LGC

LGC Valley, Inc.

Geotechnical Consulting

October 16, 2024 — Project No. 174002-05

Ms. Kim Berry
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Subject: ***Geotechnical Recommendations Report for the Proposed Widening of the East Side of Ynez Road between Station No. 101+99.21 and 117+61.56, Temecula, California***

In accordance with your request, LGC Valley, Inc. (LGC) has performed a geotechnical evaluation of the proposed widening of the east side of Ynez Road between Station No. 101+99.21 (southeast side of Tierra Vista Road) and Station No. 117+61.56 (northwest side of Rancho Vista Road) in the City of Temecula, California. The purpose of our study was to evaluate the existing on-site geotechnical conditions relative to the current grading/improvement plan design and to provide geotechnical recommendations applicable to the planned roadway median, east side travel lanes widening, and associated parkway improvements for the project. Our study included a review of the previous geotechnical documents relative to the Ynez Road improvements on the Rancho Highlands property by LGC; review of available pertinent geotechnical and geologic reports and maps relative to the general vicinity; a site reconnaissance; analysis of the collected data; and preparation of our findings, conclusions, and recommendations relative to the proposed Ynez Road widening improvements.

Based on our evaluation, it is our professional opinion that the site design is suitable from a geotechnical perspective provided the findings, conclusions, opinions, and recommendations contained within this report are

If you have any questions regarding our report, please contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

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1.0 INTRODUCTION

1.1 Purpose and Scope of Services

The main purpose of this study was to evaluate the proposed widening of the east side of Ynez Road between Station No. 101+99.21 and Station No. 117+61.56 in the City of Temecula, California (Figure 1) from a geotechnical perspective and to provide preliminary geotechnical recommendations relative to the grading and improvement operations along the roadway. This report was prepared to summarize the existing geotechnical conditions; and to provide our geotechnical findings, conclusions, opinions, and recommendations relative to the grading of the roadway. Our scope of services included:

- Review of the latest Ynez Road Improvement Plans prepared by Proactive Engineering Consultants West, Inc. (PEC West), which was used as a base for our geotechnical map (Plate 1).

- Review of pertinent available geotechnical literature/publications, geologic maps, and aerial photographs (Appendix A).

- Review of previous geotechnical reports prepared by LGC for the adjacent Rancho Highlands development (Appendix A).

- Reconnaissance and geologic mapping of the site.

- Geotechnical analysis of the data accumulated during our study.

- Preparation of this report presenting our findings, conclusions, interpretations, and recommendations including the General Earthwork and Grading Specifications for Rough Grading (Appendix B) with respect to the proposed rough and post grading of the roadway.

1.2 Site and Project Description

The proposed street improvement/widening project is located along the east side of Ynez Road between Station No. 101+99.21 (southeast side of Tierra Vista Road) and Station No. 117+61.56 (northwest side of Rancho Vista Road) in the City of Temecula, California (Figure 1). The proposed Rancho Highlands multi-family development is located along the east side of Ynez Road from Station No. 101+99.21 to 107+26 while undeveloped property is located east of Station No. 107+26 to 117+61.56.

Elevations along the roadway range from approximately 1051 feet at the northwest end or the widening project to 1120 feet at the southeast end. In general, the site is located on the east flank of a small tributary canyon running parallel to Ynez Road in a northwest-southeast direction.

Based on the street improvement plans prepared by PEC West Inc. (PEC, 2024), the proposed improvements will include the addition of a second northbound travel lane creating a east-facing fill slope up to approximately 20 to 25-feet in height, a maximum 18-foot tall masonry retaining wall (between Station No. 110+61 and 112+10), a right-turn and left-turn pocket at Tierra Vista Road, a left-turn pocket at Rancho Vista Road, a raised center median between Station No. 101+90 and 107+25), a new curb/gutter and sidewalk along the east side of the roadway, new street lights, underground utilities, landscaping, etc. Estimated design earthwork quantities are approximately 6,000 cubic yards of fill with minimal cut.

Basemap: ESRI World Imagery Basemap, Accessed September 30, 2024

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Figure 1
Site Location Map
Ynez Road Widening
Sta # 101+91.21 to 117+61.56
Temecula, California

Project Name	Ynez Road Widening
Project No.	174002-05
Eng. / Geol.	BIH/RKW
Scale	1" = 1000'
Date	October 16, 2024

2.0 GEOTECHNICAL CONDITIONS

2.1 Site Geology

Based on our subsurface investigation and geologic mapping during the development of the Rancho Highlands residential project, geologic reconnaissance mapping along the roadway widening, and review of available geologic maps and publications relative to the site and general vicinity (Appendix A), the roadway is composed of surficial units consisting of document artificial fill (Afd) placed during the Rancho Highlands grading operations, older artificial fill (Afo) associated with the construction of the existing portion of Ynez Road, and Quaternary-aged young alluvial deposits (Qya); that are underlain by the sandstone facies of the Pauba Formation (Qps). The approximate limits of the mapped units are indicated on the Geotechnical Map (Plate 1).

The documented fills along the northeast side of the proposed Ynez Road widening were placed during the grading of the Rancho Highlands residential development in November 2021 through February 2022. The fill soils generally consist of medium brown to gray yellow-brown and red brown, silty to clayey very fine to medium sands and silty fine to coarse sands (LGC, 2022a). The older fill along Ynez Road is related to the grading and construction of the existing portion of Ynez Road along the east side of the roadway and consist mainly of silty sands. Potentially compressible deposits of young alluvium were encountered along the entire east side of Ynez Road. As observed, these deposits primarily consist of medium to dark brown and gray to red-orange brown, silty to clayey very fine to medium sands that are low to highly expansive, porous, and contain scattered organics. The upper portion of the young alluvium is considered potentially compressible in the present state. The Early Pleistocene-Aged Pauba Formation, Sandstone Facies, as encountered during Rancho Highlands grading consists primarily of massively-bedded yellow gray-brown to light gray red-brown slightly silty to silty very fine to coarse sands with some interbedded clays.

2.2 Geologic Structure

The overall structure of the formational material in the general vicinity of the site is trending east-west to slightly northwest-southeast dipping 2 to 10 degrees to the north (Kennedy and Morton, 2003). Based on our professional experience, bedding within the Pauba Formation is massive to thickly-bedded. Jointing on-site is anticipated to be variable, but predominantly trends northwest-southeast (generally subparallel to the Elsinore Fault Zone), with dips moderately to steeply dipping (dips on the order of 45 to 89 degrees to the west).

2.3 Ynez Road Widening Between Station No. 101+80 and 107+25

Prior to grading along the east side of Ynez Road between Station No. 101+80 and 107+25, the area was cleared of light vegetation and other miscellaneous debris and the material was disposed of at an off-site facility. The upper 5 feet of the existing young alluvium within the limits of grading was removed to competent material (i.e. medium dense to dense young alluvial soils). Following the remedial removals, areas to receive fill were scarified approximately 6-inches, moisture-conditioned, as needed, to obtain a near-optimum moisture content and compacted to a minimum 90 percent relative compaction, as determined by ASTM Test Method D6938 (nuclear gauge method). The field density test results and the approximate test locations are presented in the Rancho Highlands As-Graded Report of Rough and Precise Grading (LGC, 2022a).

Prior to the placement of the fill slope along the east side of Ynez Road between approximate Station No. 103+75 and 107+05, a fill slope key was constructed. The fill slope key was excavated at least 2 feet into competent soil along the toe-of-slope and constructed approximately 15 feet wide with the key bottom angled a minimum of 2 percent into-the-slope. The approximate location of the fill slope key is shown on the Geotechnical Map (Plate 1).

2.4 <u>Landslides</u>

Based on our geologic reconnaissance mapping along the Ynez Road; and review of the geotechnical reports of the site, general vicinity, and geologic literature (Appendix A); no evidence of landsliding or other slope instability conditions were observed in the vicinity or noted in the literature. Consequently, the potential for the existence of landslides is considered insignificant.

2.5 <u>Groundwater</u>

Based on our review of the State of California Department of Water Resources (CDWR) website, the project lies within the Temecula Valley Groundwater Basin which is part of the larger California South Coast Hydrogeologic Region (CDWR, 2003). As indicated in the 2003 update of California Bulletin 118 (CDWR, 2003), groundwater in the Temecula Valley Groundwater Basin is mainly located within the alluvial soils present in the area, and to a lesser extent, in the fractured basement rocks. The overall groundwater movement in the area of the site is towards the southeast.

During our subsurface investigation for the Rancho Highlands project (LGC, 2019), a perched groundwater condition was encountered within the lower portion of the young alluvial soils at a depth of 15 feet below the existing ground surface. The prior geotechnical investigation of the site by Converse in 1988 encountered ground water in the alluvial soils to the northwest of the site adjacent to the Temecula Duck Pond at depths ranging from approximately 12 to 17 feet below the existing ground surface (Converse, 1988).

While there is a perched groundwater condition in the lower portion of the alluvial soils along the east side of the Ynez Road improvements, groundwater is not expected to be a significant impact to the proposed development (provided the recommendations of this report are implemented during the design, grading, and construction of the proposed site improvements).

2.6 <u>Faulting</u>

The southern California region has long been recognized as being seismically active. The seismic activity results from a number of active faults that cross the region, all of which are related to the San Andreas transform system, a broad zone of right lateral faults that extend from Baja California to Cape Mendocino. The numerous faults in Southern California include Holocene-active and pre-Holocene faults. The definitions of fault activity terms used here are based on those developed for the Alquist-Priolo (AP) Special Studies Zone Act of 1972 that was recently updated in January 2018 (CDCCGS, 2018).

Holocene-active faults are faults that have had surface displacement within Holocene time (i.e. the last 11,700 years before the present [BP]). Faults are considered pre-Holocene if the past movement is older than 11,700 years BP. A third category, age-undetermined faults are faults where the recency of faulting has not been determined (i.e. "a fault can be considered age-undetermined if the fault in question has simply not been studied in order to determine its recency of movement [CDCDMG, 2018]).

Regional active faults that occur within the southern California area include the on-shore and off-shore Rose Canyon-Newport Inglewood fault zone to the southwest, the Elsinore fault zone within a portion of the site, and the San Jacinto and San Andreas faults to the northeast. The closest known active fault to the site is the Wildomar fault (part of the Elsinore Fault Zone, Temecula Section) and is located just to the west of Ynez Road (Within 100 feet of the roadway).

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the southern California region include soil liquefaction and dynamic settlement. Other secondary seismic effects include shallow ground rupture, seiches and tsunamis. In general, these secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and the causative fault and the on-site geology.

2.7 Seismicity and Related Effects

The main seismic parameters to be considered when discussing the potential for earthquake-induced damage are the distances to the causative faults, earthquake magnitudes, and expected ground accelerations. We have performed site-specific analysis based on these seismic parameters for the site and the on-site geologic conditions. The results of our analysis are discussed in terms of the potential seismic events that could be produced by the maximum probable earthquakes. A maximum probable earthquake is the maximum earthquake likely to occur given the known tectonic framework.

2.7.1 Seismic Design Criteria

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2022 California Building Code (CBC). The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class D are provided in Table 1.

Table 1 California Building Code Site Seismic Characteristics	
Selected Parameters from 2022 CBC, Section 1613 - Earthquake Loads	**Seismic Design Values**
Site Class (per Chapter 20 of ASCE 7)	D
Risk-Targeted Spectral Acceleration for Short Periods (S_S)	1.646g
Risk-Targeted Spectral Accelerations for 1-Second Periods (S_1)	0.614g
Site Coefficient F_a [per CBC Table 1613.3.3(1)]	1.0
Site Coefficient F_v [per CBC Table 1613.3.3(2)]	1.7
Site Modified Spectral Acceleration for Short Periods (S_{MS}) for Site Class D [Note: $S_{MS} = F_aS_S$]	1.646g
Site Modified Spectral Acceleration for 1-Second Periods (S_{M1}) for Site Class D [Note: $S_{M1} = F_vS_1$]	1.044g
Design Spectral Acceleration for Short Periods (S_{DS}) for Site Class D [Note: $S_{DS} = (^2/_3)S_{MS}$]	1.097g
Design Spectral Acceleration for 1-Second Periods (S_{D1}) for Site Class D [Note: $S_{D1} = (^2/_3)S_{M1}$]	0.696g
Seismic Design Category (per CBC Section 1613.2.5)	D

Section 1803.5.12 of the 2022 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake ground motions, Peak Ground Acceleration (PGA) should be used for the geotechnical evaluations. The PGA_M for the site is equal to 0.818g (USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2).

A deaggregation of the PGA based on a 2,475-year average return period indicates that an earthquake magnitude of 7.71 at a distance of approximately 1.5 kilometers (0.93 miles) from the site would contribute the most to this ground motion (USGS, 2020).

2.7.2 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Liquefaction is typified by a buildup of pore-water pressure in the affected soil layer to a point where a total loss of shear strength occurs, causing the soil to behave as a liquid. Studies indicate that saturated, loose to medium dense, near surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures.

Based on the anticipated relative density of on-site soils and placement of compacted fill soils along the roadway; and the depth to the static groundwater in the area of the proposed roadway improvements; it is our opinion that the potential for liquefaction impacting the site is low, and seismically induced settlements are considered to be negligible.

During a strong seismic event, seismically induced settlement can occur within loose to moderately dense, dry or saturated granular soil. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement. Based on in-situ densities, and soil types, dry sand settlement and induced surface manifestations are not considered an issue at the site.

2.8 Engineering Characteristics of the On-Site Soils

Based on our review of the laboratory test results of the adjacent Rancho Highlands project and our professional experience on adjacent sites with similar soils, the engineering characteristics of the on-site soils are discussed below.

Resistance Value: Resistance Value (i.e. R-Value) testing of representative soils samples during the development of the Rancho Highlands project indicates representative roadway soils possess R-Values ranging from 16 to 41 (LGC, 2022b).

Corrosivity Testing: Based on the limited corrosivity testing during the development of the Rancho Highlands project indicates representative roadway soils have a pH ranging from 6.52 to 6.73; a sulfate content of ranging from 0.009 to 0.079 percent; a chloride content ranging from 520 to 665 ppm, and a minimum resistivity of 960 to 1,700 (ohms-cm). Caltrans currently considers a site to be corrosive to foundation elements if one or more of the following conditions exist: chloride concentrations are greater than or equal to 500 ppm, sulfate concentrations are greater than or equal to 2000 ppm or the pH is 5.5 or less. Based on the Rancho Highlands project results, the site soils have negligible soluble sulfates and are considered corrosive per Caltrans criteria.

Excavation Characteristics: The roadway widening area is anticipated to be underlain by surficial units consisting of silty to sandy soils. It is anticipated that the on-site materials can be excavated with conventional heavy-duty construction equipment and that difficult excavation and/or blasting is not anticipated.

3.0 <u>CONCLUSIONS</u>

Based on the results of our geotechnical evaluation of the Ynez Road improvements between Station No. 101+99.21 and 117+61.56, it is our professional opinion that the proposed improvement of Ynez Road is feasible from a geotechnical standpoint, provided the following conclusions and recommendations are incorporated into the project plans, specifications, and followed during the site grading operations. The following is a summary of the geotechnical conclusions derived from our study:

- The proposed roadway is composed of surficial units consisting of document artificial fill (Afd) placed during the Rancho Highlands grading operations, older artificial fill (Afo) associated with the construction of the existing portion of Ynez Road, and Quaternary-aged young alluvial deposits (Qya); that are underlain by the sandstone facies of the Pauba Formation (Qps). The approximate limits of the mapped units are indicated on the Geotechnical Map (Plate 1)

- Any undocumented fill, desiccated documented older fill soils, and the upper 5 feet of the young alluvial deposits are considered unsuitable in their present state and will require removal and recompaction in areas of proposed street improvements and design fills.

- The overall structure of the formational material in the general vicinity of the site is trending east-west to slightly northwest-southeast dipping 2 to 10 degrees to the north (Kennedy and Morton, 2003). Based on our professional experience, bedding within the Pauba Formation is massive to thickly-bedded.

- No evidence of landsliding or other slope instability conditions were observed in the vicinity or noted in the literature. Consequently, the potential for the existence of landslides is considered insignificant.

- The existing on-site soils appear to be suitable material for use as fill provided, they are relatively free of rocks (larger than 8 inches in maximum dimension), organic material and debris.

- While there is a perched groundwater condition in the lower portion of the alluvial soils along the east side of the Ynez Road improvements, groundwater is not expected to be a significant impact to the proposed development (provided the recommendations of this report are implemented during the design, grading, and construction of the proposed site improvements)

- Active faults are not known to exist along the proposed widening of Ynez Road; and consequently, the potential for surface rupture at the site is considered low.

- The main seismic hazard that may affect the site is ground shaking from one of the active regional faults.

- Resistance Value (i.e. R-Value) testing of representative soils samples during the development of the Rancho Highlands project indicates representative roadway soils possess R-Values ranging from 16 to 41.

- Based on limited laboratory testing and our professional experience on adjacent sites, the on-site soils have a low to high expansion potential, possess a negligible soluble sulfate content, and are considered corrosive per Caltrans criteria. However, some of the soils may possess a moderate to high sulfate content and may be very corrosive; therefore, corrosion testing should be performed at the completion of grading to assess this potential, as necessary.

- It is anticipated that the on-site materials can be excavated with conventional heavy-duty construction equipment and that difficult excavation and/or blasting is not anticipated.

- The anticipated site excavation and the proposed construction will not have an adverse impact on the adjacent properties.

4.0 RECOMMENDATIONS

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of site preparation and remedial grading followed by subgrade preparation for the proposed roadway widening, placement of fills for the design slope, construction of the retaining wall, construction of curb and gutters, aggregate base and asphaltic concrete placement, and sidewalk construction. We recommend that earthwork and construction onsite be performed in accordance with the following recommendations, the City of Temecula and County of Riverside requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix B. In case of conflict, the recommendations in the following sections shall supersede those included as part of Appendix B.

4.1.1 Site Preparation

Prior to grading of areas to receive structural fill or pavement areas, the areas should be cleared of surface obstructions, any existing debris, potentially compressible material (such as undocumented or unsuitable fill soils, unsuitable alluvium, or weathered bedrock) and stripped of vegetation. Vegetation and debris should be removed and properly disposed of off-site. Holes resulting from the removal of buried obstructions or utilities, should be replaced with suitable compacted fill material. Areas to receive fill and/or other surface improvements should be scarified to a minimum depth of 6 inches, brought to a near-optimum moisture condition, and recompacted to at least 90 percent relative compaction (based on American Standard of Testing and Materials [ASTM] Test Method D1557).

4.1.2 Removal and Recompaction

As discussed in Section 2.2, the upper portion of the site east of the existing roadway is underlain by potentially compressible unsuitable soils (undocumented or unsuitable fill soils, unsuitable alluvium), which may settle under the surcharge of fill and/or traffic loads. Compressible materials not removed by the planned grading should be excavated to competent material and replaced with compacted fill soils. We anticipate that the upper 5 feet of the young alluvial soils, and upper 1 to 2 feet of existing fills will need to be removed and replaced with compacted fill.

From a geotechnical perspective, material that is removed may be placed as fill provided the material is relatively free from rocks (greater than 8 inches in maximum dimension), organic material and construction debris, is moisture-conditioned or dried (as needed) to obtain above-optimum moisture content, and then recompacted prior to additional fill placement or construction.

4.1.3 Fill Slope Key

Prior to the placement of the fill slop along the east side of Ynez Road; a fill slope key should be constructed. The fill slope key should be excavated at least 2 feet into competent soil along the toe-of-slope and constructed approximately 15 feet wide with the key bottom angled a minimum of 2 percent into-the-slope.

We also recommend that a subdrain be installed along the back bottom edge of the key. The outlet locations of the subdrains should be determined in the field during site grading. The subdrains should consist of a 4-inch diameter perforated PVC pipe surrounded by 3 cubic feet (per linear foot) of crushed rock wrapped in filter fabric (Marifi 140N or equivalent). The subdrain should have a minimum fall of 1-percent toward the outlet.

4.1.4 Temporary Excavation Stability

In general, all excavations should be performed in accordance with project plans, specifications, and all Occupational Safety and Health Administration (OSHA) requirements. Excavations should be laid back or shored in accordance with OSHA requirements before personnel or equipment are allowed to enter. Soil conditions should be mapped and frequently checked by a representative of LGC to verify conditions are as anticipated. The contractor shall be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination with the geotechnical engineer should be maintained to facilitate construction while providing safe excavations. Excavation safety is the responsibility of the contractor.

Temporary excavations maybe cut vertically up to five feet. Excavations over five feet should be slot-cut, shored, or cut no steeper than 1:1 (horizontal to vertical) slope gradient. Surface water should be diverted away from the exposed cut, and not be allowed to pond on top of the excavations. Temporary cuts should not be left open for an extended period of time.

4.1.5 Fill Placement and Compaction

From a geotechnical perspective, the on-site soils are suitable for use as compacted fill, provided they are screened of rocks greater than 8-inches in maximum dimension, organic material, and construction debris. Areas prepared to receive structural fill and/or other surface improvements should be scarified to a minimum depth of 6-inches, brought to at least optimum-moisture content, and recompacted to at least 90 percent relative compaction (based on ASTM Test Method D1557). The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts generally not exceeding 8-inches in loose thickness. Placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant.

If possible, import soils should contain no materials over 3- to 6-inches in maximum dimension and have a very low expansion potential.

4.1.6 Trench Backfill and Compaction

The on-site soils may generally be suitable as trench backfill provided they are screened of rocks and other material over 3- to 6-inches in diameter and organic matter. Trench backfill should be compacted in uniform lifts (generally not exceeding 8-inches in compacted thickness) by mechanical means to at least 90 percent relative compaction (per ASTM Test Method D1557).

If trenches are shallow and the use of conventional equipment may result in damage to the utilities; clean sand, having sand equivalent (SE) of 30 or greater, should be used to bed and shade the utilities. Sand backfill should be densified. The densification may be accomplished by jetting or flooding and then tamping to ensure adequate compaction. A representative from LGC should observe, probe, and test the backfill to verify compliance with the project specifications.

4.2 Lateral Earth Pressures for Retaining Walls

The following lateral earth pressures may be used for the design of any future site retaining walls. Due to the expansive nature of some of the on-site clayey alluvium soils, we recommend site retaining walls be backfilled with either the very low expansive bedrock sandy soils (with minus 3-inch rock) or approved select soils. Approved select soils should consist of clean, granular soils (less than 15 percent passing the No. 200 sieve) of very low expansion potential (expansion index 20 or less based on UBC. 18-2). The recommended lateral pressures for approved select soils for level or sloping backfill are presented in Table 2.

Table 2
Lateral Earth Pressures for Retaining Walls

Conditions	Equivalent Fluid Weight (pcf)		
	Level Backfill	2:1 Backfill Sloping Upwards	Seismic Earth Pressure (pcf) *
	Approved Select Material	Approved Select Material	
Active	35	50	15
At Rest	51	80	--

* For walls with greater than 6-feet in backfill height, the above seismic earth pressure should be added to the static pressures given in the table above. The seismic earth pressure should be considered as an inverted triangular distribution with the resultant acting at 0.6H in relation to the base of the retaining wall footing (where H is the retained height). The aforementioned incremental seismic load was determined in general accordance with the standard of practice in the industry (using the Mononobe-Okabe method for active and Woods method for at-rest) for determining earth pressures as a result of seismic events.

For design purposes, the recommended equivalent fluid pressure for each case for walls founded above the static ground water and backfilled with approved select soils is provided in Table 2. The equivalent fluid pressure values assume free-draining conditions. If conditions other than those assumed above are anticipated, the equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical engineer. Surcharge loading effects from the adjacent structures should be evaluated by the geotechnical and structural engineers.

Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. The outlet pipe should be sloped to drain to a suitable outlet. Typical wall drainage design is illustrated on Figure 2. It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is generally a white crystalline powder (discoloration) that results when water, which contains soluble salts, migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential.

Lateral earth pressures are provided as equivalent fluid unit weights, in psf/ft of depth or pcf. These values do not contain an appreciable factor of safety. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of soil. For sliding resistance, a friction coefficient of 0.35 may be used at the concrete and soil interface. Wall footings should be designed in accordance with structural considerations.

Shallow foundations may be designed for a maximum allowable bearing capacity of 1,500 lb/ft^2 (gross), for continuous footings a minimum of 12-inches wide and 12-inches deep; and spread footings 24-inches wide and 12-inches deep, into certified compacted fill. A factor of safety greater than 3 was used in evaluating the above bearing capacity value. This value maybe increased by 300 psf for each additional foot in depth and 150 psf for each additional foot of width to a maximum value of 2,500 psf.

Lateral forces on footings may be resisted by passive earth resistance and friction at the bottom of the footing. Foundations may be designed for a coefficient of friction of 0.35, and a passive earth pressure of 250 (375 lb/ft^2/ft with no factor of safety). The passive earth pressure incorporates a factor of safety of greater than 1.5.

All footing excavations should be cut square and level as much as possible, and should be free of sloughed materials including sand, rocks and gravel, and trash debris. Subgrade soils should be pre-moistened for the assumed very low to low or medium expansion potential (to be confirmed at the completion of grading). These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5:1[horizontal to vertical]) conditions only.

Bearing values indicated above are for total dead loads and frequently applied live loads. The above vertical bearing may be increased by one-third for short durations of loading which will include the effect of wind or seismic forces.

4.3 ***Preliminary Pavement Recommendation***

Based on an assumed R-value of 15 and a Traffic Index (TI) of 8.5 according to the County of Riverside Roadway Design Requirements (Riverside County Standard No. 114) for a roadway right-of-way of 100 feet (Riverside County, 2023), we recommend the following preliminary minimum street sections for Ynez Road (as indicated in Table 3). These recommendations should be confirmed with R-value testing of representative near-surface soils at the completion of grading. Final street sections should be confirmed by the project civil engineer based upon the projected Traffic Index. In addition, additional sections can be provided based on other traffic indices.

Table 3 Preliminary Pavement Design Sections	
Traffic Index	8.5
Asphalt Concrete (inches)	6
Aggregate Base (inches)	15

Prior to placement of the street aggregate base material, the upper 12 inches of subgrade soils should be scarified, moisture-conditioned (or dried back) as necessary to at least optimum moisture content and compacted to a minimum 90 percent relative compaction based on American Standard of Testing and Materials (ASTM) Test Method D1557.

Caltrans Class 2 Aggregate Base (Class 2 AB) or Greenbook Crushed Miscellaneous Base (CMB) should then be placed and compacted to a minimum 95 percent relative compaction in accordance with ASTM Test Method D1557. The aggregate base should conform to and be placed in accordance with the latest revision of the California Department of Transportation Standard Specifications (Section 26), the "Greenbook" Standard Specifications for Public Works Construction specifications, and/or the local jurisdictional requirements. Asphalt Concrete should conform to and be placed in accordance with the "Greenbook" Standard Specifications for Public Works Construction and the local jurisdictional requirements.

If vehicular concrete paving is proposed, the Portland Cement Concrete Pavement (PCCP) may be designed using a minimum of 10-inches of PCCP over 8-inches of compacted aggregate base. The modulus of rupture of the concrete should be a minimum of 600 pounds per square inch (psi) at 28 days. Contraction joints should be placed at maximum 20-foot spacings. Where the outer edge of a concrete pavement connects to an asphalt pavement, the concrete slab should be thickened by 50 percent at a taper not to exceed a slope of 1 in 10.

If pavement is planned adjacent to landscaped areas, we recommend that appropriate measures be taken (such as keeping the amount of landscape irrigation to a minimum, installing area drains, installing cutoff walls, or other devices, etc.) to reduce the possible adverse effects of water on the pavement subgrade.

4.4 Corrosivity to Concrete and Metal

The National Association of Corrosion Engineers (NACE) defines corrosion as "a deterioration of a substance or its properties because of a reaction with its environment." From a geotechnical viewpoint, the "environment" is the prevailing foundation soils and the "substances" are the reinforced concrete foundations or various buried metallic elements such as rebar, piles, pipes, etc., which are in direct contact with or within close vicinity of the foundation soil.

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates and/or pH values of less than 5.5. ACI 318R-14 Table 19.3.1.1 provides specific guidelines for the concrete mix design when the soluble sulfate content of the soils exceeds 0.1 percent by weight or 1,000 ppm. The minimum amount of chloride ions in the soil environment that are corrosive to steel, either in the form of reinforcement protected by concrete cover, or plain steel substructures such as steel pipes or piles, is 500 ppm per California Test 532.

Based on representative soil testing, the on-site soils are classified as having a negligible/So sulfate exposure condition in accordance with ACI 318R-14 Table 19.3.1.1. As a preliminary recommendation due to the results of sulfate content testing, concrete in contact with on-site soils should be designed in accordance with ACI 318R-14 Table 19.3.1.1 for the negligible/So category. It is also our opinion that the on-site soils should be preliminarily considered corrosive to buried metals. The client and/or other members of the design team should consider this potential as they determine necessary. LGC is not a corrosion consultant and does not provide recommendations related to corrosion.

4.5 ***Curb, Gutter and Sidewalk Recommendations***

Concrete flatwork (such as curb, gutter and sidewalks) has a high potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed per the following recommendations. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints but will not eliminate all cracking or lifting. Thickening the concrete and/or adding reinforcement will further reduce cosmetic distress.

Curb and gutters should be designed per city standards, as necessary. The curb and gutters should be anticipated to be underlain by the design aggregate base section used for the street section. Sidewalks should be designed per city standards, as necessary. The sidewalk should be underlain by a minimum of 4-inches of aggregate base.

The upper 6-inches of the subgrade for the curb and gutter should be compacted to a minimum relative compaction of 90 percent, and the subgrade soil should be at or above the optimum moisture content. The upper 6-inches of the subgrade for the sidewalks should be compacted to a minimum relative compaction of 90 percent, and the subgrade soil should be at or above the optimum moisture content. Aggregate base material should be Crushed Aggregate Base or Crushed Miscellaneous Base per SSPWC The “Greenbook” Section 200-2. Aggregate base material should be compacted to a minimum relative compaction of 95 percent. Curb and gutter and sidewalks should be provided with joints and expansion joins per usual practice/standards.

4.6 Control of Surface Water and Drainage Control

Positive drainage of surface water away from slopes and pavement areas is very important. No water should be allowed to pond adjacent to the roadway. Overwatering of landscape and planter areas must be avoided. Surface water runoff relative to project design is the purview of the project civil engineer.

4.7 ***Construction Observation and Testing***

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC.

Geotechnical observation and testing should be performed by the geotechnical consultant during site excavations, subgrade for slab/foundation, backfill of utility trenches, preparation of any subgrade and placement of aggregate base, or when any unusual soil conditions are encountered at the site. Grading plans, foundation plans, and final project drawings should be reviewed by this office prior to construction.

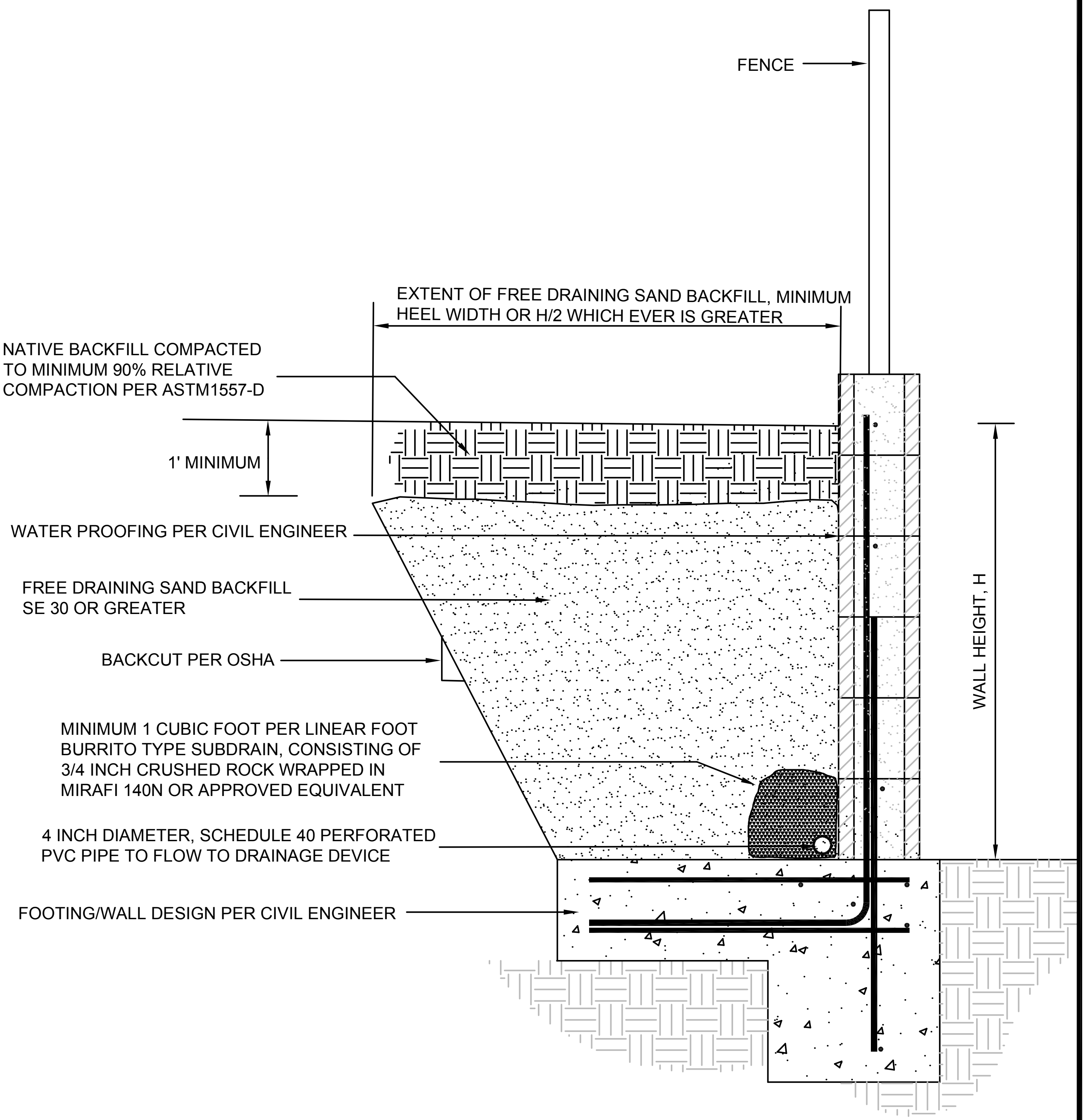
5.0 <u>LIMITATIONS</u>

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. The samples taken and submitted for laboratory testing, the observations made and the in-situ field testing performed are believed representative of the entire project; however, soil and geologic conditions revealed by excavation may be different than our preliminary findings. If this occurs, the changed conditions must be evaluated by the project soils engineer and geologist and design(s) adjusted as required or alternate design(s) recommended.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and/or project engineer and incorporated into the plans, and the necessary steps are taken to see that the contractor and/or subcontractor properly implements the recommendations in the field. The contractor and/or subcontractor should notify the owner if they consider any of the recommendations presented herein to be unsafe.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control.



LGC

Figure 2
Retaining Wall Detail, Sand Backfill

Project Name	Ynez Road Widening
Project No.	174002-05
Eng.	BIH/RKW
Scale	Not To Scale
Date	October 16, 2024

APPENDIX A

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APPENDIX B

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 ***Intent:*** These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 ***The Geotechnical Consultant of Record:*** Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 ***The Earthwork Contractor:*** The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "equipment" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 10 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 ***<u>Processing</u>:*** Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free from oversize material and the working surface is reasonably uniform, flat, and free from uneven features that would inhibit uniform compaction.

2.3 ***<u>Overexcavation</u>:*** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 ***<u>Benching</u>:*** Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 ***<u>Evaluation/Acceptance of Fill Areas</u>:*** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 <u>Fill Material</u>

3.1 ***<u>General</u>:*** Material to be used as fill shall be essentially free from organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 ***<u>Oversize</u>:*** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 ***<u>Import</u>:*** If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 <u>Fill Placement and Compaction</u>

4.1 ***<u>Fill Layers</u>:*** Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 ***<u>Fill Moisture Conditioning</u>:*** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 ***<u>Compaction of Fill</u>:*** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 ***<u>Compaction of Fill Slopes</u>:*** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheeps-foot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 ***<u>Compaction Testing</u>:*** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 ***<u>Frequency of Compaction Testing</u>:*** Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 ***<u>Compaction Test Locations</u>:*** The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 <u>Subdrain Installation</u>

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 <u>Excavation</u>

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 <u>Trench Backfills</u>

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

Geotechnical Map

Ynez Road Widening
Sta # 101+99.21 to 117+61.56
Temecula, California

LGC

Plate 1

Project Name	Ynez Road Widening
Project No.	174002-05
Eng. / Geol.	BIH/RKW
Scale	1" = 30'
Date	October 16, 2024

0 15 30 60

Legend

Afd - Artificial Fill, documented by LGC Valley during grading of Rancho Highlands

Afo - Artificial Fill, older placed during construction of Ynez Road

Qya - Quaternary-aged Young Alluvium, circled where buried

Qps - Quaternary-aged Pauba Formation, circled where buried

Approximate Location of Geologic Contact, dotted where buried, queried where uncertain

Approximate Location of Existing Fill Slope Key

Approximate Location of Recommended Fill Slope Key