figure 4) and may be related to the drain inlet located near the base of the wall between 28.0 m and 28.9 m along Profile 1.

The proposed depth of the barrier slab key is 0.91 m. Profile 3 is positioned over the northern edge of the proposed trench where the barrier slab key is to be constructed. The reflection record for Profile 3 is shown in Figures 4, 5 and 6. Two zones nearly devoid of reflections exist along the profile: one below approximately 0.5 m depth between 24 m and 40 m and another below approximately 0.75 m depth between 118 m and 137 m (see Figures 4 and 6, respectively). A smaller zone, also devoid of reflections exists along Profile 3 between 4.0 m and 8.0 m (Figure 4). The lack of reflections in these zones indicates the areas consist of a homogenous, resistive material, which could represent clean fill or unfractured rock. Given the location of the road, one might expect to find in place rock below the roadway structural section. However, in the absence of other data, the composition of the material in these zones is uncertain. With the exception of the aforementioned zones, most of Profile 3 below approximately 0.5 m depth consists of numerous short, discontinuous, and steeply dipping reflections that exhibit a relatively high degree of scattering characteristic of rubble fill and fractured rock.

Conclusions

Based on reflections observed in the GPR profiles, the upper 0.46 m in the area of the proposed barrier slab consists mainly of the roadway structural section. Locally however, in-place rock may be encountered as shallow as 0.25 m. Additionally, between approximately 27 m and 30 m along Profile 3 steel dowels might be encountered within 0.25 m of the surface, which could hamper excavation efforts. In the vicinity of the proposed barrier slab key, rubble fill and in-place rock should be anticipated below a depth of approximately 0.5 m.

Thank you for the opportunity to work on this project. If you have any questions or require further assistance, please call Charlie Narwold at 916 227-4468 or Bill Owen at 916 227-0227.

Original Signed By
Charlie Narwold, CEG 2335
Geophysics and Geology Branch

Original Signed By
Reviewed By: William Owen, Chief
Geophysics and Geology Branch

c: Project File

CN/03-ED-89-KP 26.6/26.8

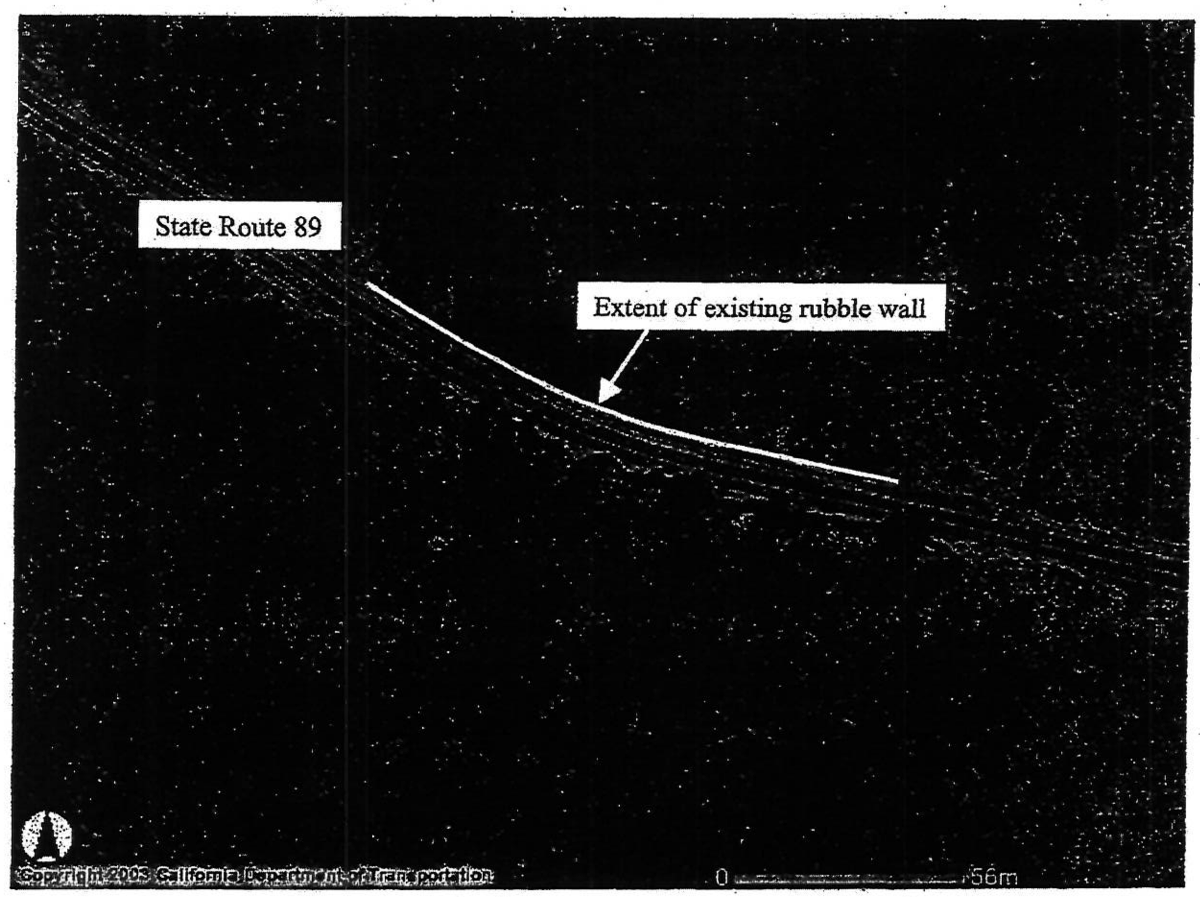


Figure 1. Aerial photo showing State Route 89 in the vicinity of the Emerald Bay Rubble Wall, 03-ED-89-KP 26.6/26.8. Extent of existing rubble wall delineated by white line parallel to roadway.

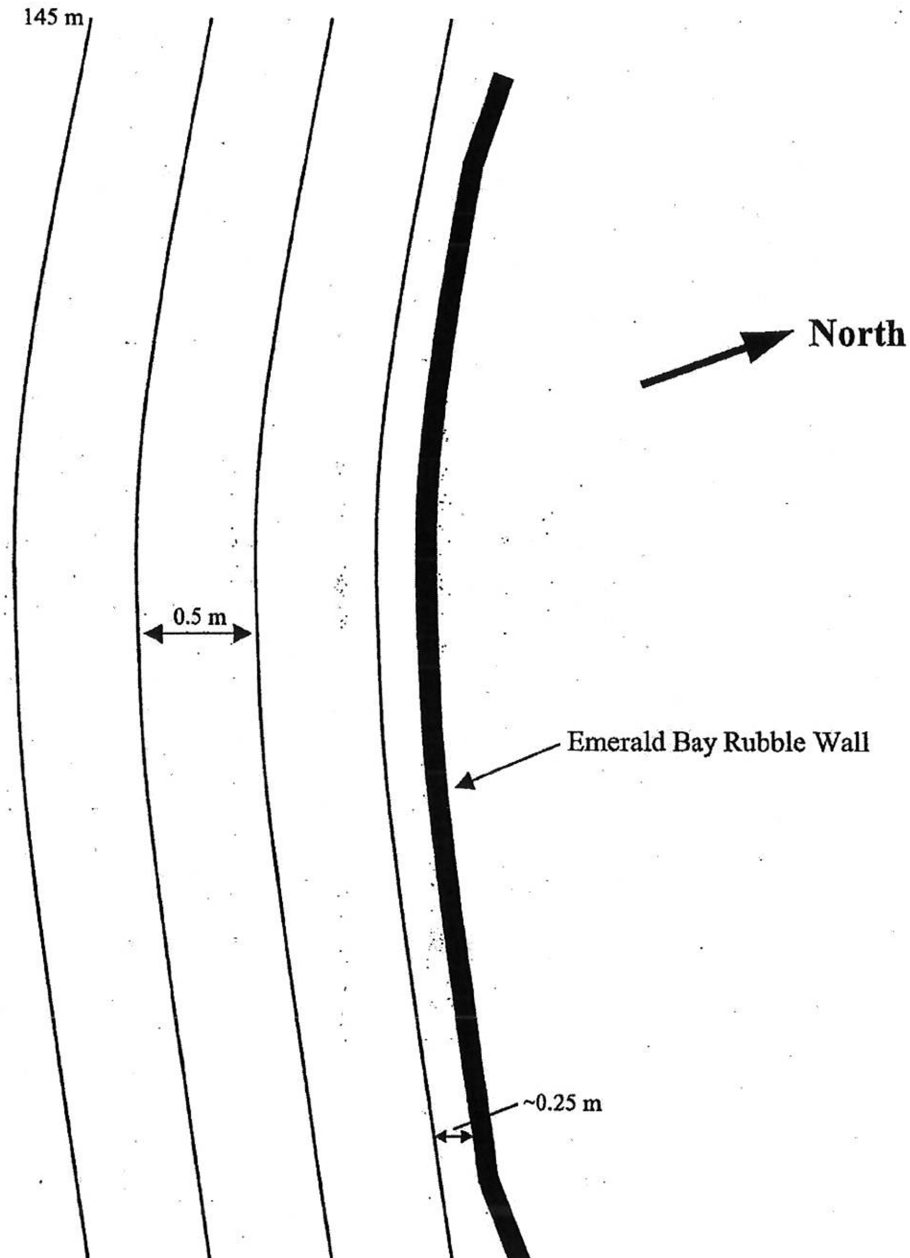


Figure 2. Map showing location of GPR survey profiles adjacent to Emerald Bay Rubble wall, 03-ED-89-KP 26.6/26.8. Profiles were surveyed from East to West and are approximately 145 m in length. Profiles start at approximately Station 113+69. Profiles are 0.5 m apart. Profile 1 is coincident with the edge of pavement except near the beginning and end of the profile. Profile 3 is approximately 2.25 m from the base of the existing wall, positioned over the northern edge of the proposed barrier slab key. Figure not drawn to scale.

Route 89 Emerald Bay Rubble Wall, 03-ED-89-KP 26.6/26.8
GPR Profile 2, 100 m to 130 m

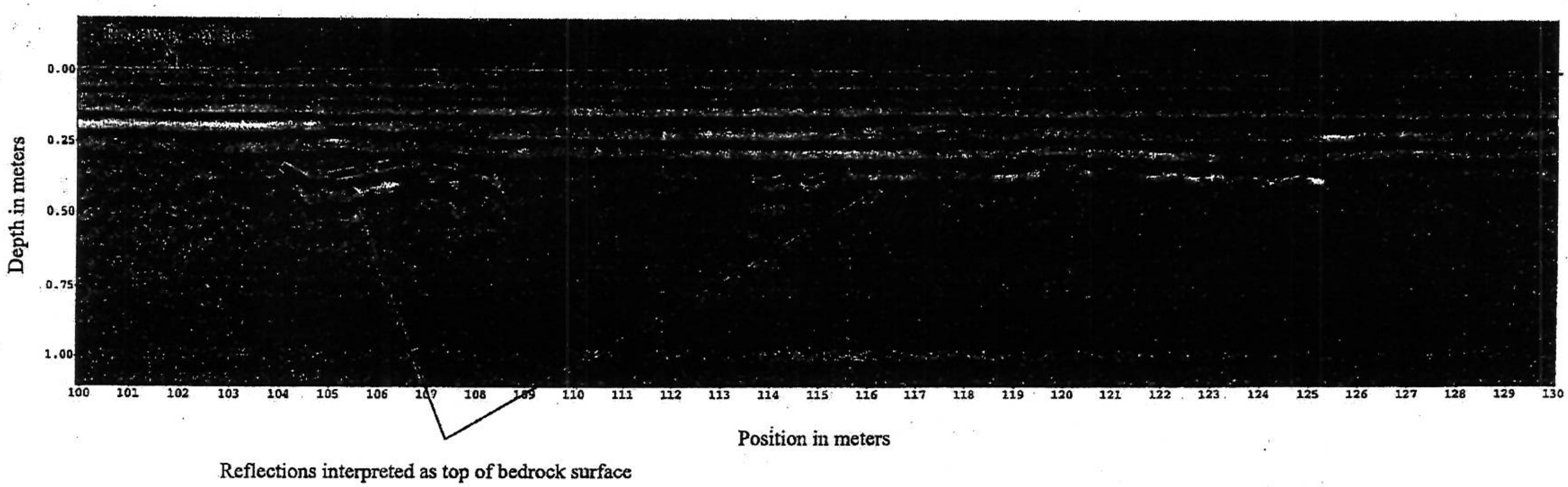


Figure 3. A portion of GPR Profile 2 showing reflections (highlighted by dashed black lines) interpreted as a shallow bedrock surface beneath the roadway.

Route 89 Emerald Bay Rubble Wall, 03-ED-89-KP 26.6/26.8
GPR Profile 3, 0 m to 50 m

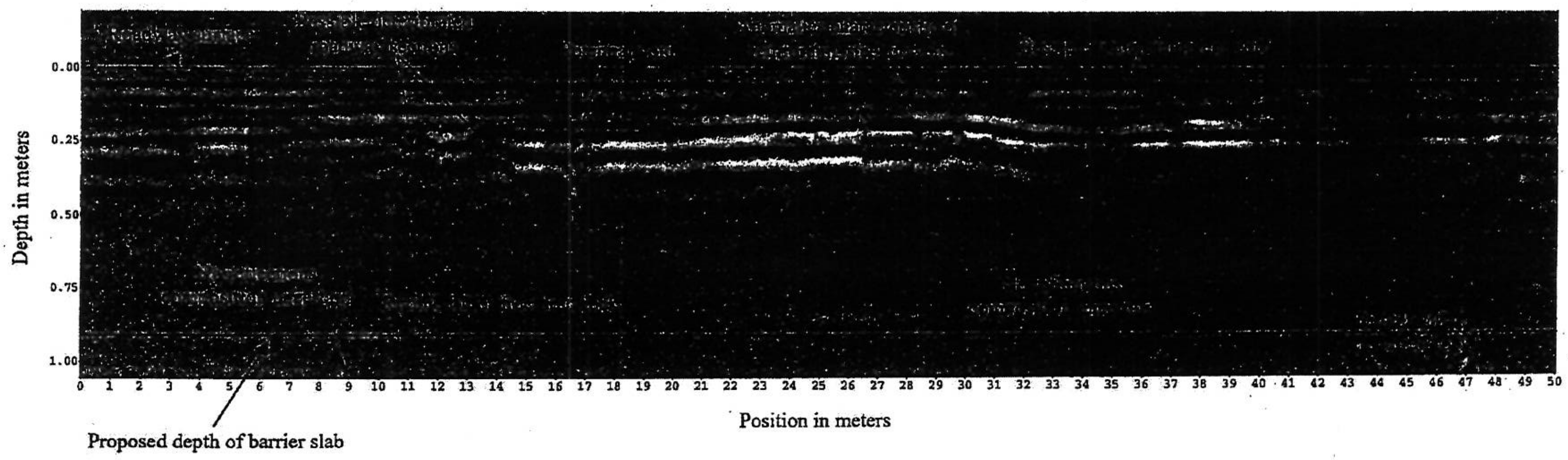


Figure 4. GPR Profile 3, 0 m to 50 m. Profile is positioned over the northern edge of the proposed barrier slab key. Total profile length is 145 m. Remainder of profile is presented in Figures 5 and 6. Laterally continuous, flat-lying reflections in upper ~0.25 m are interpreted to represent roadway structural section. Anomalies characteristic of reinforcing steel dowels exist between approximately 27 m and 30 m. Similar anomalies exist at approximately the same location along Profiles 2 and 4. Below approximately 0.5 m depth between 4 m and 8 m and between 24 m and 40 m no reflections are observed, the composition of the subsurface material here is uncertain. Areas interpreted to be rubble fill or fractured rock are noted. Prominent anomalies within the roadway structural section are also identified.

Route 89 Emerald Bay Rubble Wall, 03-ED-89-KP 26.6/26.8
GPR Profile 3, 50 m to 100 m

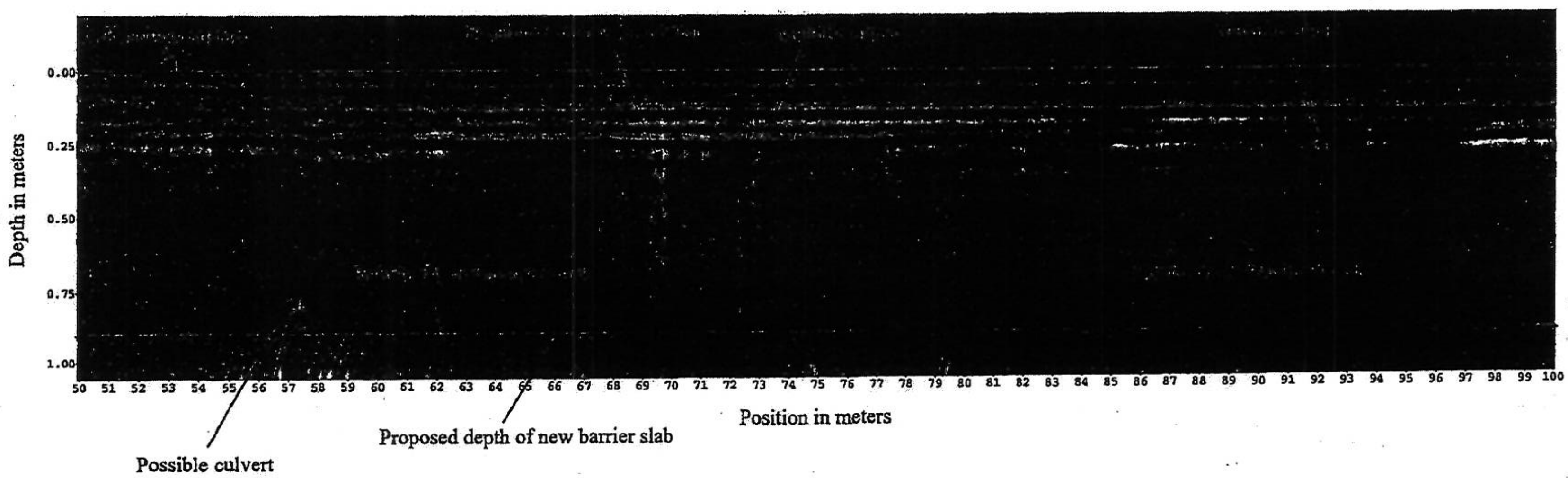


Figure 5. GPR Profile 3, 50 m to 100 m, showing areas interpreted to be rubble fill or fractured rock. Laterally continuous, flat-lying reflections in upper ~0.25 m are interpreted to represent roadway structural section. Anomalies at approximately 72.5 m and 92.5 m are characteristic of metallic objects but are of limited lateral extent, as they do not appear in adjacent profiles.

Route 89 Emerald Bay Rubble Wall, 03-ED-89-KP 26.6/26.8
GPR Profile 3, 100 m to 145 m

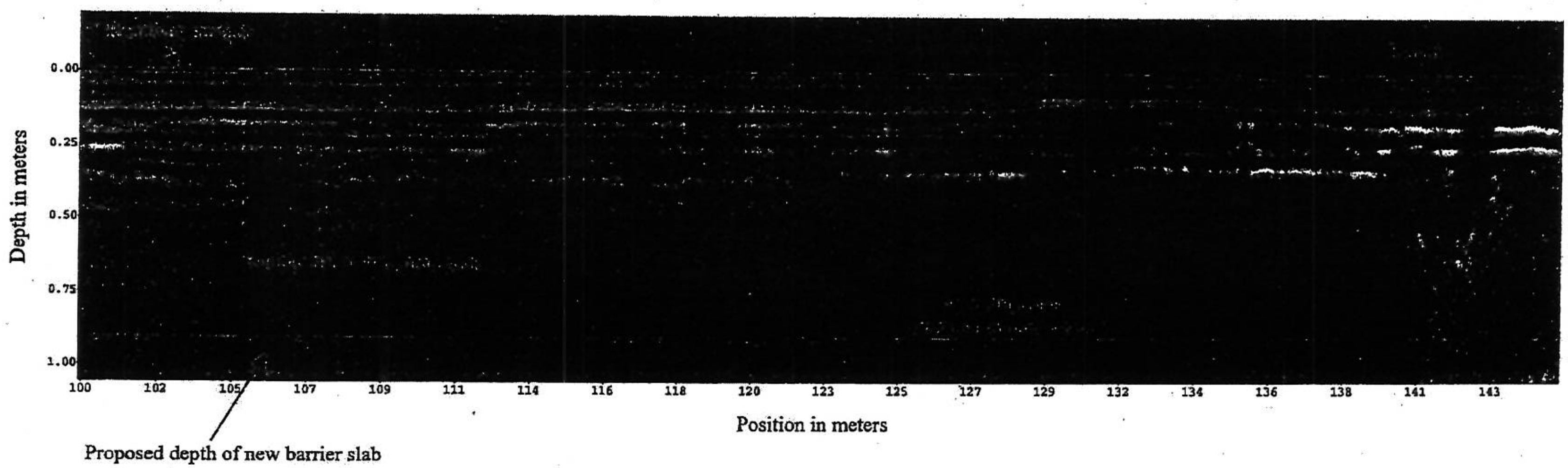


Figure 6. GPR Profile 3, 100 m to 145 m, showing areas interpreted to be rubble fill or fractured rock. Composition of subsurface material below approximately 0.75 m depth between 118 m and 137 m is uncertain. Laterally continuous, flat-lying reflections in upper ~0.25 m are interpreted to represent roadway structural section. A pronounced anomaly characteristic of a trench exists between 141 m and 143 m.

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. ANUP SINGH
Project Engineer
North Region – Design West

Date: October 29, 2003

File: 03-ED-89 KP 0.0/44.1
PM 0.0/27.4
EA: 03-1A840K
EIP Project

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: Preliminary Geotechnical Report

1. Introduction

Per the request of North Region – Design West, we are providing a Preliminary Geotechnical Report (PGR) for the proposed Tahoe Basin EIP Project. This project is located along State Highway 89 between KP 0.0 (PM 0.0) and KP 44.1 (PM 27.4), in El Dorado County, California. At this location it is proposed to widen the existing highway shoulders. In addition, to widening the existing shoulders it is proposed to construct concrete dikes, maintenance turnouts, onsite drainage collection and treatment systems. This project also proposed to include the rehabilitate existing drainage features and structures, left-turn channelization, vertical and horizontal curve corrections and overlay the highway.

This report includes a review of published data such as California Geologic Survey (CGS) publications and National Resource Conservation Service (NRCS) soil surveys, a review of previous site explorations, and a site reconnaissance. No subsurface exploration or laboratory testing was performed for this report. Therefore, actual conditions may vary from those assumed herein.

The purpose of this report is to assist designers, planners, project studies personnel, and environmental personnel. Information from this report may be included in the project report.

2. Existing Facilities and Proposed Improvements

At the time of our reconnaissance, Highway 89 is predominately a two-lane roadway paved with asphalt concrete (AC) except between KP (PM 8.56) and KP (PM 9.06) where the highway varies between three and four lanes with a continues left turn lane within the City of South Lake Tahoe. Highway 50 has paved and unpaved shoulders of variable width. Within the project area the highway is roughly aligned north/south. The City of South Lake Tahoe, Camp Richardson, Meeks Bay and Tahoma, California are located within the project limits. Overhead and underground utilities were observed in numerous locations throughout the project limits. In addition, residential homes and commercial structures were observed to front the highway sparsely throughout the project limits and moderately within the towns mentioned above.

This project involves widening on both sides of the existing highway to provide 1.2 to 2.4m wide paved shoulders. In addition to widening the existing shoulders it is proposed to construct concrete dikes, maintenance turnouts and onsite drainage collection and treatment systems.

3. Pertinent Reports and Investigations

The following documents were used in preparing this report.

a) Western Regional Climate Data Center http://www.wrcc.dri.edu/, September 2003.
b) United States Geological Survey (USGS) 7.5 minute Topographic Maps "Emerald Bay Quadrangle," dated 1969, "Freel Peak Quadrangle," dated 1994, "Meeks Bay Quadrangle," dated 1992, "Homewood Quadrangle," dated 1973 and "Echo Lake Quadrangle," dated 1992.
c) CGS, Open File Report 2000-19 "A General Guide for Ultramafic Rocks in California - Areas More Likely to Contain Naturally Occurring Asbestos", 2000.
d) CGS, "Geologic Map of the Sacramento Quadrangle", 1987
e) Caltrans DOT, "Asbestos Locations Map District 3", 2001.
f) Caltrans DOT, "California Seismic Hazards Map", 1996.
g) United States Department of Agriculture "Soil Survey Tahoe Basin Area California and Nevada", 1978

4. Caltrans Reports

1. Preliminary Rockfall Observations and Recommendations, 03-ED-89 KP 26.6, July 2003
2. Geotechnical Design Report – Addendum #1, 03-ED-89 KP 38.1/39.7, July 2003

In addition copies of these report have been attached as appendices to this report.

5. Physical Setting

The physical setting of the project site and the surrounding area was reviewed to provide climate, topography and drainage, man-made and natural features, geology and seismicity, and soil survey characteristics to aid in project design and construction. The site itself is located from approximately 13.8km (8.55mi) south of the town of Myers, California and ends within the town of Tahoma, California along State Highway 89. The following is a discussion of the above review:

5.1. Climate

According to the National Weather Service, California Climate Normals for 1914-2003, the average annual precipitation in the Tahoe City area, which is located approximately 14.0km (8.7mi) north of the northern end of the project is about 813mm (32in). The average annual air temperature is approximately 6.3°C (43.3°F) with average monthly extremes of –7.2°C (19.0°F) in January and 25.4°C (77.7°F) in July. Snowfall typically occurs within this area between the months of October through May but has been known to occur as early as September and as late as June.

5.2. Topography and Drainage

According to Reference "b" in Section 3 of this report and observations in the field, the project begins in steeply sloping mountainous topography of the Sierra Nevada's in the southern portion of the project and extends down into the gently sloping topography of the Lake Tahoe Basin. North of the City of South Lake Tahoe the highway roughly parallels the western shoreline of Lake Tahoe where it begins to climb into moderately to steeply sloping hillside topography. The highway then drops down into the Meeks Bay Basin located at the northern end of the project limits. The highway elevation varies from 2329m (7640ft) above mean sea level at the southern end of the project limits to 1902m (6240ft) above mean sea level within the Tahoe Basin and Meeks Bay Basin. The existing highway generally slopes down to the north. The Upper Truckee River, Grass Lake Creek and Big Meadow Creek are the major drainage pathways adjacent to the highway between KP 0.0 (PM 0.0) and KP 13.8 (PM 8.5). Due to the close proximity of the highway to Lake Tahoe between KP 13.8 (PM 8.5) and KP 44.1 (PM 27.4) only minor drainages are depicted draining from the highway to the lake on the maps reviewed.

Numerous residential/commercial structures are depicted on the map. In addition, overhead and underground utilities were observed during our site visit adjacent to the highway in several locations throughout the project limits.

Amounts of vegetation vary greatly throughout the project limits but include conifer trees, brush and native grass and weeds.

5.3. Man-made and Natural Features of Engineering and Construction Significance

The current highway was constructed with both cuts and fills. Existing cuts in the general vicinity of the project vary from approximately 1:1.5 (V:H) to vertical. Fills in the project limits were observed to be 1:1 (V:H) or flatter. Existing cuts appear to be in hard rock (granite), glacial till or mixed hard rock and glacial till. More detailed descriptions of cuts and fills are provided in the table in section 7 of this report.

The existing highway crosses numerous drainages of varying size with associated culverts and structures. The table below list structures maintained by Structure Maintenance.

Post Mile of Structure	Structure Number	Structure Name
4.20	25 0061	BIG MEADOWS CREEK
Post Mile of Structure	Structure Number	Structure Name
12.03	25 0016	TAYLOR CREEK
014.810	25 0017	CASCADE CREEK
017.500	25 0103	EAGLE FALLS SDHLL VDCT 1
017.500	25 0106	EAGLE FALLS SDHLL VDCT 2
017.600	25 0100	EAGLE FALLS SDHLL VDCT 3
017.800	25 0104	EAGLE FALLS SDHLL VDCT 4
017.800	25 0105	EAGLE FALLS SDHLL VDCT 5
024.900	25 0019	MEEKS CREEK

In addition to the structures listed above, cut slope retaining walls were observed at post miles 14.2, 15.03 and 16.1.

5.4. Regional Geology and Seismicity

According to the California Geological Survey (CGS) "Geologic Map of the Sacramento Quadrangle", 1987 the site is in an area of Quaternary age Lake deposits, Pleistocene aged Glacial Till deposits and Mesozoic age Granitic and Dioritic rocks. Cut slopes and native soil observed in the field compare favorably with the description on the map.

We have reviewed the CGS Map of California Showing Principal Asbestos Deposits, 2000 and the Caltrans DOT "Asbestos Location Map, District 3", 2001. According to both maps and the geologic maps reviewed, the site is not in an area of naturally occurring asbestos. In addition, the presence of ultra-mafic rock was not observed in the existing outcrops during our field visit.

We reviewed the Caltrans California Seismic Hazard Map dated 1996. The map indicated that the Lake Tahoe fault is located approximately 0.6km (8.7mi) east of the northern end of the project limits and is the controlling fault for the northern two-thirds of the project. The map indicated that the Genoa Fault is located approximately 11.5km (7.1mi) east of the southern end of the project limits and is the controlling fault for the southern one-third of the project The Lake Tahoe fault could produce a maximum credible earthquake of magnitude 6.50 and the Genoa fault has a maximum credible earthquake of magnitude 7.25. Both faults have a normal style orientation. The map indicated that the maximum credible earthquake from the Lake Tahoe fault would result in a peak horizontal bedrock acceleration of approximately 0.4g to 6.5g in the northern two-thirds of the project limits and the maximum credible earthquake form the Genoa fault would result in a peak horizontal bedrock acceleration of approximately 0.4g in the southern one-third of the project limits. Depth to competent bedrock varies throughout the project limits. A copy of the Soil Survey may be reviewed at our offices if needed.

5.5. National Resource Conservation Service Soil Survey

Our review of the Soil Survey of Tahoe Basin Area California and Nevada, 1974, indicates the project lies within a number of different soil survey classification. The soils are classified as follows:

Cagwin-Rock outcrop complex (CaE) 15 to 30 percent slopes consist of excessively drained soils underlain by weathered granitic rock. Surface runoff is rapid. Erosion potential is high and frost heave potential is moderated. Corrosion potential is low for uncoated steel (pH 5.1-6.5). Permeability is rapid (6.3 to 20in/hr). The Cagwin-Rock outcrop complex has been assigned to the Hydrologic group "C".

Cawgin-Rock outcrop Complex (CaF) 30 to 50 percent slopes consist of excessively drained soils underlain by weathered granitic rock. Surface runoff is rapid. Erosion potential is high and frost heave potential is moderated. Corrosion potential is low for uncoated steel (pH 5.1-6.5). Permeability is rapid (6.3 to 20in/hr). The Cawgin-Rock outcrop complex has been assigned to the Hydrologic group "C".

Celio gravelly loamy coarse sand (Co) consists of poorly drained soils underlain by hardpan. Surface runoff is slow. Erosion potential is slight and frost heave potential is moderated. Corrosion potential is high for uncoated steel (pH 5.6-6.5). Permeability is rapid (6.3 to 20in/hr). The Celio gravelly loamy coarse sand has been assigned to the Hydrologic group "D".

Elmira-Gefo loamy coarse sand (EfB) 0 to 5 percent slopes consist of excessively drained soils underlain by sandy granitic alluvium. Surface runoff is very slow.

Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.1-6.0). Permeability is very rapid (>20in/hr). The Elmira-Gefo loamy coarse sand has been assigned to the Hydrologic group "A".

Elmira stony loamy coarse sand (EcE) 9 to 30 percent slopes consist of excessively drained soils underlain by sandy granitic alluvium and glacial till. Surface runoff is medium to rapid. Erosion potential is moderate to high and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.1-6.0). Permeability is very rapid (>20in/hr). The Elmira loamy coarse sand has been assigned to the Hydrologic group "A".

Elmira loamy coarse sand wet variant (Ev) consists of poorly drained soils that are underlain by alluvium. Surface runoff is slow. Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.1-6.0). Permeability is moderately rapid (2.0-6.3in/hr). The Elmira loamy coarse sand wet variant has been assigned to the Hydrologic group "D"

Gefo gravelly loamy coarse sand (GeC) 2 to 9 percent slopes consist of excessively drained soils underlain by granitic sand. Surface runoff is very slow. Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is very rapid (>20in/hr). The Gefo gravelly loamy coarse sand has been assigned to the Hydrologic group "A".

Gefo gravelly loamy coarse sand (GeD) 9 to 20 percent slopes consist of excessively drained soils underlain by granitic sand. Surface runoff is medium. Erosion potential is high and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is very rapid (>20in/hr). The Gefo gravelly loamy coarse sand has been assigned to the Hydrologic group "A".

Gravelly alluvial land (Gr) consists of poorly drained recent gravel alluvium adjacent to streams. Surface runoff is very slow. Erosion potential is slight and frost heave potential is variable. Corrosion potential is unknown. Permeability is moderate. The Gravelly alluvial land has been assigned to the Hydrologic group "D".

Jabu coarse sandy loam (JaC) 0 to 9 percent slopes consist of well-drained soils that are underlain by glacial till. Surface runoff is slow. Erosion potential is slight to moderate and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.1-6.5). Permeability is moderate (0.63-2.0in/hr). The Jabu coarse sandy loam has been assigned to Hydrologic group "B".

Jabu coarse sandy loa, seeped (JaD) 2 to 15 percent slopes consist of moderately well-drained soils that are underlain by glacial till. Surface runoff is slow to medium. Erosion potential is slight to moderate and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.1-6.5). Permeability is moderate (0.63-2.0in/hr). The Jabu coarse sandy loam, seeped has been assigned to Hydrologic group "B".

Jabu sandy loam, moderately fine subsoil variant (JgC) 0 to 9 percent slopes consist of moderately well drained soils derived from granite. Surface runoff is slow. Erosion potential is slight to moderate and frost heave potential is moderate. Corrosion potential to uncoated steel is high (pH 5.6-6.0). Permeability is very slow (<0.06in/hr). The Jabu sandy loam, moderately fine subsoil variant has been assigned to Hydrologic group "B".

Loamy alluvial land (Lo) consists of poorly drained recent alluvium adjacent to streams. Surface runoff is very slow. Erosion potential slight and frost heave potential is variable. Corrosion potential and permeability are unknown. The Loamy alluvial land has been assigned to Hydrologic group "D".

Meeks gravelly loamy coarse sand (MkB) 0 to 5 percent slopes consist of excessively drained soils that are underlain by hardpan. Surface runoff is slow. Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Meeks gravelly loamy coarse sand has been assigned to Hydrologic group "B".

Meeks stony loamy coarse sand (MmB) 0 to 5 percent slopes consist of excessively drained soils that are underlain by glacial till. Surface runoff is slow. Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Meeks stony loamy coarse sand has been assigned to Hydrologic group "B".

Meeks very stony loamy coarse sand (MsD) 5 to 15 percent slopes consist of excessively drained soils that are underlain by glacial till. Surface runoff is slow. Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Meeks very stony loamy coarse sand has been assigned to Hydrologic group "B".

Meeks very stony loamy coarse sand (MsE) 15 to 30 percent slopes consist of excessively drained soils that are underlain by glacial till. Surface runoff is medium to rapid. Erosion potential is high and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Meeks very stony loamy coarse sand has been assigned to Hydrologic group "B".

Meeks very stony loamy coarse sand (MsE) 30 to 60 percent slopes consist of excessively drained soils that are underlain by glacial till. Surface runoff is rapid. Erosion potential is high and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Meeks very stony loamy coarse sand has been assigned to Hydrologic group "B".

Meeks extremely stony loamy coarse sand (MtG) 15 to 30 percent slopes consist of excessively drained soils underlain by glacial till. Surface runoff is medium. Erosion potential is high and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Meeks extremely stony loamy coarse sand has been assigned to Hydrologic group "B".

Meeks extremely stony loamy coarse sand (MtG) 30 to 60 percent slopes consist of excessively drained soils underlain by glacial till. Surface runoff is rapid. Erosion potential is high and frost heave potential is moderate. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Meeks extremely stony loamy coarse sand has been assigned to Hydrologic group "B".

Rock land (Ra) consists of slightly weathered to hard granitic, metamorphic, and volcanic rock. Surface runoff is rapid to very rapid. Erosion potential is moderate and frost heave potential is moderate. Corrosion potential is unknown. Permeability is variable. The Rock land has been assigned to Hydrologic group "D".

Rock outcrop-Toem complex (RtF) 30 to 50 percent slopes consist of 25% granitic rock outcrops and 75% excessively drained soils derived from weathered granite. Surface runoff is very rapid. Erosion potential is high and frost heave potential is slight. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Rock outcrop-Toem complex has been assigned to the Hydrologic group "C".

Rock outcrop-Toem complex (RtG) 50 to 70 percent slopes consist of 50% granitic rock outcrops and 50% excessively drained soils derived from weathered granite. Surface runoff is very rapid. Erosion potential is very high and frost heave potential is slight. Corrosion potential to uncoated steel is low (pH 5.6-6.5). Permeability is rapid (6.3-20in/hr). The Rock outcrop-Toem complex has been assigned to the Hydrologic group "C".

Rock outcrop and rubble land (Rx) consists of granitic, metamorphic and volcanic rock. Surface runoff is rapid to very rapid. Erosion potential is slight and frost heave potential is not rated. Corrosion potential is unknown. Permeability is variable. Rock outcrop and rubble land has been assigned to Hydrologic group "D"

Tallac gravelly coarse sandy loam, seeped (TcB) 0 to 5 percent slopes consist of moderately well drained soils underlain by hardpan. Surface runoff is slow. Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is moderate (pH 5.6-6.0). Permeability is moderate (2.0-6.3in/hr). The Tallac gravelly coarse sandy loam, seeped, has been assigned to the Hydrologic group "C".

Tallac gravelly coarse sandy loam, seeped (TcC) 5 to 9 percent slopes consist of well-drained soils underlain by hardpan. Surface runoff is slow to medium. Erosion potential is slight and frost heave potential is moderate. Corrosion potential to uncoated steel is moderate (pH 5.6-6.0). Permeability is moderate (2.0-6.3in/hr). The Tallac gravelly coarse sandy loam, seeped, has been assigned to the Hydrologic group "C".

6. Site Visit

The site visit for this report was performed on September 9 and 10, 2003. Mr. Steve Mahnke and Mr. Bill Webster met with Mr. Anup Singh and Mr. Ken Keaton of District 3 to discuss and conduct the field review for this project. No subsurface exploration, sampling, or testing was performed. The site consisted of State Highway 89, a variable two to four-lane highway with variable lane and shoulders width. We note that the existing cut and fill slopes have undergone some weathering and erosion and are slightly flatter than they were originally constructed. Existing site vegetation is highly variable but consists of conifer trees, brush and some moderate native grass and weeds. The highway conditions are variable with respect to cut and fill slopes, existing improvements, structures and natural conditions. Some of the existing cut and fill slope heights are summarized in the Geotechnical Recommendations below.

7. Geotechnical Recommendations

7.1. General

This memorandum is a preliminary report outlining recommendations we expect to make for the proposed widening of State Highway 89 to be included in the Project Study Report (PSR). We have compiled this table based on our observations in the field of the existing conditions, proposed improvements and current practice in design and construction. At the time of this report the exact alignment and exact heights of the cuts and fills are not known. These recommendations are general in nature and based on our understanding of the project.

The recommendations provided below are based on our field observations, attempts to limit costs and reduce environmental impacts. However other geotechnical solutions are available to provide the desired highway widening. Should the District wish to explore other geotechnical solutions our office should be contacted.

Post Mile (PM) (Notes: 3)	Location (Side of Highway)	Proposed Improvement	Existing Conditions (Notes: 1,2)	Geotechnical Recommendations (Notes: 1)
Begin Project 0.0/2.01	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders	Variable cuts up to 25' in glacial till with boulder up to 6' in diameter. Maximum slope 1:1.5. Variable fills up to 15'. Maximum slope 1:1.5.	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that widening may be required
2.01/2.08	East side of the highway	Widen highway to provide 1.2m shoulders and reduce potential rockfall from existing cut slope	1:1 cut up to 25' in glacial till with boulders up to 5' in diameter	Cut on east side of the highway 1:1.5 or flatter. Scale remaining slope if necessary
2.08/2.36	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders	Variable cuts up to 20' in glacial till with boulders up to 4' in diameter. Maximum slope 1:1.5. Variable fills up to 10'. Maximum slope 1:1.5.	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that widening may be required
2.36/2.47	East side of the highway	Widen highway to provide 1.2m shoulders and address erosion concerns on existing cut slope	1:1.5 or slightly steeper cut up to 40' in glacial till with boulders 3-4' in diameter	Cut on east side of the highway 1:1.5 or flatter. Armour slope with RSP.

Post Mile (PM) (Notes: 3)	Location (Side of Highway)	Proposed Improvement	Existing Conditions (Notes: 1,2)	Geotechnical Recommendations (Notes: 1)
2.47/4.68	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders	Variable cuts up to 35' in glacial till or glacial till with boulders up to 8' in diameter or glacial till overlying granite. Maximum slope 1:1. Variable fills up to 25'. Maximum slope 1:1.5	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that widening may be required
4.68/5.34	East side of the highway	Widen highway at various locations to provide 1.2m shoulders	Variable cuts up to 10' in glacial till with boulders up to 8' in diameter. Maximum slope 1:1.75. Variable fills up to 3'. Maximum slope 1:4.	Cuts and/or fills on east side of the highway 1:1.5 or flatter in areas the widening may be required.
5.34/11.64	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders and left turn pockets	Variable cuts up to 30' in glacial till with boulders up to 10' in diameter or mixed glacial till and granite. Maximum slope 1:1. Variable fills up to 30'. Maximum slope 1:1.5.	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that widening may be required

Post Mile (PM) (Notes: 3)	Location (Side of Highway)	Proposed Improvement	Existing Conditions (Notes: 1,2)	Geotechnical Recommendations (Notes: 1)
11.64/14.2	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders and left turn pockets	Variable cuts up to 10' in glacial till with boulders 3-4' in diameter. Maximum slope 1:1. Variable fills up to 20'. Maximum slope 1:1.5	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that widening may be required. Standard plan wall may be utilized to help reduce right of way.
14.2/14.45	West side of the highway	Widen highway to provide 1.2m shoulders	1:1 cut up to 15' in glacial till with boulders up to 8' in diameter above a 4' high retaining wall.	Retaining wall on west side of the highway or a combination of retaining wall and 1:1.5 cut with RSP amour.
14.45/15.03	Both sides of the highway	Widen highway to provide 1.2m shoulders	Variable cuts up to 10' in glacial till with boulders 6-8' in diameter. Maximum slope 1:1.5. Variable fills up to 15'. Maximum slope 1:1.5.	Cuts and/or fills on either side of the highway 1:1.5 or flatter
15.03/15.32	East side of the highway	Widen highway to provide 1.2m shoulders	1:1 cut up to 4.6m in glacial till with boulders up to 8' in diameter above a 1.2m high retaining wall.	Retaining wall or combination retaining wall and cut 1:1.5 or flatter with RSP amour.
15.32/15.47	Both sides of the highway	Widen highway to provide 1.2m shoulders	Variable cuts up to 3m in glacial till. Maximum slope 1:1. Variable fills up to 3m. Maximum slope 1:1.5.	Cuts and/or fills on either side of the highway 1:1.5 or flatter.

Post Mile (PM) (Notes: 3)	Location (Side of Highway)	Proposed Improvement	Existing Conditions (Notes: 1,2)	Geotechnical Recommendations (Notes: 1)
15.47/15.48	East side of the highway	Widen highway to provide 1.2m shoulders	1:1.5 cut up to 6.1m in glacial till.	Small standard plan retaining wall on east side of the highway.
15.48/16.01	Both sides of the highway	Widen highway to provide 1.2m shoulders	Ridge top: East side 1:1.5 for 45 to 60m down to Lake Tahoe. West side 1:1.5 or slightly flatter for 30 to 45m	Blast and remove material to lower ridge grade or solider pile tie back wall and fill to existing roadway grade.
16.01/16.35	Both sides of the highway	Widen highway to provide 1.2m shoulders	Variable cuts up to 3m in glacial till. Maximum slope 1:1. Variable fills up to 3m. Maximum slope 1:1.5. 1.2m high retaining wall for a segment of the post miles.	Cuts and/or fills on either side of the highway 1:1.5 or flatter.
16.35/16.95	Both sides of the highway	Widen highway to provide 1.2m shoulders	Slides and rock chutes on west side. Cuts up to 30m in variably competent granite. Maximum slope vertical. Fills (?) 1:1 for 30m+ to lake.	Structural solutions needed either viaducts or solider pile tie back walls. In addition, rockfall protection for highway is recommended. (See attached report for Emerald Bay for some rockfall protection ideas.)
16.95/17.18	Both sides of the highway	Widen highway to provide 1.2m shoulders	Variable cuts up to 9.1m in granite. Maximum slope vertical. Fills up to 9.1m. Maximum slope 1:1.	Cuts and/or fills on either side of the highway 1:1.5 or flatter.

Post Mile (PM) (Notes: 3)	Location (Side of Highway)	Proposed Improvement	Existing Conditions (Notes: 1,2)	Geotechnical Recommendations (Notes: 1)
17.18/18.1		None	Existing viaducts in area.	
18.1/19.03	Both sides of the highway	Widen highway to provide 1.2m shoulders	Variable cuts up to 4.6m in glacial till with boulders up to 1.2m in diameter. Maximum slope 1:1.5. Variable fills up to 3m. Maximum slope 1:1	Cuts and/or fills on either side of the highway 1:1.5 or flatter.
19.03/19.36	West side of the highway	Widen highway to provide 1.2m shoulders	Variable cuts up to 7.6m in variably competent granite. Maximum slope near vertical.	Cut on west side of the highway 1:1.5 or flatter. May consider the use of retaining walls or soil nail walls to reduce potential impacted area.
19.36/22.06	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders and left turn pockets.	Variable cuts up to 9.1m in glacial till and variably competent granite. Maximum slope 1:1.5. Variable fills up to 9.1m. Maximum slope 1:1.5	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that require widening.
22.06/22.33	West side of the highway	Widen highway to provide 1.2m shoulders.	Variable cuts up to 4.6m in glacial till armored with RSP. Maximum slope 1:1.	Cut on west side of the highway 1:1.5 or flatter. May consider the use of retaining walls or soil nail walls to reduce potential impacted area.

Post Mile (PM) (Notes: 3)	**Location (Side of Highway)**	**Proposed Improvement**	**Existing Conditions (Notes: 1,2)**	**Geotechnical Recommendations (Notes: 1)**
22.33/22.76	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders and left turn pockets.	Variable cuts up to 4.6m in glacial till. Maximum slope 1:1. Variable fills up to 3m. Maximum slope 1:1.5.	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that require widening.
22.76/23.1		No widening proposed		
23.1/23.15	East side of the highway	Widen highway to provide 1.2m shoulders.	Fill up to 4.6m with RSP armor. Maximum slope 1:1.5	Standard plan retaining wall around culvert outlet.
23.15/23.28	East side of the highway	Widen highway to provide 1.2m shoulders.	Variable fills up to 3-3.7m. Maximum slope 1:1.5.	Fill on east side of the highway 1:1.5 or flatter.
23.28/24.0	East side of the highway	Widen highway to provide 1.2m shoulders.	Fill up to 3m. Maximum slope 1:1.5.	Standard plan retaining wall on east side of the highway between highway and single-family residence.
24.0/24.71	West side of the highway	Widen highway to provide 1.2m shoulders.	Variable cuts up to 9.1m in glacial till with boulders up to 3m in diameter. Maximum slope 1:1.	Soil nail walls on west side of the highway. (See attached Silver Tip report.)

Post Mile (PM) (Notes: 3)	Location (Side of Highway)	Proposed Improvement	Existing Conditions (Notes: 1,2)	Geotechnical Recommendations (Notes: 1)
24.71/25.38	Both sides of the highway	Widen highway at various locations to provide 1.2m shoulders and left turn pockets.	Variable cuts up to 4.6m in glacial till with boulders up to 1.8m in diameter. Maximum slope 1:1.5. Variable fills up to 6.1m'. Maximum slope 1:1.5	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas that require widening.
25.38/25.43	Both sides of the highway	Widen highway to provide 1.2m shoulders and left turn pocket.	Cuts up to 3m in glacial till. Maximum slope 1:1.5. Fills up to 3m. Maximum slope 1:1.5	Cut on west side of the highway 1:1.5 or flatter. May consider the use of retaining walls or soil nail walls to reduce potential impacted area.
25.43/27.4	Both sides of the highway	Widen the highway at various locations to provide 1.2m shoulders and left turn pockets.	Variable cuts up to 4.6m in glacial till with boulders up to 1.2m in diameter. Maximum slope 1:1.5. Variable fills up to 1.5m. Maximum slope 1:1.5.	Cuts and/or fills on either side of the highway 1:1.5 or flatter in areas where widening is required.

Notes:
1. Slope ratios are expressed in (Vertical:Horizontal)
2. Slope heights are express in estimated maximum vertical height based on field observations
3. Post miles are estimated based on Aerial photos provided by District Design

7.2. Rippability

Based on our observations in the field cuts in glacial till should be considered rippable with conventional equipment. However, some oversized boulders may be encountered during the excavation, which may require blasting to break them into a workable size. Cuts identified in the table above containing compentent granite will require blasting to create a new cut. All blasting should be done utilizing Caltrans controlled blasting specification. In addition, it is recommended that pre-splitting be utilized for the cuts in compentent granite that are 1:1 or steeper.

7.3. Rockfall

It is recommended that rockfall reduction measures be incorporated for any existing slopes that exhibit rockfall potential. Rockfall reduction measures could include but are not limited to, additional catchment width at the toe of cuts, placement of cable net drapery on the slope, rock barriers, rock bolting and slope ratio reduction. In addition, we have attached a report regarding rockfall conditions in the Emerald Bay area.

7.4. Slide Potential

The only slide observed during our field visit was located at KP 28.6 (PM 17.8). This slide occurred in January 1997 and was dubbed the Vikingsholm slide. This slide appears to have been triggered by excessively high rainfall and/or snowfall during the wet season of 1997. Since 1997 the slide appears to have stabilized relatively well. A recommendation was provided in a report from our office in June 1998 to place 1 ton RSP in the upper portion of the slide to help prevent erosion and continued upslope failure. In addition, a slide occurred in the Emerald Bay area in 1953 and again in 1956 it is unknown if this slide area is the same area as the more recent Vikingsholm slide, however, based on photos from the 1956 slide it appears that they may be in the same area.

No other deep-seated slides were observed within the project limits.

7.5. Erosion

As described in section 5.5 of this report soil in the project area varies between slightly too highly erosive. Therefore it is recommended that District Landscape Architecture and District Hydraulics be consulted for erosion mitigation measures for the portions of the cuts and fills that will be comprised of soil.

7.6. Corrosion

We recommend that corrosion studies be preformed where new culverts, walls and structures are planned. They should also account for salts used for de-icing the highway.

7.7. Groundwater

Generally, groundwater should not be a concern for the proposed shoulder widening. Seepage was not observed in the existing cut or fill slopes. Depending on the time of the year, seepage may be encountered in rock fractures. Seepage and groundwater conditions will vary according variations in rainfall, snowmelt, pumping, construction activities and water levels in Lake Tahoe and the Upper Truckee River.

8. Proposed Future Investigations

After surveys are completed and locations of structures, cuts, fills and infiltration basins are known, our Office should be contacted to provide a Preliminary Geotechnical Report Update. At that time, more detailed geotechnical recommendation may be provided and we may develop a scope for a Geotechnical Design Report.

If you have any questions or comments, please call me at (916) 227-5506 CalNet 498-5506 or Steve Mahnke at (916) 227-7181 CalNet 498-7181.

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c: JimMorris, GDN File

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
North Central Region
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670-4599
916-358-2900
www.wildlife.ca.gov

EDMUND G. BROWN, Jr. Governor
Charlton H. Bonham, Director

MAY 1 5 2014
Date

Mike Bartlett
California Department of Transportation
703 B Street
Marysville, CA 95901
mike.bartlett@dot.ca.gov

Subject: Final Lake or Streambed Alteration Agreement
Notification No. 1600-2014-0057 -R2
Emerald Bay Water Quality Project ED-89

Dear Mr. Bartlett:

Enclosed is the Final Streambed Alteration Agreement (Agreement) for the Emerald Bay Water Quality Project ED-89 (Project) within El Dorado County. Before the Department of Fish and Wildlife (Department) may issue an Agreement, it must comply with the California Environmental Quality Act (CEQA). In this case, the Department, acting as a lead agency, determined your project is exempt from CEQA and filed a notice of exemption (NOE) on the same date it signed the Agreement.

Under CEQA, filing a NOE starts a 35-day period within which a party may challenge the filing agency's approval of the project. You may begin your project before the 35-day period expires if you have obtained all necessary local, state, and federal permits or other authorizations. However, if you elect to do so, it will be at your own risk.

If you have any questions regarding this matter, please contact Jennifer (JB) Garcia, Senior Environmental Scientist (Specialist) at (916) 358-2955 or Jennifer.Garcia@wildlife.ca.gov.

Sincerely,

Tracy Stanish
for Tina Bartlett
Regional Manager

ec: JB Garcia, Jennifer.Garcia@wildlife.ca.gov