APPENDIX E

GEOTECHNICAL DESIGN REPORT
(GROUP DELTA CONSULTANTS, INC., MAY 2016)

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GEOTECHNICAL DESIGN REPORT
CAMINO DEL NORTE EXTENSION

City of Lake Elsinore, Riverside County, California

Submitted to

City of Lake Elsinore

Prepared for

SC Engineering
16096 Chiwi Road
Apple Valley, CA 92308

Prepared by

GROUP DELTA CONSULTANTS, INC.
32 Mauchly, Suite B
Irvine, California 92618

GDC Project No. IR-645

May 11, 2016

GROUP DELTA

May 11, 2016

SC Engineering
16096 Chiwi Road
Apple Valley, CA 92308

Attention: Sal Chavez

Subject: Geotechnical Design Report
Camino Del Norte Extension
City of Lake Elsinore, Riverside County, California
GDC Project No. IR-645

Dear Sal:

We are pleased to submit our Geotechnical Design Report for the subject project. A concise summary of recommendations is presented in Section 12 of this report.

We appreciate the opportunity to assist you on this important project. Should you have any questions, please call us at (949) 450-2100.

Sincerely,
GROUP DELTA CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER
CURT SCHEYHING
No. 2766
Exp. 06-30-17
GEOTECHNICAL
STATE OF CALIFORNIA

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1.0 INTRODUCTION

1.1 Background

The project site is located in the City of Lake Elsinore in Riverside County, California (Figure 1A). The City proposes a new roadway to extend Camino Del Norte from the intersection of Canyon Estates Drive and Old Franklin Street on the southeast to existing Camino Del Norte on the northwest (see Figure 1B). A short section of existing Canyon View Drive and Old Franklin Street will also be improved. Group Delta performed a geotechnical field investigation consisting of review of existing data, site reconnaissance, hollow stem auger borings, backhoe test pits, seismic refraction traverses, laboratory testing of soil samples, and geotechnical analysis to characterize the site and provide geotechnical recommendations for design and construction.

1.2 Project Description

The length of the project alignment is approximately 1 mile. The project includes cut-fill mass grading and paving to create a new roadway and appurtenant facilities. No major structures or retaining walls are proposed. Cut and fill slopes will be constructed at a maximum inclination of 2h: 1v with maximum heights of less than about 26 and 34 feet, respectively. Geologic conditions are generally a localized shallow cover of fill, colluvium, young alluvial fan deposits, and/or old alluvium, underlain by Cretaceous granitic rock that is typically decomposed to moderately weathered and moderately to intensely fractured near the surface grading to less weathered and fractured with depth. The project layout plans are shown in Figures 2A through 2F, the alignment profile is shown in Figures 3A through 3E, selected cross-sections are shown in Figures 4A through 4AI, and aerial photographs of the alignment are shown in Figures 5A through 5F. Selected site photographs are included as Appendix E.

1.3 Purpose and Scope of Work

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the roadway portions of the project. This report also establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions. This report is intended for use by the project design engineer, construction personnel, bidders and contractors, and is structured in general accordance with Caltrans "Guidelines for Preparing Geotechnical Design Reports," Version 1.3, December, 2006.

This report presents the results of Group Delta's geotechnical investigation and was prepared to provide SC Engineering with final geotechnical recommendations for project design. Specifically, our scope of work included:

- Reviewing available topographic maps, aerial photographs, published regional geologic maps, and other available information;
- Performing site reconnaissance and utility clearance;
- Developing a geotechnical exploration plan;
- Obtaining necessary encroachment and right of entry permits;
- Performing surface and subsurface investigation including geotechnical borings, test pits, and performing seismic refraction survey to assess rock rippability in cut areas;
- Performing laboratory testing of selected samples;
- Characterizing the site, performing geotechnical analyses, and developing geotechnical recommendations;
- Summarizing the data and present our recommendations in this report.

1.4 Key Geotechnical Issues

Key geotechnical issues for the project include:

- Engineering properties of the subsurface materials;
- Earthwork criteria (clearing and grubbing, excavation, subgrade preparation, remedial grading, handling of oversized rock, surface and subsurface drainage, and compaction of engineered fills);
- Stability of soil and rock cut / fill slopes;
- Excavatability / Rippability;
- Soil corrosivity and material selection for culvert design;
- New pavement structural sections.

2.0 EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

2.1 Existing Facilities

The new roadway project alignment is located north of I-15 freeway and extends across mostly undeveloped land, as shown in Figure 1B. Topographic layout plans are presented in Figures 2A-2F, and aerial photographs are shown in Figures 5A-5F.

2.1.1 Geometric Base Line

The primary geometric base line for the new roadway is "Camino Del Norte" ("CDN") centerline which extends about 1 mile from Station 5+50 to 59+13. Several hundred feet of improvement are also proposed along existing "Old Franklin Street" ("OFS") and "Canyon View Drive" ("CVD") center lines. The new roadway begins on the southeast ("CDN" 5+50) adjacent to a residential subdivision near the intersection of Canyon Estates Drive, Canyon View Drive, Old Franklin Street, and Grunder Road (Figure 2B). The alignment proceeds across mostly undeveloped land over flat to rolling topography with alternating hills and canyons to its northwestern terminus at existing Camino Del Norte ("CDH" 59+13) as shown in Figure 2F.

2.1.2 Existing Improvements

Existing improvements along and adjacent to the alignment include:

- A residential subdivision at the southeast end
- Existing asphalt paved roadways:
  - Canyon Estates Drive ("CDN" 5+50)
  - Old Franklin Street ("CDN" 10+00)
  - Canyon View Drive ("OFS" 27+60)
  - Grunder Road ("OFS" 28+40)
  - El Camino Del Norte ("CDN" 57+00)
- A closed landfill (north of "CDN" 12+50)
- Named and unnamed dirt roads ("CDN" 17+00 → 52+00)
- Culverts under paved and dirt roads
- A single family residential unit at the northwest end ("CDN" 51+00 to 53+00)
- Buried and overhead utilities
- Billboard signs near the freeway

2.1.3 Existing Cut and Fill Slopes

Most of the alignment is natural ungraded topography, with a few localized cut and fill slopes.

Existing Cut Slopes

A roadway cut slope up to about 27 feet high exposing sandy decomposed to highly weathered granite is present along the north side of Old Franklin Street (“OFS” 23+50 → 25+00) with a maximum inclination of about 1.5:1 (H:V). The slope has generally performed well without rilling, but exhibits some minor surficial erosion as evidenced by deposits of sandy sediment near the toe of slope.

A 2:1 (H:V) cut slope about 15 feet high exposing similar decomposed granite is present along the west side of Canyon Estates Drive at the west end of the project (“CDN” 5+50 to 8+50). The slope has generally performed well, with only minor surficial erosion and no rilling.

A through cut (on both sides of the driveway to the residential property) exposing sandy / silty / gravelly young alluvial fan deposits with a height up to about 15 feet and inclination of about 1:1 (H:V) and locally steeper is present near the northwest end (“CDN” 55+00 to 57+50). This slope appears globally stable but exhibits some erosion and localized rilling, with sediment deposited at the toe of the slope.

A through-cut slope for a dirt road is present near “CDN” 44+00 exposing variably weathered granite with a height up to about 8 feet and inclination of about 1:1 (H:V). This slope is globally stable with localized rilling.

Fills

No major fill slopes are present within the site. Minor fill slopes associated with road grading and residential properties with heights less than 10 feet are present, but no signs of major problems or excessive erosion were observed. The fill slopes for the closed landfill are inclined at 4:1 (H:V) and appear to have performed well.

2.1.4 Existing Pavements

Asphalt pavements are present near the southeast and northeast ends of the alignment, including Old Franklin Street, Grunder Road, Canyon Estates Drive, and Camino Del Norte. All of these roadways exhibit longitudinal and transverse cracking that breaks the pavements into large scale blocks. These features appear to be related to aging rather than subgrade problems, since the blocks in between the cracks appear to be intact and un-cracked, and there are no vertical offsets at the locations of the cracks.

2.2 Proposed Improvements

The proposed project involves the primary elements:

- Construction of the new Camino Del Norte roadway and connections to existing roadways;
- Improvements to the intersection at Franklin Street / Canyon Estates Drive;
- Cut and fill mass grading including cut and fill slopes at maximum 2:1 (H:V) inclination with maximum heights of 26 feet and 34 feet, respectively (see Table 1 and Figures 4A through 4AI);
- New pavements and pavement overlay;
- New culverts and extension of existing culverts;
- Other minor appurtenances

No bridge or retaining wall structures are proposed.

3.0 PERTINENT REPORTS AND INVESTIGATIONS

Our understanding of this project is based on discussions with project designers, review of project plans, and review of available published information such as geologic maps, topographic maps, aerial photographs of the project site, and previous geotechnical reports. A list of references is provided in Section 13.0 of this report.

4.0 PHYSICAL SETTING

The site is located within the City of Lake Elsinore within the Lake Elsinore 7.5 minute series topographic map quadrangle.

4.1 Climate

The climate in this area is considered semi-arid, with hot, almost rainless summers and mild, wetter winters. Precipitation records are available from a monitoring station at Elsinore, Riverside County, California (approximate elevation 1282 feet), located southwest of the project alignment. These records, which date from 1961 to 1990, indicate that average rainfall is approximately 12 inches per year with nearly 70% of that recorded between the months of November and April. The highest average rainfall of 2 to 2.5 inches occurs in the months of January, February and March. There are an average of 32 days of precipitation, with the most precipitation occurring in January with 6 days and the least precipitation occurring in June with 0 days.

The average maximum temperature through the year ranges from 66°F in the winter-early spring to nearly 99°F in summer months. The yearly average high temperature is 80.6°F. Average minimum temperatures range from 36°F in December to 60°F in August. The annual average low temperature is 47.5°F. Soil freeze/thaw conditions are not expected to exist within the project alignment. The highest recorded extreme temperatures in Lake Elsinore are 118.0°F (47.8°C), which was recorded in August, and 10.0°F (-12.2°C), which was recorded in December.

4.2 Topography, Drainage, and Vegetation

4.2.1 Topography

A topographic plan is shown in Figures 2A-2F, the alignment profile is shown in Figures 3A-3E, and a series of transverse cross-sections illustrating the cut and fill grading is shown in Figures 4A through 4AI. The proposed roadway profile begins at El. 1392 feet (“CDN” 5+50), climbs to a high point of about El. 1463 feet (“CDN” 33+50), then descends to El. 1393 feet at the end of the project (“CDN” 60+00).

From “CDN” 5+50 to 30+00 the alignment climbs as it crosses mildly rolling hills and small valleys. From 30+00 to 39+00 the alignment levels out as it traverses relatively level ground. Between

39+00 and 58+00 the alignment descends as it crosses a series of steeper hillsides and narrow steep-walled valleys to its northwest terminus.

Finished grades will be achieved by creating alternating cuts and fills with 2:1 (H:V) side slopes. Grading includes through-cuts (cuts on both sides), side-hill cut/fills (cut on one side and fill on the other), and trapezoidal embankments (fill on both sides). Along the roadway centerline maximum depth of fill is less than 30 feet, and maximum depth of cut is less than 15 feet. Maximum cut slope height is about 26 feet (near Station 48+50), and maximum fill slope height is about 34 feet (near Station 45+00). A summary of cut and fill slopes is provided in Table 1, the existing and proposed centerline profile is shown in Figures 3A-3E, and a number of cross-sections perpendicular to the centerline illustrating the existing grades and proposed grading geometry are shown in Figures 4A-4AI.

4.2.2 Drainage

Drainage along the alignment follows the general regional terrain, flowing out of the hills and concentrating in ephemeral channels. The drainage in the site generally flows toward the south, and crosses from the northbound to the southbound side of the proposed roadway. Channels were dry during Group Delta's site visit and are dry most of the time. Flow in the ephemeral channels generally only occurs during and after rainfall events. The drainage will pass below the roadway fills in culverts. Figures 2A-2F illustrate the drainage courses and proposed culvert locations.

4.2.3 Vegetation

Typical vegetation along the alignment ranges from unvegetated soil to sparsely vegetated with low grasses, weeds, and shrubs on flatter areas, to sparse to moderately dense chaparral on the steeper slopes, to densely vegetated in some stream channels, with scattered trees.

4.3 Features of Engineering and Construction Significance

The following man-made or natural features of engineering and construction significance are present within or closely adjacent to the construction site.

- Existing roadway and surface streets
- Trees, vegetation, and trash/debris (will require some removal for grading)
- Various buried and overhead utilities
- Existing culverts
- Existing residential properties
- Existing closed landfill with nearby monitoring wells and other instruments

- Variable rock conditions for excavation
- Presence of oversized materials (cobble to large boulder sized clasts)

4.4 Regional Geology and Seismicity

The site is located within the Lake Elsinore 7.5-minute Quadrangles, along the western edge of the Perris Block, in the northern half of the Peninsular Ranges Geomorphic Province. Structurally stable for millions of years, the Perris Block is an internally unfaulted, eroded mass of Cretaceous and older granitic rocks of the Southern California Batholith and metasedimentary basement rocks. A published regional Geologic Map of the area showing natural geologic units exposed at the ground surface is overlaid on the aerial photographs in Figures 5A through 5F. The figures show that the majority of the project area has variably weathered granitic rock exposed at or near the surface, overlain by a variable thickness of relatively shallow soil materials including colluvium, young alluvium, old alluvium, and decomposed to partially decomposed rock. The depth of overburden soils is generally less than 5 to 10 feet in most of the alignment. The deepest alluvial soils over decomposed rock were encountered near Station 57+00 with a thickness of about 20 feet.

The site is in a seismically active area, and a number of major regional active faults are present that affect the seismicity at the site (see Figure 6). The closest active fault based on Caltrans fault database is the Elsinore Fault zone (Glen Ivy Section), which is mapped by Caltrans approximately 2 km (1.2 mile) southwest of the alignment. The Elsinore Fault Zone is one of a number of major active northwest-southeast trending right-lateral strike-slip fault zones, which are part of the greater San Andreas Fault system. These include the Newport-Inglewood, San Jacinto, and San Andreas Fault Zones as shown in Figure 6.

4.5 Soil Survey Mapping

Soil survey maps were not reviewed for this study since site specific borings were done.

5.0 EXPLORATION

Geologic / geotechnical field reconnaissance, subsurface explorations and collection of soil samples, and geophysical methods were employed to collect the necessary geotechnical data for design and construction of the roadway. All explorations were completed as planned. No problems were encountered that would adversely affect the design or construction.

5.1 Drilling, Excavation, and Sampling

A total of 10 hollow-stem auger borings (A-16-001 through A-16-010) were drilled, and a total of 5 test pits were excavated with a backhoe, between March 22 and 23, 2016. Borings were advanced to depths ranging from 8.5 feet to 31 feet, and test pits were excavated to depths of 5 to 8 feet, below existing ground surface. Boring and test pit locations are shown in Figures 2B-2F and 5A-5F. A detailed description of the field exploration equipment and methods, along with boring records and test pit logs, are presented in Appendix A. The details of the explorations are summarized in Table A-1 of Appendix A. Borings were located in plan and elevation by use of hand-held GPS, aerial photographs, field tape measurement from available landmarks, and the project topographic map. The exploration was conducted in general conformance with the 2010 Caltrans "Soil and Rock Logging, Classification, and Presentation Manual."

5.2 Geologic Mapping

The surface geology of the project site has been mapped at the regional level by others as illustrated in Figures 5A-5F *(reference: Preliminary Geologic Map Of The Elsinore 7.5' Quadrangle, Riverside County, California, Version 1.0, By Douglas M. Morton and F. Harold Weber, Jr., Digital preparation by Rachel M. Alvarez and Diane Burns)*. Site observations and subsurface explorations confirm that the geology is generally consistent with the regional mapping. Detailed field mapping was not performed for this study, but the geologic contacts based on the regional mapping shown in Figures 5A-5F are considered generally representative of site conditions based on our field observations and excavations. Contacts between geologic units in the field may vary, and precise geologic contacts cannot be precisely defined in most areas, since they are typically obscured by presence of shallow overburden soils. Interpreted geologic cross-sections based on the geologic map and subsurface data collected are shown in Figures 4A-4AI.

5.3 Geophysical Studies

Group Delta subcontracted with Southwest Geophysics, Inc. to perform a total of 5 seismic refraction surveys in proposed cut areas underlain by rock on March 22, 2016. The purpose of the survey was to measure the compression wave (P-Wave) velocity of rock for rippability assessment and to provide cross sections showing contours of P-Wave velocity versus depth. The locations of the seismic refraction lines are shown in Figures 2A-2F and 5A-5F. The seismic refraction survey report prepared by Southwest Geophysics is attached in Appendix C.

5.4 Instrumentation

Geotechnical instrumentation was not installed during this investigation.

5.5 Exploration Notes

Our geotechnical investigation did not include environmental evaluation. No visual or olfactory evidence of contamination was observed. Most of the rock areas have some thickness of soil and decomposed and weathered rock overlying less weathered materials. All borings were advanced to target depths, except for Boring A-16-009, which reached practical drilling refusal at a depth of about 15 feet, about 5 feet above the planned depth. An additional boring (A-16-009A) was done a short distance away and was able to penetrate to the 20 ft target depth, with difficult drilling from 15 to 20 feet. No other significant difficulties were encountered during the explorations.

6.0 GEOTECHNICAL TESTING

6.1 In Situ Testing

Standard Penetration Tests (SPT) were performed in the borings to measure blowcounts or "N-Values" (blows per foot), which were used to evaluate the general density / consistency of subsurface materials. Energy corrections were applied to adjust the blowcounts to 60% efficiency (N_{60}). Drive sample blowcounts using California ring-lined split-barrel samplers were adjusted to estimate the equivalent SPT blowcounts by using a correction factor of 0.67. The boring records including penetration resistance or blow counts and detailed description of the SPT testing and California drive sampling are presented in Appendix A.

6.2 Laboratory Testing

Laboratory testing of selected samples was performed in accordance with applicable Caltrans and ASTM standards. The following laboratory tests were conducted to determine the physical and engineering properties of the soil samples:

- Soil Classification: USCS (ASTM D 2487) and Visual/Manual (ASTM D 2488);
- Moisture content (ASTM D 2216) and Dry Unit Weight (ASTM D 2937);
- Atterberg Limits (ASTM D 4318);
- Grain Size Distribution (ASTM D 422) & % Passing #200 Sieve (ASTM D 1140);
- Direct Shear (ASTM D 3080);
- Laboratory Compaction Test (ASTM D 1557);
- Expansion Index (ASTM D 4829);
- R-Value (CTM 301);
- Collapse Potential (ASTM D 5333);
- Soil Corrosivity:

- pH (CTM 643);
- Water-Soluble Sulfate (ASTM D 516, CTM 417);
- Water-Soluble Chloride(Ion-Specific Probe, CTM 422);
- Minimum Electrical Resistivity (CTM 643);

Moisture content, dry density, percent passing No. 200 sieve, pocket penetrometer, and Atterberg Limits laboratory test results are presented on the boring records in Appendix A. Detailed descriptions of the tests performed and their results are presented in Appendix B.

7.0 GEOTECHNICAL CONDITIONS

7.1 Site Geology

7.1.1 Lithology

In general, the project site is underlain by relatively shallow Quaternary-age soils including localized man placed fills (Qaf), native young Holocene Alluvial Fan Deposits (Qyf), Old Pleistocene Alluvium (Qoa), which in turn overlie variably weathered igneous rock (Kgd). The general distribution of geologic materials exposed at the ground surface within the site based on regional geologic mapping is shown in Figures 5A-5F.

In areas mapped as Quaternary soils (Qyf, Qoa), the thickness of these soils observed in subsurface explorations is generally less than 5 to 10 feet throughout most of the site. An exception is near the northwest end of the site where as much as 20 feet of Quaternary soil (Qyf) was observed in a boring.

The mapped igneous rock areas are often overlain by relatively thin soil deposits including fill and/or shallow colluvium or alluvium and residual soil several feet thick. The upper portion of the rock material generally ranges from decomposed to highly weathered and fractured rock. The degree of weathering generally decreases with depth. No cores were taken and no unweathered or unfractured rock was observed to the maximum depths drilled. All the rock observed in borings was penetrated with a hollow stem auger.

Soil conditions are provided on the boring records and test pit logs in Appendix A. Seismic velocity profiles from seismic refraction studies are shown in Appendix C, and Group Delta's interpretation of the velocity profiles is shown in Figures 7A-7E. Geotechnical cross-sections illustrating interpreted soil and rock conditions encountered in borings and test pits are shown in Figures 4A-4AI, and the cross-section locations are shown in Figures 2A-2F and 5A-5F.

7.1.2 Geologic Structure

Geologic structure is not an issue in the fill and other soil-like materials on site. Weathered rock within the project area has fractures, joints, and other discontinuities that can affect the behavior and stability of the rock where exposed in steep cuts. Due to the high degree of weathering of surficial exposures, no significant areas are present in the site cut areas where discontinuities could be observed and measured. Since the proposed cuts in granitic rock materials have a conservative slope angle (2:1, H:V), and are expected to expose mostly highly weathered and fractured rock, it is our opinion that geologic structure is not an issue for the stability of the proposed rock cuts.

7.1.3 Natural Slope Stability

Natural hillside slopes along the alignment vary from relatively flat-lying Alluvial fans with slopes as flat as 30H: 1V, to a typical maximum of 1.3H: 1V inclination for natural granitic rock slopes. No evidence of existing or ancient landslides was observed in our reconnaissance or our review of topographic maps, geologic maps, and aerial photographs. The natural slopes along the alignment appear to be globally stable by visual inspection, and do not exhibit signs of surficial instability other than shallow rilling and sloughing in soil and decomposed rock areas. No failures have been observed on natural slopes. No areas of seepage or other surface water were observed in the site reconnaissance.

7.2 Soil and Groundwater Conditions

The soil materials at the site, including fill, native alluvium, colluvium, and decomposed rock are mostly poorly- to well-graded Sand with Silt (SP-SM, SW-SM) and Silty Sand (SM), with less frequent Clayey Sand (SC), and variable gravel content. Soils and decomposed rock tested for gradation had 0 to 74 percent Gravel (average=10%), 22 to 94 percent Sand (average=75%), and 6 to 30 percent fines passing No. 200 sieve (average=14%). Granular soils were generally observed to be non-plastic, with the exception of a clayey sand in the upper 5 feet of boring A-16-010, which had 30% passing No. 200 sieve, Liquid Limit of 29, and Plasticity Index of 13.

No significant deposits of fine grained soils (silt and clay) were observed, but could be locally present. The soils are mostly non-expansive (Expansion Index, EI=0). The clayey sand described in the previous paragraph had “Low” expansion potential (EI=30).

Based on borings, the sandy granular Quaternary soils are generally medium dense to very dense at shallow depth, becoming dense to very dense below a typical depth of about 5 feet. Isolated deposits of loose soils such as undocumented fills or recent alluvium should be expected in some areas in the upper 5 feet. In all the borings performed, only one (A-16-002) had a single SPT blowcount classifying as loose at a depth of 2.5 feet. Only one boring (A-16-010) had medium dense soils extending to a depth deeper than 5 feet, and this boring became dense to very dense below 15 feet depth. Decomposed granite generally had SPT blowcounts greater than 50, and classifies as very dense soil or very soft rock.

Due to the highly weathered nature of the upper decomposed rock materials, and the fact that the alluvium and fill are generally derived from similar rock materials and are generally dense to very dense at relatively shallow depth, it is difficult to distinguish a precise boundary between soil and rock, as the soil-like material tends to grade gradually into rock-like material. Therefore, some of the decomposed rock materials drilled and sampled were classified on the boring records as soil. As the soil-like materials transition to more rock-like materials, higher gravel content is typically observed.

No groundwater was encountered in borings. Perched water or seepage may be present seasonally in the vicinity of the drainages.

Field and laboratory data for the subsurface soils from the current investigation are presented in Appendix A and Appendix B, respectively.

7.3 Water

7.3.1 Surface Water

Surface water in the alignment area is generally not present most of the time. During site reconnaissance in March 2016, all creek beds were dry and no surface water was observed. Flow in the channels appears to be limited to storm runoff during the rainy season.

7.3.2 Groundwater

No ground water was encountered during our field exploration. The regional groundwater table is not expected within the depth of excavation for the project. Locally perched water and seeps could be encountered in excavations. Shallow surface water and local perched groundwater or seeps should be expected seasonally in the vicinity of alluvial drainages.

7.4 Project Site Seismicity

7.4.1 Ground Motion

A number of nearby regional and nearby active faults have the potential to cause strong shaking at the site. Based on current Caltrans Fault Database and ARS Online tool, the site to rupture distances, maximum magnitude, and type of fault for the closest 10 faults are presented on Figure 6. These major faults have the potential to create large magnitude events (as large as 7.7 to 7.9) and peak bedrock accelerations on the order of 0.65 to 0.72g (based on Caltrans ARS Online probabilistic analysis for 975 year return period). The selection of the design ground motion parameters is discussed in Section 8.1.1.

7.4.2 Ground Surface Rupture

There closest active fault in the Caltrans current fault database is the Elsinore Fault Zone (Glen Ivy Segment), mapped at a distance of about 1.2 miles. The State of California Special Studies Zone Map (aka “Alquist Priolo Map”) indicates that the nearest mapped Fault Rupture Hazard

Zone is more than 2 miles from the site. No known faults capable of ground rupture pass through any part of the project site, therefore potential for ground rupture at the site is considered remote.

8.0 GEOTECHNICAL ANALYSIS AND DESIGN

8.1 Dynamic Analysis

8.1.1 Parameter Selection

Deterministic and probabilistic seismic hazard analyses were performed using Caltrans ARS online method, and the higher of deterministic analysis and probabilistic analysis with 975 year average return period (5% probability of exceedence in 50 years) was considered for design. Shear wave velocity in the upper 100 feet of the soil/rock profile at the site (V_{S30}) was estimated from seismic refraction p-wave velocities and by correlations with borings to range from 360 to 760 m/s, and this was used to model the site soil conditions in the ground acceleration computation. Due to high slip rate and magnitude of the regional strike slip faults, the probabilistic analysis controls for all cases. The results of the Peak Ground Acceleration computations are as follows:

Peak Ground Acceleration, g's [Magnitude from Probabilistic Deaggregation]		
V_{S30} = 360 m/s	V_{S30} = 560 m/s	V_{S30} = 760 m/s
0.72 [6.9]	0.68 [6.9]	0.65 [7.0]

For seismic slope stability evaluation, we used a horizontal pseudo-static acceleration coefficient (K_h) of 1/3 of the highest PGA of 0.72g, or K_h = 0.24.

8.1.2 Analysis of Seismic Effects

Secondary seismic effects for any site include liquefaction, earthquake-induced settlements, slope instability, and lateral spreading.

8.1.2.1 Liquefaction

Liquefaction involves a sudden loss in strength of a saturated, cohesionless soil (predominantly sand, low plasticity silts, or sand silt mixtures) caused by cyclic loading such as an earthquake. This results in temporary transformation of the soil to a fluid mass. Typically, liquefaction occurs in areas where groundwater is less than about 60 feet from the surface and where the soils are composed predominantly of poorly consolidated fine sands, silty sands, and non-plastic silts.

Due to general lack of groundwater, dense soils, and shallow bedrock, liquefaction is not a significant hazard at the site.

8.1.2.2 Seismic Compaction

Settlement ("seismic compaction") of loose to medium dense clean dry sands can occur during seismic shaking. Due to shallow and sporadic loose to medium dense zones of limited thickness, seismic compaction settlements are considered a negligible hazard.

8.1.2.3 Seismic Slope Stability

Slope instability, in the form of landslides and mudslides, is a potential adverse impact associated with seismic shaking. Based on pseudo-static analysis seismic slope instability is not a significant hazard at the site. Static and seismic stability is evaluated quantitatively later in this report.

8.1.2.4 Lateral Spreading

Lateral spreading refers to ground or slope deformation due to presence of weak or liquefiable soils in the subsurface combined with strong seismic shaking. Due to lack of liquefaction and lack of soft soils potential for lateral spreading at the site is not significant.

8.2 Cuts and Excavations

All earthwork and grading should be performed in accordance with Division III (Sections 17 through 22) of the 2015 Caltrans Standard Specifications, and any local code requirements. Cut slopes and excavations will be required to reach planned grades is some areas. Cut and fill along centerline of the roadway are shown in profile in Figures 3A-3E, and selected grading cross-sections are shown in Figures 4A-4AI.

A number of permanent cut slopes are proposed as shown in Figures 4A-4AI. The cuts are expected to expose primarily weathered granitic rock, capped with thin deposits of surficial soils. Some of the cuts will expose alluvial fan soils. The cut slopes have a maximum height of 26 feet in weathered rock (Kgd) and 18 feet in alluvial fan soils (Qyf). The details of the proposed cut slopes are summarized in Table 1.

General geotechnical recommendations for cut slopes are summarized as follows:

- Permanent cuts should be made at 2h: 1v or flatter;
- Slope rounding should be performed at the top of cut slopes in accordance with Section 304.4 of Caltrans Highway Design Manual (HDM) and Standard Plan A62A;
- Where there may be upslope runoff, a concrete v-ditch should be provided along the top of the cut slopes to intercept upslope runoff and prevent it from discharging over the top of slope;

- If desirable from a maintenance standpoint, consideration may be given to providing a small catchment area several feet wide at the toe of cut slopes to temporarily store small amount of soil, allow for maintenance, and prevent debris from occasional minor raveling from entering the roadway;

Slope stability analysis is presented in the following section.

8.2.1 Stability

Based on the geologic conditions and the proposed angles, the cut slopes as currently proposed are expected to have adequate global stability under static and seismic conditions. Limit equilibrium global stability analysis was performed to verify this conclusion.

Global slope stability analysis refers to searching random potential failure surfaces within a mass of soil or rock to find the surface with the lowest factor of safety using 2-dimensional limit equilibrium methods. Input to the analysis includes the geometry of the land surface and subsurface stratigraphy, groundwater conditions, and unit weight and shear strength of the earth materials.

Based on our investigation and experience in similar materials, the following strength parameters were selected for the stability analyses of the cut slopes:

- Alluvial Fan Soils (Qyf) or other Quaternary Deposits:
  - Unit weight, γ = 120 pcf
  - Cohesion, c = 100 psf
  - Friction Angle, ϕ = 30 degrees
- Weathered Rock (Kgd):
  - Unit weight, γ = 130 pcf
  - Cohesion, c = 200 psf
  - Friction Angle, ϕ = 36 degrees

These strengths are considered a reasonably conservative estimate of the actual shear strengths. Critical sections representing the highest cuts in each material were selected as Station 48+50 (Kgr, 26 feet) and Station 56+00 (Qyf). Static and pseudo-static global slope stability analysis was performed using the computer program SLIDE 7.0. Following Caltrans practice, pseudo-static analysis was performed using a horizontal acceleration coefficient (K_h) equal to one third of the Peak Ground Acceleration (K_h=1/3*0.72=0.24).

Results of the global stability analysis are presented in Appendix D. The calculated static and seismic factors of safety exceed the minimum required (1.5 static and 1.0 seismic) for the proposed cut slopes.

8.2.2 Rippability

In our opinion, the fill and natural surficial soils and alluvium along the alignment can be excavated with light to moderate effort with heavy-duty grading equipment. Based on the available data, excavation of the weathered rock in the area will likely require moderate to heavy ripping, and could possibly require localized blasting. Oversized cobble to large boulder sized clasts are likely to be generated from excavations in the weathered rock.

8.2.2.1 General

"Rippability" generally refers to the ability to excavate soils by "ripping" without blasting, and to the difficulty or amount of effort that may be required to rip the materials. Ripping is the process of tearing up the rock surface to allow for removal, and this is typically accomplished by bulldozers dragging a ripper tooth or shank through the material. Material that cannot be ripped typically requires blasting with dynamite to enable excavation.

The rippability of rock material generally depends on the intact rock strength, degree of lithification, degree of weathering and decomposition, and spacing and orientation of fractures. In general, rippability can be correlated to the power of excavation equipment and to the Primary-Wave (P-Wave) or compression wave velocity of the subsurface rock materials.

8.2.2.2 Geophysical Survey

To aid in evaluating the rippability of the granitic rock formations onsite, a geophysical seismic refraction survey of the area (5 traverses or seismic lines, numbered lines SL-1 through SL-5) was performed by Southwest Geophysics, Inc. to measure the distribution of P-Wave velocity within the soil / rock profile in proposed cut areas. The locations of the seismic lines are shown on Figures 2A – 2F and 5A – 5F, interpreted rippability classification versus depth is shown on the grading cross-sections in Figures 4A – 4AI, and the methodology and results of the geophysical study are presented in Appendix C.

8.2.2.3 Interpretation of Geophysical Data

The refraction analysis results are presented as a Tomography Model, which presents the estimated variation in P-Wave velocity as contours versus distance along the line and depth below ground surface. The suggested correlation for rippability evaluation based on past experience is as follows:

* Rippability Classification		
Seismic P-wave Velocity	**Rippability**	**Color on Figures 7A-7E**
0 to 2,000 feet/second	Easy	Dark Blue to Blue
2,000 to 4,000 feet/second	Moderate	Blue to Light Blue
4,000 to 5,500 feet/second	Difficult, Possible Blasting	Blue Green to Green
5,500 to 7,000 feet/second	Very Difficult, Probable Blasting	Green to Light Green
Greater than 7,000 feet/second	Blasting Generally Required	Yellow to Red to Pink

*** Based on Caterpillar D9 Dozer with Single Shank Ripper**

Figures 7A-7E present Group Delta's interpretation of conditions along each seismic refraction line. On these figures the dashed red lines indicate the estimated boundaries between 3 velocity zones: *1. Rippable*: Easy to Moderate Rippability, *2. Marginally Rippable*: Difficult to Very Difficult Rippability (Possible to Probable Blasting), and *3. Non-Rippable*: Blasting generally required. The dashed yellow lines on the Figures represent the elevation of the finish grade at the cut slope face below the seismic line, and/or the projected finished grade at the toe of the adjacent cut slope, as indicated in the figures. Our interpretation of the 5 lines is as follows:

- **SL-1 (Station 13+90 – 15+60, Figures 4F & 4G, Figure 7A):** The seismic velocity data suggest that moderate ripping effort will be required to reach finished grade in this area.
- **SL-2 (Station 27+90 – 30+30, Figure 4K, Figure 7B):** The seismic velocity data suggest that moderate ripping will generally be required to reach finished grade in this area; however, the data also indicate some zones of higher velocities are present near the surface, and suggest that boulders and/or difficult ripping (possible blasting) could be encountered in some zones within the moderately rippable materials.
- **SL-3 (Station 46+70 – 49+10, Figure 4R – 4U, Figure 7C):** The seismic velocity data suggest that moderate ripping will generally be required to reach finished grade in this area. However, the data also indicate some zones of higher velocities are present near the surface, and suggest that boulders and/or difficult ripping (possible blasting) could be encountered in some zones within the moderately rippable materials. In addition, the bottom of the cut appears close to the zone classifying as difficult ripping to possible blasting, suggesting that these conditions could be encountered in the lower portions of the cut.
- **SL-4 (Station 50+25 – 52+65, Figure 4W – 4Y, Figure 7D):** The seismic velocity data suggest that moderate ripping will generally be required to reach finished grade in this area. However, the data also indicate some zones of higher velocities may be present near the surface, and suggest that boulders and/or difficult ripping (possible blasting) could be encountered in some zones within the moderately rippable materials. In addition, the bottom of the cut appears close to the zone classifying as difficult ripping to possible blasting, suggesting that these conditions could be encountered in the lower portions of

the cut. Hollow stem augers at this location experienced practical refusal and difficult drilling in the zones showing 3000 feet per second P-Wave velocity (moderately rippable).

- **SL-5 (Station 54+75 – 57+15, Figure 4AA – 4AC, Figure 7E):** The seismic velocity data suggest that moderate ripping will generally be required to reach finished grade in this area. However, the data also indicate some zones of higher velocities are present near the bottom of the cut, and suggest that boulders and/or difficult to very difficult ripping (possible to probable blasting) could be encountered in some zones within the moderately rippable materials and in the lower portions of the cut.

8.2.2.4 Existing Cuts to be Further Excavated for Roadway Widening

There are two locations where additional excavation into existing cuts is proposed in granitic rock materials. Seismic refraction lines were not run at these locations, but Group Delta observed the conditions exposed at the ground surface:

- Along the west side of Canyon Estates Drive ("CDN" 5+50 → 8+50):
    - Existing 2:1 (H:V) cut slope about 16 feet high
    - Will be pushed back at the same inclination by cutting horizontally up to about an additional 12 feet (+/-)
    - Examination shows the existing cut exposes friable decomposed granite
    - Boring A-16-001 penetrated the materials without excessive difficulty
    - It is Group Delta's opinion that this material can be excavated with moderate ripping effort
- Along the west side of Canyon Estates Drive ("CDN" 5+50 → 8+50):
    - Existing 1.5:1 (H:V) cut slope about 25 feet high
    - Will be pushed back at the 2:1 (H:V) by cutting horizontally up to about an additional 20 feet
    - Examination shows the cut exposes friable decomposed granite and a zone of highly weathered and fractured rock
    - Based on nearby refraction data and observation of the surface exposures it is Group Delta's opinion that this material can generally be excavated with moderate ripping effort, but could encounter more difficult ripping / possible blasting conditions locally.

8.2.2.5 Discussion and Recommendations

Group Delta concurs with the following information reproduced from the Southwest Geophysics report in Appendix C:

"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 above 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.

It should be noted that the rippability cutoffs presented above 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.

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."

In addition, the following should be noted:

- Based on the results of the seismic survey and test drilling, in our opinion, excavation of much of the proposed cut volume should be possible without blasting, assuming experienced excavation personnel using proper equipment and techniques

- The rippable / non-rippable seismic velocity threshold indicated can be significantly reduced by using smaller or less powerful excavation equipment
- Site surface observations, experience, and analysis of seismic refraction data indicate:
    - The rock mass is irregularly weathered and may contain zones of harder rock or large boulders set in otherwise rippable decomposed rock
    - Blasting is sometimes required to break up or dislodge these isolated hard rock zones and boulders or to reduce them to manageable size
    - It would be prudent to allow for some contingency or unit rates for blasting in the event that the contractor does not include blasting in the bid but finds it necessary during construction
    - Significant quantities of oversize materials may be generated during excavation of weathered rock, and use of such materials may require special handling when placing in compacted fills, and require rock corrections during compaction control (refer to Embankments section)

Our comments regarding rock rippability are based on our interpretation of existing cut exposures, drilling, and geophysical data. Our intent is to assist in the general evaluation of excavation conditions. Others may interpret the drilling and geophysical data differently. We recommend that grading and/or blasting contractors be required to draw their own conclusions regarding site excavation characteristics and whether rock requiring blasting is present, including making their own site investigations, if desired.

8.2.3 Earthwork Grading Factors

Two primary types of materials will be excavated in the cut areas. These include soils (young and older alluvium, colluvium, topsoil, existing fills, decomposed rock), and weathered granitic bedrock. In rock areas, the upper 5 to 10 feet typically contains colluvial soil and/or decomposed rock, which are soil-like materials.

Earthwork factors relate the in-place volume of material to be excavated to the in-place volume of the material after placing as fill. The factors are defined as in-place volume of compacted fill divided by in-place volume of material to be excavated.

Based on data from the investigation and our experience with similar soil and rock units in the area, we recommend the following earthwork grading factors:

<u>Alluvial Soil, Topsoil, Colluvium, Existing Fill, Decomposed Rock</u>

- Placed at 90% compaction: 0.85-0.95 (5 to 15% shrinkage)
- Placed at 95% compaction: 0.80-0.90 (10 to 20% shrinkage)

Weathered Granitic Rock

- Placed at 90% compaction: 1.05-1.15 (5 to 15% bulking)
- Placed at 95% compaction: 1.00-1.10 (0-10% bulking)

Grading factors may require adjustment during construction, and should consider the processing of oversized material, wasting of spoil, and placement compaction.

8.2.4 Roadway Excavation Specifications

Special attention should be paid to the following items from the 2015 Caltrans Standard Specifications:

- 17-2: Clearing and Grubbing
- 19: Earthwork
  - 19-2: Roadway Excavation
    - 19-2.03E: Blasting
    - 19-2.03G: Slopes

8.3 Embankment

All earthwork and grading should be performed in accordance with Division III (Sections 17 through 22) of the 2015 Caltrans Standard Specifications, and any local code requirements. Project grading includes placement of up to about 30 feet of fill. Materials excavated in the cut areas may generally be used as compacted fills. These materials are generally sandy soils (sand with silt, silty sand, and less frequently clayey sand). Excavations in the rock areas are likely to generate gravels and oversized materials (cobbles and boulders). Depending on earthwork balance, import or export may be required.

8.3.1 Slope Angles

From a geotechnical perspective graded permanent embankment slopes should not exceed 2h:1v inclination. Flatter 4h: 1v may be required to meet Caltrans highway safety requirements.

8.3.2 Imported and On-Site Fill Material Specifications

On site materials, after removal of vegetation or other deleterious materials, may generally be re-used as compacted fill. Any imported borrow materials or native materials used for embankment in the top 4 feet from finished grade should have an R-Value consistent with the pavement design and be non-corrosive, low expansion and free of other deleterious properties that adversely affect all concrete/steel structures. The Imported borrow should conform to

Section 19-7.02 of Caltrans Standard Specifications and be tested prior to placement. Maximum particle size should be 3 inches or less. In general, we recommend that imported fills have less than 35% passing No. 200 sieve and Plasticity Index (PI) less than 15 to avoid import of problematic clayey or expansive soils.

8.3.3 Site Preparation

In general, earthwork should be performed in accordance with Division III (Sections 17 through 22) of the 2015 Caltrans Standard Specifications. The new construction will have to be carefully planned to protect any existing utilities in the area.

All areas to receive fill should be stripped of existing pavements, cleared of any structures, all existing vegetation, debris, and other unsuitable materials in accordance with Section 16 of Caltrans Standard Specifications. All construction debris and/or deleterious material encountered during the clearing operations should be removed from the site. After clearing and stripping, the surface should be proof-rolled with loaded heavy equipment. Any areas of loose or yielding soils should be over-excavated and recompacted to the depth recommended by the geotechnical engineer’s representative.

If soft or wet materials are encountered and further removals are impractical, the bottom may be stabilized using biaxial geogrid (such as Tensar BX1200) and 12 to 24 inches of crushed rock. Any soils which cannot be compacted, or are otherwise unsuitable for the planned use, should be removed and disposed of off-site or at an approved on-site disposal area. The exposed surface should then be scarified and compacted to the specified density before placement of new fill.

No areas requiring major remedial grading were encountered in borings or site observations. However, some of the dry stream channel bottoms were not all accessible, and these areas may contain deposits of unsuitable materials that require removal and recompaction or other stabilization measures. It is estimated that up to 5 feet of removal and recompaction could be required to prepare the subgrade in isolated areas of alluvial canyon bottoms.

8.3.4 Settlement of Embankments

Placing new fills generally causes settlements in the underlying soils. No soft or highly compressible clay soils are present, except possibly shallow deposits in the areas listed above. Alluvial soils at the site are primarily medium dense to dense sandy soils. Weathered bedrock is generally low in compressibility. Due to lack of thick deposits of saturated clay long term consolidation settlement is not anticipated. Total settlement beneath the center of embankments is estimated to be 1/8 inch per foot of fill placed or less. Settlement is expected to occur relatively quickly, and should be completed within 15 to 30 days of completion of fill placement.

8.3.5 Stability

Compacted fill slopes placed at 2h: 1v or flatter and at heights of up to 34 feet are expected to be globally and surficially stable. Based on direct shear tests performed on onsite soils compacted to 90% relative compaction, strength parameters of c=150 psf and ϕ=33 degrees were selected for design of compacted fill slopes. Static and pseudo-static global slope stability analysis was performed using the computer program SLIDE 7.0. Pseudo-static analysis was performed using a horizontal acceleration coefficient (K_h) equal to one third of the Peak Ground Acceleration (K_h=1/3*0.72=0.24). Results of the global stability analysis for fill slopes are attached in Appendix D. The computed factors of safety exceed the minimum values required (1.5 static and 1.1 pseudo-static); therefore, the proposed fill slopes are considered statically and seismically stable.

8.3.6 Embankment Grading Specifications

Special attention should be paid to the following items from the 2015 Caltrans Standard Specifications:

- 17-2: Clearing and Grubbing
- 19: Earthwork
  - 19-1.03B: Unsuitable Material
  - 19-5: Compaction
    - 19-5.03B: Relative Compaction (95 Percent)
    - 19-5.03C: Relative Compaction (90 Percent)
    - 19-5.03D: Foundation Preparation
  - 19-6: Embankment Construction
    - 19-6.02A: Materials, General
    - 19-6.03A: Construction, General:

"If you construct an embankment against a slope, prepare original ground or embankment slopes by cutting into it at least 6 feet horizontally as you place the new embankment in layers. Compact the cut material along with the new embankment material."

- 19-6.03C: Placing and Compacting:

For oversized materials greater than 8 inches: "Break up clods or hard lumps of earth that are over 8 inches in greatest dimension before compacting material in the embankment, unless material such as hardpan or cemented gravel, cannot be broken readily in which case: 1. Distribute the material throughout the embankment, 2. Place enough earth or other fine material around the larger material as you deposit it to fill the interstices and produce a dense, compact embankment. If embankment material contains rock, the loose *thickness of each layer of embankment material before compaction below a plane 3 feet below finished grade must comply with the following requirements: 1. If embankment material contains over 50 percent by volume of rock larger than 8 inches in greatest dimension, the loose thickness of each layer must not exceed the maximum size of rock in the material. 2. If embankment material contains from 25 to 50 percent by volume of rock larger than 8 inches in greatest dimension, the loose thickness of each layer must not exceed the maximum size of rock or 3 feet, whichever is less. 3. If embankment material contains less than 25 percent by volume of rock larger than 8 inches in greatest dimension, the loose thickness of each layer must not exceed 8 inches in the area between the rocks larger than 8 inches."*

8.4 Earth Retaining Systems

No earth retaining systems are proposed for the project.

8.5 Culvert Foundations

Improvements to the alignment include construction of new culverts and extension of existing culverts. The following general guidelines can be used for the design of culverts:

- Field data indicate that the foundation soils, in general, will have adequate bearing capacity to support culverts.
- Relatively shallow deposits of unsuitable soils and localized perched groundwater maybe be encountered near the culvert bottoms in some areas. If such conditions are encountered at the time of construction, some subgrade stabilization and/or limited dewatering or groundwater control could be necessary.
- If loose, soft, wet soils, or otherwise unstable subgrade is encountered at the bottom of the trench, overexcavation and replacement with biaxial geogrid (Tensar BX 1100 or equivalent) and 12-24" of crushed rock may be used to stabilize the base prior to backfilling.
- Culverts should be designed to support the weight of the overburden and traffic surcharge. The overburden pressure on the pipe can be calculated by multiplying the unit weight of the soil cover by the thickness of this cover. For design purposes, a soil unit weight of 125 pcf may be used.
- Caltrans Standard Plans and Section 19 of Caltrans Standard Specifications should be followed in the preparation of foundation soils, bedding, and backfill for the placement of culverts.
- Corrosion characteristics of the site soils and abrasion characteristics of the flow should be considered in selection of the type of pipe in accordance with the Highway Design Manual. Corrosion recommendations are provided in Section 8.8.
- Designers may use the corrosion data in the Caltrans computer program AltPipe to select appropriate culvert materials and thickness to meet the design life requirements.

8.6 Minor Structure Foundations

No soundwalls or other minor structures have been identified for the project.

8.7 Structural Pavement Sections

Project pavements will be mostly new pavement for the roadway extension. Mill and overlay will be performed at the tie-in to existing pavements.

8.7.1 R-Value

Testing along the alignment yielded R-Values of 46, 64, and 12 (see Appendix B). For materials classifying as Sand with Silt (SP-SM, SW-SM) and Silty Sand (SM), R-Values tested were 46 to 64, and these are considered representative of the vast majority of soils along the alignment. A design R-Value of 45 is recommended, except as described below.

The low R-Value of 12 was obtained on materials classifying as Clayey Sand (SC) in the upper 5 feet in Boring A-16-010 within the young alluvial fan deposits (Qyf) which are mapped as being present between about Station 52+00 and 60+00. These materials may be present near the pavement subgrade level between about Station 54+90 and 56+00. It is recommended that materials excavated from the upper 5 feet between 52+00 and 60+00 not be placed as fill within the upper 4 feet of finished grade in pavement areas, and that the subgrade within the upper 3 feet below the grading plane between Station 54+90 and 56+00 be overexcavated and replaced with soils having minimum R-Value consistent with the pavement design. Alternatively, in lieu of overexcavation and replacement, additional base materials may be added between 54+90 and 56+00 based on design R-Value of 12.

8.7.2 Traffic Index (TI)

SC Engineering provided Traffic Index (TI) of 7 for Canyon Estates Drive, Franklin Street, and Canyon View Drive, and TI of 8 for Camino Del Norte.

8.7.3 New Structural Sections

Structural section thickness was computed using the Caltrans Highway Design Manual Method using the computer program CalFP using Hot Mix Asphalt Type A (HMA-A) over Class 2 Aggregate Base (AB). To improve performance the upper 0.10 to 0.20 feet of the surface course may be replaced with Gap Graded Rubberized Hot Mix Asphalt (RHMA-G). Recommended structural section options are summarized in Table 2.

8.7.4 Mill and Overlay

No cores were taken of the existing pavements, and no as-builts were reviewed. A nominal mill and overlay may be specified. If design of overlay for a specific design life is required, additional investigations such as coring and/or deflection studies may be performed.

8.7.5 Pavement Materials

All pavements and materials should conform to Caltrans Standard Plans and Specifications and the Caltrans Highway Design Manual.

8.8 Corrosion Investigation

Caltrans Corrosion Guidelines (version 2.0, November 2012) define a corrosive area as “an area where the soil contains more than 500 ppm of chlorides, more than 2,000 ppm of sulfates or has a pH of less than 5.5.” Representative samples of the site soils were tested to evaluate the corrosion potential. The tests include pH, electrical resistivity, and soluble chloride and sulfate concentrations. Results of the corrosivity tests are summarized in the following Table and included in Appendix B and Appendix C:

Boring No. [Sample No.]	Depth (ft)	USCS Soil Type	Minimum Resistivity CTM 643 (ohm-cm)	pH CTM 643	Soluble Sulfate Content CTM 417 (ppm)	Soluble Chloride Content CTM 422 (ppm)
A-16-001 [B-1]	0-5	SM	14,677	7.54	<100	<100
A-16-004 [B-1]	0-5	SM	3,358	7.06	<100	<100
A-16-009 [B-1]	0-5	SM / GP	3,248	7.27	<100	<100

Based the test results the on-site soils do not classify as corrosive in accordance with Caltrans criteria. Any imported soils should be evaluated for corrosion characteristics if they will be in contact with buried or at-grade structures and appropriate mitigative measures should be included. Concrete mix design and minimum concrete cover should be based on California Amendments to AASHTO LRFD Bridge Design Specifications – Sixth Edition (Sections 5.12.3 through 5.12.5) and Section 90-1.02H of the 2010 Standard Specifications. The Caltrans computer program AltPipe may be used to aid in pipe materials selection.

9.0 MATERIAL SOURCES

Material sources for the project embankments will consist of locally excavated soil materials, and possibly imported materials. On-site excavations will consist of soil (alluvium, colluvium, decomposed rock and existing fills) and variably weathered rock. After removal of vegetation and other unsuitable materials, most of these materials generated in excavations will be suitable as general embankment fill. Aggregates for pavement construction will be imported from local sources. Debris fills containing rubbish, concrete, asphalt, wood, or other unsuitable materials should be properly disposed of off-site.

Imported soils, if needed, should be tested at the borrow site to verify they are suitable for the intended use. Off-site borrow sources were not evaluated in this study. Consideration may be given to use of recycled materials such as old concrete structures and rigid or flexible pavements, or crushing of on-site rock materials.

10.0 MATERIAL DISPOSAL

Vegetation, organic matter, trash, construction debris, or other materials unsuitable for use in compacted fills should be removed from the site at the direction of the Geotechnical Engineer. Contaminated soils, if encountered, should be legally disposed of off-site in accordance with applicable regulations. Oversized boulders may be placed in fills in accordance with the Caltrans Standard Specifications. No off-site disposal areas were evaluated for this study.

11.0 CONSTRUCTION CONSIDERATIONS

11.1 Construction Advisories

Numerous buried and overhead utilities and other improvements may be present, and the contractor should take all necessary precautions to identify, protect, or relocate utilities or improvements that could be affected by the construction. Care should be taken during excavation to avoid removing support for any existing improvements, such as foundations, pavements and buried utilities. Rock conditions are likely to be highly variable, and localized blasting could be required. Excavation in rock materials may generate significant quantities of cobble to boulder sized clasts. Heavy vegetation, loose/soft soils, and perched groundwater are likely to be encountered in the canyons and drainages.

11.2 Hazardous Waste Considerations

We did not observe any evidence of contamination of subsurface materials in our borings.

11.3 Differing Site Conditions

Our characterization of the site is based on the results of our field explorations, engineering analyses of cross-sections, and interpolation between exploration locations. All cuts, excavations, and foundation areas should be observed continuously during construction to check that they are consistent with the recommendations and assumptions used in the design. If field conditions during construction appear to be different than is indicated in this report, we should be notified immediately so that we may assess the impact of such conditions on our recommendations.

12.0 RECOMMENDATIONS AND SPECIFICATIONS

If designers have questions or problems with any of these recommendations, or, if conditions are found to be different during construction, contact the geotechnical staff who prepared this report at 949-450-2100.

The following is a summary of key findings and recommendations (by report Section):

- The alignment is underlain by relatively shallow Holocene to Pleistocene alluvium and shallow roadway fills, which are in turn underlain by decomposed to variably weathered granitic rock (Section 7.1.1, Figures 2A-2F, 3A-3E, 4A-4AI, 5A-5F)
- Geologic structure is not an issue for the project as proposed (Section 7.1.2)
- Natural slopes in the area are globally stable and no signs of existing landslides are present; existing cuts are stable, with minor rilling and sloughing observed on steep cuts (Section 7.1.3)
- Site soils are granular materials, locally loose in the upper 5 feet, locally medium dense to 15 feet depth, mostly dense to very dense below a depth of 5 feet (Section 7.2):
  - Granular soils are mostly non-plastic Sand with Silt (SP-SM, SW-SM) and Silty Sand (SM), locally low plasticity Clayey Sand (SC)
  - No significant deposits of cohesive soils (Clay) were observed
  - Soils grade gradually into weathered rock, dense alluvium and decomposed granite are similar, and the exact boundary is difficult to determine
- No surface water was observed on site, and no groundwater was observed in borings, surface water is only present during runoff events, localized perched groundwater and seepage may occur and vary seasonally when surface flows occur (Sections 7.2, 7.3)
- Site seismicity is high with PGA = 0.65 to 0.72g (Section 7.4.1)
- Ground rupture hazard is not significant (Section 7.4.2)
- Pseudo-static coefficient is 1/3 of the PGA or Kh=0.24 (Section 8.1.1)
- Liquefaction, seismic settlement, and seismic slope instability potential is not significant (8.1.2.1-8.1.2.4)
- Permanent cuts (8.2, 8.2.1):
  - Have maximum height of 26 feet in weathered rock and 18 feet in alluvial soils
  - Are proposed at 2h:1v or flatter and are expected to be globally stable
  - Should include slope rounding per HDM 304.4 and Standard Plan A62A
  - Should have concrete v-ditch to intercept upslope runoff

    - To reduce maintenance frequency consideration may be given to a catchment area several feet wide at toe of cut slopes to contain occasional raveling of soil and rock and keep debris out of the roadway
- Rippability (8.2.2):
    - The rock profile is differentially weathered, varies from rippable to non-rippable, and based on available testing excavation in rock will require at least moderate ripping effort, and possibly localized blasting
    - Excavation in the rock areas should be considered rock excavation
    - The contractor should be experienced in rock excavation and perform their own independent assessment of rippability
    - It would be prudent to allow for some contingency or contractual unit rates for blasting in the event that the contractor does not include blasting in the bid but finds it necessary during construction
    - Rock excavation will generate oversized cobble to boulder sized clasts
- Caltrans Standard Specifications for Earthwork should be followed (8.2, 8.2.4, 8.3, 8.3.6)
- Permanent fill slopes may be constructed of compacted on-site excavation or imported soils and should be sloped at 2h:1v or flatter (8.3.1)
- Imported fill should have maximum particle size of 3 inches, not more than 35% passing No. 200 sieve, have Plasticity Index less than 15, and be non-corrosive (8.3.2)
- Embankment subgrade should be proof-rolled, where unstable should excavated and recompacted or stabilized, and the surface to receive new embankment should be properly compacted prior to fill (8.3.3)
- Settlement of embankments is relatively small (about 1/8 inch for each foot of fill placed) and will occur quickly (within 15-30 days of placement) (8.3.4)
- Compacted fill slopes are expected to be globally and surficially stable (8.3.5)
- Culverts may be supported on properly prepared subgrade, and pipe selection may be performed using AltPipe computer program (8.5)
- Pavement design may consist of HMA/AB or RHMA-G/HMA/AB using design R-Value of 45 and Traffic Index of 7 or 8, with the exception of Station 54+90 to 56+00, which should be designed for R-Value of 12 or overexcavated 3 feet (8.7, Table 2)
- Mill and overlay may be performed for existing pavement tie-in (8.7.4)
- On-site soils do not classify as corrosive by Caltrans criteria; corrosion data may be used in AltPipe for culvert material selection (8.8)
- Imported soils should be tested at the borrow site prior to import to verify they meet the requirements for imported borrow (9.0)

- The contractor should be aware of existing utilities and improvements, highly variable rock excavation conditions, possible need for blasting, presence of areas of heavy vegetation/seasonal surface water and perched groundwater/loose soils in the drainage channels (11.1)

13.0 REFERENCES

AASHTO LRFD Bridge Design Specifications (4th Edition) with Caltrans Amendments.

Bieniawski, 1989, "Engineering Rock Mass Classifications," Wiley and Sons.

Caltrans, ARS Online

Caltrans, Bridge Design Specifications

Caltrans, "AltPipe," Computer Program for Culvert Material Selection

Caltrans, "CalFP," Computer Program for Flexible Pavement Design

Caltrans, Corrosion Guidelines

Caltrans, "Guidelines for preparing Geotechnical Design Reports," Version 1.3, December 2006.

Caltrans, Highway Design Manual

Caltrans, Seismic Design Criteria

Caltrans, 2010 and 2015 Standard Specifications

Caltrans, 2010 and 2015 Standard Plans

Morton, Douglas M., and Weber, F. Harold, Jr., "Preliminary Geologic Map of the Elsinore 7.5' Quadrangle, Riverside County, California," Version 1.0.

SC Engineering, Camino Del Norte Project Progress Plans.

Southwest Geophysics, Inc., "Seismic Refraction Survey, Camino Del Norte Extension, Lake Elsinore, California," April 4, 2016.

14.0 LIMITATIONS

The conclusions and recommendations contained in this report are professional opinions, intended for the use of SC Engineering. This report has been prepared solely for the design of the improvements described herein, and may not contain sufficient information for other uses. The recommendations should not be extrapolated to areas not covered by this report, or used for other facilities without the review and approval of GDC.

Our investigation and evaluations were performed in accordance with generally accepted local standards using that degree of care and skill ordinarily exercised under similar circumstances by reputable geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The recommendations for this project are, to a high degree dependent upon proper quality control of site grading, subgrade preparation, and other construction activities. The owner should implement proper quality control procedures to ensure that the subgrade soils, quality of fill, placement and compaction of fill, slope excavation, etc. meet the assumptions in this report. If different field conditions are encountered during construction, GDC should be notified and remediation measures should be implemented as necessary. GDC should observe key stages of the construction to verify that the foundation conditions meet the requirements of the geotechnical report.

Tables

TABLE 1
SUMMARY OF PROPOSED CUT AND FILL SLOPES

Station	Cut/Fill	Maxium Height of Cut Slope (ft)	Station of Highest Cut Slope (ft)	Material Exposed in Cut	Maximum Height of Fill Slope (ft)	Station of Highest FIll Slope (ft)	Foundation Soil Below Embankment	Slope of Cut/Fill
5+50 to 12+00	Cut/Fill	14	6+50	Qyf / Kgd	9	9+00	Kgd	2:1
12+00 to 14+00	Fill	N/A	N/A	N/A	11	13+00	Kgd	2:1
14+00 to 15+00	Cut/Fill	15	14+50	Kgd	6	14+00	Kgd	2:1
15+00 to 17+50	Cut	25	15+00	Kgd	N/A	N/A	N/A	2:1
17+50 to 19+50	Fill	N/A	N/A	N/A	14	18+00	Qyf / Kgd	2:1
19+50 to 24+00	Cut	14	21+00	Qyf / Kgd	N/A	N/A	N/A	2:1
24+00 to 27+50	Fill	N/A	N/A	N/A	11	25+50	Qyf / Kgd	2:1
27+50 to 29+50	Cut	11	28+50	Kgd	N/A	N/A	N/A	2:1
29+50 to 40+00	Fill	N/A	N/A	N/A	18	39+00	Qyf / Kgd	2:1
40+00 to 42+00	Cut/Fill	10	41+00	Qyf / Kgd	6	40+00	Qyf / Kgd	2:1
42+00 to 47+00	Fill	N/A	N/A	N/A	**34**	45+00	Kgd	2:1
47+00 to 49+00	Cut	**26**	48+50	Qoa / Kgd	N/A	N/A	N/A	2:1
49+00 to 52+50	Cut/Fill	24	50+50	Kgd	9	49+50	Kgd	2:1
52+50 to 54+50	Fill	N/A	N/A	N/A	12	54+00	Qaf / Qyf	2:1
54+50 to 58+00	Cut/Fill	18	56+00	Qyf	13	55+50	Qyf / Kgd	2:1
	Max=	26		**Max=**	34			
	Min=	10		**Min=**	6			
	Avg=	17		**Avg=**	13			

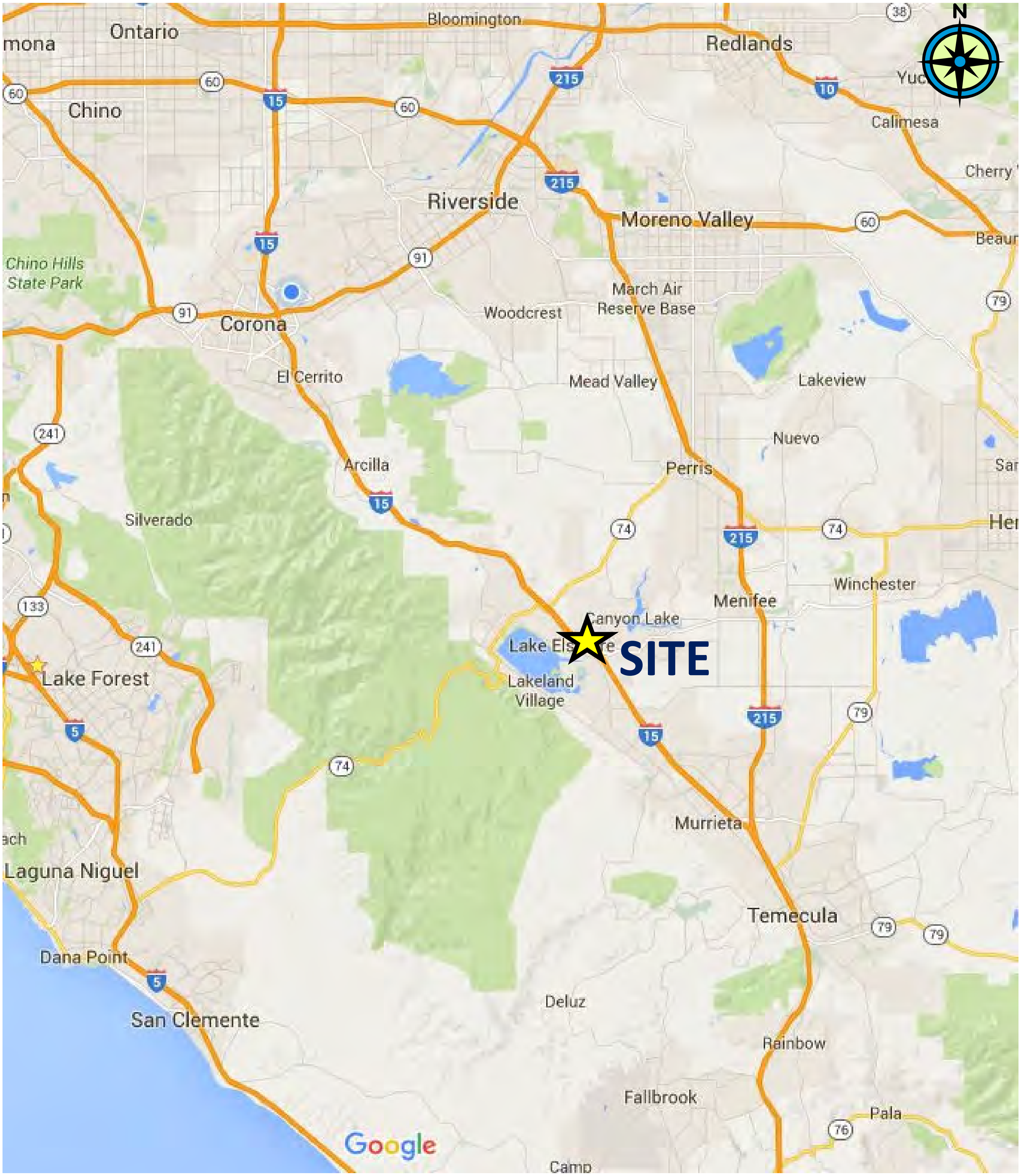
TABLE 2 - STRUCTURAL PAVEMENT SECTIONS

Location	Design R-Value	Traffic Index (TI)	Layer	Layer Thickness (feet) - Section Options		
				1	2	3
Canyon Estates Drive Franklin Street Canyon View Drive	45	7.0	RHMA-G	-	0.10	-
			HMA-A	0.30	0.20	-
			AB-Cl. 2	0.55	0.55	-
			Subgrade	Native or Fill (R≥45)	Native or Fill (R≥45)	-
Camino Del Norte (assuming 3' of overexcavate & replace with R≥45 from 54+90-56+00)	45	8.0	RHMA-G	-	0.10	0.20
			HMA-A	0.40	0.30	0.20
			AB-Cl. 2	0.55	0.55	0.55
			Subgrade	Native or Fill (R≥45)	Native or Fill (R≥45)	Native or Fill (R≥45)
Camino Del Norte (54+90-56+00 assuming no overexcavation)	12	8.0	RHMA-G	-	0.10	0.20
			HMA-A	0.40	0.30	0.20
			AB-Cl. 2	1.30	1.30	1.30
			Subgrade	Native or Fill (R≥12)	Native or Fill (R≥12)	Native or Fill (R≥12)

RHMA-G= Rubberized Hot Mix Asphalt
HMA-A= Type A Hot Mix Asphalt
AB-Cl. 2= Class 2 Aggregate Base (minimum R-Value of 78)

GROUP DELTA

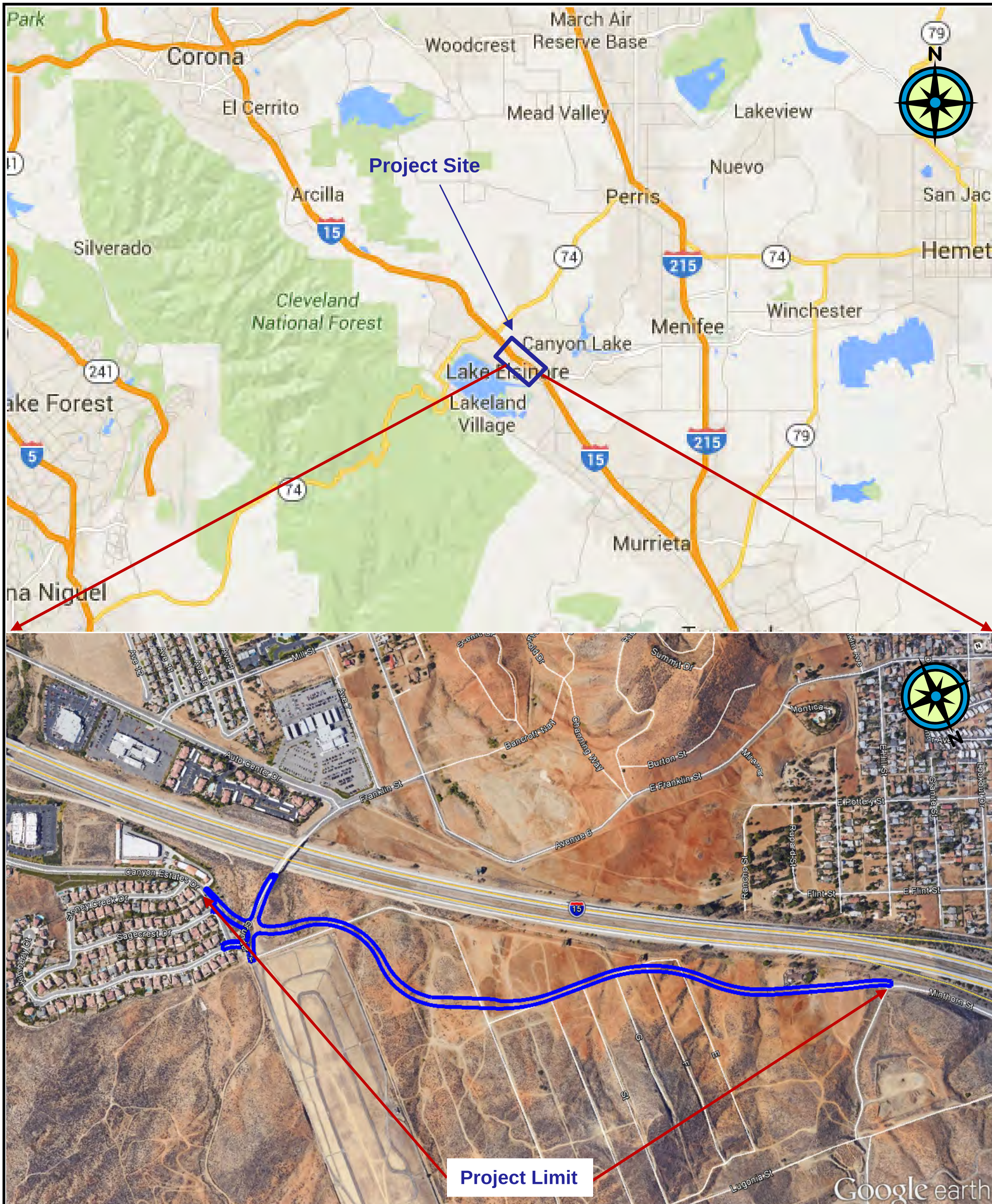
Figures



Reference: Google Maps, 2016

NOT TO SCALE

GROUP DELTA	**GROUP DELTA CONSULTANTS, INC.** ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	Figure Number: 1A
	Project Name: **CAMINO DEL NORTE, Lake Elsinore, CA**	Project Number: IR645
	VICINITY MAP	



Reference: Google Maps, 2016

NOT TO SCALE

GROUP DELTA

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

Figure Number: 1B

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

Project Number: IR645

LOCATION MAP & AERIAL PHOTO

SHEET	INDEX
1	TITLE
2-3	TYPICAL CROSS SECTIONS
4-8	LAYOUTS,
9-14	PROFILES AND SUPERELEVATION
15	CONSTRUCTION DETAILS
16-18	WATER POLLUTION CONTROL PLANS
19-21	EROSION CONTROL PLANS
22-25	DRAINAGE PROFILES
26-28	PAVEMENT DELINEATION AND SIGN PLANS

CITY OF LAKE ELSINORE

PUBLIC WORKS DEPARTMENT

PROJECT PLANS FOR CONSTRUCTION OF

CAMINO DEL NORTE IMPROVEMENTS

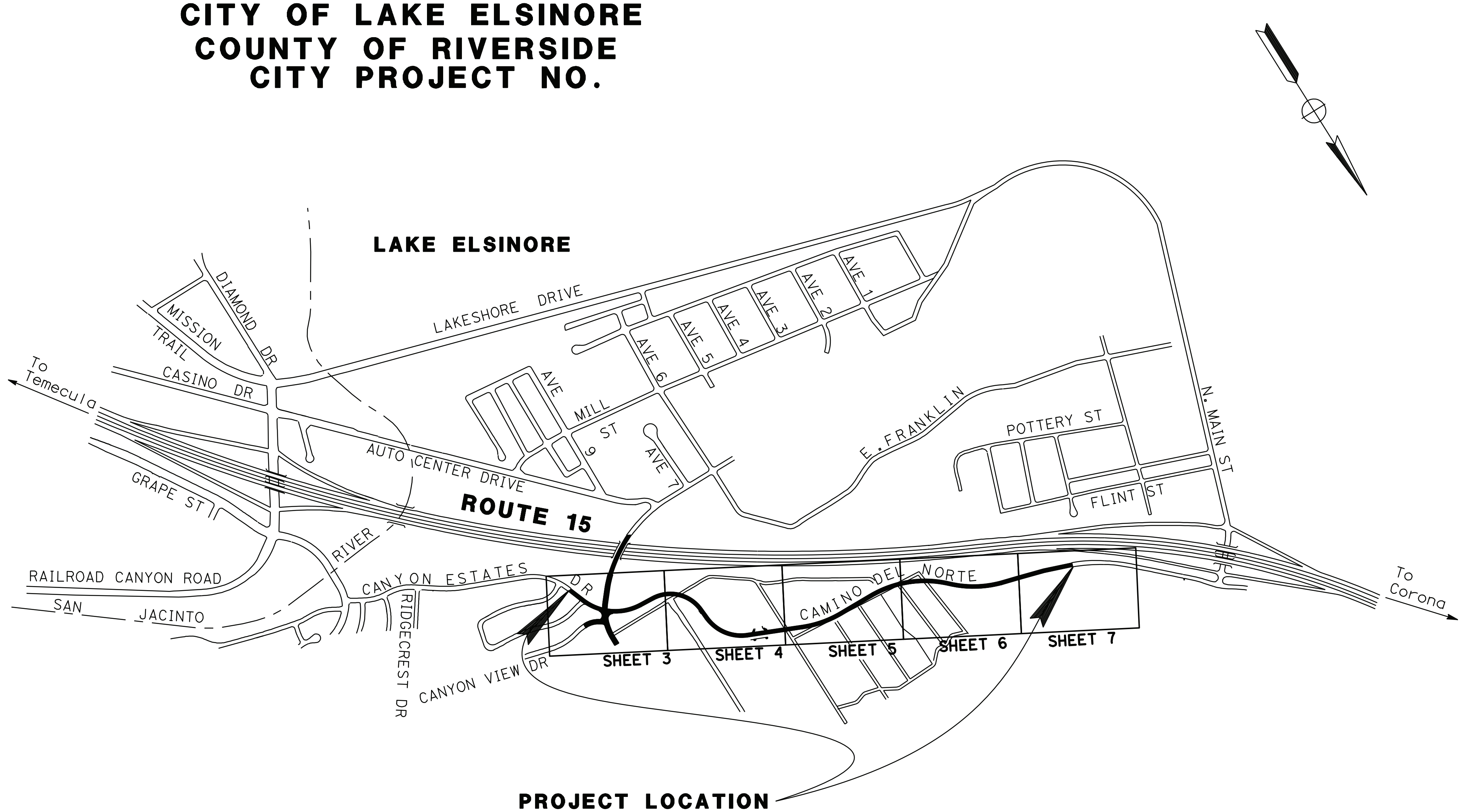
CITY OF LAKE ELSINORE
COUNTY OF RIVERSIDE
CITY PROJECT NO.

CONSTRUCTION NOTES

1. PROTECT IN PLACE.
2. HEADER CUT EXISTING ASPHALT CONCRETE PAVEMENT PER DETAIL SHEET 2.
3. NOT USED.
4. CONSTRUCT 0.45' HMA-A OVER 0.95 AB (CL 2).
5. REMOVE EXISTING PAVEMENT AND BASE.
6. CONSTRUCT TYPE 6 CURB AND GUTTER PER CITY STD NO. 200.
7. CONSTRUCT SIDEWALK PER CITY STD NO. 210.
8. EROSION CONTROL HYDROSEEDING.
9. CONSTRUCT HMA DIKE TYPE F PER CALTRANS STD. PLAN A87.
10. CONSTRUCT TYPE 6A CURB PER CITY STD NO. 202.
11. CONSTRUCT TRIPLE 72" REINFORCED CONCRETE PIPE PER CALTRANS STD D79.
12. EXISTING UTILITY TO BE REMOVED BY UTILITY OWNER.
13. CONSTRUCT 18" CSP (BITUMINOUS COATED THICKNESS=0.079" (INCLUDING BAND COUPLERS).
14. CONSTRUCT 24" CSP (BITUMINOUS COATED THICKNESS=0.079" (INCLUDING BAND COUPLERS).
15. CONSTRUCT 30" CSP (BITUMINOUS COATED THICKNESS=0.079" (INCLUDING BAND COUPLERS).
16. CONSTRUCT 36" CSP (BITUMINOUS COATED THICKNESS=0.079" INCLUDING BAND COUPLERS).
17. CONSTRUCT 42" CSP (BITUMINOUS COATED THICKNESS=0.079" INCLUDING BAND COUPLERS).
18. CONSTRUCT 8'x4' REINFORCED CONCRETE BOX PER CALTRANS STD PLAN D80.
19. CONSTRUCT TYPE "A" WINGWALL PER CALTRANS STD PLAN D84.
20. CONSTRUCT TYPE "D" STAIGHT WINGWALL PER CALTRANS STD PLAN D85.
21. CONSTRUCT LIGHT ROCK SLOPE PROTECTION (RSP) PER DETAIL SHOWN.
22. CONSTRUCT HEADWALL PER CALTRANS STD PLAN D89.
23. INSTALL 18" STEEL FLARED END SECTION PER CALTRANS STD. PLAN D94A.
24. INSTALL 24" STEEL FLARED END SECTION PER CALTRANS STD. PLAN D94A.
25. INSTALL 30" STEEL FLARED END SECTION PER CALTRANS STD.PLAN D94A.
26. INSTALL 36" STEEL FLARED END SECTION PER CALTRANS STD.PLAN D94A.
27. CONSTRUCT GO INLET WITH FRAME AND GRATE (TYPE 36RX) PER CALTRANS STD. PLAN D88A.
28. INSTALL 42" STEEL FLARED END SECTION PER CALTRANS STD. PLAN D94A.
29. CONSTRUCT CONCRETE COLLAR PER RIVERSIDE COUNTY STD DWG M803.
30. CONSTRUCT ACCESS RAMP (TYPE I) PER PER CITY STD NO. 214A.
31. NOT USED.

STREET PLAN GENERAL NOTES

1. UNLESS OTHERWISE NOTED, ALL CONSTRUCTION AND MATERIALS SHALL CONFORM TO THESE PLAND AND THE APPLICABLE PROVISIONS OF THE CITY OF LAKE ELSINORE ENGINEERING DEPARTMENT'S STANDARD SPECIFICATIONS FOR THE PUBLIC IMPROVEMENTS, LATEST REVISIONS, AND THE STANDARD DRAWINGS ON FILE WITH THE CITY OF LAKE ELSINORE.
2. THE CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY THAT THIS REQUIREMENT SHALL APPLY CONTINUALLY, AND NOT BE LIMITED TO THE NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE CITY HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT.
3. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ANY PERMITS REQUIRED BY THE CITY OF CITY OF LAKE ELSINORE ENGINEERING DEPARTMENT IN ORDER TO DO THE WORK SHOWN ON THESE PLANS.
4. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROTECT SURVEYING MONUMENTS IN PLACE, AND THE CONTRACTOR SHALL BE FINANCIALLY RESPONSIBLE FOR RESETTING DAMAGED OR DESTROYED MONUMENTS.
5. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO FAMILARIZED HIMSELF/HERSELF WITH THE JOB SITE AND ANY UNDERGROUND UTILITIES SHOWN OR NOT SHOWN ON THESE PLANS. CONTRACTOR SHALL CALL UNDERGROUND SERVICE ALERT AT (800) 422-4133 TO LOCATE UTILITIES AT LEAST 2 (TWO) WORKING DAYS BEFORE DOING ANY EXCAVATION. ALL PIPELINES, SUBSTRUCTURES OR UTILITIES OF ANY KIND, WHETHER SHOWN ON THESE PLANS OR NOT, SHALL BE PROTECTED IN PLACE OR, IF REQUIRED, BE REMOVED, RELOCATED, OR REINFORCED TO THE SATIFICATION OF THE CITY ENGINEER AND THE COMPANY OWNING THE FACILITY AT THE EXPENSE OF THE CONTRACTOR.
6. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ANY FIELD CHANGES MADE WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE ENGINEER AND THE CITY ENGINEER.
7. THE CONTRACTOR SHALL GIVE THE CITY OF LAKE ELSINORE ENGINEERING DEPARTMENT AT LEAST 2 (TWO) WORKING DAYS NOTICE TO SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE INSPECTOR PRIOR TO START OF WORK.
8. THE CONTRACTOR SHALL GIVE THE CITY OF LAKE ELSINORE ENGINEERING DEPARTMENT AT LEAST 1 (ONE) WORKING DAY NOTICE PRIOR TO ALL INSPECTIONS AT (xxx) xxxxxxx. A RE-INSPECTION FEE WILL BE RENDERED ON EACH OCCASION WHEN THE CONTRACTOR IS NOT READY FOR THE INSPECTION AT THE SCHEDULED TIME. NO FURTHER INSPECTIONS WILL BE PREFORMED UNTIL SAID RE-INSPECTION FEE IS PAID.



EXPLANATION

A-16-010	●	HOLLOW STEM AUGER BORING
TP-5	☒	TEST PIT
SL-5	├──┤	SEISMIC REFRACTION TRAVERSE

DRAINAGE COURSE

STA 57+00 — GEOTECHNICAL CROSS-SECTION & STATION NUMBER

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

65% PROGRESS PLANS

FIGURE 2A

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER — ATEFEH ESKANDARI — No. C63390 — Exp. 9/30/16 — CIVIL — STATE OF CALIFORNIA

DIGALERT
CALL TOLL FREE
1-800-227-2600
2 Working Days Before You Dig

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS

Designed by	Drawn by	Checked by
RSC	FR	AE

PLANS PREPARED UNDER SUPERVISION OF
ATEFEH ESKANDARI
Date SEPTEMBER XX, 2015 R.C.E. No. C63390

Reference Plans for these improvements

Date	By	REVISIONS	App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road
Elevation= 1289.60

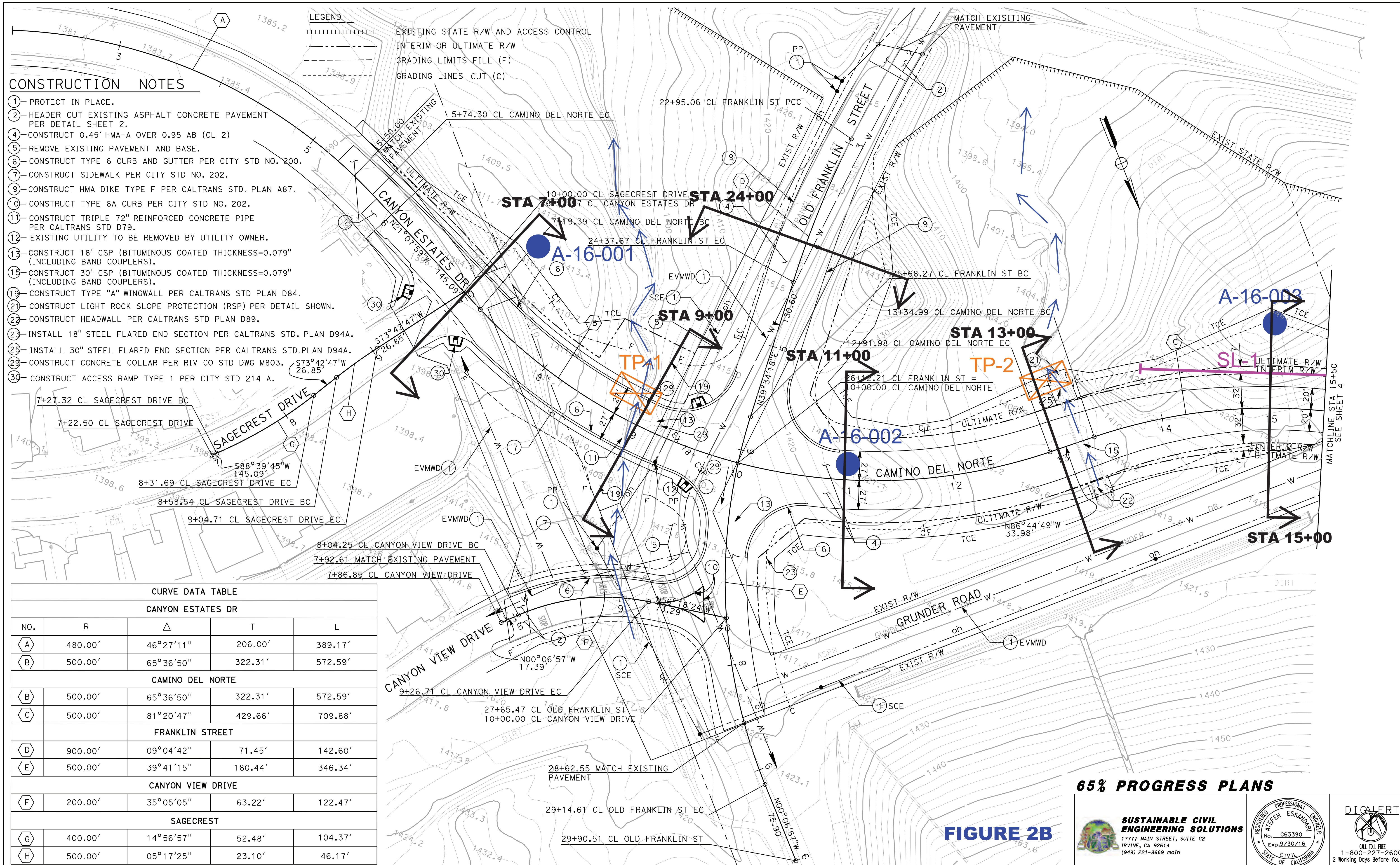
NO Scale

Engineering ____________
Traffic ____________
Approved ____________

CITY OF LAKE ELSINORE
TITLE SHEET
CAMINO DEL NORTE

Drawing No.
Sh 1 of 28

2/3/2016 9:15:34 AM N:\Projects_SW\I600\IR645 Camino Del Norte Extension, Lake Elsinore, Ca\CAD\FIGURE 2A.dgn



CONSTRUCTION NOTES

1. PROTECT IN PLACE.
2. HEADER CUT EXISTING ASPHALT CONCRETE PAVEMENT PER DETAIL SHEET 2.
4. CONSTRUCT 0.45' HMA-A OVER 0.95 AB (CL 2)
5. REMOVE EXISTING PAVEMENT AND BASE.
6. CONSTRUCT TYPE 6 CURB AND GUTTER PER CITY STD NO. 200.
7. CONSTRUCT SIDEWALK PER CITY STD NO. 202.
9. CONSTRUCT HMA DIKE TYPE F PER CALTRANS STD. PLAN A87.
10. CONSTRUCT TYPE 6A CURB PER CITY STD NO. 202.
11. CONSTRUCT TRIPLE 72" REINFORCED CONCRETE PIPE PER CALTRANS STD D79.
12. EXISTING UTILITY TO BE REMOVED BY UTILITY OWNER.
13. CONSTRUCT 18" CSP (BITUMINOUS COATED THICKNESS=0.079" (INCLUDING BAND COUPLERS).
15. CONSTRUCT 30" CSP (BITUMINOUS COATED THICKNESS=0.079" (INCLUDING BAND COUPLERS).
19. CONSTRUCT TYPE "A" WINGWALL PER CALTRANS STD PLAN D84.
21. CONSTRUCT LIGHT ROCK SLOPE PROTECTION (RSP) PER DETAIL SHOWN.
22. CONSTRUCT HEADWALL PER CALTRANS STD PLAN D89.
23. INSTALL 18" STEEL FLARED END SECTION PER CALTRANS STD. PLAN D94A.
25. INSTALL 30" STEEL FLARED END SECTION PER CALTRANS STD.PLAN D94A.
29. CONSTRUCT CONCRETE COLLAR PER RIV CO STD DWG M803.
30. CONSTRUCT ACCESS RAMP TYPE 1 PER CITY STD 214 A.

CURVE DATA TABLE

NO.	R	△	T	L
CANYON ESTATES DR				
A	480.00'	46°27'11"	206.00'	389.17'
B	500.00'	65°36'50"	322.31'	572.59'
CAMINO DEL NORTE				
B	500.00'	65°36'50"	322.31'	572.59'
C	500.00'	81°20'47"	429.66'	709.88'
FRANKLIN STREET				
D	900.00'	09°04'42"	71.45'	142.60'
E	500.00'	39°41'15"	180.44'	346.34'
CANYON VIEW DRIVE				
F	200.00'	35°05'05"	63.22'	122.47'
SAGECREST				
G	400.00'	14°56'57"	52.48'	104.37'
H	500.00'	05°17'25"	23.10'	46.17'

65% PROGRESS PLANS

FIGURE 2B

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER ATEFEH ESKANDARI No. C63390 Exp. 9/30/16 CIVIL STATE OF CALIFORNIA

DIGALERT CALL TOLL FREE 1-800-227-2600 2 Working Days Before You Dig

SUBTAINABLE CIVIL ENGINEERING SOLUTIONS

Designed by RSC | Drawn by FR | Checked by AE

PLANS PREPARED UNDER SUPERVISION OF ATEFEH ESKANDARI

Reference Plans for Road Improvements

Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road Elevation= 1289.60
Scale: NTS

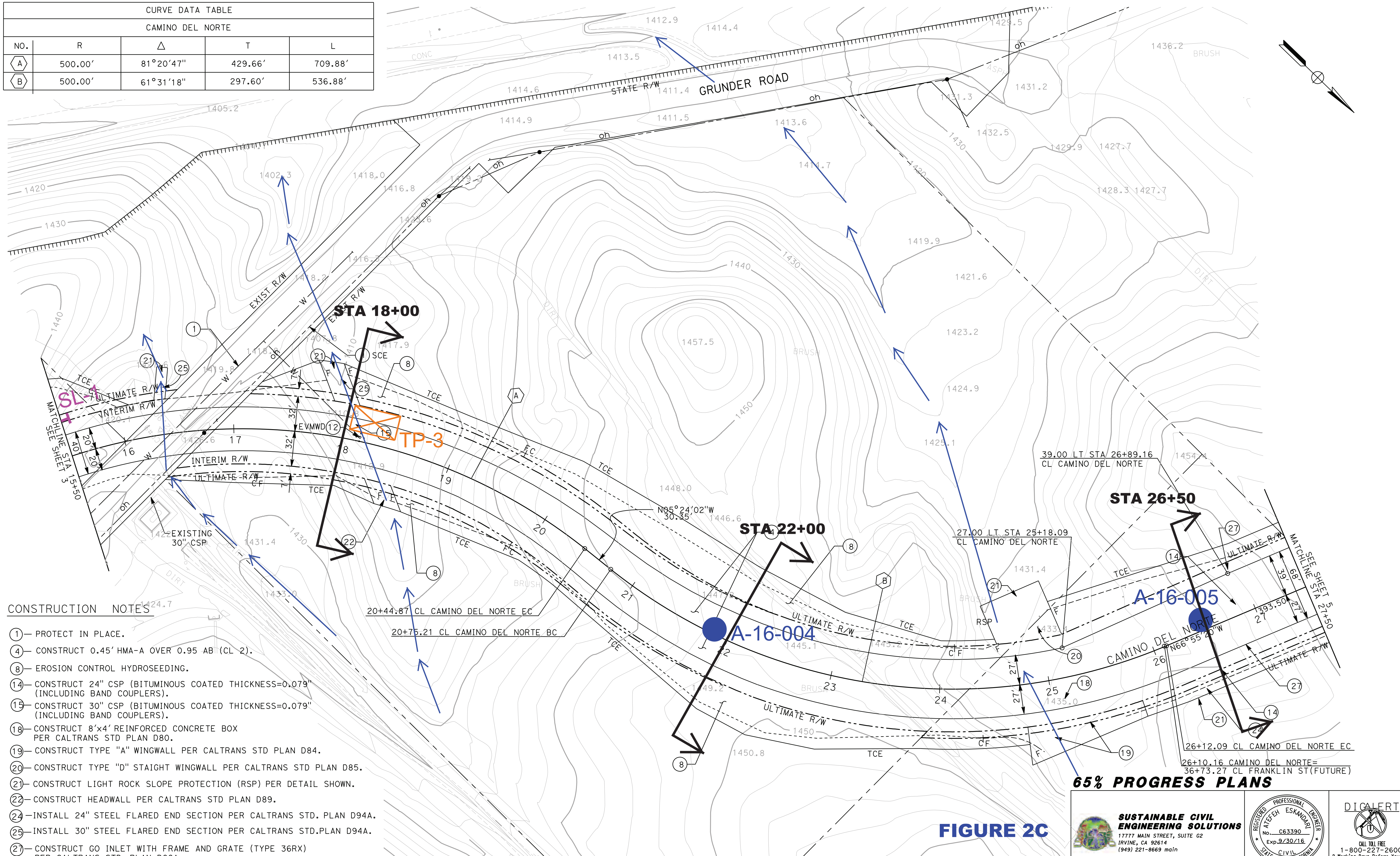
Engineering ____ Traffic ____ Approved ____

CITY OF LAKE ELSINORE
LAYOUT PLANS
CAMINO DEL NORTE

Drawing No. Sh 4 of 28

4/28/2016 9:16:05 AM N:\Projects_AV1600\...\Lake Elsinore Ca\CAD\FIGURE...

CURVE DATA TABLE				
CAMINO DEL NORTE				
NO.	R	Δ	T	L
A	500.00′	81°20′47″	429.66′	709.88′
B	500.00′	61°31′18″	297.60′	536.88′



CONSTRUCTION NOTES

1. — PROTECT IN PLACE.
4. — CONSTRUCT 0.45′ HMA-A OVER 0.95 AB (CL 2).
8. — EROSION CONTROL HYDROSEEDING.
14. — CONSTRUCT 24" CSP (BITUMINOUS COATED THICKNESS=0.079") (INCLUDING BAND COUPLERS).
15. — CONSTRUCT 30" CSP (BITUMINOUS COATED THICKNESS=0.079") (INCLUDING BAND COUPLERS).
18. — CONSTRUCT 8′x4′ REINFORCED CONCRETE BOX PER CALTRANS STD PLAN D80.
19. — CONSTRUCT TYPE "A" WINGWALL PER CALTRANS STD PLAN D84.
20. — CONSTRUCT TYPE "D" STAIGHT WINGWALL PER CALTRANS STD PLAN D85.
21. — CONSTRUCT LIGHT ROCK SLOPE PROTECTION (RSP) PER DETAIL SHOWN.
22. — CONSTRUCT HEADWALL PER CALTRANS STD PLAN D89.
24. — INSTALL 24" STEEL FLARED END SECTION PER CALTRANS STD. PLAN D94A.
25. — INSTALL 30" STEEL FLARED END SECTION PER CALTRANS STD.PLAN D94A.
27. — CONSTRUCT GO INLET WITH FRAME AND GRATE (TYPE 36RX) PER CALTRANS STD. PLAN D88A.

65% PROGRESS PLANS

FIGURE 2C

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER ATEFEH ESKANDARI No. C63390 Exp. 9/30/16 CIVIL STATE OF CALIFORNIA

DIGALERT CALL TOLL FREE 1-800-227-2600 2 Working Days Before You Dig

SUBTAINABLE CIVIL ENGINEERING SOLUTIONS

Designed by RSC | Drawn by FR | Checked by AE

PLANS PREPARED UNDER SUPERVISION OF ATEFEH ESKANDARI

Reference Plans for These Improvements

Date | By | REVISIONS | App'd

BENCH MARK: PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road Elevation= 1289.60

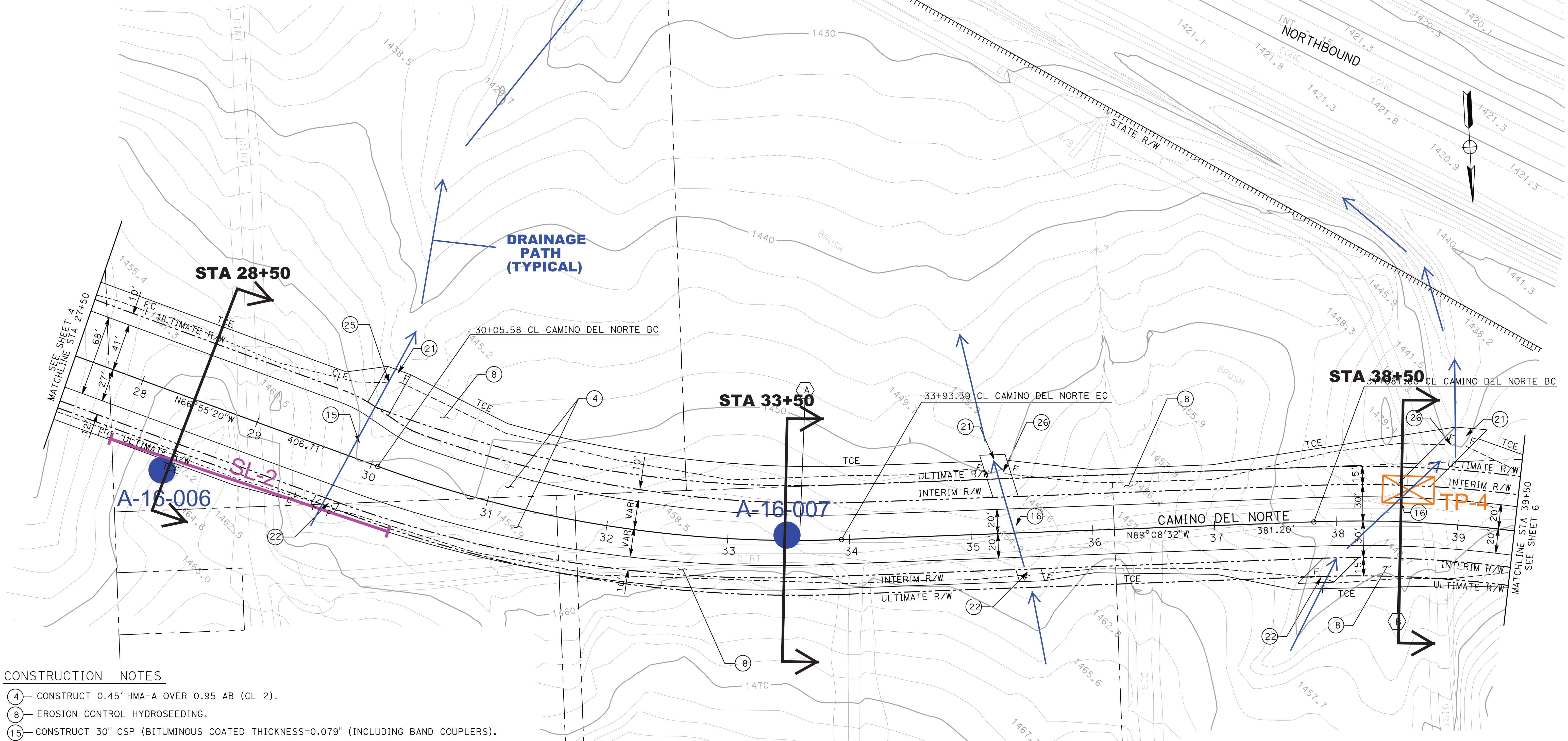
Scale: NTS

Engineering ____ Traffic ____ Approved ____

CITY OF LAKE ELSINORE
LAYOUT PLANS
CAMINO DEL NORTE

Drawing No. Sh 5 of 28

CURVE DATA TABLE				
CAMINO DEL NORTE				
NO.	R	Δ	T	L
(A)	1000.00'	22°13'12"	196.37'	387.81'
(B)	1000.00'	43°41'52"	400.96'	762.67'



CONSTRUCTION NOTES

(4)— CONSTRUCT 0.45' HMA-A OVER 0.95 AB (CL 2).

(8)— EROSION CONTROL HYDROSEEDING.

(15)— CONSTRUCT 30" CSP (BITUMINOUS COATED THICKNESS=0.079" (INCLUDING BAND COUPLERS).

(16)— CONSTRUCT 36" CSP BITUMINOUS COATED THICKNESS=0.079" INCLUDING BAND COUPLERS).

(21)— CONSTRUCT LIGHT ROCK SLOPE PROTECTION (RSP) PER DETAIL SHOWN.

(22)— CONSTRUCT HEADWALL PER CALTRANS STD PLAN D89.

(25)—INSTALL 30" STEEL FLARED END SECTION PER CALTRANS STD.PLAN D94A.

(26)—INSTALL 36" STEEL FLARED END SECTION PER CALTRANS STD.PLAN D94A.

FIGURE 2D

65% PROGRESS PLANS

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER ATEFEH ESKANDARI No. C63390 Exp. 9/30/16 CIVIL STATE OF CALIFORNIA

DIGALERT
CALL TOLL FREE
1-800-227-2600
2 Working Days Before You Dig

SUBTAINABLE CIVIL ENGINEERING SOLUTIONS

Designed by RSC | Drawn by FR | Checked by AE

PLANS PREPARED UNDER SUPERVISION OF ATEFEH ESKANDARI

Reference Plans for Road Improvements

Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road
Elevation= 1289.60
Scale: NTS

Engineering ____
Traffic ____
Approved ____

CITY OF LAKE ELSINORE
LAYOUT PLANS
CAMINO DEL NORTE

Drawing No.
Sh 6 of 28

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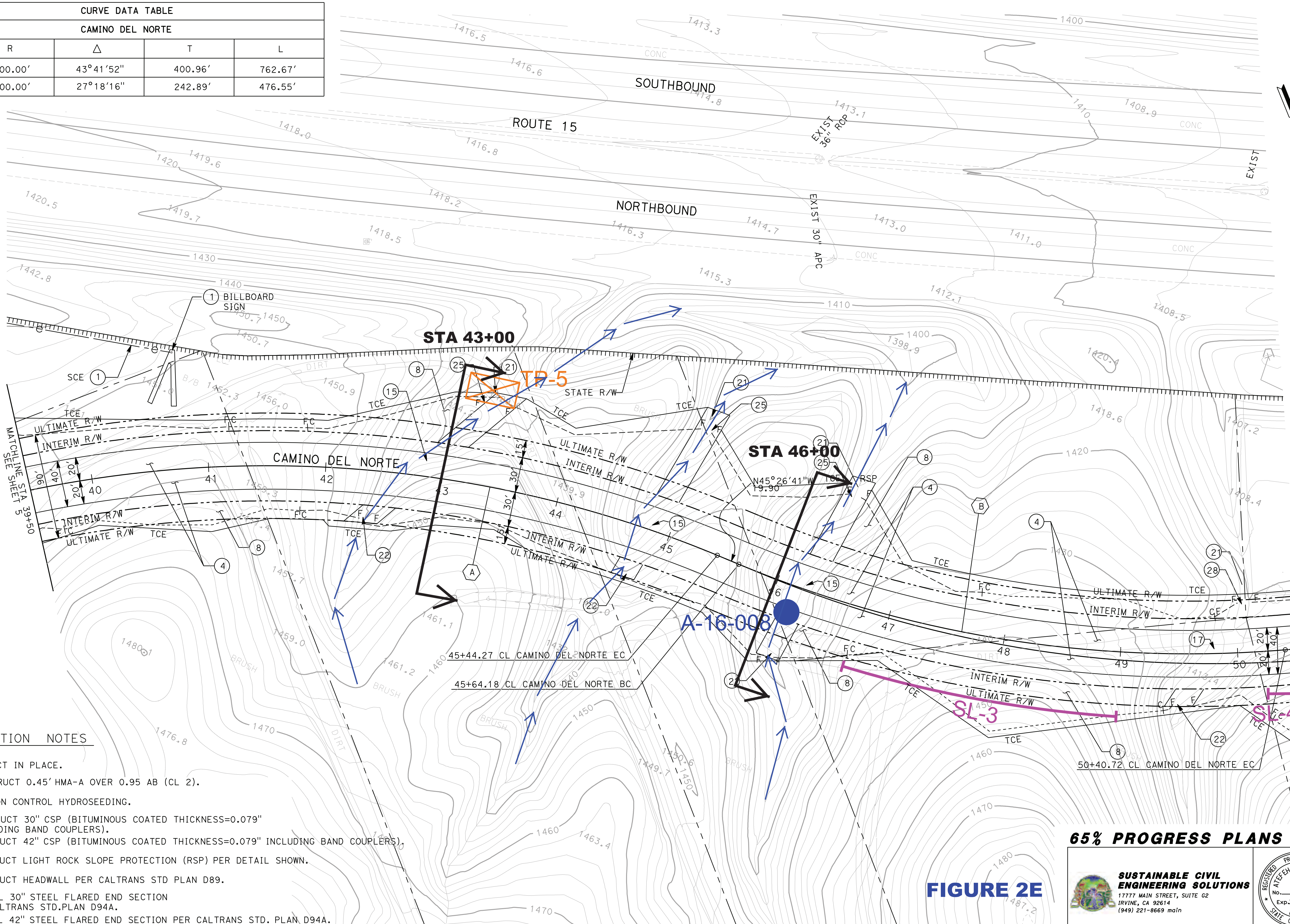
CURVE DATA TABLE				
CAMINO DEL NORTE				
NO.	R	△	T	L
A	1000.00′	43°41′52″	400.96′	762.67′
B	1000.00′	27°18′16″	242.89′	476.55′



CONSTRUCTION NOTES

(1)— PROTECT IN PLACE.

(4)— CONSTRUCT 0.45′ HMA-A OVER 0.95 AB (CL 2).

(8)— EROSION CONTROL HYDROSEEDING.

(15)— CONSTRUCT 30" CSP (BITUMINOUS COATED THICKNESS=0.079" (INCLUDING BAND COUPLERS).

(17)— CONSTRUCT 42" CSP (BITUMINOUS COATED THICKNESS=0.079" INCLUDING BAND COUPLERS).

(21)— CONSTRUCT LIGHT ROCK SLOPE PROTECTION (RSP) PER DETAIL SHOWN.

(22)— CONSTRUCT HEADWALL PER CALTRANS STD PLAN D89.

(25)— INSTALL 30" STEEL FLARED END SECTION PER CALTRANS STD.PLAN D94A.

(28)— INSTALL 42" STEEL FLARED END SECTION PER CALTRANS STD. PLAN D94A.

65% PROGRESS PLANS

FIGURE 2E

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER ATEFEH ESKANDARI No. C63390 Exp. 9/30/16 CIVIL STATE OF CALIFORNIA

DIGALERT CALL TOLL FREE 1-800-227-2600 2 Working Days Before You Dig

SUBTAINABLE CIVIL ENGINEERING SOLUTIONS

Designed by RSC | Drawn by FR | Checked by AE

PLANS PREPARED UNDER SUPERVISION OF ATEFEH ESKANDARI

Reference Plans for These Improvements

Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road Elevation= 1289.60

Scale: NTS

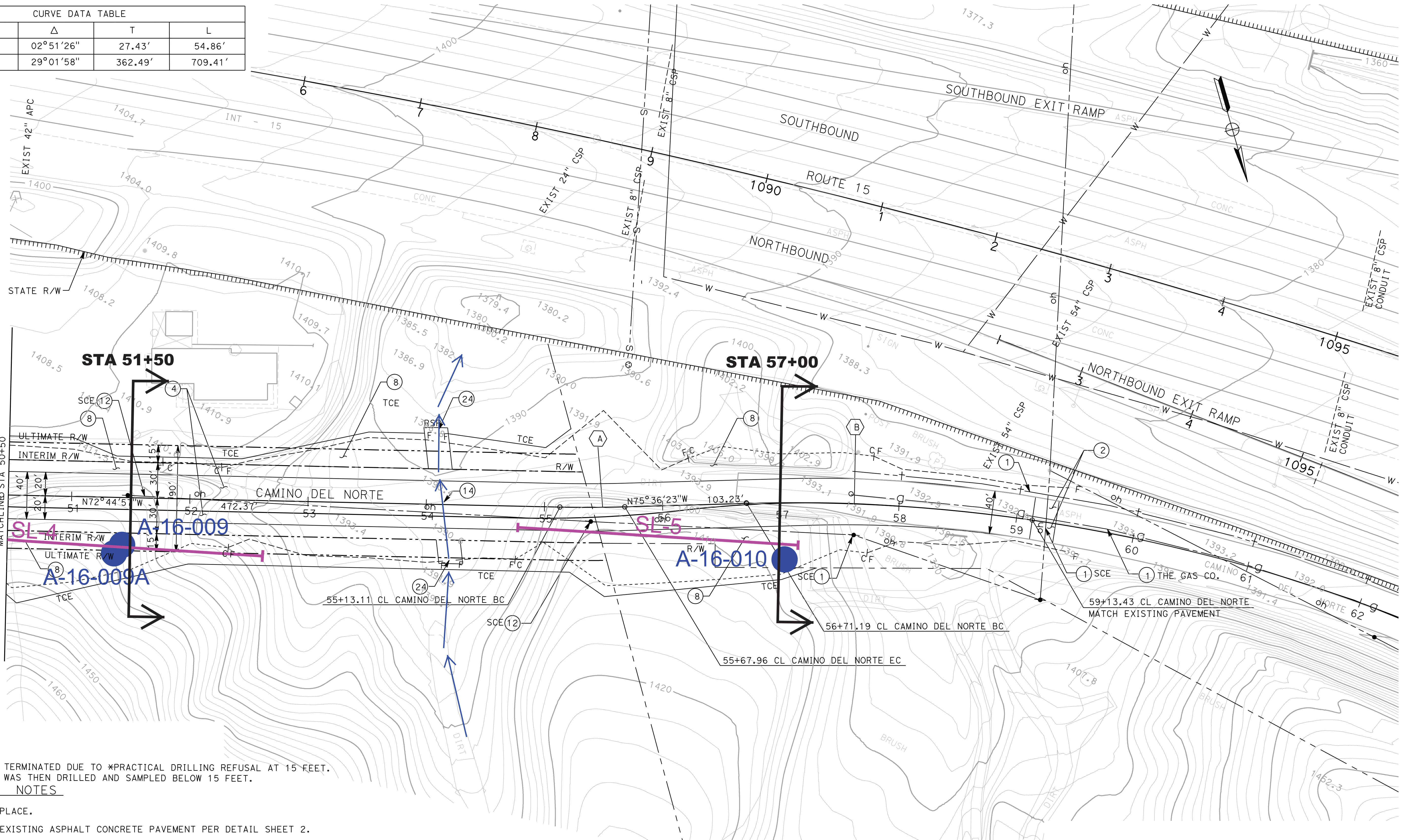
Engineering ____ Traffic ____ Approved ____

CITY OF LAKE ELSINORE
LAYOUT PLANS
CAMINO DEL NORTE

Drawing No. Sh 7 of 28

4/28/2016 9:12:03 AM N:\Projects_AV\1600\16045 Camino del Norte Extension, Lake Elsinore, Ca\CAD\FIGURE 2E.dwg

CURVE DATA TABLE				
NO.	R	Δ	T	L
A	1100.00'	02°51'26"	27.43'	54.86'
B	1400.00'	29°01'58"	362.49'	709.41'



NOTE

BORING A-16-009 TERMINATED DUE TO *PRACTICAL DRILLING REFUSAL AT 15 FEET.
BORING A-16-009 WAS THEN DRILLED AND SAMPLED BELOW 15 FEET.

CONSTRUCTION NOTES

1 — PROTECT IN PLACE.
2 — HEADER CUT EXISTING ASPHALT CONCRETE PAVEMENT PER DETAIL SHEET 2.
4 — CONSTRUCT 0.45' HMA-A OVER 0.95 AB (CL 2).
8 — EROSION CONTROL HYDROSEEDING.
12 — EXISTING UTILITY TO BE REMOVED BY UTILITY OWNER.
14 — CONSTRUCT 24" CSP (BITUMINOUS COATED THICKNESS=0.079") (INCLUDING BAND COUPLERS).
24 — INSTALL 24" STEEL FLARED END SECTION PER CALTRANS STD. PLAN D94A.

FIGURE 2F

65% PROGRESS PLANS

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER ATEFEH ESKANDARI No. C63390 Exp. 9/30/16 CIVIL STATE OF CALIFORNIA

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Reference Plans for these Improvements

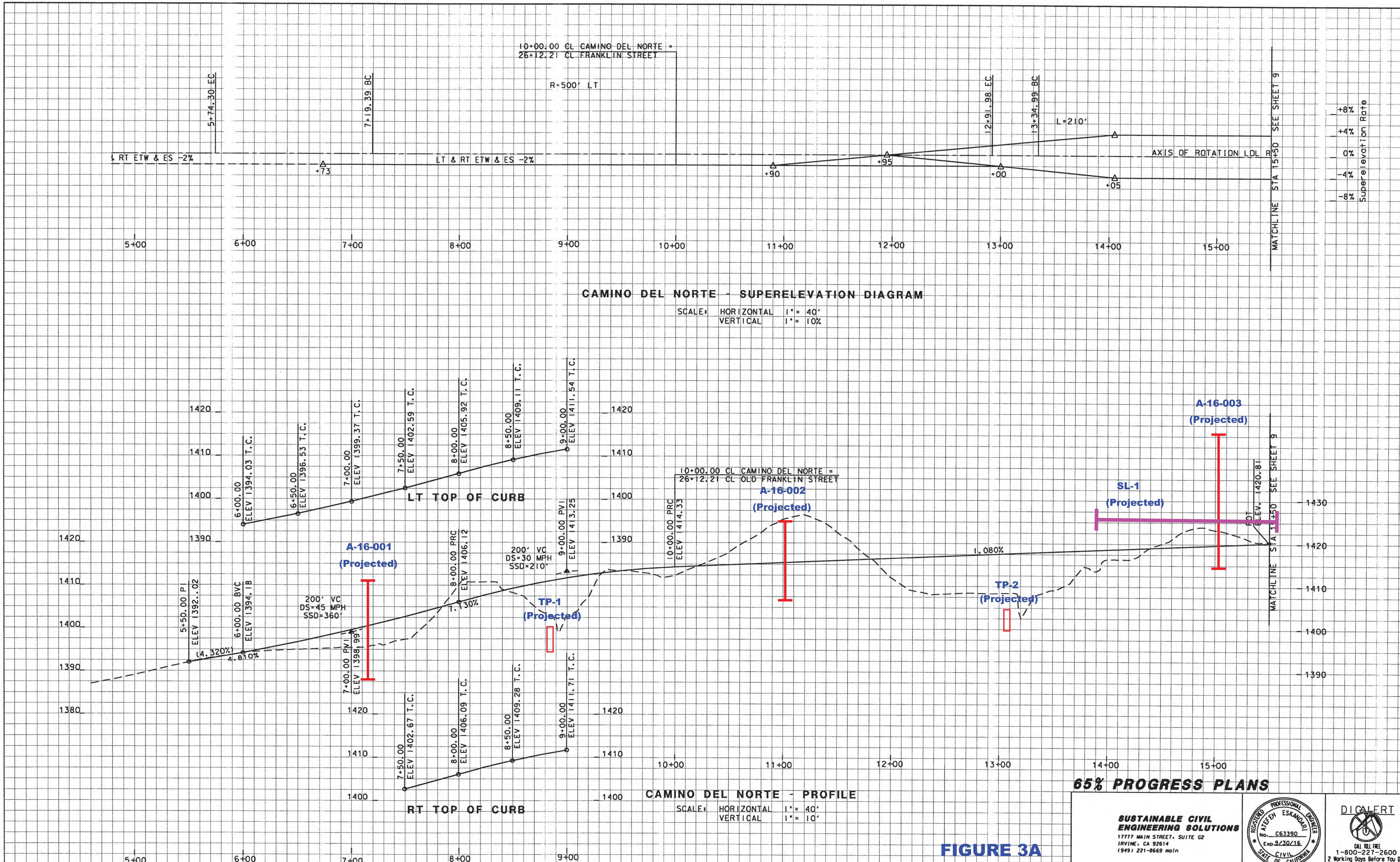
Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road
Elevation= 1289.60
Scale: NTS

Engineering ______
Traffic ______
Approved ______

CITY OF LAKE ELSINORE
LAYOUT PLANS
CAMINO DEL NORTE

Drawing No.
Sh 8 of 28



65% PROGRESS PLANS

FIGURE 3A

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE C2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER ATEFEH ESKANDARI No. C63390 Exp. 9/30/16 CIVIL STATE OF CALIFORNIA

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SUBTAINABLE CIVIL ENGINEERING SOLUTIONS

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PLANS PREPARED UNDER SUPERVISION OF ATEFEH ESKANDARI
Date SEPTEMBER XX, 2015 R.C.E. No. C63390

Reference Plans for these improvements

Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road Elevation= 1285.60
Scale: 1" =40'

Engineering ______
Traffic ______
Approved ______

CITY OF LAKE ELSINORE
SUPERELEVATION DIAGRAMS
CAMINO DEL NORTE

Drawing No.
Sh 9 of 28

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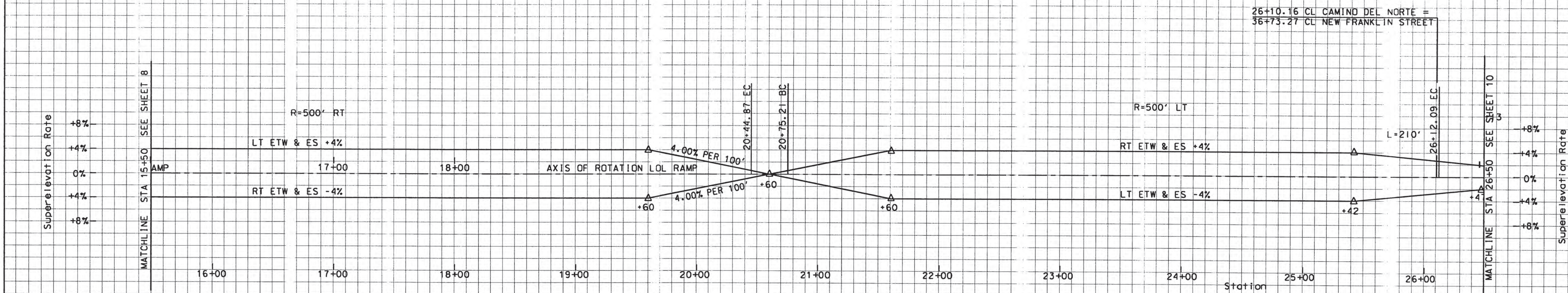
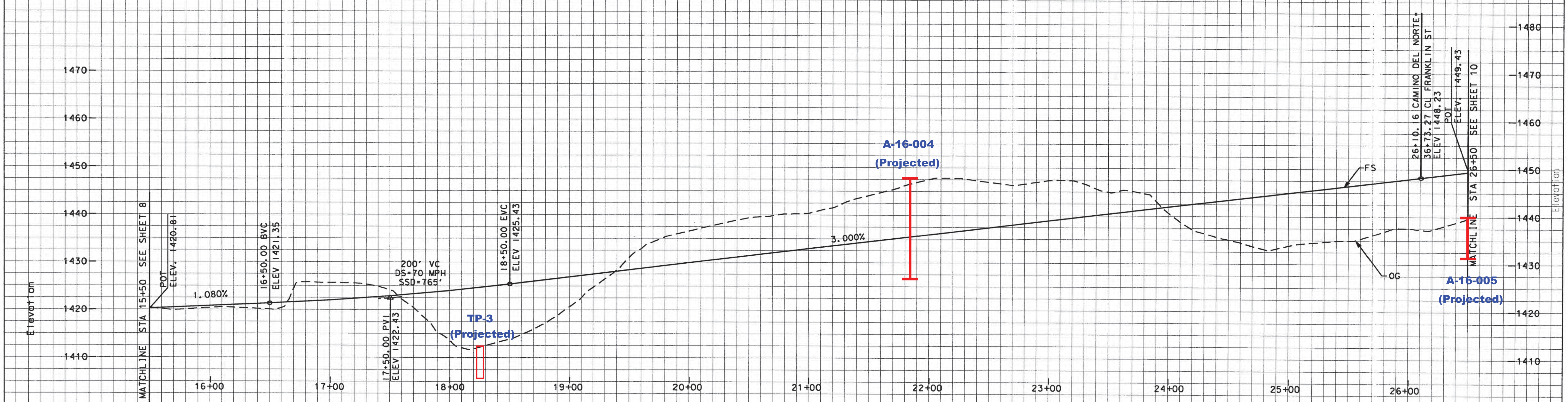


CAMINO DEL NORTE - SUPERELEVATION DIAGRAM

SCALE: HORIZONTAL 1" = 40'
VERTICAL 1" = 10%



65% PROGRESS PLANS

CAMINO DEL NORTE - PROFILE

SCALE: HORIZONTAL 1" = 40'
VERTICAL 1" = 10'

FIGURE 3B

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER
ATEFEH ESKANDARI
No. C63390
Exp 9/30/16
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SUBTAINABLE CIVIL ENGINEERING SOLUTIONS

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PLANS PREPARED UNDER SUPERVISION OF ATEFEH ESKANDARI
Date SEPTEMBER XX, 2015 R.C.E. No. C63390

Reference Plans for these improvements

Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road Elevation= 1289.60
Scale: 1" =40'

Engineering ________
Traffic ________
Approved ________

CITY OF LAKE ELSINORE
SUPERELEVATION DIAGRAMS
CAMINO DEL NORTE

Drawing No.
Sh 10 of 28

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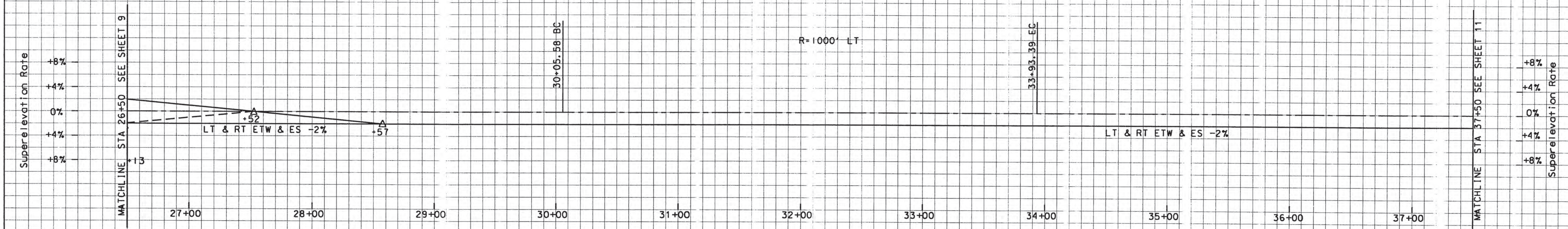
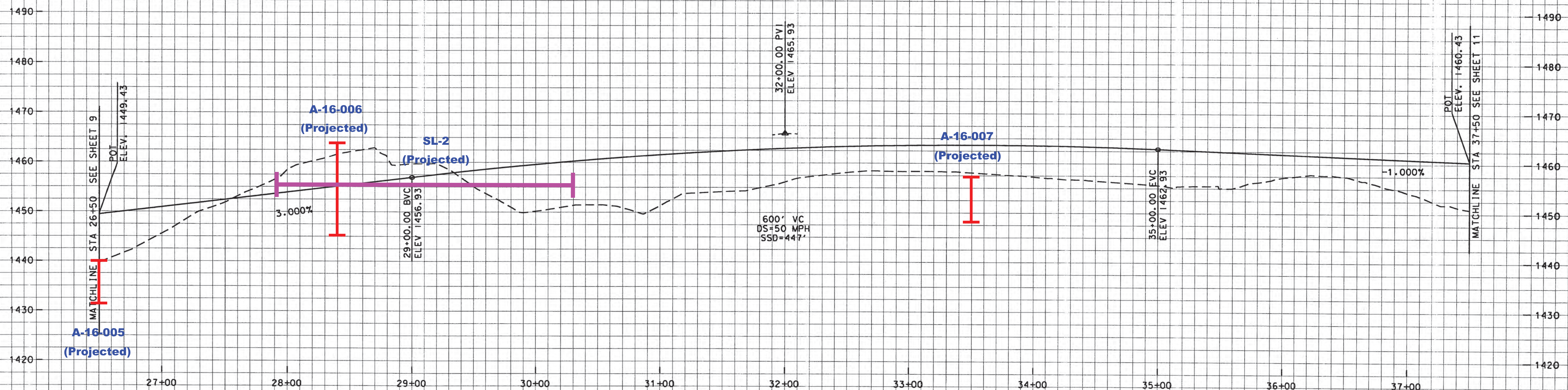


CAMINO DEL NORTE - SUPERELEVATION DIAGRAM

SCALE: HORIZONTAL 1" = 40'
VERTICAL 1" = 10%



CAMINO DEL NORTE - PROFILE

SCALE: HORIZONTAL 1" = 40'
VERTICAL 1" = 10'

65% PROGRESS PLANS

FIGURE 3C

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

REGISTERED PROFESSIONAL ENGINEER ATEFEH ESKANDARI No. C63390 Exp. 9/30/16 CIVIL STATE OF CALIFORNIA

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SUBTAINABLE CIVIL ENGINEERING SOLUTIONS	Designed by RSC	Drawn by FR	Checked by AF	Reference Plans for these Improvements

PLANS PREPARED UNDER SUPERVISION OF ATEFEH ESKANDARI
Date SEPTEMBER XX, 2015 R.C.E. No. C63390

Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island, approximately 1.0 Lt 4+92 CL Railroad Canyon Road Elevation= 1289.60
Scale: 1" =40'

Engineering ____
Traffic ____
Approved ____

CITY OF LAKE ELSINORE
SUPERELEVATION DIAGRAMS
CAMINO DEL NORTE

Drawing No.
Sh 11 of 28

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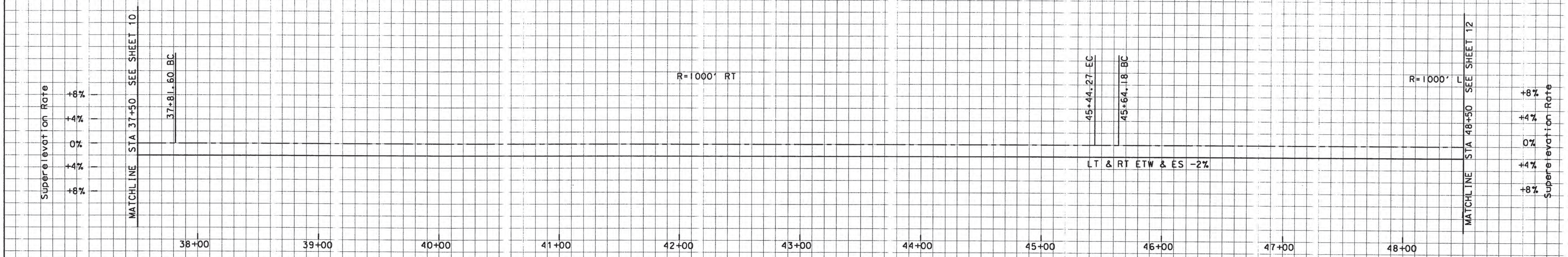
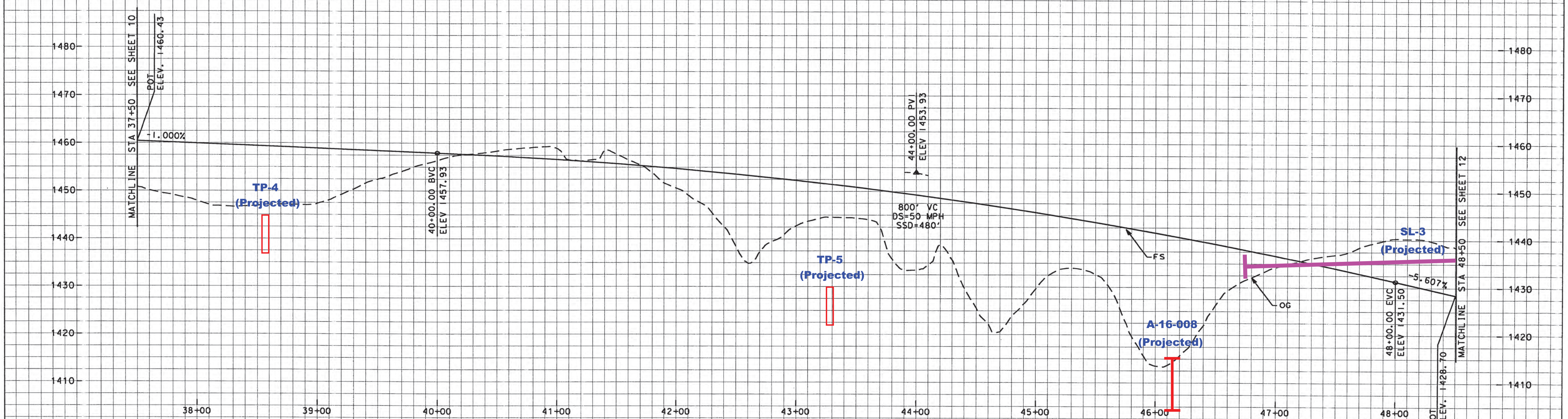


CAMINO DEL NORTE - SUPERELEVATION DIAGRAM

SCALE: HORIZONTAL 1" = 40'
VERTICAL 1" = 10%



65% PROGRESS PLANS

CAMINO DEL NORTE - PROFILE

SCALE: HORIZONTAL 1" = 40'
VERTICAL 1" = 10'

FIGURE 3D

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

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SUBTAINABLE CIVIL ENGINEERING SOLUTIONS

Designed by	Drawn by	Checked by
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Date SEPTEMBER XX, 2015 R.C.E. No. C63390

Reference Plans for these Improvements

Date | By | REVISIONS | App'd

BENCH MARK
PK Nail in pavement, flush, adjacent to median island; approximately 1.0 Lt 4+92 CL Railroad Canyon Road Elevation= 1289.60
Scale: 1" =40'

Engineering ______
Traffic ______
Approved ______

CITY OF LAKE ELSINORE
SUPERELEVATION DIAGRAMS
CAMINO DEL NORTE

Drawing No.
Sh 12 of 28

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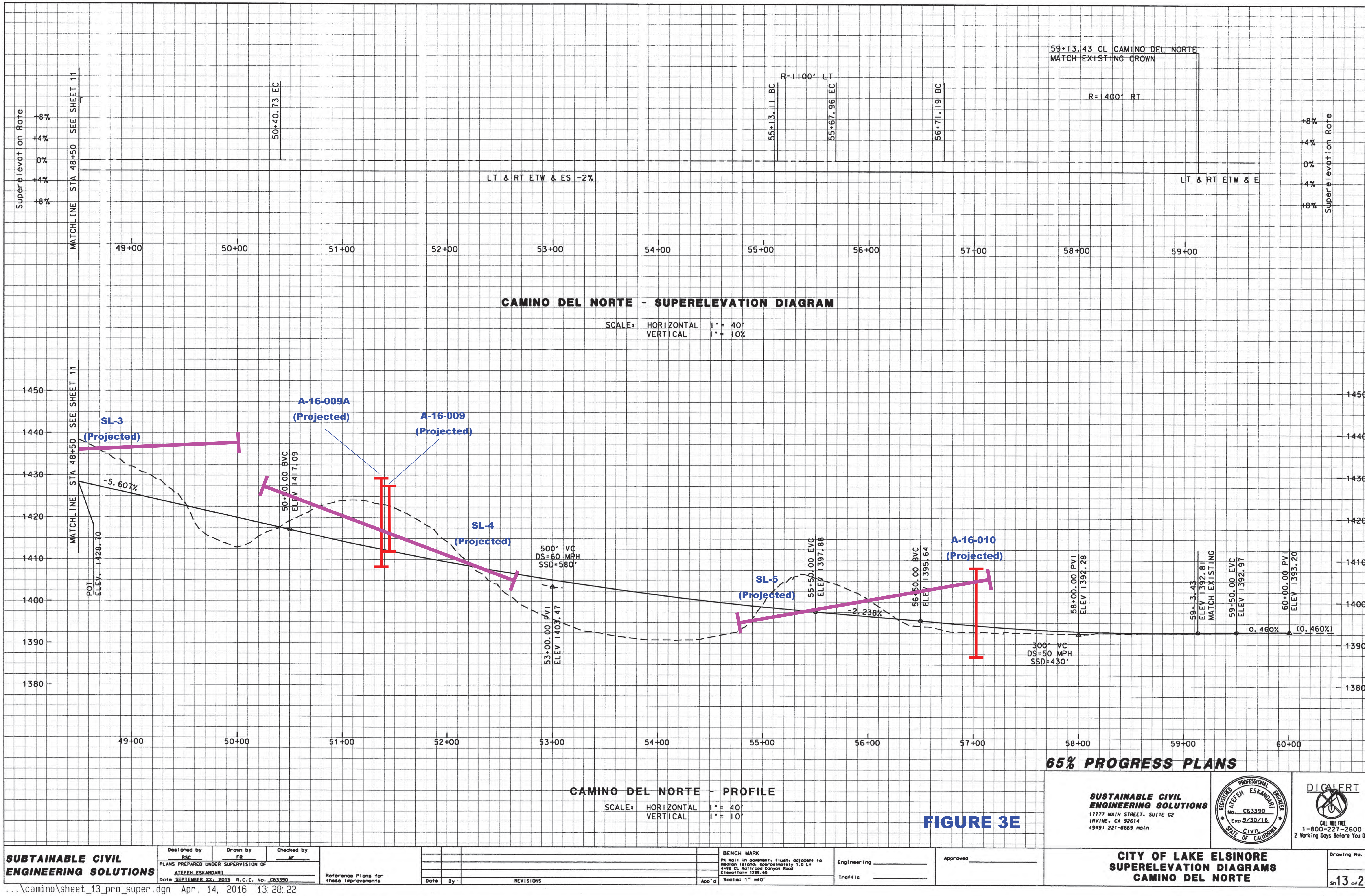
59+13.43 CL CAMINO DEL NORTE
MATCH EXISTING CROWN
R=1100' LT
R=1400' RT
50+40.73 EC
55+13.11 BC
55+67.96 EC
56+71.19 BC
Superelevation Rate
+8%
+4%
0%
+4%
+8%
MATCHLINE STA 48+50 SEE SHEET 11
LT & RT ETW & ES -2%
LT & RT ETW & E
49+00
50+00
51+00
52+00
53+00
54+00
55+00
56+00
57+00
58+00
59+00
CAMINO DEL NORTE - SUPERELEVATION DIAGRAM
SCALE: HORIZONTAL 1"= 40'
VERTICAL 1"= 10%
1450
1440
1430
1420
1410
1400
1390
1380
SL-3
(Projected)
A-16-009A
(Projected)
A-16-009
(Projected)
SL-4
(Projected)
SL-5
(Projected)
A-16-010
(Projected)
-5.607%
POT
ELEV. 1428.70
50+50.00 BVC
ELEV 1417.09
500' VC
DS=60 MPH
SSD=580'
53+00.00 PVI
ELEV 1403.47
55+50.00 EVC
ELEV 1397.88
-2.238%
56+50.00 BVC
ELEV 1395.64
58+00.00 PVI
ELEV 1392.28
300' VC
DS=50 MPH
SSD=430'
59+13.43
ELEV 1392.81
MATCH EXISTING
59+50.00 EVC
ELEV 1392.97
60+00.00 PVI
ELEV 1393.20
0.460%
(0.460%)
60+00
CAMINO DEL NORTE - PROFILE
SCALE: HORIZONTAL 1"= 40'
VERTICAL 1"= 10'
65% PROGRESS PLANS
FIGURE 3E
SUSTAINABLE CIVIL
ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main
REGISTERED PROFESSIONAL ENGINEER
ATEFEH ESKANDARI
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ENGINEERING SOLUTIONS
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Checked by AE
PLANS PREPARED UNDER SUPERVISION OF
ATEFEH ESKANDARI
Date SEPTEMBER XX, 2015 R.C.E. No. C63390
Reference Plans for these improvements
Date
By
REVISIONS
App'd
BENCH MARK
Scale: 1" =40'
Engineering
Traffic
Approved
CITY OF LAKE ELSINORE
SUPERELEVATION DIAGRAMS
CAMINO DEL NORTE
Drawing No.
Sh 13 of 28
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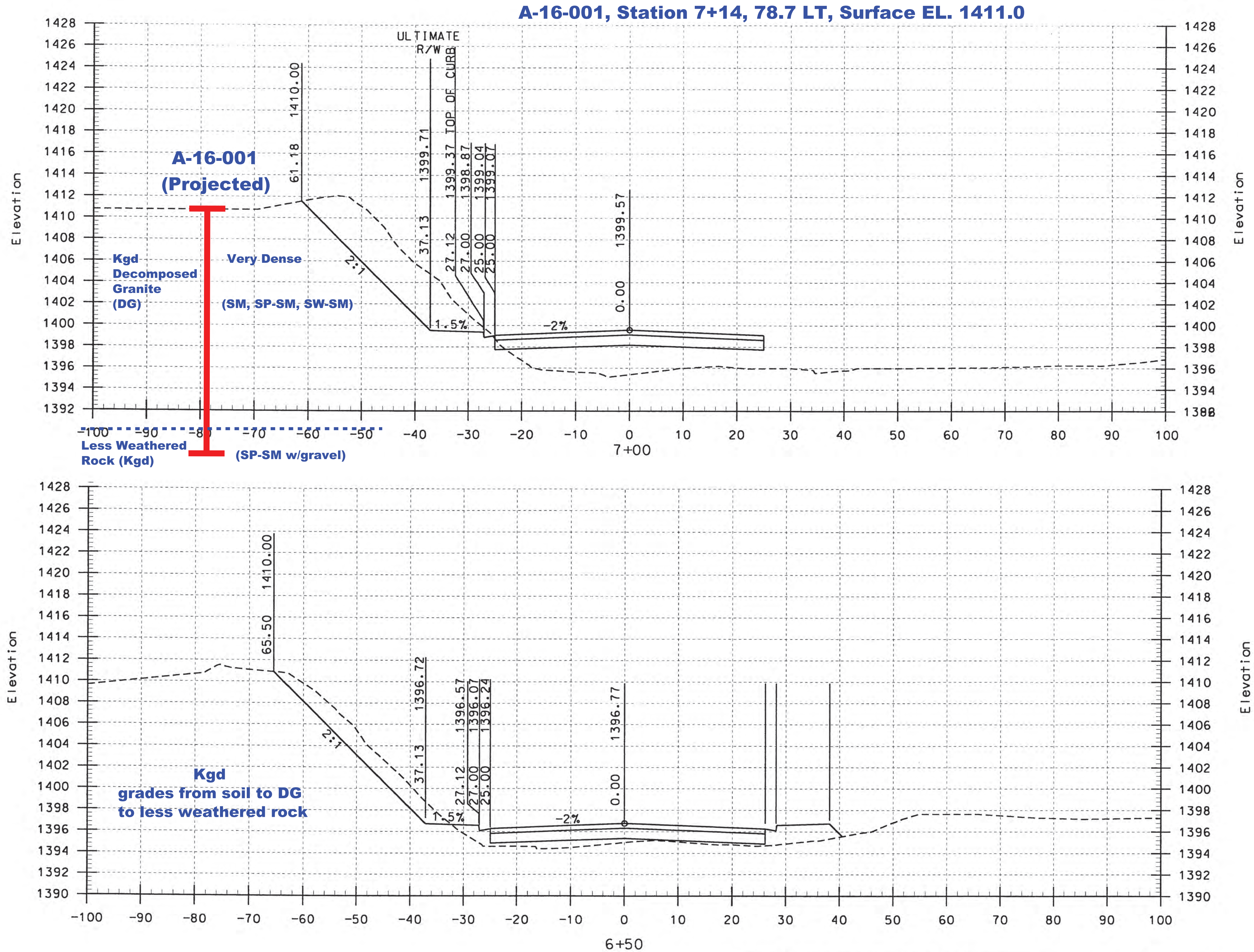

FIGURE 4A

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 2 OF 63 SHTS.
PREPARED BY: R.S. CHAVEZ; R.C.E. NO. 41904; DATE 4/2016; SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE; W.O.:	

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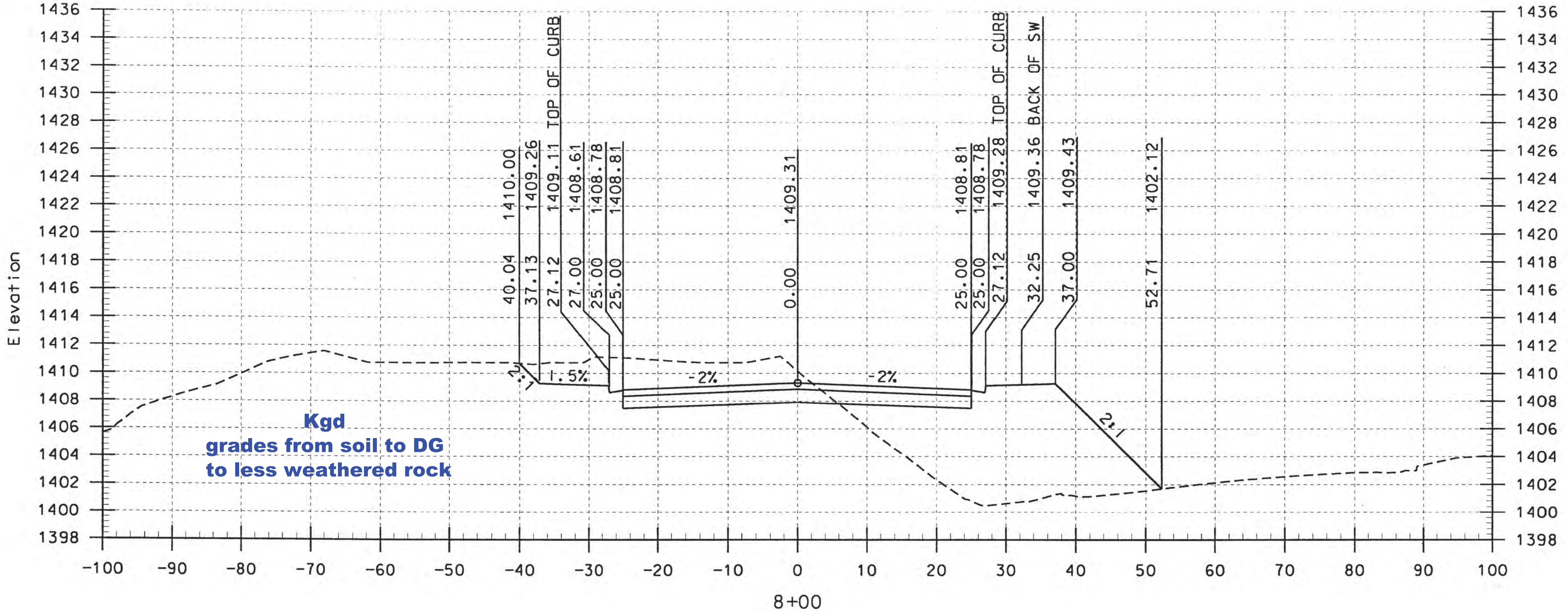

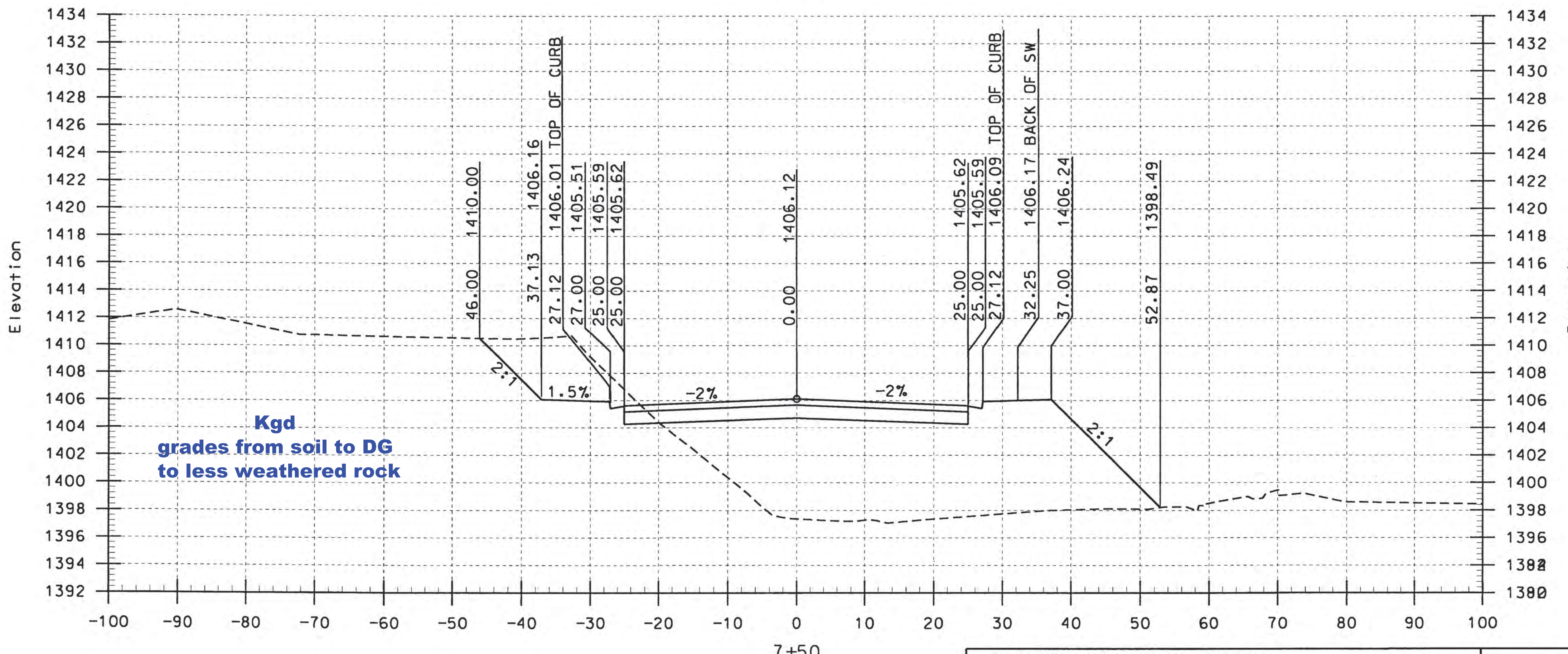

FIGURE 4B

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 3 OF 63 SHTS.
PREPARED BY: R.S. CHAVEZ — RCE.NO. 41504 — DATE 4/2016 — SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE — W.O.:	

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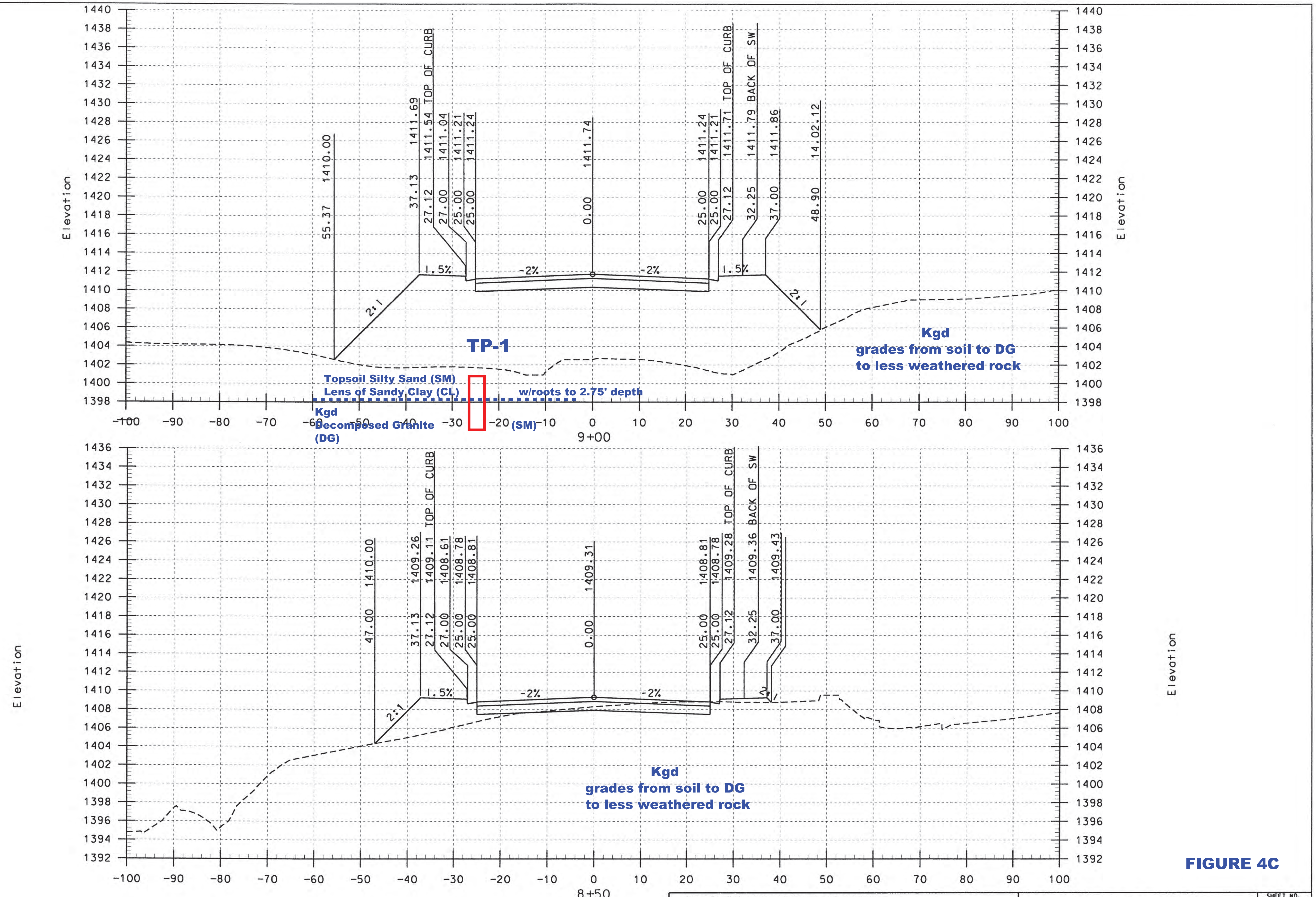

FIGURE 4C

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ
RCE NO. 41904
DATE 4/2016
SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE
W.O.:

SHEET NO. 4 OF 63 SHTS.

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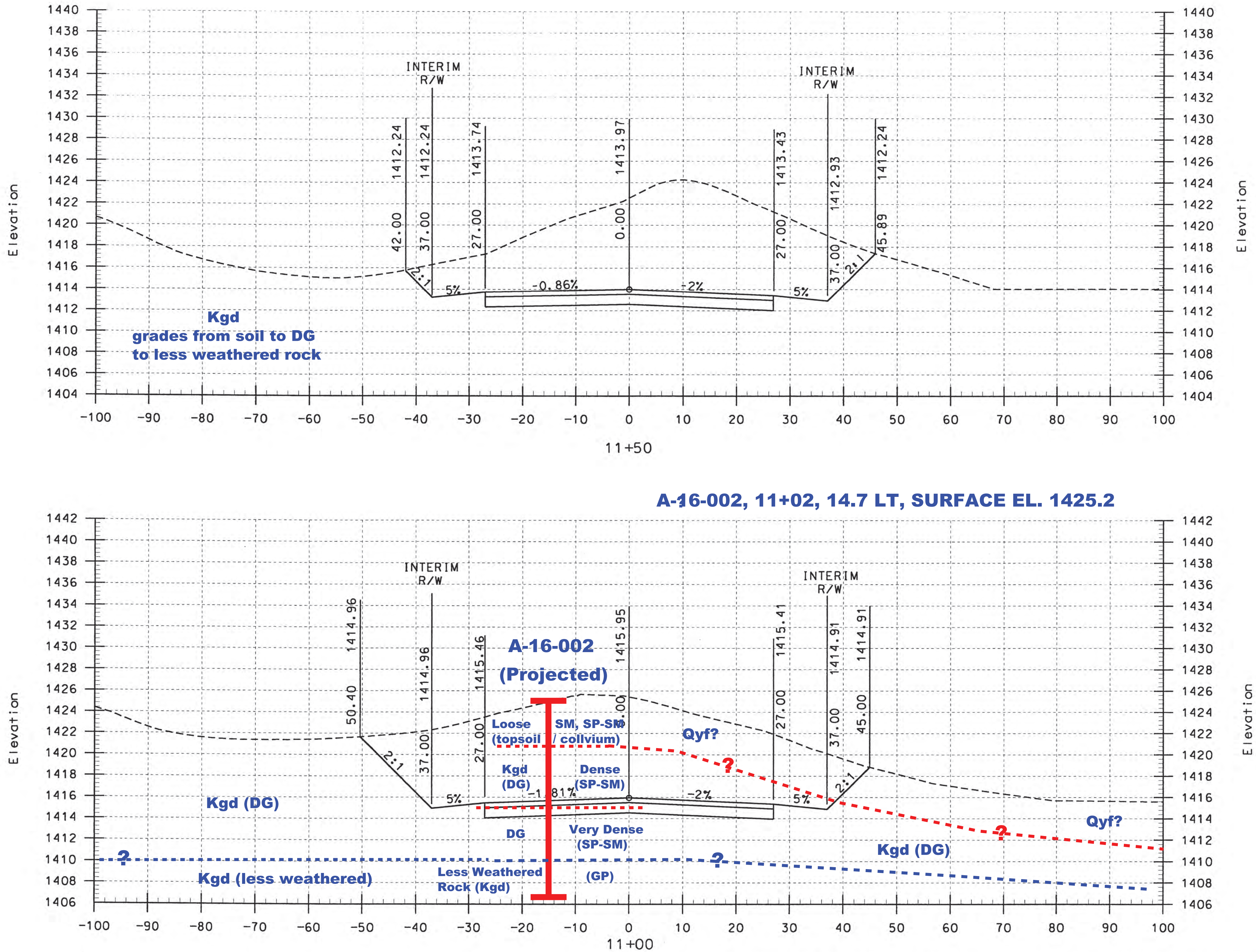

FIGURE 4D

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 5 OF 63 SHTS.

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

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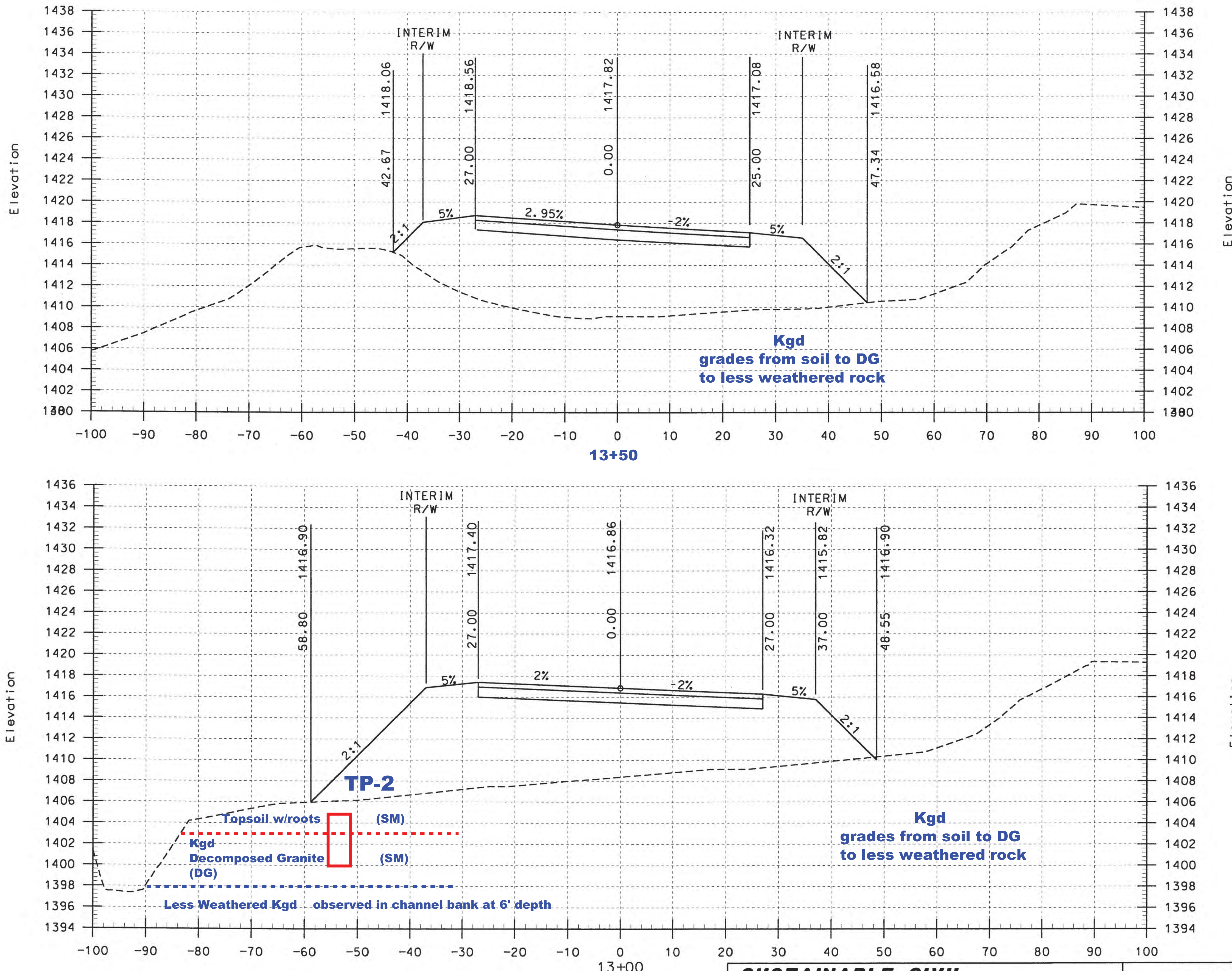

FIGURE 4E

Note: 2x Vertical Exaggeration

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SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41504 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 7 OF 63 SHTS.

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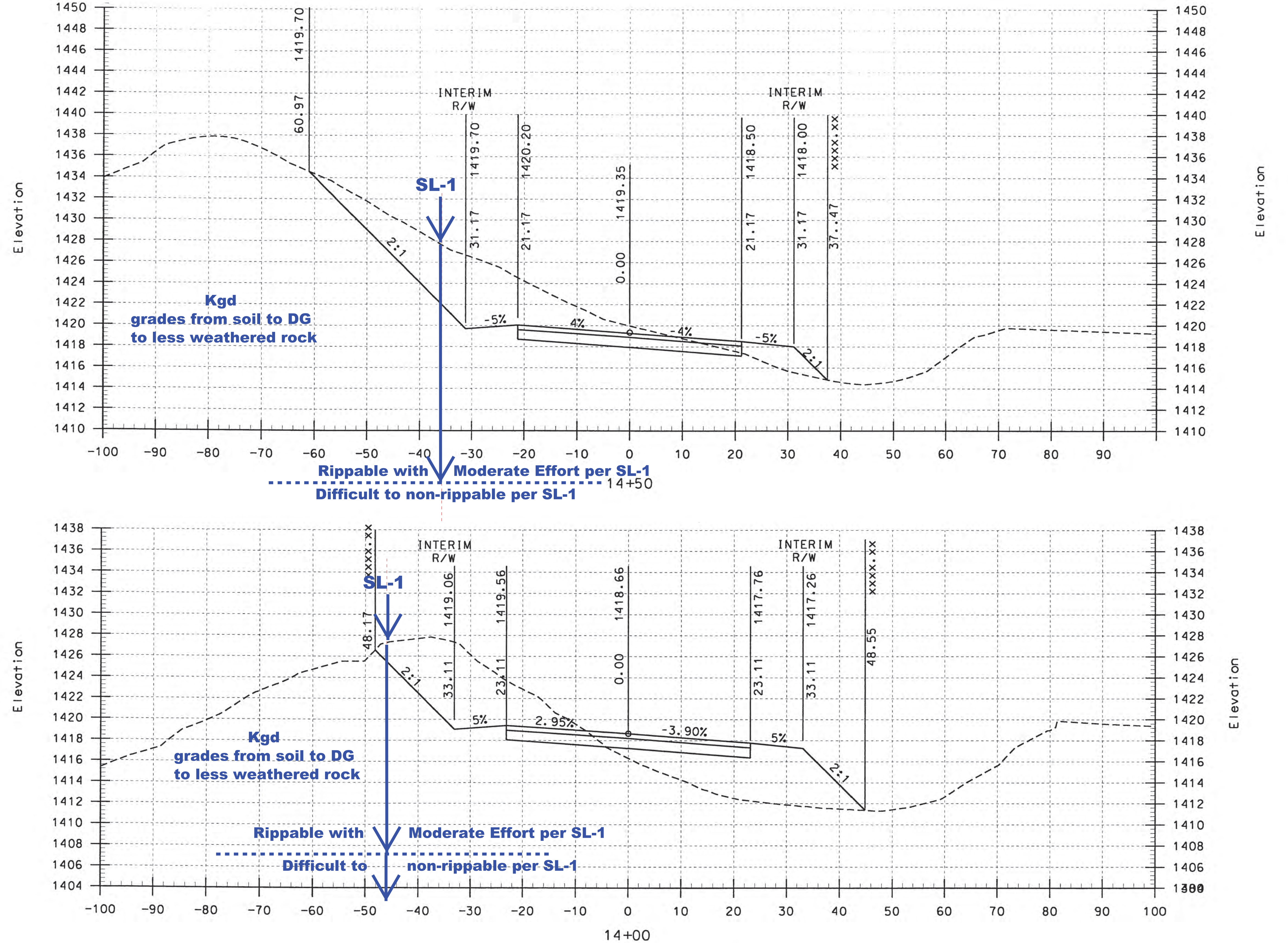

FIGURE 4F

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main		CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 8
PREPARED BY: R.S. CHAVEZ	RCE.NO. 41904 DATE 4/2016 SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE W.O.:	OF 63 SHTS.

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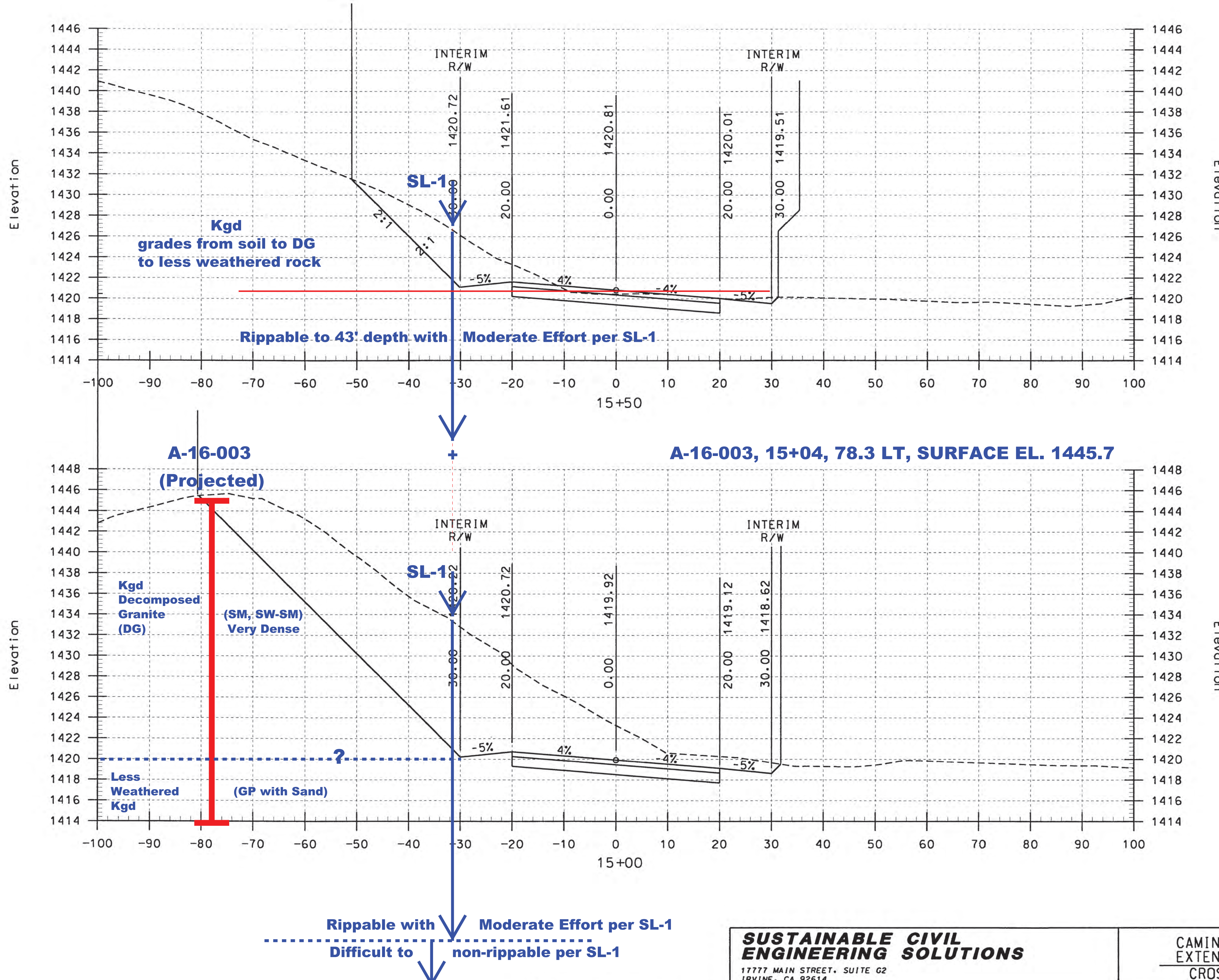

FIGURE 4G

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 9 OF 63 SHTS.

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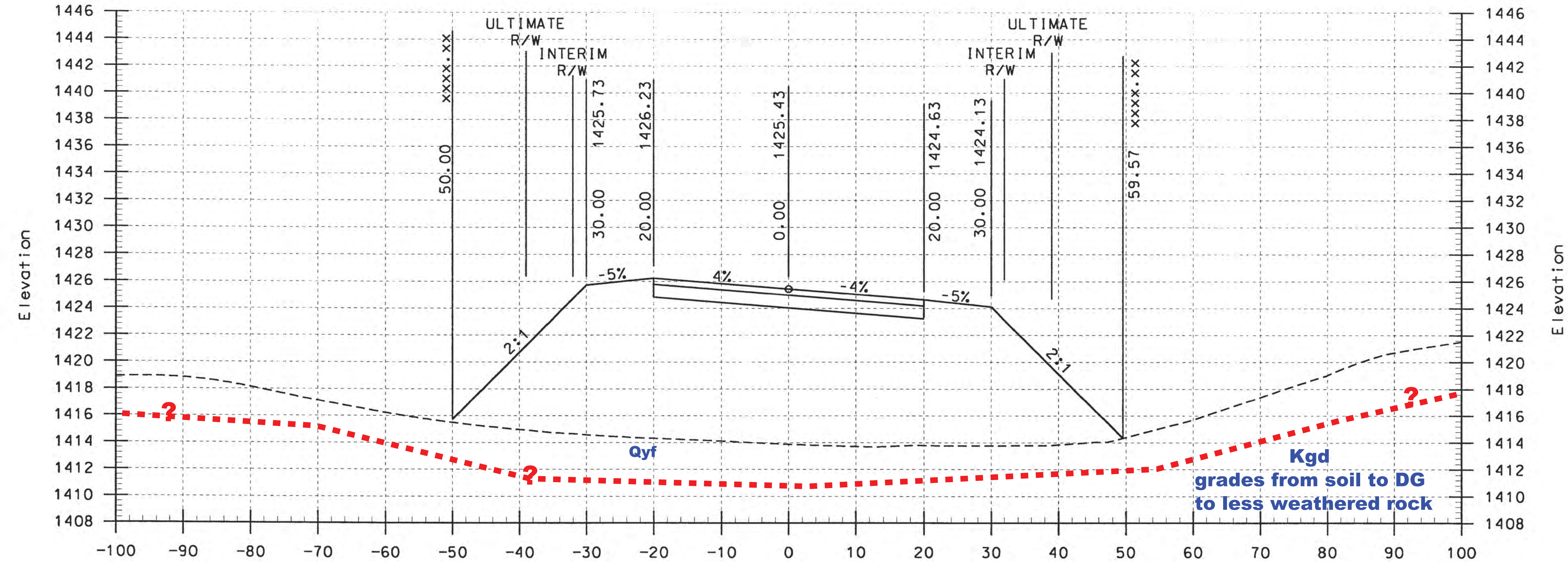
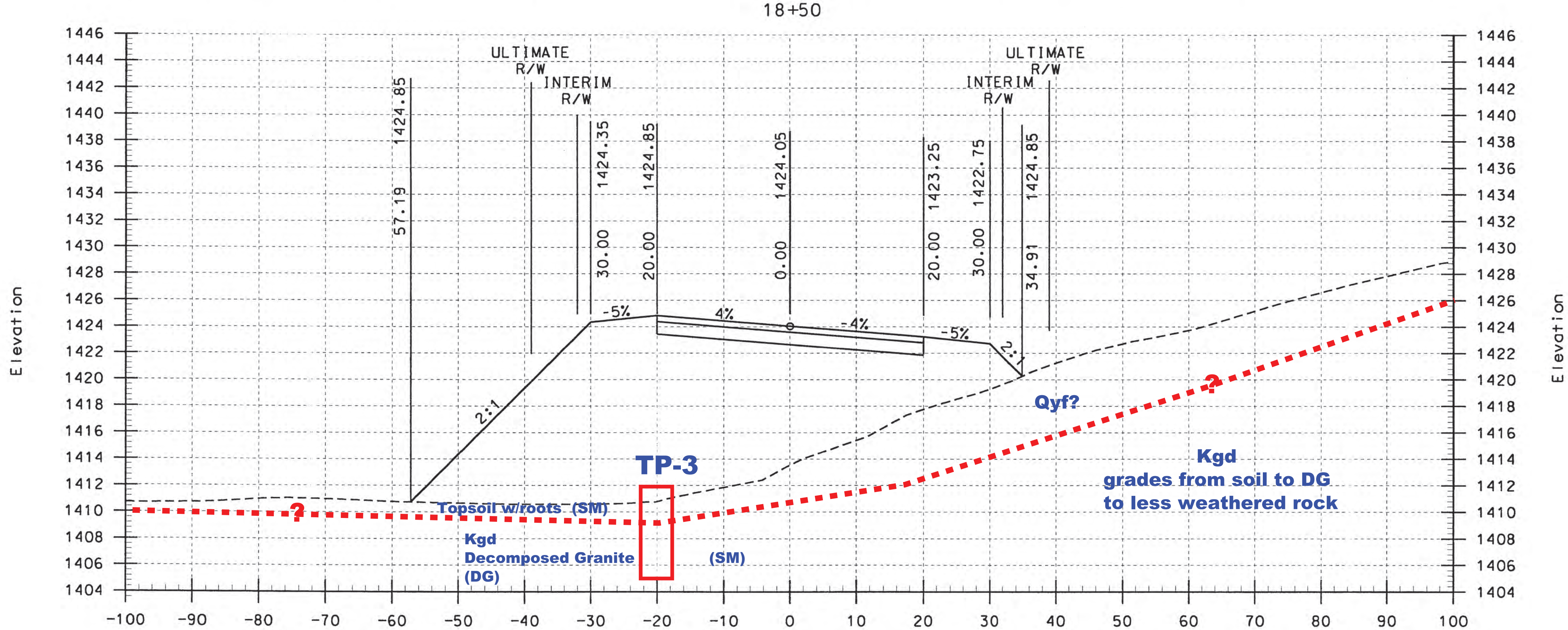


18+50



18+00

FIGURE 4H

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ
R.C.E. NO. 41904
DATE 4/2016
SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE
W.O.:

SHEET NO. 12 OF 63 SHTS.

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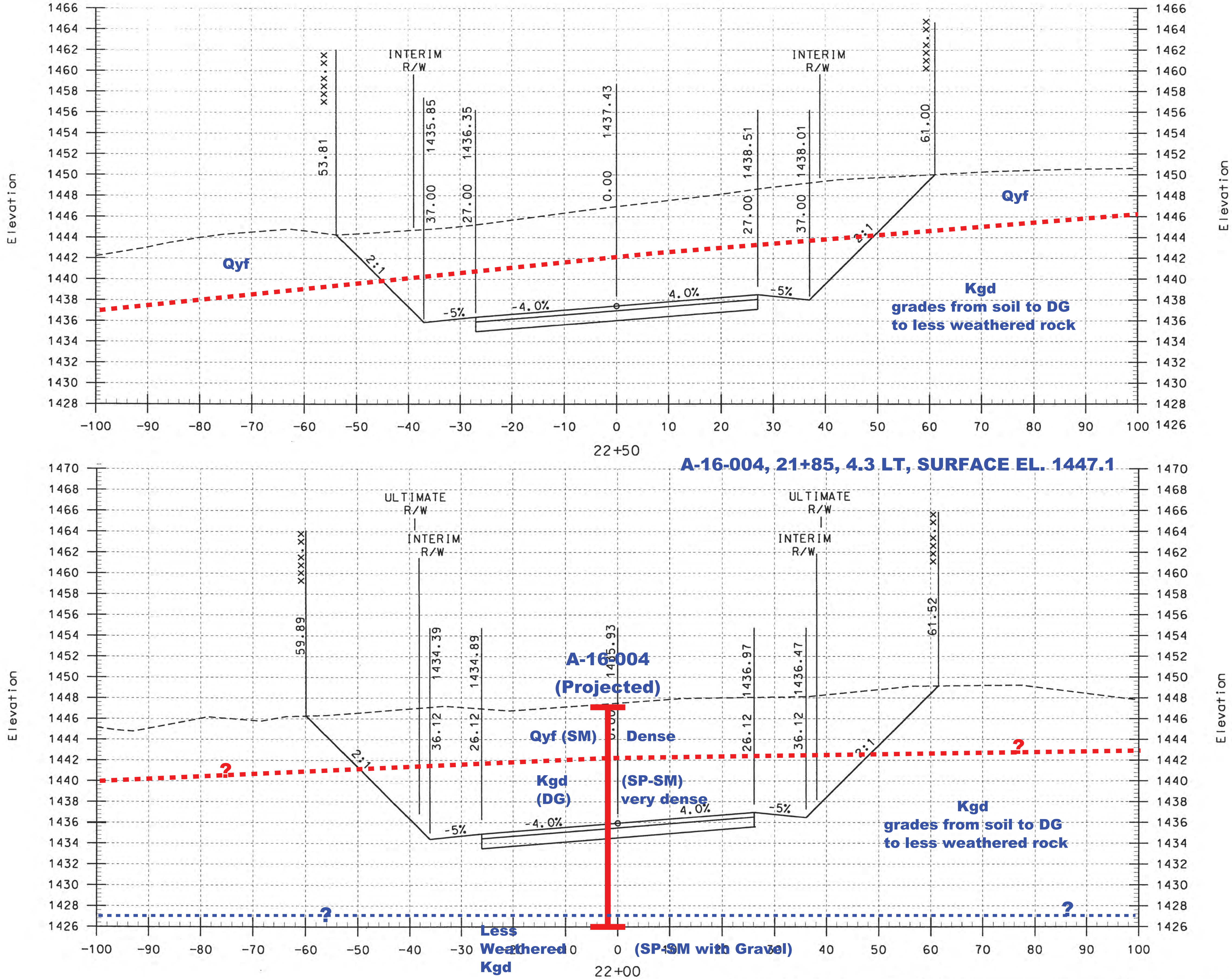

FIGURE 4I

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 16
PREPARED BY: R.S. CHAVEZ — R.C.E. NO. 41904 — DATE 4/2016 — SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE — W.O.:	OF 63 SHTS.

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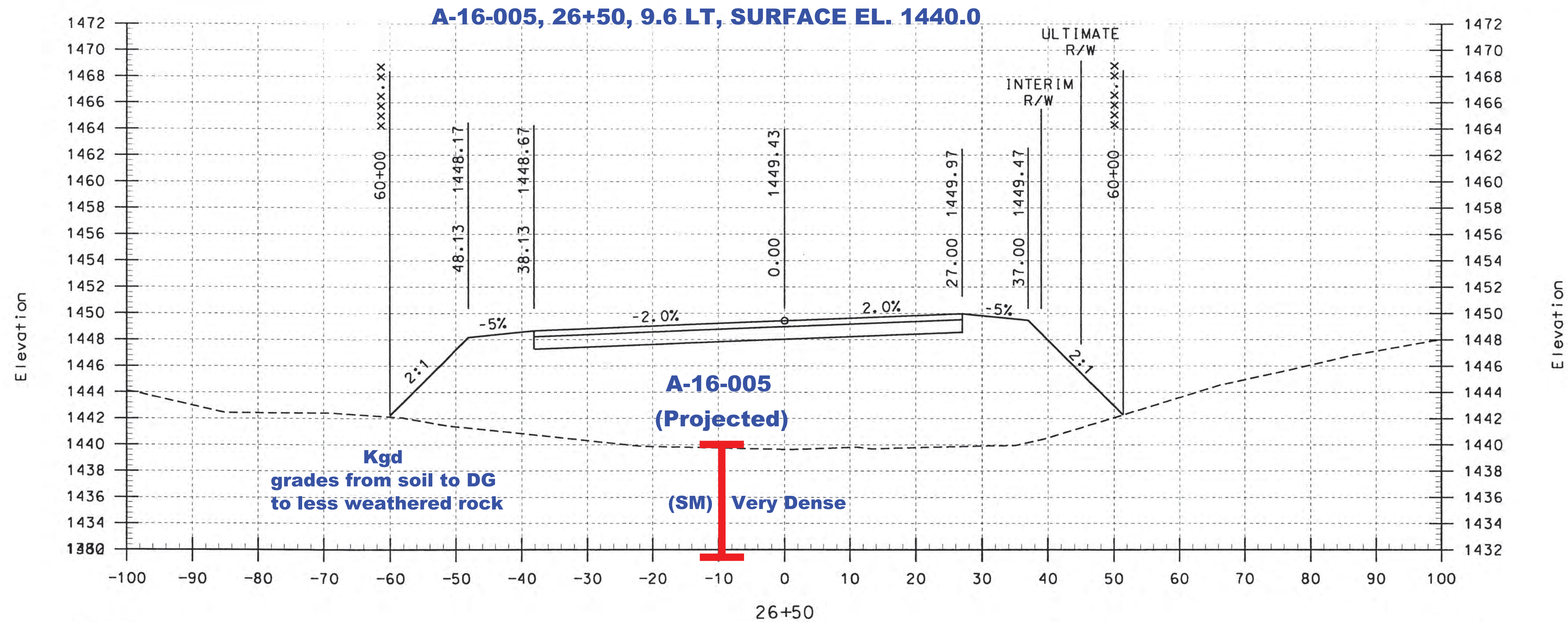

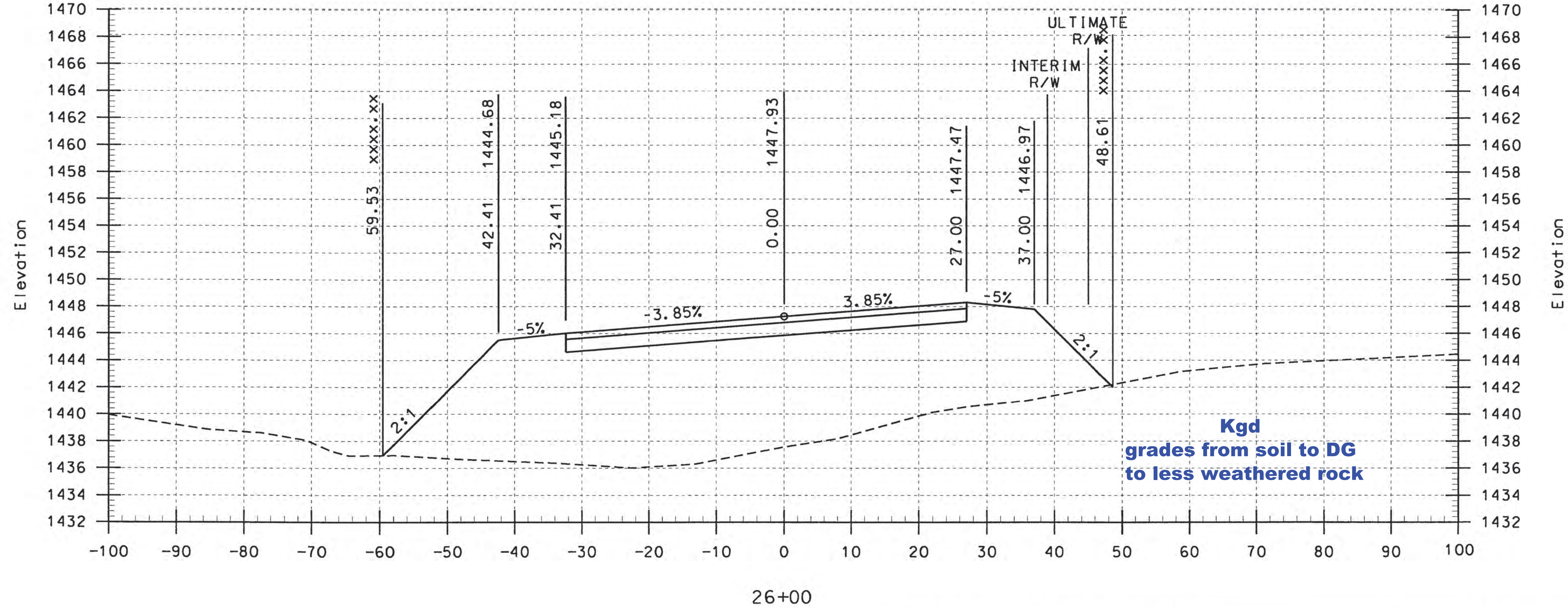

FIGURE 4J

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 20 OF 63 SHTS.
PREPARED BY: R.S. CHAVEZ — R.C.E. NO. 41904 — DATE 4/2016 — SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE — W.O.:	

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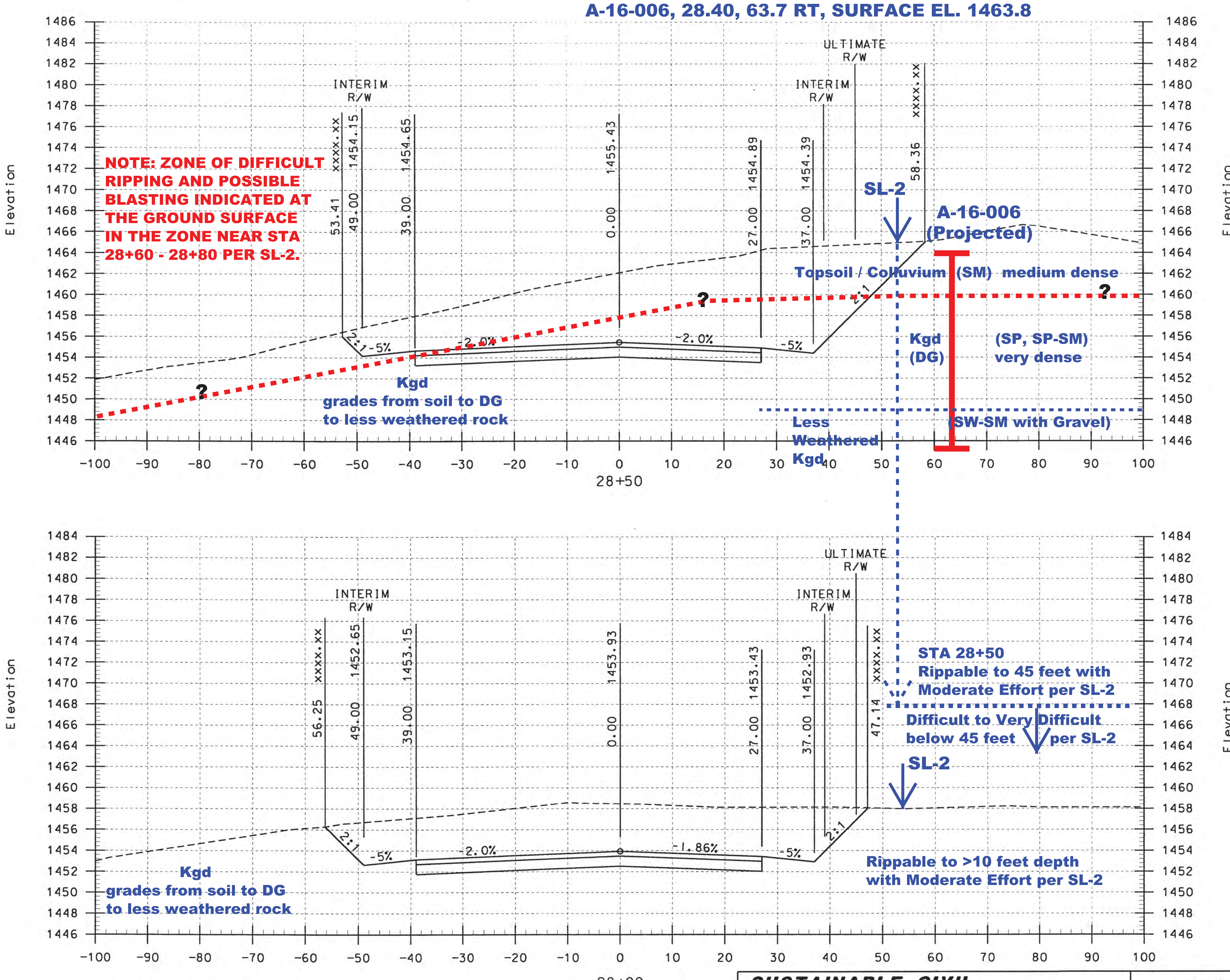

FIGURE 4K

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41504 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 22 OF 63 SHTS.

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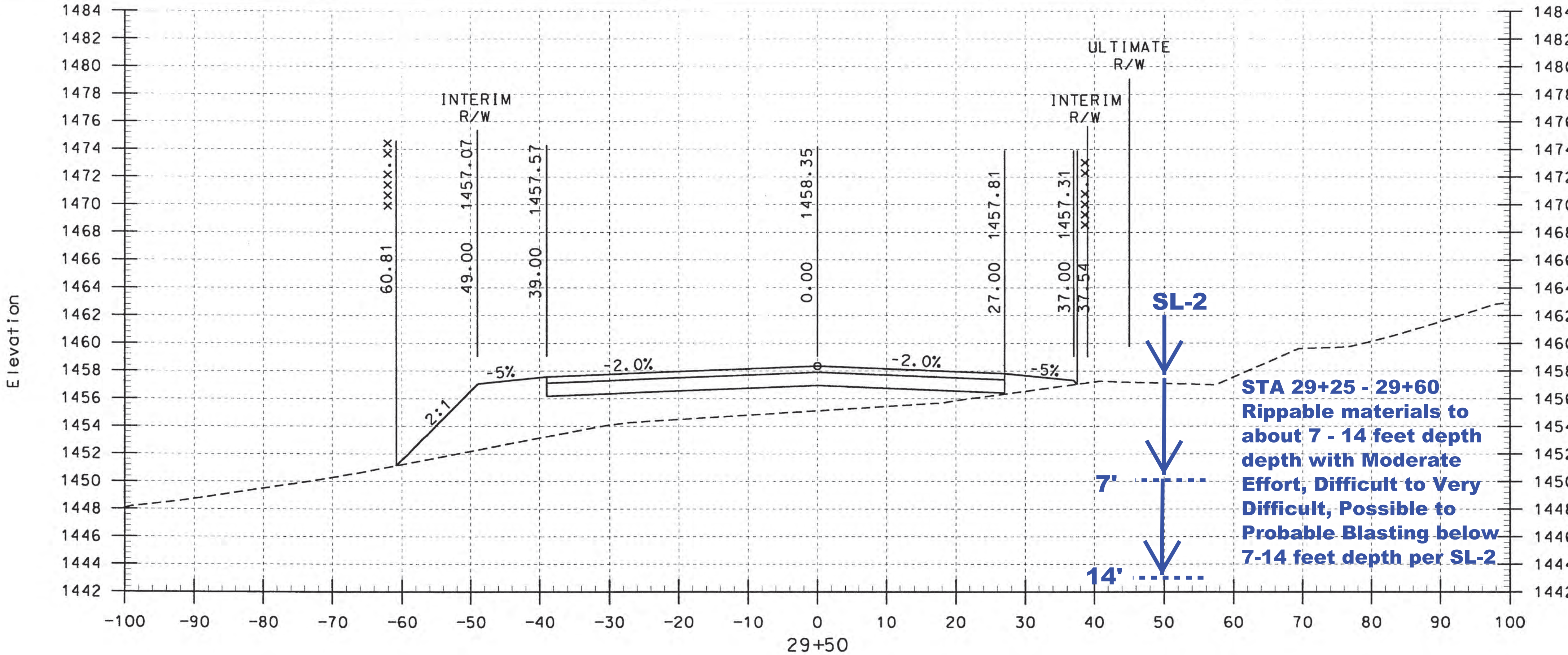

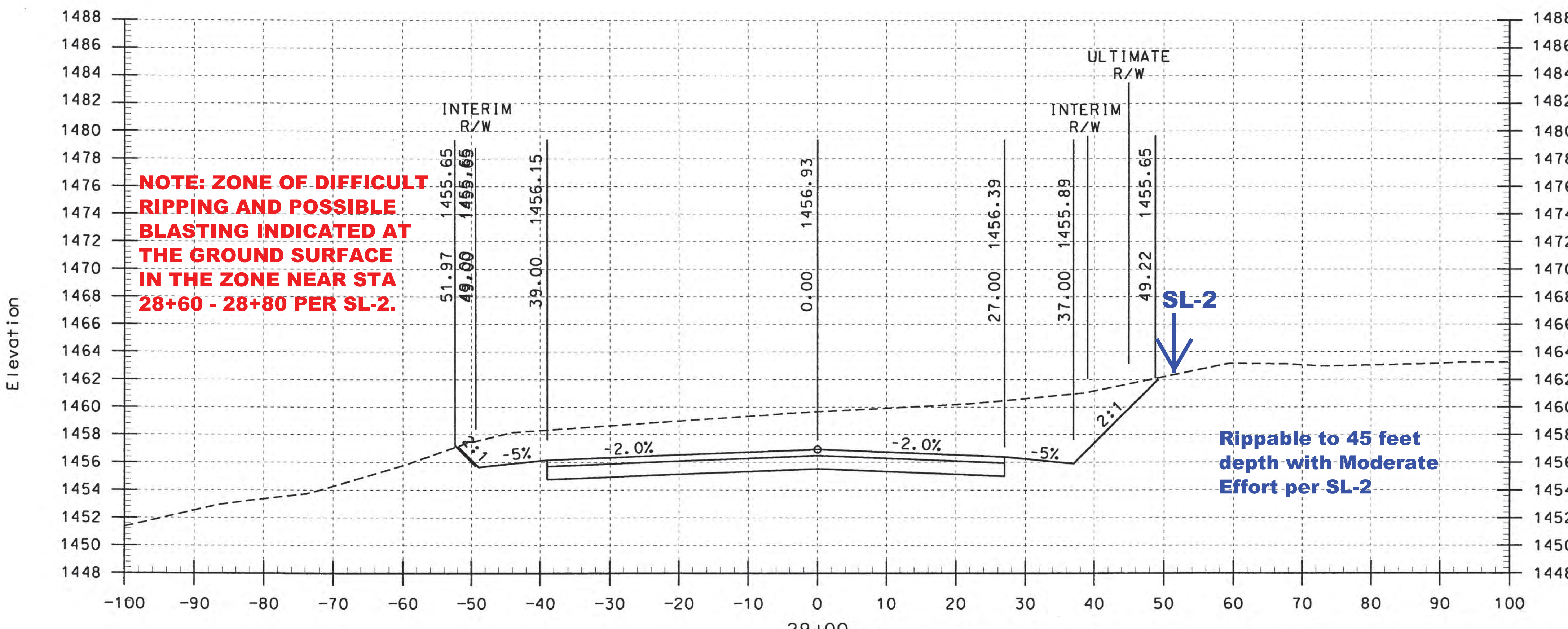

FIGURE 4L

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | RCE NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 23 OF 63 SHTS.

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A-16-007, 33+49, 4.4 LT, SURFACE EL. 1457.6

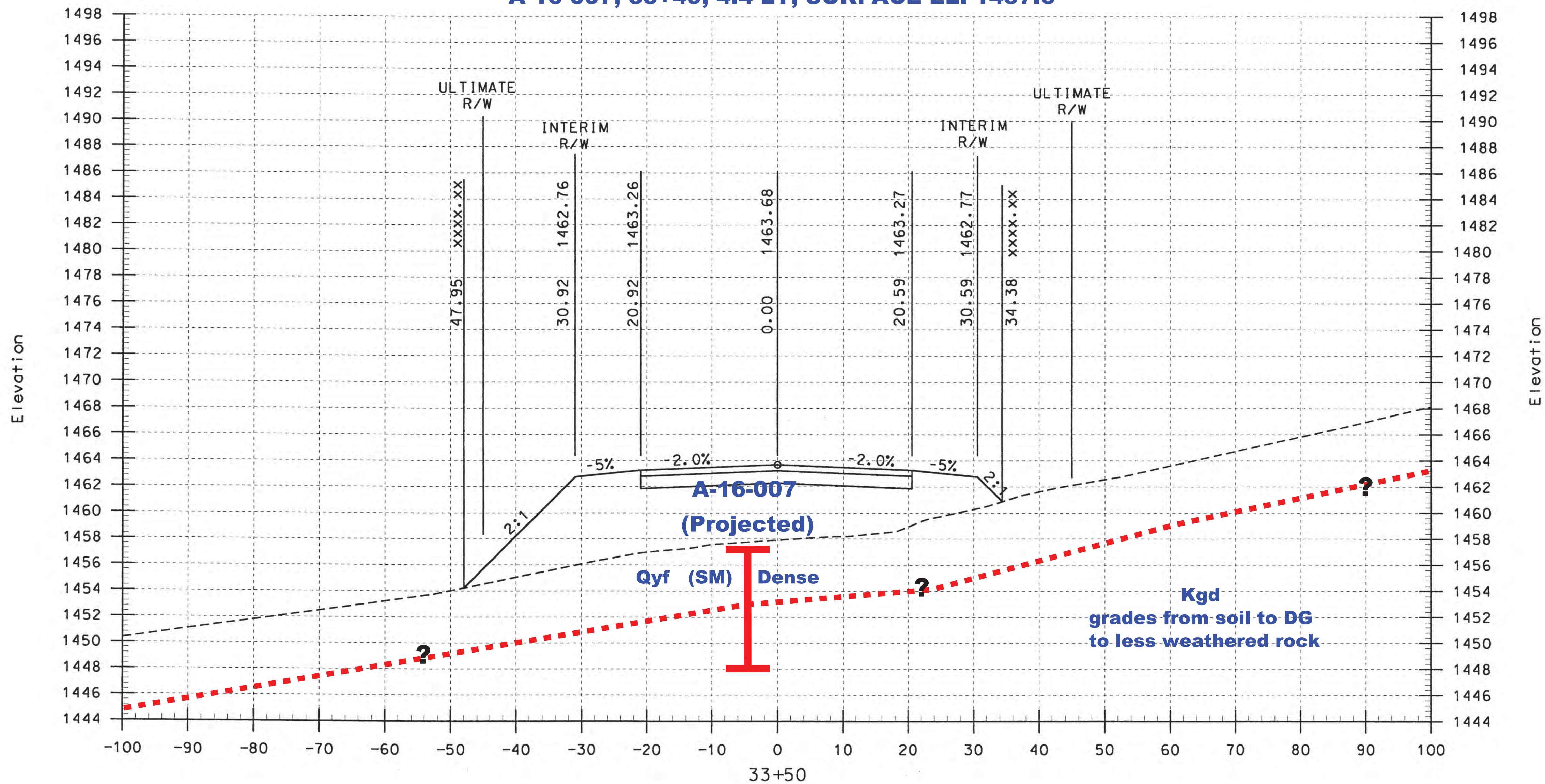

FIGURE 4M

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10' | FOR: CITY OF LAKE ELSINORE | W.O.:

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

SHEET NO. 30 OF 63 SHTS.

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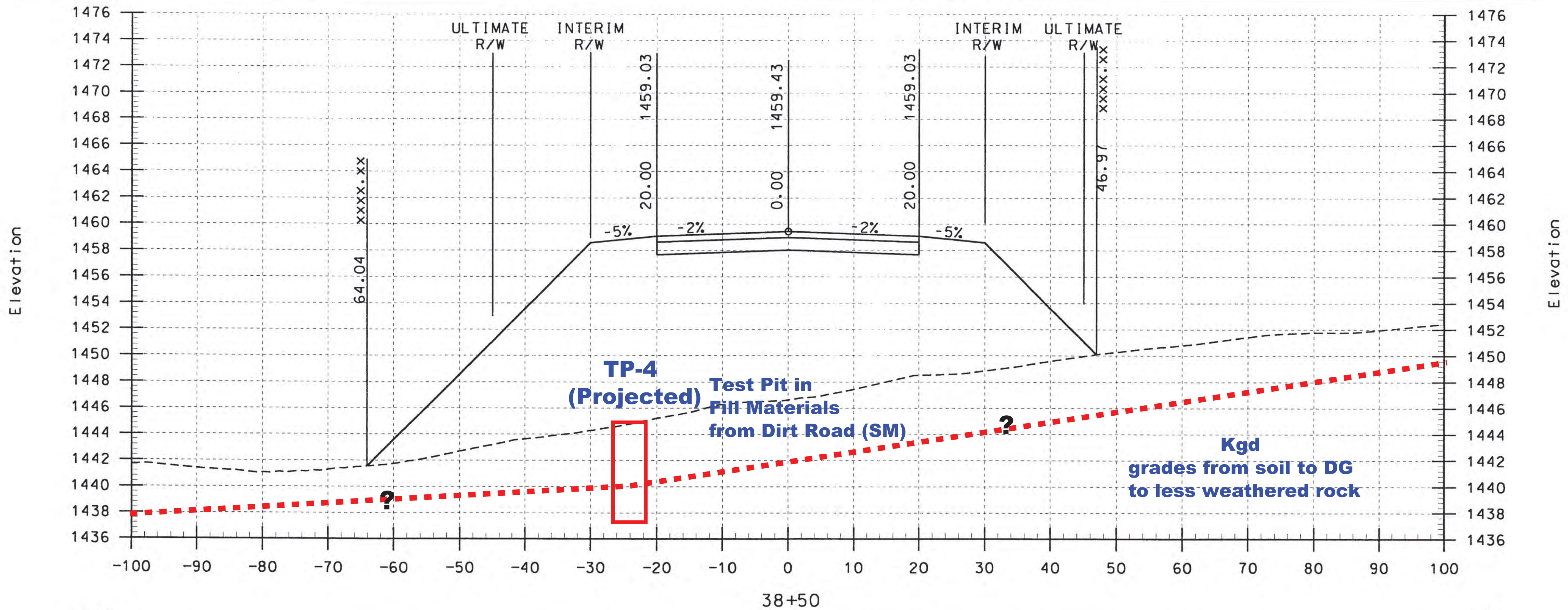

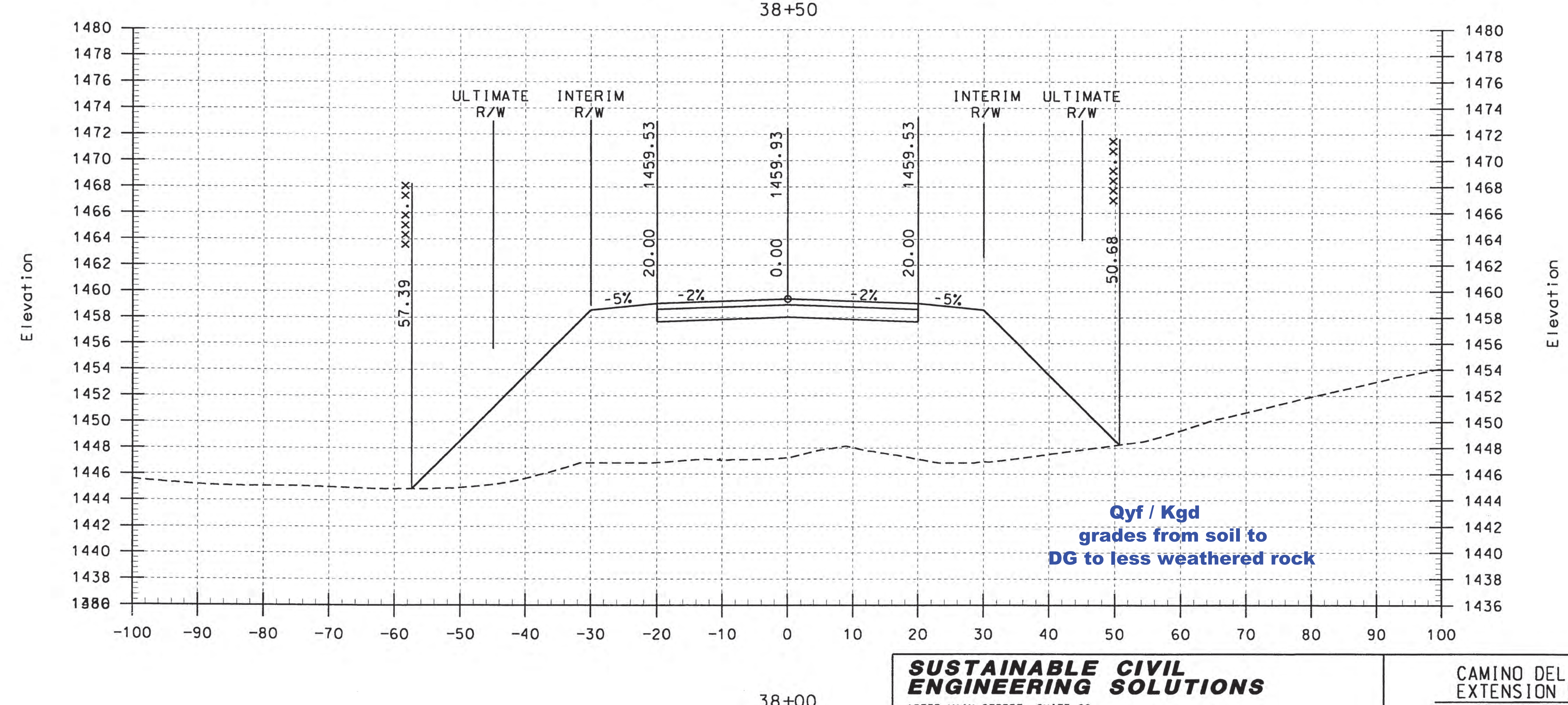

FIGURE 4N

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS

17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ

R.C.E. NO. 41904

DATE 4/2016

SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE

W.O.:

SHEET NO. 35 OF 63 SHTS.

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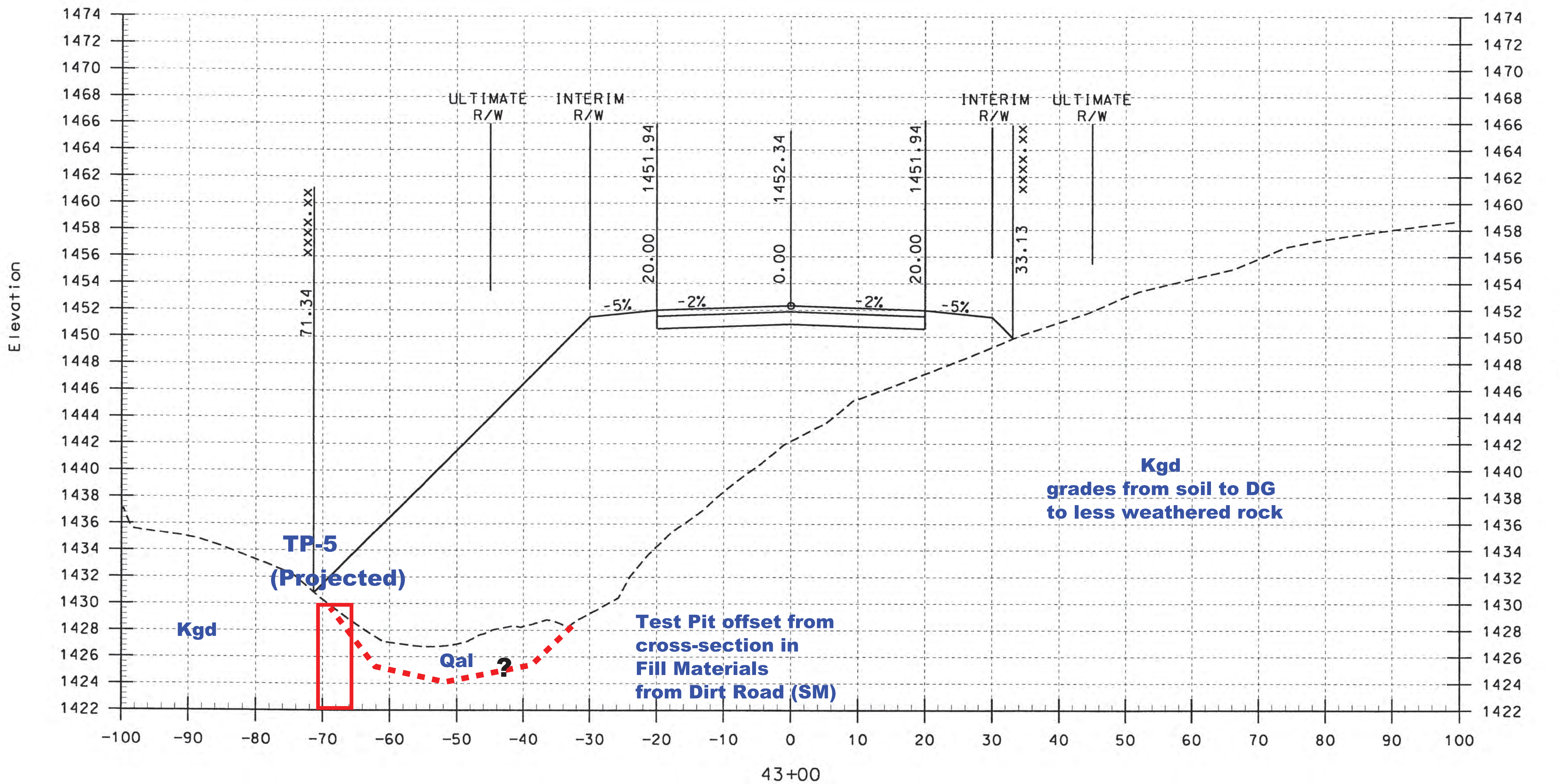

FIGURE 40

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 40	OF 63 SHTS.
PREPARED BY: R.S. CHAVEZ — RCE NO. 41904 — DATE 4/2016 — SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE	W.O.:	

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SECTION AT HIGHEST FILL SLOPE

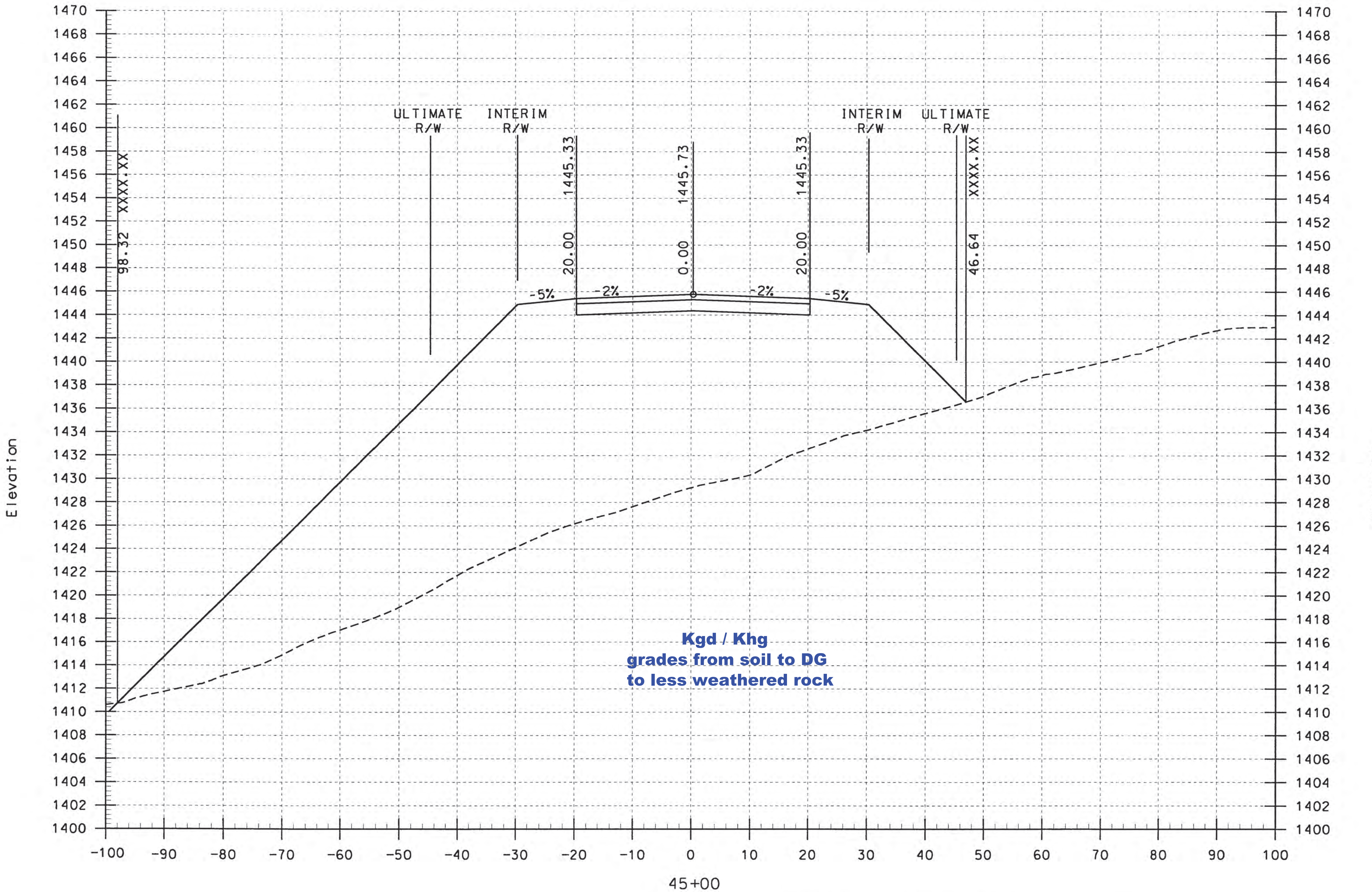

FIGURE 4P

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ
RCE NO. 41904
DATE 4/2016
SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE
W.O.:

SHEET NO. 44 OF 63 SHTS.

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A-16-008, 46+16, 23.5 RT, SURFACE EL. 1415.5

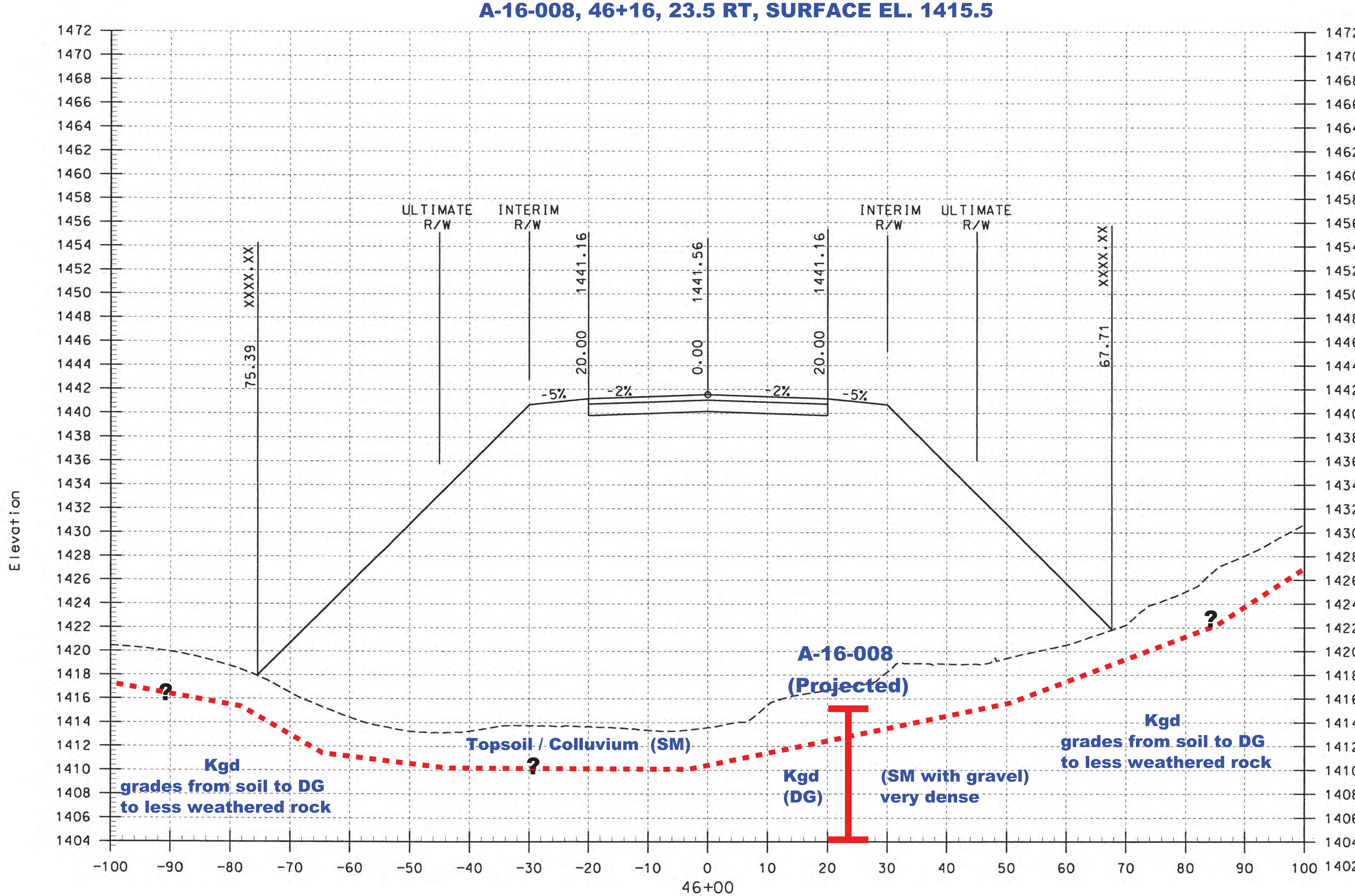

FIGURE 4Q

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 46 OF 63 SHTS.
PREPARED BY: R.S. CHAVEZ / R.C.E.NO. 41904 / DATE 4/2016 / SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE	W.O.:

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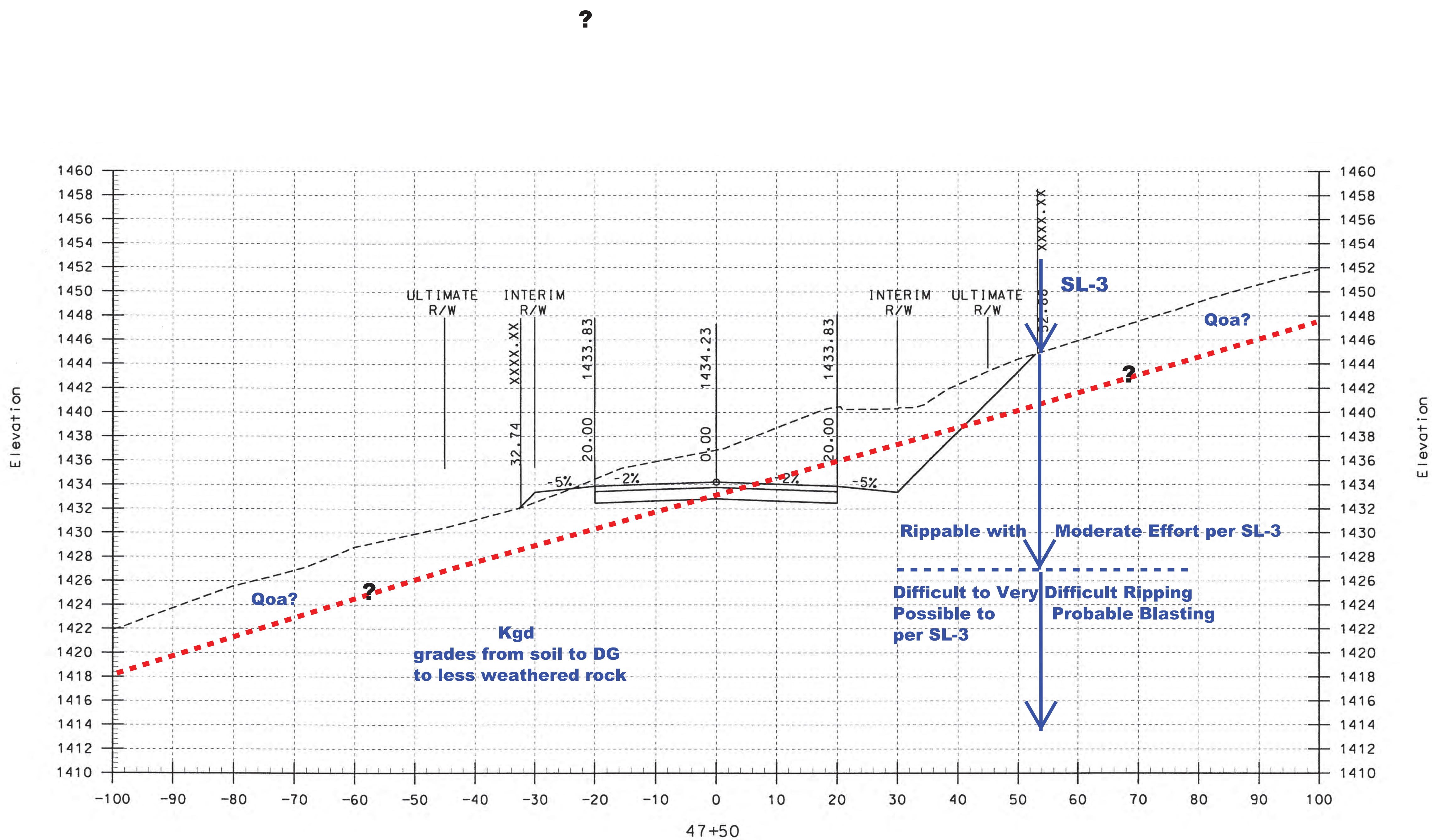

FIGURE 4R

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 49 OF 63 SHTS.

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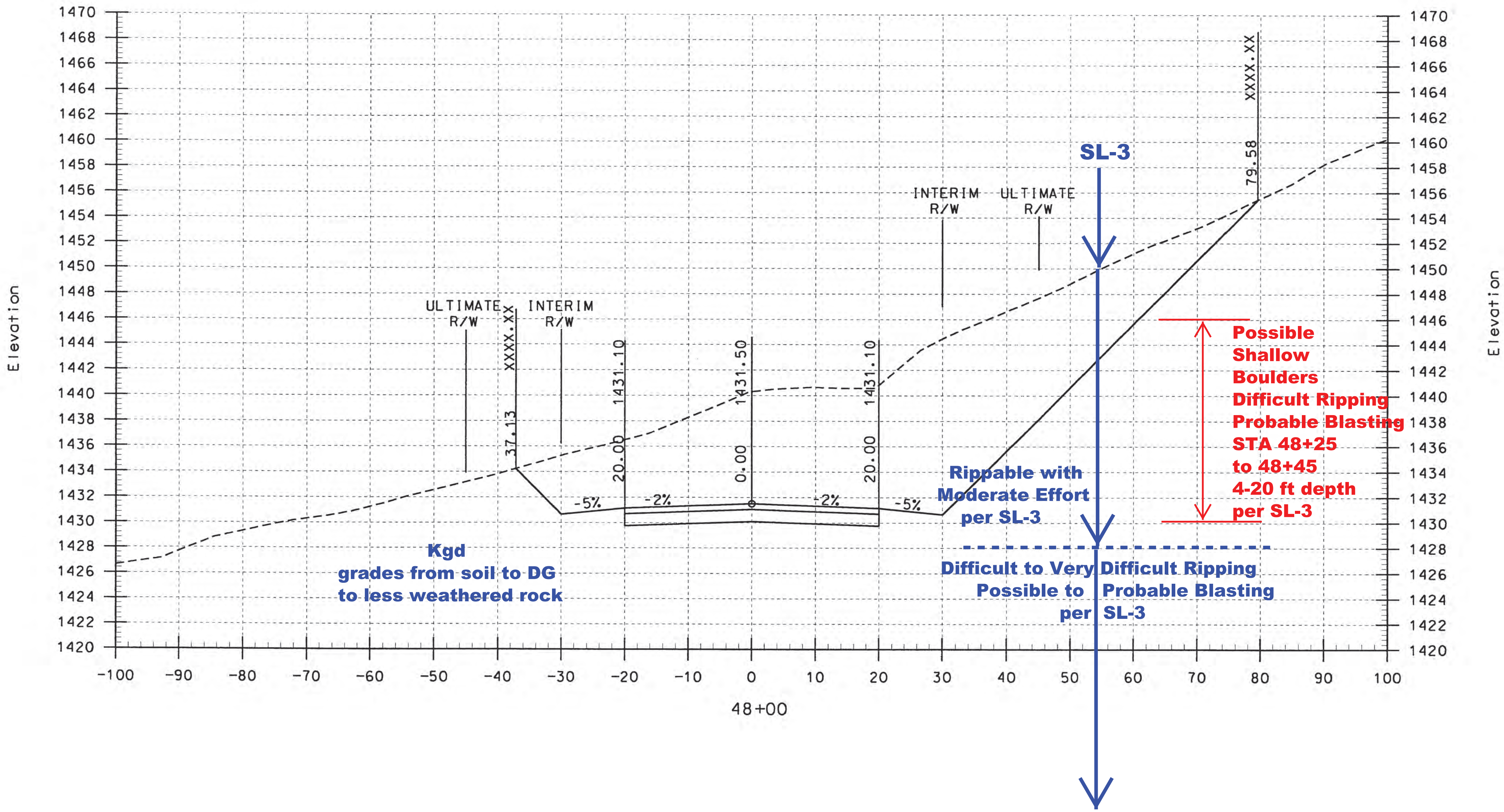

FIGURE 4S

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS		SHEET NO. 50
PREPARED BY: R.S. CHAVEZ / R.C.E. NO. 41904 / DATE 4/2016 / SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE	W.O.:	OF 63 SHTS.

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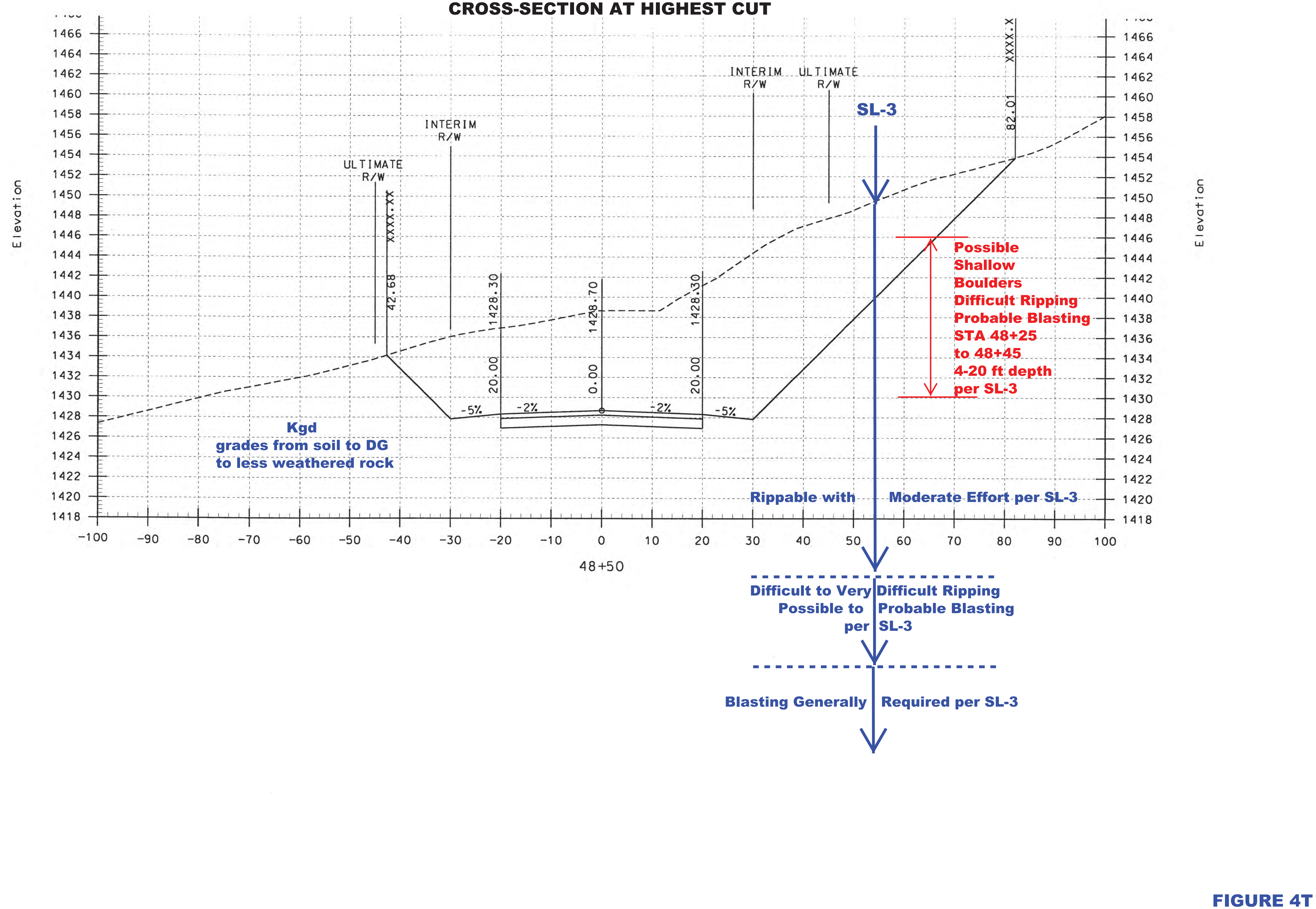

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 51
PREPARED BY: R.S. CHAVEZ · RCE NO. 41904 · DATE 4/2016 · SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE · W.O.:	OF 63 SHTS.

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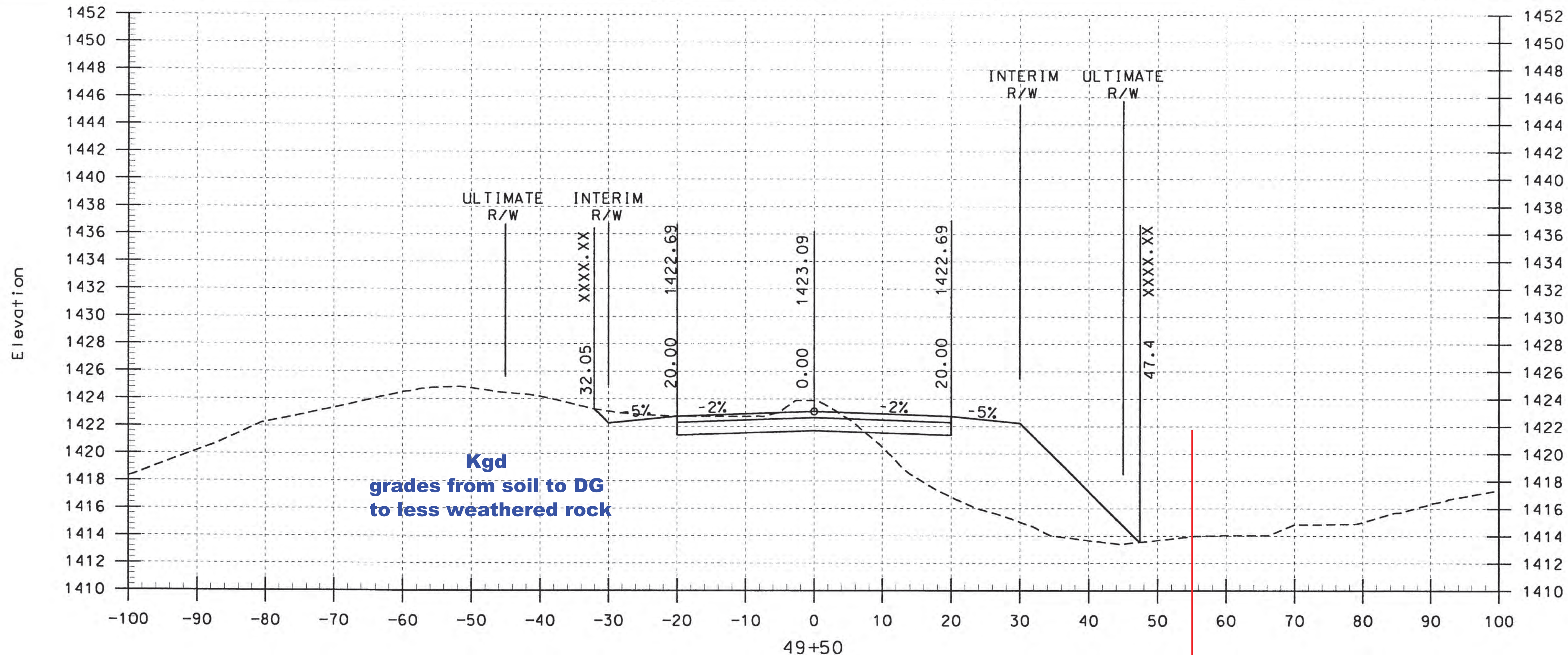

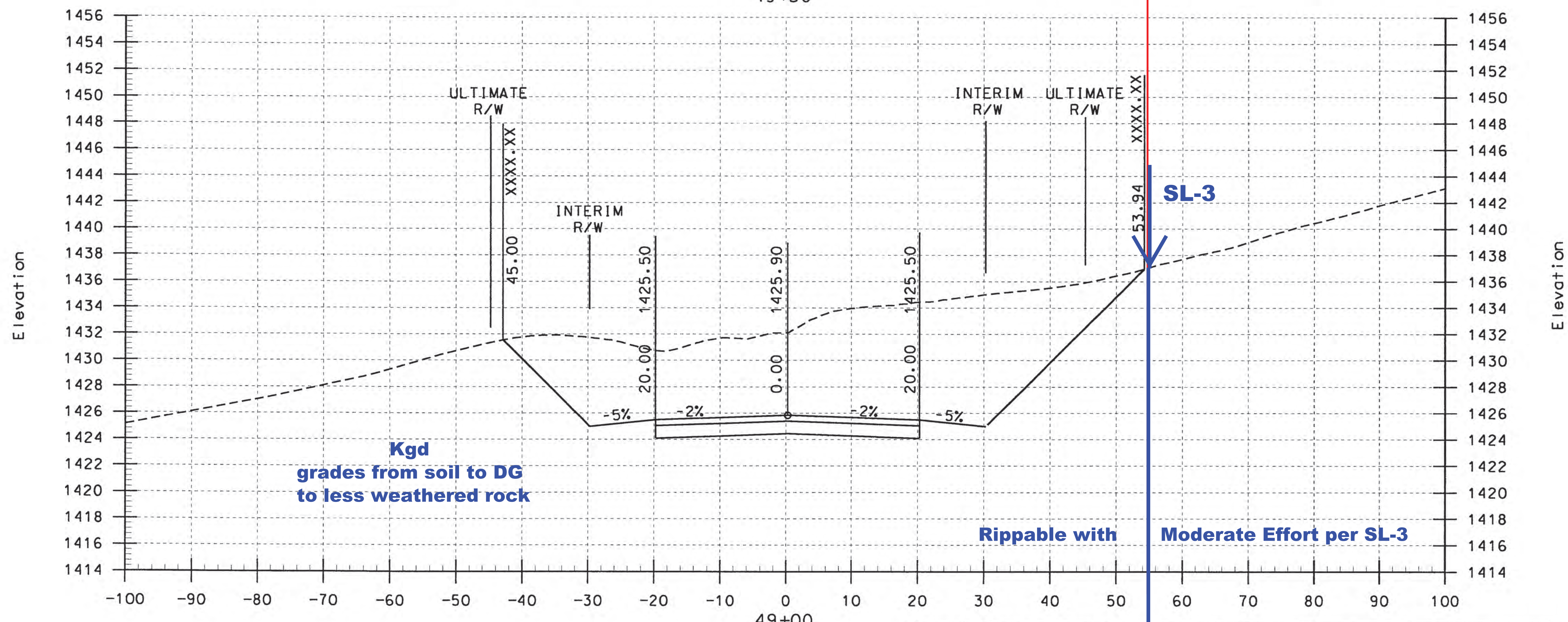

FIGURE 4U

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN ST
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ
RCE.NO. 41904
DATE 4/2016
SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE
W.O.:

SHEET NO. 52 OF 63 SHTS.

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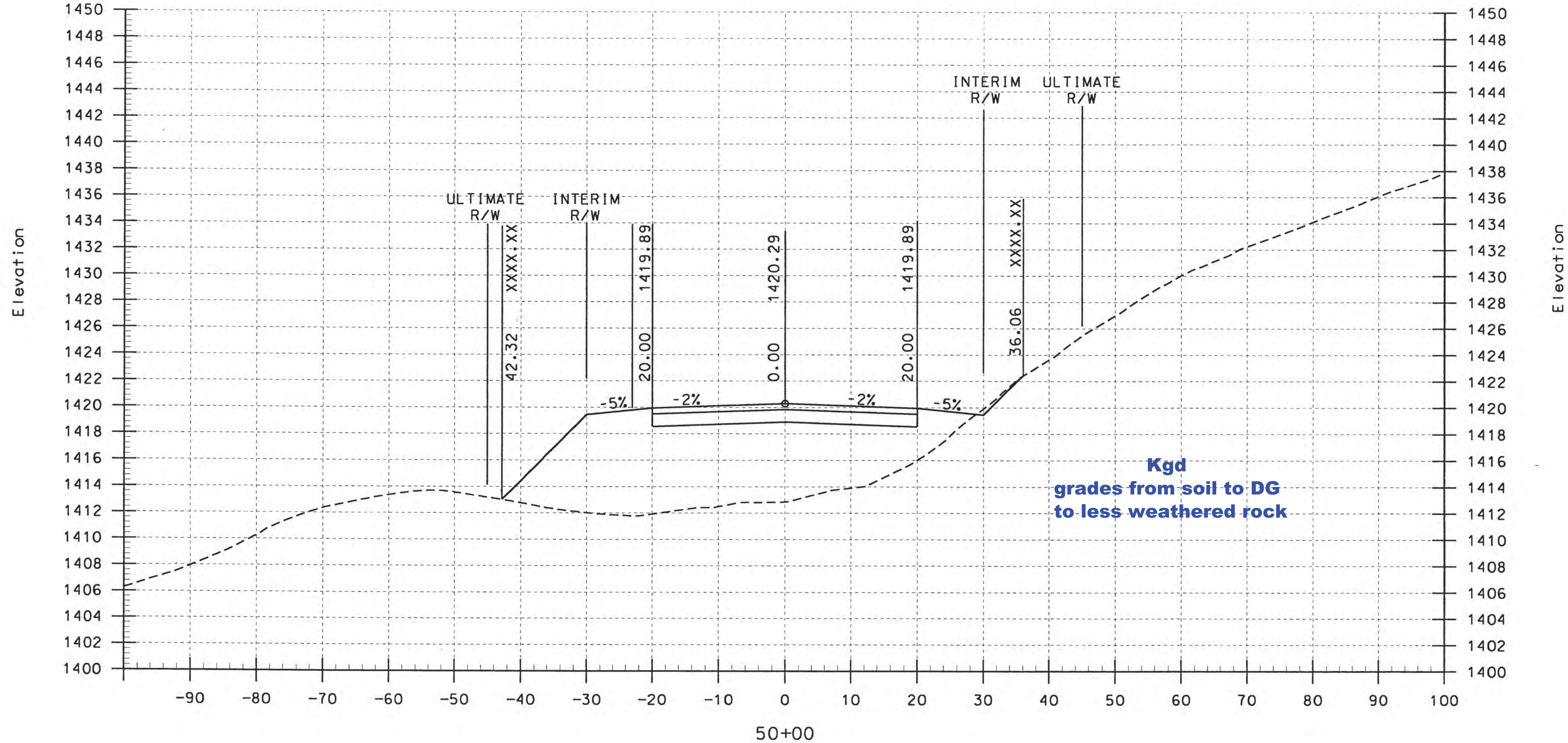

FIGURE 4V

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ
R.C.E. NO. 41904
DATE 4/2016
SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE
W.O.:

SHEET NO. 53 OF 63 SHTS.

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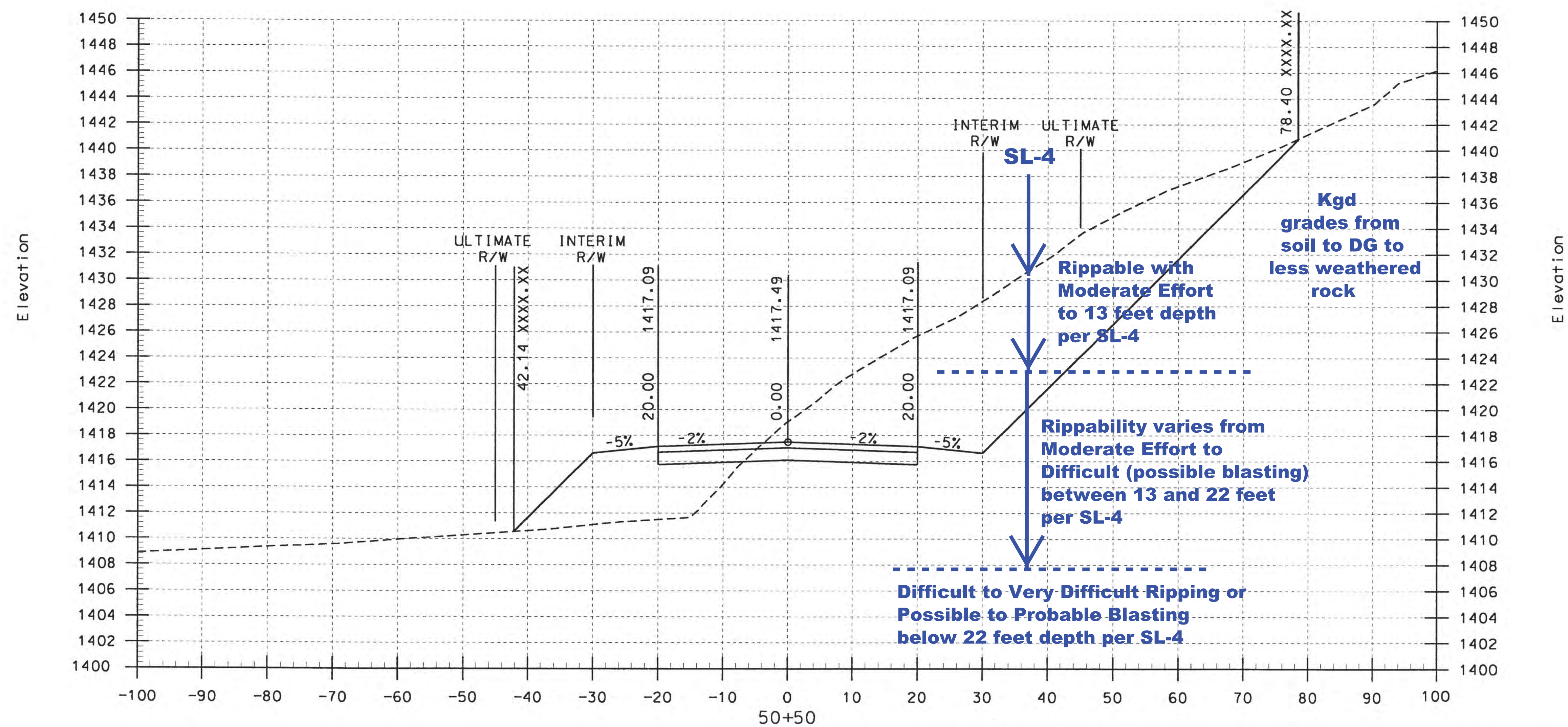

FIGURE 4W

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS

17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ
RCE NO. 41504
DATE 4/2016
SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE

W.O.:

SHEET NO. 54 OF 63 SHTS.

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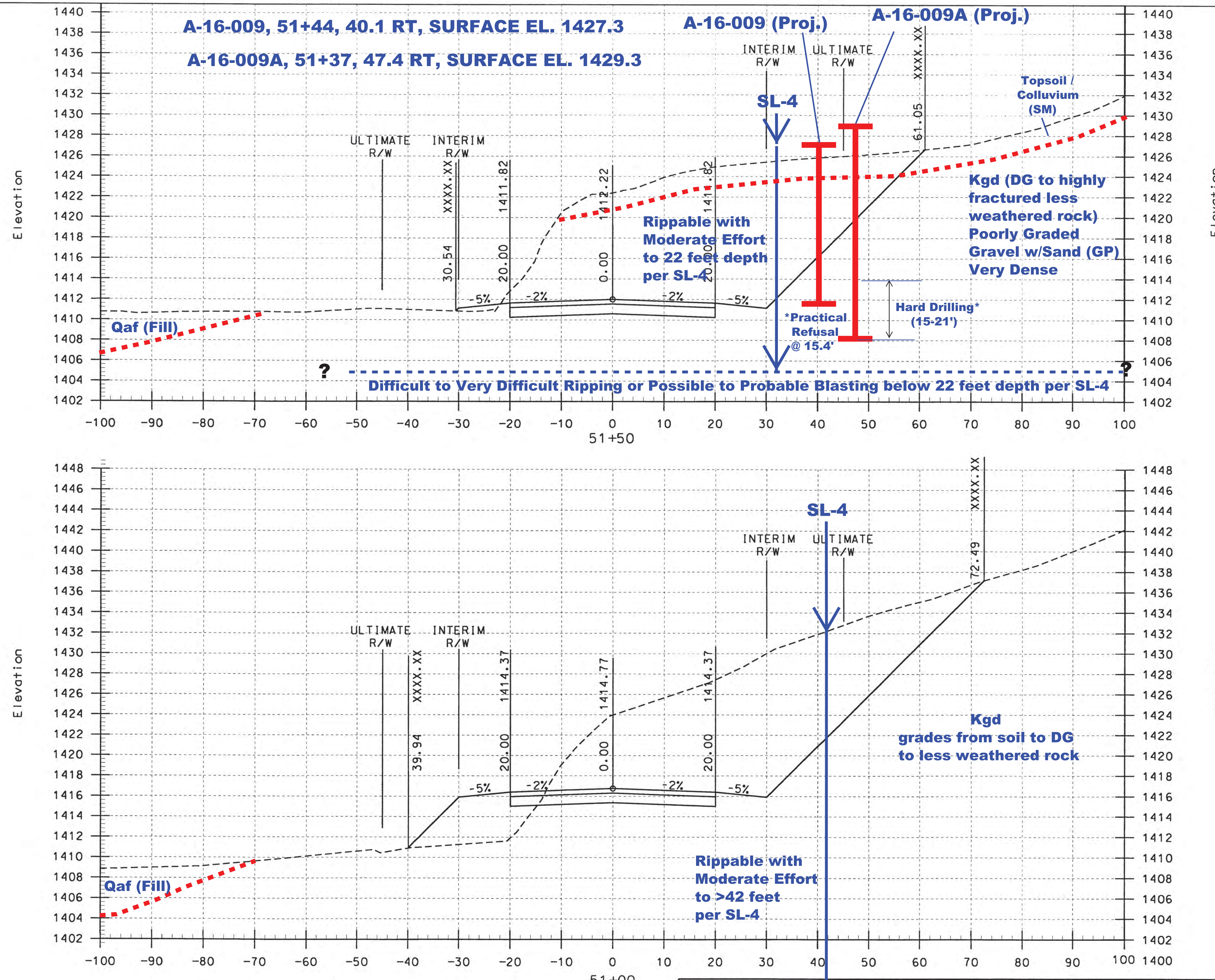

FIGURE 4X

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE C2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | RCE NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 55 OF 63 SHTS.

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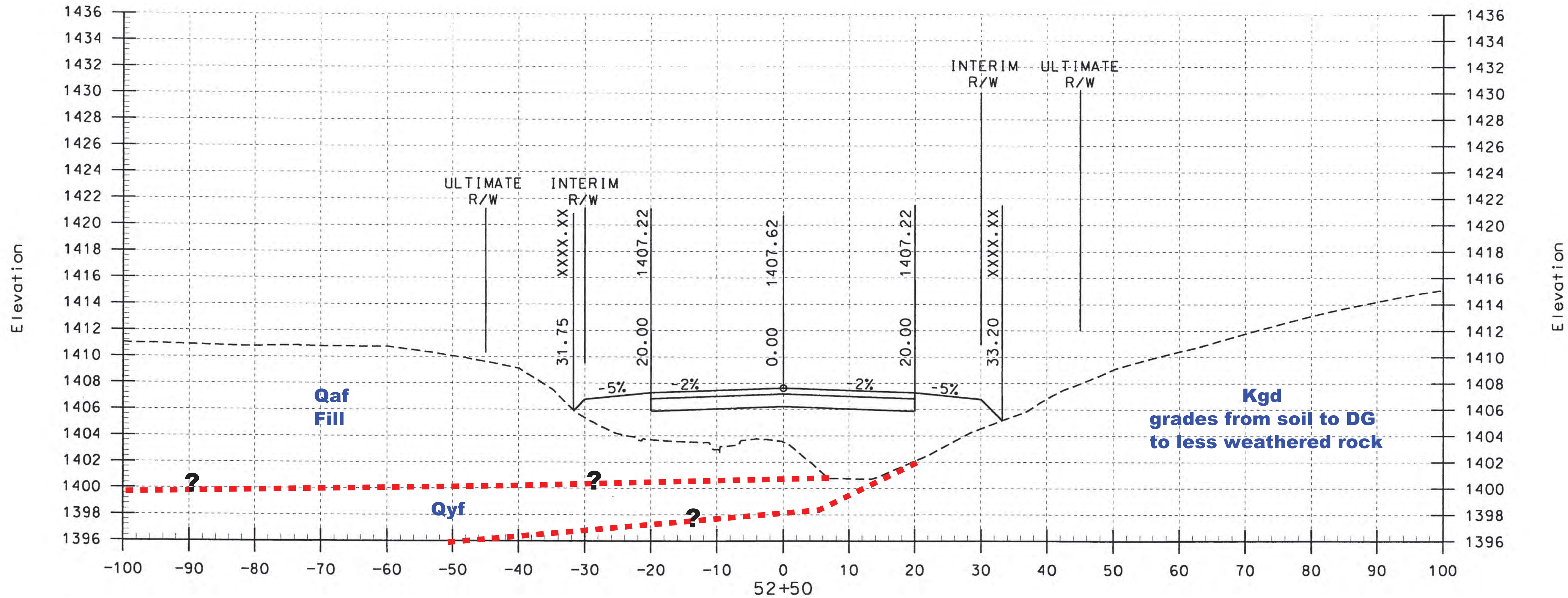

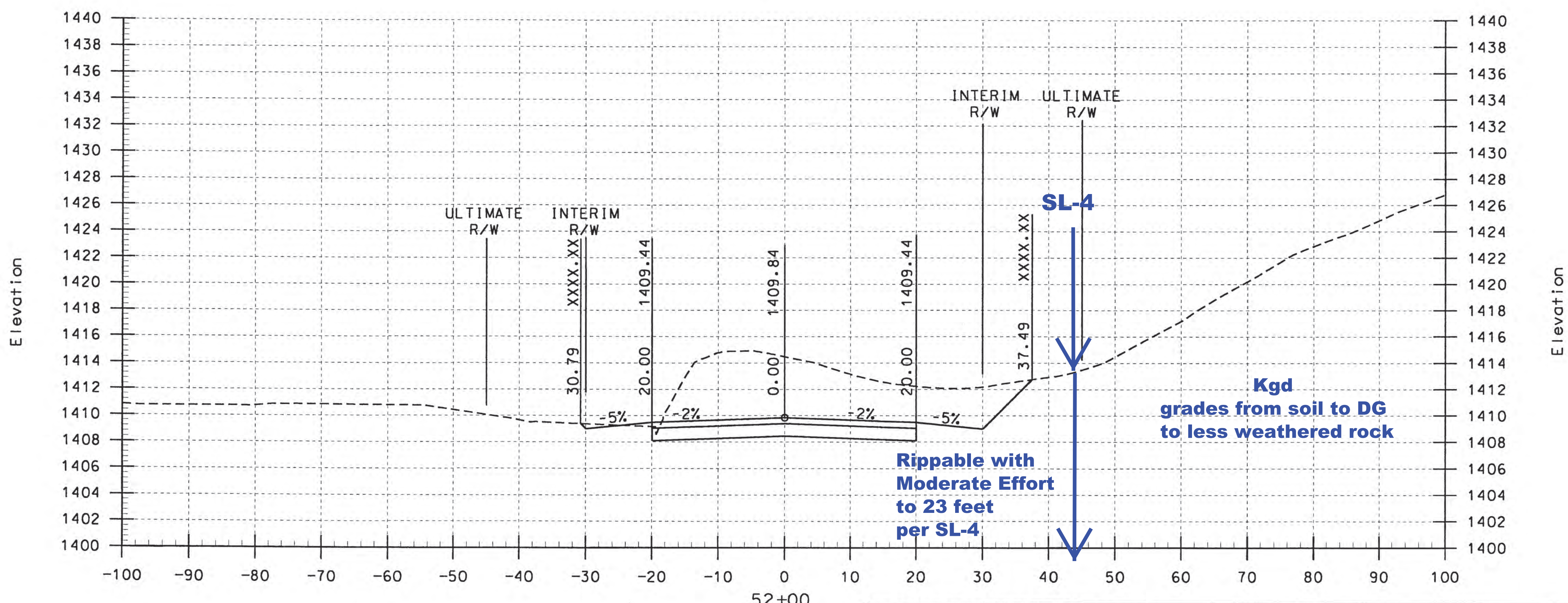

FIGURE 4Y

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ
R.C.E. NO. 41304
DATE 4/2016
SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE
W.O.:

SHEET NO. 56 OF 63 SHTS.

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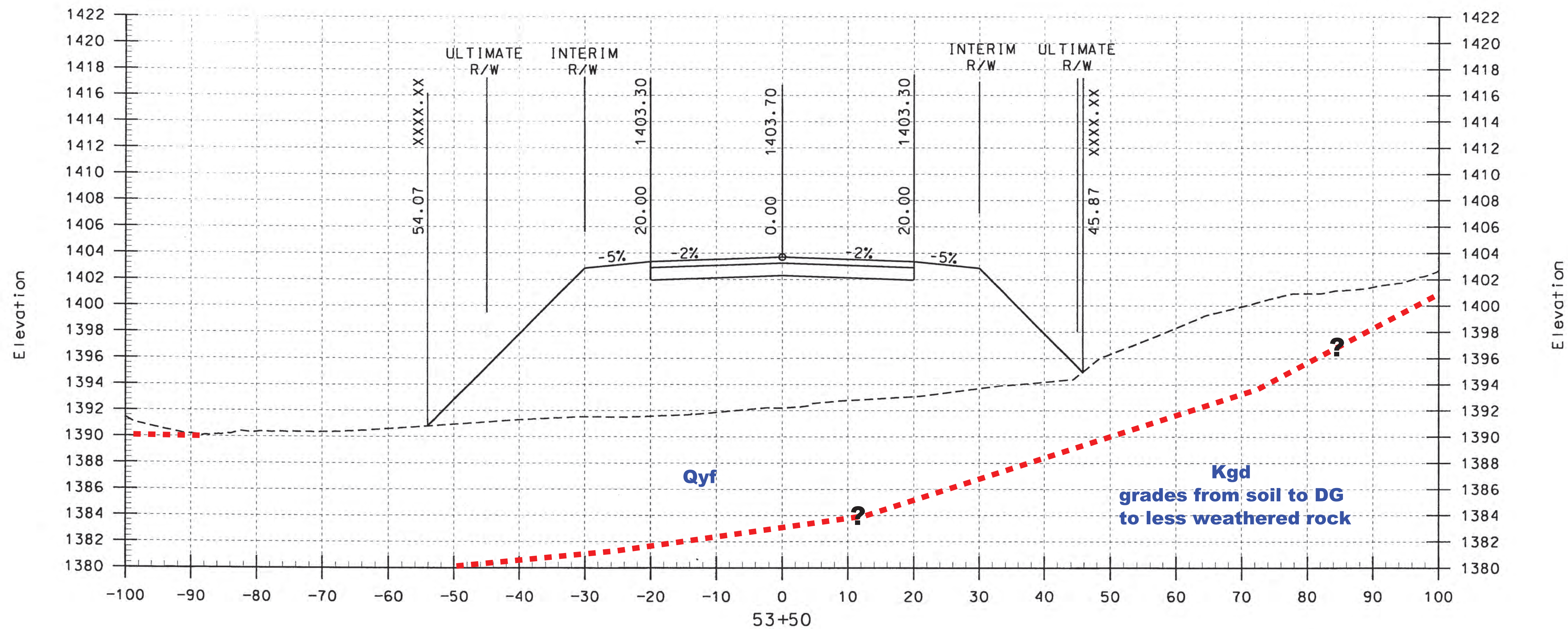

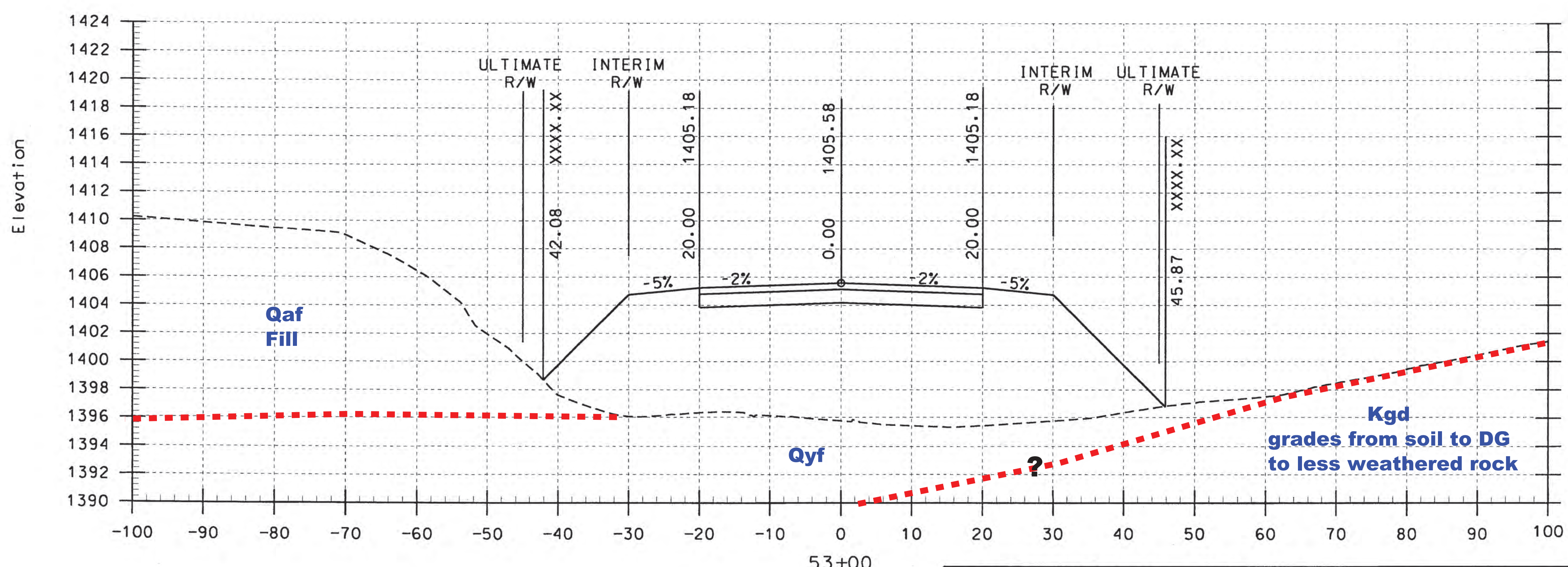

FIGURE 4Z

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 57 OF 63 SHTS.
PREPARED BY: R.S. CHAVEZ; R.C.E. NO. 41904; DATE 4/2016; SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE	W.O.:

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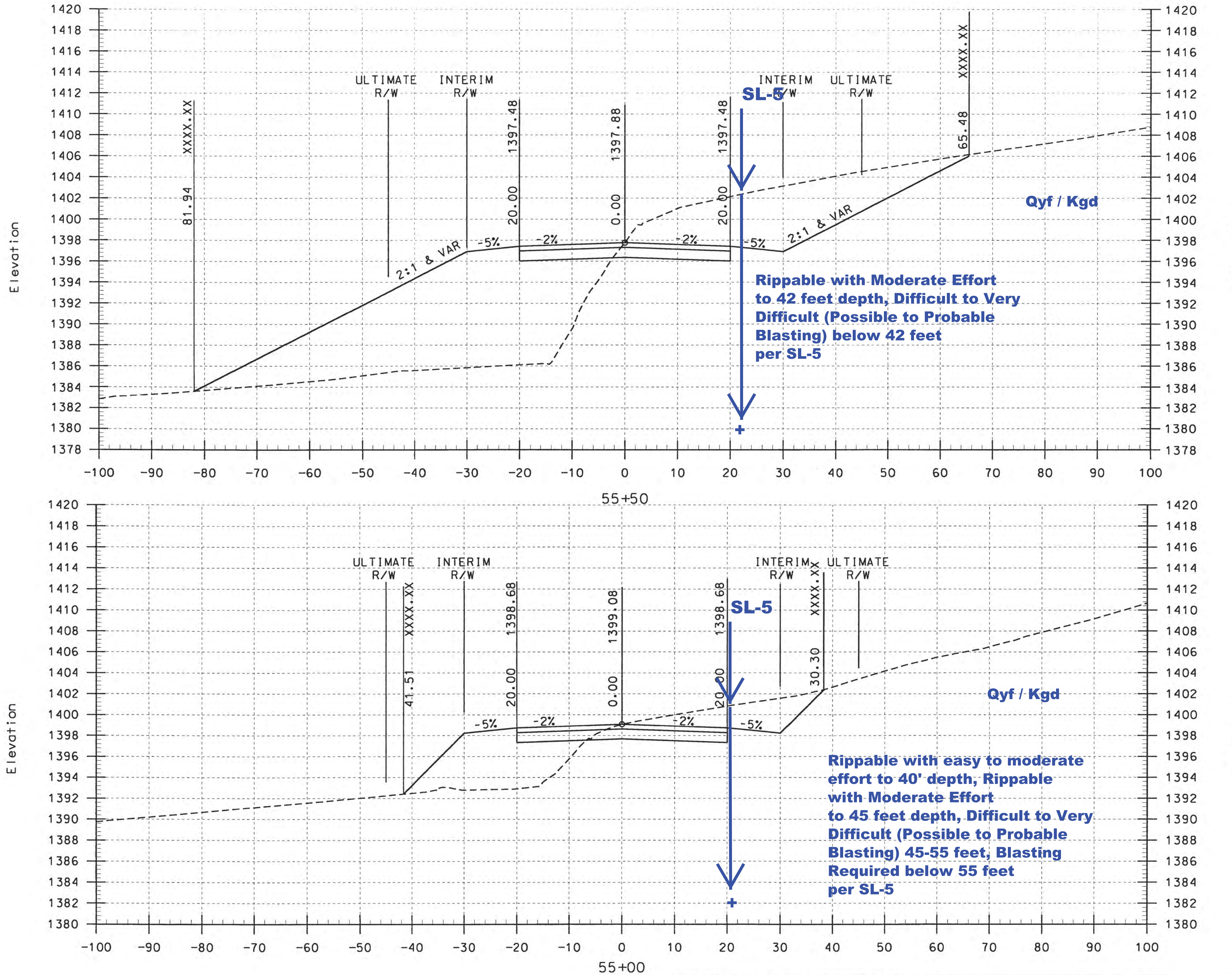

FIGURE 4AA

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41504 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 59 OF 63 SHTS.

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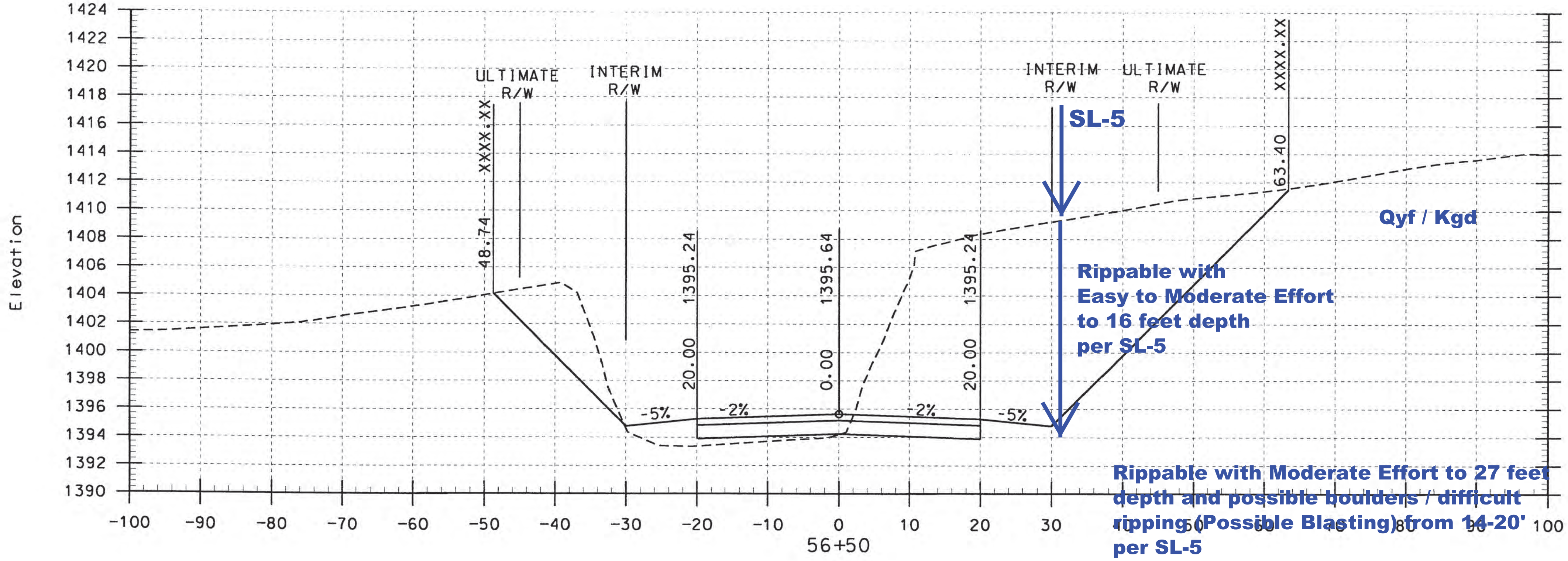

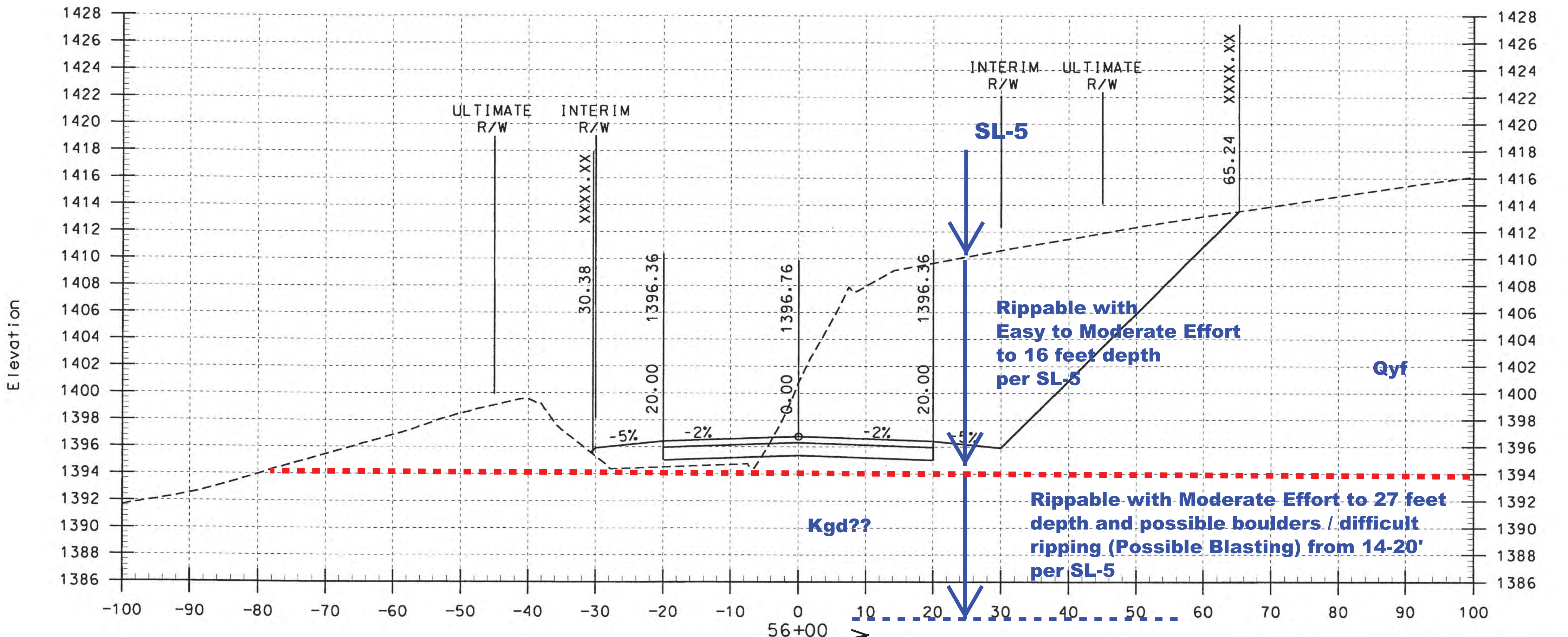

FIGURE 4AB

Difficult to Very Difficult Ripping or Possible to Probable Blasting from 27 -49 feet depth, Blasting Generally required below 49 feet, per SL-5

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 60 OF 63 SHTS.

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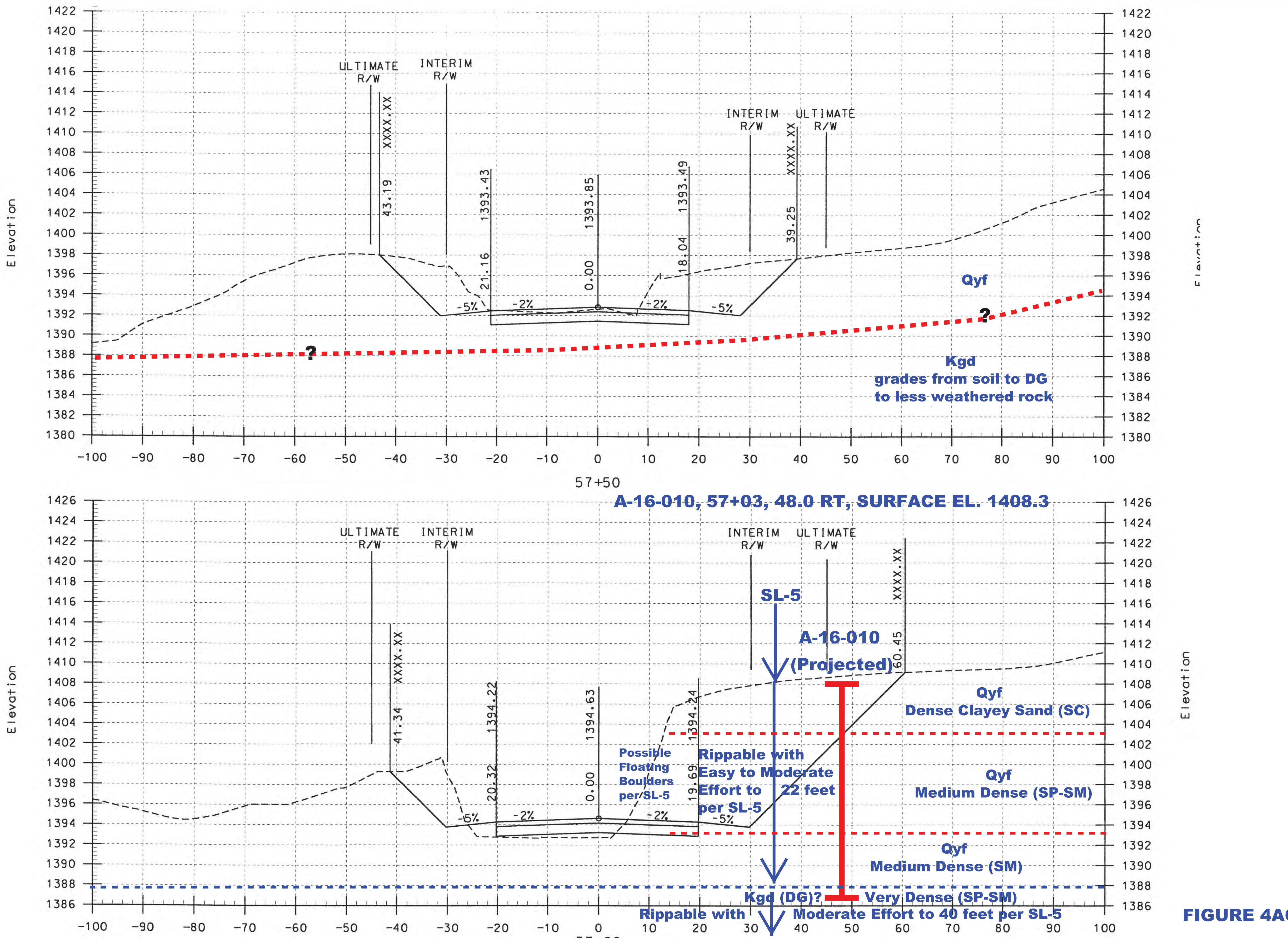

FIGURE 4AC

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS
17777 MAIN STREET, SUITE G2
IRVINE, CA 92614
(949) 221-8669 main

PREPARED BY: R.S. CHAVEZ | R.C.E. NO. 41904 | DATE 4/2016 | SCALE: H: 1"=20' V: 1"=10'

CAMINO DEL NORTE EXTENSION PROJECT
CROSS SECTIONS

FOR: CITY OF LAKE ELSINORE | W.O.:

SHEET NO. 61 OF 63 SHTS.

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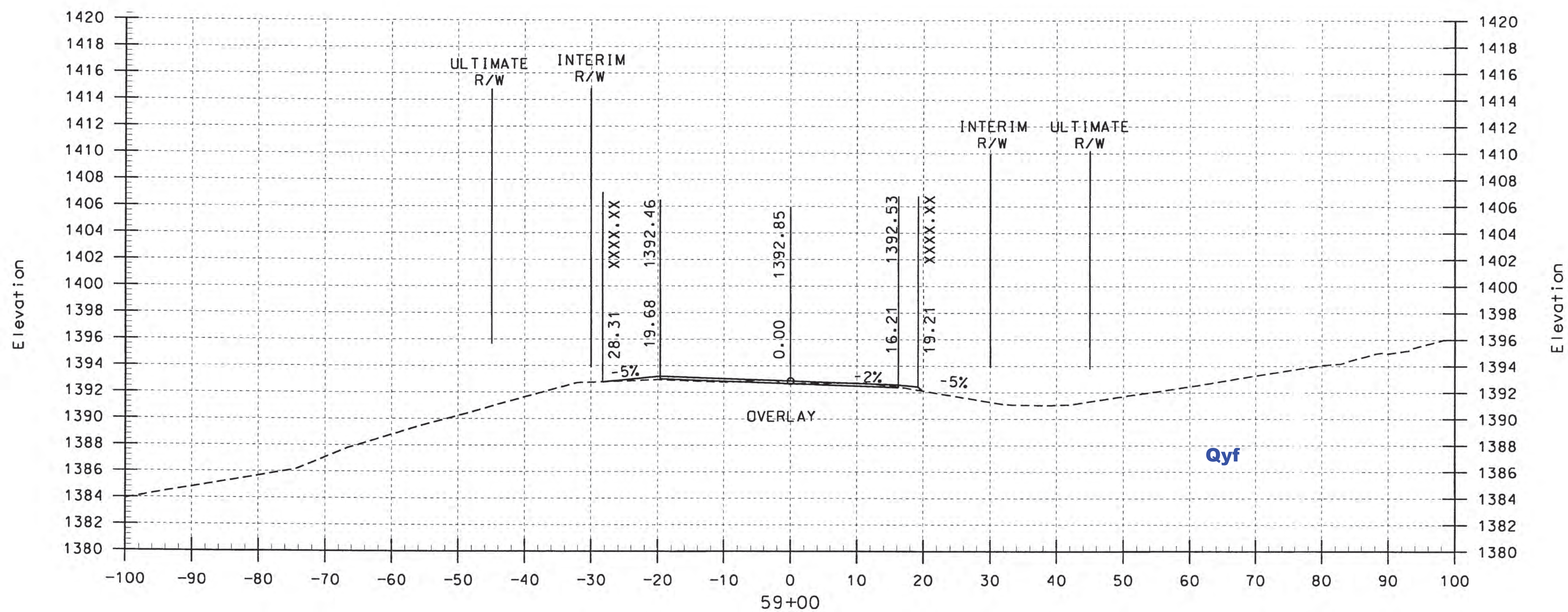

FIGURE 4AD

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SUSTAINABLE CIVIL ENGINEERING SOLUTIONS 17777 MAIN STREET, SUITE G2 IRVINE, CA 92614 (949) 221-8669 main	CAMINO DEL NORTE EXTENSION PROJECT CROSS SECTIONS	SHEET NO. 63
PREPARED BY: R.S. CHAVEZ · R.C.E. NO. 41904 · DATE 4/2016 · SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE · W.O.:	OF 63 SHTS.

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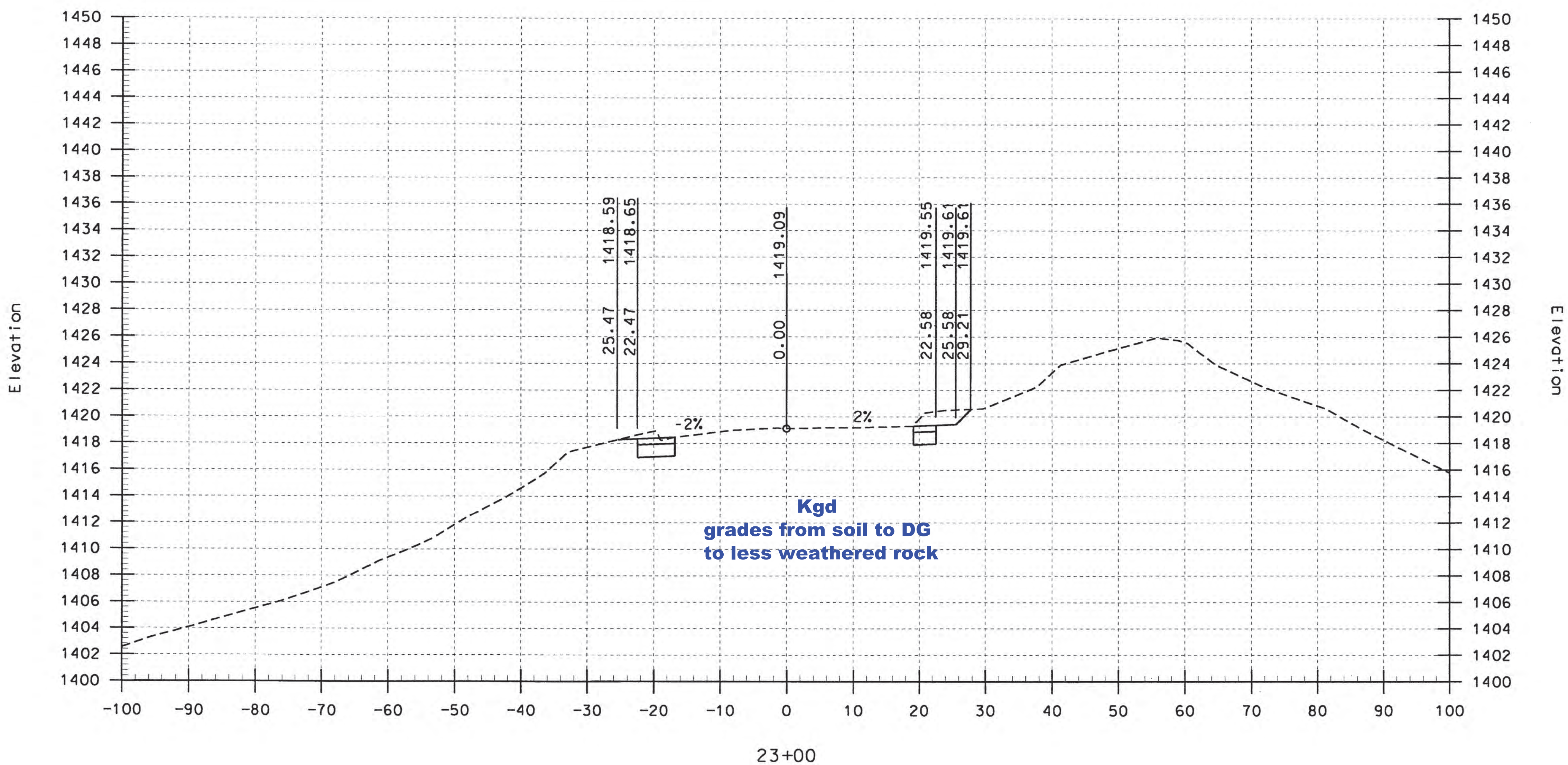

FIGURE 4AE

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SC ENGINEERING 16096 CHIWI ROAD APPLE VALLEY, CALIFORNIA 92307 TEL:(760)242-2081		OLD FRANKLIN STREET CROSS SECTIONS	SHEET NO. 1
PREPARED BY: R.S. CHAVEZ	R.C.E. NO. 41904 DATE	SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE — W.O.: — OF 6 SHTS.

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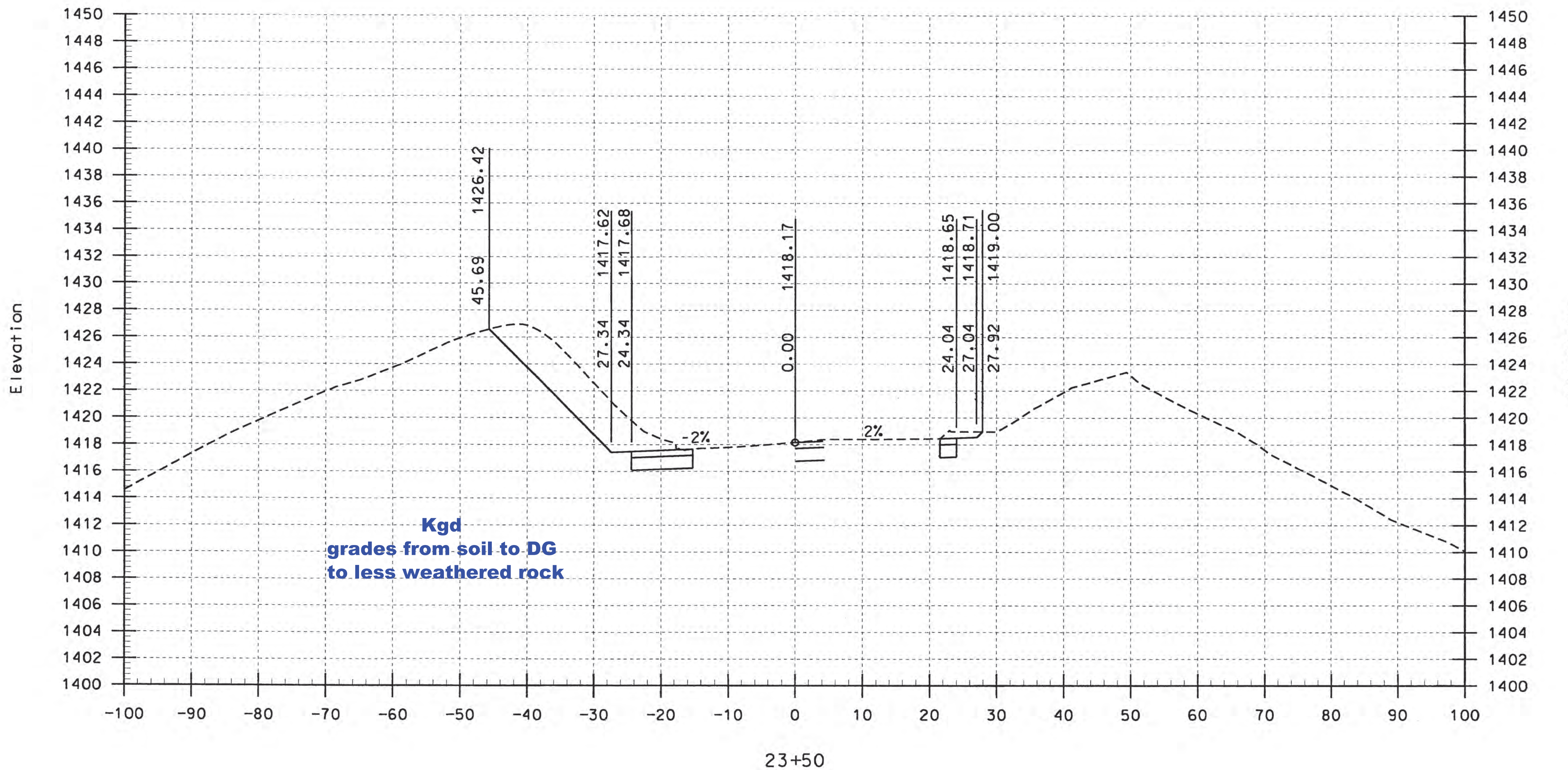

FIGURE 4AF

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SC ENGINEERING 16096 CHIWI ROAD APPLE VALLEY, CALIFORNIA 92307 TEL:(760)242-2081	OLD FRANKLIN STREET CROSS SECTIONS	SHEET NO. 2
PREPARED BY: R.S. CHAVEZ; R.C.E. NO. 41904; DATE; SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE; W.O.:	OF 6 SHTS.

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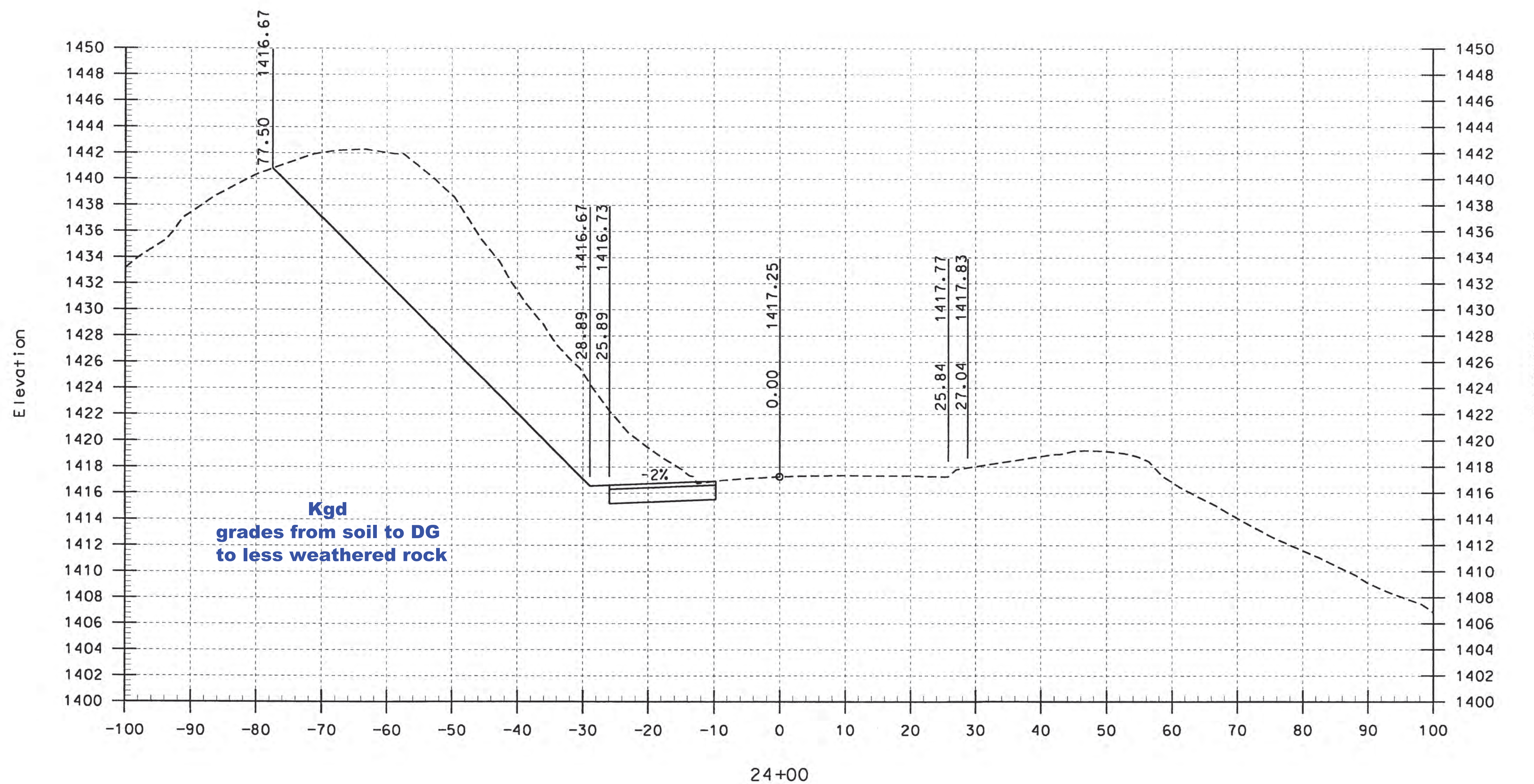

FIGURE 4AG

SC ENGINEERING 16096 CHIWI ROAD APPLE VALLEY, CALIFORNIA 92307 TEL:(760)242-2081		OLD FRANKLIN STREET CROSS SECTIONS	SHEET NO. 3
PREPARED BY: R.S. CHAVEZ	R.C.E. NO. 41904 DATE	SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE — W.O.: — OF 6 SHTS.

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

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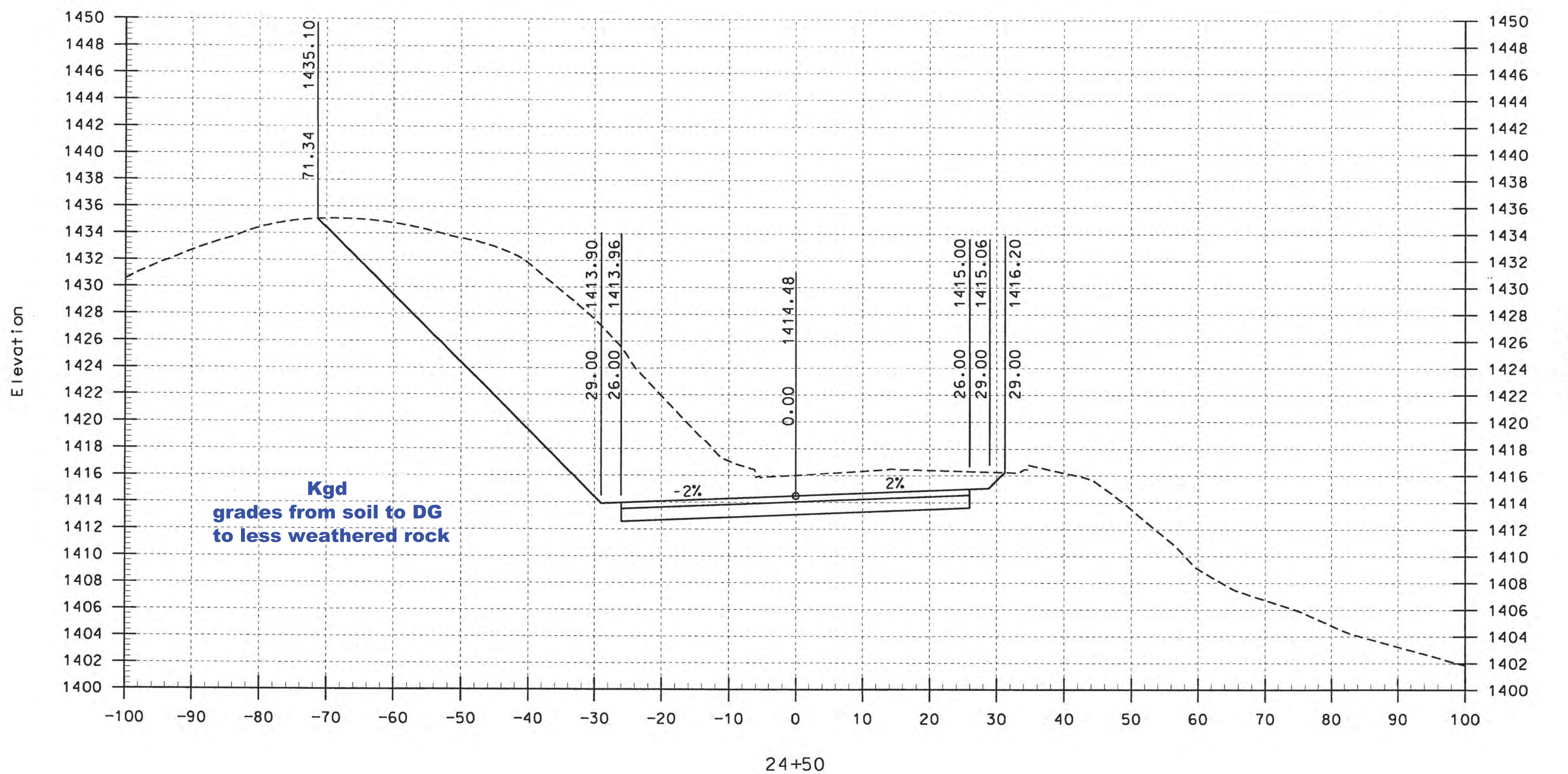

FIGURE 4AH

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

SC ENGINEERING 16096 CHIWI ROAD APPLE VALLEY, CALIFORNIA 92307 TEL:(760)242-2081	OLD FRANKLIN STREET CROSS SECTIONS	SHEET NO. 4
PREPARED BY: R.S. CHAVEZ — R.C.E. NO. 41904 DATE — SCALE: H: 1"=20' V: 1"=10'	FOR: CITY OF LAKE ELSINORE — W.O.:	OF 6 SHTS.

...\plans\camino\binder_02.dgn Apr. 14, 2016 15:47:52

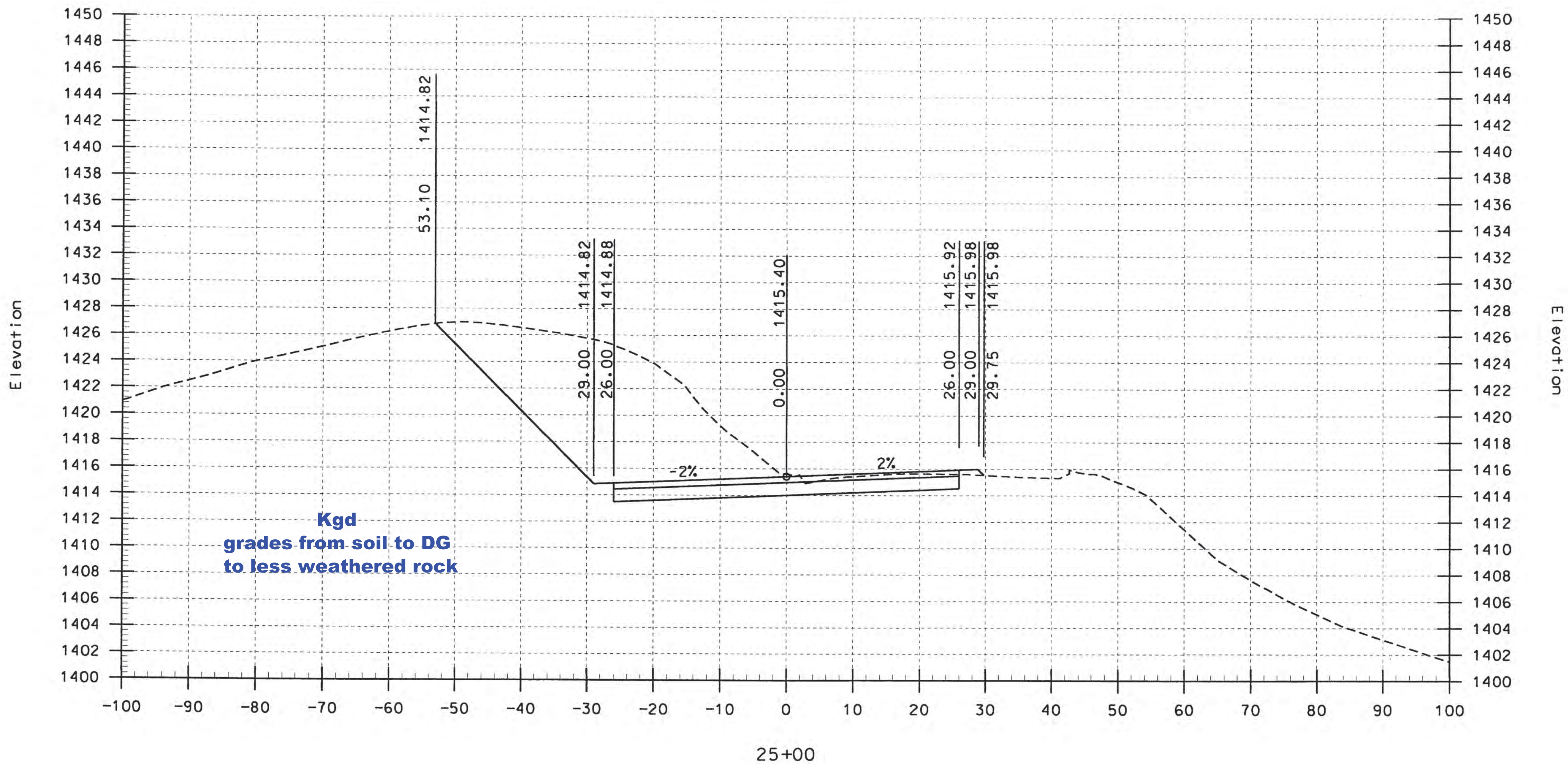

FIGURE 4AI

SC ENGINEERING
16096 CHIWI ROAD
APPLE VALLEY, CALIFORNIA 92307
TEL:(760)242-2081

OLD FRANKLIN STREET
CROSS SECTIONS

SHEET NO. 5 OF 6 SHTS.

PREPARED BY: R.S. CHAVEZ | R.C.E.NO. 41904 | DATE | SCALE: H: 1"=20' V: 1"=10' | FOR: CITY OF LAKE ELSINORE | W.O.:

Note: 2x Vertical Exaggeration

"FOR EARTHWORK ONLY"

...\plans\camino\binder_02.dgn Apr. 14, 2016 15:47:53