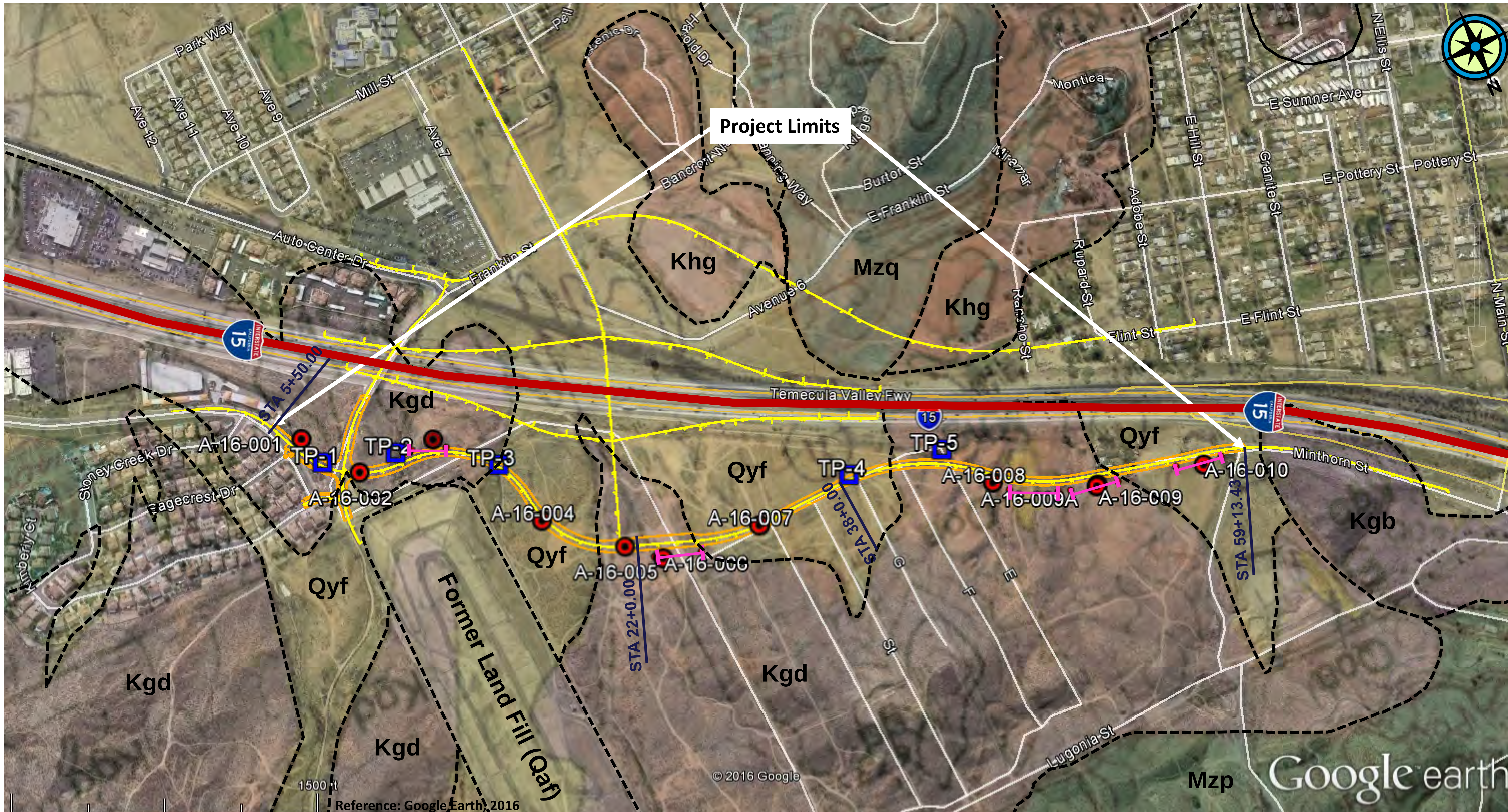


EXPLANATION

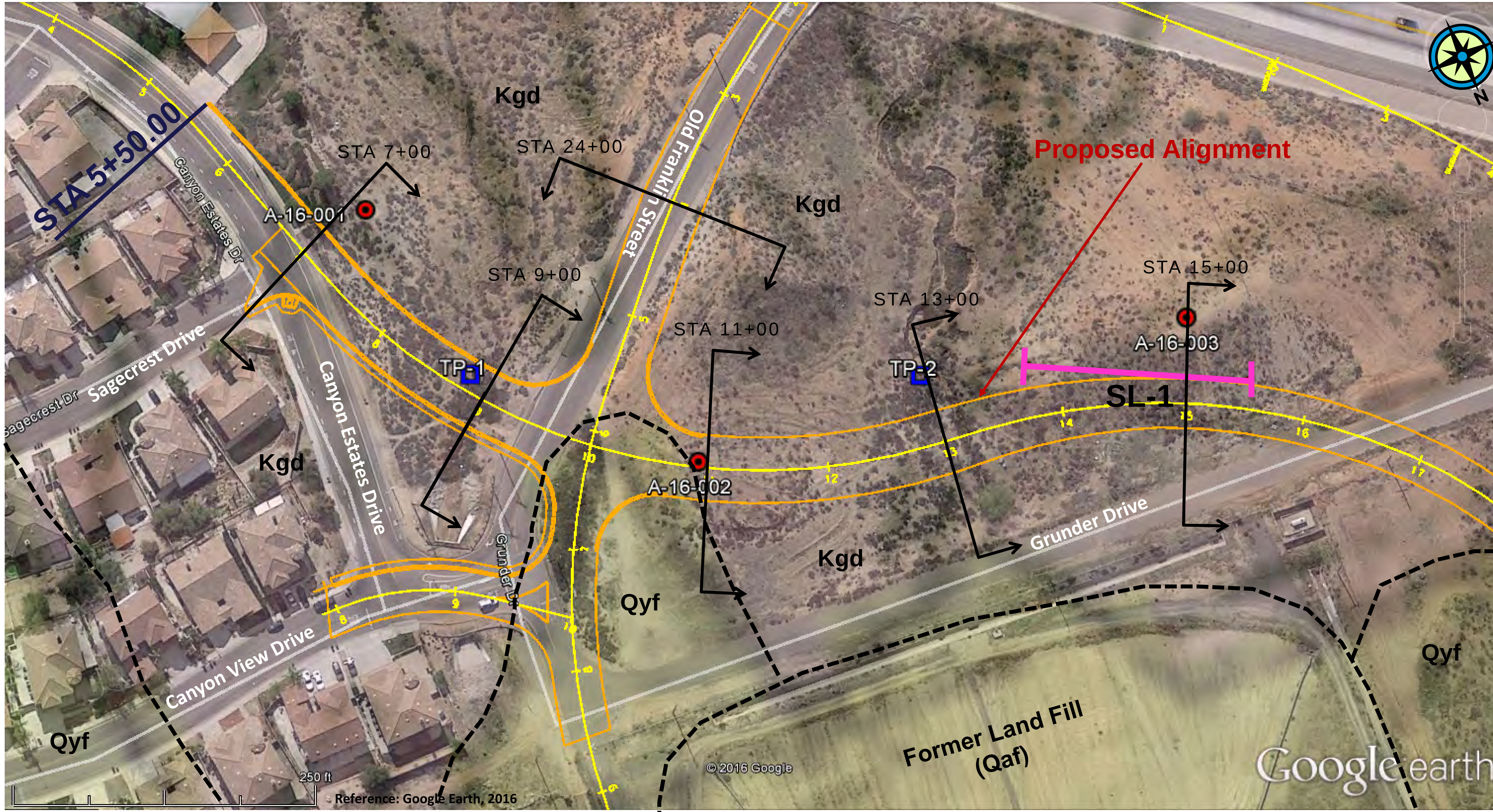
- Hollow Stem Auger Boring
- Test Pit
- Seismic Refraction Traverse

Qaf	Artificial Fill (Late Holocene)
Qyf	Young (Holocene to Late Pleistocene) Alluvial Fan and Alluvial Deposits
Kgd, Khg, Mzq, Mzp	Generic Cretaceous granitic rocks of the Peninsular Ranges batholith
	Approximate Geologic Contact Based on the Geologic Map of the Elsinore 7.5' Quadrangle

Note: Geotechnical cross-sections shown in Figures 4A through 4AI.

STA 57+00 — Geotechnical Cross-Section and Station Number

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 5A
	Project Name: CAMINO DEL NORTE EXTENSION Lake Elsinore, California	Project Number: IR 645
	EXPLORATIONS LOCATIONS AND GEOLOGY ON AERIAL PHOTOGRAPHS	



EXPLANATION

- Hollow Stem Auger Boring
- Test Pit
- Seismic Refraction Traverse

Qaf — Artificial Fill (Late Holocene)

Qyf — Young (Holocene to Late Pleistocene) Alluvial Fan and Alluvial Deposits

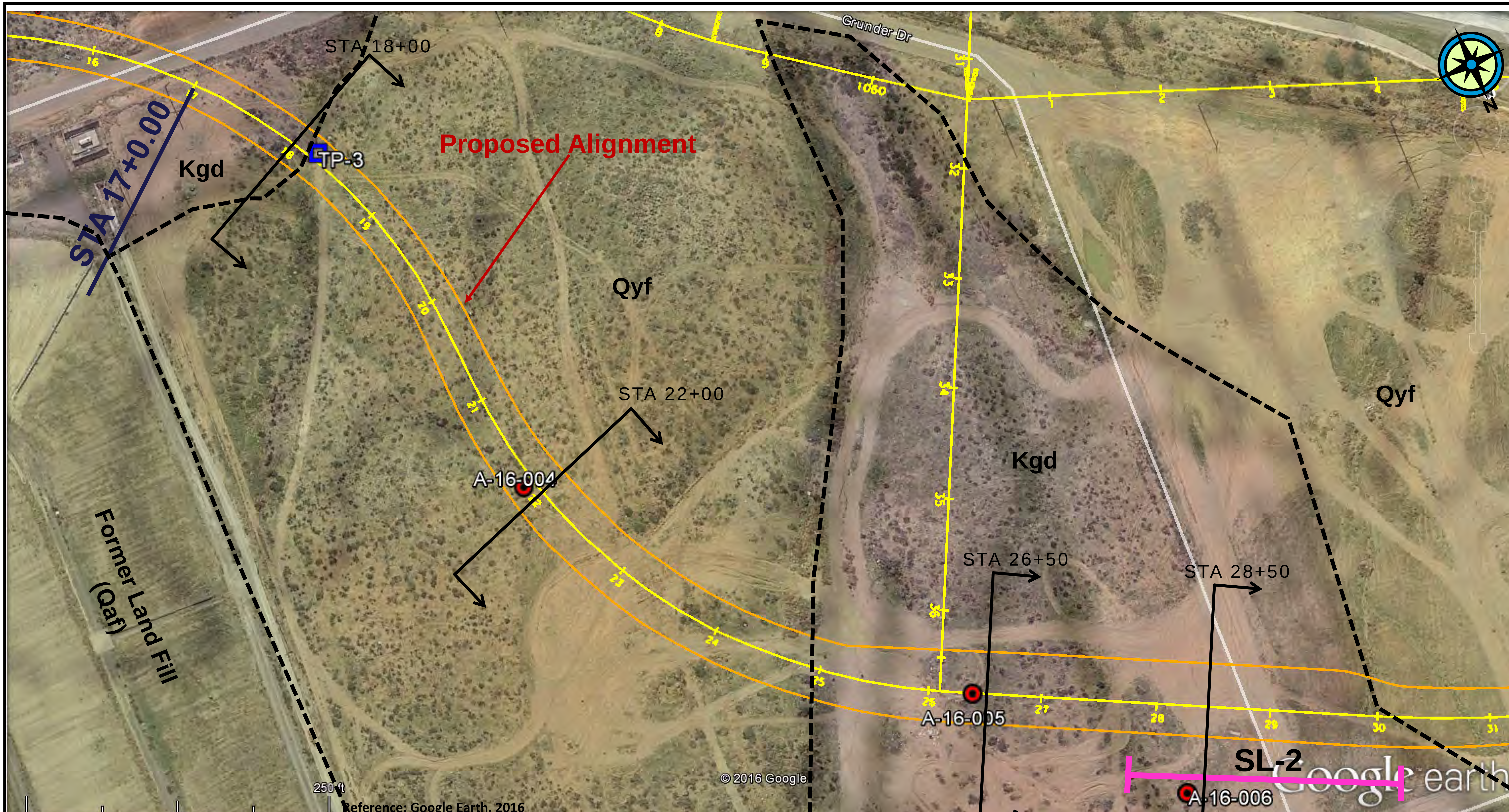
Kgd, Khg, Mzq, Mzp — Generic Cretaceous granitic rocks of the Peninsular Ranges batholith

Approximate Geologic Contact Based on the Geologic Map of the Elsinore 7.5' Quadrangle

Note: Geotechnical cross-sections shown in Figures 4A through 4AI.

STA 57+00 — Geotechnical Cross-Section and Station Number

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 5B
	Project Name: CAMINO DEL NORTE EXTENSION Lake Elsinore, California	Project Number: IR 645
	EXPLORATIONS LOCATIONS AND GEOLOGY ON AERIAL PHOTOGRAPHS	



EXPLANATION

- Hollow Stem Auger Boring
- Test Pit
- Seismic Refraction Traverse

Qaf — Artificial Fill (Late Holocene)

Qyf — Young (Holocene to Late Pleistocene) Alluvial Fan and Alluvial Deposits

Kgd, Khg, Mzq, Mzp — Generic Cretaceous granitic rocks of the Peninsular Ranges batholith

Approximate Geologic Contact Based on the Geologic Map of the Elsinore 7.5' Quadrangle

Note: Geotechnical cross-sections shown in Figures 4A through 4AI.

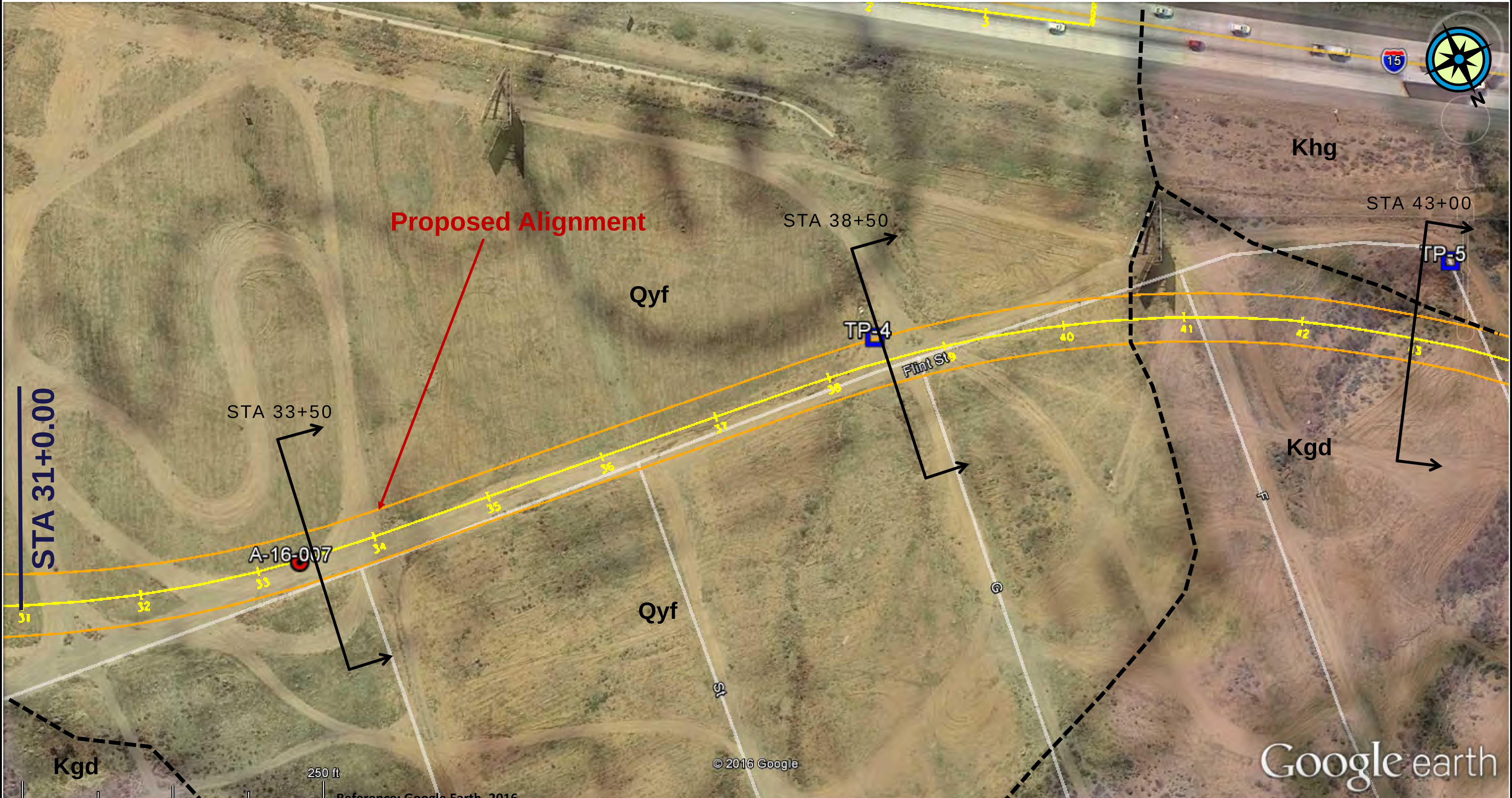
STA 57+00 — Geotechnical Cross-Section and Station Number

GROUP DELTA

GROUP DELTA CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS
32 MAUCHLY, SUITE B
IRVINE, CA 92618 (949) 450-2100

Project Name: CAMINO DEL NORTE EXTENSION, Lake Elsinore, California	Figure Number: 5C
	Project Number: IR 645

EXPLORATIONS LOCATIONS AND GEOLOGY ON AERIAL PHOTOGRAPHS



Reference: Google Earth, 2016

EXPLANATION

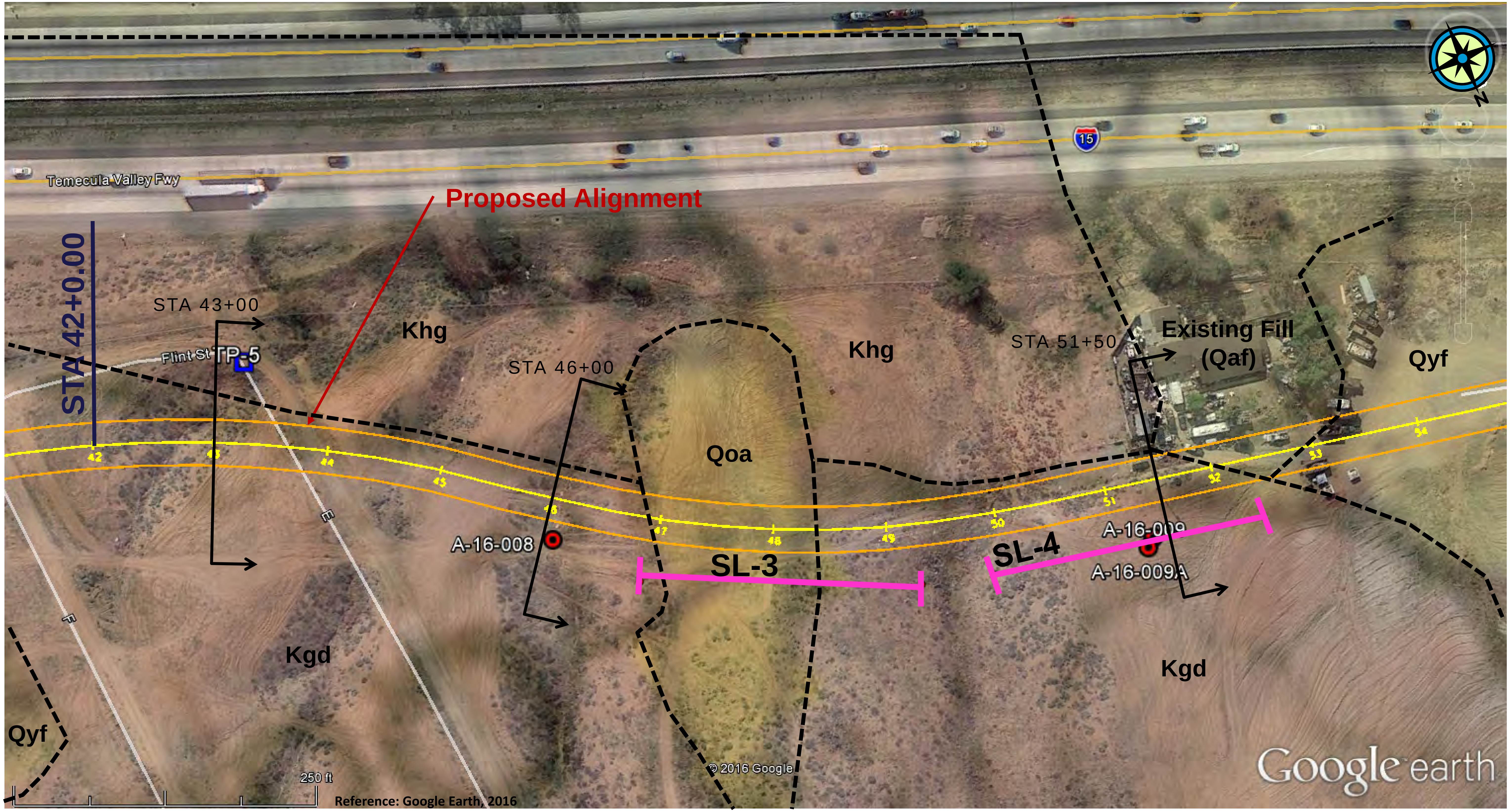
- Hollow Stem Auger Boring
- Test Pit
- Seismic Refraction Traverse

Qaf	Artificial Fill (Late Holocene)
Qyf	Young (Holocene to Late Pleistocene) Alluvial Fan and Alluvial Deposits
Kgd, Khg, Mzq, Mzp	Generic Cretaceous granitic rocks of the Peninsular Ranges batholith
(dashed line)	Approximate Geologic Contact Based on the Geologic Map of the Elsinore 7.5' Quadrangle

Note: Geotechnical cross-sections shown in Figures 4A through 4AI.

STA 57+00
Geotechnical Cross-Section and Station Number

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 5D
	Project Name: CAMINO DEL NORTE EXTENSION Lake Elsinore, California	Project Number: IR 645
	EXPLORATIONS LOCATIONS AND GEOLOGY ON AERIAL PHOTOGRAPHS	



Reference: Google Earth, 2016

EXPLANATION

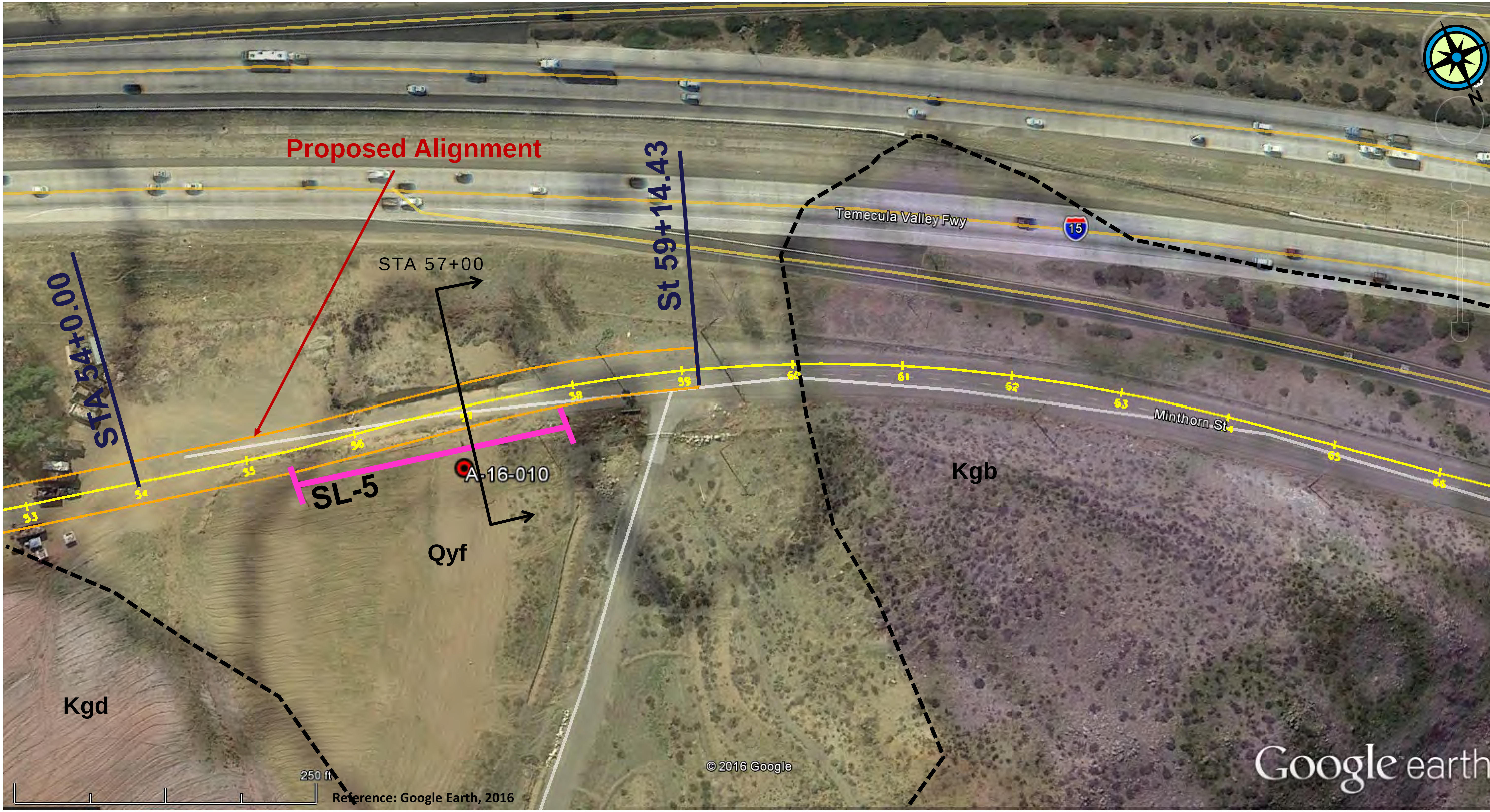
- Hollow Stem Auger Boring
- Test Pit
- Seismic Refraction Traverse

Qaf	Artificial Fill (Late Holocene)
Qyf	Young (Holocene to Late Pleistocene) Alluvial Fan and Alluvial Deposits
Qoa	Old (Holocene to Late Pleistocene) Alluvial-Fan Deposits
Kgd, Khg, Mzq, Mzp	Generic Cretaceous granitic rocks of the Peninsular Ranges batholith
- - -	Approximate Geologic Contact Based on the Geologic Map of the Elsinore 7.5' Quadrangle

Note: Geotechnical cross-sections shown in Figures 4A through 4AI.

STA 57+00 — Geotechnical Cross-Section and Station Number

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 5E
	Project Name: CAMINO DEL NORTE EXTENSION Lake Elsinore, California	Project Number: IR 645
	EXPLORATIONS LOCATIONS AND GEOLOGY ON AERIAL PHOTOGRAPHS	



EXPLANATION

- Hollow Stem Auger Boring
- Test Pit
- Seismic Refraction Traverse

Qyf	Young (Holocene to Late Pleistocene) Alluvial Fan and Alluvial Deposits
Qoa	Old (Holocene to Late Pleistocene) Alluvial-Fan Deposits
Kgd, Kgb, Mzq, Mzp	Generic Cretaceous granitic rocks of the Peninsular Ranges batholith
- - -	Approximate Geologic Contact Based on the Geologic Map of the Elsinore 7.5' Quadrangle

Note: Geotechnical cross-sections shown in Figures 4A through 4AI.

STA 57+00 — Geotechnical Cross-Section and Station Number

GROUP DELTA

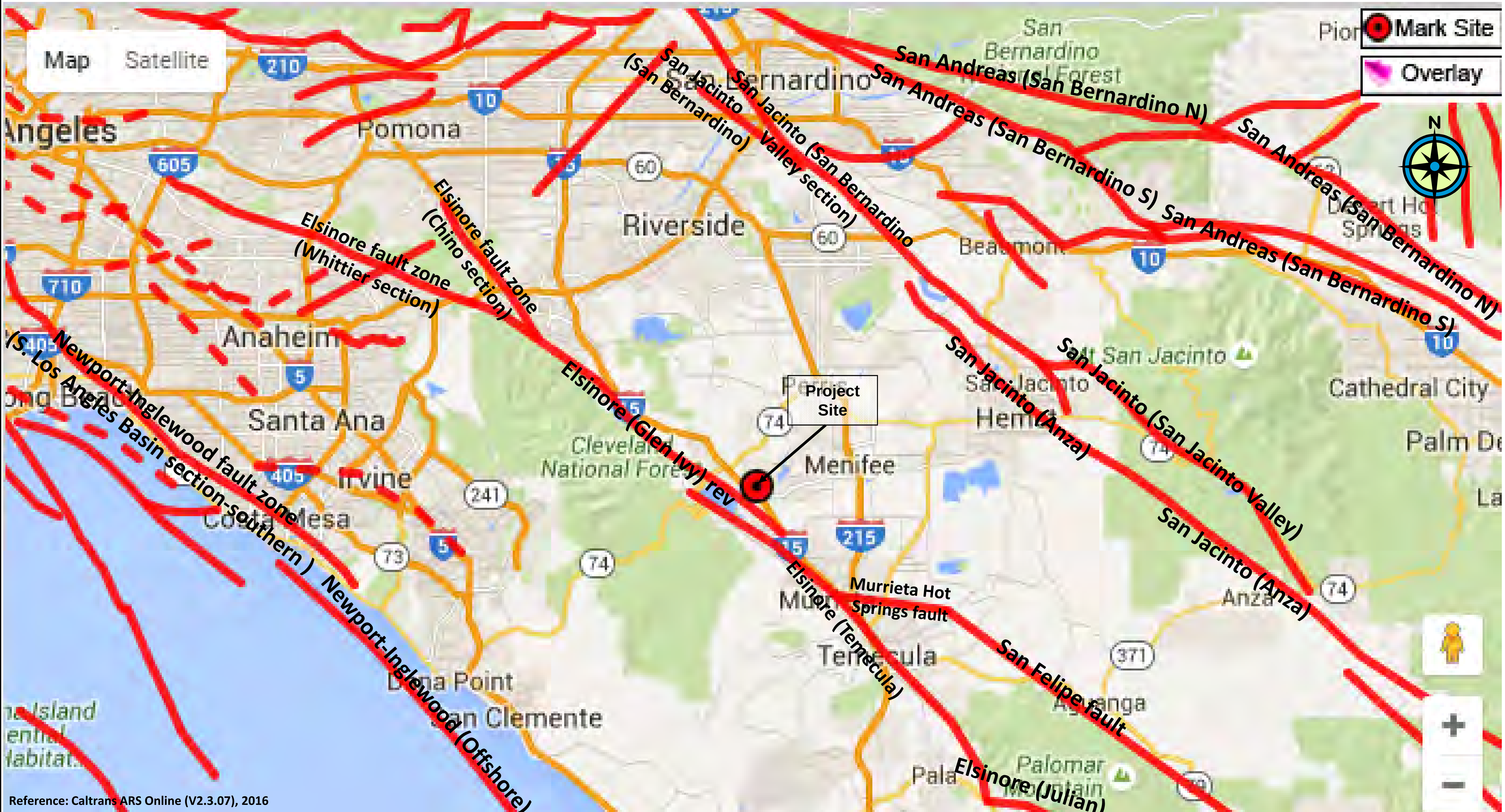
GROUP DELTA CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS
32 MAUCHLY, SUITE B
IRVINE, CA 92618 (949) 450-2100

Figure Number: 5F

Project Name: CAMINO DEL NORTE EXTENSION
Lake Elsinore, California

Project Number: IR 645

EXPLORATIONS LOCATIONS AND GEOLOGY ON AERIAL PHOTOGRAPHS



1.97	Km Elsinore (Glen Ivy) rev	M_{MAX}= 7.7	Fault Type = Strike Slip
4.25	Km Elsinore (Temecula)	M_{MAX}= 7.7	Fault Type = Strike Slip
29.42	Km San Jacinto (Anza)	M_{MAX}= 7.7	Fault Type = Strike Slip
32.46	Km San Jacinto (San Jacinto Valley)	M_{MAX}= 7.7	Fault Type = Strike Slip
35.51	Km San Jacinto (San Bernardino Valley section)	M_{MAX}= 7.7	Fault Type = Strike Slip

37.30	Km San Jacinto (San Jacinto Valley-Southern Ext.)	M_{MAX}= 7.7	Fault Type = Strike Slip
38.36	Km San Jacinto (San Bernardino)	M_{MAX}= 7.7	Fault Type = Strike Slip
51.30	Km San Andreas (San Bernardino S)	M_{MAX}= 7.9	Fault Type = Strike Slip
16.32	Km Murrieta Hot Springs fault	M_{MAX}= 6.3	Fault Type = Normal
46.72	Km Elsinore (Julian)	M_{MAX}= 7.7	Fault Type = Strike Slip

GROUP DELTA

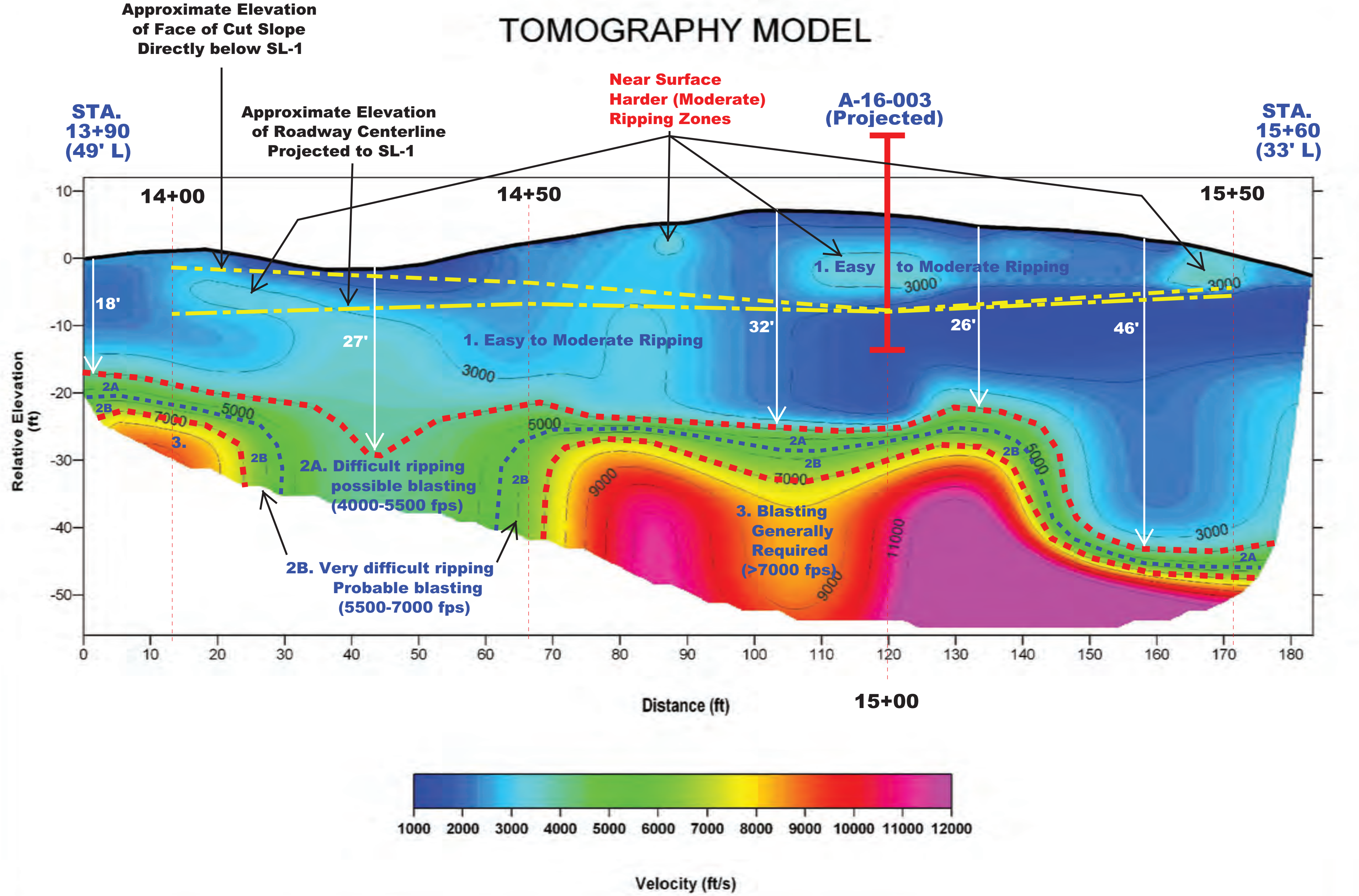
GROUP DELTA CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS
32 MAUCHLY, SUITE B
IRVINE, CA 92618 (949) 450-2100

Figure Number: 6

Project Name: **CAMINO DEL NORTE, Lake Elsinore, CA**

Project Number: IR 645

CALTRANS FAULT MAP



SEISMIC PROFILE SL-1

Camino Del Norte Extension
Lake Elsinore, California

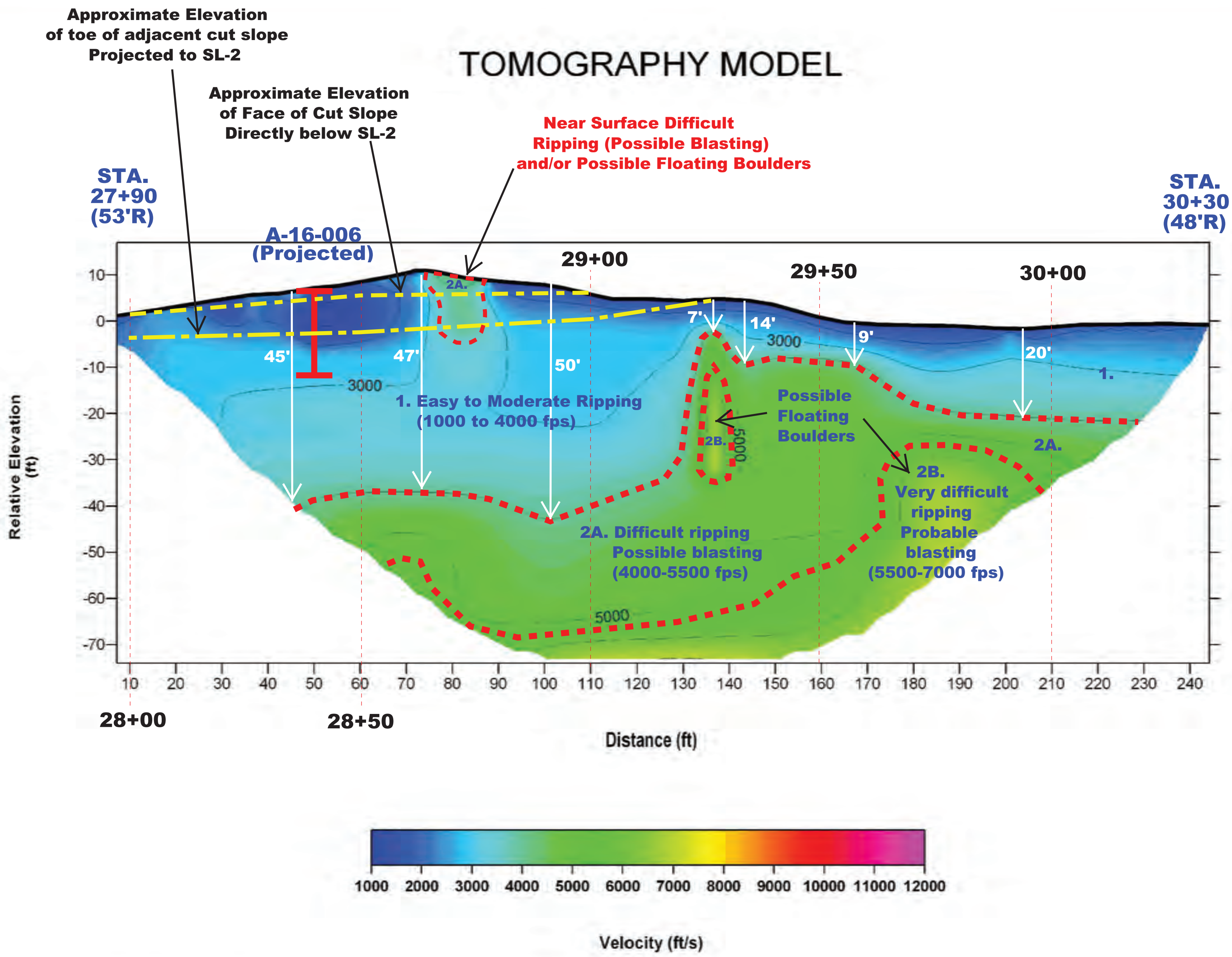
Project No.: 116130 | Date: 04/16

SOUTHWEST GEOPHYSICS INC.

Figure 4a

FIGURE 7A

Note: Contour Interval = 1,000 feet per second



SEISMIC PROFILE SL-2

Camino Del Norte Extension
Lake Elsinore, California

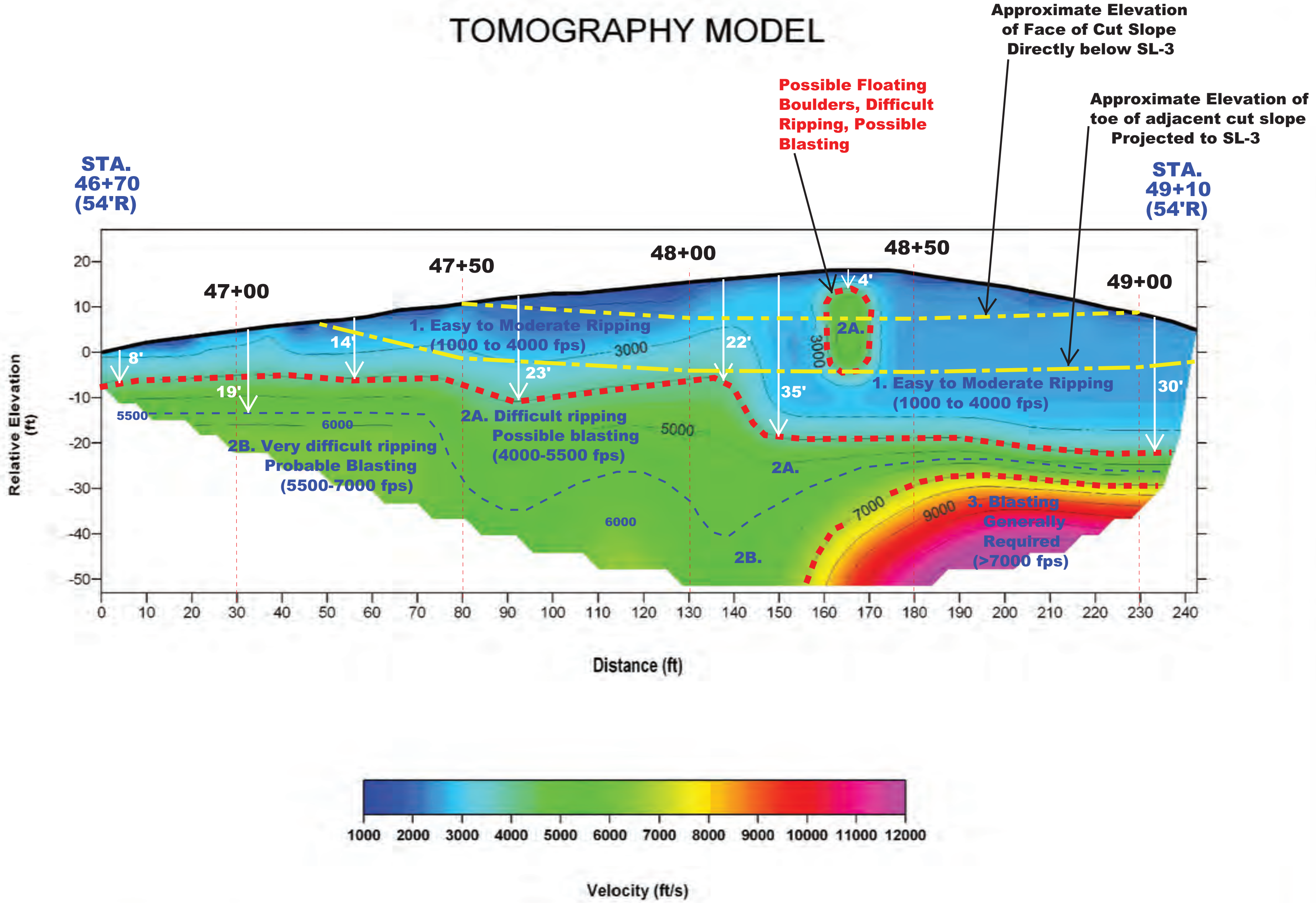
Project No.: 116130 | Date: 04/16

SOUTHWEST GEOPHYSICS INC.

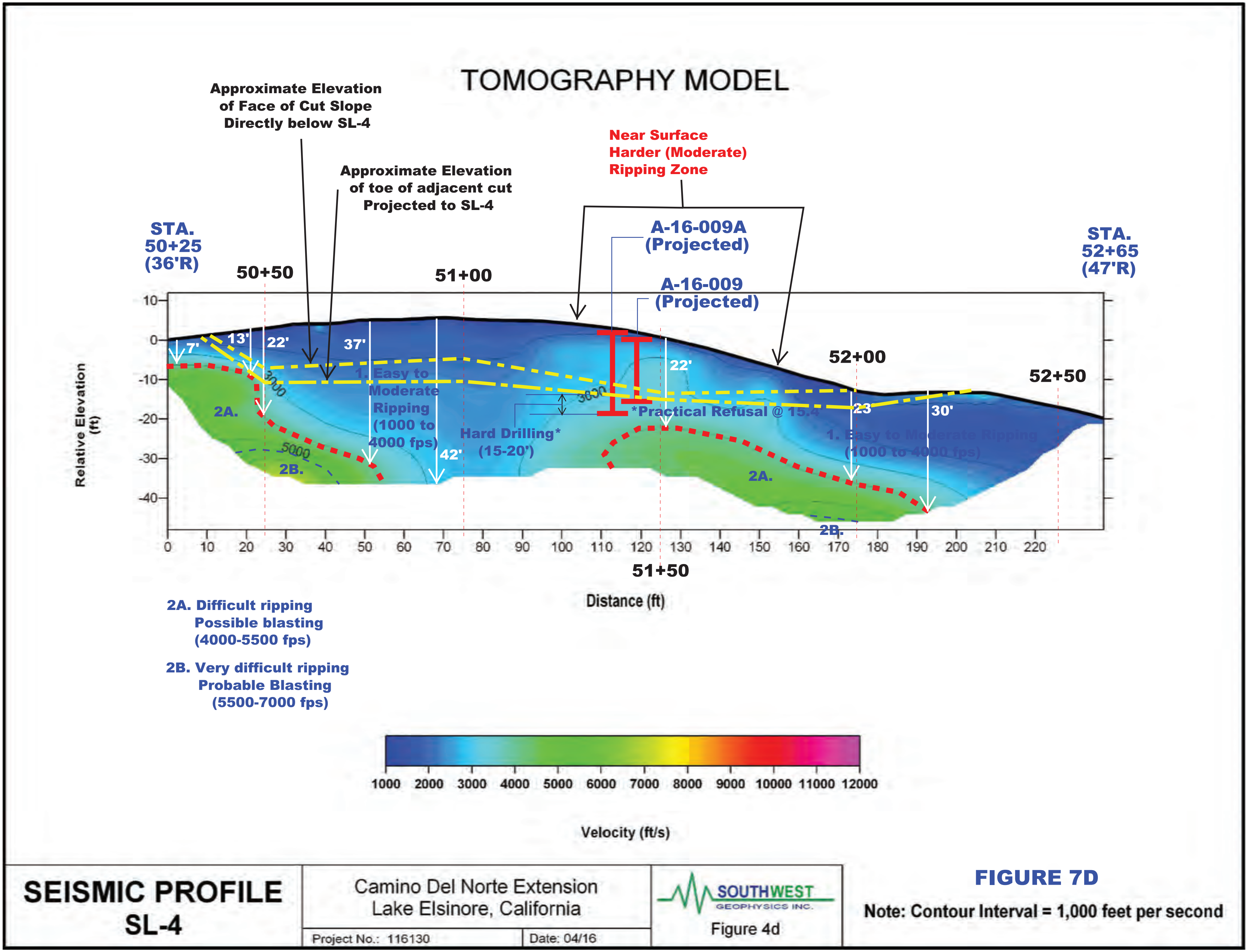
Figure 4b

FIGURE 7B

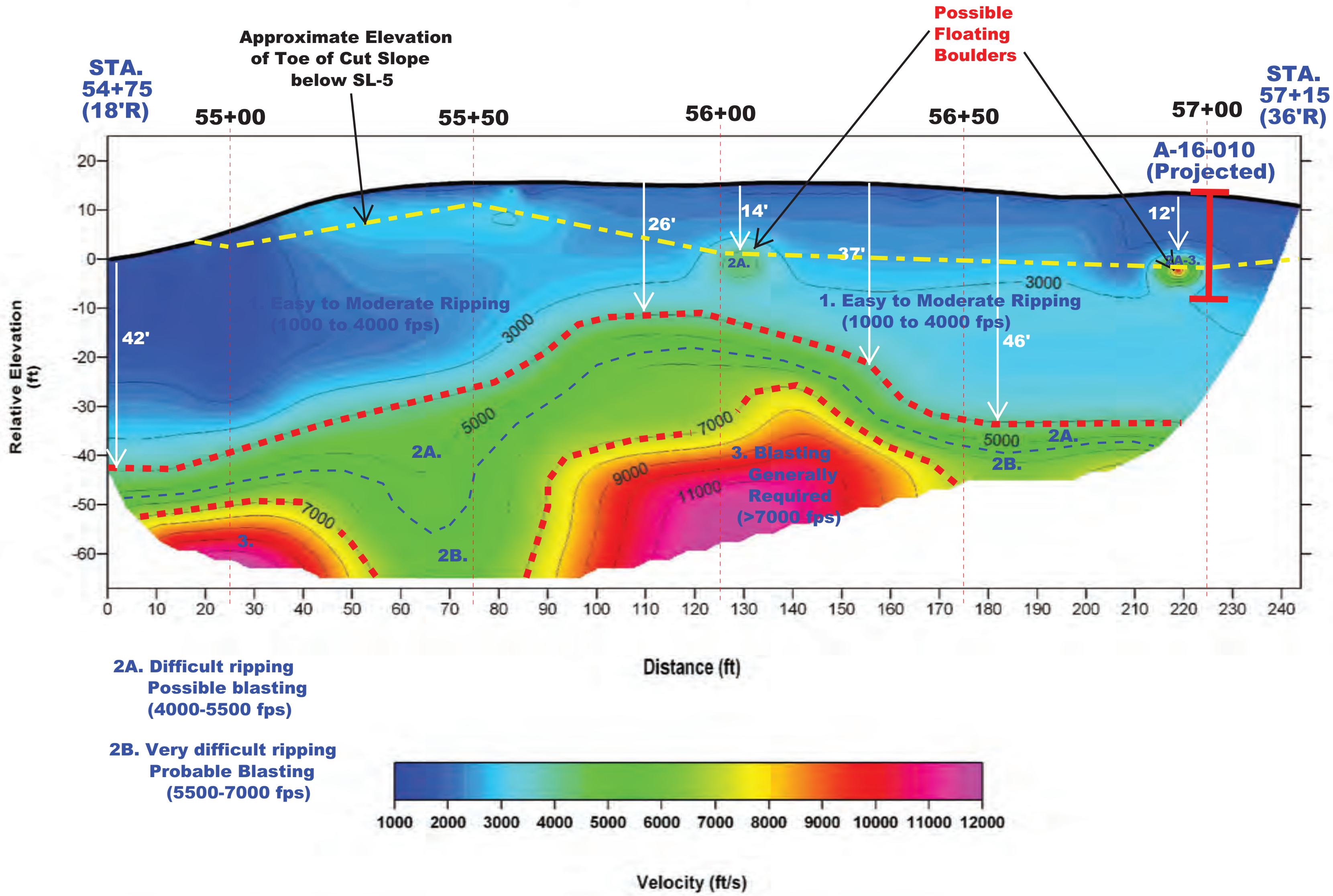
Note: Contour Interval = 1,000 feet per second



SEISMIC PROFILE SL-3	Camino Del Norte Extension Lake Elsinore, California Project No.: 116130 — Date: 04/16	SOUTHWEST GEOPHYSICS INC. Figure 4c	**FIGURE 7C** Note: Contour Interval = 1,000 feet per second


TOMOGRAPHY MODEL
Approximate Elevation of Face of Cut Slope Directly below SL-4
Approximate Elevation of toe of adjacent cut Projected to SL-4
Near Surface Harder (Moderate) Ripping Zone
A-16-009A (Projected)
A-16-009 (Projected)
STA. 50+25 (36'R)
STA. 52+65 (47'R)
50+50
51+00
51+50
52+00
52+50
Relative Elevation (ft)
Distance (ft)
7'
13'
22'
37'
42'
22'
23
30'
1. Easy to Moderate Ripping (1000 to 4000 fps)
Hard Drilling* (15-20')
*Practical Refusal @ 15.4'
1. Easy to Moderate Ripping (1000 to 4000 fps)
2A.
2B.
3000
5000
2A. Difficult ripping Possible blasting (4000-5500 fps)
2B. Very difficult ripping Probable Blasting (5500-7000 fps)
1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000 12000
Velocity (ft/s)
SEISMIC PROFILE SL-4
Camino Del Norte Extension
Lake Elsinore, California
Project No.: 116130
Date: 04/16
SOUTHWEST GEOPHYSICS INC.
Figure 4d
FIGURE 7D
Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL



SEISMIC PROFILE SL-5

Camino Del Norte Extension
Lake Elsinore, California

Project No.: 116130 | Date: 04/16

SOUTHWEST GEOPHYSICS INC.

Figure 4e

FIGURE 7E

Note: Contour Interval = 1,000 feet per second

Appendix A Field Investigation

APPENDIX A
FIELD INVESTIGATION

A.1 Introduction

The subsurface conditions for the proposed roadway extension project were investigated by performing ten (10) hollow stem auger borings (A-16-001 through A-16-010), five (5) test pits (TP-1 through TP-5), and five (5) seismic refraction traverse lines (SL-1 through SL-5) on March 22 and 23, 2016. Depths of the borings ranged from 8.5 to about 31 feet while depths of the test pits ranged from 5 to 8 feet. Boring A-16-009 met drilling refusal at about 15 feet and then Boring A-16-009A (about 10 feet east of Boring A-16-1009) was drilled down to the planned depth. The locations of the explorations are presented on topographical maps in Figures 2B through 2F of the main report. A summary of field explorations is presented in Table A-1.

Prior to beginning the exploration program, access permission was obtained by SC Engineering and provided to Group Delta. Site geology map was reviewed prior to selecting locations for subsurface investigations. Underground Service Alert (USA) was notified to clear each exploration location for underground utilities. The exploration methods are described in the following sections.

A.2 Soil Drilling and Sampling

Drilling, Logging, and Sampling

Borings were drilled by Cascade Drilling, L.P. (Cascade) using a CME 85 all-terrain drill rig. Field activities were performed under the direct and continuous supervision of a GDC field engineer. GDC field representative visually inspected the soil samples, maintained detailed records of the borings, and visually/manually classified the soils in accordance with the American Society for Testing and Materials (ASTM) D2488. Logging and classification was performed in general accordance with Caltrans guidelines “Soil and Rock Logging, Classification, and Presentation Manual (2010 Edition)”. A Boring Record Legend and Key for Soil Classification are presented in Figures A-1a through A-1f. The boring records are presented in Figures A-2 through A-12.

Sampling

Bulk samples of soil cuttings were collected at selected depths and drive samples were mainly collected from each boring at 2.5 feet, 5 feet, and every 5 feet thereafter. Drive samples were obtained using Standard Penetration Test (SPT) samplers in accordance with ASTM D1586 and Ring-Lined “California” Split Barrel samplers in accordance with ASTM D3550.

Bulk samples were collected from auger cuttings and placed in plastic bags. SPT drive samples were obtained using a 2-inch outside diameter and 1.375-inch inside diameter split-spoon sampler without lining. The soil recovered from the SPT sampling was sealed in plastic bags to preserve the natural moisture content.

California drive samples were collected with a 3-inch outside diameter and 2.5-inch inside diameter split barrel sampler equipped with a 2.42-inch inside diameter cutting shoe. The sampler barrel is lined with 12-inches of metal rings for sample collection and include an additional 6 inches of waste barrel. Stainless steel liner rings used for sample collection are 1-inch in length with inside and outside diameters of 2.42-inch and 2.5-inch, respectively. California samples were removed from the sampler, retained in the metal rings and placed in sealed plastic canisters to prevent loss of moisture.

At each sampling interval, the drive samplers were fitted onto sampling rod, lowered to the bottom of the boring, and driven 18 inches or to refusal (50 blows per 6 inches) with a 140-lb hammer free-falling a height of 30-inches using an automatic hammer. Compared to the SPT, the California sampler provides less disturbed samples.

Penetration Resistance

SPT blow counts adjusted to 60% hammer efficiency (N_{60}) are routinely used as an index of the relative density of coarse grained soils, and are sometimes used (but less reliable) to estimate consistency of cohesive soils. For samples collected using non-SPT samplers, different hammer weight and drop height, and/or efficiency different than 60%, correction factors can be applied to estimate the equivalent SPT N_{60} value following the approach of Burmister (1948) as follows:

$$N^*_{60} = N_R * C_E * C_H * C_S$$

Where;

N^*_{60} = equivalent SPT N_{60}

N_R = Raw Field Blowcount (blows per foot)

C_E = Hammer Efficiency Correction = Er_i / 60%

C_H = Hammer Energy Correction = (W * H) / (140 lb * 30 in)

C_S = Sampler Size Correction = $[(2.0 \text{ in})^2-(1.375 \text{ in})^2]/[D_o^2-D_i^2]$

Er_i = Hammer efficiency, %

W= Actual drive hammer weight, lbs

H = Actual drive hammer drop, inch

D_o, D_i = Actual sampler outside and inside diameter, respectively, inches

Burmister's correction assumes that penetration resistance (blowcount) is inversely proportional to the hammer energy. For a hammer other than a 140# hammer with 30" drop the hammer energy correction is equal to the ratio of the theoretical hammer energy (weight times drop) to the theoretical SPT hammer energy, or C_H = (W * H) / (140 lb * 30 in).

Burmister's correction assumes that penetration resistance (blowcount) is proportional to the annular end area of the drive sampler. For California drive samplers with D_o=3 inch and D_i=2.42 inch the sampler size correction factor is the ratio of the annular area of an SPT split spoon to that of the California Sampler, or $C_S = [2.0^2 - 1.375^2]/[3^2 - 2.42^2] = 0.67$.

To normalize the field SPT and California blowcounts to a hammer with 60% efficiency, an energy correction factor equal to Hammer Efficiency (%) / 60% was applied to the field blowcounts. The Hammer efficiency was provided by the drilling contractor and a copy of the calibration report is provided in Figures A-15a through A-15g

The correction factors applied to obtain N^*_{60} are summarized in the following table:

Borings	Hammer Type	Hammer Weight and Drop	C_H	Hammer Efficiency (%)	C_E	Cal Sampler Dimensions	C_S	Combined Correction Factor SPT Samples	Combined Correction Factor CAL Samples
A-16-001 through A-16-010	Automatic	140 lbs 30"	1	83.5	1.39	D_o=3.0" D_i=2.42"	0.67	1.39	0.93

Corrected N^*_{60} are generally used, with due engineering judgment, only for qualitative assessment of in place density or consistency, and are not used for other more critical analyses such as liquefaction.

Relative Density and Consistency

Equivalent SPT N_{60} values (N^*_{60}) were used as the basis for classifying relative density of granular/cohesionless soils. The correlations for consistency and relative density are shown in the Boring Record Legend, Figure A-1c. Drive sample field blow counts, SPT N^*_{60} values and corresponding density classifications are presented on the boring records.

Borehole Abandonment

Groundwater was not encountered during drilling. At the completion of drilling, borings were abandoned by backfilling the borehole with drill cuttings as indicated on the boring records. Notes describing the borehole abandonment are presented on the boring records.

Sample Handling and Transport

Geotechnical samples were sealed to prevent moisture loss, packed in appropriate protective containers, and transported to the geotechnical laboratory for further examination and geotechnical testing.

Laboratory Testing

The soils were further examined and tested in the laboratory and classified in accordance with the Unified Soil Classification System following ASTM D 2487 and D 2488 (see Figures A-1e and A-1f). Field classifications presented on the records were modified where necessary on the basis of the laboratory test results. Descriptions of the laboratory tests performed and a summary of the results are presented in Appendix B.

A.3 Test Pit Excavation and Sampling

Under the direct and continuous supervision of a GDC field geologist, test pits were excavated by Cascade Drilling using a backhoe (Bobcat). GDC field geologist visually inspected the soil materials, maintained detailed logs of the test pits, and visually/manually classified the soils in accordance with ASTM D2488. A boring record legend and key for soil classification is presented in Figures A-1a through A-1f. Test pit logs are presented in Figures A-13a to A-13c.

At each test pit location, soil was excavated in a 1 foot lift and allowed to sit for 30 to 50 minutes in between lifts. Changes in lithology, moisture content presence of caving soils were recorded for each test pit location. The bottom of the pits was probed to check for presence of soft soils if any groundwater was not encountered. Test pits were backfilled with soil cuttings and tamped with the backhoe.

A.4 Seismic Refraction Survey

GDC attained Southwest Geophysics, Inc. to complete seismic refraction traverses (SL-1 through SL-5) along the project alignment. The purpose of this seismic investigation was to measure the compressional wave velocity of subsurface material for rippability assessment. A copy of the seismic refraction report provided by Southwest Geophysics is attached in Appendix C.

A.5 List of Attached Tables and Figures

The following table and figures are attached:

List of Tables

Table A-1	Summary of Field Explorations

List of Figures

Figure A-1a through A-1d	Boring Record Legend
Figure A-1e through A-1f	Key for Soil Classification
Figures A-2 through A-12	Boring Records
Figures A-13a through A-13c	Test Pit Records
Figures A-14a through A-14g	Hammer Efficiency Calibration Report

TABLE A-1

SUMMARY OF FIELD EXPLORATIONS

Exploration Type	Exploration	Date	Exploration Location[3]							Exploration Details			Figure No.	Notes
			Station[1] (ft)	Approximate Offset[2] (ft)	Surface Elevation (ft)	Latitude	Longitude	Easting (ft)	Northing (ft)	Total Depth (ft bgs)	Depth to Groundwater (ft bgs)	Method		
Borings	A-16-001	3/22/2016	7+14	78.7 LT	1411.0	33.66933	-117.30552	6240520.853	2188798.652	22.8	NE	H.S.A	2B	Cut
	A-16-002	3/22/2016	11+02	14.7 LT	1425.2	33.67013	-117.30615	6240331.215	2189091.697	18.2	NE	H.S.A	2B	Cut
	A-16-003	3/22/2016	15+04	78.3 LT	1445.7	33.67020	-117.30751	6239917.679	2189118.815	30.9	NE	H.S.A	2B	Cut
	A-16-004	3/22/2016	21+85	4.3 LT	1447.1	33.67190	-117.30853	6239612.736	2189742.007	20.9	NE	H.S.A	2C	Cut
	A-16-005	3/22/2016	26+50	9.6 LT	1440.0	33.67275	-117.30958	6239298.565	2190054.883	8.5	NE	H.S.A	2C	Fill
	A-16-006	3/22/2016	28+40	63.7 RT	1463.8	33.67314	-117.31006	6239152.441	2190196.836	18.5	NE	H.S.A	2D	Cut
	A-16-007	3/23/2016	33+49	4.4 LT	1457.6	33.67334	-117.31174	6238642.705	2190276.988	9	NE	H.S.A	2D	Fill
	A-16-008	3/23/2016	46+16	23.5 RT	1415.5	33.67432	-117.31555	6237486.907	2190643.224	10.8	NE	H.S.A	2E	Fill
	A-16-009	3/23/2016	51+44	40.1 RT	1427.3	33.67501	-117.31710	6237017.948	2190901.3	15.4	NE	H.S.A	2F	Cut
	A-16-009A	3/23/2016	51+37	47.4 RT	1429.3	33.67503	-117.31707	6237026.519	2190906.307	20.8	NE	H.S.A	2F	Cut
	A-16-010	3/23/2016	57+03	48.0 RT	1408.3	33.67546	-117.31887	6236482.642	2191067.631	21	NE	H.S.A	2F	Cut
Test Pits	TP-1	3/22/2016	8+86	25.8 LT	1400.5	33.66977	-117.30563	6240488.083	2188958.011	6	NE	Excavation	2B	Fill
	TP-2	3/22/2016	13+09	63.6 LT	1404.6	33.67012	-117.30680	6240133.407	2189088.607	5	NE	Excavation	2B	Fill
	TP-3	3/22/2016	18+25	19.7 LT	1412.3	33.67093	-117.30826	6239692.213	2189388.574	7	NE	Excavation	2C	Fill
	TP-4	3/22/2016	38+58	26.5 LT	1444.8	33.67330	-117.31342	6238131.135	2190266.553	8	NE	Excavation	2D	Fill
	TP-5	3/22/2016	43+29	81.5 LT	1430.0	33.67358	-117.31501	6237648.454	2190373.738	8	NE	Excavation	2E	Fill
Seismic Refraction	SL-1 (Begin)	3/22/2016	13+90	49.0 LT	1426.1	33.67018	-117.30708	6240048.323	2189111.398	N/A	N/A	Traverse	2B/2C	Cut
	SL-1 (End)	3/22/2016	15+57	33.8 LT	1425.6	33.67038	-117.30763	6239883.316	2189184.593	N/A	N/A	Traverse		Cut
	SL-2 (Begin)	3/22/2016	27+92	54.1 RT	1456.8	33.67306	-117.30993	6239193.275	2190169.008	N/A	N/A	Traverse	2D	Cut
	SL-2 (End)	3/22/2016	30+30	47.8 RT	1456.5	33.67330	-117.31066	6238969.908	2190257.015	N/A	N/A	Traverse		Cut
	SL-3 (Begin)	3/22/2016	46+74	52.7 RT	1434.4	33.67448	-117.31564	6237459.843	2190703.919	N/A	N/A	Traverse	2E	Cut
	SL-3 (End)	3/22/2016	49+99	55.4 RT	1438.0	33.67483	-117.31630	6237259.481	2190831.309	N/A	N/A	Traverse		Cut
	SL-4 (Begin)	3/22/2016	50+24	36.3 RT	1427.8	33.67491	-117.31672	6237131.848	2190861.863	N/A	N/A	Traverse	2E/2F	Cut
	SL-4 (End)	3/22/2016	52+62	46.9 RT	1405.5	33.67512	-117.31747	6236906.387	2190943.123	N/A	N/A	Traverse		Cut
	SL-5 (Begin)	3/22/2016	54+78	18.1 RT	1394.7	33.67543	-117.31891	6236468.343	2191059.181	N/A	N/A	Traverse	2F	Cut
	SL-5 (End)	3/22/2016	57+15	35.9 RT	1406.2	33.67522	-117.31817	6236692.150	2190979.453	N/A	N/A	Traverse		Cut

Notes: 1) Boring locations are illustrated in topographic map Figures 2A through 2F of the main report.

2) Stations referenced to centerline of proposed Camino Del Norte, perpendicular offset Right or Left of center line looking up direction.

3) Locations estimated by GPS, Google Earth, field measurments from landmarks, and topographic map.

Abbreviations:

H.S.A: Hollow Stem Auger
ROW: Right of Way
bgs: below ground surface
N/A: Not Applicable
NE: Not Encountered

SOIL IDENTIFICATION AND DESCRIPTION SEQUENCE

Sequence		Refer to Section		Required	Optional
		Field	Lab		
1	Group Name	2.5.2	3.2.2	●	
2	Group Symbol	2.5.2	3.2.2	●	
	Description Components				
3	Consistency of Cohesive Soil	2.5.3	3.2.3	●	
4	Apparent Density of Cohesionless Soil	2.5.4		●	
5	Color	2.5.5		●	
6	Moisture	2.5.6		●	
7	Percent or Proportion of Soil	2.5.7	3.2.4	●	◍
	Particle Size	2.5.8	2.5.8	●	◍
	Particle Angularity	2.5.9			○
	Particle Shape	2.5.10			○
8	Plasticity (for fine-grained soil)	2.5.11	3.2.5		○
9	Dry Strength (for fine-grained soil)	2.5.12			○
10	Dilatency (for fine-grained soil)	2.5.13			○
11	Toughness (for fine-grained soil)	2.5.14			○
12	Structure	2.5.15			○
13	Cementation	2.5.16		●	
14	Percent of Cobbles and Boulders	2.5.17		●	
	Description of Cobbles and Boulders	2.5.18		●	
15	Consistency Field Test Result	2.5.3		●	
16	Additional Comments	2.5.19			○

Describe the soil using descriptive terms in the order shown

Minimum Required Sequence:

USCS Group Name (Group Symbol); Consistency or Density; Color; Moisture; Percent or Proportion of Soil; Particle Size; Plasticity (optional).

◍ = optional for non-Caltrans projects

Where applicable:

Cementation; % cobbles & boulders;
Description of cobbles & boulders;
Consistency field test result

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010)

HOLE IDENTIFICATION

Holes are identified using the following convention:

H-YY-NNN

Where:
H: Hole Type Code
YY: 2-digit year
NNN: 3-digit number (001-999)

Hole Type Code	Description
A	Auger boring (hollow or solid stem, bucket)
R	Rotary drilled boring (conventional)
RC	Rotary core (self-cased wire-line, continuously-sampled)
RW	Rotary core (self-cased wire-line, not continuously sampled)
P	Rotary percussion boring (Air)
HD	Hand driven (1-inch soil tube)
HA	Hand auger
D	Driven (dynamic cone penetrometer)
CPT	Cone Penetration Test
O	Other (note on LOTB)

Description Sequence Examples:

SANDY lean CLAY (CL); very stiff; yellowish brown; moist; mostly fines; some SAND, from fine to medium; few gravels; medium plasticity; PP=2.75.

Well-graded SAND with SILT and GRAVEL and COBBLES (SW-SM); dense; brown; moist; mostly SAND, from fine to coarse; some fine GRAVEL; few fines; weak cementation; 10% GRANITE COBBLES; 3 to 6 inches; hard; subrounded.

Clayey SAND (SC); medium dense, light brown; wet; mostly fine sand,; little fines; low plasticity.

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. GEOTECHNICAL ENGINEERS AND GEOLOGISTS	FIGURE NUMBER A-1a
	PROJECT NAME Camino Del Norte Extension	PROJECT NUMBER IR-645
	BORING RECORD LEGEND #1	

GROUP SYMBOLS AND NAMES

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

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (after drilling, date)

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010)

DEFINITIONS FOR CHANGE IN MATERIAL

Term	Definition	Symbol
Material Change	Change in material is observed in the sample or core, and the location of change can be accurately measured.	———
Estimated Material Change	Change in material cannot be accurately located because either the change is gradational or because of limitations in the drilling/sampling methods used.	- - - - - - - - -
Soil/Rock Boundary	Material changes from soil characteristics to rock characteristics.	~~~

GROUP DELTA

GROUP DELTA CONSULTANTS, INC. GEOTECHNICAL ENGINEERS AND GEOLOGISTS	FIGURE NUMBER A-1b
PROJECT NAME Camino Del Norte Extension	PROJECT NUMBER IR-645

BORING RECORD LEGEND #2

CONSISTENCY OF COHESIVE SOILS

Descriptor	Shear Strength (tsf)	Pocket Penetrometer, PP Measurement (tsf)	Torvane, TV. Measurement (tsf)	Vane Shear, VS. Measurement (tsf)
Very Soft	< 0.12	< 0.25	< 0.12	< 0.12
Soft	0.12 - 0.25	0.25 - 0.50	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.50	0.50 - 1.0	0.25 - 0.50	0.25 - 0.50
Stiff	0.50 - 1.0	1.0 - 2.0	0.50 - 1.0	0.50 - 1.0
Very Stiff	1.0 - 2.0	2.0 - 4.0	1.0 - 2.0	1.0 - 2.0
Hard	> 2.0	> 4.0	> 2.0	> 2.0

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

Descriptor		Size (in)
Boulder		> 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		< 1/300

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CONSISTENCY OF COHESIVE SOILS VS. N_{60}

Description	SPT N_{60} (blows / foot)
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	> 30

Ref: Peck, Hansen, and Thornburn, 1974, "Foundation Engineering", Second Edition

Note: Only to be used (with caution) when pocket penetrometer or other data on undrained shear strength are unavailable. Not allowed by Caltrans Soil and Rock Logging and Classificaton Manual, 2010

CEMENTATION

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

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010), with the exception of consistency of cohesive soils vs. N_{60}.

GROUP DELTA

GROUP DELTA CONSULTANTS, INC. GEOTECHNICAL ENGINEERS AND GEOLOGISTS	FIGURE NUMBER A-1c
PROJECT NAME Camino Del Norte Extension	PROJECT NUMBER IR-645

BORING RECORD LEGEND #3

ROCK GRAPHIC SYMBOLS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

BEDDING SPACING

Descriptor	Thickness or Spacing
Massive	> 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8 inches to 1 ft
Thinly bedded	1-1/4 to 3-5/8 inches
Very thinly bedded	3/8 inch to 1-1/4 inches
Laminated	< 3/8 inch

WEATHERING DESCRIPTORS FOR INTACT ROCK

	Diagnostic Features					
	Chemical Weathering-Discoloration-Oxidation		Mechanical Weathering and Grain Boundary Conditions	Texture and Solutioning		
Descriptor	Body of Rock	Fracture Surfaces		Texture	Solutioning	General Characteristics
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No solutioning	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull	Minor to complete discoloration or oxidation of most surfaces	No visible separation, intact (tight)	Preserved	Minor leaching of some soluble minerals may be noted	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty"; feldspar crystals are "cloudy"	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally preserved	Soluble minerals may be mostly leached	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation (refer to grain boundary conditions)	All fracture surfaces are discolored or oxidized; surfaces are friable	Partial separation, rock is friable; in semi-arid conditions, granitics are disaggregated	Altered by chemical disintegration such as via hydration or argillation	Leaching of soluble minerals may be complete	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures or veinlets. Rock is significantly weakened.
Decomposed	Discolored of oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregated)	Resembles a soil; partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes".

Note: Combination descriptors (such as "slightly weathered to fresh") are used where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant identifiable zones can be delineated. Only two adjacent descriptors shall be combined. "Very intensely weathered" is the combination descriptor for "decomposed to intensely weathered".

RELATIVE STRENGTH OF INTACT ROCK

Descriptor	Uniaxial Compressive Strength (psi)
Extremely	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

ROCK HARDNESS

Descriptor	Criteria
Extremely Hard	Specimen cannot be scratched with pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows
Very hard	Specimen cannot be scratched with pocket knife or sharp pick; breaks with repeated heavy hammer blows
Hard	Specimen can be scratched with pocket knife or sharp pick with heavy pressure; heavy hammer blows required to break specimen
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure; breaks with moderate hammer blows
Moderately Soft	Specimen can be grooved 1/6 in. with pocket knife or sharp pick with moderate or heavy pressure; breaks with light hammer blow or heavy hand pressure
Soft	Specimen can be grooved or gouged with pocket knife or sharp pick with light pressure, breaks with light to moderate hand pressure
Very Soft	Specimen can be readily indented, grooved, or gouged with fingernail, or carved with pocket knife; breaks with light hand pressure

CORE RECOVERY CALCULATION (%)

$$\frac{\Sigma \text{ Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100$$

RQD CALCULATION (%)

$$\frac{\Sigma \text{ Length of intact core pieces > 4 in.}}{\text{Total length of core run (in.)}} \times 100$$

FRACTURE DENSITY

Descriptor	Criteria
Unfractured	No fractures
Very Slightly Fractured	Lengths greater 3 ft
Slightly Fractured	Lengths from 1 to 3 ft, few lengths outside that range
Moderately Fractured	Lengths mostly in range of 4 in. to 1 ft, with most lengths about 8 in.
Intensely Fractured	Lengths average from 1 in. to 4 in. with scattered fragmented intervals with lengths less than 4 in.
Very Intensely Fractured	Mostly chips and fragments with few scattered short core lengths

Ref.: Caltrans Soil and Rock Logging Classification, and Presentation Manual (2010)

GROUP DELTA

GROUP DELTA CONSULTANTS, INC. GEOTECHNICAL ENGINEERS AND GEOLOGISTS	FIGURE NUMBER A-1d
PROJECT NAME Camino Del Norte Extension	PROJECT NUMBER IR-645

BORING RECORD LEGEND #4

CLASSIFICATION OF INORGANIC FINE GRAINED SOILS (Soils with ≥50% finer than No. 200 Sieve)

GROUP SYMBOL → **GROUP NAME**

CL
- <30% plus No. 200
  - <15% plus No. 200 → Lean clay
  - 15-25% plus No. 200
    - %sand ≥ %gravel → Lean clay with sand
    - %sand < %gravel → Lean clay with gravel
- ≥30% plus No. 200
  - % sand ≥ % gravel
    - <15% gravel → Sandy lean clay
    - ≥15% gravel → Sandy lean clay with gravel
  - % sand < % gravel
    - <15% sand → Gravelly lean clay
    - ≥15% sand → Gravelly lean clay with sand

ML
- <30% plus No. 200
  - <15% plus No. 200 → Silt
  - 15-25% plus No. 200
    - %sand ≥ %gravel → Silt with sand
    - %sand < %gravel → Silt with gravel
- ≥30% plus No. 200
  - % sand ≥ % gravel
    - <15% gravel → Sandy silt
    - ≥15% gravel → Sandy silt with gravel
  - % sand < % gravel
    - <15% sand → Gravelly silt
    - ≥15% sand → Gravelly silt with sand

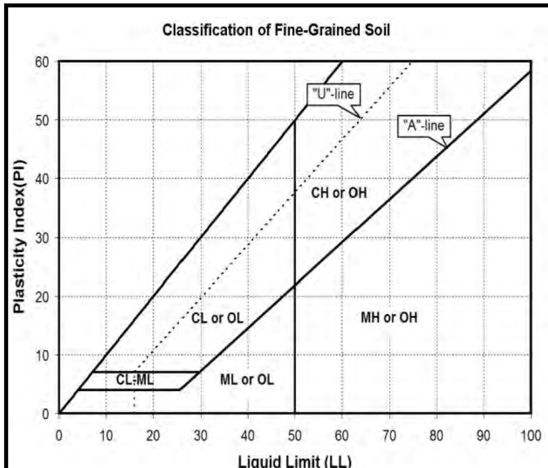
CH
- <30% plus No. 200
  - <15% plus No. 200 → Fat clay
  - 15-25% plus No. 200
    - %sand ≥ %gravel → Fat clay with sand
    - %sand < %gravel → Fat clay with gravel
- ≥30% plus No. 200
  - % sand ≥ % gravel
    - <15% gravel → Sandy fat clay
    - ≥15% gravel → Sandy fat clay with gravel
  - % sand < % gravel
    - <15% sand → Gravelly fat clay
    - ≥15% sand → Gravelly fat clay with sand

MH
- <30% plus No. 200
  - <15% plus No. 200 → Elastic silt
  - 15-25% plus No. 200
    - %sand ≥ %gravel → Elastic silt with sand
    - %sand < %gravel → Elastic silt with gravel
- ≥30% plus No. 200
  - % sand ≥ % gravel
    - <15% gravel → Sandy elastic silt
    - ≥15% gravel → Sandy elastic silt with gravel
  - % sand < % gravel
    - <15% sand → Gravelly elastic silt
    - ≥15% sand → Gravelly elastic silt with sand

Reference:
ASTM D 2487 and 2488

Laboratory Classification of Clay and Silt

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).



CL: LL<50; above A-Line.

CH: LL≥50; above A-Line.

ML: LL<50; below A-Line, or PI<4, or Non-Plastic

MH: LL≥50; below A-Line.

CL-ML: above A-Line and PI=4 to 7

CL/CH, ML/MH: at or near LL=50

ML/CL, MH/CH: at or near the A-Line

Field Identification of Clays and Silts

Group Symbol	Dry Strength	Dilatancy	Toughness	Plasticity
ML	None to low	Slow to rapid	Low or thread cannot be formed	Low to nonplastic
CL	Medium to high	None to slow	Medium	Medium
MH	Low to medium	None to slow	Low to medium	Low to medium
CH	High to very high	None	High	High

GROUP DELTA

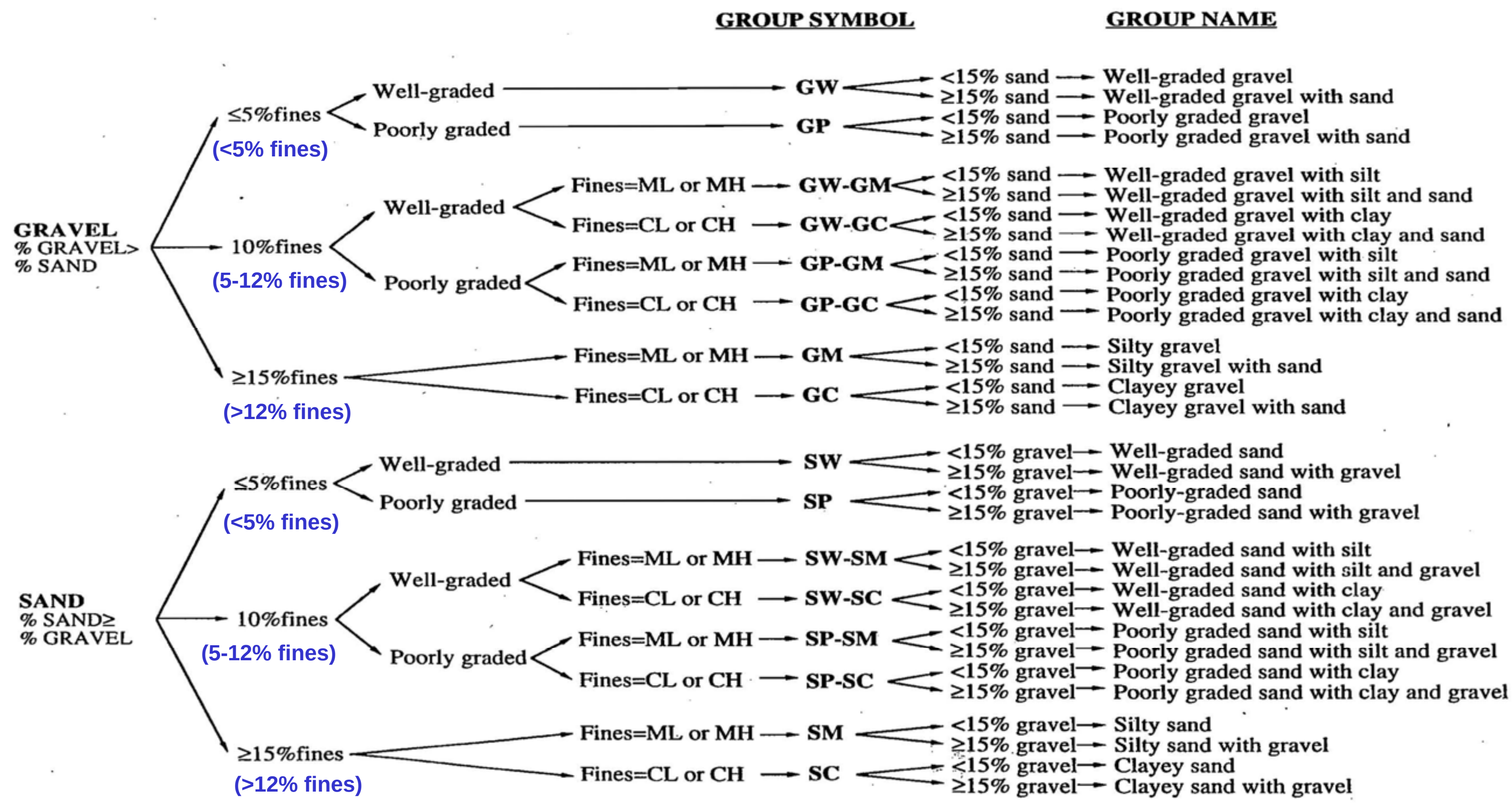
GDC Project No. IR-645

Camino Del Norte Extension

KEY FOR SOIL CLASSIFICATION #1

Figure A-1e

CLASSIFICATION OF COARSE-GRAINED SOILS (Soils with <50% "fines" passing No. 200 Sieve)



Reference:

ASTM D 2487 and 2488

Note: Values estimated to nearest 5% to be used for visual identification, values in parentheses to be used for classification when based on laboratory grain size data.

Granular Soil Gradation Parameters

Coefficient of Uniformity: $C_u = D_{60}/D_{10}$

Coefficient of Curvature: $Cc = D_{30}^2 / (D_{60} \times D_{10})$

D_{10} = 10% of soil is finer than this diameter

D_{30} = 30% of soil is finer than this diameter

D_{60} = 60% of soil is finer than this diameter

Group Symbol	Gradation or Plasticity Requirement
SW	$C_u > 6$ and $1 \le C_c \le 3$
GW	$C_u > 4$ and $1 \le C_c \le 3$
GP or SP	Clean gravel or sand not meeting requirement for SW or GW
SM or GM	Non-plastic fines or below A-Line or PI<4
SC or GC	Plastic fines or above A-Line and PI>7

GROUP DELTA

GDC Project No. IR-645

Camino Del Norte Extension

KEY FOR SOIL CLASSIFICATION #2

Figure A-1f

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	**A-16-001**

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/22/2016	3/22/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	22.8	1411	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
SPT (1.4"), CAL (2.4")	$N_{60}* = 1.39\ N_{SPT} = 0.93\ N_{MC}$

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
0	1410											SILTY SAND with GRAVEL (SM); brown; moist; mostly fine to medium SAND; some fines; little fine angular GRAVEL; nonplastic.
		B-1 S-2	41 50/5"	50/5"	70/5"						CP CR DS*	Very dense; light brown.
5	1405	R-3	33 50/3"	50/3"	47/3"			2.8	117	0:0	#200	SILTY SAND (SM); very dense; brown; moist; mostly fine to medium SAND; little fines; nonplastic. 87% SAND; 13% fines
10	1400	S-4	36 50/4"	50/4"	70/4"							Poorly-graded SAND with SILT and GRAVEL (SP-SM); very dense; light brown; moist; mostly fine to coarse SAND; little fine angular GRAVEL; few fines; nonplastic.
15	1395	R-5-1 R-5-2	16 47 50/3"	97/9"	90/9"			2.7	113		PA	Well-graded SAND with SILT (SW-SM); very dense; light brown; moist, mostly fine to coarse SAND; trace fine GRAVEL; non plastic. 1% Gravel; 87% SAND; 12% fines.
20	1390	S-6	42 50/3"	50/3"	70/3"							IGNEOUS ROCK; light brown; decomposed; (Poorly-graded SAND with SILT and GRAVEL (SP-SM); very dense; moist; mostly fine to coarse SAND; little fine angular GRAVEL; few fines; nonplastic). No Recovery.
		S-7	50/3"	REF	REF							

Bottom of borehole at 22.8 feet.
Boring terminated at planned depth.
This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

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FIGURE A-2

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-002

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/22/2016	3/22/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	18.2	1425.2	▽ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
SPT (1.4"), CAL (2.4")	$N_{60}* = 1.39 N_{SPT} = 0.93 N_{MC}$

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^*_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	1425														SILTY SAND with GRAVEL (SM); light brown; moist; mostly fine to medium SAND; some fines; little fine to coarse angular GRAVEL; nonplastic.
			B-1									EI			Poorly-graded SAND with SILT (SP-SM); loose; light brown; moist; mostly fine to medium SAND; few fines; nonplastic.
			R-2	4 4 6	10	9			2.3	108		R #200 DS			90% SAND; 10% fines.
5	1420		S-3	9 13 22	35	49									Dense.
10	1415		R-4-2 R-4-1	10 29 50/3"	79/9"	74/9"			2.5	93					Very dense.
15	1410		S-5	13 50/5"	50/5"	70/5"									IGNEOUS ROCK; orangish brown; decomposed; (Poorly-graded GRAVEL with SAND (GP); very dense; moist; mostly fine subangular to subrounded GRAVEL; little medium to coarse SAND; trace fines; nonplastic).
			S-6	33 50/2"	50/2"	70/2"									
20	1405														Bottom of borehole at 18.2 feet. Boring terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

GDC_LOG_BORING_2013 IR-645.GPJ GDC2013.GDT 5/3/16

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-3

BORING RECORD

PROJECT NAME	Camino Del Norte Extension
PROJECT NUMBER	IR 645
HOLE ID	A-16-003
SITE LOCATION	Lake Elsinore, California
START	3/22/2016
FINISH	3/22/2016
SHEET NO.	1 of 2
DRILLING COMPANY	Cascade Drilling
DRILL RIG	CME 85
DRILLING METHOD	Hollow Stem Auger
LOGGED BY	Barzin
CHECKED BY	Mohsen
HAMMER TYPE (WEIGHT/DROP)	Automatic, (140lbs, 30")
HAMMER EFFICIENCY (ERi)	83.5%
BORING DIA. (in)	8
TOTAL DEPTH (ft)	30.9
GROUND ELEV (ft)	1445.7
DEPTH/*ELEV.* GW (ft)	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING
DRIVE SAMPLER TYPE(S) & SIZE (ID)	SPT (1.4"), CAL (2.4")
NOTES	$N_{60}^* = 1.39\ N_{SPT} = 0.93\ N_{MC}$

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}^*	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	1445	Bulk													SILTY SAND with GRAVEL (SM); light brown; moist; mostly fine to coarse SAND; little fines; little fine to coarse angular GRAVEL; nonplastic.
			B-1												Very dense.
		CAL	R-2-1, R-2-2	13, 50/5"	50/5"	47/5"			2.5	117		PA			Well-graded SAND with SILT (SW-SM); very dense; light brown; moist; mostly fine to coarse SAND; few fines; nonplastic. 94% SAND; 6% fines.
5	1440	SPT	S-3	29, 50/6"	50/6"	70/6"									
10	1435	CAL	R-4	23, 50/6"	50/6"	47/6"			2.6	118		PA			SILTY SAND (SM); very dense; dark brown with orangish brown; moist; mostly fine to coarse SAND; little fines; trace fine GRAVEL; nonplastic. 1% GRAVEL; 82% SAND; 17% fines.
15	1430	SPT	S-5	32, 50/4"	50/4"	70/4"									
20	1425	CAL	R-6	13, 39, 50/3"	89/9"	83/9"			3.1	118					

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-003

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/22/2016	3/22/2016	2 of 2

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	30.9	1445.7	⊻ NE / *NE* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")	$N_{60}^{*} = 1.39\ N_{SPT} = 0.93\ N_{MC}$	▼ NE / *NE*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^{*}_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	1420	SPT	S-7	50/4"	REF	REF									IGNEOUS ROCK; dark brown with orangish brown; decomposed; (Poorly-graded GRAVEL with SAND (GP); very dense; moist; mostly subrounded and subangular GRAVEL; little medium to coarse SAND; trace fines; nonplastic).
30	1415	CAL	R-8	23 50/5"	50/5"	47/5"			2.9	110					light brown; (Poorly-graded SAND with SILT (SP-SM); very dense; moist; mostly fine to medium SAND; some subrounded GRAVEL; few fines; nonplastic).
															Bottom of borehole at 30.9 feet. Boring terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
35	1410														
40	1405														
45	1400														

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FIGURE A-4 b

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-004

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/22/2016	3/22/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	20.9	1447.1	⊻ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID): SPT (1.4"), CAL (2.4")

NOTES: $N_{60}^{*} = 1.39\ N_{SPT} = 0.93\ N_{MC}$

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}^{*}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
0	1447.1											SILTY SAND (SM); light brown; moist; mostly fine SAND; little fines; trace fine GRAVEL; nonplastic.
	1445	B-1									CP CR DS*	Dense.
		S-2	6 12 14	26	36							
5		R-3	16 28 21	49	46			5.5	115	0:0	#200	Poorly-graded SAND with SILT (SP-SM); dense; light brown with dark olive brown; moist; mostly fine to coarse SAND; few fines; trace fine GRAVEL; nonplastic. 1% GRAVEL; 92% SAND; 7% fines
	1440											
10		S-4	21 37 50/5"	87/11"	121/11"							Poorly-graded SAND with GRAVEL (SP); very dense; pale brown with light gray; mostly medium to coarse SAND; some fine subrounded to subangular GRAVEL; trace fines; nonplastic.
	1435											
15		R-5	18 31 50/5"	81/11"	76/11"			9.3	107			
	1430											
20		S-6	17 50/5"	50/5"	70/5"							IGNEOUS ROCK; light brown with gray; decomposed; (Poorly-graded SAND with SILT and GRAVEL(SP-SM); very dense; moist; mostly fine to coarse SAND; some fine subrounded GRAVEL; few fines; nonplastic).
	1425											Bottom of borehole at 20.9 feet. Boring terminated at planned depth.

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

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	**A-16-005**

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/22/2016	3/22/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	8.5	1440	▽ NE / *NE* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	
SPT (1.4"), CAL (2.4")	$N_{60}^* = 1.39\ N_{SPT} = 0.93\ N_{MC}$	▼ NE / *NE* AFTER DRILLING

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}^*	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	1440														SILTY SAND (SM); light brown; moist; mostly fine SAND; little fines; nonplastic.
			B-1												
			S-2	23 24 28	52	72						#200			Very dense. 87% SAND; 13 fines.
5	1435		R-3	26 50	50/6"	47/6"			3.4	125		PA			IGNEOUS ROCK; light brown with gray; decomposed; (SILTY SAND (SM); very dense; light brown with gray; moist; mostly fine to medium SAND; little fines; nonplastic). 81% SAND; 19% fines.
			S-4	23 50	50/6"	70/6"									
8.5															Bottom of borehole at 8.5 feet. Boring terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
10	1430														
15	1425														
20	1420														

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FIGURE A-6

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-006

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/22/2016	3/22/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	18.5	1463.8	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
SPT (1.4"), CAL (2.4")	$N_{60}^{*} = 1.39\ N_{SPT} = 0.93\ N_{MC}$

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^{*}_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
0												SILTY SAND (SM); light brown; moist; mostly fine to medium SAND; little fines; trace fine GRAVEL; nonplastic.
		B-1									R	Medium dense.
	1460	S-2	6 8 13	21	29			3.4			#200	1% GRAVEL; 80% SAND; 19% fines.
5		R-3	11 23 50	73	68			2.7	123			Poorly-graded SAND (SP); very dense; light brown with orangish brown; moist; mostly medium to coarse SAND; trace fines; trace fine GRAVEL; nonplastic.
	1455											
10		S-4	16 33 50	83	116							Poorly-graded SAND with SILT (SP-SM); very dense; light grayish brown; moist; mostly fine to medium SAND; few fines; trace fine GRAVEL; nonplastic.
	1450											
15		R-5	21 24 50	74	69			3.7	124		PA	IGNEOUS ROCK; light brown with orangish brown; decomposed; (Well-graded SAND with SILT (SP-SM); very dense; moist; mostly fine to coarse SAND; few fines; trace fine GRAVEL; nonplastic). 2% GRAVEL; 90% SAND; 8% fines.
		S-6	28 50/6"	50/6"	70/6"							
	1445											Bottom of borehole at 18.5 feet. Boring terminated at planned depth.
20												This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
	1440											

GDC_LOG_BORING_2013 IR-645.GPJ GDC2013.GDT 5/3/16

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-007

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/23/2016	3/23/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	9	1457.6	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
SPT (1.4"), CAL (2.4")	$N_{60}^{*} = 1.39\ N_{SPT} = 0.93\ N_{MC}$

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}^{*}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	1457.6														SILTY SAND (SM); orangish brown; moist; mostly fine to medium SAND; little fines; trace fine GRAVEL; nonplastic.
	1455		B-1									CL DS #200			
			R-2	7 13 28	41	38			3.6						Dense. 1% GRAVEL; 73% SAND; 26% fines.
5			S-3	28 50/6"	50/6"	70/6"									Very dense.
	1450														IGNEOUS ROCK; light brown with orangish brown; decomposed; (SILTY SAND (SM); very dense; moist; mostly fine to coarse SAND; little fines; trace subrounded to subangular GRAVEL; nonplastic).
			R-4	18 27 33	60	56			6.5	121		PA			2% GRAVEL; 78% SAND; 20% fines.
10															Bottom of borehole at 9 feet. Boring terminated at planned depth.
	1445														This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
15															
	1440														
20															
	1435														

GDC_LOG_BORING_2013 IR-645.GPJ GDC2013.GDT 5/3/16

BORING RECORD

PROJECT NAME Camino Del Norte Extension	**PROJECT NUMBER** IR 645	**HOLE ID** A-16-008	
SITE LOCATION Lake Elsinore, California	**START** 3/23/2016	**FINISH** 3/23/2016	**SHEET NO.** 1 of 1
DRILLING COMPANY Cascade Drilling	**DRILL RIG** CME 85	**DRILLING METHOD** Hollow Stem Auger	**LOGGED BY** Barzin / **CHECKED BY** Mohsen
HAMMER TYPE (WEIGHT/DROP) Automatic, (140lbs, 30")	**HAMMER EFFICIENCY (ERi)** 83.5%	**BORING DIA. (in)** 8 / **TOTAL DEPTH (ft)** 10.8 / **GROUND ELEV (ft)** 1415.5	**DEPTH/*ELEV.* GW (ft)** ▽ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING
DRIVE SAMPLER TYPE(S) & SIZE (ID) SPT (1.4"), CAL (2.4")	**NOTES** $N_{60}^* = 1.39\ N_{SPT} = 0.93\ N_{MC}$		

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}^*	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	1415														SILTY SAND with GRAVEL (SM); brown; moist; some fine to medium SAND; some fine to coarse GRAVEL; little fines; nonplastic.
			B-1												
			S-2	19 42 50/5"	92/11"	128/11"			2.8			#200			Very Dense. 38% GRAVEL; 48% SAND; 14% fines
5	1410		R-3	31 50/3"	50/3"	47/3"			2.6	114		PA			IGNEOUS ROCK; brown; decomposed; (SILTY SAND with GRAVEL (SM); very dense; moist; mostly fine to coarse SAND; some fine to coarse GRAVEL; little fines; nonplastic). 34% GRAVEL; 54% SAND; 12% fines.
10	1405		S-4	18 50/4"	50/4"	70/4"									
															Bottom of borehole at 10.8 feet. Boring terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
15	1400														
20	1395														

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-9

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-009

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/23/2016	3/23/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	15.4	1427.3	▽ NE / *NE* DURING DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES	AFTER DRILLING
SPT (1.4"), CAL (2.4")	$N_{60}^{*} = 1.39\ N_{SPT} = 0.93\ N_{MC}$	▼ NE / *NE*

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N^{*}_{60}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	1427.3	Bulk												SM	SILTY SAND (SM); brown; moist; mostly fine to medium SAND; some fines; trace fine GRAVEL; nonplastic.
	1425		B-1 R-2	37 50/3"	50/3"	47/3"			1.3			CR PA			IGNEOUS ROCK; brown; decomposed; (Poorly-graded GRAVEL with SAND (GP); very dense; moist; mostly fine to coarse subrounded to subangular GRAVEL; little fine to coarse SAND; trace fines; nonplastic). 74% GRAVEL; 22% SAND; 4% fines.
5			S-3	23 50/4"	50/4"	70/4"									
	1420														
10			R-4	21 50/6"	50/6"	47/6"									No Recovery.
	1415														
15			S-5	50/5"	REF	REF									Practical drilling refusal at 15 feet.
															Bottom of borehole at 15.4 ft bgs. Boring terminated due to practical drilling refusal. Boring A-16-009A was then drilled and sampled below 15 feet. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
	1410														
20															
	1405														

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FIGURE

A-10

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-009A

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/23/2016	3/23/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	20.8	1429.3	∇ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
SPT (1.4"), CAL (2.4")	N_{60}^{*} = 1.39 N_{SPT} = 0.93 N_{MC}

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}^{*}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DRILLING METHOD	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0															Boring was drilled down to 15 feet without sampling.
	1425														
5															
	1420														
10															
	1415														
15		SPT	S-1	22 50/2"	50/2"	70/2"									Rig chatter at 15 ft bgs. IGNEOUS ROCK; brown; decomposed; (Poorly-graded GRAVEL with SAND (GP); very dense; moist; mostly fine to coarse subrounded to subangular GRAVEL; little fine to coarse SAND; trace fines; nonplastic).
	1410														
20		SPT	S-2	37 50/3"	50/3"	70/3"									
															Bottom of borehole at 20.8 ft. Boring terminated at planned depth. This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
	1405														

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32 MAUCHLY SUITE B
IRVINE/CA 92718

FIGURE

A-11

BORING RECORD

PROJECT NAME	PROJECT NUMBER	HOLE ID
Camino Del Norte Extension	IR 645	A-16-010

SITE LOCATION	START	FINISH	SHEET NO.
Lake Elsinore, California	3/23/2016	3/23/2016	1 of 1

DRILLING COMPANY	DRILL RIG	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	CME 85	Hollow Stem Auger	Barzin	Mohsen

HAMMER TYPE (WEIGHT/DROP)	HAMMER EFFICIENCY (ERi)	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GW (ft)
Automatic, (140lbs, 30")	83.5%	8	21	1408.3	▽ NE / *NE* DURING DRILLING; ▼ NE / *NE* AFTER DRILLING

DRIVE SAMPLER TYPE(S) & SIZE (ID)	NOTES
SPT (1.4"), CAL (2.4")	$N_{60}^{*} = 1.39\ N_{SPT} = 0.93\ N_{MC}$

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}^{*}	RECOVERY (%)	RQD (%)	MOISTURE (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (LL:PI)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
0	1408.3											CLAYEY SAND (SC); orangish brown; moist; mostly fine to medium SAND; some fines; few fine to coarse GRAVEL; medium plasticity.
		B-1									EI	Dense.
	1405	S-2	7 11 11	22	31			6.1		29:13	R #200	11% GRAVEL; 59% SAND; 30% fines
5												Poorly-graded SAND with SILT (SP-SM); medium dense; brown with orangish brown; moist; mostly medium to coarse SAND; few fines; few fine GRAVEL; nonplastic.
		R-3	12 13 12	25	23			6.8	105			
	1400											
10		S-4	7 8 12	20	28							
	1395											
15												SILTY SAND (SM); dense; brown with gray; moist; mostly fine to medium SAND; little fines; few fine to coarse angular GRAVEL, nonplastic.
		R-5	12 16 19	35	33			6.3	107			
	1390											
20												Poorly-graded SAND with SILT (SP-SM); very dense; light gray; moist; mostly medium to coarse SAND; few fines; few fine GRAVEL; nonplastic.
		S-6	26 50/6"	50/6"	70/6"							Bottom of borehole at 21.0 ft. Boring terminated at planned depth.
	1385											This Boring Record was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

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FIGURE A-12

LOG OF TEST PIT TP-1

Date Excavated: 3/22/16 — Logged by: Kevin

Equipment: Bobcat E35 — Surface Elevation (ft.): 1400.5

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	POCKET PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER TESTS
		SILTY SAND (SM); brown; dry; mostly fine to medium SAND, some fines; trace fine GRAVEL; nonplastic; roots in soil.					
		Moist.					
		SANDY lean CLAY (CL); brown; moist; mostly fines, some some fine SAND; medium plastic; roots in soil.		3.5			
		SILTY SAND (SM); brown; moist; mostly fine SAND, some fines; trace fine GRAVEL; nonplastic; roots in soil.					
		Light brown.					
		IGNEOUS ROCK; light brown; decomposed; (SILTY SAND (SM); light brown; moist; mostly fine SAND, some fines; trace fine GRAVEL; nonplastic).					
5							

LOG OF TEST PIT TP-2

Date Excavated: 3/22/16 — Logged by: Kevin

Equipment: Bobcat E35 — Surface Elevation (ft.): 1404.6

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	POCKET PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER TESTS
		SANDY SILT (ML); brown; moist; mostly fines, some coarse SAND; trace fine GRAVEL; nonplastic; roots in soil.					
		SILTY SAND (SM); brown; moist; mostly fine SAND, little fines; few fine GRAVEL; nonplastic; roots in soil.					
		Mostly medium to coarse SAND.					
		Mostly fine to coarse SAND.					
5							
		Igneous rock observed at a depth of about 6 feet in adjacent drainage channel.					

GDC_TEST_PIT IR-645.GPJ GDCLOG.GDT 5/3/16

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Irvine, CA 92618

Camino Del Norte Extension Lake Elsinore, California IR 645

FIGURE A-13a

LOG OF TEST PIT TP-3

Date Excavated: 3/22/16 | Logged by: Kevin

Equipment: Bobcat E35 | Surface Elevation (ft.): 1412.3

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	POCKET PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER TESTS
		SILTY SAND (SM); light brown; moist; mostly fine to medium SAND; nonplastic; roots in soil. Trace fine GRAVEL.					
		IGNEOUS ROCK; light brown; decomposed; (SILTY SAND (SM)); brown; moist; mostly fine to medium SAND; some fines; trace fine GRAVEL; nonplastic.					
5							

LOG OF TEST PIT TP-4

Date Excavated: 3/22/16 | Logged by: Kevin

Equipment: Bobcat E35 | Surface Elevation (ft.): 1444.8

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	POCKET PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER TESTS
		SILTY SAND (SM); brown to reddish brown; moist; mostly fine SAND; some fines, few fine to coarse GRAVEL; (FILL).					
5							

LOG OF TEST PIT TP-5

Date Excavated: 3/22/16 Logged by: Kevin

Equipment: Bobcat E35 Surface Elevation (ft.): 1430

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	POCKET PEN. (tsf)	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER TESTS
		SILTY SAND (SM); brown ; moist; mostly fine SAND; some fines, few fine to coarse GRAVEL; (FILL).					
5							

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Printed: 10-March-2015

Test started: 26-February-2015

CASCADE DRILLING - NWJ ROD AUTODROP HAMMER L1241-TEST1

CME1050 SN263250

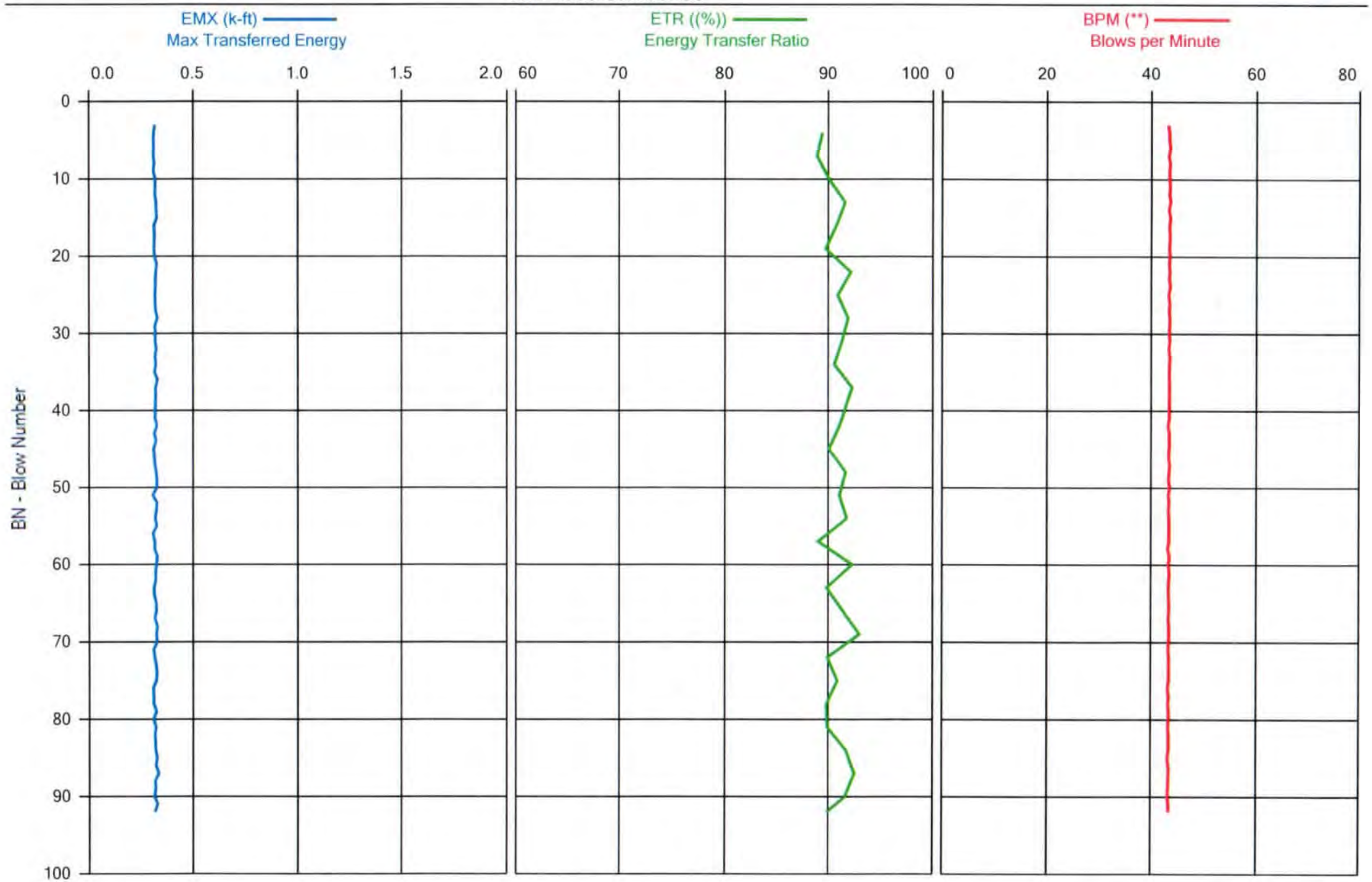

Plate - 35

FIGURE A-14a

CASCADE DRILLING - NWJ ROD AUTODROP HAMMER L1241-TEST1
OP: SD

CME1050 SN263250
Date: 26-February-2015

AR: 1.46 in²
LE: 8.10 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.50 []

EMX: Max Transferred Energy
ETR: Energy Transfer Ratio

BPM: Blows per Minute
FMX: Maximum Force

BL#	depth	TYPE	EMX	ETR	BPM	FMX
	ft		k-ft	(%)	**	kips
7	4	AV5	0.3	89.1	43.4	39
		MAX	0.3	90.5	43.6	40
		MIN	0.3	88.3	43.2	39
12	4	AV5	0.3	90.0	43.4	39
		MAX	0.3	91.0	43.5	40
		MIN	0.3	88.3	43.4	38
17	4	AV5	0.3	91.4	43.5	40
		MAX	0.3	93.3	43.6	40
		MIN	0.3	89.2	43.3	38
22	4	AV5	0.3	90.9	43.5	40
		MAX	0.3	93.0	43.5	40
		MIN	0.3	89.4	43.4	40
27	4	AV5	0.3	91.1	43.4	39
		MAX	0.3	91.5	43.6	40
		MIN	0.3	90.6	43.3	39
32	4	AV5	0.3	91.7	43.4	40
		MAX	0.3	94.1	43.5	40
		MIN	0.3	90.4	43.3	39
37	4	AV5	0.3	91.4	43.4	40
		MAX	0.3	94.1	43.5	40
		MIN	0.3	89.7	43.4	39
42	4	AV3	0.3	91.7	43.3	40
		MAX	0.3	93.1	43.4	41
		MIN	0.3	90.7	43.2	40
47	4	AV5	0.3	90.0	43.4	40
		MAX	0.3	92.0	43.5	41
		MIN	0.3	88.6	43.3	40
52	4	AV5	0.3	91.6	43.4	40
		MAX	0.3	93.1	43.5	41
		MIN	0.3	87.4	43.3	40
57	4	AV5	0.3	90.6	43.4	40
		MAX	0.3	92.7	43.4	41
		MIN	0.3	87.5	43.3	39
62	4	AV5	0.3	91.6	43.4	40
		MAX	0.3	93.8	43.5	41
		MIN	0.3	89.7	43.2	39
67	4	AV5	0.3	90.5	43.3	40
		MAX	0.3	92.2	43.4	41
		MIN	0.3	88.9	43.3	39
72	4	AV5	0.3	91.4	43.4	40
		MAX	0.3	93.5	43.4	41
		MIN	0.3	88.3	43.3	40
77	4	AV5	0.3	90.6	43.4	40
		MAX	0.3	92.8	43.4	41
		MIN	0.3	87.7	43.2	39
82	4	AV5	0.3	90.1	43.4	40
		MAX	0.3	92.3	43.4	40
		MIN	0.3	88.1	43.3	39
87	4	AV5	0.3	92.5	43.4	40
		MAX	0.3	95.6	43.4	40
		MIN	0.3	90.7	43.2	39
92	4	AV5	0.3	91.0	43.4	40
		MAX	0.3	94.1	43.4	41
		MIN	0.3	89.6	43.3	39
		Average	0.3	90.9	43.4	40
		Maximum	0.3	95.6	43.6	41
		Minimum	0.3	87.4	43.2	38

CASCADE DRILLING - NWJ ROD AUTODROP HAMMER L1241-TEST1
OP: SD

CME1050 SN263250
Date: 26-February-2015

BL#	depth	TYPE	EMX	ETR	BPM	FMX
	ft		k-ft	(%)	**	kips

Total number of blows analyzed: 88

BL# Sensors

1-92 F3: [NWJ1] 211.5 (1.10); F4: [NWJ2] 210.7 (1.10); A3: off; A4: [K1067] 342.0 (0.95)

Time Summary

Drive 2 minutes 49 seconds 11:55 AM - 11:57 AM BN 1 - 92

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Printed: 10-March-2015

Test started: 26-February-2015

CASCADE DRILLING - NWJ ROD AUTODROP HAMMER L1241-TEST2

CME1050 SN263250

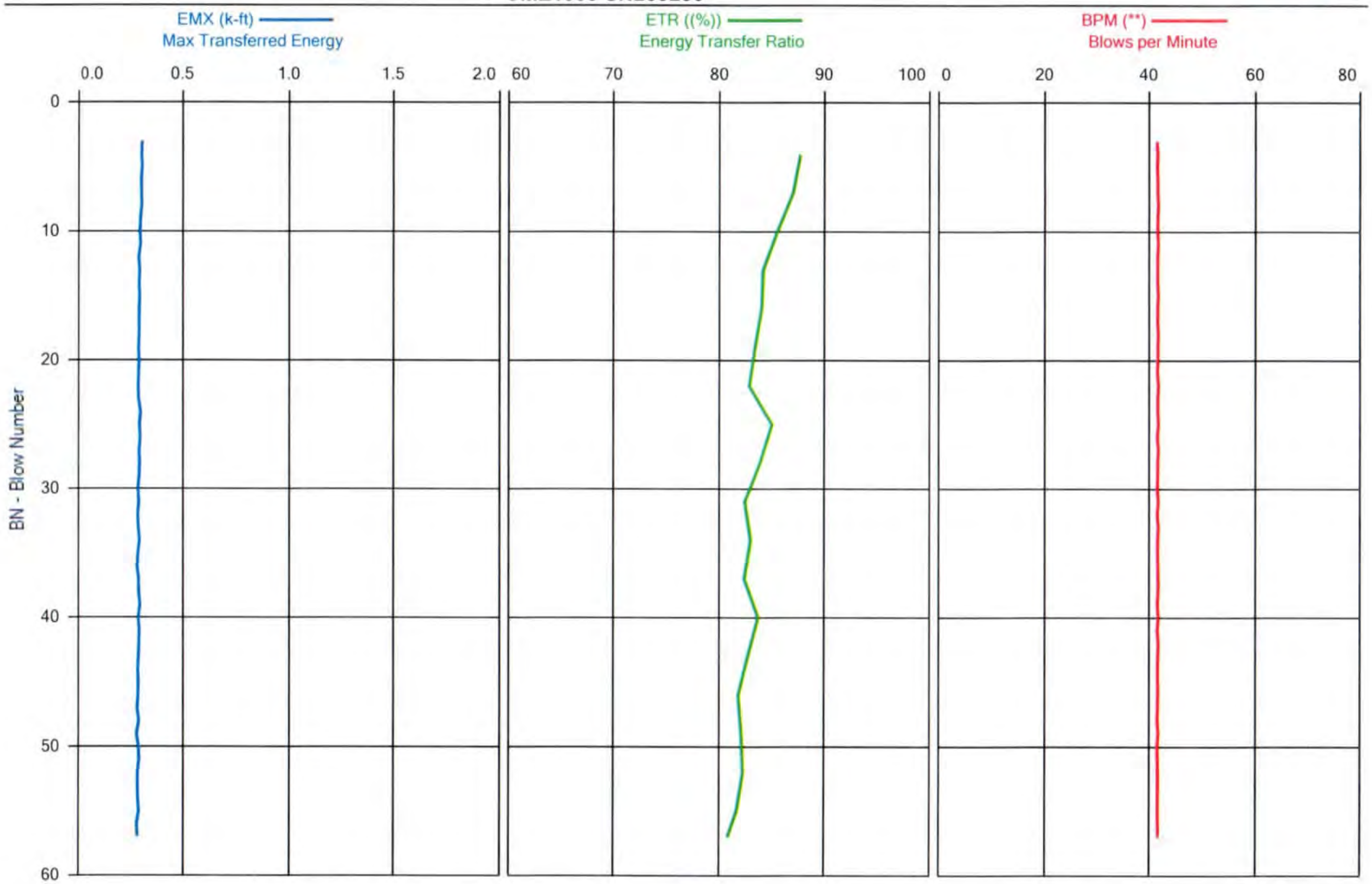

FIGURE A-14d

CASCADE DRILLING - NWJ ROD AUTODROP HAMMER L1241-TEST2
OP: SD

CME1050 SN263250
Date: 26-February-2015

AR: 1.46 in²
LE: 8.10 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000 ksi
JC: 0.50 []

EMX: Max Transferred Energy
ETR: Energy Transfer Ratio

BPM: Blows per Minute
FMX: Maximum Force

BL#	depth ft	TYPE	EMX k-ft	ETR (%)	BPM **	FMX kips
6	6	AV4	0.3	87.4	41.6	40
		MAX	0.3	88.1	41.6	41
		MIN	0.3	86.7	41.5	39
10	6	AV4	0.3	86.2	41.6	40
		MAX	0.3	87.3	41.7	41
		MIN	0.3	84.9	41.6	39
14	6	AV4	0.3	84.5	41.6	39
		MAX	0.3	85.8	41.7	40
		MIN	0.3	83.5	41.6	38
18	6	AV4	0.3	83.9	41.7	40
		MAX	0.3	84.4	41.7	40
		MIN	0.3	83.6	41.6	39
22	6	AV4	0.3	82.9	41.6	40
		MAX	0.3	83.4	41.7	40
		MIN	0.3	82.6	41.5	39
26	6	AV4	0.3	84.4	41.6	39
		MAX	0.3	85.7	41.7	40
		MIN	0.3	82.9	41.5	38
30	6	AV4	0.3	83.4	41.8	39
		MAX	0.3	84.2	41.7	40
		MIN	0.3	82.3	41.5	39
34	6	AV4	0.3	82.8	41.6	39
		MAX	0.3	83.9	41.7	40
		MIN	0.3	81.7	41.5	39
38	6	AV4	0.3	82.3	41.6	39
		MAX	0.3	83.1	41.7	40
		MIN	0.3	80.9	41.6	39
42	6	AV4	0.3	83.6	41.6	40
		MAX	0.3	84.6	41.7	40
		MIN	0.3	82.7	41.5	39
46	6	AV4	0.3	82.3	41.6	39
		MAX	0.3	82.7	41.6	40
		MIN	0.3	82.0	41.6	39
50	6	AV4	0.3	81.7	41.6	40
		MAX	0.3	83.1	41.7	40
		MIN	0.3	80.2	41.5	40
54	6	AV4	0.3	82.1	41.6	39
		MAX	0.3	83.5	41.6	40
		MIN	0.3	81.5	41.6	39
57	6	AV3	0.3	81.3	41.6	40
		MAX	0.3	83.0	41.6	40
		MIN	0.3	80.1	41.6	39
		Average	0.3	83.5	41.6	40
		Maximum	0.3	88.1	41.7	41
		Minimum	0.3	80.1	41.5	38

Total number of blows analyzed: 55

BL# Sensors

1-57 F3: [NWJ1] 211.5 (1.10); F4: [NWJ2] 210.7 (1.10); A3: [K4296] 370.0 (0.90); A4: [K1067] 342.0 (0.90)

Time Summary

Drive 1 minute 25 seconds 11:59 AM - 12:00 PM BN 1 - 57

Printed: 10-March-2015

EarthSpectives - PDIPLOT2 Ver 2014.2.48.1 - Case Method & iCAP® Results

Test started: 26-February-2015

CASCADE DRILLING - NWJ ROD AUTODROP HAMMER L1241-TEST3

CME1050 SN263250

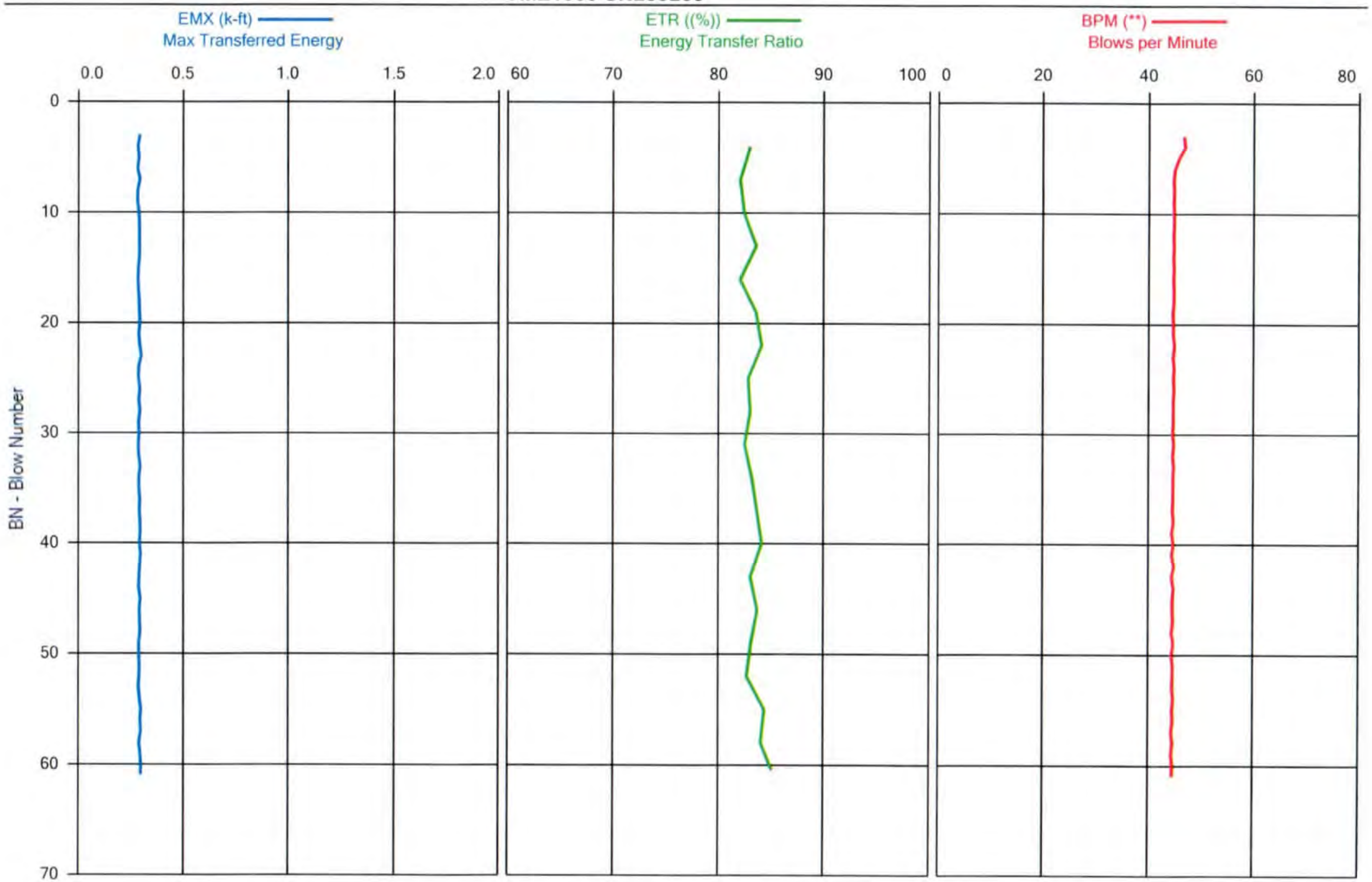

Plate - 40

FIGURE A-14f

CASCADE DRILLING - NWJ ROD AUTODROP HAMMER L1241-TEST3 — CME1050 SN263250

OP: SD — Date: 26-February-2015

AR: 1.46 in² — SP: 0.492 k/ft³

LE: 8.10 ft — EM: 30,000 ksi

WS: 16,807.9 f/s — JC: 0.50 []

EMX: Max Transferred Energy — BPM: Blows per Minute

ETR: Energy Transfer Ratio — FMX: Maximum Force

BL#	depth	TYPE	EMX	ETR	BPM	FMX
	ft		k-ft	(%)	**	kips
7	7	AV5	0.3	82.9	45.7	40
		MAX	0.3	84.6	46.8	40
		MIN	0.3	81.1	44.6	39
12	7	AV5	0.3	82.4	44.7	40
		MAX	0.3	83.6	44.7	40
		MIN	0.3	80.9	44.6	39
17	7	AV5	0.3	82.7	44.7	39
		MAX	0.3	83.7	44.7	40
		MIN	0.3	82.0	44.6	39
22	7	AV5	0.3	83.5	44.6	39
		MAX	0.3	84.2	44.8	40
		MIN	0.3	82.6	44.5	39
27	7	AV5	0.3	83.4	44.6	40
		MAX	0.3	85.9	44.7	40
		MIN	0.3	82.3	44.5	39
32	7	AV5	0.3	82.8	44.6	39
		MAX	0.3	84.1	44.7	40
		MIN	0.3	82.0	44.5	39
37	7	AV5	0.3	83.3	44.6	39
		MAX	0.3	84.4	44.7	40
		MIN	0.3	82.6	44.5	39
42	7	AV5	0.3	84.1	44.6	39
		MAX	0.3	84.6	44.8	40
		MIN	0.3	83.6	44.4	38
47	7	AV5	0.3	83.3	44.5	39
		MAX	0.3	84.3	44.7	40
		MIN	0.3	82.4	44.4	38
52	7	AV5	0.3	83.1	44.5	39
		MAX	0.3	84.2	44.7	39
		MIN	0.3	82.6	44.4	39
57	7	AV5	0.3	84.1	44.5	39
		MAX	0.3	85.4	44.7	40
		MIN	0.3	82.1	44.4	38
61	7	AV4	0.3	84.4	44.5	39
		MAX	0.3	85.3	44.6	40
		MIN	0.3	82.7	44.4	38
		Average	0.3	83.3	44.7	39
		Maximum	0.3	85.9	46.8	40
		Minimum	0.3	80.9	44.4	38

Total number of blows analyzed: 59

BL# Sensors

1-61 F3: [NWJ1] 211.5 (1.10); F4: [NWJ2] 210.7 (1.10); A3: [K4296] 370.0 (0.90); A4: [K1067] 342.0 (0.90)

Time Summary

Drive 1 minute 27 seconds 12:02 PM - 12:03 PM BN 1 - 61

Appendix B Laboratory Testing

APPENDIX B
LABORATORY TESTING

B.1 General

The laboratory testing was performed in accordance with the American Society for Testing and Materials (ASTM) and Caltrans Test Methods (CTM).

Modified California drive samples, Standard Penetration Test (SPT) drive samples, and bulk samples collected during the field investigation were carefully sealed in the field to prevent moisture loss. Soil samples were then transported to the laboratory for further examination and testing. Tests were performed on selected samples as an aid in classifying the earth materials and to evaluate their physical properties and engineering characteristics.

Laboratory testing for this investigation included:

- Soil Classification: USCS (ASTM D2487) and Visual/Manual (ASTM D2488);
- Moisture content (ASTM D2216) and Dry Unit Weight (ASTM D2937);
- Atterberg Limits (ASTM D4318);
- Grain Size Distribution (ASTM D422) & % Percent Passing #200 Sieve (ASTM D1140);
- Direct Shear (ASTM D3080);
- Laboratory Compaction Test (ASTM D1557);
- Expansion Index (ASTM D4829);
- R-Value (CTM 301);
- Collapse Potential (ASTM D5333);
- Soil Corrosivity:
  - pH (CTM 643);
  - Water-Soluble Sulfate (ASTM D516, CTM 417);
  - Water-Soluble Chloride(Ion-Specific Probe, CTM 422);
  - Minimum Electrical Resistivity (CTM 643);

A summary of laboratory test results is presented in Table B-1. Brief descriptions of the laboratory testing program and test results are presented below.

B.2 Soil Classification

Earth materials recovered from subsurface explorations were classified in general accordance with Caltrans' "Soil and Rock Logging Classification Manual, 2010". The subsurface soils were classified visually / manually in the field in accordance with the Unified Soil Classification System (USCS) following ASTM D2488; soil classifications were modified as necessary based on testing in the laboratory in accordance with ASTM D2487. The details of the soil and rock classification systems and boring records are presented in Appendix A.

B.3 Moisture Content and Dry Unit Weight

The in-situ moisture content of selected bulk, SPT and Ring samples was determined by oven drying in general accordance with ASTM D2216. Selected California Ring samples were trimmed flush in the metal rings and wet weight was measured. After drying, the dry weight of each sample was measured, volume and weight of the metal containers was measured, and moisture content and dry density were calculated in general accordance with ASTM D2216 and D2937. Moisture content and dry unit weight test results are presented in Table B-1 and on the boring records in Appendix A.

B.4 Atterberg Limits

Characterization of the fine-grained fractions of soils was evaluated using the Atterberg Limits test. This test includes Liquid Limit and Plastic Limit tests to determine the Plasticity Index in accordance with ASTM D4318. Atterberg Limits test results are presented on the boring records in Appendix A, are summarized in Table B-1, and are plotted on a Plasticity Chart in Figure B-1.

B.5 Grain Size Distribution and Percent Passing No. 200 Sieve:

Representative samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. The percentage of fines (soil passing No. 200 sieve) was determined for selected samples in accordance with ASTM D1140. For selected samples the washed fraction retained on the No. 200 sieve was then screened on a No. 4 sieve, and the fraction retained on No. 4 was weighed to determine the percentage of gravel. For selected samples, the washed material retained on No. 200 sieve was shaken through a standard stack of sieves in accordance with ASTM D422 to determine the grain size distribution. The results of grain size distribution tests are plotted in Figures B-2a and B-2b. The relative proportion (or percentage) by dry weight of gravel (retained on No. 4 sieve), sand (passing No. 4 and retained on No. 200 sieve), and fines (passing No. 200 sieve) are listed on the boring records in Appendix A and summarized in Table B-1.

B.6 Direct Shear Test

Direct shear tests were performed on selected in situ samples in accordance with ASTM D3080 to evaluate the drained shear strength parameters of the on-site soils. After the initial weight and volume were measured, the sample was placed in the shear machine, and a selected normal load was applied. The sample was saturated or kept at field moisture (to model worst case field conditions), allowed to consolidate under the selected normal load, and then sheared to failure. Shear rate was selected to maintain drained conditions. Shear stress and vertical/horizontal sample deformations were monitored throughout the test.

The process was repeated on additional samples of the same soil material at two additional normal loads. The test results are presented in Figures B-3a though B-3d.

B.7 Laboratory Compaction Test

The laboratory maximum dry density and optimum water content for compacted soils were determined in accordance with ASTM D1557. Compaction test results are presented in Figures B-4a and B-4b and are listed in Table B-1.

B.8 Expansion Index

The expansion potential of the site soils was estimated using the Expansion Index Test in accordance with ASTM D4829. The expansion index test results are presented in Figures B-5a and B-5b and listed in Table B-1.

B.9 R-Value Tests

Resistance or R-value tests were performed on selected bulk samples of the subgrade soils encountered along the proposed roadway project site. The tests were conducted in general accordance with CTM 301. The R-value test results are presented in Figures B-6a through B-6f.

B.10 Collapse Potential

Collapse potential tests were performed in general accordance with ASTM D5333. Collapse potential of soil method is used to determine the magnitude of collapse of soil that may occur for a given vertical (axial) stress when unsaturated soils become 100% saturated with fluid. Collapse potential test results are presented in Figure B-7.

B.11 Soil Corrosivity

Soil corrosivity tests were performed to determine corrosion potential of site soils on concrete and ferrous metals. Corrosivity testing included minimum electrical resistivity and soil pH (Caltrans method 643), and water-soluble sulfates (ASTM D516). Corrosivity test results are presented in Figure B-8 and listed Table B-1.

B.12 List of Attached Figures

The following table and figures are attached:

List of Table

Table B-1	Summary of Laboratory Test Results

List of Figures

Figure B-1	Atterberg Limits Test Results
Figures B-2a and B-2b	Grain Size Analysis Test Results
Figures B-3a through B-3d	Direct Shear Test Results
Figure B-4a and B-4b	Laboratory Compaction Test Results
Figure B-5a and B-5b	Expansion Index Test Results
Figure B-6a though B-6f	R-Value Test Results
Figure B-7	Collapse Potential Test Result
Figure B-8	Corrosion Test Results

Boring No.	Sample No.	Depth (ft)	Sample Type	USCS Group Symbol	SPT N*60 (blows/ft)	Undrained Shear Strength, Su (ksf): Pocket Pen.	Undrained Shear Strength, Su (ksf): Mini Vane	Undrained Shear Strength, Su (ksf): UU Test	Moisture Content (%)	Dry Unit Weight (pcf)	Total Unit Wt (pcf)	Atterberg Limits: LL	Atterberg Limits: PL	Atterberg Limits: PI	Grain Size Distribution (%) by dry weight: Gravel	Grain Size Distribution (%) by dry weight: Sand	Grain Size Distribution (%) by dry weight: Fines	Other Tests
A-16-001	B-1	0.0	BULK	SM														CP, CR, DS
A-16-001	S-2	2.5	SPT	SM	70/5"													
A-16-001	R-3	5.0	MC	SM	47/3"				2.8	117	120	NP	NP	NP	0	87	13	#200
A-16-001	S-4	10.0	SPT	SP-SM	70/4"													
A-16-001	R-5	15.0	MC	SW-SM	90/9"										1	87	12	PA
A-16-001	R-5-2	15.3	MC	SW-SM														
A-16-001	R-5-1	15.8	MC	SW-SM					2.7	113	116							
A-16-001	S-6	20.0	SPT	IGNEOUS ROCK	70/3"													
A-16-001	S-7	22.5	SPT	IGNEOUS ROCK	REF													
A-16-002	B-1	0.0	BULK	SM														EI, R
A-16-002	R-2	2.5	MC	SP-SM	9				2.3	108	110				0	90	10	#200, DS
A-16-002	S-3	5.0	SPT	SP-SM	49													
A-16-002	R-4	10.0	MC	SP-SM	74/9"													
A-16-002	R-4-2	10.8	MC	SP-SM														
A-16-002	R-4-1	11.3	MC	SP-SM					2.5	93	95							
A-16-002	S-5	15.0	SPT	IGNEOUS ROCK	70/5"													
A-16-002	S-6	17.3	SPT	IGNEOUS ROCK	70/2"													
A-16-003	B-1	0.0	BULK	SM														
A-16-003	R-2	2.5	MC	SM	47/5"													
A-16-003	R-2-2	2.8	MC	SW-SM														
A-16-003	R-2-1	3.0	MC	SW-SM					2.5	117	120				0	94	6	PA
A-16-003	S-3	5.0	SPT	SW-SM	70/6"													
A-16-003	R-4	10.0	MC	SM	47/6"				2.6	118	121				1	82	17	PA
A-16-003	S-5	15.0	SPT	SM	70/4"													
A-16-003	R-6	20.0	MC	SM	83/9"				3.1	118	122							
A-16-003	S-7	25.0	SPT	IGNEOUS ROCK	REF													
A-16-003	R-8	30.0	MC	IGNEOUS ROCK	47/5"				2.9	110	113							
A-16-004	B-1	0.0	BULK	SM														CP, CR, DS*
A-16-004	S-2	2.5	SPT	SM	36													
A-16-004	R-3	5.0	MC	SP-SM	46				5.5	115	121	NP	NP	NP	1	92	7	#200

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TABLE B-1: Summary of Laboratory Results

Project: Camino Del Norte Extension

Location: Lake Elsinore, California

Number: IR 645

Boring No.	Sample No.	Depth (ft)	Sample Type	USCS Group Symbol	SPT N*60 (blows/ft)	Undrained Shear Strength, Su (ksf)			Moisture Content (%)	Dry Unit Weight (pcf)	Total Unit Wt (pcf)	Atterberg Limits			Grain Size Distribution (%) by dry weight			Other Tests
						Pocket Pen.	Mini Vane	UU Test				LL	PL	PI	Gravel	Sand	Fines	
A-16-004	S-4	10.0	SPT	SP	121/11"													
A-16-004	R-5	15.0	MC	SP	76/11"				9.3	107	117							
A-16-004	S-6	20.0	SPT	IGNEOUS ROCK	70/5"													
A-16-005	B-1	0.0	BULK	SM														
A-16-005	S-2	2.5	SPT	SM	72										0	87	13	#200
A-16-005	R-3	5.0	MC	IGNEOUS ROCK	47/6"				3.4	125	129				0	81	19	PA
A-16-005	S-4	7.5	SPT	IGNEOUS ROCK	70/6"													
A-16-006	B-1	0.0	BULK	SM														R
A-16-006	S-2	2.5	SPT	SM	29				3.4						1	80	19	#200
A-16-006	R-3	5.0	MC	SP	68				2.7	123	126							
A-16-006	S-4	10.0	SPT	SP-SM	116													
A-16-006	R-5	15.0	MC	IGNEOUS ROCK	69				3.7	124	129				2	90	8	PA
A-16-006	S-6	17.5	SPT	IGNEOUS ROCK	70/6"													
A-16-007	B-1	0.0	BULK	SM														CL, DS
A-16-007	R-2	2.5	SPT	SM	38				3.6						1	73	26	#200
A-16-007	S-3	5.0	MC	SM	70/6"													
A-16-007	R-4	7.5	SPT	IGNEOUS ROCK	56				6.5	121	129				2	78	20	PA
A-16-008	B-1	0.0	BULK	SP-SM														
A-16-008	S-2	2.5	SPT	SP-SM	128/11"				2.8						38	48	14	#200
A-16-008	R-3	5.0	MC	IGNEOUS ROCK	47/3"				2.6	114	117				34	54	12	PA
A-16-008	S-4	10.0	SPT	IGNEOUS ROCK	70/4"													
A-16-009	B-1	0.0	BULK	SM														CR
A-16-009	R-2	2.5	MC	IGNEOUS ROCK	47/3"				1.3						74	22	4	PA
A-16-009	S-3	5.0	SPT	IGNEOUS ROCK	70/4"													
A-16-009	R-4	10.0	MC	IGNEOUS ROCK	47/6"													
A-16-009	S-5	15.0	SPT	IGNEOUS ROCK	REF													
A-16-009A	S-1	15.0	SPT	IGNEOUS ROCK	70/2"													
A-16-009A	S-2	20.0	SPT	IGNEOUS ROCK	70/3"													
A-16-010	B-1	0.0	BULK	SC														EI, R
A-16-010	S-2	2.5	SPT	SC	31				6.1			29	16	13	11	59	30	#200

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TABLE B-1: Summary of Laboratory Results

Project: Camino Del Norte Extension

Location: Lake Elsinore, California

Number: IR 645

Boring No.	Sample No.	Depth (ft)	Sample Type	USCS Group Symbol	SPT N*60 (blows/ft)	Undrained Shear Strength, Su (ksf)			Moisture Content (%)	Dry Unit Weight (pcf)	Total Unit Wt (pcf)	Atterberg Limits			Grain Size Distribution (%) by dry weight			Other Tests
						Pocket Pen.	Mini Vane	UU Test				LL	PL	PI	Gravel	Sand	Fines	
A-16-010	R-3	5.0	MC	SP-SM	23				6.8	105	112							
A-16-010	S-4	10.0	SPT	SP-SM	28													
A-16-010	R-5	15.0	MC	SM	33				6.3	107	114							
A-16-010	S-6	20.0	SPT	SP-SM	70/6"													

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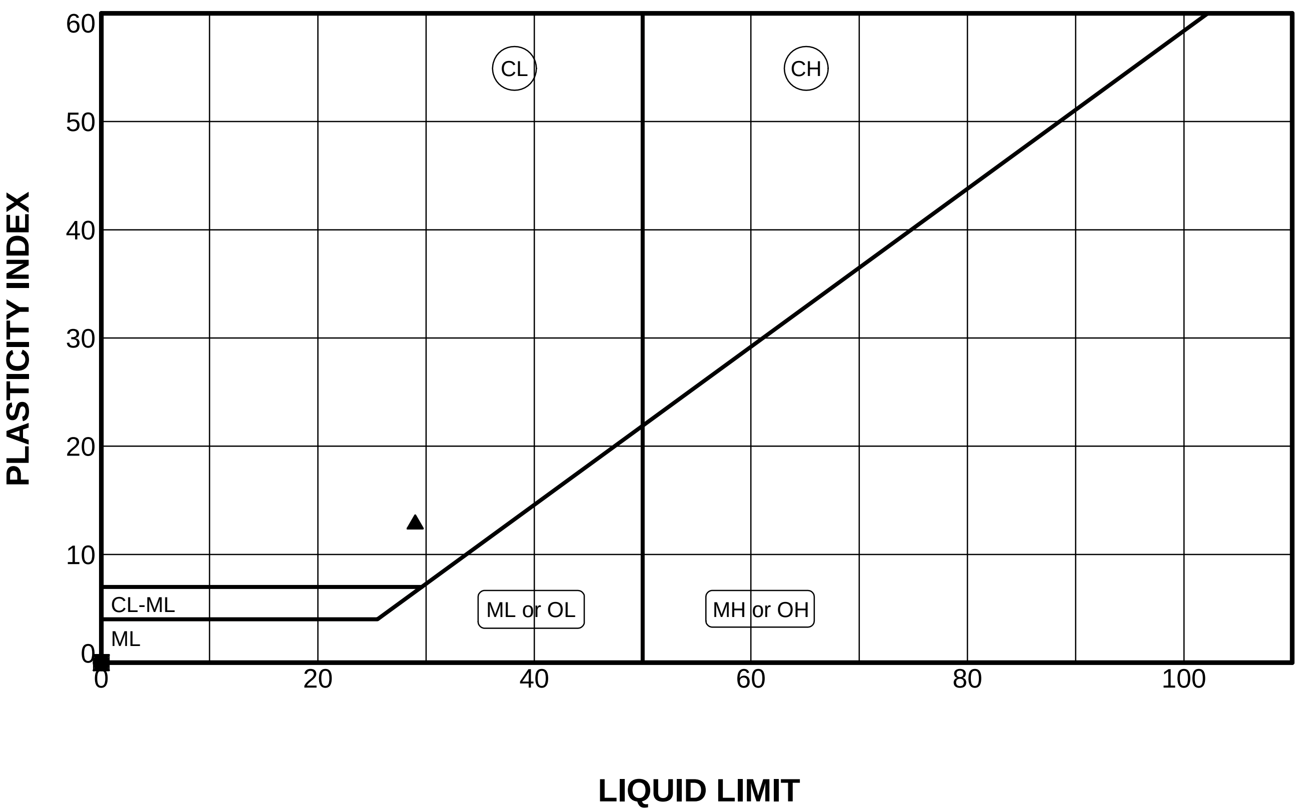
TABLE B-1: Summary of Laboratory Results

Project: Camino Del Norte Extension

Location: Lake Elsinore, California

Number: IR 645



SYMBOL	BORING	DEPTH (ft)	LL	PL	PI	LI	w%	USCS CLASSIFICATION
●	**A-16-001**	**5.0**	**NP**	**NP**	**NP**		**3**	**SILTY SAND (SM)**
⊠	**A-16-004**	**5.0**	**NP**	**NP**	**NP**		**6**	**Poorly-graded SAND with SILT (SP-SM)**
▲	**A-16-010**	**2.5**	**29**	**16**	**13**	**-0.77**	**6**	**CLAYEY SAND (SC)**

GDC_ATTERBERG_APP_E_IR-645.GPJ GDC_WLOG.GDT 4/21/16

GROUP DELTA

ATTERBERG LIMITS

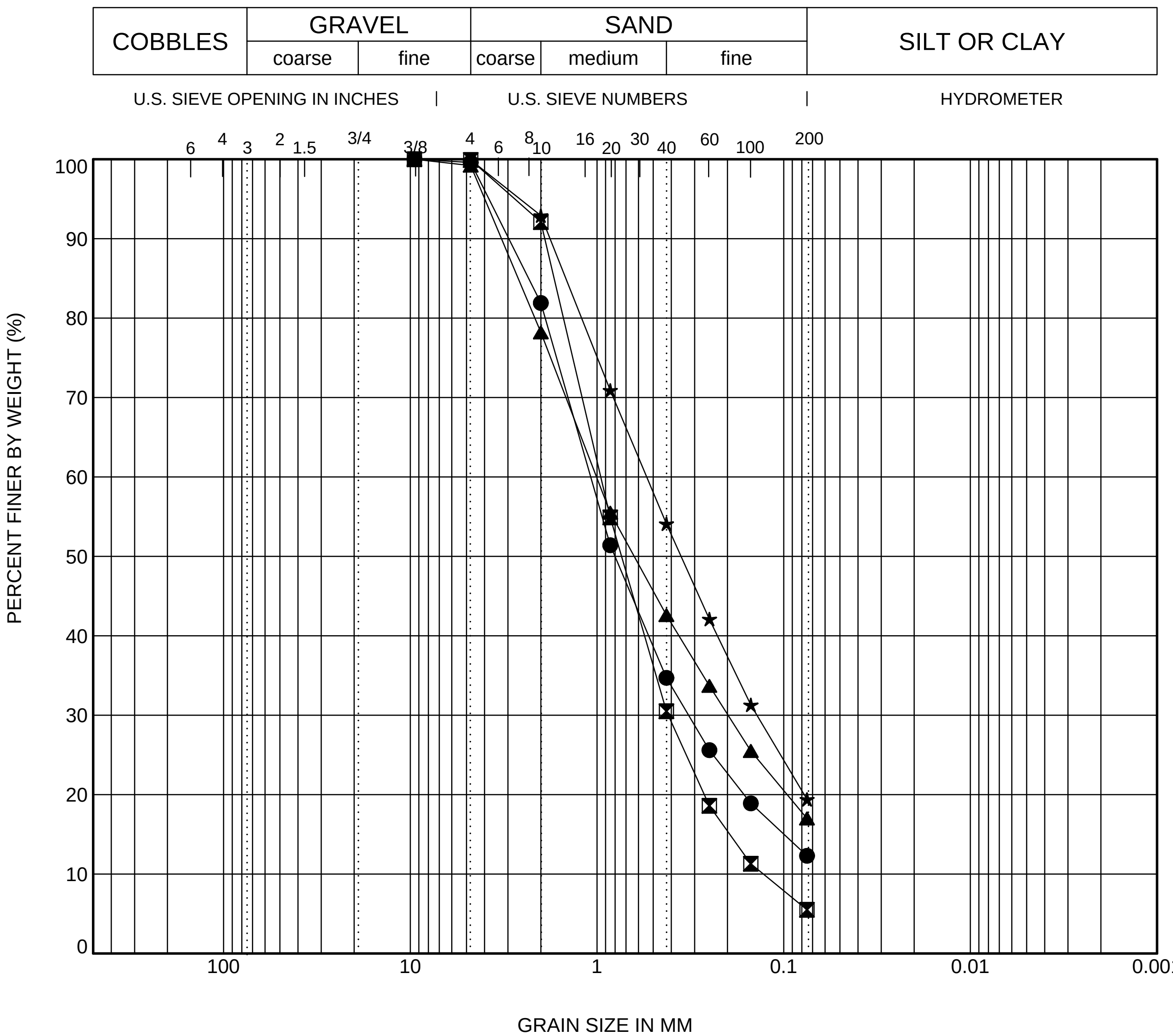
GROUP DELTA CONSULTANTS

Project: Camino Del Norte Extension

Location: Lake Elsinore, California

Number: IR 645

FIGURE B-1



SYMBOL	BORING	DEPTH (ft)	USCS CLASSIFICATION
●	A-16-001	15.8	**Well-graded SAND with SILT (SW-SM)**
⊠	A-16-003	3.0	**Well-graded SAND with SILT (SW-SM)**
▲	A-16-003	10.0	**SILTY SAND (SM)**
★	A-16-005	5.0	**SILTY SAND (SM)**

SYMBOL	BORING	DEPTH (ft)	D100	D60	D30	D10	LL	PL	PI	Cc	Cu
●	A-16-001	15.8	9.5	1.082	0.323					1.64	18.37
⊠	A-16-003	3.0	9.5	0.956	0.416	0.128				1.41	7.44
▲	A-16-003	10.0	9.5	1.007	0.199						
★	A-16-005	5.0	9.5	0.542	0.139						

GDC GRAIN SIZE APP E IR-645.GPJ GDC WLOG.GDT 4/21/16

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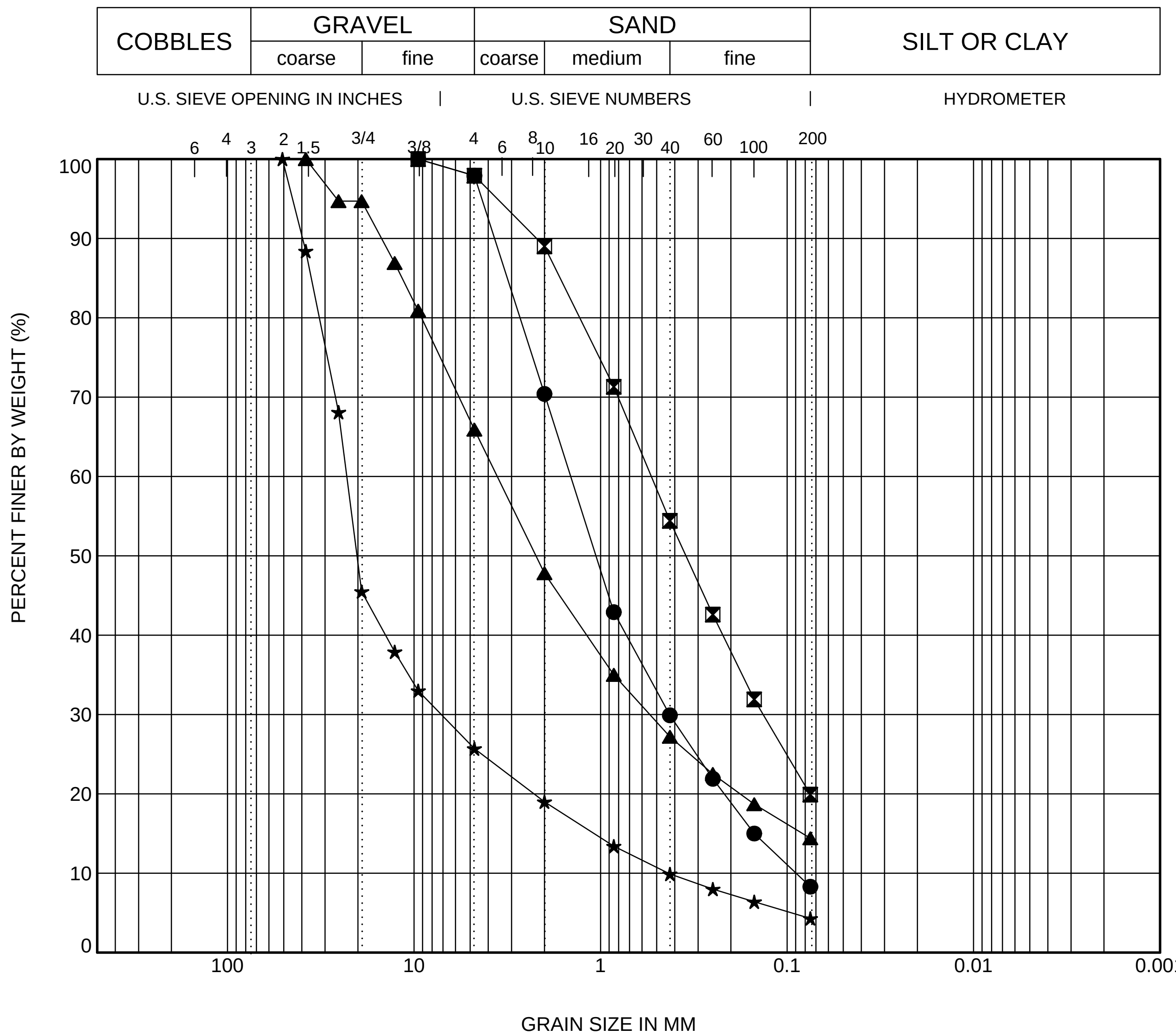
GRAIN SIZE DISTRIBUTION
(ASTM D 422)

GROUP DELTA CONSULTANTS

Project: Camino Del Norte Extension
Location: Lake Elsinore, California
Number: IR 645

FIGURE B-2a



SYMBOL	BORING	DEPTH (ft)	USCS CLASSIFICATION
●	**A-16-006**	**15.0**	**Well-graded SAND with SILT (SP-SM)**
⊠	**A-16-007**	**7.5**	**SILTY SAND (SM)**
▲	**A-16-008**	**5.0**	**SILTY SAND with GRAVEL (SM)**
★	**A-16-009**	**2.5**	**Poorly-graded GRAVEL with SAND (GP)**

SYMBOL	BORING	DEPTH (ft)	D100	D60	D30	D10	LL	PL	PI	Cc	Cu
●	**A-16-006**	**15.0**	**9.5**	**1.447**	**0.427**	**0.089**				**1.41**	**16.18**
⊠	**A-16-007**	**7.5**	**9.5**	**0.535**	**0.134**						
▲	**A-16-008**	**5.0**	**38.1**	**3.583**	**0.545**						
★	**A-16-009**	**2.5**	**50.8**	**22.933**	**7.145**	**0.434**				**5.14**	**52.90**

GDC_GRAIN_SIZE_APP_E_IR-645.GPJ GDC_WLOG.GDT 4/21/16

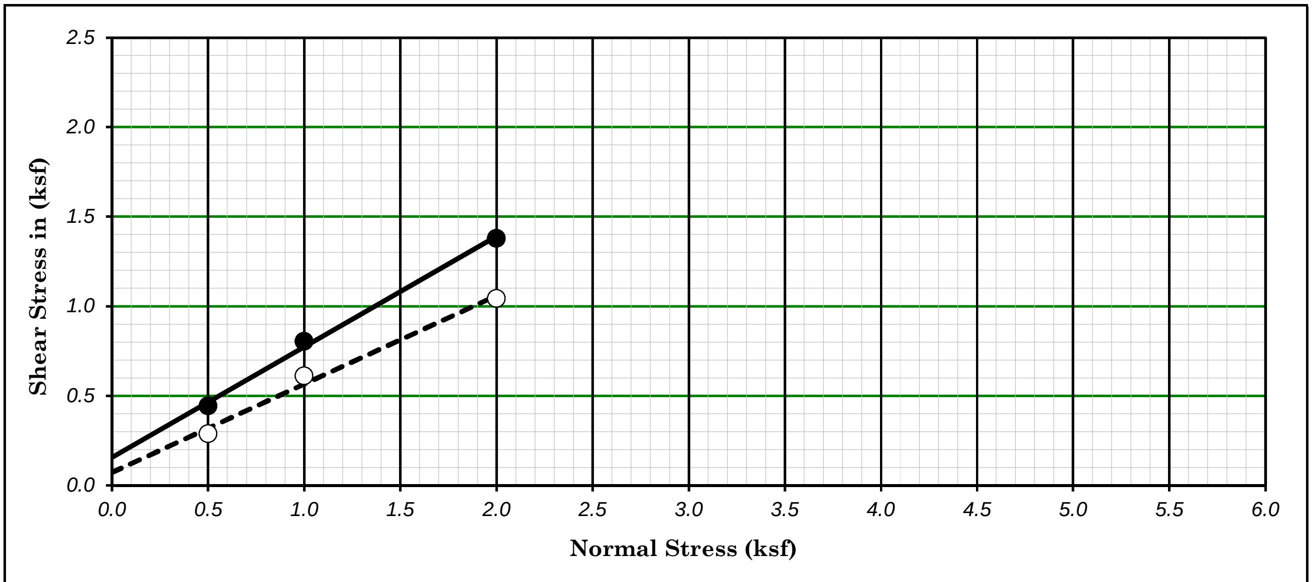
GROUP DELTA

GRAIN SIZE DISTRIBUTION
(ASTM D 422)

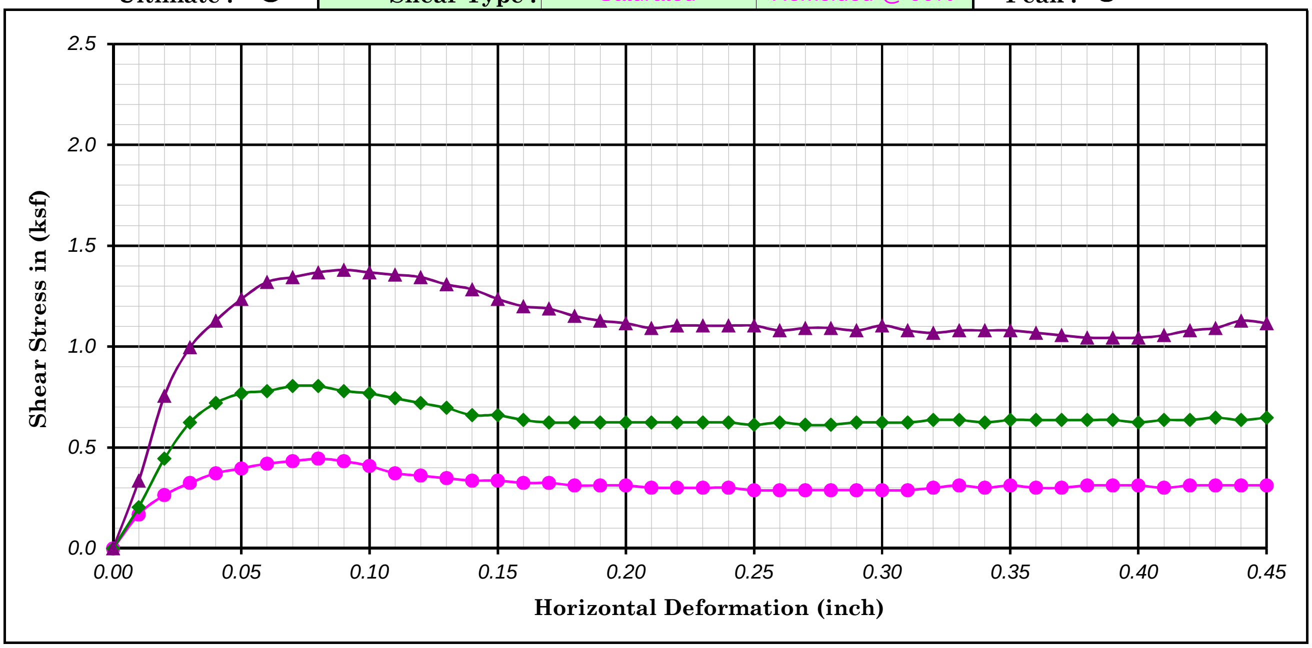
GROUP DELTA CONSULTANTS

Project: Camino Del Norte Extension
Location: Lake Elsinore, California
Number: IR 645

FIGURE B-2b



Ultimate : ○	Shear Type :	Saturated	Remolded @ 90%	Peak : ●



Boring No. : A-16-001	Strength Intercept (C) :	0.16	(ksf)	Peak	0.07	(ksf)	Ultimate
Sample No. : B-1		7.47	(kPa)		3.45	(kPa)	
Depth (ft/m) : 0 - 5	Friction Angle (ϕ) :	31.68	Degree		26.28	Degree	
Description : Brown Silty Sand - Remolded				Shear Rate (inch/minute) :	0.005		

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	14.77	119.20	18.76	0.39	0.50	23.94	0.44	21.26	0.29	13.79
◆	14.43	119.22	18.77	0.39	1.00	47.88	0.80	38.50	0.61	29.30
▲	14.36	119.84	18.86	0.38	2.00	95.76	1.38	66.07	1.04	49.99

GROUP DELTA

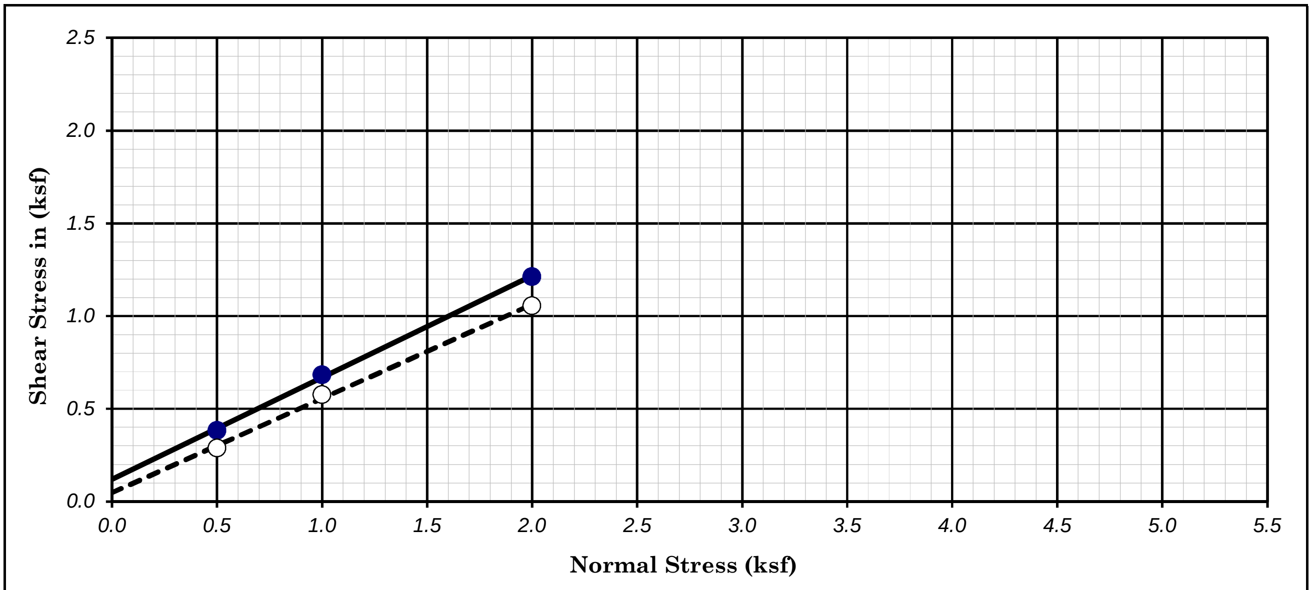
Camino Del Norte Extension

Project No. : IR645 **Date :** 04/07/16

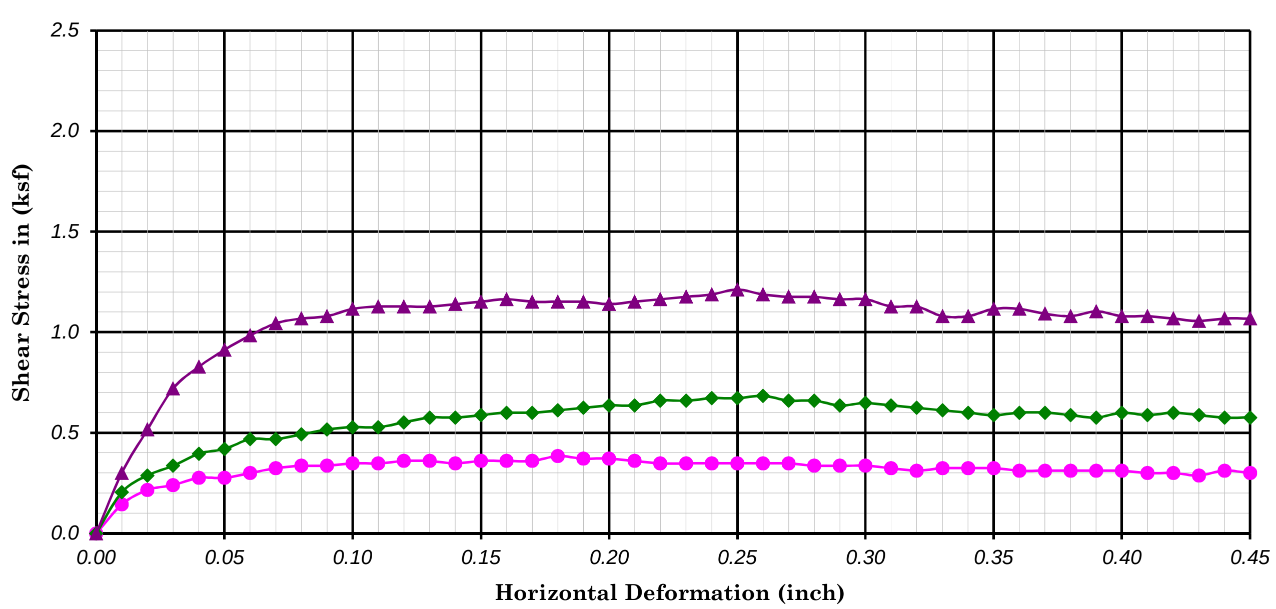
DIRECT SHEAR TEST

(ASTM D -3080)

Figure No. : B-3a

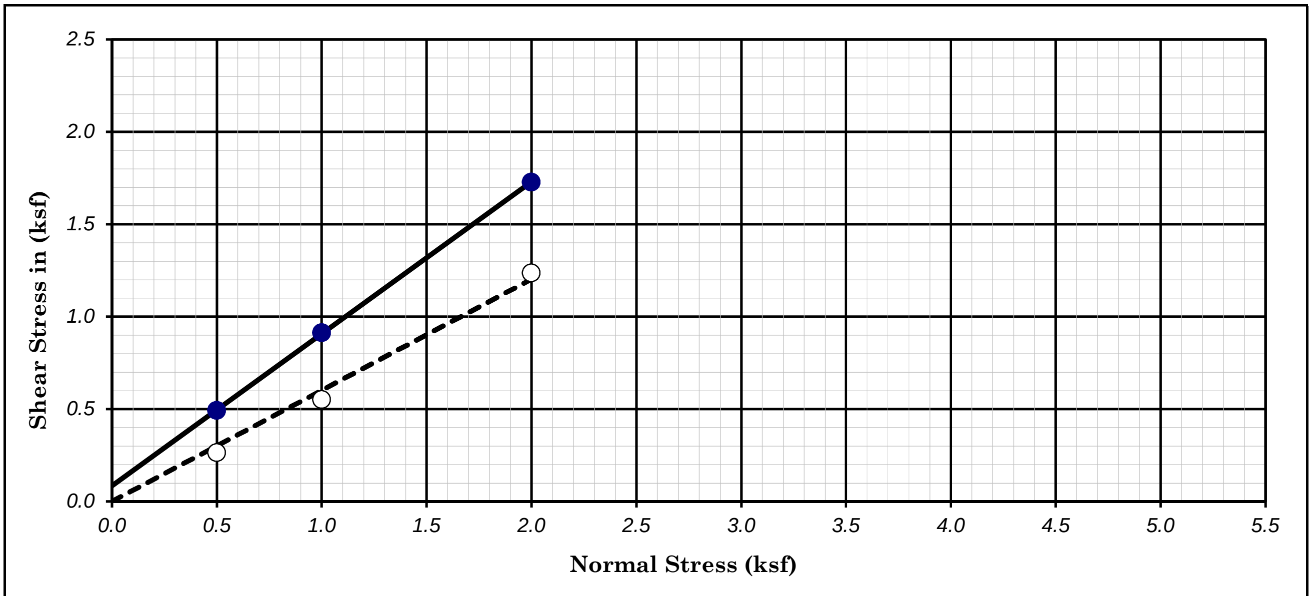


Ultimate : ○	Shear Type :	Saturated	Undisturbed	Peak : ●

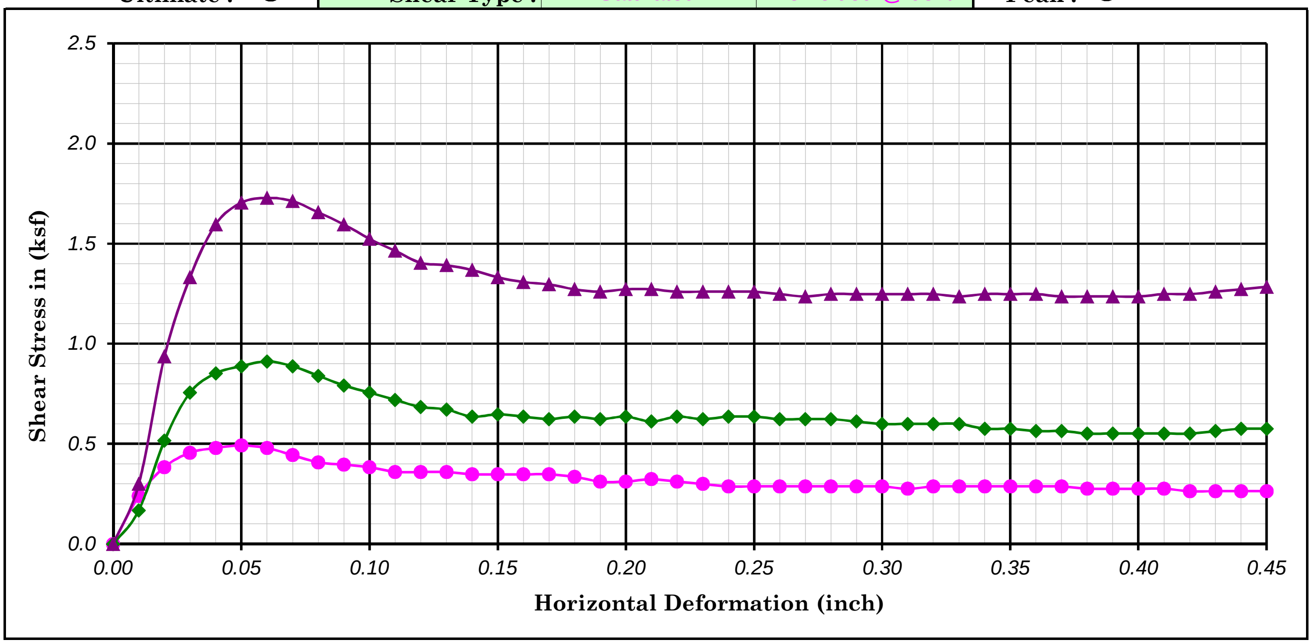


Boring No. : A-16-002		Strength Intercept (C) :		0.12	(ksf)	Peak		0.05	(ksf)	Ultimate	
Sample No. : R-2				5.75	(kPa)			2.30	(kPa)		
Depth (ft/m) : 2.5	0.76	Friction Angle (ϕ) :		28.75	Degree			26.90	Degree		
Description : Light Brown Poorly-graded SAND with SILT							Shear Rate (inch/minute) :			0.005	
SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)	
●	19.04	105.37	16.59	0.48	0.50	23.94	0.38	18.39	0.29	13.79	
◆	18.96	106.52	16.77	0.47	1.00	47.88	0.68	32.75	0.58	27.58	
▲	17.47	107.19	16.87	0.46	2.00	95.76	1.21	58.03	1.06	50.56	

GROUP DELTA	**Camino Del Norte Extension**	**DIRECT SHEAR TEST** (ASTM D -3080)
	Project No. : IR645 / Date : 04/07/16	Figure No. : B-3b



Ultimate : ○	Shear Type :	Saturated	Remolded @ 95%	Peak : ●



Boring No. : A-16-004	Strength Intercept (C) :	0.08	(ksf)	Peak	0.00	(ksf)	Ultimate
Sample No. : B-1		4.02	(kPa)		0.00	(kPa)	
Depth (ft/m) : 0 - 5	Friction Angle (ϕ) :	39.45	Degree		31.01	Degree	
Description : Light Brown Silty Sand - Remolded				Shear Rate (inch/minute) :	0.005		

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	15.57	125.83	19.81	0.45	0.50	23.94	0.49	23.56	0.26	12.64
◆	15.58	126.30	19.88	0.45	1.00	47.88	0.91	43.67	0.55	26.43
▲	15.20	126.92	19.98	0.44	2.00	95.76	1.73	82.74	1.24	59.18

GROUP DELTA

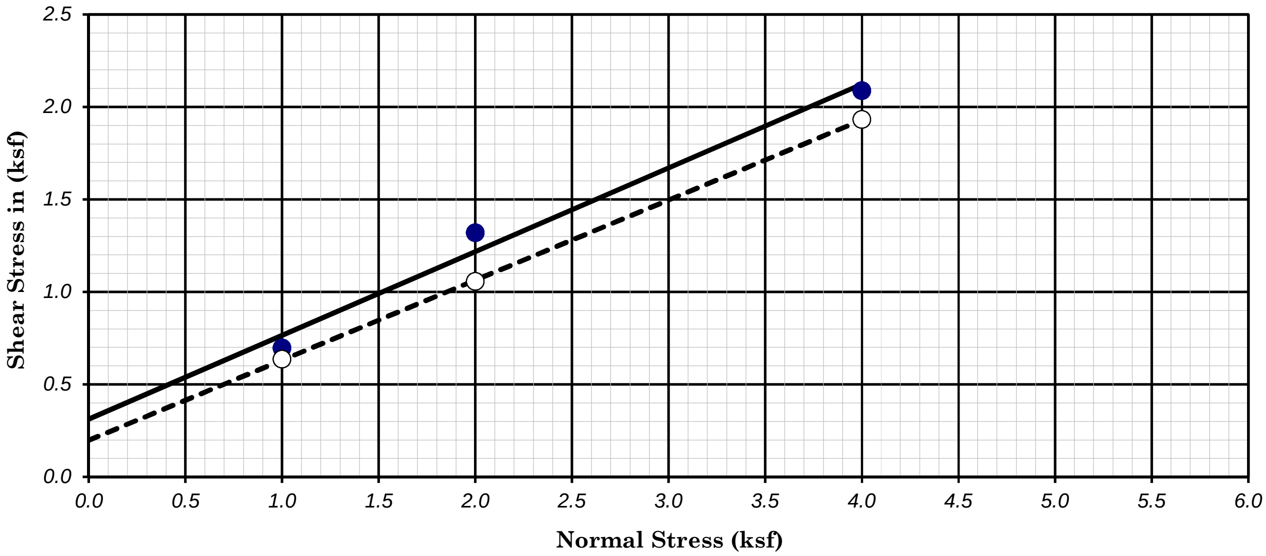
Camino Del Norte Extension

Project No. : IR645 **Date :** 04/08/16

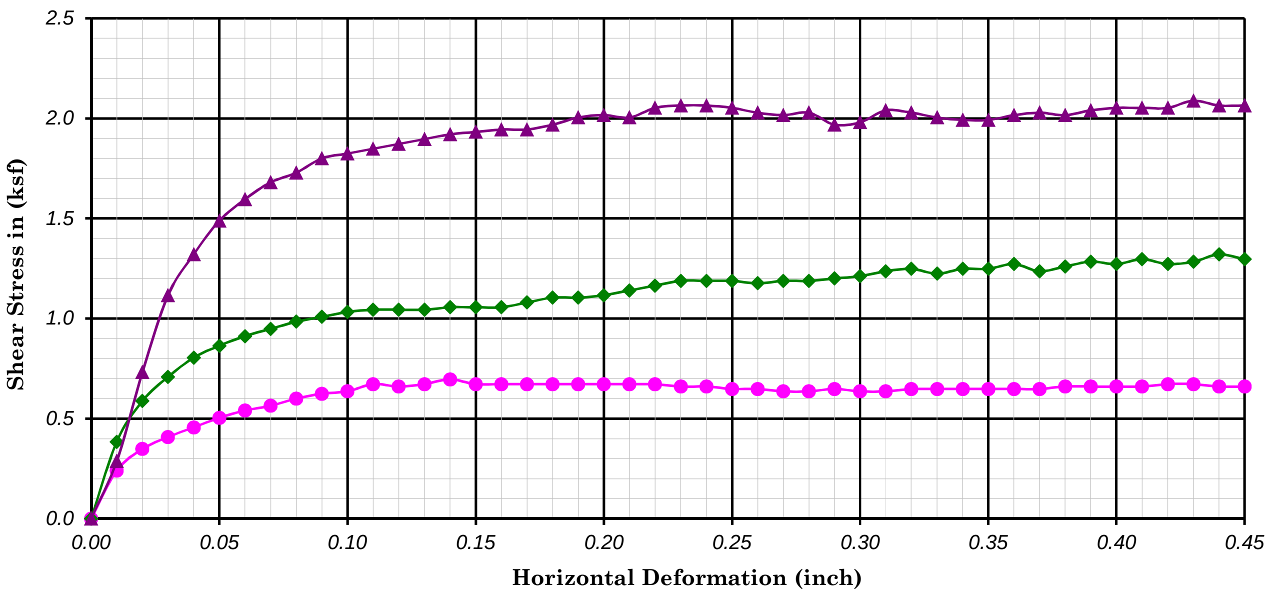
DIRECT SHEAR TEST

(ASTM D -3080)

Figure No. : B-3c



Ultimate : ○ | Shear Type : Saturated | Undisturbed | Peak : ●



Boring No. : A-16-007		Strength Intercept (C) :	0.31	(ksf)	Peak	0.20	(ksf)	Ultimate	
Sample No. : R-2			14.94	(kPa)		9.48	(kPa)		
Depth (ft/m) : 2.5	0.76	Friction Angle (ϕ) :	24.35	Degree		23.41	Degree		

Description : Orangish Brown Silty Sand

Shear Rate (inch/minute) : 0.005

SYMBOL	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DRY DENSITY (kN/m^3)	VOID RATIO	NORMAL STRESS (ksf)	NORMAL STRESS (kPa)	PEAK STRESS (ksf)	PEAK STRESS (kPa)	ULTIMATE STRESS (ksf)	ULTIMATE STRESS (kPa)
●	19.80	108.17	17.03	0.60	1.00	47.88	0.70	33.32	0.64	30.45
◆	19.20	113.23	17.82	0.53	2.00	95.76	1.32	63.20	1.06	50.56
▲	18.68	114.06	17.95	0.52	4.00	191.52	2.09	99.97	1.93	92.50

GROUP DELTA

Camino Del Norte Extension

Project No. : IR645

Date : 04/08/16

DIRECT SHEAR TEST
(ASTM D -3080)

Figure No. : B-3d

GROUP DELTA	GROUP DELTA CONSULTANTS 1320 South Simpson Circle Anaheim, CA 92806 (714) 660-7500 office (714) 660-7550 fax

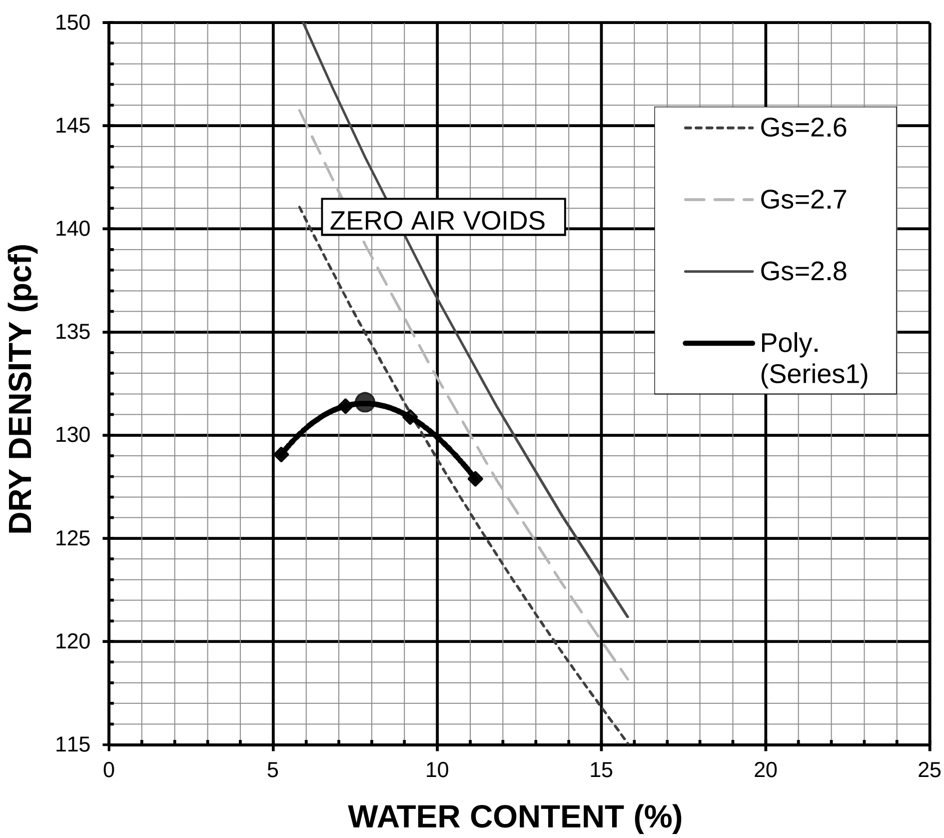
STANDARD TEST METHOD FOR MOISTURE - DENSITY RELATIONSHIP (ASTM D1557)

REV Aug 2012

PROJECT:	*Camino Del Norte Extension*	SAMPLE ID:	*SO3935*
PROJECT NO.:	*IR645*	DATE:	*March 30, 2016*
TESTED BY:	*B.Palma*	CHECKED BY:	*D. Robinson*
SAMPLE LOCATION:	*A-16-001 B-1 @ 0 - 5'*	DATE:	
SAMPLE DESCRIPTION::	*Brown Silty Sand*		

A) WATER ADDED	104	156	208	52			milliliters
B) MOLD TARE WEIGHT	2035.0	2035.0	2035.0	2035.0			grams
C) WEIGHT OF WET SOIL AND MOLD	4149.5	4179.6	4168.8	4073.8			grams
D) WET SOIL WEIGHT (C - B)	2114.5	2144.6	2133.8	2038.8			grams
E) WET DENSITY (D / V)	140.9	142.9	142.2	135.8			pcf
F) DRY DENSITY (E / [(L/100) + 1])	131.4	130.9	127.9	129.1			pcf

G) TARE WEIGHT	230.8	226.0	227.3	234.9			grams
H) WEIGHT OF WET SOIL AND TARE	1647.0	1711.5	1644.2	1729.5			grams
I) WEIGHT OF DRY SOIL AND TARE	1551.9	1586.7	1502.0	1655.0			grams
J) WEIGHT OF WATER (H - I)	95.1	124.8	142.2	74.5			grams
K) DRY WEIGHT OF SOIL (I - G)	1321.1	1360.7	1274.7	1420.1			grams
L) MOISTURE CONTENT (J / K * 100)	7.2	9.2	11.2	5.2			percent



4 INCH (4-1): V=15.01 pcf/gm
6 INCH (6-1): V=34.20 pcf/gm

B	METHOD USED (A,B or C)

A4-1	MOLD USED
15.01	MOLD VOLUME CORRECTION (V)
3/8	SIEVE NUMBER
0.4%	PERCENT RETAINED

131.6	**MAXIMUM DENSITY [PCF]**
7.8	**OPTIMUM MOISTURE [%]**

FIGURE B-4a

GROUP DELTA CONSULTANTS
1320 South Simpson Circle
Anaheim, CA 92806
(714) 660-7500 office
(714) 660-7550 fax

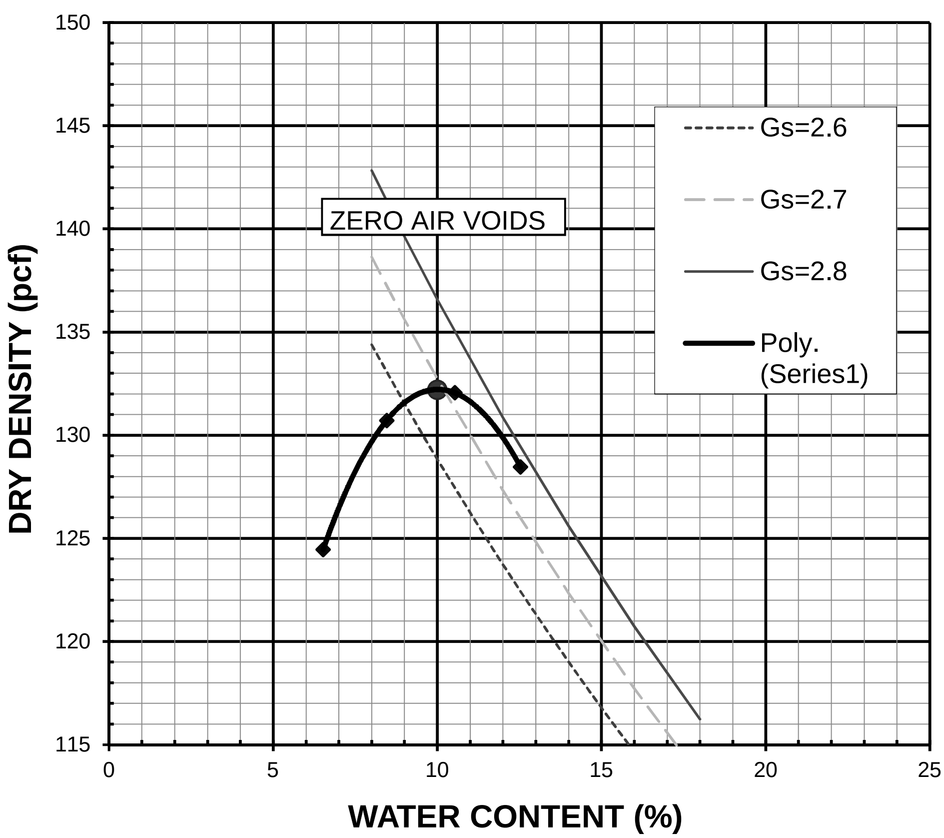
STANDARD TEST METHOD FOR MOISTURE - DENSITY RELATIONSHIP (ASTM D1557)

REV Aug 2012

PROJECT:	***Camino Del Norte Extension***	SAMPLE ID:	***SO3935***
PROJECT NO.:	***IR645***	DATE:	***April 1, 2016***
TESTED BY:	***B.Palma***	CHECKED BY:	***D. Robinson***
SAMPLE LOCATION:	***A-16-004 B-1 @ 0 - 5'***	DATE:	
SAMPLE DESCRIPTION::	***Light Brown Silty Sand***		

A) WATER ADDED	104	156	208	52			milliliters
B) MOLD TARE WEIGHT	2035.0	2035.0	2035.0	2035.0			grams
C) WEIGHT OF WET SOIL AND MOLD	4162.9	4225.9	4204.9	4025.0			grams
D) WET SOIL WEIGHT (C - B)	2127.9	2190.9	2169.9	1990.0			grams
E) WET DENSITY (D / V)	141.8	146.0	144.6	132.6			pcf
F) DRY DENSITY (E / [(L/100) + 1])	130.7	132.1	128.5	124.5			pcf

G) TARE WEIGHT	227.3	226.0	230.9	229.7			grams
H) WEIGHT OF WET SOIL AND TARE	1635.6	1664.6	1643.9	1611.6			grams
I) WEIGHT OF DRY SOIL AND TARE	1525.8	1527.5	1486.5	1527.0			grams
J) WEIGHT OF WATER (H - I)	109.8	137.1	157.4	84.6			grams
K) DRY WEIGHT OF SOIL (I - G)	1298.5	1301.5	1255.6	1297.3			grams
L) MOISTURE CONTENT (J / K * 100)	8.5	10.5	12.5	6.5			percent



4 INCH (4-1): V=15.01 pcf/gm
6 INCH (6-1): V=34.20 pcf/gm

B	METHOD USED (A,B or C)

A4-1	MOLD USED
15.01	MOLD VOLUME CORRECTION (V)
3/8	SIEVE NUMBER
0.4%	PERCENT RETAINED

132.2	**MAXIMUM DENSITY [PCF]**
10.0	**OPTIMUM MOISTURE [%]**

FIGURE B-4b

GROUP DELTA

EXPANSION INDEX OF SOIL

ASTM D-4829-10 / UBC 29-2

Project Name	: Camino Del Norte Extension : IR645				
Project No.	: A-16-002	Sampled By :	Barzin	Date :	03/22/16
Boring No.	: B-1	Prepared By :	Eric Y.	Date :	04/01/16
Sample No.	: 0 - 5' ###	Test By :	Eric Y.	Date :	04/04/16
Depth (ft/m)	:	Calculated By :	Eric Y.	Date :	04/05/16
Location	: Light Brown Poorly-graded SAND with SILT	Checked By :	Dave R.	Date :	
Description					

Sample Preparation

1 | 1

Weight of Total Soil		Weight of Soil Retained on No. 4 Sieve		% Passing No. 4 Sieve	

Trail	Field	2	3	4	Tested	M & D After Test	
Container No.	SP-1	P-2				Container No.	
Weight of Wet Soil + Container (gm)	695.10	1279.30				Wet Soil+Cont.+Ring	
Weight of Dry Soil + Container (gm)	681.70	1251.60				Dry Soil+Cont.+Ring	
Weight of Container (gm)	195.70	902.30				Wt. of Container	
Moisture Content (%)	2.76	7.93			7.93	Moisture Content	
Weight of Wet Soil + Ring (gm)		626.56					
Weight of Ring (gm) No. 1.0		202.45			202.45		
Weight of Wet Soil (gm)		424.11					
Wet Density of Soil (pcf)		127.93				Wet Density (pcf)	
Dry Density of Soil (pcf)		118.53				Dry Density (pcf)	
Precent Saturation of Soil $S_{(Meas.)}$		50.73			50.73	(%) Saturation	

Loading Machine No.		1		
Date	Reading Time	Elapsed Time	Dial Reading	Expansion
04/04/16	15:15:00	0:10:00		0.0000
04/04/16				
04/04/16	15:25:00	**0:00:00**	**0.4000**	**0.0000**
Add Distilled Water to Sample				
04/04/16	16:25:00	1:00:00	0.3990	-0.0010
04/04/16	17:25:00	2:00:00	0.3990	-0.0010
04/04/16	18:25:00	3:00:00	0.3990	-0.0010
04/05/16	7:30:00	16:05:00	0.3990	-0.0010

Remark :

1. Screen sample through **No. 4** *Sieve*

2. Sample should be compacted into a metal ring of the Degree of Saturation of **50 + / - 2% (48 - 52).**

3. Inundated sample in distilled water to 24 h, or until the rate of expansion > (0.0002 in./h), no less than 3 h.

Volume of Mold (ft^3)	0.00731	Specific Gravity	2.70
Rammer Weight (lb.)	5.0	Blows/Layer	15
Vertical Confining Pressure		1.0 (lbf/in^2) / 6.9 (kPa)	

$$(\%)\ S = \frac{S.G. \times W \times Dd}{Wd \times S.G. - Dd}$$

S.G.=Specific Gravity, W=Water Content

Dd=Dry Soil Density, Wd=Unit Wt. of Water

$$E.I._{(meas)} = \frac{\text{Change in High}}{\text{Initial Thickness}} \times 1000 = \quad -1.00$$

$$\text{Expansion Index}_{(50)} = EI_{(meas.)} - (50 - S_{(meas.)}) \times \frac{65 + EI_{(meas.)}}{220 - S_{(meas.)}}$$

-1	No Expansion

Expansion Index	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
> 130	Very High

FIGURE B-5a

GROUP DELTA

EXPANSION INDEX OF SOIL

ASTM D-4829-10 / UBC 29-2

Project Name	: Camino Del Norte Extension				
Project No.	: IR645	**Sampled By :**	Barzin	**Date :**	03/22/16
Boring No.	: A-16-010	**Prepared By :**	Eric Y.	**Date :**	04/01/16
Sample No.	: B-1	**Test By :**	Eric Y.	**Date :**	04/04/16
Depth (ft/m)	: 0 - 5' ##	**Calculated By :**	Eric Y.	**Date :**	04/05/16
Location	:	**Checked By :**	Dave R.	**Date :**	
Description	: Orangish Brown CLAYEY SAND				

Sample Preparation

2 2

Weight of Total Soil		Weight of Soil Retained on No. 4 Sieve		% Passing No. 4 Sieve	

Trail	Field	2	3	4	Tested	M & D After Test	
Container No.	SP-2	P-1				Container No.	
Weight of Wet Soil + Container (gm)	654.80	1283.30				Wet Soil+Cont.+Ring	
Weight of Dry Soil + Container (gm)	628.40	1250.30				Dry Soil+Cont.+Ring	
Weight of Container (gm)	180.60	902.20				Wt. of Container	
Moisture Content (%)	5.90	9.48			9.48	Moisture Content	
Weight of Wet Soil + Ring (gm)		603.26					
Weight of Ring (gm) No. 2.0		198.76			198.76		
Weight of Wet Soil (gm)		404.50					
Wet Density of Soil (pcf)		122.01				Wet Density (pcf)	
Dry Density of Soil (pcf)		111.45				Dry Density (pcf)	
Precent Saturation of Soil $S_{(Meas.)}$		49.95			49.95	(%) Saturation	

Loading Machine No.			2	
Date	**Reading Time**	**Elapsed Time**	**Dial Reading**	**Expansion**
04/04/16	16:05:00	0:10:00		0.0000
04/04/16				
04/04/16	16:15:00	**0:00:00**	**0.5000**	**0.0000**
Add Distilled Water to Sample				
04/04/16	17:15:00	1:00:00	0.5270	0.0270
04/04/16	18:15:00	2:00:00	0.5280	0.0280
04/05/16	7:30:00	15:15:00	0.5300	0.0300
04/05/16	8:30:00	16:15:00	0.5300	0.0300
04/05/16	9:30:00	17:15:00	0.5300	0.0300

Remark :

1. Screen sample through **No. 4** *Sieve*

2. Sample should be compacted into a metal ring of the Degree of Saturation of ***50 +/- 2% (48 - 52).***

3. Inundated sample in distilled water to 24 h, or until the rate of expansion > (0.0002 in./h), no less than 3 h.

Volume of Mold (ft³)	0.00731	Specific Gravity	2.70
Rammer Weight (lb.)	5.0	Blows/Layer	15
Vertical Confining Pressure		1.0 (lbf/in²) / 6.9 (kPa)	

$$(\%)\ S = \frac{S.G. \times W \times Dd}{Wd \times S.G. - Dd}$$

S.G.=Specific Gravity, W=Water Content, Dd=Dry Soil Density, Wd=Unit Wt. of Water

$$E.I._{(meas)} = \frac{\text{Change in High}}{\text{Initial Thickness}} \times 1000 = \mathbf{30.00}$$

$$\text{Expansion Index}_{(50)} = EI_{(meas.)} - (50 - S_{(meas.)}) \times \frac{65 + EI_{(meas.)}}{220 - S_{(meas.)}}$$

30	Low

Expansion Index	Potential Expansion
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
> 130	Very High

LABORATORY NO.: *SO.3935* **SAMPLE DATE:** *3/28/2016*

SAMPLE LOCATION: *A-16-002 / B-1 @ 0-5'* **TEST DATE:** *3/30/2016*

SAMPLE DESCRIPTION: *Light Brown SILTY SAND with GRAVEL*

LABORATORY TEST DATA

	TEST SPECIMEN	1	2	3	4	5	
A	COMPACTOR PRESSURE	350	350	350			[PSI]
B	INITIAL MOISTURE	2.3	2.3	2.3			[%]
C	BATCH SOIL WEIGHT	1200	1200	1200			[G]
D	WATER ADDED	84	90	78			[ML]
E	WATER ADDED (D*(100+B)/C)	7.2	7.7	6.7			[%]
F	COMPACTION MOISTURE (B+E)	9.5	10.0	9.0			[%]
G	MOLD WEIGHT	2101.7	2133.5	2134.5			[G]
H	TOTAL BRIQUETTE WEIGHT	3292.4	3346.0	3301.8			[G]
I	NET BRIQUETTE WEIGHT (H-G)	1190.7	1212.5	1167.3			[G]
J	BRIQUETTE HEIGHT	2.50	2.51	2.50			[IN]
K	DRY DENSITY (30.3*I/((100+F)*J))	131.8	133.1	129.8			[PCF]
L	EXUDATION LOAD	3940	2470	4790			[LB]
M	EXUDATION PRESSURE (L/12.54)	314	197	382			[PSI]
N	STABILOMETER AT 1000 LBS	29	36	19			[PSI]
O	STABILOMETER AT 2000 LBS	61	80	42			[PSI]
P	DISPLACEMENT FOR 100 PSI	4.39	4.72	5.26			[Turns]
Q	R VALUE BY STABILOMETER	48	35	57			
R	CORRECTED R-VALUE (See Fig. 14)	48	35	57			
S	EXPANSION DIAL READING	0.0000	0.0000	0.0000			[IN]
T	EXPANSION PRESSURE (S*43,300)	0	0	0			[PSF]

R-VALUE BY EXUDATION: **46**

NITIAL MOISTURE (%

Wet & Tare:	494.3
Dry & Tare:	483.1
Tare:	0
Moisture:	2.3

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R-VALUE TEST RESULTS

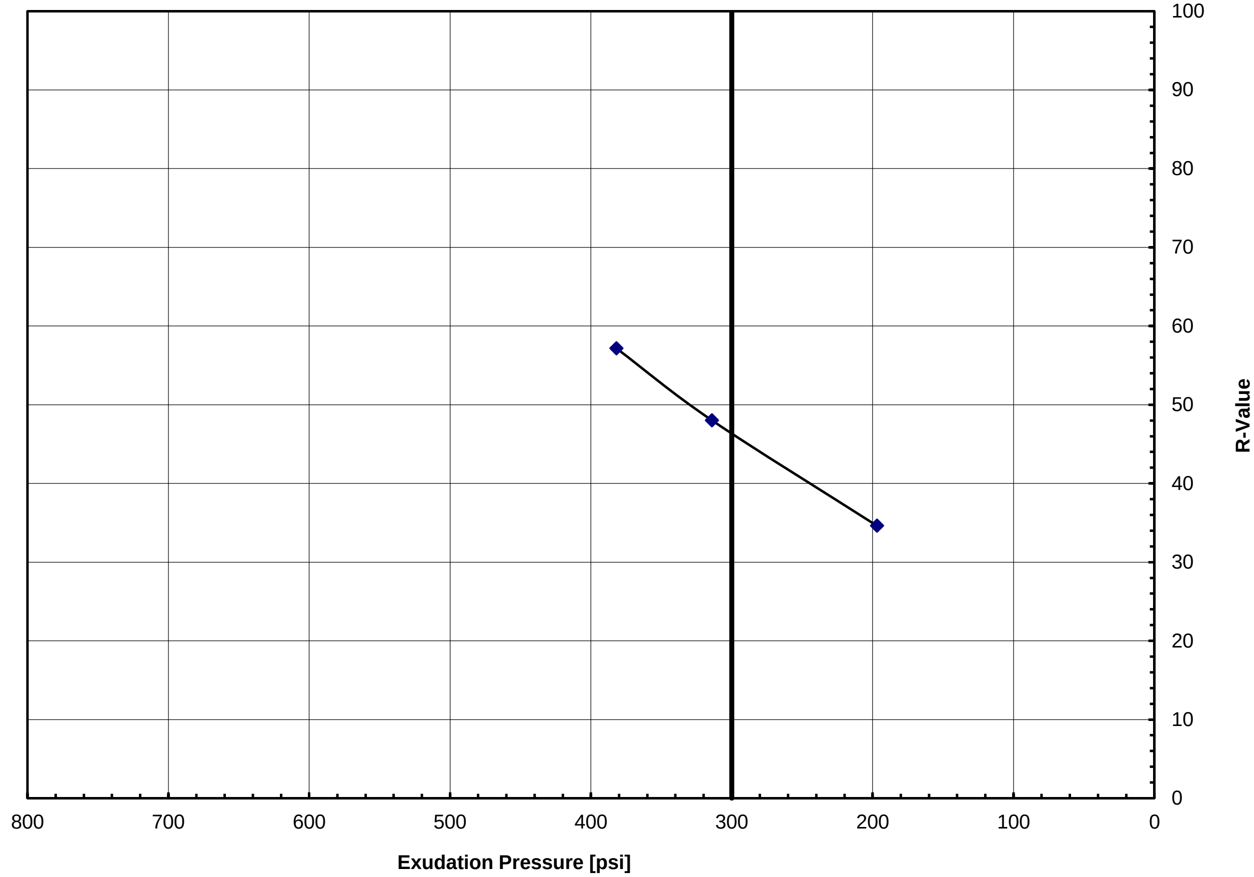
Project Name: Camino Del Norte
Project Number: IR-645
Report Date: 3/31/2016

FIGURE B-6a

Sample #: SO.3935
Sample Location: A-16-002 / B-1 @ 0-5'
Sample Description: Light Brown SILTY SAND with GRAVEL

R-Value by Stabilometer:	48	35	57
Exudation Pressure:	314	197	382

R-Value by Exudation: 46



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R-VALUE EXUDATION CHART

Project Name: Camino Del Norte
Project Number: IR-645
Report Date: 3/31/2016

FIGURE B 6b

LABORATORY NO.: *SO.3935*
SAMPLE LOCATION: *A-16-006 / B-1 @ 0-5'*
SAMPLE DESCRIPTION: *Light Brown Silty Sand*
SAMPLE DATE: *3/28/2016*
TEST DATE: *3/31/2016*

LABORATORY TEST DATA

	TEST SPECIMEN	1	2	3	4	5	
A	COMPACTOR PRESSURE	350	350	350			[PSI]
B	INITIAL MOISTURE	3.0	3.0	3.0			[%]
C	BATCH SOIL WEIGHT	1200	1200	1200			[G]
D	WATER ADDED	96	84	72			[ML]
E	WATER ADDED (D*(100+B)/C)	8.2	7.2	6.2			[%]
F	COMPACTION MOISTURE (B+E)	11.2	10.2	9.1			[%]
G	MOLD WEIGHT	2133.2	2132.8	2101.4			[G]
H	TOTAL BRIQUETTE WEIGHT	3337.4	3303.5	3264.9			[G]
I	NET BRIQUETTE WEIGHT (H-G)	1204.2	1170.7	1163.5			[G]
J	BRIQUETTE HEIGHT	2.54	2.49	2.50			[IN]
K	DRY DENSITY (30.3*I/((100+F)*J))	129.2	129.3	129.2			[PCF]
L	EXUDATION LOAD	2290	4010	5140			[LB]
M	EXUDATION PRESSURE (L/12.54)	183	320	410			[PSI]
N	STABILOMETER AT 1000 LBS	38	20	17			[PSI]
O	STABILOMETER AT 2000 LBS	51	37	28			[PSI]
P	DISPLACEMENT FOR 100 PSI	4.20	4.42	4.60			[Turns]
Q	R VALUE BY STABILOMETER	56	65	72			
R	CORRECTED R-VALUE (See Fig. 14)	56	65	72			
S	EXPANSION DIAL READING	0.0000	0.0000	0.0000			[IN]
T	EXPANSION PRESSURE (S*43,300)	0	0	0			[PSF]

R-VALUE BY EXUDATION: 64

INITIAL MOISTURE (%)

Wet & Tare:	295.3
Dry & Tare:	286.8
Tare:	0
Moisture:	3.0

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R-VALUE TEST RESULTS

Project Name: Camino Del Norte
Project Number: IR-645
Report Date: 4/1/2016

FIGURE B-6c

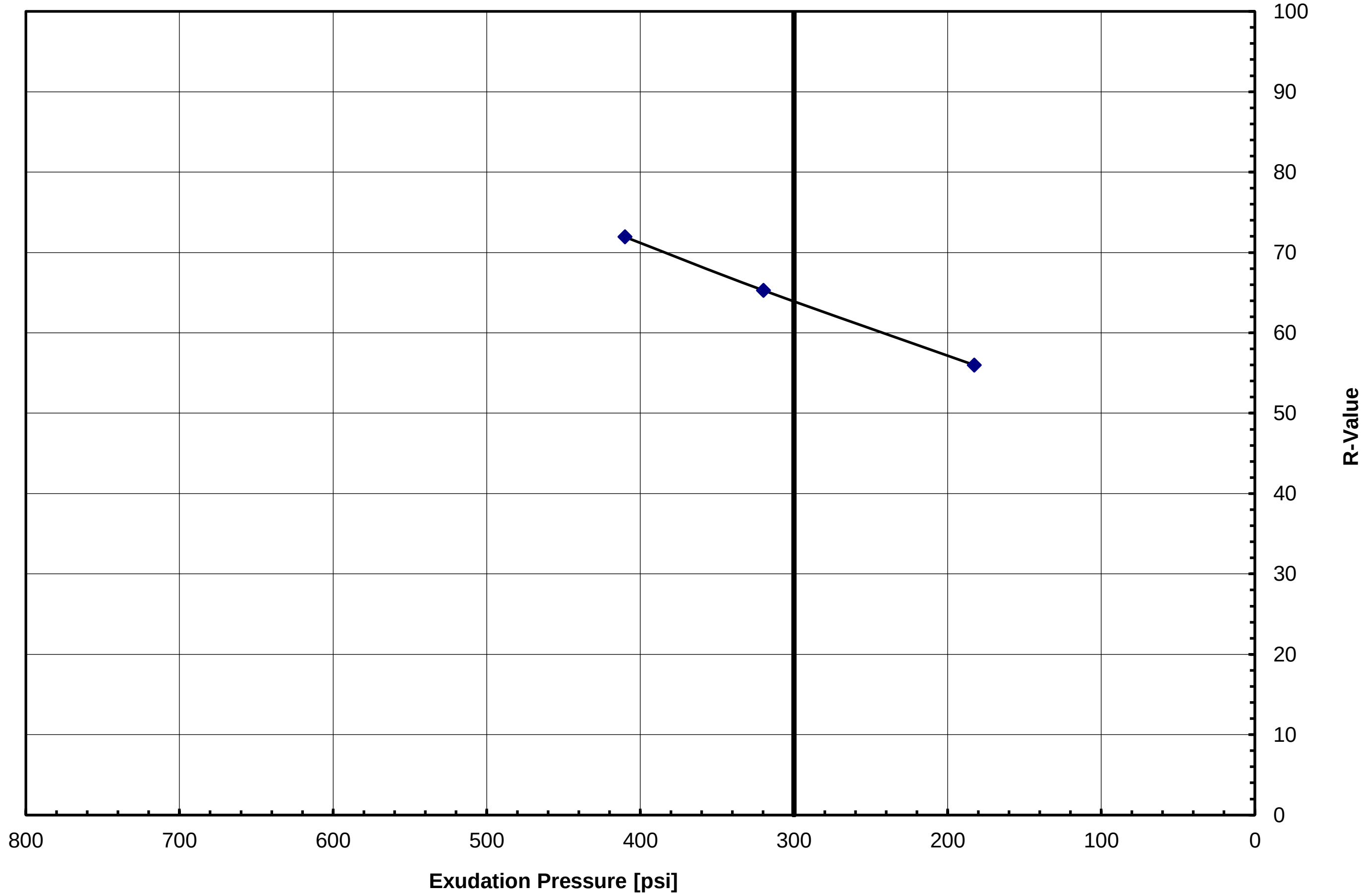
Sample #: ***SO.3935***

Sample Location: ***A-16-006 / B-1 @ 0-5'***

Sample Description: ***Light Brown Silty Sand***

R-Value by Stabilometer:	***56***	***65***	***72***
Exudation Pressure:	***183***	***320***	***410***

R-Value by Exudation: **64**



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R-VALUE EXUDATION CHART

Project Name: Camino Del Norte

Project Number: IR-645

Report Date: ***4/1/2016***

FIGURE B-6d

LABORATORY NO.: *SO.3935* **SAMPLE DATE:** *3/28/2016*

SAMPLE LOCATION: *A-16-010 / B-1 @ 0-5'* **SAMPLE** **TEST DATE:** *3/30/2016*

DESCRIPTION: *Orangish Brown CLAYEY SAND*

LABORATORY TEST DATA

	TEST SPECIMEN	1	2	3	4	5	
A	COMPACTOR PRESSURE	350	350	350			[PSI]
B	INITIAL MOISTURE	4.9	4.9	4.9			[%]
C	BATCH SOIL WEIGHT	1200	1200	1200			[G]
D	WATER ADDED	120	114	126			[ML]
E	WATER ADDED (D*(100+B)/C)	10.5	10.0	11.0			[%]
F	COMPACTION MOISTURE (B+E)	15.4	14.9	16.0			[%]
G	MOLD WEIGHT	2101.7	2067.0	2067.7			[G]
H	TOTAL BRIQUETTE WEIGHT	3378.5	3340.0	3283.9			[G]
I	NET BRIQUETTE WEIGHT (H-G)	1276.8	1273.0	1216.2			[G]
J	BRIQUETTE HEIGHT	2.50	2.51	2.54			[IN]
K	DRY DENSITY (30.3*I/((100+F)*J))	134.1	133.7	125.1			[PCF]
L	EXUDATION LOAD	3760	5020	2500			[LB]
M	EXUDATION PRESSURE (L/12.54)	300	400	199			[PSI]
N	STABILOMETER AT 1000 LBS	58	51	69			[PSI]
O	STABILOMETER AT 2000 LBS	131	120	138			[PSI]
P	DISPLACEMENT FOR 100 PSI	4.25	3.87	4.71			[Turns]
Q	R VALUE BY STABILOMETER	12	18	8			
R	CORRECTED R-VALUE (See Fig. 14)	12	18	8			
S	EXPANSION DIAL READING	0.0006	0.0004	0.0010			[IN]
T	EXPANSION PRESSURE (S*43,300)	26	17	43			[PSF]

R-VALUE BY EXUDATION: *12*

NITIAL MOISTURE (%

Wet & Tare:	527.5
Dry & Tare:	502.7
Tare:	0
Moisture:	4.9

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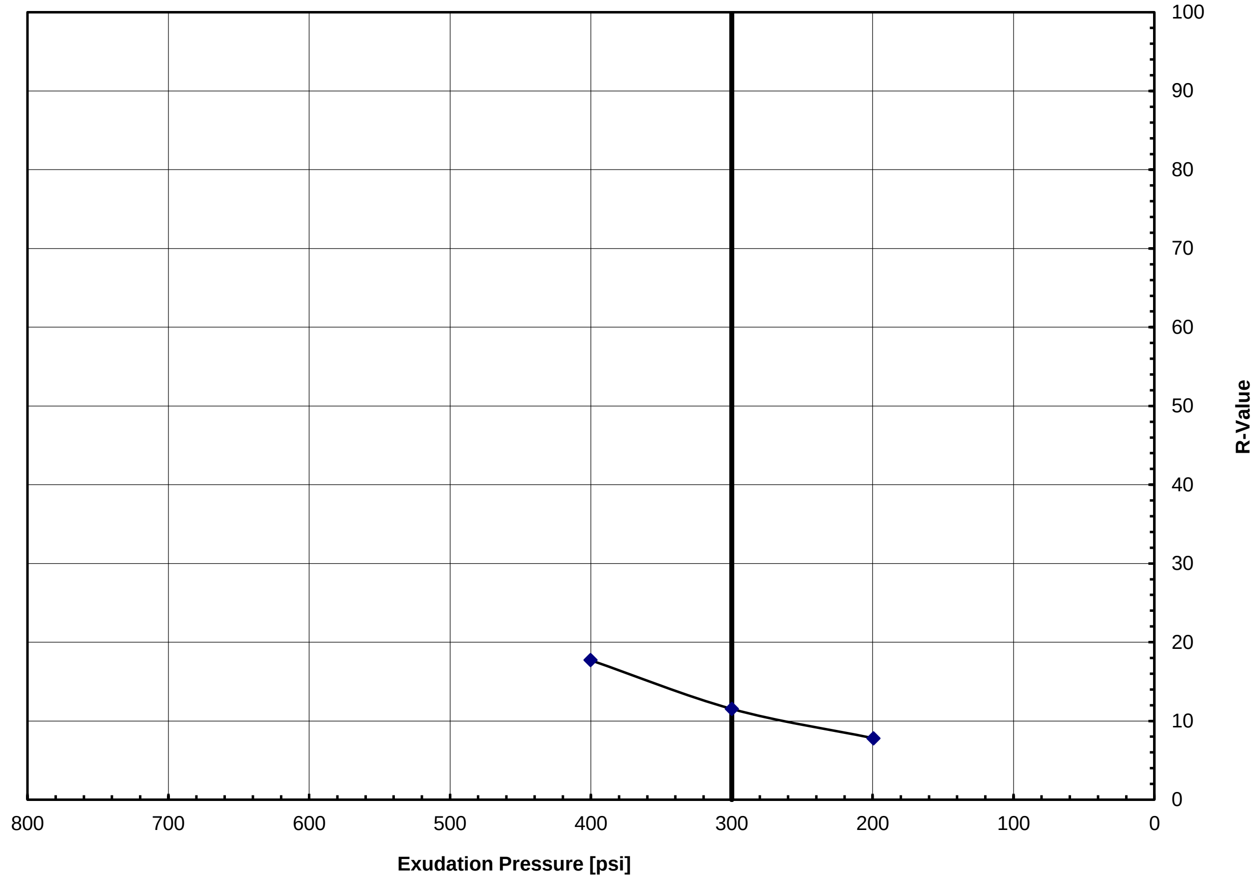
R-VALUE TEST RESULTS

Project Name: Camino Del Norte
Project Number: IR-645
Report Date: 3/31/2016

Sample #: SO.3935
Sample Location: A-16-010 / B-1 @ 0-5'
Sample Description: Orangish Brown CLAYEY SAND SAND

R-Value by Stabilometer:	12	18	8
Exudation Pressure:	300	400	199

R-Value by Exudation: 12



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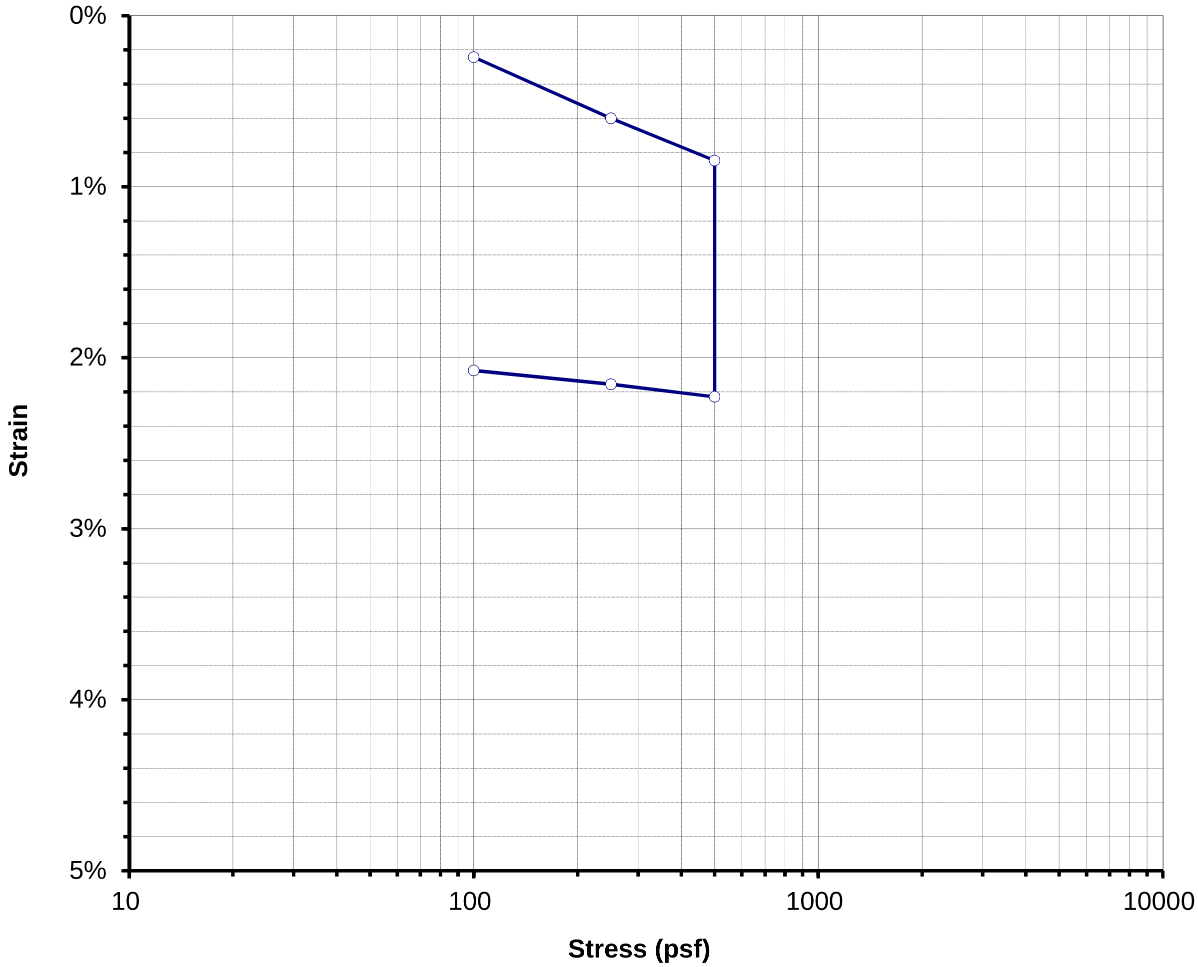
R-VALUE EXUDATION CHART

Project Name: Camino Del Norte
Project Number: IR-645
Report Date: 3/31/2016

FIGURE B-6f

Measurement of Collapse Potential of Soil ASTM D-5333



Boring No.	A-16-007	**Sample Depth**	2.5'
Sample No.	R-2	**USCS**	SM

@ 90%

BEFORE TEST

Initial Moisture Content:	4.9%	
Initial Dry Unit Wt:	107.0	**pcf**
Initial Total Unit Wt.:	112.2	**pcf**
Initial Void Ratio:	0.4971	
Initial Degree of Saturation:	25.4%	

AFTER TEST

Final Moisture Content:	18.2%	
Final Dry Unit Wt:	109.2	**pcf**
Final Total Unit Wt.:	129.1	**pcf**
Final Void Ratio:	0.4660	
Final Degree of Saturation:	100%	

Water Added at: 500 **psf**

ATTERBERG LIMITS					
LL=		**PL=**		**PI=**	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.24%	0.4934
250	0.60%	0.4881
500	0.85%	0.4844
500	2.23%	0.4637
250	2.16%	0.4648
100	2.07%	0.4660

Assumed Specific Gravity of Solids, Gs: 2.60

PROJECT NUMBER: IR645 **PROJECT NAME:** Camino Del Norte Extension

FIGURE B-7

CORROSIVITY TEST RESULTS
(ASTM D516, CTM 643)

SAMPLE	pH	RESISTIVITY (OHM-CM)	SULFATE CONTENT (PPM)	CHLORIDE CONTENT (PPM)
A-16-001 B-1 @ 0-5'	*7.54*	*14,677*	*<100*	*<100*
A-16-004 B-1 @ 0-5'	*7.06*	*3,358*	*<100*	*<100*
A-16-009 B-1 @ 0-5'	*7.27*	*3,248*	*<100*	*<100*

GENERAL CORROSIVITY PARAMETERS

SULFATE CONTENT (PPM)	SULFATE EXPOSURE	CEMENT TYPE
0 to 1,000	Negligible	--
1,000 to 2,000	Moderate	II, IP(MS), IS(MS)
2,000 to 20,000	Severe	V
Above 20,000	Very Severe	V plus pozzolan

SOIL RESISTIVITY (OHM-CM)	GENERAL DEGREE OF CORROSIVITY TO FERROUS METALS
0 to 1,000	Very Corrosive
1,000 to 2,000	Corrosive
2,000 to 5,000	Moderately Corrosive
5,000 to 10,000	Mildly Corrosive
Above 10,000	Slightly Corrosive

CHLORIDE (Cl) CONTENT (PPM)	GENERAL DEGREE OF CORROSIVITY TO METALS
0 to 300	Negligible
300 to 1,500	Corrosive
Above 1,500	Severely Corrosive

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Project Name: *Camino Del Norte*
Project Number: *IR-65*
Laboratory Number: *SO.3935*
Sampled By / Date: *Barzin / 03/22/2016*
Report Date: *3/31/2016*

Appendix I   Seismic Refraction Survey

SEISMIC REFRACTION SURVEY
CAMINO DEL NORTE EXTENSION
LAKE ELSINORE, CALIFORNIA

PREPARED FOR:
Group Delta Consultants
25 Mauchly, Suite 301
Irvine, CA 92618

PREPARED BY:
Southwest Geophysics, Inc.
8057 Raytheon Road, Suite 9
San Diego, CA 92111

April 4, 2016
Project No. 116130

SOUTHWEST GEOPHYSICS, INC.
YOUR SUBSURFACE SOLUTION

April 4, 2016
Project No. 116130

Mr. Sathis Kumar
Group Delta Consultants
25 Mauchly, Suite 301
Irvine, CA 92618

Subject: Seismic Refraction Survey
Camino Del Norte Extension
Moreno Valley, California

Dear Mr. Kumar:

In accordance with your authorization, we have performed a seismic refraction survey pertaining to the Camino Del Norte Extension project located in Lake Elsinore, California. Specifically, our survey consisted of performing five seismic refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas surveyed, and to assess the apparent rippability of the subsurface materials. This data report presents our survey 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.

Sincerely,
SOUTHWEST GEOPHYSICS, INC.

Timothy W. Brandt
Staff Geophysicist

Patrick F. Lehrmann, P.G., P.Gp.
Principal Geologist/Geophysicist

REGISTERED GEOPHYSICIST
PATRICK F. LEHRMANN
No. 1043
Exp. 1/31/16
STATE OF CALIFORNIA

TWB/PFL/HV/hv

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Figure 4e – Seismic Profile, SL-5

1. INTRODUCTION

In accordance with your authorization, we have performed a seismic refraction survey pertaining to the Camino Del Norte Extension located in Lake Elsinore, California (Figure 1). Specifically, our survey consisted of performing five seismic refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas surveyed, and to assess the apparent rippability of the subsurface materials. This data report presents our survey methodology, equipment used, analysis, and results.

2. SCOPE OF SERVICES

Our scope of services included:

- Performance of five seismic P-wave refraction lines at the project site.
- Compilation and analysis of the data collected.
- Preparation of this data report presenting our results, conclusions and recommendations.

3. SITE DESCRIPTION

The project site is located just northwest of the intersection between Grunder Drive and Canyon View Road in Lake Elsinore, California (Figure 1). Several dirt roads cross the site and much of the property has been tilled. Topography at the site consists of hills and valleys. Outcrops of granitic rock occur at and near the project site. Vegetation in the area consists of scattered scrub brush and annual grass. Figures 2 and 3 depict the site conditions in the area of the seismic traverses.

Based on our discussions with you it is our understanding that the project involves the construction of a new road. It is also our understanding that cuts up to 30 feet deep may be performed.

4. SURVEY METHODOLOGY

A seismic P-wave (compression wave) refraction survey was conducted at the site to evaluate the rippability characteristics of the subsurface materials and to develop subsurface velocity profiles of the areas surveyed. 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.

Five seismic lines (SL-1 through SL-5) were conducted in the study area. The general locations and lengths of the lines were selected by your office. Shot points (signal generation locations) were conducted along the lines at the ends, midpoint, and intermediate points between the ends and the midpoint.

The seismic refraction theory requires that subsurface velocities increase with depth. 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.

In general, seismic wave velocities can be correlated to material density and/or rock hardness. The relationship between rippability and seismic velocity is empirical and assumes a homogenous mass. Localized areas of differing composition, texture, and/or structure may affect both the measured data and the actual rippability of the mass. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

The rippability values presented in Table 1 are based on our experience with similar materials and assume 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 characteristics, such as fracture spacing and orientation, play a significant role in determining rock rippability. These characteristics may also vary with location and depth.

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 a narrow trench, 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 (Caterpillar, 2011). 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.

5. ANALYSIS AND RESULTS

As previously indicated, five seismic traverses were conducted as part of our study. The collected data were processed using SIPwin (Rimrock Geophysics, 2003), a seismic interpretation program, and analyzed using SeisOpt Pro (Optim, 2008). SeisOpt Pro uses first arrival picks and elevation data to produce subsurface velocity models through a nonlinear optimization technique called adaptive simulated annealing. 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.

Figures 4a through 4e present the velocity models generated from our study. The approximate locations of the seismic refraction traverses are shown on the Line Location Map (Figure 2). In general, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the traverse.

6. CONCLUSIONS AND RECOMMENDATIONS

The results from our seismic survey revealed distinct layers/zones in the near surface that likely represent soil overlying granitic bedrock with varying degrees of weathering. Distinct vertical and lateral velocity variations are evident in the models. These inhomogeneities are likely related to the presence of remnant boulders, intrusions and/or differential weathering of the bedrock materials. It is also evident in the tomography models that the depth to bedrock is highly variable across the site.

Based on the refraction results, variability in the excavatability (including depth of rippability) of the subsurface materials should be expected across the project area. Furthermore, blasting may be required depending on the excavation depth, location, equipment used, and desired rate of production. In addition, oversized materials should be expected. A contractor with excavation experience in similar difficult conditions should be consulted for expert advice on excavation methodology, equipment and production rate.

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 surveying 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. Southwest Geophysics, Inc. 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

Caterpillar, Inc., 2011, Caterpillar Performance Handbook, Edition 41, Caterpillar, Inc., Peoria, Illinois.

Mooney, H.M., 1976, Handbook of Engineering Geophysics, dated February.

Optim, Inc., 2008, SeisOpt Pro, V-5.0.

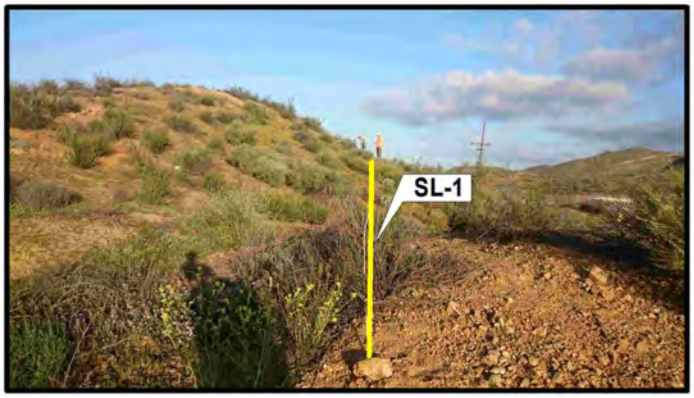
Rimrock Geophysics, 2003, Seismic Refraction Interpretation Program (SIPwin), V-2.76.

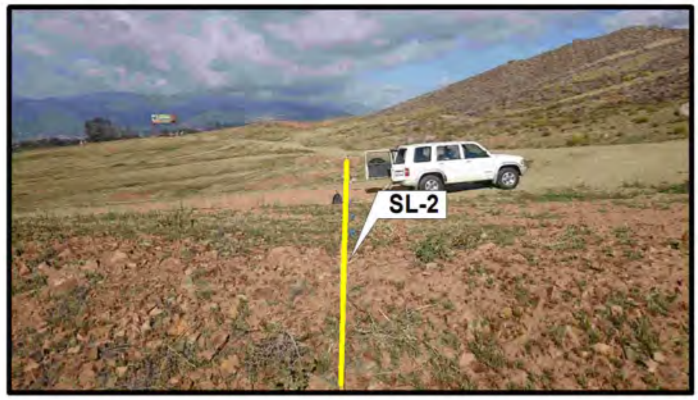
Telford, W.M., Geldart, L.P., Sheriff, R.E., and Keys, D.A., 1976, Applied Geophysics, Cambridge University Press.

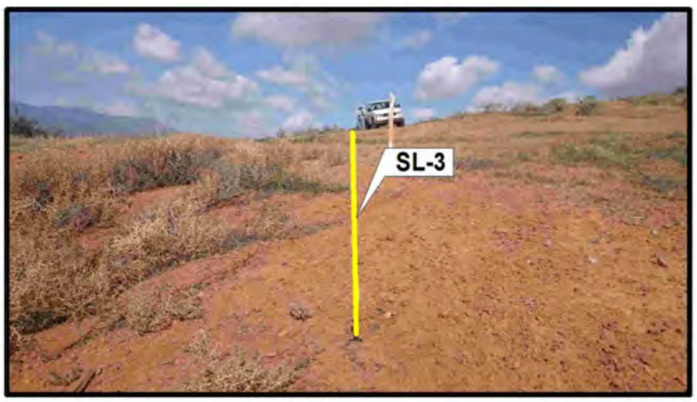
SITE LOCATION MAP	N	Camino Del Norte Extension Lake Elsinore, California	SOUTHWEST GEOPHYSICS INC. Figure 1
		Project No.: 116130 — Date: 04/16	

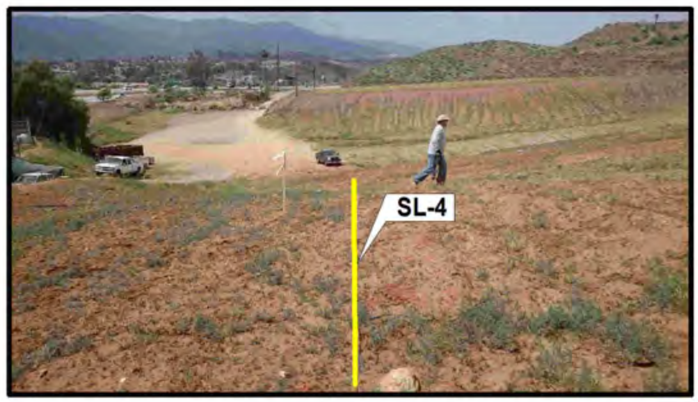
SEISMIC LINE LOCATION MAP	N	Camino Del Norte Extension Lake Elsinore, California Project No.: 1116130 Date: 04/16	SOUTHWEST GEOPHYSICS INC. Figure 2

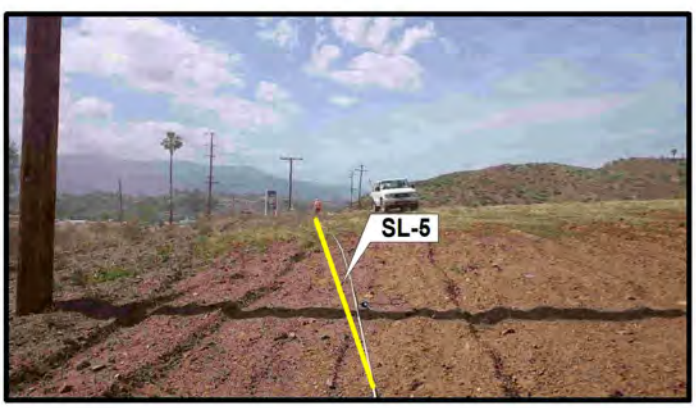
0 300 600
approximate scale in feet





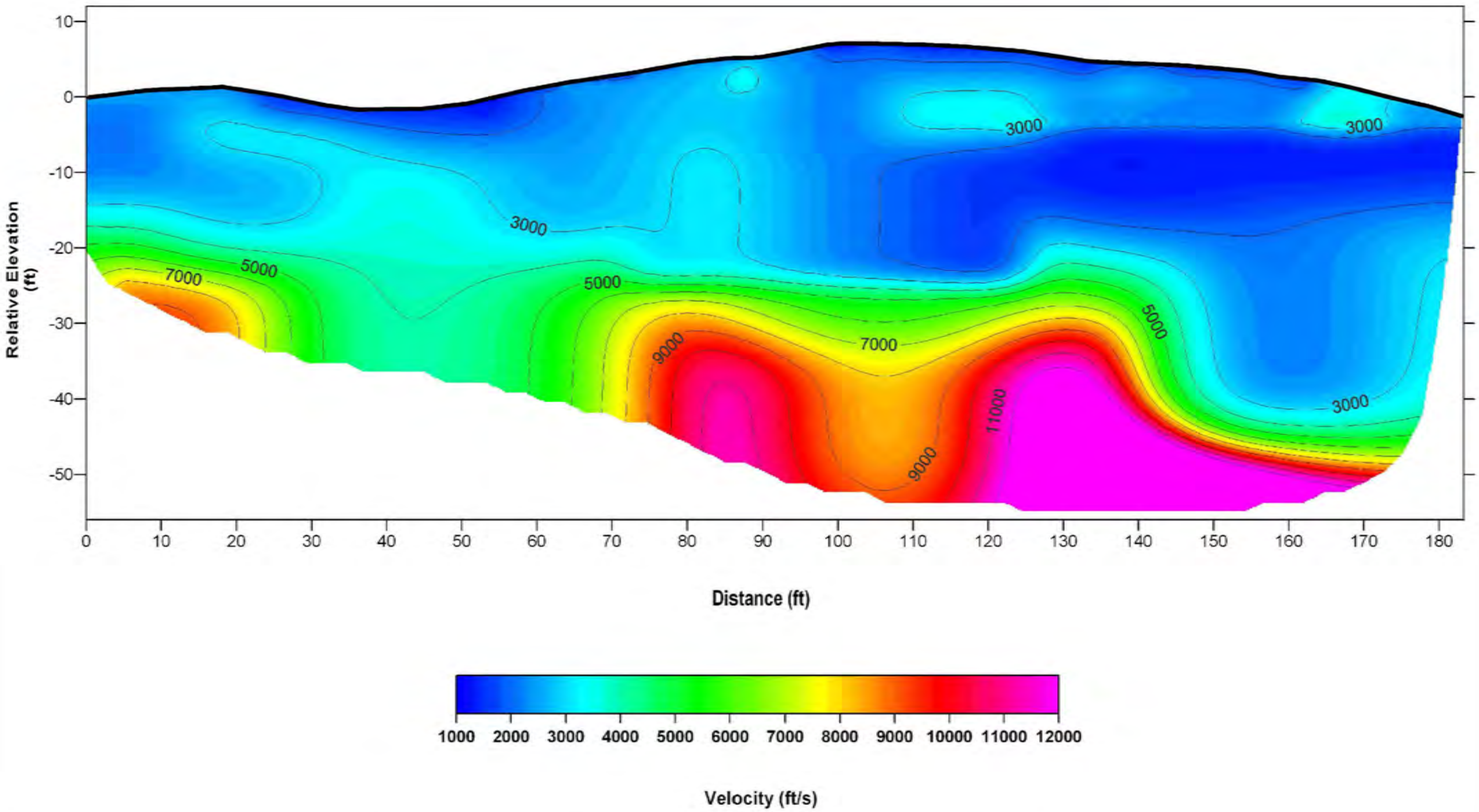






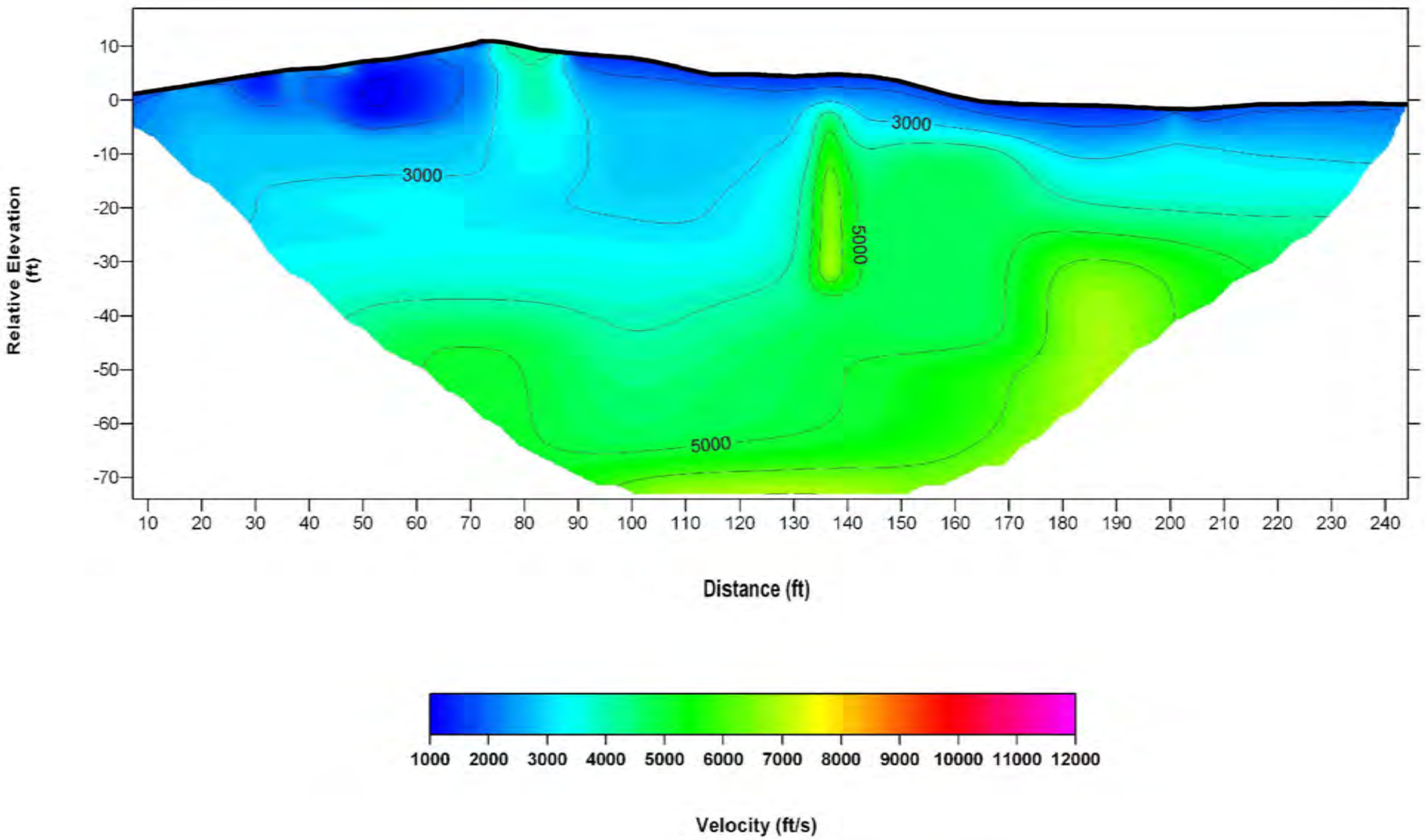
SITE PHOTOGRAPHS	Camino Del Norte Extension Lake Elsinore, California Project No.: 116130 · Date: 04/16	SOUTHWEST GEOPHYSICS INC. Figure 3

TOMOGRAPHY MODEL



SEISMIC PROFILE SL-1	Camino Del Norte Extension Lake Elsinore, California Project No.: 116130 / Date: 04/16	SOUTHWEST GEOPHYSICS INC. Figure 4a	**Note: Contour Interval = 1,000 feet per second**

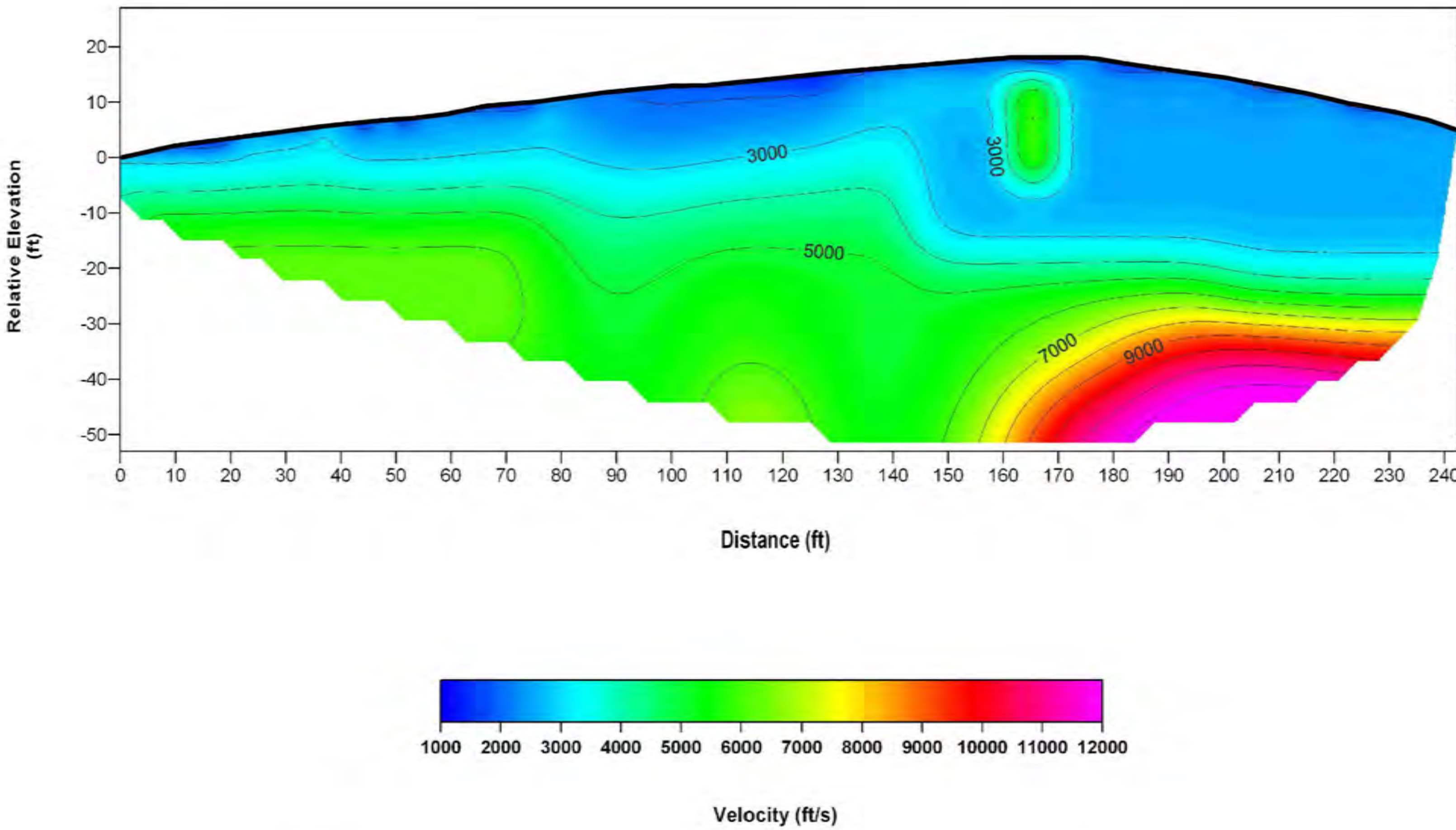
TOMOGRAPHY MODEL



SEISMIC PROFILE SL-2	Camino Del Norte Extension Lake Elsinore, California		SOUTHWEST GEOPHYSICS INC. Figure 4b
	Project No.: 116130	Date: 04/16	

Note: Contour Interval = 1,000 feet per second

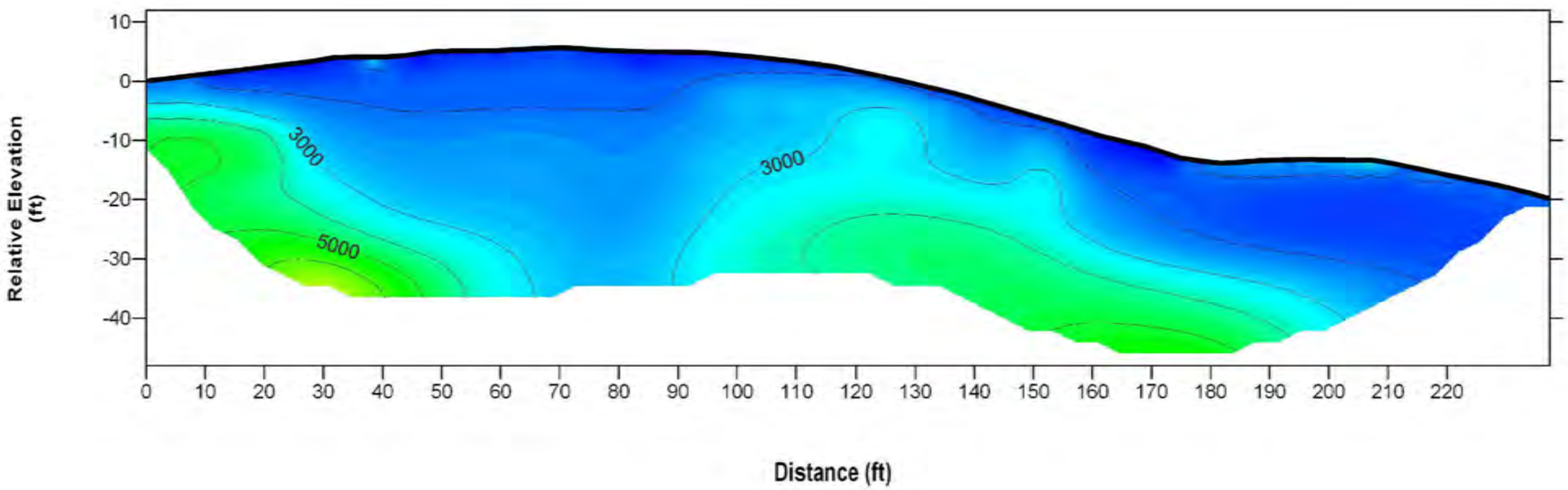
TOMOGRAPHY MODEL

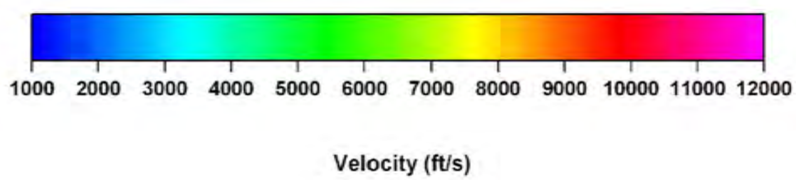


SEISMIC PROFILE SL-3	Camino Del Norte Extension Lake Elsinore, California Project No.: 116130 Date: 04/16	SOUTHWEST GEOPHYSICS INC. Figure 4c

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

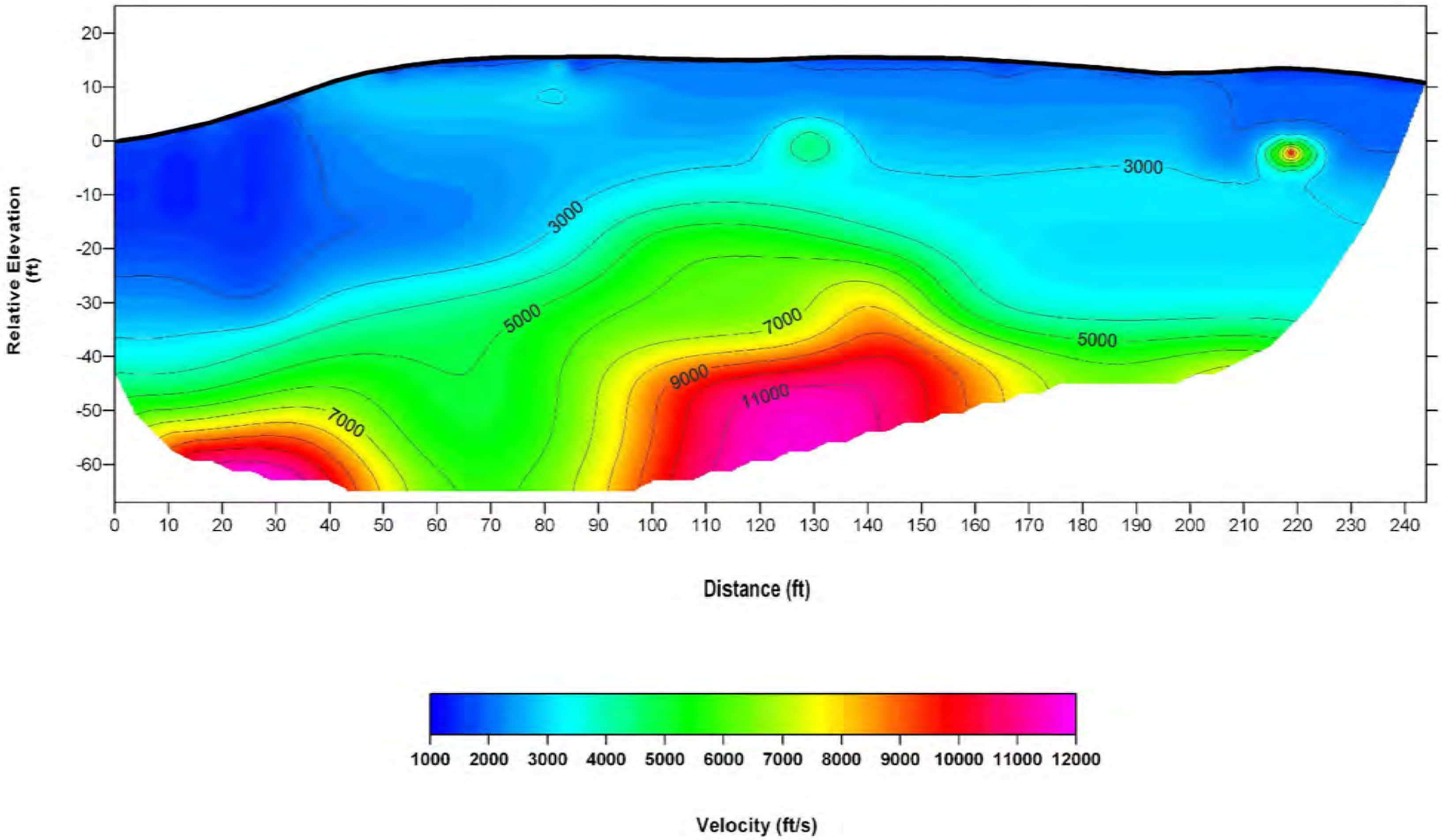




SEISMIC PROFILE SL-4	Camino Del Norte Extension Lake Elsinore, California Project No.: 116130 / Date: 04/16	SOUTHWEST GEOPHYSICS INC. Figure 4d

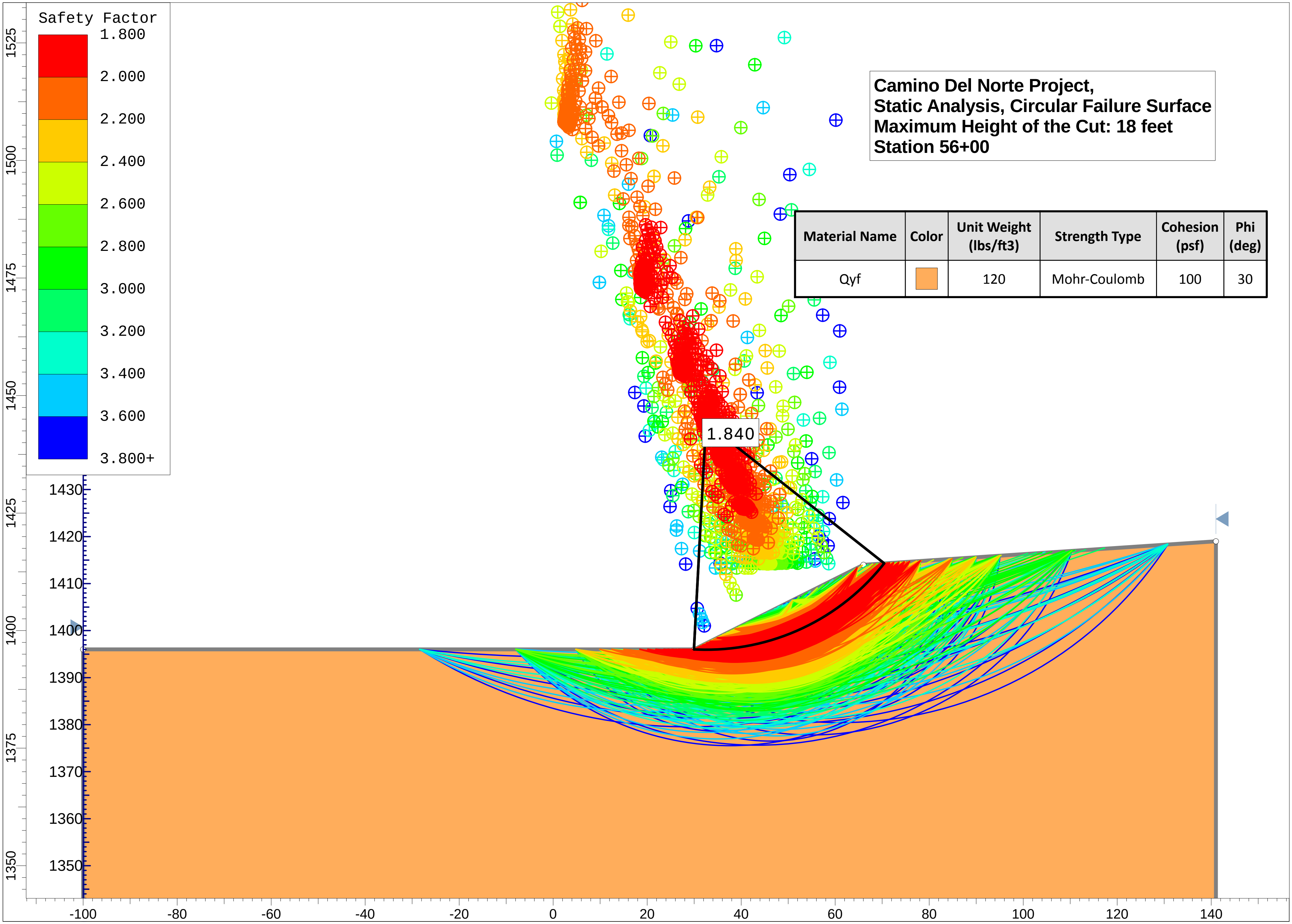
Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL



SEISMIC PROFILE SL-5	Camino Del Norte Extension Lake Elsinore, California	SOUTHWEST GEOPHYSICS INC. Figure 4e	**Note: Contour Interval = 1,000 feet per second**
	Project No.: 116130 / Date: 04/16		

Appendix D Calculations



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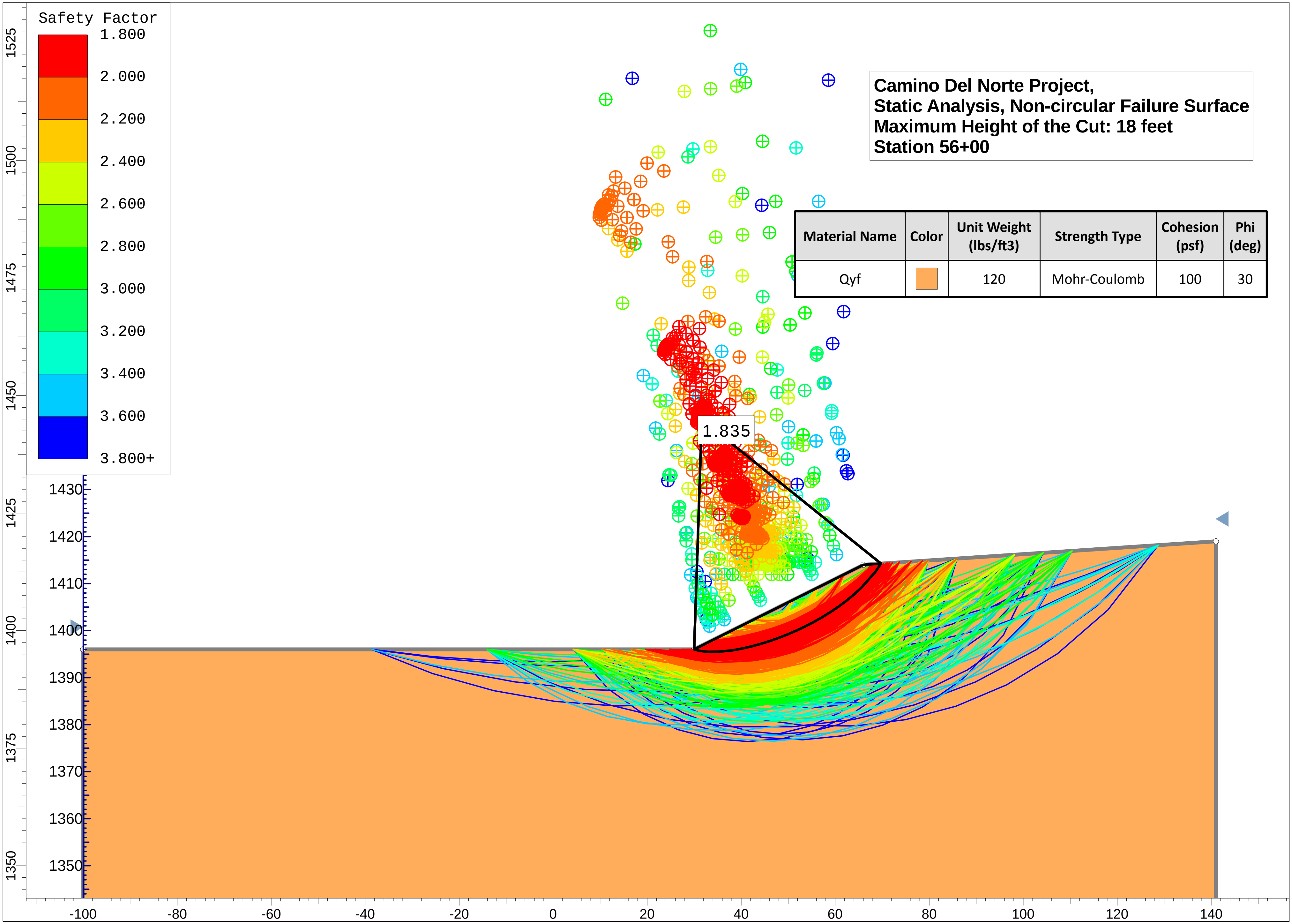
Qyf		120	Mohr-Coulomb	100	30



Safety Factor
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2.200
2.400
2.600
2.800
3.000
3.200
3.400
3.600
3.800+
Camino Del Norte Project,
Static Analysis, Non-circular Failure Surface
Maximum Height of the Cut: 18 feet
Station 56+00
Material Name
Color
Unit Weight (lbs/ft3)
Strength Type
Cohesion (psf)
Phi (deg)
Qyf
120
Mohr-Coulomb
100
30
1.835
1525
1500
1475
1450
1425
1400
1375
1350
1430
1420
1410
1400
1390
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-20
0
20
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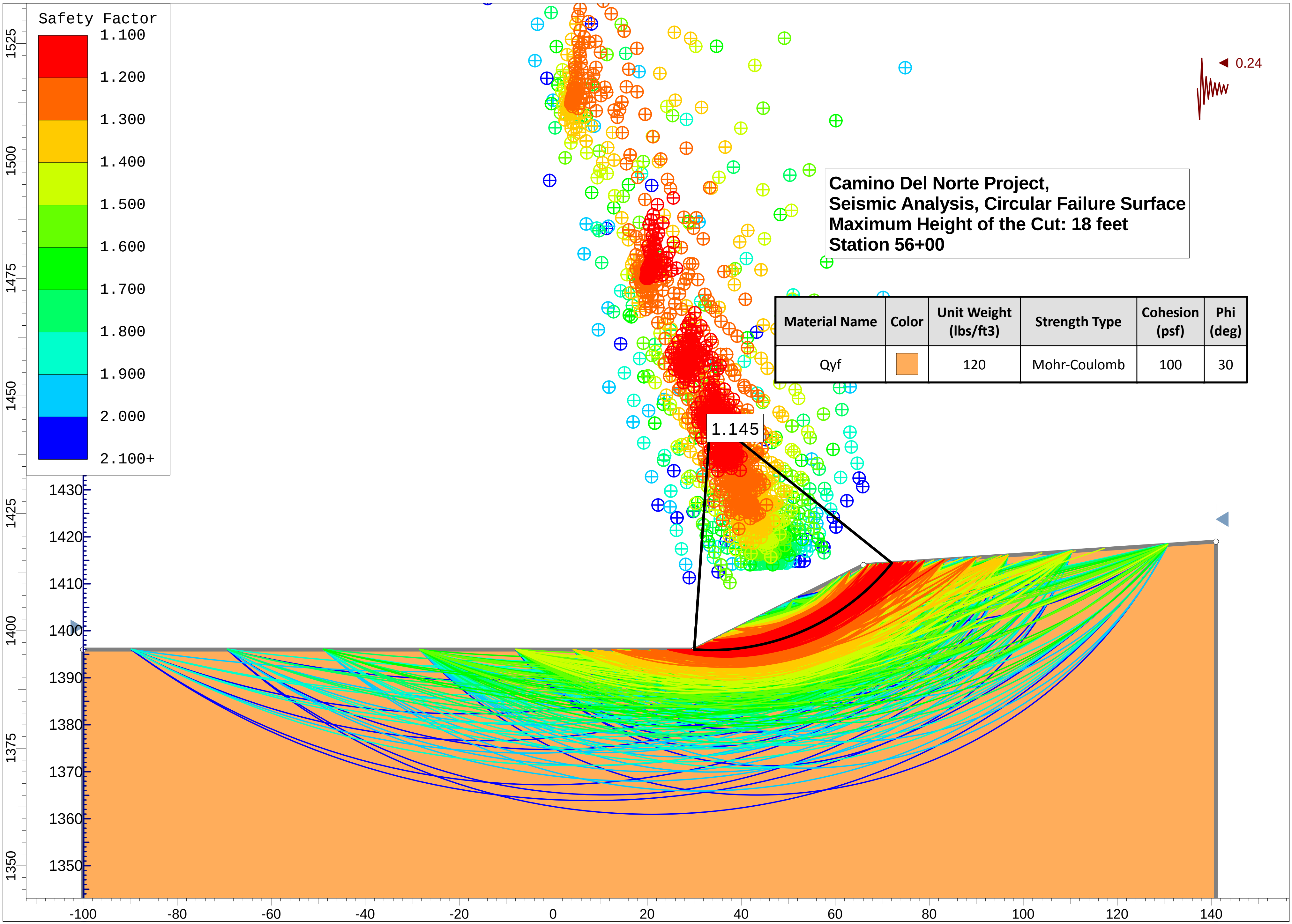
60
80
100
120
140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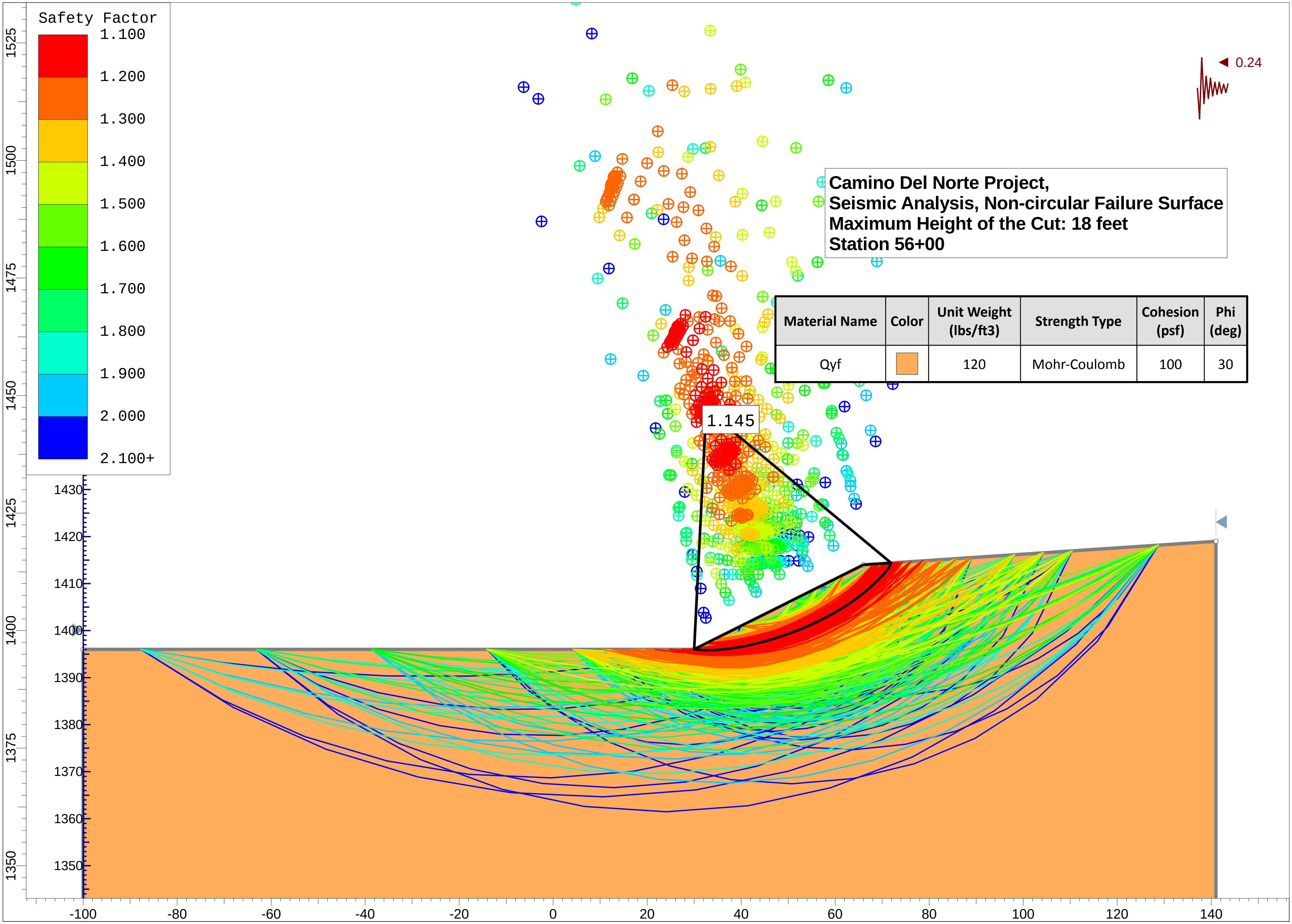
1.400
1.500
1.600
1.700
1.800
1.900
2.000
2.100+
0.24
Camino Del Norte Project,
Seismic Analysis, Circular Failure Surface
Maximum Height of the Cut: 18 feet
Station 56+00
1.145
Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg)
Qyf | | 120 | Mohr-Coulomb | 100 | 30


Safety Factor
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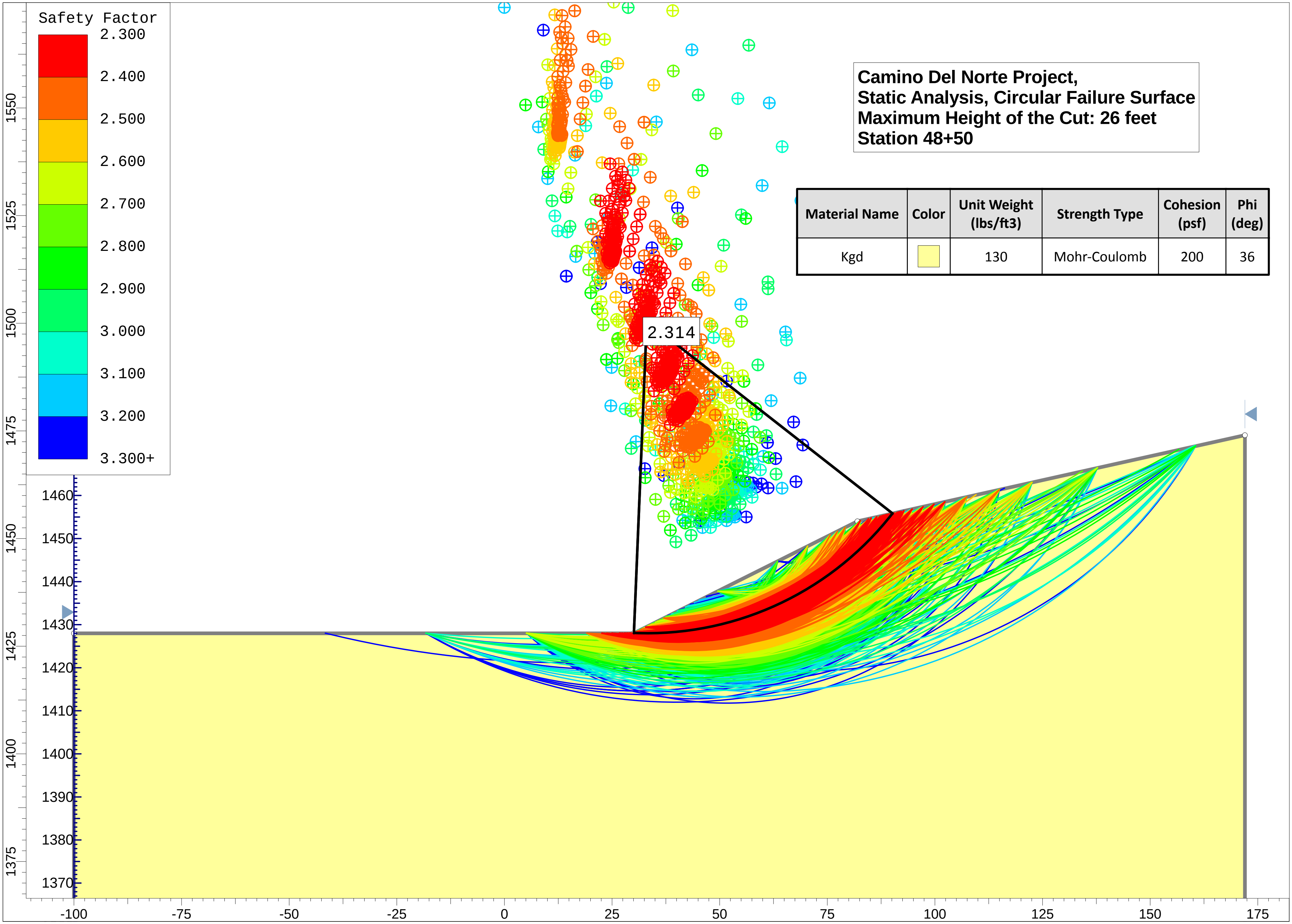
1.200
1.300
1.400
1.500
1.600
1.700
1.800
1.900
2.000
2.100+
0.24
Camino Del Norte Project,
Seismic Analysis, Non-circular Failure Surface
Maximum Height of the Cut: 18 feet
Station 56+00
1.145
Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg)
Qyf | | 120 | Mohr-Coulomb | 100 | 30



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
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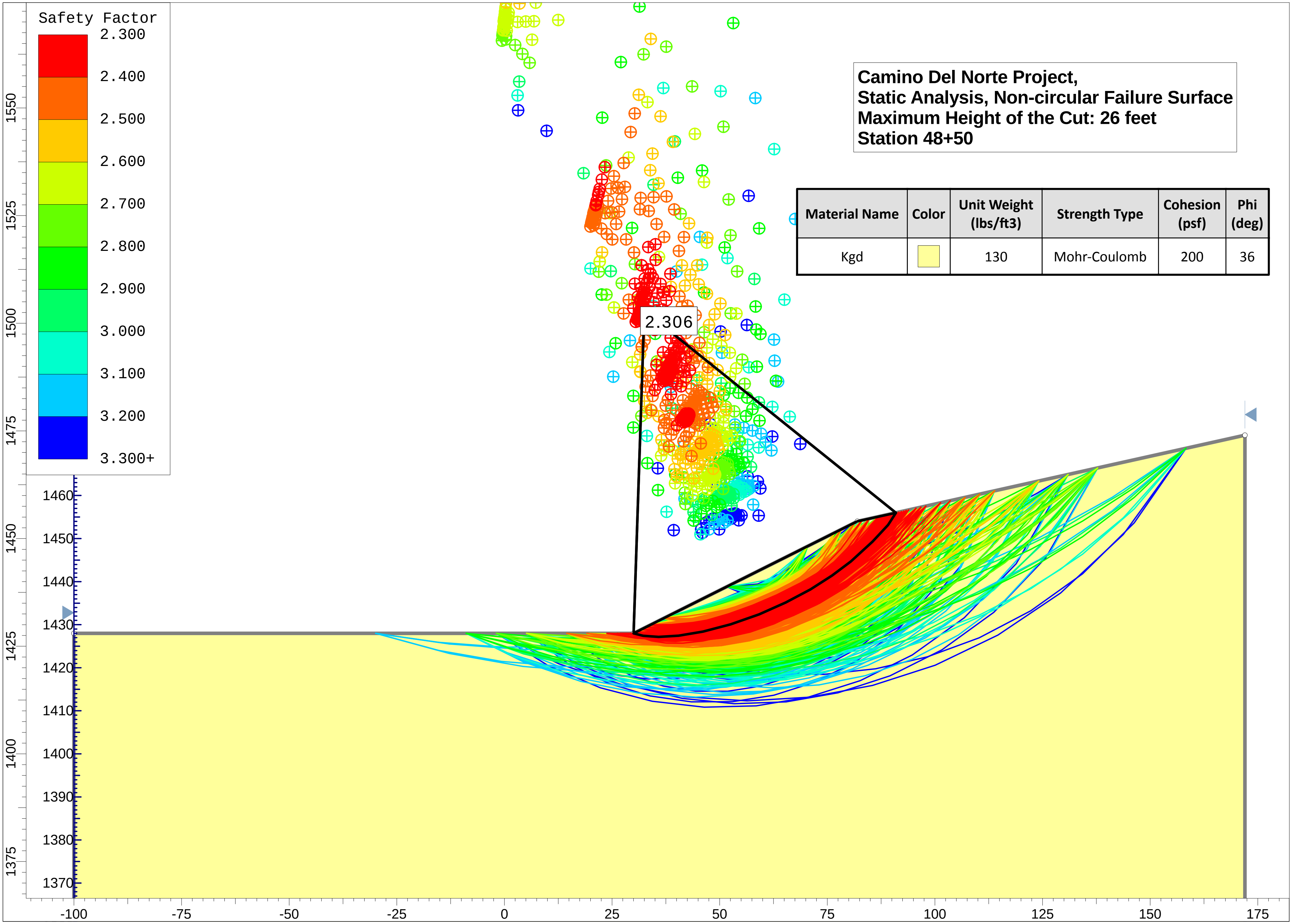
Safety Factor
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2.600
2.700
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3.000
3.100
3.200
3.300+
Camino Del Norte Project,
Static Analysis, Non-circular Failure Surface
Maximum Height of the Cut: 26 feet
Station 48+50
Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg)
Kgd | | 130 | Mohr-Coulomb | 200 | 36
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1550
1525
1500
1475
1450
1425
1400
1375
1460
1450
1440
1430
1420
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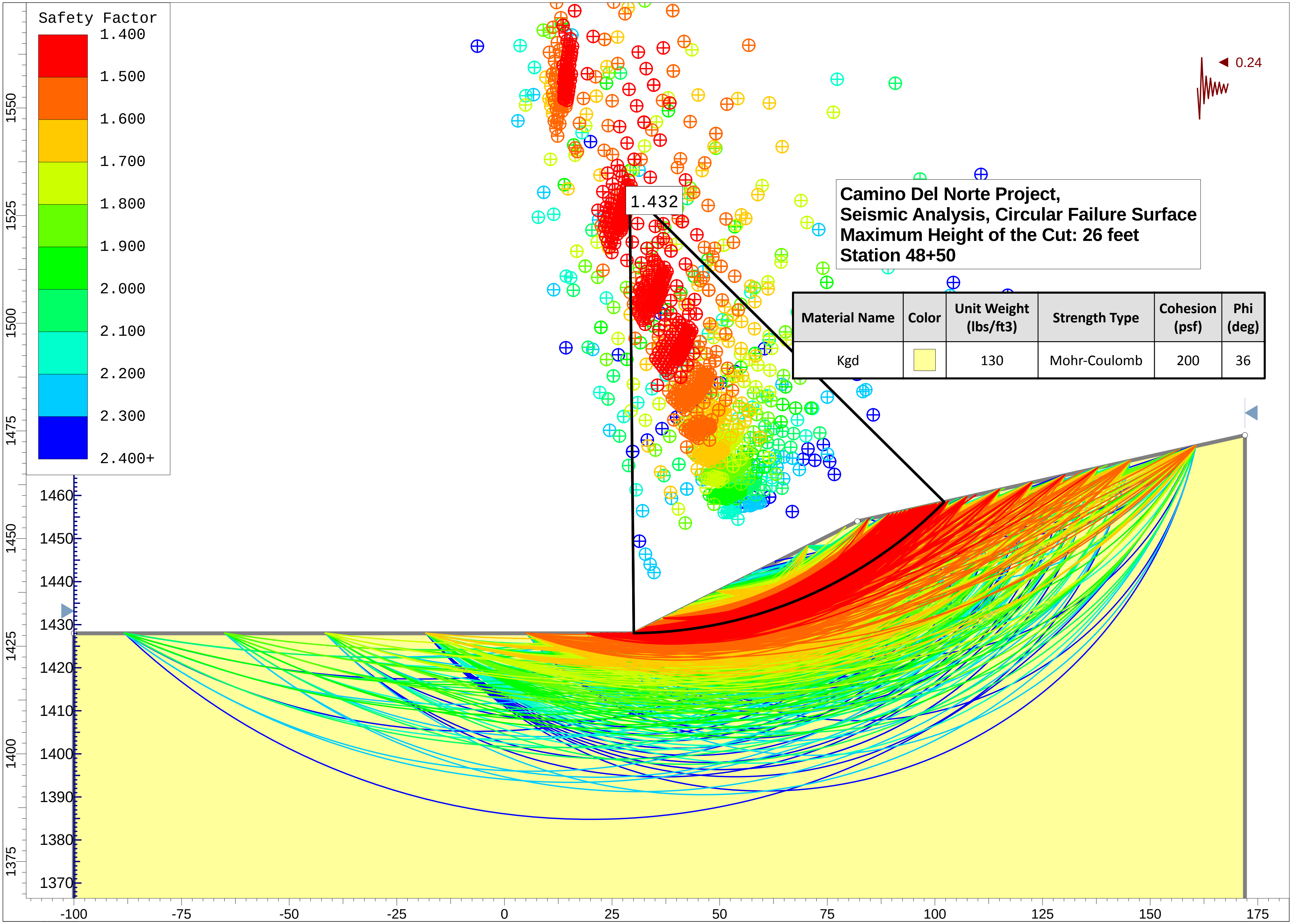
50
75
100
125
150
175



Safety Factor
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1.700
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2.000
2.100
2.200
2.300
2.400+
1.432
0.24
Camino Del Norte Project,
Seismic Analysis, Circular Failure Surface
Maximum Height of the Cut: 26 feet
Station 48+50
Material Name
Color
Unit Weight (lbs/ft3)
Strength Type
Cohesion (psf)
Phi (deg)
Kgd
130
Mohr-Coulomb
200
36
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1525
1500
1475
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1400
1375
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1450
1440
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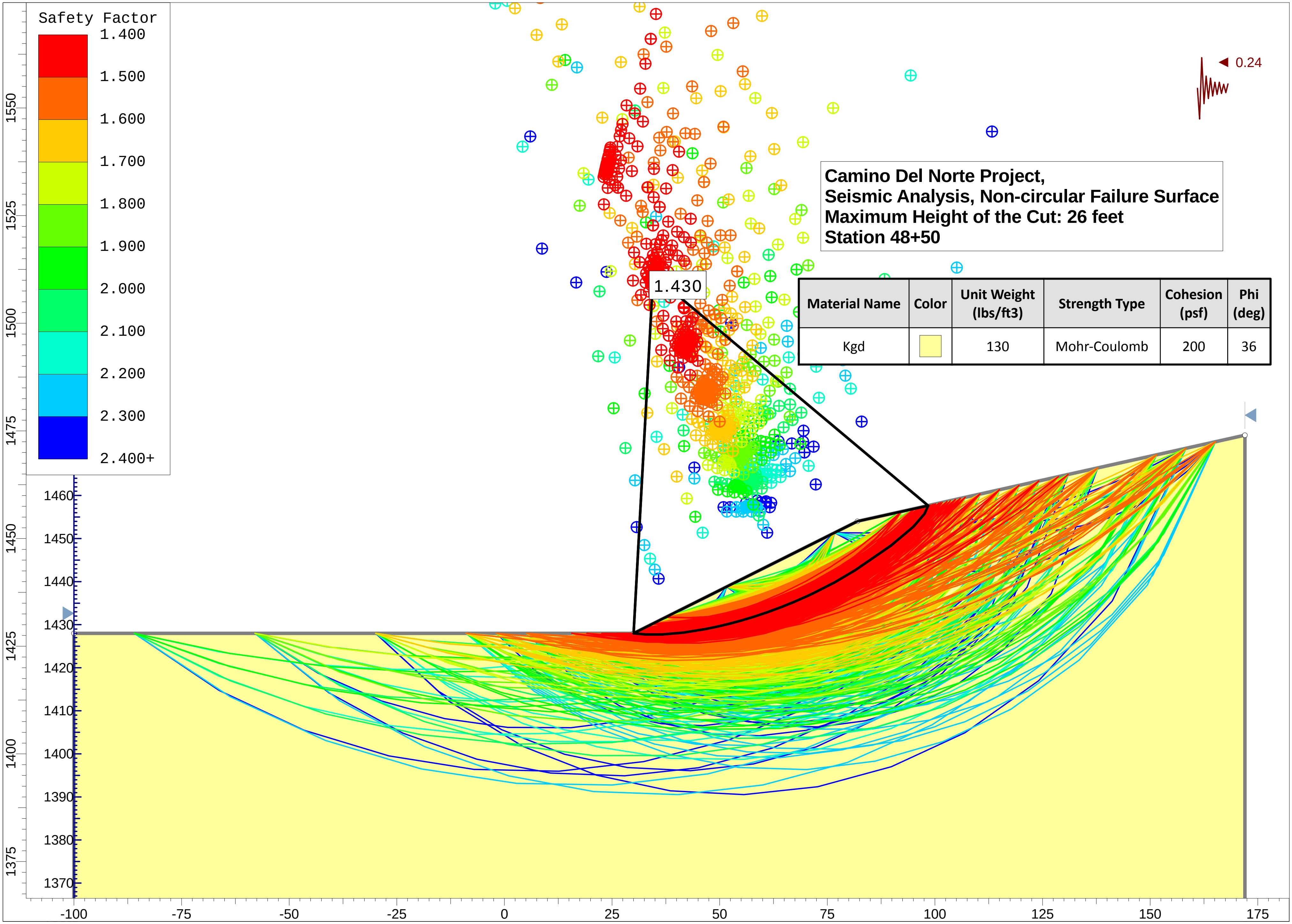
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2.100
2.200
2.300
2.400+
0.24
Camino Del Norte Project,
Seismic Analysis, Non-circular Failure Surface
Maximum Height of the Cut: 26 feet
Station 48+50
1.430
Material Name | Color | Unit Weight (lbs/ft3) | Strength Type | Cohesion (psf) | Phi (deg)
Kgd | | 130 | Mohr-Coulomb | 200 | 36
1550
1525
1500
1475
1450
1425
1400
1375
1460
1450
1440
1430
1420
1410
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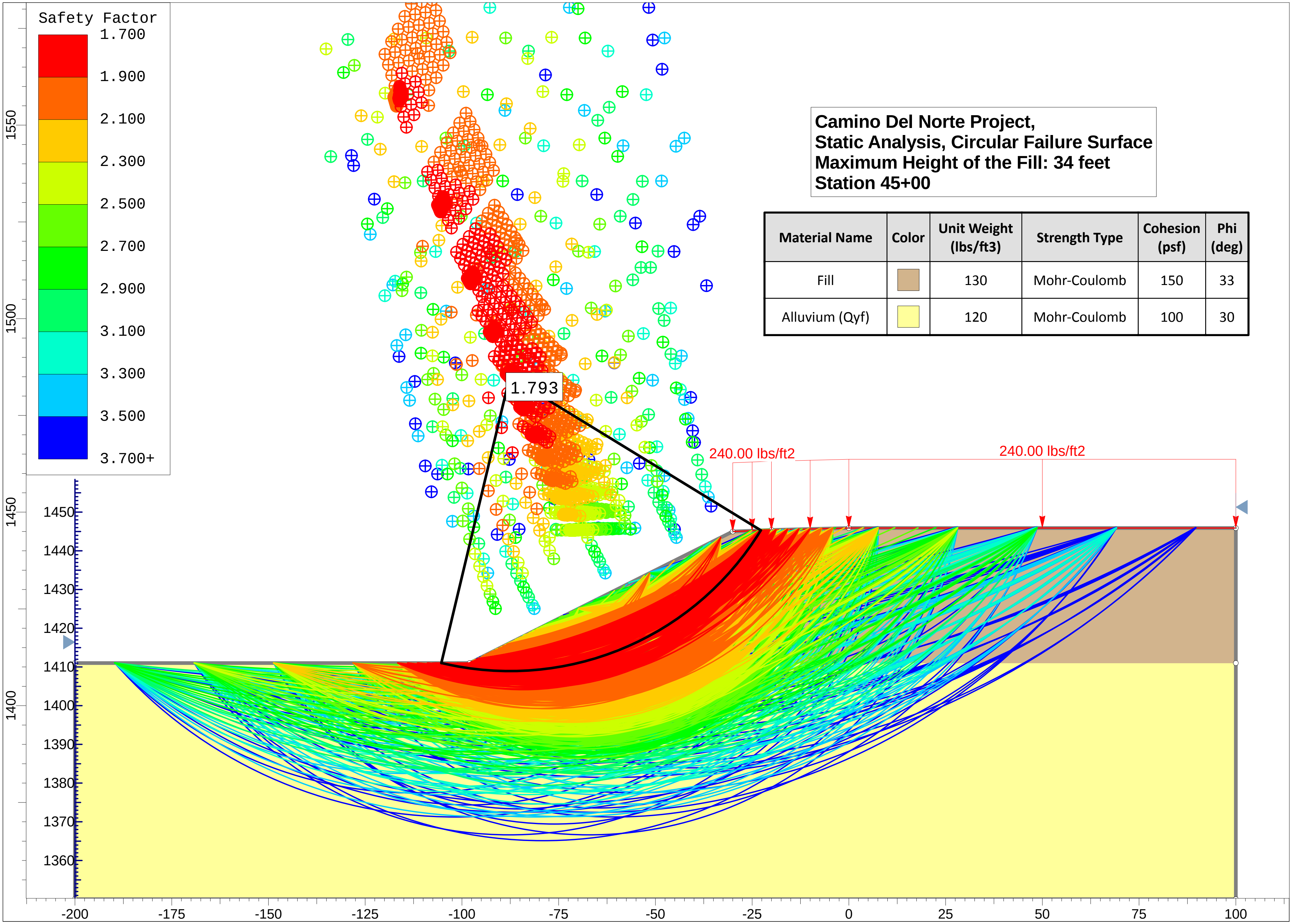
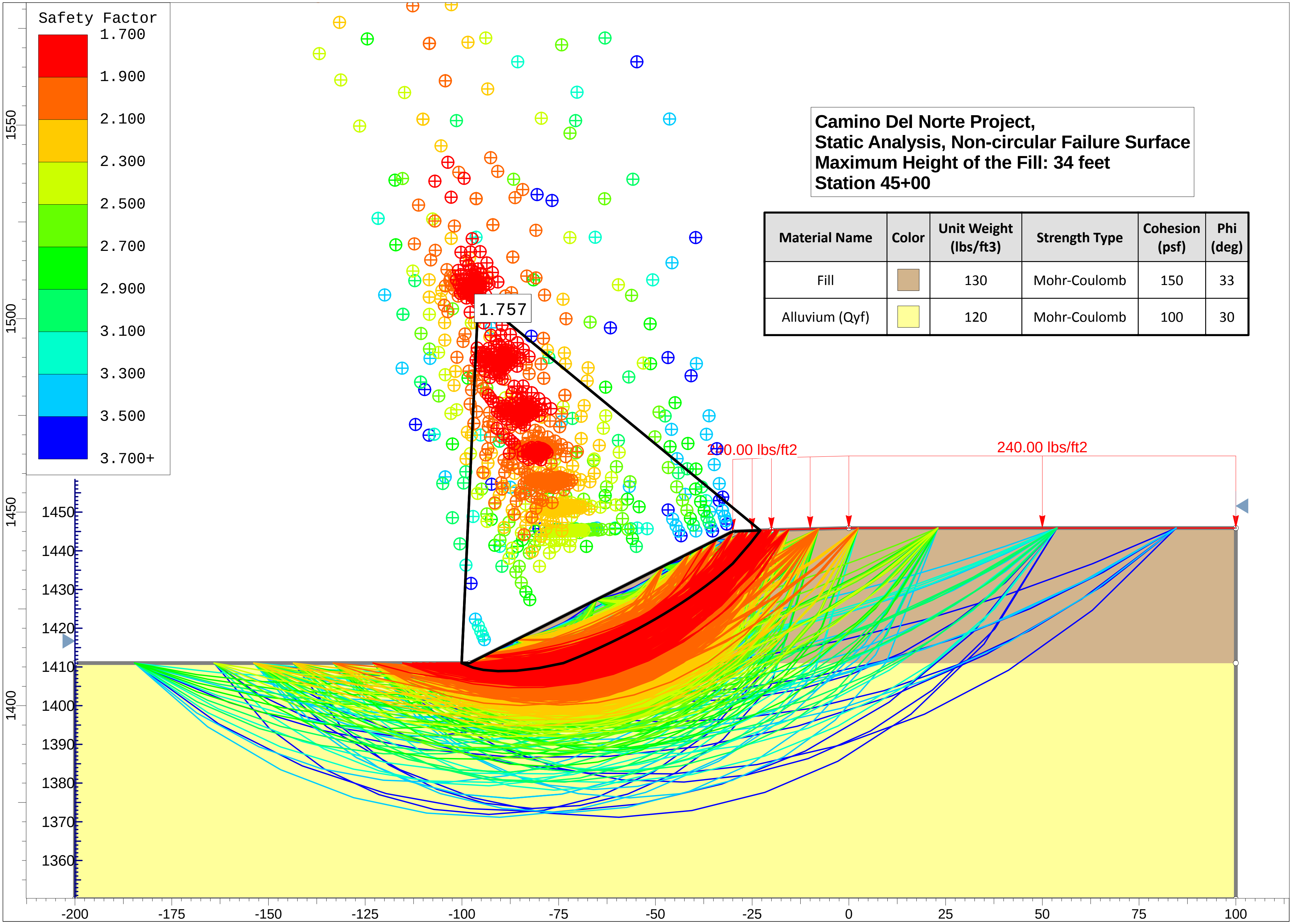
75
100
125
150
175



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Fill		130	Mohr-Coulomb	150	33
Alluvium (Qyf)		120	Mohr-Coulomb	100	30



Camino Del Norte Project,
Static Analysis, Non-circular Failure Surface
Maximum Height of the Fill: 34 feet
Station 45+00

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
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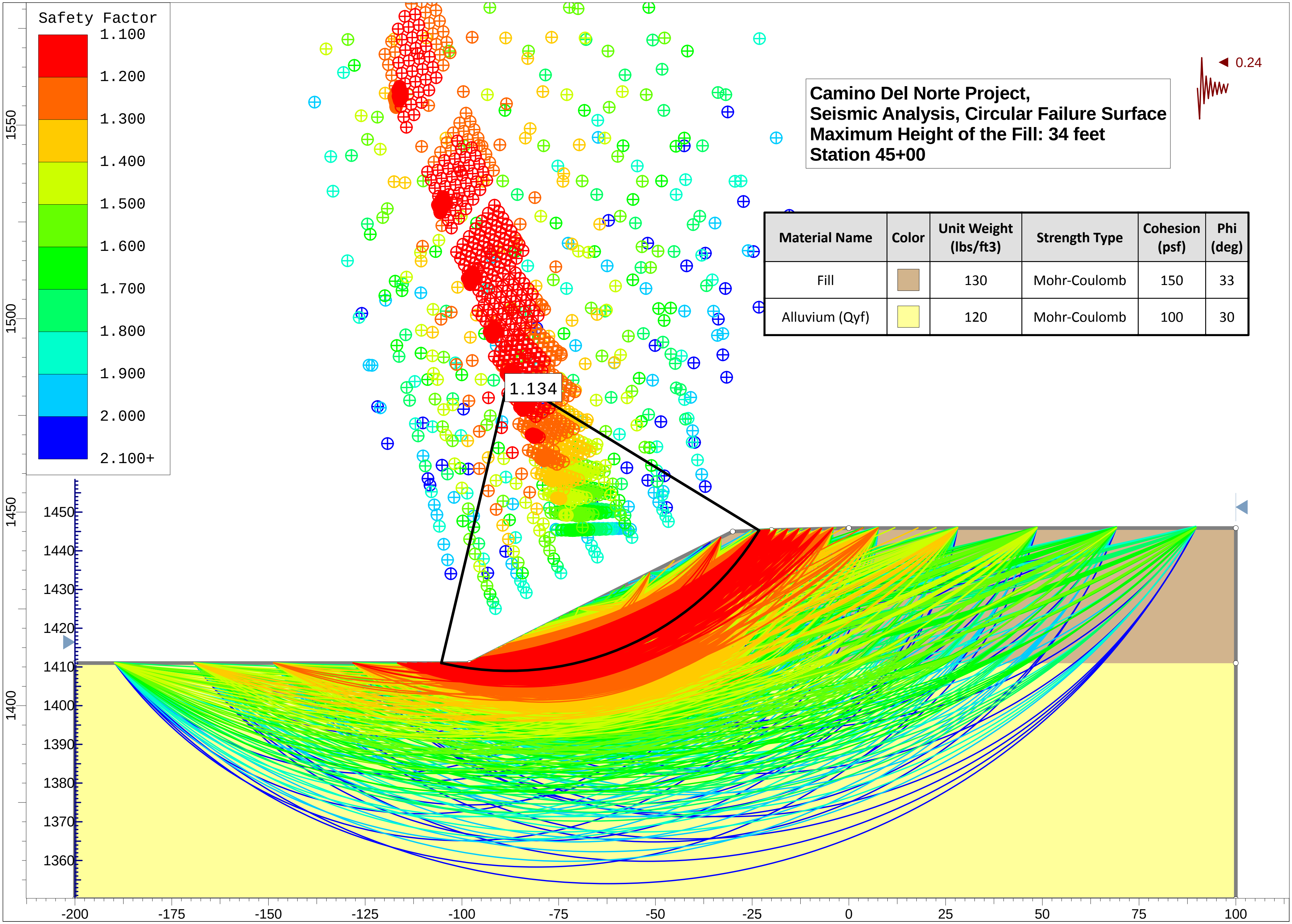
Alluvium (Qyf)		120	Mohr-Coulomb	100	30



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
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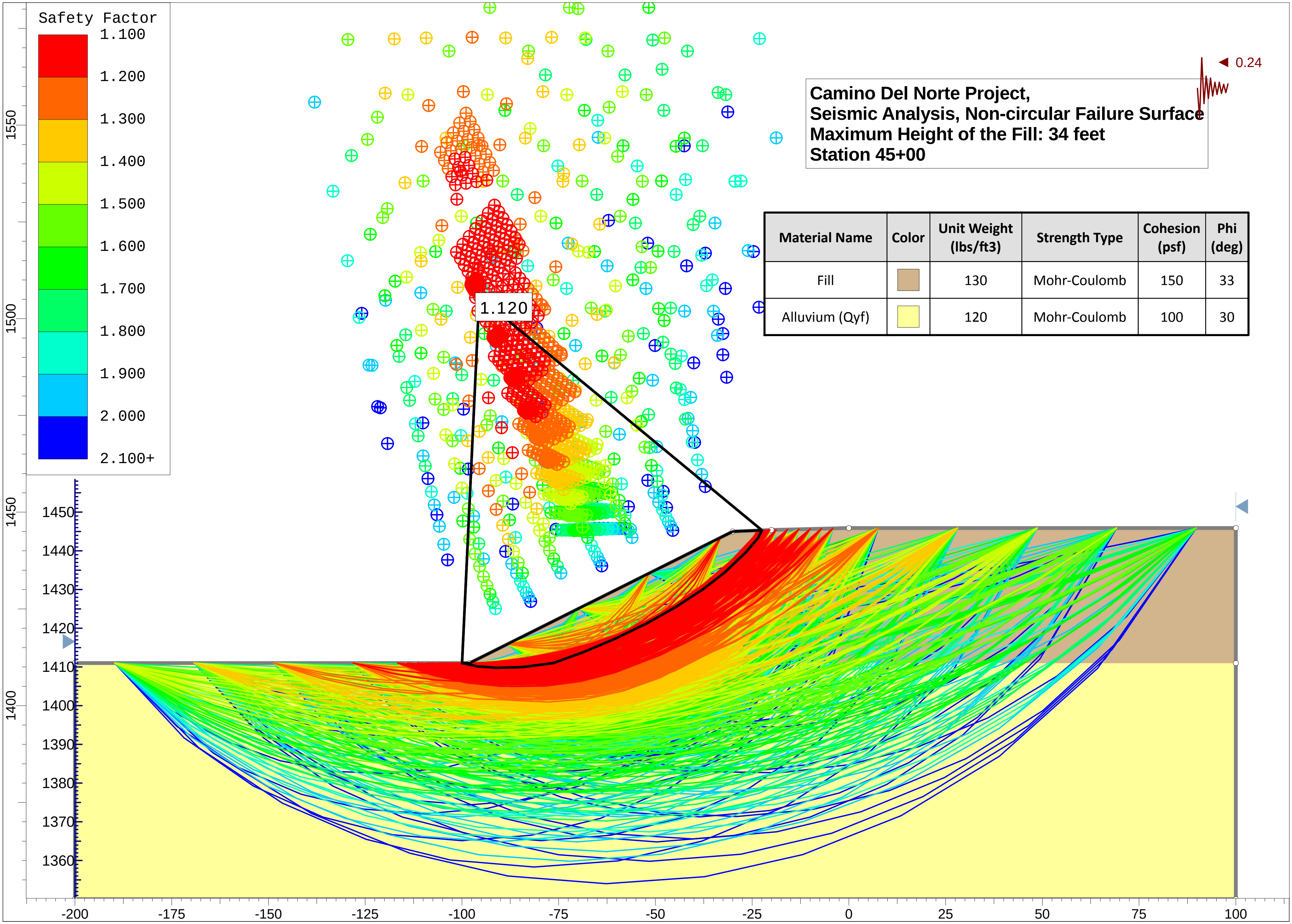
Alluvium (Qyf)		120	Mohr-Coulomb	100	30



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Fill		130	Mohr-Coulomb	150	33
Alluvium (Qyf)		120	Mohr-Coulomb	100	30

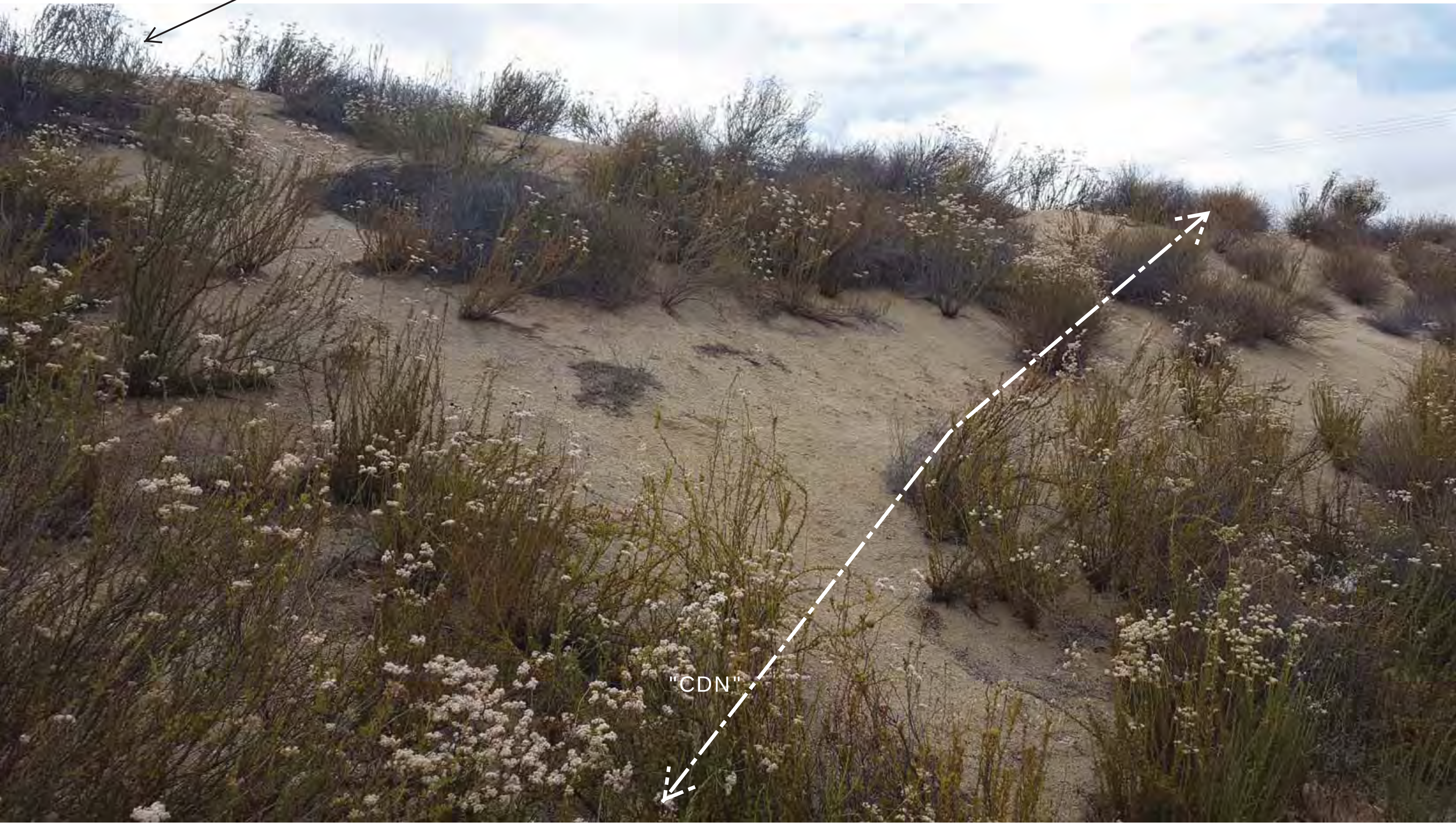
Appendix E Site Photographs

A-16-001
NEAR STA. 7+00

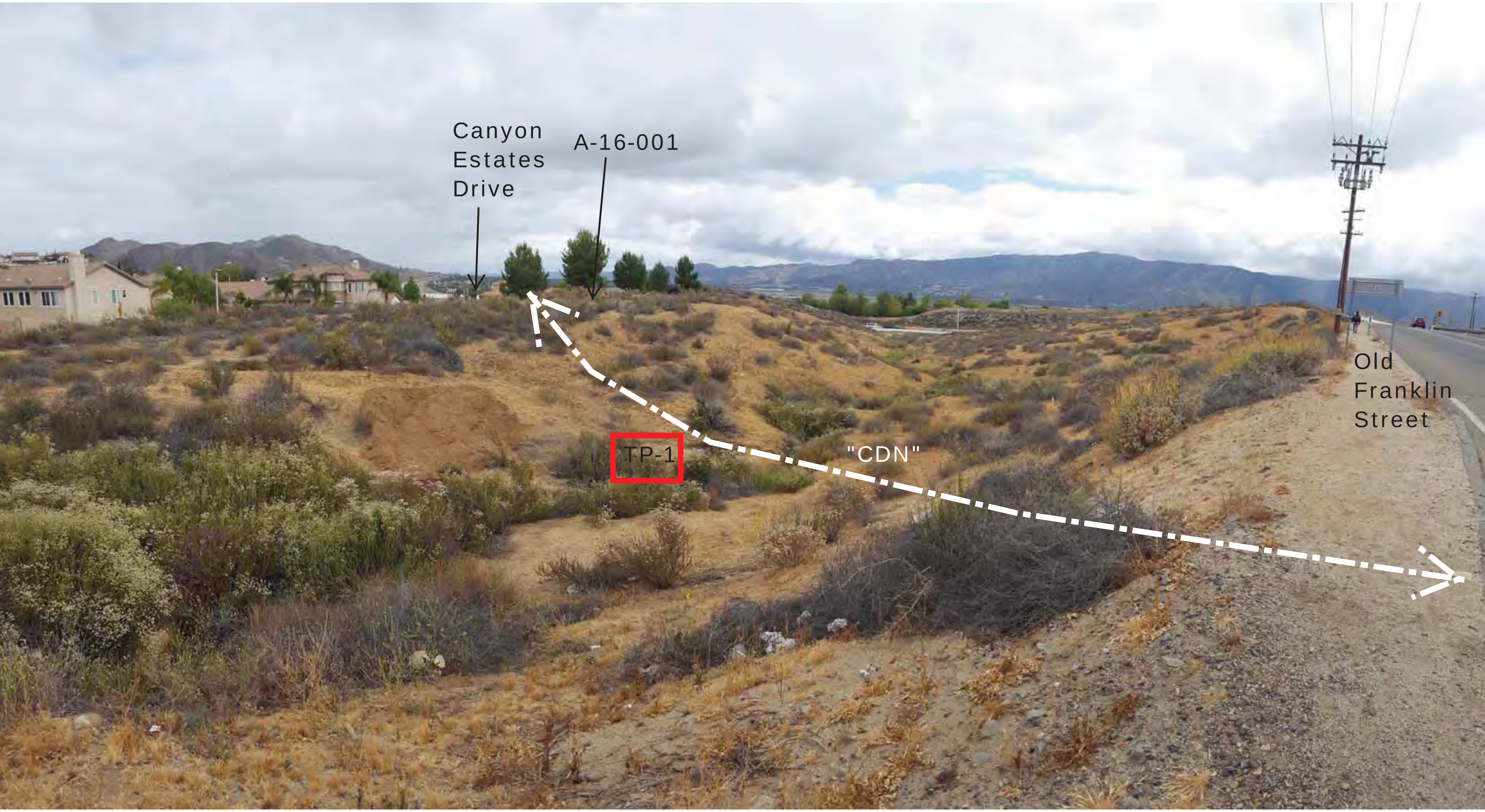
A-16-001
NEAR STA. 7+00

Existing Decomposed Granite Cut Slope along West Side of Canyon Estates to be Further Cut Into

Boring A-16-001
at Top of Slope



Existing Decomposed Granite Cut Slope along West Side of Canyon Estates to be Further Cut Into



Location of TP-1
Near "CDN" 9+00

Existing Triple RCP Culvert
at Canyon Estates Drive and
Canyon View Drive

Old Franklin Street at
Canyon Estates Drive
/ Canyon View Drive

Existing Cut Slope along
Old Franklin Street to be
Cut Further

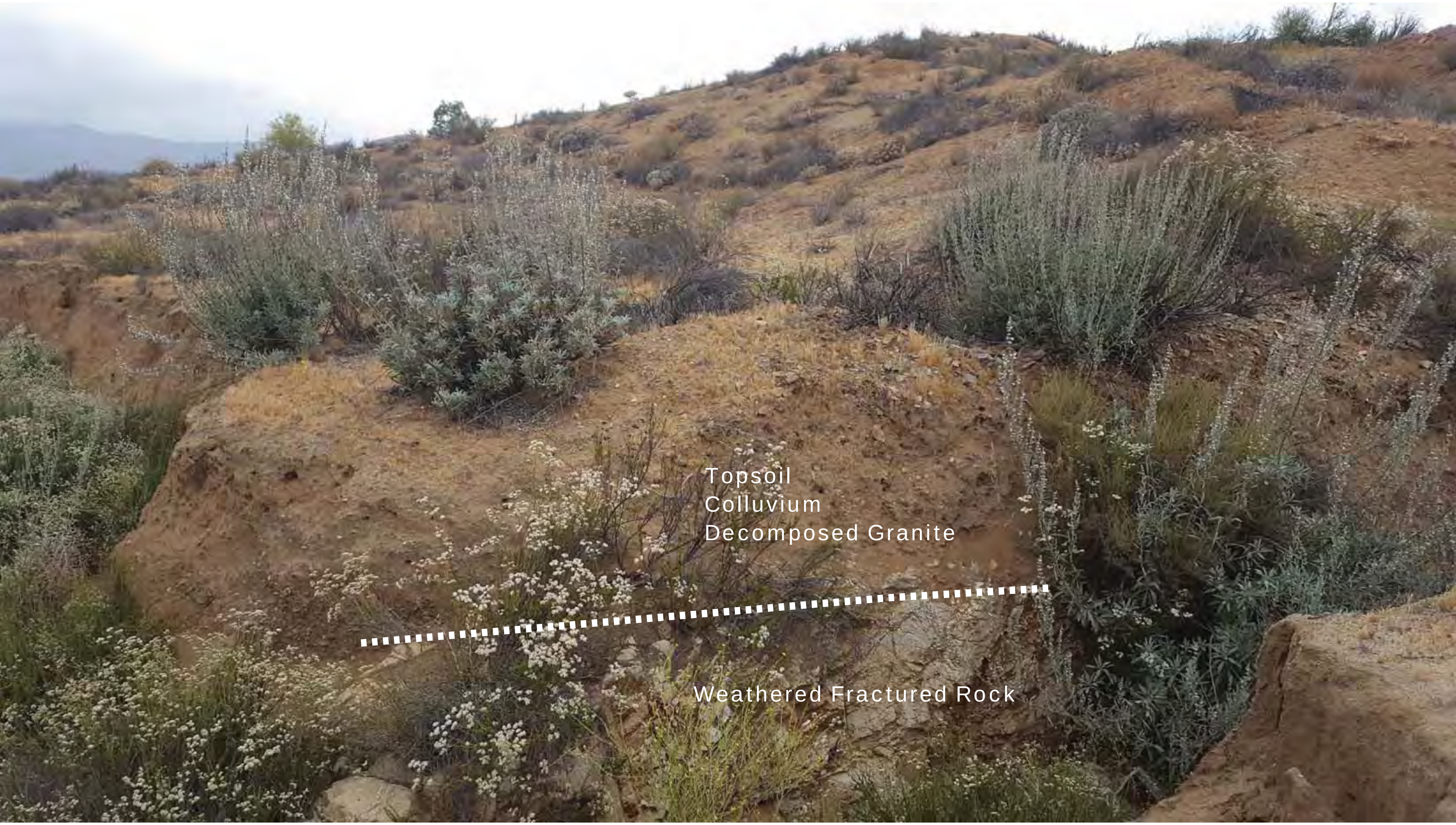
Existing Cut Slope along
Old Franklin Street to be
Cut Further

Existing Cut Slope along
Old Franklin Street to be
Cut Further

A-16-002
NEAR STA. 11+00

Location of Boring
A-16-002

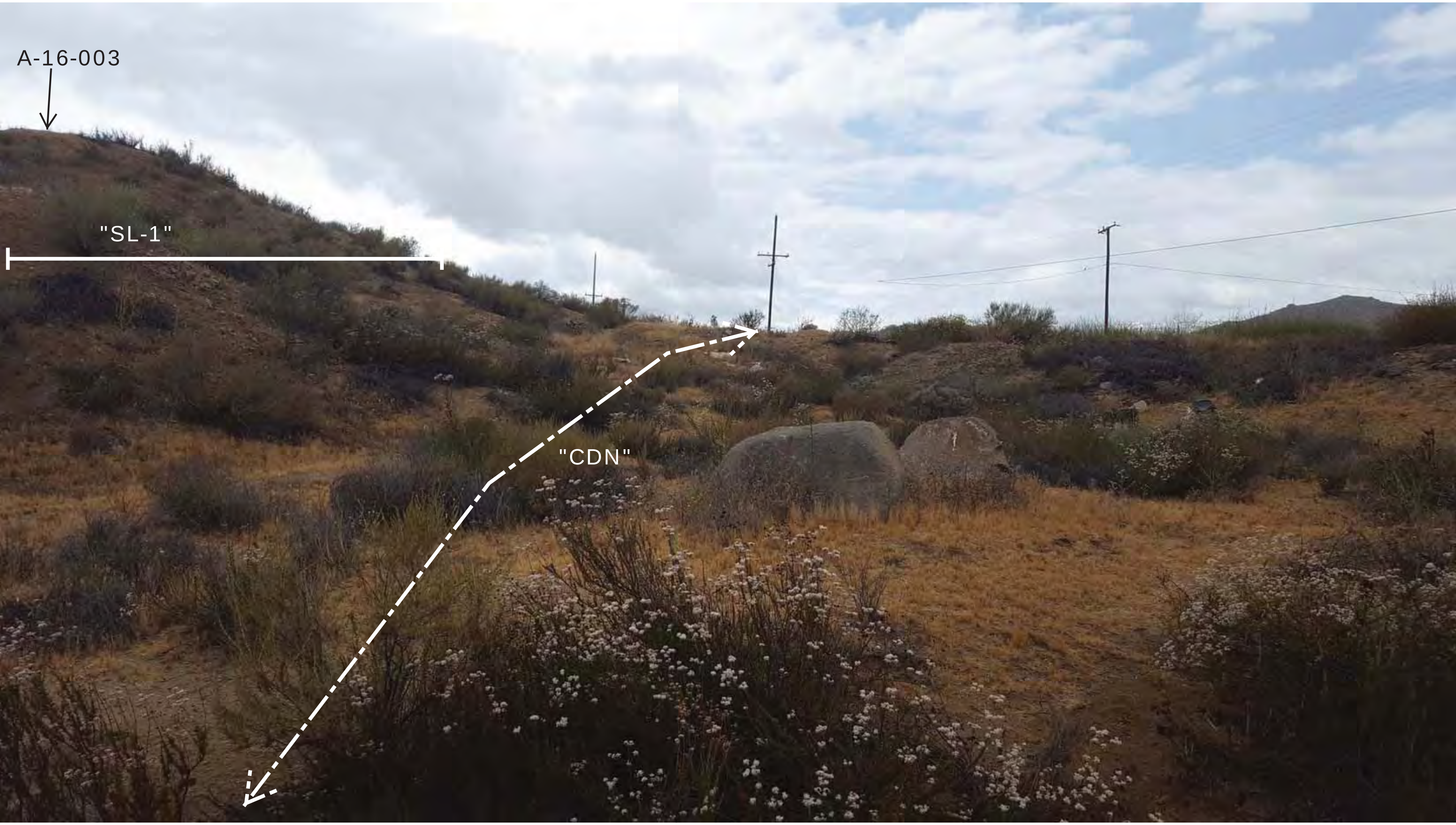
Eroded Gully Downstream
of Station "CDN" 13+20



Soil over Weathered Rock in
Eroded Gully Downstream
of Station "CDN" 13+20
Near TP-2


Weathered Fractured Rock

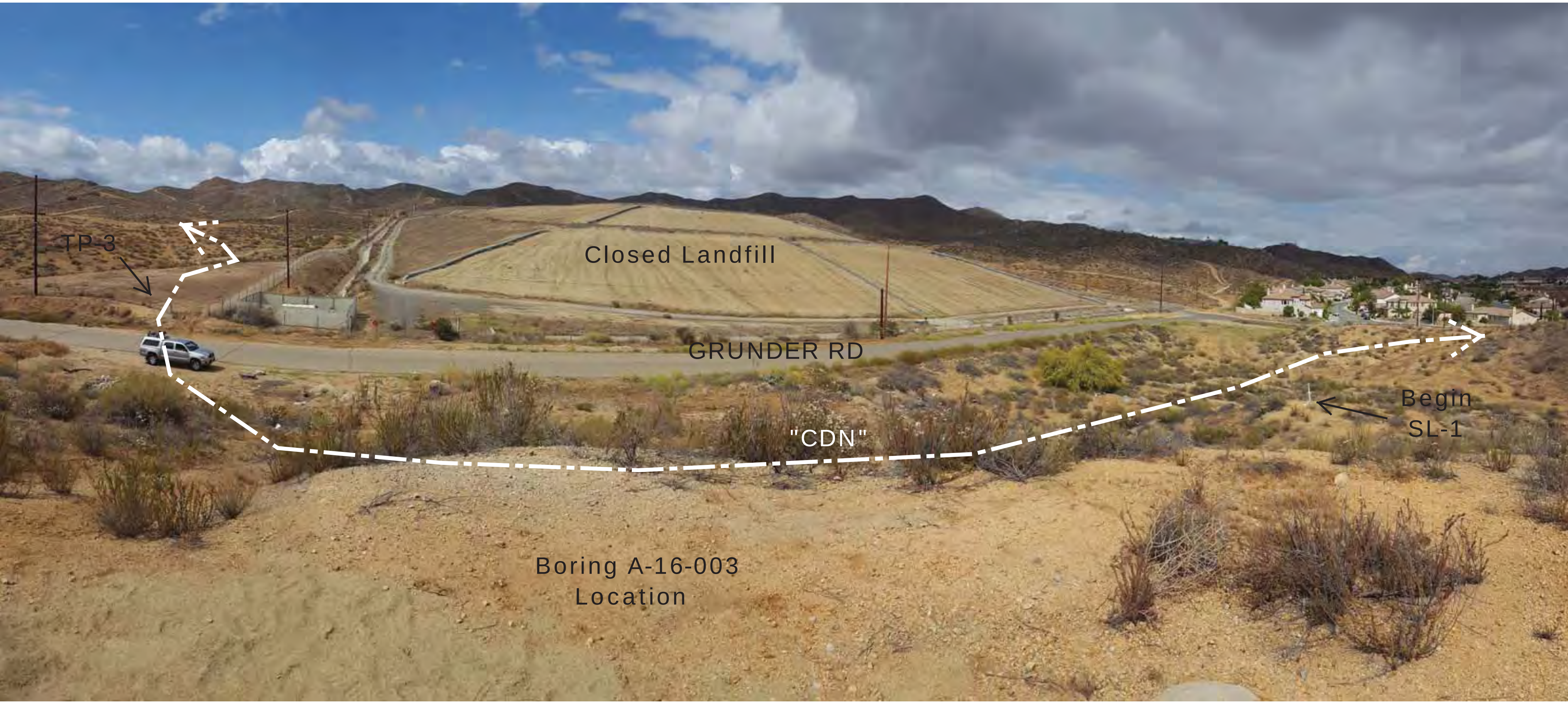
Eroded Gully
Station "CDN" 13+20
Near TP-2



Boulders near
"CDN" 14+00

Existing Grunder Road

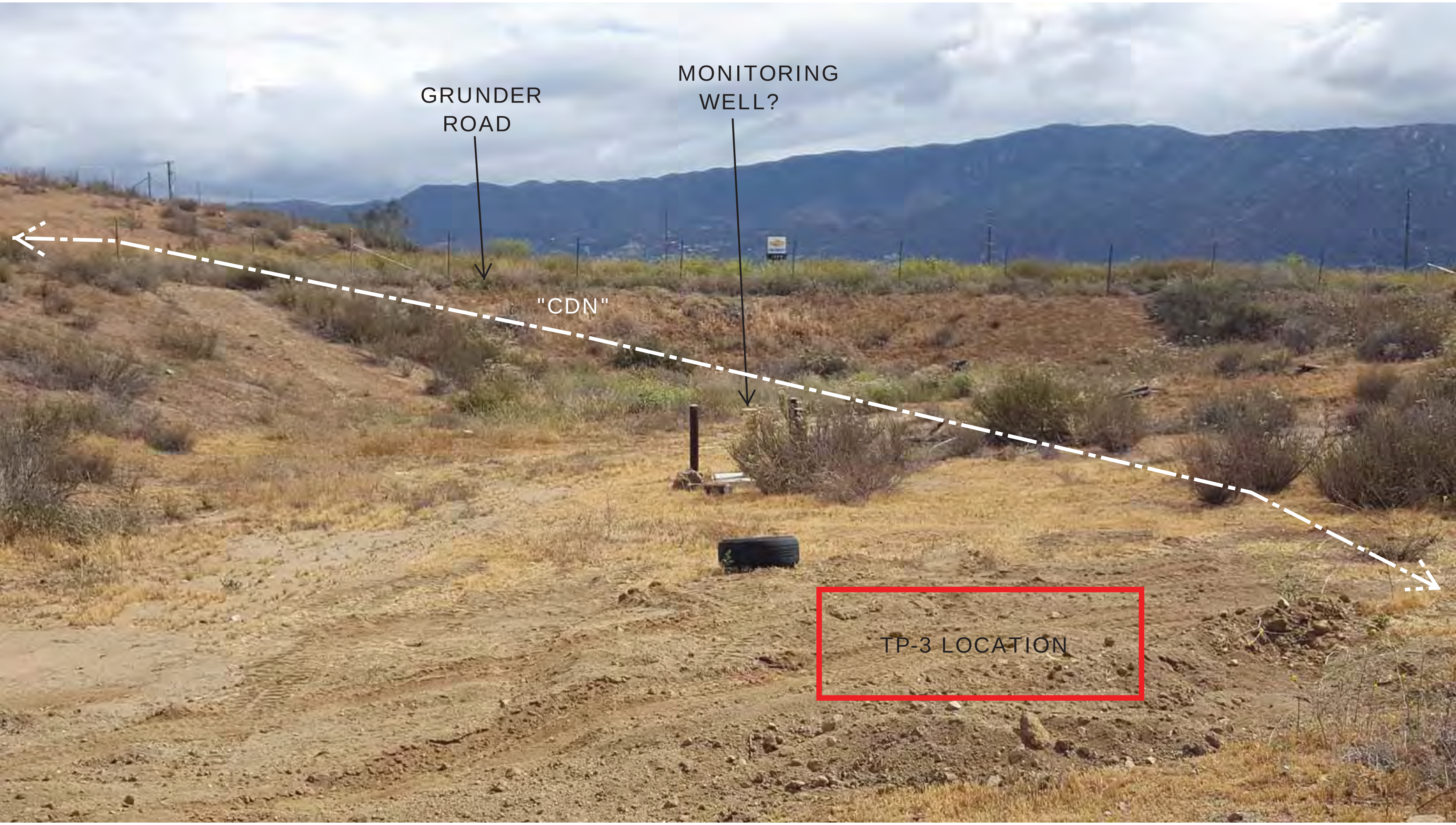
Near 15+00
Looking East
from A-16-003



Near Station 15+00
Looking North

Near Station 15+00
Looking Northwest

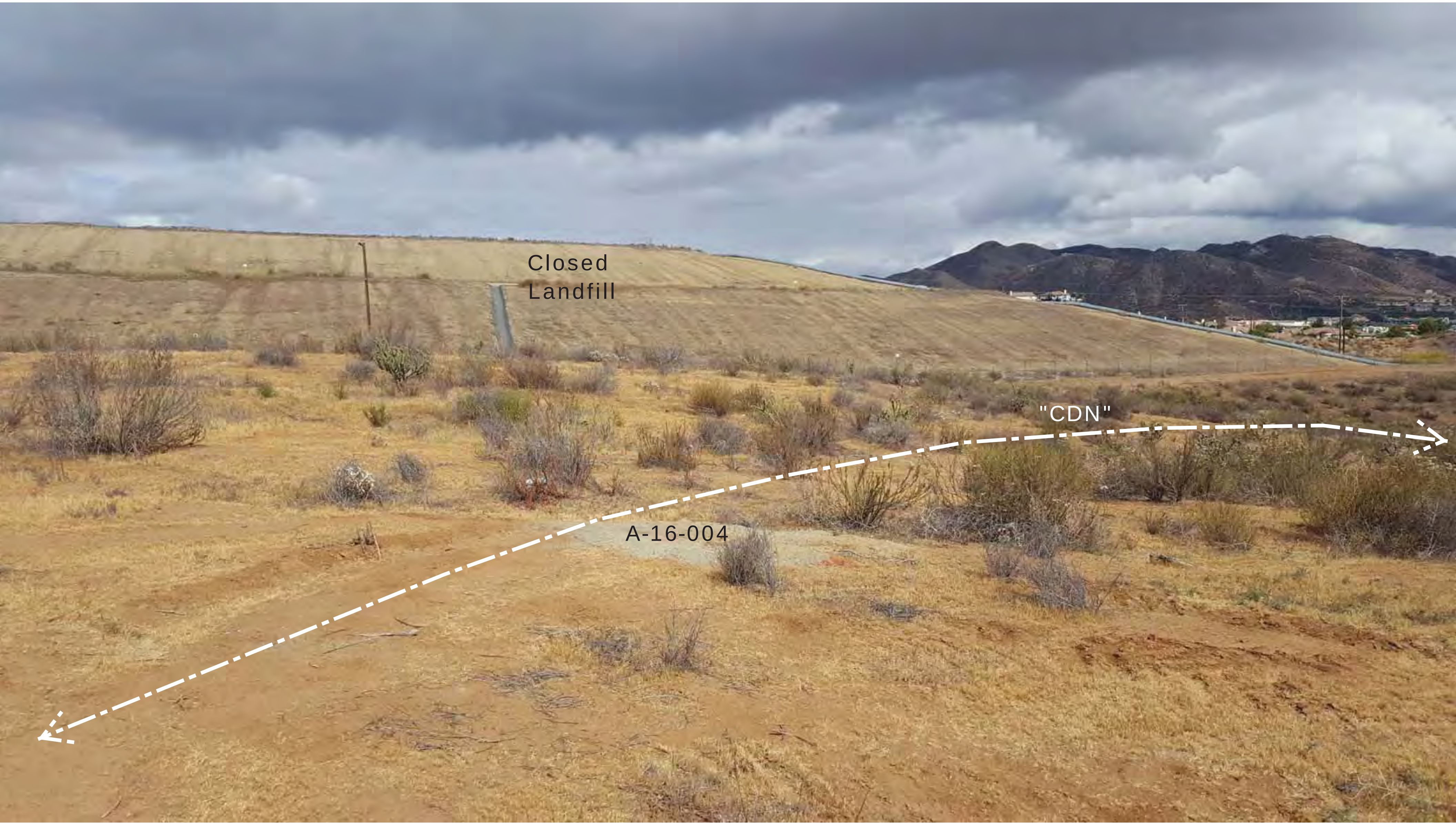

A-16-003
SL-1
"CDN"



NEAR 19+00
LOOKING SOUTH

NEAR 17+50
LOOKING NORTH

Near A-16-004
Looking Southeast



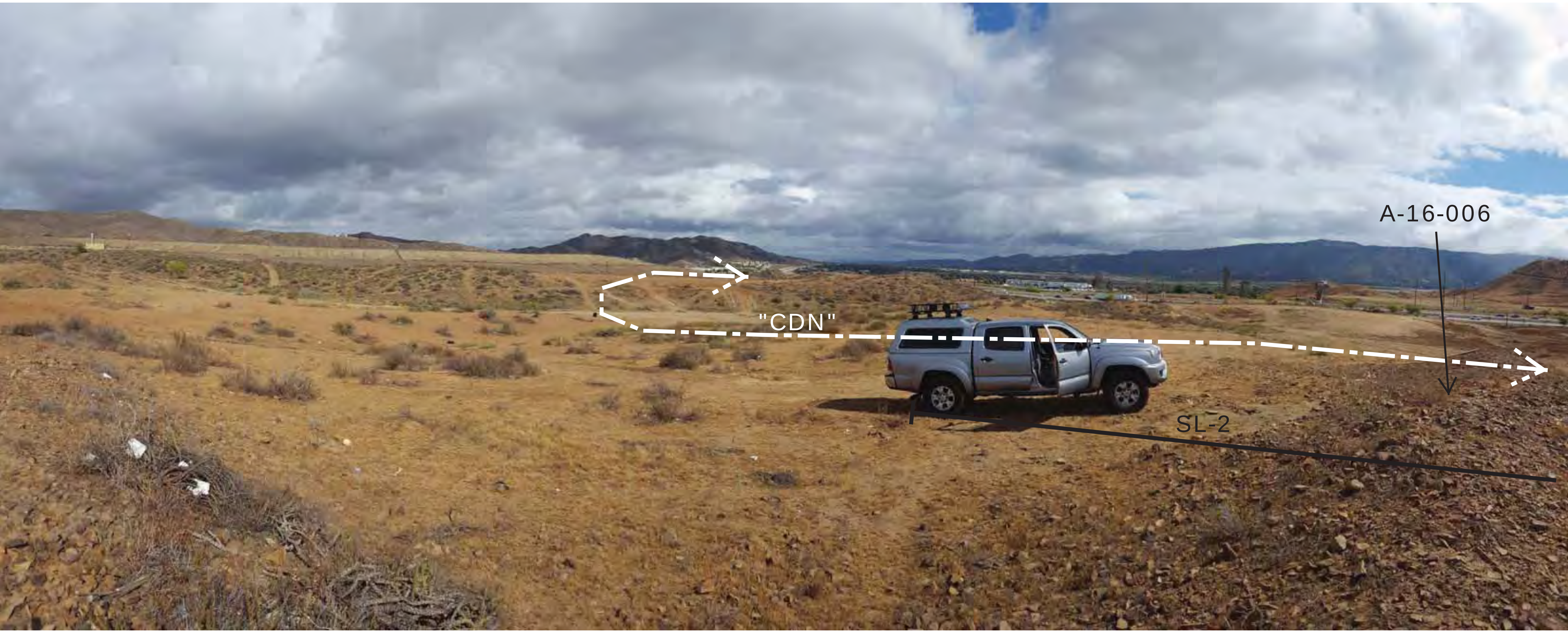
A-16-004
Looking East

Near A-16-004
Looking South

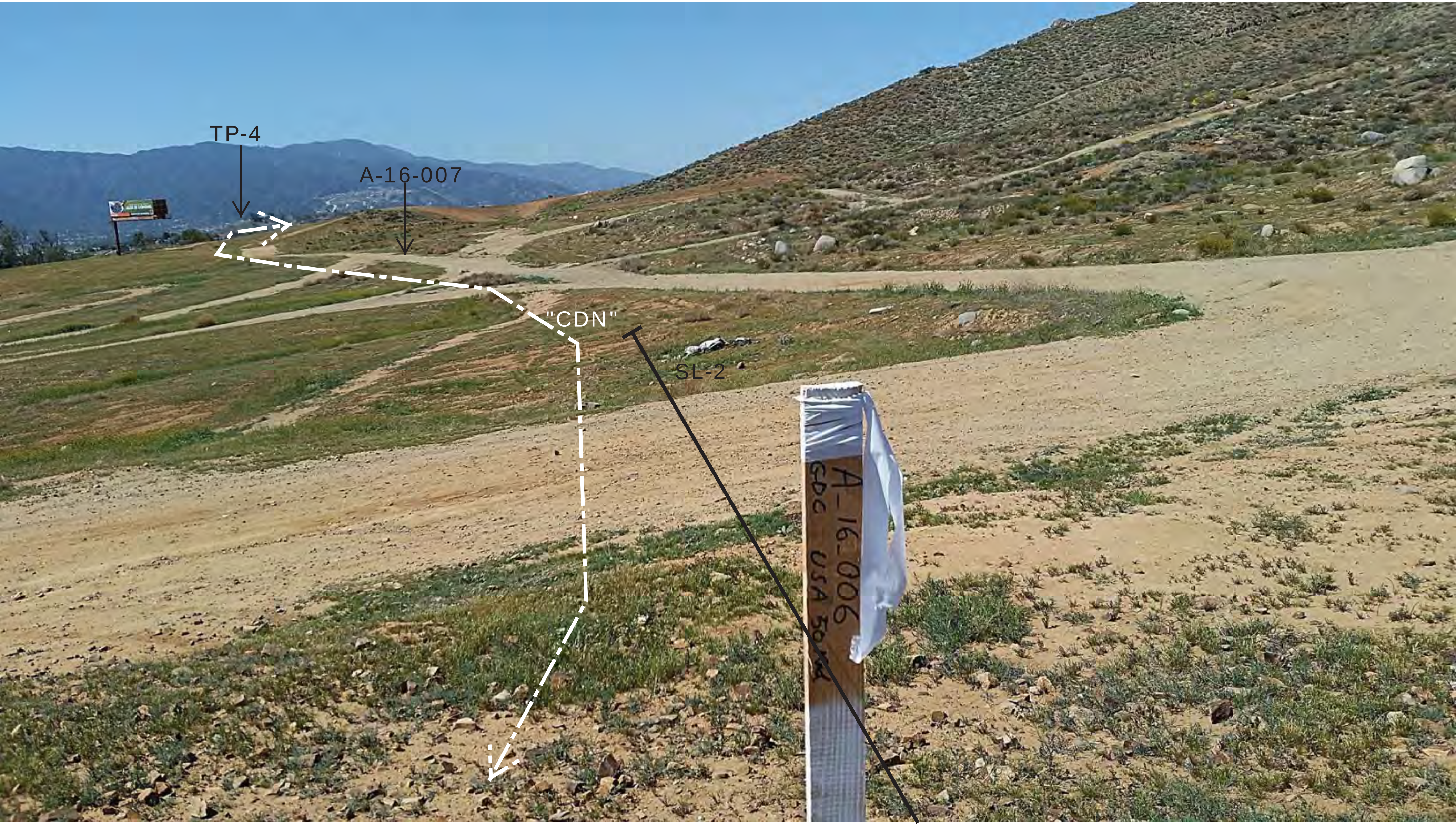
A-16-005
Looking East

Near A-16-005
Looking East

A-16-006



Near A-16-006
Looking East



Near A-16-006
Looking West

I-15

A-16-007
Looking South

TP-4
Looking South

TP-4
Looking North

Near TP-5
Looking South

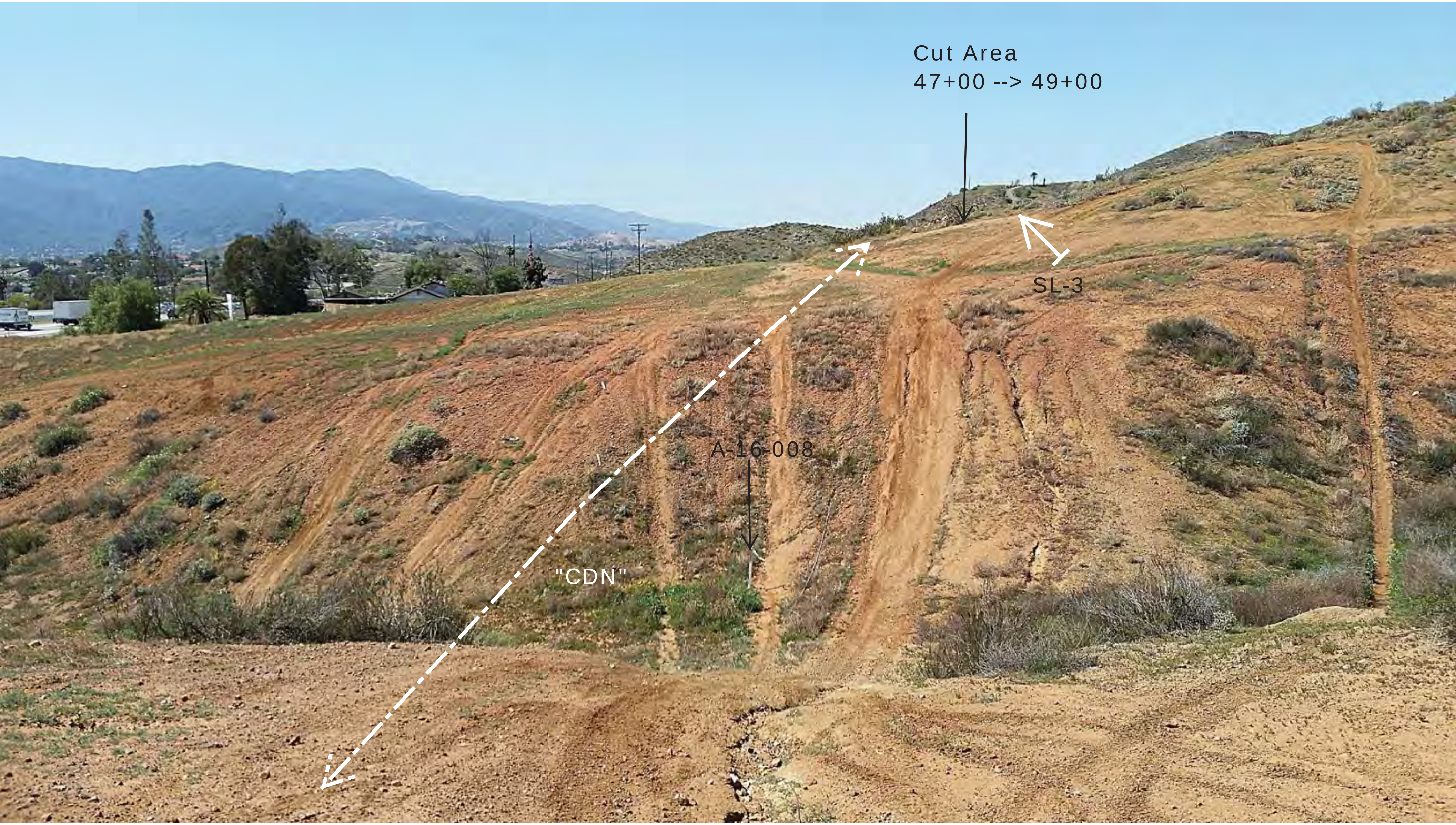
Near "CDN" 43+50

Existing Small
Through-Cut
"CDN" 44+00

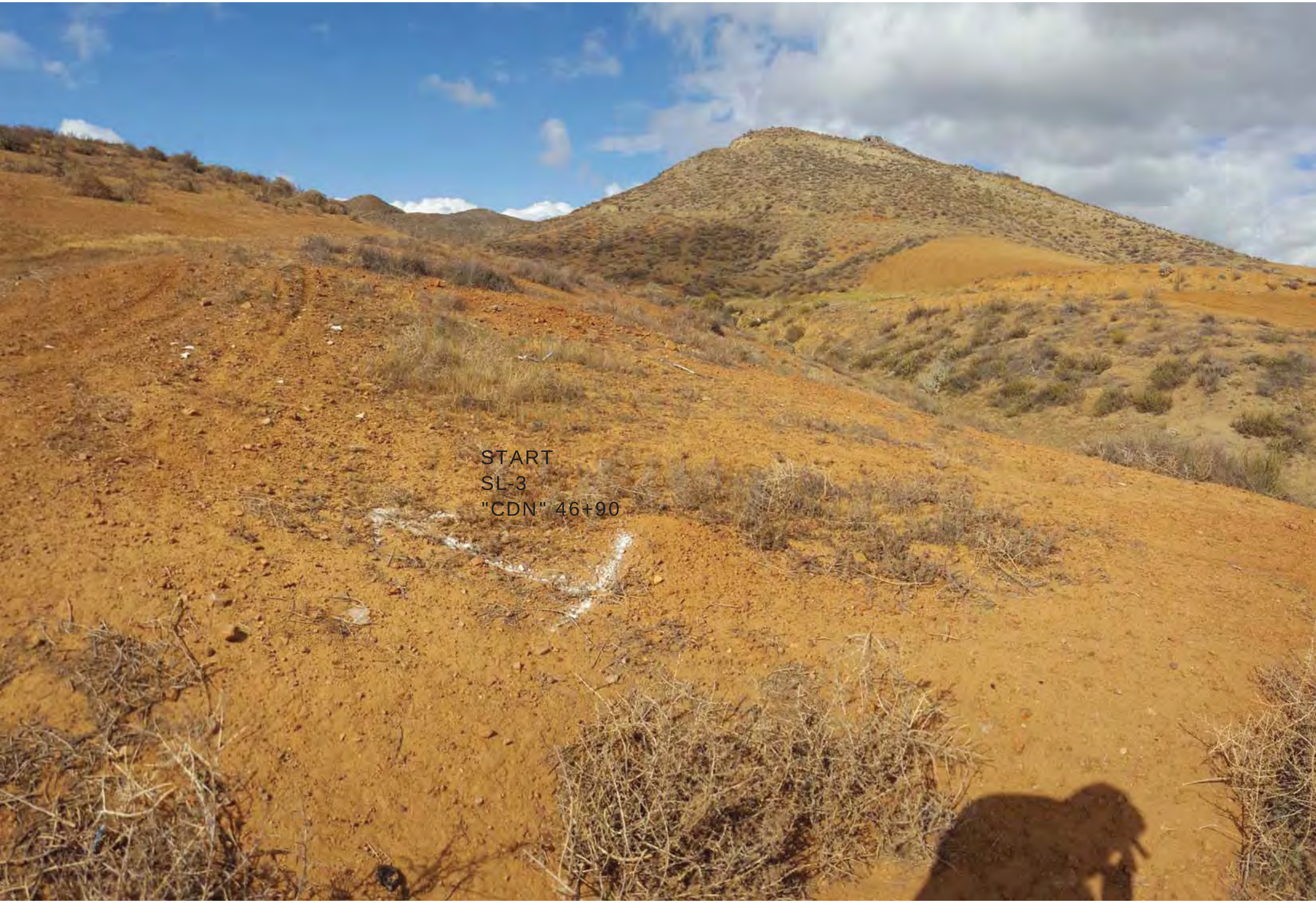
Minor Rilling
in Decomposed
Granite Cut
"CDN" 44+00

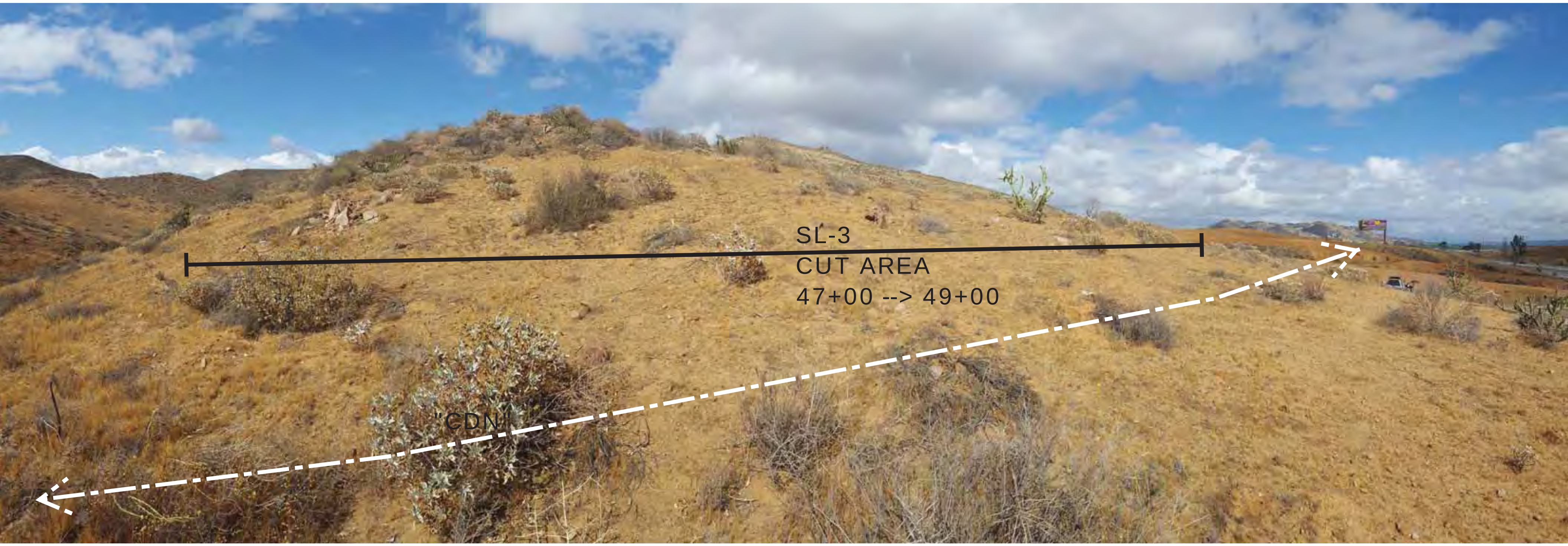
Canyon Near
A-16-008
Looking
Southeast

Canyon to be Filled near "CDN" 46+00

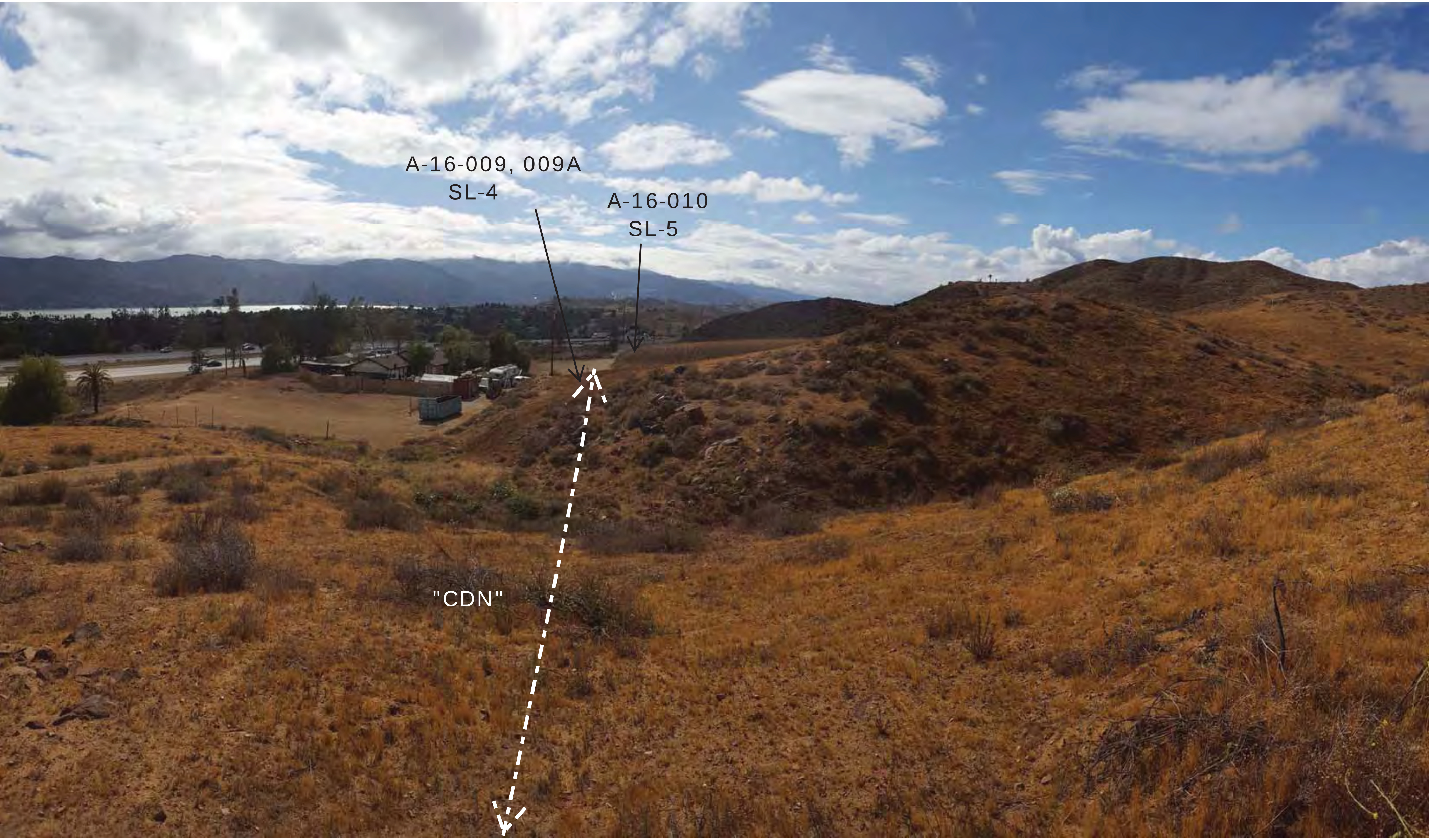


Near "CDN" 45+50
Looking Northwest

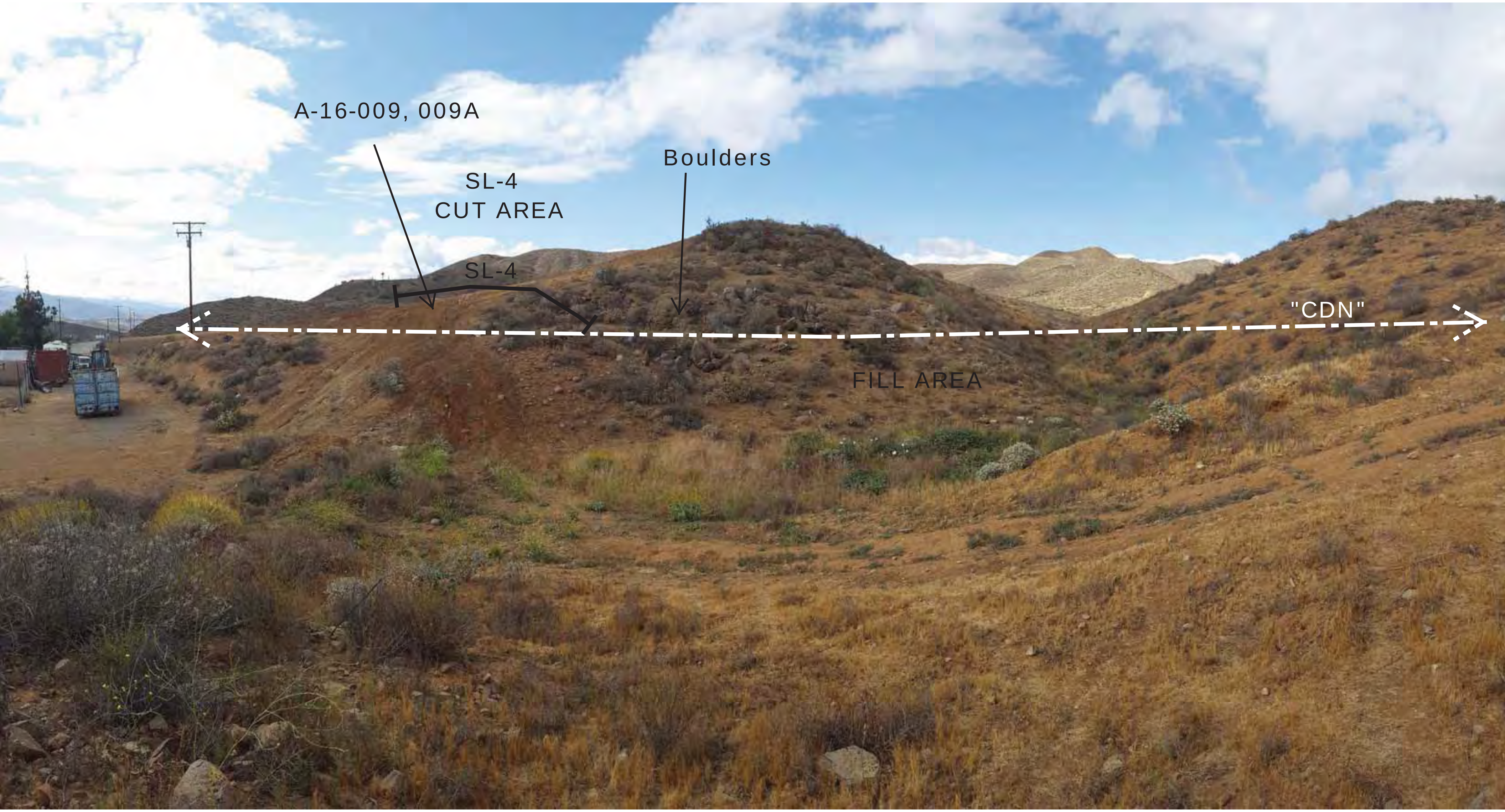

START
SL-3
"CDN" 46+90


SL-3
CUT AREA
47+00 --> 49+00
"CDN"


SL-3
CUT AREA
47+00 --> 49+00
Surface Geology mapped as Old Alluvial Terrace (Qoa)


A-16-009, 009A
SL-4
A-16-010
SL-5
"CDN"

Near "CDN" 50+50
Looking North



"CDN" 49+50
Looking Northwest

Existing Cut Exposing
Alluvial Fan Deposits (Qyf)
at A-16-010 Location


A-16-009, 009A
SL-4
"CDN"

A-16-010
Existing Through-Cut
Exposing Qyf Soils
SL-5
SALE PENDING
32.76 ACRES

BLOCK CRACKING NORTHWEST END OF JOB
EXISTING CAMINO DEL NORTE


BLOCK CRACKING NORTHWEST END OF JOB
EXISTING CAMINO DEL NORTE