YOUNGDAHL CONSULTING GROUP, INC.
Building Innovative Solutions
1234 Glenhaven Court, El Dorado Hills, Ca 95762
5750 Arabian Lane, Loomis, Ca 95650
ph 916.933.0633 fx 916.933.6482
www.youngdahl.net
25 YEARS

El Dorado County Department of Transportation
2850 Fairlane Court, Building C
Placerville, California 95667

Project No. E09015.013
30 September 2011

Attention: Mr. Adam Bane, P.E.

Subject: PLEASANT VALLEY ROAD AT PATTERSON DRIVE SIGNALIZATION
Pleasant Valley Road at Patterson Drive, El Dorado, El Dorado County, California
GEOTECHNICAL ENGINEERING STUDY FOR INTERSECTION SIGNALIZATION

References:
1. Phase I Environmental Site Assessment, prepared by Youngdahl Consulting Group, Inc. dated 29 July 2011 (Project No. E09015.013).
2. Project Plans for the Construction of Pleasant Valley Road (SR 49) / Patterson Drive Intersection Signalization, prepared by Couth of El Dorado Department of Transportation.
3. Work Order No. 08-1814-12 prepared by El Dorado County Department of Transportation, executed 23 June 2011, Client Project No. 73362.

Dear Mr. Bane:

In accordance with your authorization, Youngdahl Consulting Group, Inc. has performed a geotechnical engineering study for the project site located at the intersection of Pleasant Valley Road at Patterson Drive in El Dorado, El Dorado County, California. The purpose of this study was to observe and document the site conditions related to the proposed intersection signalization, as well as develop geotechnical and geologic information and design criteria for the proposed project.

Based upon our site reconnaissance and limited subsurface explorations within the existing roadway alignments, we believe the primary geotechnical issues to be addressed consist of stability of roadbank cuts, removal and reprocessing of the existing roadway materials, shallow slate bedrock conditions, and drainage related issues associated with the shallow bedrock. Other geotechnical issues may become more apparent during grading operations which are not listed above. The descriptions, findings, conclusions, and recommendations provided in this report are formulated as a whole, and specific conclusions or recommendations should not be derived or used out of context. Please review the limitations and uniformity of conditions section of this report.

This report has been prepared for the exclusive use of the El Dorado County Department of Transportation and their consultants, for specific application to this project, in accordance with generally accepted geotechnical engineering practice. Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,
Youngdahl Consulting Group, Inc.

REGISTERED PROFESSIONAL ENGINEER
MATTHEW J. GROSS
No. 77630
Exp. 06-30-13
CIVIL
STATE OF CALIFORNIA

Matthew J. Gross, P.E.
Project Engineer

Distribution: (4) to Client

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GEOTECHNICAL ENGINEERING STUDY
for
PLEASANT VALLEY ROAD AT PATTERSON DRIVE SIGNALIZATION

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering study performed for the proposed signalization project at the intersection of Pleasant Valley Road at Patterson Drive in El Dorado, El Dorado County, California. Refer to Figure A-1 for a vicinity map for the project site.

Purpose and Scope

The purpose of this study was to prepare a geotechnical engineering study to address the existing site conditions and to develop geotechnical information and design criteria for the proposed project. The scope of this study includes the following:

- A review of geotechnical and geologic data available to us at the time of our study;
- A field study consisting of a visual site reconnaissance and limited subsurface exploration to observe and document the surface and near-surface soil and asphalt conditions;
- Engineering analysis of the data and information from literature review and our previous field study;
- Development of recommendations for site preparation and grading, and geotechnical design criteria for retaining structures, underground facilities, and asphalt concrete pavements.
- Preparation of this report summarizing our findings, conclusions, and recommendations regarding the geotechnical aspects for the project.

2.0 PROJECT UNDERSTANDING

Based on the layout plans (Reference 2) we understand that the proposed project includes the reconstruction of a portion of Pleasant Valley Road and Patterson Drive in order to incorporate additional turning lanes, deceleration/acceleration lanes, and signal lights. As part of the alterations to the roadway, we also understand that a retaining wall is proposed along the west side of Pleasant Valley Road and a new culvert crossing is proposed to cross Pleasant Valley Road approximately 400 feet north of the intersection.

3.0 FINDINGS

Surface Observations

The majority of the project site is along the alignment of Pleasant Valley Road extending approximately 450 north and south of the intersection with Patterson Drive. Pleasant Valley Road generally slopes toward the south at a gentle gradient with the west side bordered by a soil road embankment which may be a historic roadway prism fills and on the east side by slightly higher terrain cut to expse slate bedrock south of Patterson Drive and a Chevron Station to the north. The north end of the project has an existing culvert connecting a wetland area to the west (north of the embankment) to the outflow on the east side of the road.

The asphalt along Pleasant Valley Road appears to be moderately cracked in the intersection and has sustained rutting at the stop signs with identifiable wheel tracks leading to and from the intersection.

The cut slope along Pleasant Valley Road at Ryan Drive was observed to be approximately 4 to 7 feet high and cut to an orientation of approximately 1H:1V (Horizontal:Vertical). The cut slope surface exposed moderately to highly weathered slate metatuff with very closely spaced foliations, widely spaced joints, and was weakly indurated. Some evidence of topple failures were observed on the slope east of the utility pole.

Patterson Drive appeared to have minor cracking along the alignment and sustained significant alligator cracking at the intersection where the roadway joins with Pleasant Valley Road and where utility lines were installed after the asphalt concrete pavement.

Subsurface Conditions
Our field study included a site reconnaissance by a representative of our firm followed by a limited subsurface exploration program conducted on 23 August 2011. The exploration program included the coring through the asphalt concrete and advancing 5 exploratory hand augered borings at the approximate locations shown on Figure A-2 through A-5, Appendix A. The corings and hand augers were performed to document the thicknesses of the existing asphalt concrete and aggregate baserock of Pleasant Valley Road.

The subsurface conditions generally consisted of asphalt concrete pavement overlying subgrade soils along Pleasant Valley Road and asphalt concrete pavement overlying aggregate baserock on subgrade soils along Patterson Drive. The pavement along Pleasant Valley Road appeared to be placed in 3 layers with distinctive thicknesses which are reported in the following table. The pavement along Patterson Drive appeared to be placed with 2 layers. A more detailed description of the subsurface conditions encountered during our subsurface exploration is presented in the table below.

Table 1: Subsurface Conditions

Location				Depth (ft)	Thickness
Core #1	STA 7+75	CL	Pleasant Valley	AC - Layer 1	5 inches
				AC - Layer 2	2¼ inches
				AC - Layer 3	1½ inches
				AB	None
Core #2	STA 13+10	NW Bound	Pleasant Valley	AC - Layer 1	4½ inches
				AC - Layer 2	2 inches
				AC - Layer 3	2 inches
				AB	None
Core #3	STA 15-20	SE Bound	Pleasant Valley	AC - Layer 1	4½ inches
				AC - Layer 2	6¼ inches
				AC - Layer 3	2¾ inches
				AB	None
Core #4	STA 15+80	NW Bound	Pleasant Valley	AC - Layer 1	7¾ inches
				AC - Layer 2	3½ inches
				AC - Layer 3	1½ inches
				AB	None
Core #5	STA 14+20	NW Bound	Patterson	AC - Layer 1	1 inch
				AC - Layer 2	2¼ inches
				AB	14 inches

Groundwater Conditions
Groundwater was not encountered during our explorations. However, subsurface water conditions typically vary in the foothill region. Our experience in the area shows that water may

be perched on less weathered rock and present in the fractures, and seams of the weathered rock found beneath the site at varying times of the year.

Laboratory Testing
The laboratory testing of collected samples was directed towards determining the physical and engineering properties of the soil underlying the site. A description of the tests performed and their results are presented in Appendix B. The following tests were performed:

- Maximum Dry Density (ASTM D1557);
- Direct Shear (ASTM D3080);
- R-Value tests (California Test Method 301F);
- Corrosivity Suite (CA DOT Test #'s 417, 422, and 643).

Soil Expansion Potential
The materials encountered in our explorations are non-plastic materials which are considered to be relatively non-expansive. We do not anticipate that special design considerations for expansive soils will need to be addressed for the design or construction of the proposed improvements. If expansive soils are encountered which were not disclosed during our study, recommendations can be made at that time based on our observations.

Soil Corrosivity
A corrosivity testing suite consisting of Soil pH, resistivity, sulfate, and chloride content tests were performed on selected soil samples collected during our site exploration. We are not corrosion specialists and recommend that the results be evaluated by a qualified corrosion expert. The laboratory test results (provided by Sunlab, Inc.) are provided in Appendix B and are summarized in Table 3, below.

Table 2: Corrosivity Summary

Location	Depth (ft)	Soil pH	Minimum Resistivity ohm-cm (x1000)	Chloride (ppm)	Sulfate (ppm)	Caltrans Environment	ACI Environment
Culvert	Surface	7.08	3.75	39.8	19.5	Low	Negligible

According to Caltrans Corrosion Guidelines Version 1.0, September 2003, the test results appear to indicate a low potential for corrosive environment. According to the 2010 California Building Code Section 1907.7.6 and ACI 318 Table 4.3.1, the test results indicate the onsite soils have a negligible potential for sulfide attack of concrete. Accordingly, Type I//II Portland cement is appropriate for use in concrete construction. A certified corrosion engineer should be consulted to review the above tests and site conditions in order to develop specific mitigation recommendations if metallic pipes or structural elements are designed to be in contact with or buried in soil.

Geologic Conditions
The geologic portion of this report included a review of geologic data pertinent to the site, and an interpretation of our observations and the exploratory test pits excavated during the field study. The site is located within the western foothills region of the Sierra Nevada Mountain Range. According to the General Geologic Map of the Folsom 15-Minute Quadrangle (R.C. Loyd, et. al., 1984) this portion of the foothills and the project area are underlain by slates of the Mariposa Formation of the Mesozoic Era.

Seismicity
According to the Fault Activity Map of California and Adjacent Areas (Jennings, 2010) and the Peak Acceleration from Maximum Credible Earthquakes in California (CDMG, 1992), no active faults or Earthquake Fault Zones (Special Studies Zones) are located on the project site. No evidence of recent or active faulting was observed during our field study. The nearest mapped faults to the site are related to the Bear Mountains and Melones Fault Zones. Splays of the Bear Mountains Fault Zone are mapped approximately 9 and 20 kilometers west of the site and splays of the Melones Fault Zone are mapped approximately 2 kilometers west and 3 kilometers east of the site. The nearest mapped active fault to the site is the West Tahoe Fault located about 18 kilometers to the east-northeast.

Based on our literature review of shear-wave velocity characteristics of geologic units in California (Wills and Silva; August 1998: Earthquake Spectra, Volume 14, No. 3) and subsurface interpretations, we recommend that the project be designed in accordance with the 2010 California Building Code (CBC), Chapter 16. This site is classified as Site Class C in accordance with Table 1613.5.2.

Earthquake Inducted Liquefaction, Slope Instability, and Surface Rupture Potential
Liquefaction is the sudden loss of soil shear strength and sudden increase in porewater pressure caused by shear strains, as could result from an earthquake. Research has shown that saturated, loose to medium-dense sands with a silt content less than about 25 percent located within the top 40 feet are most susceptible to liquefaction and surface rupture/lateral spreading. Slope instability can occur as a result of seismic ground motions and/or in combination with weak soils and saturated conditions.

Due to the absence of a permanent elevated groundwater table, the relatively low seismicity of the area, the relatively shallow depth to bedrock, the potential damage due to site liquefaction, slope instability and surface rupture are considered negligible. The existing slopes on the project site were observed to have adequate vegetation on the slope face, appropriate drainage away from the slope face, and no apparent tension cracks or slump blocks in the slope face or at the head of the slope. No other indications of slope instability such as seeps or springs were observed. For the above-mentioned reasons, mitigation for these potential hazards is not generally practiced in the geographic vicinity of the project site.

4.0 RECOMMENDATIONS

General
Based upon the results of our field explorations and analysis, it is our opinion that construction of the proposed improvements is feasible from a geotechnical standpoint, provided the recommendations contained in this report are incorporated into the design plans and implemented during construction. The native soils and/or rock, if composed of like materials and processed and compacted as recommended below, are considered suitable for support of the planned improvements. The existing utility trenches appear to have settled and therefore, we recommend that the trenches be overexcavated and recompacted to mitigate for potential future settlement. Recommendations are presented below for the overexcavation and recompaction of the existing fill materials on the site.

4.1 SITE GRADING AND IMPROVEMENTS

Site Preparation
Preparation of the project site should involve demolition, site drainage controls, dust control, clearing, stripping, existing utility trenches, and exposed grade compaction considerations. The following paragraphs state our geotechnical comments and recommendations concerning site preparation.

Demolition: As part of the demolition operation, any concrete and asphalt concrete separated from the other debris, and adequately broken down in particle size, may be mixed thoroughly with native soils and placed as engineered fill as described below. If this option is exercised, a representative from our firm should be contacted to observe the adequacy of grading operations associated with the breaking and mixing of these elements.

Site Drainage Controls: We recommend that initial site preparation involve intercepting and diverting any potential sources of surface or near-surface water within the construction zones. Because the selection of an appropriate drainage system will depend on the water quantity, season, weather conditions, construction sequence, and contractor's methods, final decisions regarding drainage systems are best made in the field at the time of construction. All drainage and/or water diversion performed for the site should be in accordance with the Clean Water Act and applicable Storm Water Pollution Prevention Plan.

Dust Control: Dust control provisions should be provided for as required by the local jurisdiction's grading ordinance (i.e. water truck or other adequate water supply during grading).

Clearing and Stripping: Clearing and stripping operations should remove all organic laden materials including trees, bushes, root balls, root systems, and any soft or loose material generated from removal operations. Surface grass stripping operations are necessary for improvement adjacent to the roadway alignment based upon the observations during our site visit. Short or mowed dry grasses may be pulverized and lost within fill materials provided no concentrated pockets of organics result. It is the responsibility of the grading contractor to remove excess organics from the fill materials. No more than 2 percent of organic material, by weight, should be allowed within the fill materials at any given location.

General site clearing should also include removal of any loose or saturated materials from the proposed structural improvement and pavement areas. A representative of our firm should be present during site clearing operations to identify the location and depth of potential fills not disclosed by this report, to observe removal of deleterious materials, and to identify any existing site conditions which may require mitigation prior to site development. Preserved trees may require tree root protection which should be addressed on an individual basis by a qualified arborist.

Addressing Existing Utility Trenches: Based on the cracking and surface differential of the asphalt concrete pavement, the utility trenches within the vicinity of the intersection appear to have settled. Therefore, we recommend that the backfill within the utility trenches be overexcavated 36 inches from subgrade (or to the top of the shading, whichever is shallower) then be recompacted to a minimum of 95 percent relative compaction per the ASTM D1557 test method. Additional excavation depth may be required based on the conditions observed during the overexcavation procedures.

Addressing Existing Fills: A review of existing fills was not included in the scope of work. If existing fills are encountered within the roadway during grading and are not addressed during recompaction of the existing utilityes, the fills should be over-excavated down to firm native materials. Any depressions extending below final grade resulting from the removal of fill materials or other deleterious materials should be properly prepared as discussed below and backfilled with engineered fill. Prior to placement of engineered fill, the exposed soil surfaces receiving fills should be scarified to a minimum depth of 8 inches, moisture conditioned as necessary, and compacted to at least 90 percent of the maximum dry density based on the ASTM D1557 test method.

Exposed Grade Compaction: Exposed soil grades following initial site preparation activities should be scarified to a minimum depth of 8 inches and compacted to the requirements for engineered fill. Prior to placing fill, the exposed subgrades should be in a firm, unyielding state. Any localized zones of soft or pumping soils observed within a subgrade should either be scarified and recompacted or be overexcavated and replaced with engineered fill as detailed in the engineered fill section below.

Soil Moisture Considerations

The near-surface soils may become partially or completely saturated during the rainy season. Grading operations during this time period may be difficult since compaction efforts may be hampered by saturated materials. It is, therefore, suggested that consideration be given to the seasonal limitations and costs of winter grading operations on the site. Special attention should be given regarding the drainage of the project site. If the project is expected to work through the wet season, the contractor should install appropriate temporary drainage systems at the construction site and should minimize traffic over exposed subgrades due to the moisture-sensitive nature of the on-site soils. During wet weather operations, the soil should be graded to drain and should be sealed by rubber tire rolling to minimize water infiltration.

Excavation Characteristics

Bedrock conditions were observed at the surface within the vicinity of the proposed roadway improvements. Based on the bedrock exposure, we anticipate that excavations at this site will require the use of larger equipment such as a CAT 330 equipped with a single shank ripper for trench excavating and a CAT D9 or D10 equipped with a single shank or multi shank ripper for grading of the roadway alignment.

Several parameters may influence the excavatability of the hard rock including but not limited to joint orientation, rock quality, and operator control. When hard rock is encountered, we should be contacted to provide additional recommendations prior to performing an alternative such as blasting.

Engineered Fills

All materials placed as fills on the site should be placed as "Engineered fill" observed and compacted as described in the following paragraphs.

Suitability of Onsite Materials: We anticipate that a small amount of onsite soils will be generated during grading and wall construction operations. We expect that soil generated from excavations on the site, excluding deleterious material, may be used as engineered fill provided the material does not exceed the maximum size specifications listed below.

Engineered fills should consist of soils or soils mixed with rocks and/or rock fragments less than 12 inches in maximum dimension. The rock fragments should be thoroughly mixed with soil so that a uniform mixture of rocks and compacted soil is obtained without voids. Boulders over 12 inches in maximum dimension should be disposed of to an offsite location or mechanically reduced to less than 12 inches in maximum dimension. The contractor should avoid placing rocks or rock fragments larger than 12 inches in maximum dimension within zones of proposed underground facilities.

Fill Placement and Compaction: All areas proposed to receive fill should be scarified to a minimum depth of 8 inches, moisture conditioned as necessary, and compacted to at least 90 percent of the maximum dry density based on the ASTM D1557 test method. The fill should be placed in thin horizontal lifts not to exceed 12 inches in uncompacted thickness. The fill should be moisture conditioned as necessary and compacted to a relative compaction of not less than 90 percent based on the ASTM D1557 test method. The upper 8 inches of fills placed under proposed pavement areas should be compacted to a relative compaction of not less than 95 percent based on the ASTM D1557 test method. Expansive clays, if encountered, should not be placed within the upper three feet of building pad and subgrade level. Alternatively, clays may be mixed thoroughly with less expansive on site materials (silts, sands, and gravels). Proper disposition of clays on site should be verified by a representative of Youngdahl Consulting Group, Inc.

Fill soil compaction should be verified by means of in-place density tests performed during fill placement so that adequacy of soil compaction efforts may be evaluated as earthwork progresses.

Import Materials: If imported fill material is needed for this project, import material should be approved by the Geotechnical Engineer prior to transporting it to the project. It is preferable that import material meet the following requirements:

1. Plasticity index not to exceed 12.
2. "R"-value of equal to or greater than 40.
3. Should not contain rocks larger than 6 inches in diameter.
4. Not more than 15% passing through the No. 200 sieve.

If these requirements are not met, additional testing and evaluation may be necessary to determine the appropriate design parameters for foundations, pavement and other improvements.

Slope Configuration and Grading

The project site is proposed to have minor cuts and fill with a maximum slope orientation of 2H:1V (Horizontal:Vertical). Generally a cut slope orientation of 2H:1V is considered stable with the material types encountered on the site. A fill slope constructed at the same orientation is considered stable if compacted to the engineered fill recommendations as stated in the recommendations section of this report. All slopes should have appropriate drainage and vegetation measures to minimize erosion of slope soils. Steeper gradients may be achievable if prepared in accordance with cut-slope construction evaluation prepared by our firm and provided in this report as Attachment C.

Placement of Fills on Slopes: Placement of fill material on natural slopes should be stabilized by means of keyways and benches. Where the slope of the original ground equals or exceeds 5H:1V, a keyway should be constructed at the base of the fill. The keyway should consist of a trench excavated to a depth of at least two feet into firm, competent materials. The keyway trench should be at least eight feet wide or as designated by the Geotechnical Engineer.

Benches should be cut into the original slope as the filling operation proceeds. Each bench should consist of a level surface excavated at least six feet horizontally into firm soils or four feet horizontally into rock. The rise between successive benches should not exceed 36 inches. The need for subdrainage should be evaluated at the time of construction.

Slope Face Compaction: All slope fills should be laterally overbuilt and cut back such that the required compaction is achieved at the proposed finish slope face. As a less preferable alternative, the slope face could be track walked or compacted with a wheel. If this second alternative is used, additional slope maintenance may be necessary.

Slope Drainage: Surface drainage should not be allowed to flow uncontrolled over any slope face. Adequate surface drainage control should be designed by the project civil engineer in accordance with the latest applicable edition of the CBC. All slopes should have appropriate drainage and vegetation measures to minimize erosion of slope soils.

Underground Improvements

Trench Excavation: Trenches or excavations in soil should be shored or sloped back in accordance with current OSHA regulations prior to persons entering them. The potential use of a shield to protect workers cannot be precluded. Refer to the Excavation Characteristics section of Site Grading and Improvements of this report for anticipated excavation conditions.

Backfill Materials: Backfill materials for utilities should conform to the local jurisdiction's requirements. It should be realized that permeable backfill materials will likely carry water at some time in the future.

When backfilling within structural footprints, compacted low permeability materials are recommended to be used a minimum of 5 feet beyond the structural footprint to minimize moisture intrusion. If a permeable material is used as backfill within this zone, subdrainage mitigation may be required. In addition, if the structure is oriented below the roadway and associated utilities, grout cutoffs or plug and drains around all utility penetrations are useful to keep moisture out from underneath the structure.

Backfill Compaction: All backfill, placed after the underground facilities have been installed, including wet/dry utilities and lateral connections, should be compacted a minimum of 90 percent relative compaction. Compaction should be accomplished using lifts which do not exceed 12 inches. However, thickness of the lifts should be determined by the contractor. If the contractor can achieve the required compaction using thicker lifts, the method may be judged acceptable based on field verification by a representative of our firm using standard density testing procedures. Lightweight compaction equipment may require thinner lifts to achieve the required densities.

Drainage Considerations: In areas with the potential for a perched groundwater condition (i.e. shallow bedrock), underground utilities can become collections points for subsurface water. When these conditions are present, we recommend permanent subdrainage mitigation measures be installed. Such measures may include plug and drains within the utility trenches to collect and convey water to the storm drain system or other approved outlet. Temporary dewatering measures may be necessary and could include the installation of submersible pumps and/or point wells.

4.2 DESIGN RECOMMENDATIONS

Seismic Criteria
Based on the 2010 California Building Code, Chapter 16, and our previous site investigation findings, the following seismic parameters are recommended from a geotechnical perspective for structural design. The final choice of design parameters, however, remains the purview of the project structural engineer.

Chapter 16	Seismic Parameter	Recommended Value
Table No. 1613.5.2	Site Class	B
Figure No. 1613.5(3)*	Short-Period MCE at 0.2s, S_S	0.40g
Figure No. 1613.5(4)*	1.0s Period MCE, S_1	0.19g
Table No. 1613.5.3(1)**	Site Coefficient, F_a	1.0
Table No. 1613.5.3(2)**	Site Coefficient, F_v	1.0
Equation 16-36	Adjusted MCE Spectral Response Parameters, $S_{MS} = F_aS_s$	0.40
Equation 16-37	Adjusted MCE Spectral Response Parameters, $S_{M1} = F_vS_1$	0.19
Equation 16-38	Design Spectral Acceleration Parameters, $S_{DS} = ⅔S_{MS}$	0.26
Equation 16-39	Design Spectral Acceleration Parameters, $S_{D1} = ⅔S_{M1}$	0.13
Table 1613.5.6(1)	Seismic Design Category (Short Period) Occupancy I to III	B
Table 1613.5.6(1)	Seismic Design Category (Short Period) Occupancy IV	C
Table 1613.5.6(2)	Seismic Design Category (1-Second Period) Occupancy I to III	B
Table 1613.5.6(2)	Seismic Design Category (1-Second Period) Occupancy IV	C

* Values from Figures 1613.5(3)/(4) are derived from the National Earthquake Hazards Reduction Program (NEHRP) for Site Class B soil profiles.
** Values from Tables 1613.3(1)/(2) are adjustments to account for the Site Class (Project Specific) provided in Table 1613.5.2.

Retaining Walls
In our opinion, a conventional shallow will provide adequate support for the proposed retaining walls if the subgrades are properly prepared as described in the Site Grading and Improvement section. We offer the following comments and recommendations for purposes of footing design and construction. The provided minimums do not constitute a structural design of foundations which should be performed by the structural engineer. Our firm should be afforded the opportunity to review the project grading and foundation plans to confirm the applicability of the recommendations provided below. Modifications to these recommendations may be made at the time of our review. In addition to the provided recommendations, foundation design and construction should conform to applicable sections of the 2010 California Building Code.

Bearing Capacities: An allowable dead plus live load bearing pressure of 3,500 psf may be used for design of footings based on firm native soils or engineered fills. An allowable dead plus live load bearing pressure of 4,000 psf may be used for design of footings based on weathered bedrock. These capacities are based upon minimum foundation widths of 24 inches wide and depths of 12 inches below lowest adjacent grade. The above allowable pressures are for support of dead plus live loads and may be increased by 1/3 for short-term wind and seismic loads.

Resisting Forces: Lateral forces on the retaining walls may be resisted by passive pressure acting against the side of the wall footing and/or friction between the soil and the bottom of the footing. A passive equivalent fluid weight of 350 pcf may be used against the sides of shallow footings founded in firm native soil or engineered fill and 400 psf for bedrock. A friction factor of 0.35 may be used at the base of footings founded on firm native soil or engineered fill and 0.45 for bedrock. If friction and passive pressures are combined, the lesser value should be reduced by 50 percent. All backfill placed behind retaining walls or against retaining wall footings should be compacted in accordance with the "Engineered Fill" section of this report.

Retaining Wall Lateral Pressures: Based on our observations and testing, the retaining wall should be designed to resist lateral pressure exerted from a soil media having an equivalent fluid weight as follows.

Wall Type	Wall Slope Configuration	Equivalent Fluid Weight (pcf)	Surcharge Load (psf)*	Lateral Pressure Coefficient	Earthquake Loading (plf)***
Free Cantilever	Flat	35	per structural	0.27	$4H^2$ Applied 0.6H above the base of the wall
	2H:1V	50	per structural	0.39	
Restrained**	Flat	55	per structural	0.43	

* The surcharge loads should be applied as uniform loads over the full height of the walls as follows: Surcharge Load (psf) = (q) (K), where q = surcharge in psf, and K = coefficient of lateral pressure. Final design is the purview of the project structural engineer.

** Restrained conditions shall be defined as walls which are structurally connected to prevent flexible yielding, or rigid wall configurations (i.e. walls with numerous turning points) which prevent the yielding necessary to reduce the driving pressures from an at-rest state to an active state.

*** Section 1803.5.12 of the 2010 California Building Code states that a determination of lateral pressures on basement and retaining walls due to earthquake loading shall be provided for structures to be designed in Seismic Design Categories D, E or F (Load value derived from Wood (1973) and modified by Whitman (1991)).

Wall Drainage: The above criteria are based on fully drained conditions. For these conditions, we recommend that a blanket of filter material be placed behind all proposed walls. The blanket of filter material should be a minimum of 12 inches thick and should extend from the bottom of the wall to within 12 inches of the ground surface. The filter material should conform to Class One, Type B permeable material as specified in Section 68 of the California Department of Transportation Standard Specifications, current edition. A clean ⅜ inch angular gravel or ¾ inch crushed rock is also acceptable, provided filter fabric is used to separate the open graded gravel/rock from the surrounding soils. The top 12 inches of wall backfill should consist of a compacted native soil cap. A filter fabric should be placed on top of the gravel filter material to separate it from the native soil cap. A 4 inch diameter drain pipe should be installed near the bottom of the filter blanket with perforations facing down. The drainpipe should be underlain by at least 4 inches of filter-type material. As an alternative to drain pipe, where deemed appropriate, weep holes may be provided. Adequate gradients should be provided to discharge water that collects behind the retaining wall to a controlled discharge system. Prior to placement of the drainage blanket, additional consideration should be given to the use of a waterproofing membrane such as bituthene or equivalent membrane system on the outside of the wall.

Footing Configuration: Foundation reinforcement should be provided by the structural engineer. The reinforcement schedule should account for typical construction issues such as load consideration, concrete cracking, and the presence of isolated irregularities.. Where foundations are constructed within a cut-fill transition, soil to rock interface, or over minor surface irregularities (i.e. point load conditions within resistant bedrock), as a consideration to span these localized differential irregularities, we suggest that structural footing reinforcing steel be doubled top and bottom extending a minimum of 10 feet continuous length on both sides of the transition/irregularity.

All footings should be founded below an imaginary 2H:1V plane projected up from the bottoms of adjacent footings and/or parallel utility trenches, or to a depth that achieves a minimum horizontal clearance of 6 feet from the outside toe of the footings to the slope face, whichever requires a deeper excavation.

Foundations for the retaining wall are anticipated to be a minimum of 24 inches width and be founded a minimum of 18 inches below the lowest adjacent grade.

Subgrade Conditions: Footings should never be cast atop soft, loose, organic, slough, debris, nor atop subgrades covered by ice or standing water. A representative of our firm should be retained to observe all subgrades during footing excavations and prior to concrete placement so that a determination as to the adequacy of subgrade preparation can be made.

Shallow Footing / Wall Backfill: All footing/wall backfill soil should be compacted to at least 90 percent of the maximum dry density (based on ASTM D1557).

Pavement Design
We understand that asphalt concrete pavements will be used for the associated roadway improvements. We further understand that the majority of the existing roadway will remain following construction with some portions saw cut and removed to accommodate for the construction of turn lanes. The following comments and recommendations are given for pavement design and construction purposes. All pavement construction and materials used should conform to applicable sections of the latest edition of the California Department of Transportation Standard Specifications.

Subgrade Compaction: After installation of any underground facilities, the upper 8 inches of subgrade soils under pavements sections should be compacted to a minimum relative compaction of 95 percent based on the ASTM D1557 test method at a moisture content near or above optimum. Aggregate bases should also be compacted to a minimum relative compaction of 95 percent based on the aforementioned test method. All subgrades and aggregate base should be proof-rolled with a full water truck or equivalent immediately before paving, in order to verify their condition.

Design Criteria: Critical features that govern the durability of a pavement section include the stability of the subgrade; the presence or absence of moisture, free water, and organics; the fines content of the subgrade soils; the traffic volume; and the frequency of use by heavy vehicles. Soil conditions can be defined by a soil resistance value, or "R"-Value, and traffic conditions can be defined by a Traffic Index (TI).

Design Values: Table 1 provides recommended pavement sections based on the R-Value test (California Test Method 301F) performed on a bulk sample representative of the silty SAND materials expected to be exposed at subgrade as well as our experience with similar materials in the area. The R-Value based on laboratory testing for exudation pressure was 55; however, due to expansion pressures generated during testing, the design R-Value was reduced to 40. The recommended design thicknesses presented in Table 1 were calculated in accordance with the methods presented in the latest update of the Sixth Edition of the California Department of Transportation Highway Design Manual. A varying range of traffic indices are provided for use by the project Civil Engineer for roadway design.

If clay soils are encountered, we should review pavement subgrades to determine the appropriateness of the provided sections, and provide additional pavement design recommendations as field conditions dictate. Even minor clay constituents will greatly reduce the design R-Value.

Design values provided are based upon properly drained subgrade conditions. Although the R-Value design to some degree accounts for wet soil conditions, proper surface and landscape drainage design is integral in performance of adjacent street sections with respect to stability and degradation of the asphalt.

Modifications to the surface are anticipated to correct for the existing rutting conditions along Pleasant Valley Road. The cause for the observed rutting was not explored at this time and may occur during the surface modifications. Full depth pavement sections may be possible; however additional testing of the asphalt concrete pavement conditions and consistency may be required for these recommendations. Additionally studies may be performed under a separate contract if this information is desired.

Table 1. Recommended Pavement Design Thickness

Design Traffic Indices*	Location	Alternative Pavement Sections (Inches)	
		Asphalt Concrete **	Aggregate Base ***
7.5	Paterson Drive	5.5	4.0
10.0	Pleasant Valley Road	7.5 8.0	5.0 4.0

* Design indices provided by client
** Asphaltic Concrete: Meets specifications for Caltrans Type B Asphaltic Concrete
*** Aggregate Base: Meets specifications for Caltrans Class II Aggregate Base (R-Value=minimum 78)

Drainage Considerations

In order to maintain the engineering strength characteristics of the soil presented for use in this Geotechnical Engineering Study, maintenance of the site will need to be performed. This maintenance generally includes, but is not limited to, proper drainage and control of surface and subsurface water which could affect structural support and fill integrity. A difficulty exists in determining which areas are prone to the negative impacts resulting from high moisture conditions due to the diverse nature of potential sources of water; some of which are outlined in the paragraph below. We suggest that measures be installed to minimize exposure to the adverse effects of moisture, but this will not guarantee that excessive moisture conditions will not affect the structure.

Some of the diverse sources of moisture could include water from annual rainfall, offsite construction activities, runoff from impermeable surfaces, collected and channeled water, and water perched in the subsurface soils on the bedrock horizon or present in fractures in the weathered rock horizon. Some of these sources can be controlled through drainage features installed either by the Department or the Contractor. Others may not become evident until they, or the effects of the presence of excessive moisture, are visually observed on the property.

All grades should provide rapid removal of surface water runoff; ponding water should not be allowed on or adjacent to foundations or other structural improvements (during and following construction). All soils placed against foundations during finish grading should be compacted to minimize water infiltration. Finish grading should include positive drainage away from all foundations. Surface drainage design is the purview of the Civil Engineer. Review of drainage design and implementation adjacent to the improvements is recommended as performance of these improvements are crucial to the performance of the foundation and construction improvements.

Post Construction: All drainage related issues may not become known until after construction is complete. Therefore, some mitigation measures may be necessary following site development. On foothill areas constructed in shallow bedrock conditions, seepage may not be apparent until post construction. In order to mitigate these conditions additional subdrainage measures may be necessary.

5.0 DESIGN REVIEW AND CONSTRUCTION MONITORING

The design plans and specifications should be reviewed and accepted by Youngdahl Consulting Group, Inc., hereinafter described as the Geotechnical Engineer, prior to contract bidding. A review should be performed to determine whether the recommendations contained within this report are still applicable and/or are properly reflected and incorporated into the project plans and specifications.

Construction Monitoring

Construction monitoring is a continuation of the findings and recommendations provided in this report. It is essential that our representative be involved with all grading activities in order for us to provide supplemental recommendations as field conditions dictate. Youngdahl Consulting Group, Inc. should be notified at least two working days before site clearing or grading operations commence, and should observe the stripping of deleterious material, overexcavation of existing fills, and provide consultation to the Grading Contractor in the field.

Post Construction Monitoring

As described in Post Construction section of this report, all drainage related issues may not become known until after construction is complete. Youngdahl Consulting Group, Inc. can provide consultation services upon request that relate to proper design and installation of drainage features during and following site development.

6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. This report has been prepared for the exclusive use of El Dorado County Department of Transportation for specific application to the Pleasant Valley Road at Patterson Drive Signalization Project project. Youngdahl Consulting Group, Inc. has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Youngdahl Consulting Group, Inc. makes no other warranty, expressed or implied.

2. As of the present date, the findings of this report are valid for the property studied. With the passage of time, changes in the conditions of a property can occur whether they be due to natural processes or to the works of man on this or adjacent properties. Legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may cause this report to be invalid, wholly or partially. Therefore, this report should not be relied upon after a period of three years without our review nor should it be used or is it applicable for any properties other than those studied.

3. Section 107.3.4.1 of the 2010 California Building Code states that, in regard to the design professional in responsible charge, the building official shall be notified in writing by the owner if the registered design professional in responsible charge is changed or is unable to continue to perform the duties.

   WARNING: Do not apply any of this report's conclusions or recommendations if the nature, design, or location of the facilities is changed. If changes are contemplated, Youngdahl Consulting Group, Inc. must review them to assess their impact on this report's applicability. Also note that Youngdahl Consulting Group, Inc. is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of this report's subsurface data or engineering analyses without the express written authorization of Youngdahl Consulting Group, Inc.

4. The analyses and recommendations contained in this report are based on limited windows into the subsurface conditions and data obtained from a limited subsurface exploration in the existing pavement area. The methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Samples cannot be relied on to accurately reflect the strata variations that usually exist between sampling locations. Should any variations or undesirable conditions be encountered during the development of the site, Youngdahl Consulting Group, Inc., will provide supplemental recommendations as dictated by the field conditions.

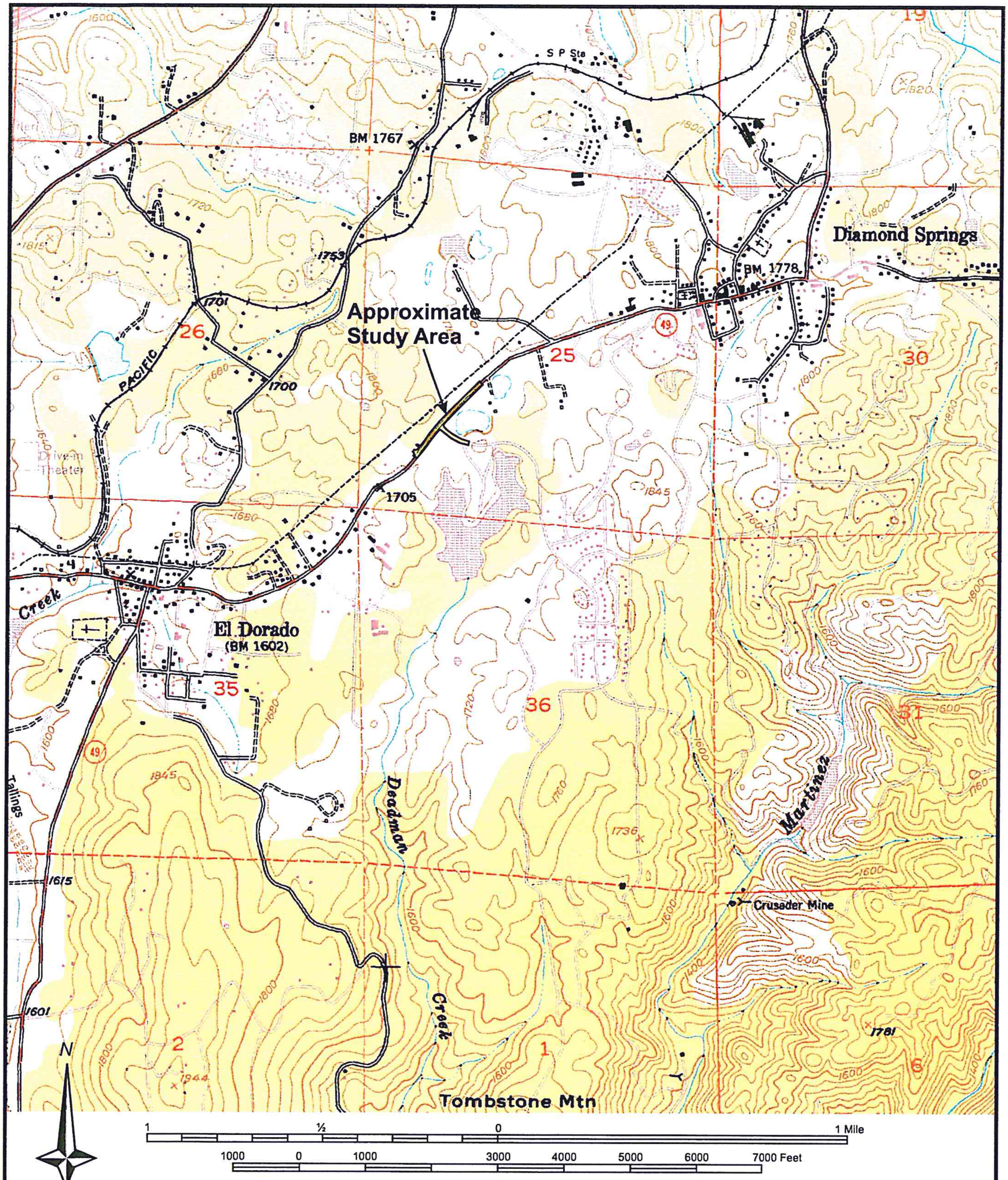
5. The recommendations included in this report have been based in part on assumptions about strata variations that may be tested only during earthwork. Accordingly, these recommendations should not be applied in the field unless Youngdahl Consulting Group, Inc. is retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method. Youngdahl Consulting Group, Inc. cannot assume responsibility or liability for the adequacy of its recommendations when they are used in the field without Youngdahl Consulting Group, Inc. being retained to observe construction. Unforeseen subsurface conditions containing soft native soils, loose or previously placed non-engineered fills should be a consideration while preparing for the grading of the property. It should be noted that it is the responsibility of the owner or his/her representative to notify Youngdahl Consulting Group, Inc., in writing, a minimum of 48 hours before any excavations commence at the site.

CHECKLIST OF RECOMMENDED SERVICES

	Item Description	Recommended	Not Anticipated
1	Provide foundation design parameters	Included	
2	Review grading plans and specifications	✓	
3	Review foundation plans and specifications	✓	
4	Observe and provide recommendations regarding demolition	✓	
5	Observe and provide recommendations regarding site stripping	✓	
6	Observe and provide recommendations on moisture conditioning removal, and/or recompaction of unsuitable existing soils	✓	
7	Observe and provide recommendations on the installation of subdrain facilities	✓	
8	Observe and provide testing services on fill areas and/or imported fill materials	✓	
9	Review as-graded plans and provide additional foundation recommendations, if necessary	✓	
10	Observe and provide compaction tests on storm drains, water lines and utility trenches	✓	
11	Observe foundation excavations and provide supplemental recommendations, if necessary, prior to placing concrete	✓	
12	Observe and provide moisture conditioning recommendations for foundation areas and slab-on-grade areas prior to placing concrete		✓
13	Provide design parameters for retaining walls	Included	
14	Provide finish grading and drainage recommendations	Included	
15	Provide geologic observations and recommendations for keyway excavations and cut slopes during grading	✓	
16	Excavate and recompact all test pits within structural areas		✓

APPENDIX A

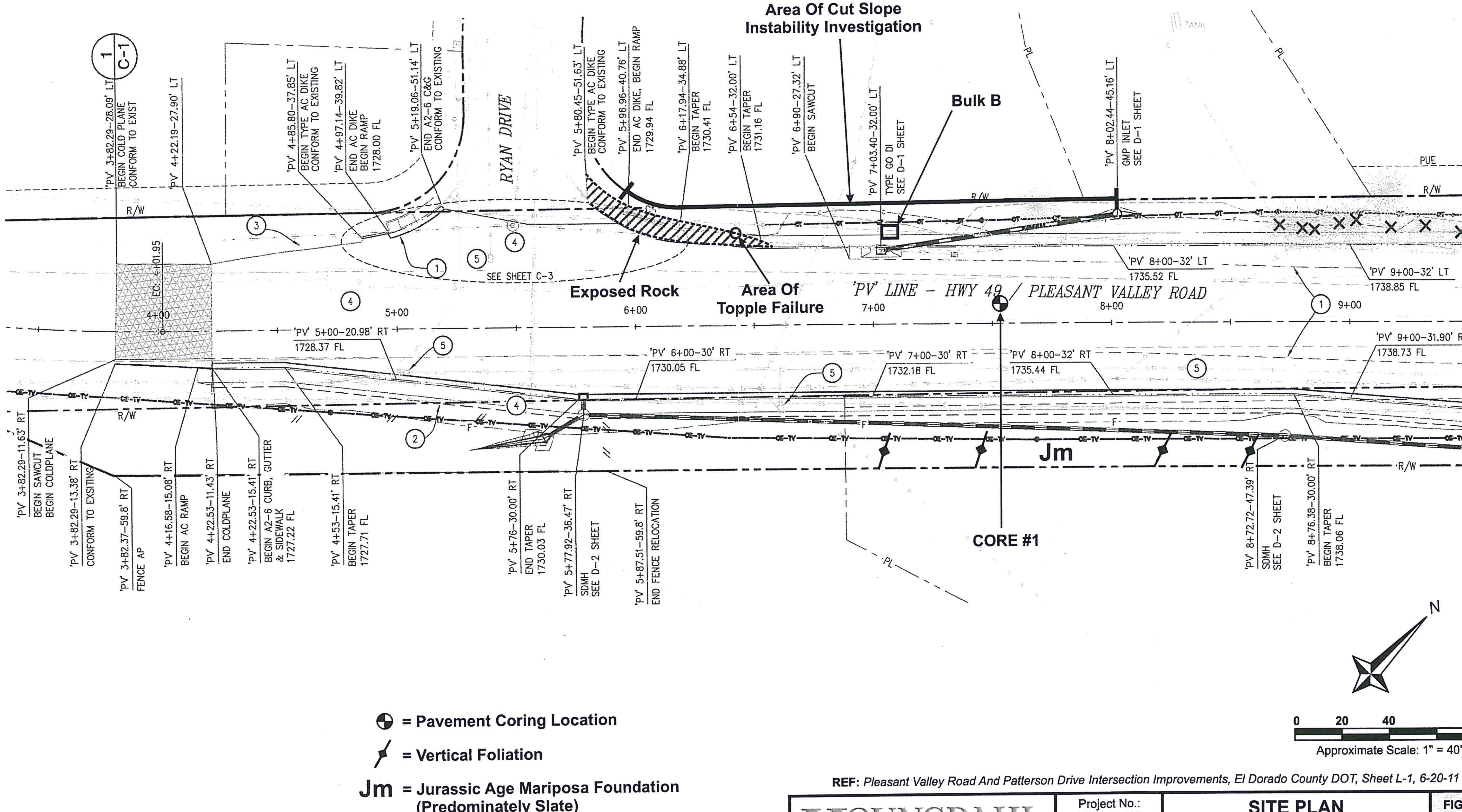
Vicinity Map
Site Plan



Scale: 1:24,000

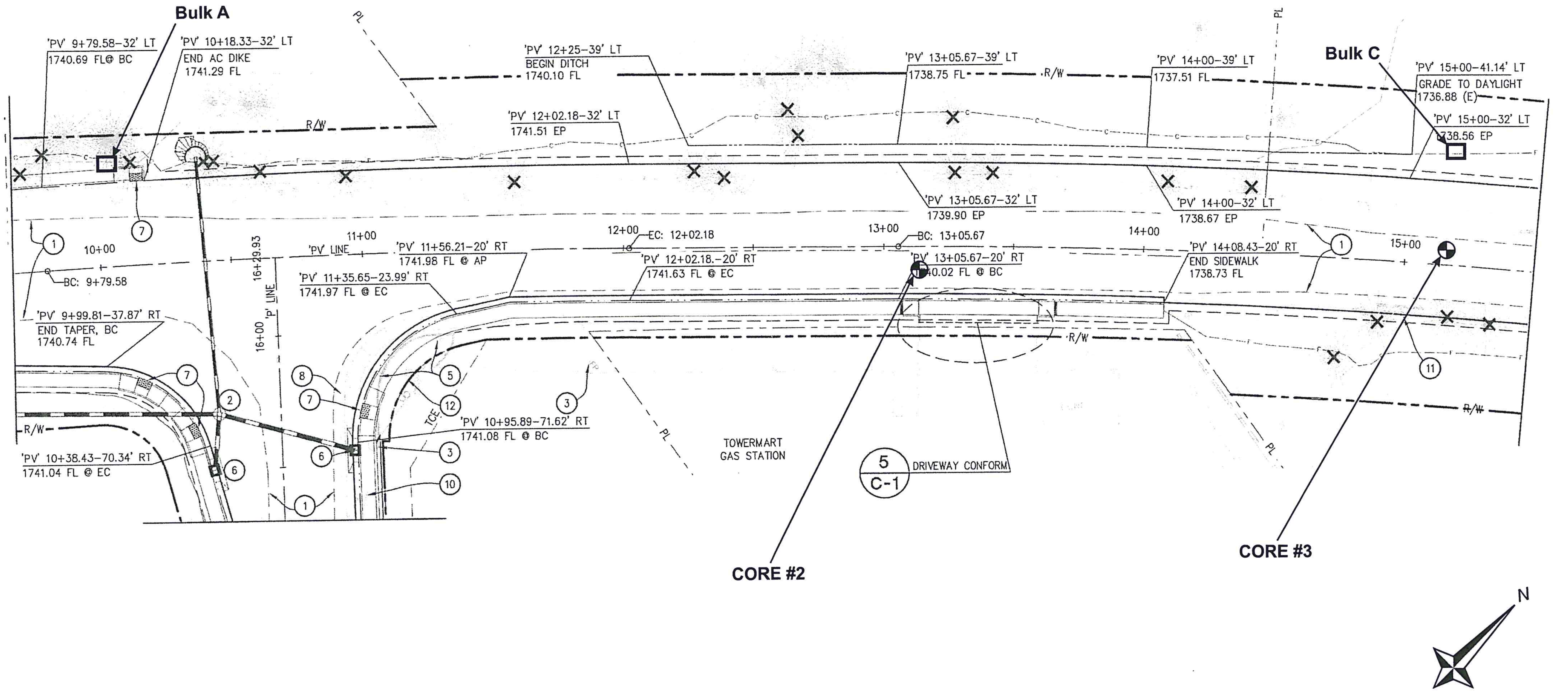
BASE MAP REFERENCE: *U.S.G.S. 7.5 Minute Topographic Series, Placerville Quadrangle, Dated 1949 (PR 1973)*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E09015.013	**VICINITY MAP**	**FIGURE**
	September 2011	**Pleasant Valley Road - Patterson Drive** Diamond Springs, California	**A-1**



REF: *Pleasant Valley Road And Patterson Drive Intersection Improvements, El Dorado County DOT, Sheet L-1, 6-20-11*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E09015.013	SITE PLAN	FIGURE
	September 2011	Pleasant Valley Road - Patterson Drive Diamond Springs, El Dorado, California	A-2



⊕ = Pavement Coring Location

= Vertical Foliation

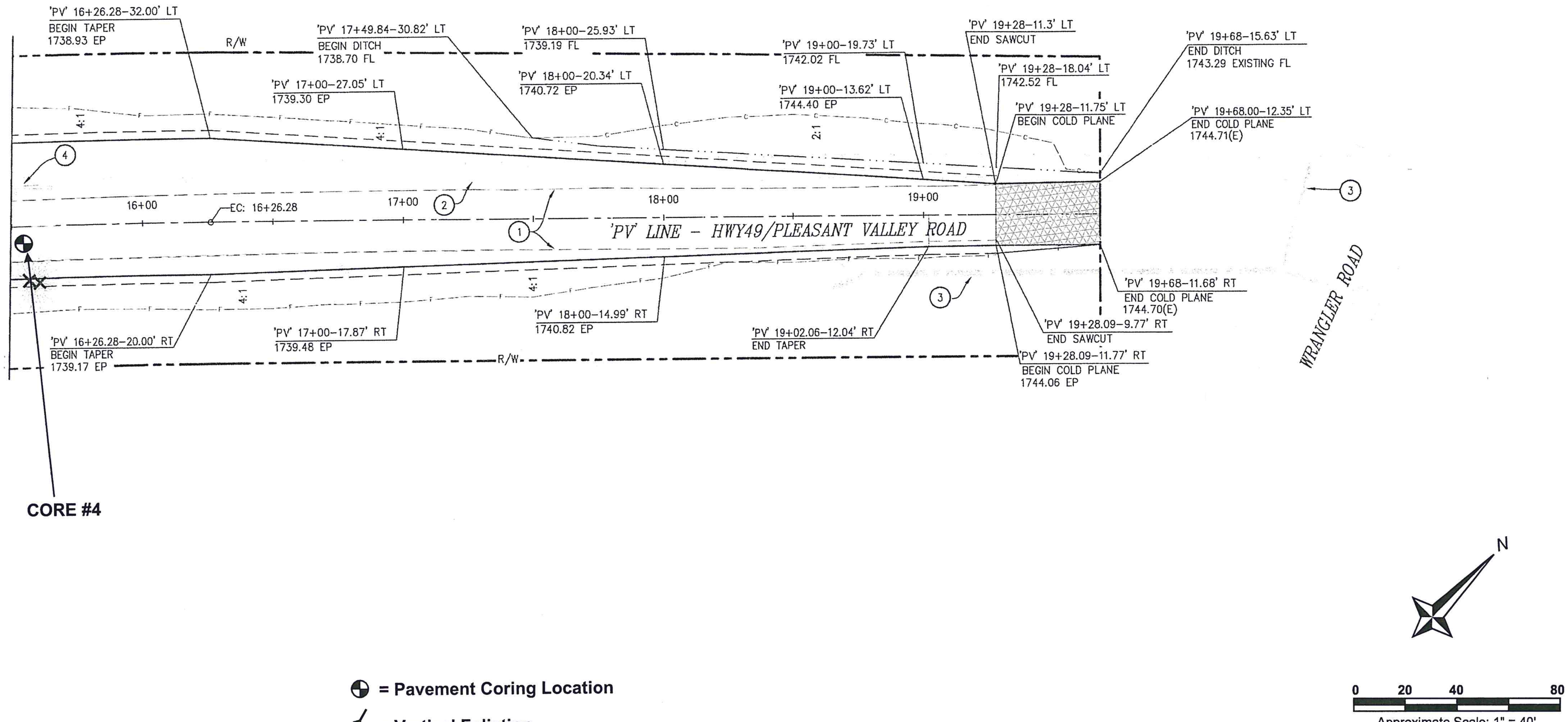
Jm = Jurassic Age Mariposa Foundation (Predominately Slate)

0 20 40 80

Approximate Scale: 1" = 40'

REF: *Pleasant Valley Road And Patterson Drive Intersection Improvements, El Dorado County DOT, Sheet L-2, 5-26-11*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E09015.013 September 2011	**SITE PLAN** **Pleasant Valley Road - Patterson Drive** Diamond Springs, El Dorado, California	**FIGURE** **A-3**



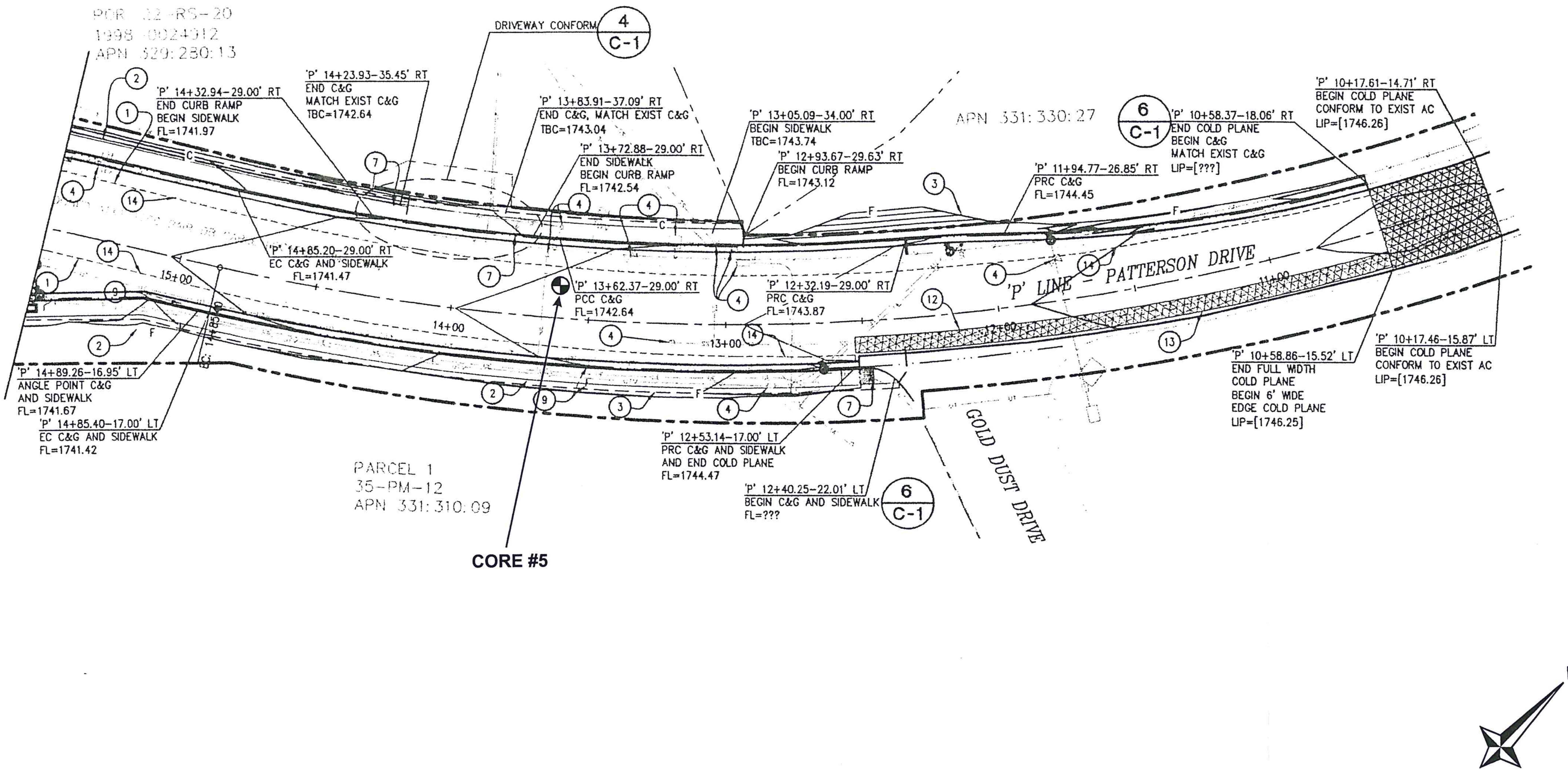
⊕ = Pavement Coring Location

= Vertical Foliation

Jm = Jurassic Age Mariposa Foundation (Predominately Slate)

REF: *Pleasant Valley Road And Patterson Drive Intersection Improvements, El Dorado County DOT, Sheet L-3, 6-20-11*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E09015.013 **September 2011**	**SITE PLAN** **Pleasant Valley Road - Patterson Drive** Diamond Springs, El Dorado, California	**FIGURE** **A-4**



⊕ = Pavement Coring Location

= Vertical Foliation

Jm = Jurassic Age Mariposa Foundation (Predominately Slate)

0 20 40 80

Approximate Scale: 1" = 40'

REF: *Pleasant Valley Road And Patterson Drive Intersection Improvements, El Dorado County DOT, Sheet L-4, 10-5-10*

YOUNGDAHL CONSULTING GROUP, INC. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING	Project No.: E09015.013 / September 2011	**SITE PLAN** Pleasant Valley Road - Patterson Drive, Diamond Springs, El Dorado, California	FIGURE **A-5**

APPENDIX B

Laboratory Testing

Direct Shear Test
Modified Proctor Test
R-Value Test
Corrosivity Test

Introduction
Our laboratory testing program for this evaluation included numerous visual classifications, a direct shear, modified Proctor, Resistance Value, and corrosivity tests. The following paragraphs describe our procedures associated with each type of test. Graphical results of certain laboratory tests are enclosed in this appendix. The contents of this appendix shall be integrated with the geotechnical engineering study of which it is a part. They shall not be used in whole or in part as a sole source for information or recommendations regarding the subject site.

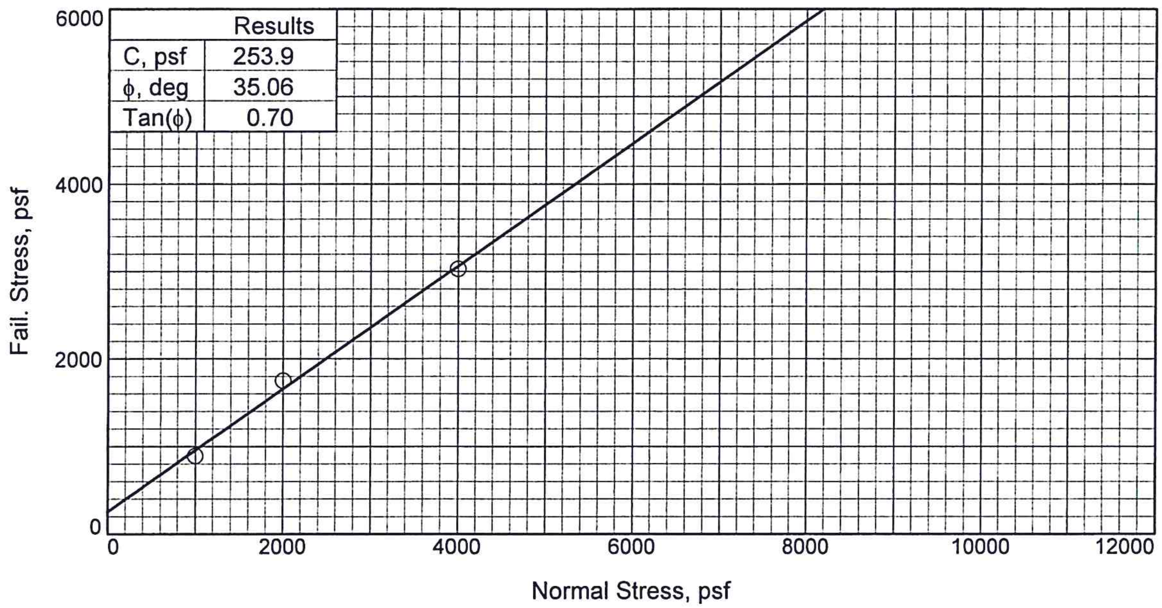
Laboratory Testing
Visual Classification Procedures
Visual soil classifications were conducted on all samples in the field and on selected samples in our laboratory. All soils were classified in general accordance with the Unified Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types.

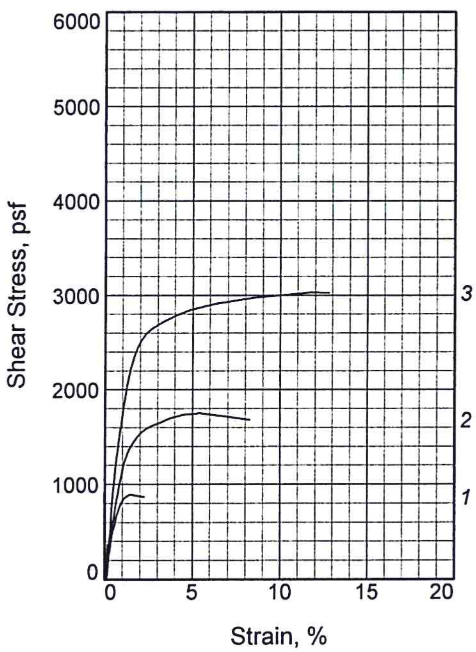
Soil Strength Determination Procedures
The strength parameters of the foundation soils were based on a direct shear test (ASTM D3080) performed on a representative remolded sample of the near-surface soils. The results of these tests are presented on Figure B-1, this Appendix.

Maximum Dry Density Determination Procedures
A modified Proctor Test (ASTM D1557) was conducted to provide the optimum moisture and maximum dry density on the near surface material. The results of this test are presented on Figure B-2, this Appendix.

Resistance Value Determination Procedures
A R-Value test
s (California Test Method 301F) was performed to obtain asphalt concrete pavement design parameters. The results of this test are presented on Figure B-3, this Appendix.

Corrosivity Test Procedures
A corrosivity test typically comprises individual measurements of pH, electrical resistivity, sulfate content, and chloride content, which together indicate the corrosiveness of a soil. Corrosivity tests were performed on selected samples by an independent analytical laboratory working under subcontract to Youngdahl Consulting Group, Inc. The results of these tests are presented on the enclosed analytical certificate and are attached to this Appendix.





Sample No.		1	2	3
Initial	Water Content, %	16.2	16.2	16.2
	Dry Density, pcf	95.7	95.7	95.7
	Saturation, %	69.6	69.6	69.6
	Void Ratio	0.5532	0.5532	0.5532
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	21.9	21.6	20.9
	Dry Density, pcf	97.7	98.1	99.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5210	0.5146	0.4965
	Diameter, in.	2.500	2.500	2.500
	Height, in.	0.979	0.975	0.964
Normal Stress, psf		1000.0	2000.0	4000.0
Fail. Stress, psf		892.8	1751.8	3029.5
Strain, %		1.4	5.4	11.7
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.003	0.003	0.003

Sample Type: Remolded
Description: Brown Sandy SILT

Specific Gravity= 2.38
Remarks: Remolded to 90% of 106.5 pcf

Figure B-1

Client:

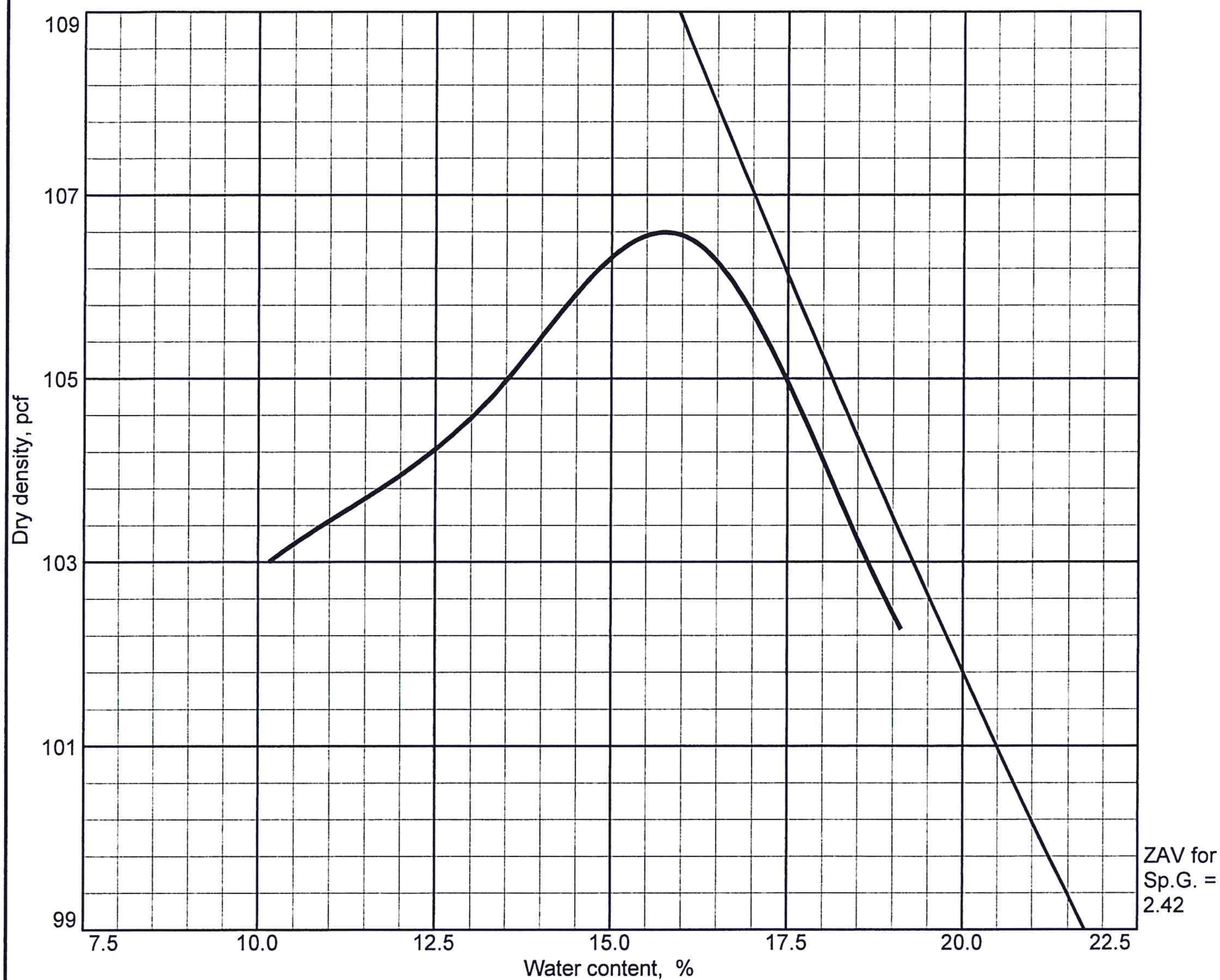
Project: Pleasant Vally Road @ Patterson Drive

Source of Sample: Native
Sample Number: BK 2
Proj. No.: E09015.013 **Date Sampled:**

DIRECT SHEAR TEST REPORT
YOUNGDAHL CONSULTING GROUP, INC.
El Dorado Hills, California

Tested By: BLM **Checked By:** MJG

COMPACTION TEST REPORT



Test specification: ASTM D 698-91 Procedure A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
				2.38				

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 106.5 pcf Optimum moisture = 16.0 %	Brown Sandy SILT

Project No. E09015.013 **Client:**
Project: Pleasant Vally Road @ Patterson Drive
Date: 8/25/11
● **Source:** Native **Sample No.:** BK 2

Remarks:

YOUNGDAHL CONSULTING GROUP, INC.
El Dorado Hills, California

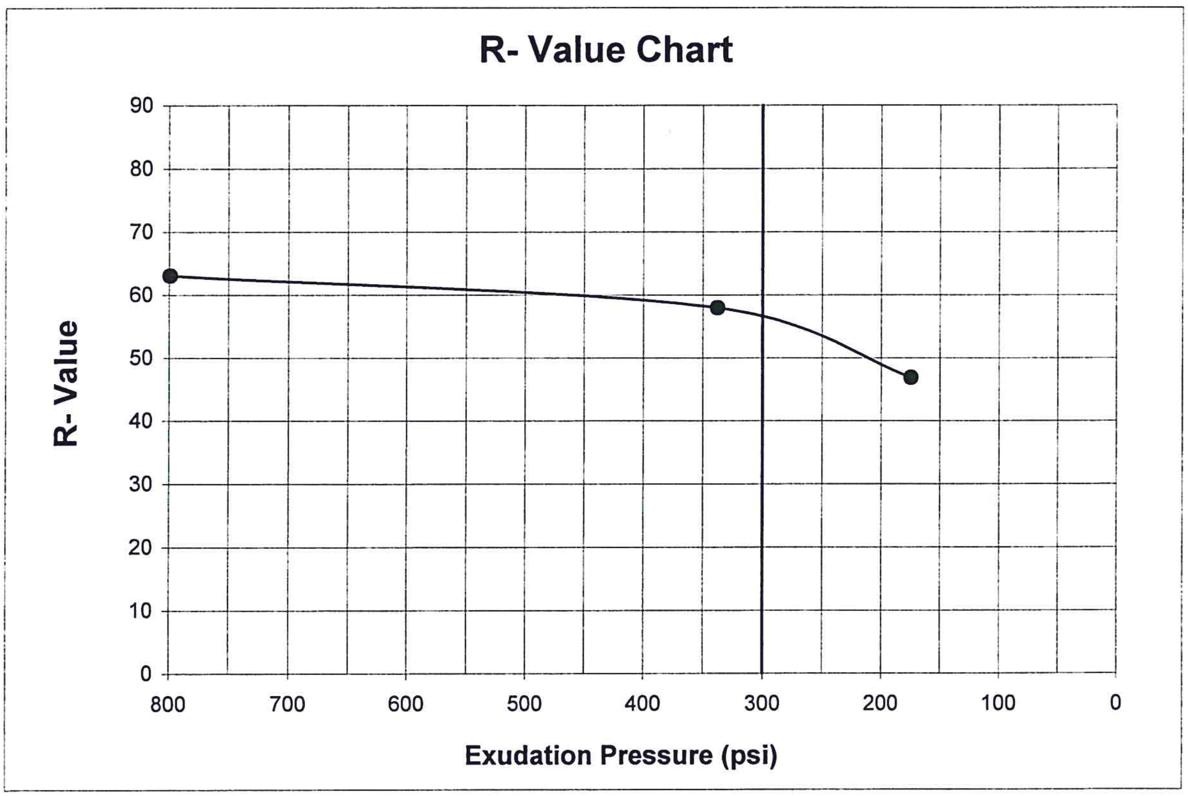
Figure B-2

RESISTANCE VALUE TEST (Cal Test 301, ASTM D2844)

Sample I.D.: BK 1 Depth:

Description: Brown Silty SAND

Test Specimen	P	A	F
Moisture Content (%)	14.9	13.8	12.7
Dry Density (pcf)	104.4	104.3	103.6
Expansion Dial (0.0001")	73	82	113
Expansion Pressure (psf)	316.1	355.1	489.3
Exudation Pressure (psi)	174.3	337.4	799.0
Resistance Value "R"	47	58	63
R Value at 300 psi Exudation Pressure:			**55**



YOUNGDAHL CONSULTING GROUP, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING

Pleasant Vally Rd. @ Patterson Drive		FIGURE NO
PROJECT NO	DATE	**B-3**
E09015.013	**September 2011**	

Sunland Analytical

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

Date Reported 08/31/2011
Date Submitted 08/26/2011

To: Matt Gross
Youngdahl Consulting Group
1234 Glenhaven Ct.
El Dorado Hills, CA 95762

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

The reported analysis was requested for the following location:
Location : E09015.013/PLEASANT Site ID : BK 3-1.
Thank you for your business.

* For future reference to this analysis please use SUN # 60898-124937.

EVALUATION FOR SOIL CORROSION

Soil pH	7.08	
Minimum Resistivity	3.75 ohm-cm (x1000)	
Chloride	39.8 ppm	00.00398 %
Sulfate	19.5 ppm	00.00195 %

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX C

Cut-Slope Evaluation

El Dorado County Department of Transportation
2850 Fairlane Court
Placerville, CA 95762

Project No. E09015.013
30 September 2011

Attention: Mr. Adam Bane, P.E.

Subject: **PLEASANT VALLEY RD (SR49)/PATTERSON DR INTERSECTION SIGNALIZATION, NE CORNER OF RYAN DRIVE AND PLEASANT VALLEY ROAD, CIP NO. 73320I**
Diamond Springs, El Dorado County, California
Recommendations for Slope Configuration

References:

1. Loyd, R.C., (1983): "Mineral Land Classification of the Placerville 15-Minute Quadrangle, El Dorado and Amador Counties, California", California Department of Conservation, Division of Mines and Geology, Open-File Report 83-29.
2. Project Plans for the Construction of Pleasant Valley Road (SR 49)/Patterson Drive Intersection Signalization, prepared by the El Dorado County Department of Transportation, Contract No. 73320, dated 22 June 2011.
3. Geotechnical and Geological Engineering Support Services for Capital Improvement Program Project No's 73320, 73360, 73362, and 7715. El Dorado County Department of Transportation Task Order # 08-1814-12, executed 22 June 2011.
4. Geotechnical Engineering Study for Pleasant Valley Road at Patterson Drive Signalization, prepared by Youngdahl Consulting Group, Inc. (Project No. E09015.013), dated 30 September 2011.

Dear Mr. Bane:

Under Task Order # 08-1814-12, Youngdahl Consulting Group, Inc. has completed a cut slope evaluation for the northeast corner of Ryan Drive and Pleasant Valley Road. This work was done in conjunction with a geotechnical engineering study (Reference No. 4).

Introduction

Based on the layout plans (Reference No. 2) we understand that the proposed project includes the reconstruction of a portion of Pleasant Valley Road and Patterson Drive in order to incorporate additional turning lanes, deceleration/acceleration lanes, and signal lights. As part of the alterations to the roadway, we also understand that a retaining wall is proposed along the west side of Pleasant Valley Road and a new culvert crossing is proposed to cross Pleasant Valley Road approximately 400 feet north of the intersection.

A Youngdahl Consulting Group, Inc. (YCG) geologist performed a field study on 23 August 2011 to measure the attitudes of rock joints and rock foliations in the existing cut slope at the northeast corner of Ryan Drive and Pleasant Valley Road.

Geology

The subject property is located in northern California and in the western portion of the Sierra Nevada Foothills. According to Reference No. 1, the property is underlain by rocks of the Jurassic Age Mariposa Formation, described as dark gray slate with subordinate tuff, greywacke, and conglomerate.

Observations

We observed the existing road cut at the northeast corner of Ryan Drive and Pleasant Valley Road to be 4 to 7 feet high with an exiting gradient as steep as 1H:1V. The cut is in moderately to highly weathered and weakly indurated slate and metatuff, with very closely spaced foliations and widely spaced joints. The soil cover was observed to be 2 to 3 deep above the highly weathered rock. The slope east of the utility pole near the eastern portion of the existing cut exhibits some moderate topple failure. The surface and toe of the cut slope exhibited a moderate amount of loose rock fragments.

The rock joints and foliations were observed to all be dry at the time of our site visit. No clay coatings or filling were observed. The existing cut slope was observed to strike at a bearing of 41 degrees and dip 43 degrees to the south. The foliation strikes were observed to range from 0 degrees to 20 degrees with dips ranging from 58 degrees east to vertical. The joints were observed have strikes ranging from 15 degrees to 320 degrees with dips ranging from 5 degrees west to vertical.

Analysis

RockPack III slope analysis software was used to plot the foliation and joint information for analysis. No adverse rock structures were identified for the existing cut slope. The steepest foliations were observed to become adverse for topple failure at a slope gradient of 0.58H:1V.

Conclusions and Recommendations

The current cut slope is grossly stable at the corner of Ryan Drive and Pleasant Valley Road. The portion of the cut slope at the utility pole east of the corner appears to be in a moderate state of topple failure.

The cut slope at the immediate corner may be steepened to a gradient of 0.6H:1V in the rock portion. The upper two to three feet of the existing cut slope is in soil at a gradient as steep as 1H:1V and will continue to have minor sloughing and failures that will require maintenance. The area of the cut slope from the utility pole eastwards should not be oversteepened any further and will continue to exhibit minor slough and failures requiring periodic maintenance.

Youngdahl Consulting Group, Inc. should be retained to observe the initial, middle, and final stages of any cut slope steepening work for this cut.

We trust that this provides you with the information needed at this time. Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,
Youngdahl Consulting Group, Inc.

David C. Sederquist, C.E.G., C.H.G
Senior Engineering Geologist/Hydrogeologist

Distribution: Attached as Appendix C to the Reference No. 4 Geotechnical Engineering Study.