GEOTECHNICAL DESIGN REPORT

Western Placerville Interchange
Phase 2 Project
Placerville, California

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GEOCON PROJECT NO. S9420-05-04

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GEOCON
CONSULTANTS, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. S9420-05-04
November 28, 2016

VIA ELECTRONIC MAIL

Juann Ramos
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Folsom, California 95630

Subject: GEOTECHNICAL DESIGN REPORT
WESTERN PLACERVILLE INTERCHANGE PHASE 2 PROJECT
PLACERVILLE, CALIFORNIA

Dear Mr. Ramos:

In accordance with your authorization, we herein submit our Geotechnical Design Report (GDR) for the proposed Western Placerville Interchange Phase 2 Project in Placerville, California. This report evaluates the geotechnical conditions within the project area based on field exploration and laboratory test data and provides geotechnical recommendations for project design and construction.

Please contact the undersigned at your convenience if you have any questions regarding this report or if we may be of further service.

Sincerely,

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GEOTECHNICAL DESIGN REPORT

1.0 INTRODUCTION

This Geotechnical Design Report (GDR) presents the results of the geotechnical investigation for the proposed Western Placerville Interchange Phase 2 Project in Placerville, California. The approximate site location is depicted on the Vicinity Map, Figure 1.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend geotechnical design and construction criteria for the project as presently proposed. This report also establishes a geotechnical baseline to aid in assessing the existence and scope of potential changed site conditions encountered during construction. This report has been prepared for the Plan Specification and Estimate (PS&E) phase of the project. A draft *Geotechnical Design Report* (Draft GDR) for the project (Western Placerville Interchange Phase 2 Project) was prepared by Geocon Consultants, Inc., dated March 2016. This GDR supersedes the Draft GDR for the project and addresses Caltrans comments received October 2016.

Major components of the project include adding a new eastbound off-ramp from US Highway 50 (US 50) at the Ray Lawyer Drive Overcrossing and associated US 50 mainline auxiliary lane improvements, widening/realignment of Forni Road near the new off-ramp location, and the addition of a Park and Ride lot. These improvements are being made to better serve the needs of local and regional traffic, including providing alternative travel routes and improving safety for vehicle, bicycle, and pedestrian travel.

In the project area, Forni Road generally parallels the south side of US 50 (aligned northeast/southwest) with Ray Lawyer Drive forming a "T" intersection with Forni Road approximately 350 feet southeast of the eastbound US 50 mainline. Within the project limits, the local roads (roadways except US 50) have one travel lane in each direction. The proposed project includes widening Forni Road to allow for widened shoulders, additional turn lanes at intersections and sidewalk, curb, and gutter improvements. The roadway widening/realignment will require significant earthwork (cuts and fills of varying heights) and a new retaining wall. The new alignment of Forni Road will provide for a smooth transition between Forni Road (southwest of the intersection with Ray Lawyer Drive) and Ray Lawyer Drive. The new US 50 off-ramp will intersect Forni Road near the location of the current "T" intersection and require construction of a new auxiliary lane along the eastbound US 50 mainline prior to the new off-ramp. A new 4-way intersection will have Forni Road/Ray Lawyer Drive as the through street with the new US 50 off-ramp and East Forni Road (to the northeast) forming the cross streets. The realignment of Forni Road will also require minor changes to the existing intersections with East Forni Road, the El Dorado County Jail driveway, and the El Dorado Trail access point. The new Park and Ride lot will require significant fill placement in

order to obtain desired finish grade elevations and will be accessed by a new driveway off Forni Road. The proposed improvements are depicted on the Site Plan, Figure 2.

2.0 EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

2.1 Existing Facilities

The proposed project affects about 2,400 feet of existing Forni Road and Ray Lawyer Drive in Placerville, California. Forni Road and Ray Lawyer Drive are two-lane local roadways with paved and unpaved shoulders of various widths. Traffic control at the existing intersection of Forni Road with Ray Lawyer Drive is via stop signs in all directions. Traffic is controlled at the El Dorado County Jail driveway via a stop sign at the end of the driveway.

US 50 in the project area consists of two travel lanes in each direction with paved shoulders and center median and a concrete divider between the eastbound and westbound lanes. There is currently only one connecting ramp with US 50 from Ray Lawyer Drive (westbound US 50 on-ramp). This project will affect approximately 1,500 feet of the eastbound US 50 shoulder area.

The proposed eastbound US 50 off-ramp will require demolition of and filling in a temporary detention basin. This will require removal of the concrete basin lining around the southeast corner of the basin. There is an existing stockpile of soil at the southwest corner of the Ray Lawyer Drive Overcrossing of US 50. This material is from construction of the US 50 onramp on the north side of the freeway and it is anticipated to be used as fill for the Phase 2 project.

2.2 Proposed Improvements

The improvements discussed herein are based on preliminary project plans provided by Dokken Engineering. According to Dokken, all elevations shown on project plans (and referenced herein) are per the National Geodetic Vertical Datum of 1929 (NGVD 29). The following improvements are proposed:

- A new auxiliary lane along the eastbound US 50 mainline from station (Sta.) 542+25.22 to Sta. 557+19.91 (“ED-50”-Line). The auxiliary lane will require minor fills for roadway widening.
- A new westbound US 50 off-ramp for Ray Lawyer Drive / Forni Road from Sta. 554+50.00. to Sta. 567+59.38 (“RL-2”-Line) that intersects Forni Road at Sta. 39+03.68 (“F”-Line). The new ramp will require embankment fills up to approximately 18 feet in height along the proposed ramp (approximate Sta. 561+00). No retaining walls are proposed along the off-ramp.
- Realign and widen Forni Road throughout the project limits. Project improvements begin at Sta. 22+48.49 (“F”-Line) on the southwest end of the project and end at Sta. 42+27.60 on the northeast end of the project (“RL”-Line). Forni Road (“F”-Line) will changes name to Ray Lawyer Drive (“RL”-Line) at Sta. 39+23.38 after the improvements are completed. New cut

and fill slopes as well as construction of a new retaining wall will be necessary to accommodate the roadway widening. A maximum cut height of approximately 20 feet is indicated near Sta. 26+00 (shoulder area). A maximum fill height of approximately 19 feet is indicated near Sta. 28+50.

- Construction of a new retaining wall along Forni Road. The proposed retaining wall will be a Caltrans Type 5 cantilever wall approximately 412 feet in length and up to 8 feet high. The wall will be subject to Load Case 1 loading conditions (level backfill). Wall begin and end stations are Sta. 23+32.00 and Sta. 27+37.48, respectively ("F"-Line). The bottom of spread footing is stepped and varies from elevation 1,821.7 (west) to elevation 1,841.3 feet (east) along the wall alignment. The proposed wall footings are 1.5 feet thick.
- Construction of a new Park and Ride lot between realigned Forni Road and the new US 50 off-ramp. Construction of the lot will require placement of engineered fill of up to about 20 feet thick. The proposed Park and Ride lot driveway will be located near Sta. 29+50 along Forni Road ("F"-Line).
- Construction of a new detention basin to replace the existing temporary basin (to be filled in during off-ramp construction).
- Local road widening and intersection improvements at:
    - East Forni Road ("F-1"-Line),
    - El Dorado County Jail driveway ("CJ"-Line), and
    - El Dorado Trail access point.
- Construction of new hot mix asphalt (HMA) pavement along the existing roadways. Traffic indices for the project have been provided by Dokken Engineering and are as follows:

TABLE 2.2
DESIGN TRAFFIC INDICES

Portion of Project	Traffic Index
US 50 Auxiliary Lane (Mainline)	12, 14, and 16
US 50 Off-Ramp	8, 10, and 12
Forni Road / Ray Lawyer Drive	6, 8, and 10
Park and Ride	5, 6, and 7

- Construction of concrete gutters, curbs and sidewalks along Forni Road along the realigned section.

Configuration of proposed improvements is shown on the Site Plan, Figure 2.

3.0 PROJECT PLANS

We reviewed the following plans related to the project: *Contour Grading (Sheets G-1, G-2, and G-3), Layout (Sheets L-1, L-2, and L-3), and Survey Control (Sheet SC-1),* labeled "65% Plans Not For Construction" prepared by Dokken Engineering, dated April 1, 2016, as well as supplemental topographic and proposed improvement information provided electronically between March 3 and 11, 2016.

4.0 PHYSICAL SETTING

4.1 Climate

Table 4.1 presents monthly climate data near the project site. These data were obtained from information published by the Western Regional Climate Center (www.wrcc.dri.edu). The monthly data were recorded from 1900 to 2011, and the recording station used was located at Latitude 38.44°N; Longitude 120.48°W; elevation 1,890 feet (Placerville Station, #046960-2, California).

TABLE 4.1
MONTHLY CLIMATE SUMMARY

Climate Data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Total Precipitation (inches)	6.92	6.65	5.76	3.19	1.51	0.44	0.07	0.09	0.54	2.13	4.40	6.47	38.16
Avg. High (°F)	53.4	56.9	60.5	66.3	74.8	83.9	92.7	91.4	85.7	74.8	61.3	53.8	71.3
Avg. Low (°F)	32.6	35.0	37.6	40.5	46.3	51.9	57.2	56.2	52.1	45.0	37.4	33.1	43.8

Based on the information obtained, the average precipitation for a calendar year is 38.16 inches. The majority of this precipitation (approximately 88 percent) falls between November and April. The warmest month is July with an average high of 92.7°F and average low of 57.2°F. The coolest month is January with an average high of 53.4°F and an average low of 32.6°F. Contractors should be aware of compaction and workability difficulties that can occur during earthwork in wetter months or periods of precipitation. In addition, grading operations conducted during warmer months may require significant addition of water to properly moisture-condition fill materials.

4.2 Topography and Drainage

The project is located in mountainous terrain with diverse topography. Based on the topographic information provided by Dokken, the highest elevation within the project limits is approximately 1,905 feet at the top of the soil stockpile south of the Ray Lawyer Drive overcrossing of US 50. The lowest elevation is approximately 1,786 feet along the shoulder of US 50 at the southwestern extent of the proposed auxiliary lane improvements. The surface elevations of Forni Road range from approximately 1,820 feet at the southwest end of the project to approximately 1,888 feet near the northeast end of the project. Existing elevations along the proposed off-ramp alignment vary from about 1,823 feet near Sta. 558+00 (“RL-2”-Line) to 1,888 feet at the proposed intersection with realigned Forni Road. The topography along the project alignment includes numerous manmade and natural slopes of various inclinations. The manmade slopes are typically cut and fill slopes associated with past grading of Forni Road, US 50, and adjacent areas. Documentation relative to past site grading or characteristics of the soil stockpile was not available for our review.

Thickness of existing embankment fills likely range from a few feet up to approximately 8 to 10 feet and at general inclinations of 2:1 horizontal to vertical. The tallest existing cut slopes along Forni Road appear to be near Sta. 25+50 near the southwest end of the project. The cut slopes appear to be about 15 feet tall and are at general inclinations up to approximately 1:1.

Site drainage generally occurs via sheet flow with runoff directed to intermittent natural and man-made drainages along Forni Road. Drainage across much of the northern portion of the project site flows into a detention basin between US 50 and Forni Road (at approximate Sta. 560+00 of the proposed US 50 off-ramp, "RL-2"-Line) and then continues southwest in a drainage ditch between US 50 and Forni Road. Site topography is depicted on the Site Plan, Figure 2.

4.3 Man-Made and Natural Features of Engineering and Construction Significance

Earthwork in the project area will accommodate the proposed roadway realignment/widening, new off-ramp, Park and Ride facility, and associated improvements. The man-made features that will be impacted by the project include the existing roadways, embankments, driveways to businesses and residences, drainage basin and culverts, and overhead and underground utilities. We understand that the soil stockpile is to be used as borrow material for engineered fill placement on this project. Given that the project area has already been altered by the existing roadways/improvements, the potential for impact on natural features by the project is considered low. Most of the proposed improvements will be in areas that have been previously graded or altered (existing roadways, cut and fill slopes/graded areas, drainage basin, and soil stockpile).

4.4 Regional Geology and Seismicity

Site geologic information was obtained from the *Geologic Map of the Sacramento Quadrangle,* (CGS, 1981). The site is located within the western foothills area of the Sierra Nevada Geomorphic Province, or what is more commonly referred to as the Mother Lode Region. The western foothills area is bounded by the Sierra Nevada to the east and the Central Valley to the west.

The site is generally underlain by Jurassic metamorphic rocks of the Logtown Ridge Formation (map symbol Jlr) and Mariposa Formation (map symbol Jm) (CGS, 1981). A portion of the geologic map covering the site vicinity is presented as Figure 3. Published mapping of the site geology is consistent with the conditions encountered in our explorations; the site is generally underlain by completely to highly weathered metamorphic bedrock within the depths explored for this investigaiton. Previous borings by Geocon (2012) in the detention basin area encountered decomposed to fresh bedrock conditions.

The site is not located within an Alquist-Priolo Earthquake Fault Zone as established by the State Geologist around known active faults. Review of available literature and field reconnaissance revealed no indication of an active fault trace through or near the site.

Regional seismicity was analyzed based on Caltrans' *2012 "Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations"*. This procedure is based on current Caltrans *Seismic Design Criteria (Appendix B), Deterministic PGA Map, ARS Online Report, Geotechnical Manual,* and USGS probabilistic seismic hazard analysis and tools. Based on Caltrans' web-based *ARS Online* application (V2.3.06, accessed March 3, 2016) and associated reports, key information for the controlling faults is summarized in Table 4.4 below.

TABLE 4.4
FAULT INFORMATION

Fault Name	Foothills Fault System-North Central Reach Section (DeWitt Fault)	Carson Range (Genoa)	West Tahoe
Fault ID#	423	83	77
M_{Max}	6.3	7.2	7.0
Fault Type	N	N	N
Fault Dip	50°	50°	50°
Dip Direction	West	E	East
Bottom of Rupture	10 km	15.0 km	13 km
Top of Rupture	0 km	0 km	0 km
Distance to Fault (R_{RUP})	30.84 km	87.32 km	68.87 km
$Z_{1.0}$	n/a	n/a	n/a
$Z_{2.5}$	n/a	n/a	n/a

4.5 Soil Survey Mapping

We reviewed soil survey mapping from the United States Department of Agriculture (USDA). The online soil data are provided by the USDA National Resources Conservation Service (NRCS) at their website (http://websoilsurvey.nrcs.usda.gov) as accessed on March 4, 2016.

Based on the information obtained from USDA mapping, soils within the project area include (followed by the map unit symbol):

- Boomer gravelly loam with 3 to 15 percent slopes (BhC),
- Boomer gravelly loam with 15 to 30 percent slopes (BhD), and
- Boomer very rocky loam with 30 to 50 percent slopes (BkE).

Soil erosion is typically associated with high-intensity precipitation, steep slopes, and degree of weathering of surficial exposed rock. Based on the site topographic features, climate data, and the surficial materials encountered during our investigation, the proposed project may be impacted by soil erosion. To reduce impacts related to erosion, surface drainage flow should be appropriately collected

and drained by appropriate drainage systems. All slope areas should be appropriately protected by appropriate erosion control measures.

5.0 FIELD EXPLORATION

5.1 Previous Investigation (Geocon, 2012)

Previous field investigation at the project site by Geocon consists of two borings (A-12-001 and A-12-002) and two test pits (O-12-003 and O-12-004) performed in the existing detention basin location on August 15, 2012. The borings were drilled using a track-mounted Speedstar 25 drill rig equipped with 4-inch-diameter solid-stem augers. Borings were advanced to depths of approximately 10 and 20 feet. Test pits were excavated by a backhoe to depths of approximately 7½ and 10 feet. The locations of these explorations are shown on the Site Plan, Figure 2. Copies of the exploration logs are included in Appendix A (Figures A9 through A12).

5.2 Current Field Investigation (2016)

The field investigation for this Geotechnical Design Report was performed between February 17 and March 5, 2016, and consisted of a site reconnaissance, drilling 7 borings (including 2 hand-auger borings), and obtaining a bulk sample of soil from the stockpile for laboratory testing. The explorations were located based on preliminary project plans and information from Dokken Engineering. Table 5.2 summarizes the exploration locations, approximate surface elevations, and depths.

TABLE 5.2
SUMMARY OF EXPLORATIONS

Exploration No.	Approximate Exploration Location				Exploration Depth (feet)
	Station No.	Line	Offset (feet)	Elevation (feet)	
A-16-001	24+28	“F”-Line	18 Left	1834	25.2
A-16-002	26+11	“F”-Line	15 Left	1844	25.2
A-16-003	564+53	“RL-2”-Line	70 Right	1849	11.4
A-16-004	38+57	“F”-Line	51 Left	1880	11.5
A-16-005	12+45	“F-1”-Line	26 Right	1900	10.2
HA-16-006	563+07	“RL-2”-Line	77 Right	1839	2.0
HA-16-007	561+29	“RL-2”-Line	130 Right	1838	2.5
O-16-008	40+40	“F”-Line	104 Left	1894	1.5

5.3 Drilling and Sampling

Borings A-16-001 through A-16-005 were drilled using a truck-mounted Mobile B-57 drill rig equipped with 8-inch-diameter hollow-stem augers. Borings were advanced to depths ranging from approximately 10 to 25 feet. Borings HA-16-006 and HA-16-007 were advanced using a hand-auger. Surficial bulk soil sample O-16-008 was obtained using a shovel in the side of the soil stockpile present at the project site.

Sampling during drilling was performed in general accordance with the current Caltrans' *Soil and Rock Logging, Classification and Presentation Manual* (2010). Soil samples were typically collected at approximately 2.5- to 5-foot intervals. Relatively undisturbed soil samples were obtained by driving an approximately 3-inch outside-diameter (OD) split-spoon sampler (Modified California Sampler) and an approximately 2.5-inch OD split-spoon sampler (Standard California Sampler) into the "undisturbed" soil mass with blows from a 140-pound hammer falling 30 inches. The samplers were equipped with 6-inch-long brass sample tubes to facilitate sample removal and laboratory testing. Standard Penetration Tests (SPTs) were performed by driving a 2-inch OD split-spoon sampler 18 inches in general accordance with American Society for Testing and Materials (ASTM) D-1586. The number of blows required to drive the samplers (blow counts) the last 12 inches of the 18-inch sample drive (or portion thereof) are reported on the logs of borings and Logs of Test Boring (LOTB) sheets included in Appendices A and C, respectively. Bulk samples of soil cuttings were also collected during the field exploration.

The exploratory borings were sampled and logged by a registered civil engineer during drilling operations. The soils encountered in the exploratory borings were classified in accordance with the Caltrans' *Soil and Rock Logging, Classification, and Presentation Manual* (2010). Upon completion of the field exploration program, the exploratory borings were backfilled with cement grout. Borings in paved areas were capped with quick set concrete.

Samples were placed in sealed containers and transported to our laboratory for testing and further classification. Boring logs are included in Appendix A. The LOTB sheets in Caltrans format are presented in Appendix C.

5.4 Site Geologic Mapping

Regional geology is discussed in Section 4.4. Site geology encountered during our field investigation generally includes previously placed fill, residual soil, and intensely to completely weathered (decomposed) metamorphic rock. Fill and weathered metamorphic rock are present at or near the existing ground surface along the Forni Road alignment. Fills of variable thickness exist along Forni Road and Ray Lawyer Drive. Residual soil was noted to approximate 4.5-foot depth in Boring B3 near the proposed US 50 off-ramp and Park and Ride facility.

5.5 Geophysical Studies

The exploration program did not include geophysical studies.

5.6 Instrumentation

The exploration program did not include the installation of geotechnical instrumentation.

5.7 Exploration Notes

Borings A-16-001 and A-16-002 were advanced for the purpose of evaluating subsurface conditions for the proposed retaining wall, improvements to the south end of Forni Road, and the new auxiliary lane for US 50. Borings A-16-003 through A-16-005 were advanced for the purpose of evaluating subgrade conditions for the purpose of embankment/pavement design. Hand-auger borings HA-16-006 and HA-16-007 were advanced within the proposed Park and Ride facility location to evaluate earthwork preparation stripping depths. Sample O-16-008 was taken to evaluate the stockpiled material for use as engineered fill. Borings A-12-001 and A-12-002 and test pits O-12-003 and O-12-004 were used to evaluate the subsurface conditions for the proposed US 50 off-ramp.

6.0 GEOTECHNICAL TESTING

6.1 In-situ Testing

Relatively undisturbed soil samples were obtained by driving an approximately 3-inch OD split-spoon sampler (Modified California Sampler) and an approximately 2.5-inch OD split-spoon sampler (Standard California Sampler) into the "undisturbed" soil mass with blows from a 140-pound hammer falling 30 inches. The samplers were equipped with 6-inch-long brass sample tubes to facilitate sample removal and laboratory testing. Standard Penetration Tests (SPTs) were performed by driving a 2-inch OD split-spoon sampler 18 inches in general accordance with American Society for Testing and Materials (ASTM) D-1586. The number of blows required to drive the samplers (blow counts) the last 12 inches of the 18-inch sample drive (or portion thereof) are reported on the logs of borings and Logs of Test Boring (LOTB) sheets included in Appendices A and C, respectively.

6.2 Laboratory Testing

Laboratory tests were performed in accordance with California Test Methods (CTM) or generally accepted test methods of the ASTM. The types of the tests performed are listed below:

- In-Place Dry Density and Moisture Content: ASTM D2937
- Grain Size Distribution: ASTM D422
- Atterberg Limits: ASTM D4318
- pH and Resistivity: CTM 643

- Sulfate Content: CTM 417
- Chloride Content: CTM 422
- Moisture-Density Relationship: ASTM D1557C
- R-Value: CTM 301

Test results and related information are provided in Appendix B. The results of dry density and moisture content testing are presented on the boring logs (Appendix A) and LOTB sheets (Appendix C).

7.0 GEOTECHNICAL CONDITIONS

7.1 Site Geology

Site geologic mapping and soil conditions are discussed in Sections 5.4 and 7.2, respectively. The foundation for the proposed retaining wall will extend into weathered metamorphic rock.

7.1.1 Lithology

Detailed descriptions of subsurface conditions are presented in Section 7.2 of this report.

7.1.2 Structure

Detailed descriptions of subsurface conditions are presented in Section 7.2 of this report.

7.1.3 Natural Slope Stability

Natural slopes steeper than 2:1 (horizontal:vertical) were not observed within the project limits. Cut slopes with inclinations of approximately 1:1 or flatter exist at various locations, with the most significant cuts being on the east side of Forni Road. The existing embankments are composed of fill presumably placed during the original construction for Forni Road and Ray Lawyer Drive. No obvious signs of slope instability were noted in the cut or fill slopes; the slopes generally appear to be in good condition.

7.2 Soil and Groundwater Conditions

7.2.1 Soil Conditions

The soil and groundwater conditions encountered are described in detail below and on the exploration logs and LOTB sheets presented in Appendices A and C, respectively.

7.2.1.1 Fill

Approximately 3 feet of existing fill was noted in A-12-001 and O-12-003. This fill consisted of hard clayey silt with varied sand and gravel content likely derived from native residual soil. No significant amounts of existing fill were encountered in our current borings for this investigation. Existing fill observed at the project site appears to be performing well and is generally considered suitable for support of grading/pavement improvements (minor cuts/fills, pavement, concrete flatwork, etc.) provided near-surface soils are processed and replaced as engineered fill. However, any existing fill encountered below proposed retaining wall footings (not anticipated) will require removal and recompaction. Specific recommendations are provided herein.

A large stockpile of material excavated for the westbound US 50 on-ramp construction north of the freeway is present south of the Ray Lawyer Drive Overcrossing of US 50. The stockpile is up to 40 feet high and is approximately 200 feet long across the top. The soil sample taken from this stockpile consisted of clayey gravel with sand. We understand this material is to be used as engineered embankment fill for construction of the proposed US 50 off-ramp and new Park and Ride facility. No documentation of fill placement at the stockpile location has been provided for review and the composition of the stockpile may vary significantly from the sample tested, including the possible presence of significantly oversized materials or debris.

For excavation purposes, existing fill soils are considered a Cal/OSHA Type C soil. All excavations and trenches should be properly maintained and/or shored in accordance with applicable Cal/OSHA rules and regulations for the safety of construction personnel and stability of the excavation slope and any adjacent existing improvements.

7.2.1.2 Residual Soil

Residual soil was encountered in Boring A-16-003, hand auger Borings HA-16-006 and HA-16-007, and in Boring A-12-002 and Test Pit O-12-004. The residual soil encountered generally consisted of soft to very stiff clay. Residual soil is defined as decomposed (completely weathered) bedrock materials. Undisturbed residual soil is genrally considered suitable for support of additional fill or structural/pavement improvements after near-surface soils are processed and recompacted as engineered fill.

For excavation purposes, existing soft residual soils are considered a Cal/OSHA Type C soil. Medium stiff to very stiff clay soils (unless submerged or subject to seepage) are considered a Cal/OSHA Type B soil.

7.2.1.3 Metamorphic Rock

Below the paved surface in Borings A-16-001, A-16-002, A-16-004, and A-16-005 and below the residual soil in Boring A-16-003, metamorphic rock of the Logtown Ridge Formation was encountered to the maximum depths explored. The Logtown Ridge Formation material encountered in our investigation generally consisted of intensely to completely weathered, weak metavolcanic rock. These materials are suitable for foundation support for the proposed retaining walls and may exhibit locally difficult excavation characteristics using conventional heavy-duty grading equipment. Anticipated excavation characteristics are discussed in section 8.2.2.

Below the fill and residual soil encountered in our explorations in 2012, metamorphic rock of the Mariposa Formation was encountered to the maximum depths explored. The Mariposa Formation material encountered in our investigation generally consisted of highly weathered to fresh/unweathered argillite. The degree of weathering and fracturing decreased somewhat with depth. Anticipated excavation characteristics are discussed in section 8.2.2.

Intact/undisturbed weathered rock is considered suitable for direct support of the proposed retaining wall or embankment fill without additional processing.

For excavation purposes, existing decomposed/weathered rock materials (unless submerged or subject to seepage) are considered a Cal/OSHA Type B soil.

7.2.2 Groundwater Conditions

Groundwater was not encountered in the test borings performed for this project. Groundwater was encountered in Test Pit O-12-004 at a depth of 7 feet and in Boring A-12-002 at a depth of 13 feet. Based on our experience in the area, we expect perched groundwater/seepage may develop at variable depths generally near the contacts between surficial soils and formational materials (bedrock), especially during winter and spring. Seepage can also occur within formational material based on the degree of weathering, fracturing, and bedding. Fluctuations of groundwater levels may occur due to variations in precipitation, temperature, and other factors. Depth to groundwater can also vary significantly due to localized pumping, irrigation practices, and seasonal fluctuations. Therefore, it is possible that future groundwater may be higher or lower than the levels observed during our investigation.

7.3 Water

7.3.1 Surface Water

The site is not located in the immediate vicinity of any large bodies of water. There are no creeks or streams located within the project limits. Drainage features direct ephemeral flows to the existing

detention basin. Project grading plans show the existing detention basin will be relocated to the northeast (immediately adjacent to the existing stockpile location) and the site regraded to direct surface water to the new basin location. As such, surface water is not expected to significantly affect the proposed improvements.

7.3.1.1 Scour

No active year-round watercourses exist within the project limits; therefore, scour is not expected to affect the proposed improvements.

7.3.1.2 Erosion

Soil erosion is typically associated with high-intensity precipitation, steep slopes, and nature of surficial soil or type and degree of weathering of exposed rock. Based on the site topographic features, climate data, and the surficial materials encountered during our investigation, the proposed project may be impacted by soil erosion. To reduce impacts related to erosion, surface drainage flow should be appropriately collected and drained by appropriate drainage systems. All slope areas should be appropriately protected by appropriate erosion control measures.

We recommend using surface treatments to minimize surficial erosion until adequate erosion-resistant vegetation can become established. All roadway drainage should be directed to appropriate collection and discharge facilities to prevent run-off from flowing over the tops of slopes.

7.3.2 Regional Groundwater

Groundwater was not encountered in our current explorations for this project. Groundwater was encountered in Test Pit O-12-004 at a depth of 7 feet and in Boring A-12-002 at a depth of 13 feet. Groundwater elevation information available through the California State Water Resources Control Board GeoTracker website (http://geotracker.waterboards.ca.gov) indicates the following groundwater depths measured in monitoring wells at two nearby sites:

TABLE 7.3
SUMMARY OFREGIONAL GROUNDWATER DEPTHS

Location	Well Numbers	Dates	Depths to Groundwater Range, feet
701 Forni Road	MW-1 through MW-3	2007 to 2008	2.5 to 12.1
150 Placerville Drive	MW-1 through MW-11	2011	7.2 to 18.4

It should be noted that fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors. Depth to groundwater can also vary significantly due to localized

pumping, irrigation practices, and seasonal fluctuations. Therefore, it is possible that groundwater may be higher or lower than the levels observed during our investigation.

7.4 Project Site Seismicity

Seismic design of project structures should be developed in accordance with Caltrans' *2012 "Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations"*. This procedure is based on current Caltrans *Seismic Design Criteria (Appendix B), Deterministic PGA Map, ARS Online Report, Geotechnical Services Design Manual,* and USGS probabilistic seismic hazard analysis and tools. The recommended design response spectrum for structures is discussed in Section 8.1.1.

7.4.1 Ground Motions

Regional faults that may cause ground motions at the site are listed in Section 4.4. It is our opinion that the site could be subject to ground shaking in the event of an earthquake along faults in Northern California. However, we do not consider the site to possess any greater risk than that of the surrounding developments. The maximum earthquake event along the controlling faults may generate a horizontal peak ground acceleration (PGAs) of approximately 0.22g at the project site, where "g" represents the acceleration due to gravity.

7.4.2 Ground Rupture

There are no known or suspected faults that cross the project alignment or near vicinity; therefore, ground rupture due to active faulting is not considered a hazard to the project.

8.0 GEOTECHNICAL ANALYSES AND DESIGN

Geotechnical analyses were performed to evaluate site seismicity, parameters for retaining wall design, and pavement support characteristics. These analyses were performed based on the results of in-situ and laboratory testing as well as our experience with similar soils. These results are incorporated within the recommendations in this report.

8.1 Dynamic Analysis

8.1.1 Parameter Selection

Site seismicity for structures was analyzed based on Caltrans *2012 "Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations"*. Both the deterministic and probabilistic response spectrums for the site were estimated using Caltrans' *Deterministic Response Spectrum Spreadsheet, Probabilistic Response Spectrum Spreadsheet* (after USGS), *USGS 2008 Interactive Deaggregations,* and the *Caltrans ARS Online* web tools. The design response spectrum for

structure is the upper envelope of the spectral values of deterministic response spectrum and the probabilistic response spectrum. Based on our analysis, California minimum and USGS results control the design response spectrum for the project. The recommended design response spectrum is presented as Figure 4 (Recommended Design Response Spectrum).

8.1.2 Analysis

Liquefaction is a phenomenon in which loose, saturated and relatively cohesionless soil deposits located beneath the groundwater table lose strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground accelerations, characteristics of the subsurface soil, in-situ stress conditions, and depth to groundwater. Based on the subsurface conditions and anticipated seismic conditions, the potential for liquefaction at the site is considered low.

The existing slopes and proposed slopes, constructed in accordance with the recommendations of this report, should have an adequate factor of safety against deep-seated and shallow failures under static loading and pseudo-static (seismic) loading.

8.2 Cuts and Excavations

Based on the preliminary project cross sections provided by Dokken, a maximum cut on the order of up to about 20 feet deep will be required at a roadway shoulder area to widen/realign existing Forni Road. Cuts of about 5 foot depth or less will be required at/near the location of the proposed 4-way intersection and other locations in order to meet proposed grades. Where necessary, these cuts will be laid back at maximum 2H:1V slopes during excavation. There are no retaining walls proposed in cut areas.

8.2.1 Stability

Permanent cut slopes should be constructed no steeper than 2H:1V. Temporary construction slopes may be constructed at a maximum gradient of 1.5H:1V. The stability of cut slopes is generally governed by the composition and competency of the excavated soils/weathered rock materials. We recommend that all cut slopes be observed by our engineering geologist during grading to determine if adversely oriented bedding planes or other features that may impact stability exist. Mitigation recommendations can be provided, if necessary. To mitigate potential erosion, slopes should be vegetated as soon as possible and surface drainage should be directed away from the tops of slopes. Placing V-ditches across tops of slopes will aid in reducing the potential for surficial erosion.

Provided slopes are constructed at a maximum gradient of 2H:1V and do not include irregular geometry, they should perform satisfactorily under anticipated long-term and seismic conditions. This conclusion is based on our experience with similar soil and rock types and slope configurations. If steeper slopes are planned, we should be consulted for additional recommendations and potential stability analyses, if necessary.

The existing weathered bedrock (generally excavates as clayey sand with gravel) and existing stockpiled fill materials (clayey gravel with sand) are considered Cal/OSHA Type C soils. Temporary excavations must conform to Cal/OSHA requirements.

It is the Contractor's responsibility to provide sufficient and safe support for excavation, as well as nearby utilities, structures and other improvements that could be damaged by earth movements. Temporary excavations should be in compliance with applicable governing agency regulations. The Contractor should also execute a monitoring program for structures in proximity to deep excavations so that appropriate modifications to the excavation/shoring system can be implemented to minimize the surface deflection or structure damage in a timely manner, if warranted. The Contractor should also provide a temporary dewatering system if excavations extend below the groundwater elevation or where seepage is encountered.

8.2.2 Rippability/Excavatability

Based on the subsurface conditions encountered in our investigation, anticipated excavation characteristics are summarized in Table 8.2.2.

TABLE 8.2.2
ANTICIPATED EXCAVATION CHARACTERISTICS

Geologic Unit	Anticipated Excavation Characteristics
Fill / Residual Soil	These soils generally consist of variable consistency clayey gravel with sand and clays with variable amounts of sand and gravel. We anticipate standard excavation effort with conventional, heavy-duty grading equipment. We anticipate excavations will generate material predominantly 6 inches and smaller. Stockpiled soil materials may contain oversize rock fragments or debris. We would expect that oversized decomposed to intensely weathered bedrock materials encountered in existing fills could be broken down to 6-inch minus material.
Weathered Metamorphic Bedrock	Bedrock within exploration depths across much of the site consists of weathered metamorphic rock, excavating as very dense clayey sand with gravel. We anticipate standard excavation effort with conventional, heavy-duty grading equipment. We anticipate excavations will generate material predominantly 6 inches and smaller. Bedrock within exploration depths at the existing detention basin location consists of decomposed to fresh metamorphic rock, excavating as clayey silt with sand and gravel. We anticipate that excavation of bedrock below elevation 1,828 feet in the vicinity of the Boring A-12-002 and Test Pit O-12-004 may potentially require a greater level of effort and/or larger excavating/grading equipment. Similar conditions may be encountered at other locations in the project site. We anticipate excavations will generate material predominantly 6 inches and smaller. Larger particle sizes may be encountered in more resistant rock excavations. We would expect that oversized materials encountered in decomposed to intensely weathered bedrock could be broken down to 6-inch minus material.

8.2.3 Grading Factors

Excavated soil and weathered rock may be re-used as engineered fill provided it meets the project specifications. Based on laboratory test results and our engineering judgment and experience, we anticipate that existing residual soil and completely weathered (decomposed) rock will experience approximately 5% volume shrinkage to 5% volume bulking when re-compacted as engineered fill.

Stockpiled soil materials may be re-used as engineered fill provided it meets the project specifications and/or Section 8.3.1 of this report. Based on laboratory test results and our engineering judgment and experience, we anticipate that the stockpiled soil materials will experience approximately 10 to 20% volume shrinkage when re-compacted as engineered fill.

The volume shrinkage/bulking estimates presented above are estimates only. Actual volume changes can vary from our estimates due to variations in soil density, moisture content, and the degree of compaction achieved during grading.

8.3 Embankments

New embankment fills are proposed along the realigned Forni Road and new US 50 off-ramp locations. Maximum heights of engineered fill of approximately 18 to 20 feet are proposed along these alignments. New embankment fill should be benched into existing embankment material in accordance with Caltrans' *Standard Specifications*.

8.3.1 Materials for Fill

Excavated soil and rock generated from cut operations at the site and the existing stockpiled material from previous US 50 on-ramp construction activities are suitable for use as general fill in structural areas provided they are examined and selectively placed during grading in accordance with the following recommendations:

- Deleterious material, material with greater than 3% organics, and debris should be exported from the site and not incorporated into structural fill. We anticipate limited quantities of these materials (primarily organics).
- Soil, rock, cobble, and boulders may be selectively incorporated into structural fill provided this material is less than 2 feet in maximum dimension. Rock or cementations greater than 2 feet in maximum dimension should not be used.
- Rock or cementations larger than 6 inches but less than 2 feet in maximum dimension may be incorporated into structural fill, but shall be limited to areas outside of planned underground utility excavations, and at least 5 feet from slope faces. Nesting of rock should be avoided.
- Fill material in areas with underground utilities, proposed foundations, and areas within 5 feet of slope faces should consist of 6-inch-minus material.

Backfill placed behind retaining walls should consist of "structure backfill" meeting Section 19-3.02C of Caltrans' *Standard Specifications*. In addition to the criteria shown in Section 19.3.02C, structure backfill should have a "very low" to "low" expansion potential (Expansion Index of 50 or less).

Import fill material should be primarily granular with a "very low" to "low" expansion potential (Expansion Index less than 50), a Plasticity Index less than 15, a minimum R-value of 40, be free of organic material and construction debris, and not contain rock larger than 6 inches in greatest dimension.

Environmental characteristics and corrosion potential of import soil materials should also be considered. Proposed import materials should be sampled, tested, and approved by Geocon prior to transportation to the site.

8.3.2 Fill Area Preparation and Fill Placement

Areas to be developed should be cleared and stripped of obstructions, trees, bushes, grass, roots, and the upper few inches of soil containing organic debris. Soils/organics removed by stripping can be transported offsite or stockpiled for use in landscaping. Existing drainage and utility lines or other existing subsurface structures that are not to be utilized, if any, should be removed, destroyed or abandoned in compliance with applicable regulations.

In general, all loose, soft, or wet surficial soil in the areas planned to receive new improvements or fill materials should be removed to expose competent materials. We estimate removal depths will range from about ½ to 3 feet. The actual removal depth is dependent upon the depth to competent materials and depth/extent of tree root systems or any other other deleterious materials.

Relative compaction for new fill should conform per Caltrans' *Standard Specifications*, Sections 19-3, 19-5, and 19-6. New embankment fill placed on sloping ground and adjacent to existing embankments/slopes should be keyed and benched in accordance with Caltrans' *Standard Specifications*.

All earthwork, grading, and engineered fill placement should be performed in conformance with Sections 6-3, 19-3, 19-5, and 19-6 of Caltrans' *Standard Specifications*. Ponding or jetting of backfill should not be permitted.

8.3.3 Embankment Stability

Proposed embankment fills will be constructed with slope inclinations of 2H:1V or flatter. Embankments constructed in accordance with Caltrans requirements should possess adequate factor of safety against slope instability.

8.3.4 Fill Settlement

Due to the dense nature of the materials underlying proposed embankment fills, a settlement period is not considered necessary assuming the new fill is properly placed and compacted.

8.4 Caltrans Standard Type 5 Retaining Wall

A retaining wall is proposed along Forni Road as described in Section 2.2. The wall will be used for a fill application for the proposed roadway widening/realignment. The proposed retaining wall details are listed below.

- Caltrans Standard Plans, Retaining Wall Type 5 (Case 1), Plan No. B3-4A
- Load Case 1 (level backfill)
- Fill application
- Wall is up to 8 feet high
- Approximate wall begin and end stations of Sta. 23+25 and Sta. 27+37 ("F" Line) [Sta. 10+00 and Sta. 14+12 ("RW1" Line)]
- Bottom of stepped footing elevation will be between 1,821.7 and 1,841.3 feet.

Based on the subsurface conditions encountered in our investigation and the currently proposed location and dimensions of this wall, we anticipate that the wall foundations will be located within weathered metamorphic rock. Localized removals of disturbed or loose materials may be necessary to provide more uniform foundation support.

Retaining wall loads provided by Dokken are the design loading conditions provided in Caltrans 2015 Standard Plan B3-4A, *Retaining Wall Type 5 (Case 1).*

The geotechnical analysis results, wall configuration, and factored load demands are presented in Tables 8.4a through 8.4c. Table 8.4d is the summary *Spread Footing Data Table*.

TABLE 8.4A
STRENGTH LIMIT STATE FOUNDATION DATA TABLE

Earth Retaining System (ERS) Stationing (ft)	Design Height (ft)	Bottom of Footing Elevation (ft)	Footing Width (ft)	Minimum Footing Embedment Depth (ft)	Effective Footing Width for Strength Limit State (ft)	Strength Limit State Gross Uniform Bearing Stress $q_{g,u}$ (ksf)	Strength Limit State Factored Bearing Resistance (ksf) $q_R = \varphi_b * q_n$ $\varphi_b = 0.45$
10+00 to 10+24	4	1821.70	7.25	3	6.2	2.4	29.1
10+24 to 10+48	6	1821.70	7.75	3	6.1	2.9	28.8
10+48 to 10+72	6	1823.75	7.75	3	6.1	2.9	28.8
10+72 to 11+04	6	1825.50	7.75	3	6.1	2.9	28.4
11+04 to 11+28	6	1827.00	7.75	3	6.1	2.9	28.8
11+28 to 11+52	6	1828.50	7.75	3	6.1	2.9	28.8
11+52 to 11+76	6	1830.00	7.75	3	6.1	2.9	28.8
11+76 to 12+08	8	1830.00	8.50	3	5.3	3.0	26.1
12+08 to 12+40	8	1831.50	8.50	3	5.3	3.0	26.1
12+40 to 12+80	8	1833.30	8.50	3	5.3	3.0	26.1
12+80 to 13+20	8	1834.70	8.50	3	5.3	3.0	26.1
13+20 to 13+60	8	1836.00	8.50	3	5.3	3.0	26.1
13+60 to 13+96	6	1838.90	7.75	3	6.1	2.9	28.4
13+96 to 14+12	4	1841.30	7.25	3	6.2	2.4	29.3

TABLE 8.4B
EXTREME LIMIT STATE FOUNDATION DATA TABLE

ERS Stationing (ft)	Design Height (ft)	Bottom of Footing Elevation (ft)	Footing Width (ft)	Minimum Footing Embedment Depth (ft)	Effective Footing Width for Extreme I Limit State (ft)	Extreme I Limit State Gross Uniform Bearing Stress $q_{g,u}$ (ksf)	Extreme I Limit State Factored Bearing Resistance (ksf) $q_R = \varphi_b * q_n$ $\varphi_b = 1.0$	Effective Footing Width for Extreme II Limit State (ft)	Extreme II Limit State Gross Uniform Bearing Stress $q_{g,u}$ (ksf)	Extreme II Limit State Factored Bearing Resistance (ksf) $q_R = \varphi_b * q_n$ $\varphi_b = 1.0$
10+00 to 10+24	4	1821.70	7.25	3	4.4	1.5	52.0	2.5	2.7	39.5
10+24 to 10+48	6	1821.70	7.75	3	4.1	2.2	50.0	3.1	3.0	43.5
10+48 to 10+72	6	1823.75	7.75	3	4.1	2.2	50.0	3.1	3.0	43.5
10+72 to 11+04	6	1825.50	7.75	3	4.1	2.2	50.0	3.1	3.0	43.5
11+04 to 11+28	6	1827.00	7.75	3	4.1	2.2	50.0	3.1	3.0	43.5
11+28 to 11+52	6	1828.50	7.75	3	4.1	2.2	50.0	3.1	3.0	43.5
11+52 to 11+76	6	1830.00	7.75	3	4.1	2.2	50.0	3.1	3.0	43.5
11+76 to 12+08	8	1830.00	8.50	3	4.0	3.1	49.4	3.8	3.2	48.1
12+08 to 12+40	8	1831.50	8.50	3	4.0	3.1	49.4	3.8	3.2	48.1
12+40 to 12+80	8	1833.30	8.50	3	4.0	3.1	49.4	3.8	3.2	48.1
12+80 to 13+20	8	1834.70	8.50	3	4.0	3.1	49.4	3.8	3.2	48.1
13+20 to 13+60	8	1836.00	8.50	3	4.0	3.1	49.4	3.8	3.2	48.1
13+60 to 13+96	6	1838.90	7.75	3	4.1	2.2	50.0	3.1	3.0	43.5
13+96 to 14+12	4	1841.30	7.25	3	4.4	1.5	54.2	2.5	2.7	39.5

TABLE 8.4C
SERVICE LIMIT STATE FOUNDATION DATA TABLE

ERS Stationing (ft)	Design Height (ft)	Bottom of Footing Elevation (ft)	Footing Width (ft)	Minimum Footing Embedment Depth (ft)	Effective Footing Width for Service Limit State (ft)	Service Limit State Net Bearing Stress $q_{n,\,u}$ (ksf)	Calculated Settlement at Net Bearing Pressure (inches)	Total Permissible Settlement (inches)
10+00 to 10+24	4	1821.70	7.25	3	6.2	1.0	0.03	1.0
10+24 to 10+48	6	1821.70	7.75	3	6.1	1.4	0.05	1.0
10+48 to 10+72	6	1823.75	7.75	3	6.1	1.4	0.05	1.0
10+72 to 11+04	6	1825.50	7.75	3	6.1	1.4	0.05	1.0
11+04 to 11+28	6	1827.00	7.75	3	6.1	1.4	0.05	1.0
11+28 to 11+52	6	1828.50	7.75	3	6.1	1.4	0.05	1.0
11+52 to 11+76	6	1830.00	7.75	3	6.1	1.4	0.05	1.0
11+76 to 12+08	8	1830.00	8.50	3	5.3	1.7	0.06	1.0
12+08 to 12+40	8	1831.50	8.50	3	5.3	1.7	0.06	1.0
12+40 to 12+80	8	1833.30	8.50	3	5.3	1.7	0.06	1.0
12+80 to 13+20	8	1834.70	8.50	3	5.3	1.7	0.06	1.0
13+20 to 13+60	8	1836.00	8.50	3	5.3	1.7	0.06	1.0
13+60 to 13+96	6	1838.90	7.75	3	6.1	1.4	0.05	1.0
13+96 to 14+12	4	1841.30	7.25	3	6.2	1.0	0.03	1.0

TABLE 8.4D
SPREAD FOOTING DATA TABLE

ERS Stationing (ft)	Design Height (ft)	Service Limit State Permissible Net Contact Stress q_{pn} (ksf)	Strength Limit State Factored Gross Nominal Bearing Resistance for Controlling Load Case q_n $\varphi_b = 0.45$ (ksf)	Extreme Event Limit State Factored Gross Nominal Bearing Resistance for Controlling Load Case (ksf) $q_R = \varphi_b * q_n$ $\varphi_b = 1.0$
10+00 to 10+24	4	17.0	64.6	39.5
10+24 to 10+48	6	17.0	64.1	43.5
10+48 to 10+72	6	17.0	64.1	43.5
10+72 to 11+04	6	17.0	63.2	43.5
11+04 to 11+28	6	17.0	64.1	43.5
11+28 to 11+52	6	17.0	64.1	43.5
11+52 to 11+76	6	17.0	64.1	43.5
11+76 to 12+08	8	18.0	57.9	48.1
12+08 to 12+40	8	18.0	57.9	48.1
12+40 to 12+80	8	17.0	57.9	48.1
12+80 to 13+20	8	17.0	57.9	48.1
13+20 to 13+60	8	17.0	57.9	48.1
13+60 to 13+96	6	16.0	63.2	43.5
13+96 to 14+12	4	18.0	65.0	39.5

If disturbed or loose soil is encountered at bottom of footing elevations, we recommend that the footings be supported on structural fill founded on competent intact weathered bedrock. This will require remedial grading in the form of removal and re-compaction below footings and where applicable, extending at an inclination of 2H:1V away from the footing toe. The fill below the footings and the outer portion of the embankment fill should consist of structural fill compacted to a minimum of 95 percent of the maximum density. The weathered/decomposed metamorphic rock at the proposed wall location generally consisted of very dense clayey sand with gravel.

Assuming that all foundations are underlain by undisturbed weathered metamorphic rock and/or new, engineered fill founded thereon, Caltrans Standard Plan shallow foundations (as detailed on Caltrans 2015 Standard Plan B3-4A) are considered appropriate for the support of proposed Type 5 retaining walls with respect to settlement, bearing capacity, and slope stability considerations.

Foundations designed in accordance with the recommendations above should experience total settlements of approximately 1 inch or less and differential settlements of approximately ½ inch or less over a horizontal distance of approximately 50 feet. The majority of the settlement will be immediate and will occur as loads are applied during construction.

Soil placed for retaining wall backfill should meet the requirements outlined in Section 8.3.1 of this report, including meeting the requirements for Caltrans "structure backfill" (Section 19.3.02C of Caltrans *Standard Plans*) and have a "very low" to "low" expansion potential (Expansion Index of 50 or less). The retaining wall should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces. The drainage system should consist of weepholes or backdrains.

8.5 Others

8.5.1 Corrosion Studies

According to Caltrans' *Corrosion Guidelines* (Version 2.1, January 2015), soils are considered corrosive to foundation elements if one or more of the following conditions exist: chloride concentration is 500 parts per million (ppm) or greater, sulfate concentration is 2,000 ppm or greater, or the potential of hydrogen (pH) is 5.5 or less. Resistivity serves as an indicator parameter for the possible presence of soluble salts and is not included as a parameter to define a corrosive area for structures. A minimum resistivity value for soil and/or water less than 1,000 ohm-centimeters may indicate the presence of high quantities of soluble salts and a higher propensity for corrosion.

Resistivity, pH, chlorides, and sulfates tests were performed on a sample selected from the proposed wall location to evaluate the corrosion potential to subsurface structures. These tests were performed in accordance with CTM Nos. 417, 643, and 422. The results are presented in Appendix B and should be considered for design of underground structures. Based on the laboratory test results, the site would not be considered corrosive according to Caltrans' *Corrosion Guidelines*.

Proposed improvements in contact with the ground should be designed and constructed in accordance with Caltrans' *Standard Specifications* and good construction practices. Geocon does not practice in the field of corrosion engineering. If corrosion sensitive improvements are planned, it is recommended that further evaluations by a corrosion engineer be performed to incorporate the necessary precautions to avoid premature corrosion on buried metal pipes and concrete structures in direct contact with the soils.

8.5.2 Culverts

Laboratory test results discussed in the preceding section indicate that native onsite soils are unlikely to be corrosive to buried culverts or other subsurface improvements. If culverts are installed in import fill soils or the stockpiled soils on site, these materials should also be evaluated for corrosion potential.

Locations of proposed culverts have not been identified at this time; therefore, additional soil sampling and corrosion testing may need to be performed once any proposed culvert locations are identified.

8.5.3 Drainage Design

A site drainage system for storm management should include pollution prevention best management practices (BMPs) and/or treatment BMPs in accordance with Caltrans' *Storm Water Quality Handbook* (2010). The site topographic features, groundwater condition, anticipated amounts of rainfall and runoff, and the infiltration characteristics of on-site materials should be considered during the design of site drainage systems.

9.0 PAVEMENT

Based on laboratory testing, Resistance Values (R-Values) of 11, 21 and 47 were obtained from representative samples as presented on Table B2 in Appendix B. To account for subgrade variability and to allow greater flexibility with potential import soils, our pavement design recommendations are based on design R-values of 10 and 20 for native subgrade and an R-Value of 40 for subgrade constructed with material currently stockpiled at the site. The top 18 inches of pavement subgrade should consist of the stockpiled fill in order to use the higher design R-Value.

El Dorado County Standard Plans recommend the use of a subgrade enhancement geotextile (SEG) between the AB and subgrade soil in areas in areas with and R-Value of less than 20. An R-Value of 25 can be assumed for design when an SEG is used.

Table 9.0 summarizes our recommended pavement structural sections using HMA and Class 2 AB based on a range of Traffic Indices (TI) and were developed in accordance with Chapter 630 of the Caltrans *Highway Design Manual* (HDM) and a 20-year design life. Traffic Index values for the various proposed roadway sections provided by Dokken are shown below.

TABLE 9.0
DESIGN TRAFFIC INDICES

Portion of Project	Traffic Index
US 50 Auxiliary Lane (Mainline)	12, 14, and 16
US 50 Off-Ramp	8, 10, and 12
Forni Road / Ray Lawyer Drive	6, 8, and 10
Park and Ride	5, 6, and 7

Pavement structural sections provided below correspond to the subgrade soils encountered in the improvement location and/or anticipated soils to be used for fill below the proposed improvement.

TABLE 9.1
PAVEMENT STRUCTURAL SECTIONS

Traffic Index	Design R-Value = 10[1]		Design R-Value = 20[2]		Design R-Value = 25[3]		Design R-Value = 40[4]	
	HMA[5] (ft.)	AB[6] (ft.)	HMA[5] (ft.)	AB[6] (ft.)	HMA[5] (ft.)	AB[6] (ft.)	HMA[5] (ft.)	AB[6] (ft.)
5.0	--	--	0.25	0.60	0.25	0.55	0.25	0.35
6.0	0.30	0.95	0.30	0.80	0.30	0.70	0.30	0.50
7.0	--	--	0.35	1.00	0.35	0.85	0.35	0.55
8.0	0.40	1.40	0.40	1.15	0.40	1.05	0.40	0.70
10.0	0.55	1.75	0.55	1.45	0.55	1.30	0.55	0.85
12.0	--	--	0.65	1.80	0.65	1.60	0.65	1.10
14.0	--	--	0.80	2.00	0.80	1.80	--	--
16.0	--	--	0.95	2.25	0.95	2.05	--	--

Notes:
1. Native subgrade: Ray Lawyer Dr. and Forni Rd. NE of Sta. 37+00
2. Native subgrade: Forni Rd. SW of Sta. 37+00, US 50 off-ramp, US 50 mainline.
3. Using a SEG between native subgrade and AB.
4. Stockpiled fill. Top 18 inches of subgrade to consist of stockpiled material or import material with an R-Value of 40 or greater.
5. HMA = Hot-mix Asphalt
6. AB = Aggregate Base (Class 2)

Use of Rubberized Hot Mix Asphalt (RHMA, a non-structural wearing course) can be implemented in this project by subtracting 0.1 feet of HMA in the above table and adding 0.2 feet of RHMA as the surficial layer of asphalt. This RHMA section consists of 0.1 feet as the sacrificial layer and 0.1 feet as the top of the surface layer (which reduces the HMA layer by 0.1 feet).

The recommended alternative pavement sections are based on the following assumptions:

1. The top 12 inches of subgrade is compacted to 95% or higher relative compaction at or near optimum moisture content
2. Prior to placing AB or SEG (if used), subgrade soil should be proof-rolled with a loaded water truck to verify stability.
3. Class 2 AB has a minimum R-Value of 78 and meets the requirements of Section 26 of Caltrans' latest *Standard Specifications*.
4. Class 2 AB is compacted to 95% or higher relative compaction at or near optimum moisture content. Prior to placing HMA, the AB should be proof-rolled with a loaded water truck to verify stability.

10.0 MATERIAL SOURCES

This study did not include the evaluation of potential sources of import materials. We understand that material stockpiled on site is desired to be used as engineered embankment fill. Initial screening tests (Grain Size Distribution, Atterberg Limits, Moisture-Density Relationship [compaction curve] and R-Value) were performed on a sample of this material (Bulk E from sample location O-16-008) for preliminary evaluation of soil suitability as engineered fill and pavement subgrade support characteristics.

Based on the results of our initial laboratory testing, the stockpiled soils classify as a clayey gravel with sand. Plasticity Index testing indicates low plasticity and corresponding low expansion potential for these materials. The gradation of the material meets the criterial for Caltrans structure backfill per Section 19-3.02C of the Caltrans 2015 *Standard Specifications*. We recommend that a design R-Value of 40 be used for this material based on our testing of sample Bulk E.

Based on the test results of the bulk sample obtained at sample location O-16-008, the stockpiled materials are suitable for use as structure backfill providing the sand equivalent criteria is also met. Periodic testing of the stockpiled materials will be required during construction to verify that the excavated and blended materials meet the project specifications for use as structure backfill.

11.0 MATERIAL DISPOSAL

Cuts and fills are anticipated along the project alignment. If required, information regarding disposal of potentially unsuitable and/or surplus materials should be provided by the Resident Engineer and District Materials Engineer.

12.0 CONSTRUCTION CONSIDERATIONS

12.1 Construction Advisories

The proposed improvements are located along existing US 50, Forni Road and Ray Lawyer Drive and include portions of East Forni Road, the El Dorado County Jail driveway, and the El Dorado Trail access point. Traffic control with lane and shoulder closures and detours are anticipated during construction. In addition, there are a significant number of underground and overhead utilities along the proposed widening alignment. The Contractor should verify these utility conditions and plan the construction activities accordingly.

12.2 Construction Considerations that Influence Specifications

All grading should be performed in conformance with Section 19 of Caltrans' *Standard Specifications* or equivalent. Backfill placed behind retaining walls should have a very low to low expansion potential. The

extent and placement of the low-expansive soils should conform to Caltrans' *Standard Specifications* Section 19-5.03.

The Contractor should verify the existing utility line conditions. These areas should not to be used for stockpiling of construction materials. Any conflicts should be reviewed prior to construction.

12.3 Construction Monitoring and Instrumentation

Site grading, footing excavation, removal of any unsuitable soils or oversize material, and replacement and compaction of backfill and subgrade should be observed by the Geotechnical Engineer of Record. Faces of cut slopes in native materials should be observed by an engineering geologist for indications of instability. Appropriate field tests should be conducted to provide quality control, quality assurance for structural fills and related earthwork elements.

The Contractor should execute the monitoring program for structures in proximity to any deep excavations so that appropriate modifications to the excavation/shoring system and/or foundation type are implemented to minimize the surface deflection or structure damage in a timely manner.

12.4 Hazardous Waste Considerations

This geotechnical study did not include the determination of the existence of possible hazardous materials. If any hazardous materials are identified during construction, regulatory officials should be notified immediately.

12.5 Differing Site Conditions

Differing site conditions are conditions unusual to the site or are conditions that were not encountered during the field investigation. The subsurface conditions described in this report are based on available exploration data. These explorations depict subsurface conditions only at the locations explored. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface conditions could change between and/or beyond the explored locations. It is imperative that the designers, the resident engineer, and the Contractor notify the geotechnical engineer immediately upon recognition of any condition that differs from that described in this report. Additional recommendations could be provided if such conditions arise.

12.6 Groundwater

Groundwater encountered during grading activities would likely be locally perched and, during dry season construction, controllable with sump pumps or similar dewatering methods.

13.0 RECOMMENDATIONS AND SPECIFICATIONS

If the designers have questions or issues regarding any of the recommendations in this report, or if conditions are found to be different during construction, the geotechnical staff who prepared this report should be contacted. Additional fieldwork, analysis, or changes in recommendations may be required.

This report provides the following geotechnical design and construction recommendations for the proposed improvements:

- Seismic design parameters are presented in Section 8.1.
- Cuts and excavations including stability, rippability, and grading factors are presented in Section 8.2.
- Embankments including the embankment fill area preparation and fill placement, embankment stability, and the embankment settlement are presented in Section 8.3.
- Retaining wall design parameters are presented in Section 8.4.
- Corrosion information is presented in Section 8.5.
- Pavement recommendations are presented in Section 9.
- Construction considerations are presented in Section 12.
- Unless otherwise stated in the special provisions, all specifications should conform to Caltrans' *Standard Specifications*, latest edition.

14.0 CLOSURE

14.1 Foundation and Grading Plan Review

Geocon should review the grading plans and foundation plans prior to final design submittal to determine if additional analysis and/or recommendations are required.

14.2 Limitations and Uniformity of Conditions

The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, we should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials or environmental contamination was not part of our scope of services.

This report is issued with the understanding that it is the responsibility of the owner or their representative to ensure that the information and recommendations contained herein are brought to the attention of the design team for the project and incorporated into the plans and specifications and the necessary steps are taken to see that the Contractor and subcontractors carry out such recommendations in the field.

The recommendations contained in this report are preliminary until verified during construction by representatives of our firm. Changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. Additionally, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated partially or wholly by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices used in the site area at this time. No warranty is provided, express or implied.

15.0 REFERENCES

1. California Department of Transportation, *ARS Online Version 2.3.06,* http://dap3.dot.ca.gov/shake_stable/, accessed March 3, 2016.

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6. California Department of Transportation, *Memo to Designers 5-20, Foundation Report / Geotechnical Design Report Checklist for Earth Retaining Systems*, August 2004.

7. California Department of Transportation, *Methodology for Developing Design Response Spectrum for Use in Seismic Design Recommendations*, November 2012

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9. California Department of Transportation, 2015, *Standard Plans.*

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12. California State Water Resources Control Board, GeoTracker, http://geotracker.waterboards.ca.gov/, accessed March 7, 2016.

13. *Department of Naval Facilities Engineering Command (NAVFAC) Manual, DM 7.1*, September 1996.

14. Dokken Engineering, *Contour Grading (Sheets G-1, G-2, and G-3), Layout (Sheets L-1, L-2, and L-3), and Survey Control (Sheet SC-1),* labeled "65% Plans Not For Construction", undated.

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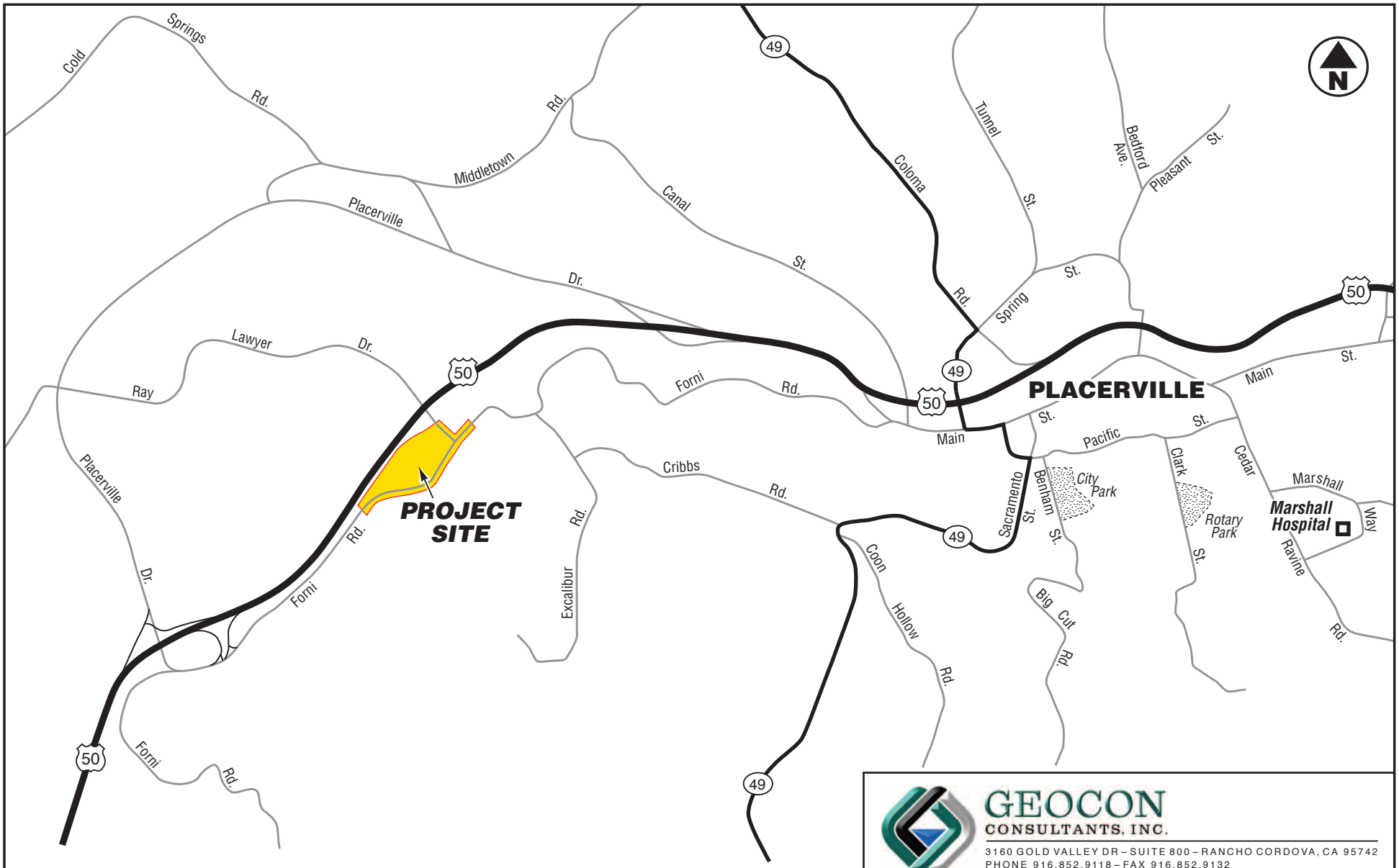

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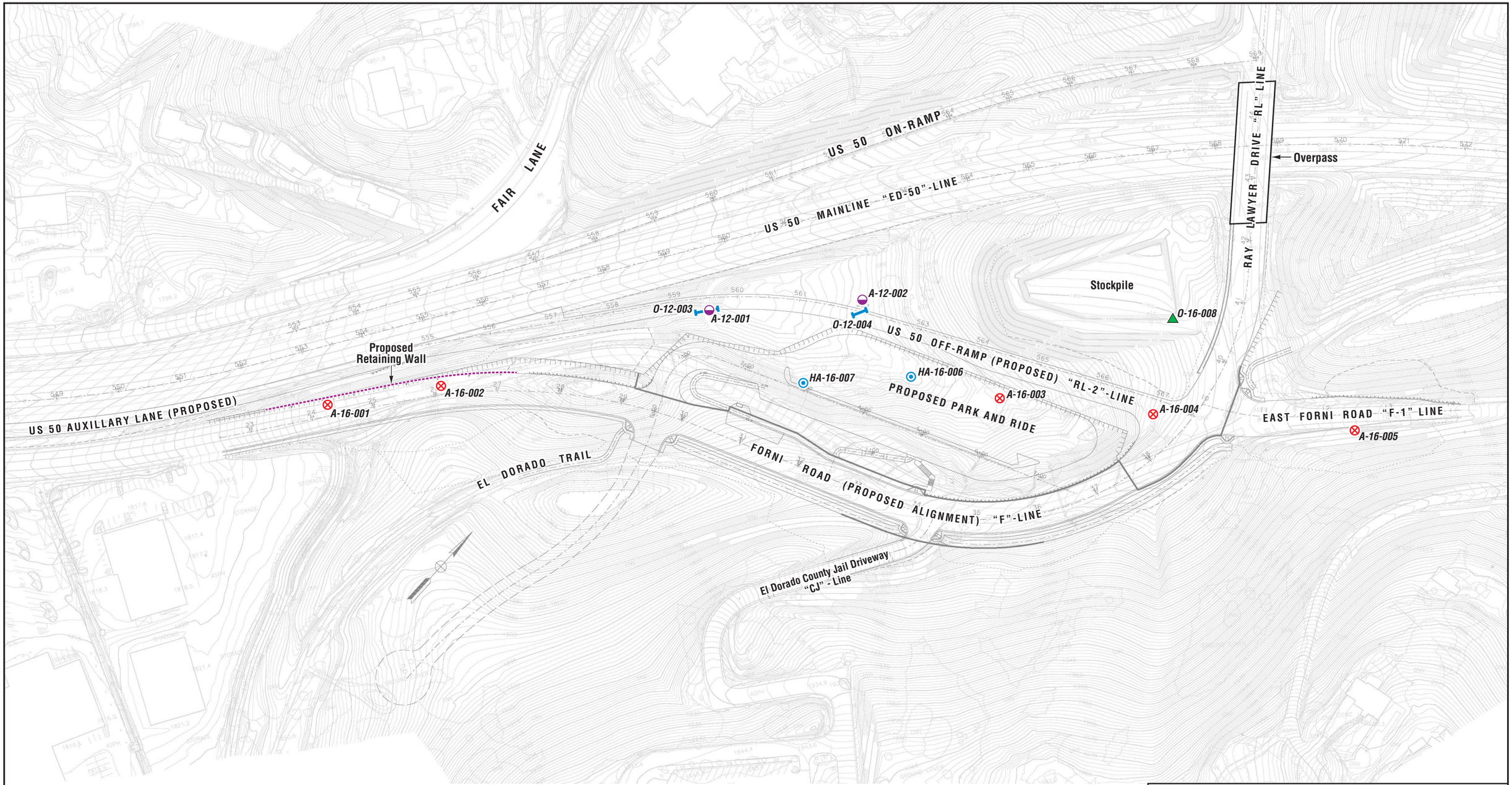
Western Placerville Interchange Phase 2

Placerville,
California

VICINITY MAP

S9420-05-04	November 2016	Figure 1



LEGEND:

- A-16-001 — Approximate Boring Location
- HA-16-006 — Approximate Hand-Auger Boring Location
- O-16-008 — Approximate Bulk Sample Location
- A-12-002 — Approximate Boring Location (2012)
- O-12-004 — Approximate Test Pit Location (2012)

0 150
Scale in Feet

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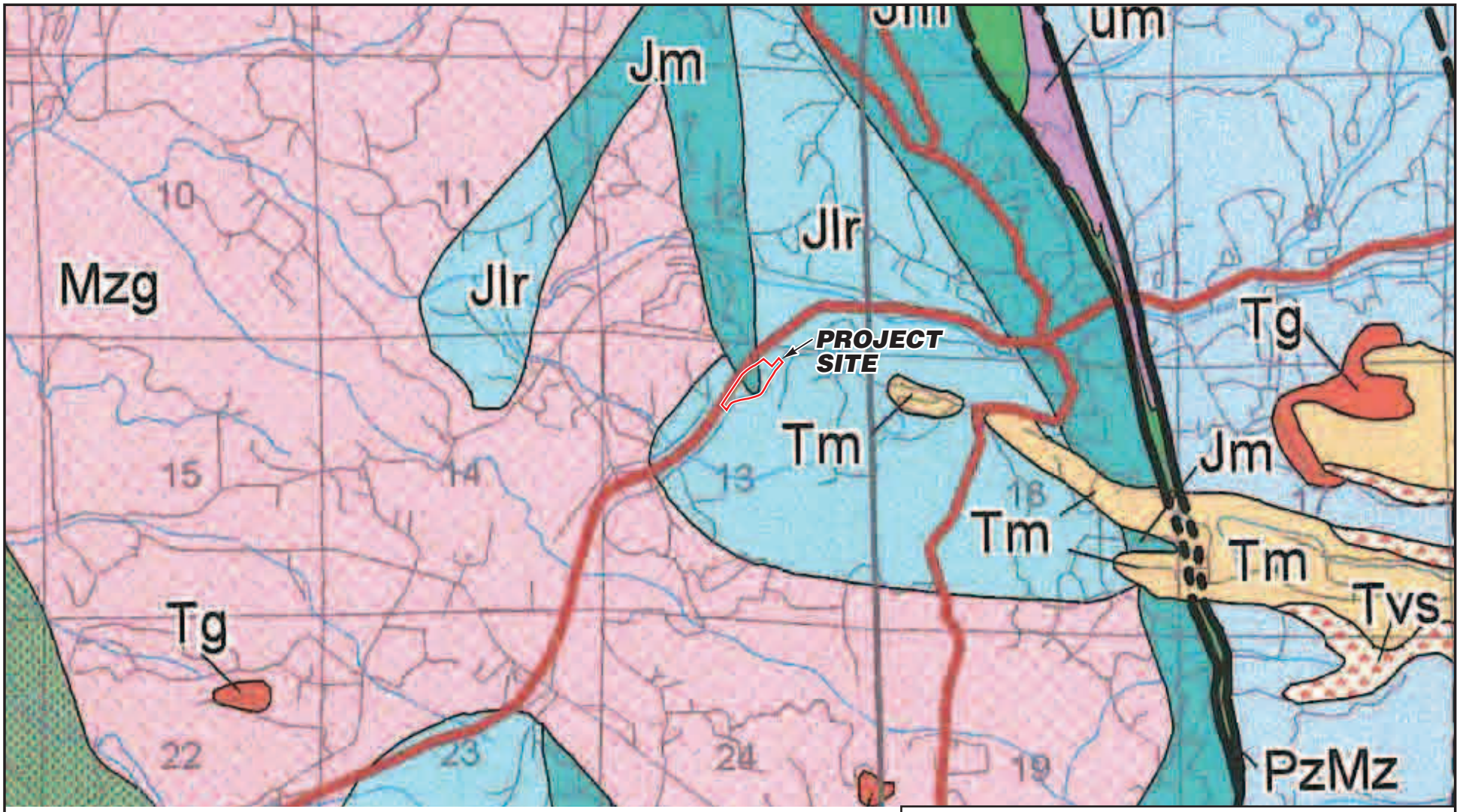
Placerville,
California

SITE PLAN

S9420-05-04	November 2016	Figure 2



Tm	Mehrten Formation
Tvs	Valley Springs Formation
Tg	River Channel Deposits (Auriferous Gravel)
Mzg	Granitic Intrusive Rock, Chiefly Granodiorite
Jm	Mariposa Formation
Jmb	Mariposa Formation, Bower Creek Member
Jlr	Logtown Ridge Formation
PzMz	Paleozoic-Mesozoic Metamorphic Rocks

Ref: *Generalized Geologic Map of El Dorado County, California*, Lawrence L. Busch, June, 2001

N

0 1

Scale in Miles

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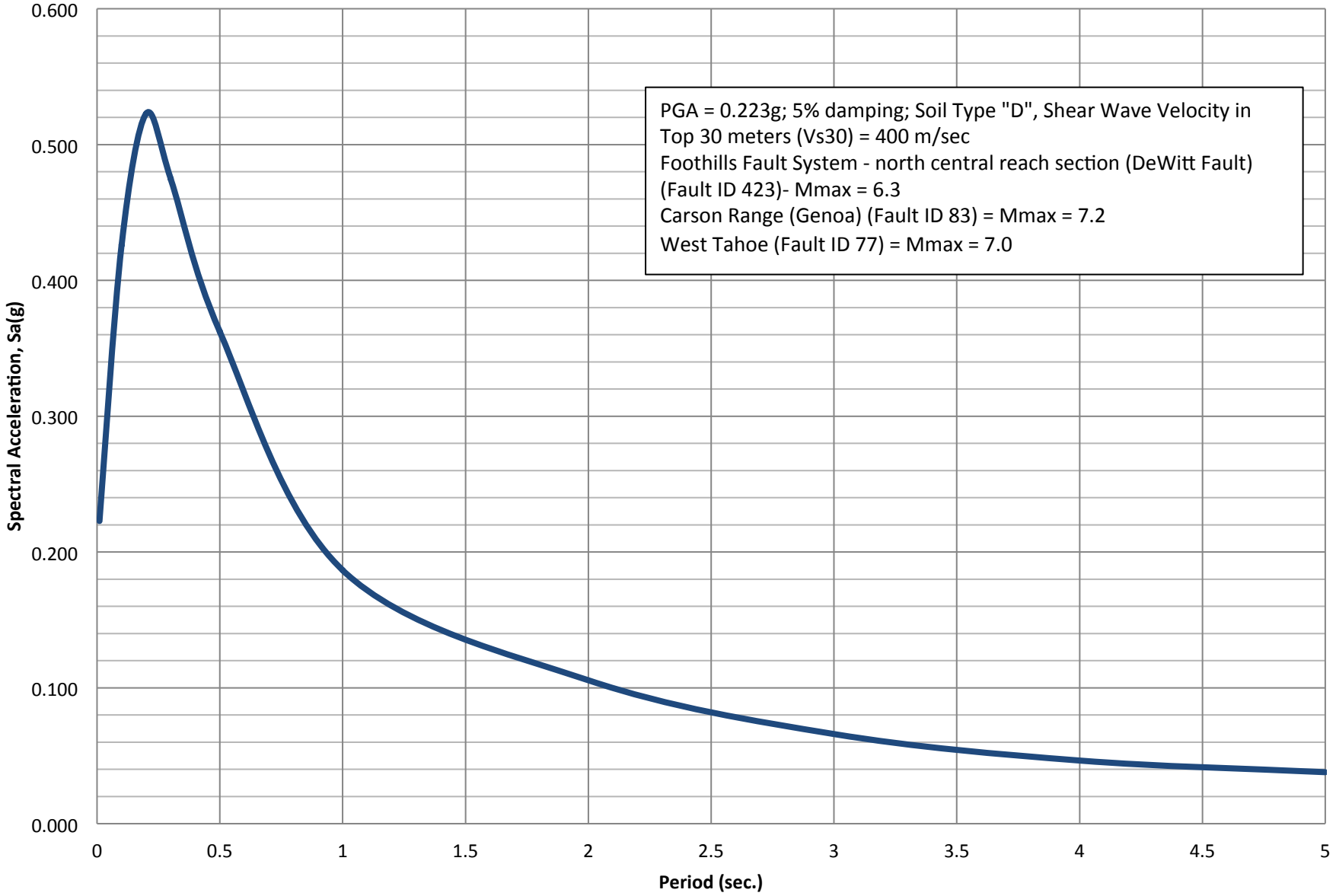
Western Placerville Interchange Phase 2

Placerville, California

GEOLOGIC MAP

S9420-05-04	November 2016	Figure 3



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Recommended Design Response Spectrum

Western Placerville Interchange Phase 2

Placerville, California

S9420-05-04	November 2016	Figure 4

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

The field investigation for this Geotechnical Design Report was performed between February 17 and March 5, 2016, and consisted of a site reconnaissance, drilling 7 borings (including 2 hand-auger borings), and obtaining a bulk sample of soil from the stockpile for laboratory testing. The explorations were located based on preliminary project plans and information from Dokken Engineering. Table A-1 summarizes the exploration locations, approximate surface elevations, and depths.

TABLE A-1
SUMMARY OF EXPLORATIONS

Exploration No.	Approximate Exploration Location				Exploration Depth (feet)
	Station No.	Line	Offset (feet)	Elevation (feet)	
A-16-001	24+28	"F"-Line	18 Left	1834	25.2
A-16-002	26+11	"F"-Line	15 Left	1844	25.2
A-16-003	564+53	"RL-2"-Line	70 Right	1849	11.4
A-16-004	38+57	"F"-Line	51 Left	1880	11.5
A-16-005	12+45	"F-1"-Line	26 Right	1900	10.2
HA-16-006	563+07	"RL-2"-Line	77 Right	1839	2.0
HA-16-007	561+29	"RL-2"-Line	130 Right	1838	2.5
O-16-008	40+40	"F"-Line	104 Left	1894	1.5

Borings A-16-001 through A-16-005 were drilled using a truck-mounted Mobile B-57 drill rig equipped with 8-inch-diameter hollow-stem augers. Borings were advanced to depths ranging from approximately 10 to 25 feet. Borings HA-16-006 and HA-16-007 were advanced using a hand-auger. Surficial bulk soil sample O-16-008 was obtained using a shovel in the side of the soil stockpile present at the project site.

Sampling during drilling was performed in general accordance with the current Caltrans' *Soil and Rock Logging, Classification and Presentation Manual* (2010). Soil samples were typically collected at approximately 2.5- to 5-foot intervals. Relatively undisturbed soil samples were obtained by driving an approximately 3-inch outside-diameter (OD) split-spoon sampler (California modified sampler) into the "undisturbed" soil mass with blows from a 140-pound hammer falling 30 inches. The sampler was equipped with 6-inch-long by 2½-inch-diameter brass sample tubes to facilitate sample removal and laboratory testing. Standard Penetration Tests (SPTs) were performed by driving a 2-inch OD split-spoon sampler 18 inches in general accordance with American Society for Testing and Materials (ASTM) D-1586. The number of blows required to drive the samplers (blow counts) the last 12 inches of the 18-inch sample drive (or portion thereof) are reported on the logs of borings and Logs of Test Boring (LOTB) sheets included in Appendices A and C, respectively. Bulk samples of soil cuttings were also collected during the field exploration.

The exploratory borings were sampled and logged by a registered civil engineer during drilling and trenching operations. The soils encountered in the exploratory borings were classified in accordance with the Caltrans' *Soil and Rock Logging, Classification, and Presentation Manual* (2010). Upon completion of the field exploration program, the exploratory borings were backfilled with cement grout. Borings in paved areas were capped with quick set concrete.

Samples were placed in sealed containers and transported to our laboratory for testing and further classification. Boring logs are included in Appendix A. The LOTB sheets in Caltrans format are presented in Appendix C.

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISIONS				TYPICAL NAMES
COARSE-GRAINED SOILS, MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS, MORE THAN HALF COARSE FRACTION IS LARGER THAN NO.4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC	CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS, MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO.4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS WITH OR WITHOUT GRAVEL
			SC	CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS, MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS, LIQUID LIMIT 50% OR LESS		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL	ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS, LIQUID LIMIT GREATER THAN 50%		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
	HIGHLY ORGANIC SOILS		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

BORING/TRENCH LOG LEGEND

- No Recovery
- Shelby Tube Sample 3" O.D.
- Bulk Sample
- SPT Sample 2" O.D., 1.4" I.D.
- Modified California Sample 3" O.D., 2.4" I.D.
- Groundwater Level (At Completion)
- Groundwater Level (Seepage)

PENETRATION RESISTANCE

SAND AND GRAVEL			SILT AND CLAY			
RELATIVE DENSITY	BLOWS PER FOOT (SPT)*	BLOWS PER FOOT (MOD-CAL)*	CONSISTENCY	BLOWS PER FOOT (SPT)*	BLOWS PER FOOT (MOD-CAL)*	COMPRESSIVE STRENGTH (tsf)
VERY LOOSE	0 - 4	0 - 6	VERY SOFT	0 - 2	0 - 3	0 - 0.25
LOOSE	5 - 9	7 - 14	SOFT	3 - 4	4 - 6	0.25 - 0.50
MEDIUM DENSE	10 - 29	15 - 45	MEDIUM STIFF	5 - 8	7 - 12	0.50 - 1.0
DENSE	30 - 49	46 - 75	STIFF	9 - 15	13 - 23	1.0 - 2.0
VERY DENSE	OVER 49	OVER 75	VERY STIFF	16 - 30	24 - 46	2.0 - 4.0
			HARD	OVER 30	OVER 46	OVER 4.0

*NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE LAST 12 INCHES OF AN 18-INCH DRIVE

MOISTURE DESCRIPTIONS

DESCRIPTION	CRITERIA
DRY	NO DISCERNABLE MOISTURE
MOIST	MOISTURE PRESENT, BUT NO FREE WATER
WET	VISIBLE FREE WATER

QUANTITY DESCRIPTIONS

APPROX. ESTIMATED PERCENT	DESCRIPTION
<5%	TRACE
5 - 10%	FEW
15 - 25%	LITTLE
30 - 50%	SOME
>50%	MOSTLY

GRAVEL/COBBLE/BOULDER DESCRIPTIONS

CRITERIA	DESCRIPTION
PASS THROUGH A 3-INCH SIEVE AND BE RETAINED ON A NO. 4 SIEVE (#4 TO 3")	GRAVEL
PASS A 12-INCH SQUARE OPENING AND BE RETAINED ON A 3-INCH SIEVE (3"-12")	COBBLE
WILL NOT PASS A 12-INCH SQUARE OPENING (>12")	BOULDER

CP – COMPACTION CURVE (ASTM D1557)
CR – CORROSION ANALYSIS (CTM 422, 643, 417)
DS – DIRECT SHEAR (ASTM D3080)
EI – EXPANSION INDEX (ASTM D4829)
PA – GRAIN SIZE ANALYSIS (ASTM D422)
M – MOISTURE CONTENT (ASTM D2216)
PI - PLASTICITY INDEX (ASTM D4318)
R – R-VALUE (CTM 301)
SE – SAND EQUIVALENT (CTM 217)
CU – CONSOLIDATED UNDRAINED TRIXIAL (ASTM D4767)
UU – UNCONSOLIDATED UNDRAINED TRIXIAL (ASTM D2850)
UC – UNCONFINED COMPRESSIVE STRENGTH (ASTM D2166)

BEDDING SPACING DESCRIPTIONS

THICKNESS/SPACING	DESCRIPTOR
GREATER THAN 10 FEET	MASSIVE
3 TO 10 FEET	VERY THICKLY BEDDED
1 TO 3 FEET	THICKLY BEDDED
4-INCH TO 1 FOOT	MODERATELY BEDDED
1-INCH TO 4-INCH	THINLY BEDDED
¼-INCH TO 1-INCH	VERY THINLY BEDDED
LESS THAN ¼-INCH	LAMINATED

STRUCTURE DESCRIPTIONS

CRITERIA	DESCRIPTION
ALTERNATING LAYERS OF VARYING MATERIAL OR COLOR WITH LAYERS AT LEAST ¼-INCH THICK	STRATIFIED
ALTERNATING LAYERS OF VARYING MATERIAL OR COLOR WITH LAYERS LESS THAN ¼-INCH THICK	LAMINATED
BREAKS ALONG DEFINITE PLANES OF FRACTURE WITH LITTLE RESISTANCE TO FRACTURING	FISSURED
FRACTURE PLANES APPEAR POLISHED OR GLOSSY, SOMETIMES STRIATED	SLICKENSIDED
COHESIVE SOIL THAT CAN BE BROKEN DOWN INTO SMALLER ANGULAR LUMPS WHICH RESIST FURTHER BREAKDOWN	BLOCKY
INCLUSION OF SMALL POCKETS OF DIFFERENT SOIL, SUCH AS SMALL LENSES OF SAND SCATTERED THROUGH A MASS OF CLAY	LENSED
SAME COLOR AND MATERIAL THROUGHOUT	HOMOGENOUS

CEMENTATION/INDURATION DESCRIPTIONS

FIELD TEST	DESCRIPTION
CRUMBLES OR BREAKS WITH HANDLING OR LITTLE FINGER PRESSURE	WEAKLY CEMENTED/INDURATED
CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE	MODERATELY CEMENTED/INDURATED
WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE	STRONGLY CEMENTED/INDURATED

IGNEOUS/METAMORPHIC ROCK STRENGTH DESCRIPTIONS

DESCRIPTION	CRITERIA
EXTREMELY HARD	CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	BREAKS WITH HEAVY HAMMER BLOWS
MODERATELY HARD	BREAKS WITH MODERATE HAMMER BLOWS
MODERATELY SOFT	BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	BREAKS WITH LIGHT MANUAL PRESSURE

IGNEOUS/METAMORPHIC ROCK WEATHERING DESCRIPTIONS

DEGREE OF DECOMPOSITION	FIELD RECOGNITION	ENGINEERING PROPERTIES
SOIL	DISCOLORED, CHANGED TO SOIL, FABRIC DESTROYED	EASY TO DIG
DECOMPOSED	DISCOLORED, CHANGED TO SOIL, FABRIC MAINLY PRESERVED	EXCAVATED BY HAND OR RIPPING (Saprolite)
INTENSELY WEATHERED	DISCOLORED, HIGHLY FRACTURED, FABRIC ALTERED AROUND FRACTURES	EXCAVATED BY HAND OR RIPPING, WITH SLIGHT DIFFICULTY
MODERATELY WEATHERED	DISCOLORED, FRACTURES, INTACT ROCK-NOTICEABLY WEAKER THAN FRESH ROCK	EXCAVATED WITH DIFFICULTY WITHOUT EXPLOSIVES
SLIGHTLY WEATHERED	MAY BE DISCOLORED, SOME FRACTURES, INTACT ROCK-NOT NOTICEABLY WEAKER THAN FRESH ROCK	REQUIRES EXPLOSIVES FOR EXCAVATION, WITH PERMEABLE JOINTS AND FRACTURES
FRESH	NO DISCOLORATION, OR LOSS OF STRENGTH	REQUIRES EXPLOSIVES

IGNEOUS/METAMORPHIC ROCK JOINT/FRACTURE DESCRIPTIONS

FIELD TEST	DESCRIPTION
NO OBSERVED FRACTURES	UNFRACTURED/UNJOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT GREATER THAN 3-FOOT INTERVALS	VERY SLIGHTLY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 1 TO 3 FOOT INTERVALS	SLIGHTLY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 4-INCH TO 1 FOOT INTERVALS	MODERATELY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT 1-INCH TO 4-INCH INTERVALS WITH SCATTERED FRAGMENTED INTERVALS	INTENSELY FRACTURED/JOINTED
MAJORITY OF JOINTS/FRACTURES SPACED AT LESS THAN 1-INCH INTERVALS; MOSTLY RECOVERED AS CHIPS AND FRAGMENTS	VERY INTENSELY FRACTURED/JOINTED

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KEY TO LOGS

Figure A1

Caltrans Key to Logs

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	2-17-16	2-17-16	38° 43' 27.6276" / -120° 49' 37.9266"	A-16-001
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Woodward Drilling			18.00' Lt Sta 24+28 F-Line	1834.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			Mobile B-57	8 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2"), SPT (1.4")			Downhole Hammer 140# 30"	80%
BORE HOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Neat Cement Grout			N/A	N/A	25.2 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT (AC) 9 inches.												
	1		Poorly graded GRAVEL (GP); AGGREGATE BASE (AB) 12 inches.												
1832.00	2		METAVOLCANIC ROCK; dark brown; decomposed; (CLAYEY SAND with GRAVEL (SC); very dense; moist).		Bulk A			100							
	3														
1830.00	4														
	5		Becomes intensely weathered, moist to wet.		5.0	50/5"	50/5"	100		6					PA
1828.00	6														
	7														
1826.00	8				7.5	50/5"	50/5"	100							
	9														
1824.00	10				10.0	50/3"	50/3"	100		10					PA, PI
	11														
1822.00	12														
	13														
1820.00	14														
	15				15.0	50/3"	50/3"	100		4					
1818.00	16														
	17		Difficult drilling.												
1816.00	18														
	19														
1814.00	20				20.0	50/2"	50/2"	100		3					
	21														
1812.00	22														
	23														
1810.00	24														
	25				25.0	50/2"	50/2"	100							
1808.00	26		Bottom of borehole at 25.2 ft bgs Boring Terminated at planned depth.												
	27														
1806.00	28		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				A-16-001
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	ED			S94200504
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		3-7-16	1 of 1

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A2

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	2-17-16	2-17-16	38° 43' 29.121" / -120° 49' 36.3576"	A-16-002
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Woodward Drilling			15.00' Lt Sta 26+11 F-Line	1844.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			Mobile B-57	8 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Std Cal (2"), SPT (1.4")			Downhole Hammer 140# 30"	80%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Neat Cement Grout			N/A	N/A	25.2 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT (AC) 7.5 inches.												
	1		Poorly graded GRAVEL (GP); AGGREGATE BASE (AB) 12 inches.												
1842.00	2		METAVOLCANIC ROCK; dark brown; intensely weathered to decomposed; (CLAYEY SAND with GRAVEL (SC); very dense; moist to wet).		1.5	50/5"	50/5"	100							
	3				3.0	43 39	89/10"	100		4	117				
1840.00	4				3.5	50/4"				8	109				
	5				5.0	27 50/6"	50/6"	100		8					
1838.00	6														
	7														
1836.00	8														
	9														
1834.00	10				10.0	35 37 46	83	100		7					
	11														
1832.00	12														
	13														
1830.00	14														
	15		Becomes intensely weathered.		15.0	50/5"	50/5"	100							
1828.00	16														
	17														
1826.00	18														
	19														
1824.00	20				20.0	50/4"	50/4"	100							
	21														
1822.00	22														
	23														
1820.00	24														
	25				25.0	50/2"	50/2"	100							
1818.00	26		Bottom of borehole at 25.2 ft bgs Boring Terminated at planned depth.												
	27														
1816.00	28		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				A-16-002
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	ED			S94200504
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		3-7-16	1 of 1

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A3

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	2-17-16	2-17-16	38° 43' 34.8162" / -120° 49' 27.7386"	A-16-003
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Woodward Drilling			70.00' Rt Sta 564+53 RL-2-Line	1849.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			Mobile B-57	8 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2"), SPT (1.4")			Downhole Hammer 140# 30"	80%
BORE HOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Neat Cement Grout			N/A	N/A	11.4 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY lean CLAY (CL); very stiff; red; moist.												
	1				Bulk B			100							
1847.00	2														
	3					12	42	100							
					3.0	18				22	90				PA
1845.00	4				3.5	24									
	5														
						12	50	100							
1843.00	6				5.5	24									
			METAVOLCANIC ROCK; olive brown; decomposed; (SANDY lean CLAY (CL); hard; moist).		6.0	26									
1841.00	8														
	9														
1839.00	10				10.0	11	88/11"	100							
	11					38									
						50/5"									
1837.00	12		Bottom of borehole at 11.4 ft bgs												
	13		Boring Terminated at planned depth.												
1835.00	14		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	15														
1833.00	16														
	17														
1831.00	18														
	19														
1829.00	20														
	21														
1827.00	22														
	23														
1825.00	24														
	25														
1823.00	26														
	27														
1821.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				A-16-003
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	ED			S94200504
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		3-7-16	1 of 1

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A4

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	2-17-16	2-17-16	38° 43' 36.195" / -120° 49' 25.32"	A-16-004
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Woodward Drilling			51.00' Lt Sta 38+57 F-Line	1880.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			Mobile B-57	8 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Std Cal (2"), SPT (1.4")			Downhole Hammer 140# 30"	80%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Neat Cement Grout			N/A / N/A	11.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Poorly graded GRAVEL (GP); with COBBLES and asphalt debris.												
	1		METAVOLCANIC ROCK; olive brown; decomposed; (CLAYEY SAND with GRAVEL (SC); medium to very dense; moist).		Bulk C			100							
1878.00	2					3									
	3				2.5 3.0	19 25	44	100		18	107				
1876.00	4														
	5					12									
1874.00	6				5.5 6.0	38 43	81	100		14	113				PI
	7														
1872.00	8														
	9														
1870.00	10				10.0	25 25 50	75	100							
	11														
1868.00	12		Bottom of borehole at 11.5 ft bgs Boring Terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	13														
1866.00	14														
	15														
1864.00	16														
	17														
1862.00	18														
	19														
1860.00	20														
	21														
1858.00	22														
	23														
1856.00	24														
	25														
1854.00	26														
	27														
1852.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				A-16-004
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	ED			S94200504
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		3-7-16	1 of 1

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A5

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	2-17-16	2-17-16	38° 43' 38.0994" / -120° 49' 22.1412"	A-16-005
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Woodward Drilling			26.00' Rt Sta 12+45 F-1-Line	1900.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			Mobile B-57	8 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk, Mod Cal (2.4"), SPT (1.4")			Downhole Hammer 140# 30"	80%
BORE HOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Neat Cement Grout			N/A	N/A	10.2 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT (AC) 8 inches.												
	1		Poorly graded GRAVEL (GP); AGGREGATE BASE (AB) 10 inches.												
1898.00	2		METAVOLCANIC ROCK; olive brown; decomposed; (CLAYEY SAND with GRAVEL (SC); very dense; moist).		Bulk D			100							
	3				3.0	6 29	79/9"	100		11					PA
1896.00	4				3.5	50/3"				12	113				
	5		Becomes intensely weathered; moist to wet.		5.0	50/6"	50/6'	100							
1894.00	6														
	7														
1892.00	8														
	9														
1890.00	10				10.0	50/2"	50/2"	100							
	11		Bottom of borehole at 10.2 ft bgs												
	12		Boring Terminated at planned depth.												
1888.00	13		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
1886.00	14														
	15														
1884.00	16														
	17														
1882.00	18														
	19														
1880.00	20														
	21														
1878.00	22														
	23														
1876.00	24														
	25														
1874.00	26														
	27														
1872.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				A-16-005
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	ED			S94200504
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		3-7-16	1 of 1

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A6

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	**3-5-16**	**3-5-16**	**38° 43' 34.1148" / -120° 49' 29.3802"**	**HA-16-006**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geocon Consultants, Inc.			**77.00' Rt Sta 563+07 RL-2-Line**	**1839.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hand Auger			**N/A**	**4 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Mod Cal (2.4")			**N/A**	**N/A**
BORHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Soil Cuttings			**N/A** / **N/A**	**2.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0														
	1		SANDY lean CLAY with GRAVEL (CL); soft; reddish brown; wet; fine GRAVEL.		1.0			100							PA, PI
1837.00	2		Becomes medium stiff.												
			Bottom of borehole at 2.0 ft bgs												
	3		Boring Terminated at planned depth.												
1835.00	4		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	5														
1833.00	6														
	7														
1831.00	8														
	9														
1829.00	10														
	11														
1827.00	12														
	13														
1825.00	14														
	15														
1823.00	16														
	17														
1821.00	18														
	19														
1819.00	20														
	21														
1817.00	22														
	23														
1815.00	24														
	25														
1813.00	26														
	27														
1811.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				**HA-16-006**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	**ED**			**S94200504**
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		**3-8-16**	**1 of 1**

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A7

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	3-5-16	3-5-16	38° 43' 32.6964" / -120° 49' 30.9786"	HA-16-007
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geocon Consultants, Inc.			130.00' Rt Sta 561+29 RL-2-Line	1840.0 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hand Auger			N/A	4 in
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Mod Cal (2.4")			N/A	N/A
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE) / TOTAL DEPTH OF BORING
Soil Cuttings			N/A	N/A / 2.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0														
	1		SANDY lean CLAY with GRAVEL (CL); soft; reddish brown; moist; fine GRAVEL.												
1838.00	2				1.5			100							
	3		Becomes stiff.												
1836.00	4		Bottom of borehole at 2.5 ft bgs												
	5		Boring Terminated at planned depth.												
1834.00	6		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	7														
1832.00	8														
	9														
1830.00	10														
	11														
1828.00	12														
	13														
1826.00	14														
	15														
1824.00	16														
	17														
1822.00	18														
	19														
1820.00	20														
	21														
1818.00	22														
	23														
1816.00	24														
	25														
1814.00	26														
	27														
1812.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				HA-16-007
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	ED			S94200504
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		3-8-16	1 of 1

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A8

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
R. Church	**3-5-16**	**3-5-16**	**38° 43' 37.5168" / -120° 49' 26.3064"**	**O-16-008**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geocon Consultants, Inc.			**104.00' Lt Sta 40+40 F-Line**	**1895.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hand Auger			**N/A**	**4 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Bulk			**N/A**	**N/A**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Soil Cuttings			**N/A** / **N/A**	**1.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY GRAVEL with SAND (GC); loose; yellowish brown; moist.		Bulk E			100							PA, PI
	1														
1893.00	2		Bottom of borehole at 1.5 ft bgs												
	3		Boring Terminated at planned depth.												
1891.00	4		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	5														
1889.00	6														
	7														
1887.00	8														
	9														
1885.00	10														
	11														
1883.00	12														
	13														
1881.00	14														
	15														
1879.00	16														
	17														
1877.00	18														
	19														
1875.00	20														
	21														
1873.00	22														
	23														
1871.00	24														
	25														
1869.00	26														
	27														
1867.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				**O-16-008**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	**ED**			**S94200504**
PROJECT OR BRIDGE NAME				
Western Placerville Interchange Phase 2				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		**3-8-16**	**1 of 1**

5 BR - STANDARD S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A9

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Pfieffer	**8-15-12**	**8-15-12**	**38° 43' 32.7606" / -120° 49' 33.4302"**	**A-12-001**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration			**19.50' Rt Sta 529+54 RL-2-Line**	**1834.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Solid-Stem Auger			**Speedstar 25**	**4 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Mod Cal (2.4")			**Downhole Hammer 140# 30"**	**80%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Soil Cuttings			**N/A** / **N/A**	**10.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method / Casing Depth	Remarks
	0		CLAYEY SILT (ML/CL); hard; brown; dry; trace fine GRAVEL; medium to fine SAND; (Fill).											
1832.00	2				1.5 2.0		74	100						
1830.00	4		METAMORPHIC ROCK (SHALE), Argillite, very dark gray, yellowish red fracture coatings, moderately weathered, strong, intensely fractured, (Mariposa Formation).											
	5				5.0		56/6"	100						
1828.00	6													
1826.00	8						50/5"	100						
	9		- becomes wet in fractures, red brown fracture coatings.											
1824.00	10						50/4"	100						
			Bottom of borehole at 10.0 ft bgs Boring Terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.											

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REPORT TITLE				HOLE ID
BORING RECORD				**A-12-001**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	**ED**			**S94200503**
PROJECT OR BRIDGE NAME				
Western Placerville Detention Basin				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		**11-4-16**	**1 of 1**

5 BR - STANDARD S9420-05-03 WESTERN PLACERVILLE DETENTION BASIN - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
J. Pfieffer	**8-15-12**	**8-15-12**	**38° 43' 34.521" / -120° 49' 31.2198"**	**A-12-002**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration			**19.60' Lt Sta 561+97 RL-2-Line**	**1836.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**Speedstar 25**	**6 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Mod Cal (2.4")			**Downhole Hammer 140# 30"**	**80%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Soil Cuttings			**13.5 ft** / **13.5 ft on**	**20.2 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method / Casing Depth	Remarks
	0		SANDY SILT (ML); stiff; yellowish red; dry; trace fine GRAVEL; medium to fine SAND; (Residual Soil).		1.0		20	100						
1834.00	2				1.5									
1832.00	4		- becomes multicolored yellowish brown, brown and gray, CLAYEY SILT with SAND and GRAVEL.											
	5		METAMORPHIC ROCK (SHALE), Argillite, gray, trace yellowish brown fracture coatings, intensely weathered, strong, very intensely fractured, (Mariposa Formation).				70	100						
1830.00	6				6.0									
1828.00	8		- becomes moderately weatehred; intensely fractured.											
1826.00	10		- becomes slightly weathered, dark gray, wet in fractures.				86/11"	100						
1824.00	12		- hard drilling.											
1822.00	14		- becomes fresh (unweathered), dark greenish gray.											
1820.00	16						50/3"	100						
1816.00	20		- becomes very strong.				50/2"	100						
	21		Bottom of borehole at 20.2 ft bgs											
1814.00	22		Boring Terminated at planned depth.											
1812.00	24		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.											
1810.00	26													
1808.00	28													
	30													

5 BR - STANDARD S9420-05-03 WESTERN PLACERVILLE DETENTION BASIN - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

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REPORT TITLE				HOLE ID
BORING RECORD				**A-12-002**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	**ED**			**S94200503**
PROJECT OR BRIDGE NAME				
Western Placerville Detention Basin				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		**11-4-16**	**1 of 1**

Figure A11

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
N. Bieniek/J. Pfieffe	**8-15-12**	**8-15-12**	**38° 43' 32.7318" / -120° 49' 33.4668"**	**O-12-003**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geocon Consultants, Inc.			**20.50' Rt Sta 559+50 RL-2-Line**	**1834.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
36" Bucket			**JD 310 Extendahoe**	**N/A**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
			N/A	**N/A**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Soil Cuttings			**N/A** / **N/A**	**10.0 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		CLAYEY SILT (ML/CL); hard; brown; dry; trace fine GRAVEL; medium to fine SAND; (Fill).												
1832.00	2														
	3														
1830.00	4		METAMORPHIC ROCK (SHALE), Argillite, very dark gray, moderately to slightly weathered, strong, intensely to moderately fractured, (Mariposa Formation).												
	5														
1828.00	6														
	7														
1826.00	8														
	9		- becomes wet in fractures, reddish brown fracture coatings.												
1824.00	10		Bottom of borehole at 10.0 ft bgs Test Pit Terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	11														
1822.00	12														
	13														
1820.00	14														
	15														
1818.00	16														
	17														
1816.00	18														
	19														
1814.00	20														
	21														
1812.00	22														
	23														
1810.00	24														
	25														
1808.00	26														
	27														
1806.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				**O-12-003**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	**ED**			**S94200503**
PROJECT OR BRIDGE NAME				
Western Placerville Detention Basin				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		**11-4-16**	**1 of 1**

5 BR - STANDARD S9420-05-03 WESTERN PLACERVILLE DETENTION BASIN - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A12

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
N. Bieniek/J. Pfieffe	**8-15-12**	**8-15-12**	**38° 43' 34.3344" / -120° 49' 31.101"**	**O-12-004**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Geocon Consultants, Inc.			**2.00' Rt Sta 561+97 RL-2-Line**	**1836.0 ft**
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
36" Bucket			**JD 310 Extendahoe**	**N/A**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
			N/A	**N/A**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Soil Cuttings			**7.0 ft** / **7.0 ft on**	**7.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		SANDY SILT (ML); stiff; yellowish red; dry; trace fine, subangular GRAVEL; coarse to fine SAND; (Residual Soil).												
1834.00	2														
	3														
1832.00	4		METAMORPHIC ROCK (SANDSTONE/CONGLOMERATE), gray, multicolored fracture coatings, intensely weathered, strong to very strong, intensely to moderately fractured, (Mariposa Formation).												
1830.00	6		- becomes wet, very strong, moderately weathered, difficult excavating.												
	7														
1828.00	8		Bottom of borehole at 7.5 ft bgs												
	9		Test Pit Terminated due to groundwater at 7 feet.												
1826.00	10		This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2010) except as noted on the Soil or Rock Legend or below.												
	11														
1824.00	12														
	13														
1822.00	14														
	15														
1820.00	16														
	17														
1818.00	18														
	19														
1816.00	20														
	21														
1814.00	22														
	23														
1812.00	24														
	25														
1810.00	26														
	27														
1808.00	28														
	29														
	30														

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REPORT TITLE				HOLE ID
BORING RECORD				**O-12-004**
DIST.	COUNTY	ROUTE	POSTMILE	PROJECT NO.
03	**ED**			**S94200503**
PROJECT OR BRIDGE NAME				
Western Placerville Detention Basin				
BRIDGE NUMBER	PREPARED BY		DATE	SHEET
	B. Perez		**11-4-16**	**1 of 1**

5 BR - STANDARD S9420-05-03 WESTERN PLACERVILLE DETENTION BASIN - CALTRANS FORMAT.GPJ CALTRANS LIBRARY DEC09-UNLOCK.GLB 11/4/16

Figure A13

APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with California Test Methods or generally accepted test methods of the American Society for Testing and Materials (ASTM). The types of the tests performed are listed below:

- In-Place Dry Density and Moisture Content: ASTM D2937 (CTM 226)
- Grain Size Distribution: ASTM D422
- Atterberg Limits: ASTM D 4318
- pH and Resistivity: CTM 643
- Sulfate Content: CTM 417
- Chloride Content: CTM 422
- R-value: CTM 301

TABLE B-1
SUMMARY OF R-VALUE TEST RESULTS
ASTM D 2844

Boring No. (sample depth in feet)	Soil Type (USCS Classification)	R-Value
A-16-001 (2-4.5)	Clayey Sand with Gravel (SC)	21
A-16-005 (2-5)	Clayey Sand with Gravel (SC)	11
O-16-008 (0.5-1.5)	Clayey Gravel with Sand (GC)	47

TABLE B-2
SUMMARY OF SOIL CORROSION PARAMETERS
(CTM 643, CTM 417, CTM 422)

Boring No. (sample depth in feet)	Soil Type (USCS Classification)	Resistivity (ohm-cm)	pH	Chloride (ppm)	Sulfate (ppm)
A-16-001 (7.5)	Clayey Sand with Gravel (SC)	3,400	7.3	61	80

Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Water Content (%)	Dry Density (pcf)
A-16-001-5.0	5				0.075	35.9	6.0	
A-16-001-10.0	10	33	23	10	0.075	38.7	10.0	
A-16-001-15.0	15						4.4	
A-16-001-20.0	20						2.5	
A-16-002-3.0	3						4.3	117.2
A-16-002-3.5	3.5						8.2	109.3
A-16-002-5.0	5						7.9	
A-16-002-10.0	10						7.4	
A-16-003-3	3				0.075	82.8	21.9	89.9
A-16-004-3.0	3						17.5	107.2
A-16-004-5.5	5.5	37	22	15				
A-16-004-6.0	6						13.7	112.9
A-16-005-3.0	3				0.075	41.9	10.7	
A-16-005-3.5	3.5						12.3	112.8
HA-16-006-1.0	1	33	23	10	12.5	63.0		
O-16-008-Bulk E	0	38	23	15	50	38.3		

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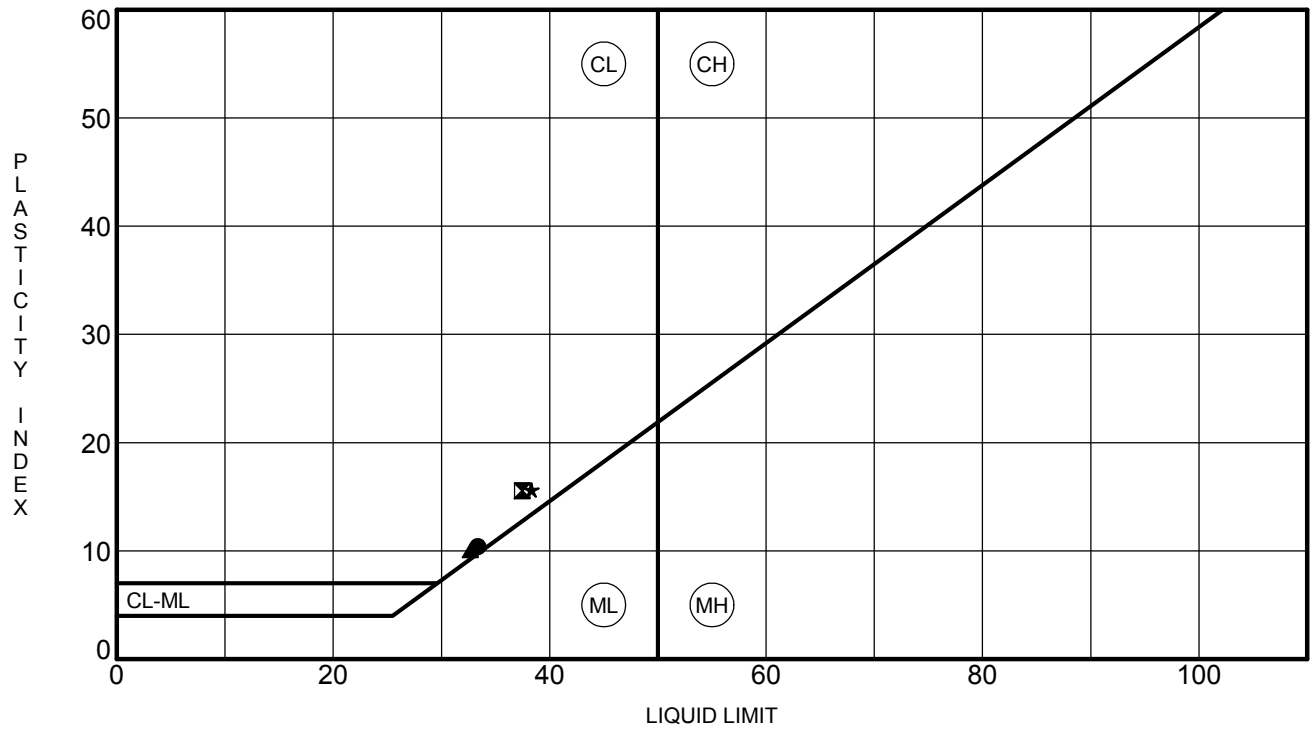
Summary of Laboratory Results

Project Name: Western Placerville Interchange Phase 2

Project Number: S94200504

Figure: B1

US LAB SUMMARY GEOTECH REPORTS (CALTRANS) S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ US_LAB.GDT 11/4/16



	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	% Pass #200 Sieve	Unified Soil Classification Description	Preparation Method
●	**A-16-001-10.0**	**33**	**23**	**10**	**38.7**	**Sandy CLAY**	
⊠	**A-16-004-5.5**	**37**	**22**	**15**		**Lean CLAY**	
▲	**HA-16-006-1.0**	**33**	**23**	**10**	**63.0**	**SANDY LEAN CLAY(CL)**	
★	**O-16-008-Bulk E**	**38**	**23**	**15**	**38.3**	**CLAYEY GRAVEL with SAND(GC)**	

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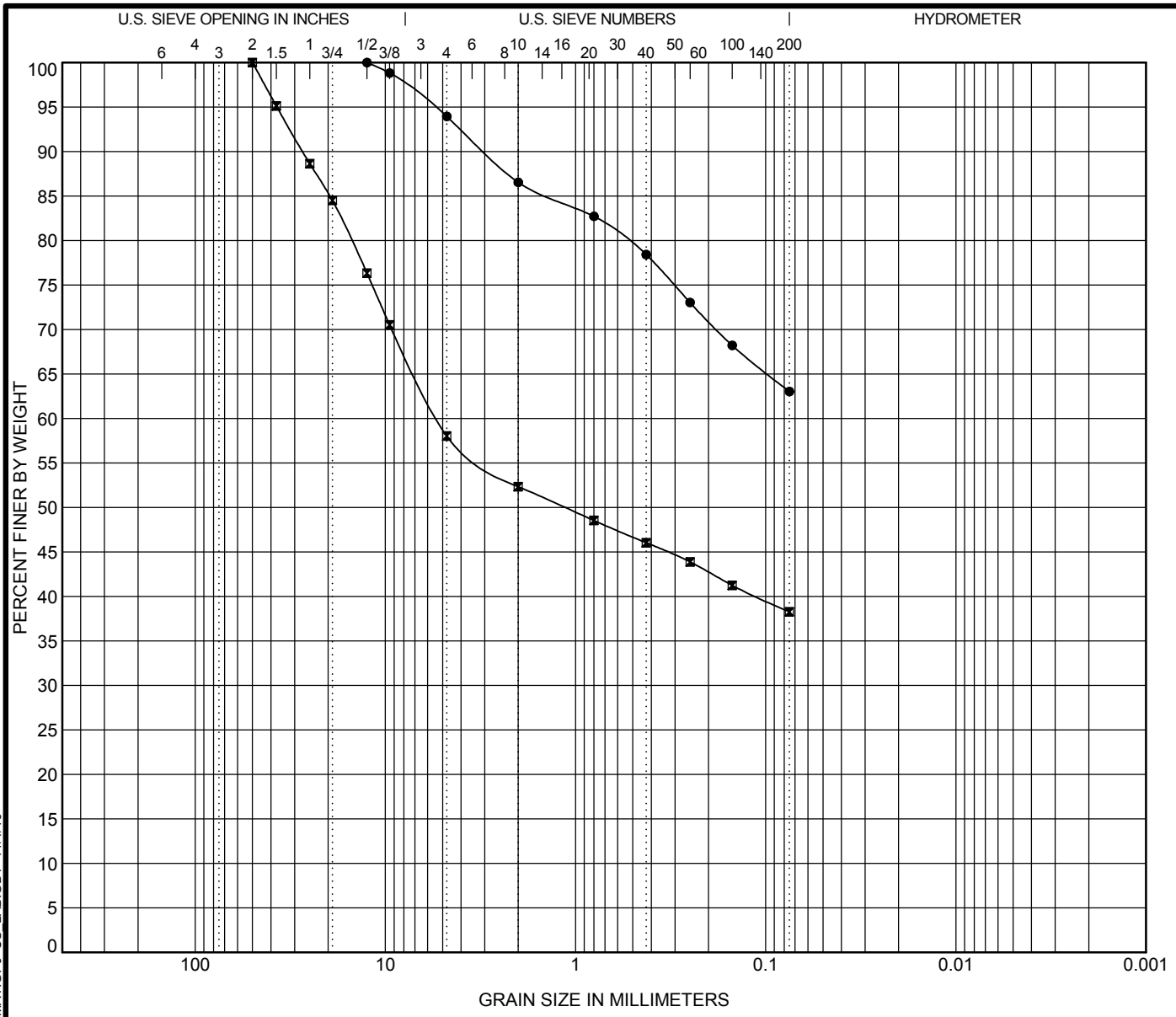
ATTERBERG LIMITS (ASTM D4318)

Project Name: Western Placerville Interchange Phase 2
Location: Placerville, California
Project Number: S94200504
Figure: B2

PI COPY 2 S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ US_LAB.GDT 11/4/16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	**HA-16-006-1.0**	**SANDY LEAN CLAY(CL)**	**33**	**23**	**10**		
⊠	**O-16-008-Bulk E**	**CLAYEY GRAVEL with SAND(GC)**	**38**	**23**	**15**		

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**HA-16-006-1.0**	**12.5**				**6.0**	**30.9**	**63.0**	
⊠	**O-16-008-Bulk E**	**50**	**5.303**			**42.0**	**19.7**	**38.3**	

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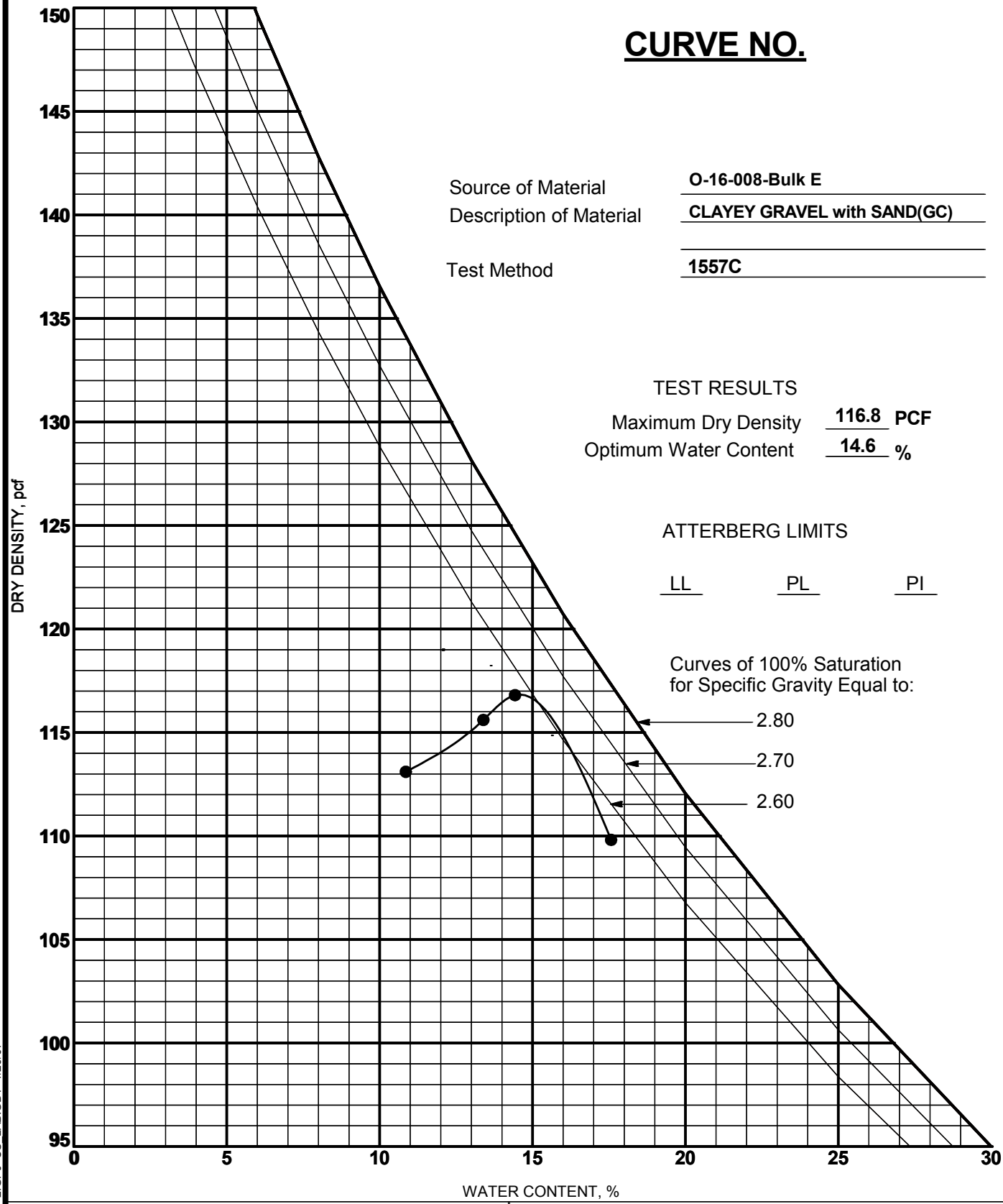
GRAIN SIZE DISTRIBUTION (ASTM D422, D6913)

Project Name: Western Placerville Interchange Phase 2
Location: Placerville, California
Project Number: S94200504
Figure: B3

GRAIN SIZE COPY 2 S9420-05-04 WESTERN PLACERVILLE INTERCHANGE PH 2 - CALTRANS FORMAT.GPJ US_LAB.GDT 11/4/16

CURVE NO.



Source of Material: **O-16-008-Bulk E**

Description of Material: **CLAYEY GRAVEL with SAND(GC)**

Test Method: **1557C**

TEST RESULTS

Maximum Dry Density: **116.8** **PCF**

Optimum Water Content: **14.6** **%**

ATTERBERG LIMITS

LL PL PI

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MOISTURE-DENSITY RELATIONSHIP

Project Name: Western Placerville Interchange Phase 2

Location: Placerville, California

Project Number: S94200504

Figure: B4

US_COMPACTION_COPY 2.GPJ US_LAB.GDT 1/26/07

APPENDIX C

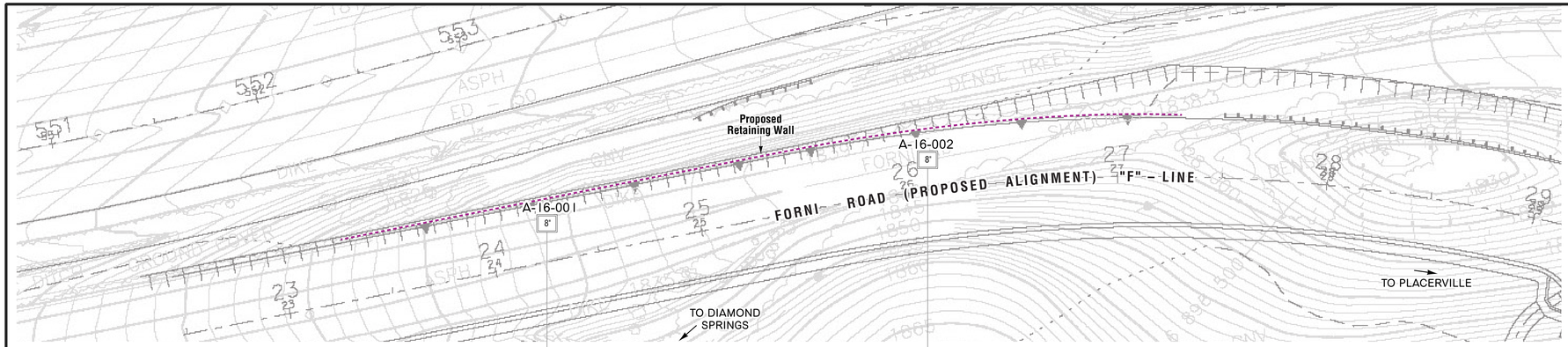
APPENDIX C

LOG OF TEST BORING (LOTB) SHEETS

FOR

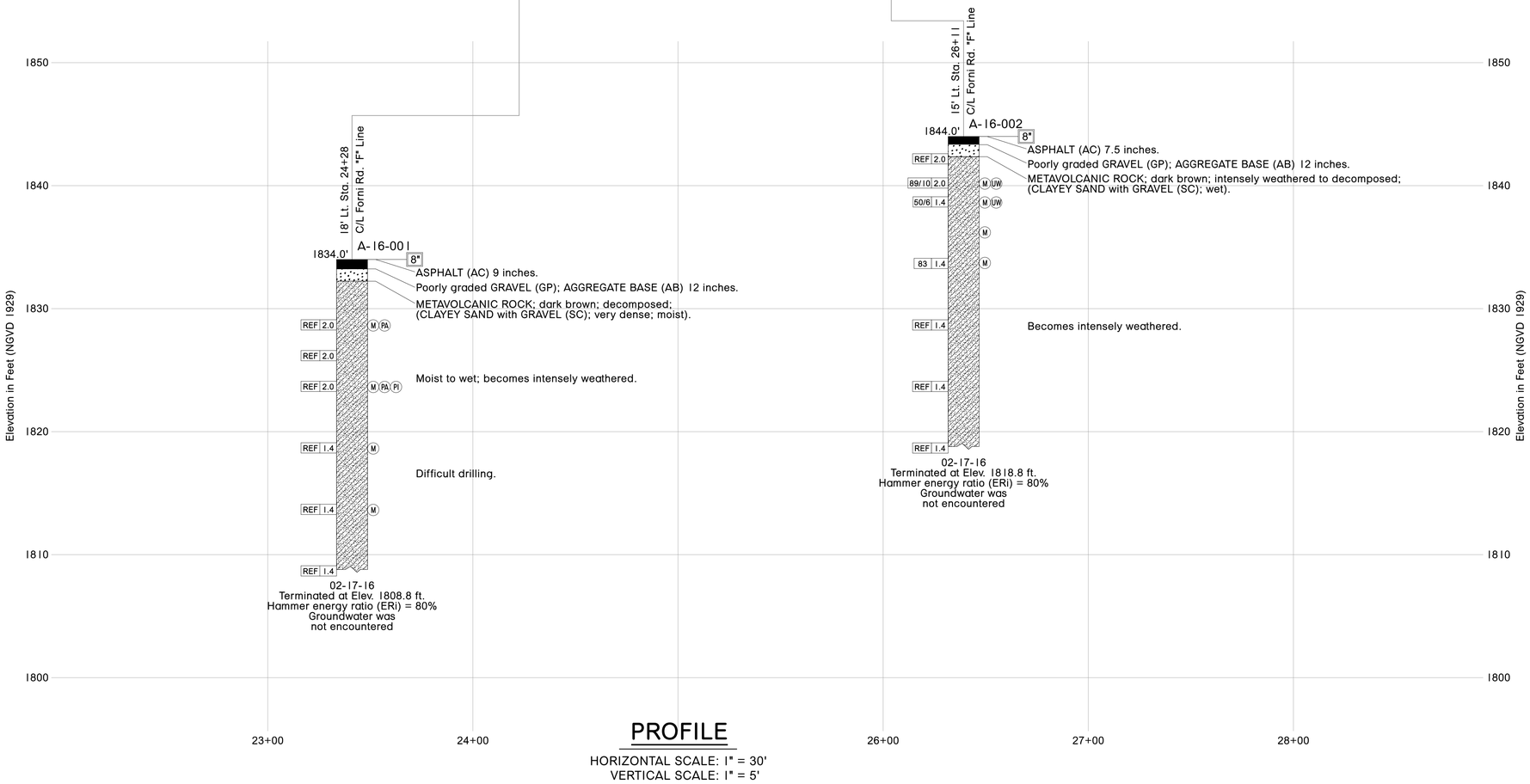
WESTERN PLACERVILLE INTERCHANGE PHASE 2 PROJECT
PLACERVILLE, CALIFORNIA

PROJECT NO. S9420-05-04



PLAN

1" = 30'



PROFILE

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 5'

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
03	ED	50	16.0 - 16.6		

REGISTERED PROFESSIONAL ENGINEER

JEREMY JACOB ZORNE
No. GE2636
GEOTECHNICAL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

11/2/16
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.

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PHONE 916.852.9118 – FAX 916.852.9132

Geocon Project No. S9420-05-04

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

BENCH MARK

DESCRIPTION

Set Berntsen Spike V205 located at N2027792.376 E6896099.564, elevation 1,816.42 feet, NGVD 1929, per sheet SC-1 of undated "Survey Control" 65% plan provided by Dokken Engineering.

NOTES:

1. The consistency/apparent density descriptions are from Figures 2-9 and 2-10 of the Caltrans "Soil and Rock Logging, Classification, and Presentation Manual". These descriptors are based upon the Standard Penetration Test (ASTM D 1586) and split spoon sampling method (ASTM D 3550). The descriptors based on the split-spoon method have been modified by the utilization of the Burmister's (1948) input energy correction equation and NAVFAC DM 7.1.

2. Relatively undisturbed soil samples were obtained by driving a 2.5-inch outside diameter, with a 2-inch inside diameter (Standard California) split-spoon sampler for split-spoon sampling methods and a 2-inch outside diameter split-spoon sampler for Standard Penetration Test Sampling Methods.

3. The boring logs and related information represent the opinion of the professional engineer as to the character of the material at the locations shown. Soil and groundwater conditions between adjacent test holes and at other locations may differ from those shown. Groundwater conditions may change with passage of time.

4. Test boring locations were determined in the field based on staking and pacing from mapped site features. The locations of the explorations should be considered accurate only to the degree implied by the measuring methods used.

5. A downhole 140-pound automatic hammer falling 30 inches was used to drive samplers.

6. Visual classification of earth materials was based on field inspection and was confirmed or revised with laboratory test results.

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	PREPARED FOR THE	DIVISION OF ENGINEERING SERVICES	BRIDGE NO.	WESTERN PLACERVILLE INTERCHANGE
FUNCTIONAL SUPERVISOR	DRAWN BY: D. HANSEN	STATE OF CALIFORNIA	STRUCTURE DESIGN	POST MILES	LOG OF TEST BORINGS (1 OF 3)
NAME:	CHECKED BY: R. LOUTZENHISER	DEPARTMENT OF TRANSPORTATION	DESIGN BRANCH		
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3	CU EA	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES	SHEET OF

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2010)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	ED	50	16.0 - 16.6		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — JEREMY JACOB ZORNE — No. GE2636 — GEOTECHNICAL — STATE OF CALIFORNIA

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

GEOCON CONSULTANTS, INC.
3160 GOLD VALLEY DR - SUITE 800 - RANCHO CORDOVA, CA 95742
PHONE 916.852.9118 - FAX 916.852.9132

Geocon Project No. S9420-05-04

CEMENTATION

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

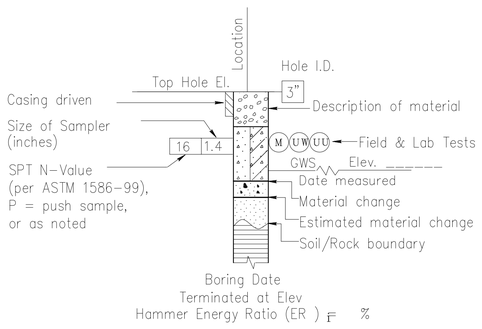
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
◉	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

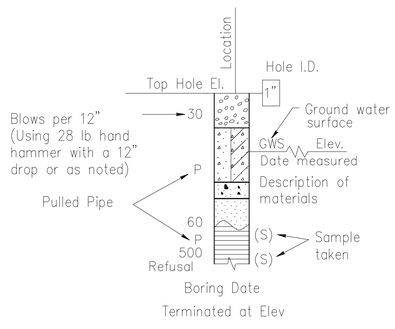
Note: Size in inches.

CONSISTENCY OF COHESIVE SOILS

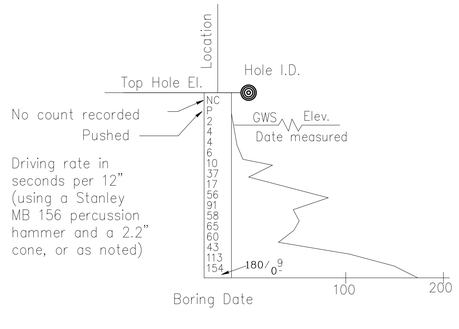
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 – 0.25	0.25 – 0.5	0.12 – 0.25	0.12 – 0.25
Medium Stiff	0.25 to 0.5	0.5 – 1	0.25 – 0.5	0.25 – 0.5
Stiff	0.5 – 1	1 – 2	0.5 – 1	0.5 – 1
Very Stiff	1 – 2	2 – 4	1 – 2	1 – 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



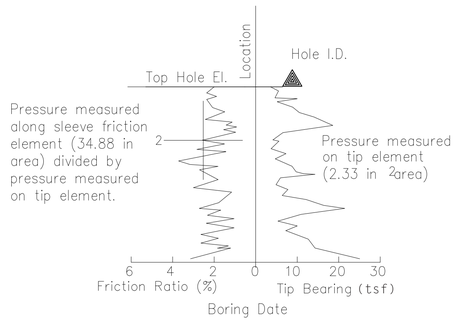
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	PREPARED FOR THE	DIVISION OF ENGINEERING SERVICES	BRIDGE NO.	WESTERN PLACERVILLE INTERCHANGE
FUNCTIONAL SUPERVISOR	DRAWN BY: D. HANSEN	STATE OF CALIFORNIA	STRUCTURE DESIGN	POST MILES	LOG OF TEST BORINGS (2 OF 3)
NAME:	CHECKED BY: R. LOUTZENHISER	DEPARTMENT OF TRANSPORTATION	DESIGN BRANCH		
OGS CIVIL LOG OF TEST BORINGS SHEET	FIELD INVESTIGATION BY: R. CHURCH	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3	CU EA 0E1501	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES / SHEET / OF

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2010)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	ED	50	16.0 - 16.6		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — JEREMY JACOB ZORNE — No. GE2636 — GEOTECHNICAL — STATE OF CALIFORNIA

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PHONE 916.852.9118 - FAX 916.852.9132

Geocon Project No. S9420-05-04

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Greater than 50

MOISTURE

Description	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

Description		Size (in.)
Boulder		Greater than 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		Less than 1/300

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	WESTERN PLACERVILLE INTERCHANGE
FUNCTIONAL SUPERVISOR	DRAWN BY: D. HANSEN	FIELD INVESTIGATION BY: R. CHURCH	DESIGN BRANCH	POST MILES	LOG OF TEST BORINGS (3 OF 3)
NAME:	CHECKED BY: R. LOUTZENHISER				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3	CU EA 0E1501	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES	SHEET OF

APPENDIX D

APPENDIX D

CALTRANS COMMENTS AND RESPONSES

FOR

WESTERN PLACERVILLE INTERCHANGE PHASE 2 PROJECT
PLACERVILLE, CALIFORNIA

PROJECT NO. S9420-05-04

Office of Geotechnical Engineering
Comment & Response Form

(Revised 10/21/09)

General Project Information (OSFP Liaison to complete)	**Review Phase** (OSFP Liaison to complete)	**Reviewer Information** (Reviewer Liaison to complete)
Dist: EA: 03-37281 (E-Fis 0314000301) **Project Name: Western Placerville Interchange Phase II** **Senior Engineer: _____** **Phone:_____** **e-mail:** ***xxxxx@dot.ca.gov***	**__ PSR/PDS (Review No.__)** **__ APS/PSR (Review No.__)** **__ APS/PR (Review No.__)** **__ Type Selection** **_X_ 65% PS&E Unchecked Details** **__ PS&E (Review No _)** **__ Construction** **__ Other:**	**Reviewer Name: Fernando De Haro** **Functional Unit: 3657** **Cost Center: 059** **Phone Number: 916-227-1069** **e-mail: *Fernando.de.haro@dot.ca.gov*** **Date of Review: 08/04/2016** **Structure Name*:_____** **Br No*: _____** (*Use if necessary to when comment sheets are by individual structure)

Consultant Information (to be filled in by Consultant)

Consulting Company Lead (First and Last Name)	**Consulting Company Name**	**Phone Number**	**e-mail**	**Response Date**
Ronald Loutzenhiser	**Geocon**	**(916) 852-9132**		

#	Doc./ Page (See Note 1)	Section	Reviewer Comments	Consultant Responses	✓
1	GDR Page 8	5.3	It states that 6-inh hollow-stem augers were used. The LOTBs and Boring records show 8 inches. Make proper corrections.	The report text has been revised.	
2	GDR Page 19	8.4	Third Paragraph – It mentions that a maximum toe pressure of 3,200 psf is considered appropriate… Include the Retaining Wall foundation loading information and present the loads in a table format as required per Memo To Designers 4-1.	We have presented the foundation information per the table format in "Foundation Reports for Earth Retaining Systems" (August 2015).	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	FWP = Falsework Plans
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	FWC = Falsework Calcs.

✓= Comment Resolved
(for Reviewer's use)

Submittal Data (Reviewer to complete)

Dist-EA:03-37281 E-FIS#:0314000301 Reviewer: Fernando De Haro Str Name: _____

Date of Review: 07/28/16 Functional Unit: 3657 Br No. _____

3	GDR	Appendix A	It states that the boring records were prepared in accordance with the 2010 Soil Logging Manual. The following items are not in accordance with the soil logging manual: A) Borehole Location information - Section 5.2.3.4 B) Borehole Identification names – Section 2.4 C) Hammer Efficiency is missing - Section 5.2.3.4 D) Key Sheet for the sample symbols - Section 5.2.3.1 E) Rock description - Section 2.6 Make proper corrections.	The Boring Records have been revised.	
4	LOTB	LOTB Sheet 1 of 3	A) The signature block shows District 05. It should be 03. B) For the borehole location, add "F" Line to C/L Forni Road. Make proper corrections.	The LOTB has been revised.	
5	LOTB	Sheet 1 of 3	The presented blow counts in the LOTBs don't match the information presented in the Boring Records. Boring records show "REF". Make proper corrections.	The LOTB has been revised	
6	LOTB	Sheet 1 of 3	The LOTBs show ID = 2.0 for the Mod. Cal. It should be 2.4 inches. Make proper corrections.	The LOTB note has been revised.	
7	LOTB	Sheet 1 of 3	Note 1 mentions that the soil consistency and apparent density descriptors are based on the SPT uncorrected hammer energy ratio. The soil logging manual requires these descriptors be based on the N_{60} values – Section 2.5. Make proper corrections.	The LOTB note has been revised.	
8	LOTB	Sheet 1 of 3	Note 4 mentions that borehole elevations are approximate based on the topographic base map. Boreholes are to be surveyed as required in Section 5.23.3.d of the Soil Logging Manual. If the boreholes were surveyed, remove note 4.	The LOTB note has been removed.	
9			Submit an electronic copy of the GDR.		