APPENDIX D
Geotechnical and Paleo Reports

A Report Prepared for:

Orange County Public Works
601 N. Ross Street
Santa Ana, CA 92703

GEOTECHNICAL REPORT
MODJESKA GRADE ROAD IMPROVEMENTS
MODJESKA CANYON

Project No. 2022-017

by

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TABLE OF CONTENTS

1 INTRODUCTION 1
2 DATA REVIEW, FIELD EXPLORATION, AND LABORATORY TESTING 6
2.1 DATA REVIEW 6
2.2 FIELD EXPLORATION 6
2.3 LABORATORY TESTING 8
3 SITE CONDITIONS 9
3.1 GEOLOGY 9
3.1.1 Regional Geology 9
3.1.2 Local Geology 9
3.2 SURFACE CONDITIONS 13
3.3 SUBSURFACE CONDITIONS 14
3.4 GROUNDWATER 20
4 CONCLUSIONS AND RECOMMENDATIONS 21
4.1 SEISMIC/GEOLOGIC HAZARDS 22
4.2 EARTHWORK 25
4.2.1 Site Preparation and Grading 25
4.2.2 Earthwork Considerations 27
4.2.3 Excavations and Temporary Slopes 28
4.2.4 Permanent Slopes 29
4.2.5 Drainage and Infiltration 30
4.2.6 Erosion 31
4.3 RETAINING WALL TYPE SELECTION (STATION 58+50) 31
4.4 FOUNDATION DESIGN 32
4.5 RESISTANCE TO LATERAL LOADS AND LATERAL EARTH PRESSURES 32
4.6 UTILITY TRENCHES 34
4.7 PAVEMENT THICKNESS DESIGN 36
4.8 SOIL CORROSION POTENTIAL 39
5 PLAN REVIEW, CONSTRUCTION OBSERVATION, AND TESTING 41
6 LIMITATIONS 42
7 REPORT REVISION LOG 43
8 BIBLIOGRAPHY 44

LIST OF TABLES

Table 1 - SUMMARY OF GEOLOGIC UNITS 10
Table 2 - EXISTING PAVEMENT SECTIONS 13
Table 3 - SUMMARY OF GEOTECHNICAL CHARACTERISTICS (ROADWAY) 15
Table 4 - IDEALIZED GEOTECHNICAL DESIGN PROFILE (CUT SLOPE - STATION 38+50) 18
Table 5 - IDEALIZED GEOTECHNICAL DESIGN PROFILE – (RETAINING WALL - STATION 58+50) 19
Table 6 - SEISMIC/GEOLOGIC DESIGN CRITERIA 22
Table 7 - FILL AND BACKFILL CRITERIA 27

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Table 8 - PERMANENT SLOPE STABILITY 29
Table 9 - RETAINING WALL ALTERNATIVES 32
Table 10 - CORROSION POTENTIAL 40

LIST OF FIGURES

Figure 1 - VICINITY MAP 1
Figure 2 - SITE PLAN (GEOTECHNICAL) 4
Figure 3 - SITE PLAN (AGRONOMY) 7
Figure 4 - GEOLOGY MAP 12
Figure 5 - CROSS SECTION A-A' 17
Figure 6 - SEISMIC HAZARDS MAP 23
Figure 7 - GRADING/FOUNDATION DETAILS (RETAINING WALL NEAR STATION 74+75) .. 26
Figure 8 - LATERAL EARTH PRESSURES (RETAINING WALL NEAR STATION 74+75) 33
Figure 9 - RETAINING OR BASEMENT WALL DRAINAGE 34
Figure 10 - PIPELINE BACKFILL SCHEMATIC 36
Figure 11 - PAVEMENT THICKNESS (ORANGE COUNTY DESIGN CRITERIA) 38
Figure 12 - PAVEMENT THICKNESS (CALTRANS DESIGN CRITERIA) 39

LIST OF APPENDICES

APPENDIX A - PRELIMINARY PROJECT DRAWINGS
APPENDIX B - EXISTING GEOTECHNICAL DATA
APPENDIX C - FIELD EXPLORATION
APPENDIX D - GEOPHYSICAL SURVEYS
APPENDIX E - GEOTECHNICAL LABORATORY TESTING
APPENDIX F - AGRONOMY LABORATORY TESTING
APPENDIX G - SLOPE STABILITY ANALYSES

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1 INTRODUCTION

This report presents the results of the geotechnical services performed by Diaz•Yourman & Associates (DYA) for the proposed Modjeska Grade Road Improvements (Project) in Orange County, California. The County of Orange Department of Public Works (OCPW) authorized this work on October 13, 2022.

The Project alignment is located along Modjeska Grade Road from its intersection with Santiago Canyon Road to approximately 100 feet south of Modjeska Canyon Road in the City of Silverado, as shown on the Vicinity Map, Figure 1.

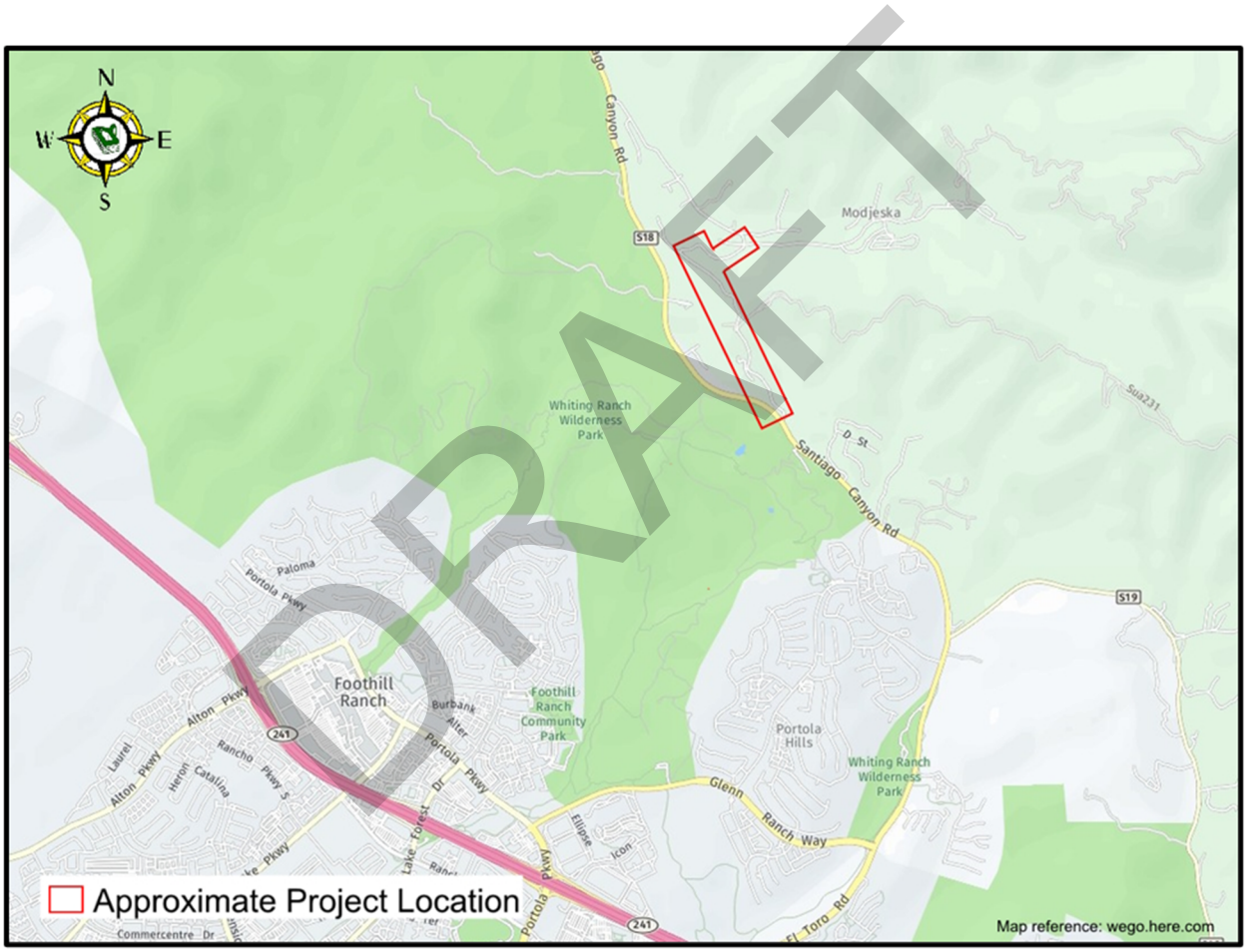

Figure 1 - VICINITY MAP

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We understand that the proposed Project will primarily consist of roadway and drainage improvements along Modjeska Grade Road. The purpose of the proposed improvements will be to rehabilitate the existing pavement, improve the existing drainage systems, identify potential approaches to mitigate and/or remediate erosion along the Project alignment, and address localized shallow slope instability. The approximate location of the proposed improvements is shown on the site plan, Figure 2, and preliminary Project drawings (OCPW, 2022) are presented for reference in Appendix A. Based on our review of the preliminary Project drawings and our discussions with the Project design team, we understand that the following components of the Project will require geotechnical input for design:

- Reconstruction of the existing pavement along the Project alignment.
- Erosion control devices (e.g., hydroseeding, open-weave textiles, and/or wire blankets).
- A cut slope near Station 38+50 that will be approximately 20 to 25 feet high.
- An approximately 3-foot-high, 50-foot-long retaining wall near Station 74+75 that will retain a slope that ascends from Modjeska Grade Road to an adjacent residential property. Based on our review of the preliminary Project drawings, we understand that the Project could potentially include as many as six additional retaining walls along the Project alignment. The design of these additional retaining walls is not included in this report and should be evaluated during final design if added to the Project.
- Potentially installing a retaining wall near Station 58+50 with retained soil heights ranging from approximately 15 to 20 feet. Based on our discussions with the Project design team, we understand that the proposed retaining wall is currently undergoing type selection and that the design will be performed for the 90% design submittal.

We understand that a cut slope near Station 42+00 and a fill slope near Station 58+50 were originally planned for the proposed Project, as shown on the preliminary Project drawings presented in Appendix A. However, based on our discussions with the Project design team, we understand that these proposed slopes are no longer planned for the Project. The geotechnical data collected during DYA's field exploration for slopes is presented herein for completeness.

Modjeska Grade Road is currently fully developed, and the proposed pavement improvement locations are generally covered with existing asphalt concrete (AC) pavements; however, the majority of the adjacent hillsides are generally undeveloped, and potential alterations to current

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stormwater runoff or infiltration patterns or rates will be evaluated by others as a part of the Project.

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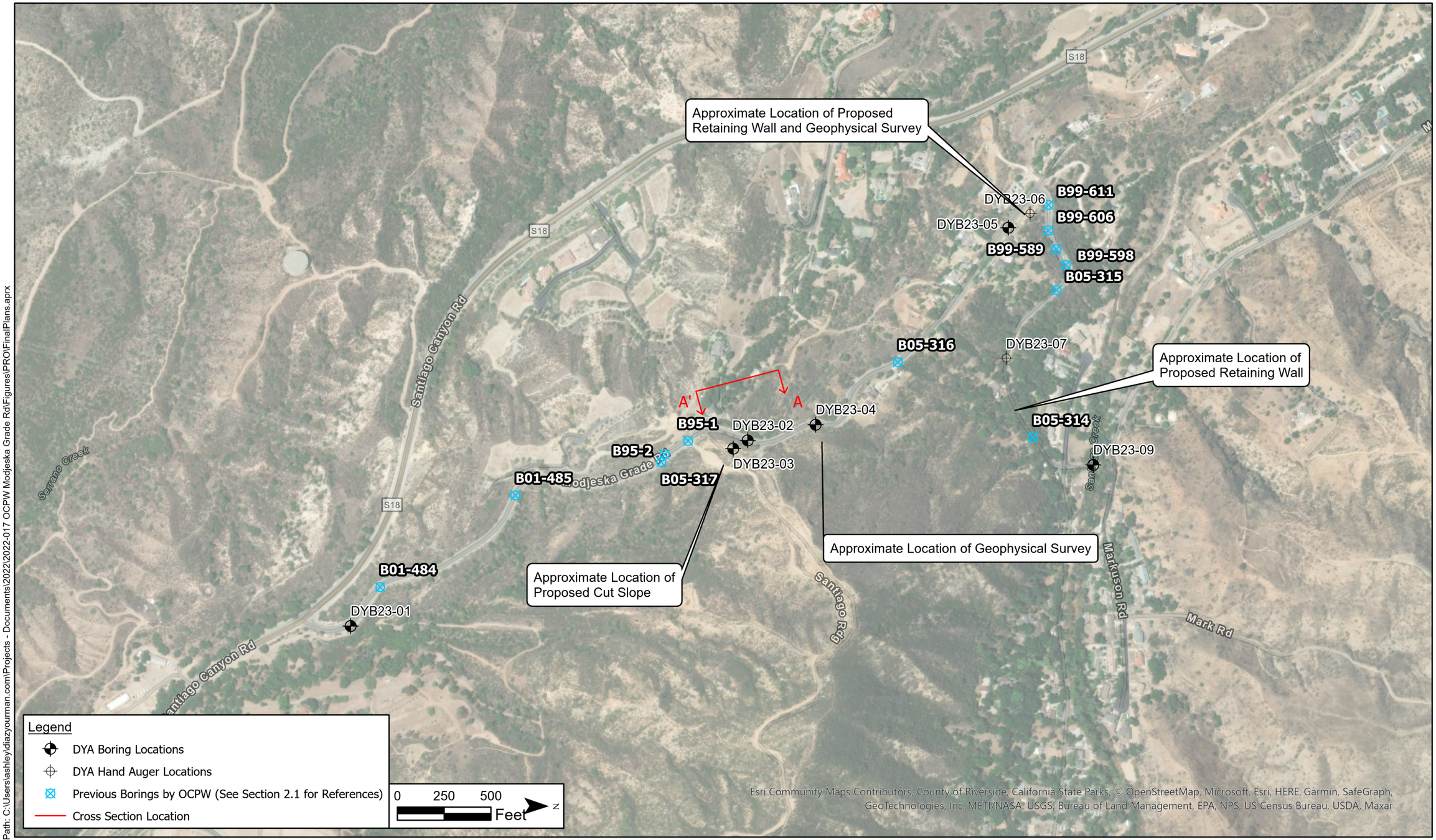

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Figure 2 - SITE PLAN (GEOTECHNICAL)

The purpose of DYA's services was to provide geotechnical input for the design of the proposed improvements. The scope of our services consisted of the following tasks:

- Reviewing available geotechnical data.
- Conducting a field exploration to supplement geotechnical data previously collected at the Project site.
- Performing geotechnical and agronomy laboratory tests on selected soil samples.
- Performing engineering analyses to develop conclusions and recommendations regarding the following:
    - Subsurface conditions
    - Geologic and seismic hazards
    - Site preparation and grading
    - Temporary and permanent slope stability
    - Infiltration potential
    - Erosion control device design parameters
    - Shallow foundation allowable bearing capacity
    - Estimated total and differential foundation settlements
    - Lateral earth pressures
    - Pavement thickness design
    - Soil corrosion potential
- Preparing this report.

DYA previously prepared a letter report summarizing our conceptual evaluation of the potential for and mitigation of erosion along the Project alignment (DYA, 2021).

We understand that the design of the proposed improvements addressed in this report will be subject to review by OCPW.

Investigation for the mitigation of methane gas or other hazardous materials was not part of DYA's scope of services. Evaluation of pavement rehabilitation and non-destructive testing (NDT) and infiltration testing was also not included in DYA's scope of services.

The elevations presented herein refer to the North American Vertical Datum of 1988 (NAVD 88) unless otherwise noted.

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2 DATA REVIEW, FIELD EXPLORATION, AND LABORATORY TESTING

2.1 DATA REVIEW

Geotechnical data from the Project vicinity collected during previous field explorations performed by County of Orange were reviewed to supplement site data collected during this exploration. A list of the documents reviewed is presented in the bibliography (Section 8). Previous geotechnical data reviewed by DYA for the Project included boring logs and laboratory testing results which are presented in Appendix B for reference.

2.2 FIELD EXPLORATION

DYA's field exploration, which was conducted between April 6 and May 4, 2023, consisted of drilling six soil borings, advancing two hand augers, and collecting 36 bag samples for agronomy testing. The boring and hand auger locations are shown on Figure 2, and the agronomy sample locations are shown on Figure 3. The boring and hand auger locations were chosen by DYA based on site access constraints. Site access was limited due to underground utility conflicts and overhead obstructions (e.g., overhead power lines and trees). The field exploration locations were selected to provide areal coverage of the Project site for earthwork and grading in addition to pavement, foundation, and drainage design. The boring and hand auger depths, which ranged from approximately 10 inches to 41 feet below ground surface (bgs), were selected to supplement data previously collected by others and to extend to the depth of significant influence of the proposed improvements. Details of the field exploration, including sampling procedures and boring logs, are presented in Appendix C.

DYA's field exploration also consisted of performing geophysical surveys to evaluate the subsurface conditions of the existing slopes adjacent to Modjeska Grade Road. The geophysical surveys, which consisted of two seismic P-wave refraction traverses and one-dimensional seismic surface wave refraction microtremor (ReMi) profiles, were performed by Atlas Technical Consultants LLC (Atlas) on March 23 and May 3, 2023. The geophysical surveys were performed in areas that were inaccessible to the drill rig to supplement the data collected during the current and previous field explorations performed by DYA and others. The locations of the geophysical surveys are shown on Figure 2, and the results are presented in Appendix D.

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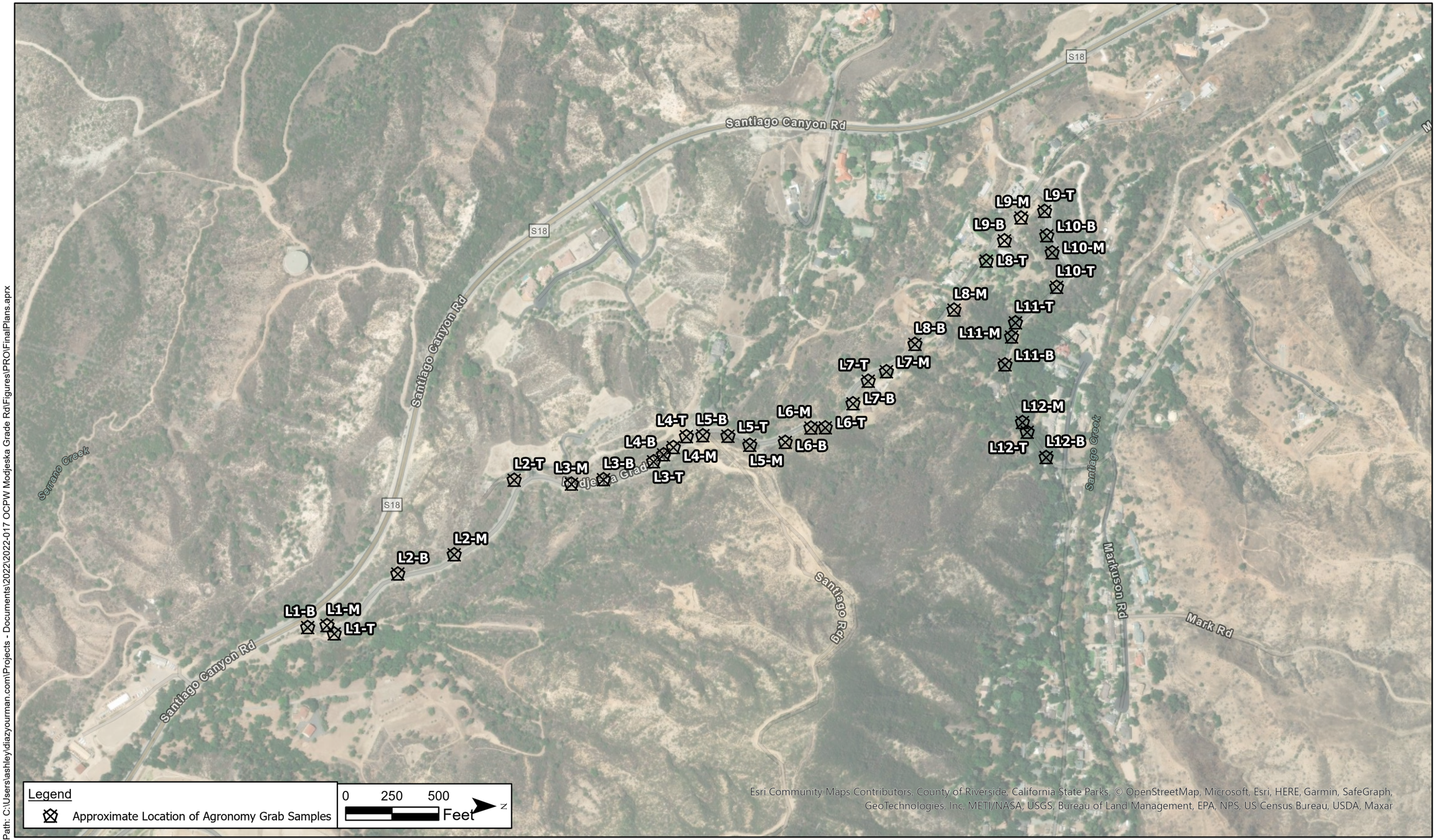

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Figure 3 - SITE PLAN (AGRONOMY)

2.3 LABORATORY TESTING

Soil samples collected from the borings were re-examined in the laboratory to substantiate field classifications. Selected soil samples were tested for moisture content, dry density, grain-size distribution, percent passing the No. 200 sieve, Atterberg limits, shear strength, compaction characteristics, and pavement support capacity (R-Value). The soil samples tested are identified on the boring logs. Laboratory test data are summarized on the boring logs in Appendix C and presented on individual test reports in Appendix E.

Agronomy testing was performed by Wallace Laboratories on selected soil samples. Tests included standard agricultural suitability, growth studies, and nematode testing. Results of the agronomy testing and recommendations for the Project site are summarized in the report prepared by Wallace Laboratories that is presented in Appendix F.

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3 SITE CONDITIONS

3.1 GEOLOGY

3.1.1 Regional Geology

The Project site is located in the mid-west section of the Peninsular Ranges. The Peninsular Ranges are a series of ranges that are separated by northwest trending valleys, subparallel to faults branching from the San Andres Fault. The Peninsular Ranges are bound to the north by the Transverse Ranges, to the east by Santiago Peak, to the south by Trabuco Canyon, and to the west by the Orange County groundwater basin. Geologically the Peninsular Ranges are similar to the Sierra Nevada, with older metamorphic rocks containing granitic intrusions (CGS[1] , 2002).

3.1.2 Local Geology

The Project site is located in the Santa Ana Mountains. Based on mapping performed by Morton and Miller (2006), the Santa Ana Mountains, within the Project alignment, are underlain by continental and marine sandstone and conglomerate of the late Eocene, Santiago Formation (Tsa), nonmarine and marine sandstone, siltstone and conglomerate of the Paleocene, Silverado Formation (Tsi-Tsicg), Pleistocene-age very old axial-channel deposits (Qvoa3-Qvoa2), marine sandstone of the Pleasants Sandstone Member (Kwps-Kwps1), and Holocene-age young axialchannel deposits (Qya). A summary of the Morton and Miller (2006) geologic units mapped along the Project alignment and the previous and current borings located within each geologic unit are presented in Table 1, and a geologic map of the Project alignment is presented on Figure 4.

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[1] Formerly California Division of Mines and Geology (CDMG).

Table 1 - SUMMARY OF GEOLOGIC UNITS

GEOLOGIC UNIT[1]	DESCRIPTION	Boring ID
Qls	Late Holocene age, fragmented to coherent active landslides. Unconsolidated to consolidated.	--
Santiago Formation Sandstone (Tsa)	Eocene-age non-marine and marine sandstone and conglomerate. Conglomerate is composed of a variety of rock clasts including quartzite, volcanic and granitic rock, sandstone, and metamorphic rock. Overlying the conglomerate is a thick sequence of sandstone with lesser interbedded siltstone. Unit is moderately soft to hard, moderately to highly fractured, poorly to moderately well-bedded.	DYB23-01 B95-1[1] B95-2[1]
Silverado Formation Sandstone (Tsi and Tsicg)	Paleocene-age non-marine and marine sandstone, siltstone and conglomerate. Conglomerate is composed of a variety of rock clasts, including quartzite, volcanic and granitic rock, sandstone, and metamorphic rock. Basal conglomerate is overlain by a relatively thin sequence of sandstone with lesser interbedded siltstone. Above this sequence is a distinctive claystone bed (Claymont) overlain by a thicker sequence of sandstone, siltstone, and conglomerate and a second 3- to 4-foot-thick clay bed (Serrano) that contains carbonaceous shale and lignite. Unit is moderately soft to hard, moderately to highly fractured, poorly to moderately well-bedded.	DYB23-03 DYB23-04 DYB23-05 DYB23-06 DYB23-07 B99-611[1] B99-606[1] B99-589[1] B99-598[1]
Very old alluvium (Qvoa3)	Sand containing scattered gravel and cobbles and having silt- and clay-rich layers. Generally reddish brown to yellowish tan, slightly to well indurated/consolidated, poorly bedded, and covered with a weathered pedogenic surface soil cap often with a higher percentage of clay.	DYB23-02
Qvoa2	Fluvial sediments, reddish brown, mostly very dissected gravel, sand, silt, and clay.	--
Williams Formation Pleasants Sandstone (Kwps and Kwps1)	Late Cretaceous; white to pale gray; coarse-grained marine sandstone containing pebbles and cobbles, as well as siltstone beds, poorly bedded, moderately to very hard, moderately fractured, generally massive with scattered conglomerate lenses.	Possibly Underlaying DYB23-09[2]
Young alluvium (Qya)	Slightly to moderately consolidated silt, sand, and gravel deposits. Deposits can contain abundant boulders from steep tributary canyons. Some alluvial-fan deposits are present from tributary canyons and gulches.	DYB23-09

Note(s):

1. Borings previously performed by the County of Orange (1995, 1999); see Appendix B.
2. Boring DYB23-09 is mapped within the Qya geologic unit; however, based on the results of the current subsurface exploration, Boring DYB23-09 appeared to be closer to the Kwps and/or Kwps1 geologic units.

In general, the Tsa, Tsi, and Kwps formations are massive and poorly bedded, which suggests a low potential for gross slope instability. Bedding planes in the Kwps formation were generally steeper than those observed in the Tsa and Tsi formations. Where observed, bedding planes

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were oriented into slope or were oriented such that out-of-slope conditions were judged to be unlikely to affect the proposed Project. However, fractures were noted that crosscut bedding and produced small- to medium-sized blocks of material that could be surficially unstable for cut slopes. In addition, DYA observed evidence of localized slope instabilities during our previous geologic site reconnaissance (2021) in the Tsa, Tsi, and Kwps formations. The slope instabilities were observed near Station 24+50 in the Tsa, near Stations 32+50, 37+00, and 64+50 in the Tsi, and near Station 77+00 in the Kwps.

A north-to-northwest-trending geologic fault separates the units presented in Table 1 through much of the alignment, with Tsa located predominantly to the west of the fault and Tsi predominantly to the east. The fault is believed to be non-active and will likely have little to no impact on the proposed Project improvements. However, past fault movement can increase the level of fracturing and degrade bedrock quality; therefore, additional evaluation of the fault's effects on bedrock properties might be required during future location-specific phases of Project design.

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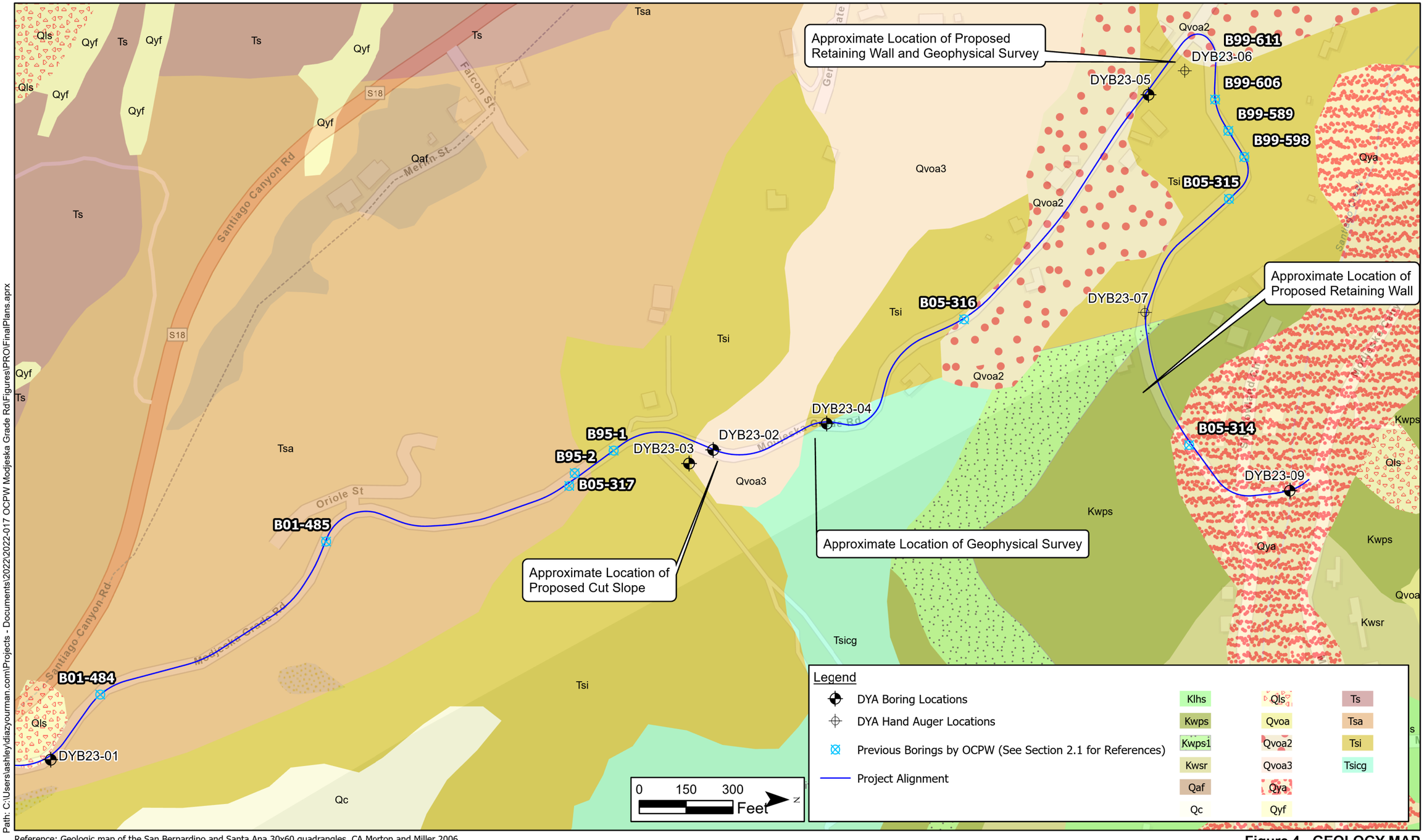

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Reference: Geologic map of the San Bernardino and Santa Ana 30x60 quadrangles, CA Morton and Miller 2006

Figure 4 - GEOLOGY MAP

3.2 SURFACE CONDITIONS

At the time of DYA's field exploration, Modjeska Grade Road generally consisted of existing AC-paved roads with one lane in each direction. The existing pavement sections encountered during DYA's field exploration are summarized in Table 2. Overhead powerlines, guardrails, and large trees bordered portions of Modjeska Grade Road throughout the Project alignment, and existing shoulders were generally unpaved. The adjacent hillsides were generally undeveloped with residential properties located along isolated portions of the Project alignment. The topography of the Project alignment varied significantly (OCPW, 2019); the ground surface elevation along Modjeska Grade Road was approximately 1,385 feet at the intersection of Modjeska Grade Road and Santiago Canyon Road and approximately 1,275 feet approximately 100 feet south of Modjeska Canyon Road. The maximum ground surface elevation along Modjeska Grade Road was approximately 1,651 feet near Station 35+50.

Table 2 - EXISTING PAVEMENT SECTIONS

BORING ID	ASPHALT CONCRETE (INCHES)	AGGREGATE BASE (INCHES)
DYB23-01	3	5
DYB23-02	2	4
DYB23-04	1	9
DYB23-05	2	--
DYB23-07	3	4
DYB23-09	5	4

Note(s):
- Pavement not encountered at Borings DYB23-03 and DYB23-06.

Modjeska Grade Road generally appeared to have been formed via a series of cuts and fills along natural hillsides, resulting in slopes that ascend from one shoulder of the roadway and descend from the opposite shoulder. The inclination of the ascending slopes typically ranged from steep (i.e., equal to or steeper than 0.5H:1V) to moderate (approximately 2H:1V to 3H:1V); site access constraints generally precluded DYA from evaluating the inclinations of the slopes that descended from the roadway. Surface conditions along the slopes observed by DYA appeared to consist of 2 to 4 feet of surficial materials (e.g., soil/colluvium and alluvium) underlain by formational units. The surficial material was moderately to densely vegetated with natural grasses, shrubs, and/or trees, with some isolated areas of landscaping associated with adjacent residential properties.

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Little to no alluvium and vegetation were observed where slope inclinations were steeper than approximately 1H:1V; in such areas, the formational units were exposed.

During DYA's previous site reconnaissance (DYA, 2021), evidence of erosion on the slope faces in the form of rills, gullies, and weathered jointing in the formational units was observed; however, evidence of erosion on the roadway surface (e.g., soil and gravel on the roadway) was not observed. Google (2023) Street View imagery and photographs previously provided by OCPW indicate that erosional rills, gullies, and cracks have occurred along unpaved shoulders and slopes and that soil and gravel have been deposited along the roadway during and after rain events. DYA also observed that erosion control devices (e.g., sandbags, wood panel barriers, and water-filled plastic barriers) have been implemented along the Project alignment.

3.3 SUBSURFACE CONDITIONS

The subsurface soils along Modjeska Grade Road generally consisted of artificial fill underlain by natural soils. Based on borings previously performed by OCPW (1995, 1999) along the Project alignment, the fills generally range from 4 to 7 feet thick and are typically composed of sandy clay, clayey sand, and silty sand. Descriptions of the fill presented on the boring logs prepared by OCPW suggest that the fill was likely derived from the topsoil in the adjacent areas. The soils encountered during DYA's field exploration were generally similar across the Project site and consisted primarily of medium dense to very dense coarse-grained soils (e.g., sands) with isolated areas of fine-grained soils (e.g., silts and clays).

Borings performed by OCPW in 1995 and 1999 (see Appendix B) encountered the Santiago (Tsa) and Silverado (Tsi) formations, respectively. Borings that encountered the Tsa were performed between Station 33+00 and Station 35+00; borings that encountered the Tsi were performed between Station 61+00 and Station 65+00. Descriptions of the Tsa and Tsi in the OCPW boring logs were generally consistent with the descriptions in Table 1, with blow counts indicating that the formations are generally very dense. However, boring logs performed in the Tsa indicated that, when disturbed during drilling, the granular components were prone to decomposition.

Boring DYB23-09 likely encountered the Williams Formation. As shown on Figure 4, Boring DYB23-09 is mapped within Young alluvium (Qya); however, we judge that the geologic characteristics observed during the current field exploration were closer to what would be expected from the Williams Formation. Refusal was met in Boring DYB23-09 indicating that the underlying formational unit is likely hard.

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A summary of the sub-near-surface soils encountered along Modjeska Grade Road is presented in Table 3.

Table 3 - SUMMARY OF GEOTECHNICAL CHARACTERISTICS (ROADWAY)

SOIL LAYER[1]	DEPTH (feet)	SPT_{N60} BLOW COUNT[2] (bpf)	DRY DENSITY[3] (pcf)	MOISTURE CONTENT[3] (%)	R-VALUE
Silty Sand (SM), Clayey Sand (SC), Sandy Lean Clay (CL)	0 to 5	> 40	111 (5)	9 (4)	15 to 67

Note(s):
1. Soil types classified in accordance with Unified Soil Classification System (USCS) based on results of field and laboratory testing.
2. SPT N_{60} – Standard penetration test (SPT) corrected for hammer efficiency (see Appendix C).
3. Average values presented; standard deviations are indicated in parentheses.

- bpf = blows per foot; pcf = pounds per cubic foot.

The subsurface soils in the vicinity of the proposed cut slope and retaining wall generally consisted of medium dense to very dense natural coarse-grained soils. Boring DYB23-03 was performed at the top of the proposed cut slope near Station 38+50. A geophysical survey was performed at the top of the proposed retaining wall near Station 58+50 based on site access constraints (see Section 2.2). A geophysical survey was also performed at the top of the previously proposed cut slope near Station 42+00; however, this slope was removed from the Project scope after DYA's subsurface exploration, as discussed in Section 1; the results of the geophysical survey are presented herein for completeness. The results of the geophysical surveys generally indicated the following:

- The geophysical survey performed at the top of the previously proposed cut slope near Station 42+00 likely encountered the Silverado Formation, and the geophysical survey performed at the top of the proposed retaining wall near Station 58+50 likely encountered alluvium at shallow depths (i.e., the upper 20 to 40 feet) and potentially the Silverado Formation at deeper depths.
- Shear wave velocities generally ranged from approximately 750 to 2,100 feet per second (ft/s) and 550 to 1,440 ft/s in the vicinity of the cut slope near Station 42+00 and retaining wall near Station 58+50, respectively.
- P-wave velocities generally ranged from approximately 2,000 to 6,000 ft/s and 1,500 to 4,500 ft/s in the vicinity of the cut slope near Station 42+00 and retaining wall near Station 58+50, respectively.

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Graphical depictions of the subsurface conditions for the proposed cut slope near Station 38+50 are shown on the cross-section presented on Figure 5; the locations of the cross-section line are shown on Figure 2. For design purposes, the subsurface conditions were divided into idealized units presented in Table 4 and Table 5 for the proposed cut slope and retaining wall near Stations 38+50 and 58+50, respectively.

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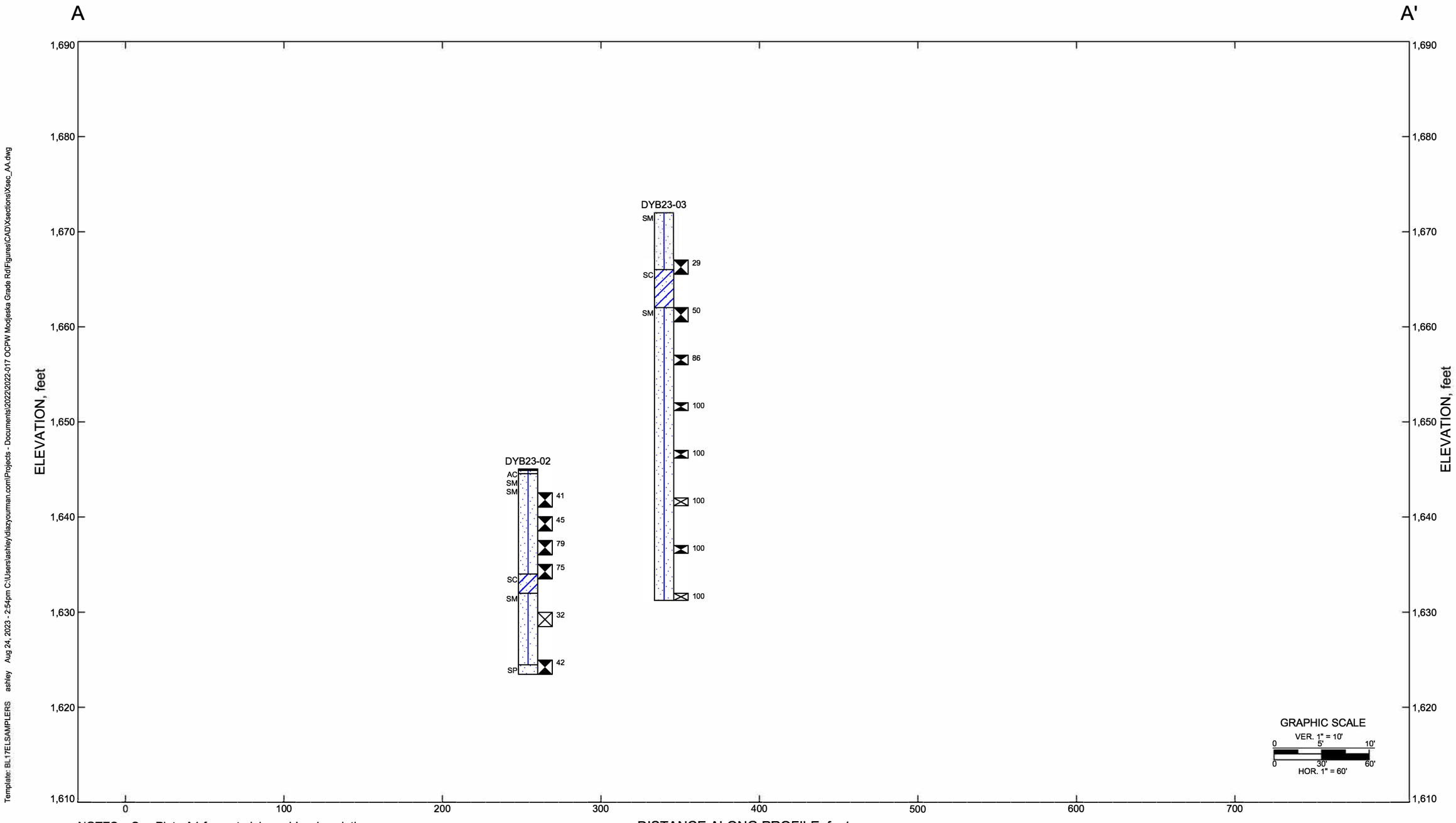

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NOTES: See Plate A1 for material graphics description.
Symbol to left of graphic column is based on ASTM D2487 and D2488.
Number to right of graphic column is equivalent to N60 SPT blow count per foot.

Figure 5 - CROSS SECTION A-A'

Table 4 - IDEALIZED GEOTECHNICAL DESIGN PROFILE (CUT SLOPE - STATION 38+50)

SOIL TYPE[1]	APPROXIMATE ELEVATION[2] (feet)		THICKNESS[2] (feet)	SPT_{N60} BLOW COUNT[3,4,5] (bpf)	MOISTURE CONTENT[5] (%)	TOTAL UNIT WEIGHT[6] (pcf)	FRICTION ANGLE[6] (degree)	COHESION[6] (psf)
	Top	Bottom						
Medium Dense Sands	1672	1664	8	29 (--)	9 (1)	130	34	50
Dense to Very Dense Sands	1664	1631	33	58 (18)	6 (2)	120	38	100
Medium Dense to Dense Sands	1631	1624	7	37 (7)	6 (--)	125	32	200

Note(s):

1. Simplified soil types. See boring logs presented in Appendix C for classifications in accordance with Unified Soil Classification System (USCS) based on the results of field and laboratory testing.
2. Depth below the ground surface at the time of the field exploration.
3. SPT N_{60} –SPT corrected for hammer efficiency (see Appendix C).
4. Values do not include SPT blow counts where refusal was met.
5. Mean values presented; standard deviations are indicated in parentheses.
6. Idealized soil profile developed from geotechnical data collected during the current subsurface investigation and from correlations with field and laboratory test results (Bowles, 1977; Caltrans, 2014; FHWA, 2002; Kulhawy and Mayne, 1990; Wolff, 1989).

- SPT = Standard penetration test; bpf = blows per foot; pcf = pounds per cubic foot; psf = pounds per square foot

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Table 5 - IDEALIZED GEOTECHNICAL DESIGN PROFILE – (RETAINING WALL - STATION 58+50)

SOIL TYPE[1]	APPROXIMATE ELEVATION[2] (feet)		THICKNESS[2] (feet)	SPT_{N60} BLOW COUNT[3,4,5] (bpf)	MOISTURE CONTENT[5] (%)	TOTAL UNIT WEIGHT[6] (pcf)	FRICTION ANGLE[6] (degree)	COHESION[6] (psf)
	Top	Bottom						
--	1462[7]	1440[7]	22[7]	--	--	110[8]	32[8]	100[8]
Very Dense Sands	1440	1420	20	> 50	7 (2)	110	32	100

Note(s):

1. Simplified soil types. See boring logs presented in Appendix C for classifications in accordance with Unified Soil Classification System (USCS) based on the results of field and laboratory testing.
2. Depth below the ground surface at the time of the field exploration.
3. SPT N_{60} –SPT corrected for hammer efficiency (see Appendix C).
4. Values do not include SPT blow counts where refusal was met.
5. Mean values presented; standard deviations are indicated in parentheses.
6. Idealized soil profile developed from geotechnical data collected during the current subsurface investigation and from correlations with field and laboratory test results (Bowles, 1977; Caltrans, 2014; FHWA, 2002; Kulhawy and Mayne, 1990; Wolff, 1989).
7. Layer boundaries estimated from the results of the geophysical survey presented in Appendix D and engineering judgement.
8. Developed from correlations between seismic shear wave velocity and SPT N values presented in Table 20.3-1 of American Society of Civil Engineers/Seismic Engineers Institute (ASCE/SEI) 7-16 (2017) and engineering judgement.

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3.4 GROUNDWATER

Groundwater was not encountered in the borings performed during DYA's current field exploration, which extended to approximate elevations ranging from 1403 to 1672 feet. Groundwater was also not encountered during previous investigations performed by OCPW (1995, 1999, 2001, 2006). Historical groundwater levels along the Project alignment have not been mapped by CGS (2000).

Groundwater monitoring data (California Department of Water Resources, 2023) approximately 3 miles southwest of the Project site indicates groundwater elevations ranging from approximately 710 to 715 over the last 5 years.

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4 CONCLUSIONS AND RECOMMENDATIONS

Based on geotechnical considerations, the site is suitable for the proposed improvements. The primary geotechnical considerations consist of the variability of the geologic units across the Project site and potentially difficult grading; the temporary and permanent stability of the proposed cut slope; the impact of the design and construction on existing adjacent improvements, such as the private properties located at the tops of the existing slopes; and the ability of the near-surface soils to support the proposed erosion control devices.

As discussed in Section 3.1, several geologic units were encountered throughout the Project site. The subsurface conditions generally consisted of dense to very dense coarse-grained soils (e.g., sands) with varying degrees of gravel and formational units. Difficult grading should be anticipated in the Santiago (Tsa), Silverado (Tsi and Tsig), and Williams (Kwps and Kwps1) Formations based on the results of the current and previous field explorations. As discussed in Section 3.3, the rippability of the Silverado Formation could potentially range from moderate to very difficult.

Note that some of the preferred erosion control measures might have reduced effectiveness because of the steepness of the existing or planned slopes. For slopes with inclinations steeper than 2H:1V, more hydroseed or special mixes to encourage adhesion of the hydroseed to slopes may be required and might also require more frequent reapplication of hydroseed than slopes having inclinations flatter than 2H:1V.

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4.1 SEISMIC/GEOLOGIC HAZARDS

The site, like most of Southern California, will be subject to strong ground shaking during major earthquakes. Seismic design can be performed according to the criteria listed in Table 6. Seismic and geologic considerations based on various mapping studies are also summarized in Table 6 and shown on Figure 6.

Table 6 - SEISMIC/GEOLOGIC DESIGN CRITERIA

CHARACTERISTIC	CRITERIA	
	Proposed Cut Slope	**Proposed Retaining Wall**
Geographic Coordinates (Latitude/Longitude)	33.704197, -117.636681	33.707465, -117.640718
Site Class[1,2]	C	D
Risk Category[1]	I, II, or III	
S_s - mapped risk targeted maximum considered earthquake (MCE_R) spectral response acceleration at short periods (g)[1,3]	1.414	1.42
S_1 - mapped MCE_R spectral response acceleration at 1-second period (g) [1,3]	0.498	0.5
F_a - site coefficient[1,3]	1.2	1
F_v - site coefficient[1]	1.5[3]	1.8[4]
S_{MS} - adjusted MCE_R spectral response acceleration at short periods (g)[1,3]	1.697	1.42
S_{M1} - adjusted MCE_R spectral response acceleration at 1-second period (g)[1]	0.747[3]	0.9[4]
S_{DS} - design MCE_R spectral response acceleration at short periods (g)[1,3]	1.131	0.947
S_{D1} - design MCE_R spectral response acceleration at 1-second period (g)[1]	0.498[3]	0.6[4]
PGA - mapped MCE_G peak ground acceleration (g)[3]	0.5	0.5
F_{PGA} - site coefficient[3]	1.2	1.1
PGA_M - mapped MCE_G peak ground acceleration adjusted for site class effects, g[3]	0.6	0.55
Alquist - Priolo Special Study Zone[5]	Site outside a special study zone	
California Seismic Hazards Mapping Act, Liquefaction Zone[5]	Portions of the Project alignment located within and/or adjacent to a liquefaction zone[6]	
California Seismic Hazards Mapping Act, Landslide Zone[5]	Portions of the Project alignment located adjacent to a landslide zone[6]	

Note(s):
1. California Building Code (CBC) Section 1613 (International Code Council [ICC], 2022).
2. Based on shear wave velocity measurements recorded at the Project site. See Appendix D.
3. ASCE/SEI 7-16 mapped values obtained from ASCE 7 online hazard tool (ASCE, 2017, 2023).
4. Selected using Table 11.4-2 of ASCE/SEI 7-16 Supplement 1 (ASCE, 2018) and assumes that Exception 2 of Section 11.4.8 is applicable such that a site-specific ground motion hazard analysis is not required.
5. CGS website, 2023.
6. See Figure 6.

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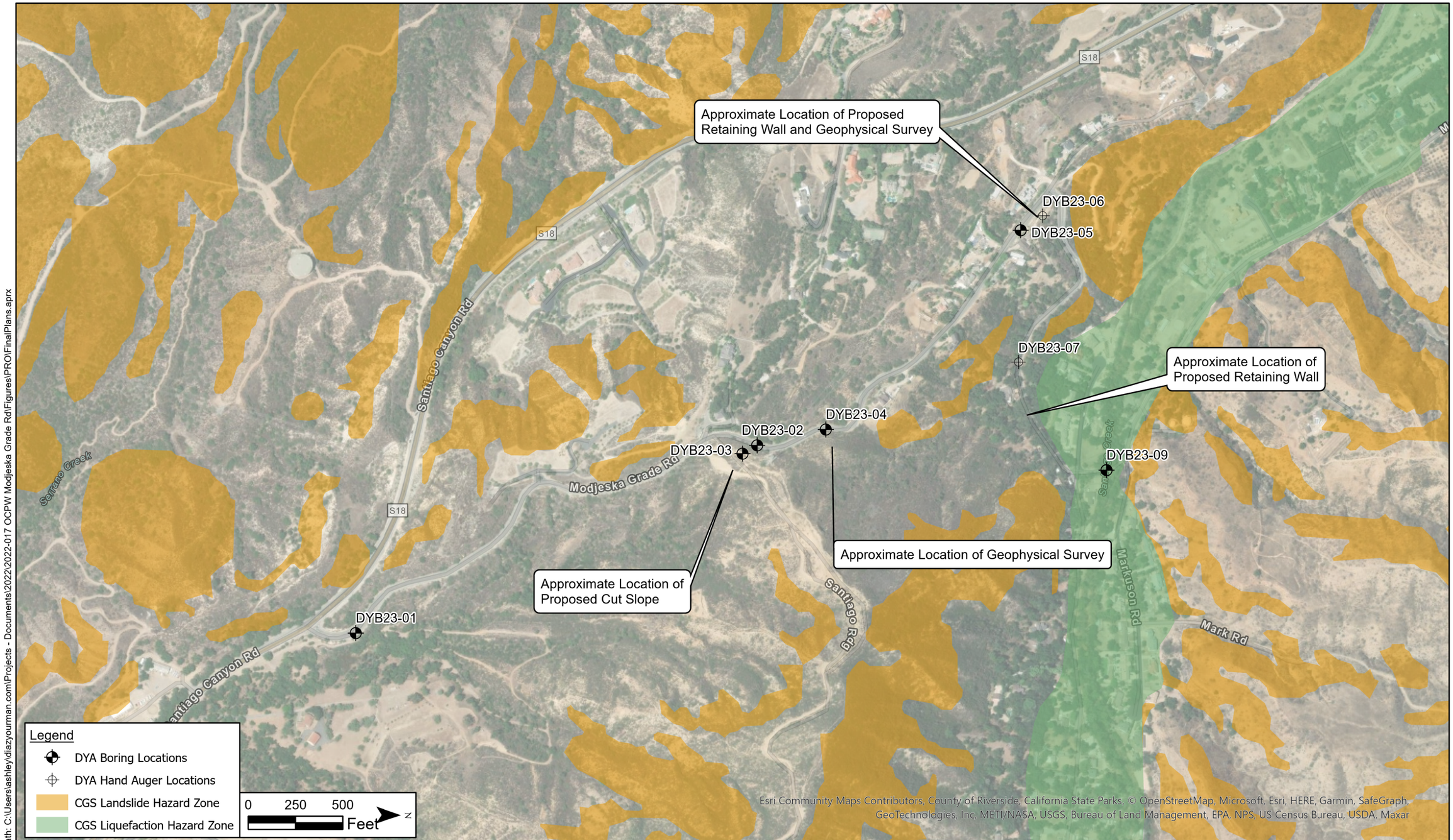

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Figure 6 - SEISMIC HAZARDS

We judge that the subsurface sandy soils will not be subject to liquefaction and/or seismic settlement. Liquefaction and seismic settlement analyses (CGS, 2008) were not performed based on the following considerations:

- The majority of the Project site was not mapped within a zone designated as being potentially susceptible to seismically-induced liquefaction (CGS, 2023), as shown on Figure 6. The Project alignment, between Shadowland Circuit and Modjeska Canyon Road, is mapped within a zone designated as being potentially susceptible to liquefaction; however, the subsurface conditions encountered during the current subsurface exploration are not typically associated with liquefaction, as discussed in Section 3.3.
- The Project site is approximately 700 feet above the groundwater levels measured in nearby monitoring wells; see Section 3.4.
- The SPT N-values and equivalent SPT N-values of the sandy soils at the Project site were greater than values typically associated with soils that are prone to liquefaction and/or dry sand settlement.

Some of the adjacent hillsides to the proposed Project alignment are mapped within a zone designated as being potentially susceptible to seismically induced landslides (CGS, 2023), as shown on Figure 6. However, the proposed cut slope near Station 38+50 and the proposed retaining walls are not mapped within zones designated as being potentially susceptible to seismically induced landslides. Seismically induced landslides are not anticipated to affect the proposed improvements. The seismic stability of the design geometries for the proposed cut slope is discussed in Section 4.2.4. Note that it was not in DYA's scope of services to evaluate the seismic stability of the existing slopes adjacent to the proposed improvements.

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4.2 EARTHWORK

4.2.1 Site Preparation and Grading

Prior to the start of construction, the following should be performed:

- All utilities should be located in the field and rerouted, removed, abandoned, or protected.
- Areas to be graded should be stripped of vegetation and debris, and the material should be removed from the site. Roots greater than ½ inch diameter should be removed.
- Pavement and concrete should be separated for recycling.
- A condition survey of existing adjacent improvements should be performed where excavations are planned within the zone of influence of existing structures.

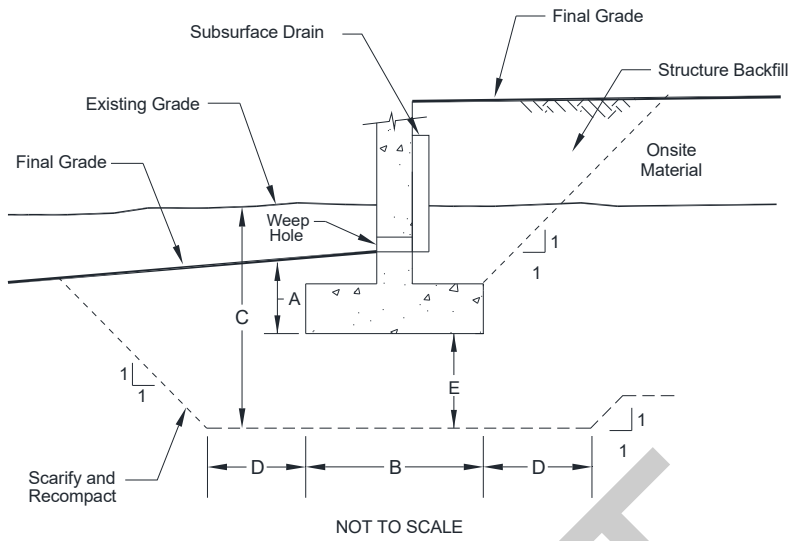
The upper soil should be excavated and replaced with compacted fill as shown on Figure 7 for the proposed retaining wall near Station 74+75. The bottom of the excavation should be:

- Scarified to a depth of 8 inches.
- Moisture-conditioned to above-optimum moisture content.
- Compacted to at least 90% relative compaction[2].

The bottom of the excavation should be firm, hard, and unyielding.

DRAFT

[2] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by ASTM International (ASTM) D1557 test method. Optimum moisture content is the moisture content corresponding to the maximum dry density, as determined by the ASTM D1557 test method.



LOCATION	MINIMUM DIMENSIONS (feet)
A. Footing Embedment Below Subgrade	1.5
B. Footing Width	1
C. Excavation Below Existing Grade (Footing)	3
D. Excavation Beyond Footing	2
E. Excavation Below Footing	1.5
	PRESSURE (psf)
Static (net) Allowable Bearing Capacity (FS≥3)	2,000[1]
Increase per foot of Depth	300
Increase per foot of Width	200
Maximum Transient Bearing Capacity (FS≥2)[2]	3,000

Note(s):
1. Based on Table 1806.2 in the California Building Code (2022).
2. The static bearing capacity should be increased by 33% to calculate the transient bearing capacity.
- FS = factor of safety; psf = pounds per square foot.

Figure 7 - GRADING/FOUNDATION DETAILS (RETAINING WALL NEAR STATION 74+75)

Where the soils at the bottom of the excavation preclude compaction, they should be excavated to a sufficient depth that a firm and unyielding surface is achieved at the planned bottom of excavation or the base of fill. Generally, an overexcavation depth of 1 to 2 feet is sufficient. If desired, a 6-inch-thick working pad consisting of ¾-inch crushed rock can be placed at the bottom of the excavation to facilitate grading and construction. The crushed rock should be placed and spread evenly using manual or mechanical methods and proof rolled using a vibratory compactor or equivalent.

Fill and backfill should be compacted by:

DRAFT

- Placing loose layers less than 8 inches thick.
- Moisture-conditioning to above optimum moisture content.
- Compacting to at least 95% relative compaction.

The compacted subgrade soils should be firm, hard, and unyielding.

4.2.2 Earthwork Considerations

In general, the in situ moisture contents of the near surface soils were approximately 1% to 3% above/below optimum moisture content. Moisture conditioning to near optimum moisture content will be required for compaction.

Based on the existing in situ dry densities and an assumed relative compaction of 95% for fill and backfill, we estimate that the shrinking and swelling from cut to fill for the existing on-site soils will be less than approximately 5% (e.g., 1 cubic yard of existing soil will yield 0.95 to 1.05 cubic yards of fill).

Structure backfill should meet the criteria in Table 7. We judge that the Project will result in a net export. Criteria for import fill are presented in Table 7 for completeness.

Table 7 - FILL AND BACKFILL CRITERIA

CRITERIA	STRUCTURE BACKFILL[1]	IMPORT FILL
Caltrans Specifications Section[2]	19-3.02.C	19-7.02
Greenbook Specifications Section[2]	217-3	300-5
Maximum particle size (inches)	2	1
Maximum percentage passing the No. 200 sieve (%)	30	20
Maximum liquid limit (%)	30	20
Maximum plasticity index (%)	10	7
Minimum sand equivalent	-[3]	--

1. Structure backfill is material placed within the zone shown on Figure 7 and Figure 8.
2. The fills and backfill shall meet the specified Caltrans (Caltrans, 2018)/Greenbook (Building News, 2021) criteria and the additional recommendations provided in this table.
3. Minimum sand equivalent of 20 is required behind retaining/basement walls (within a horizontal distance of 5 feet or one-half of the wall height, whichever is greater).

We judge that the sandy soils encountered in the borings will likely satisfy the above criteria for structure backfill but should be checked prior to construction. The near surface fine-grained soils, if encountered, are not expected to meet the above criteria for structure backfill. The fine-grained soils should not be used as structure backfill without proper blending and moisture-conditioning,

DRAFT

and laboratory testing should be performed to check that the blended soil satisfies the criteria for structure backfill in Table 7.

Site grading may be accomplished with conventional heavy-duty construction equipment. The fill should be compacted using soil compactors as recommended by the most recent version of the Caterpillar Performance Handbook, or equivalent. Some of the fill and backfill may be located in areas with limited access to conventional large compaction equipment. In such areas, lightweight compaction equipment should be used, and extra care should be exercised when moisture-conditioning and compacting the fills. Where compaction is performed adjacent to existing retaining or basement walls, lightweight compaction equipment should be used, or the walls should be braced. Care should be taken to protect existing structures where earthwork will be performed near existing improvements.

Note that difficult grading should be anticipated in the Silverado Formation (e.g., the proposed cut slope near Station 38+50). Based on the geophysical survey performed on the previously proposed cut slope near Station 42+00, as discussed in Section 3.3 and presented in Appendix D, the slope material has seismic P-wave velocities ranging from approximately 1,000 to 2,000 ft/s within the upper 10 feet of the existing slope and seismic P-wave velocities ranging from approximately 2,000 to 4,500 ft/s at deeper depths. Therefore, we judge that the rippability of the onsite soils in the vicinity of the proposed cut slope near Station 38+50 will range from easy to difficult based on the Caterpillar Performance Handbook (which assumes that a Caterpillar D-9 dozer with a single shank is used) and that the rippability difficulty will generally increase with depth.

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4.2.3 Excavations and Temporary Slopes

The stability of temporary excavations is a function of several factors, including the total time the excavation is exposed, moisture condition, soil type and consistency, and contractor's operations. The contractor is responsible for excavation safety. As a guideline, temporary construction excavations should be planned with slopes no steeper than 1.5H:1V (horizontal to vertical). For steeper temporary construction slopes or deeper excavations, shoring should be provided for stability and protection. The contractor should strictly adhere to grading requirements of the Grading Manual for the County of Orange (2017) and applicable health and safety regulations, including those of the Occupational Safety and Health Administration (OSHA, 2008).

We judge that the on-site soils will likely be classified as OSHA Type C soils. Accordingly, temporary shoring should be provided for excavations ranging from 5 to 15 feet deep that will have slopes steeper than 1.5H:1V.

4.2.4 Permanent Slopes

We understand that one permanent slope with an inclination of approximately 2H:1V is planned as a part of the proposed improvements. DYA performed static and pseudostatic slope stability analyses for the critical cross sections, determined by DYA based on slope height and potential surcharges at the top of the slope, using the computer program Slide2 (Rocscience, 2020). A summary of the proposed slope analyzed is presented in Table 8. A summary of surcharges and seismic coefficients included in the slope stability analyses is presented below:

- A traffic surcharge load of 240 psf was applied to slopes with adjacent access roads.
- A horizontal acceleration coefficient of 0.2g (one-third of the PGA presented in Section 4.1) was used for our pseudostatic analyses in accordance with the Southern California Earthquake Center guidelines (SCEC, 2002)

The minimum calculated FS for static and pseudostatic conditions for the proposed slope was greater than or equal to 1.5 and 1.1, respectively, for the cross sections analyzed as part of our investigation. Results of the slope stability analyses are presented in Appendix G.

Table 8 - PERMANENT SLOPE STABILITY

SLOPE	BEGINNING STATION[1]	END STATION[1]	SLOPE HEIGHT (feet)	SLOPE INCLINATION (H:V)	TYPE	FACTOR OF SAFETY		
						Static	Seismic	Temporary
1	37+91	38+66	20 to 22	2H:1V	Cut	2.2	1.5	--

Note(s):
1. Stations based on preliminary Project drawings (OCPW, 2022).

Terracing and drainage of the proposed permanent slopes should be provided in accordance with the Grading Manual for the County of Orange (2017). The slopes should be paved or covered with vegetation to reduce surface erosion. DYA should be consulted if revisions to the proposed improvements will result in permanent slopes with inclinations steeper than 2H:1V.

DRAFT

4.2.5 Drainage and Infiltration

Where feasible, best management practices (BMPs) should be implemented. Runoff water should be collected and directed away from structures, if any, into a closed drainage system, an infiltration system, and/or onto landscaped areas. Infiltration and landscaped areas should be designed to not seep below building foundations or slabs-on-grade.

Based on our review of the geologic conditions, the results of the current and previous field explorations, and soil type correlations, we judge the near surface soils likely consist of a hydrologic soil group (HSG) ranging from B to D (U.S. Department of Agriculture [USDA], 2009). Note HSG D are generally considered to have moderate to high runoff potential when thoroughly wet.

Based on our conceptual assessment of the subsurface conditions, the near surface coarse-grained soils (i.e., sands) and formational units are likely not suitable for infiltration based on the following items:

- The infiltration potential of the near surface soils will likely vary across the Project site due to the fluctuating amount of fines (i.e., clays and silts) encountered throughout the subsurface profile.
- The near-surface soils along Modjeska Grade Road are generally dense to very dense, and the slopes of the adjacent hillsides generally range from moderate to steep.
- Based DYA's conceptual evaluation of erosion along the Project alignment (DYA, 2021), the geologic units surrounding the Project site generally have low to severe erosion potential based on the composition, competency, and cementation of the surrounding geologic units; the degree of weathering of the formation; and the presence, orientation, and degree of weathering of bedding planes and joints, where present.
- Based on our discussions with the Project team, we understand that infiltration would likely be planned along the proposed roadway shoulders. Based on the proximity of the roadway shoulders to the toes and/or tops of the existing slopes infiltration is not advisable.

DRAFT

4.2.6 Erosion

DYA previously prepared a letter report summarizing our conceptual evaluation of the potential for and mitigation of erosion along the Project alignment (DYA, 2021). We understand that the preferred erosion control measures were subsequently selected by the Project team with input from OCPW. Based on our review of the preliminary Project drawings (OCPW, 2022), we understand that open weave textiles and hydroseeding were the preferred erosion control measures selected by the Project team and OCPW.

Note that some of the preferred erosion control measures might have reduced effectiveness because of the steepness of the existing or planned slopes (e.g., the hydroseeding planned south of Station 13+25 and between approximate Stations 62+00 and 64+25). During initial hydroseed placement, such areas might require more hydroseed or special mixes to encourage adhesion of the hydroseed to slopes inclined steeper than 2H:1V. These areas might also require more frequent reapplication of hydroseed than slopes having inclinations flatter than 2H:1V.

In addition to slope geometry, the effectiveness of the hydroseed will depend on the ability of the soils to support growth of the hydroseed mix. The results of the agronomy laboratory testing presented in Appendix F can be used by others to help assess the appropriate hydroseed mix.

4.3 RETAINING WALL TYPE SELECTION (STATION 58+50)

Various retaining wall types can be used for the proposed retaining wall near Station 58+50. Table 9 summarizes the advantages and disadvantages of the different wall types.

We understand that the primary concerns for selecting the appropriate retaining wall include aesthetics of the wall to the public, the amount of excavation, temporary construction stability, and the effect on adjacent properties and structures. The existing slope will then require shoring or a slope cut to provide a safe work environment in which to construct the wall.

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Table 9 - RETAINING WALL ALTERNATIVES

WALL TYPE	CONSTRUCTION SEQUENCE	ADVANTAGES	DISADVANTAGES
Soil Nailed/Tie-Back	Top Down	• No back slope excavation or earthwork • Least expensive	• Specialty contractors required • Corrosion protection required for soil nails/tie-backs • Limited seismic performance history • May require permanent easement on adjacent residential property
Soldier Pile	Top Down	• Conventional design/ construction • No back slope excavation or earthwork • History of satisfactory seismic performance	• More expensive than soil nailed walls • Specialty contractors required • Permanent tie-back anchors may be required • Corrosion protection required for tie-back anchors • May require permanent easement on adjacent residential property if tie-backs are required
Crib/Gabion	Bottom Up	• Conventional design/ construction • Potential landscaping advantages • Some performance history • Specialty contractor may not be required	• Requires back slope excavation • Increased earthwork compared to top down construction • Relatively expensive • Requires import fill material (sand or gravel)
Cantilever Concrete	Bottom Up	• Conventional design/ construction • Specialty contractor not required • History of seismic performance	• Requires back slope excavation • Increased earthwork compared to top down construction • Relatively expensive

4.4 FOUNDATION DESIGN

The proposed retaining wall near Station 74+75 can be supported on shallow foundations placed on a layer of compacted natural soils as shown on Figure 7. The static and temporary allowable bearing capacities include factors of safety of at least 3 and 2, respectively, against shear failure. For properly constructed foundations, total static settlement due to the proposed structural loads is estimated to be less than ½ inch. Differential static settlements between similarly loaded footings are expected to be less than ¼ inch. Most of the static settlements are expected to occur as the loads are applied or shortly thereafter. The static settlements noted above are in addition to the seismic settlements noted in Section 4.1.

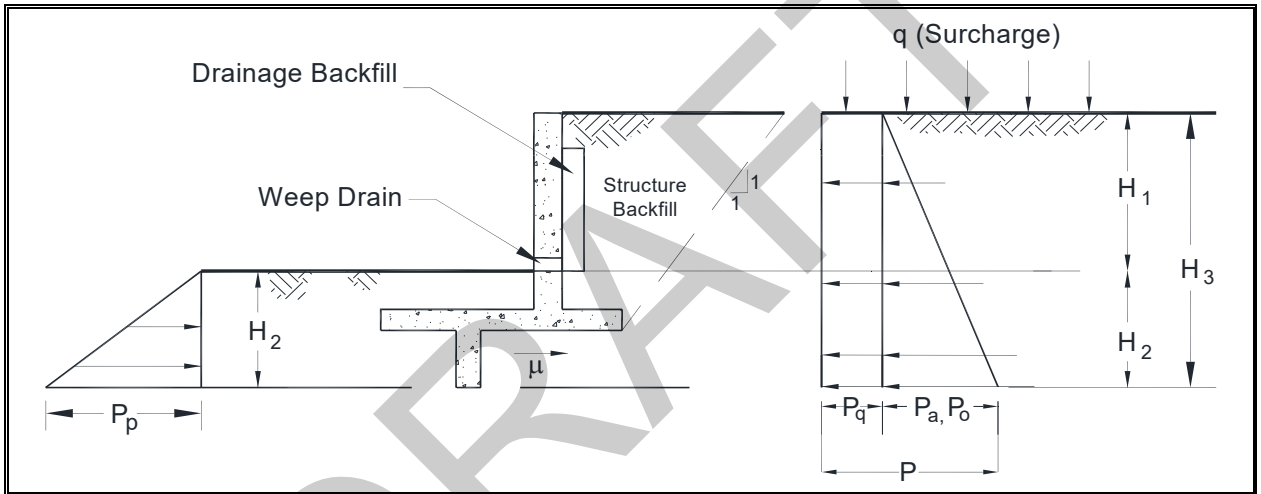
4.5 RESISTANCE TO LATERAL LOADS AND LATERAL EARTH PRESSURES

The proposed retaining wall near Station 74+75 should be designed to resist lateral earth pressures with fluid pressures equivalent to those illustrated on Figure 8. Lateral earth pressures

DRAFT

are presented for walls free to rotate and restrained walls. At-rest earth pressures (restrained walls) should be used for basement walls and where the top of the wall is not expected to move laterally more than 0.001 H1 (see Figure 8). The lateral earth pressures on Figure 9 are based on the structural backfill material noted in Table 7, natural on-site soils, and recompacted on-site soils. See Figure 9 for typical sections of wall drains.

The lateral resistance may be calculated using the minimum of the following: 50% of passive resistance plus 80% of base friction, 100% of passive resistance only, or 100% of the base friction only. Lateral loads can be resisted by an allowable passive soil pressure and base friction, as outlined on Figure 8 for compacted fill, applied against below-grade walls and foundation elements.



$P_p = 150\ H_2 \leq 4{,}000$ psf $\mu = 0.3$	Cantilever Walls $P = P_a + P_q = 45\ H_3 + 0.4q$	Restrained Walls $P = P_o + P_q = 60\ H_3 + 0.4q$

Note(s):

- All values of height (H) in feet, pressure (P) and surcharge (q) in psf, and force (F) in pounds.
- Design lateral earth pressures based on CBC Table 1610A.1 (CBC, 2022).
- P_p, P_a, and P_o are the passive, active, and at-rest earth pressures, respectively.
- P_q is the incremental surcharge pressure; μ is the allowable friction coefficient applied to dead normal (buoyant) loads. Below groundwater, in areas of potential pipeline rupture, or areas of potential surface water infiltration, active and at-rest pressure should be reduced by 50% and hydrostatic pressure should be added to active and at-rest pressures. P_p should be reduced by 50% below the groundwater.
- For 2H:1V slopes above the wall, increase the active and at-rest pressures by 50%; for 1.5H:1V slope, increase the active and at-rest pressures by 100%.
- Neglect the upper 1 foot for passive pressure unless the surface is contained by a pavement or slab.
- See Figure 9 for drainage details.

Figure 8 - LATERAL EARTH PRESSURES (RETAINING WALL NEAR STATION 74+75)

The passive earth pressure and coefficient of sliding friction values presented on Figure 8 include an implicit FS of approximately 1.5 because of simplifying assumptions (e.g., neglecting wall

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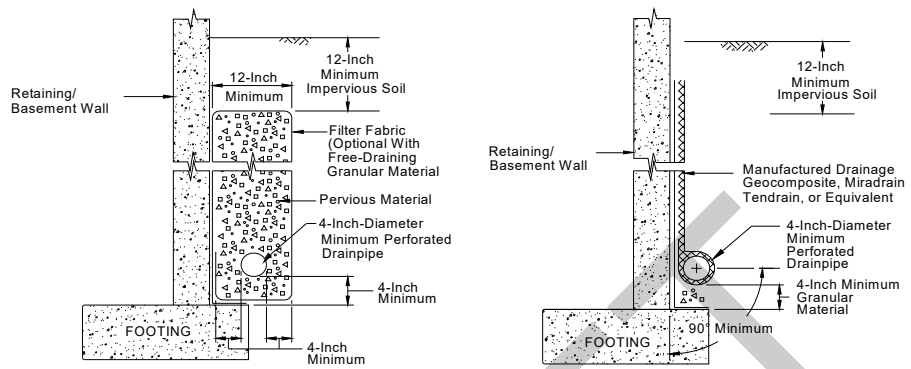
friction, Coulomb earth pressure theory) and assumptions regarding soil slab interface, respectively. The implicit FS for the passive earth pressure presented on Figure 8 can be reduced to 1.1 for seismic loading conditions. The active earth pressure on Figure 8 does not include an implicit FS.



MATERIAL	CALTRANS SPECIFICATIONS	GREENBOOK SPECIFICATIONS
Free-Draining Granular Material	68-2.02 (Class 2)	300-3.5.2
Geotextile Filter Fabric	88-1.02B	300-8
Perforated Pipe	68-2.02	207-13.4

Note(s):
- Drainpipe should drain to an outlet.
- Filter fabric wraps completely around perforated drainpipe and pervious materials.

Figure 9 - RETAINING OR BASEMENT WALL DRAINAGE

For retaining walls less than 3 feet high that have a granular select backfill (see Table 7), the wall drains on Figure 9 can be omitted. For retaining walls where the designer can show that hydrostatic lateral pressures resulting from infiltration of surface water, pipeline rupture, or groundwater will not occur, hydrostatic pressure and wall drainage are not required.

4.6 UTILITY TRENCHES

Utility trenches (either open or backfilled) that parallel structures, pavement, or flatwork should be planned so that they do not extend below a plane with a downward slope of 1.5H:1V from the bottom edge of footings, pavement, or flatwork. Temporary shoring to provide footing, pavement, flatwork, or utility support is recommended unless localized settlements on the order of 1 percent of the trench depth can be tolerated.

All excavations should comply with appropriate safety standards outlined in Section 4.2.3.

DRAFT

Utility pipes should be placed on the bottom of a neatly cut trench on a layer of bedding as outlined on Figure 10 or according to the manufacturer's recommendations, whichever is greater. Jetting should not be allowed for compaction purposes. We anticipate that the near-surface sandy soils will be suitable for use as backfill and as bedding material; however, we recommend that these soils be checked prior to construction for conformance with the Caltrans (2018) and Greenbook (Building News, 2021) specifications shown on Figure 10.

To expedite construction, excavatable controlled low-strength material (CLSM), or “slurry,” can also be used for the backfill of utility trenches. In general, CLSM should satisfy the criteria of Section 201-6 of the Greenbook (Building News, 2021) or Caltrans (2018) Specifications 19-3.02G and 19-3.03I; however, when used within the upper 2 feet of trench zone backfill (dimension E on Figure 10), CLSM should consist of a minimum of 100 pounds of cement per cubic yard (approximate equivalent of 1-sack slurry). Where approved by the manufacturer, CLSM can also be used as bedding or within the pipe zone.

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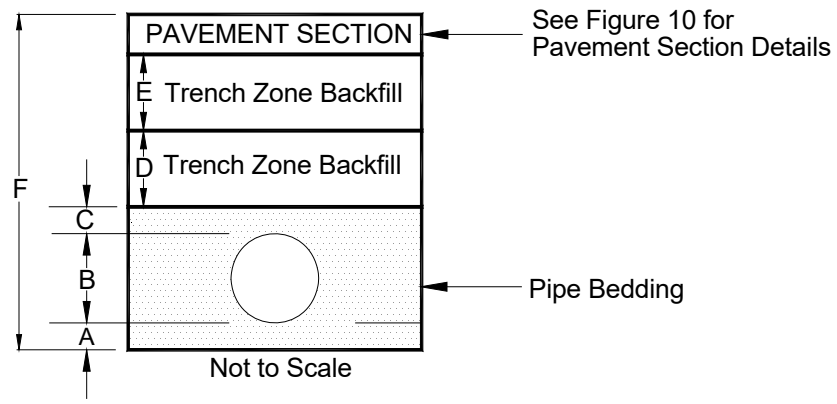

MATERIAL	MINIMUM THICKNESS[1] (feet)	MINIMUM RELATIVE COMPACTION[2] (%)	BACKFILL SPECIFICATIONS	
			Caltrans Specifications	Greenbook Specifications
Pipe Bedding	A = 0.33 or B/4	--	19-3.02F(2), 19-3.03H	217-1, 306-6
Pipe Zone	C = 1	--	19-3.02F(2), 19-3.03H	217-1, 306-6
Trench Zone	D varies	90[3,4]	--	217-2, 306-12
Trench Zone[3]	E = 2[5]	95[4]	--	217-2, 306-12

Note(s):
1. Minimum values; use manufacturer's recommendations if greater.
2. Based on ASTM D1557.
3. To reduce settlement, use 95 percent relative compaction.
4. For slurry backfill, Section 201-6 of the Greenbook (Building News, 2021) or Caltrans (2018) Specifications 19-3.02G and 19-3.03I can be used.
5. E = 0 if no pavement or settlement-sensitive structures at surface.

- See Section 4.7 for pavement section details.

Figure 10 - PIPELINE BACKFILL SCHEMATIC

4.7 PAVEMENT THICKNESS DESIGN

Recommended minimum dense graded hot mix asphalt (HMA) pavement sections are presented on Figure 11 and Figure 12. The recommended minimum pavement sections are based on the following:

- The Orange County Highway Design Manual (County of Orange, 2005) and Caltrans Highway Design Manual (2020). We understand that the proposed Project is subject to OCPW review; however, minimum pavement sections in accordance with Caltrans design criteria are also provided for comparison.
- The flexible pavement design charts on Figure 605.1A and Figure 605.1B from the Orange County Highway Design Manual (County of Orange, 2005).

DRAFT

- R-value of 15, which is based on the most conservative R-value laboratory test result presented in Appendix E.
- Traffic index (TI) of 5.9, as provided by OCPW.
- Design life of 20 years.

The minimum thickness requirement of compacted basement soil and aggregate base are outlined on Figure 11. The basement soils should be firm, hard, and unyielding, and not "pumping" prior to placing the aggregate base. The aggregate base requirements and specifications also are outlined on Figure 11. If the basement soil cannot be compacted, the soil should be overexcavated as noted in Section 4.2.1.

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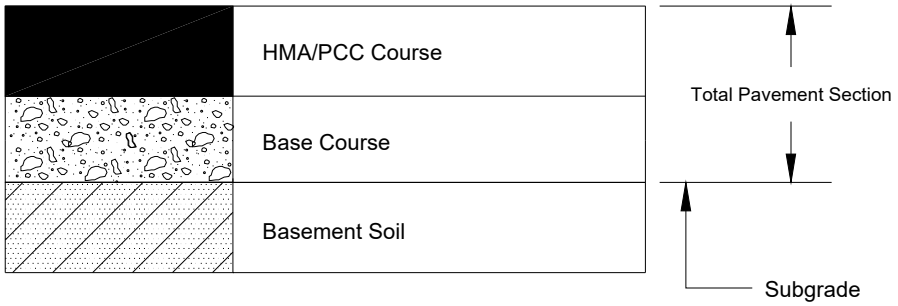


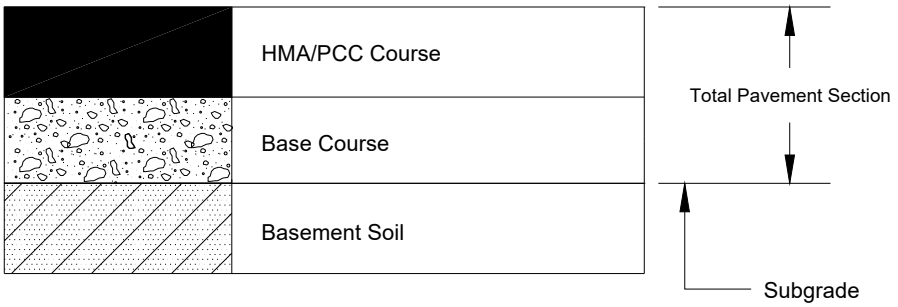
COURSE	MINIMUM THICKNESS (feet)	
	HMA Over Base	Full Depth HMA
HMA[1]	0.3[2]	0.65
AB[3,4]	0.9	--
Basement Soil[5]	1	1

Note(s):

1. Dense-graded AC should satisfy the requirements of Caltrans Standard Specifications Section 30 (Caltrans, 2018) or Greenbook (Building News, 2021) Sections 203-6 and 302-5.
2. Corresponds to minimum thickness per Orange County Highway Design Manual (2005).
3. AB = Class 2 aggregate base in accordance with Caltrans Standard Specifications Section 26 or crushed aggregate base (CAB) or crushed miscellaneous base (CMB) in accordance with Greenbook Sections 200-2.2 and 200-2.4, respectively. The minimum relative compaction is 95%.
4. G_f value of 1 was used for AB per Table 605.1A of the Orange County Highway Design Manual.
5. Compacted in-place natural soil or fill; the minimum is 95% relative compaction.

Figure 11 - PAVEMENT THICKNESS (ORANGE COUNTY DESIGN CRITERIA)

DRAFT



COURSE	MINIMUM THICKNESS (feet)	
	HMA Over Base	Full Depth HMA
HMA[1]	0.4	0.7
Class 2 AB[2]	0.7	--
Basement Soil[3]	1	1

Note(s):
1. HMA should satisfy the requirements of Caltrans Standard Specifications Section 39 (Caltrans, 2018).
2. Class 2 AB should satisfy the requirements of Caltrans Standard Specifications Section 26 (Caltrans, 2018). The minimum relative compaction is 95%.
3. Compacted in-place natural soil; the minimum is 95% relative compaction.

Figure 12 - PAVEMENT THICKNESS (CALTRANS DESIGN CRITERIA)

Where the pavement basement soils shown on Figure 11 and Figure 12 preclude compaction because fine-grained soils are encountered at the pavement subgrade, the basement soils should be overexcavated to a sufficient depth such that a firm and unyielding surface is achieved at the planned bottom of the excavation or the base of fill. Overexcavation limits, if required, are best and most accurately determined in the field after the pavement subgrade (i.e., the bottom of the aggregate base [AB] layer shown on Figure 11 and Figure 12) is exposed and proof rolled.

The dense-graded HMA layers should not be replaced with open-graded asphalt concrete (OGAC) and pervious PCC, respectively, to provide a fully permeable pavement. A separate design is recommended for fully permeable pavements.

4.8 SOIL CORROSION POTENTIAL

Four soil samples were tested for soluble sulfate during previous field investigations performed by the County of Orange (2006). The range of test values is summarized in Table 10. The corrosion potential test results are presented in Appendix B for reference.

DRAFT

Table 10 - CORROSION POTENTIAL

CONSTITUENT	CRITERIA FOR CORROSIVE MATERIALS[1]	RANGE OF VALUES
Soluble sulfate content (ppm)	>1,500	82 to 466

Note(s):
1. More restrictive criteria of Caltrans (2021) and LACDPW (2013) are indicated.
- ppm = parts per million.

Analytical chemical test results indicated 82 to 466 ppm soluble sulfate concentrations in the subsurface soils. Based on these test results, we recommend that the concrete be designed for exposure class S1 from American Concrete Institute (ACI) 318 (ACI, 2014). Note that 25 additional soil samples were tested for soluble sulfate during previous field investigations performed by the County of Orange (1995, 1999, 2001); however, the individual test results were not available at the time of this report. The available data generally indicate a soluble sulfate content of less than 2,000 ppm in those samples.

In addition to the soil characteristics, external factors such as nearby active corrosion systems will greatly affect the need for an active corrosion protection system. We recommend that a corrosion specialist be contacted for details of corrosion protection and that additional corrosion potential laboratory testing for pH, soluble chloride, and soil electrical resistivity be performed if corrosion protection is required.

Potential import soils should be tested prior to transport to the site to check that they are not classified as corrosive to buried metal pipes or concrete based on Caltrans (2021) and LACDPW (2013) criteria.

DRAFT

5 PLAN REVIEW, CONSTRUCTION OBSERVATION, AND TESTING

DYA should be retained to review the finished grading plans and related specifications for conformance with the intent of our recommendations. The review will enable DYA to modify the recommendations if final design conditions are different than presently understood.

During construction, DYA should provide field observation and testing to check that the site preparation, excavation, foundation installation, and finished grading conform to the intent of these recommendations, project plans, and specifications. This would allow DYA to develop supplemental recommendations as appropriate for the actual soil conditions encountered and the specific construction techniques used by the contractor. If retained during construction, DYA should also be consulted on geotechnical questions, construction problems, and unanticipated site conditions.

In accordance with CBC Chapter 17, Section 1704A, DYA cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction. The parties that do observe construction of grading and foundation installation should be prepared to accept transfer of responsibility under CBC 1704A and deliver required submittals during and after construction, assuming all responsibility and liability.

DRAFT

6 LIMITATIONS

This report has been prepared for this Project in accordance with generally accepted geotechnical engineering practices common to the local area. No other warranty, expressed or implied, is made.

The analyses and recommendations contained in this report are based on the literature review, field exploration, and laboratory testing conducted in the area. The results of the field exploration indicate subsurface conditions only at the specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between such locations. Although subsurface conditions have been evaluated as part of the exploration, we have not conducted chemical laboratory testing on samples obtained or evaluated the site with respect to the presence or potential presence of contaminated soil or groundwater conditions, mold, or methane gas.

The validity of our recommendations is based in part on assumptions about the stratigraphy. Observations during construction can help confirm such assumptions. If subsurface conditions different from those described are noted during construction, recommendations in this report must be re-evaluated. DYA should be retained to observe earthwork construction to help confirm that our assumptions and recommendations are valid or to modify them accordingly. DYA cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction.

This report is intended for use only for the Project described. If any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by DYA. We are not responsible for any claims, damages, or liability associated with the interpretation of subsurface data or reuse of the subsurface data or engineering analyses without our express written authorization.

DRAFT

7 REPORT REVISION LOG

REVISION NO.	DATE	REVISION DESCRIPTION
Version 1	October 30, 2023	Internal Draft to Client

DRAFT

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APPENDIX A -
PRELIMINARY PROJECT DRAWINGS

DRAFT

County of Orange

OC PublicWorks

SANTA ANA, CALIFORNIA

JAMES TREADAWAY, P.E., S.E., DIRECTOR

PLANS FOR CONSTRUCTION OF

MODJESKA GRADE ROAD IMPROVEMENTS

FROM: SANTIAGO CANYON ROAD
TO: SILVERADO CREEK BRIDGE

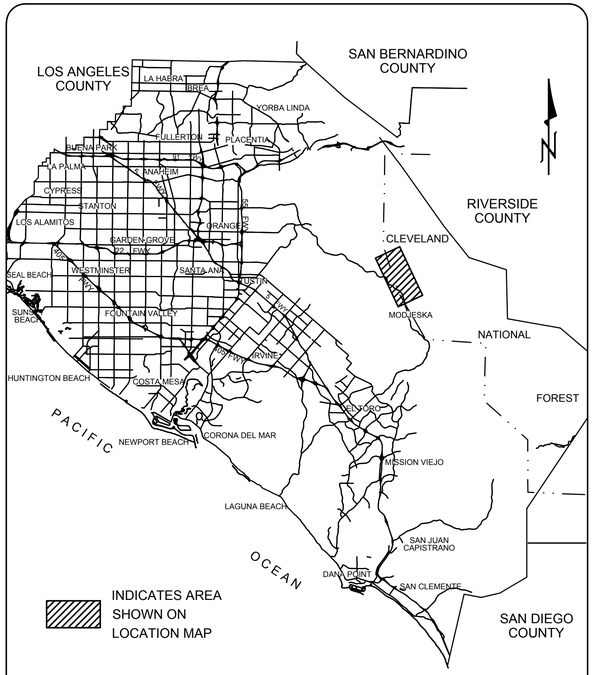
W.O. NO. EQ17009C

35% SUBMITTAL

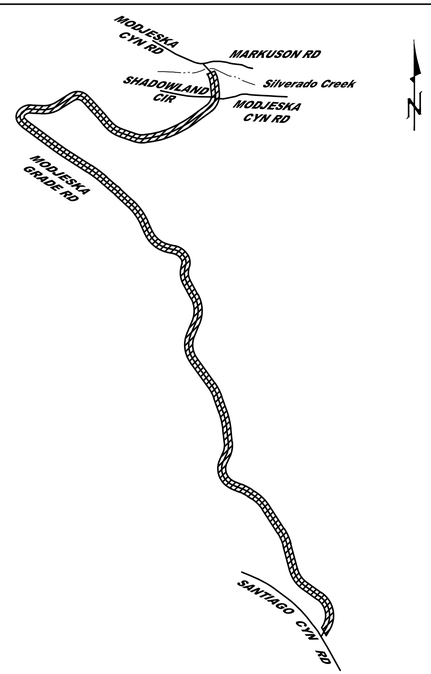
OCTOBER 2021

REVISED FEB 2022

FUNDED BY: ROAD MAINTENANCE AND REHABILITATION ACCOUNT (RMRA) FUNDS (SENATE BILL 1)
MAINTAINED BY: COUNTY OF ORANGE
POST-PROJECT OWNERSHIP: COUNTY OF ORANGE



VICINITY MAP
NTS



LOCATION MAP
NTS

PROJECT LIMIT

INDEX OF SHEETS

SHEET	No.	DESCRIPTION
------	01	TITLE SHEET
G-01	02	CONSTRUCTION NOTES, ABBREVIATIONS, UTILITY NOTES, LEGEND
X-01	03	TYPICAL SECTIONS
K-01	04	KEY MAP
ST-01 - ST-10	05-14	STREET IMPROVEMENT PLAN
D-01 - D-05	15-19	DRAINAGE & GRADING PLAN
EC-01 - EC-05	20-24	EROSION CONTROL PLAN

UTILITY OWNER	CONTACT	PHONE NO.
AT&T	MICHAEL BALADAD	714-618-9113
COX COMMUNICATIONS	ROSENDO YANEZ	949-563-8374
IRVINE RANCH WATER DISTRICT	BRIANNA PALECEK	949-453-5811
SOUTHERN CALIFORNIA EDISON	LAUREN BLACK	949-343-5787
TRABUCO CANYON WATER DISTRICT	LORRIE LAUSTEN	949-858-0277
AIRTOUCH CELLULAR/ VERIZON	JOHN CROSSE	818-923-9298

DEVIATIONS

1. OCHDM TOPIC 201.1, USE OF CALTRANS HDM TO DETERMINE MINIMUM SIGHT DISTANCE, TO MAINTAIN EXISTING ROADWAY GEOMETRY AND ADJACENT SLOPES/TERRAIN.
2. OCHDM TOPIC 202.2, 6% MAXIMUM SUPERELEVATION , TO MAINTAIN EXISTING SUPERELEVATION RATES.
3. OCHDM TOPIC 203.2(1), USE OF CALTRANS HDM TO DETERMINE CORRECT SUPERELEVATION, TO MAINTAIN EXISTING SUPERELEVATION RATES.
4. OCHDM TOPIC 204.3, 10% MAXIMUM GRADE ON COUNTY LOCAL AND COLLECTOR STREETS, TO MAINTAIN EXISTING GRADES.
5. OCHDM SP 1107 AND TOPIC 301.1, 40' MINIMUM PAVEMENT WIDTH FOR RURAL COLLECTOR STREET, TO BETTER MATCH EXISTING PAVEMENT WIDTH.

APPROVED: _____ DATE
KEVIN ONUMA, P.E.
COUNTY ENGINEER

RECORD DRAWING

CONTRACTOR: _____
RESIDENT ENGINEER: _____
INSPECTOR: _____
CONSTRUCTION START DATE: _____
CONSTRUCTION COMPLETION DATE: _____

COUNTY OF ORANGE PUBLIC WORKS DEPARTMENT

SUBMITTED: _____ DATE
FIONA MAN, P.E.
MANAGER
OC INFRASTRUCTURE PROGRAMS
PROJECT MANAGEMENT

RECOMMENDED: _____ DATE
NARDY KHAN, P.E.
DEPUTY DIRECTOR
OC INFRASTRUCTURE PROGRAMS

APPROVED: _____ DATE
KEVIN ONUMA, P.E.
COUNTY ENGINEER

BENCH MARK:

O.C.S. BM. UU-4-92 ELEV.=1420.44' YEAR LEVELED:1992

NAVD 1988 (O.C.S. 1995 ADJUSTMENT)

DESCRIPTION: FOUND 3 3/4" OCS ALUMINUM BENCHMARK DISK STAMPED "3UU-4-92", SET IN THE TOP OF A 6 IN BY 6 IN. CONCRETE POST. MONUMENT IS LOCATED IN THE SOUTHERLY PORTION OF THE INTERSECTION OF MODJESKA GRADE ROAD AND CANYON HEIGHTS DRIVE, 35 FT. WESTERLY OF THE CENTERLINE OF MODJESKA GRADE ROAD AND 1 FT. WESTERLY OF THE WESTERLY UPHILL BARRICADE. MONUMENT IS SET LEVEL WITH THE GRADE.

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS BASED ON THE CALIFORNIA COORDINATE SYSTEM (CCS83), ZONE VI, NAD 83, OCS (2017.50) EPOCH ADJUSTMENT, AS DETERMINED LOCALLY BY A LINE BETWEEN CONTINUOUS GLOBAL POSITIONING STATIONS CGPS (MJPK) AND (OEOC) BEING NORTH 71°36'55" WEST AS DERIVED FROM THE COORDINATES PUBLISHED BY THE CALIFORNIA SPATIAL REFERENCE CENTER (CSRC) ALONG WITH DATA SHEETS ON FILE IN THE OFFICE OF THE ORANGE COUNTY SURVEYOR.

PREPARED BY

PREPARED UNDER RESPONSIBLE CHARGE OF:

_____ DATE
RAVI P. SHAH, P.E.

NO.	DESCRIPTION	SHT.	APPROVED	DATE

REVISIONS

W. O. NO. EQ17009C
DWG. NO. _____

STREET CONSTRUCTION NOTES

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD. PLAN 120-2
3. CONSTRUCT MODIFIED ROLLED CURB (2' GUTTER)
4. CONSTRUCT CONCRETE SWALE
5. CONSTRUCT CONCRETE V-DITCH
6. CONSTRUCT MODIFIED CURB AND GUTTER (TYPE A2-8 WITH 1' GUTTER)
7. CONSTRUCT RETAINING WALL
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2
9. RECONSTRUCT PORTION OF DRIVEWAY
10. CONSTRUCT CURB AND GUTTER (TYPE A2-6) PER OCPW STD 120-2
11. REMOVE AND RECONSTRUCT EROSION FENCE
12. CONSTRUCT 6" AC DIKE

DRAINAGE CONSTRUCTION NOTES

101. CONSTRUCT INLET (TYPE GO) PER CALTRANS STD. PLAN D72E AND D72F.
102. NOT USED
103. CONSTRUCT INLET MODIFIED WITH SIDE OPENING. SEE DETAIL ON SHEET D-01.
104. CONSTRUCT FLARED END INLET
105. CONSTRUCT 36" R.C.P.
106. CONSTRUCT 18" R.C.P.
107. CONSTRUCT JUNCTION STRUCTURE
108. CONSTRUCT 24" R.C.P.
109. CONSTRUCT DIVERSION STRUCTURE
110. CONSTRUCT 48" R.C.P.
111. CONSTRUCT R.C.B.
112. CONSTRUCT INLET (TYPE TBD)
113. CONSTRUCT OUTLET DISSIPATION
114. ABANDON PIPE

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN
3. RELOCATE, PER PLAN
4. ADJUST TO GRADE, PER PLAN

UTILITY:

A. SOUTHERN CALIFORNIA EDISON (SCE)
B. AT&T
C. COX COMMUNICATION
D. IRVINE RANCH WATER DISTRICT (IRWD)
E. TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ABBREVIATIONS:

AB	AGGREGATE BASE
AC	ASPHALT CONCRETE
AP	ANGLE POINT
APPROX.	APPROXIMATE
BC	BEGIN CURVE
BEG	BEGIN
BVC	BEGIN VERTICAL CURVE
C&G	CURB AND GUTTER
CMP	CORRUGATED METAL PIPE
COMM	COMMUNICATION
CONC	CONCRETE
DI	DRAINAGE INLET
EC	END CURVE
EL	ELEVATION
ELEC	ELECTRIC
END	ENDING
EP	EDGE OF PAVEMENT
ESMT	EASEMENT
ETW	EDGE OF TRAVELED WAY
EVC	END VERTICAL CURVE
EXIST	EXISTING
FG	FINISHED GRADE
FH	FIRE HYDRANT
H	HEIGHT
H	HORIZONTAL
L	LENGTH
LT	LEFT
MAX	MAXIMUM
MBGR	METAL BEAM GUARDRAIL
MGS	MIDWEST GUARDRAIL SYSTEM
MH	MANHOLE
MOD	MODIFIED
OG	ORIGINAL GROUND
OH	OVERHEAD
PB	PULL BOX
PCC	POINT OF COMPOUND CURVE
PG	PROPOSED GRADE
PP	POWER POLE
PVC	POLYVINYL CHLORIDE PIPE
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
R/W	RIGHT OF WAY
R.C.B.	REINFORCED CONCRETE BOX
R.C.P.	REINFORCED CONCRETE PIPE
RET	RETAINING
RD	ROAD
RT	RIGHT
STA	STATION
STD	STANDARD
STL	STEEL
TBD	TO BE DETERMINED
TC	TOP OF CURB
TCE	TEMPORARY CONSTRUCTION EASEMENT
UG	UNDERGROUND
V	VERTICAL
VAR	VARIES
WM	WATER METER
WV	WATER VALVE

NO WORK SHALL BE DONE ON THIS SITE UNTIL BELOW AGENCY IS NOTIFIED OF INTENTION TO GRADE OR EXCAVATE.

Underground Service Alert
Call: TOLL FREE
1-800
227-2600

CALL BEFORE YOU DIG

TWO WORKING DAYS BEFORE YOU DIG

ATTENTION IS DIRECTED TO THE POSSIBLE EXISTENCE OF UNDERGROUND FACILITIES NOT KNOWN OR IN A LOCATION DIFFERENT FROM THAT WHICH IS SHOWN ON THE PLANS OR IN THE SPECIAL PROVISIONS. THE CONTRACTOR SHALL TAKE STEPS TO ASCERTAIN THE EXACT LOCATION OF ALL UNDER-GROUND FACILITIES PRIOR TO DOING WORK THAT MAY DAMAGE SUCH FACILITIES OR INTERFERE WITH THEIR SERVICE.

BEFORE EXCAVATING, THE CONTRACTOR SHALL VERIFY THE LOCATION OF UNDERGROUND UTILITIES BY CONTACTING UNDERGROUND SERVICE ALERT AT 1-(800)-227-2600.

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER
RAM P. SHAH
No. 79183
Exp. 3/31/24
CIVIL
STATE OF CALIFORNIA

DATE

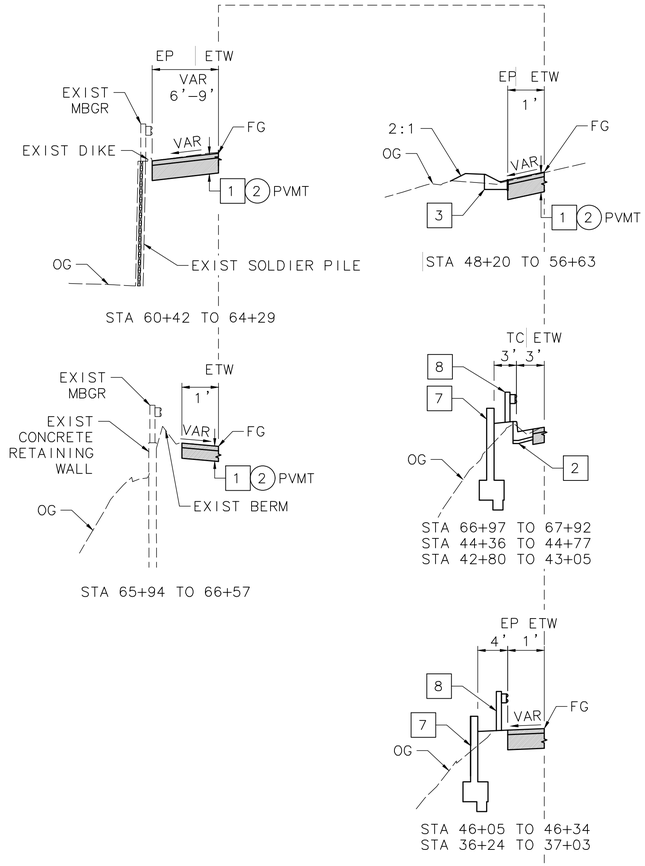
DESIGNED BY: TK
DRAWN BY: MV
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_G1.DWG
PLOT DATE: Friday, February 11, 2022
SCALE: AS SHOWN

County of Orange
OC Public Works

PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS
CONSTRUCTION NOTES
ABBREVIATIONS, UTILITY NOTES, LEGEND

SHEET
G-01



CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD. PLAN 120-2
3. CONSTRUCT MODIFIED ROLLED CURB (2' GUTTER)
4. CONSTRUCT CONCRETE SWALE
5. CONSTRUCT CONCRETE V-DITCH
6. CONSTRUCT MODIFIED CURB AND GUTTER (TYPE A2-8 WITH 1' GUTTER)
7. CONSTRUCT RETAINING WALL
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2

REMOVALS :

(2) REMOVE, PER PLAN

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER — RAM P. SHAH — No. 79183 — Exp. 3/31/24 — CIVIL — STATE OF CALIFORNIA

DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_X-1.DWG
PLOT DATE: Friday, February 11, 2022
SCALE: AS SHOWN

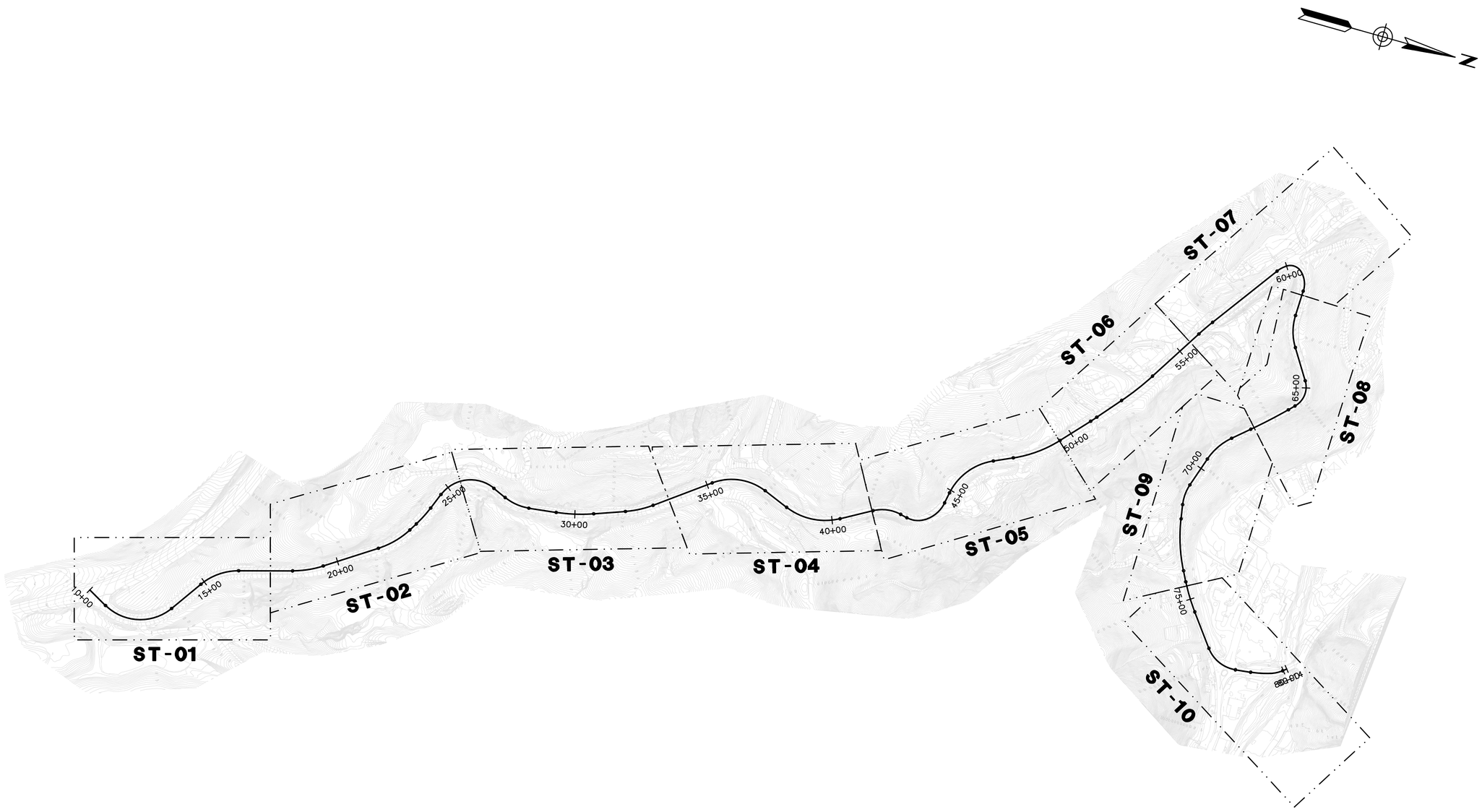
County of Orange
OC Public Works
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS

TYPICAL SECTIONS

SHEET

X-01



INDEX MAP
1" = 200'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER
RAM P. SHAH
No. 79183
Exp. 3/31/24
CIVIL
STATE OF CALIFORNIA

DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_L0.DWG
PLOT DATE: Friday, February 11, 2022
SCALE: AS SHOWN

County of Orange
Public Works

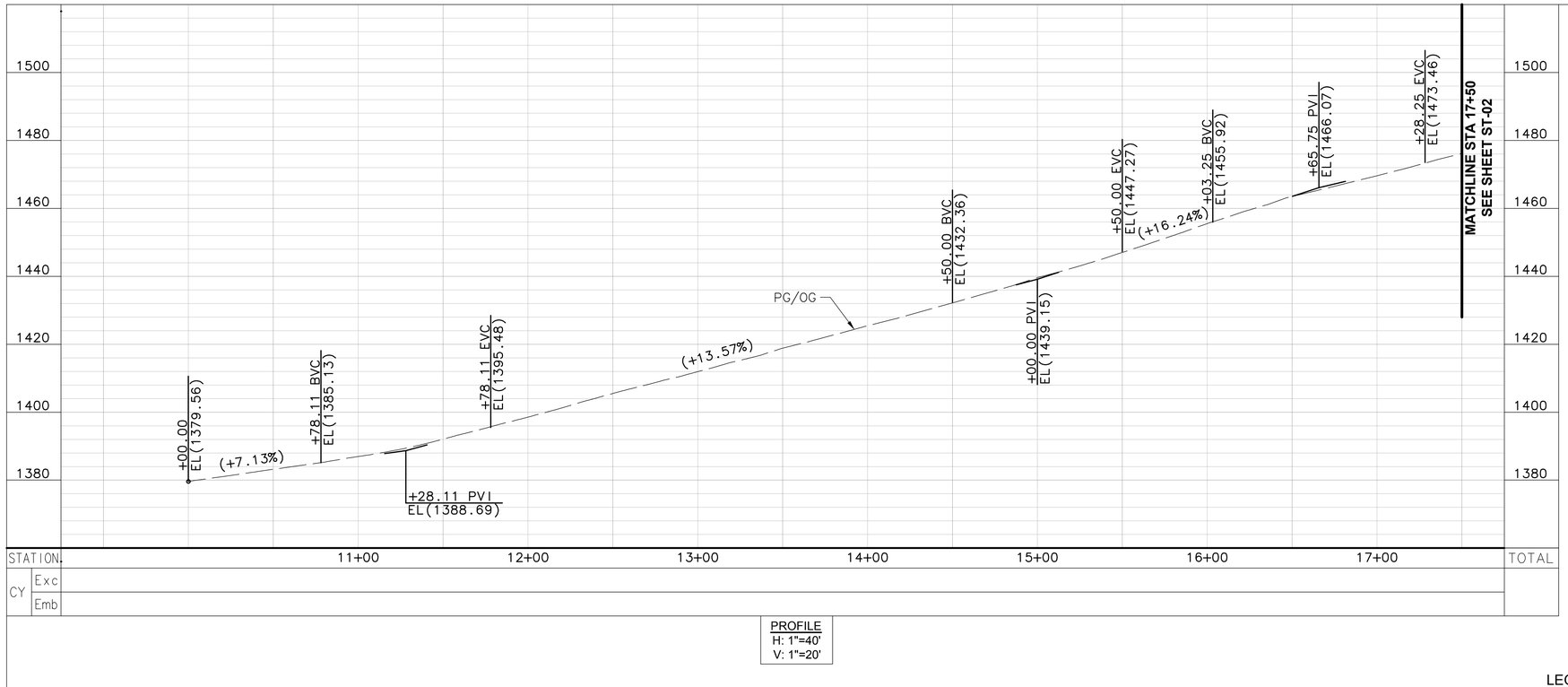
PREPARED BY:
MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS

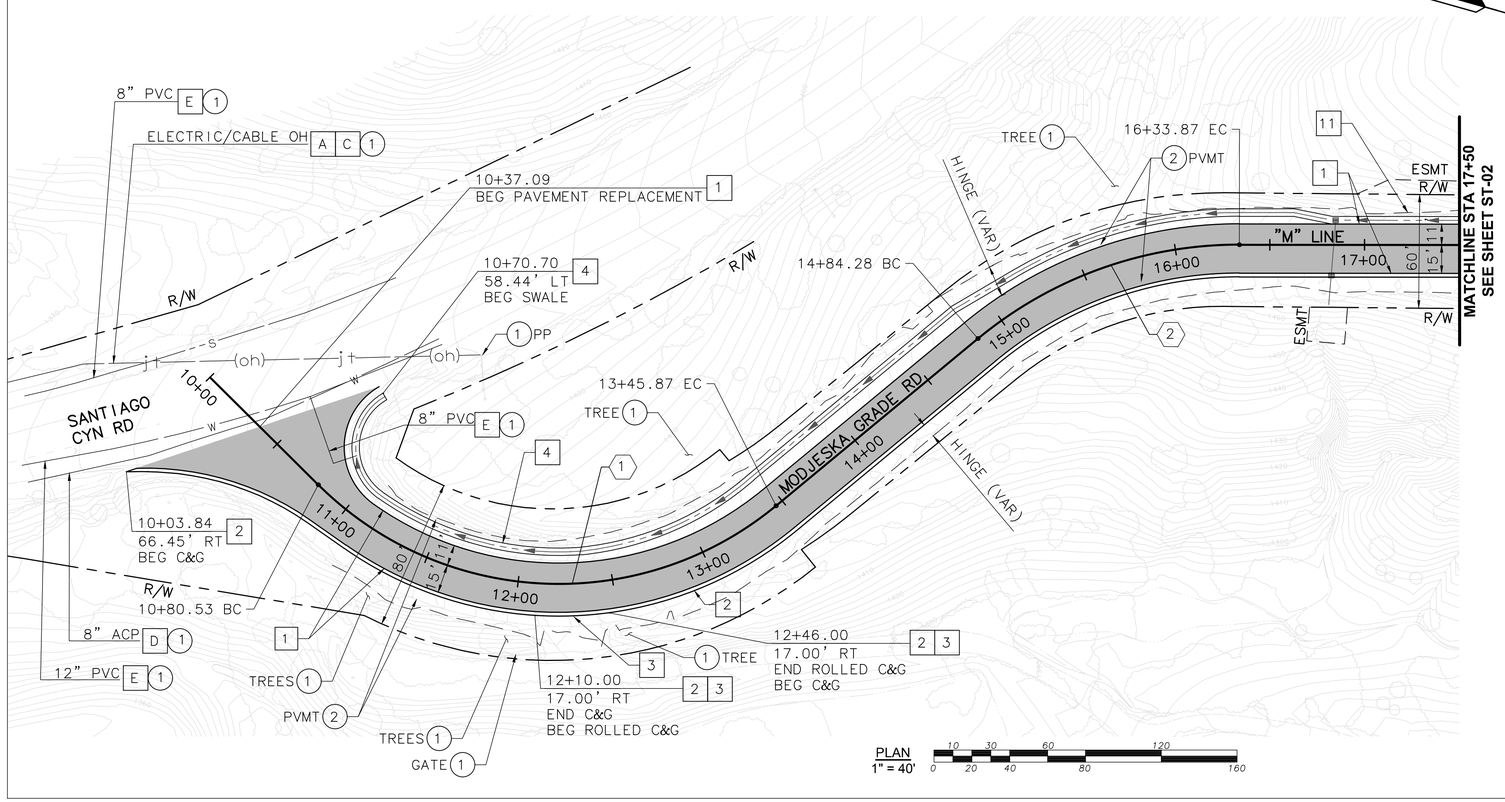
KEY MAP

SHEET

K-01



PROFILE
H: 1"=40'
V: 1"=20'



PLAN
1" = 40'

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
3. CONSTRUCT MODIFIED ROLLED CURB (2' GUTTER)
4. CONSTRUCT CONCRETE SWALE
11. REMOVE AND RECONSTRUCT EROSION FENCE

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN

UTILITY:

A. SOUTHERN CALIFORNIA EDISON (SCE)
B. AT&T
C. COX COMMUNICATION
D. IRVINE RANCH WATER DISTRICT (IRWD)
E. TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE				
CURVE #	RADIUS	DELTA	TANGENT	LENGTH
1	180.00'	84°27'34"	163.38'	265.34'
2	216.00'	39°40'52"	77.94'	149.59'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_L1-4.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

County of Orange
OC Public Works
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 10+00 TO STA 17+50
STREET IMPROVEMENT PLAN

SHEET
ST-01

PROFILE
H: 1"=40'
V: 1"=20'

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
4. CONSTRUCT CONCRETE SWALE
11. REMOVE AND RECONSTRUCT EROSION FENCE

DISPOSITION NOTES:

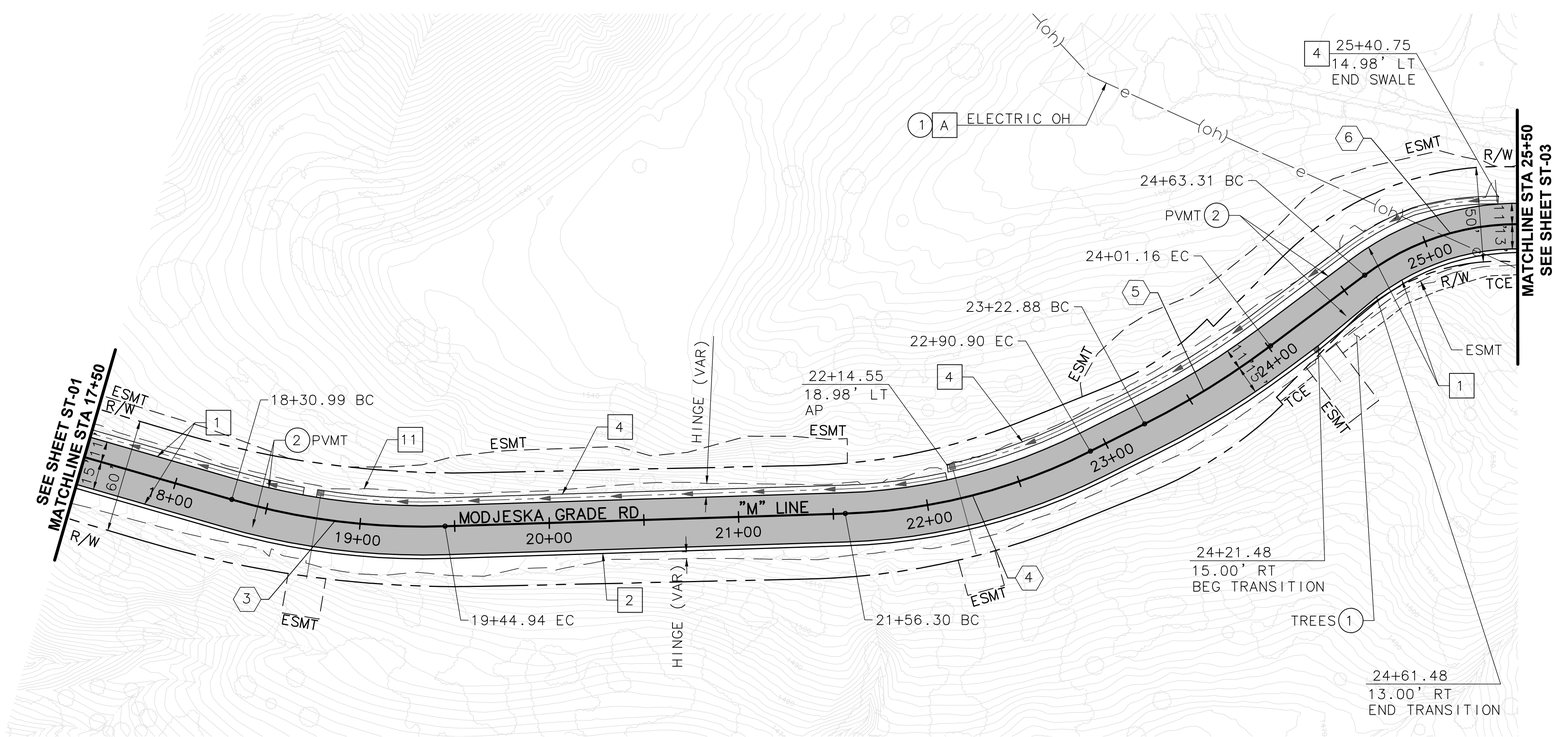
1. PROTECT IN PLACE
2. REMOVE, PER PLAN

UTILITY:

A. SOUTHERN CALIFORNIA EDISON (SCE)
B. AT&T
C. COX COMMUNICATION
D. IRVINE RANCH WATER DISTRICT (IRWD)
E. TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION



PLAN
1" = 40'

ALIGNMENT CURVE TABLE				
CURVE #	RADIUS	DELTA	TANGENT	LENGTH
3	365.00'	17°53'11"	57.44'	113.94'
4	310.00'	24°52'41"	68.38'	134.60'
5	440.00'	10°11'39"	39.25'	78.28'
6	135.00'	92°21'04"	140.66'	217.60'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

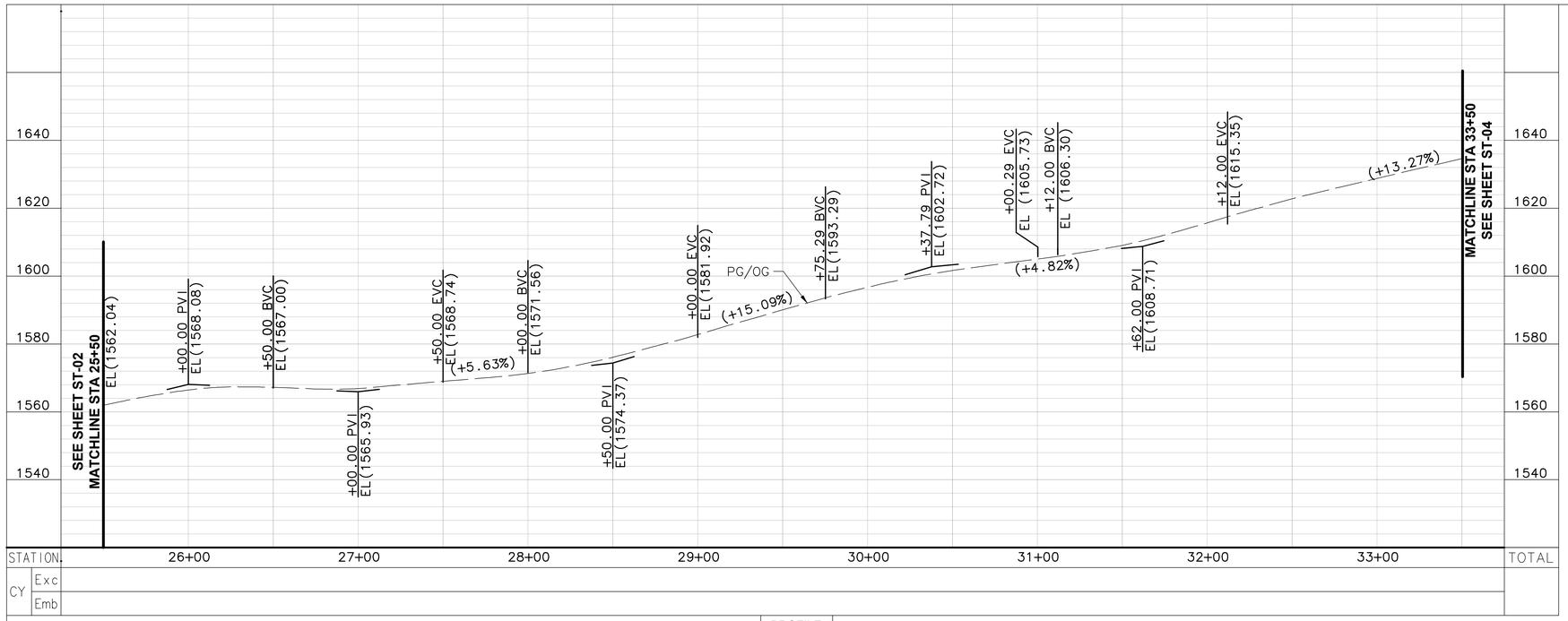
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 78183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: BS
DRAWING NO.:
FILE NAME: IR 20108_I 1-4.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

County of Orange PublicWorks
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 17+50 TO STA 25+50
STREET IMPROVEMENT PLAN

SHEET
ST-02



PROFILE
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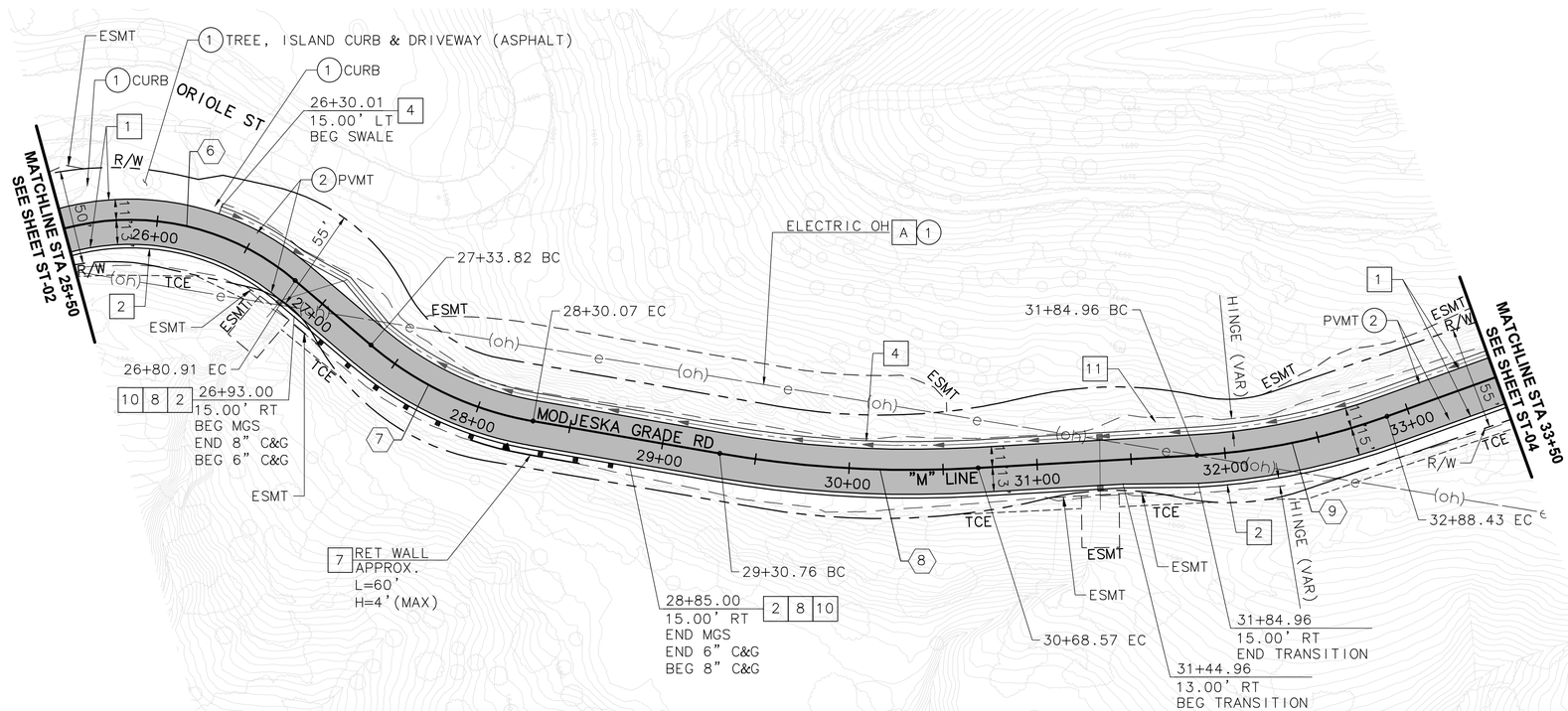
V: 1"=20'



PLAN
1" = 40'

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
4. CONSTRUCT CONCRETE SWALE
7. CONSTRUCT RETAINING WALL
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2
10. CONSTRUCT CURB AND GUTTER (TYPE A2-6) PER OCPW STD PLAN 120-2
11. REMOVE AND RECONSTRUCT EROSION FENCE

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN

UTILITY:

- A SOUTHERN CALIFORNIA EDISON (SCE)
- B AT&T
- C COX COMMUNICATION
- D IRVINE RANCH WATER DISTRICT (IRWD)
- E TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE

CURVE #	RADIUS	DELTA	TANGENT	LENGTH
6	135.00'	92°21'04"	140.66'	217.60'
7	180.00'	30°38'07"	49.30'	96.24'
8	600.00'	13°09'34"	69.21'	137.81'
9	360.00'	16°28'02"	52.09'	103.47'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

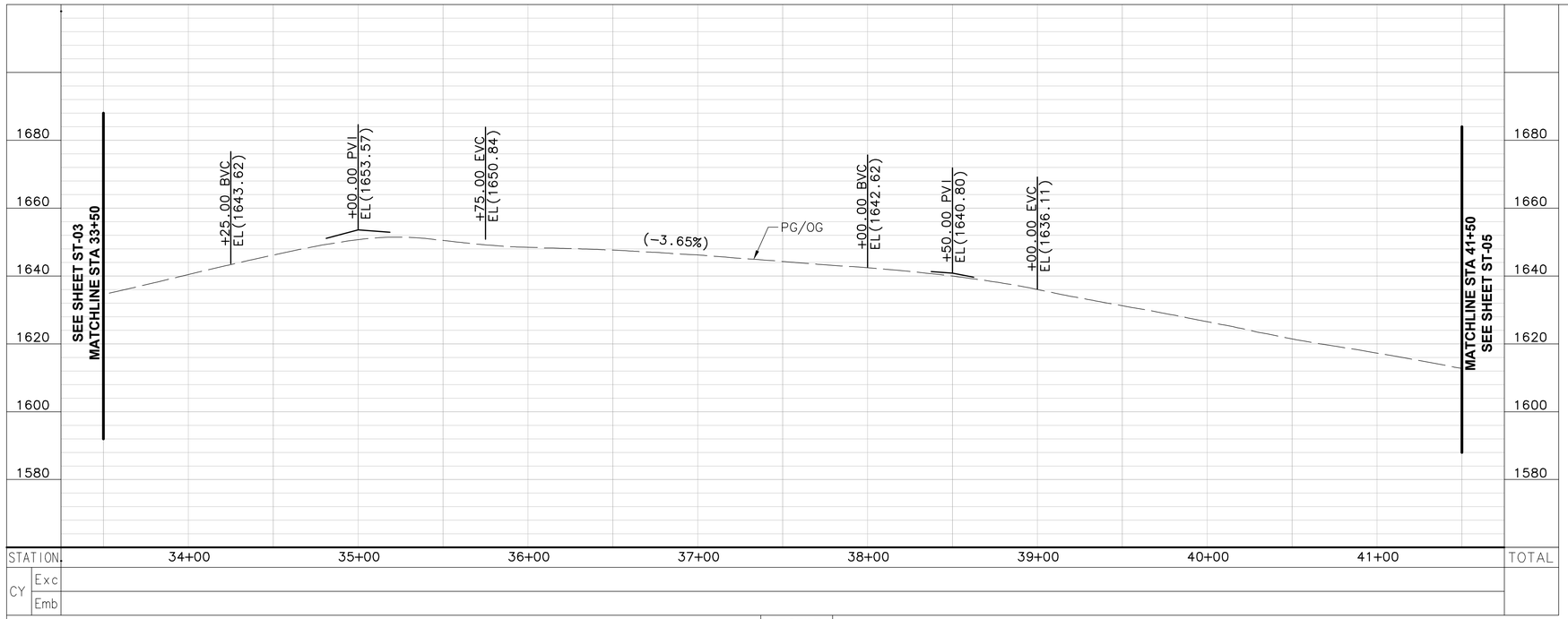
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 78183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MV
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_L-14.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

County of Orange
OC PublicWorks
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 25+50 TO STA 33+50
STREET IMPROVEMENT PLAN

SHEET
ST-03



PROFILE
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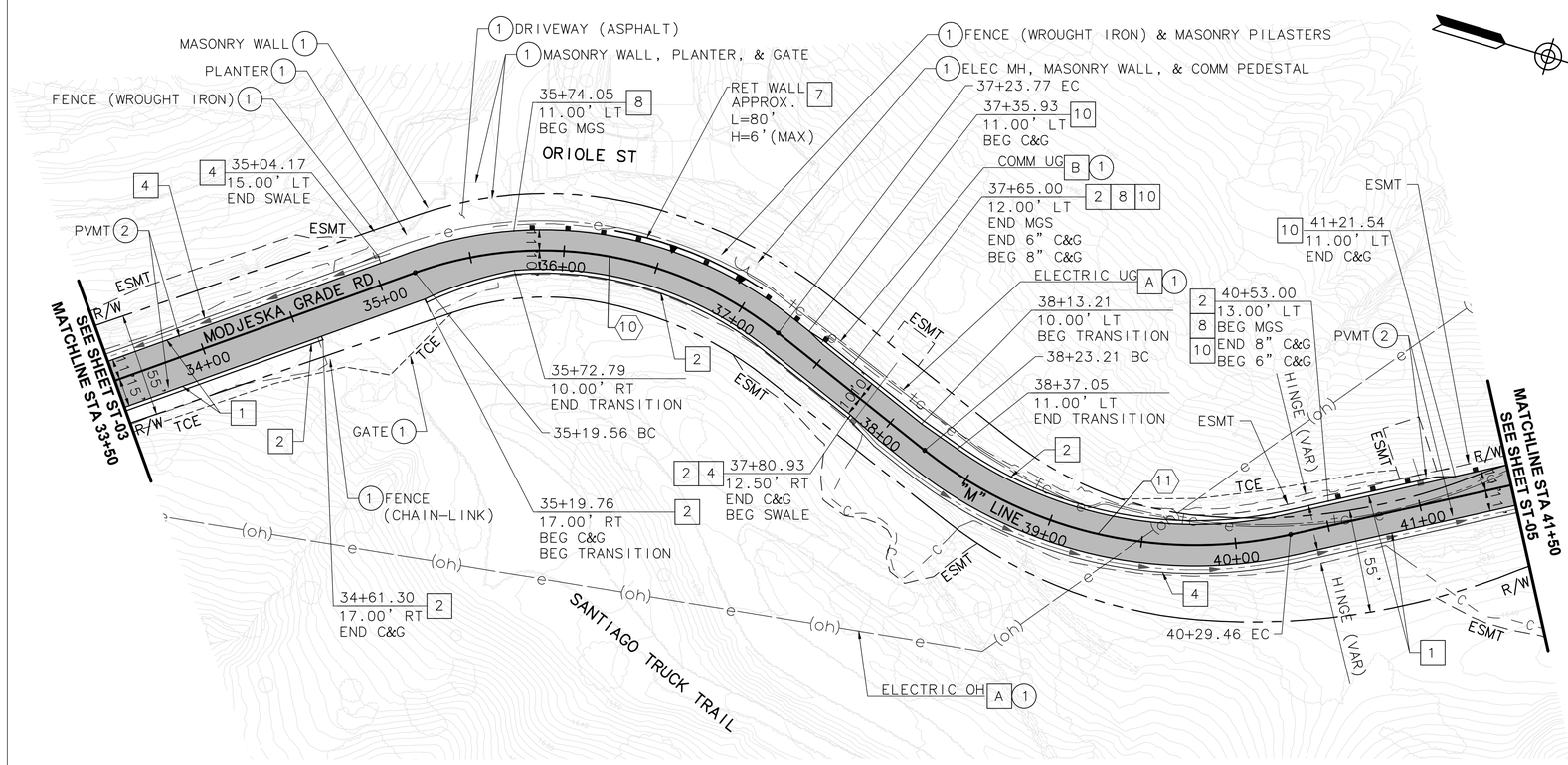
V: 1"=20'



PLAN
1" = 40'

0 10 20 30 40 60 80 120 160

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
4. CONSTRUCT CONCRETE SWALE
7. CONSTRUCT RETAINING WALL
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2
10. CONSTRUCT CURB AND GUTTER (TYPE A2-6) PER OCPW STD PLAN 120-2

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN

UTILITY:

- A SOUTHERN CALIFORNIA EDISON (SCE)
- B AT&T
- C COX COMMUNICATION
- D IRVINE RANCH WATER DISTRICT (IRWD)
- E TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE

CURVE #	RADIUS	DELTA	TANGENT	LENGTH
10	200.00'	58°30'03"	112.01'	204.21'
11	230.00'	51°22'52"	110.64'	206.26'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

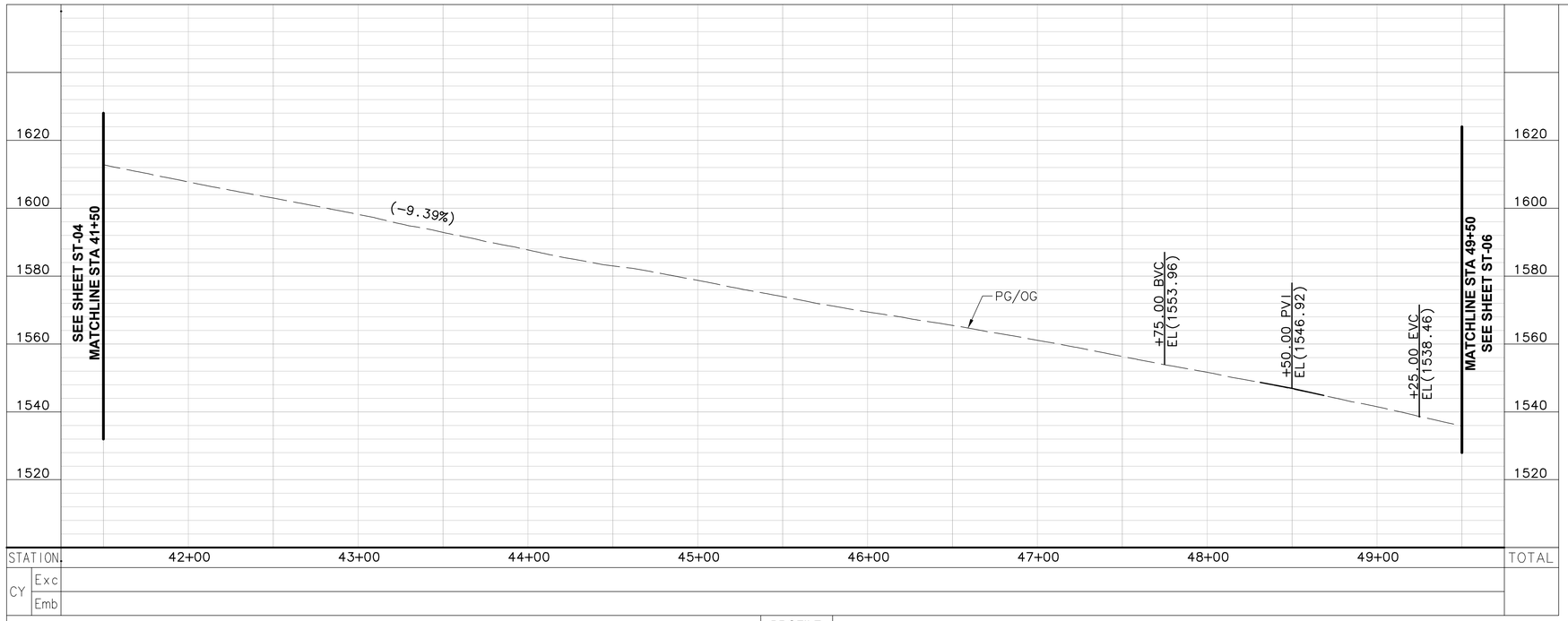
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_L-14.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

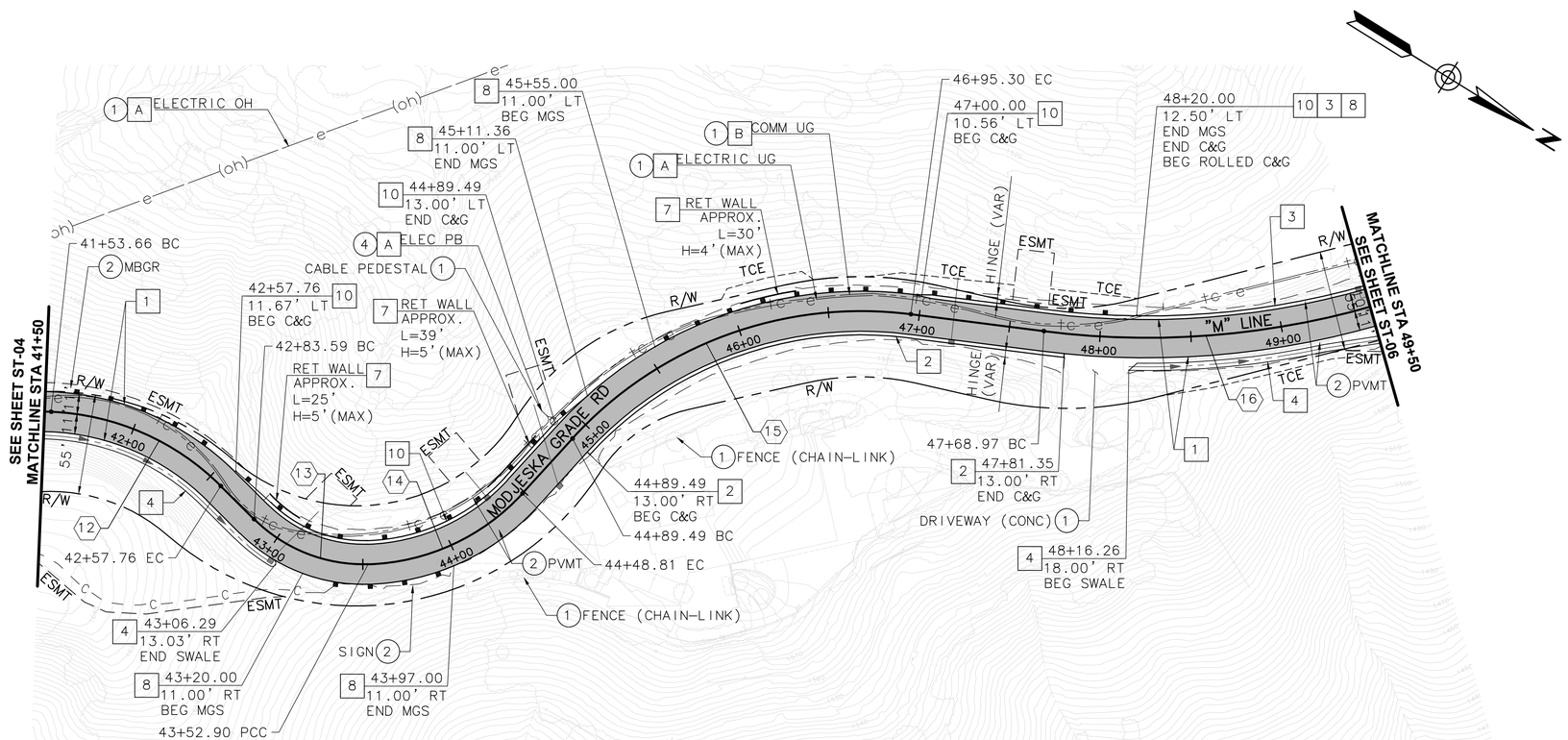
County of Orange
PublicWorks
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 33+50 TO STA 41+50
STREET IMPROVEMENT PLAN

SHEET
ST-04



PROFILE
H: 1"=40'
V: 1"=20'



PLAN
1" = 40'

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
3. CONSTRUCT MODIFIED ROLLED CURB (2' GUTTER)
4. CONSTRUCT CONCRETE SWALE
7. CONSTRUCT RETAINING WALL
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2
10. CONSTRUCT CURB AND GUTTER (TYPE A2-6) PER OCPW STD PLAN 120-2

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN

A. SOUTHERN CALIFORNIA EDISON (SCE)
B. AT&T
C. COX COMMUNICATION
D. IRVINE RANCH WATER DISTRICT (IRWD)
E. TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE

CURVE #	RADIUS	DELTA	TANGENT	LENGTH
12	140.00'	42°36'08"	54.59'	104.10'
13	85.00'	46°43'21"	36.71'	69.31'
14	120.00'	45°47'33"	50.68'	95.91'
15	215.00'	54°50'43"	111.55'	205.80'
16	450.00'	23°22'20"	93.08'	183.56'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

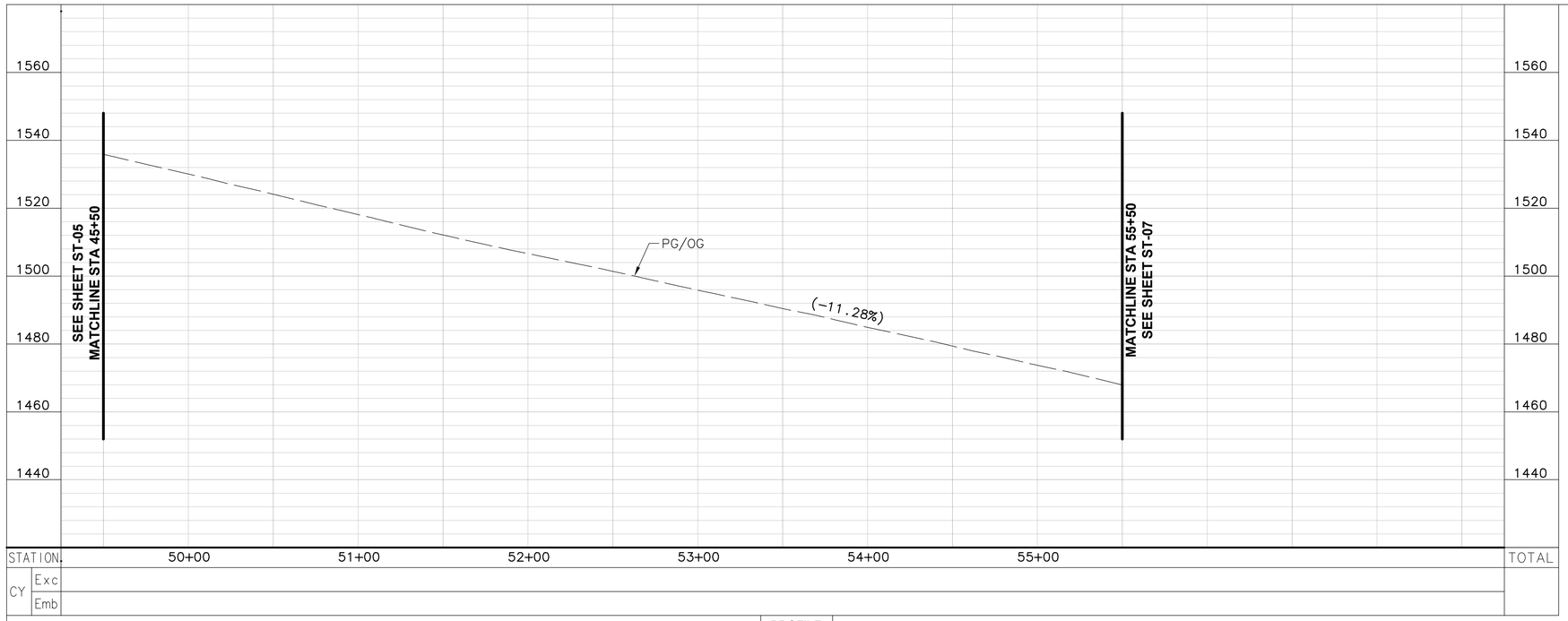
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MV
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-23108_L-58.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

County of Orange OC PublicWorks
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 41+50 TO STA 49+50
STREET IMPROVEMENT PLAN

SHEET
ST-05



PROFILE
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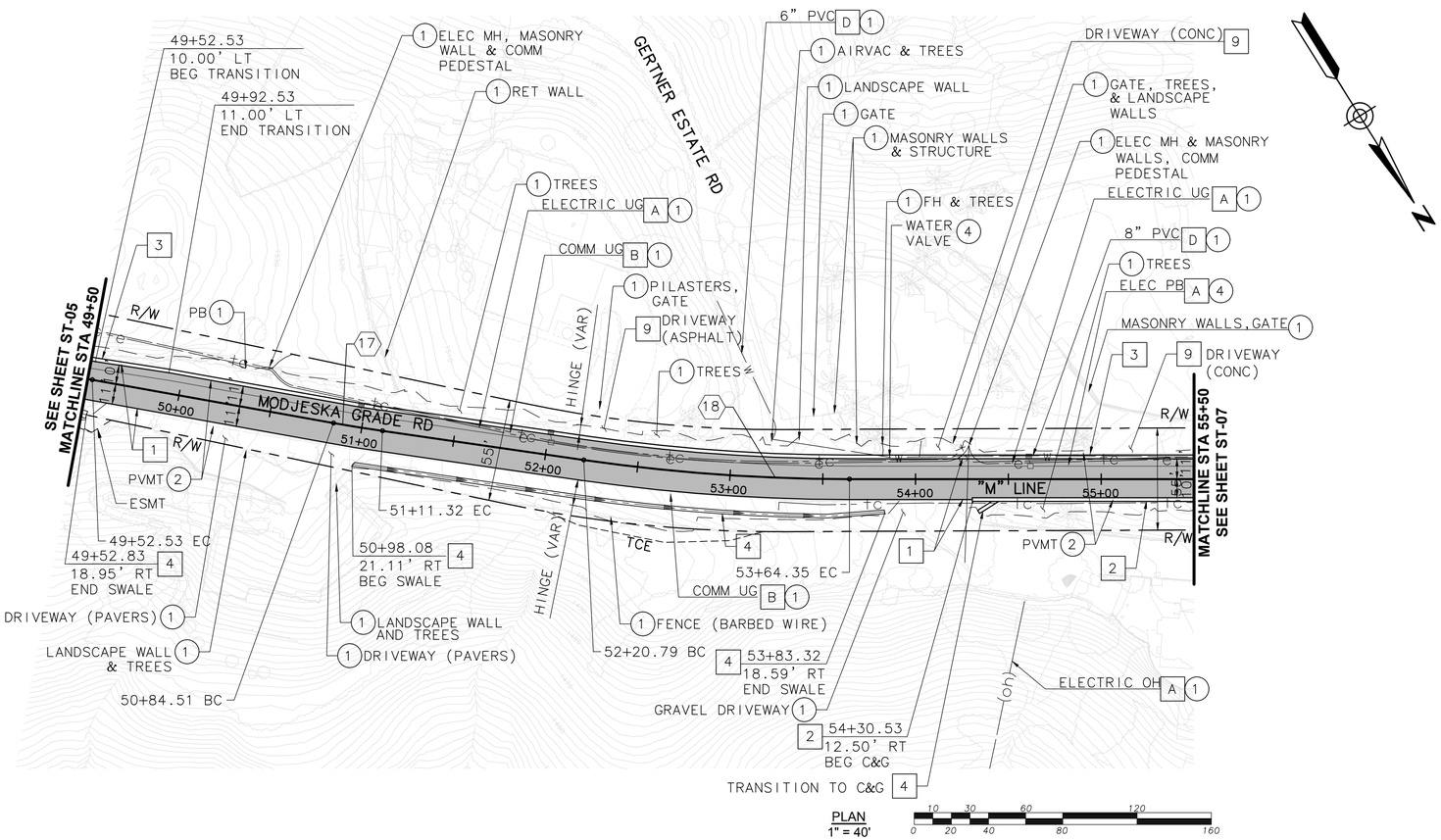
V: 1"=20'



PLAN
1" = 40'

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
3. CONSTRUCT MODIFIED ROLLED CURB (2' GUTTER)
4. CONSTRUCT CONCRETE SWALE
9. RECONSTRUCT PORTION OF DRIVEWAY

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN
4. ADJUST TO GRADE, PER PLAN

UTILITY:

A. SOUTHERN CALIFORNIA EDISON (SCE)
B. AT&T
C. COX COMMUNICATION
D. IRVINE RANCH WATER DISTRICT (IRWD)
E. TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE

CURVE #	RADIUS	DELTA	TANGENT	LENGTH
17	800.00'	1°55'11"	13.40'	26.80'
18	1000.00'	8°13'31"	71.90'	143.56'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

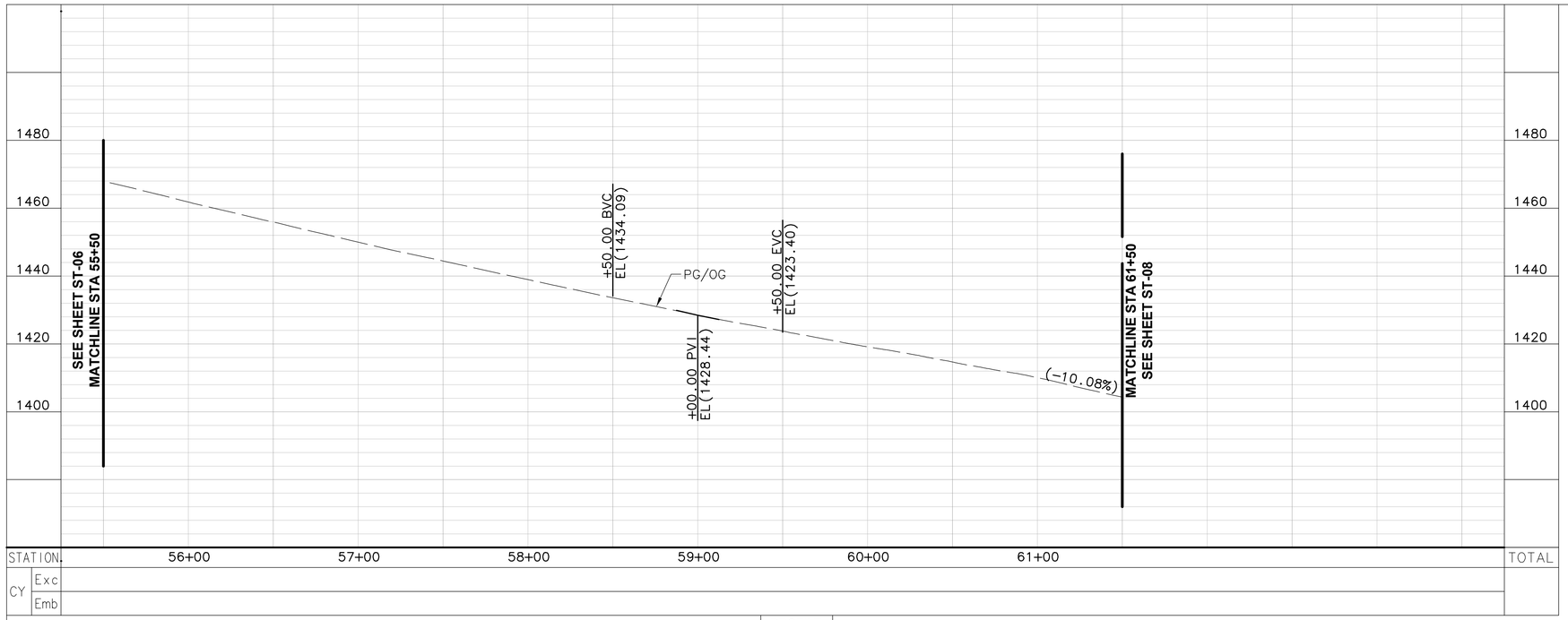
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
CHECKED BY: RS
DRAWN BY: MY
DRAWING NO.:
FILE NAME: IR-20108_L-5-8.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

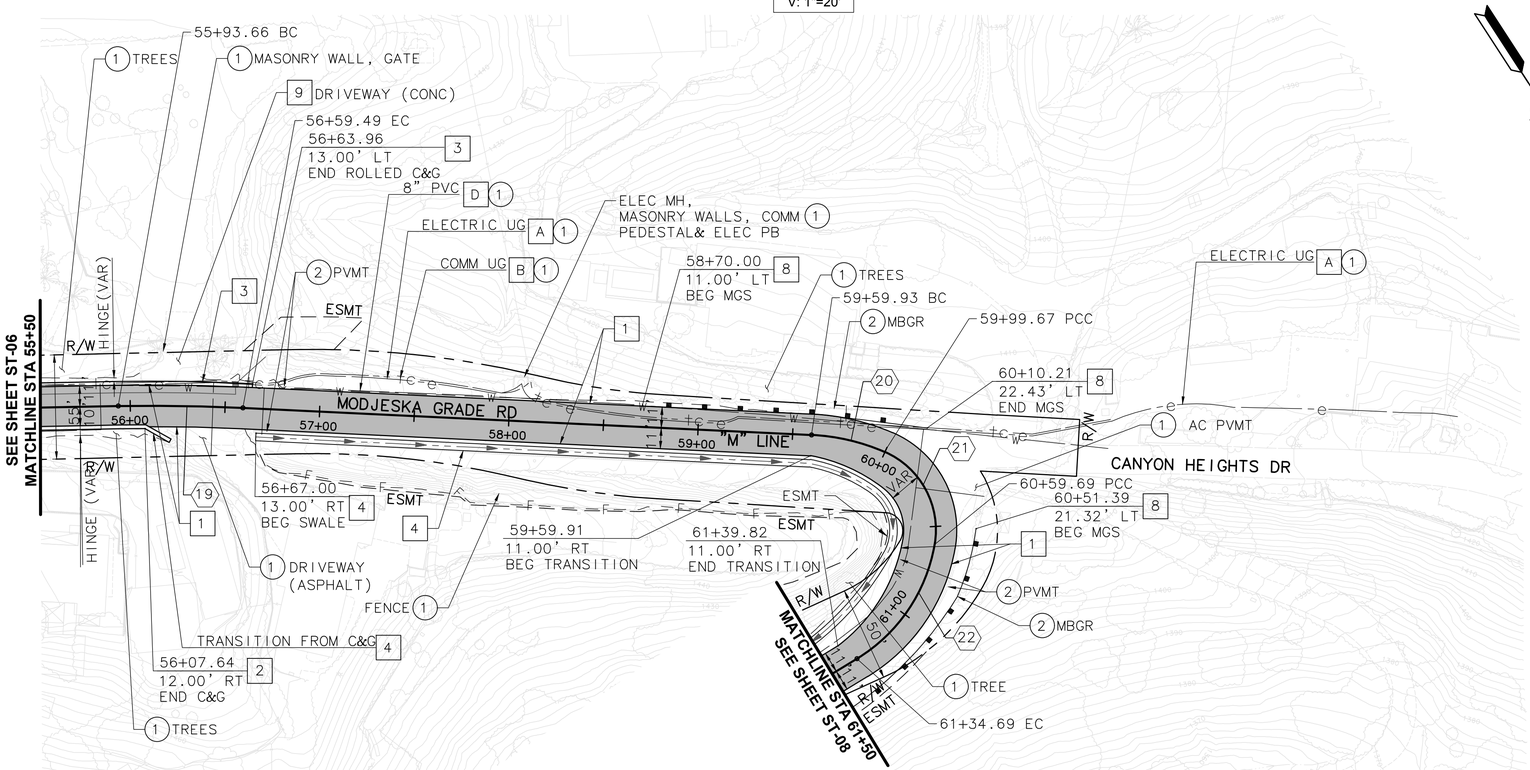
County of Orange PublicWorks
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 45+50 TO STA 55+50
STREET IMPROVEMENT PLAN

SHEET
ST-06



PROFILE
H: 1"=40'
V: 1"=20'



PLAN
1" = 40'

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
3. CONSTRUCT MODIFIED ROLLED CURB (2' GUTTER)
4. CONSTRUCT CONCRETE SWALE
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2
9. RECONSTRUCT PORTION OF DRIVEWAY

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN

UTILITY:

- A SOUTHERN CALIFORNIA EDISON (SCE)
- B AT&T
- C COX COMMUNICATION
- D IRVINE RANCH WATER DISTRICT (IRWD)
- E TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE

CURVE #	RADIUS	DELTA	TANGENT	LENGTH
19	1000.00'	3°46'19"	32.93'	65.83'
20	110.00'	20°41'56"	20.09'	39.74'
21	45.00'	76°24'51"	35.42'	60.02'
22	88.00'	48°49'54"	39.95'	75.00'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

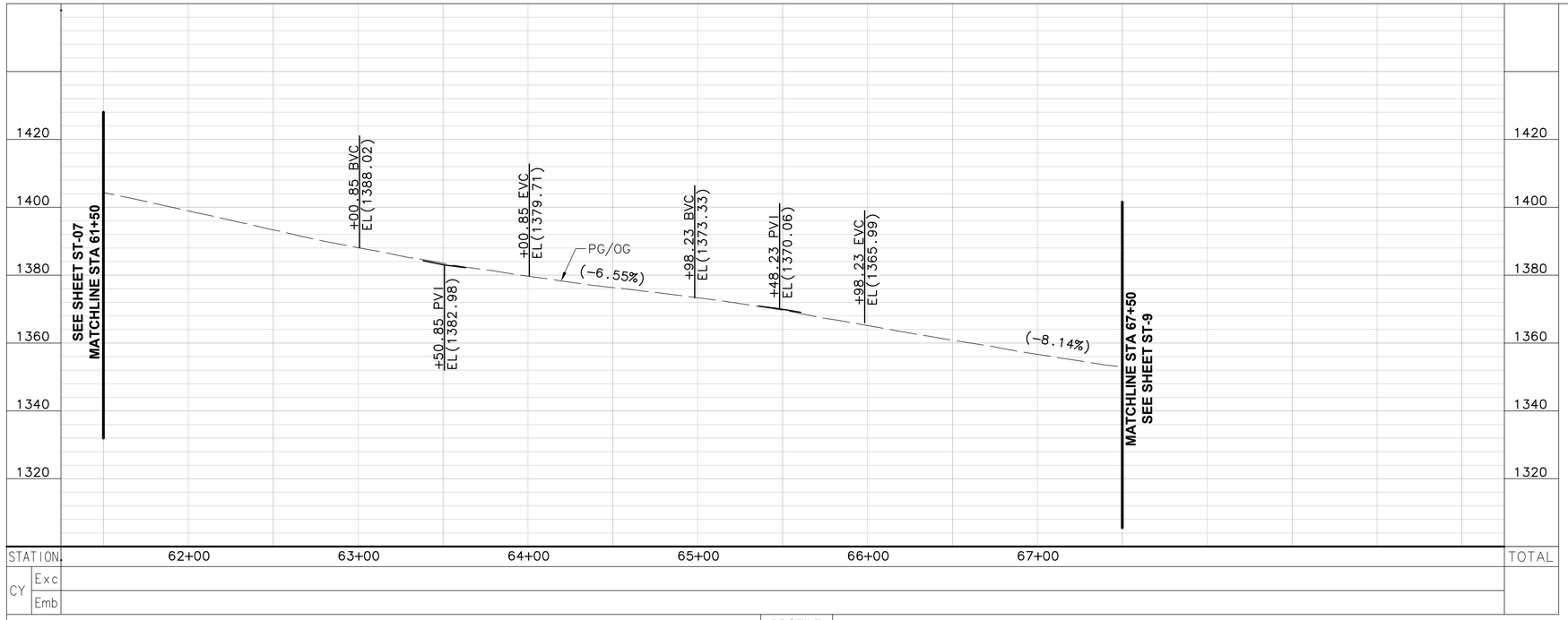
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_L-5-8.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

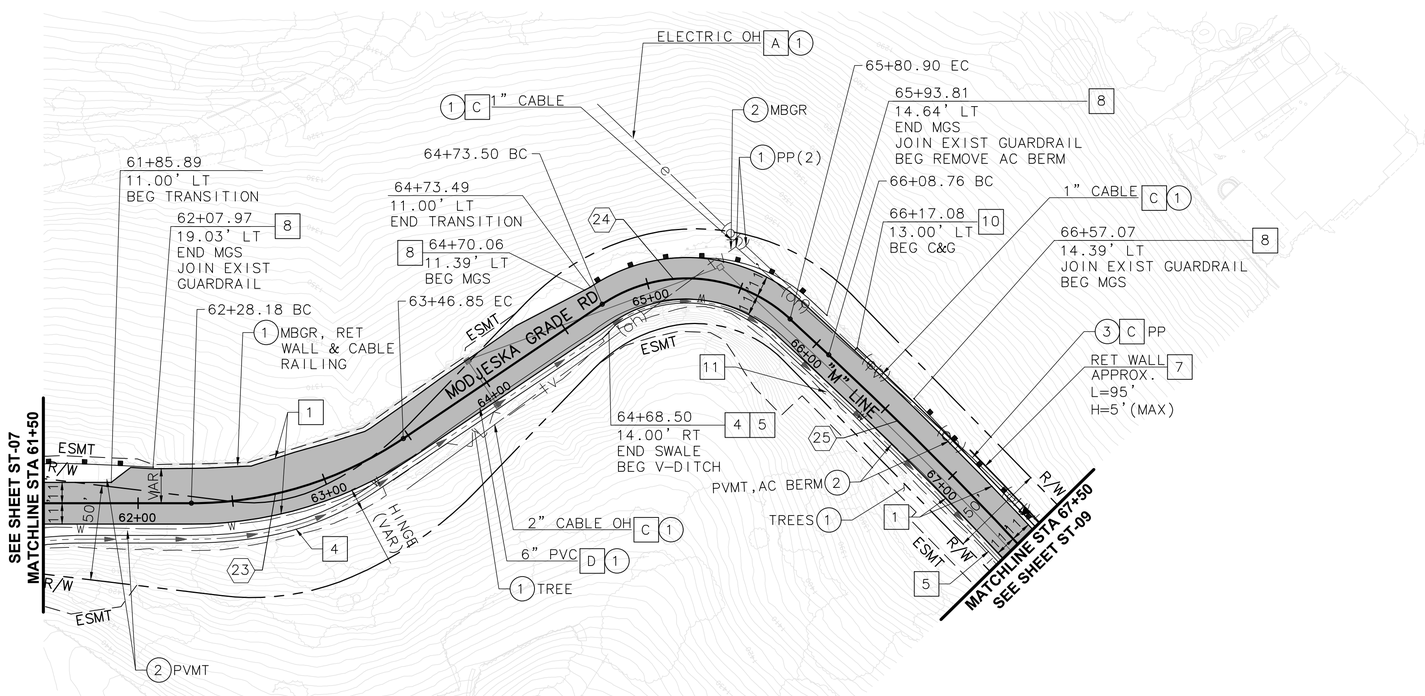
County of Orange PublicWorks
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 55+50 TO STA 61+50
STREET IMPROVEMENT PLAN

SHEET
ST-07



PROFILE
H: 1"=40'
V: 1"=20'



PLAN
1" = 40'

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
4. CONSTRUCT CONCRETE SWALE
5. CONSTRUCT CONCRETE V-DITCH
7. CONSTRUCT RETAINING WALL
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2
10. CONSTRUCT CURB AND GUTTER (TYPE A2-6) PER OCPW STD PLAN 120-2
11. REMOVE AND RECONSTRUCT EROSION FENCE

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN
3. RELOCATE, PER PLAN

UTILITY:

- A SOUTHERN CALIFORNIA EDISON (SCE)
- B AT&T
- C COX COMMUNICATION
- D IRVINE RANCH WATER DISTRICT (IRWD)
- E TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE				
CURVE #	RADIUS	DELTA	TANGENT	LENGTH
23	200.00'	33°59'50"	61.14'	118.67'
24	80.00'	76°55'15"	63.54'	107.40'
25	2000.00'	4°26'00"	77.41'	154.75'

35% PLANS
NOT FOR CONSTRUCTION

MARK	DESCRIPTION	DATE	APPR.

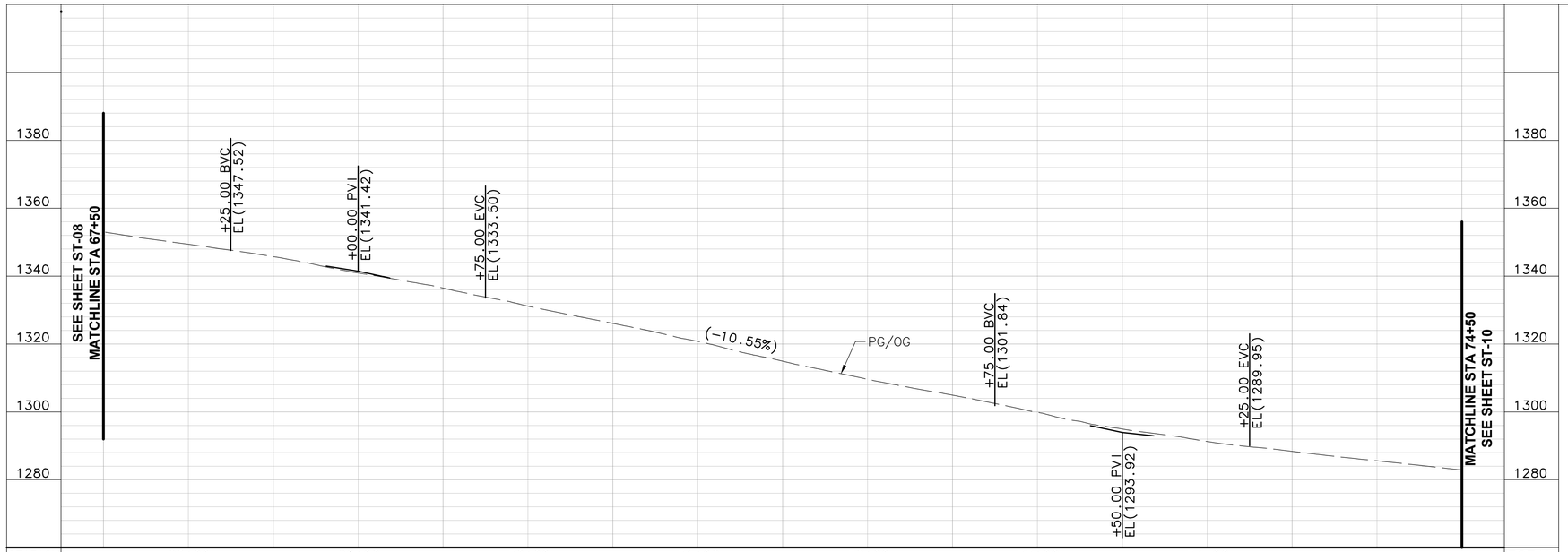
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 78183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_L-5-8.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

PREPARED BY: County of Orange OC Public Works
MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 61+50 TO STA 67+50
STREET IMPROVEMENT PLAN

SHEET
ST-08



PROFILE
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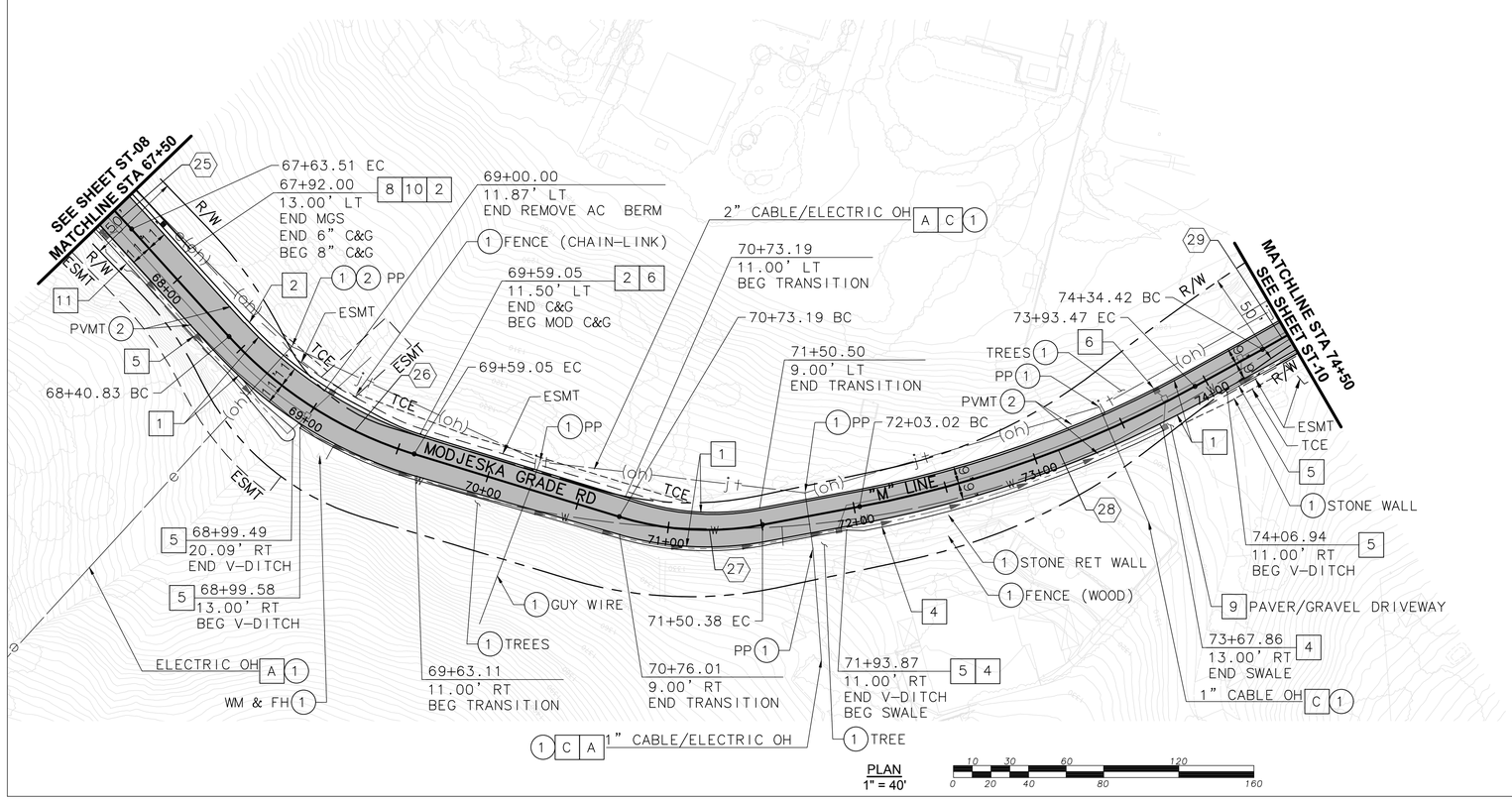
V: 1"=20'



PLAN
1" = 40'

N

CONSTRUCTION NOTES:

1. CONSTRUCT 0.30'AC/1.0'AB
2. CONSTRUCT CURB AND GUTTER (TYPE A2-8) PER OCPW STD PLAN 120-2
4. CONSTRUCT CONCRETE SWALE
5. CONSTRUCT CONCRETE V-DITCH
6. CONSTRUCT MODIFIED CURB AND GUTTER (TYPE A2-8 WITH 1' GUTTER)
8. INSTALL MIDWEST GUARDRAIL SYSTEM PER CALTRANS STD PLAN A77L2
10. CONSTRUCT CURB AND GUTTER(TYPE A2-6) PER OCPW STD PLAN 120-2
11. REMOVE AND RECONSTRUCT EROSION FENCE

DISPOSITION NOTES:

1. PROTECT IN PLACE
2. REMOVE, PER PLAN

UTILITY:

A. SOUTHERN CALIFORNIA EDISON (SCE)
B. AT&T
C. COX COMMUNICATION
D. IRVINE RANCH WATER DISTRICT (IRWD)
E. TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE				
CURVE #	RADIUS	DELTA	TANGENT	LENGTH
25	2000.00'	4°26'00"	77.41'	154.75'
26	220.00'	30°47'19"	60.57'	118.22'
27	160.00'	27°38'21"	39.36'	77.18'
28	600.00'	18°11'11"	96.03'	190.45'
29	700.00'	9°24'11"	57.57'	114.88'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

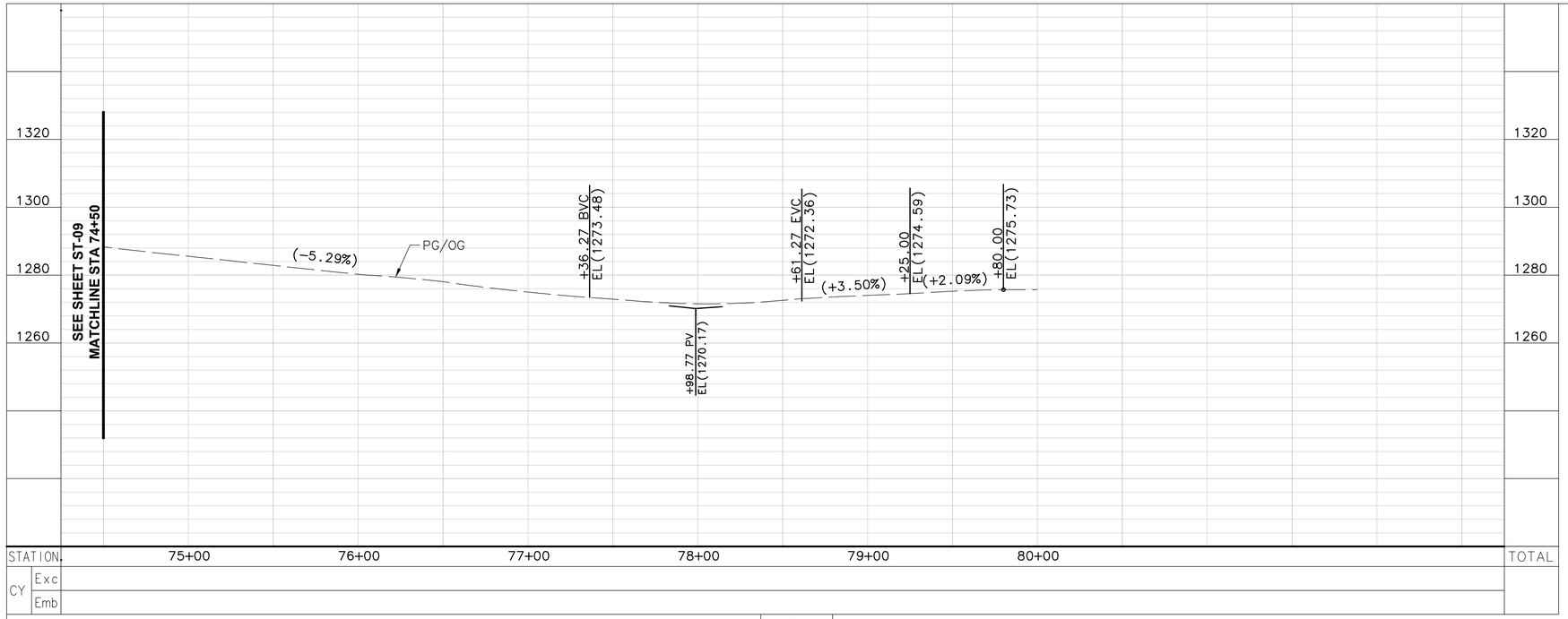
PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER
RAM P. SHAH
No. 79183
Exp. 3/31/24
CIVIL
STATE OF CALIFORNIA
DATE

DESIGNED BY: TK
DRAWN BY: MV
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_L 9-10.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

County of Orange
PublicWorks
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENT
STA 67+50 TO STA 74+50
STREET IMPROVEMENT PLAN

SHEET
ST-09



PROFILE
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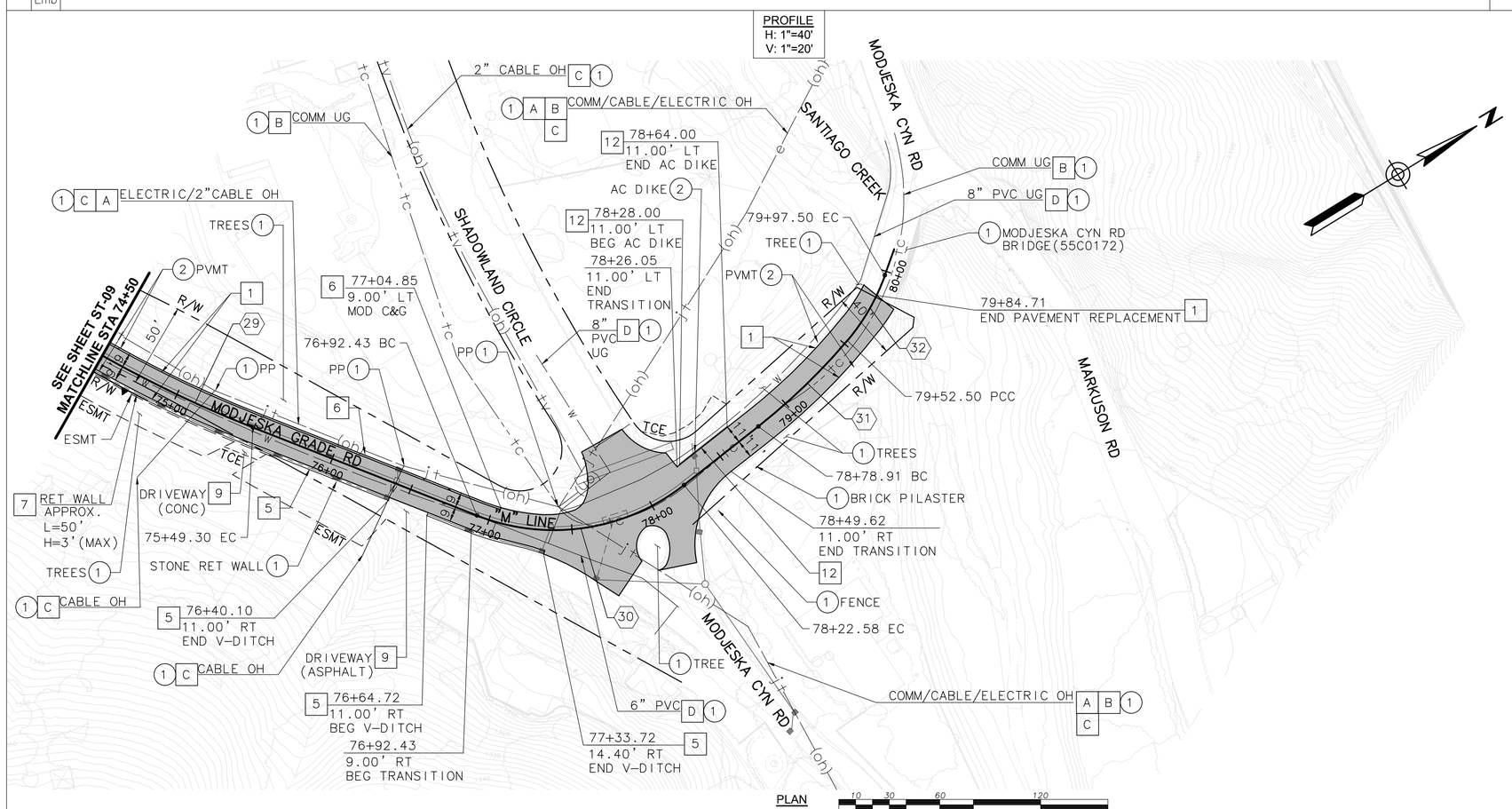
V: 1"=20'



PLAN
1" = 40'

CONSTRUCTION NOTES:

- 1 CONSTRUCT 0.30'AC/1.0'AB
- 5 CONSTRUCT CONCRETE V-DITCH
- 6 CONSTRUCT MODIFIED CURB AND GUTTER (TYPE A2-8 WITH 1' GUTTER)
- 7 CONSTRUCT RETAINING WALL
- 9 RECONSTRUCT PORTION OF DRIVEWAY
- 12 CONSTRUCT 6" AC DIKE

DISPOSITION NOTES:

- (1) PROTECT IN PLACE
- (2) REMOVE, PER PLAN

UTILITY:

- A SOUTHERN CALIFORNIA EDISON (SCE)
- B AT&T
- C COX COMMUNICATION
- D IRVINE RANCH WATER DISTRICT (IRWD)
- E TRABUCO CANYON WATER DISTRICT (TCWD)

LEGEND:

- MIDWEST GUARDRAIL SYSTEM
- EXISTING R/W
- EASEMENT
- TEMPORARY CONSTRUCTION EASEMENT
- RETAINING WALL
- CONSTRUCT PAVEMENT PER STRUCTURAL SECTION

ALIGNMENT CURVE TABLE

CURVE #	RADIUS	DELTA	TANGENT	LENGTH
29	700.00'	9°24'11"	57.57'	114.88'
30	125.00'	59°39'18"	71.67'	130.15'
31	365.00'	11°33'05"	36.92'	73.59'
32	125.00'	20°37'35"	22.75'	45.00'

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA

DATE

DESIGNED BY: TK
DRAWN BY: MV
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_I_9-10.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

County of Orange PublicWorks

PREPARED BY: MARK THOMAS

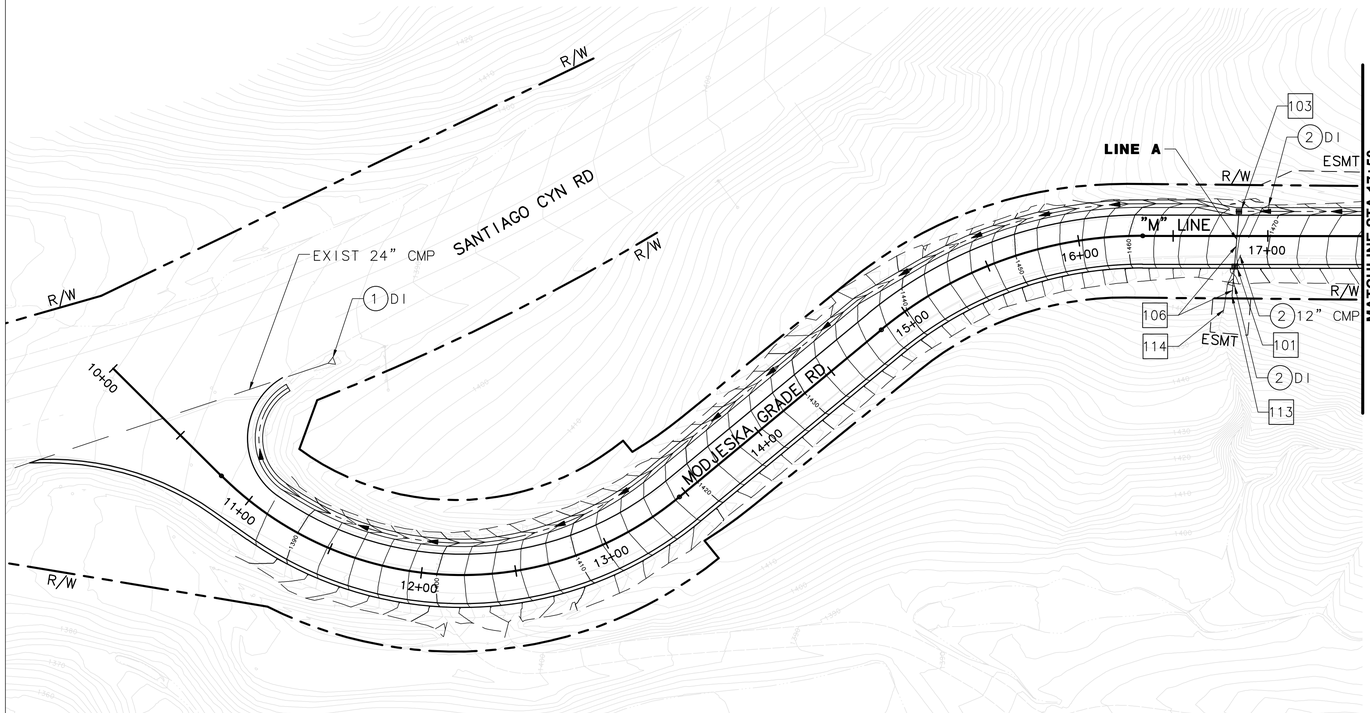
MODJESKA GRADE ROAD IMPROVEMENT

STA 74+50 TO STA 80+00

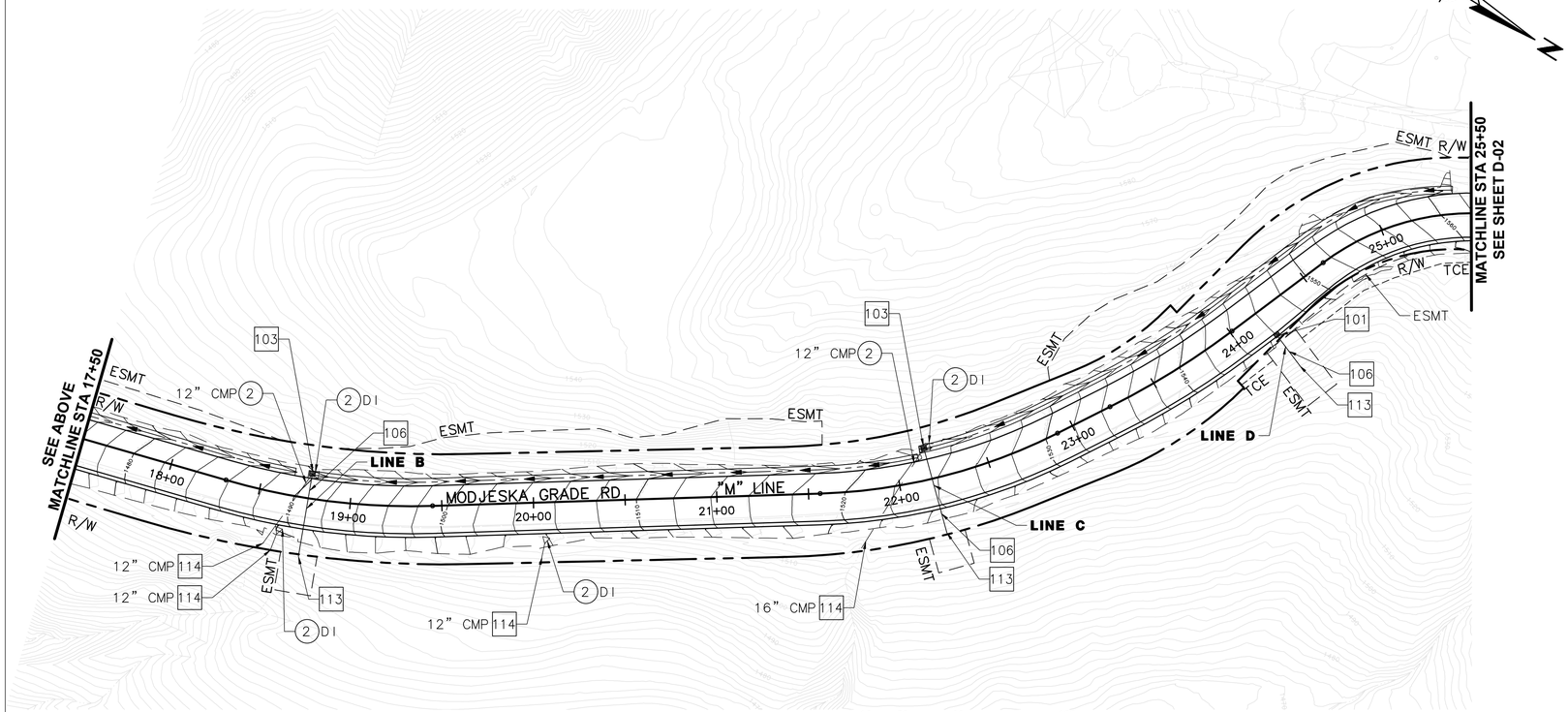
STREET IMPROVEMENT PLAN

SHEET

ST-10



PLAN
1" = 40'



PLAN
1" = 40'

0 10 20 30 40 60 80 120 160

CONSTRUCTION NOTES

101 CONSTRUCT INLET (TYPE GO) PER CALTRANS STD PLAN D72E AND D72F.

103 CONSTRUCT INLET MODIFIED WITH SIDE OPENING. SEE DETAIL ON SHEET D-01.

106 CONSTRUCT 18" R.C.P.

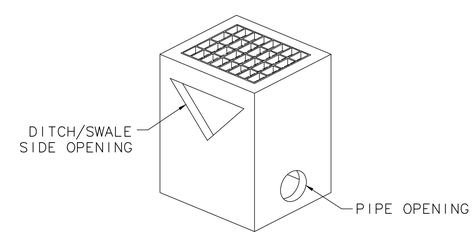
113 CONSTRUCT OUTLET DISSIPATION

114 ABANDON PIPE

DISPOSITION NOTES:

1 PROTECT IN PLACE

2 REMOVE, PER PLAN



103 INLET MODIFIED WITH SIDE OPENING

NO SCALE

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA

DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: BS
DRAWING NO.:
FILE NAME: IR-20108_D 1-5.DWG
PLOT DATE: Monday, February 14, 2022
SCALE: AS SHOWN

County of Orange OC Public Works

PREPARED BY: MARK THOMAS

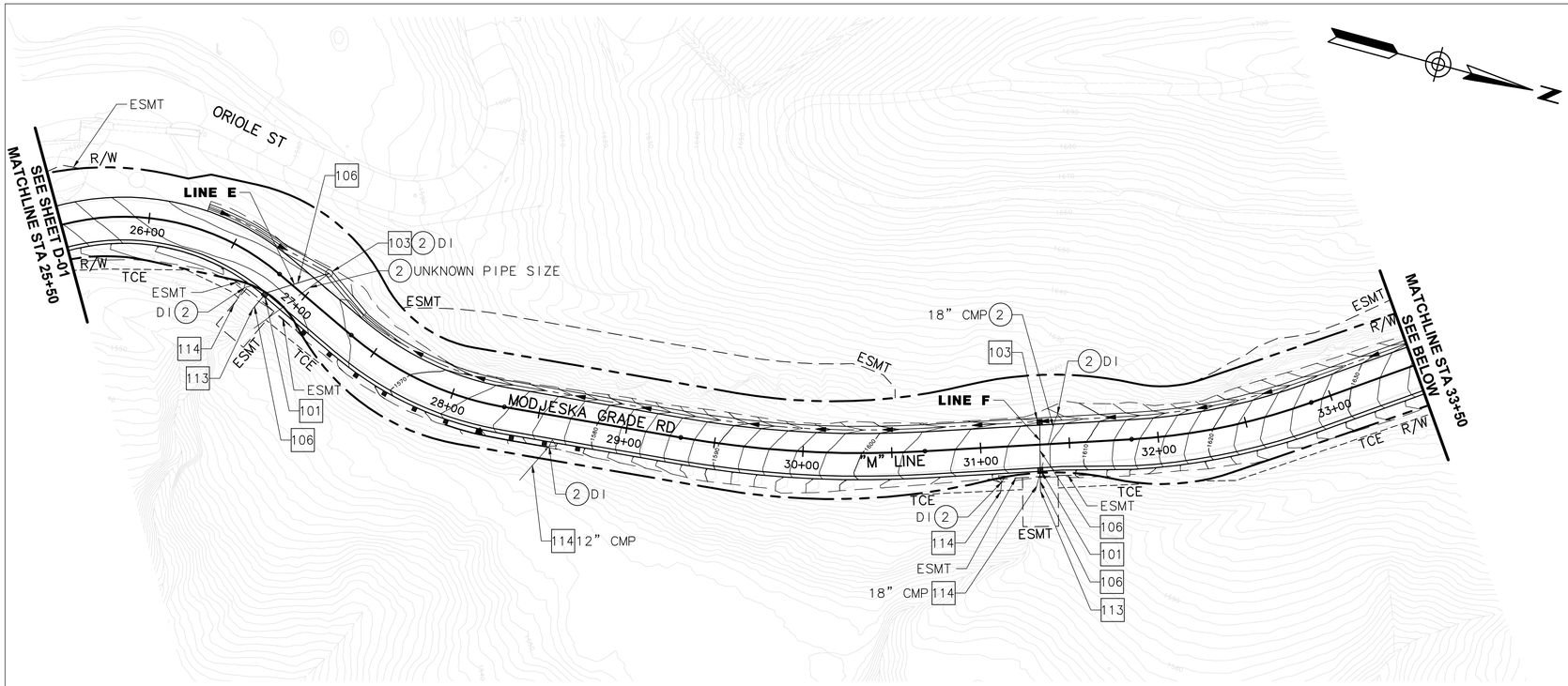
MODJESKA GRADE ROAD IMPROVEMENTS

STA 10+00 TO STA 25+50

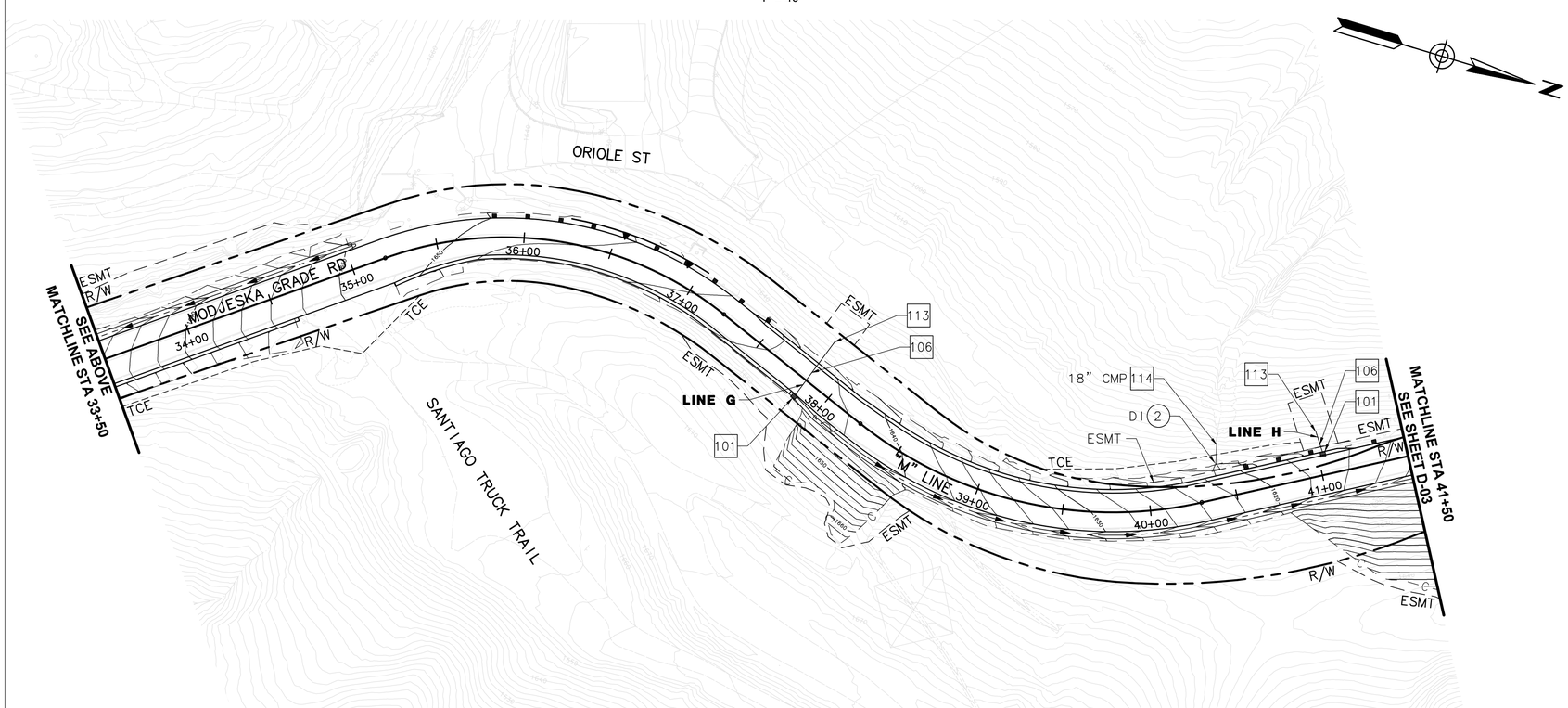
DRAINAGE & GRADING PLAN

SHEET

D-01



PLAN
1" = 40'



PLAN
1" = 40'

CONSTRUCTION NOTES

101 CONSTRUCT INLET (TYPE GO) PER CALTRANS STD PLAN D72E AND D72F.

103 CONSTRUCT INLET MODIFIED WITH SIDE OPENING. SEE DETAIL ON SHEET D-01.

106 CONSTRUCT 18" R.C.P.

113 CONSTRUCT OUTLET DISSIPATION

114 ABANDON PIPE

REMOVALS :

(2) REMOVE, PER PLAN

35% PLANS
NOT FOR CONSTRUCTION

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER
RAM P. SHAH
No. 79183
Exp. 3/31/24
CIVIL
STATE OF CALIFORNIA

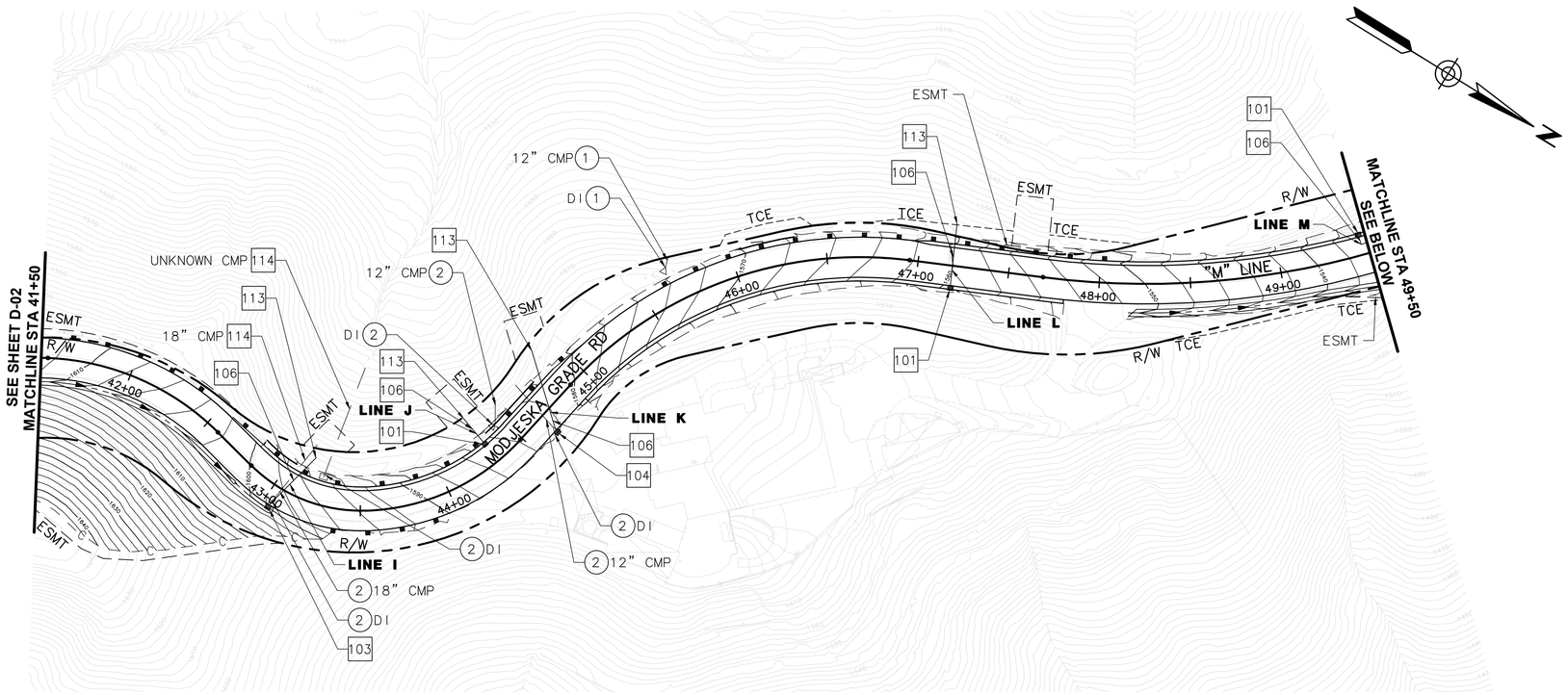
DATE

DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_D 1-5.DWG
PLOT DATE: Sunday, February 13, 2022
SCALE: AS SHOWN

County of Orange
OC Public Works
PREPARED BY: MARK THOMAS

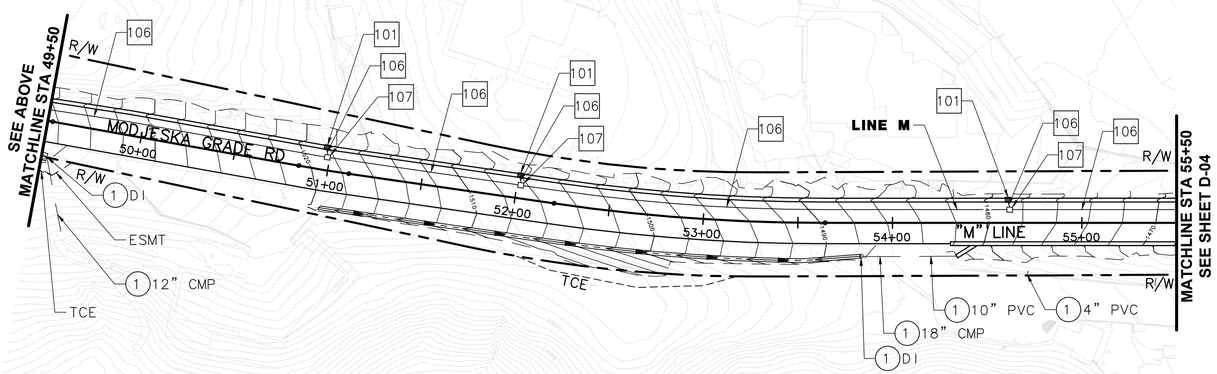
MODJESKA GRADE ROAD IMPROVEMENTS
STA 25+50 TO STA 41+50
DRAINAGE & GRADING PLAN

SHEET
D-02



PLAN
1" = 40'

NOTE: LINE M CONFIGURATION SHOULD BE REVISITED DURING FINAL DESIGN WHEN ADDITIONAL UNDERGROUND UTILITY DATA IS AVAILABLE.



PLAN
1" = 40'

CONSTRUCTION NOTES

101 CONSTRUCT INLET (TYPE GO) PER CALTRANS STD PLAN D72E AND D72F.

103 CONSTRUCT INLET MODIFIED WITH SIDE OPENING. SEE DETAIL ON SHEET D-01.

104 CONSTRUCT FLARED END INLET

106 CONSTRUCT 18" R.C.P.

107 CONSTRUCT JUNCTION STRUCTURE

113 CONSTRUCT OUTLET DISSIPATION

114 ABANDON PIPE

DISPOSITION NOTES:

(1) PROTECT IN PLACE

(2) REMOVE, PER PLAN

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA

DATE

DESIGNED BY: TK
DRAWN BY: MV
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_D 1-5.DWG
PLOT DATE: Sunday, February 13, 2022
SCALE: AS SHOWN

County of Orange PublicWorks

PREPARED BY: MARK THOMAS

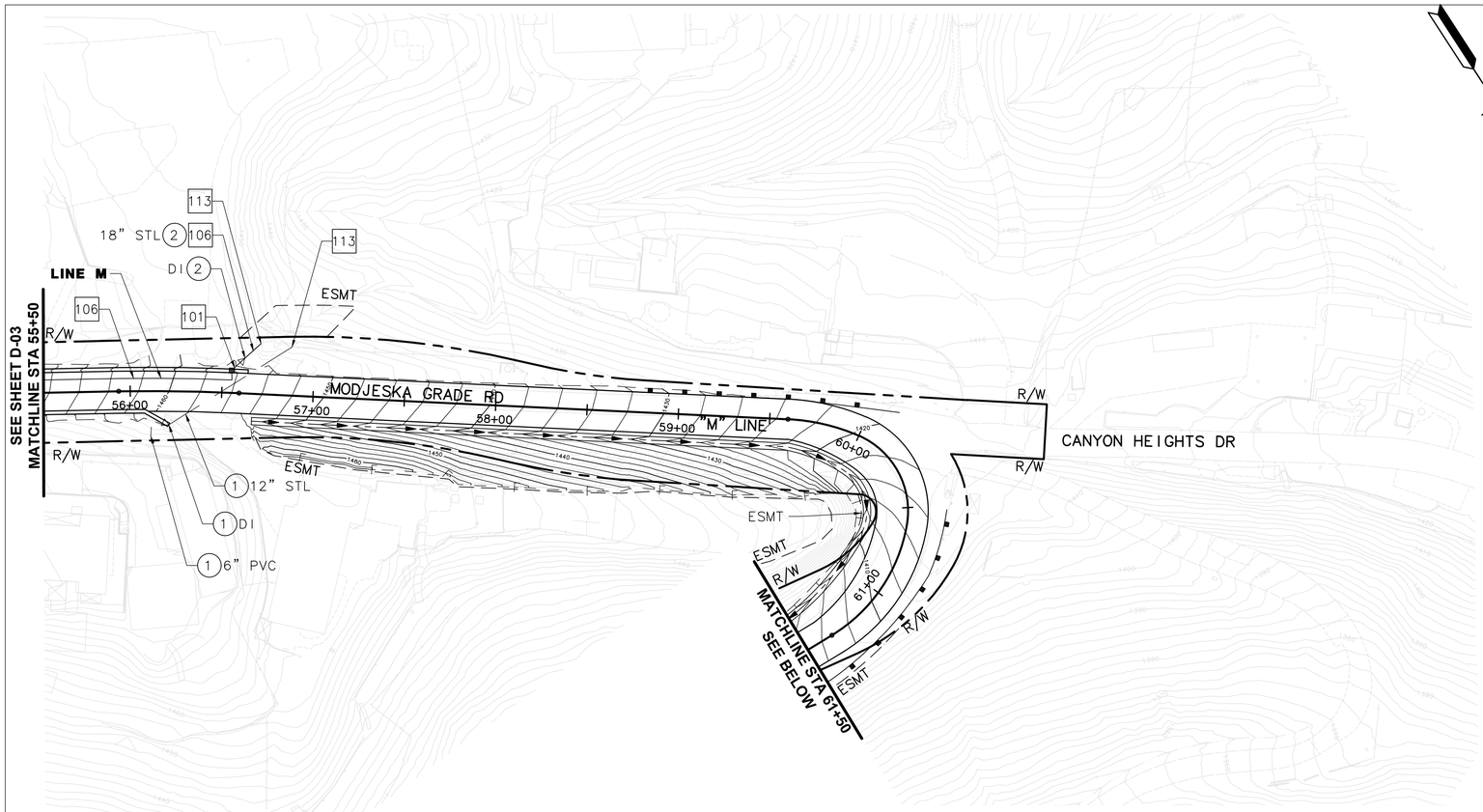
MODJESKA GRADE ROAD IMPROVEMENTS

STA 41+50 TO STA 55+50

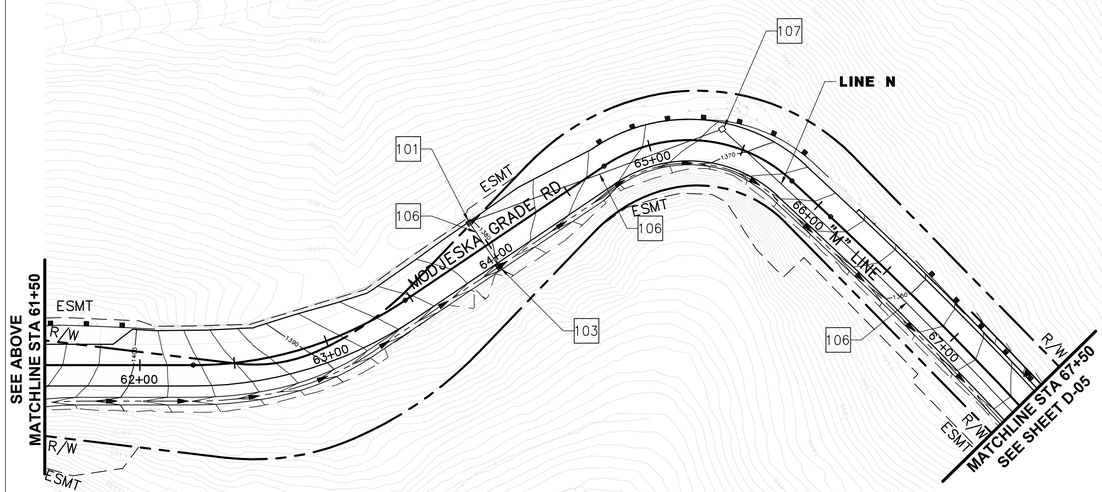
DRAINAGE & GRADING PLAN

SHEET

D-03



PLAN
1" = 40'



PLAN
1" = 40'

0 10 20 30 40 60 80 120 160

CONSTRUCTION NOTES

101 CONSTRUCT INLET (TYPE GO) PER CALTRANS STD PLAN D72E AND D72F.

103 CONSTRUCT INLET MODIFIED WITH SIDE OPENING. SEE DETAIL ON SHEET D-01.

106 CONSTRUCT 18" R.C.P.

107 CONSTRUCT JUNCTION STRUCTURE

113 CONSTRUCT OUTLET DISSIPATION

DISPOSITION NOTES:

(1) PROTECT IN PLACE

(2) REMOVE, PER PLAN

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA

DATE

DESIGNED BY: TK
DRAWN BY: MV
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_D 1-5.DWG
PLOT DATE: Sunday, February 13, 2022
SCALE: AS SHOWN

County of Orange
OC Public Works

PREPARED BY: MARK THOMAS

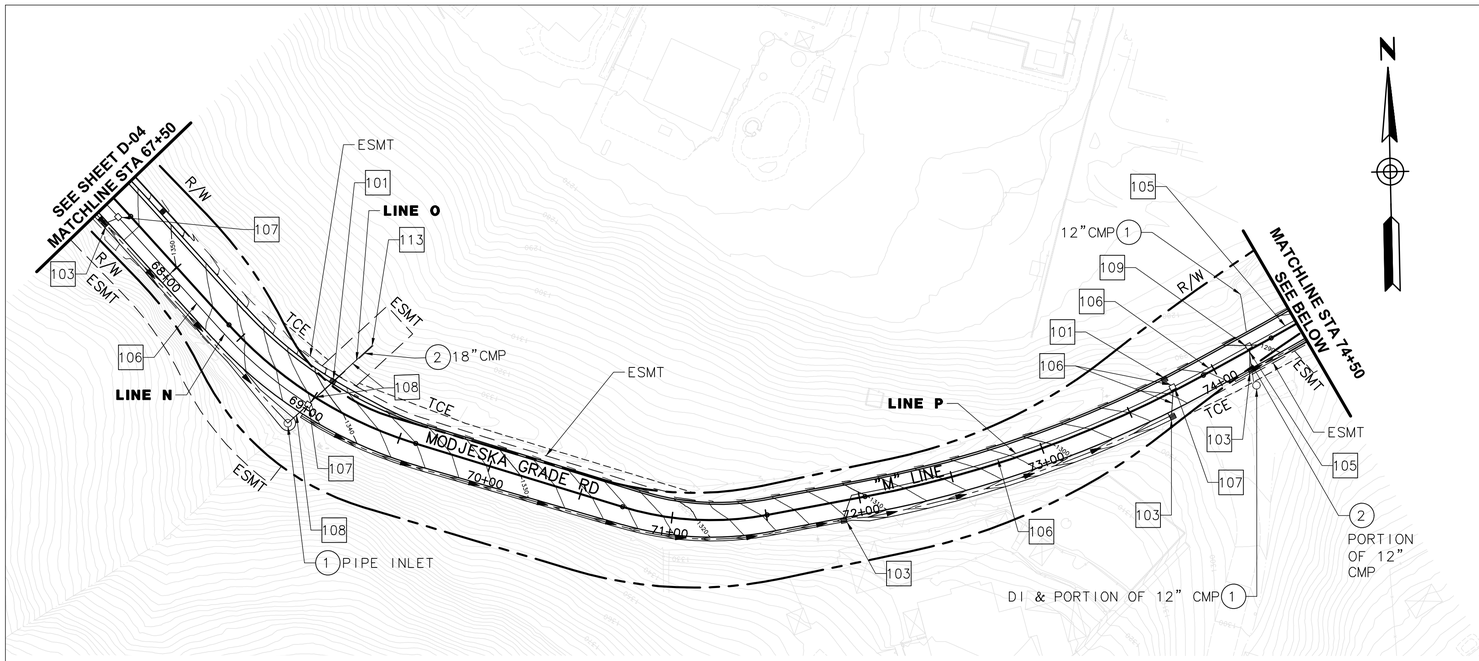
MODJESKA GRADE ROAD IMPROVEMENTS

STA 55+50 TO STA 67+50

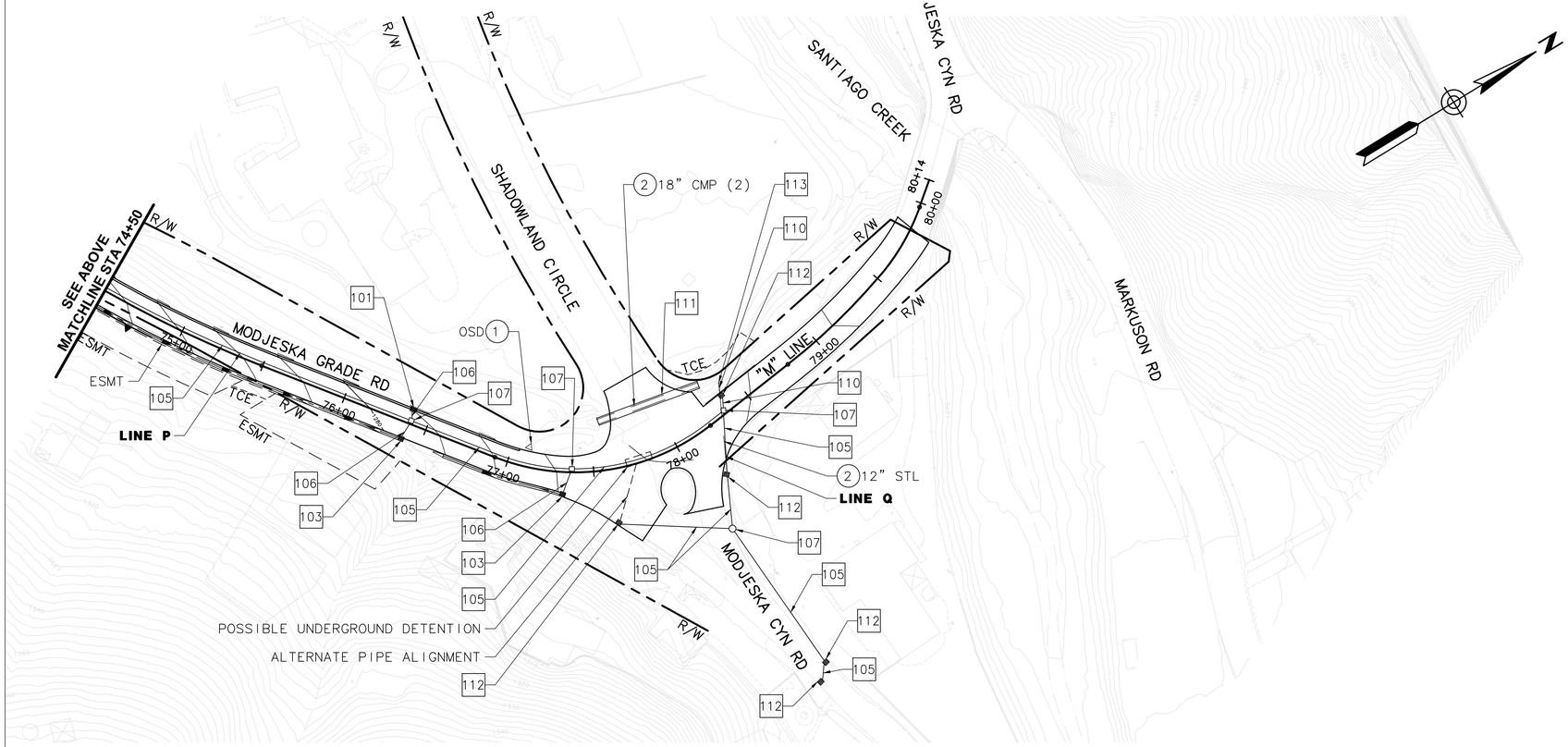
DRAINAGE & GRADING PLAN

SHEET

D-04



PLAN
1" = 40'



PLAN
1" = 40'

0 20 40 80 160
10 30 60 120

CONSTRUCTION NOTES

101 CONSTRUCT INLET (TYPE GO) PER CALTRANS STD PLAN D72E AND D72F.

103 CONSTRUCT INLET MODIFIED WITH SIDE OPENING. SEE DETAIL ON SHEET D-01.

105 CONSTRUCT 36" R.C.P.

106 CONSTRUCT 18" R.C.P.

107 CONSTRUCT JUNCTION STRUCTURE

108 CONSTRUCT 24" R.C.P.

109 CONSTRUCT DIVERSION STRUCTURE

110 CONSTRUCT 48" R.C.P.

111 CONSTRUCT R.C.B.

112 CONSTRUCT INLET (TYPE TBD)

113 CONSTRUCT OUTLET DISSIPATION

DISPOSITION NOTES:

1 PROTECT IN PLACE

2 REMOVE, PER PLAN

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER RAM P. SHAH No. 79183 Exp. 3/31/24 CIVIL STATE OF CALIFORNIA

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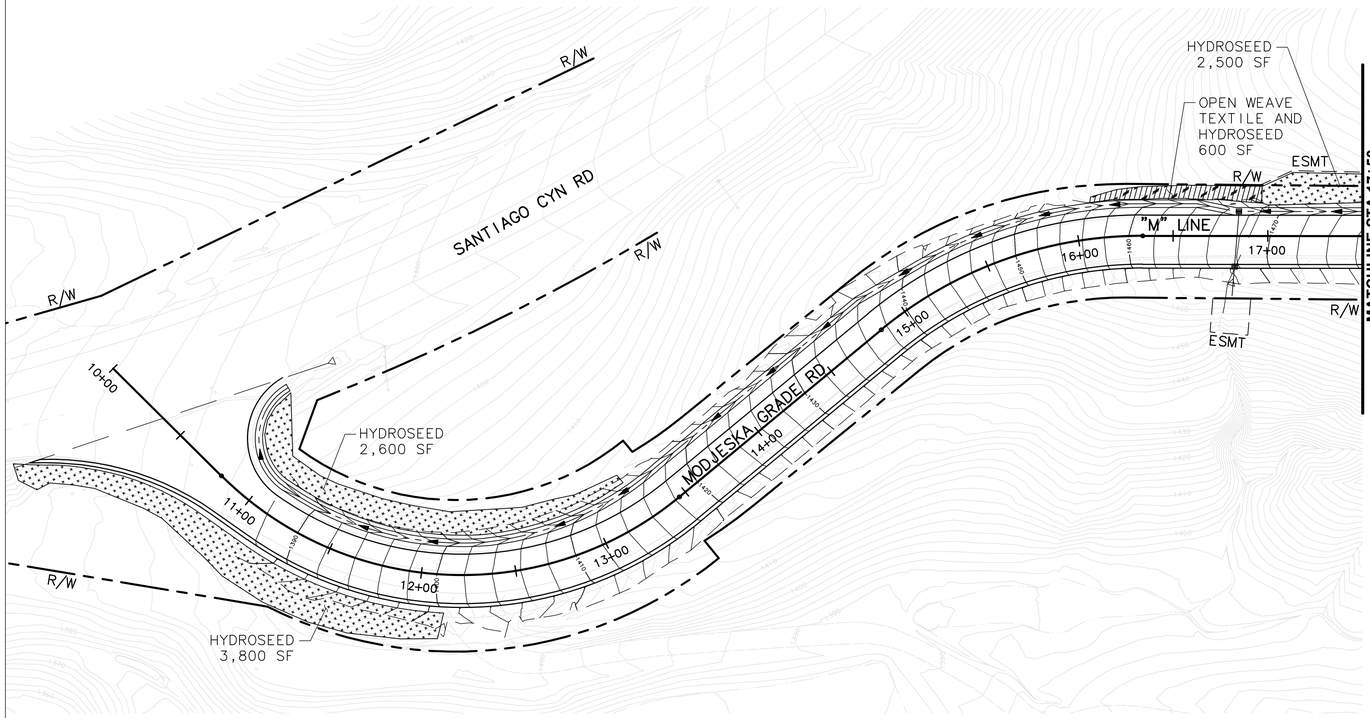
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_D 1-5.DWG
PLOT DATE: Sunday, February 13, 2022
SCALE: AS SHOWN

County of Orange
OC Public Works

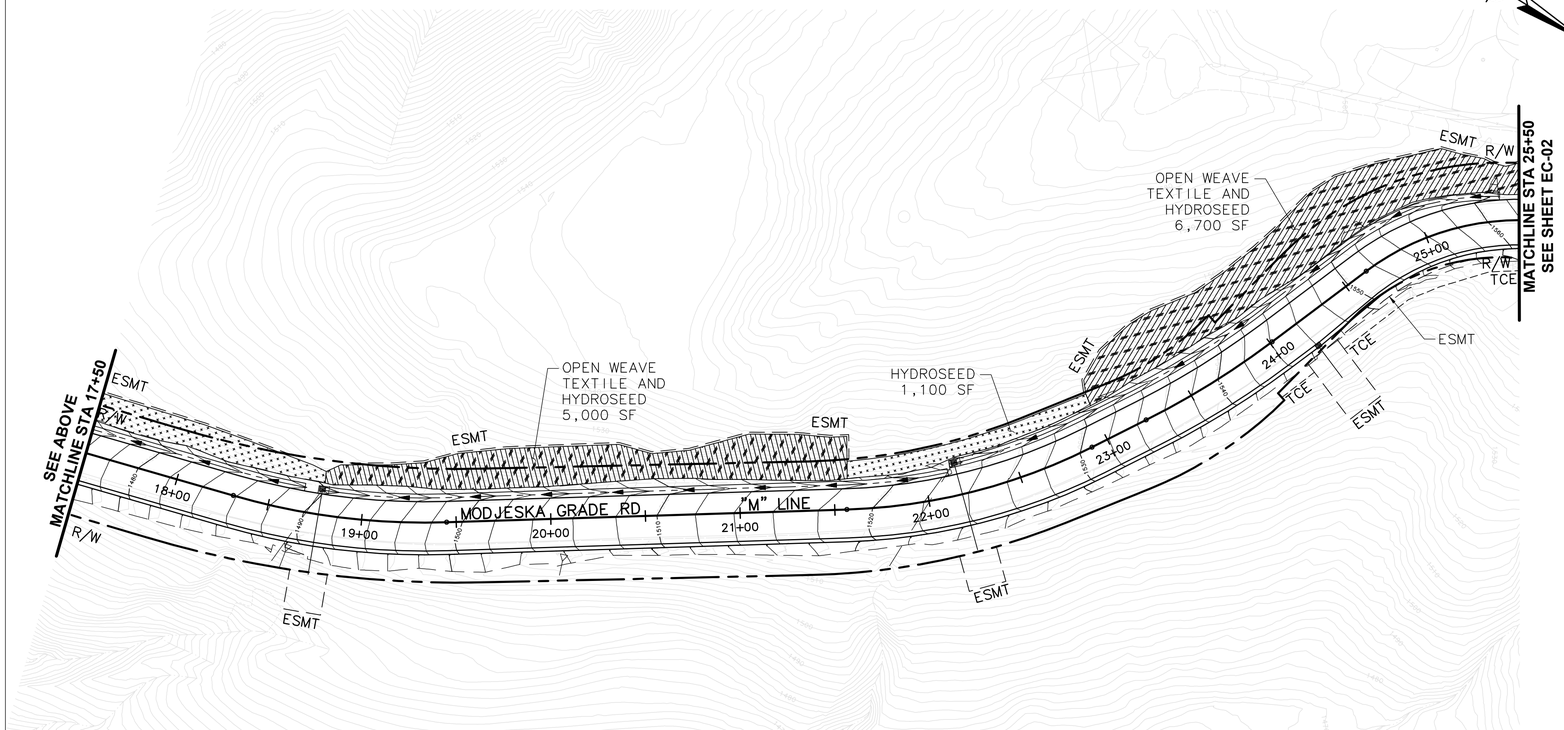
PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS
STA 67+50 TO STA 80+00
DRAINAGE & GRADING PLAN

SHEET
D-05



PLAN
1" = 40'



PLAN
1" = 40'

0 10 20 30 40 60 80 120 160

NOTE:
ALL EROSION CONTROL TYPES AND AREAS SHOWN ON THIS PLAN ARE PRELIMINARY. ADDITIONAL GEOTECHNICAL DATA REGARDING SOIL TYPES AND GEOLOGICAL FORMATIONS, AS WELL AS COORDINATION WITH COUNTY MAINTENANCE, SHOULD BE CONSIDERED FOR FINAL DESIGN.

- HYDROSEED
- OPEN WEAVE TEXTILE & HYDROSEED
- WIRE BLANKET & HYDROSEED
- WIRE BLANKET

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:

REGISTERED PROFESSIONAL ENGINEER
RAM P. SHAH
No. 79183
Exp. 3/31/24
CIVIL
STATE OF CALIFORNIA

DATE

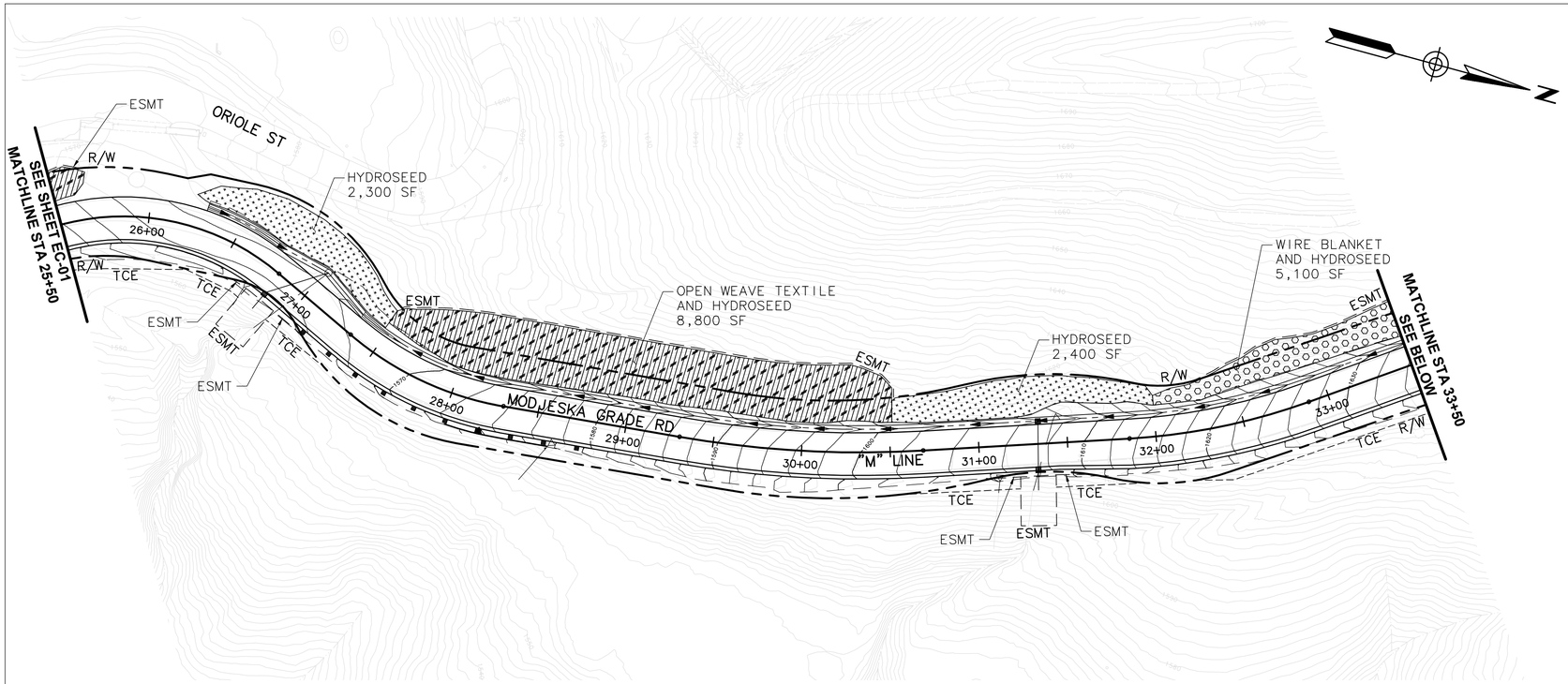
DESIGNED BY: TK
DRAWN BY: MY
CHECKED BY: RS
DRAWING NO.:
FILE NAME: IR-20108_EC 1-5.DWG
PLOT DATE: Sunday, February 13, 2022
SCALE: AS SHOWN

County of Orange
OC Public Works

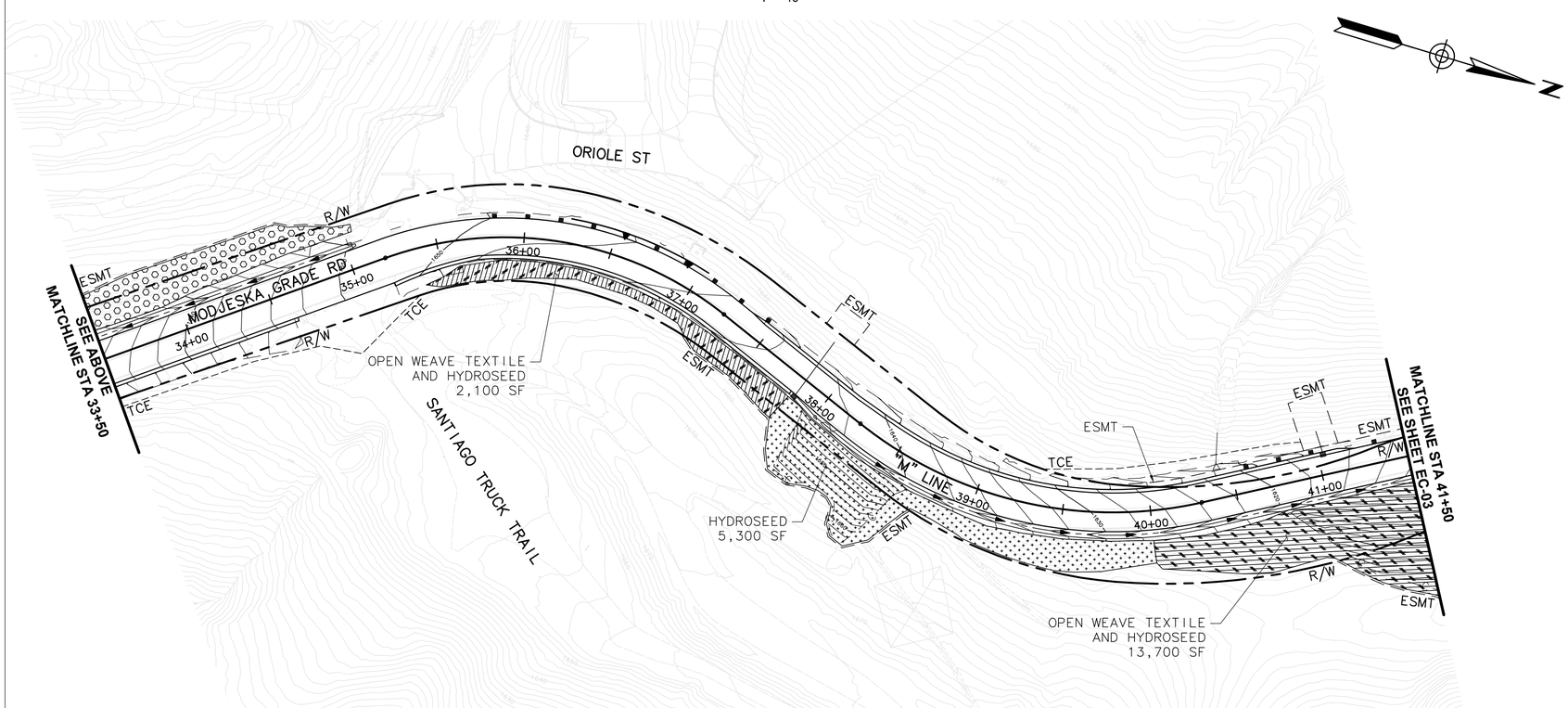
PREPARED BY:
MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS
STA 10+00 TO STA 25+50
EROSION CONTROL PLAN

SHEET
EC-01



PLAN
1" = 40'



PLAN
1" = 40'

0 20 40 80 160
10 30 60 120

NOTE:

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- HYDROSEED
- OPEN WEAVE TEXTILE & HYDROSEED
- WIRE BLANKET & HYDROSEED
- WIRE BLANKET

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

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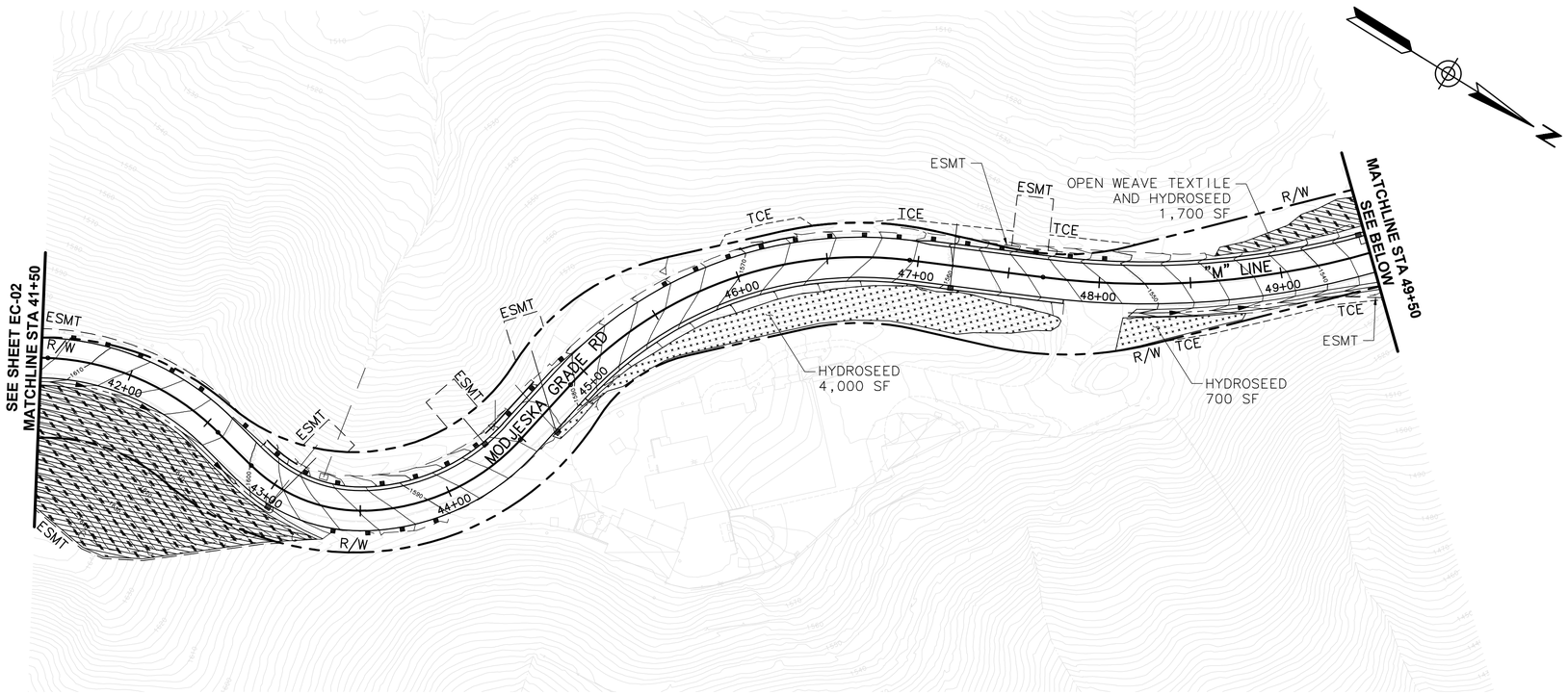
FILE NAME: IR-20108_EC-1-5.DWG
PLOT DATE: Sunday, February 13, 2022
SCALE: AS SHOWN

County of Orange
OC Public Works

PREPARED BY: MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS
STA 25+50 TO STA 41+50
EROSION CONTROL PLAN

SHEET
EC-02



PLAN
1" = 40'

PLAN
1" = 40'

0 10 20 30 40 60 80 120 160

NOTE:

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- HYDROSEED
- OPEN WEAVE TEXTILE & HYDROSEED
- WIRE BLANKET & HYDROSEED
- WIRE BLANKET

35% PLANS
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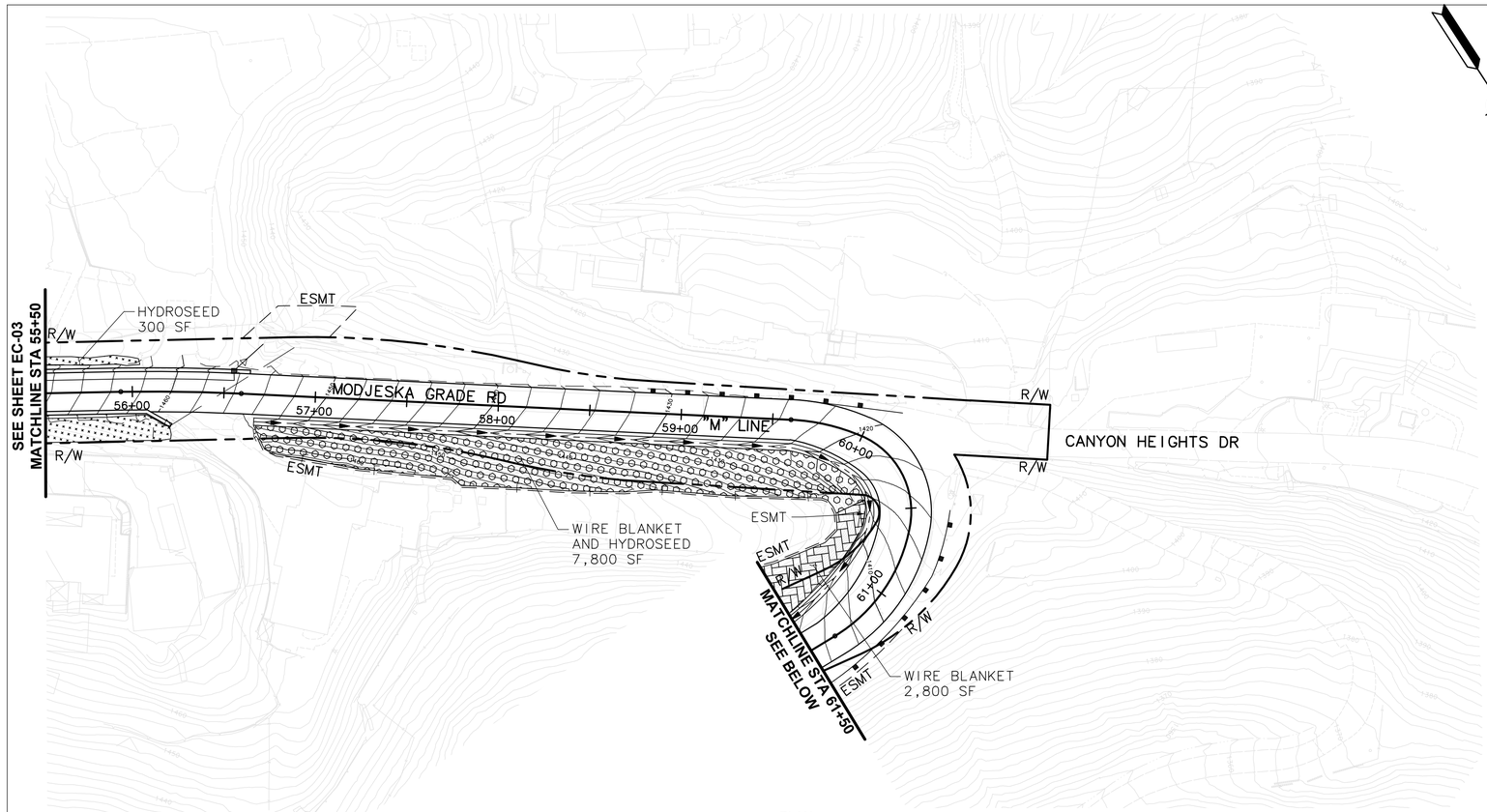
FILE NAME: IR-20108_EC 1-5.DWG
PLOT DATE: Sunday, February 13, 2022
SCALE: AS SHOWN

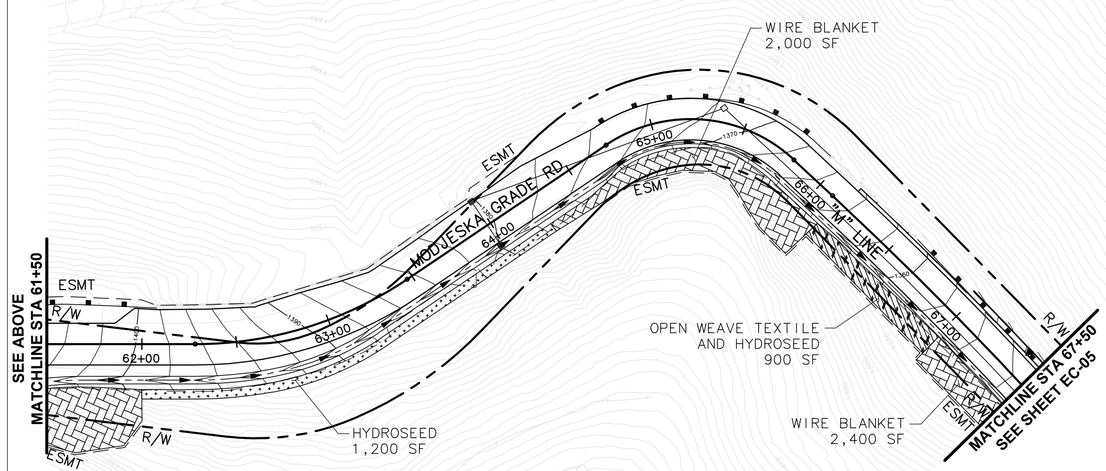
County of Orange
OC Public Works
PREPARED BY:
MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS
STA 41+50 TO STA 55+50
EROSION CONTROL PLAN

SHEET
EC-03



PLAN
1" = 40'



PLAN
1" = 40'

0 20 40 80 160

NOTE:

ALL EROSION CONTROL TYPES AND AREAS SHOWN ON THIS PLAN ARE PRELIMINARY. ADDITIONAL GEOTECHNICAL DATA REGARDING SOIL TYPES AND GEOLOGICAL FORMATIONS, AS WELL AS COORDINATION WITH COUNTY MAINTENANCE, SHOULD BE CONSIDERED FOR FINAL DESIGN.

- HYDROSEED
- OPEN WEAVE TEXTILE & HYDROSEED
- WIRE BLANKET & HYDROSEED
- WIRE BLANKET

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

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County of Orange
OC Public Works

PREPARED BY:
MARK THOMAS

MODJESKA GRADE ROAD IMPROVEMENTS
STA 55+50 TO STA 67+50

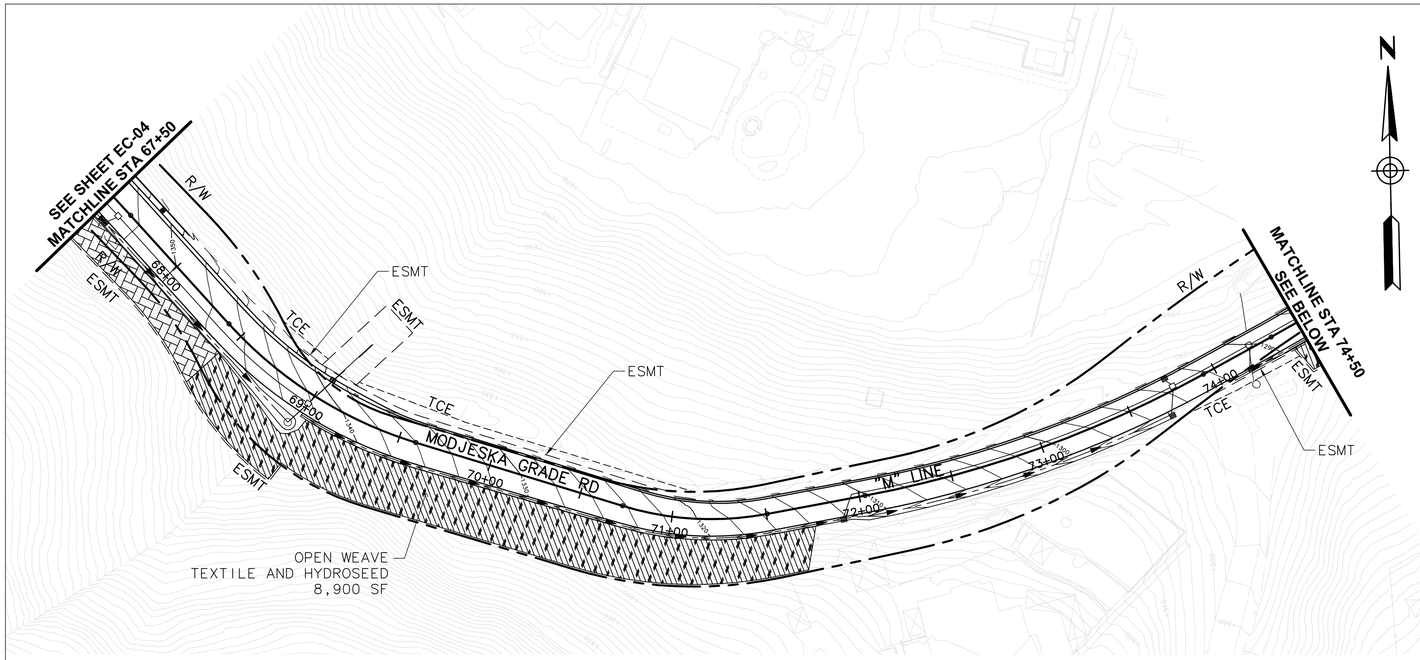
EROSION CONTROL PLAN

SHEET

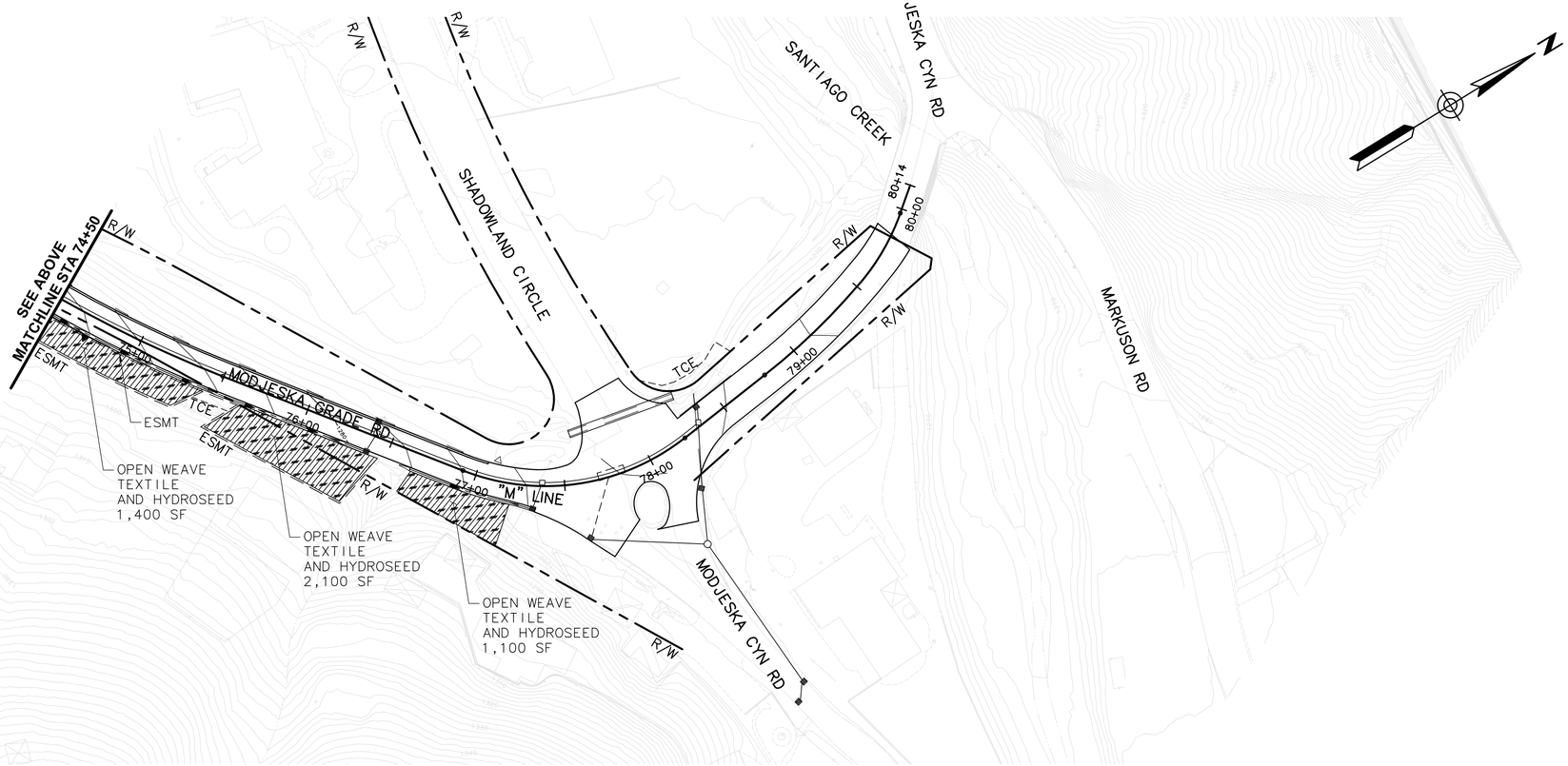
EC-04

NOTE:
ALL EROSION CONTROL TYPES AND AREAS SHOWN ON THIS PLAN ARE PRELIMINARY. ADDITIONAL GEOTECHNICAL DATA REGARDING SOIL TYPES AND GEOLOGICAL FORMATIONS, AS WELL AS COORDINATION WITH COUNTY MAINTENANCE, SHOULD BE CONSIDERED FOR FINAL DESIGN.

- HYDROSEED
- OPEN WEAVE TEXTILE & HYDROSEED
- WIRE BLANKET & HYDROSEED
- WIRE BLANKET



PLAN
1" = 40'



PLAN
1" = 40'
0 10 20 30 40 60 80 120 160

35% PLANS
NOT FOR CONSTRUCTION

COUNTY OF ORANGE CALIFORNIA

MARK	DESCRIPTION	DATE	APPR.

PREPARED UNDER THE RESPONSIBLE CHARGE OF:
REGISTERED PROFESSIONAL ENGINEER
RAM P. SHAH
No. 79183
Exp. 3/31/24
CIVIL
STATE OF CALIFORNIA
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FILE NAME: IR-20108_EC 1-5.DWG
PLOT DATE: Sunday, February 13, 2022
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County of Orange
OC Public Works
PREPARED BY: MARK THOMAS

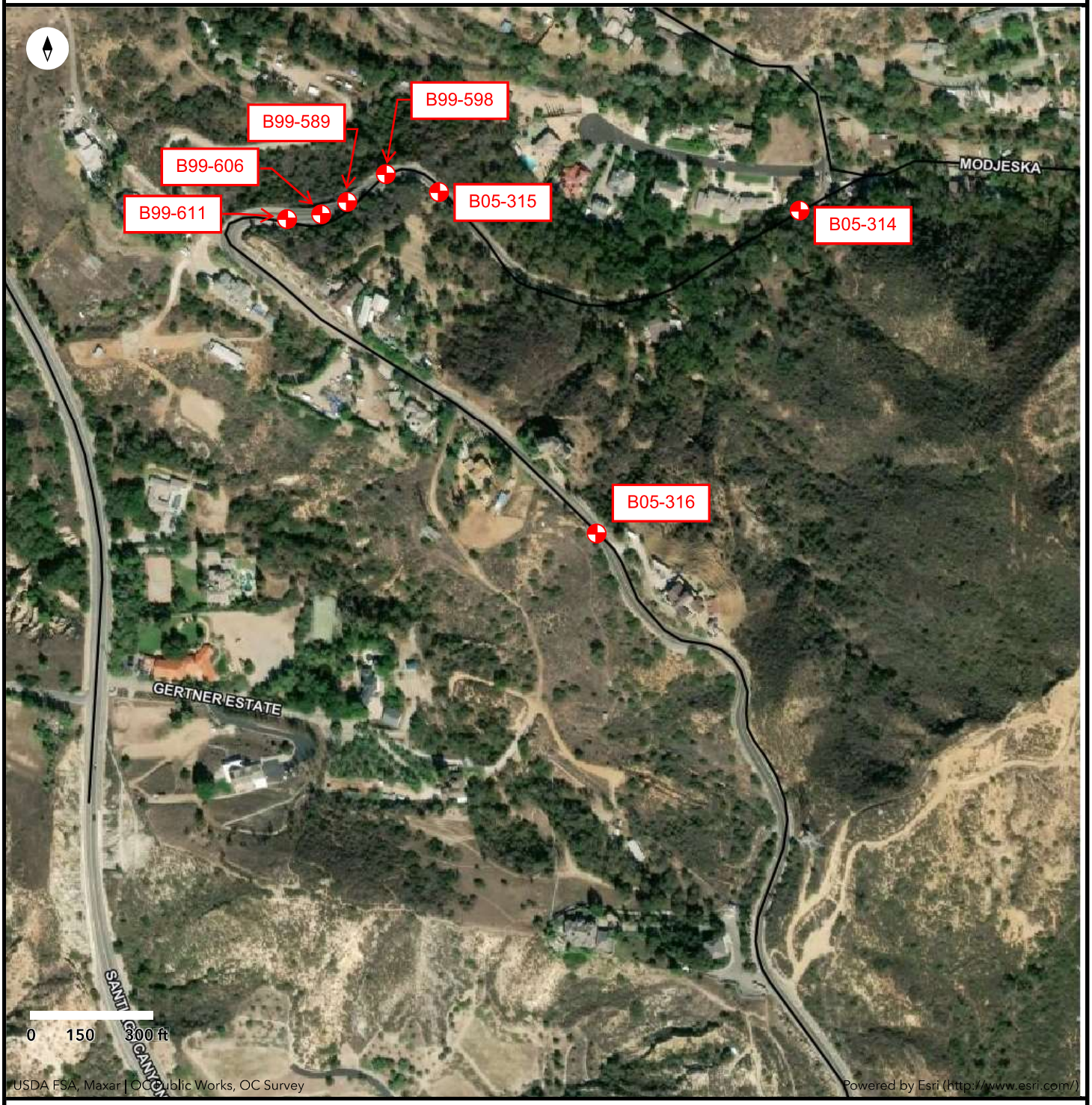
MODJESKA GRADE ROAD IMPROVEMENTS
STA 67+50 TO STA 80+00
EROSION CONTROL PLAN

SHEET
EC-05
24 OF 24

APPENDIX B -
EXISTING GEOTECHNICAL DATA

DRAFT

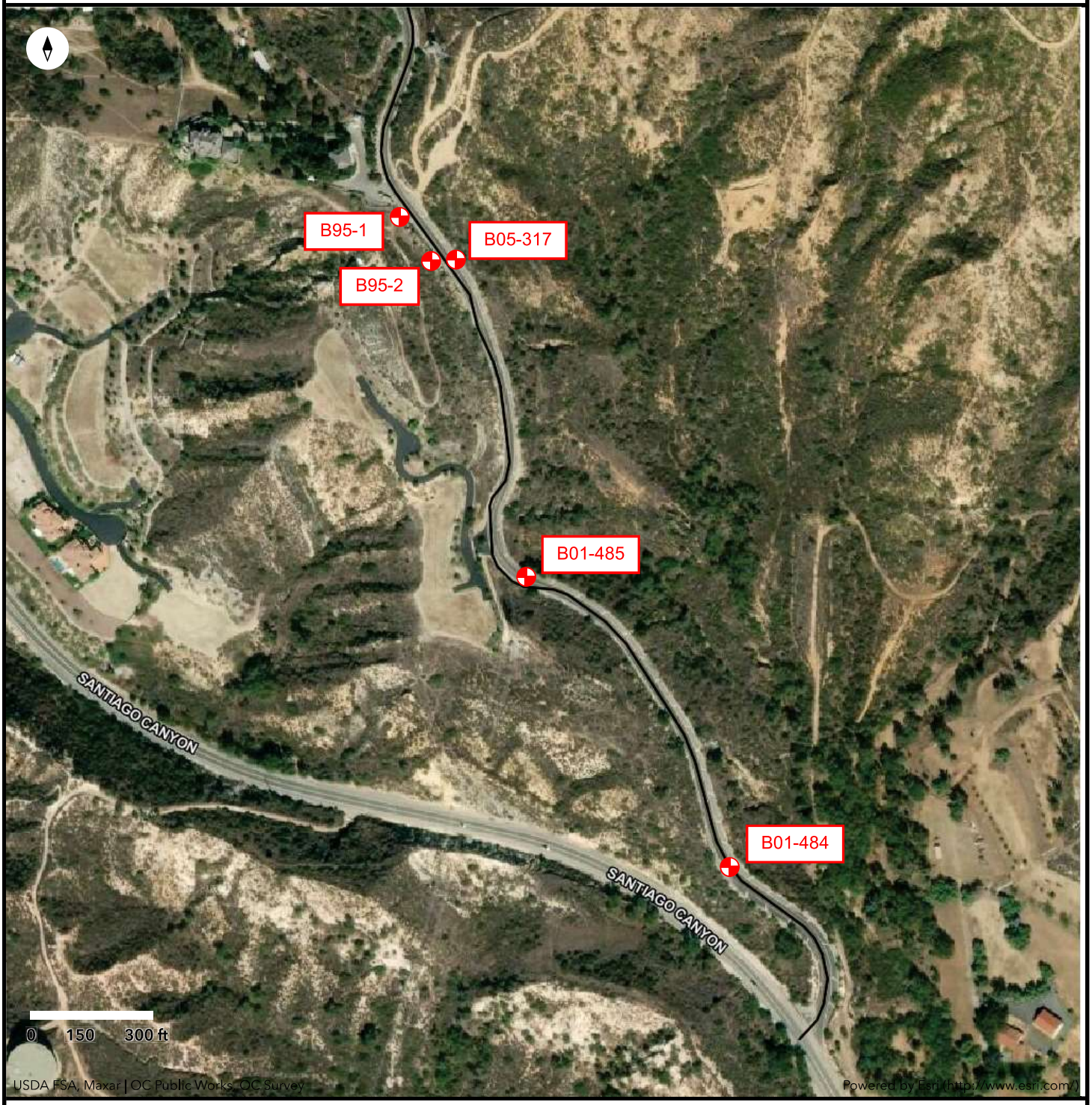
MODJESKA GRADE ROAD SHEET 1 OF 2



Legend

- Approximate Historical Boring Location
- Modjeska Grade Road

MODJESKA GRADE ROAD SHEET 2 OF 2



Legend

- Approximate Historical Boring Location
- Modjeska Grade Road

SOIL SURVEY SHEET

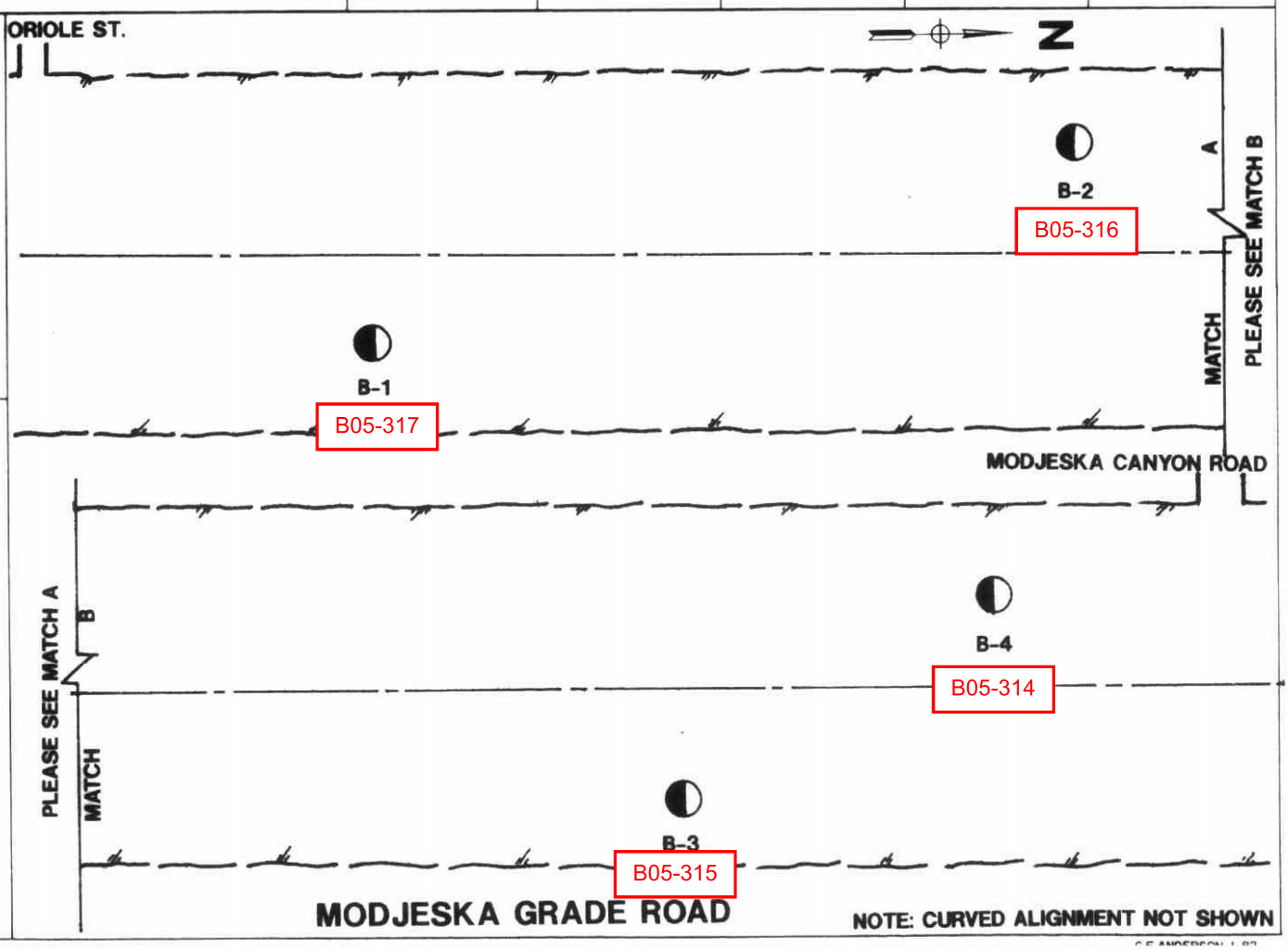
DATE **JAN. 2006** BY **RAM** SH. **1** of **1**

PROJECT **MODJESKA GRADE ROAD - ORIOLE STREET TO MODJESKA CANYON ROAD** ER20483

DESCRIPTION	BORING OR SAMPLE NO.	B-1			B-2			B-3			B-4				
	LAB NUMBER	05 - 317			05 - 316			05 - 315			05 - 314				
	DATE SAMPLED	12 - 08 - 05			12 - 08 - 05			12 - 08 - 05			12 - 08 - 05				
	STATION	750'N/ORIOLE			2307'N/ORIOLE			3970'N/ORIOLE			4666'N/ORIOLE				
	DISTANCE FROM ℄	5'E			6'W			6'E			4'W				
	DEPTH OR ELEVATION	1.0' - 4.0'			1.0' - 4.0'			1.0' - 4.0'			1.0' - 4.0'				
	TYPE OF MATERIAL	SANDY CLAY			SILTY CLAY			SILTY SAND			CLAYEY SAND				
MECHANICAL ANALYSIS	% PASSING NO. 4														
	% PASSING NO. 200	59			84			28			57				
	% SAND & ROCK (+200)	41			16			72			43				
	% SILT (-200 to 5 microns)	21			51			15			30				
	% CLAY (-5 microns)	38			33			13			27				
STABILOMETER TEST	SPECIMEN IDENTIFICATION	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
	COMPACTOR PRESSURE	60	80	150	150	175	300	175	260	350	75	125	200			
	MOISTURE AT COMP. %	17.1	16.2	14.8	19.4	18.0	16.0	13.6	11.8	10.9	14.5	13.2	11.9			
	DRY DENS. OF BRIQ. lbs/cu.ft.	110	112	116	106	109	114	117	120	122	115	119	126			
	EXUDATION PRESSURE P.S.I.	250	380	560	220	360	560	200	410	730	160	320	460			
	STABILOMETER R-VALUE	9	12	16	8	24	31	28	61	63	8	14	26			
	G.E.-STABILOMETER-FEET	1.57	1.52	1.45	1.59	1.31	1.19	1.24	0.67	0.64	1.59	1.49	1.28			
	EXPAN. PRESSURE-FEET	0.77	0.63	2.83	1.83	4.33	6.83	0.43	1.53	2.33	0	0.50	0.77			
	R-VALUE at EQUILIBRIUM	10			13			49			12					
	G.E. at EQUILIBRIUM - FEET	1.56			1.50			0.88			1.52					
	FIELD MOISTURE %	15.2			16.8			8.3			8.1					
	TRAFFIC INDEX	5.4			5.4			5.4			5.4					
MISC.	SULFATES	82			82			466			137					
	EXISTING STRUCTURAL SECTION	0.35'AC/NS			0.42'AC/NS			0.50'AC/NS			0.42'AC/NS					

PLAN VIEW - Scales VERT. 1" = 10' HOROZ. 1" = 400'

LOG OF TEST BORINGS SCALE - VERT. 1" =



SOIL SURVEY SHEET

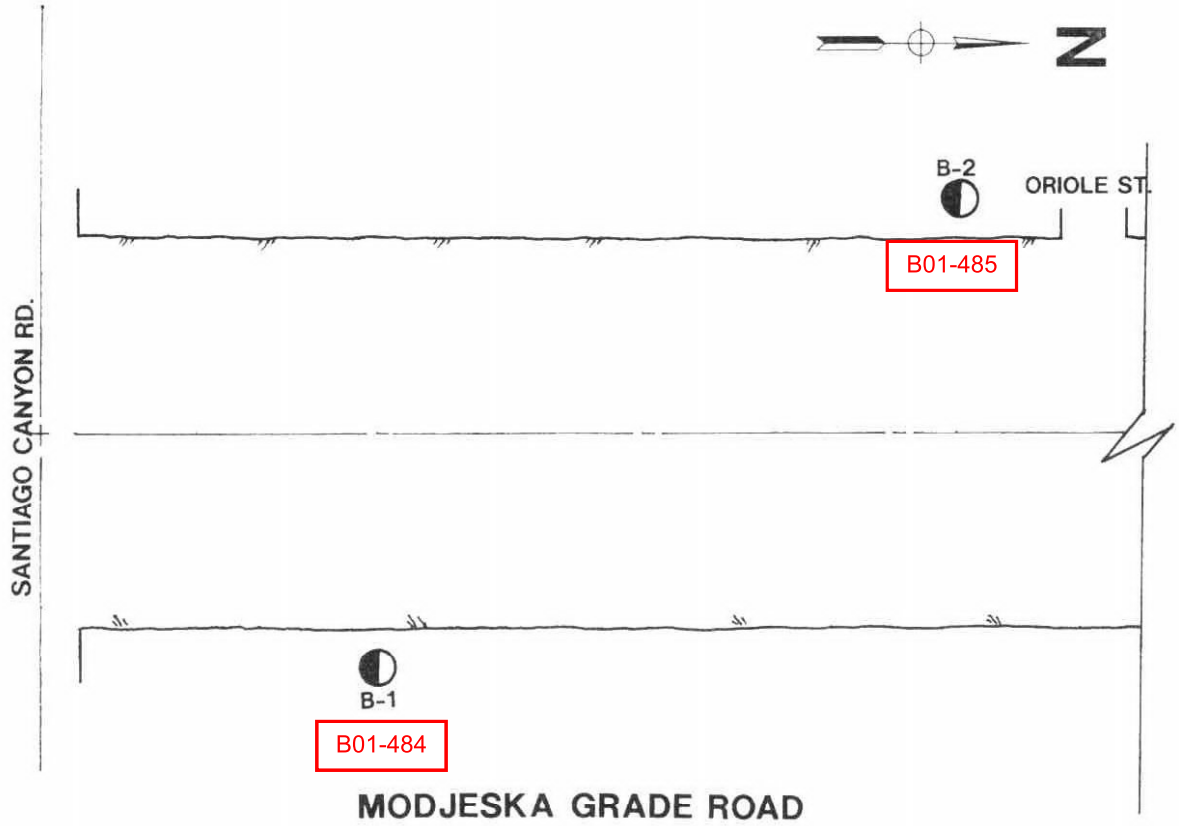
DATE 11/01 BY RAM SH. 1 of 1

PROJECT MODJESKA GRADE ROAD - SANTIAGO CANYON RD. TO ORIOLE ST. ER20483

DESCRIPTION	BORING OR SAMPLE NO.	B-1									B-2					
	LAB NUMBER	01-484									01-485					
	DATE SAMPLED	10-24-01									10-24-01					
	STATION	520'N/SANTIAGO CYN. RD.									1420'N/SANTIAGO CYN. RD.					
	DISTANCE FROM ℄	12'E									12'W					
	DEPTH OR ELEVATION	0' - 4.0'									0'-4.0'					
	TYPE OF MATERIAL	CLAYEY SAND									CLAYEY SAND					
MECHANICAL ANALYSIS	% PASSING NO. 4															
	% PASSING NO. 200	47									57					
	% SAND & ROCK (+200)	53									43					
	% SILT (-200 to 5 microns)	18									32					
	% CLAY (-5 microns)	29									25					
STABILOMETER TEST	SPECIMEN IDENTIFICATION	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
	COMPACTOR PRESSURE	20	20	50							35	75	75			
	MOISTURE AT COMP. %	18.1	15.8	13.5							20.0	18.1	18.1			
	DRY DENS. OF BRIQ. lbs/cu.ft.	107	112	118							104	107	108			
	EXUDATION PRESSURE P.S.I.	205	380	540							260	495	535			
	STABILOMETER R-VALUE	≤5	12	14							8	13	14			
	G.E.-STABILOMETER-FEET	1.64	1.52	1.49							1.59	1.50	1.49			
	EXPAN. PRESSURE-FEET	Ø	Ø	Ø							0.13	1.07	1.33			
	R-VALUE at EQUILIBRIUM	10									10					
	G.E. at EQUILIBRIUM - FEET	1.56									1.56					
	FIELD MOISTURE %	12.2									16.9					
	TRAFFIC INDEX	5.4									5.4					
MISC.	SULFATES	<2000									<2000					

PLAN VIEW - Scales VERT 1" = 10' HORIZ. 1" = 300'

LOG OF TEST BORINGS SCALE - VERT 1" =



NOTE: CURVED ALIGNMENT NOT SHOWN

G.E. ANDERSON 1-82

COUNTY OF ORANGE
PUBLIC FACILITIES & RESOURCES DEPARTMENT
DAVE DIXON MEMORIAL MATERIALS LAB

BORING LOG

Project: **Modjeska Grade Road (ER27657)** Date: **12/14/99**

Test Boring No.: **1** Location: **292' E/ Canyon Heights Drive**

Penetrometer No.: **1** Surface Elevation: **1387.73'**

B99-589

Lab No.	Depth (ft)	Blows per half foot	Description
			140 LB. HAMMER, 30 IN. DROP
	0		**ASPHALT CONCRETE**
99-589		11, 6, 5, 6, 4, 6	**DISPLACED FILL, NON-CERTIFIED** *Clay, sandy (f) and silty, brown, yellowish brown, and dark brown, moist, root mold and insect burrow mold porosity as high as 15 – 20 % in some horizons* **SANDY CLAY** SE = 9 SO_4 < 2000 ppm H_2O = 13.0 %
99-596		8, 6, 10, 9	**STIFF SANDY CLAY** SE = 9 γ = 95.0 lbs/ft^3
99-590	5	10, 10, 12, 8, 8, 8, 7	**SANDY CLAY** SE = 10 SO_4 < 2000 ppm H_2O = 10.6 % γ_{max} = 119.1 lbs/ft^3 @ 11.7 %
99-591	10	6, 6, 4, 5, 5	**SANDY CLAY** SO_4 < 2000 ppm H_2O = 12.3 %
99-592		5, 3, 6, 7, 10, 8	**SANDY CLAY** SO_4 < 2000 ppm H_2O = 16.9 %
99-597		16, 21, 13, 10	**HARD SILTY SAND** γ = 94.1 lbs/ft^3 ϕ = 34° c = 22 lbs/ft^3 H_2O = 12.8 %
99-593	15	8, 7, 11, 13, 15, 16, 16, 16	**BEDROCK, SILVERADO FORMATION** *Sandstone (f-m), orangish-brown, very well indurated, staining appears ancient and typical of formations, slightly moist, dense to very dense* **SANDY CLAY** SO_4 < 2000 ppm H_2O = 17.0 % γ_{max} = 116.5 lbs/ft^3 @ 13.9 %
99-594	20	17, 15, 13, 11, 11, 11, 11, 14	**SANDY CLAY** SO_4 < 2000 ppm H_2O = 16.7 %
99-595	25	13, 13, 14, 20, 19, 20	**SANDY CLAY** SO_4 < 2000 ppm H_2O = 23.9 %
		25, 30	Total depth of boring = 26' No groundwater. Hole backfilled and cold-patched

COUNTY OF ORANGE
PUBLIC FACILITIES & RESOURCES DEPARTMENT
DAVE DIXON MEMORIAL MATERIALS LAB

BORING LOG

Project: **Modjeska Grade Road (ER27657)** Date: **12/15/99**

Test Boring No.: **2** Location: **260' E/ Canyon Heights Drive**

Penetrometer No.: **2** Surface Elevation: **1391.44'**

B99-606

Lab No.	Depth (ft)	Blows per half foot	Description
			140 LB. HAMMER, 30 IN. DROP
	0		**ASPHALT CONCRETE (0.63')**
99-606		6, 5, 4, 4, 8, 6, 6, 6, 5, 4, 6, 6, 8	**DISPLACED FILL, NON-CERTIFIED** *Sandy silty clay, dark brown, moist* **SILTY SAND** SE = 14 SO_4 < 2000 ppm H_2O = 8.2 % *Pale yellowish brown*
99-607	5	8, 8, 7, 6, 7, 9	**SANDY CLAY** SO_4 < 2000 ppm H_2O = 14.3 % γ_{max} = 117.8 lbs/ft^3 @ 14.2 %
	10	11, 9	
99-610		22, 14, 21, 18	**HARD SANDY CLAY**
99-608		30, 52	**BEDROCK, SILVERADO FORMATION** *Clayey gravelly sandstone, yellowish, brown, moist, dense to very dense* **SANDY CLAY** SE = 7 SO_4 < 2000 ppm H_2O = 11.4 %
99-609			**CLAYEY SAND** SO_4 < 2000 ppm H_2O = 10.7 %
	15		
	20		
	25		Total depth of boring = 15' No groundwater. Hole backfilled and cold-patched.

COUNTY OF ORANGE
PUBLIC FACILITIES & RESOURCES DEPARTMENT
DAVE DIXON MEMORIAL MATERIALS LAB

BORING LOG

Project: **Modjeska Grade Road (ER27657)** Date: **12/15/99**

Test Boring No.: **3** Location: **203' E/ Canyon Heights Drive**

Penetrometer No.: **3** Surface Elevation: **1398.24**

B99-611

Lab No.	Depth (ft)	Blows per half foot	Description
			140 LB. HAMMER, 30 IN. DROP
	0		**ASPHALT CONCRETE**
99-611		8, 10, 10, 14, 10	**DISPLACED FILL, NON-CERTIFIED** *Clayey sand (f-m), yellowish-brown, moist; silty clay, pale yellowish-brown, moist* **SANDY CLAY** SO_4 < 2000 ppm H_2O = 11.7 %
99-612	5	12, 11, 10, 15, 8, 9, 9	**CLAYEY SAND** SO_4 < 2000 ppm H_2O = 11.7 %
99-615		6, 12, 13, 12, 18, 22, 47	**MEDIUM DENSE CLAYEY SAND** γ = 105.5 lbs/ft^3 ϕ = 43° c = 48 lbs/ft^3 H_2O = 15.3 %
99-613	10		**BEDROCK, SILVERADO FORMATION** *Silty sandstone (f) with minor clay, moist, yellowish brown, micaceous, dense to very dense* **CLAYEY SAND** SE = 10 SO_4 < 2000 ppm H_2O = 11.5 % γ_{max} = 117.3 lbs/ft^3 @ 12.0 %
99-614			**SANDY CLAY** SO_4 < 2000 ppm H_2O = 12.9 %
	15 20 25		Total depth of boring = 14' No groundwater. Hole backfilled and cold-patched.

COUNTY OF ORANGE
PUBLIC FACILITIES & RESOURCES DEPARTMENT
DAVE DIXON MEMORIAL MATERIALS LAB

BORING LOG

Project: **Modjeska Grade Road (ER27657)** Date: **12/14/99**

Test Boring No.: **4** Location: **394' E/ Canyon Heights Drive**

Penetrometer No.: **4** Surface Elevation: **1379.88'**

B99-598

Lab No.	Depth (ft)	Blows per half foot	Description
			140 LB. HAMMER, 30 IN. DROP
	0		**ASPHALT CONCRETE**
			DISPLACED FILL, NON-CERTIFIED
		14	*Clayey silty sand (f-m), yellowish-brown to dark brown, moist*
		9	
99-598		8	
		9	**SANDY CLAY**
		8	SE = 8 SO_4 < 2000 ppm H_2O = 11.3 %
		12	
		10	
		10	
	5	15	
		13	**SANDY CLAY**
99-599		12	SO_4 < 2000 ppm H_2O = 13.1 %
		13	γ_{max} = 117.3 lbs/ft^3 @ 12.0 %
		12	
		12	
		7 14	
99-601		18 21	**DENSE CLAYEY SAND** H_2O = 13.3 %
		28 21	
99-600		21	**SILTY CLAY** SO_4 < 2000 ppm H_2O = 12.8 %
	10	21	**BEDROCK, SILVERADO FORMATION**
		27	*Clayey silty sandstone (f-m), pale yellowish brown, moist dense to very dense*
		30	
	15		
	20		
	25		Total depth of boring = 10' No groundwater. Hole backfilled and cold-patched.

COUNTY OF ORANGE MATERIALS LAB

BY ____ Sh. ____ of ____

DATE 12-28-95

PROJECT MODJESKA GRADE ROAD, PRELIM INVEST, RETAIN. WALL

TEST BORING NO. B-1 LOCATION W. SIDE RD, 3' OFF PVMNT, 36 FT S OF ℄ OF SANTIAGO TRUCK TRAIL SURF. EL. ____

B95-1

LOG OF BORING

ER38001

DRY DENSITY (pcf)	MOISTURE	BLOWS PER FOOT	DEPTH	
			0	FILL 0-4' CLAYEY SILTY SAND (F-M) SC DARK BROWN, MOIST
128.1	5.6 % 7.8 %	200	5	SANTIAGO FORMATION 4-12.5' FELDSPATHIC SANDSTONE (F-M), DRILL CUTTINGS PRODUCE CLAYEY SILT TO SILTY CLAY, PALE YELLOW-BROWN, SLIGHTLY MOIST; FELD. SAND GRAINS ARE WEATHERED AND ALTERED AND TURN TO POWDER DURING DRILLING SO BEDROCK CUT-SLOPE EXPOSURES OF SANDSTONE APPEAR DIFFERENT THAN DRILL-CUTTINGS THAT CONSIST OF PULVERIZED SAND THAT TURNS TO CLAY AND SILT @ 5-5' $\phi = 54°$ $c = 125$ psf $SO_4 < 2000$ ppm
119.8	7.9 %	220	10	@ 9-9.5' $\phi = 46°$ $c = 53$ psf $SO_4 < 2000$ ppm

TOTAL DEPTH OF BORING 12.5'
NO GROUNDWATER
HOLE BACKFILLED

COUNTY OF ORANGE MATERIALS LAB

BY ____ Sh. ____ of ____

DATE 12-28-95

PROJECT MODJESKA GRADE ROAD, PRELIM INVEST, RETAIN. WALL

TEST BORING NO. B-2 LOCATION W. SIDE RD, 3' OFF PVMNT, SURF. EL. ____

B95-2

200' ~~36~~ FT S OF ℄ OF SANTIAGO TRUCK TRAIL

LOG OF BORING

ER38001

DRY DENSITY (pcf)	MOISTURE	BLOWS PER FOOT	DEPTH	
	17.1%	—	0	FILL 0-1' CLAYEY SAND (F-M), SC, DARK BROWN, MOIST
104.7 112.5	14.2% 14.1%	56	5	SANTIAGO FORMATION 1-10.3' FELDSPATHIC SANDSTONE (F-M), DRILL CUTTINGS PRODUCE SANDY CLAYEY SILT TO SILTY CLAY, PALE YELLOWISH BROWN, SLIGHTLY MOIST. @ 4.5'-5' $\phi = 31°$ $c = 341$ psf $SO_4 < 2000$ ppm
121.8	6.1%	178+	10	@ 5-5.5' $\phi = 55°$ $c = 178$ psf $SO_4 < 2000$ ppm @ 9.9-10.3' $\phi = 58°$ $c = 0$ $SO_4 < 2000$ ppm

TOTAL DEPTH OF BORING 10.3'
NO GROUNDWATER
HOLE BACKFILLED

APPENDIX C -
FIELD EXPLORATION

DRAFT

APPENDIX C - FIELD EXPLORATION

The field exploration for the proposed Project consisted of drilling six borings (DYB23-01, 02, 03, 04, 05, and 09), advancing two hand augers (DYB23-06 and DYB23-07), and collecting 36 bag samples for agronomy testing. The borings and hand augers were advanced to depths ranging from approximately 10 inches to 41 feet below ground surface (bgs). The approximate boring and hand auger locations are shown on Figure 2, and the approximate agronomy samples are shown on Figure 3.

Prior to drilling the borings, the field exploration locations were marked in the field using a hand-held global positioning system (GPS) unit with an estimated 12-foot horizontal accuracy and checked for underground utilities using geophysical techniques. The geophysical survey was performed by Atlas Technical Consultants LLC (Atlas), a subconsultant to DYA, on November 21, 2022, and March 23, 2023. Underground Service Alert (USA) was notified a minimum of two working days, not including the date of notification, prior to performing the field exploration. Prior to drilling, positive confirmation regarding potential utility conflicts was obtained from each utility responder designated by USA.

Borings DYB23-01, 02, 04, 05, and 09 were drilled by 2R Drilling Inc. (2R) using a truck-mounted drill rig using hollow-stem-auger (HSA) drilling techniques on May 2 and May 3, 2023. Boring DYB23-03 was drilled by Cascade with a limited access track-mounted drill rig using HSA drilling techniques on April 6, 2023. DYA field personnel observed the drilling operations and collected bulk, drive, and grab samples for visual examination and subsequent laboratory testing. The bulk samples were collected from the upper 5 feet of the boring spoils (not including existing pavement section materials, where present); drive samples were collected with a 2.4-inch-inside-diameter (3.0-inch-outside-diameter) modified California split-barrel sampler lined with stainless steel tubes and a standard split-spoon penetrometer with dimensions in accordance with ASTM D3550 and D1586, respectively. Both samplers were driven with a 140-pound automatic trip hammer falling 30 inches. The hammer blows required to drive the samplers were recorded in the field by DYA. The efficiency ratings (ER) for the hammers used during the field exploration are included on the boring logs presented herein.

The hand augers were also performed by 2R. Hand tools were used to collect bulk samples for identification and testing from the upper 5 feet of the boring spoils.

DRAFT

Soils encountered in the borings were classified in general accordance with ASTM D2487, which is summarized on Plate C1, and D2488. Boring logs presented on Plates C2 through C10 were prepared from visual examination of the samples, cuttings obtained during drilling operations, and results of laboratory tests. The equivalent standard penetration test (SPT) N_{60}-values presented on the boring logs were derived from the hammer blow counts recorded in the field as follows:

- The hammer blows recorded for the last 12 inches of modified California sampler penetration were multiplied by 0.65 to obtain the equivalent SPT N-value.
- The equivalent SPT N-value for each sample was modified by multiplying by the ratio of ER/60 to obtain the SPT N_{60}-value indicated for each sample on the boring log.
- Where sampler refusal (i.e., 50 hammer blows for less than 6 inches of sampler penetration) was encountered, the equivalent SPT N-value was calculated by multiplying the sampler blow count (usually 50 blows) by the ratio of 6 inches divided by the actual sampler penetration in inches. Where the modified California sampler met driving refusal, then the prorated equivalent SPT blow count was further modified as noted above for samples that did not meet sampler driving refusal.
- The equivalent SPT N-value for each sample was modified by multiplying by the ratio of ER/60 to obtain the SPT N_{60}-value indicated for each sample on the boring log.

A photo-ionization detector (PID) was used during the field exploration to screen for potential hydrocarbon contamination in select soil samples. PID readings are shown on the boring logs presented herein.

Groundwater was not encountered in the borings to the maximum depth explored, approximately 41 feet bgs. Borings were backfilled with soil cuttings. Paved surfaces, where present, were patched with rapid set concrete.

DRAFT

SOIL CLASSIFICATION SYSTEM-ASTM D2487

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

"Push" Sampler

Split Barrel "Drive" Sampler With Liner

Standard Penetration Test (SPT) Sampler

Bag Sample

Concrete/Rock Core

Groundwater Surface

NP = Nonplastic
EI = Expansion Index Test
SG = Specific Gravity
SE = Sand Equivalent
UU = Unconfined Comp.
CD = Consol. Drained Triaxial.
CU = Consol. Undrained Triaxial.
UU = Undrained, Unconsol. Triaxial.
R = R-Value
CR = Corrosivity
DS = Direct Shear
C = Consolidation
CL = Collapse Potential
PA = Particle size; HD = Hydrometer
CP = Compaction Test
P = Permeability Test
[PID] Reading in ppm above background

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE
C1

Library: DYLIB.GLB; Template: DYLG; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1409
LATITUDE:	33.69764	**LONGITUDE:**	-117.63316
DRILLING EQUIPMENT:	Gtechdrill GT-16	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	6
DATE STARTED: 5-4-23	**COMPLETED:** 5-4-23	**HAMMER TYPE:** Automatic	**EFFICIENCY:** 87.8%
DRILLING CONTRACTOR:	2R Drilling, Inc.	**HAMMER DROP:** 30 inches	**WEIGHT:** 140 lbs
LOGGED BY: AS	**CHECKED BY:** NM	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N60 Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 3 inches						
							SILTY SAND (SM): dark brown; moist; medium dense; medium to fine SAND; trace fine GRAVEL; BASE - 5 inches						[12.4] MD, RV
				15 55/5"	100		SILTY SAND (SM): dark brown; moist; very dense; medium to fine SAND; iron oxide stains; micaceous	109	9			32	[88], SA
1405													
	5			50 55/5"	100		light yellowish brown; trace fine GRAVEL; iron oxide stringers; micaceous	114	3			17	[23.4]
							Bottom of boring at 6 feet. No groundwater encountered during drilling. Boring backfilled with soil cuttings. Surface patched with rapidset concrete dyed black.						
1400													
	10												
1395													
	15												
1390													
	20												
1385													
	25												
1380													

LOG OF BORING DYB23-01

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE

C2

Library: DYLIB.GLB; Template: DYLG; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1645
LATITUDE:	33.70344	**LONGITUDE:**	-117.63652
DRILLING EQUIPMENT:	Gtechdrill GT-16	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	21.5
DATE STARTED: 5-2-23	**COMPLETED:** 5-2-23	**HAMMER TYPE:** Automatic	**EFFICIENCY:** 87.8%
DRILLING CONTRACTOR:	2R Drilling, Inc.	**HAMMER DROP:** 30 inches	**WEIGHT:** 140 lbs
LOGGED BY: AS	**CHECKED BY:** NM	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N60 Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 2 inches						
							SILTY SAND (SM): dark brown; dry; medium dense; medium to fine SAND; BASE - 4 inches						[0.0] MD, RV
				18 20 23	41		SILTY SAND (SM): pale yellow; moist; dense; medium to fine SAND; micaceous	118	6			31	[3.9], SA
1640	5			21 24 24	45		yellowish brown; dense; coarse to fine SAND; micaceous	115	8				[40.5], DS
				20 38 45	79		very dense	114	5			23	[8.1]
1635	10			27 34 45	75								[2.6]
							CLAYEY SAND (SC): olive yellow; moist; very dense; medium to fine SAND; iron oxide stringers	114	12	39	21	47	
							SILTY SAND (SM): yellowish brown; moist; dense; medium to fine SAND; manganese oxide spots; calcium carbonate spots						
1630	15			7 10 12	32				6				[75.2]
1625	20			13 21 23	42			117	6				[14.9], DS
							POORLY GRADED SAND (SP): pale yellow; moist; dense; medium to fine SAND; manganese oxide spots; calcium carbonate spots						
							Bottom of boring at 21.5 feet. No groundwater encountered during drilling. Boring backfilled with soil cuttings. Surface patched with rapidset concrete dyed black.						
1620	25												

LOG OF BORING DYB23-02

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE

C3

Library: DYLIB.GLB; Template: DYLG; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1672
LATITUDE:	33.70323	**LONGITUDE:**	-117.63637
DRILLING EQUIPMENT:	Limited Access Rig	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	40.75
DATE STARTED: 4-6-23	**COMPLETED:** 4-6-23	**HAMMER TYPE:** Automatic	**EFFICIENCY:** 79%
DRILLING CONTRACTOR:	Cascade	**HAMMER DROP:** 30 inches	**WEIGHT:** 140 lbs
LOGGED BY: AS	**CHECKED BY:** BB	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N60 Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							SILTY SAND (SM): olive yellow; moist; medium dense; medium to fine SAND; trace CLAY nodules; slightly micaceous						
1670													
	5			2 4 30	29		increased CLAY nodules						[0.0]
1665							CLAYEY SAND (SC): yellowish brown; moist; medium dense; medium to fine SAND; trace fine GRAVEL; trace roots; micaceous		10	34	17		
	10			3 8 50/6"	50		SILTY SAND (SM): yellowish brown; moist; dense; coarse to fine SAND; trace fine GRAVEL; trace roots; calcium carbonate stringers	119	8			23	[0.0], SA
1660													
	15			34 50/6"	86		very dense	117	6				[0.0], DS
1655													
	20			19 50/4"	100			111	3			19	[0.0]
1650													
	25			4 50/5"	100			109	4				[0.0]
1645													

LOG OF BORING DYB23-03

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE

C4

Library: DYLIB.GLB; Template: DYLG; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N60 Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
		X		42 50/4"	100				4				[0.1]
1640							rig chatter at 33 feet						
	35	▼		20 50/4"	100			103	4			16	[0.0]
1635													
	40	X		48 50/3"	100		light olive brown		5				[0.0]
1630							Bottom of boring at 40.75 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
	45												
1625													
	50												
1620													
	55												
1615													
	60												
1610													
	65												
1605													

LOG OF BORING DYB23-03

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE

C5

Library: DYLIB.GLB; Template: DYLG; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1615
LATITUDE:	33.70444	**LONGITUDE:**	-117.63681
DRILLING EQUIPMENT:	Gtechdrill GT-16	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	20.4
DATE STARTED: 5-2-23	**COMPLETED:** 5-2-23	**HAMMER TYPE:** Automatic	**EFFICIENCY:** 87.8%
DRILLING CONTRACTOR:	2R Drilling, Inc.	**HAMMER DROP:** 30 inches	**WEIGHT:** 140 lbs
LOGGED BY: AS	**CHECKED BY:** NM	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N60 Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 1 inch		8				[0.2]
							SILTY SAND with GRAVEL (SM): dark green; dry; medium dense; medium to fine SAND; coarse to fine GRAVEL; BASE - 9 inches						MD, RV
				50/5"	100		CLAYEY SAND (SC): yellowish brown; moist; very dense; medium plasticity; medium to fine SAND; trace coarse SAND; micaceous		6	36	20	30	[1.3], SA
1610	5			50/3"	100		CLAYEY SAND with GRAVEL (SC): yellowish brown; moist; very dense; coarse to fine SAND; coarse to fine GRAVEL		5				[5.9]
				50/6"	100				9			21	[220]
1605	10			50/6"	100				5	30	16		[85]
1600	15			50/6"	100		decrease GRAVEL content		7				[51]
1595	20			50/5"	100		POORLY GRADED GRAVEL with SAND (GP): olive brown; moist; very dense; coarse to fine SAND; coarse to fine GRAVEL						[12.6]
							Bottom of boring at 20.4 feet. No groundwater encountered during drilling. Boring backfilled with soil cuttings. Surface patched with rapidset concrete dyed black.						
1590	25												

LOG OF BORING DYB23-04

Page 1 of 1

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE

C6

Library: DYLIB.GLB; Template: DYLG; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1445
LATITUDE:	33.70724	**LONGITUDE:**	-117.64032
DRILLING EQUIPMENT:	Gtechdrill GT-16	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	20.5
DATE STARTED: 5-3-23	**COMPLETED:** 5-3-23	**HAMMER TYPE:** Automatic	**EFFICIENCY:** 87.8%
DRILLING CONTRACTOR:	2R Drilling, Inc.	**HAMMER DROP:** 30 inches	**WEIGHT:** 140 lbs
LOGGED BY: AS	**CHECKED BY:** NM	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N60 Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 2 inches						
							SILTY SAND (SM): yellow; moist; very dense; medium to fine SAND; trace coarse SAND; trace coarse to fine GRAVEL; micaceous					21	SA, MD, RV
				50/6"	100			106	6				[6.6], DS
1440	5			42 50/5"	100		pale yellow; no GRAVEL	105	7				[6.5]
				50/6"	100		iron oxide stringers	104	6				[15.7]
1435	10			50/6"	95			105	6			18	[8.2], DS
1430	15			24 39 50/6"	100		dark brown; calcium carbonate spots; micaceous		11	NP	NP	42	[58]
							POORLY GRADED SAND with SILT (SP-SM): yellow; moist; very dense; coarse to fine SAND; micaceous @ 19 feet thin CLAY lense						
1425	20			50/6"	100			102	7				[55]
							Bottom of boring at 20.5 feet. No groundwater encountered during drilling. Boring backfilled with soil cuttings. Surface patched with rapidset concrete dyed black.						
1420	25												

LOG OF BORING DYB23-05

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE

C7

Template: DYLG HAND AUGER; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1444
LATITUDE:	33.70756	**LONGITUDE:**	-117.640586
DRILLING EQUIPMENT:	Hand Auger	**DRILLING METHOD:**	Hand Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	5.5
DATE STARTED:	4/6/23	**DATE COMPLETED:**	4/6/23
LOGGED BY:	AS	**CHECKED BY:**	BB

Elevation (feet)	Depth (feet)	Sampler	Symbol			Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							SILTY SAND (SM): yellowish brown; moist; medium dense; nonplastic; coarse to fine SAND; trace fine GRAVEL; trace roots						MD
													DS
1440							black mottling at 4 feet						
	5						no mottling at 5 feet					20	SA
							Bottom of boring at 5.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
1435													

LOG OF BORING DYB23-06

OCPW Modjeksa Grade Road Improvements

Project No. 2022-017

PLATE

C8

Template: DYLG HAND AUGER; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1329
LATITUDE:	33.707237	**LONGITUDE:**	-117.638032
DRILLING EQUIPMENT:	Hand Auger	**DRILLING METHOD:**	Hand Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	5.5
DATE STARTED:	5/3/23	**DATE COMPLETED:**	5/3/23
LOGGED BY:	AS	**CHECKED BY:**	NM

Elevation (feet)	Depth (feet)	Sampler	Symbol			Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 3 inches						MD, RV
							SILTY SAND with GRAVEL (SM): medium dense; BASE - 4 inches						
							SILTY SAND (SM): brown; moist; medium dense; coarse to fine SAND; fine GRAVEL; trace fine GRAVEL;						
							dark brown; no trace fine GRAVEL					14	DS
1325													
	5												
							Bottom of boring at 5.5 feet. No groundwater encountered during drilling. Boring backfilled with soil cuttings. Surface patched with rapidset concrete dyed black.						
1320													

LOG OF BORING DYB23-07

OCPW Modjeksa Grade Road Improvements

Project No. 2022-017

PLATE

C9

Library: DYLIB.GLB; Template: DYLG; Prj ID: 2022-017 MODJESKA GRADE ROAD.GPJ

BORING LOCATION:	See Figure No. 2	**ELEVATION (feet):**	1277
LATITUDE:	33.70853	**LONGITUDE:**	-117.63617
DRILLING EQUIPMENT:	Gtechdrill GT-16	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	8	**BORING DEPTH (feet):**	0.83
DATE STARTED: 5-3-23	**COMPLETED:** 5-3-23	**HAMMER TYPE:** Automatic	**EFFICIENCY:** 87.8%
DRILLING CONTRACTOR:	2R Drilling, Inc.	**HAMMER DROP:** 30 inches	**WEIGHT:** 140 lbs
LOGGED BY: AS	**CHECKED BY:** NM	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N60 Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 5 inches						
							SANDY SILT with GRAVEL (ML): dark brown; moist; medium dense; medium to fine SAND; coarse to fine GRAVEL; trace roots; BASE - 4 inches						[3.8]
1275							rig chatter at 9 inches						
							Boring terminated at 10 inches due to refusal.						
							No groundwater encountered during drilling.						
							Surface patched with rapidset concrete dyed black.						
	5												
1270													
	10												
1265													
	15												
1260													
	20												
1255													
	25												
1250													

LOG OF BORING DYB23-09

OCPW Modjeksa Grade Road Improvements
Project No. 2022-017

PLATE

C10

APPENDIX D -
GEOPHYSICAL SURVEYS

DRAFT

GEOPHYSICAL EVALUATION

MODJESKA GRADE ROAD IMPROVEMENTS

Silverado, California

PREPARED FOR:

Ms. Ashley Scholder
Diaz Yourman & Associates
1616 East 17th Street
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April 7, 2023

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April 7, 2023

Atlas No. 2437

MS. ASHLEY SCHOLDER
DIAZ YOURMAN & ASSOCIATES
1616 East 17th Street
SANTA ANA, CA 92705

Subject: Geophysical Evaluation
Modjeska Grade Road Improvements
Silverado, California

Dear Ms. Scholder:

In accordance with your authorization, Atlas has performed a seismic refraction study pertaining to the subject project located in Silverado, California. The purpose of our study was to perform a seismic P-wave refraction traverse, and a one-dimensional (1-D) seismic surface wave refraction microtremor (ReMi) profile to assess the depth to bedrock, apparent rippability of subsurface materials, and seismic velocities at the project site. Our services were conducted on March 23rd, 2023. This data report presents our methodology, equipment used, analysis, and results.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact the undersigned at your convenience.

Respectfully submitted,
Atlas Technical Consultants LLC

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PATRICK F. LEHRMANN
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CONTENTS

1. INTRODUCTION 1
2. SCOPE OF SERVICES 1
3. SITE AND PROJECT DESCRIPTION 1
4. STUDY METHODOLOGY 1
   4.1 P-wave Refraction 1
   4.2 ReMi 3
5. DATA ANALYSIS 4
   5.1 P-wave Refraction 4
   5.2 ReMi 4
6. RESULTS AND CONCLUSIONS 4
   6.1 P-wave Refraction 4
   6.2 ReMi 5
7. LIMITATIONS 5
8. SELECTED REFERENCES 6

TABLES

Table 1: Rippability Classification 3
Table 2: ReMi Results 5

FIGURES

Figure 1: Site Location Map
Figure 2: Line Location Map
Figure 3: Site Photographs
Figure 4: P-Wave Profile, SL-1
Figure 5: ReMi Results, RL-1

1. INTRODUCTION

In accordance with your authorization, Atlas has performed a seismic refraction study pertaining to the subject project located in Silverado, California (Figure 1). The purpose of our study was to perform a seismic P-wave refraction traverse, and a one-dimensional (1-D) seismic surface wave refraction microtremor (ReMi) profile to assess the depth to bedrock, apparent rippability of subsurface materials, and seismic velocities at the project site. Our services were conducted on March 23rd, 2023. This data report presents our methodology, equipment used, analysis, and results.

2. SCOPE OF SERVICES

Our scope of services included:

- Performance of a seismic P-wave refraction traverse (SL-1).
- Performance of a ReMi profile (RL-1).
- Compilation and geophysical analysis of the data collected.
- Preparation of this illustrated report presenting our methodology and findings.

3. SITE AND PROJECT DESCRIPTION

The project site is located east of the intersection of Modjeska Grade Road and Canyon Heights Drive in Silverado, California (Figure 1). Specifically, the seismic profiles were located on the property east of the intersection (Figure 2). The seismic P-wave and ReMi traverses were collocated and conducted in a northwest-southeast orientation, in an area selected by you and your office. Figures 2 and 3 present the seismic line location and depict the general site conditions along the study area.

Based on our discussion with you, it is our understanding that the site is in the planning phase of development and that the results from our study may be used in the formulation of design and construction parameters for the project.

4. STUDY METHODOLOGY

4.1 P-wave Refraction

A seismic P-wave (compression wave) refraction study was conducted at the project to develop subsurface velocity profiles of the areas studied, and to assess the depth to bedrock and apparent rippability of the subsurface materials. The seismic refraction method uses first-arrival times of refracted seismic waves to estimate the thicknesses and seismic velocities of subsurface layers. Seismic P-waves generated at the surface, using a hammer and plate, are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface vertical component 14-Hz geophones and recorded with a 24-channel Geometrics Geode seismograph. The travel times of the seismic P-waves are used in conjunction

with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

Geophones were placed at regularly spaced intervals of 5 feet for total line lengths of 125 feet for SL-1, including two off-end shots. The general locations and lengths of the lines were determined by surface conditions, site access, depth of investigation, and you and your office. Shot points (signal-generation locations) were conducted along the lines at the ends, midpoint, and intermediate points between the ends of the midpoint.

In general, classical seismic refraction theory requires that subsurface velocities increase with depth (generalized reciprocal method (GRM) and time-intercept modeling). In classical analysis methods a layer having a velocity lower than that of the layer above will not generally be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity such as those caused by core stones, intrusions, or boulders can also result in the misinterpretation of the subsurface conditions. Application of seismic tomography methods, as was performed for this project by Atlas, produces velocity models which, in general, are not subject to this limitation. However, even the application of seismic tomography analysis does have certain limitations regarding vertical and horizontal resolution. When a velocity anomaly target is of similar scale length to the seismic wavelet (or smaller), then diffraction behavior dominates because scattering is governing the loci of the wave-fronts. For travel time analysis a target feature must be at a scale versus its depth that is detectable relative to the scale length of the seismic wavelet we produce and receive. Therefore, there is a general limit to what scale of feature seismic tomography methods can detect regarding relatively small velocity anomaly features, related to both source and to medium velocities, and travel time uncertainties. In effect, some relatively smaller scale features including "thin" velocity inversion layers or voids, and some types of lateral and vertical velocity variations caused by core stones and intrusions might not be detected in our results. In general, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth of the length of the spread.

Generally, the seismic P-wave velocity of a material can be correlated to rippability (see Table 1 below), or to some degree “hardness.” Table 1 is based on published information from the Caterpillar Performance Handbook (Caterpillar, 2018), as well as our experience with similar materials, and assumes that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristic, such as fracture spacing and orientation, play a significant role in determining rock quality or rippability. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

For trenching operations**,** the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in narrow trenching operations, should be anticipated.

Table 1: Rippability Classification

Seismic P-wave Velocity	Rippability
0 to 2,000 feet/second	Easy
2,000 to 4,000 feet/second	Moderate
4,000 to 5,500 feet/second	Difficult, Possible Blasting
5,500 to 7,000 feet/second	Very Difficult, Probable Blasting
Greater than 7,000 feet/second	Blasting Generally Required

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook. Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

4.2 ReMi

The passive source 1-D ReMi technique uses recorded surface waves (specifically Rayleigh waves) that are contained in background noise to develop a seismic velocity profile of the study area down to a depth, in this case, of approximately 100 feet below ground surface (bgs). The depth of exploration is dependent on the length of the line and the frequency content of the background noise. The results of the ReMi method are displayed as a one-dimensional sounding which represents the average condition across the length of the line. The ReMi method does not require an increase of material velocity with depth; therefore, low-velocity zones (velocity inversions) are detectable with ReMi.

Our ReMi evaluation included the use of a 24-channel Geometrics Geode seismograph and 24, 14-Hz vertical component geophones. The geophones were spaced 5 feet apart for a total line length of 115 feet at RL-1. A total of 21 records, each 32 seconds in duration, were recorded, with 15 of the files utilizing passive data collection of ambient ground vibration noise and six files utilizing an active source generated by a 20-pound sledgehammer and an HDPE plastic strike plate. The active source data gathers included conducting hammer blows at locations on each end of the seismic spread at approximately 10 and 20 feet off the end of the geophone array. Three active source files were collected at each end of the line to supplement the passive data collection. Using off-end active source supplemental data reduces the chances for indeterminate dominant phase angle of energy arriving at the seismic spread, which typically increases the accuracy of the recorded dispersion curve and model results. For the ReMi method, the average surface wave velocity (analogous to shear wave velocity) is calculated across the length of the line, and the resulting 1-D model represents the center or midpoint point of the line. It should be noted the ReMi results represent the average condition across the length of the line.

5. DATA ANALYSIS

5.1 P-wave Refraction

The collected datasets were processed and analyzed using Rayfract® Version 4.03 (Intelligent Resources Inc., 2022) which employs wave path analysis. Rayfract® first provides forward modeling of refraction, transmission, and diffraction and then back-projects travel-time residuals along wave paths also known as Fresnel volumes instead of conventional analysis by rays. This increases the numerical robustness of the inversion. A smooth minimum-structure 1-D starting velocity-depth profile model is determined automatically directly from the seismic travel-time data first arrival picks and elevation data to produce subsurface velocities by horizontally averaging via the Delta t-V method. The Delta t-V method is based on common mid-point (CMP) sorted travel times and assumes multiple horizontal layers with constant interior velocity gradients (Rohdewald 2007; Gebrande 1985). Modeled seismic rays follow circular arcs inside each modeled layer. The Delta t-V starting model is then refined with 2D Wavepath Eikonal Traveltime (WET) inversion method (Schuster, 1993). The resulting 2-D WET velocity model provides a 2-D tomographic image of the P-wave velocities which can be used to estimate subsurface geologic conditions. Both vertical and lateral velocity information is contained in the tomography model. Changes in layer velocity are generally revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions. The collected data was processed using and analyzed using Rayfract®, version 4.03. Rayfract uses first arrival picks and elevation data to produce subsurface velocity models through a nonlinear optimization technique Wavepath Eikonal Traveltime Inversion (WET). The resulting velocity model provides a tomography image of the estimated geologic conditions. Both vertical and lateral velocity information is contained in the tomography model. Changes in layer velocity are revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions.

5.2 ReMi

The data collected was downloaded to a field computer and the data were later processed using Surface Plus 9.1 - Advanced Surface Wave Processing Software (Geogiga Technology Corp., 2020), which uses the refraction microtremor method (Louie, 2001) and other surface wave analysis methods. The program generates phase-velocity dispersion curves for each record and provides an interactive dispersion modeling tool to provide the best-fitting model. The result is a 1-D surface wave velocity model of the study area which, based on published studies, is typically 85 to 95 percent of the velocity of shear waves. Therefore, using the ReMi surface wave data and analysis method results in a relatively conservative estimate of shear wave velocity.

6. RESULTS AND CONCLUSIONS

6.1 P-wave Refraction

As previously indicated, one P-wave transverse was performed in an accessible portion of the project site. Figure 4 presents the velocity model generated from our analysis. Based on the

results, it appears that the study areas are generally underlain by low-velocity materials in the near subsurface and higher-velocity materials at depth. Distinct vertical and lateral velocity variations are evident in the model. Moreover, the degree of weathering and the depth to possible bedrock varies across the study area.

Based on the refraction results, variability in the excavatability (including depth of rippability) of the subsurface materials may be expected across the project area.

6.2 ReMi

As discussed, the purpose of our ReMi study was to develop shear-wave velocity profiles to be used for design and construction at the study site. Table 2 and Figure 5 presents the results from our ReMi evaluation. When the 1-D ReMi surface wave velocity results (analogous to shear wave) show an IBC Vs100 velocity value that is close to the "border line" boundary between IBC Site Classes, the project geotechnical consultant of record should be consulted. The geotechnical consultant of record should also consider other existing available site information and whether obtaining additional new geotechnical evaluation data such as boreholes, surface to downhole seismic (ASTM D7400), cross hole seismic (ASTM D4428), and/or additional 1-D remit data collections would be needed concerning the site's subsurface geologic stratigraphy and structure, soil mechanics and soil modulus, along with the initial 1-D Remit evaluation results when assessing the "borderline" IBC Vs100 Seismic Site Class.

Table 2: ReMi Results

Line No.	Depth (feet)	Shear Wave Velocity (feet/second)	Average Shear Wave Velocity (Vs in feet/second)	Site Class (IBC, 2019)
RL-1 (NW-SE)	0-8	555	Vs = 1,009 ft/s	D
	8-16	855		
	16-26	951		
	26-37	968		
	37-50	972		
	50-66	993		
	66-84	1420		
	84-100	1441		

7. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, express or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not

observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluations will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Atlas should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

8. SELECTED REFERENCES

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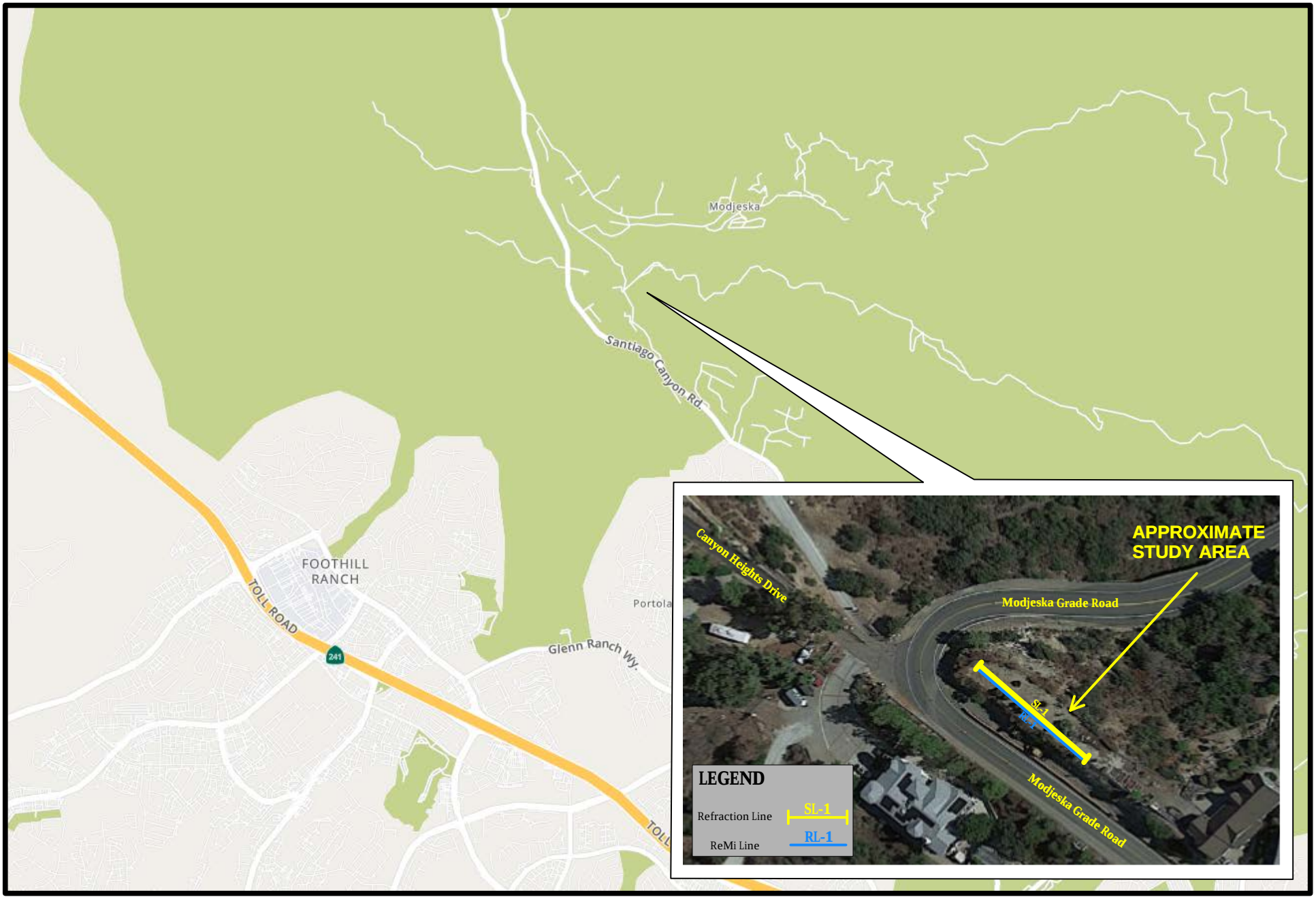
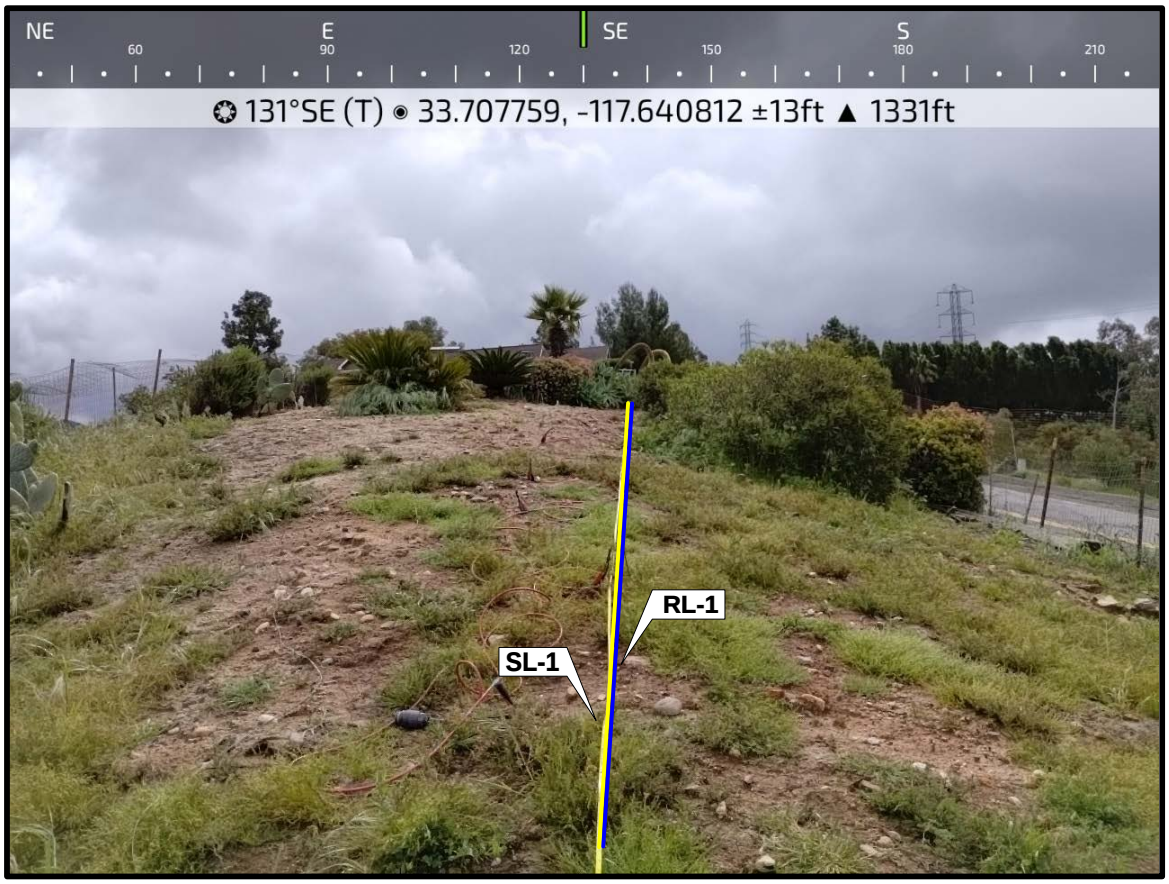
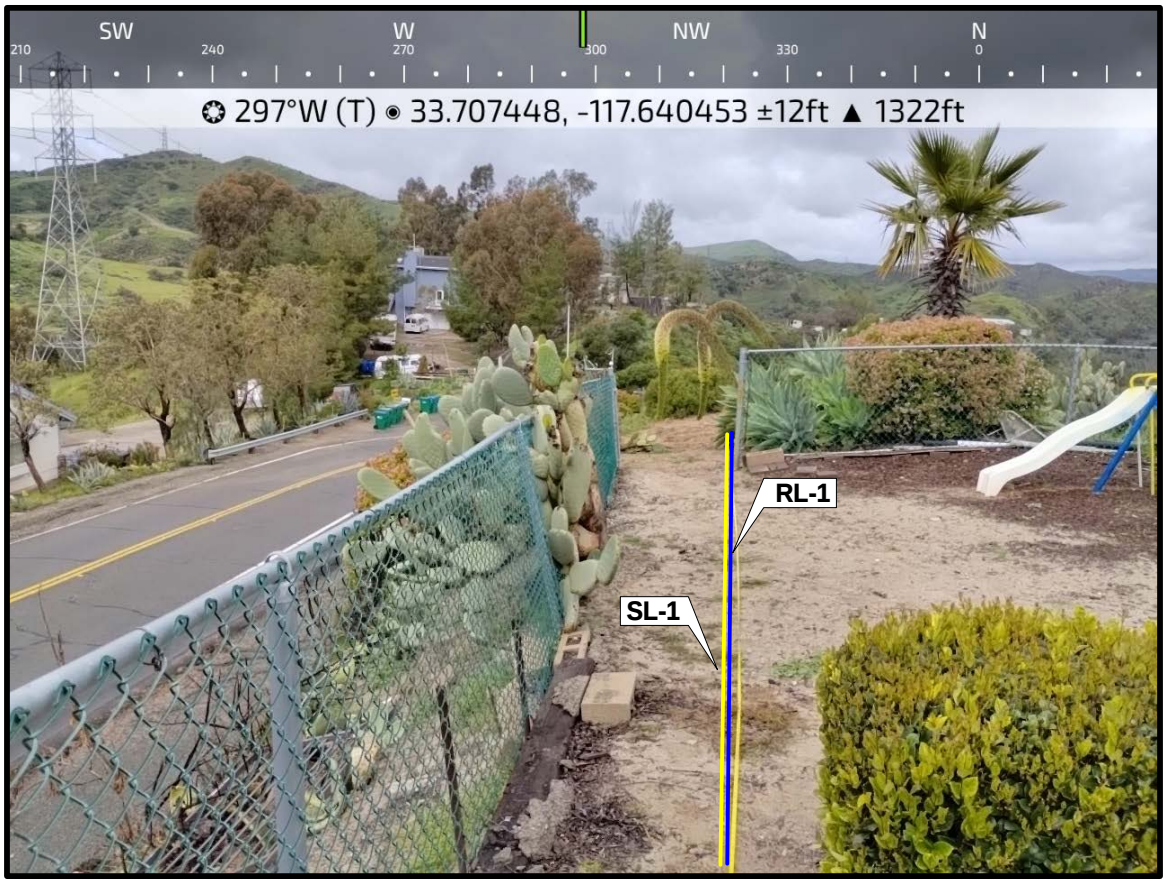


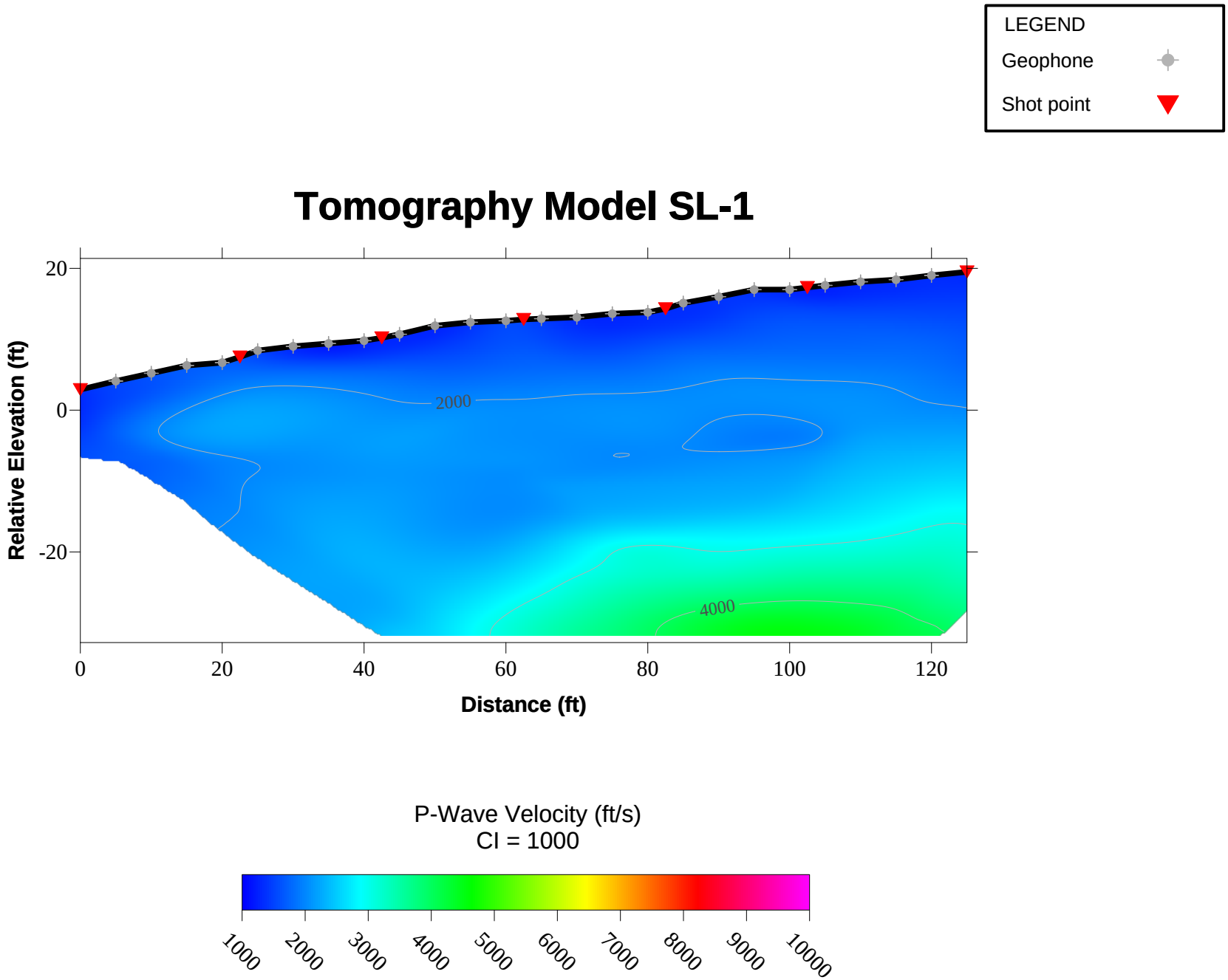
ATLAS	Modjeska Grade Road Improvements Silverado, California	Project No: 2437 Date: 04/23	Figure 1	Site Location Map

ATLAS	Modjeska Grade Road Improvements Silverado, California	Project No: 2437 Date: 04/23	Figure 2	Line Location Map



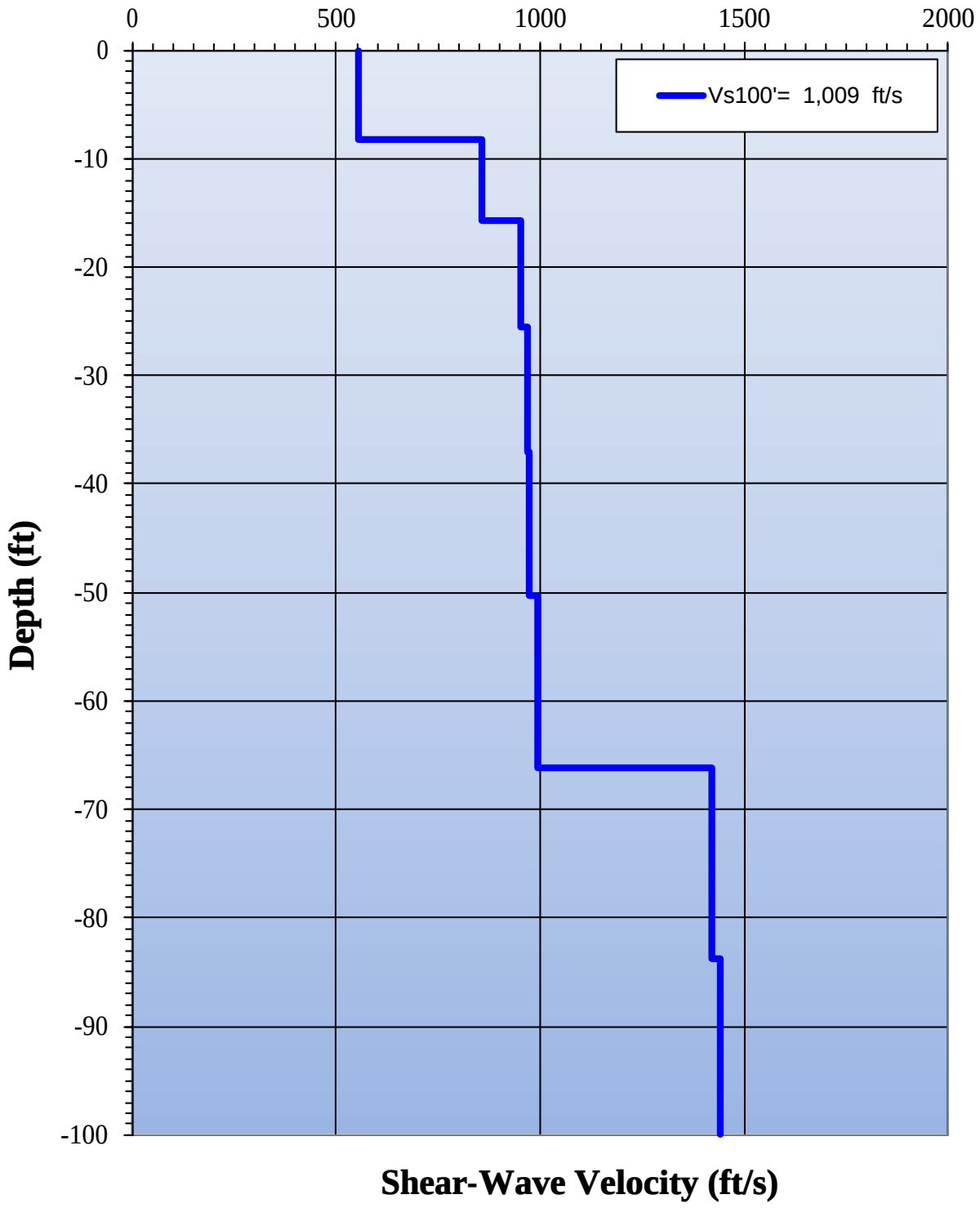


ATLAS	Modjeska Grade Road Improvements Silverado, California	Project No.: 2437 Date: 04/23	Figure 3	SITE PHOTOGRAPHS



ATLAS	Modjeska Grade Road Improvements Silverado, California	Project No.: 2437 Date: 04/23	Figure 4	**P-WAVE PROFILE SL-1**

RL-1: Vs Model



ATLAS	Modjeska Grade Road Improvements Silverado, California	Project No.: 2437 Date: 04/23	Figure 5	REMI RESULTS R-1

GEOPHYSICAL EVALUATION

MODJESKA GRADE ROAD IMPROVEMENTS PHASE 3

Silverado, California

PREPARED FOR:

Ms. Ashley Scholder
Diaz Yourman & Associates
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June 2, 2023

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June 2, 2023

Atlas No. 2437
Report No. 2

MS. ASHLEY SCHOLDER
DIAZ YOURMAN & ASSOCIATES
1616 EAST 17TH STREET
SANTA ANA, CA 92705

Subject: Geophysical Evaluation
Modjeska Grade Road Improvements Phase 3
Silverado, California

Dear Ms. Scholder:

In accordance with your authorization, Atlas has performed a seismic refraction study pertaining to the subject project located in Silverado, California. The purpose of our study was to perform a seismic P-wave refraction traverse, and a one-dimensional (1-D) seismic surface wave refraction microtremor (ReMi) profile to assess the depth to bedrock, apparent rippability of subsurface materials, and seismic velocities at the project site. Our services were conducted on May 3rd, 2023. This data report presents our methodology, equipment used, analysis, and results.

We appreciate the opportunity to be of service on this project. Should you have any questions, please contact the undersigned at your convenience.

Respectfully submitted,
Atlas Technical Consultants LLC

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CONTENTS

1. INTRODUCTION 1
2. SCOPE OF SERVICES 1
3. SITE AND PROJECT DESCRIPTION 1
4. STUDY METHODOLOGY 1
   4.1 P-wave Refraction 1
   4.2 ReMi 3
5. DATA ANALYSIS 4
   5.1 P-wave Refraction 4
   5.2 ReMi 4
6. RESULTS AND CONCLUSIONS 4
   6.1 P-wave Refraction 4
   6.2 ReMi 5
7. LIMITATIONS 5
8. SELECTED REFERENCES 6

TABLES

Table 1: Rippability Classification 3
Table 2: ReMi Results 5

FIGURES

Figure 1: Site Location Map
Figure 2: Line Location Map
Figure 3: Site Photograph
Figure 4: P-Wave Profile, SL-1
Figure 5: ReMi Results, RL-1

1. INTRODUCTION

In accordance with your authorization, Atlas has performed a seismic refraction study pertaining to the subject project located in Silverado, California (Figure 1). The purpose of our study was to perform a seismic P-wave refraction traverse, and a one-dimensional (1-D) seismic surface wave refraction microtremor (ReMi) profile to assess the depth to bedrock, apparent rippability of subsurface materials, and seismic velocities at the project site. Our services were conducted on May 3rd, 2023. This data report presents our methodology, equipment used, analysis, and results.

2. SCOPE OF SERVICES

Our scope of services included:

- Performance of a seismic P-wave refraction traverse (SL-1).
- Performance of a ReMi profile (RL-1).
- Compilation and geophysical analysis of the data collected.
- Preparation of this illustrated report presenting our methodology and findings.

3. SITE AND PROJECT DESCRIPTION

The project site is located east of the intersection of Modjeska Grade Road and Oriole Street in Silverado, California (Figure 1). Specifically, the seismic profiles were located just north of the powerline pole near the intersection (Figure 2). The seismic P-wave and ReMi traverses were collocated and conducted in a south-north orientation, in an area selected by you and your office. Figures 2 and 3 present the seismic line locations and depict the general site conditions along the study area.

Based on our discussion with you, it is our understanding that the site is in the planning phase of development and that the results from our study may be used in the formulation of design and construction parameters for the project.

4. STUDY METHODOLOGY

4.1 P-wave Refraction

A seismic P-wave (compression wave) refraction study was conducted at the project to develop subsurface velocity profiles of the areas studied, and to assess the depth to bedrock and apparent rippability of the subsurface materials. The seismic refraction method uses first-arrival times of refracted seismic waves to estimate the thicknesses and seismic velocities of subsurface layers. Seismic P-waves generated at the surface, using a hammer and plate, are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface vertical component 14-Hz geophones and recorded with a 24-channel Geometrics Geode seismograph. The travel times of the seismic P-waves are used in conjunction

with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

Geophones were placed at regularly spaced intervals of 7 feet for total line lengths of 175 feet for SL-1, including two off-end shots on each end. The general locations and lengths of the lines were determined by surface conditions, site access, depth of investigation, and you and your office. Shot points (signal-generation locations) were conducted along the lines at the ends, midpoint, and intermediate points between the ends of the midpoint.

In general, classical seismic refraction theory requires that subsurface velocities increase with depth (generalized reciprocal method (GRM) and time-intercept modeling). In classical analysis methods a layer having a velocity lower than that of the layer above will not generally be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity such as those caused by core stones, intrusions, or boulders can also result in the misinterpretation of the subsurface conditions. Application of seismic tomography methods, as was performed for this project by Atlas, produces velocity models which, in general, are not subject to this limitation. However, even the application of seismic tomography analysis does have certain limitations regarding vertical and horizontal resolution. When a velocity anomaly target is of similar scale length to the seismic wavelet (or smaller), then diffraction behavior dominates because scattering is governing the loci of the wave-fronts. For travel time analysis a target feature must be at a scale versus its depth that is detectable relative to the scale length of the seismic wavelet we produce and receive. Therefore, there is a general limit to what scale of feature seismic tomography methods can detect regarding relatively small velocity anomaly features, related to both source and to medium velocities, and travel time uncertainties. In effect, some relatively smaller scale features including "thin" velocity inversion layers or voids, and some types of lateral and vertical velocity variations caused by core stones and intrusions might not be detected in our results. In general, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth of the length of the spread.

Generally, the seismic P-wave velocity of a material can be correlated to rippability (see Table 1 below), or to some degree “hardness.” Table 1 is based on published information from the Caterpillar Performance Handbook (Caterpillar, 2018), as well as our experience with similar materials, and assumes that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristic, such as fracture spacing and orientation, play a significant role in determining rock quality or rippability. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

For trenching operations**,** the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in narrow trenching operations, should be anticipated.

Table 1: Rippability Classification

Seismic P-wave Velocity	Rippability
0 to 2,000 feet/second	Easy
2,000 to 4,000 feet/second	Moderate
4,000 to 5,500 feet/second	Difficult, Possible Blasting
5,500 to 7,000 feet/second	Very Difficult, Probable Blasting
Greater than 7,000 feet/second	Blasting Generally Required

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook. Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

4.2 ReMi

The passive source 1-D ReMi technique uses recorded surface waves (specifically Rayleigh waves) that are contained in background noise to develop a seismic velocity profile of the study area down to a depth, in this case, of approximately 100 feet below ground surface (bgs). The depth of exploration is dependent on the length of the line and the frequency content of the background noise. The results of the ReMi method are displayed as a one-dimensional sounding which represents the average condition across the length of the line. The ReMi method does not require an increase of material velocity with depth; therefore, low-velocity zones (velocity inversions) are detectable with ReMi.

Our ReMi evaluation included the use of a 24-channel Geometrics Geode seismograph and 24, 4.5-Hz vertical component geophones. The geophones were spaced 7 feet apart for a total line length of 161 feet at RL-1. A total of 21 records, each 32 seconds in duration, were recorded, with 15 of the files utilizing passive data collection of ambient ground vibration noise and six files utilizing an active source generated by a 20-pound sledgehammer and an HDPE plastic strike plate. The active source data gathers included conducting hammer blows at locations on each end of the seismic spread at approximately 20 feet off the end of the geophone array. Three active source files were collected at each end of the line to supplement the passive data collection. Using off-end active source supplemental data reduces the chances for indeterminate dominant phase angle of energy arriving at the seismic spread, which typically increases the accuracy of the recorded dispersion curve and model results. For the ReMi method, the average surface wave velocity (analogous to shear wave velocity) is calculated across the length of the line, and the resulting 1-D model represents the center or midpoint point of the line. It should be noted the ReMi results represent the average condition across the length of the line.

5. DATA ANALYSIS

5.1 P-wave Refraction

The collected datasets were processed and analyzed using Rayfract® Version 4.03 (Intelligent Resources Inc., 2022) which employs wave path analysis. Rayfract® first provides forward modeling of refraction, transmission, and diffraction and then back-projects travel-time residuals along wave paths also known as Fresnel volumes instead of conventional analysis by rays. This increases the numerical robustness of the inversion. A smooth minimum-structure 1-D starting velocity-depth profile model is determined automatically directly from the seismic travel-time data first arrival picks and elevation data to produce subsurface velocities by horizontally averaging via the Delta t-V method. The Delta t-V method is based on common mid-point (CMP) sorted travel times and assumes multiple horizontal layers with constant interior velocity gradients (Rohdewald 2007; Gebrande 1985). Modeled seismic rays follow circular arcs inside each modeled layer. The Delta t-V starting model is then refined with 2D Wavepath Eikonal Traveltime (WET) inversion method (Schuster, 1993). The resulting 2-D WET velocity model provides a 2-D tomographic image of the P-wave velocities which can be used to estimate subsurface geologic conditions. Both vertical and lateral velocity information is contained in the tomography model. Changes in layer velocity are generally revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions. The collected data was processed using and analyzed using Rayfract®, version 4.03. Rayfract uses first arrival picks and elevation data to produce subsurface velocity models through a nonlinear optimization technique Wavepath Eikonal Traveltime Inversion (WET). The resulting velocity model provides a tomography image of the estimated geologic conditions. Both vertical and lateral velocity information is contained in the tomography model. Changes in layer velocity are revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions.

5.2 ReMi

The data collected was downloaded to a field computer and the data were later processed using Surface Plus 9.1 - Advanced Surface Wave Processing Software (Geogiga Technology Corp., 2020), which uses the refraction microtremor method (Louie, 2001) and other surface wave analysis methods. The program generates phase-velocity dispersion curves for each record and provides an interactive dispersion modeling tool to provide the best-fitting model. The result is a 1-D surface wave velocity model of the study area which, based on published studies, is typically 85 to 95 percent of the velocity of shear waves. Therefore, using the ReMi surface wave data and analysis method results in a relatively conservative estimate of shear wave velocity.

6. RESULTS AND CONCLUSIONS

6.1 P-wave Refraction

As previously indicated, one P-wave transverse was performed in an accessible portion of the project site. Figure 4 presents the velocity model generated from our analysis. Based on the

results, it appears that the study areas are generally underlain by low-velocity materials in the near subsurface and higher-velocity materials at depth. Distinct vertical and lateral velocity variations are evident in the model. Moreover, the degree of weathering and the depth to possible bedrock varies across the study area.

Based on the refraction results, variability in the excavatability (including depth of rippability) of the subsurface materials may be expected across the project area.

6.2 ReMi

As discussed, the purpose of our ReMi study was to develop shear-wave velocity profiles to be used for design and construction at the study site. Table 2 and Figure 5 present the results from our ReMi evaluation. When the 1-D ReMi surface wave velocity results (analogous to shear wave) show an IBC Vs100 velocity value that is close to the "border line" boundary between IBC Site Classes, the project geotechnical consultant of record should be consulted. The geotechnical consultant of record should also consider other existing available site information and whether obtaining additional new geotechnical evaluation data such as boreholes, surface to downhole seismic (ASTM D7400), cross hole seismic (ASTM D4428), and/or additional 1-D remit data collections would be needed concerning the site's subsurface geologic stratigraphy and structure, soil mechanics and soil modulus, along with the initial 1-D ReMi evaluation results when assessing the "borderline" IBC Vs100 Seismic Site Class.

Table 2: ReMi Results

Line No.	Depth (feet)	Shear Wave Velocity (feet/second)	Average Shear Wave Velocity (Vs in feet/second)	Site Class (IBC, 2019)
RL-1 (NW-SE)	0-8	758	Vs = 1,670 ft/s	C
	8-16	1472		
	16-26	1489		
	26-36	1653		
	36-56	2021		
	56-66	2048		
	66-84	2077		
	84-100	2105		

7. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, express or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not

observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluations will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Atlas should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

8. SELECTED REFERENCES

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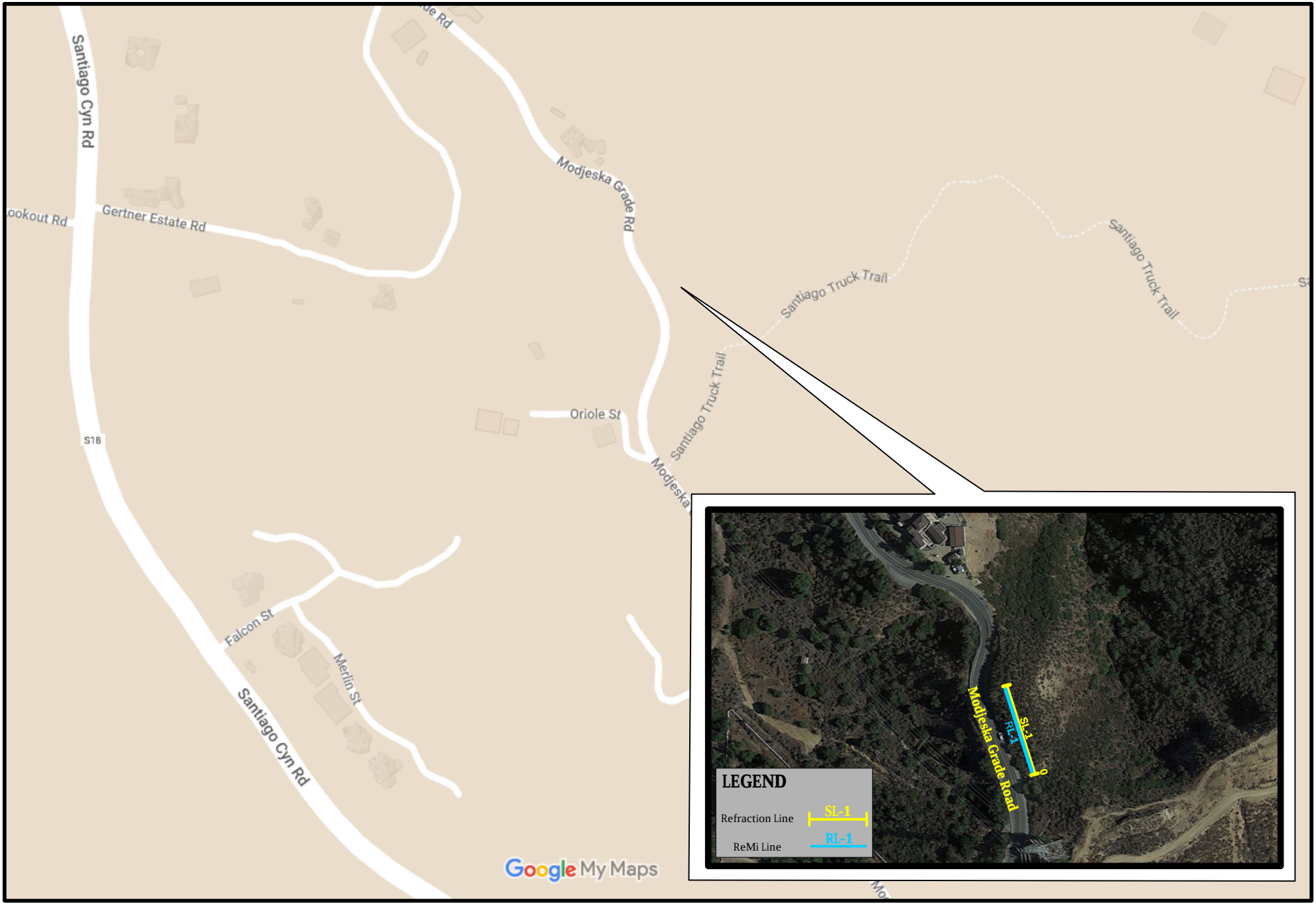
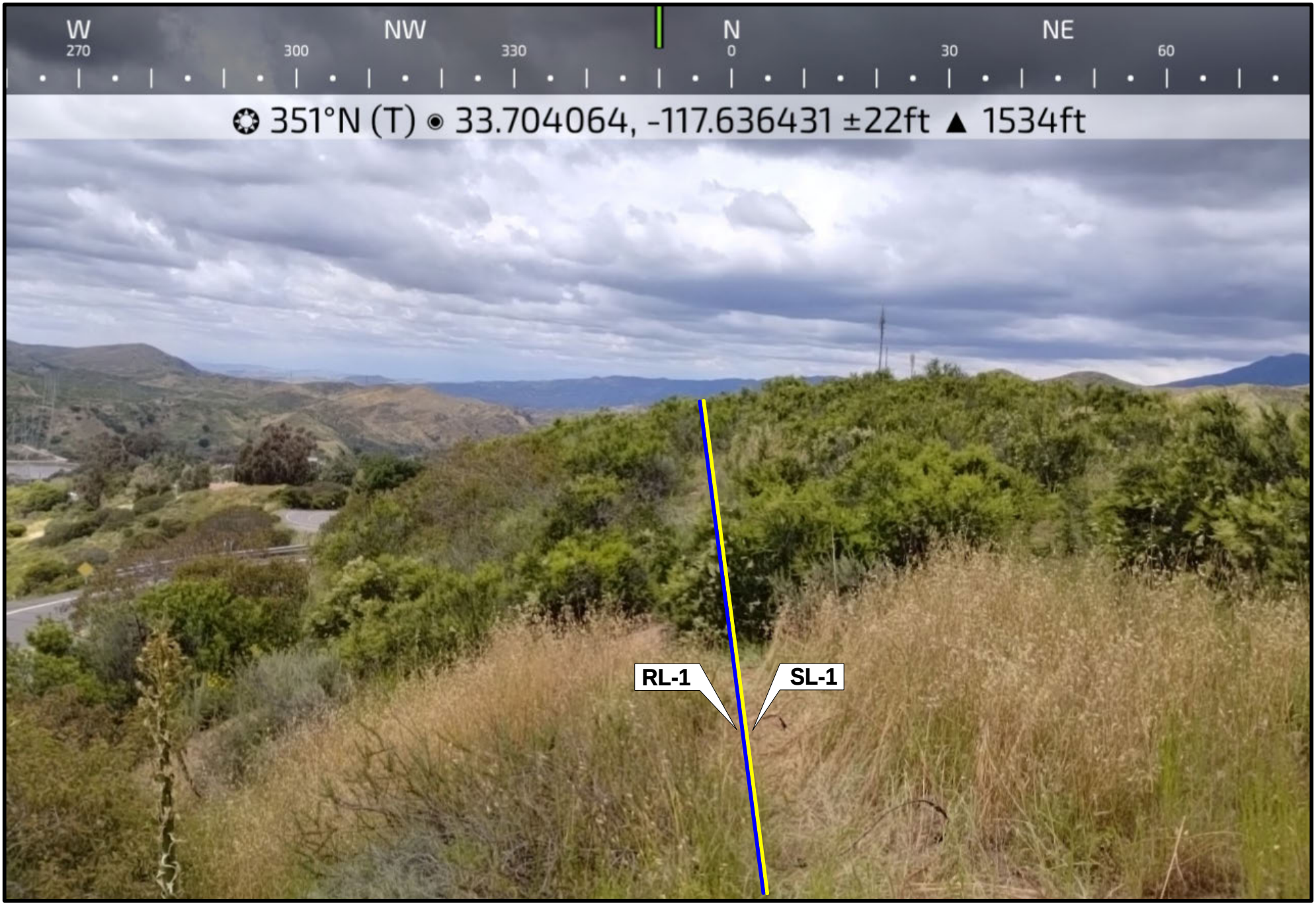
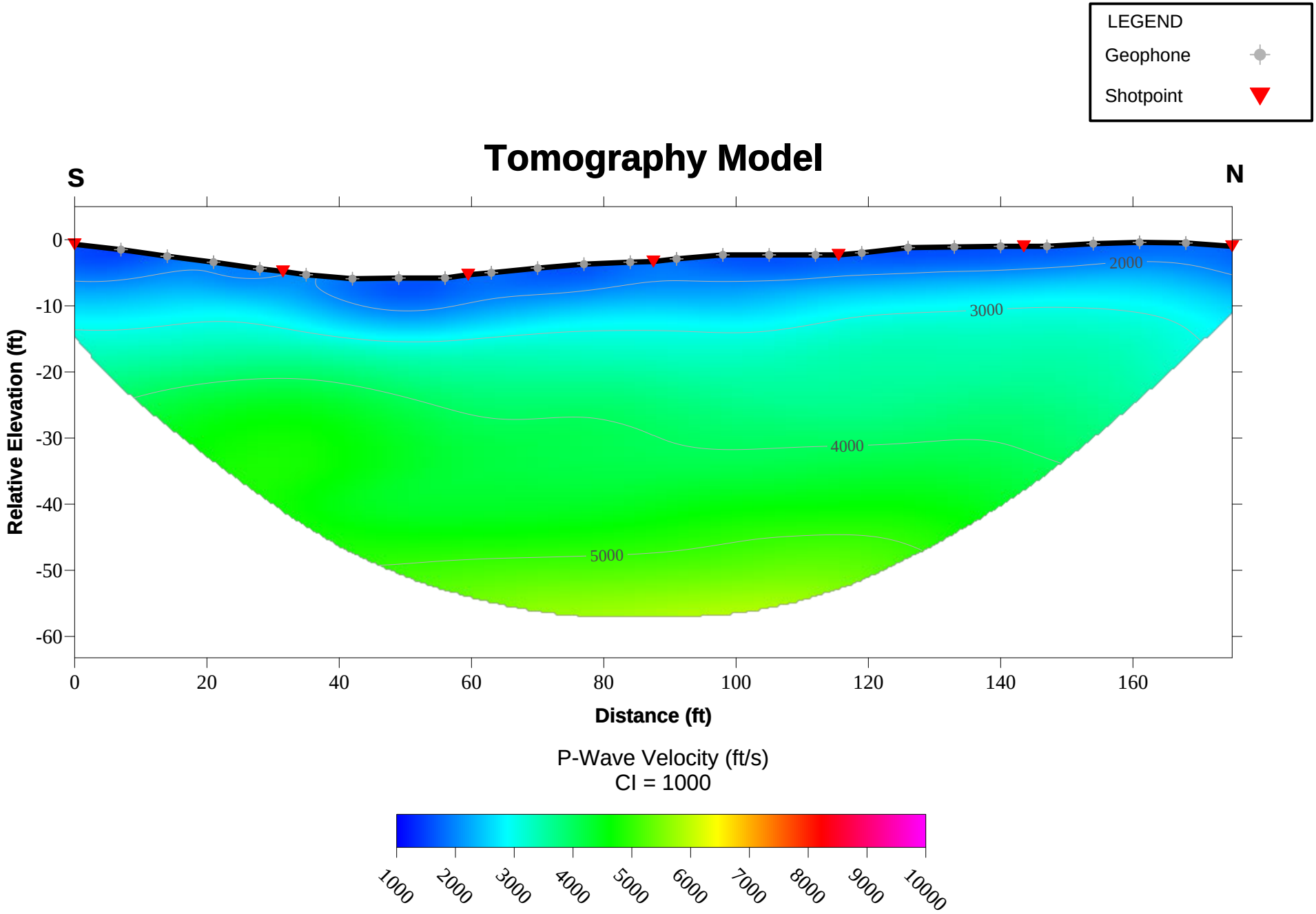


ATLAS	Modjeska Grade Road Improvements Phase 3 Silverado, California	Project No.: 2437 Date: 06/23	Figure 1	**SITE LOCATION MAP**

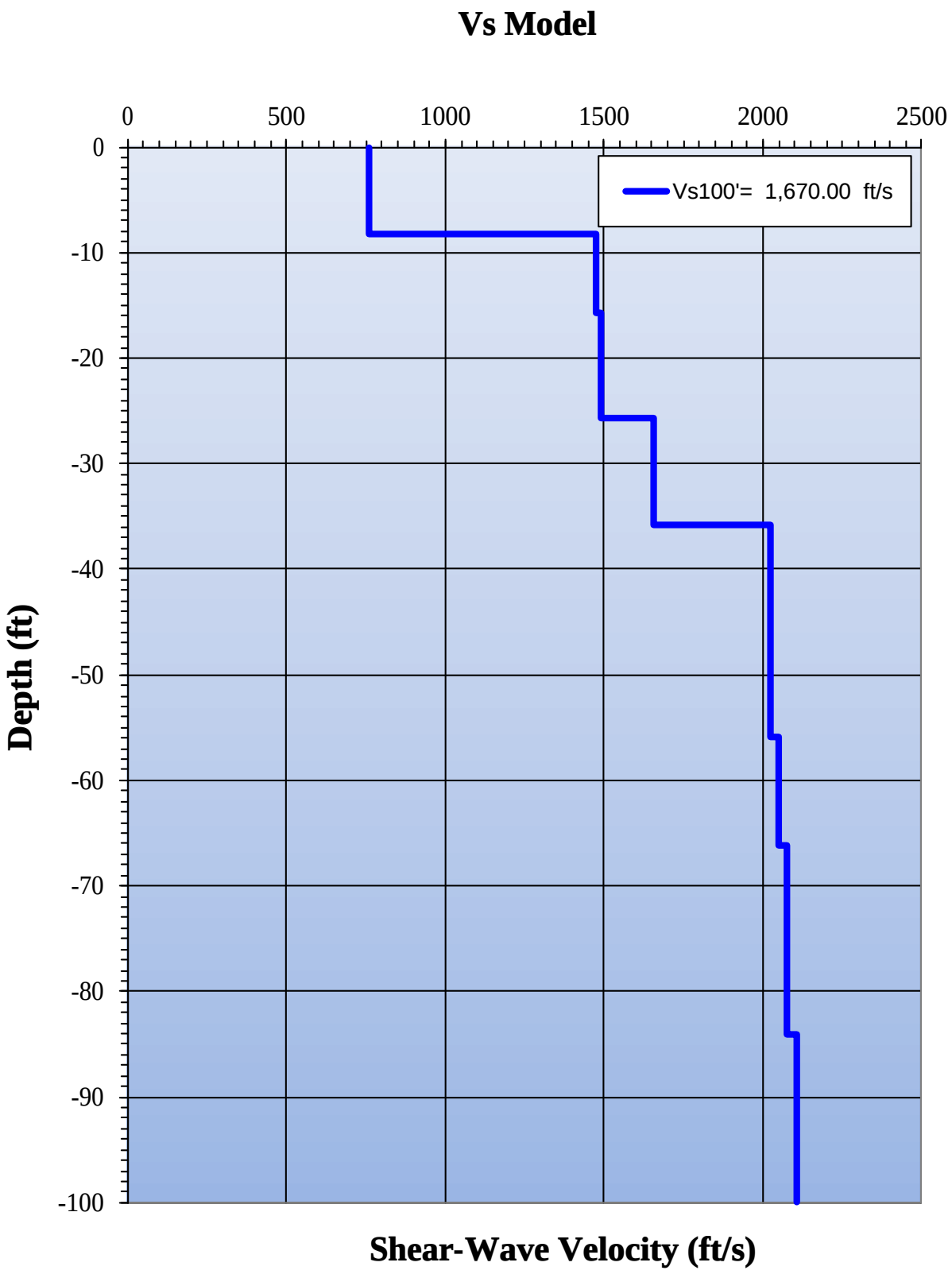
ATLAS	Modjeska Grade Road Improvements Phase 3 Silverado, California	Project No.: 2437 Date: 06/23	Figure 2	**LINE LOCATION MAP**



ATLAS	Modjeska Grade Road Improvements Phase 3 Silverado, California	Project No.: 2437 Date: 06/23	Figure 3	**SITE PHOTOGRAPH**



ATLAS	Modjeska Grade Road Improvements Phase 3 Silverado, California	Project No.: 2437 Date: 06/23	Figure 4	**P-WAVE PROFILE**



ATLAS	Modjeska Grade Road Improvements Phase 3 Silverado, California	Project No.: 2437 Date: 06/23	Figure 5	**REMI RESULTS RL-1**

APPENDIX E -
GEOTECHNICAL LABORATORY TESTING

DRAFT

APPENDIX E - GEOTECHNICAL LABORATORY TESTING

Diaz•Yourman & Associates (DYA) selected soil samples to be tested and the tests to be performed on the selected samples. Laboratory testing was performed by Hushmand Associates, Inc. (a City of Los Angeles certified testing laboratory). Laboratory data are summarized on the boring logs in Appendix E and presented on Plates E1 through E26. We have reviewed and concur with the test results and accept full responsibility for their use in our analysis. A summary of the geotechnical laboratory testing is presented in Table E1.

Table E1 - LABORATORY TESTING SUMMARY

TEST NAME	PROCEDURE	PURPOSE	LOCATION
Percent Passing the No. 200 Sieve	ASTM D1140	Classification, index properties	Boring Logs
Moisture Content, Dry Density	ASTM D2216	Classification, index properties	Boring Logs
Grain-Size Distribution	ASTM D422	Classification, index properties	Plate E1
Atterberg Limits	ASTM D4318	Expansion potential, classification, index properties	Plate E2
Compaction	ASTM D1557	Earthwork	Plates E3 through E8
Direct Shear	ASTM D3080	Shear strength	Plates E9 through E15
Resistance (R-) Value	CTM 301	Pavement thickness design	Plates E16 through E26

Note(s):
- ASTM = ASTM International
- CTM = Caltrans Test Method

DRAFT

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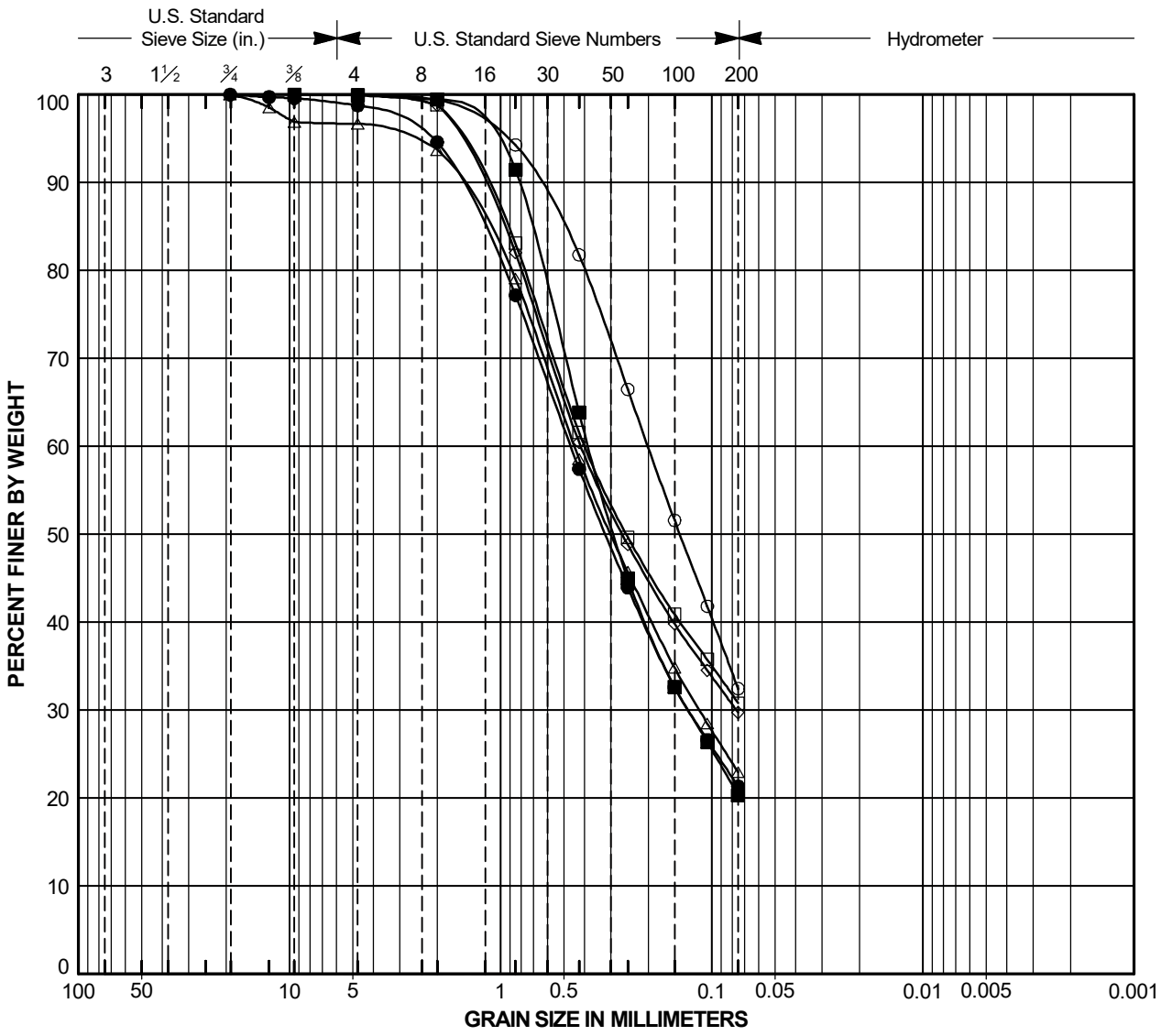


COBBLES	Coarse	Fine	Coarse	Medium	Fine	SILT or CLAY
	GRAVEL		SAND			

Laboratory Testing by: Hushmand Associates, Incorporated

Symbol	Source	Depth (feet)	Classification	Natural M. C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
⊙	DYB23-01	2.5	SILTY SAND (SM)	9			32
□	DYB23-02	2.5	SILTY SAND (SM)	6			31
△	DYB23-03	10.0	SILTY SAND (SM)	8			23
◇	DYB23-04	2.5	CLAYEY SAND (SC)	6	36	20	30
●	DYB23-05	0.2	SILTY SAND (SM)				21
■	DYB23-06	5.0	SILTY SAND (SM)				20

PARTICLE SIZE ANALYSIS

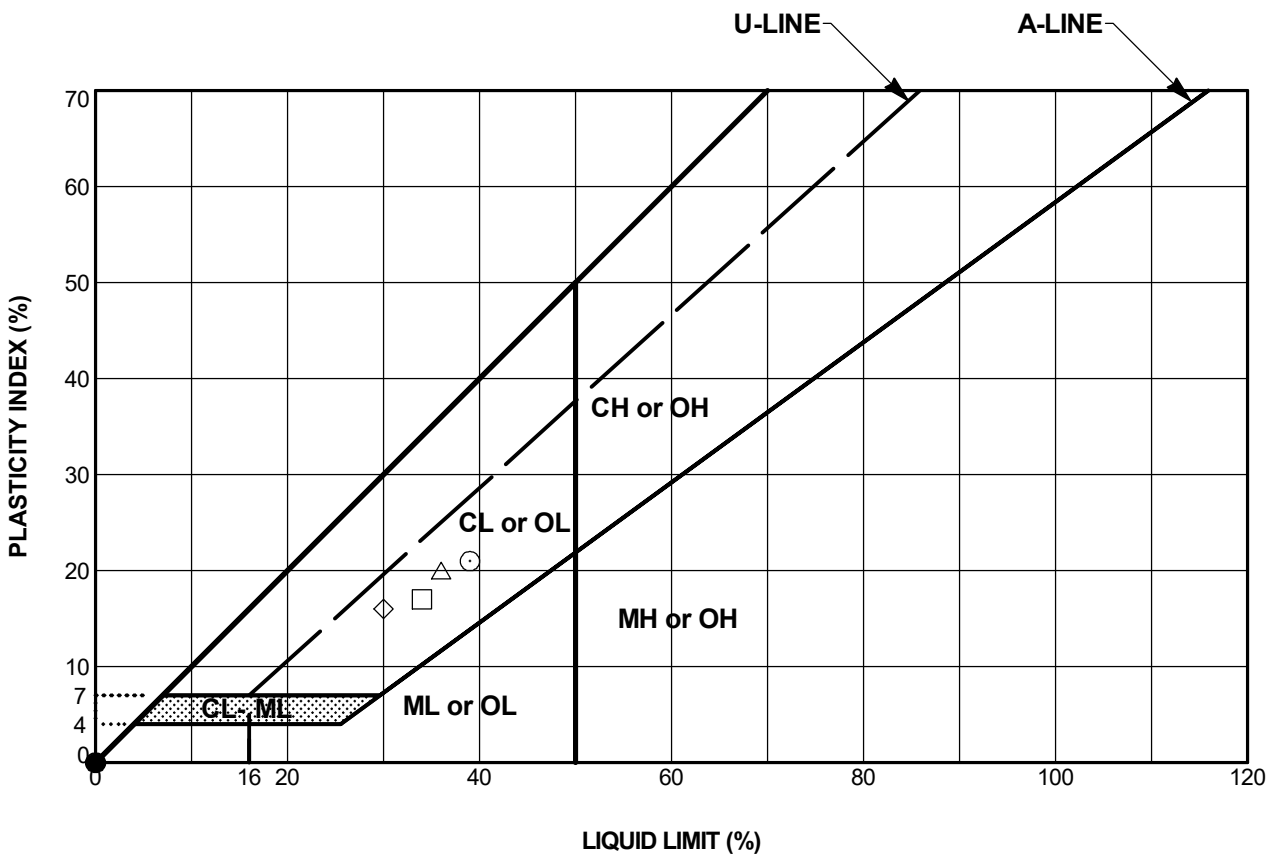
OCPW Modjeksa Grade Road Improvements

Project No. 2022-017

PLATE

E1

Template: DY_ATTERBERG_CHART_WIN



Laboratory Testing by: Hushmand Associates, Incorporated

Test Method: ASTM D4318

Symbol	Source	Depth (feet)	Classification	Natural M. C. (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
⊙	DYB23-02	11.0	CLAYEY SAND (SC)	12	39	18	21	47
□	DYB23-03	6.0	CLAYEY SAND (SC)	10	34	17	17	
△	DYB23-04	2.5	CLAYEY SAND (SC)	6	36	16	20	30
◇	DYB23-04	10.0	CLAYEY SAND WITH GRAVEL (SC)	5	30	14	16	
●	DYB23-05	15.0	SILTY SAND (SM)	11	NP	NP	NP	42

PLASTICITY CHART

OCPW Modjeksa Grade Road Improvements

Project No. 2022-017

PLATE

E2

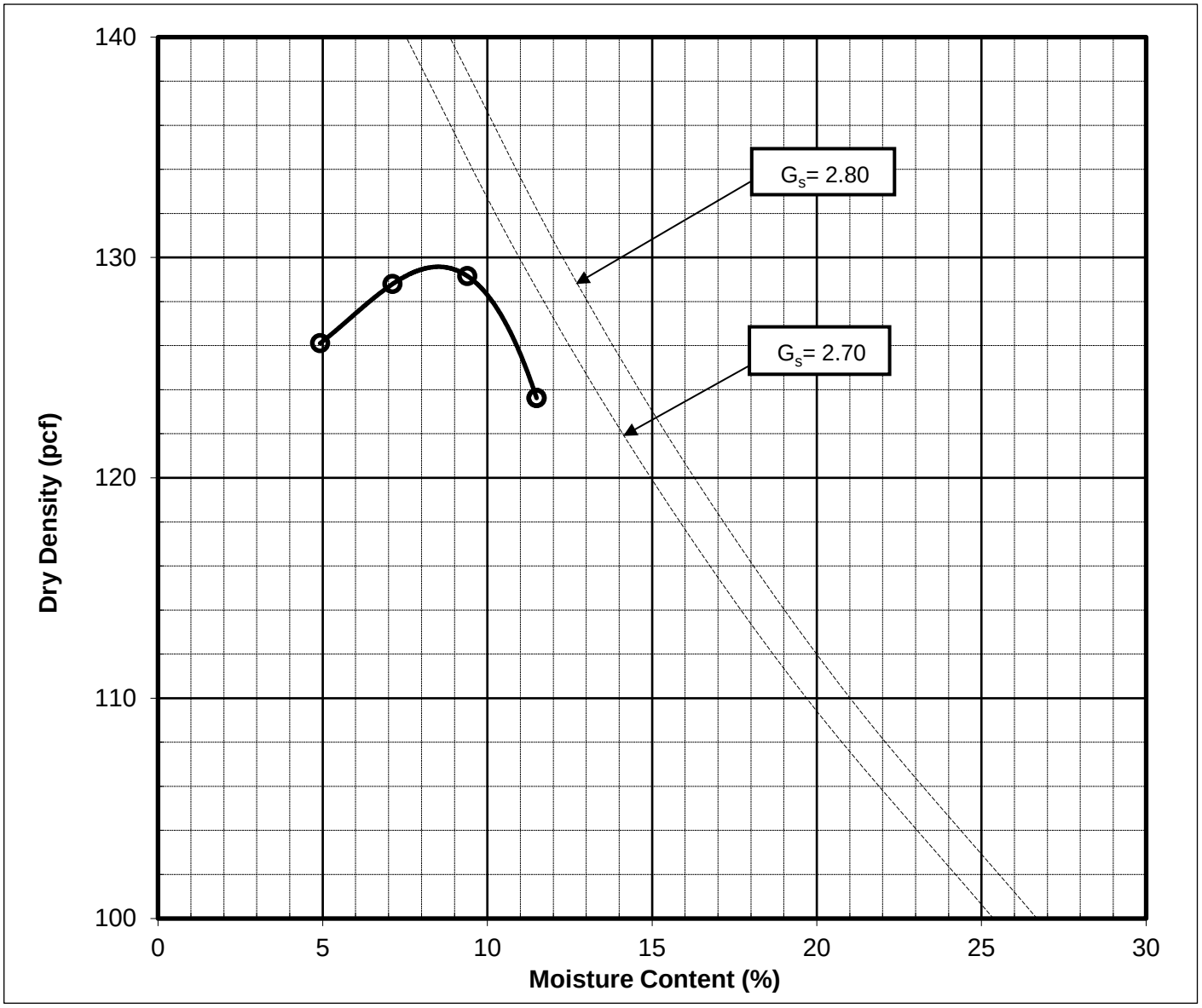
Compaction Characteristics of Soils Using Modified Effort

ASTM D1557

Client:	Diaz Yourman	*HAI Project No.:*	DYAL-23-007-2
Project:	Modjeska Grade Road	*Tested by:*	GA
Project No.:	2022-017	*Checked by:*	KL
Boring Number:	DYB23-01	*Date:*	05/08/23
Sample Number:	Bulk		
Depth (ft) :	0-5		
Soil Description:	Brown, Clayey Sand with Gravel (SC)		

Mold size (in)	4"
Procedure	B
Weight Retained on:	13.4
Remarks:	

Maximum Dry Density (pcf)	**129.6**
Optimum Moisture Content (%)	**8.5**
Corrected Maximum Dry Density (pcf)	**132.6**
Corrected Optimum Moisture Content (%)	**7.4**



PLATE

E3

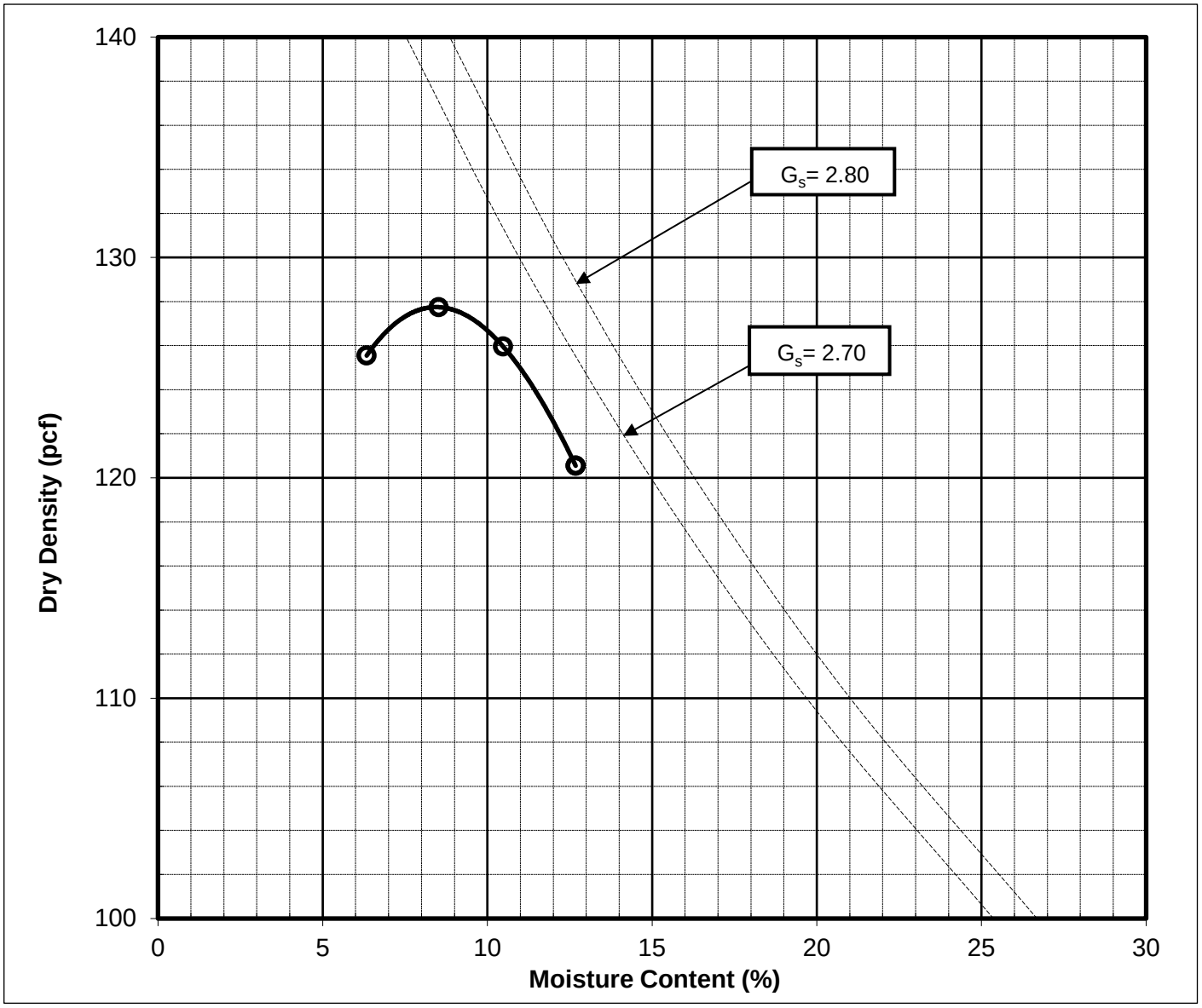
Compaction Characteristics of Soils Using Modified Effort

ASTM D1557

Client:	Diaz Yourman	*HAI Project No.:*	DYAL-23-007-2
Project:	Modjeska Grade Road	*Tested by:*	GA
Project No.:	2022-017	*Checked by:*	KL
Boring Number:	DYB23-02	*Date:*	05/08/23
Sample Number:	Bulk		
Depth (ft) :	0-5		
Soil Description:	Brown, Clayey Sand (SC)		

Mold size (in)	4"
Procedure	A
Weight Retained on:	0.3
Remarks:	

Maximum Dry Density (pcf)	**127.7**
Optimum Moisture Content (%)	**8.4**
Corrected Maximum Dry Density (pcf)	**-**
Corrected Optimum Moisture Content (%)	**-**



PLATE

E44

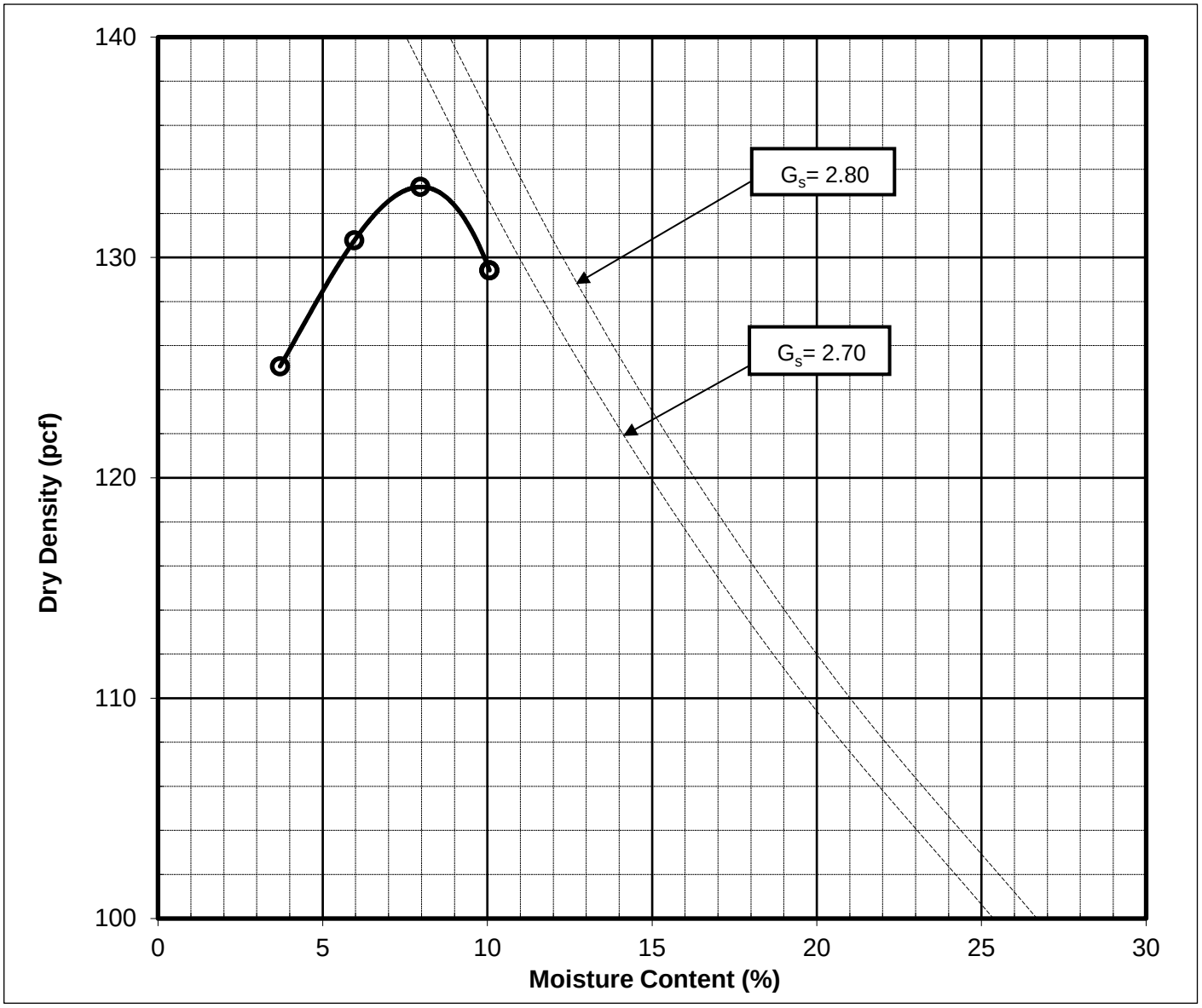
Compaction Characteristics of Soils Using Modified Effort

ASTM D1557

Client:	Diaz Yourman	*HAI Project No.:*	DYAL-23-007-2
Project:	Modjeska Grade Road	*Tested by:*	GA
Project No.:	2022-017	*Checked by:*	KL
Boring Number:	DYB23-04	*Date:*	05/08/23
Sample Number:	Bulk		
Depth (ft) :	0-5		
Soil Description:	Olive Brown, Clayey Sand (SC)		

Mold size (in)	6"
Procedure	C
Weight Retained on:	5.5
Remarks:	

Maximum Dry Density (pcf)	**133.2**
Optimum Moisture Content (%)	**8.0**
Corrected Maximum Dry Density (pcf)	**134.3**
Corrected Optimum Moisture Content (%)	**7.6**



PLATE

E55

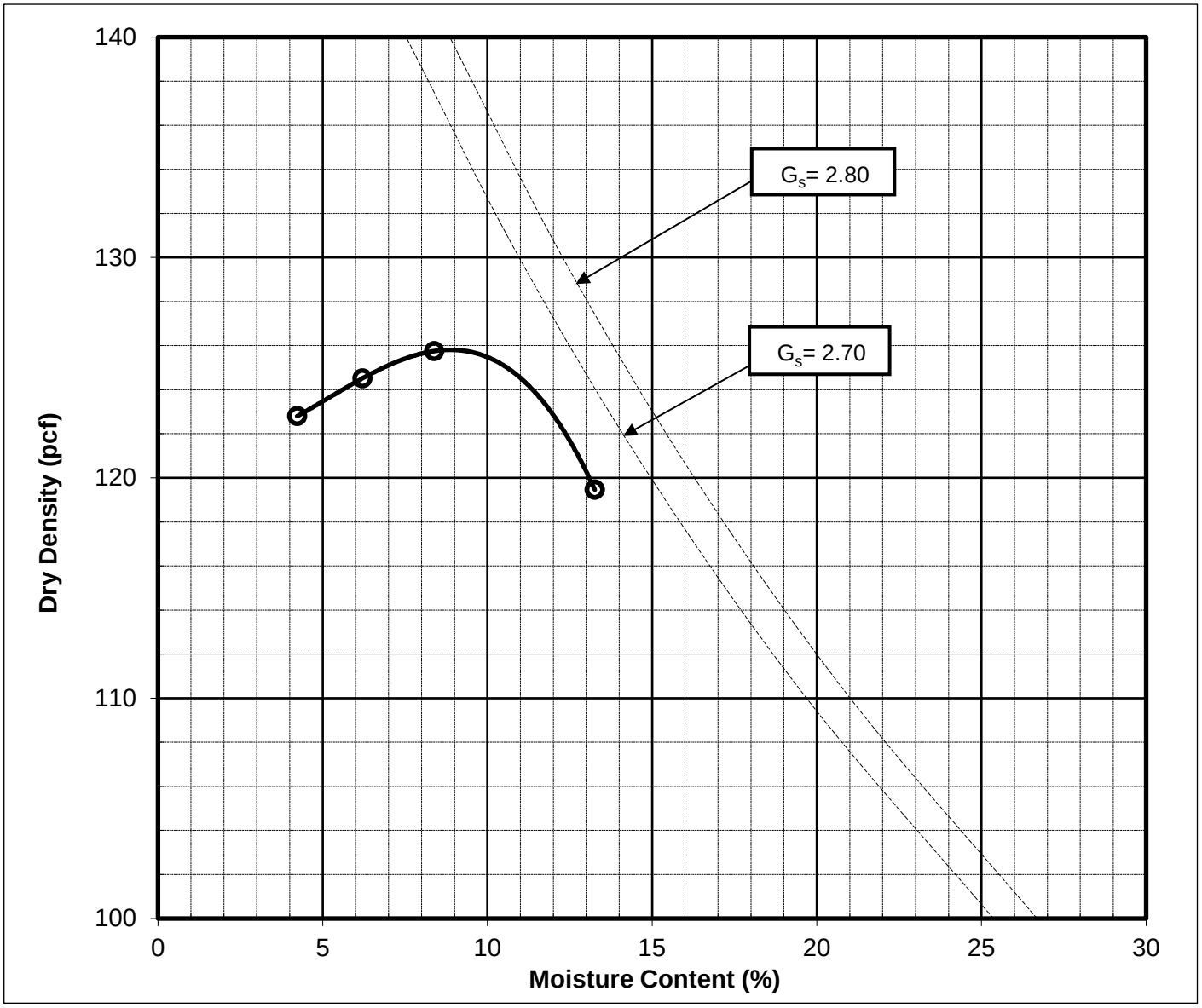
Compaction Characteristics of Soils Using Modified Effort

ASTM D1557

Client:	Diaz Yourman	*HAI Project No.:*	DYAL-23-007-2
Project:	Modjeska Grade Road	*Tested by:*	GA
Project No.:	2022-017	*Checked by:*	KL
Boring Number:	DYB23-05	*Date:*	05/08/23
Sample Number:	Bulk		
Depth (ft) :	0-5		
Soil Description:	Yellowish Brown, Clayey Sand (SC)		

Mold size (in)	4"
Procedure	A
Weight Retained on:	1.3
Remarks:	

Maximum Dry Density (pcf)	**125.8**
Optimum Moisture Content (%)	**8.9**
Corrected Maximum Dry Density (pcf)	**-**
Corrected Optimum Moisture Content (%)	**-**



PLATE

E66

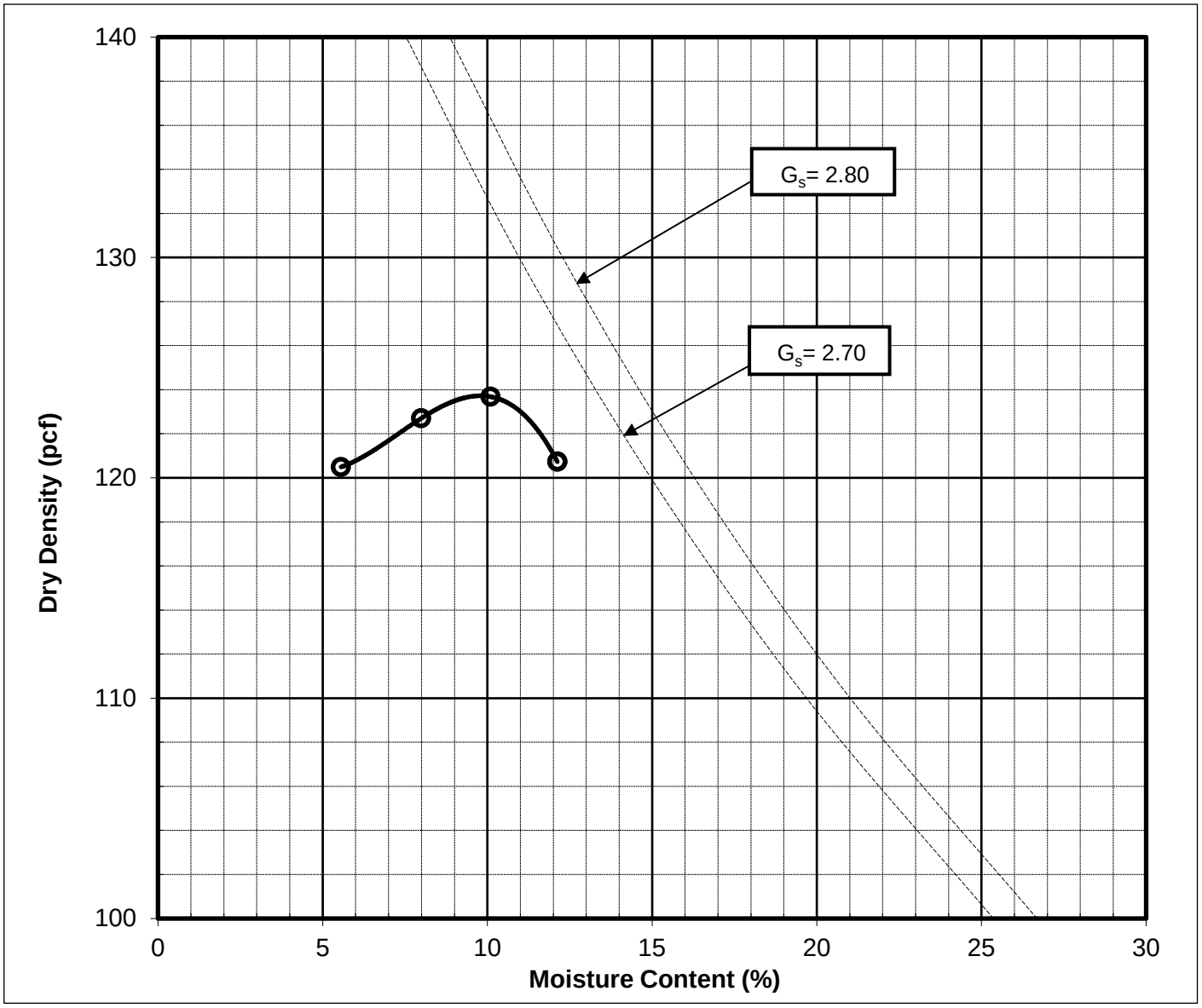
Compaction Characteristics of Soils Using Modified Effort

ASTM D1557

Client:	Diaz Yourman	*HAI Project No.:*	DYAL-23-007
Project:	Modjeska Grade Road	*Tested by:*	GA
Project No.:	2022-017	*Checked by:*	KL
Boring Number:	DYB23-06	*Date:*	05/04/23
Sample Number:	1		
Depth (ft) :	0-2		
Soil Description:	Brown, Silty Sand (SM)		

Mold size (in)	4"
Procedure	A
Weight Retained on:	2.5
Remarks:	

Maximum Dry Density (pcf)	**123.7**
Optimum Moisture Content (%)	**9.8**
Corrected Maximum Dry Density (pcf)	**-**
Corrected Optimum Moisture Content (%)	**-**



PLATE

E77

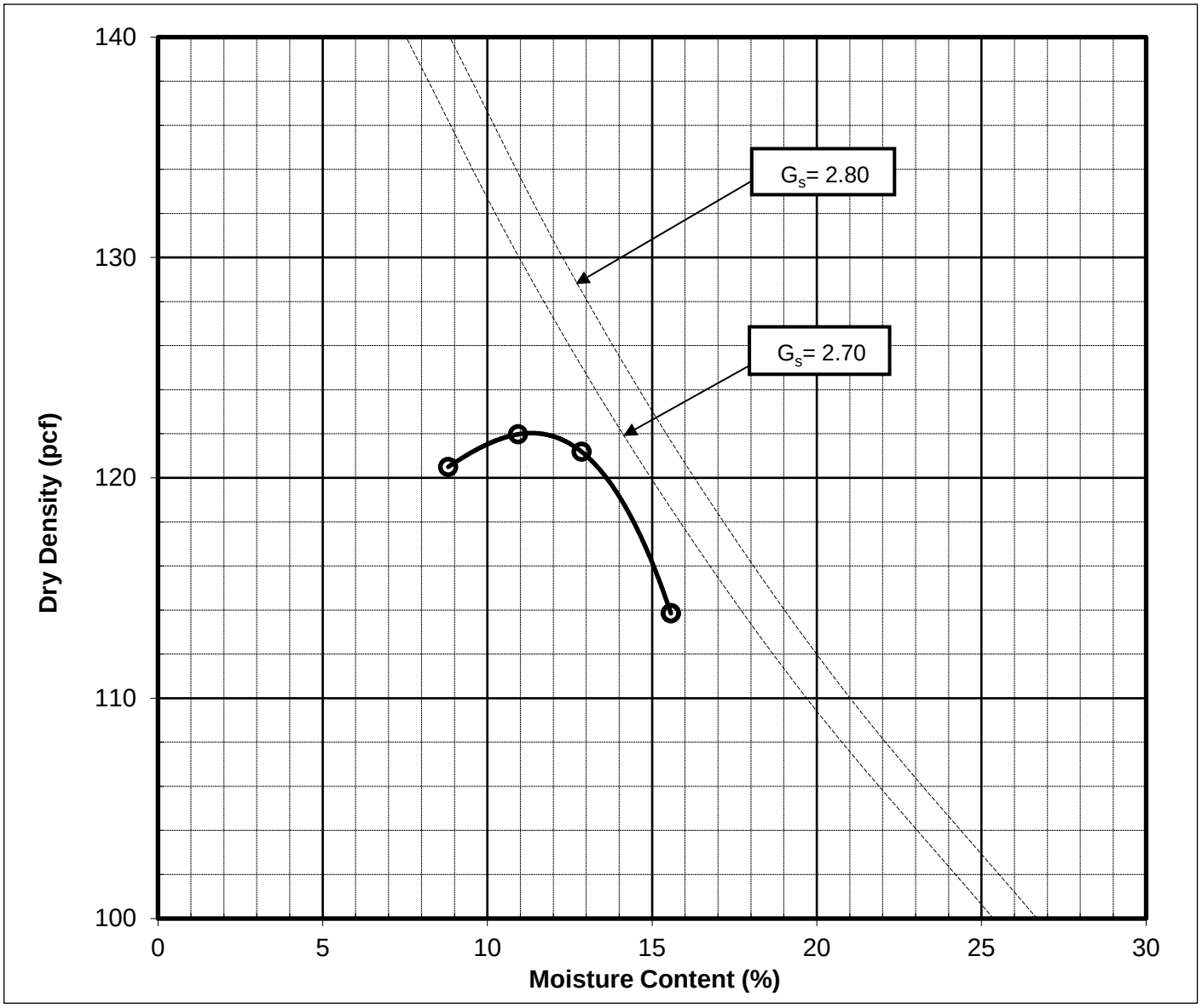
Compaction Characteristics of Soils Using Modified Effort

ASTM D1557

Client:	Diaz Yourman	*HAI Project No.:*	DYAL-23-007-2
Project:	Modjeska Grade Road	*Tested by:*	GA
Project No.:	2022-017	*Checked by:*	KL
Boring Number:	DYB23-07	*Date:*	05/08/23
Sample Number:	Bulk		
Depth (ft) :	0-5		
Soil Description:	Brown, Sandy Lean Clay (CL)		

Mold size (in)	4"
Procedure	A
Weight Retained on:	1.5
Remarks:	

Maximum Dry Density (pcf)	**122.0**
Optimum Moisture Content (%)	**11.3**
Corrected Maximum Dry Density (pcf)	**-**
Corrected Optimum Moisture Content (%)	**-**



PLATE

E8

HUSHMAND ASSOCIATES, INC.
Geotechnical and Earthquake Engineers

DIRECT SHEAR TEST

ASTM D3080

HAI Project No.: DYAL-23-007-2

Client: Diaz Yourman

Project Name: Modjeska Grade Road

Project Number: 2022-017

Boring No.: DYB23-02

Sample No.: S2

Sample Type: Undisturbed Tube

Depth (ft): 5

Soil Description: Light Gray, Clayey Sand (SC)

Tested by: GA

Checked by: KL

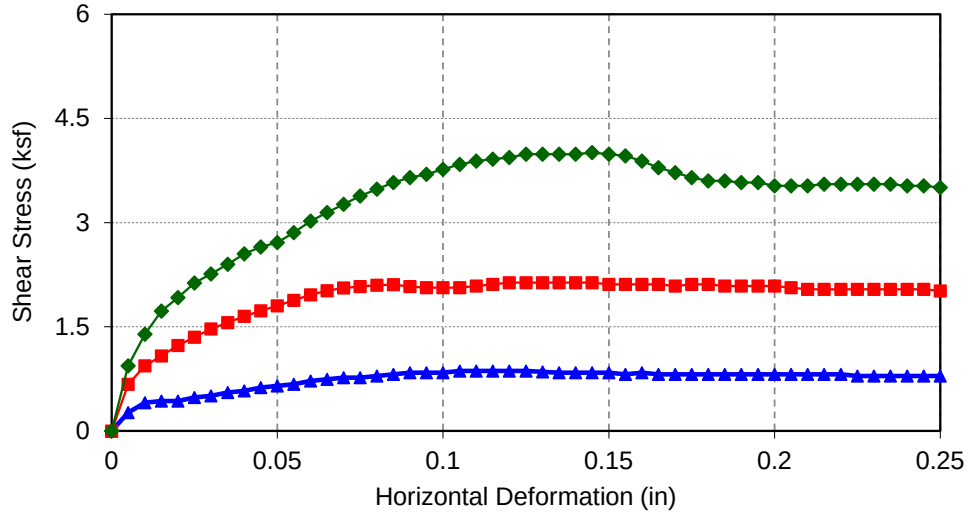
Date: 5/8/2023

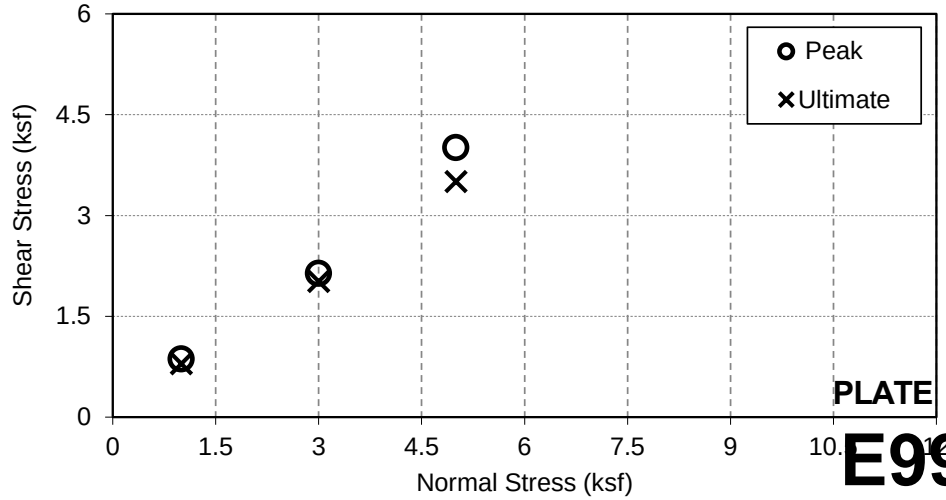
Type of test: **Consolidated, Drained**

Test No.	1	2	3
Symbol	▲	■	◆
Normal Stress (ksf)	**1**	**3**	**5**
Deformation Rate (in/min)	**0.002**	**0.002**	**0.002**

Peak Shear Stress (ksf)	**O**	**0.86**	**2.14**	**4.01**
Shear Stress @ End of Test (ksf)	**X**	**0.79**	**2.02**	**3.50**

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in)	0.9971	0.9863	0.9853
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	**7.5**	**7.5**	**7.5**
Final Moisture Content (%)	**16.7**	**15.7**	**15.0**
Dry Density (pcf)	**113.5**	**116.9**	**115.2**





PLATE

E99

DIRECT SHEAR TEST

ASTM D3080

HUSHMAND ASSOCIATES, INC.
Geotechnical and Earthquake Engineers

HAI Project No.: DYAL-23-007-2

Client: Diaz Yourman
Project Name: Modjeska Grade Road
Project Number: 2022-017
Boring No.: DYB23-02
Sample No.: S6
Sample Type: Undisturbed Tube
Depth (ft): 20
Soil Description: Yellowish Brown, Silty Sand (SM)

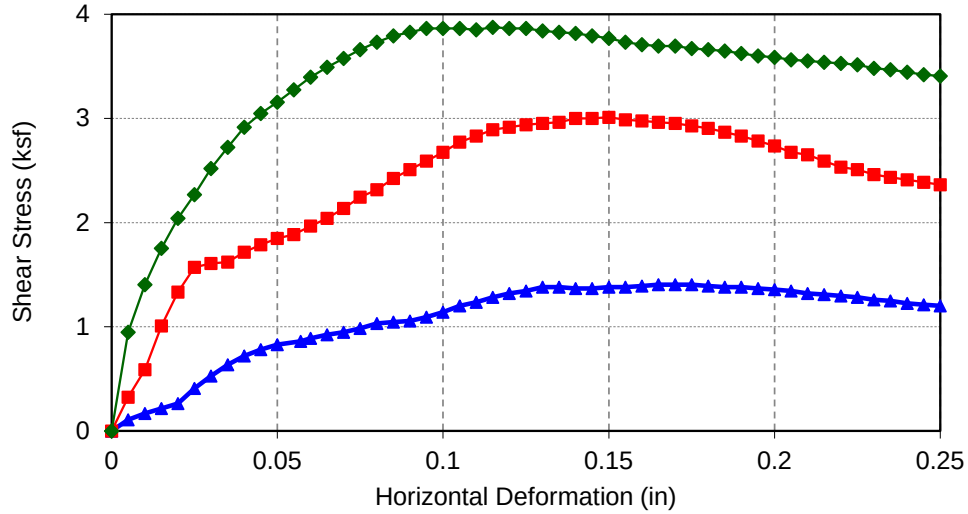
Tested by: GA
Checked by: KL
Date: 5/8/2023

Type of test: **Consolidated, Drained**

Test No.	1	2	3
Symbol	▲	■	◆
Normal Stress (ksf)	**2**	**4**	**6**
Deformation Rate (in/min)	**0.002**	**0.002**	**0.002**

Peak Shear Stress (ksf)	**O**	**1.40**	**3.01**	**3.88**
Shear Stress @ End of Test (ksf)	**X**	**1.20**	**2.36**	**3.41**

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in)	0.9902	0.9724	0.9609
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	**5.8**	**5.8**	**5.8**
Final Moisture Content (%)	**17.9**	**16.6**	**16.7**
Dry Density (pcf)	**116.3**	**116.7**	**118.8**



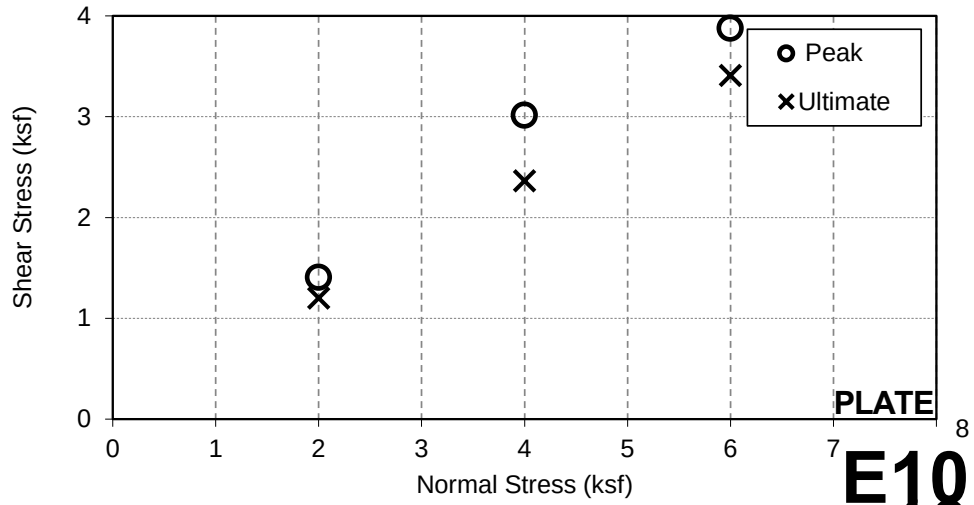


PLATE
E10
10

HUSHMAND ASSOCIATES, INC.
Geotechnical and Earthquake Engineers

DIRECT SHEAR TEST

ASTM D3080

HAI Project No.: DYAL-23-007

Client: Diaz Yourman

Project Name: Modjeska Grade Road

Project Number: 2022-017

Boring No.: DYB23-03

Sample No.: 4

Sample Type: Undisturbed Tube

Depth (ft): 15

Soil Description: Yellowish Brown, Silty Sand (SM)

Tested by: GA

Checked by: KL

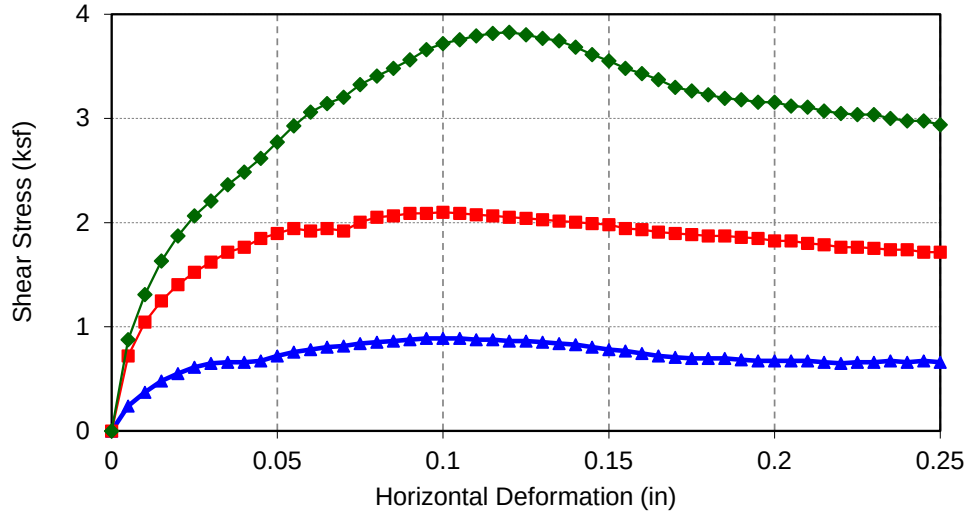
Date: 5/4/2023

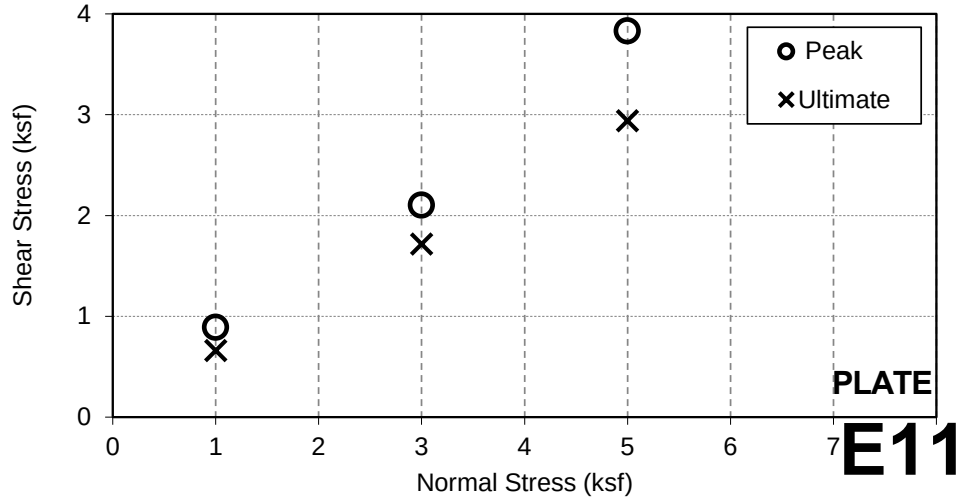
Type of test: **Consolidated, Drained**

Test No.	1	2	3
Symbol	▲	■	◆
Normal Stress (ksf)	**1**	**3**	**5**
Deformation Rate (in/min)	**0.002**	**0.002**	**0.002**

Peak Shear Stress (ksf)	**O**	**0.89**	**2.10**	**3.83**
Shear Stress @ End of Test (ksf)	**X**	**0.66**	**1.72**	**2.94**

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in)	0.9963	0.9919	0.9730
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	**5.6**	**5.6**	**5.6**
Final Moisture Content (%)	**16.4**	**17.2**	**15.0**
Dry Density (pcf)	**116.7**	**116.2**	**117.5**





PLATE

E1111

HUSHMAND ASSOCIATES, INC.
Geotechnical and Earthquake Engineers

DIRECT SHEAR TEST

ASTM D3080

HAI Project No.: DYAL-23-007-2

Client: Diaz Yourman

Project Name: Modjeska Grade Road

Project Number: 2022-017

Boring No.: DYB23-05

Sample No.: S1

Sample Type: Undisturbed Tube

Depth (ft): 2.5

Soil Description: Yellowish Brown, Silty Sand (SM)

Tested by: GA

Checked by: KL

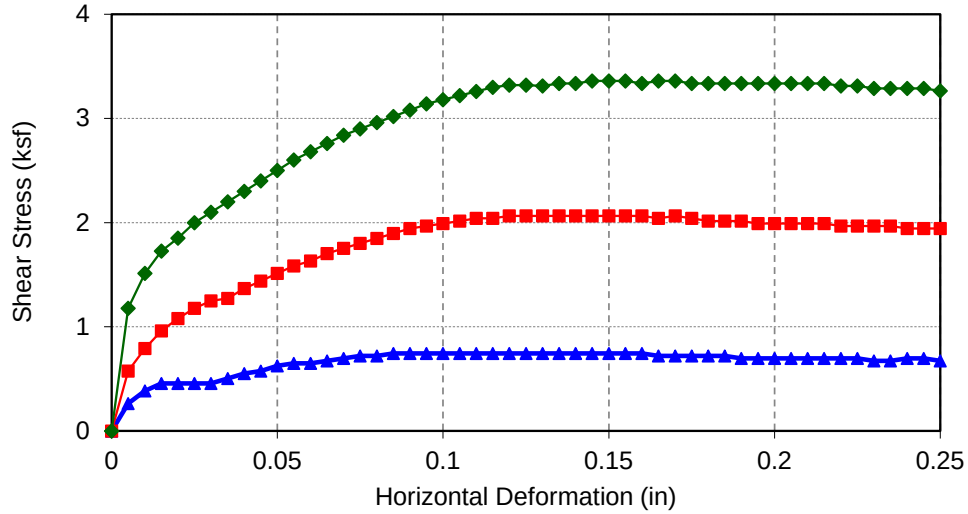
Date: 5/8/2023

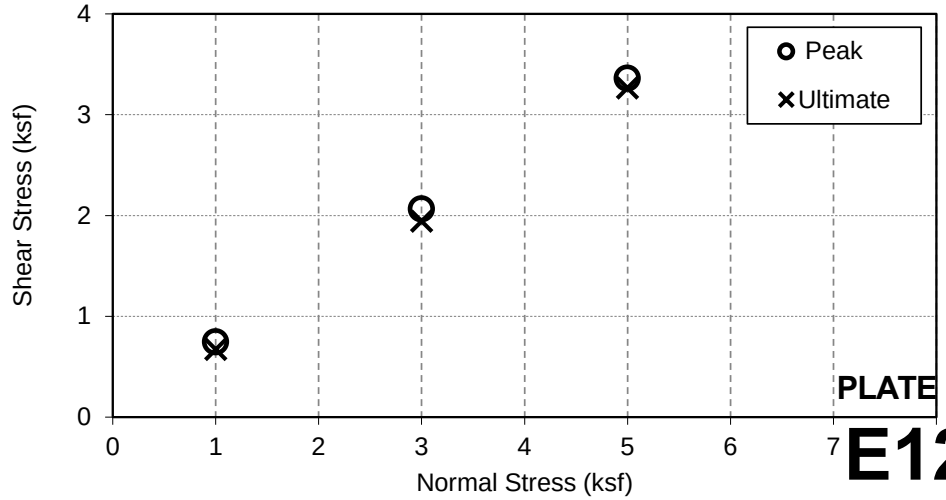
Type of test: **Consolidated, Drained**

Test No.	1	2	3
Symbol	▲	■	◆
Normal Stress (ksf)	**1**	**3**	**5**
Deformation Rate (in/min)	**0.002**	**0.002**	**0.002**

Peak Shear Stress (ksf)	**O**	**0.74**	**2.06**	**3.36**
Shear Stress @ End of Test (ksf)	**X**	**0.67**	**1.94**	**3.26**

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in)	0.9892	0.9638	0.9450
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	**6.0**	**6.0**	**6.0**
Final Moisture Content (%)	**17.9**	**17.9**	**16.2**
Dry Density (pcf)	**106.3**	**103.8**	**108.0**





PLATE

E121

HUSHMAND ASSOCIATES, INC.
Geotechnical and Earthquake Engineers

DIRECT SHEAR TEST

ASTM D3080

HAI Project No.: DYAL-23-007-2

Client: Diaz Yourman

Project Name: Modjeska Grade Road

Project Number: 2022-017

Boring No.: DYB23-05

Sample No.: S4

Sample Type: Undisturbed Tube

Depth (ft): 10

Soil Description: Yellowish Brown, Silty Sand (SM)

Tested by: GA

Checked by: KL

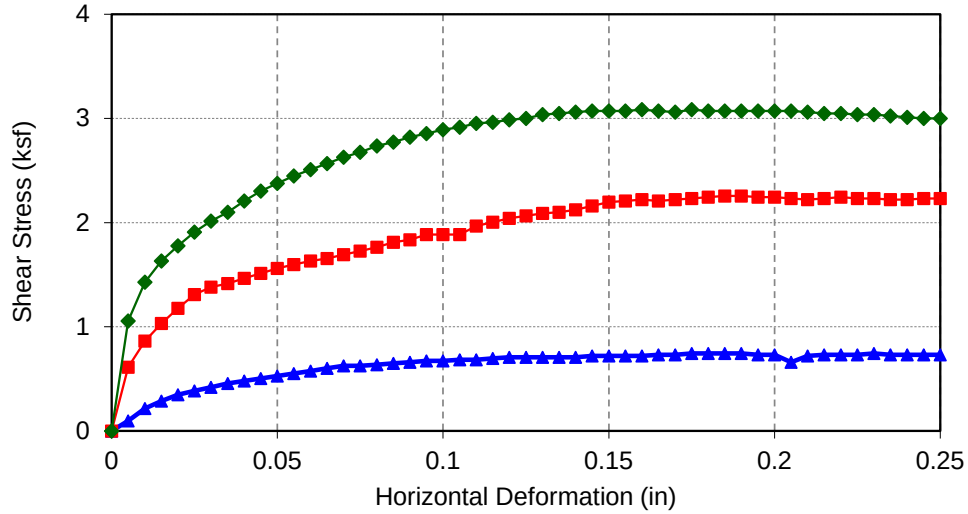
Date: 5/8/2023

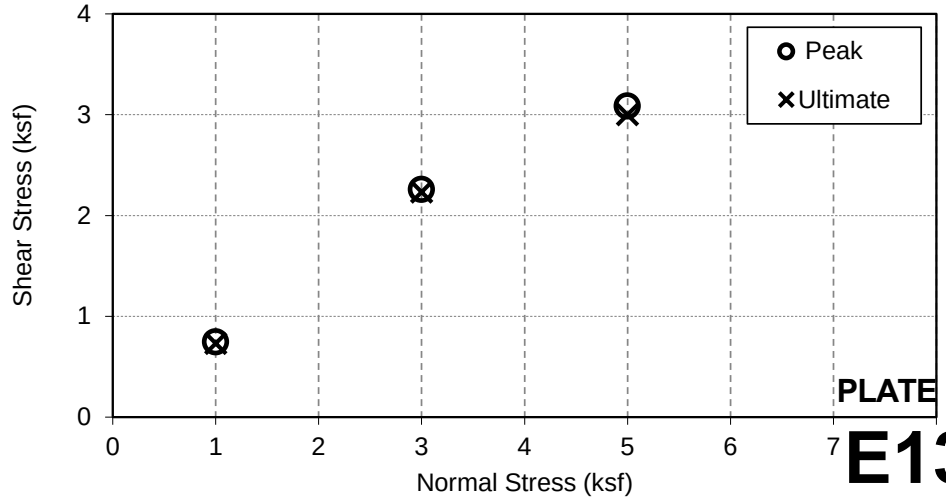
Type of test: **Consolidated, Drained**

Test No.	1	2	3
Symbol	▲	■	◆
Normal Stress (ksf)	**1**	**3**	**5**
Deformation Rate (in/min)	**0.002**	**0.002**	**0.002**

Peak Shear Stress (ksf)	**O**	**0.74**	**2.26**	**3.08**
Shear Stress @ End of Test (ksf)	**X**	**0.73**	**2.23**	**3.00**

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in)	0.9958	0.9932	0.9841
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	**6.2**	**6.2**	**6.2**
Final Moisture Content (%)	**17.4**	**17.0**	**17.4**
Dry Density (pcf)	**104.5**	**105.3**	**106.4**





PLATE

E1313

HUSHMAND ASSOCIATES, INC.
Geotechnical and Earthquake Engineers

DIRECT SHEAR TEST

ASTM D3080

HAI Project No.: DYAL-23-007

Client: Diaz Yourman
Project Name: Modjeska Grade Road
Project Number: 2022-017
Boring No.: DYB23-06
Sample No.: 2
Sample Type: Sample Remold
Depth (ft): 2
Soil Description: Brown, Silty Sand (SM)

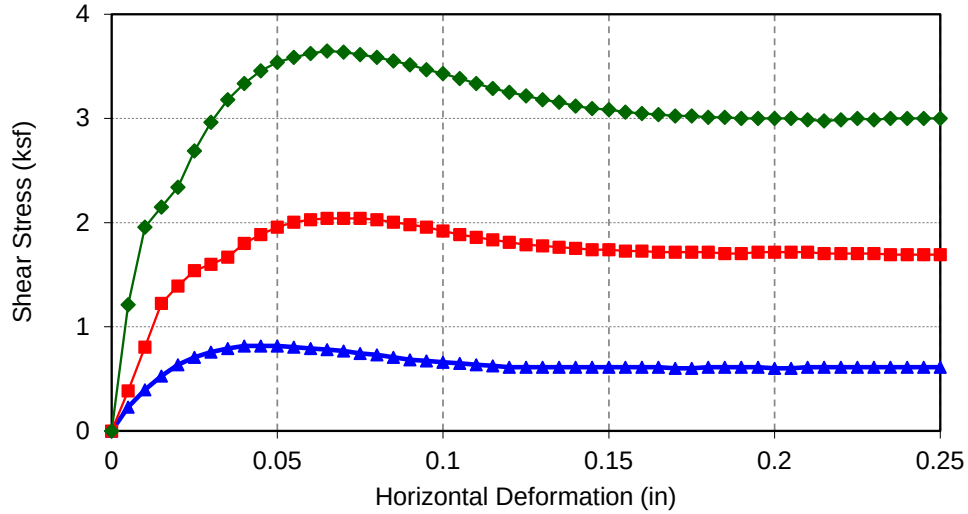
Tested by: GA
Checked by: KL
Date: 5/4/2023

Type of test: **Consolidated, Drained**

Test No.	1	2	3
Symbol	▲	■	◆
Normal Stress (ksf)	**1**	**3**	**5**
Deformation Rate (in/min)	**0.002**	**0.002**	**0.002**

Peak Shear Stress (ksf)	**O**	**0.82**	**2.04**	**3.65**
Shear Stress @ End of Test (ksf)	**X**	**0.61**	**1.69**	**3.00**

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in)	0.9981	0.9883	0.9848
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	**9.8**	**9.8**	**9.8**
Final Moisture Content (%)	**15.2**	**14.9**	**13.6**
Dry Density (pcf)	**117.5**	**117.5**	**117.5**



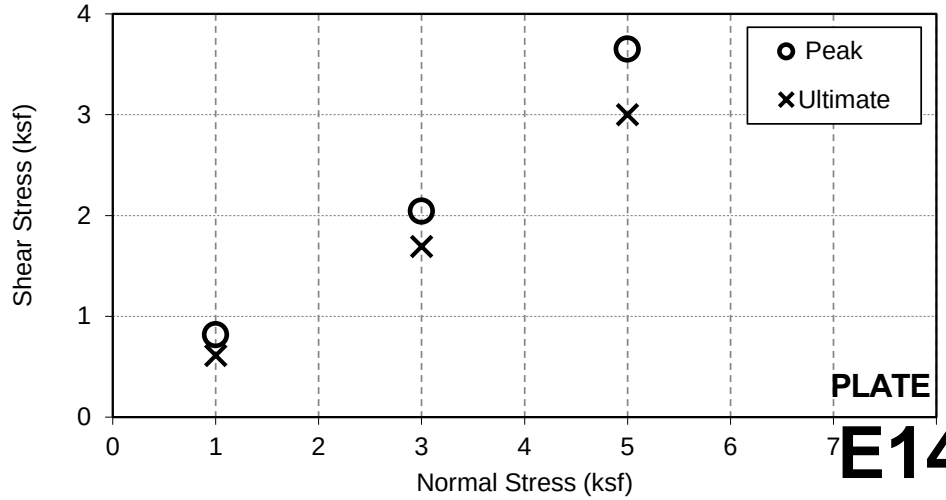


PLATE
E14

HUSHMAND ASSOCIATES, INC.
Geotechnical and Earthquake Engineers

DIRECT SHEAR TEST

ASTM D3080

HAI Project No.: DYAL-23-007-2

Client: Diaz Yourman

Project Name: Modjeska Grade Road

Project Number: 2022-017

Boring No.: DYB23-07

Sample No.: S1

Sample Type: Sample Remold

Depth (ft): 2.5

Soil Description: Brown, Sandy Lean Clay (CL)

Tested by: GA

Checked by: KL

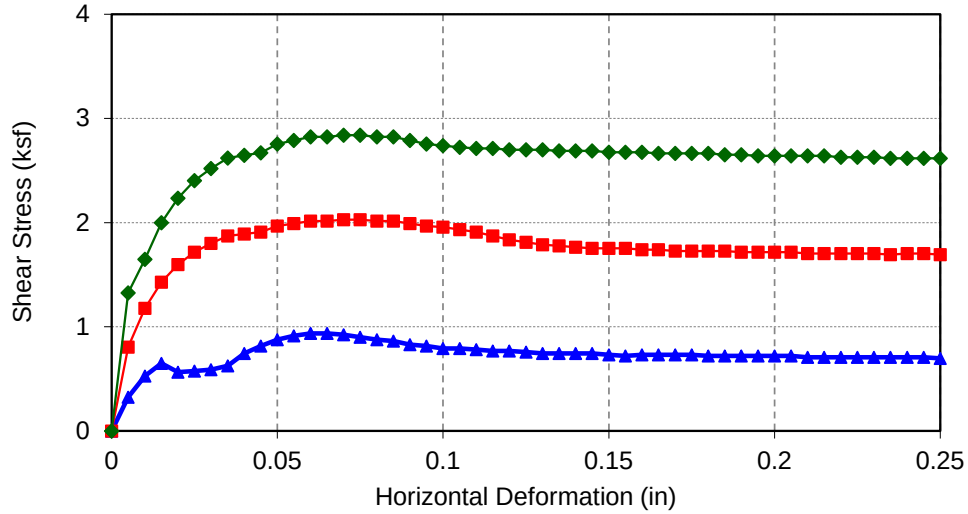
Date: 5/8/2023

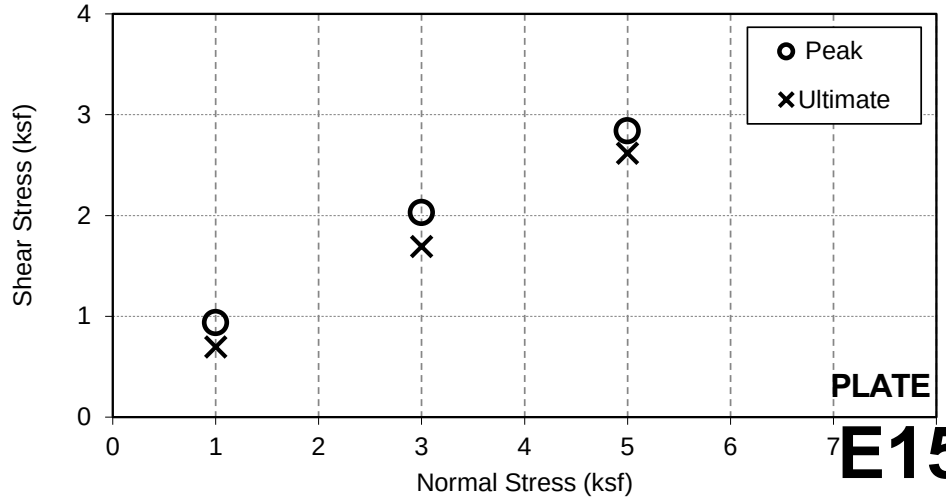
Type of test: **Consolidated, Drained**

Test No.	1	2	3
Symbol	▲	■	◆
Normal Stress (ksf)	**1**	**3**	**5**
Deformation Rate (in/min)	**0.002**	**0.002**	**0.002**

Peak Shear Stress (ksf)	**O**	**0.94**	**2.03**	**2.84**
Shear Stress @ End of Test (ksf)	**X**	**0.70**	**1.69**	**2.62**

Initial Height of Sample (in)	1.000	1.000	1.000
Height of Sample before Shear (in)	0.9897	0.9867	0.9901
Diameter of Sample (in)	2.416	2.416	2.416
Initial Moisture Content (%)	**11.3**	**11.3**	**11.3**
Final Moisture Content (%)	**17.1**	**17.0**	**16.5**
Dry Density (pcf)	**115.9**	**115.9**	**115.9**





PLATE

E15

• ANALYSIS
• DESIGN

LaBelle • Marvin

PROFESSIONAL PAVEMENT ENGINEERING
A CALIFORNIA CORPORATION

• SOILS, ASPHALT TECHNOLOGY

May 23, 2023

Kang Chieh Lin
Hushmand Associates, Inc.
250 Goddard
Irvine, California 92618

Project No. 49199

Attention: Kang Chieh Lin
Testing of the bulk soil samples delivered to our laboratory on 5/15/2023 has been completed.

P.N.:	**DYAL-23-007-2 / 2022-017**
Reference:	**Modjeska Grade Road**
Samples:	**DYB23-01 Bulk @ 0-5**
	DYB23-02 Bulk @ 0-5
	DYB23-04 Bulk @ 0-5
	DYB23-05 Bulk @ 0-5
	DYB23-07 Bulk @ 0-5

Data sheets are attached for your use and file. Any untested portion of the sample will be retained for a period of 60 days prior to disposal. The opportunity to be of service is sincerely appreciated and should you have any questions, kindly call.

Very truly yours,

REGISTERED PROFESSIONAL ENGINEER
STEVEN R. MARVIN
NO. 30659
CIVIL
STATE OF CALIFORNIA

Steven R. Marvin
RCE 30659

SRM:tw
Enclosure

2700 S. GRAND AVENUE • SANTA ANA, CA 92705-5404 • (714) 546-3468 • FAX (714) 546-5841
INFO@LABELLEMARVIN.COM

R - VALUE DATA SHEET

LaBelle Marvin

PROJECT No. 49199

DATE: 5/22/2023

BORING NO. DYB23-01 Bulk @ 0'-5'

Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

SAMPLE DESCRIPTION: Brown Sandy Silt

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	13	14	15
Water added, grams	35	55	23
Initial Test Water, %	10.1	12.0	9.0
Compact Gage Pressure,psi	130	55	230
Exudation Pressure, psi	324	166	447
Height Sample, Inches	2.51	2.62	2.48
Gross Weight Mold, grams	3085	3128	3075
Tare Weight Mold, grams	1935	1964	1940
Sample Wet Weight, grams	1150	1164	1135
Expansion, Inches x 10exp-4	38	17	83
Stability 2,000 lbs (160psi)	32 / 74	41 / 98	24 / 52
Turns Displacement	4.47	5.05	4.28
R-Value Uncorrected	39	24	55
R-Value Corrected	39	26	55
Dry Density, pcf	126.1	120.2	127.3

DESIGN CALCULATION DATA

Traffic Index	Assumed:	4.0	4.0	4.0
G.E. by Stability		0.62	0.76	0.46
G. E. by Expansion		1.27	0.57	2.77

Equilibrium R-Value	**31** by EXPANSION	Examined & Checked: 5 /22/ 23
REMARKS:	Gf = 1.25 0.0% Retained on the 3/4" Sieve.	REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN NO. 30659 CIVIL STATE OF CALIFORNIA Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

PLATE

E17

R-VALUE GRAPHICAL PRESENTATION

LaBelle Marvin

PROJECT NO. 49199

DATE: 5 /22/ 23

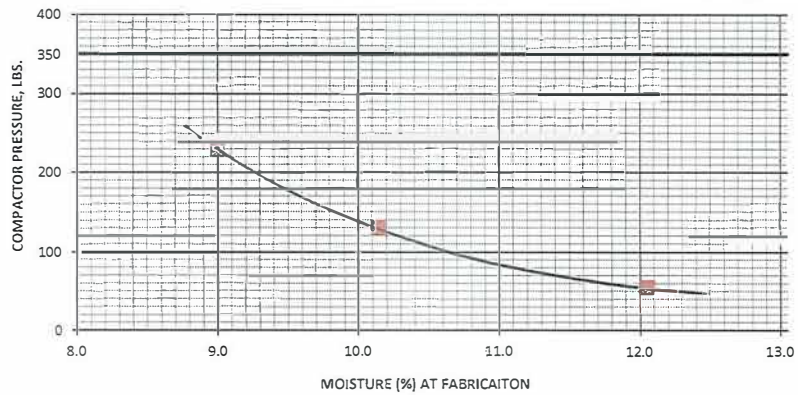
REMARKS:

BORING NO. DYB23-01 Bulk @ 0'-5'

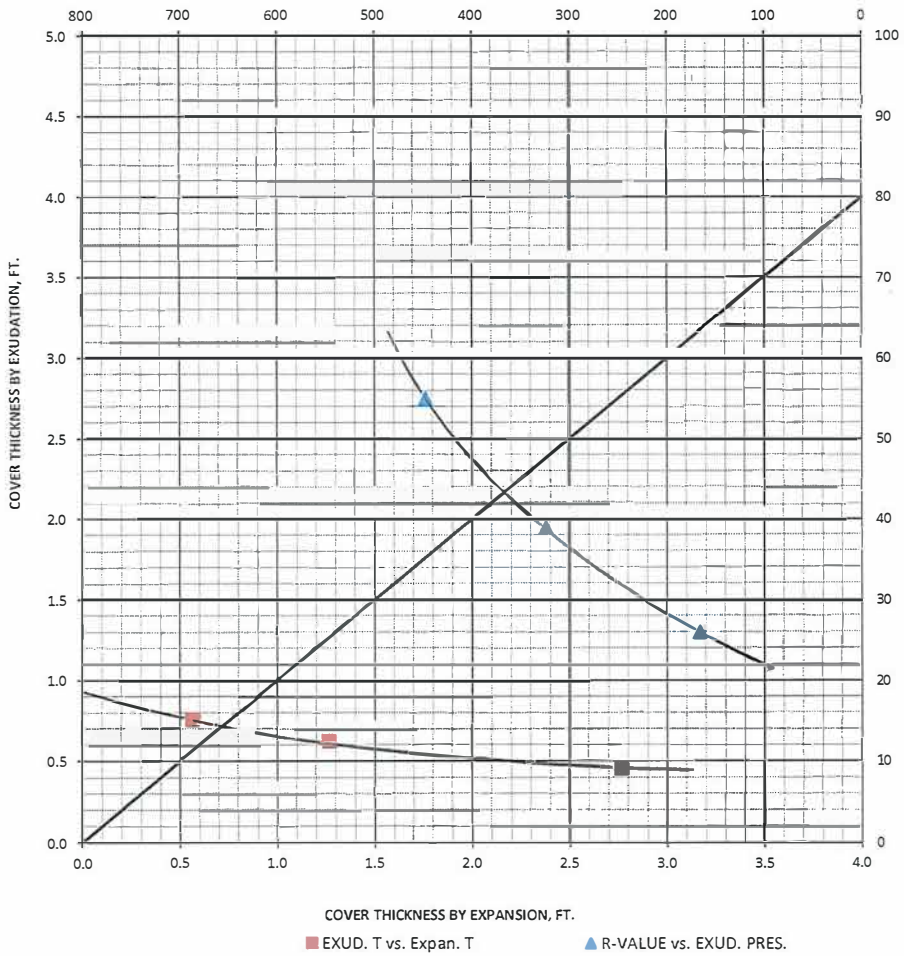
Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

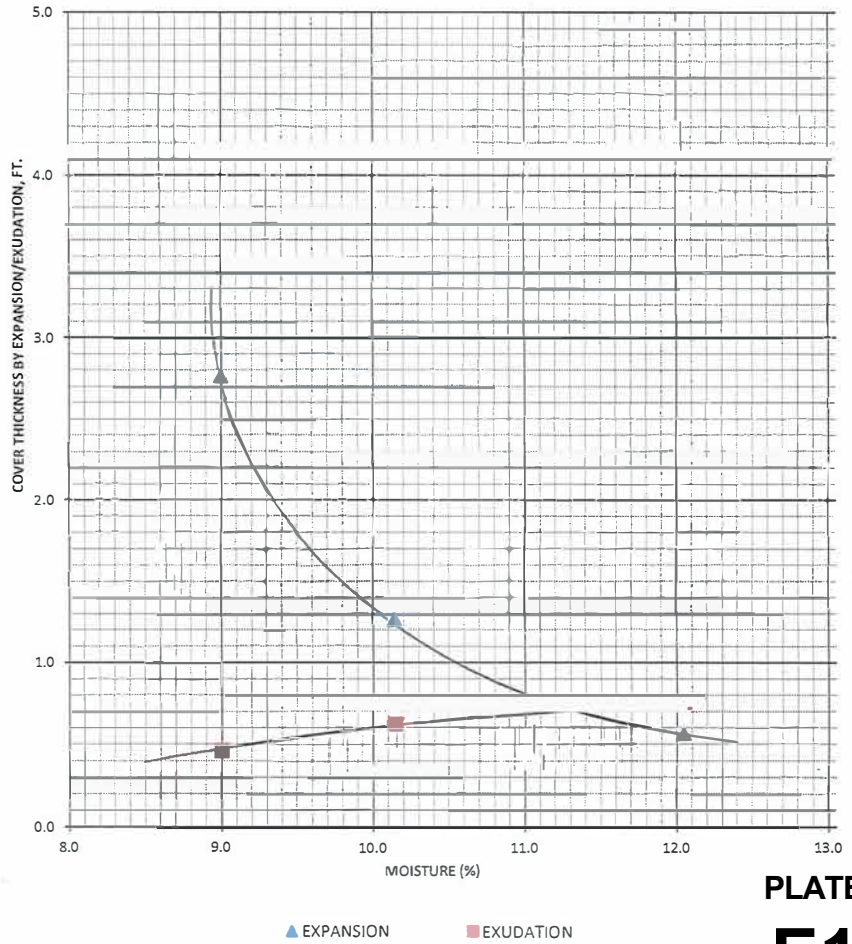
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



PLATE

E18

R - VALUE DATA SHEET

LaBelle Marvin

PROJECT No. 49199

DATE: 5/23/2023

BORING NO. DYB23-02 Bulk @ 0'-5'

Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

SAMPLE DESCRIPTION: Brown Sandy Silt

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	16	17	18
Water added, grams	75	33	16
Initial Test Water, %	15.0	10.7	9.0
Compact Gage Pressure,psi	40	120	240
Exudation Pressure, psi	222	466	758
Height Sample, Inches	2.62	2.41	2.36
Gross Weight Mold, grams	3084	3034	3032
Tare Weight Mold, grams	1945	1939	1953
Sample Wet Weight, grams	1139	1095	1079
Expansion, Inches x 10exp-4	13	63	88
Stability 2,000 lbs (160psi)	63 / 142	33 / 83	25 / 61
Turns Displacement	4.83	3.65	3.26
R-Value Uncorrected	6	39	55
R-Value Corrected	6	37	52
Dry Density, pcf	114.6	124.3	127.1

DESIGN CALCULATION DATA

Traffic Index	Assumed:	4.0	4.0	4.0
G.E. by Stability		0.96	0.65	0.49
G. E. by Expansion		0.43	2.10	2.93

Equilibrium R-Value	**15** by EXPANSION	Examined & Checked: 5 /23/ 23
REMARKS:	Gf = 1.25 0.0% Retained on the 3/4" Sieve.	REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN NO. 30659 CIVIL STATE OF CALIFORNIA Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

PLATE

E19

R-VALUE GRAPHICAL PRESENTATION

LaBelle Marvin

PROJECT NO. 49199

DATE: 5 /23/ 23

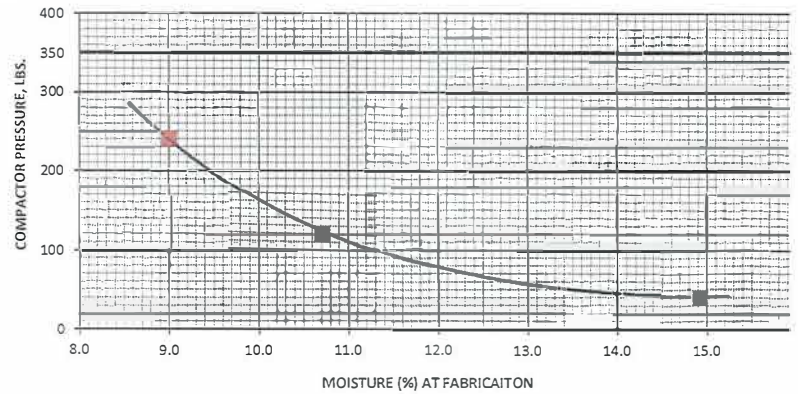
REMARKS:

BORING NO. DYB23-02 Bulk @ 0'-5'

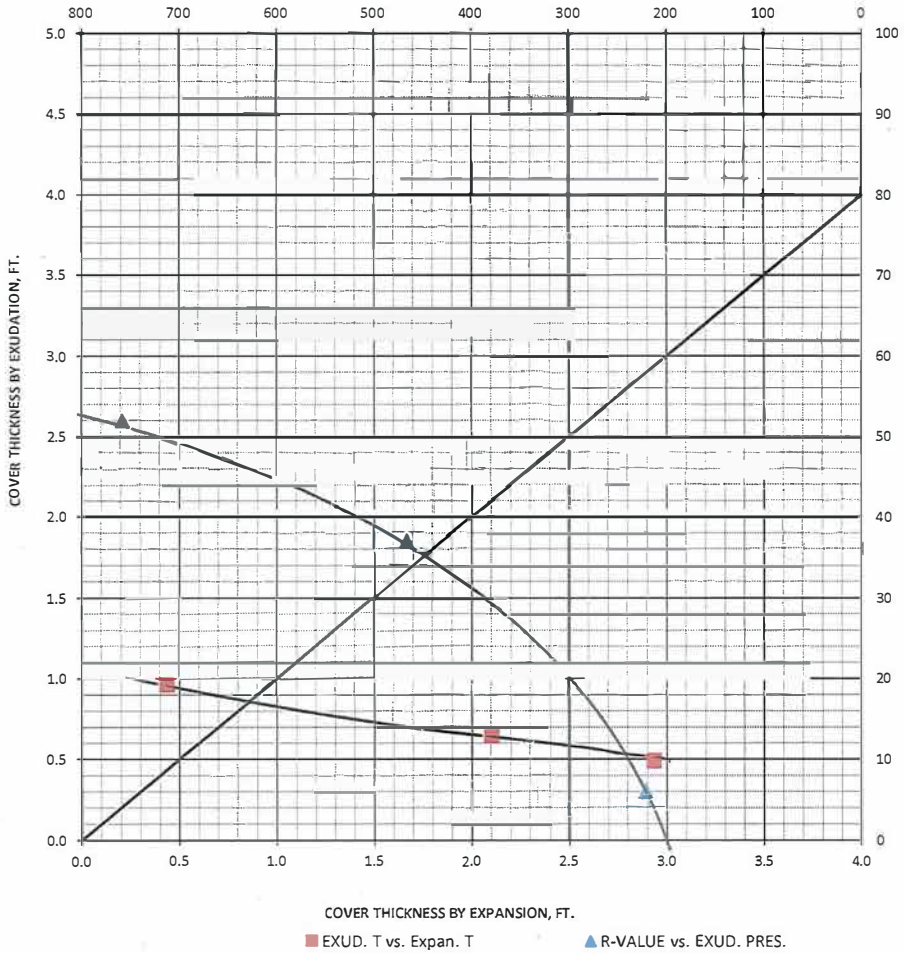
Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

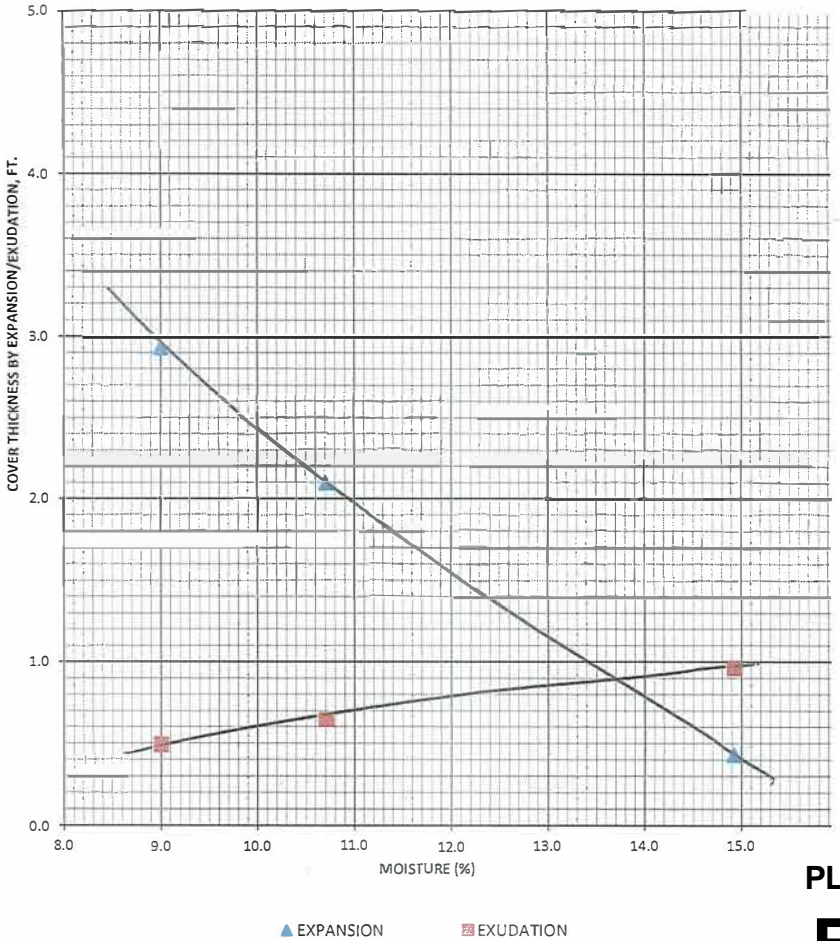
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



PLATE

E20

R - VALUE DATA SHEET

LaBelle Marvin

PROJECT No. 49199

DATE: 5/22/2023

BORING NO. DYB23-04 Bulk @ 0'-5'

Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

SAMPLE DESCRIPTION: Brown Gravelly Silt

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	10	11	12
Water added, grams	47	67	32
Initial Test Water, %	10.5	12.4	9.1
Compact Gage Pressure,psi	75	40	175
Exudation Pressure, psi	275	112	414
Height Sample, Inches	2.54	2.61	2.44
Gross Weight Mold, grams	3114	3126	3085
Tare Weight Mold, grams	1953	1948	1943
Sample Wet Weight, grams	1161	1178	1142
Expansion, Inches x 10exp-4	17	13	70
Stability 2,000 lbs (160psi)	37 / 90	52 / 123	29 / 67
Turns Displacement	4.13	4.52	3.79
R-Value Uncorrected	32	14	48
R-Value Corrected	32	15	47
Dry Density, pcf	125.3	121.7	130.0

DESIGN CALCULATION DATA

Traffic Index	Assumed:	4.0	4.0	4.0
G.E. by Stability		0.70	0.87	0.54
G. E. by Expansion		0.57	0.43	2.33

Equilibrium R-Value	**34** by EXUDATION	Examined & Checked: 5 /22/ 23
REMARKS:	Gf = 1.25 9.6% Retained on the 3/4" Sieve.	REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN NO. 30659 CIVIL STATE OF CALIFORNIA Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

PLATE

E21

R-VALUE GRAPHICAL PRESENTATION

LaBelle Marvin

PROJECT NO. 49199

DATE: 5 /22/ 23

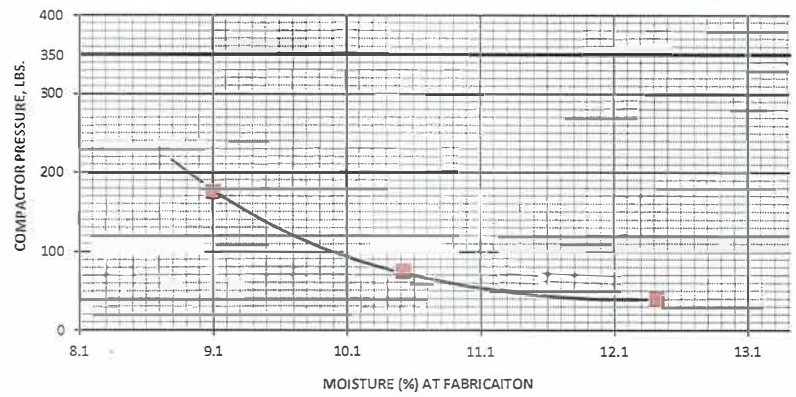
REMARKS:

BORING NO. DYB23-04 Bulk @ 0'-5'

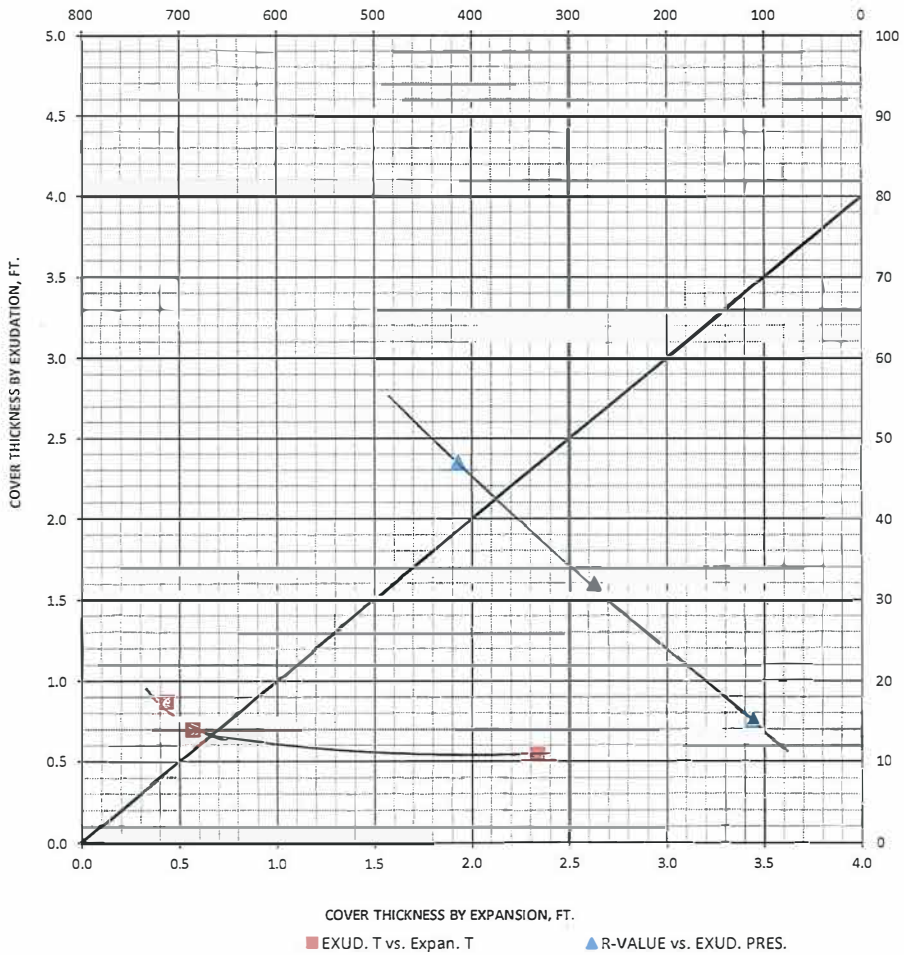
Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

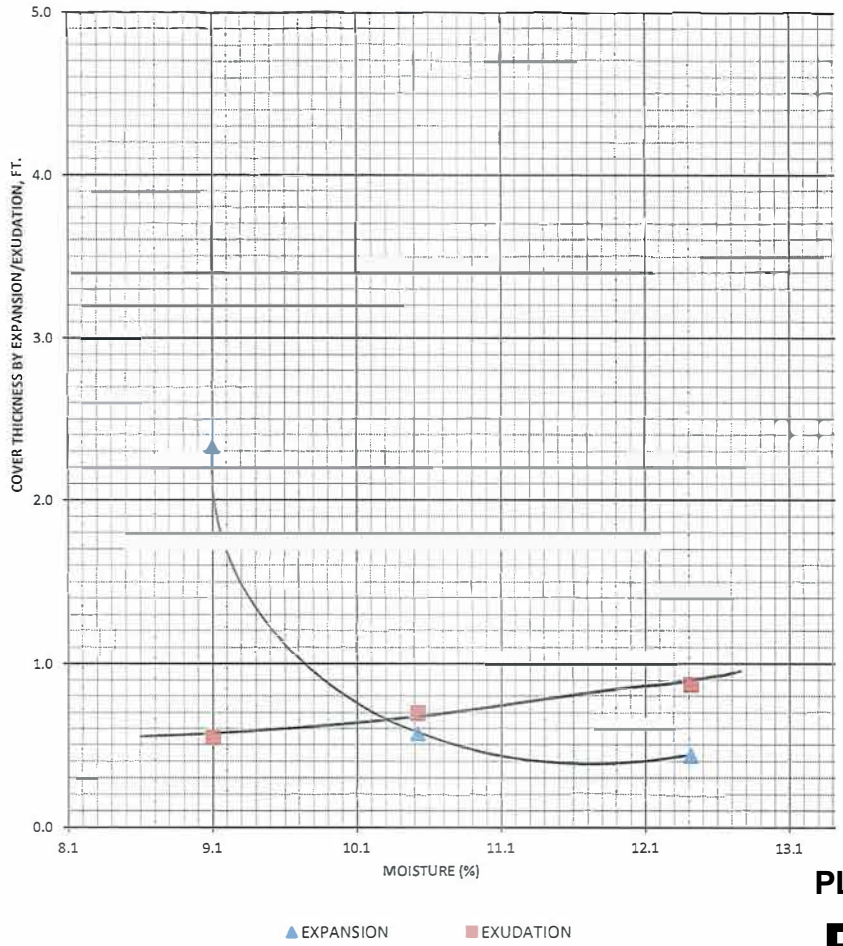
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



PLATE

E22

R - VALUE DATA SHEET

LaBelle Marvin

PROJECT No. 49199

DATE: 5/22/2023

BORING NO. DYB23-05 Bulk @ 0'-5'

Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

SAMPLE DESCRIPTION: Brown Silty Sand

R-VALUE TESTING DATA | CA TEST 301			
	SPECIMEN ID		
	a	b	c
Mold ID Number	4	5	6
Water added, grams	30	47	36
Initial Test Water, %	8.8	10.4	9.3
Compact Gage Pressure,psi	350	150	350
Exudation Pressure, psi	576	161	309
Height Sample, Inches	2.53	2.56	2.53
Gross Weight Mold, grams	3074	3080	3081
Tare Weight Mold, grams	1949	1940	1950
Sample Wet Weight, grams	1125	1140	1131
Expansion, Inches x 10exp-4	10	5	8
Stability 2,000 lbs (160psi)	14 / 25	27 / 47	18 / 31
Turns Displacement	4.67	5.23	4.88
R-Value Uncorrected	74	53	68
R-Value Corrected	74	54	68
Dry Density, pcf	123.9	122.2	123.9

DESIGN CALCULATION DATA

Traffic Index	Assumed:	4.0	4.0	4.0
G.E. by Stability		0.27	0.47	0.33
G. E. by Expansion		0.33	0.17	0.27

Equilibrium R-Value	**67** by EXUDATION	Examined & Checked: 5 /22/ 23
REMARKS:	Gf = 1.25 0.0% Retained on the 3/4" Sieve.	REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN NO. 30659 CIVIL STATE OF CALIFORNIA Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

PLATE

E23

R-VALUE GRAPHICAL PRESENTATION

LaBelle Marvin

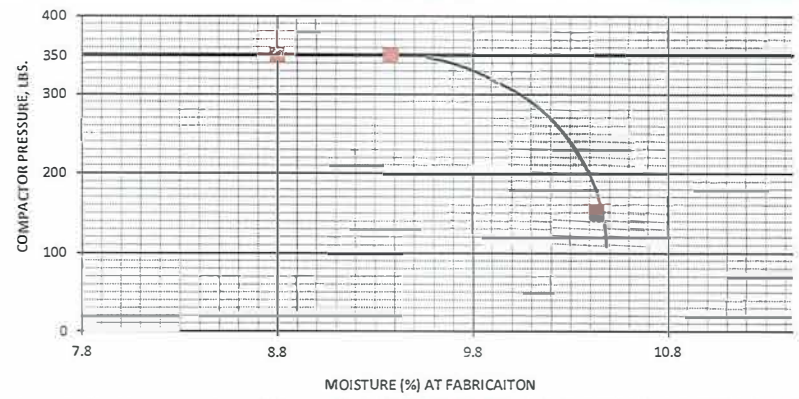
PROJECT NO. 49199

DATE: 5 /22/ 23

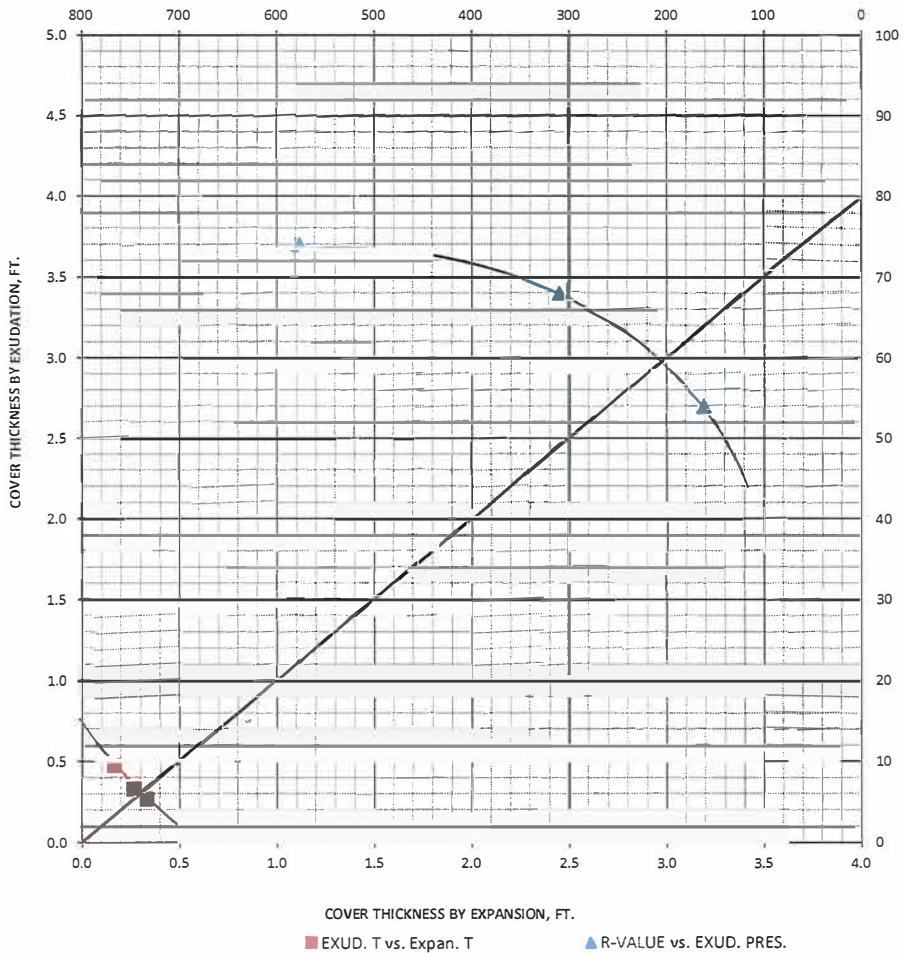
REMARKS:

BORING NO. DYB23-05 Bulk @ 0'-5'
Modjeska Grade Road
P.N. DYAL-23-007-2/2022-017

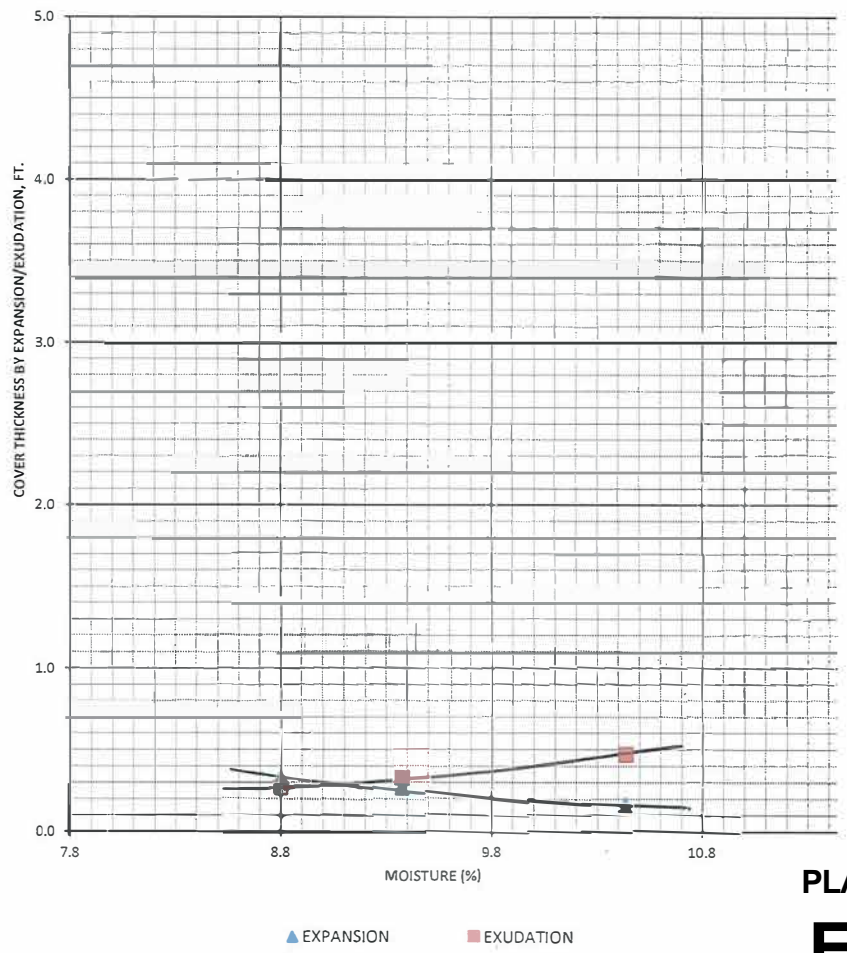
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



PLATE

E24

R - VALUE DATA SHEET

LaBelle Marvin

PROJECT No. 49199

DATE: 5/22/2023

BORING NO. DYB23-07 Bulk @ 0'-5'

Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

SAMPLE DESCRIPTION: Brown Sandy Silt

R-VALUE TESTING DATA | CA TEST 301

	SPECIMEN ID		
	a	b	c
Mold ID Number	7	8	9
Water added, grams	46	21	10
Initial Test Water, %	14.4	11.9	10.8
Compact Gage Pressure,psi	50	170	260
Exudation Pressure, psi	156	277	536
Height Sample, Inches	2.62	2.51	2.43
Gross Weight Mold, grams	3082	3058	2871
Tare Weight Mold, grams	1942	1945	1768
Sample Wet Weight, grams	1140	1113	1103
Expansion, Inches x 10exp-4	29	86	107
Stability 2,000 lbs (160psi)	42 / 106	30 / 68	29 / 67
Turns Displacement	4.73	4.63	4.01
R-Value Uncorrected	21	42	46
R-Value Corrected	23	42	44
Dry Density, pcf	115.3	120.1	124.2

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.79	0.59	0.57
G. E. by Expansion	0.97	2.87	3.57

Equilibrium R-Value	**20** by EXPANSION	Examined & Checked: 5 /22/ 23
REMARKS:	Gf = 1.25 0.0% Retained on the 3/4" Sieve.	REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN NO. 30659 CIVIL STATE OF CALIFORNIA Steven R. Marvin, RCE 30659

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PLATE

E25

R-VALUE GRAPHICAL PRESENTATION

LaBelle Marvin

PROJECT NO. 49199

DATE: 5 /22/ 23

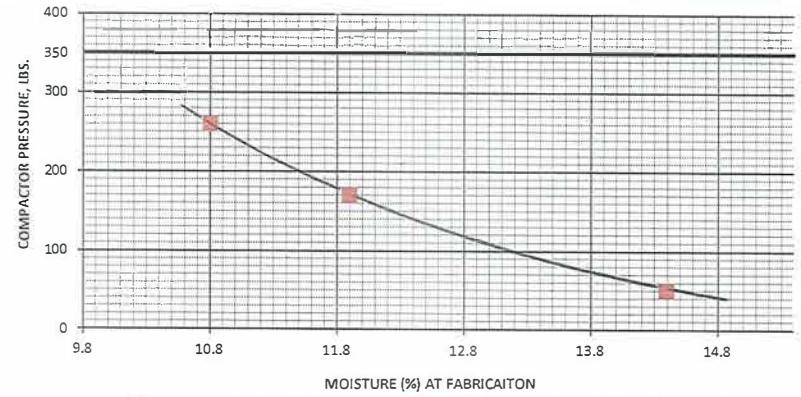
REMARKS:

BORING NO. DYB23-07 Bulk @ 0'-5'

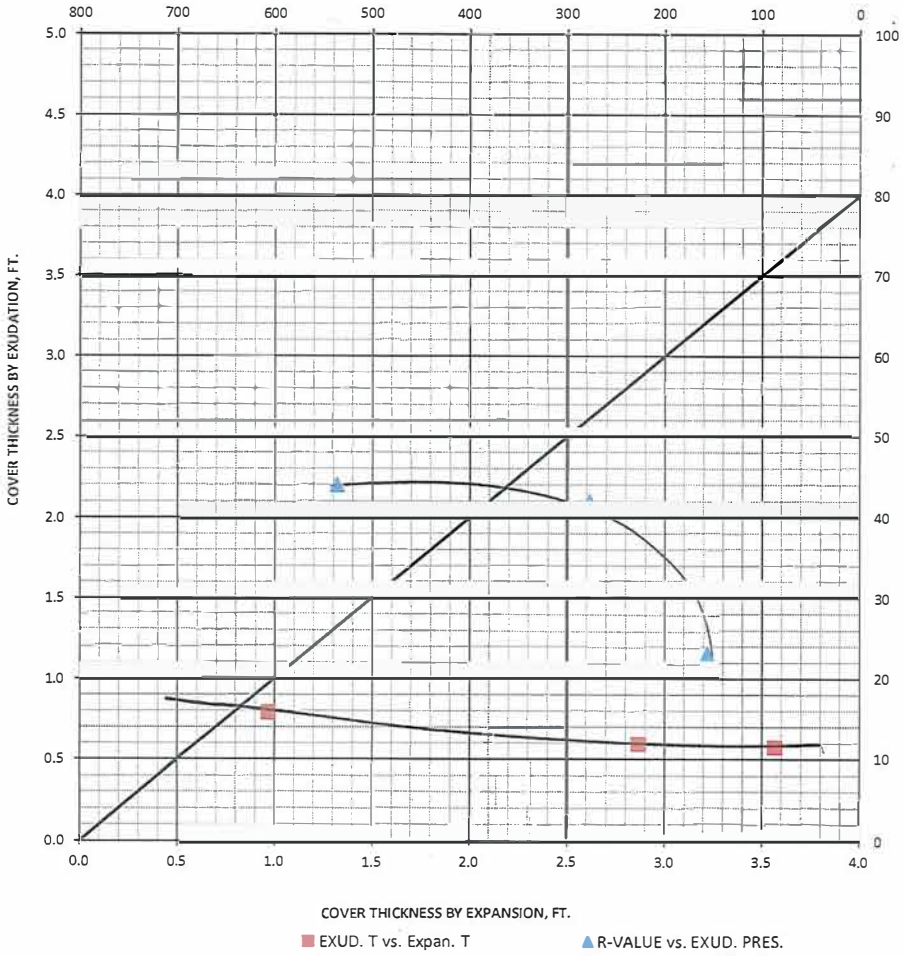
Modjeska Grade Road

P.N. DYAL-23-007-2/2022-017

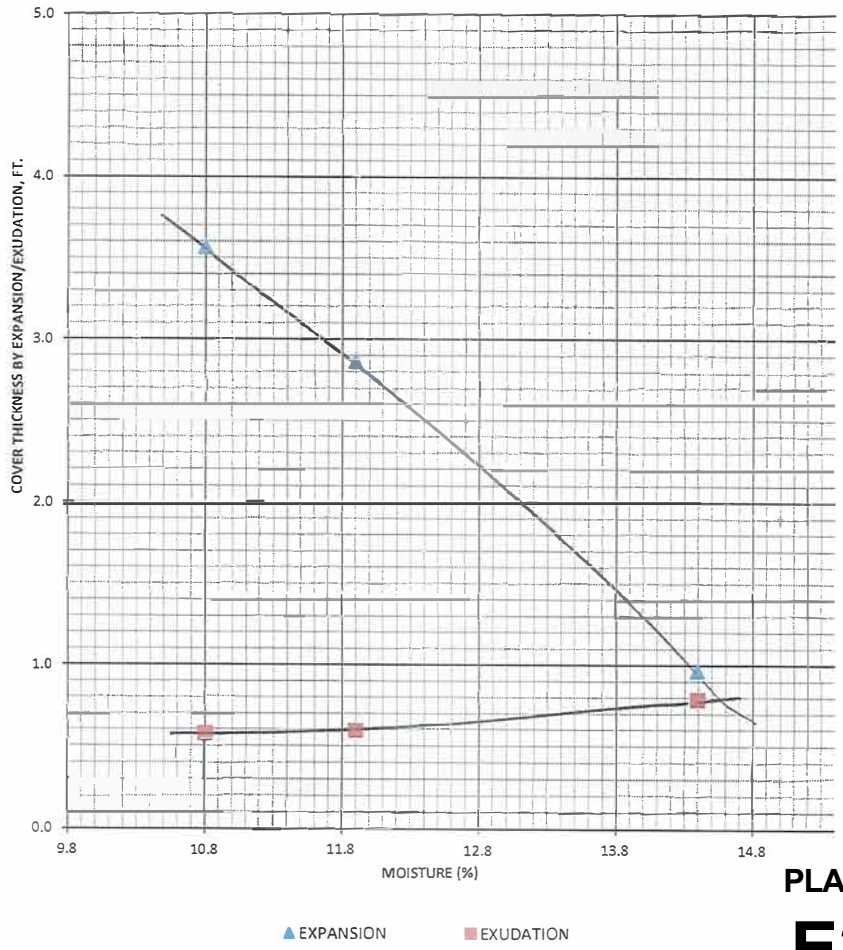
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



PLATE

E26

APPENDIX F -
AGRONOMY LABORATORY TESTING

DRAFT

WALLACE LABORATORIES, LLC
365 Coral Circle
El Segundo, CA 90245
phone (310) 615-0116 fax (310) 640-6863

December 13, 2022

Beatrice Torres, Beatrice@diazyourman.com
Diaz Yourman & Associates
1616 East 17th Street
Santa Ana, CA 92705

RE: OCPW Modjeska Grade Road Improvements, Project No. 2022-017
36 samples received December 1, 2022

Dear Beatrice,

Twelve locations: Top, Middle and Bottom

Analytical Results

Acidity/Alkalinity – The overall average pH is 6.46. The pH values range from 4.03 to 7.96. The average pH of the Top samples is 6.46. The average pH of the Middle samples is 6.46. The average pH of the Bottom samples is 6.76.

Normally, the optimal pH is generally in the range of about 6.5 to 7.5. The pH of acidic soils can be increases with the addition of ground limestone or calcium carbonate.

Salinity – The overall average salinity or electrical conductivity is 0.39 millimho/cm. Salinity ranges from 0.11 millimho/cm to 1.76 millimho/cm. The average salinity of the Top samples is 0.33 millimho/cm. The average salinity of the Middle samples is 0.28 millimho/cm. The average salinity of the Bottom samples is 0.55 millimho/cm.

Fertility -

Nitrogen – Nitrogen is moderate on average. Nitrogen is moderate on average for the Bottom samples. Nitrogen is modest on average for the Top and Middle samples. Nitrogen is high for Location 11, Bottom. Nitrogen is low for 20 samples.
Phosphorus – Phosphorus is low on average. Phosphorus is low for 27 samples.
Potassium – Potassium is moderate on average. Potassium is high on average for the Bottom samples. Potassium is low for 14 samples.
Iron – Iron is sufficient on average. Iron is low for 3 samples.
Manganese – Manganese is sufficient on average. Manganese is low for 5 samples.
Zinc – Zinc is low on average for the Middle samples. Zinc is low for 18 samples.
Copper – Copper is sufficient on average. Copper is low for 10 samples.
Boron – Boron is sufficient on average for the Top and Bottom samples. Boron is modest on average for the Middle samples.
Magnesium – Magnesium is high.
Sulfur – Sulfur is low on average.

Sodicity – Sodium is low on average. The average SAR (sodium adsorption ratio) is 1.1. Available sodium is modestly high for Location 8, Bottom. SAR is 5.0 for that location.

Ideally, SAR should be less than about 3. High sodium and high SAR values limit soil physical properties, reduces water percolation, decreases soil aggregate stability, increases clay dispersion, increases swelling of expandable clays, increases surface crusting and reduces soil tilth. High sodium also restricts the uptake of competitive ions such as potassium and calcium. Sodium and SAR can be lowered with the addition of gypsum followed with leaching.

Soil organic matter – The overall average soil organic matter is 1.80% on a dry weight basis. The average soil organic matter is 1.97% on a dry weight basis for the Top samples. The average soil organic matter is 0.98% on a dry weight basis for the Middle samples. The average soil organic matter is 2.45% on a dry weight basis for the Bottom samples.

Soil organic matter is 4.58% on a dry weight basis on average for Locations 11 and 12. The lowest soil organic matter is for the Middle samples.

Texture - The average texture is sandy clay loam. Based on the non-gravel fraction, the soils contain on average 55% sand, 25% silt and 20% clay. The gravel content is 8% on average. The soil texture is sandy clay loam for the Top and Middle samples. The average soil texture is sandy loam for the Bottom samples.

Water percolation - The average estimated rate of water percolation based on Soil Water Characteristics version 6.02.74 model developed by Keith Saxton of the USDA is moderately slow at 0.75 inches per hour for normal soil compaction. The model is based on the soil texture, percent gravel and percent soil organic matter.

The average estimated rate of water percolation is 0.71 inches per hour for the Top samples. The average estimated rate of water percolation is 0.61 inches per hour for the Middle samples. The average estimated rate of water percolation is 0.91 inches per hour for the Bottom samples.

Heavy metals - The concentrations of common non-essential heavy metals are low except for modest plant-available lead for two samples.

Aluminum – Location 11, Top has high aluminum. The pH of that sample is low at 4.03.

Aluminum restricts growth by interfering with the metabolism of phosphorus and calcium. It causes stunting and discoloration. Foliage may turn a dull gray green. Aluminum is high in poorly aerated soil and in overly acidic soils. Soluble calcium helps to reduce the toxicity of aluminum.

Hydrophobicity – Location 7, Bottom is hydrophobic. It is difficult to wet. Water beads up on the soil surface initially and then slowly moves into the soil.

Recommendations

Samples with low fertility and low soil organic matter have been highlighted on the attached Excel file in the database worksheet. Micronutrients will be increased with the addition of soil organic amendments.

General soil preparation on a square foot basis. Broadcast the following uniformly; rates are per 1,000 square feet for a 6-inch lift. Incorporate them homogeneously 6" deep.

Ammonium sulfate (21-0-0) – 5 pounds where nitrogen is low and the pH is over 7.0
Calcium ammonium nitrate (27-0-0) – 4 pounds where nitrogen is low and the pH is between 6.5 and 7.0
Calcium nitrate (15.5-0-0) – 6 pounds were nitrogen is low and the pH is less than 6.5
Potassium sulfate (0-0-50) – 10 pounds where potassium is low
Triple superphosphate (0-45-0) – 4 pounds where phosphorus is low
Agricultural gypsum - 20 pounds for all except 40 pounds for Location 8, Bottom
Ground limestone – 50 pounds where the pH is below 5
Organic soil amendment - about 4 cubic yards, sufficient for 4% to 6% soil organic matter on a dry weight basis where soil organic matter is low

For the preparation on a volume basis, homogeneously blend the following materials into the soil. Rates are expressed per cubic yard:

Ammonium sulfate (21-0-0) – 1/4 pound where nitrogen is low and the pH is over 7.0
Calcium ammonium nitrate (27-0-0) – 1/4 pound where nitrogen is low and the pH is between 6.5 and 7.0
Calcium nitrate (15.5-0-0) – 1/4 pound were nitrogen is low and the pH is less than 6.5
Potassium sulfate (0-0-50) – 1/2 pound where potassium is low
Triple superphosphate (0-45-0) – 1/4 pound where phosphorus is low
Agricultural gypsum – 1 pound for all except 2 pounds for Location 8, Bottom
Ground limestone – 3 pounds where the pH is below 5
Organic soil amendment - about 20% by volume, sufficient for 4% to 6% soil organic matter on a dry weight basis where soil organic matter is low

Organic soil amendment:

1. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. Organic matter shall be at least 50% on a dry weight basis.
2. The pH of the material shall be between 6 and 7.5.
3. The salt content shall be less than 10 millimho/cm @ 25° C. on a saturated paste extract.
4. Boron content of the saturated extract shall be less than 1.0 part per million.
5. Silicon content (acid-insoluble ash) shall be less than 50%.
6. Calcium carbonate shall not be present if to be applied on alkaline soils.
7. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.

8. Composted wood products are conditionally acceptable [stable humus must be present]. Wood based products are not acceptable which are based on red wood or cedar.
9. Sludge-based materials are not acceptable.
10. Carbon:nitrogen ratio is less than 25:1.
11. The compost shall be aerobic without malodorous presence of decomposition products.
12. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen for soil amending.

Maximum total permissible pollutant concentrations in amendment in parts per million on a dry weight basis:

arsenic	12	copper	100	selenium	20
cadmium	15	lead	200	silver	10
chromium	150	mercury	10	vanadium	50
cobalt	30	molybdenum	20	zinc	200
		nickel	100		

Higher amounts of salinity or boron may be present if the soils are to be preleached to reduce the excess or if the plant species will tolerate the salinity and/or boron.

Normally irrigate deeply but not frequently. Balance soil moisture with soil aeration.

Irrigate hydrophobic soils slowly. Use multiple starts and soaking periods between irrigation cycles. Slightly moist soils are easier to wet than dry soils. Balance soil aeration with soil moisture.

For site maintenance, apply ammonium sulfate (21-0-0) at 5 pounds per 1,000 square feet about once per quarter where the pH is over 7.0.

For site maintenance, apply calcium ammonium nitrate (27-0-0) at 4 pounds per 1,000 square feet about once per quarter where the pH is between 6.5 and 7.0.

For site maintenance, apply calcium nitrate (15.5-0-0) at 6 pounds per 1,000 square feet about once per quarter where the pH is less than 6.5

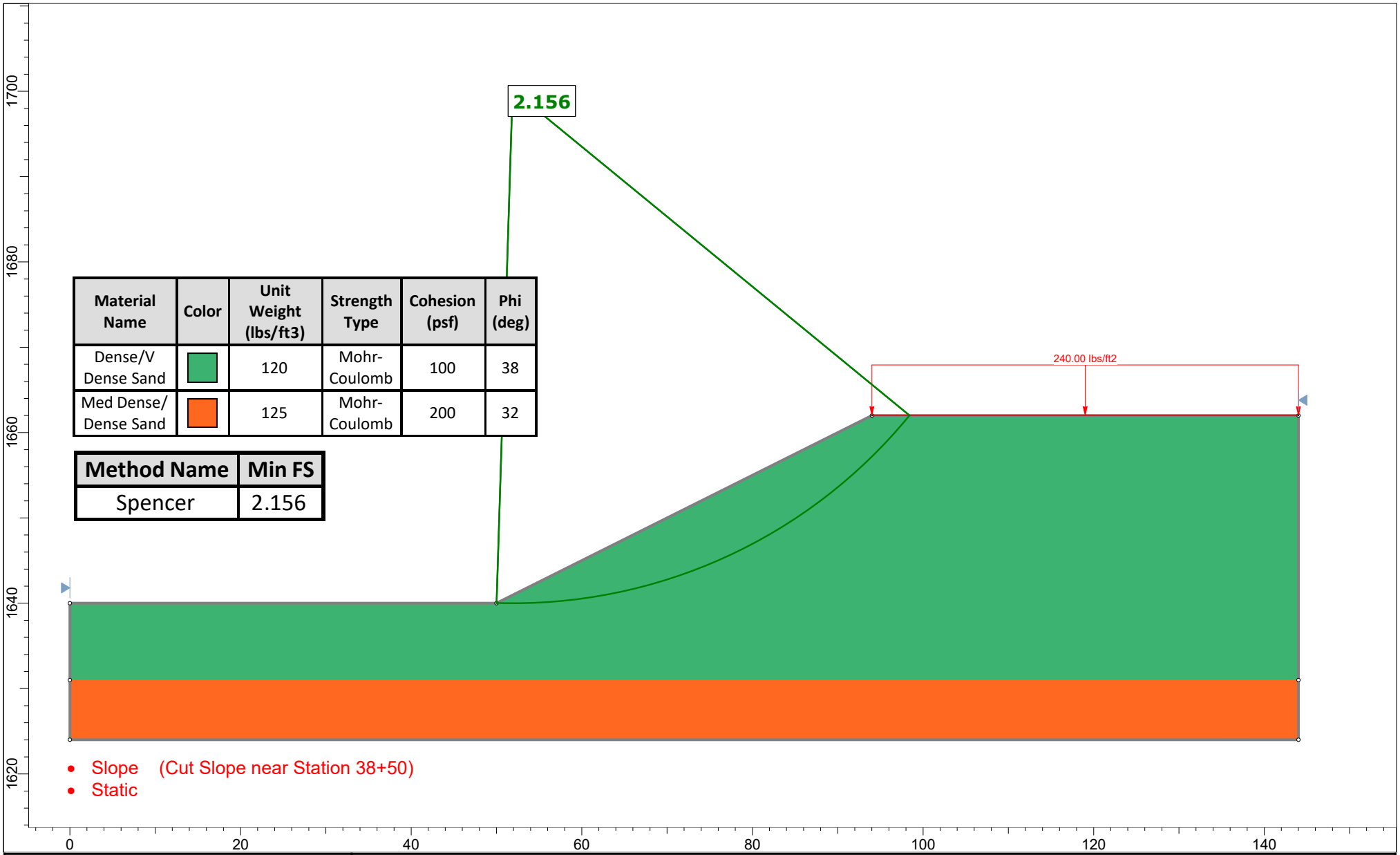
Monitor the site with periodic soil and leaf tissue testing. Adjust the maintenance program as needed.

Sincerely,

Garn A. Wallace, Ph. D.
GAW:n

APPENDIX G -
SLOPE STABILITY ANALYSES

DRAFT



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Dense/V Dense Sand		120	Mohr-Coulomb	100	38
Med Dense/ Dense Sand		125	Mohr-Coulomb	200	32

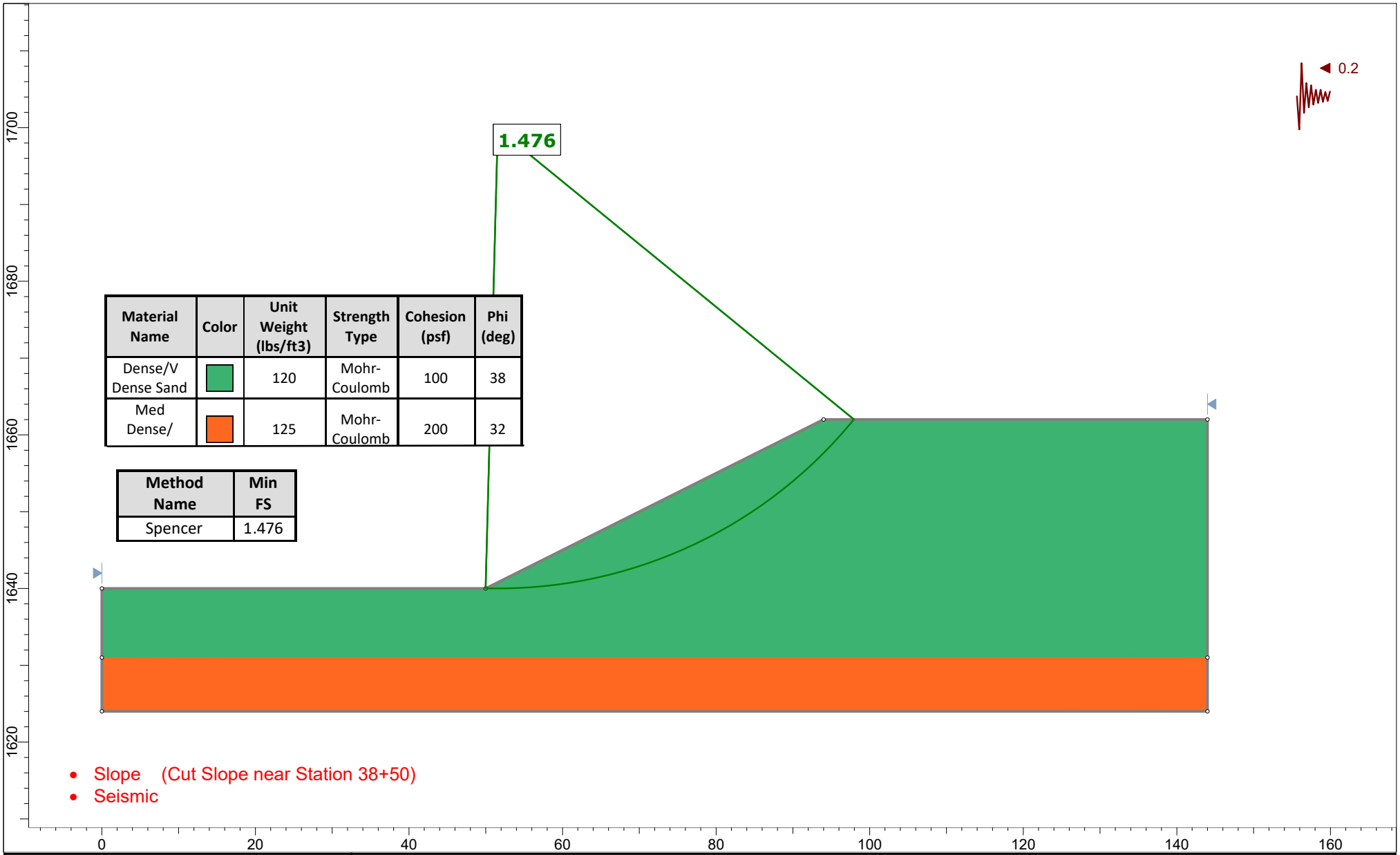
Method Name	Min FS
Spencer	2.156

- Slope (Cut Slope near Station 38+50)
- Static

rocscience

SLIDEINTERPRET 9.010

Project	2022-017 OCPW Modjeska Grade Rd		
Group	Group 1	*Scenario*	Master Scenario
Drawn By	NM	*Company*	DYA
Date	8/7/2023	*File Name*	Slope 1.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Dense/V Dense Sand		120	Mohr-Coulomb	100	38
Med Dense/		125	Mohr-Coulomb	200	32

Method Name	Min FS
Spencer	1.476

- Slope (Cut Slope near Station 38+50)
- Seismic

rocscience

SLIDEINTERPRET 9.010

Project	2022-017 OCPW Modjeska Grade Rd		
Group	Group 1	*Scenario*	Master Scenario
Drawn By	NM	*Company*	DYA
Date	8/7/2023	*File Name*	Slope 1.slmd

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PALEONTOLOGICAL RESOURCES IDENTIFICATION

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

COUNTY OF ORANGE, CALIFORNIA

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TABLE OF CONTENTS

1.0 INTRODUCTION 2
1.1 PROJECT LOCATION 2
1.2 PROJECT DESCRIPTION 2
2.0 GEOLOGICAL SETTING 3
3.0 RECORDS SEARCH AND LITERATURE SEARCH 4
4.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS 7
PREPARER QUALIFICATIONS 9
REFERENCES CITED 10

ATTACHMENTS

Attachment 1 Figures
Attachment 2 Records Search Results

1.0 INTRODUCTION

In support of the proposed Modjeska Grade Road Improvements Project (project), Michael Baker International staff conducted a fossil locality search at the Natural History Museum of Los Angeles County (NHMLA), literature and geologic map review, and a paleontological resources sensitivity analysis. These efforts identified the paleontological sensitivity of the project area and determined whether the project could result in significant impacts to paleontological resources in accordance with the California Environmental Quality Act (CEQA). Methods, results, and recommendations are summarized below; figures are provided in Attachment 1.

1.1 PROJECT LOCATION

The project is mapped within the El Toro US Geological Survey (USGS) 7.5-minute topographic quadrangle map (Township 5 South, Range 7 West, San Bernardino Base and Meridian) (Attachment 1: Figures 1-3). The project area begins 100 feet south of the intersection of Modjeska Canyon Road and Markuson Road and follows the length of Modjeska Grade Road to the intersection of Modjeska Grade Road and East Santiago Canyon Road in Orange County, California.

1.2 PROJECT DESCRIPTION

Modjeska Grade Road is an Orange County Public Works (OC Public Works) maintained County Highway. This road has a long history of extensive maintenance needs during the storm seasons. OC Public Works proposes to improve the drainage and erosion deficiencies along Modjeska Grade Road within the project limits. These improvements would result in safety enhancements for residents and travelers along Modjeska Grade Road, in addition to the surrounding uses along the corridor.

Roadway improvements would generally include pavement rehabilitation, paved shoulder (northbound shoulder from Santiago Truck Trail to East Santiago Canyon Road), construction of retaining walls, and installing guardrails. The existing pavement would be rehabilitated by removing and replacing the existing structural section for the entire length of the Project. Similar to existing conditions, the travel lanes would typically be 10 feet wide, except for a segment from the Shadowland Circle and Modjeska Grade Road intersection to approximately 630 feet south, where the travel lanes will be 8 feet wide. Paved shoulders will typically be one-foot wide, minimum. Roadway re-pavement would include a five- to seven-foot-wide paved northbound shoulder from the Santiago Truck Trail to East Santiago Canyon Road. The Project would construct up to four retaining walls ranging in height from three to six feet tall, and install and upgrade guardrails at approximately seven locations within the Project limits. For the purposes of improving the existing drainage system, the proposed Project would reconstruct up to four residential driveways.

Drainage improvements along Modjeska Grade Road would reduce the existing flooding, channelize storm flows, and reduce the potential for erosion. The proposed Project would construct concrete-lined swales, v-ditches, and asphalt concrete dikes along the roadway edges. Additional improvements would include replacing or upsizing the existing drainpipes and installing catch basins and inlets within Project limits to adequately capture and convey on-site stormwater flows. Energy dissipation measures would be installed to the system outlets to minimize erosion, turbulence, and turbidity since the Project discharges indirectly to the Santiago Creek and Aliso Creek, which are not engineered or hardened and are susceptible to hydromodification. An existing unlined manmade drainage structure adjacent to Modjeska Canyon Road

between Shadowland Circle and Santiago Creek will be modified to improve capacity and minimize erosion. The structure will be widened, and the westerly bank will be shifted west. The easterly bank and associated trees will be protected in place. Channel protection such as rip rap will be included where necessary to protect the structure bottom and banks.

The soil erosion of unpaved roadway shoulders and side slopes on-site would be reduced by paving roadway shoulders and installing erosion control measures such as hydroseed containing only locally prevalent native plant species, open weave textile, and turf reinforcement mat. Erosion along the roadway edges, which lead to sediment collection, inlet clogging, and slope stability issues at the tops of slopes, would be reduced by constructing concrete-lined swales and asphalt dikes that would convey channelized surface flows. The Project site includes both overhead and underground utilities, including overhead electric and telecommunication lines and power poles, as well as underground power, communication, and water lines.

Maximum depths of ground disturbance associated with Project construction are estimated to reach approximately 4 feet for the replacement of the existing pavement and drainage improvement work. Maximum depth for storm drain work may reach a depth of 8–10 feet at isolated locations within the APE.

2.0 GEOLOGICAL SETTING

California is divided into 11 geomorphic provinces, each defined by unique geologic and geomorphic characteristics. The project is in the northwestern portion of the Peninsular Ranges geomorphic province, which is marked by northwest-trending mountain ranges and valleys subparallel to the San Andreas Fault. This geomorphic province also includes physiogeographic features such as the Los Angeles Basin, the southern members of the Channel Islands, and the continental shelf (CGS 2002). The Peninsular Ranges province crosses several counties, as well as Baja California, and is bound by the Pacific Ocean to the west, the Transverse Ranges geomorphic province to the north, and the Colorado Desert geomorphic province to the east. The Peninsular Ranges are dominated by the Peninsular Ranges batholith (Prothero 2017).

The geology of the eastern Orange County area has been mapped by Rodgers (1965) at a scale of 1:250,000, by Morton and Miller (2006) at a scale of 1:100,000, and by Schoellhamer et al. (1981) at a scale of 1:24,000. The project area is located within the Santa Ana Mountains, which marks the eastern border of the Los Angeles Basin (Yerkes et al. 1965). Geologic units underlying the project area are mapped as young axial channel deposits (Qya), Santiago Formation (Tsa), Silverado Formation (Tsi), Pleasants Sandstone and Schulz Ranch Members of the Williams Formation (Kwps1 and Kwsr, respectively), and Baker Canyon Member of the Ladd Formation (Klbc) (Morton and Miller 2006).

The young axial channel deposits (Qya; Morton and Miller 2006) consist of slightly to moderately consolidated silts, sands, and gravels dating from the Late Pleistocene to Holocene epochs (126,000 years ago to the present) and have further been mapped and described as colluvial deposits, very old axial channel deposits (units 2 and 3), and young axial channel deposits by Diaz Yourman & Associates (DYA 2020). The Santiago Formation (Tsa) contains marine and nonmarine sandstones and conglomerates and dates to the middle Eocene epoch (47.8 to 46.2 million years ago; Prothero 2001). The Silverado Formation (Tsi), consisting of a basal conglomerate with overlying sandstones, siltstones, and clay layers of marine and nonmarine origin, dates to the Paleocene epoch (60.9 to 58.1 million years ago; Prothero and Lopez 2001). Dating to the late Campanian age of the Late Cretaceous Epoch (77 to 71 million years ago; Saul 1982; Saul and Squires 2008), the Pleasants Sandstone and Schulz Ranch Members of the Williams

Formation contain marine sandstones and particularly, course-grained conglomeratic sandstone near the project area (Morton and Miller 2006). The Baker Canyon Member of the Ladd Formation consists of marine and nonmarine conglomerates dating to the late Turonian age of the Late Cretaceous (94 to 89 million years ago; Saul 1982; Squires and Saul 2006).

The project area is within the Diegan Coastal Hills and Valleys ecoregion of California (Griffith et al. 2016). Ecoregions denote general similarity in ecosystems and environmental resources. This region comprises coastal terraces and steep foothills of the Peninsular Ranges and is cut by canyons with few wide valleys. This ecoregion stretches from the Santa Ana River to the Mexican border. Climate in this region is influenced by the ocean with thermic soil temperatures and xeric soil moisture, and vegetation present includes grasslands (annual and perennial), coastal scrub and chapparal, and small areas of oak woodlands.

The soil in the project area has been mapped as 13 distinct soil map units (NRCS 2022). Anaheim (Pachic Haploxerolls), Calleguas (Typic Xerorthents), Capistrano (Entic Haploxerolls), and Soper (Typic Argixerolls) series units are the most common soils of the project area, each composing at least 10 percent of the observed surface up to 26 percent (USDA 2001a, 2001b, 2003a, 2003b). Pachic Haploxerolls are a subgroup of fine loamy sands with a lithic contact (bedrock) within 50 centimeters of the soil surface and a base saturation of 75 percent in one of more horizons. Typic Xerorthents are a subgroup of well-drained, clay loam soils that have a lithic contact within 50 centimeters of the soil surface. Entic Haploxerolls are a subgroup of sandy loams with a lithic contact within 50 centimeters of the soil surface and either lacks a cambic horizon or has free carbonate material at depths below 25 centimeters of the surface. Typic Argixerolls are a subgroup of cobbly loams that have a lithic contact within 50 centimeters of the soil surface and a base saturation of 75 percent in one or more horizons (USDA 2010).

An erosion assessment report (DYA 2020) included bore logs from OC Public Works from along portions of the project area. These bore logs indicate the presence of undisturbed bedrock at depths as shallow as 1 to 4 feet below the current surface in the southern half of the project area (less than 200 feet south of the Santiago Truck Trailhead) and 8.5 to 14 feet near the northern end of the project (200 to 400 feet east of Canyon Heights Drive). Photographs included in the erosion report show bedrock exposures (outcrops) of Santiago and Silverado Formations and the Pleasants Sandstone Member of the Williams Formation at surface levels alongside the shoulders of Modjeska Grade Road.

3.0 RECORDS SEARCH AND LITERATURE SEARCH

Michael Baker International staff requested and received a fossil locality records search through the NHMLAC on May 24, 2022 (Attachment 2). The NHMLAC records search did not find any previously known localities within the project area. However, NHMLAC staff identified hundreds of localities bearing invertebrate fossils within 5 miles of the project area from similar sedimentary deposits as those found on the project. Additionally, vertebrate fossils have been collected from similar sedimentary deposits from one locality located 42 miles southeast of the project area (Table 1).

Table 1 – Previously Recorded Paleontological Resources from NHMLA Records Search

Collection Number	Taxa	Formation	Intervals	Depth	Distance to Project Site
Hundreds of invertebrate localities	Diverse Cretaceous assemblage including bivalves, gastropods, cephalopods, and scaphopods	Pleasants Sandstone Member, Williams Formation	Late Cretaceous	Surface	<1 mile N
LACM IP 7198	Unspecified invertebrates	Santiago Formation	middle Eocene	Surface	~2.5 miles N
12 invertebrate localities	Invertebrates	Silverado Formation	Paleocene	Surface	~5 miles NE
LACM VP 3881	Ungulates (perissodactyls and artiodactyls), brontotheres, turtles, and crocodiles	Santiago Formation	middle Eocene	Unknown	~42 miles SE

Michael Baker International conducted supplemental paleontological records searches within 5 miles of the project area using the following databases:

- University of California Museum of Paleontology Locality Search (UCMP 2022)
- San Diego Natural History Museum Collection Database (SDNHM 2022)
- The Paleobiology Database (PBDB 2022)

While these databases showed no previously identified fossil-bearing localities within the property area, several localities have been reported within 5 miles of the project site (Table 2). There are additional invertebrate and vertebrate localities within 5 miles of the project site but that correspond to geologic units not represented within the project area on the local geologic map (Morton and Miller 2006) or the erosion assessment report (DYA 2020), such as the Holz Shale Member of the Ladd Formation, and the Sespe, Vaqueros, Puente, Topanga, Monterey, and Capistrano Formations. The records searches were limited to data available online.

Table 2 – Previously Recorded Paleontological Resources from Online Databases

Collection	Taxa	Formation	Intervals	Distance to Project Site
PBDB	Bivalves (clams, cockles, mussels, oysters), gastropods (snails, conchs)	Santiago Formation	Middle Eocene	~5 miles NW
PBDB	Bivalves (clams, cockles), gastropods (snails, conchs), cephalopods (ammonites, baculites), scaphopods	Pleasants Sandstone Member, Williams Formation	Late Cretaceous	<1 mile N
PBDB	Bivalves (clams, cockles), gastropods (snails, conchs), cephalopods (ammonites, baculites)	Pleasants Sandstone Member, Williams Formation	Late Cretaceous	~2 miles N

Collection	Taxa	Formation	Intervals	Distance to Project Site
PBDB	Bivalves (clams), gastropods (snails, cowries), cephalopods (nautilus, baculites, ammonites)	Pleasants Sandstone Member, Williams Formation	Late Cretaceous	~4 miles W
PBDB	Bivalves (clams), gastropods (snails), cephalopods (baculites)	Williams Formation	Late Cretaceous	<1 mile N
PBDB	Bivalves (oysters, clams, cockles), gastropods (snails, conchs)	Williams Formation	Late Cretaceous	~5 miles NW
PBDB	Bivalves (clams, cockles, oysters), gastropods (snails), cephalopods (ammonites), bryozoans	Baker Canyon Member, Ladd Formation	Late Cretaceous	<1 mile N
PBDB	Bivalves (clams, cockles, mussels), gastropods (snails), cephalopods (ammonites, baculites)	Baker Canyon Member, Ladd Formation	Late Cretaceous	~2 miles N
PBDB	Bivalves (clams, cockles), gastropods (snails, conchs), cephalopods (ammonites, baculites)	Baker Canyon Member, Ladd Formation	Late Cretaceous	~3 miles N
PBDB	Gastropods (snails)	Baker Canyon Member, Ladd Formation	Late Cretaceous	~3 miles SE
PBDB	Bivalves (clams), gastropods (snails, conchs), cephalopods (ammonites, baculites)	Ladd Formation	Late Cretaceous	~3 miles N
PBDB	Hadrosaurs (duck-billed dinosaurs)	Williams or Ladd Formation	Late Cretaceous	Unknown (within Orange County)
SDNHM	Gastropods (snails), bivalves (clams, cockles, oysters), cephalopods (baculites)	Williams Formation	Late Cretaceous	~1.5 miles N
SDNHM	Bivalves (clams, scallops, oysters), gastropods (snails), decapods (ghost shrimp), worms	Ladd Formation	Late Cretaceous	~3 miles N
UCMP	Gastropods (snails)	Pleasants Sandstone Member, Williams Formation	Late Cretaceous	<1 mile S
UCMP	Bivalves (clams)	Pleasants Sandstone Member, Williams Formation	Late Cretaceous	Unknown (within Orange County)
UCMP	Bivalves (clams, mussels), gastropods (snails)	Williams Formation	Late Cretaceous	Unknown (within Orange County)

Collection	Taxa	Formation	Intervals	Distance to Project Site
UCMP	Plesiosaurs (marine reptiles), bivalves (clams, cockles, mussels, oysters, scallops), gastropods (snails, cowries), echinoderms (urchins)	Ladd Formation	Late Cretaceous	Unknown (within Orange County)
UCMP	Gastropods (snails)	Ladd Formation	Late Cretaceous	Unknown (within Riverside County)

Reviewing the published scientific literature also yielded reported occurrences of fossils throughout the Santa Ana Mountains and the geologic formations underlying the project area. Numerous vertebrate fossils, including birds, marsupials, shrews, carnivores, primates, rodents, even- and odd-toed ungulates, crocodiles, snakes, and turtles, from the Santiago Formation were recovered during housing construction near San Clemente (Santos 2018). Not many fossils have been published from the Silverado Formation but the pollen spore fossils present have been used to refine the age of the formation (late Paleocene) and to identify the depositional environment as a lowland swamp within a river delta (Gaponoff 1984).

A variety of fossils have been recovered from the Late Cretaceous geologic formations of the Santa Ana Mountains. Fossils from the Williams Formation include hadrosaurs and unidentified dinosaurs (Hilton 2003), invertebrates from the Pleasants Sandstone Member (Enzweiler and Bottjer 1986), and gastropods and trace fossils from the Schulz Ranch Member (Bottjer, Buck, and Enzweiler 1982; Groves, Filkorn, and Alderson 2011). The Ladd Formation has yielded hadrosaur, turtle, and plesiosaur specimens (Hilton 2003), trace fossils (Link and Bottjer 1982), bivalves (Stallwood 1995), and gastropods (Groves 2004). Within the Ladd Formation, the Baker Canyon Member has produced trace fossils (Bottjer, Buck, and Enzweiler 1982) and gastropods (Saul 1996).

4.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS

The NHMLAC paleontological records search and fossil locality searches within online databases (PBDB, SDNHM, and UCMP) did not identify any paleontological resources within the project area. However, several hundred localities have been found within 5 miles of the project area from similar rock formations to those underlying the project. Per mitigation impact guidelines set forth by the Society of Vertebrate Paleontology (SVP 2010), due to the fossil sensitivity of the rock formations present within the project area (young axial channel deposits of Holocene to late Pleistocene age, Eocene Santiago Formation, Paleocene Silverado Formation, Late Cretaceous Pleasants Sandstone and Schulz Ranch Members of the Williams Formation, and Late Cretaceous Baker Canyon Member of the Ladd Formation), the project has a high potential to disturb paleontological resources within undisturbed bedrock.

Full-time paleontological monitoring is recommended during ground disturbance in undisturbed geologic contexts (i.e., bedrock and outcrops) which have the potential to contain significant paleontological resources. Ground disturbance refers to activities that would impact subsurface geologic deposits, such as grading, excavation, boring, etc. Activities taking place in current topsoil or within previously disturbed fill sediments, e.g., clearing, grubbing, and pavement rehabilitation, do not require paleontological monitoring. Bedrock can occur at shallow depths (e.g., 1 to 4 feet below current surface) or depths greater

than 8 feet depending on the portion of the project area. Undisturbed geologic outcrops can be found along the length of the project, along the shoulders of Modjeska Grade Road. The following mitigation measures are recommended to be implemented such that in the event of any discovery of unknown paleontological resources during earthwork, impacts would be **less than significant**.

The OC Public Works shall retain a Society of Vertebrate Paleontology-qualified paleontologist (SVP 2010) to provide or supervise a paleontological sensitivity training to all personnel planned to be involved with earth-moving activities, prior to grading or excavation in sedimentary rock material other than topsoil. The training session will focus on how to identify paleontological resources, such as fossils that may be encountered, and the procedures to follow if identified.

> A qualified professional paleontologist is a professional with a graduate degree in paleontology, geology, or related field, with demonstrated experience in the vertebrate, invertebrate, or botanical paleontology of California, as well as at least one year of full-time professional experience or equivalent specialized training in paleontological research (i.e., the identification of fossil deposits, application of paleontological field and laboratory procedures and techniques, and curation of fossil specimens), and at least four months of supervised field and analytic experience in general North American paleontology (SVP 2010).

Prior to grading or excavation in sedimentary rock material other than topsoil, OC Public Works shall retain an SVP-qualified paleontologist to monitor or supervise the monitoring of these activities. In the event that paleontological resources are encountered during earth-disturbing activities, the paleontological monitor, in discussion with the SVP-qualified paleontologist, will notify the on-site construction supervisor, who shall redirect construction activities within 50 feet of the discovery. The qualified paleontologist shall evaluate the find. If the qualified paleontologist finds that the resource is not a significant fossil, then work may resume immediately. If the qualified paleontologist finds the resource is potentially significant, then the qualified paleontologist shall make recommendations for appropriate treatment in accordance with Society for Vertebrate Paleontology guidelines for identification, evaluation, disclosure, avoidance, recovery, and/or curation, as appropriate.

If the fossils are determined to be significant, then the SVP-qualified paleontologist shall prepare and implement a data recovery plan. The plan shall include, but not be limited to, the following measures:

- The paleontologist shall ensure that all significant fossils collected are cleaned, identified, catalogued, and permanently curated with an appropriate institution with a research interest in the materials (which may include the County of Orange Paleontology and Archaeology Collections);
- The paleontologist shall ensure that specialty studies are completed, as appropriate, for any significant fossil collected; and
- The paleontologist shall ensure that curation of fossils is completed in consultation with the OC Public Works. A letter of acceptance from the curation institution shall be submitted to the OC Public Works.

PREPARER QUALIFICATIONS

Peter A. Kloess, Ph.D.- Principal Investigator

Dr. Kloess is a principal investigator and paleontologist with over 20 years of experience in paleontology, with 7 years in paleontology mitigation. His experience includes private and public consultation, field monitoring, excavation, and laboratory research on projects across the western United States, in California. He has consulting experience with a range of projects, including construction, transportation, utility, transmission, monitoring, and surveys, as well as expertise recovering a diversity of fossils from project sites, such as marine invertebrates, microfossils, plants, small mammals, and birds, large marine and terrestrial mammals, and dinosaurs. He also has extensive experience in paleontological museum collections and lab settings. He has worked on and co-led scientific excavations of large mammals and dinosaurs in California, Utah, New Mexico, and Montana. Dr. Kloess has served as a lab preparator and assistant curator for paleontology museums in California and Montana, where his duties included manual preparation of specimens, casting, jacketing, public outreach, cataloging, and curation. He meets the Society of Vertebrate Paleontology's standards for paleontological Principal Investigator.

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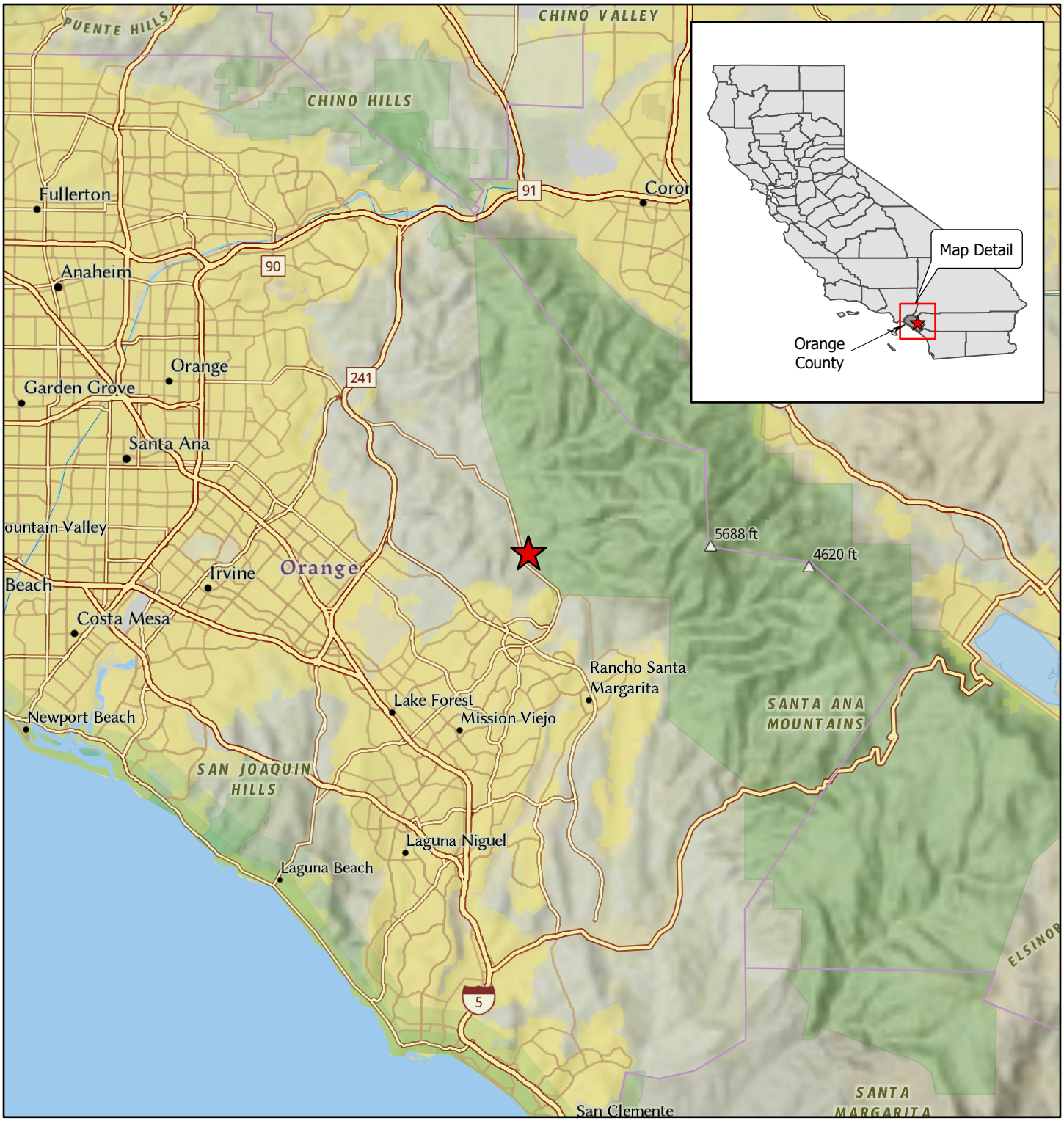
Attachment 1 **Figures**

Attachment 2 **Records Search Results**



Legend

Project Location

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

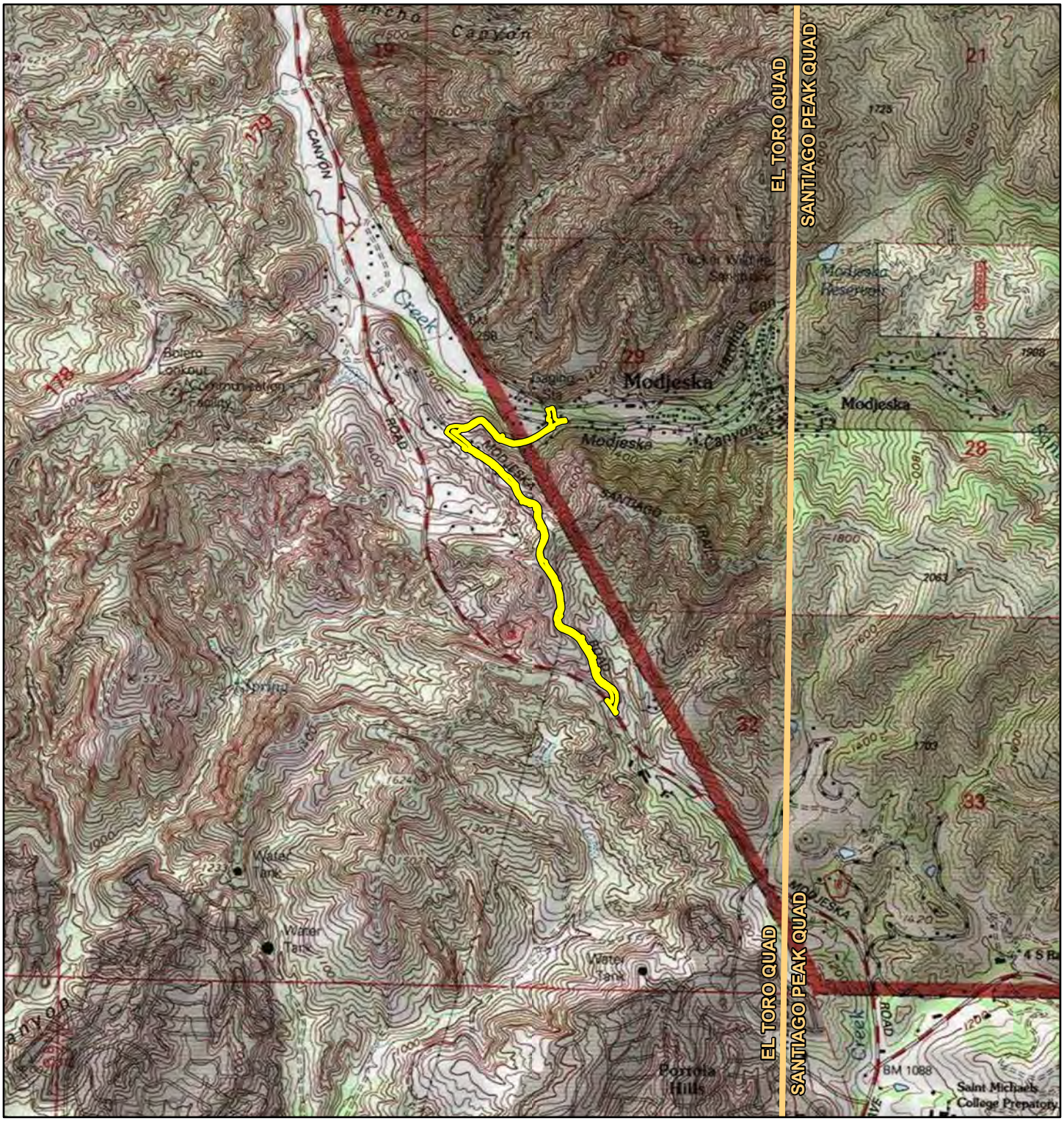
Michael Baker INTERNATIONAL

0 2.5 5 Miles

Source: Esri, ArcGIS Online, National Geographic World Map: *Silverado, California*

Project Vicinity

Figure 1



Legend

Area of Potential Effects

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

0 0.25 0.5 Miles

Source: Esri, ArcGIS Online, El Toro USGS 7.5-Minute topographic quadrangle maps: *Silverado, California*

Project Location

Figure 2

Area of Potential Effects

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

0 500 1,000 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: Silverado, California

Figure 3

Area of Potential Effects

Parcels

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

N

0 50 100 200 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: *Silverado, California*

Area of Potential Effects

Parcels

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

N

0 50 100 200 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: *Silverado, California*

Area of Potential Effects

Parcels

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

N

0 50 100 200 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: *Silverado, California*

Area of Potential Effects

Parcels

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

N

0 50 100 200 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: *Silverado, California*

Area of Potential Effects

Parcels

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

N

0 50 100 200 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: *Silverado, California*

Area of Potential Effects

Parcels

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

N

0 50 100 200 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: *Silverado, California*

Area of Potential Effects

Parcels

MODJESKA GRADE ROAD IMPROVEMENTS PROJECT

Michael Baker INTERNATIONAL

N

0 50 100 200 Feet

Area of Potential Effects

Source: Esri, ArcGIS Online, 2021 Nearmap Imagery: *Silverado, California*

Attachment 2 **Records Search Results**

Natural History Museum
of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
www.nhm.org

Research & Collections

e-mail: paleorecords@nhm.org

May 29, 2022

Michael Baker International

Attn: Jacob Parsley

re: Paleontological resources for the Modjeska Grade Road Project

Dear Jacob:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for proposed development at the the Modjeska Grade Road project area as outlined on the portion of the El Toro USGS topographic quadrangle map that you sent to me via e-mail on May 24, 2022. We do not have any fossil localities that lie directly within the proposed project area, but we do have fossil localities nearby from the same sedimentary deposits that occur in the proposed project area, either at the surface or at depth.

The following table shows the closest known localities in the collection of the Natural History Museum of Los Angeles County (NHMLA).

Locality Number	Location	Formation	Taxa	Depth
Hundreds of invertebrate localities	Ridge on either side of Modjeska Canyon and west side of Santiago Canyon	Pleasant Sandstone Member, Williams Formation	Diverse Cretaceous assemblage including bivalves (*Cucullaea*, *Pterotrigonia, Cymbophora, Petromactra, Meekia, Alleinacin, Glycymerita, Lembulus),* gastropods (*Anchura, Aporrhaidae, Turritella)*, scaphopods, ammonites (Baculitidae) and others.	Surface
LACM IP 7198	7/8 mile N, 14 mi E of B.M. 610 in Santiago Canyon	Santiago Formation (concretionary sandstone)	Invertebrates (unspecified)	Surface
12 invertebrate localities	West of Star Peak and east of Highway 241	Silverado Formation	Invertebrates, largely uncatalogued but including murex snalis (*Pseudoperissolax*)	Surface
LACM VP 3881	Carlsbad Palisades housing development along El Camino Real (southwest side) 0.2	Santiago Formation (transition zone from white sandstone below to olive mudstone	Odd-toed ungulate (Perissodactyla), even-toed ungulates (Artiodactyla), brontothere (Brontotheriidae), rhinoceras relative (*Amynodon*),	Unknown; discovered during housing construction

	mile west of intersection of El Camino Real & Kelly Drive; Carlsbad, CA	above)	rhinoceras family (Rhinocerotoidae), softshell turtle (Trionichidae), tortoises (Testudinidae), crocodile (Crocodilia), other uncatalogued vertebrates

VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface

This records search covers only the records of the NHMLA. It is not intended as a paleontological assessment of the project area for the purposes of CEQA or NEPA. Potentially fossil-bearing units are present in the project area, either at the surface or in the subsurface. As such, NHMLA recommends that a full paleontological assessment of the project area be conducted by a paleontologist meeting Bureau of Land Management or Society of Vertebrate Paleontology standards.

Sincerely,

Alyssa Bell, Ph.D.
Natural History Museum of Los Angeles County

enclosure: invoice