INFORMATION HANDOUT

For Contract No. 01-0B5404
At 01-MEN-162-13.9, 22.7

Identified by
Project ID 01 1200 0136

AGREEMENTS

PLAC - California Department of Fish and Wildlife, Region 1-Northern

1602 Lake and Streambed Alteration Agreement
Notification No. 1600-2015-0515-R1
Dated March 2, 2016

MATERIALS INFORMATION

Geotechnical Design Report (GDR)/Foundation Report (FR)

Dated January 22, 2014

Addendum to January 22, 2014 GDR/FR

Dated May 27, 2016

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
REGION 1 - NORTHERN
619 SECOND STREET
EUREKA, CALIFORNIA, 95501

RECEIVED
MAR 02 2016
CDFW - EUREKA

STREAMBED ALTERATION AGREEMENT
NOTIFICATION NO. 1600-2015-0515-R1
UNNAMED TRIBUTARY TO EEL RIVER

CALIFORNIA DEPARTMENT OF TRANSPORTATION
DOS RIOS SLIPS
EA 01-0B540, S.R. 101 PM 13.91, MENDOCINO COUNTY

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Wildlife (CDFW) and the California Department of Transportation (Caltrans) (Permittee) as represented by Steven Blair.

RECITALS

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified CDFW on December 11, 2015 that Permittee intends to complete the project described herein.

WHEREAS, pursuant to FGC section 1602, CDFW has determined that the project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources.

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources.

NOW THEREFORE, Permittee agrees to complete the project in accordance with the Agreement.

PROJECT LOCATION

The project location is approximately 1 mile south of the town of Dos Rios along State Highway 162 at Post Mile (PM) 13.91 on APNs 035-050-RW and 035-050-03 affecting an Unnamed Tributary to the Eel River in the County of Mendocino, State of California; Section 7, Township 21N, Range 13W; Mount Diablo Base and Meridian, in the Dos Rios U.S.G.S. 7.5-minute quadrangle.

PROJECT DESCRIPTION

The project involves removing and replacing an existing 24 inch culvert with a 30-inch welded steel pipe culvert with a downdrain and ¼-to ½-ton rock energy dissipater at the base of the downdrain. No tree removal is proposed although clearing and grubbing is needed to install the culvert, downdrain and rock energy dissipater. No work in water is proposed.

PROJECT IMPACTS

Existing fish or wildlife resources the project could substantially adversely affect include: downstream populations of Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), steelhead (*O. mykiss*), foothill yellow-legged frog (*Rana boylii*) and other aquatic and riparian species.

The adverse effects the project could have on the fish or wildlife resources identified above include:

- direct and/or indirect mortality of fish, amphibians and other aquatic species;
- injury to downstream fish and benthic invertebrates and spawning and/or rearing habitats through sediment transport and deposition and/or spills of deleterious materials;
- changes in channel form and contour of bed, bank, or channel;
- temporary increase of sediment and turbidity; and
- colonization by non-native and/or invasive plants.

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee shall meet each administrative requirement described below.

1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the project site at all times and shall be presented to CDFW personnel, or personnel from another state, federal, or local agency upon request.

1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the project at the project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.

1.3 Notification of Conflicting Provisions. Permittee shall notify CDFW if Permittee determines or learns that a provision in the Agreement might conflict with a provision imposed on the project by another local, state, or federal agency. In that event, CDFW shall contact Permittee to resolve any conflict.

1.4 Project Site Entry. Permittee agrees that CDFW personnel may enter the project site at any time to verify compliance with the Agreement.

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below.

2.1 Except where otherwise stipulated in this Agreement, all work shall be in accordance with the forms, work plans, biological reports and maps submitted with Notification No. 1600-2015-0515-R1 on December 11, 2015.

2.2 All work within the bed, bank and channel shall be confined to the period June 1 through October 15 of each year. Work may be conducted in or near the stream during the late season work period October 15 through November 1, provided adherence to all conditions in this Agreement and a) – c) below.

a) The Permittee shall complete any unfinished encroachment work, including erosion control measures, within 24 hours of CDFW directing the Permittee to do so.

b) Prior to any work at a site, the Permittee shall stock-pile erosion control materials at the site. All bare mineral soil exposed in conjunction with crossing construction, deconstruction, maintenance or repair or removal shall be treated for erosion immediately upon completion of work on the crossing, and prior to the onset of precipitation capable of generating runoff.

c) When a 7-day National Weather Service forecast of rain includes a minimum of 5 consecutive days with any chance of precipitation, 3 consecutive days with a 30% or greater chance of precipitation, or 2 consecutive days of 50% or greater chance of precipitation, the Permittee shall finish work underway at encroachment and refrain from starting any new work at encroachment prior to the rain event.

2.3 No fill material shall be placed within a stream except as specified in this Agreement.

2.4 Any equipment or vehicles driven and/or operated within or adjacent to the stream channel shall be checked and maintained in a manner which prevents materials

that, if introduced to water, could be deleterious to aquatic life, wildlife, or riparian habitat.

2.5 Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations.

2.6 Adequate and effective erosion and siltation control measures shall be used at all times to prevent sediment or turbid or silt-laden water from entering streams. Where needed, the Permittee shall use native vegetation or other treatments including native slash, jute netting, straw wattles, and geotextiles to protect and stabilize soils. Geotextiles, fiber rolls, and other erosion control treatments shall not contain plastic mesh netting that can entrap or harm wildlife. Photodegradable synthetic products are not considered biodegradable.

2.7 All bare mineral soil exposed in conjunction with project related activities shall be treated for erosion prior to the onset of precipitation capable of generating run-off or the end of the yearly work period, whichever comes first. Treatments shall include using native slash or seeding and mulching of all bare mineral soil exposed in conjunction with encroachment work. Only clean straw (such as rice, barley, wheat, or weed-free straw), and seeding with regional native seed or non-native seed that is known not to persist or spread (e.g., barley (*Hordeum vulgare*) or wheat (*Triticum aestivum*) shall be used. No known invasive grass seed shall be used such as annual or perennial ryegrass (*Lolium multiflorum or L. perenne*, which are now referred to as *Festuca perennis*).

2.8 Only wildlife-friendly 100 percent biodegradable erosion control products that will not entrap or harm wildlife shall be used. Erosion control products shall not contain synthetic (e.g., plastic or nylon) netting. Photodegradable synthetic products are not considered biodegradable.

2.9 The Permittee shall provide site maintenance including, but not limited to, re-applying erosion control to minimize surface erosion and ensuring drainage structures, streambeds and banks remain sufficiently armored and/or stable.

2.10 Refueling of equipment and vehicles and storing, adding or draining lubricants, coolants or hydraulic fluids shall not take place within or adjacent to any stream. All such fluids and containers shall be disposed of properly. Heavy equipment parked within or adjacent to the stream shall use drip pans or other devices (e.g., absorbent blankets, sheet barriers or other materials) as needed to prevent soil and water contamination.

2.11 All activities performed in the field which involve the use of petroleum or oil based substances shall employ absorbent material designated for spill containment and clean up activity on site for use in case of accidental spill. Clean-up of all spills shall begin immediately. The Permittee shall immediately notify the State Office of

Emergency Services at 1-800-852-7550. CDFW shall be notified by the Permittee and consulted regarding clean-up procedures.

2.12 No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete washings, oil or petroleum products, or other organic or earthen material from construction work, or associated activity of whatever nature shall be allowed to enter into, or be placed where it may be washed by rainfall or runoff into Waters of the State. When operations are completed, any excess materials or debris shall be removed from the work area.

2.13 Upon CDFW determination that turbidity/siltation levels resulting from project related activities constitute a threat to aquatic life, activities associated with the turbidity/siltation, shall be halted until effective CDFW-approved control devices are installed, or abatement procedures are initiated.

2.14 Installation or modification of culverts shall be such that water flow is not impaired and upstream or downstream passage of all aquatic life-forms is assured at all times.

2.15 Equipment shall not operate in a live (flowing) stream or wetted channel.

3. Reporting Measures

Permittee shall meet each reporting requirement described below.

3.1 Permittee shall notify CDFW, in writing, at least five (5) days prior to initiation of construction (project) activities and at least five (5) days prior to completion of construction (project) activities. Notification shall be faxed to CDFW at (707) 441-2021, Attn: JoAnn Loehr, Senior Environmental Scientist (Specialist), or via e-mail at joann.dunn@wildlife.ca.gov.

CONTACT INFORMATION

Written communication that Permittee or CDFW submits to the other shall be delivered to the address below unless Permittee or CDFW specifies otherwise:

To Permittee:

Mr. Steven Blair
Caltrans
1656 Union Street
Eureka, California 95501
Office Phone: 707-441-5899
E-Mail: steven.blair@dot.ca.gov

To CDFW:

Department of Fish and Wildlife
Region 1
619 Second Street
Eureka, California 95501
Attn: Lake and Streambed Alteration Program
Notification #1600-2015-0515-R1
Fax: 441-2021

LIABILITY

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents or contractors and subcontractors, to complete the project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute CDFW's endorsement of, or require Permittee to proceed with the project. The decision to proceed with the project is Permittee's alone.

SUSPENSION AND REVOCATION

CDFW may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before CDFW suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before CDFW suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited to a directive to immediately cease the specific activity or activities that caused CDFW to issue the notice.

ENFORCEMENT

Nothing in the Agreement precludes CDFW from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects CDFW's enforcement authority or that of its enforcement personnel.

OTHER LEGAL OBLIGATIONS

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the project or an activity related to it.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the FGC including, but not limited to, FGC sections 2050 et seq. (threatened and endangered species), 3503 (bird nests and eggs), 3503.5 (birds of prey), 5650 (water pollution), 5652 (refuse disposal into water), 5901 (fish passage), 5937 (sufficient water for fish), and 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

AMENDMENT

CDFW may amend the Agreement at any time during its term if CDFW determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by CDFW and Permittee. To request an amendment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

TRANSFER AND ASSIGNMENT

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective, unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter CDFW approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

EXTENSIONS

In accordance with FGC section 1605(b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to CDFW a completed CDFW "Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). CDFW shall process the extension request in accordance with FGC 1605(b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the project the Agreement covers (Fish & G. Code, § 1605, subd. (f)).

EFFECTIVE DATE

The Agreement becomes effective on the date of CDFW's signature, which shall be: 1) after Permittee's signature; 2) after CDFW complies with all applicable requirements under the California Environmental Quality Act (CEQA); and 3) after payment of the applicable FGC section 711.4 filing fee listed at http://www.dfg.ca.gov/habcon/ceqa/ceqa_changes.html.

TERM

This Agreement shall expire **five years** from the effective date, unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as FGC section 1605(a)(2) requires.

EXHIBITS

None

AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

AUTHORIZATION

This Agreement authorizes only the project described herein. If Permittee begins or completes a project different from the project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify CDFW in accordance with FGC section 1602.

CONCURRENCE

The undersigned accepts and agrees to comply with all provisions contained herein.

FOR CALIFORNIA DEPT. OF TRANSPORTATION

3-2-16

Steven Blair
Project Manager

Date

FOR DEPARTMENT OF FISH AND WILDLIFE

3/2/16

Gordon Leppig
Senior Environmental Scientist Supervisor

Date

Prepared by: JoAnn Loehr, Sr. Environmental Scientist (Specialist), February 17, 2016; rev. 2/29/16

INFORMATION HANDOUT

For Contract No. 01-0B5404
At 01-MEN-162-13.9, 22.7

Identified by
Project ID 01 1200 0136

AGREEMENTS

PLAC - California Department of Fish and Wildlife, Region 1-Northern

1602 Lake and Streambed Alteration Agreement
Notification No. 1600-2015-0515-R1
Dated March 2, 2016

MATERIALS INFORMATION

Geotechnical Design Report (GDR)/Foundation Report (FR)

Dated January 22, 2014

Addendum to January 22, 2014 GDR/FR

Dated May 27, 2016

State of California
DEPARTMENT OF TRANSPORTATION

California State Transportation Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. STEVEN BLAIR
Project Manager
Office of Design-North Region
Design Branch E1

Date: January 22, 2014

File: 01-MEN-162-PM 22.67
01 – 0B5401
Efis-0112000136
Tieback Soldier Pile wall

Attention: Andre Guimaraes

From: WILLAIM BERTUCCI
Associate Engineering Geologist
Office of Geotechnical Design – North
Geotechnical Services
Division of Engineering Services

MOHAMMAD ZABOLZADEH
Associate Materials and Research Engineer
Office of Geotechnical Design - West
Geotechnical Services
Division of Engineering Services

BENJAMIN M. BARNES
Transportation Engineer
Office of Geotechnical Design – North
Geotechnical Services
Division of Engineering Services

Subject: GEOTECHNICAL DESIGN REPORT (GDR)/FOUNDATION REPORT (FR)

1. INTRODUCTION

This memorandum presents our geotechnical recommendations to mitigate the impact of a landslide that occurred on Route 162, Post Mile 22.67 in Mendocino County. The recommendations contained in the memorandum are based on support from the Office of Geotechnical Design North, Eureka Office and the Office of Geotechnical Design West, Oakland Office. Ground survey to provide topographic control and lane closure support were provided by the NROS Ukiah Survey Field Unit, and personnel from the Willits Maintenance Station, respectively. Site location is shown in **Figure 1**.

2. SCOPE OF WORK

The recommendations contained in this report are based on the results from:

- Review of the geologic Literature
- Site meetings, review of geologic literature, site reconnaissance, exploratory drilling, slope inclinometer monitoring and a geophysical survey, reconnaissance and mapping
- Subsurface explorations performed in January and May of 2013
- Slope inclinometer and groundwater monitoring
- Geophysical survey

- Review of existing files

3. SUBSURFACE INVESTIGATION

The Office of Geotechnical Design – North, METS / GS, Division of Engineering Services investigated the subsurface conditions at the site using an Acker truck mounted drill rig. Two borings (R-13-001 and R-13-002) were drilled (January and May 2013, respectively) utilizing a rotary wash drilling method. Standard Penetration Test (SPT) and rock core sampling were performed to the maximum boring depths (50 and 55 feet, respectively). Upon completion of drilling perforated slope inclinometer pipe back filled with No. 8 sand were installed in the borings for the purpose of monitoring groundwater levels and ground movement.

4. PHYSIOGRAPHIC SETTING

The project lies within the Coast Ranges Physiographic Province, a northwest-southeast trending band of folded and faulted steep mountain ranges with intervening narrow valleys and canyons. State Highway 162 at the site traverses the nose of a steep east ascending ridge at elevation 2031+/- feet. The ridge above the site reaches elevation 2865 feet (Turner Peak). Below the roadway, the ridge terminates where it merges with the head of a canyon that descends to the Eel River at about elevation 1700 feet. Slope gradients above and below the roadway are highly variable ranging steeper that 1:1 to 5:1 (H: V) and the terrain is typically hummocky.

5. SITE GEOLOGY AND SEISMICITY

5.1 Regional Geology and Structure

According the U.S. Geological Survey Miscellaneous Field Studies Map (MF-2001), the region south and southwest of Round Valley that includes the project site is underlain predominately by Eocene to Cretaceous age rock of the Great Valley Sequence (GVS) and Tertiary to Upper Jurassic age Mélange matrix rocks (Geologic Map, **Figure 2**). Structurally, the site is located within the San Andres Fault System. The system includes the San Andres Fault Zone located 30.5 miles west of the site, the Pacific Star Fault located 23.5 miles west of the site, and the Maacama Fault zone located 11.6 miles west of the site and the Bartlett Springs Fault System located 0.8 miles east of the site. These four major fault zones are northwest-trending steeply dipping dextral strike-slip faults (Fault Map, **Figure 3**). Within this fault system are numerous inactive north-west trending fault blocks that separate many of the geologic rock units. The project site is nearly centered within an approximately 1.7 mile wide block of GVS that is bound on either side by the Mélange matrix unit.

The GVS consists mainly of interbedded sandstone, argillite, mass flow deposits, minor conglomerate, and rare limestone. The Mélange matrix unit consists mainly of an argillite-matrix mélange locally containing blocks of sedimentary, volcanic, metamorphic and mass flow

deposits. Quaternary and younger deposits in this area consist of stream sand and gravels, terrace deposits, slope wash, landslide deposits and valley alluvium. The near surface deposits at the proposed wall site are mapped as the Hopland-Sanhedrin-Kekawaka complex (Clay Loam) Series soils category according to the Mendocino County Eastern Part Soil Survey, 1977 report. The underlying bedrock is sandstone. Where soils are bare runoff is rapid and erosion is moderate to high. See Soil Map, **Figure 4** for distribution of soil type at the site and vicinity.

5.2 Site Geology

Earth materials exposed at the site include GVS bedrock and patches of Clay loam exposed in the road cut opposite the southbound travel lane. The bedrock consists of massive moderately weathered and moderately soft to moderately hard fine grained sandstone. The clay loam deposits in terms of Caltrans Soil and Rock Classification Manual (2010 Edition) consist of a nearly equal quantity of sand, silt and clay with a slightly higher quantity of the clay constituent. The southbound lane and part of the northbound lane are underlain by the same rock material.

The boring data (RC-13-001 and R-13-002) including exposures below the roadway indicate the northbound lane and adjacent descending slope (Station 1+60 to 3+20) are underlain by fill and fill over cast deposits underlain be displaced sandstone followed by in place sandstone bedrock. Based on the boring data, the fill consists of a mixture of sand, gravel size and larger fragments of sandstone. Below the fill from a depth of about 5 feet to 15 feet, the sandstone is moderate to intensely weathered, locally decomposed and very soft. From a depth of 15 ft to approximately 20 ft, the sandstone becomes less weathered and more competent. Beneath the Sandstone, a dark gray, intensely fractured and locally sheared sandy siltstone was encountered in Boring RC-13-001 and R-13-002 at a depth of 20 and 35 feet, respectively. This unit extended to a depth of 35 feet in RC-13-001, but in R-13-002 the base of this unit was not penetrated. Below a depth of 35 feet (RC-13-001) to the bottom of boring, the material becomes fine grained sandstone, massive, slightly weathered and very hard. In Boring R-13-002, the material consisted of dark gray sandy siltstone as described above. See Boring Log Spread Sheets, **Appendix A** for subsurface condition details. The LOTB Sheets will be forwarded to you when finalized and should be included with the Contract Plans.

5.3 Landslide

This landslide is located on the slope adjacent the northbound travel lane from approximately Station 2+30 to Station 3+10, as shown in **Figures 5 and 6**. The slide scarp had reached to within 2 to 10 feet of edge of pavement by the time it was first reported in 2011. At present tension cracked now paved over indicate the head scarp has migrated into the northbound travel lane. Also, tension cracks in the roadway that have not been paved over (Station 2+30 to Station 1+70) indicate the slide is starting to expand laterally.

The subsurface geometry and soil/ rock condition of the landslide mass was investigated using seismic refraction survey methods, no borings were drilled in the down slope slide area. The Seismic Refraction Survey (SRS) is attached **(Appendix B)**. A summary of the report findings are as follows. In general, three velocities units (V1-V3) were identified. The upper unit (V1) with a maximum thickness of 8 feet is geologically interpreted as mainly unconsolidated side cast fill and landslide debris. The underlying unit (V2) with a maximum thickness of 27 feet is interpreted as the main slide mass. It most likely consists of displaced and disturbed (poorly consolidated) sandstone and/ or silty sandstone. Below, unit (V3) with an undetermined maximum thickness is interpreted as in place relatively undisturbed hard sandstone. This unit probably correlates to the sandstone logged in boring RC-13-001 below a depth of approximately 20 feet. Additionally, the SRS revealed that the landslide (Units V1 and V2) extends down slope about 50 feet further than its topographic expression suggests.

5.4 Seismic Refraction Survey Summary:

A summary of the Seismic Refraction Survey at the site is presented below.

Table 1- Seismic Fraction Data

Seismic Line Number	*Velocity Unit Number*	*Layer Maximum Thickness (ft)*	*Unit Velocity (ft/sec)*	*Rippability Rating*	*Interpreted Geological Material Type*
S1	V1	8	843	Easily Ripped	Overcast/Slide Deposits
	V2	27	1690	Easily Ripped	Slide Debris Deposit
	V3	>50	5400	Difficult Ripping	In place Bedrock
S2	V1	5	643	Easily Ripped	Overcast/Slide Deposits
	V2	23	1380	Easily Ripped	Slide Debris Deposit
	V3	>50	5500	Difficult Ripping	In Place Bedrock

Ripping is based on unpublished Caltrans data for a Caterpillar D9 series bulldozer with single-tooth ripper. The velocities and corresponding rippibility ratings are as follows:

Table 2- Rippability Rating

Velocity (ft/sec)	*Rippability Rating*
<3445	Easily Ripped
3445-4921	Moderately Difficult Ripping
4921-6562	Difficult Ripping
>6562	Not Rippable

Different excavation equipment may experience different results. Penetrating efficiency of the ripping tooth is often more important in predicting ripping success than seismic velocity alone (see Section 5.3).

5.5 Seismicity

Based on the subsurface investigation, a Vs_{30} of 760 m/s is considered to be applicable to the foundation material for the project site.

The deterministic spectrum from the Caltrans ARS Online Tool (Version 2.3.06) is based on the nearest active fault which controls ground motion. This fault is the Bartlett Springs 2011 CFM (ID No. 53) with a MMax of 7.2. The fault is located northeast of the project site and the closest distance from the site to the fault rupture plane is approximately 0.7 miles. The fault is a strike-slip fault with a dip angle of 90 degrees (vertical dip).

Based on the "Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations, November 2012", the governing design Acceleration Response Spectrum (ARS) curves are obtained by any or a combination of the following three methods for the project site:

1. Statewide minimum deterministic spectrum with MMax of 6.5, vertical strike-slip event with a rupture distance of 7.5 miles.
2. Deterministic Seismic Hazard spectrum from the Caltrans ARS Online Tool (Version 2.3.06).
3. The USGS Interactive Deaggregation procedure with a 5% Probability of Exceedance in 50 years (975 years return period).

The peak ground acceleration for the project site was determined using method 3 as stated above and is estimated to be 0.5g.

Liquefaction, which is commonly observed during earthquakes, is a phenomenon where saturated loose granular soils lose their strength during an earthquake and become fluid-like and

mobile. As a result, the ground may undergo large permanent displacements that can damage structures. Saturated loose granular soils were not encountered during the subsurface investigation, therefore, the potential for liquefaction at the project site is considered insignificant. The potential for surface rupture at the project site due to fault movement is considered insignificant as there are no known faults projecting towards or passing directly through the project site.

5.6 Groundwater

Groundwater measurements were made starting at the end of January 2013 (RC-13-001) and near the beginning of May 2013 (R-13-002) and continued into November of that year. Readings taken throughout much of the year (RC-13-001) showed very little change between January and April. From that point on the water level continued to drop similarly in both borings suggesting a possible seasonal affect. A summary of the readings taken in 2013 are presented in Table 3 below.

Table 3- Groundwater Depth (GWD) Readings

Reading Date	RC-13-001	R-13-002	
	GWD (ft)	Reading Date	GWL (ft)
1-30-2013	26.9	*	*
2-13-2013	27.8	*	*
3-26-2013	27.9	*	*
4-16-2013	27.8	*	*
5-1-2013	29.3	5-7-2013	31.2
5-20-2013	30.9	5-20-2013	32.2
6-18-2013	39.1	6-18-2013	33.3
7-10-2013	32.9	7-7-2013	34.2
11-11-2013	36.0	11-11-2013	37.2

Note: GWL readings are referenced from the existing roadway pavement grade (top of Boring).

6. GEOTECHNICAL TESTING

6.1 In-Situ Testing

Slope Inclinometer (SI) monitoring

Slope inclinometers were installed in the borings in order to monitor the stability of the roadway and the slope below. At this site, the landslide movement direction is oblique to the down slope direction. However, the Boring RC-13-001) SI pipe slots were oriented parallel with the down slope direction; therefore, movement was recorded in both the A-Axis and B-Axis directions.

The slide movement was resolved into a single resultant vector of about 0.5 inches taken over a period of 9 months. In the case of R-13-002, the SI pipe slots were oriented parallel with the landslide movement; therefore, only significant movement was recorded in the A-Axis direction. The recorded readings show a total movement approximately 0.30 inches measured over a 5 month period.

The estimated depths of slide movement were approximately 35 feet and 20 feet in borings RC-13-001 and R-13-002, respectively. The differences in the recorded depths seem reasonable because boring RC-001 was located near the center of the slide mass while R-13-002 boring was located closer to the periphery of the slide mass. See **Appendix C** that shows the Slope Inclinometer results.

Additional Subsurface Investigation

Two additional borings are recommended to ensure that we have adequate geotechnical information for the present tieback soldier pile wall design.

7. CORROSION EVALUATION

Corrosion studies were conducted in accordance with the requirements of California Test Method No. 643. The Department considers the site to be corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site: *Chloride concentration is greater than or equal to 500 ppm, sulfate concentration is greater than or equal to 2000 ppm, or the pH is 5.5 or less*.

The following table provides our corrosion test summary:

Boring	***SIC Number***	***Sample Depth***	***Resistivity (Ohm-Cm)***	***pH***	***Chloride Content (ppm)***	***Sulfate Content (ppm)***	***Is Sample Corrosive***
RC-13-001	C704861	10’-15’	1780	5.87	12.4	22.2	No
RC-13-001	C704862	25’-30’	1046	4.86	5.6	1029	Yes

Based on the laboratory test results on the soil samples, the site appears to be <u>*corrosive*</u>. Controlling corrosion parameters are as follows: pH is 5.5 or less.

8. SLOPE STABILITY ANALYSES (Back-analyses)

Using Slope W 2007 computer software, we back calculated the soil strength parameters along the failure plane of the sliding mass for a factor of safety of slightly about 1.0. This safety factor was used to simulate the creeping (slide is moving at a very slow rate) movement of the slide mass. For the analysis, we used field measurements, SI data for the landslide, and groundwater to simulate the existing ground condition and slide mass movement into Slope W computer software. Our back analyses show that slide soil material has an effective friction angle of 20° and cohesion of 450 psf along the slip-plane for factor of safety of about 1.0. The graphical outputs generated by the computer program are attached. According to the LOTB, the soil properties below the slide are estimated to have cohesion of 0 psf and effective friction angle of 36°. Refer to **Figure 7-**Landslide/Slope Stability Analyses.

9. FOUNDATION RECOMMENDATIONS

To address the landslide, we considered several repair strategy alternatives: soldier pile wall, tieback wall, soil nail wall, crib wall, gabion wall, MSE wall, and RSP. However, because of the significant size of the landslide below the road, constructability concerns, and since the head scarp of the land slide has reached the centerline of the roadway, we believe a tieback wall (TBW) with at least one row of anchors is the most appropriate repair strategy. The proposed TBW is intended to hold the roadway in place and isolate it from down slope slide activity. The length of the proposed wall is about 162 feet between Stations 1+63 and 3+25 and its height is estimated to be about 20 feet. Actual height will be determined after wall layout plans are made available. See **Figure 8**, Wall Plan Sketches.

9.1 Tieback Soldier Pile Wall (TBW)

Based on our analyses, we recommend the following requirements for the design of the proposed TBW:

- The proposed row of TBW anchors should be installed at maximum depth below the existing ground surface. The anchors should be installed with an angle of 15-20 degrees below the horizontal plane spaced at 8 ft (maximum) on center.

- The unbounded length of the tieback anchors should be a minimum 30 ft long as shown on the attached **Figure 9 –**Tieback Wall Design.

- Based on our stability analyses using Slope W computer program, use the total minimum force of 12 Kips per foot of wall length. See attached **Figure 9 –**Tieback Wall Design.

- The design of the anchor type and any anchor length in excess of the minimum length specified herein should be left up to the contractor.

9.2 Earth Pressures

The wall should be designed for the following:

For *active pressure* against the wall, use the following:

- Internal friction angle $\phi = 20°$, c = 300 psf & soil moist unit weight (γ) = 125 pcf.

- Use earth pressures and criteria outline in Bridge Design Specifications (BDS) Section 5.5.5 Earth Pressure, Art 5.5.5.7 Figure 5.5.5.7.1-1.

- For traffic surcharge, include an additional rectangular pressure diagram equivalent to 2 ft of fill from top of the wall to a depth equal to the wall height.

- The tieback wall shall be capable of resisting an additional seismic uniform earth pressure estimated to be equal to 15H psf.

The above-recommended loadings are based on the assumption that an adequate drainage system will be provided to prevent the development of hydrostatic pressure behind the wall. If complete drainage of the wall cannot be achieved, add hydrostatic pressure assuming groundwater at 5 feet below top of wall.

For *passive pressure* against the soldier piles, use the following input:

a. Below depth of 20' use $\phi = 36°$, C = 0 psf, and γ = 140 pcf.
b. Minimum of 5-foot wide bench at the base of the wall.
c. Friction Factor (δ) = $2/3\phi$.

9.3 Vertical CIDH Pile Capacities and Penetration Depth

Soldier piles should be embedded a minimum of 40 feet below the ground surface at the existing roadway elevation.

Pile spacing should be limited to 8 feet maximum.

The minimum pile diameter shall be 24-inches (Wet Spec requirement).

The ultimate vertical compression and tension capacities of piles may be calculated using the following design parameters:

- Use a unit pile shaft friction of 1.25 kips per unit surface area of the pile length below the dredge line of the wall.

- Use 70 percent of the compression shaft resistance values mentioned above to calculate the ultimate tension (uplift) resistance of the pile.

10. DIFFERING SITE CONDITIONS

The surface and subsurface conditions "in the contract" are defined by this report. Early communication between the Engineer of record, the Contractor and the Geotechnical Professional is recommended as soon as conditions that differ from those established by the GDR are recognized.

11. CONSTRUCTION CONSIDERATIONS

All earthwork shall conform to Section 19 Earthwork of the 2010 Standard Specifications. The boring data indicates the rock behind the landslide (back cut construction area) below a depth of 30 to 35 feet will be difficult to excavate. Also, zones of relatively unstable highly fractured dark gray argillite should be encountered.

If rock encountered within the limits of the proposed slide removal, excavation cannot be removed by ripping, removal of the rock will be performed in accordance with Standard Specification 19-4 Rock Excavation. Based on the seismic refraction survey, blasting will most likely not be required but difficult ripping should occur at the boundary between the landslide deposits and the bedrock. If blasting is required, all blasting will be performed in accordance with Standard Special Provision 19-4 Rock Excavation (Control Blasting).

Groundwater should be anticipated in the slide removal excavation. Depending on the time of year and the storm severity of the previous year(s), dewatering may be required.

Material Disposal: Removal and disposal of the excavated soil and rock debris shall be the responsibility of the Contractor. The Contractor should coordinate with Caltrans to determine a suitable disposal site.

12. DISCLAIMER AND CONTRACT INFORMATION

The analyses, conclusions, and recommendations contained in this report are based upon site conditions that we observed at the time of our investigation, data from our subsurface

exploration, and our current understanding of proposed project. We have assumed that the information obtained from our limited subsurface exploration is representative of subsurface conditions throughout the site. If the scope of the proposed project changes from that described in this report, the recommendations should be reviewed by this Office.

Project Information

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

Data and information attached with the project plans are:
A. None.
Data and Information included in the Information Handout provided to the bidders and Contractors are: Geotechnical Design Report for EA 01-0B5401 dated January 10, 2014. Data and Information available for inspection at the District Office:

B. Field Boring Logs formatted in Micro Soft Excel spreadsheet. Borings were drilled in January and April 2013. Drafted Log of Test Borings will be provided in the Foundation Report.

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

C. Core boxes.

If there have any questions or comments in regards to this report, please contact William Bertucci at 916-203-7992 or Mohammad Zaboladeh at 510-286-4832.

cc: TPokrywka, HNikoui, MZabolzadeh, AKaddoura (GS west), RMahallati, WBertucci-(GS North), GBrittsan (Geotechnical Support - Office Chief), Structure Construction RE pending File, John Stayton (DES OE), SBlair (District 01 PM), BBarnes (GS North) AGuimaraes (District 01 PE),

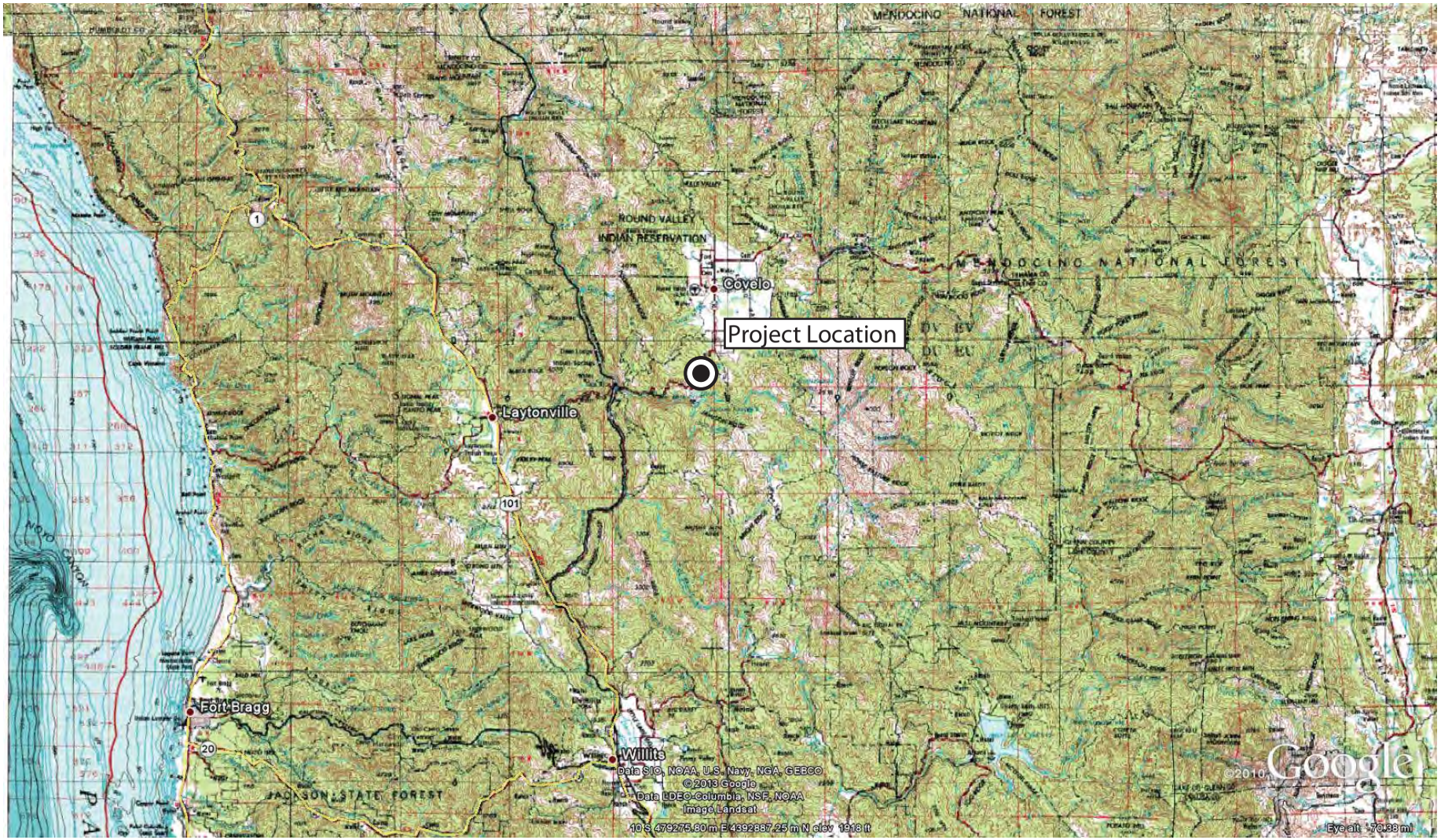
Attachments

Figures:
Figure No. 1: Location – Site 3

Figure No. 2: Geologic Map
Figure No. 3: Fault Map
Figure No. 4: Soil Map
Figure No. 5: Landslide Map
Figure No. 6: Landslide Profile
Figure No.7: Wall Plan Sketches

Appendix A: Boring Log Spread Sheets
Appendix B: Seismic Refraction Study
Appendix C: Slope Inclinometer Results

REGISTERED PROFESSIONAL ENGINEER
MOHAMMAD ZABOLZADEH
No. C 052953
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA



SCALE

0 15 miles

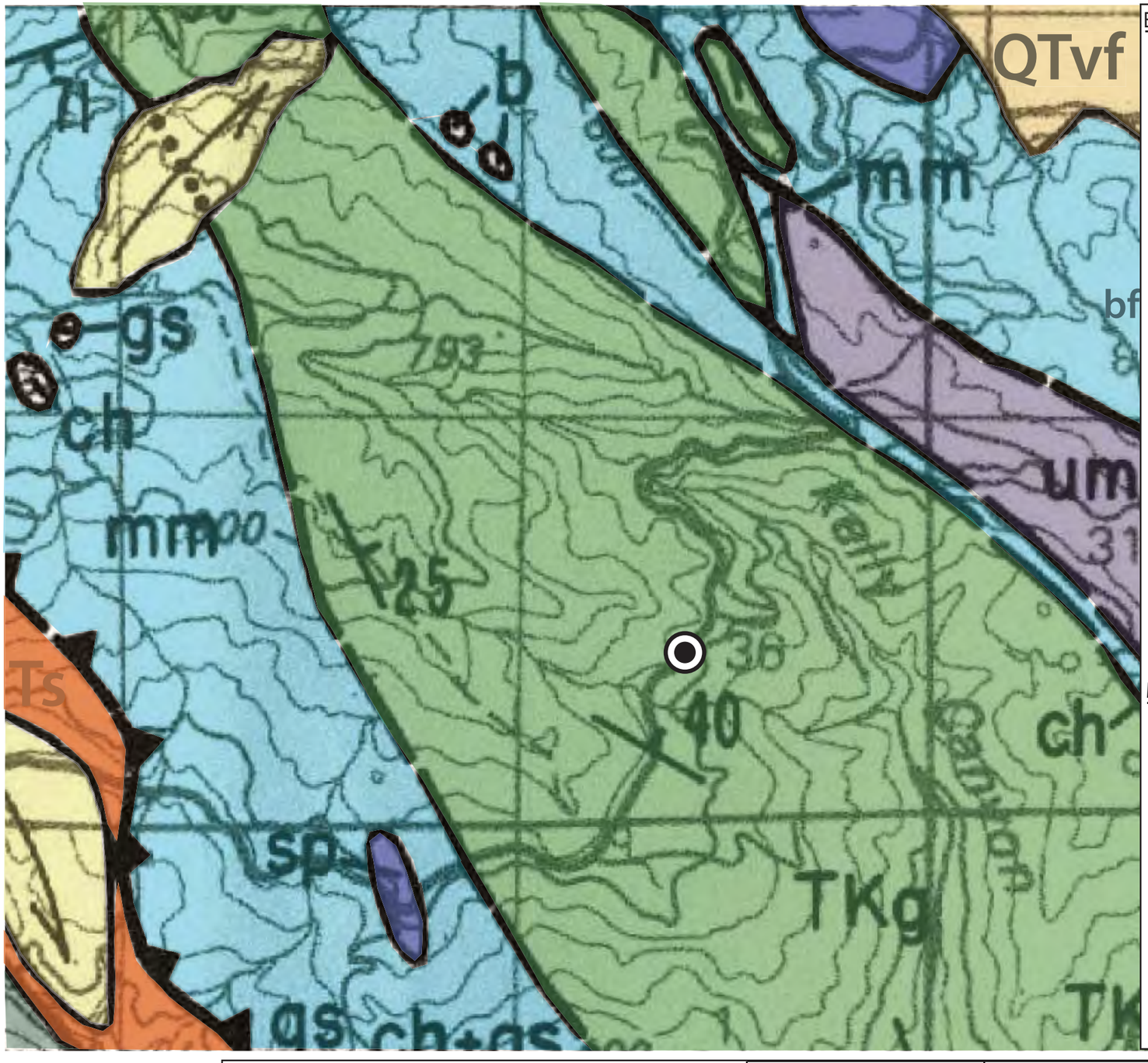
Caltrans

DIVISION OF
ENGINEERING SERVICES
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

LOCATION-SITE 3

04-MEN-162	**0112000136**
PM. 22.67	**January 2014**

FIGURE 1



Explanation

QTvf — Valley fill (Quaternary and (or) Tertiary)--Unconsolidated continental intermountain basin fill deposits, probably includes intercalated lacustrine and alluvial deposits.

Landslide deposits (Quaternary)--Arrows indicate direction of down-slope movement

Ts — Sandstone, conglomerate and mudstone (Miocene?)--Shallow-marine and nonmarine friable sandstone, pebble conglomerate, mudstone, and thin local coal horizons; oyster bearing

CENTRAL FRANCISCAN BELT

mm — Melange matrix (Tertiary to Upper Jurassic)--Argillite-matrix melange locally containing blocks of greenstone (gs), radiolarian chert (ch), blueschist or eclogite (bs), amphibolite (am), ultramafic rocks and serpentinite (sp), limestone (ls), graywacke (gry) and undivided blocks (b).

Tkg — Great Valley sequence and associated sedimentary rocks (Eocene to Lower Cretaceous)--Unmetamorphosed thin- and thick-bedded, interbedded potassium feldspar-bearing, light-colored sandstone, argillite, subordinate conglomerate, and rare coquina; weathered outcrops are typically yellowish brown; may show spheroidal weathering serpentinized ultramafic rock

um — Ultramafic rock (age unknown)--Generally tectonized and serpentinized ultramafic rock

Map Symbols

44 Inclined

Contact - dashed where inferred

High angle fault - dashed where inferred; dotted where concealed

Thrust fault - dashed where inferred; dotted where

Project Location

Reference:
USGS; 1989; Reconnaissance Geologic Map of the Covelo 30- by 60-Minute Quadrangle, Northern California: Jayko, et al.

SCALE
0 1/2 mile

Caltrans

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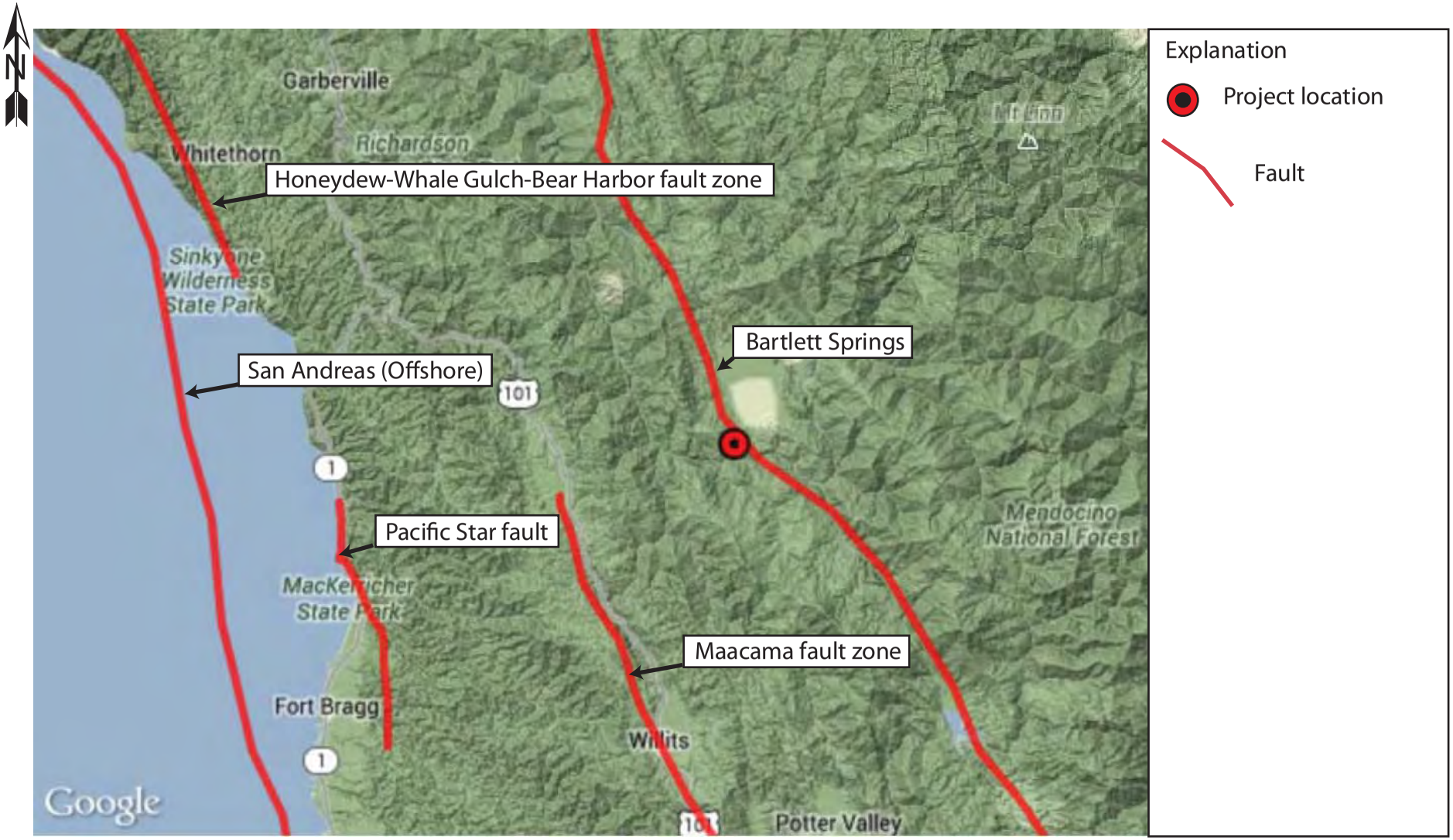
GEOTECHNICAL DESIGN - WEST – BRANCH B

GEOLOGIC MAP-SITE 3

04-MEN-162 0112000136

PM. 22.67 JANUARY 2014

FIGURE 2



SCALE

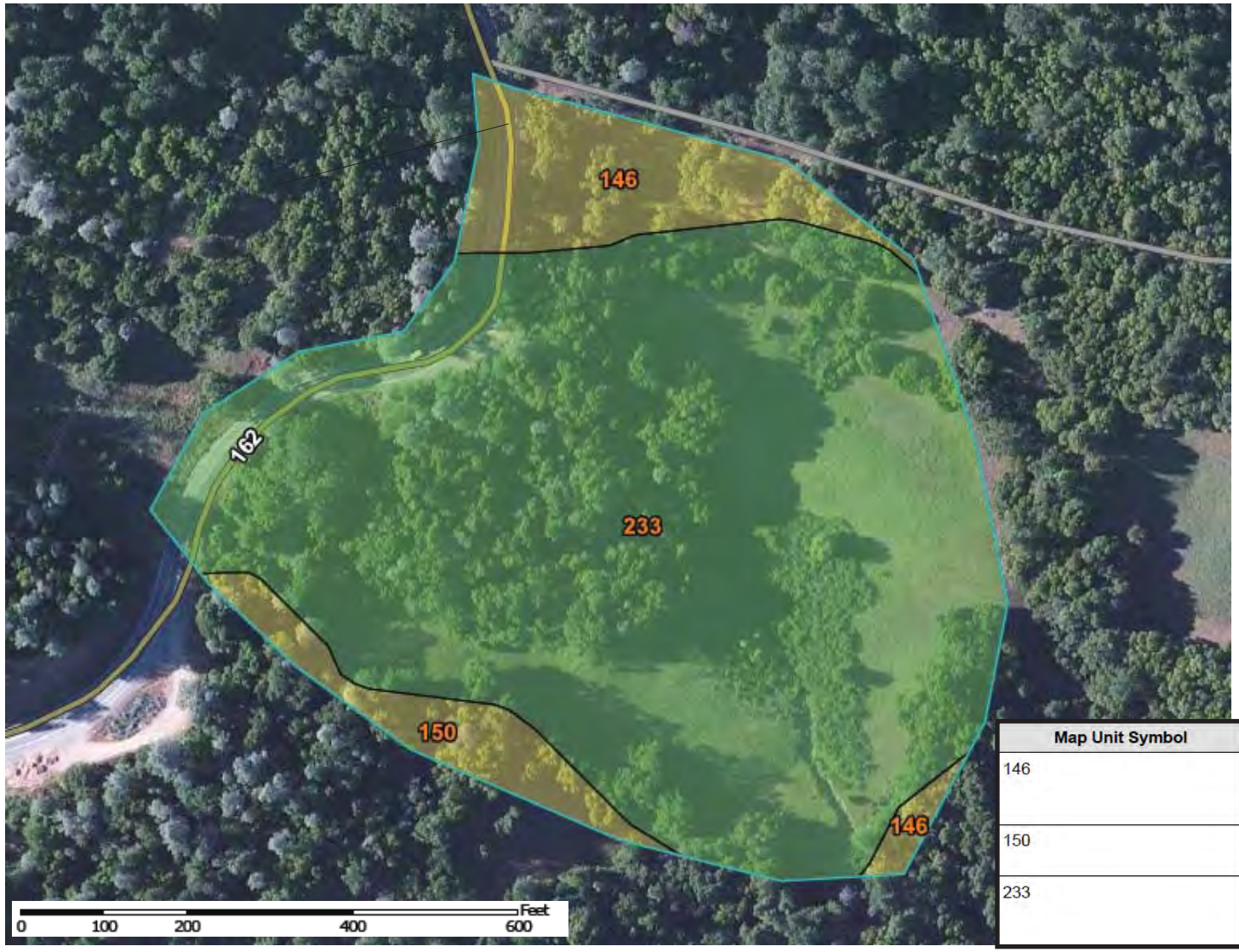
0 15 miles

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

FAULT MAP - SITE 3

04-MEN-162	**0112000136**
PM. 22.67	**January 2014**

FIGURE 3



Map Unit Symbol	Map Unit Name
146	Hopland-Sanhedrin-Kekawaka complex, 30 to 50 percent slopes
150	Hopland-Wohly loams, 30 to 50 percent slopes
233	Yorkville-Squawrock-Witherell complex, 30 to 50 percent slopes

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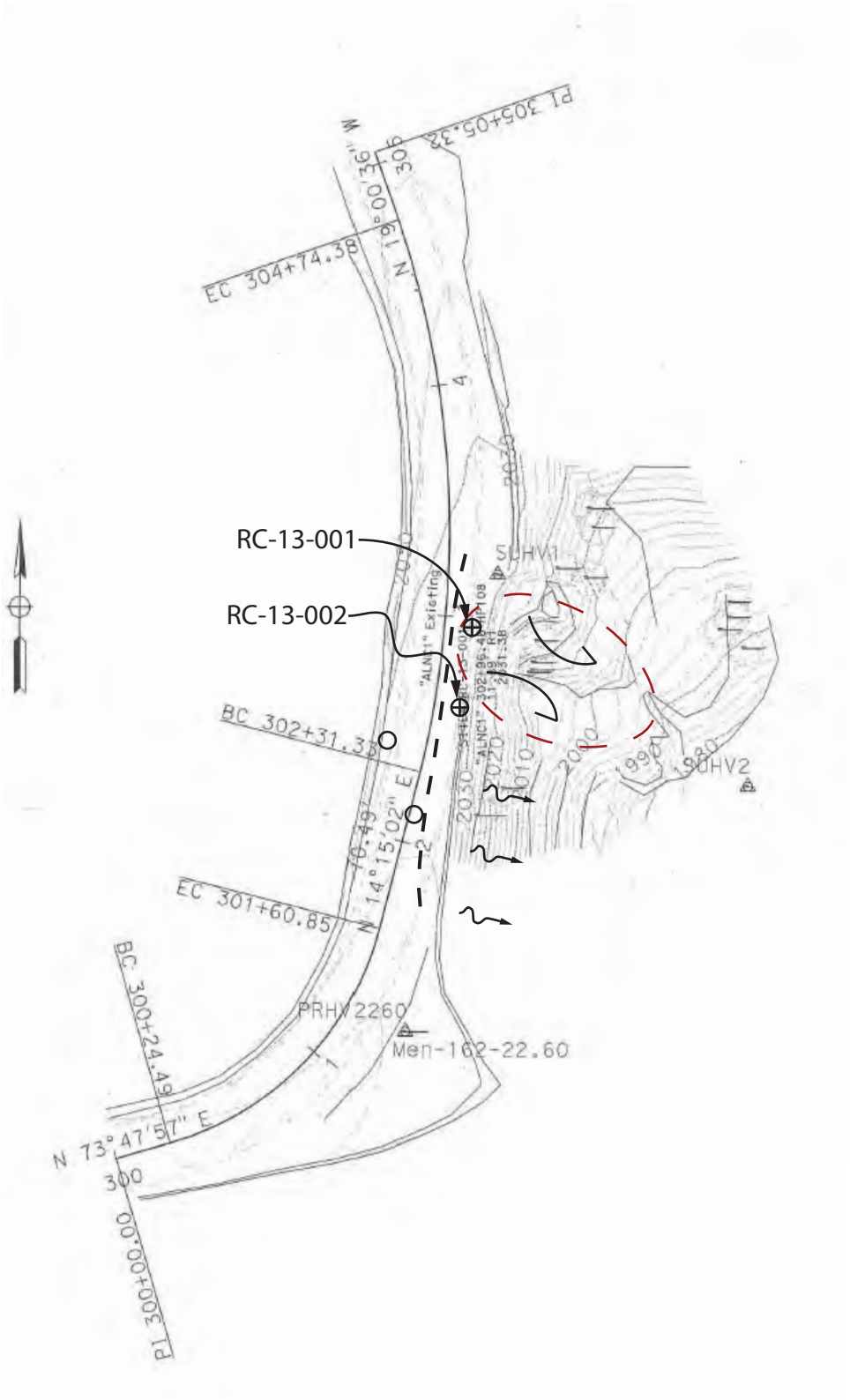
GEOTECHNICAL DESIGN - WEST – BRANCH B

SOIL MAP - SITE 3

04-MEN-162 **0112000136**

PM. 22.67 **January 2014**

FIGURE 4



Explanation

Slide Zone Arrows - Indicate direction of movement

Slide Creep Zone

Fractures in Roadway

RC-13-001: Approximate Locations of Existing Borings

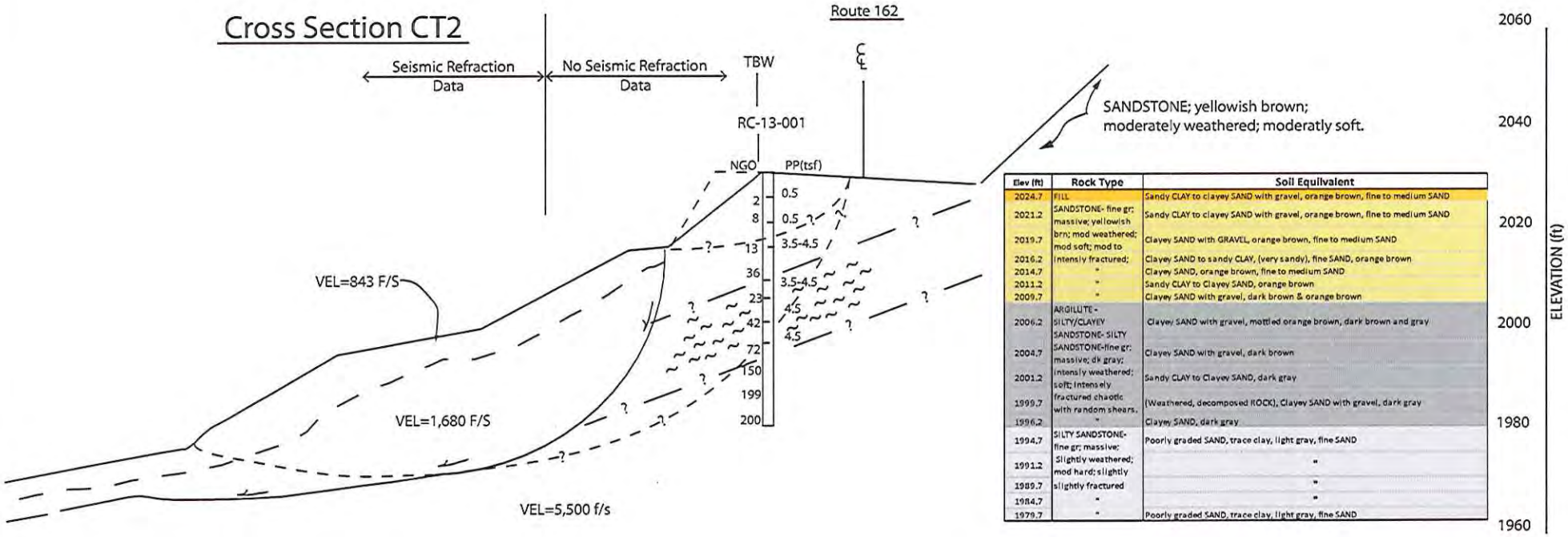
Approximate Locations of Proposed Borings

Scale

0 100ft

Caltrans	**DIVISION OF ENGINEERING SERVICES** GEOTECHNICAL SERVICES GEOTECHNICAL DESIGN - WEST – BRANCH B	**LANDSLIDE MAP SITE 3** **04-MEN-162** **0112000136** **PM. 22.67** **January 2014** **FIGURE 5**

Storm Damage Site 3
01-MEN-162-PM 22.67
EA: 01-0B5401
ID:0112000136



Elev (ft)	Rock Type	Soil Equivalent
2024.7	FILL	Sandy CLAY to clayey SAND with gravel, orange brown, fine to medium SAND
2021.2	SANDSTONE- fine gr; massive; yellowish brn; mod weathered; mod soft; mod to intensly fractured;	Sandy CLAY to clayey SAND with gravel, orange brown, fine to medium SAND
2019.7		Clayey SAND with GRAVEL, orange brown, fine to medium SAND
2016.2		Clayey SAND to sandy CLAY, (very sandy), fine SAND, orange brown
2014.7	"	Clayey SAND, orange brown, fine to medium SAND
2011.2	"	Sandy CLAY to Clayey SAND, orange brown
2009.7	"	Clayey SAND with gravel, dark brown & orange brown
2006.2	ARGILLITE - SILTY/CLAYEY SANDSTONE- SILTY SANDSTONE-fine gr; massive; dk gray; intensly weathered; soft; intensely fractured chaotic with random shears.	Clayey SAND with gravel, mottled orange brown, dark brown and gray
2004.7		Clayey SAND with gravel, dark brown
2001.2		Sandy CLAY to Clayey SAND, dark gray
1999.7		(Weathered, decomposed ROCK), Clayey SAND with gravel, dark gray
1996.2	"	Clayey SAND, dark gray
1994.7	SILTY SANDSTONE- fine gr; massive; Slightly weathered; mod hard; slightly slightly fractured	Poorly graded SAND, trace clay, light gray, fine SAND
1991.2		"
1989.7		"
1984.7	"	"
1979.7	"	Poorly graded SAND, trace clay, light gray, fine SAND

Reference:

SCALE
0 20 ft

Caltrans

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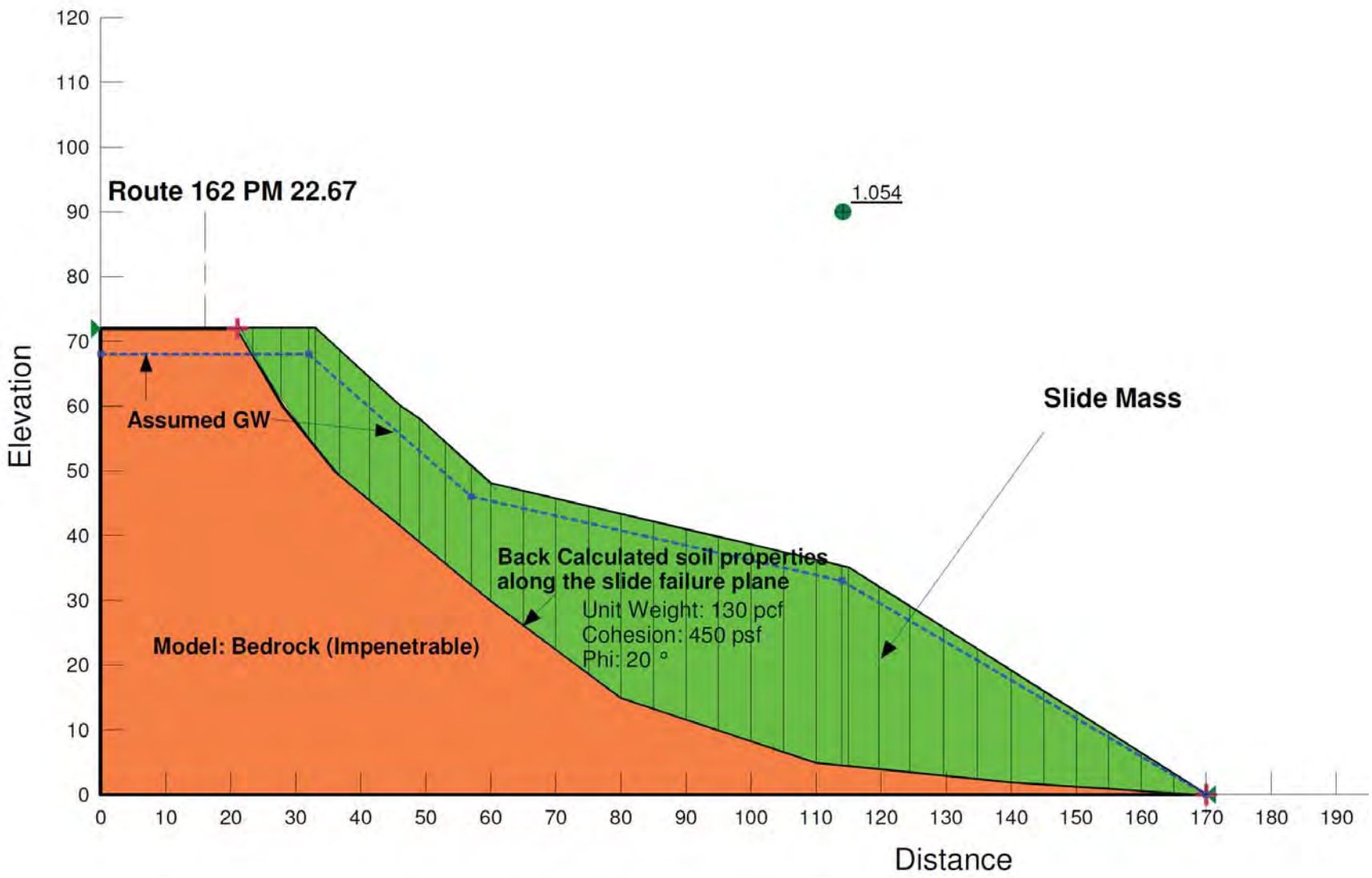
ENGINEERING SERVICES
GEOTECHNICAL SERVICES
GEOTECHNICAL DESIGN - WEST – BRANCH B

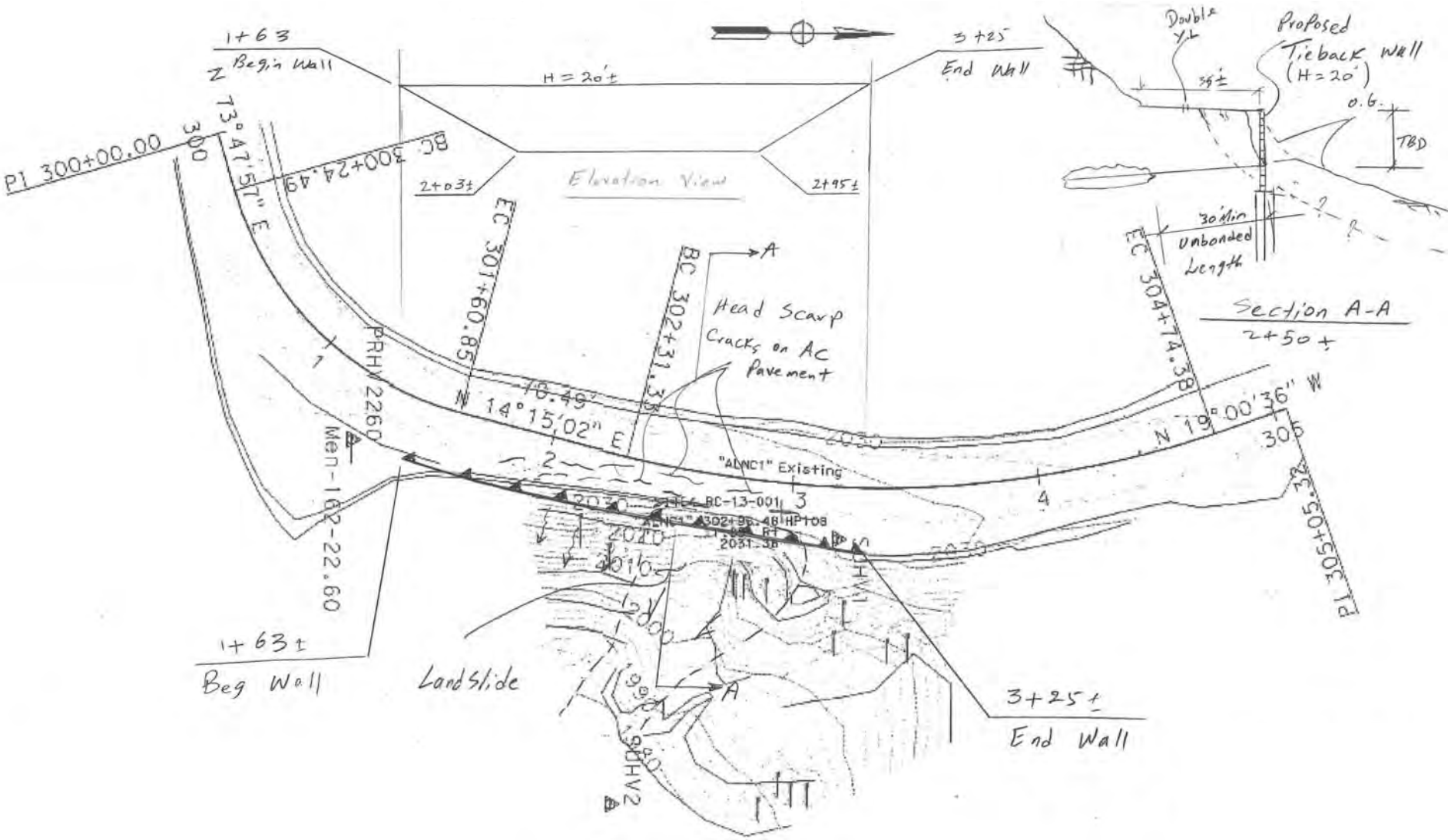
LANDSLIDE PROFILE-SITE 3

04-MEN-162	0112000136
PM. 22.67	JANUARY 2014

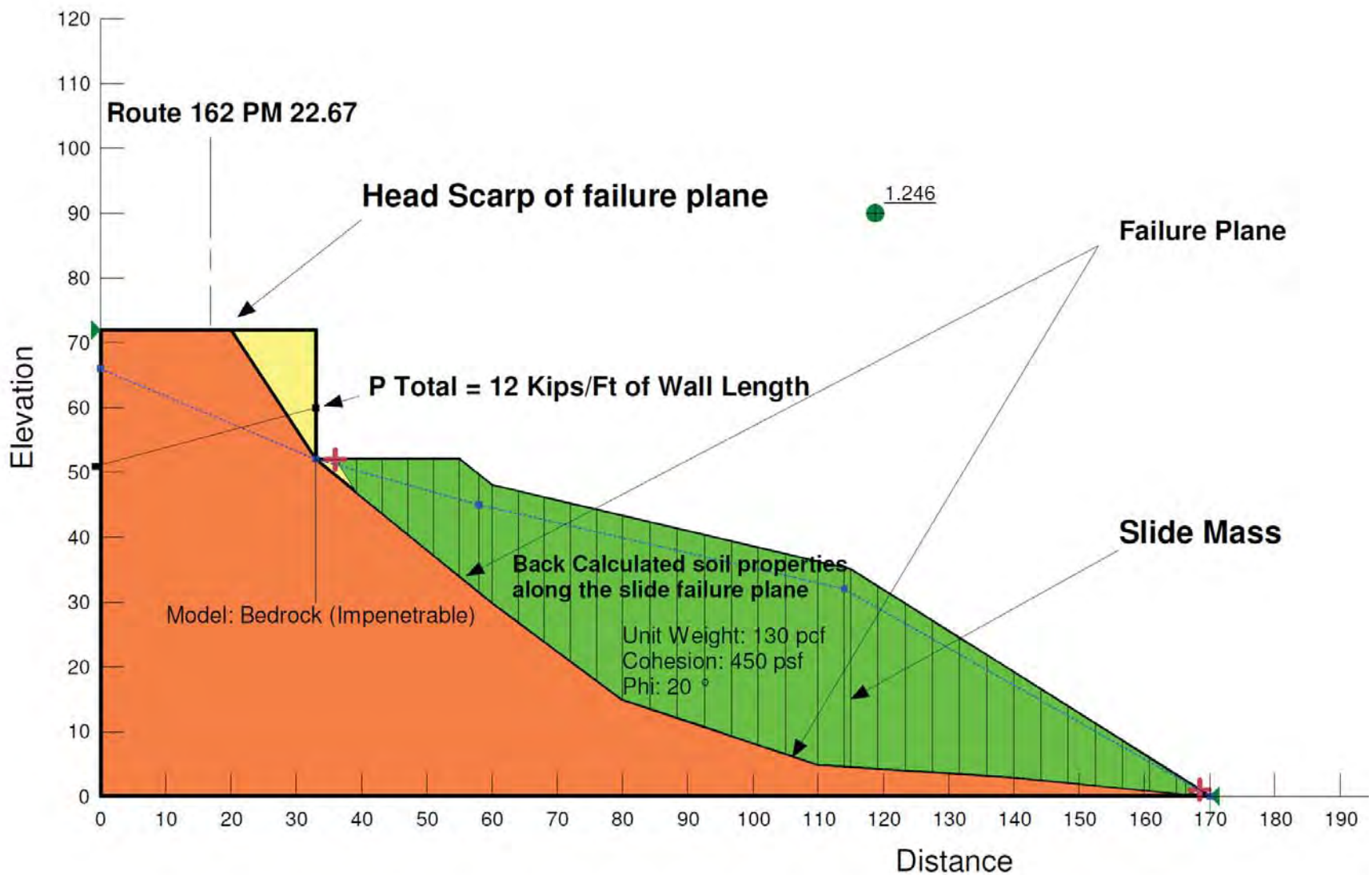
FIGURE 6



Scale: Not to Scale	Caltrans	**DIVISION OF ENGINEERING SERVICES** GEOTECHNICAL SERVICES GEOTECHNICAL DESIGN - WEST – BRANCH B	**LANDSLIDE/SLOPE STABILITY ANALYSIS- SITE 3** **04-MEN-162** **0112000136** **PM. 22.67** **January 2014** **FIGURE 7**



Scale: Not to Scale	Caltrans	**DIVISION OF ENGINEERING SERVICES** GEOTECHNICAL SERVICES GEOTECHNICAL DESIGN - WEST – BRANCH B	**WALL PLAN SKETCHES- SITE 3** **04-MEN-162** **0112000136** **PM. 22.67** **January 2014** **FIGURE 8**



Scale: Not to Scale	Caltrans	DIVISION OF ENGINEERING SERVICES GEOTECHNICAL SERVICES GEOTECHNICAL DESIGN - WEST – BRANCH B	TIE BACK WALL DESIGN- SITE 3 04-MEN-162 0112000136 PM. 22.67 January 2014 FIGURE 9

APPENDIX A

Boring Log Spread Sheets

BORING FIELD LOG SPEAD SHEET

RC-13-001
Storm Damage Site 3
01-Men 162 PM 22.67
Boring Elev 2031.2 ft
BEN BARNES
Jan, 2013

83	83	Hammer Efficiency	83
1.38	1.38	Correction Factor	1.38

Begin	End	Elev (ft)	Sample	Tool	Blow Counts			N	N60	LAB TEST	Phi /C	PP	Soil Equilvalent	Rock Type
5	6.5	2024.7	1	SPT	1	1	1	2	0			0.5	Sandy CLAY to clayey SAND with gravel, orange brown, fine to medium SAND	FILL
5	10	2021.2	2	PC						MA		0.5	Sandy CLAY to clayey SAND with gravel, orange brown, fine to medium SAND	SANDSTONE- fine gr; massive; yellowish
10	11.5	2019.7	3	SPT	4	4	4	8	0				Clayey SAND with GRAVEL, orange brown, fine to medium SAND	brn; mod weathered; mod soft; mod to
10	15	2016.2	4	PC									Clayey SAND to sandy CLAY, (very sandy), fine SAND, orange brown	intensly fractured;
15	16.5	2014.7	5	SPT	5	5	8	13	0				Clayey SAND, orange brown, fine to medium SAND	"
15	20	2011.2	6	PC								3.5-4.5	Sandy CLAY to Clayey SAND, orange brown	"
20	21.5	2009.7	7	SPT	10	16	20	36	0				Clayey SAND with gravel, dark brown & orange brown	"
20	25	2006.2	8	PC								3.5-4.5	Clayey SAND with gravel, mottled orange brown, dark brown and gray	ARGILLITE - SILTY/CLAYEY SANDSTONE- SILTY
25	26.5	2004.7	9	SPT	8	9	14	23	0	MA			Clayey SAND with gravel, dark brown	SANDSTONE-fine gr; massive; dk gray;
25	30	2001.2	10	PC								4.5	Sandy CLAY to Clayey SAND, dark gray	intensly weathered; soft; intensely
30	31.5	1999.7	11	SPT	9	19	23	42	0				(Weathered, decomposed ROCK), Clayey SAND with gravel, dark gray	fractured chaotic with random shears.
30	35	1996.2	12	PC								4.5	Clayey SAND, dark gray	"
35	36.5	1994.7	13	SPT	19	43	29	72	0				Poorly graded SAND, trace clay, light gray, fine SAND	SILTY SANDSTONE- fine gr; massive;
35	40	1991.2	14	PC									"	Slightly weathered; mod hard; slightly
40	41.5	1989.7	15	SPT	50/4"			150	0				"	slightly fractured
45	46.5	1984.7	16	SPT	40	49	50/3"	149	0				"	"
50	51.5	1979.7	17	SPT	50/3"			200	0	MA			Poorly graded SAND, trace clay, light gray, fine SAND	"
														Bottom of Boring @ 50 feet Slope Inclinometer installed

BORING FIELD LOG SPEAD SHEET

R-13-002
Storm Damage Site 3
01-Men 162 PM 22.67
Boring Elev 2031.4 ft
Bill Bertucci
April, 2013

Hammer Efficiency	83
Correction Factor	1.38

Begin	End	Elev (ft)	Sample	Tool	Blow Counts			N	N60	LAB TEST	Phi /C	PP	Soil Type	Rock Equivalent
0	**1**	2030.4											**12-in Asphalt pavement**	
1	**5**	2026.4											0-5 ft Fill:	Fill
5	6.5	2024.9	1	PC/SPT	5	6	5	11	0					
5	10	2021.4	2	PC						MA			5- 10 ft SILTY SAND (SM), medium dense, moderate yellowish brn;	SANDSTONE- fine to med gr; massive; yellowish brn;
10	11.5	2019.9	3	PC/SPT	10	8	7	15	0				dry; some fines sand; fine to med grained.	intensely weathered; mod soft.
10	15	2016.4	4	PC									"	"
15	16.5	2014.9	5	PC/SPT	50/3"				100	MA			10-15 ft 21 % fine GRAVEL	SANDSTONE- w/ few fine GRAVEL
15	20	2011.4	6	ROCK CORE									15- 34.8 ft SILTY SAND (SM), medium dense, moderate yellowish brn;	SANDSTONE- fine to med gr; massive; yellowish brn;
20	21.5	2009.9	7	"									some fines sand; fine to med grained.	intensely weathered; mod soft.
20	25	2006.4	8	"									"	"
25	26.5	2004.9	9	"									"	"
25	30	2001.4	10	"									"	"
30	31.5	1999.9	11	"									"	"
32.5	35	1996.4	12	"									"	"
35	36.5	1994.9	13	"									34.8- 55 ft SILTY SAND - SANDY SILT (SM-ML); med dense; dark gray; dry;	ARGILLITE -(SILTY SANDSTONE / SANDY SILTSTONE)
35	40	1991.4	14	"									some and mostly fines; fine to med grained; Est 5-10 % clay.	fine gr; massive; dk gray; intensely weathered; mod
40	41.5	1989.9	15	"										soft; intensy fractured chaotic w/random shears.
45	46.5	1984.9	16	"										34.8 ft paper thin polished shear dipping @ 25 deg.
50	51.5	1979.9	17	"										
55	51.5	1979.9	18	ROCK CORE										
														Bottom of Boring @ 55 feet Slope Inclinometer/ piezometer installed

APPENDIX B

Seismic Refraction Survey

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: **QIANG HUANG**
Senior M&R Engineer
Geotechnical Design West
Division of Engineering Services

Date: July 17, 2013

File: 01-MEN-162-22.67
Project: 01-1200-0136

Attention: William Bertucci

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

Subject: Results of Seismic Refraction Survey at PM 22.67 (Site 4), Highway 162, in Mendocino County

Introduction

This memo summarizes the results of a refraction seismic survey to assist in the design of storm damage related repairs to the roadway and shoulder/embankment area at PM 22.67 on Highway 162 in Mendocino County. This is one of four storm damage related sites being repaired under separate projects. At this site (Site 4) the seismic refraction method was employed to supplement drilling data and geologic mapping to determine the engineering characteristics of the material comprising the damaged area. Two seismic refraction lines were employed. Plate 1 shows the locations of the seismic lines.

Results and Discussion

Seismic Line 1
Seismic Line 1 was nearest Boring R-13-002, located in the roadway. The offset shot at -39.3 ft is 7.5 feet east of the boring. The profile traverses a 16' to 18' near vertical head scarp between the end shot (0 ft) and the off-end shot at -39.4 ft. A second scarp is traversed about 40 feet along the seismic line. The scarp was within a tangle of down timber and stacked brush piles but appeared to be about a 6 to 8 foot drop in elevation. Plate 2 shows the profile of Seismic Line 1 with a geologic interpretation of the velocity units encountered. Plate 2 also contains Boring R-13-002 with the top of rock and shear zone shown as described in the field log. The seismic profile shows three velocity units. The first unit is mainly side cast, riprap and unconsolidated landslide debris with a seismic velocity of 843 ft/s. This unit thickens to the east from about 2 to 8.2 feet. The second velocity unit has a measured seismic velocity of 1690 ft/s, and is described in the field log as massive sandstone. Seismic velocity indicates this unit must be very soft and poorly indurated. This unit varies in thickness from 28 ft midway through the seismic line to 3.2 ft from about 80 ft to the end of the profile. The third velocity unit has a seismic velocity of 5400 ft/s. This unit is described in field logs as silty sandstone. The thickness of this unit is not defined.

Seismic Line 2
Seismic Line 2 was laid out on contour and normal to Seismic Line 1. This profile traversed hummocky topography covered in dense brush and timber. Seismic Line 2 also identified three

velocity units with similar seismic velocities as Seismic Line 1. The first velocity unit had a measured seismic velocity of 650 ft/s. It is mainly side cast material containing angular float up to 14" in diameter. It was approximately 3 ft thick. The second velocity unit was measured at 1380 ft/s and is interpreted on the field log as massive sandstone. Based on seismic velocity this unit must be very soft and poorly indurated. This unit is about 25 ft thick. Velocity unit three was measured at 5500 ft/s and is described in field logs as moderately weathered, moderately soft, moderately fractured silty sandstone. The thickness of this unit not defined.

Data Acquisition and Processing

Seismic refraction data were recorded using an EG&G Smartseis 24-channel seismograph with 14 MHz geophones. The profiles varied in length. The energy source employed was a hammer and striker plate and a downhole seismic source using 8-gauge, 500-grain black powder cartridges. Refraction data from each shot were stored in the seismograph's memory. Both profile geometry and refraction data were backed-up to paper and floppy disk upon completion of the survey.

Profiles in this report are presented in terms of velocity units. A velocity unit is a three-dimensional unit, which due to its elastic properties and density, propagates seismic waves at a characteristic velocity or within a characteristic velocity range. Velocities denoted in this report and in the seismic refraction sections are expressed in feet per second. At least one velocity is present within a geological rock unit. In addition, each zone of weathering, or fracturing within that geological unit can constitute its own velocity unit. Conversely, when two rock units, such as water saturated gravel and moderately weathered rock, propagate seismic waves at the same velocity and are adjacent to each other, both units would be part of the same velocity unit. Lastly, discontinuous velocities might result from variation in the degree of alteration in the form of physical and chemical weathering and should be considered in the interpretation of the data.

Thank you for the opportunity to work on this project. If you have any questions or need additional assistance, please contact me at (916) 227-1307 or Mr. Bill Owen at (916) 227-0227.

Report by:

Dennison Leeds
Engineering Geologist
Geophysics and Geology Branch

Reviewed By:

William Owen, PGP 1031
Chief, Geophysics and Geology Branch

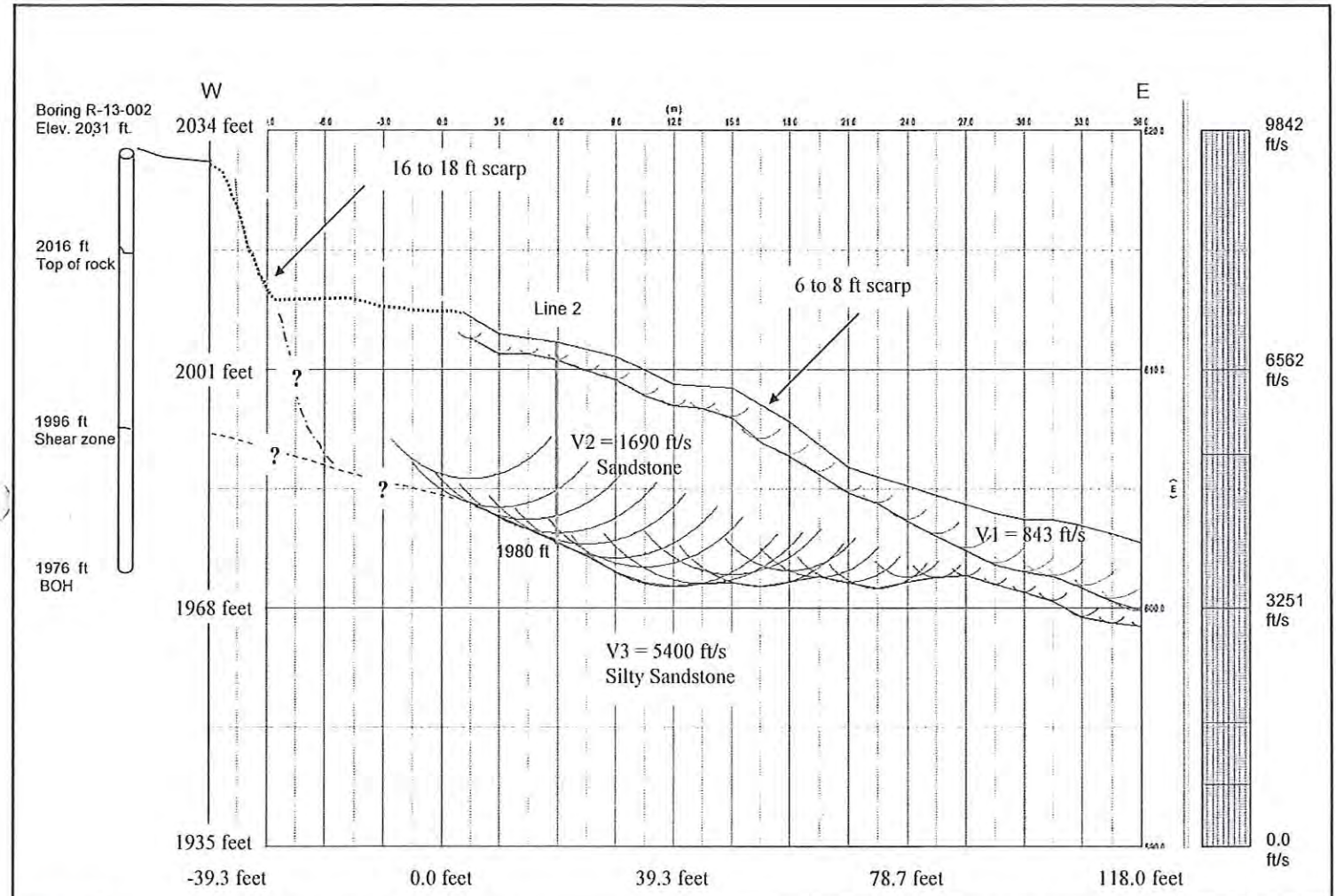
PROFESSIONAL GEOPHYSICIST
W.P. OWEN
No. 1031
3/31/14
Exp.
STATE OF CALIFORNIA

c: Project File.

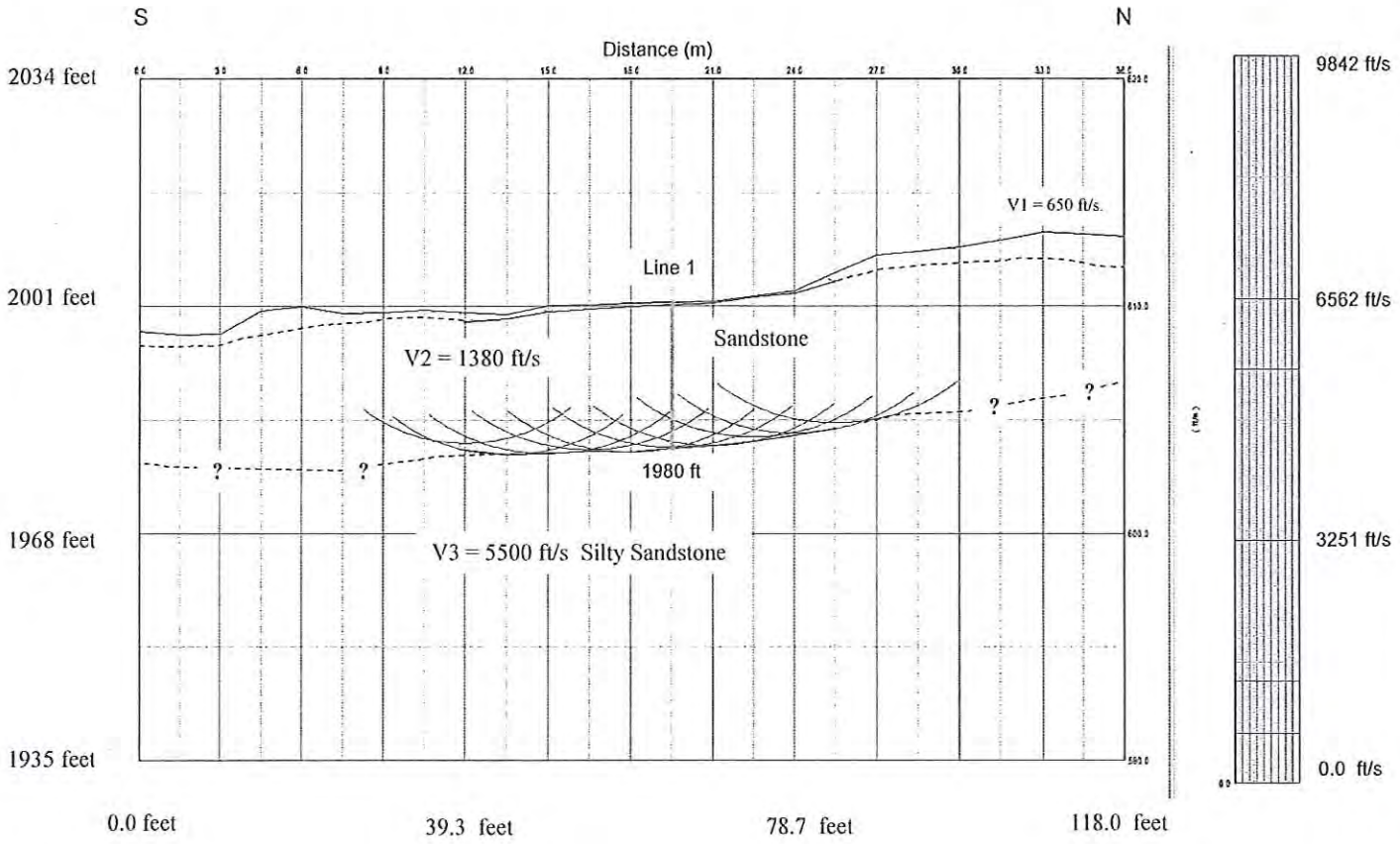
DL/WO

01_Men_162_22.67_2013_SEI.doc

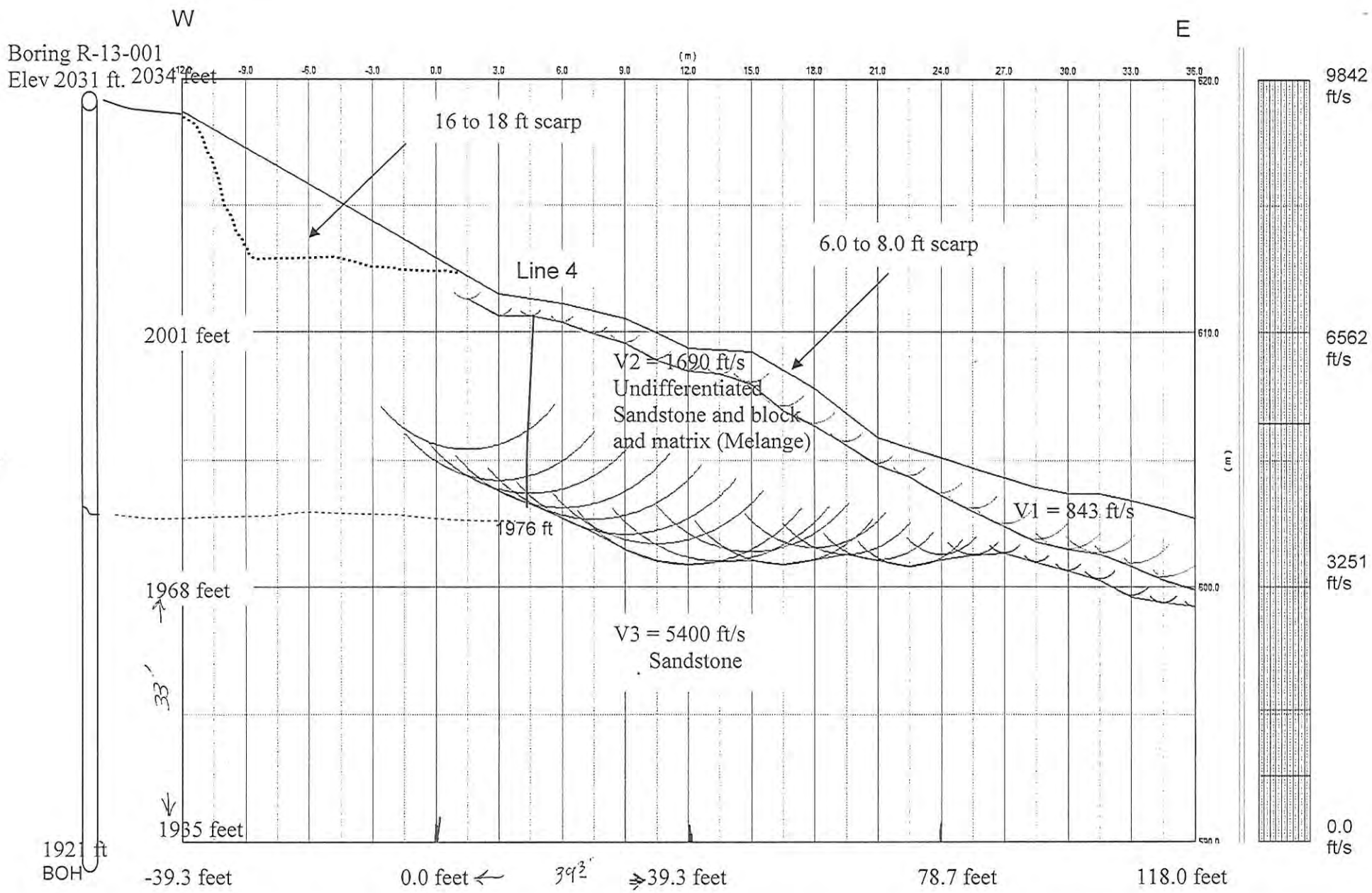
Caltrans	Division of Engineering Services Office of Geotechnical Support Geophysics and Geology Branch	EA 0B5401	Location Map, Site 4	Plate No.1
		ID 0112000136	01-Men-162-22.67	



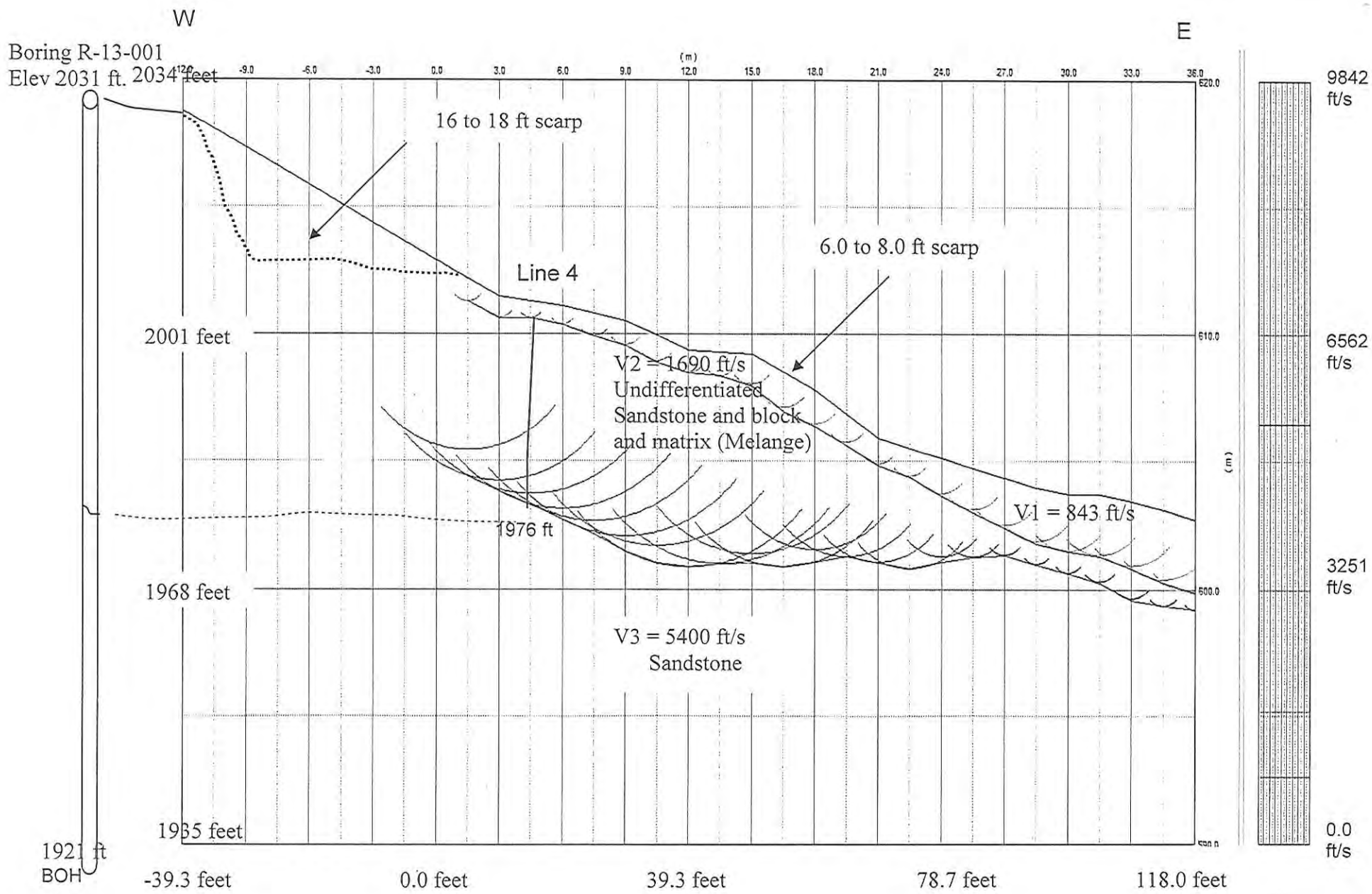
Caltrans	Division of Engineering Services Office of Geotechnical Support Geophysics and Geology Branch	EA 0B5401	Depth & Velocity Section for Seismic Line 1 & Boring Log for R-13-002	Plate No. 2
		01-120020136	Site 4 01-Men-162-PM 22.67	



Caltrans	Division of Engineering Services Office of Geotechnical Support Geophysics and Geology Branch	EA 0B5401 01-120020136	Depth and Velocity Section for Seismic Line 2 Site 4 01-Men-162-PM 22.67	Plate No.3



Caltrans Division of Engineering Services Office of Geotechnical Support Geophysics and Geology Branch	EA 0B540	Depth & Velocity Section for Seismic Line 3 & Boring Log for R-13-001	Plate No.3
	01-120020137	01-Men-162-PM 22.67	



Division of Engineering Services Office of Geotechnical Support Geophysics and Geology Branch	EA 0B540	Depth & Velocity Section for Seismic Line 3 & Boring Log for R-13-001	Plate No.3
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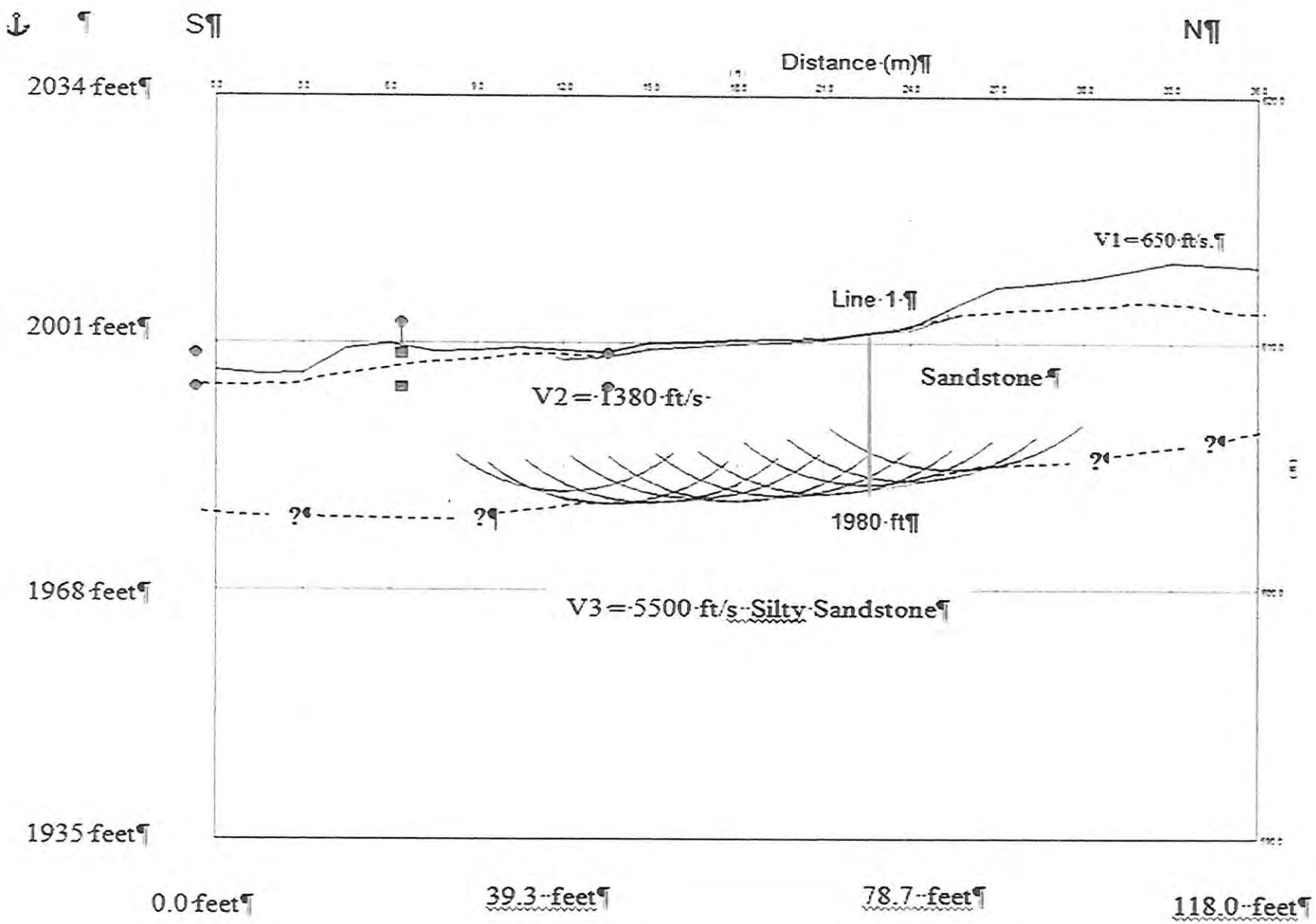
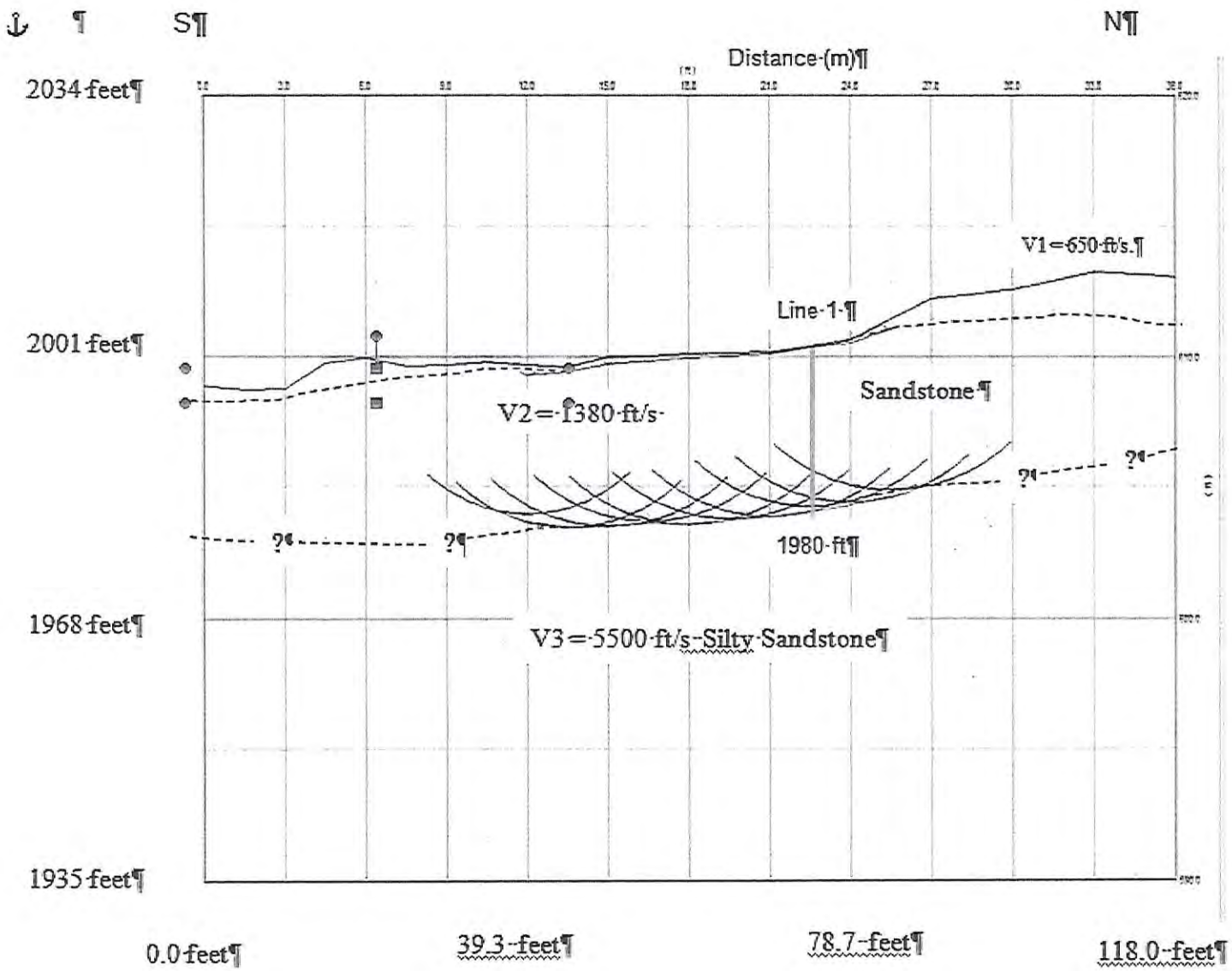
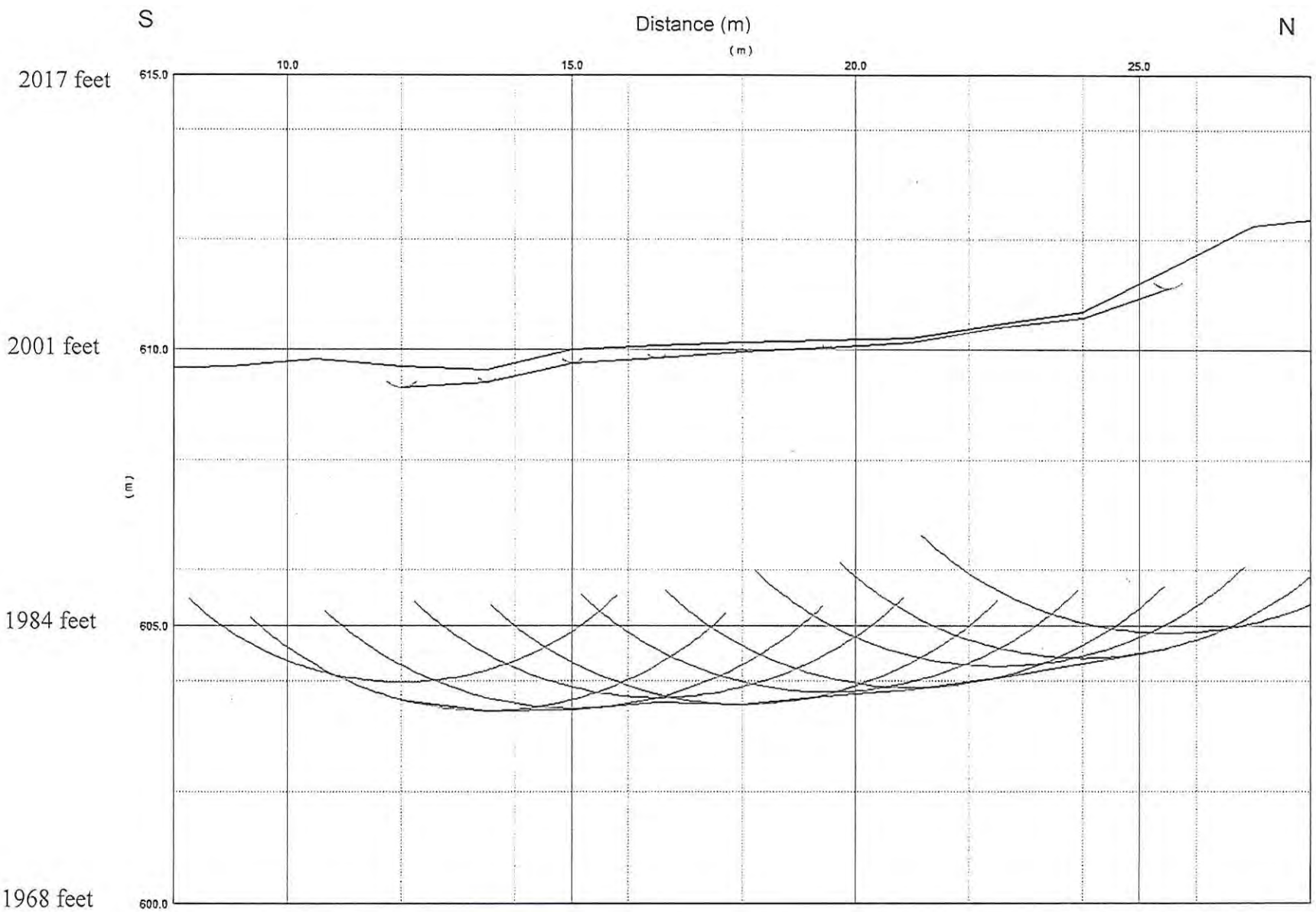


Caltrans	Division of Engineering Services Office of Geotechnical Support Geophysics and Geology Branch	EA 0B5401	Site 4 Seismic Line 2 @ 1:1	Plate No.1
		ID 0112000136	01-MEN-162-22.67	


S
N
Distance (m)
2034 feet
2001 feet
1968 feet
1935 feet
V1=650 ft/s.
Line 1
Sandstone
V2=1380 ft/s
?
?
?
?
1980 ft
V3=5500 ft/s Silty Sandstone
0.0 feet
39.3 feet
78.7 feet
118.0 feet

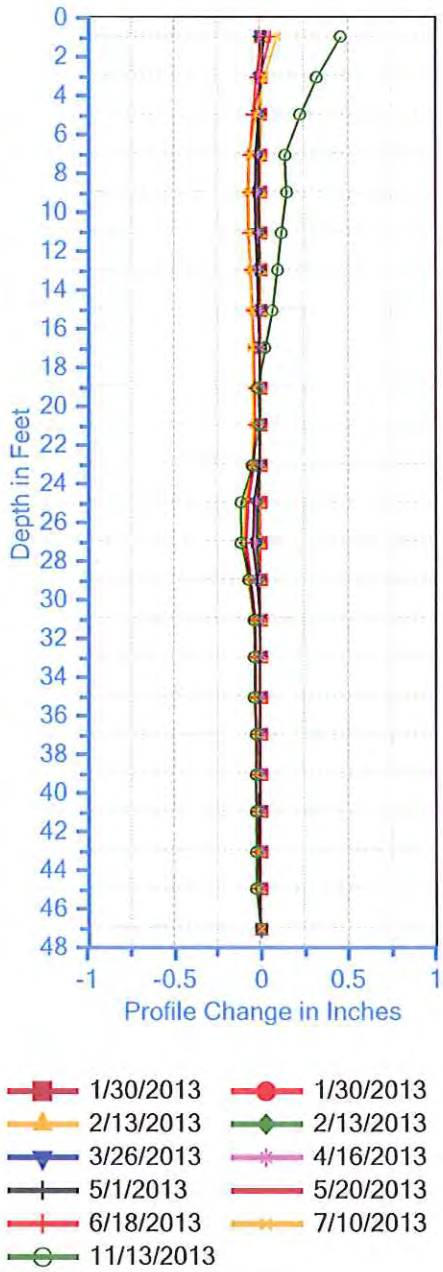


Caltrans Division of Engineering Services Office of Geotechnical Support Geophysics and Geology Branch	EA 0B5401	Depth and Velocity Section for Seismic Line 2	Plate No.3
	01-120020136	Site 4 01-Men-162-PM 22.67	

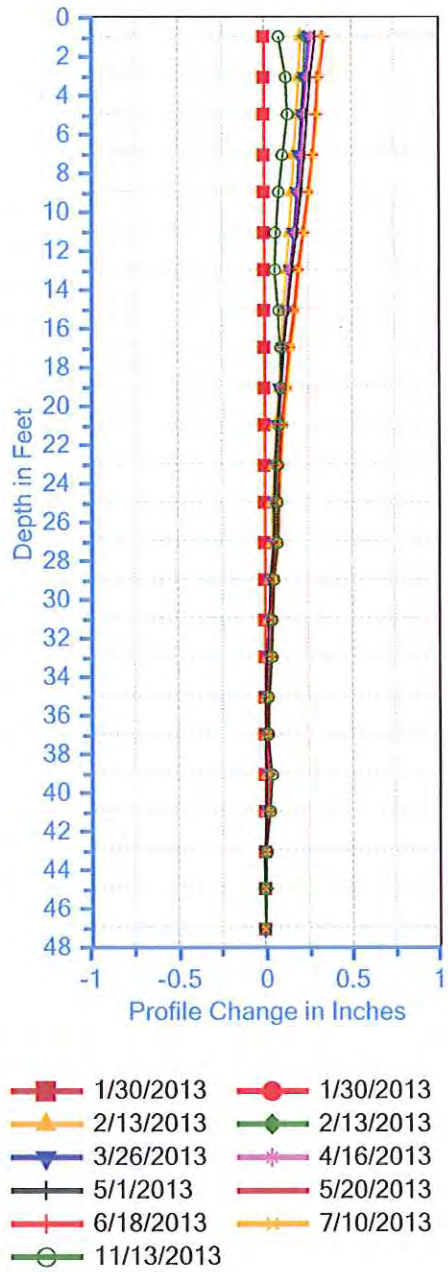
APPENDIX C

Slope Inclinometer Results

SITE3 RC-13-001, A-Axis



SITE3 RC-13-001, B-Axis



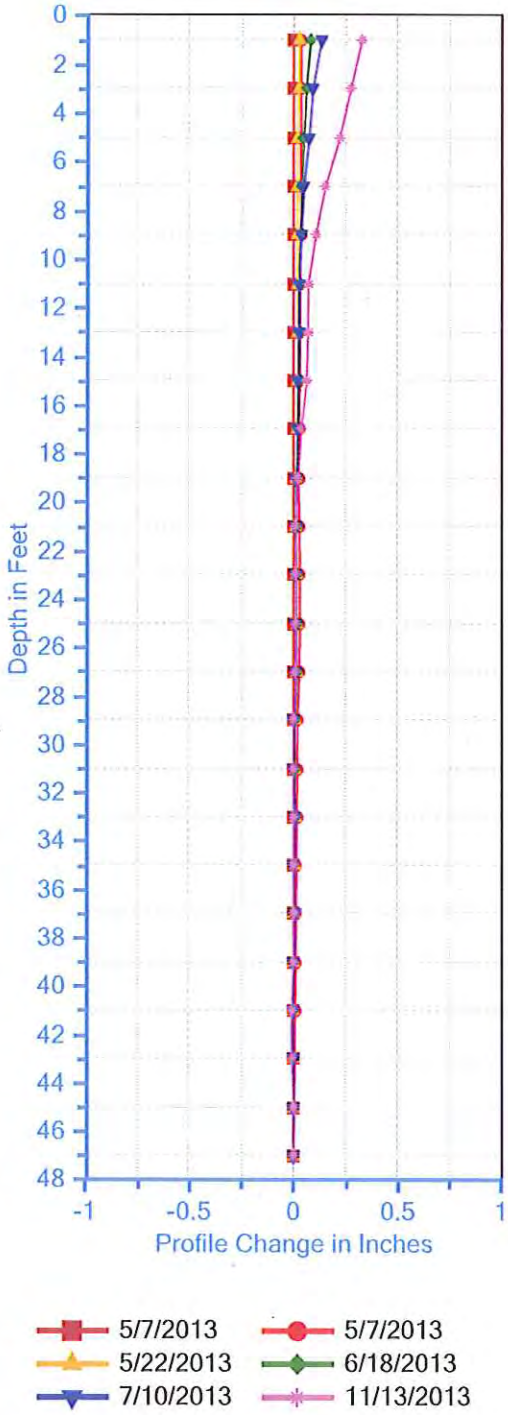
INCLINOMTER RESULTS

01-MEN-HWY 162 P.M. 22.67
STORM DAMAGE SITE 3
EFIS No. 0112000136

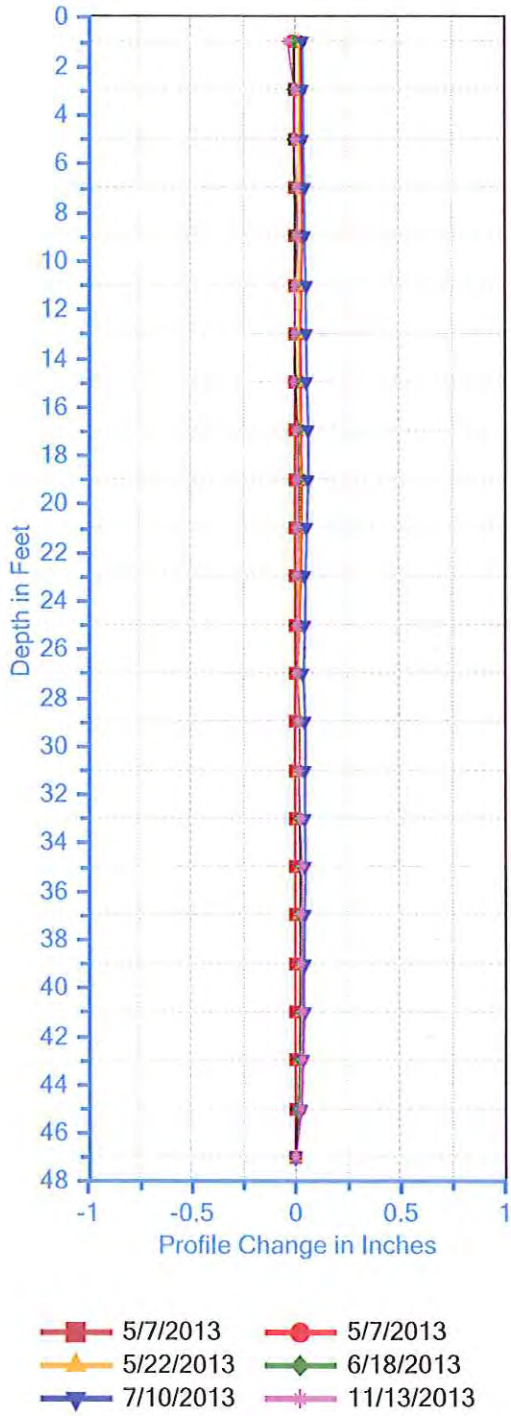
Depth of Inclinometer Casing: 49.33 ft
Ao Direction: 83 (Magnetic North)
Location: 01-MEN HWY 162 PM 22.67

Caltrans

Site3, R-13-002, A-Axis



Site3,R-13-002, B-Axis



INCLINOMTER RESULTS

01-MEN-HWY 162 PM 22.67
STORM DAMAGE SITE 3
EFIS No. 0112000136

Depth of Inclinometer Casing: 49.0 ft
Ao Direction: 81 (Magnetic North)
Location: 01-MEN HWY 162 PM 22.67

Caltrans

State of California
Department of Transportation

California State Transportation Agency

Memorandum

Serious Drought!
Help Save Water!

To: MR. STEVE BLAIR
Project Manager
Office of Design North Region
Design Branch E1

Attention: Andre Guimaraes
Project Engineer

Date: May 27, 2016

File: 01-MEN-162
PM 22.67
Dos Rios Slips
Tieback Soldier Pile Wall
EA 01-0B5401
ID 0112000136

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

Subject: Addendum supersedes "Wet Spec" language page 9 Section 9.3 of the GDR/FR dated January 22, 2014

As requested, we are providing this Addendum to the referenced GDR that in affect strikes the language "Wet Spec requirement" noted on Page 9 Section 9.3 of the GDR. The application of "Wet Spec." is not appropriate for soldier pile construction. For expected construction conditions at the site refer to Section 11 Construction Considerations in referenced GDR. In Summary, groundwater should be expected at the site during construction and dewatering most likely will be required. Although not stated in the GDR dewatering implies the requirement to use a tremie pipe to place concrete. Also, there is a potential for caving therefore it would be advisable to have temporary casing available. If there are any questions and/or comments feel free to call.

WILLIAM BERTUCCI
Associate Engineering Geologist
Office of Geotechnical Design North

BENJAMIN M. BARNES, PE
Transportation Engineer
Office of Geotechnical Design North

REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

c: Qiang Huang (Geotechnical Services, OGDN-E)
Sam Gentle (Right of Way)
Liza Walker (Environmental)
Sean Marquis (Environmental)