LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

PRELIMINARY GEOTECHNICAL AND INFILTRATION FEASIBILITY INVESTIGATION PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT INDEPENDENCE AT CANYON SPRINGS RIVERSIDE, CALIFORNIA

PROJECT NO. 34019.1
AUGUST 21, 2024
Revised April 25, 2025

Prepared For:

LS BTR Development, LLC c/o Lewis MC.
1156 N. Mountain Avenue
Upland, California 91786

Attention: Mr. James Kim

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Subject: Preliminary Geotechnical and Infiltration Feasibility Investigation, Proposed Multi- Family Residential Development, Northwest Corner of Gateway Drive and Canyon Park Drive Riverside, California.

LOR Geotechnical Group, Inc., is pleased to present this report of our geotechnical investigation for the subject project. In summary, it is our opinion that the proposed development is feasible from a geotechnical perspective, provided the recommendations presented in the attached report are incorporated into design and construction. However, the contents of this summary should not be solely relied upon.

To provide adequate support for the proposed structures and structural improvements, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils. All existing undocumented fill material and any loose, compressible older alluvial materials should be removed from structural areas and areas to receive engineered compacted fills. The data developed during this investigation indicates that removals on the order of approximately 2 to 3 feet will be required from currently planned development areas. The given removal depth is preliminary and the actual depths of the removals should be determined during the grading operation by observation and/or in-place density testing.

Very low expansion potential and poor R-value quality generally characterize the upper onsite materials. Near completion and/or at the completion of site grading, additional foundation and subgrade soils should be tested, as necessary, to verify their expansion potential, soluble sulfate content, and R-value quality.

Our percolation test result indicates that the soils tested are not conducive to infiltration.

LOR Geotechnical Group, Inc.

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INTRODUCTION

During July and August 2024, a Preliminary Geotechnical and Infiltration Feasibility Investigation was performed by LOR Geotechnical Group, Inc., for the proposed Independence at Canyon Springs multi-family residential development within Assessor's Parcel Numbers (APNs) 291-440-003 and -005 through -007, located within the northwest corner of Gateway Drive and Canyon Park Drive, in the city of Riverside, California. The purpose of this investigation was to provide a technical evaluation of the geologic setting of the site and to provide geotechnical design recommendations for the proposed development. The scope of our services included:

- Review of available geotechnical literature, reports, maps, and agency information pertinent to the study area;
- Interpretation of aerial photographs of the site and surrounding regions dated 1948 through 2024;
- Geologic field reconnaissance mapping to verify the areal distribution of earth units and significance of surficial features as compiled from documents, literature, and reports reviewed;
- A subsurface field investigation to determine the physical soil conditions pertinent to the proposed development;
- Percolation testing via the borehole test method to determine Infiltration characteristics;
- Laboratory testing of selected soil samples obtained during the field investigation;
- Development of geotechnical recommendations for site grading and foundation design; and
- Preparation of this report summarizing our findings, and providing conclusions and recommendations for site development.

The approximate location of the site is shown on the attached Index Map, Enclosure A-1, within Appendix A.

PROJECT CONSIDERATIONS

To orient our investigation at the site, a site plan, prepared by Angeleno Associates Inc., dated March 22, 2024, was furnished for our use. The proposed development is illustrated

on this plan. As illustrated, the site is proposed to be developed with multi-family residences and the associated landscape, parking, and driveways. Additionally, a recreational area with a pool, gym, BBQ area, and spa are also proposed. Underground infiltration systems to receive onsite storm water runoff flows are proposed for WQMP purposes.

This plan was utilized as a base map for our field investigation and is presented as Enclosure A-2, within Appendix A.

The proposed structures are anticipated to consist of one and two-story wood frame and stucco or similar type construction. Conventional foundation systems with light to moderate foundation loads are anticipated with such structures.

Grading plans have not yet been developed. However, based on the current topography of the site and adjacent areas, very minor cuts and fills are anticipated to create level surfaces for the proposed improvements.

PREVIOUS REPORTS/PLANS

A records request to the City of Riverside discovered that a Preliminary Geotechnical Investigation (PGI) was previously conducted for infrastructure and rough grading of the Canyon Springs Development, an approximate 351-acre area which included the subject property (IT Corporation, 1984). The 351-acre area was bounded on the north by Highway 60, on the east by Day Street, on the west by the Atchison Topeka and Santa Fe (AT&SF) rail line (west of the I-215 Freeway), and Eucalyptus Avenue on the south. The investigation area was crossed by State of California and Metropolitan Water District water pipelines, and was described as being undeveloped and covered with grass, some fill, dumped trash, and some sheep excrement. Drainage was stated to be generally to the southwest. Natural surface drainage swales were reported to be only slightly incised over most of the investigation area, with the larger stream channels west of the I-215 Freeway. The PGI included the advancement of fifteen (15) soil borings (D-1 through D-15) to maximum exploration depths ranging from approximately 12.5 to 28 feet below the ground surface, (bgs) and excavation of seven (7) backhoe trenches to maximum exploration depths ranging from approximately 5 to 20 feet bgs. One of the soil borings, D-9, was advanced to a maximum depth of approximately 18 feet bgs in the far southeast portion of the subject property near the intersection at Canyon Park and Gateway Drives. The soils encountered include a red brown sandy silt from ground surface to 2 feet bgs, underlying which was a dense to very dense red brown silty sand. Neither bedrock nor groundwater

were encountered in boring D-9, nor were they encountered in any of the rest of the soil borings or backhoe trenches. However, the geotechnical report prepared by IT Corporation (IT) refers to a previous geotechnical investigation by John R. Byerly, Inc. conducted in 1980 which encountered groundwater in two soil borings, B-5 and B-6, at 21.5 and 11 feet bgs, respectively. The locations of these two borings are shown on a figure ("Geotechnical Map") in the IT geotechnical report, the closest of which is soil boring B-5, located approximately 750 feet east-northeast of the subject property.

Following the preparation of the IT geotechnical report, a mass grading plan was prepared for an approximate 230-acre area, Phase I of Parcel Map No. 19617, which included the subject property (Greiner Engineering of California, 1984). This 230-acre area is within the approximate 351-acre area discussed above. The mass grading plan suggests that approximately 1 to 8 feet of engineered fill soil materials were to be placed across the subject property, with two limited areas of approximately 1 to 2 feet of cut. The mass grading plan earthwork quantities estimates for Phase I of Parcel Map No. 19617 indicated an overall balance of the soil materials to be cut and filled, with a total amount of earth to be moved upwards of 700,000 cubic yards.

AERIAL PHOTO ANALYSIS

The aerial photographs reviewed consisted of vertical aerial photograph images of varying scales. We reviewed imagery available from Google Earth Pro (2024) computer software and from online Historic Aerials (2024).

To summarize briefly, the site appears to be vacant land used for agricultural purposes (dryland farming) from 1948 until 1994 when the site appears to have been mass graded in association with the surrounding Canyon Spring Business Park Specific Plan area. The site has remained vacant to present time. No evidence for the presence of faults traversing the site area or mass movement features was noted during our review of the photographs covering the site and nearby vicinity.

EXISTING SITE CONDITIONS

The subject property consists of 9.13 acres of roughly square shaped vacant land, located along the northwest corner of Gateway Drive and Canyon Park Drive in Riverside, California. The topography of the site consists of a very gentle gradient to the south. The site is currently vacant and contains some light annual grasses and weeds on the exterior area and some moderately heavy to heavy annual grasses and weeds in the central area of the site. Some minor wind blown trash and debris is also present.

Gateway Drive, a fully improved roadway, bounds the site on the south with a commercial building and a school beyond. Vacant land bounds the site on the north followed by a strip mall. West of the site lies a county government office. Canyon Park Drive, a fully improved roadway bounds the site on the east with vacant land beyond. An office building, lies to the northeast.

SUBSURFACE FIELD INVESTIGATION

Our subsurface field exploration program was conducted on July 29, 2024. The work consisted of advancing a total of 6 exploratory borings using a truck-mounted drill rig equipped with 8-inch diameter hollow stem augers. In addition, four borehole percolation tests were conducted in general accordance with the Deep Percolation Test procedure as outlined in the Technical Guidance Document for Water Quality Management Plans (RCFCWCD, 2011). The approximate locations of our exploratory borings and percolation test are presented on Enclosure A-2, within Appendix A.

The subsurface conditions encountered in the exploratory borings were logged by a geologist from this firm. The borings were drilled to depths ranging from approximately 20.33 and 51.50 feet below the existing ground surface. Relatively undisturbed and bulk samples were obtained at a maximum depth interval of 5 feet, and returned to our geotechnical laboratory in sealed containers for further testing and evaluation.

Four percolation test borings were drilled at the requested locations and to the requested depth of approximately 10 feet below the existing ground surface, and tested on July 30, 2024.

A detailed description of the subsurface field exploration program and the boring logs are presented in Appendix B, while a detailed description of our borehole percolation testing program and the test results are presented in Appendix C.

LABORATORY TESTING PROGRAM

Selected soil samples obtained during the field investigation were subjected to geotechnical laboratory testing to evaluate their physical and engineering properties. Laboratory testing included in-place moisture content and dry density, laboratory compaction characteristics, direct shear, sieve analysis, sand equivalent, R-value, expansion index, and corrosion screening. Physical testing was conducted in our geotechnical laboratory and chemical testing was conducted by our subconsultant, Project

X Corrosion Engineering. A detailed description of the geotechnical laboratory testing program and the test results are presented in Appendix D.

GEOLOGIC CONDITIONS

Regional Geologic Setting

The site is located within the eastern portion of the city of Riverside which in turn lies within the northern end of the Perris Valley just south of the base of the Box Springs Mountains. This area is located on the Perris block within the northern Peninsular Ranges geologic province of southern California. While the Perris block is considered to be a relatively stable structural block, it is bounded by active faults. These include the Elsinore fault zone on the southwest, the San Jacinto fault zone on the east and the Cucamonga fault zone on the north. The Perris block is underlain predominately by a very large mass of crystalline igneous rocks of Cretaceous age and older metasedimentary and metavolcanic rocks.

The Perris block has a series of erosional surfaces, marked by low topographic relief and capped with unconsolidated alluvial sediments stripped from the surrounding highlands, such as the Box Springs Mountains. The Perris Valley is a long and narrow alluviated valley which drains to the southeast. This region of and around the site was mapped by the California Division of Mines and Geology as being underlain by deposits of slightly to well consolidated to indurated older alluvium (Morton and Matti, 2001).

The nearest known active fault zone is the San Jacinto fault zone located approximately 9.7 kilometers (6.0 miles) to the northeast. Other major faults within the region include the San Andreas fault zone located approximately 24.2 kilometers (15.0 miles) to the northeast and the Elsinore fault zone located approximately 26.4 kilometers (16.4 miles) to the southwest.

The site and the regional geologic setting are shown on Enclosure A-3 within Appendix A.

Site Geologic Conditions

The majority of the subject site is underlain by a relatively thin layer of fill materials overlying older alluvial materials as encountered within our subsurface exploratory borings. These units are described in further detail in the following sections:

Fill: Fill materials were encountered within our exploratory borings to depths of approximately 3 feet. These materials were comprised of silty sand to sandy silt. The fill

materials are believed to be associated with past site use as well as previous grading and weed abatement practices and are considered to be non-engineered fill. No professional grading reports for the site were found during our review of available geotechnical literature, reports, maps, and agency information.

Older Alluvium: Older alluvial materials were encountered within all of our exploratory borings to the maximum depths explored. These units were noted to mainly consist of silty sand to sandy silt with occasional clayey sand units encountered. These materials were typically yellow brown, red brown, to dark brown in color. The older alluvial materials were in a dense/stiff state upon first encounter, generally becoming increasingly dense/stiff with increasing depth based on our equivalent Standard Penetration Test (SPT) data and in-place density testing.

A detailed description of the subsurface soil conditions as encountered within our exploratory borings is presented on the Boring Logs within Appendix B.

Groundwater Hydrology

Groundwater was encountered at approximately 48.5 feet below the existing ground surface within our deepest exploratory soil boring (B-1) which was advanced to a maximum depth of approximately 51.5 feet below the existing ground surface from an elevation of approximately 1565 feet above mean sea level.

Local groundwater level measurements were researched at the California Department of Water Resources (CDWR) online Water Data Library (CDWR, 2024). However, there is no groundwater level data for wells within 1 mile of the site.

Other sources of groundwater level data includes the online State Water Resources Control Board (SWRCB) GeoTracker database (SWRCB, 2024). Two nearby leaking underground storage tank (LUST) regulatory cases involved the installation and monitoring of groundwater wells. The closest site, ARCO #5632/Riverside Better Gas at 6287 Day Street, located approximately 0.15 mile east-northeast of the site, has groundwater level measurements in the time period of 2003 to 2012 ranging from approximately 4 to 48 feet below the ground surface at reference elevations ranging from approximately 1,576 to 1,582 feet above mean sea level. The second LUST site, Texaco Day at 6189 Day Street, located approximately 0.25 mile northeast of the site, has groundwater level measurements in the time period of 2004 to 2008 ranging from approximately 7 to 12 feet below the ground surface at reference elevations ranging from approximately 1,595 to 1,600 feet above mean sea level.

The Spring 2023 Cooperative Well Measuring Program includes groundwater level data for State Well No. 03S04W10A001S (“Box Springs Mutual #17") located approximately 0.33 mile south-southeast of the site (Watermaster Support Services et al., 2023). This well, with a reference elevation at approximately 1,540 feet above mean sea level, has groundwater level measurements in the time period of April 1996 to December 2013 ranging from approximately 30 to 105 feet below the ground surface, with the most recent (2008-2013) measurements less than 50 feet below the ground surface.

Based on the above information, the depth to groundwater beneath the subject property is anticipated to be encountered at depths less than 50 feet below the existing ground surface and is not anticipated to be a factor during site development.

Mass Movement

The site lies on a relatively flat surface. The occurrence of mass movement failures such as landslides, rockfalls, or debris flows within such areas is generally not considered common, and no evidence of mass movement was observed on the site.

Faulting

As noted on the Regional Geologic Map, Enclosure A-3, within Appendix A, the United States Geological Survey mapped a small fault running along the base of the small ravine to the west of the site. This fault is shown as dotted, or a "concealed fault" on the map. We contacted Dr. D. Morton, with the U.S.G.S., the author of this map (personal communication, 2002). Dr. Morton informed us that this fault has been inferred as running down the upper portions of Box Springs Canyon based primarily on a trench he observed located nearby. In this trench the fault fractured materials almost to the surface. However, Dr. Morton estimated the age of these materials as on the order of 700,000 years, and no recent geomorphic evidence has been noted along this feature. Therefore, Dr. Morton believes that there is no evidence to consider this feature as an active fault.

No active or potentially active faults are known to exist at the subject site. In addition, the subject site does not lie within a current State of California Earthquake Fault Zone (Hart and Bryant, 2010) nor does the site lie within a County of Riverside fault zone (TLMA, 2024).

As previously mentioned, the closest known active fault is the San Jacinto Valley segment of the San Jacinto fault zone, located approximately 9.7 kilometers (6.0 miles) to the northeast. In addition, other relatively close active faults include the San Bernardino

segment of the San Andreas fault zone located approximately 24.2 kilometers (15.0 miles) to the northeast and the Glen Ivy segment of the Elsinore fault zone, located approximately 26.4 kilometers (16.4 miles) to the southwest.

The San Jacinto fault zone is a sub-parallel branch of the San Andreas fault zone, extending from the northwestern San Bernardino area, southward into the El Centro region. This fault has been active in recent times with several large magnitude events. It is believed that the San Jacinto fault is capable of producing an earthquake magnitude on the order of 6.5 or greater.

The San Andreas fault is considered to be the major tectonic feature of California, separating the Pacific Plate and the North American Plate. While estimates vary, the San Andreas fault is generally thought to have an average slip rate on the order of 24mm/yr and capable of generating large magnitude events on the order of 7.2 or greater.

The Elsinore fault zone is one of the largest in southern California. At its northern end it splays into two segments and at its southern end it is cut by the Yuba Wells fault. The primary sense of slip along the Elsinore fault is right lateral strike-slip. It is believed that the Elsinore fault zone is capable of producing an earthquake magnitude on the order of 6.5 to 7.5.

Current standards of practice include a discussion of all potential earthquake sources within a 100 kilometer (62 mile) radius. However, while there are other large earthquake faults within a 100 kilometer (62 mile) radius of the site, none of these are considered as relevant to the site as the faults described above, due to their closer distance and larger anticipated magnitudes.

Historical Seismicity

In order to obtain a general perspective of the historical seismicity of the site and surrounding region a search was conducted for seismic events at and around the area within various radii. This search was conducted utilizing the historical seismic search website of the U.S.G.S. (2024). This website conducts a search of a user selected cataloged seismic events database, within a specified radius and selected magnitudes, and then plots the events onto a map. At the time of our search, the database contained data from January 1, 1932 through August 6, 2024.

In our first search, the general seismicity of the region was analyzed by selecting an epicenter map listing all events of magnitude 4.0 and greater, recorded since 1932, within

a 100 kilometer (62 mile) radius of the site, in accordance with guidelines of the California Division of Mines and Geology. This map illustrates the regional seismic history of moderate to large events. As depicted on Enclosure A-4, within Appendix A, the site lies within a relatively active region of southern California with numerous medium and larger sized events.

In the second search, the micro seismicity of the area lying within a 15 kilometer (9.2 mile) radius of the site was examined by selecting an epicenter map listing events on the order of 2.0 and greater since 1978. The results of this search is a map that presents the seismic history around the area of the site with much greater detail, not permitted on the larger map. The reason for limiting the time period for the events on the detail map is to enhance the accuracy of the map. Events recorded prior to the mid to late 1970's are generally considered to be less accurate due to advancements in technology. As depicted on this map, Enclosure A-5, numerous very small events associated with the San Jacinto fault to the northeast have occurred in the past.

In summary, the historical seismicity of the site entails numerous small to medium magnitude earthquake events occurring in the region around the subject site. Any future developments at the subject site should anticipate that moderate to large seismic events could occur very near the site.

Secondary Seismic Hazards

Other secondary seismic hazards generally associated with severe ground shaking during an earthquake include liquefaction, seismic-induced settlement, seiches and tsunamis, earthquake induced flooding, landsliding, and rockfalls.

Liquefaction: The potential for liquefaction generally occurs during strong ground shaking within granular loose sediments where the groundwater is usually less than 50 feet below the ground surface. Groundwater was encountered at 48.5 feet below the ground surface. However, because the site is underlain by relatively dense/stiff to very dense/hard older alluvial materials the possibility of liquefaction at the site is considered nil.

Seiches/Tsunamis: The potential for the site to be affected by a seiche or tsunami (earthquake generated wave) is considered nil due to absence of any large bodies of water near the site.

Flooding (Water Storage Facility Failure): There are no large water storage facilities located on or near the site which could possibly rupture during in earthquake and affect the site by flooding.

Seismically-Induced Landsliding: Due to the low relief of the site and surrounding region, the potential for landslides to occur at the site is considered nil.

Rockfalls: No large, exposed, loose or unrooted boulders are present above the site that could affect the integrity of the site.

Seismically-Induced Settlement: Settlement generally occurs within areas of loose, granular soils with relatively low density. Since the site is underlain by relatively dense older alluvial materials, the potential for settlement is considered very low. In addition, the recommended earthwork operations to be conducted during the development of the site should mitigate any near surface loose soil conditions.

SOILS AND SEISMIC DESIGN CRITERIA (California Building Code 2022)

Design requirements for structures can be found within Chapter 16 of the 2022 California Building Code (CBC) and 2022 California Residential Code (CRC) based on building type, use, and/or occupancy. The classification of use and occupancy of all proposed structures at the site, shall be the responsibility of the building official.

Site Classification

Chapter 20 of the ASCE 7-16 defines six possible site classes for earth materials that underlie any given site. Our investigation, mapping by others, and our experience in the site region indicates that the materials beneath the site are considered Site Class D stiff soils.

CBC Earthquake Design Summary

Earthquake design criteria have been formulated in accordance with the 2022 CBC and ASCE 7-16 for the site based on the results of our investigation to determine the Site Class and an assumed Risk Category II. However, these values should be reviewed and the final design should be performed by a qualified structural engineer familiar with the region. In addition, the building official should confirm the Risk Category utilized in our design (Risk Category II). Our design values are provided below:

CBC 2022/ASCE 7-16 SEISMIC DESIGN SUMMARY* Site Location (USGS WGS84) 33.9359, -117.2830, Risk Category II	
Site Class Definition Chapter 20 ASCE 7	D
$\mathbf{S_s}$ Mapped Spectral Response Acceleration at 0.2s Period	1.500
$\mathbf{S_1}$ Mapped Spectral Response Acceleration at 1s Period	0.600
$\mathbf{S_{MS}}$ Adjusted Spectral Response Acceleration at 0.2s Period	1.676
$\mathbf{S_{M1}}$ Adjusted Spectral Response Acceleration at 1s Period	1.330
$\mathbf{S_{DS}}$ Design Spectral Response Acceleration at 0.2s Period	1.117
$\mathbf{S_{D1}}$ Design Spectral Response Acceleration at 1s Period	0.887
$\mathbf{F_a}$ Short Period Site Coefficient at 0.2s Period	1.0
$\mathbf{F_v}$ Long Period Site Coefficient at 1s Period	1.7
$\mathbf{PGA_M}$ Site Modified Peak Ground Acceleration	0.638
Seismic Design Category	D
*See Appendix E for detailed calculations	

CONCLUSIONS

This investigation provides a broad overview of the geotechnical and geologic factors which are expected to influence future site planning and development. On the basis of our field investigation and testing program, it is the opinion of LOR Geotechnical Group, Inc., that the proposed development of the site for the proposed use is feasible from a geotechnical standpoint, provided the recommendations presented in this report are incorporated into design and implemented during grading and construction.

It should be noted that the subsurface conditions encountered in our exploratory borings are indicative of the locations explored and the subsurface conditions may vary. If conditions are encountered during the construction of the project that differ significantly from those presented in this report, this firm should be notified immediately so we may assess the impact to the recommendations provided.

Foundation Support

To provide adequate support for the proposed structures, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils.

Conventional foundation systems utilizing either individual spread footings and/or continuous wall footings will provide adequate support for the anticipated downward and lateral loads when utilized in conjunction with the recommended fill mat.

Soil Expansiveness

The upper materials encountered during this investigation were tested and found to have a very low expansion potential. Therefore, specialized construction procedures to specifically resist expansive soil activity for this type of soil are not anticipated at this time.

Corrosion Screening

Select representative samples from our borings were taken to Project X Corrosion Engineering for full corrosion series testing. Results from soil corrosivity testing completed by Project X Corrosion Engineering are presented within Appendix D.

The corrosivity test results indicate that soluble sulfate concentrations in the samples were less than 0.10 percent by weight. These concentrations indicate an exposure class S0 for sulfate (ACI 318). No special mitigation methods are considered necessary.

The corrosivity test results indicate that chloride concentrations were below 500 ppm. This concentration indicates an exposure class C1 for chloride (ACI 318). Special mitigation measures are not considered necessary.

Soil pH for the samples was 7.9 to 8.2, slightly basic. Therefore, the need for specialized design is not anticipated.
Concentrations of ammonium and nitrate indicate the soil may be aggressive towards copper.

Resistivity results for the samples indicate the soils tested are mildly to moderately corrosive to ferrous metals.

LOR Geotechnical does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer should be consulted.

Infiltration

The results of our field investigation and percolation test data indicate that the site soil materials at the depth and location tested are not conducive to infiltration.

Geologic Mitigations

No special mitigation methods are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

Seismicity

Seismic ground rupture is generally considered most likely to occur along pre-existing active faults. Since no known faults are known to exist at, or project into the site, the probability of ground surface rupture occurring at the site is considered nil.

Due to the site's close proximity to the faults described above, it is reasonable to expect a relatively strong ground motion seismic event to occur during the lifetime of the proposed development on the site. Large earthquakes could occur on other faults in the general area, but because of their lesser anticipated magnitude and/or greater distance, they are considered less significant than the faults described above from a ground motion standpoint.

The effects of ground shaking anticipated at the subject site should be mitigated by the seismic design requirements and procedures outlined in Chapter 16 of the California Building Code. However, it should be noted that the current building code requires the minimum design to allow a structure to remain standing after a seismic event, in order to allow for safe evacuation. A structure built to code may still sustain damage which might ultimately result in the demolishing of the structure (Larson and Slosson, 1992).
No secondary seismic hazards are anticipated to impact the proposed development.

RECOMMENDATIONS

Geologic Recommendations

No special geologic recommendations are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

General Site Grading

It is imperative that no clearing and/or grading operations be performed without the presence of a qualified geotechnical engineer. An onsite, pre-job meeting with the developer, the contractor, the jurisdictional agency, and the geotechnical engineer should occur prior to all grading related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed in accordance with the following recommendations as well as applicable portions of the California Building Code, and/or applicable local ordinances.

All areas to be graded should be stripped of significant vegetation and other deleterious materials. Any undocumented fill encountered during grading should be completely removed, cleaned of significant deleterious materials and may then be reused as compacted fill. It is our recommendation that any existing fills under any proposed flatwork and paved areas be removed and replaced with engineered compacted fill. If this is not done, premature structural distress (settlement) of the flatwork and pavement may occur.

Cavities created by the removal of any subsurface obstructions that could be encountered, such as foundations, utilities, and septic systems associated with the previous on-site development, should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended in the following Engineered Compacted Fill section of this report.

Initial Site Preparation

The existing undocumented fill soil and any loose older alluvial soils should be removed from all proposed structural and/or fill areas. The data developed during this investigation indicates that removals on the order of 2 to 3 feet deep will be required from proposed development areas in order to encounter competent older alluvium upon which engineered

compacted fill can be placed. The given removal depths are preliminary. Deeper fills may be present locally. Removals should expose older alluvial materials with an in-situ relative compaction of at least 85 percent (ASTM D 1557). The actual depths of the removals should be determined during the grading operation by observation and/or in-place density testing.

Preparation of Fill Areas

Prior to placing fill, the surfaces of all areas to receive fill should be scarified to a minimum depth of 12 inches. The scarified soil should be brought to near optimum moisture content and compacted to a relative compaction of at least 90 percent (ASTM D 1557).

Engineered Compacted Fill

The onsite soils should provide adequate quality fill material, provided they are free from oversized and/or organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 6 inches should not be buried or placed in fills.

If required, import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. Sources for import fill should be approved by the geotechnical engineer prior to their use. Fill should be spread in maximum 8-inch uniform, loose lifts, each lift brought to near optimum moisture content, and compacted to a relative compaction of at least 90 percent in accordance with ASTM D 1557.

Based upon the relative compaction of the near surface soils determined during this investigation and the relative compaction anticipated for compacted fill soil, we estimate a compaction shrinkage factor of approximately 5 to 10 percent. In addition, we would anticipate subsidence of approximately 0.10 feet. These values are for estimating purposes only, and are exclusive of losses due to stripping or the removal of subsurface obstructions. These values may vary due to differing conditions within the project boundaries and the limitations of this investigation. Shrinkage should be monitored during construction. If percentages vary, provisions should be made to revise final grades or adjust quantities of borrow or export.

Preparation of Foundation Areas

All footings should rest upon at least 24 inches of properly compacted fill material placed over competent older alluvium. In areas where the required fill thickness is not accomplished by the recommended removals or by site rough grading, the footing areas should be further subexcavated to a depth of at least 24 inches below the proposed footing base grade, with the subexcavation extending at least 5 feet beyond the footing lines. The bottom of all excavations should be scarified to a depth of 12 inches, brought to near optimum moisture content, and recompacted to at least 90 percent relative compaction (ASTM D 1557) prior to the placement of compacted fill.

Concrete floor slabs should bear on a minimum of 24 inches of compacted soil. This should be accomplished by the recommendations provided above. The final pad surfaces should be rolled to provide smooth, dense surfaces upon which to place the concrete.

Short-Term Excavations

Following the California Occupational and Safety Health Act (CAL-OSHA) requirements, excavations 5 feet deep and greater should be sloped or shored. All excavations and shoring should conform to CAL-OSHA requirements. Short-term excavations of 5 feet deep and greater will conform to Title 8 of the California Code of Regulations, Construction Safety Orders, Section 1504 and 1539 through 1547. Based on the findings from our exploratory borings, it appears that Type C soils are the predominant type of soil on the project and all short-term excavations should be based on this type of soil.

Deviation from the standard short-term slopes are permitted using option four, Design by a Registered Professional Engineer (Section 1541.1).

Short-term excavation construction and maintenance are the responsibility of the contractor and should be a consideration of his methods of operation and the actual soil conditions encountered.

Slope Construction

Preliminary data indicates that cut and fill slopes should be constructed no steeper than two horizontal to one vertical. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction, then roll the final slopes to provide dense, erosion-resistant surfaces.

Slope Protection

Since the site soil materials are susceptible to erosion by running water, measures should be provided to prevent surface water from flowing over slope faces. Slopes at the project should be planted with a deep rooted ground cover as soon as possible after the completion of grading. The use of succulent ground covers such as iceplant or sedum is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the irrigation system and to prevent over watering.

Soil Expansiveness

The upper materials encountered during this investigation were tested and found to have a very low expansion potential. Therefore, specialized construction procedures to specifically resist expansive soil activity are not anticipated at this time.

Additional evaluation of on-site and any imported soils for their expansion potential should be conducted following completion of the grading operation.

Foundation Design

If the site is prepared as recommended, the proposed structures may be safely supported on conventional shallow foundations, either individual spread footings and/or continuous wall footings, bearing entirely on a minimum of 24 inches of engineered compacted fill placed over competent alluvial materials. All foundations should have a minimum width of 12 inches. Footings placed upon very low expansive soils should be established a minimum of 12 inches below lowest adjacent grade.

For the minimum width and depth, spread foundations may be designed using an allowable bearing pressure of 2,000 psf. This bearing pressure may be increased by 200 psf for each additional foot of width, and by 500 psf for each additional foot of depth, up to a maximum of 4,000 psf. For example, a footing 2 feet wide and embedded 2 feet will have an allowable bearing pressure of 2,700 psf.

The above values are net pressures; therefore, the weight of the foundations and the backfill over the foundations may be neglected when computing dead loads. The values apply to the maximum edge pressure for foundations subjected to eccentric loads or overturning. The recommended pressures apply for the total of dead plus frequently

applied live loads, and incorporate a factor of safety of at least 3.0. The allowable bearing pressures may be increased by one-third for temporary wind or seismic loading.

The resultant of the combined vertical and lateral seismic loads should act within the middle one-third of the footing width. The maximum calculated edge pressure under the toe of foundations subjected to eccentric loads or overturning should not exceed the increased allowable pressure.

Resistance to lateral loads will be provided by passive earth pressure and base friction. For footings bearing against compacted fill, passive earth pressure may be considered to be developed at a rate of 400 pounds per square foot per foot of depth. Base friction may be computed at 0.40 times the normal load. Base friction and passive earth pressure may be combined without reduction. These values are for dead load plus live load and may be increased by one-third for wind or seismic loading.

Settlement

Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Maximum settlement of shallow foundations designed and constructed in accordance with the preceding recommendations are estimated to be on the order of 0.5 inch. Differential settlements between adjacent footings should be about one-half of the total settlement. Settlement of all foundations is expected to occur rapidly, primarily as a result of elastic compression of supporting soils as the loads are applied, and should be essentially completed shortly after initial application of the loads.

Building Area Slab-on-Grade

To provide adequate support, concrete floor slabs-on-grade should bear on a minimum of 24 inches of engineered fill compacted soil over competent older alluvium. The final pad surfaces should be rolled to provide smooth, dense surfaces.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor retarder/barrier. We recommend that a vapor retarder/barrier be designed and constructed according to the American Concrete Institute 302.1R, Concrete Floor and Slab Construction, which addresses moisture vapor retarder/barrier construction. At a minimum, the vapor retarder/barrier should comply with ASTM E1745 and have a nominal thickness of at least 10 mils. The vapor retarder/barrier should be properly sealed, per the manufacturer's recommendations, and protected from punctures and other damage.

Per the Portland Cement Association, for slabs with vapor-sensitive coverings, a layer of dry, granular material (sand) should be placed under the vapor retarder/barrier.

For slabs in humidity-controlled areas, a layer of dry, granular material (sand) should be placed above the vapor retarder/barrier.

The slabs should be protected from rapid and excessive moisture loss which could result in slab curling. Careful attention should be given to slab curing procedures, as the site area is subject to large temperature extremes, humidity, and strong winds.

Exterior Flatwork

To provide adequate support, exterior flatwork improvements should rest on a minimum of 12 inches of soil compacted to at least 90 percent (ASTM D 1557).

Flatwork surface should be sloped a minimum of 1 percent away from buildings and slopes, to approved drainage structures.

Wall Pressures

The design of footings for retaining walls should be performed in accordance with the recommendations described earlier under Preparation of Foundation Areas and Foundation Design. For design of retaining wall footings, the resultant of the applied loads should act in the middle one-third of the footing, and the maximum edge pressure should not exceed the basic allowable value without increase.

For design of retaining walls unrestrained against movement at the top, we recommend an active pressure of 40 pounds per square foot (psf) per foot of depth be used. This assumes level backfill consisting of compacted, non-expansive, on-site soils placed against the structures and within the back cut slope extending upward from the base of the stem at 35 degrees from the vertical or flatter.

Retaining structures subject to uniform surcharge loads within a horizontal distance behind the structures equal to the structural height should be designed to resist additional lateral loads equal to 0.50 times the surcharge load. Any isolated or line loads from adjacent foundations or vehicular loading will impose additional wall loads and should be considered individually.

To avoid over stressing or excessive tilting during placement of backfill behind walls, heavy compaction equipment should not be allowed within the zone delineated by a 45-degree line extending from the base of the wall to the fill surface. The backfill directly behind the walls should be compacted using light equipment such as hand operated vibrating plates and rollers. No material larger than three inches in diameter should be placed in direct contact with the wall.

Wall pressures should be verified prior to construction, when the actual backfill materials and conditions have been determined. Recommended pressures are applicable only to level, non-expansive, properly drained backfill with no additional surcharge loadings. If inclined backfills are proposed, this firm should be contacted to develop appropriate active earth pressure parameters.

Preliminary Pavement Design

Testing and design for preliminary onsite pavement was conducted in accordance with the California Highway Design Manual.

Based upon our preliminary sampling and testing, and upon an assumed Traffic Index generally used for similar projects, it appears that the structural sections tabulated below should provide satisfactory pavements for the subject on-site pavement improvements:

AREA	T.I.[1]	DESIGN R-VALUE	PRELIMINARY SECTION
On site vehicular parking with occasional truck traffic	5.0	15	0.25’ AC / 0.65' AB
On site vehicular parking with occasional truck traffic	6.0	15	0.25’ AC / 0.95' AB

AC - Asphalt Concrete
AB - Class 2 Aggregate Base
[1] to be determined by project engineer

The above structural sections are predicated upon 90 percent relative compaction (ASTM D 1557) of all utility trench backfills and 95 percent relative compaction (ASTM D 1557) of the upper 12 inches of pavement subgrade soils and of any aggregate base utilized.

In addition, the aggregate base should meet Caltrans specifications for Class 2 Aggregate Base.

In areas of the pavement which will receive high abrasion loads due to start-ups and stops, or where trucks will move on a tight turning radius, consideration should be given to installing concrete pads. Such pads should be a minimum of 5 inch thick concrete, with a 4 inch thick aggregate base. Concrete pads are also recommended in areas adjacent to trash storage areas where heavier loads will occur due to operation of trucks lifting trash dumpsters.

It should be noted that all of the above pavement design was based upon the results of preliminary sampling and testing, and should be verified by additional sampling and testing during construction when the actual subgrade soils are exposed.

Infiltration

The results of our field investigation and percolation test data indicates the site earth materials at the depth and location tested are not conducive to acceptable infiltration. Therefore, water quality storm water systems should not be incorporate on-site infiltration when determining storm water treatment capacity.

Corrosion Protection

Based on the test results, this soil is classified as mildly to moderately corrosive to ferrous metals and potentially aggressive towards copper. The laboratory data above should be reviewed and corrosion design should be completed by a qualified corrosion engineer.

In lieu of corrosion design for metal piping, ABS/PVC may be used. Soil corrosion is not considered a factor with ABS/PVC materials. ABS/PVC is considered suitable for use due to the corrosion potential of the on-site soils with respect to metals.

LOR Geotechnical does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer should be consulted.

Construction Monitoring

Post investigative services are an important and necessary continuation of this investigation. Project plans and specifications should be reviewed by the project

geotechnical consultant prior to construction to confirm that the intent of the recommendations presented in this report have been incorporated into the design.

Additional R-value, expansion potential, and soluble sulfate content testing should be conducted after/during site rough grading.

During construction, sufficient and timely geotechnical observation and testing should be provided to correlate the findings of this investigation with the actual subsurface conditions exposed during construction. Items requiring observation and testing include, but are not necessarily limited to, the following:

1. Site preparation-stripping and removals.

2. Excavations, including approval of the bottom of excavations prior to the processing and preparation of the bottom areas for fill placement.

3. Scarifying and compacting prior to fill placement.

4. Foundation excavations.

5. Subgrade preparation for pavements and slabs-on-grade.

6. Placement of engineered compacted fill and backfill, including approval of fill materials and the performance of sufficient density tests to evaluate the degree of compaction being achieved.

LIMITATIONS

This report contains geotechnical conclusions and recommendations developed solely for use by LS BTR Development, LLC c/o Lewis MC, and their design consultants, for the purposes described earlier. It may not contain sufficient information for other uses or the purposes of other parties. The contents should not be extrapolated to other areas or used for other facilities without consulting LOR Geotechnical Group, Inc.

The recommendations are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations and a surficial site reconnaissance.

The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. If conditions are encountered during the

construction of the project, which differ significantly from those presented in this report, this firm should be notified immediately so we may assess the impact to the recommendations provided. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed and tested by the project geotechnical consultant.

If parties other than LOR Geotechnical Group, Inc., provide construction monitoring services, they must be notified that they will be required to assume responsibility for the geotechnical phase of the project being completed by concurring with the recommendations provided in this report or by providing alternative recommendations.

The report was prepared using generally accepted geotechnical engineering practices under the direction of a state licensed geotechnical engineer. No warranty, expressed or implied, is made as to conclusions and professional advice included in this report. Any persons using this report for bidding or construction purposes should perform such independent investigations as deemed necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc., verifying the suitability of the conclusions and recommendations.

CLOSURE

It has been a pleasure to assist you with this project. We look forward to being of further assistance to you as construction begins. Should conditions be encountered during construction that appear to be different than indicated by this report, please contact this office immediately in order that we might evaluate their effect.

Should you have any questions regarding this report, please do not hesitate to contact our office at your convenience.

Respectfully submitted,
LOR Geotechnical Group, Inc.

Cristina Carranza
Staff Geologist

Andrew A. Tardie, CEG 2794
Vice President

John P. Leuer, GE 2030
President

CC:AAT:JPL:ss

Distribution: Addressee (2) and via email james.kim@lewismc.com
gerardo.garduno@lewis.com

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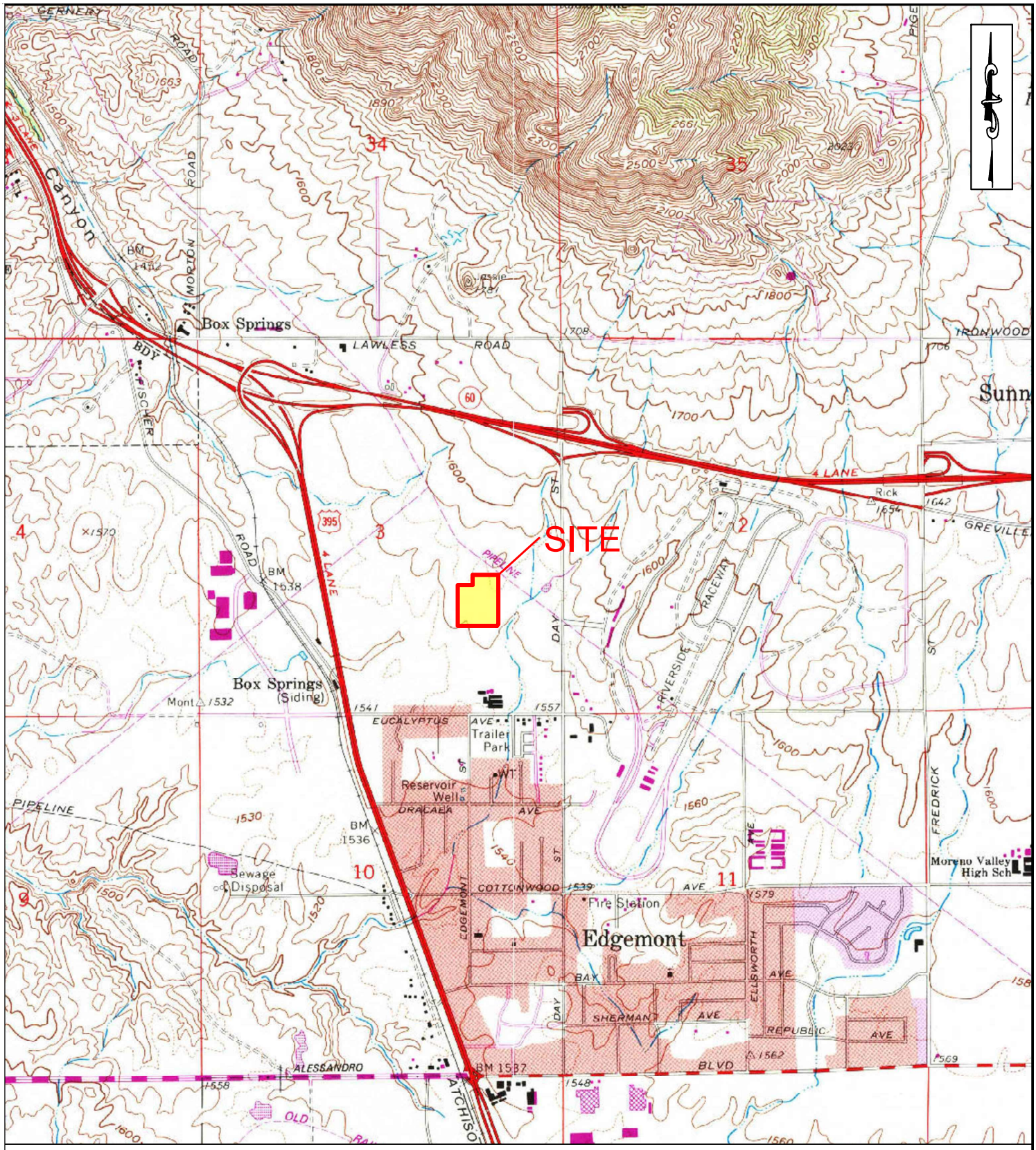
APPENDIX A

Index Map, Site Plan, Regional Geologic Map, and Historical Seismicity Maps



INDEX MAP

PROJECT:	Independence at Canyon Springs, Riverside, California	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ENCLOSURE:**	A-1
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	August 2024
		SCALE:	1" ≈ 2,000'

APARTMENTS

NET RENTABLE AREA- INCLUDES WALL THICKNESS OF EXTERIOR WALLS & EXTENDING FROM UNIT-TO-UNIT DEMISING WALL CENTERLINE

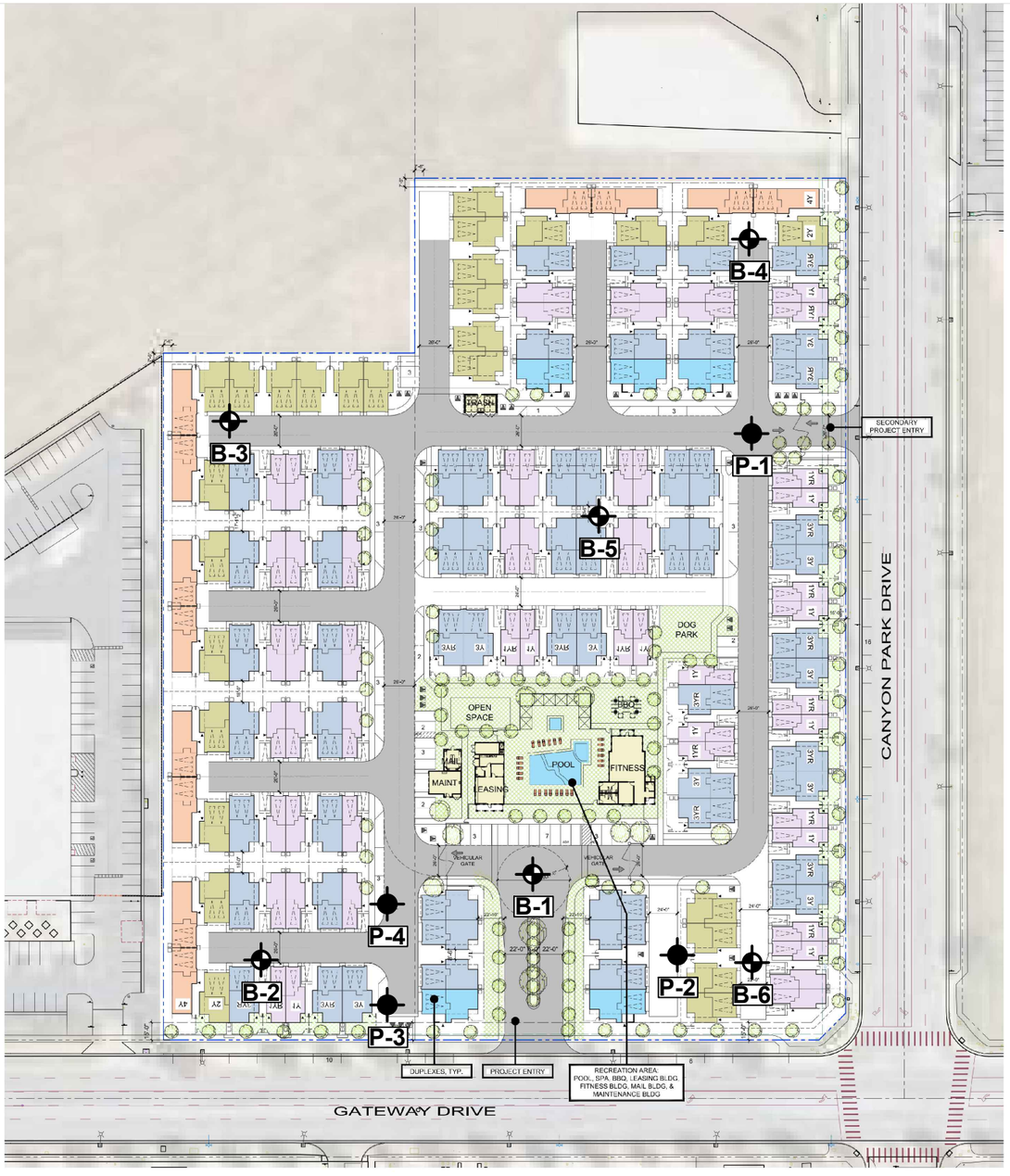
33	21.2%	PLAN 1	1,176 SF, 2 BED, 2 BA
20	12.8%	PLAN 1Y	1,176 SF, 2 BED, 2 BA
25	16.0%	PLAN 2	1,477 SF, 3 BED, 2.5 BA
2	1.3%	PLAN 2Y	1,477 SF, 3 BED, 2.5 BA
31	19.9%	PLAN 3	1,606 SF, 3 BED, 2.5 BA
28	17.9%	PLAN 3Y	1,606 SF, 3 BED, 2.5 BA
5	3.2%	PLAN 3X	1,632 SF, 3 BED, 2.5 BA
12	7.7%	PLAN 4	1,722 SF, 3 BED, 2.5 BA
156	100.0%		

Canyon Springs- Scheme 11

Parking Table

Unit Name	No. of Units	No. of Bedrooms	Parking Ratio	Required Stalls	
Backyard Duplex					
Plan 1	53	2	1.9	100.7	
Plan 2	27	3	2.1	56.7	
Plan 3	59	3	2.1	123.9	
Plan 3x	5	3	2.1	10.5	
Plan 4	12	3	2.1	25.2	
Plan 5	0	3	2.1	0	
				317	Subtotal Residential
Guest	156		0.333	52	Subtotal Guest
				369	Total

	Stalls		Stalls	
Residents	317		259	Garage Stalls
			52	Partly Covered Stalls
			6	Open Stalls, assigned
			317	Subtotal A
		+	0	*Plus: Driveway Stalls*
			317	Subtotal A and Driveway Plus
Guests	52		28	Open Stalls, unassigned
			13	Open Leasing Stalls
			41	Subtotal B
		+	0	*PLUS: Street Parking, Dedicated*
		+	38	*PLUS: Street Parking, Not Dedicated*
			79	Subtotal B & Street Parking Plus
Total	369		317	Stalls-Residents
			41	Stalls-Guests
			358	Subtotals A + B
		+	13	*Subtotal PLUS*
			371	Subtotals A + B + Plusses



Legend

(Locations Approximate)

Map Symbols

- **B-6** - Exploratory Boring
- **P-4** - Percolation Test

CONCEPTUAL SITE PLAN

SCHEME 11- 156 UNITS:

ADRRESS: RIVERSIDE
SITE AREA: 9.13 ACRES (+/- 397,660 SF)

ZONE:
ALLOWABLE DENSITY: 21 DU/AC MAX.

PROPOSED HEIGHT: 30'- 2- STORY

0 50' 200'
25' 100'

INDEPENDENCE AT CANYON SPRINGS RIVERSIDE, CA

SITE PLAN

A.1.0

LS BTR DEVELOPMENT, LLC
1156 N. MOUNTAIN AVENUE, UPLAND CA 91786
PHONE: (909) 985-0971

ANGELENO ASSOCIATES, INC.
147 E. CITY PLACE DR. SANTA ANA CA 92705
PHONE: (714) 285-1888

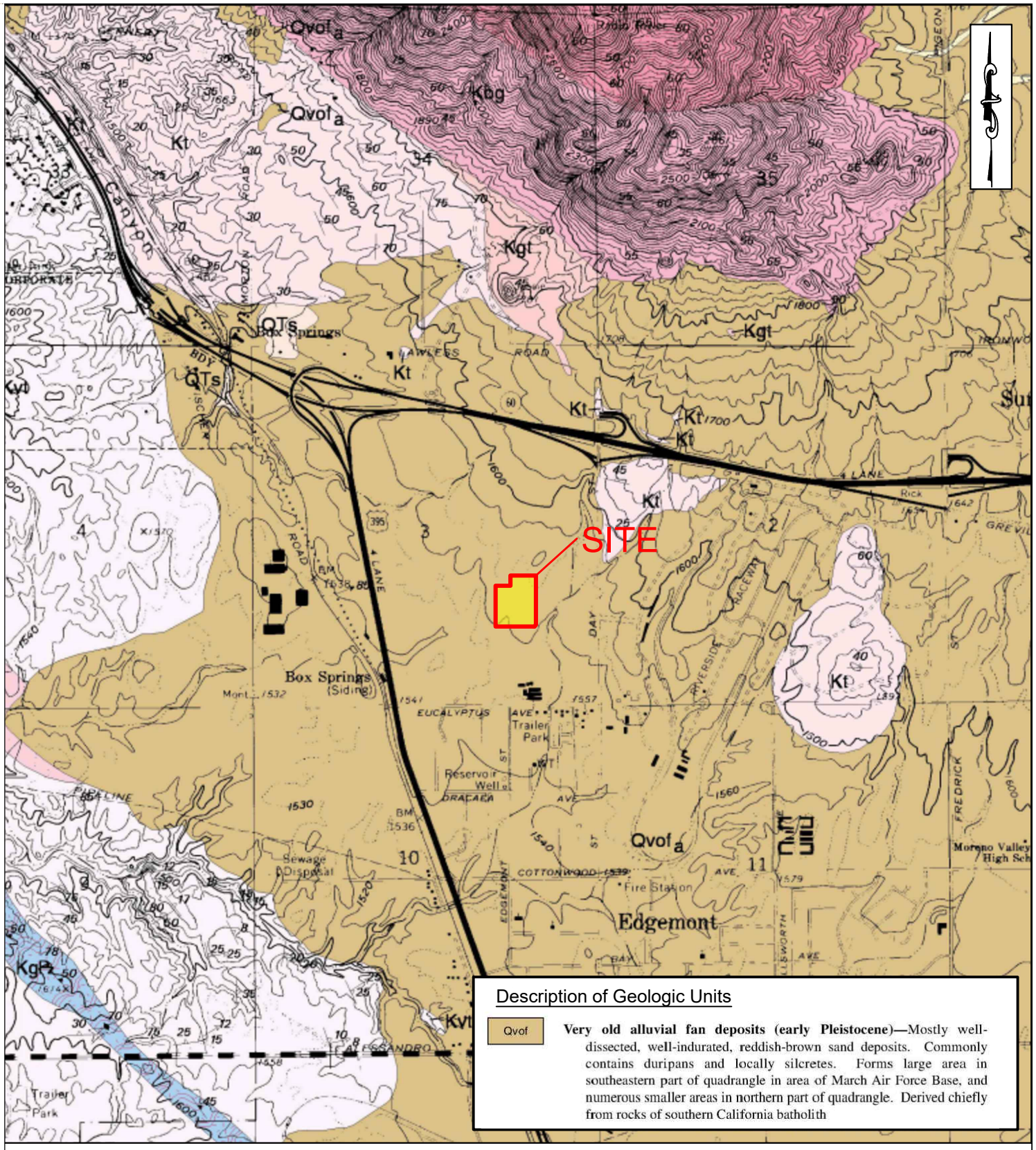
03.04.25
JOB: 2305

SITE PLAN

PROJECT: Independence at Canyon Springs, Riverside, California
CLIENT: LS BTR Development, LLC c/o Lewis MC

PROJECT NO.: 34019.1
ENCLOSURE: A-2
DATE: August 2024
SCALE: 1" ≈ 120'

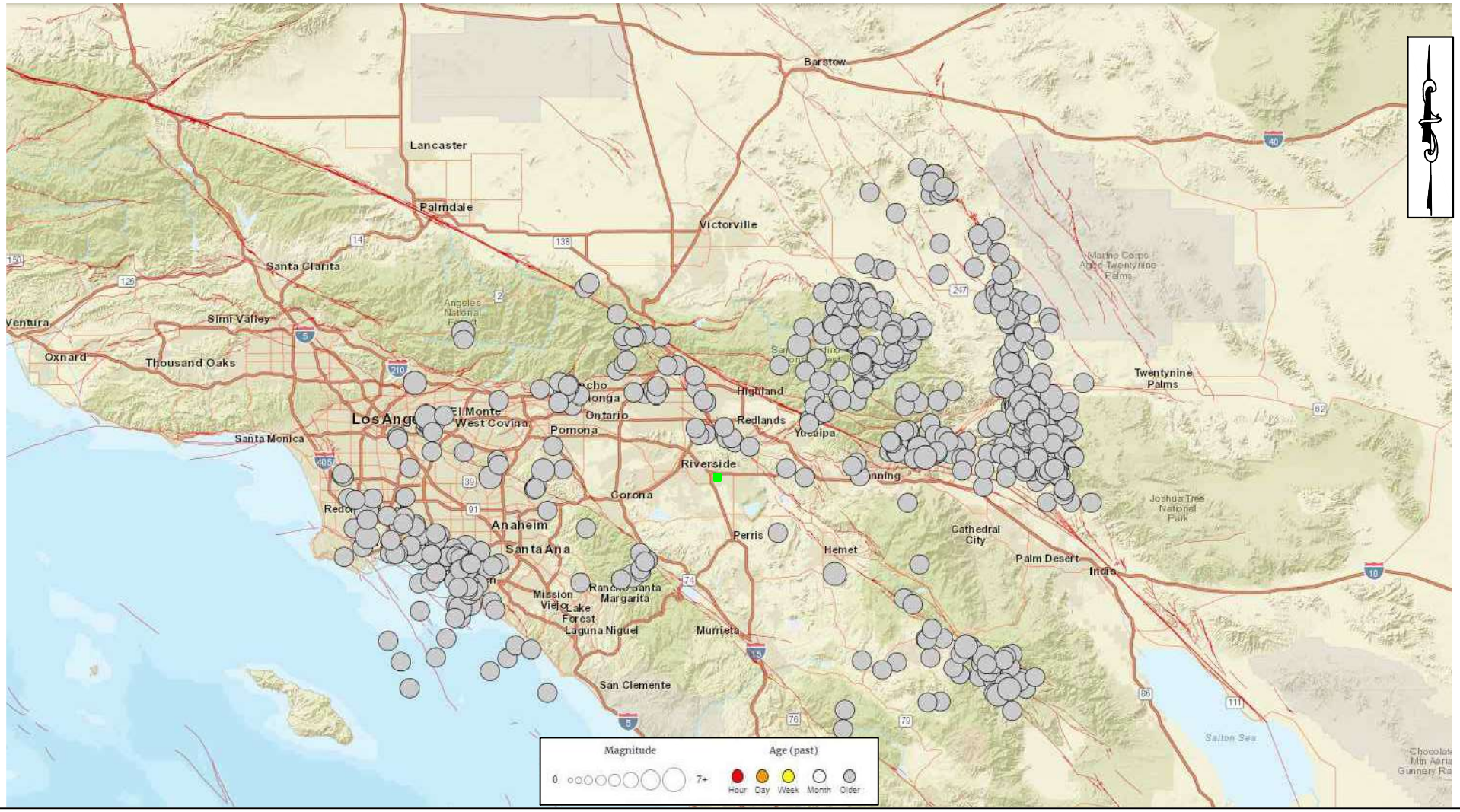
LOR GEOTECHNICAL GROUP, INC.



REGIONAL GEOLOGIC MAP

(Morton at.al, 2002)

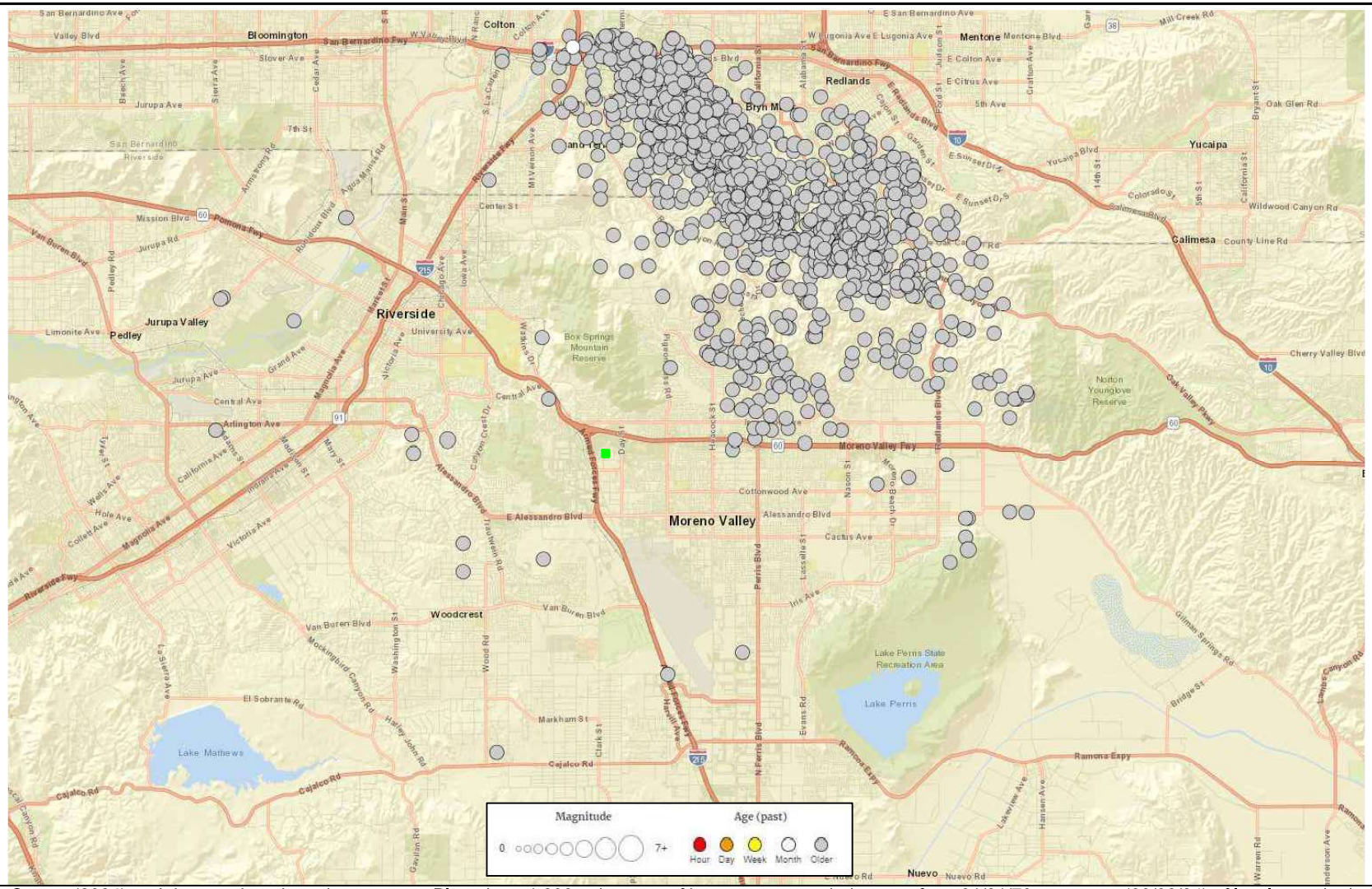
PROJECT:	Independence at Canyon Springs, Riverside, California	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ENCLOSURE:**	A-3
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	August 2024
		SCALE:	1" ≈ 2,000'



U.S. Geologic Survey (2024) real-time earthquake epicenter map. Plotted are 542 epicenters of instrument-recorded events from 01/01/32 to present (08/06/24) of local magnitude 4+ within a radius of ~62 miles (100 kilometers) of the site. Location accuracy varies. The site is indicated by the green square (■). The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These events are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 100km Radius

PROJECT:	Independence at Canyon Springs, Riverside, California	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ENCLOSURE:**	A-4
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	August 2024
		SCALE:	1" ≈ 40km



U.S. Geologic Survey (2024) real-time earthquake epicenter map. Plotted are 1,292 epicenters of instrument-recorded events from 01/01/78 to present (08/06/24) of local magnitude 2+ within a radius of ~9.2 miles (15 kilometers) of the site. Location accuracy varies. The site is indicated by the green square (■). The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These events are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 15km Radius

PROJECT:	Independence at Canyon Springs, Riverside, California	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ENCLOSURE:**	A-5
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	August 2024
		SCALE:	1" ≈ 15km

APPENDIX B

Field Investigation Program and Boring Logs

APPENDIX B
FIELD INVESTIGATION

Subsurface Exploration

Our subsurface exploration of the site consisted of drilling 6 exploratory borings to depths of approximately 20.33 and 51.50 feet below the existing ground surface using a CME 55 drill rig July 29, 2024. The approximate locations of the borings are shown on Enclosure A-2 within Appendix A.

The drilling exploration was conducted using a CME 55 drill rig equipped with 8-inch diameter hollow stem augers. The soils were continuously logged by a geologist from this firm who inspected the site, created detailed logs of the borings, obtained undisturbed, as well as disturbed, soil samples for evaluation and testing, and classified the soils by visual examination in accordance with the Unified Soil Classification System.

Relatively undisturbed samples of the subsoils were obtained at a maximum interval of 5 feet. The samples were recovered by using a California split barrel sampler of 2.50 inch inside diameter and 3.25 inch outside diameter or a Standard Penetration Sampler (SPT) from the ground surface to the total depth explored. The samplers were driven by a 140 pound automatic trip hammer dropped from a height of 30 inches. The number of hammer blows required to drive the sampler into the ground the final 12 inches were recorded and further converted to an equivalent SPT N-value. Factors such as efficiency of the automatic trip hammer used during this investigation (80%), borehole diameter (8"), and rod length at the test depth were considered for further computing of equivalent SPT N-values corrected for field procedures (N60) which are included in the boring logs, Enclosures B-1 through B-6.

The undisturbed soil samples were retained in brass sample rings of 2.42 inches in diameter and 1.00 inch in height, and placed in sealed plastic containers. Disturbed soil samples were obtained at selected levels within the borings and placed in sealed containers for transport to our geotechnical laboratory.

All samples obtained were taken to our geotechnical laboratory for storage and testing. Detailed logs of the borings are presented on the enclosed Boring Logs, Enclosures B-1 through B-6. A Boring Log Legend is presented on Enclosure B-i. A Soil Classification Chart is presented as Enclosure B-ii.

CONSISTENCY OF SOIL

SANDS

SPT BLOWS	CONSISTENCY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Over 50	Very Dense

COHESIVE SOILS

SPT BLOWS	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very Stiff
30-60	Hard
Over 60	Very Hard

SAMPLE KEY

Symbol	Description
	INDICATES CALIFORNIA SPLIT SPOON SOIL SAMPLE INDICATES BULK SAMPLE INDICATES SAND CONE OR NUCLEAR DENSITY TEST INDICATES STANDARD PENETRATION TEST (SPT) SOIL SAMPLE

TYPES OF LABORATORY TESTS

1	Atterberg Limits
2	Consolidation
3	Direct Shear (undisturbed or remolded)
4	Expansion Index
5	Hydrometer
6	Organic Content
7	Proctor (4", 6", or Cal216)
8	R-value
9	Sand Equivalent
10	Sieve Analysis
11	Soluble Sulfate Content
12	Swell
13	Wash 200 Sieve

BORING LOG LEGEND

PROJECT:	Independence at Canyon Springs, Riverside, California	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ENCLOSURE:**	B-i
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	August, 2024

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

PARTICLE SIZE LIMITS

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" No. 4 No. 10 No. 40 No. 200

(U.S. STANDARD SIEVE SIZE)

SOIL CLASSIFICATION CHART

PROJECT:	Independence at Canyon Springs, Riverside, California	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ENCLOSURE:**	B-ii
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	August 2024

LOG OF BORING B-1

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0	72	9, 10	8.5		128.3			SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 15% coarse grained sand, 25% medium grained sand, 20% fine grained sand, 40% silty fines with trace clay, red brown, dry.
5	63 for 3"		6.3		128.7				@ 2 feet, OLDER ALLUVIUM: SILTY SAND, approximately 20% coarse grained sand, 20% medium grained sand, 20% fine grained sand, 40% silty fines with trace clay, red brown, damp.
10	46		6.2		112.6				@ 5 feet, SILTY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines, yellow brown, damp, trace pinhole porosity.
15	46 for 2"		6.1		121.7				@ 10 feet, becomes slightly coarser grained, micaceous.
20	92 for 3"		8.0		127.9				@ 20 feet, SILTY SAND, approximately 15% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 30% silty fines, yellow brown, damp, difficult drilling.
25	89		7.1						
30	144		9.5					SC	@ 30 feet, CLAYEY SAND, approximately 20% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 30% clayey fines of low plasticity, brown, damp.
35	107		7.7					SM	@ 35 feet, SILTY SAND, approximately 25% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 20% silty fines, yellow brown, damp.
40	72		9.1						@ 40 feet, contains trace clay.
45	89		10.8						@ 45 feet, becomes moist.
50	120		11.3						@ 48.5 feet, groundwater.
55									@ 50 feet, SILTY SAND, approximately 25% coarse grained sand, 30% medium grained sand, 30% fine grained sand, 15% silty fines, red brown, wet.

END OF BORING @ 51.5'

Fill to 2'
Groundwater @ 48.5'
No bedrock

PROJECT:	Independence at Canyon Springs	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ELEVATION:**	--
		DATE DRILLED:	July 29, 2024
LOR	**GEOTECHNICAL GROUP, INC.**	**EQUIPMENT:**	CME 55
		HOLE DIA.: 8"	**ENCLOSURE:** B-1

LOG OF BORING B-2

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0	35		4.2		123.0			SM	@ 0 feet, FILL/TOPSOIL: **SILTY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines with trace clay, red brown, dry.**
									@ 3 feet, OLDER ALLUVIUM: **SILTY SAND, approximately 20% 25% medium grained sand, 25% fine grained sand, 30% silty fines with trace clay, red brown, dry, trace roothairs.**
5	27		6.3		124.3				@ 5 feet, micaceous, brown.
10	78 for 4"		5.6		122.9				@ 10 feet, SILTY SAND, approximately 20% coarse grained sand, 30% medium grained sand, 30% fine grained sand, 20% silty fines, brown, damp.
15	82 for 4"		6.4		125.2				@ 15 feet, slightly micaceous.
20	70		14.2		115.1			ML	@ 20 feet, SANDY SILT, approximately 15% coarse grained sand, 25% fine grained sand, 60% silty fines, yellow brown, damp.
									END OF BORING @ 21.0'
									Fill to 3' **No groundwater** **No bedrock**

PROJECT:	Independence at Canyon Springs	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP, INC.		**DATE DRILLED:**	July 29, 2024
		EQUIPMENT:	CME 55
		HOLE DIA.: 8"	**ENCLOSURE:** B-2

LOG OF BORING B-3

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0		3, 4, 7, 8, 9, 10						SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 15% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 35% silty fines with trace clay, red brown, dry.
	17		7.0		127.4				@ 2 feet, OLDER ALLUVIUM: SILTY SAND, approximately, 10% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 35% silty fines, dark red brown, damp.
5	68 for 4"		6.9		128.2				@ 5 feet, becomes more medium grained.
10	82 for 4"		6.8		115.5				
15	46		6.4		118.1				@ 15 feet, SILTY SAND, 10% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 35% silty fines, red brown, damp.
20	51		6.3						@ 20 feet, becomes gray brown, micaceous.
									END OF BORING @ 20.5'
									Fill to 2'
									No groundwater
									No bedrock

PROJECT:	Independence at Canyon Springs	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP, INC.		**DATE DRILLED:**	July 29, 2024
		EQUIPMENT:	CME 55
		HOLE DIA.: 8"	**ENCLOSURE:** B-3

LOG OF BORING B-4

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0		9, 10						SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 5% gravel, 15% coarse grained sand, 25% medium grained sand, 20% fine grained sand, 35% silty fines, red brown, dry.
	42		6.8						@ 2 feet, OLDER ALLUVIUM: SILTY SAND, approximately 20% coarse grained sand, 20% medium grained sand, 25% fine grained sand, 35% silty fines, red brown, dry, rings disturbed.
5	24		7.1		131.0			ML SM	@ 5 feet, SILTY SAND/SANDY SILT, approximately 5% coarse grained sand, 15% medium grained sand, 30% fine grained sand, 50% silty fines, red brown, damp.
10	38		3.1		131.0			SM	@ 10 feet, SILTY SAND, approximately, 10% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 40% silty fines, yellow brown.
15	81 for 3"		6.2		149.6				@ 15 feet, becomes more coarse grained.
20	51 for 5"		7.9		118.2				
25	51 for 5"		5.4						@ 25 feet, SILTY SAND, approximately 10% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 40% silty fines, red brown, dry, ring disturbed.
									END OF BORING @ 25.4'
									Fill to 2'
									No groundwater
									No bedrock

PROJECT:	Independence at Canyon Springs	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ELEVATION:**	--
		DATE DRILLED:	July 29, 2024
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	CME 55
		HOLE DIA.: 8"	**ENCLOSURE:** B-4

LOG OF BORING B-5

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0	28		7.4		124.8			SM	@ 0 feet, FILL/TOPSOIL: **SILTY SAND, trace gravel, approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines, red brown, dry.**
									@ 3 feet, OLDER ALLUVIUM: **20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines, dark brown, damp.**
5	18		8.8		122.3			ML	@ 5 feet, **SANDY SILT, approximately 20% medium grained sand, 20% fine grained sand, 60% silty fines, dark brown, dry, micaceous.**
10	28		6.8		127.3				@ 10 feet, **becomes red brown**
15	46		5.9		115.8			SM	@ 15 feet, **SILTY SAND, approximately 20% coarse grained sand, 20% medium grained sand, 20% fine grained sand, 40% silty fines, red brown, damp.**
20	51		8.6		122.6			ML	@ 20 feet, **SANDY SILT, approximately 20% medium grained sand, 20% fine grained sand, 60% silty fines with trace clay, red brown damp, micaceous.**
									END OF BORING @ 20.5'
									Fill to 3' **No groundwater** **No bedrock**

PROJECT:	Independence at Canyon Springs	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ELEVATION:**	--
		DATE DRILLED:	July 29, 2024
LOR	**GEOTECHNICAL GROUP, INC.**	**EQUIPMENT:**	CME 55
		HOLE DIA.: 8"	**ENCLOSURE:** B-5

LOG OF BORING B-6

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0	63		6.6		129.4			SM	@ 0 feet, FILL/TOPSOIL: SILTY SAND, approximately 15% coarse grained sand, 25% medium grained sand, 35% fine grained sand, 25% silty fines with trace clay, red brown, dry.
								ML SM	@ 3 feet, OLDER ALLUVIUM: SANDY SILT/SILTY SAND, approximately 10% coarse grained sand, 15% medium grained sand, 25% fine grained sand, 50% silty fines, grey brown, damp.
5	40		7.1		110.2			ML	@ 5 feet, SANDY SILT, approximately 10% medium grained sand, 30% fine grained sand, 60% silty fines, red brown, damp, micaceous.
10	46 for 3"		5.4		126.5				
15	46		6.2		125.3				
20	51 for 4"		5.3		118.4			ML SM	@ 20 feet, SANDY SILT/SILTY SAND, approximately 20% medium grained sand, 30% fine grained sand, 50% silty fines, yellow brown, dry.

END OF BORING @ 20.33'

Fill to 3'
No groundwater
No bedrock

PROJECT:	Independence at Canyon Springs	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**ELEVATION:**	--
LOR GEOTECHNICAL GROUP, INC.		**DATE DRILLED:**	July 29, 2024
		EQUIPMENT:	CME 55
		HOLE DIA.: 8"	**ENCLOSURE:** B-6

APPENDIX C

Borehole Percolation Testing Program and Infiltration Rate Test Results

APPENDIX C
BOREHOLE PERCOLATION TESTING PROGRAM AND INFILTRATION RATE TEST RESULTS

Four borehole percolation tests were conducted in general accordance with the Deep Percolation Test procedure as outlined in the Design Handbook for Low Impact Development Best Management Practices (RCFCWCD, 2011). Our test was conducted at the requested locations and depth as illustrated on Enclosure A-2. Subsequent to drilling, a 3-inch diameter, perforated PVC pipe wrapped in filter fabric was placed within the test hole and 3/4-inch gravel was placed between the outside of the pipe and the hole wall. The test hole was pre-soaked the same day as drilling. Testing took place the next day, July 30, 2024, within 26 hours but not before 15 hours, of the pre-soak. The hole was filled using water from a 200 gallon water tank. Test periods consisted of allowing the water to drop in 30-minute intervals. After each reading, the hole was refilled. Testing was terminated after a total of 12 readings were recorded. The percolation test data was converted to an infiltration rate using the Porchet Method as outlined by the Design Handbook for Low Impact Development Best Management Practices (RCFCWCD, 2011).

Infiltration test results are summarized in the following table:

Test No.	Depth* (ft)	Infiltration Rate** (in/hr)
P-1	10.0	0.4
P-2	10.0	0.3
P-3	10.0	0.2
P-4	10.0	0.1

* depth measured below existing ground surface
** Porchet Method determined clear water rate

The results of this testing are presented as Enclosures C-1 through C-4.

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Independence at Canyon Spings, Riverside, California	Test Date:	July 30, 2024
Project No.:	34019.1	Test Hole No.:	P-1
Soil Classificaiton:	(ML) Sandy Silt	Hole Diameter:	8.0 in.
Depth of Test Hole:	10.0 ft.	Date Excavated:	July 29, 2024
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	10:02 AM	10:32 AM	30	0.50	0.50	48.00	60.00	120.00	120.00	12.00	66.00	10.6
2	10:33 AM	11:03 AM	30	0.50	1.00	60.00	64.00	120.00	120.00	4.00	58.00	4.0
3	11:04 AM	11:34 AM	30	0.50	1.50	60.00	63.00	120.00	120.00	3.00	58.50	3.0
4	11:35 AM	12:05 PM	30	0.50	2.00	63.00	66.25	120.00	120.00	3.25	55.38	3.4
5	12:06 PM	12:36 PM	30	0.50	2.50	60.00	63.00	120.00	120.00	3.00	58.50	3.0
6	12:37 PM	1:07 PM	30	0.50	3.00	63.00	66.00	120.00	120.00	3.00	55.50	3.1
7	1:08 PM	1:38 PM	30	0.50	3.50	60.00	62.75	120.00	120.00	2.75	58.63	2.7
8	1:39 PM	2:09 PM	30	0.50	4.00	62.75	65.75	120.00	120.00	3.00	55.75	3.1
9	2:10 PM	2:40 PM	30	0.50	4.50	60.00	63.00	120.00	120.00	3.00	58.50	3.0
10	2:41 PM	3:11 PM	30	0.50	5.00	63.00	65.75	120.00	120.00	2.75	55.63	2.9
11	3:12 PM	3:42 PM	30	0.50	5.50	60.00	62.75	120.00	120.00	2.75	58.63	2.7
12	3:43 PM	4:13 PM	30	0.50	6.00	60.00	65.50	120.00	120.00	5.50	57.25	5.6

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	60.00	
H_f	54.50	
ΔH	5.50	
H_{avg}	57.25	
I_t	**0.4**	in/hr (clear water rate)

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Independence at Canyon Spings, Riverside, California	Test Date:	July 30, 2024
Project No.:	34019.1	Test Hole No.:	P-2
Soil Classificaiton:	(SM) Silty sand	Hole Diameter:	8.0 in.
Depth of Test Hole:	10.0 ft.	Date Excavated:	July 29, 2024
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	10:05 AM	10:35 AM	30	0.50	0.50	48.00	52.25	120.00	120.00	4.25	69.88	3.5
2	10:36 AM	11:06 AM	30	0.50	1.00	52.25	57.00	120.00	120.00	4.75	65.38	4.2
3	11:07 AM	11:37 AM	30	0.50	1.50	48.00	52.50	120.00	120.00	4.50	69.75	3.8
4	11:38 AM	12:08 PM	30	0.50	2.00	52.50	57.75	120.00	120.00	5.25	64.88	4.7
5	12:09 PM	12:39 PM	30	0.50	2.50	48.00	52.25	120.00	120.00	4.25	69.88	3.5
6	12:40 PM	1:10 PM	30	0.50	3.00	52.25	57.00	120.00	120.00	4.75	65.38	4.2
7	1:11 PM	1:41 PM	30	0.50	3.50	48.00	52.00	120.00	120.00	4.00	70.00	3.3
8	1:42 PM	2:12 PM	30	0.50	4.00	52.00	56.75	120.00	120.00	4.75	65.63	4.2
9	2:13 PM	2:43 PM	30	0.50	4.50	48.00	52.25	120.00	120.00	4.25	69.88	3.5
10	2:44 PM	3:14 PM	30	0.50	5.00	52.25	56.25	120.00	120.00	4.00	65.75	3.5
11	3:15 PM	3:45 PM	30	0.50	5.50	48.00	52.00	120.00	120.00	4.00	70.00	3.3
12	3:46 PM	4:16 PM	30	0.50	6.00	52.00	56.25	120.00	120.00	4.25	65.88	3.8

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	68.00	
H_f	63.75	
ΔH	4.25	
H_{avg}	65.88	
I_t	**0.3**	in/hr (clear water rate)

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Independence at Canyon Spings, Riverside, California	Test Date:	July 30, 2024
Project No.:	34019.1	Test Hole No.:	P-3
Soil Classificaiton:	(ML) Sandy silt	Hole Diameter:	8.0 in.
Depth of Test Hole:	10.0 ft.	Date Excavated:	July 29, 2024
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	10:08 AM	10:38 AM	30	0.50	0.50	48.00	52.50	120.00	120.00	4.50	69.75	3.8
2	10:39 AM	11:09 AM	30	0.50	1.00	52.50	55.50	120.00	120.00	3.00	66.00	2.6
3	11:10 AM	11:40 AM	30	0.50	1.50	48.00	51.75	120.00	120.00	3.75	70.13	3.1
4	11:41 AM	12:11 PM	30	0.50	2.00	51.75	55.00	120.00	120.00	3.25	66.63	2.8
5	12:12 PM	12:42 PM	30	0.50	2.50	48.00	51.50	120.00	120.00	3.50	70.25	2.9
6	12:43 PM	1:13 PM	30	0.50	3.00	51.50	55.00	120.00	120.00	3.50	66.75	3.1
7	1:14 PM	1:44 PM	30	0.50	3.50	48.00	51.50	120.00	120.00	3.50	70.25	2.9
8	1:45 PM	2:15 PM	30	0.50	4.00	51.50	55.00	120.00	120.00	3.50	66.75	3.1
9	2:16 PM	2:46 PM	30	0.50	4.50	48.00	51.25	120.00	120.00	3.25	70.38	2.7
10	2:47 PM	3:17 PM	30	0.50	5.00	51.25	54.75	120.00	120.00	3.50	67.00	3.0
11	3:18 PM	3:48 PM	30	0.50	5.50	48.00	51.25	120.00	120.00	3.25	70.38	2.7
12	3:49 PM	4:19 PM	30	0.50	6.00	51.25	54.50	120.00	120.00	3.25	67.13	2.8

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	68.75	
H_f	65.50	
ΔH	3.25	
H_{avg}	67.13	
I_t	**0.2**	in/hr (clear water rate)

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	Independence at Canyon Spings, Riverside, California	Test Date:	July 30, 2024
Project No.:	34019.1	Test Hole No.:	P-4
Soil Classificaiton:	(ML) Sandy silt	Hole Diameter:	8.0 in.
Depth of Test Hole:	10.0 ft.	Date Excavated:	July 29, 2024
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	10:11 AM	10:41 AM	30	0.50	0.50	48.00	49.50	120.00	120.00	1.50	71.25	1.2
2	10:42 AM	11:12 AM	30	0.50	1.00	49.50	51.50	120.00	120.00	2.00	69.50	1.7
3	11:13 AM	11:43 AM	30	0.50	1.50	48.00	49.50	120.00	120.00	1.50	71.25	1.2
4	11:44 AM	12:14 PM	30	0.50	2.00	49.50	51.00	120.00	120.00	1.50	69.75	1.3
5	12:15 PM	12:45 PM	30	0.50	2.50	48.00	49.50	120.00	120.00	1.50	71.25	1.2
6	12:46 PM	1:16 PM	30	0.50	3.00	49.50	51.00	120.00	120.00	1.50	69.75	1.3
7	1:17 PM	1:47 PM	30	0.50	3.50	48.00	49.75	120.00	120.00	1.75	71.13	1.4
8	1:48 PM	2:18 PM	30	0.50	4.00	49.75	51.25	120.00	120.00	1.50	69.50	1.3
9	2:19 PM	2:49 PM	30	0.50	4.50	48.00	49.50	120.00	120.00	1.50	71.25	1.2
10	2:50 PM	3:20 PM	30	0.50	5.00	49.50	51.00	120.00	120.00	1.50	69.75	1.3
11	3:21 PM	3:51 PM	30	0.50	5.50	48.00	49.50	120.00	120.00	1.50	71.25	1.2
12	3:52 PM	4:22 PM	30	0.50	6.00	49.50	51.00	120.00	120.00	1.50	69.75	1.3

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	70.50	
H_f	69.00	
ΔH	1.50	
H_{avg}	69.75	
I_t	**0.1**	in/hr (clear water rate)

APPENDIX D

Laboratory Testing Program and Test Results

APPENDIX D
LABORATORY TESTING

General

Selected soil samples obtained from the borings were tested in our geotechnical laboratory to evaluate the physical properties of the soils affecting foundation design and construction procedures. Laboratory testing included in-place moisture content and dry density, laboratory compaction characteristics, direct shear, sieve analysis, sand equivalent, R-value, expansion index, and corrosion screening. Descriptions of the laboratory tests are presented in the following paragraphs:

Moisture Density Tests

The moisture content and dry density information provides an indirect measure of soil consistency for each stratum, and can also provide a correlation between soils on this site. The dry unit weight and field moisture content were determined for selected undisturbed samples, in accordance with ASTM D 2921 and ASTM D 2216, respectively, and the results are shown on the boring logs, Enclosures B-1 through B-6 for convenient correlation with the soil profile.

Laboratory Compaction

A selected soil sample was tested in the laboratory to determine compaction characteristics using the ASTM D 1557 compaction test method. The results are presented in the following table:

LABORATORY COMPACTION				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Maximum Dry Density (pcf)**	**Optimum Moisture Content (percent)**
B-3	0-3	(SM) Silty Sand	138.0	5.0

Direct Shear Test

Shear tests are performed in general accordance with ASTM D 3080 with a direct shear machine at a constant rate-of-strain (0.04 inches/minute). The machine is designed to test a sample partially extruded from a sample ring in single shear. Samples are tested at varying normal loads in order to evaluate the shear strength parameters, angle of internal friction and cohesion. Samples are tested in remolded condition (90 percent relative compaction per ASTM D 1557) and soaked, to represent the worst case conditions expected in the field.

The results of the shear test on a selected soil sample is presented in the following table:

DIRECT SHEAR TEST				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Apparent Cohesion (psf)**	**Angle of Internal Friction (degrees)**
B-3	0-3	(SM) Silty Sand	450	26

Sieve Analysis

A quantitative determination of the grain size distribution was performed for selected samples in accordance with the ASTM D 422 laboratory test procedure. The determination is performed by passing the soil through a series of sieves, and recording the weights of retained particles on each screen. The results of the grain size distribution analyses are presented graphically on Enclosure D-1.

Sand Equivalent

The sand equivalent of selected soils were evaluated using the California Sand Equivalent Test Method, Caltrans Number 217. The results of the sand equivalent tests are presented with the grain size distribution analyses on Enclosure D-1.

R-Value Test

Soil samples were obtained at probable pavement subgrade level and sieve analysis and sand equivalent tests were conducted. A selected soil sample was tested to determine its

R-value using the California R-Value Test Method, Caltrans Number 301. The results of the sieve analysis, sand equivalent, and R-value tests are presented on Enclosure D-1.

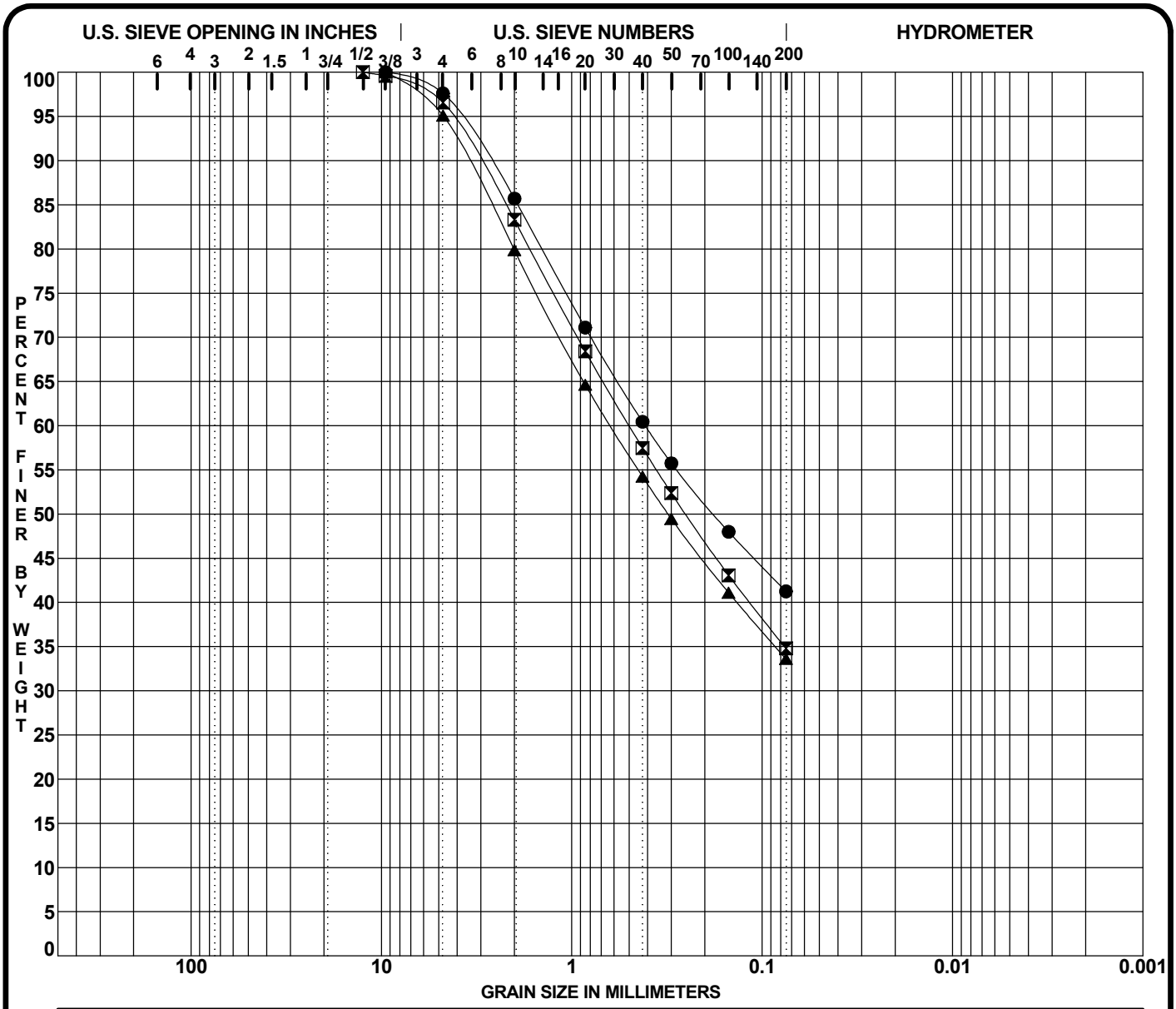
Expansion Index Tests

Remolded samples are tested to determine their expansion potential in accordance with the Expansion Index (EI) test. The test is performed in accordance with the Uniform Building Code Standard 18-2. The test results are presented in the following table:

EXPANSION INDEX TESTS				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Expansion Index (EI)**	**Expansion Potential**
B-3	0-3	(SM) Silty Sand	0	Very Low
Expansion Index:	0-20 Very low	21-50 Low	51-90 Medium	91-130 High

Corrosion

Corrosion testing was conducted by our subconsultant, Project X Corrosion Engineering. Test results are enclosed.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Soil Classification	SE	RV	PL	PI	Cc	Cu
●	B-1	@ 0-3'	(SM) Silty Sand	15	--				
⊠	B-3	@ 0-3'	(SM) Silty Sand	15	15				
▲	B-4	@ 0-3'	(SM) Silty Sand	15	--				

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	@ 0-3'	9.50	0.41			2.4	56.4	41.2	
⊠	B-3	@ 0-3'	12.50	0.50			3.4	61.8	34.8	
▲	B-4	@ 0-3'	9.50	0.62			4.9	61.5	33.6	

PROJECT:	Independence at Canyon Springs	**PROJECT NO.:**	34019.1
CLIENT:	LS BTR Development, LLC c/o Lewis MC	**DATE:**	September 2024

GRADATION CURVES

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: D-1

Results Only Soil Testing for NW Corner Gateway Drive

August 5, 2024

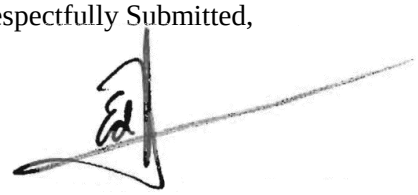
Prepared for:

Cristina Carranza
LOR Geotechnical Group, Inc.
6121 Quail Valley Ct
Riverside, CA 92507
ccarranza@lorgeo.com

Project X Job#: S240802A
Client Job or PO#: 34019.1

Prepared by:
M. Williams

Respectfully Submitted,





Eduardo Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

Soil Analysis Lab Results

Client: LOR Geotechnical Group, Inc.
Job Name: NW Corner Gateway Drive
Client Job Number: 34019.1
Project X Job Number: S240802A
August 5, 2024

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM G51	ASTM G200	SM 4500-D	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd | Minimum		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^{2-}	**Phosphate** PO_4^{3-}
	(ft)	**(mg/kg)**	**(wt%)**	**(mg/kg)**	**(wt%)**	**(Ω-cm)**	**(Ω-cm)**		**(mV)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
RV-1 B-3 (SM)	0-3	69.6	0.0070	24.9	0.0025	21,440	3,350	7.9	147	1.4	0.3	0.8	ND	66.6	4.8	23.3	56.8	13.0	3.5
RV-2 B-3 (SM/ML)	0-3	42.1	0.0042	17.5	0.0017	30,150	10,720	7.8	135	3.3	3.3	7.8	ND	49.3	8.8	25.9	72.7	8.1	0.6
RV-3 B-4 (SM)	0-3	344.4	0.0344	146.0	0.0146	9,380	3,953	8.2	158	3.2	6.8	0.6	ND	205.7	8.5	54.2	152.2	9.4	0.1

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)

Note: Sometimes a bad sulfate hit is a contaminated spot. Typical fertilizers are Potassium chloride, ammonium sulfate or ammonium sulfate nitrate (ASN). So this is another reason why testing full corrosion series is good because we then have the data to see if those other ingredients are present meaning the soil sample is just fertilizer-contaminated soil. This can happen often when the soil samples collected are simply surface scoops. This is why it's best to dig in a foot, throw away the top and test the deeper stuff. Dairy farms are also notorious for these items.

If one sample pops up much more corrosive than all others, we would recommend collecting more samples surrounding the problem sample location to determine if the peak is isolated to it. This allows us to conclude it was a contaminated sample and able to declare it an outlier.

Try out our new online forms: SOIL CORROSIVITY & THERMAL RESISTIVITY LAB REQUEST FORM & IN-SITU WENNER 4 PIN QUOTE REQUEST FORM

Project X
Corrosion Engineering
Corrosion Control - Soil, Water, and Metallurgy Lab

Lab Request Sheet Chain of Custody
Phone: (213) 928-7213 · Fax (951) 226-1720 · www.projectxcorrosion.com

Ship Samples To: 29990 Technology Dr, Suite 13, Murrieta, CA 92563

Project X Job Number
S240802A LOR 34019.1 GATEWAY 3FULL

IMPORTANT: Please complete Project and Sample Identification Data as you would like it to appear in report & include this form with samples.

Company Name:	LOR Geotechnical Group, Inc.	**Contact Name:**	Cristina Carranza
Phone No:	951-653-1760		
Mailing Address:	6121 Quail Valley	**Contact Email:**	ccarranza@lorgeo.com
Accounting Contact:	John Leuer	**Invoice Email:**	atardie@lorgeo.com
Client Project No:	34019.1	**Project Name:**	NW Corner Gateway Dr
P.O. #:	--		

	3-5 Day Standard	3 Day Guarantee 50% mark-up	24 Hour RUSH 100% mark-up
(Business Days) Turn Around Time:	●		

For Corrosion Control Recommendations (350g soil sample):
NEED (1) Groundwater depth and
(2) Soil Sample Locations Map

FOR THERMAL RESISTIVITY PROVIDE (1,500g soil sample):
(1) Optimal Moisture %
(2) Dry Density{PCF}
(3) Desired Compaction
Date & Received By:

METHOD ANALYSIS REQUESTED (Please circle)

	Soil Resistivity	pH	Sulfate	Chloride	Redox Potential	Sulfide	Ammonia	Nitrate	Flouride	Phosphate	Lithium	Sodium	Potassium	Magnesium	Calcium	Full Corrosion Series	Soil Corrosivity Evaluation Report	Water Corrosivity Mini Report	Moisture Content	Total Alkalinity	Soil Remolding	Thermal Resistivity	(ANC) Alk Neutr Cap	(SRB) Sulfate Reducing	Puckorius Index	XRF Elemental Analysis	Water Hardness
Default Method	ASTM G187	ASTM G51	ASTM D4327	ASTM D4327	ASTM G200	SM 4500-S2	ASTM D4327	ASTM D4327	SM 2320B	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	350g Sample	*Req: Min. 3 Samples, site map, and groundwater info		ASTM D2216	SM 2520B	ASTM D698	IEEE 442 6-inch	HACH BART		ASTM E1621	ASTM E322	ASTM A751
	Caltrans CTM643	Caltrans CTM643	Caltrans CTM417	Caltrans CT422																							
	AASHTO T2888	AASHTO T289	AASHTO T290	AASHTO T291	SM 2580B		SM 4500-NH3	SM 4500-NO3													ASTM D2216	ASTM D5334 8-inch					

Full Corrosion Series: Geo Quad

Reports

	SAMPLE ID - BORE # - Description	DEPTH (ft)	DATE COLLECTED	Soil Resistivity	pH	Sulfate	Chloride	Redox Potential	Sulfide	Ammonia	Nitrate	Flouride	Phosphate	Lithium	Sodium	Potassium	Magnesium	Calcium	Full Corrosion Series	Soil Corrosivity Evaluation Report	Water Corrosivity Mini Report	Moisture Content	Total Alkalinity	Soil Remolding	Thermal Resistivity	(ANC) Alk Neutr Cap	(SRB) Sulfate Reducing	Puckorius Index	XRF Elemental Analysis	Water Hardness
22 1	RV-1 B-3 (SM)	0-3	07/29/24																●											
23 2	RV-2 B-3 (SM/ML)	0-3	07/29/24																●											
24 3	RV-3 B-4 (SM)	0-3	07/29/24																●											
4																														
5																														
6																														
7																														
8																														
9																														
10																														
11																														
12																														
13																														
14																														
15																														

APPENDIX E

Seismic Design Spectra

SITE-SPECIFIC GROUND MOTION ANALYSIS
(ASCE 7-16)

ALL values on this page were used for determination of ASCE 7-16 Section 21.3 General Spectrum and are NOT intended to be used for design

Project: NW Corner Gateway Dr
Project Number: 34019.1
Client: Lewis MC
Site Lat/Long: 33.9359, -117.2830
Controlling Seismic Source: San Jacinto

REFERENCE	NOTATION	VALUE
Site Class	C, D, D default, or E	D measured
Site Class D - Table 11.4-1	F_a	1.0
Site Class D - 21.3(ii)	F_v	2.5
$0.2*(S_{D1}/S_{DS})$	T_0	0.200
S_{D1}/S_{DS}	T_S	1.000
Fundamental Period (12.8.2)	T	Period
Seismic Design Maps or Fig 22-14	T_L	8
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	1.0000
Equation 11.4-2 - F_V*S_1 [1]	S_{M1}	1.5000

[1] - F_V as determined by Section 21.3

REFERENCE	NOTATION	VALUE
Fv (Table 11.4-2)[Used for General Spectrum]	F_v	1.7
Design Maps	S_s	1.500
Design Maps	S_1	0.600
Equation 11.4-1 - F_A*S_S	S_{MS}	1.500
Equation 11.4-3 - $2/3*S_{MS}$	S_{DS}	1.000
Design Maps	PGA	0.611
Table 11.8-1	F_{PGA}	1.1
Equation 11.8-1 - $F_{PGA}*PGA$	PGA_M	0.672
Section 21.5.3	80% of PGA_M	0.538
Design Maps	C_{RS}	0.929
Design Maps	C_{R1}	0.906

REFERENCE	NOTATION	VALUE
$0.2*(S_{D1}/S_{DS})$	T_0	0.136
S_{D1}/S_{DS}	T_S	0.680
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	0.680
Equation 11.4-2 - F_V*S_1	S_{M1}	1.020

RISK COEFFICIENT

Cr - At Perods <=0.2, Cr=C_{RS}	C_{RS}	0.929
Cr - At Periods >=1.0, Cr=C_{R1}	C_{R1}	0.906

Cr - At Periods between 0.2 and 1.0 use trendline formula to complete

Period	Cr
0.200	0.929
0.300	0.926
0.400	0.923
0.500	0.920
0.600	0.918
0.680	0.915
1.000	0.906

Mapped values from https://hazards.atcouncil.org/

PROBABILISTIC SPECTRA[1]
2% in 50 year Exceedence

Project No: 34019.1

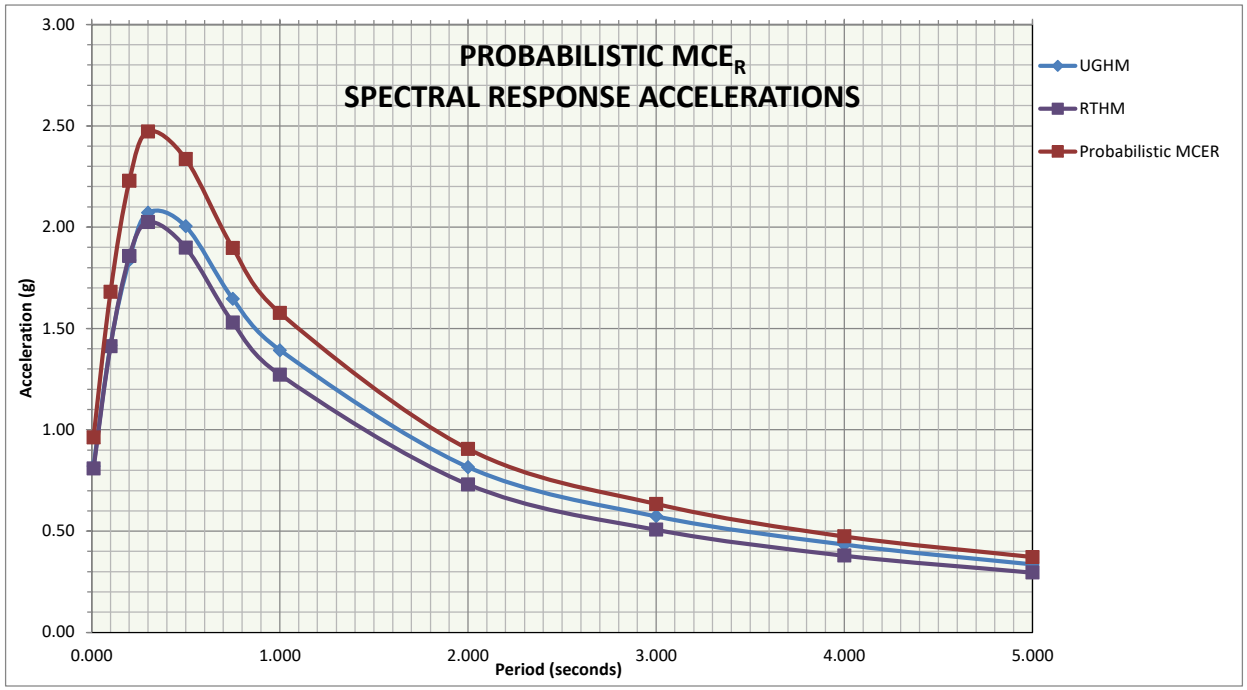
Period	UGHM	RTGM	Max Directional Scale Factor[2]	Probabilistic MCE
0.010	0.821	0.809	1.19	0.963
0.100	1.417	1.412	1.19	1.680
0.200	1.837	1.858	1.20	2.230
0.300	2.071	2.026	1.22	2.472
0.500	2.004	1.899	1.23	2.336
0.750	1.646	1.530	1.24	1.897
1.000	1.393	1.272	1.24	1.577
2.000	0.816	0.730	1.24	0.905
3.000	0.573	0.507	1.25	0.634
4.000	0.433	0.379	1.25	0.474
5.000	0.335	0.295	1.26	0.372

Probabilistic PGA: 0.821

Is Probabilistic $Sa_{(max)}<1.2F_a$? NO

[1] Data Sources:
https://earthquake.usgs.gov/hazards/interactive/
https://earthquake.usgs.gov/designmaps/rtgm/

[2] Shahi-Baker RotD100/RotD50 Factors (2014)



DETERMINISTIC SPECTRUM

Largest Amplitudes of Ground Motions Considering All Sources Calculated using Weighted Mean of Attenuation Equations[1]

Controlling Source: San Jacinto

Is Probabilistic $Sa_{(max)}$<1.2Fa? NO

Period	Deterministic PSa Median + 1.σ for 5% Damping	Max Directional Scale Factor[2]	Deterministic MCE	Section 21.2.2 Scaling Factor Applied
0.010	0.638	1.19	0.760	0.760
0.020	0.641	1.19	0.762	0.762
0.030	0.653	1.19	0.777	0.777
0.050	0.699	1.19	0.832	0.832
0.075	0.841	1.19	1.001	1.001
0.100	1.003	1.19	1.193	1.193
0.150	1.239	1.20	1.487	1.487
0.200	1.387	1.20	1.665	1.665
0.250	1.482	1.21	1.793	1.793
0.300	1.526	1.22	1.862	1.862
0.400	1.526	1.23	1.877	1.877
0.500	1.466	1.23	1.803	1.803
0.750	1.176	1.24	1.458	1.458
1.000	0.980	1.24	1.215	1.215
1.500	0.695	1.24	0.862	0.862
2.000	0.526	1.24	0.652	0.652
3.000	0.355	1.25	0.443	0.443
4.000	0.248	1.25	0.310	0.310
5.000	0.183	1.26	0.230	0.230

Project No: 34019.1

Is Determinstic $Sa_{(max)}$<1.5*Fa? NO

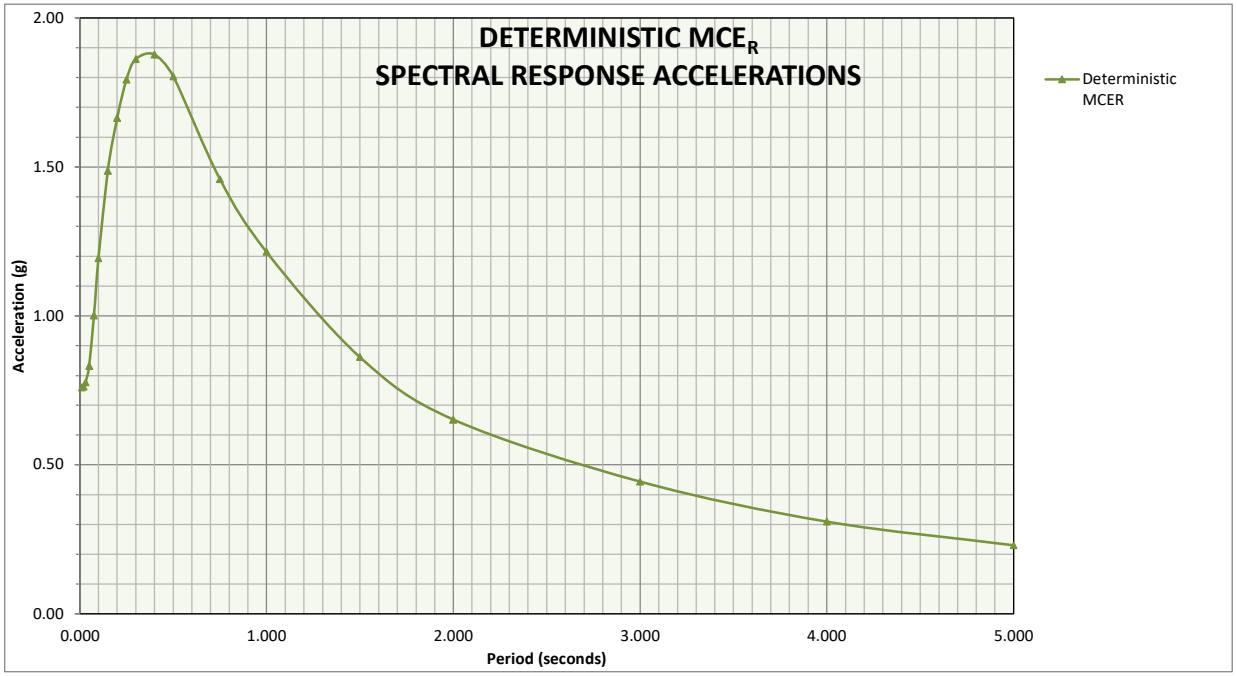
Section 21.2.2 Scaling Factor: N/A

Deterministic PGA: 0.638

Is Deterministic PGA >=F_{PGA}*0.5? YES

[1] NGAWest 2 GMPE worksheet and Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3) - Time Dependent Model

[2] Shahi-Baker RotD100/RotD50 Factors (2014)



SITE SPECIFIC SPECTRA

Period	Probabilistic MCE	Deterministic MCE	Site-Specific MCE	Design Response Spectrum (Sa)
0.010	0.963	0.760	0.760	0.506
0.100	1.680	1.193	1.193	0.796
0.200	2.230	1.665	1.665	1.110
0.300	2.472	1.862	1.862	1.242
0.500	2.336	1.803	1.803	1.202
0.750	1.897	1.458	1.458	0.972
1.000	1.577	1.215	1.215	0.810
2.000	0.905	0.652	0.652	0.435
3.000	0.634	0.443	0.443	0.296
4.000	0.474	0.310	0.310	0.206
5.000	0.372	0.230	0.230	0.160

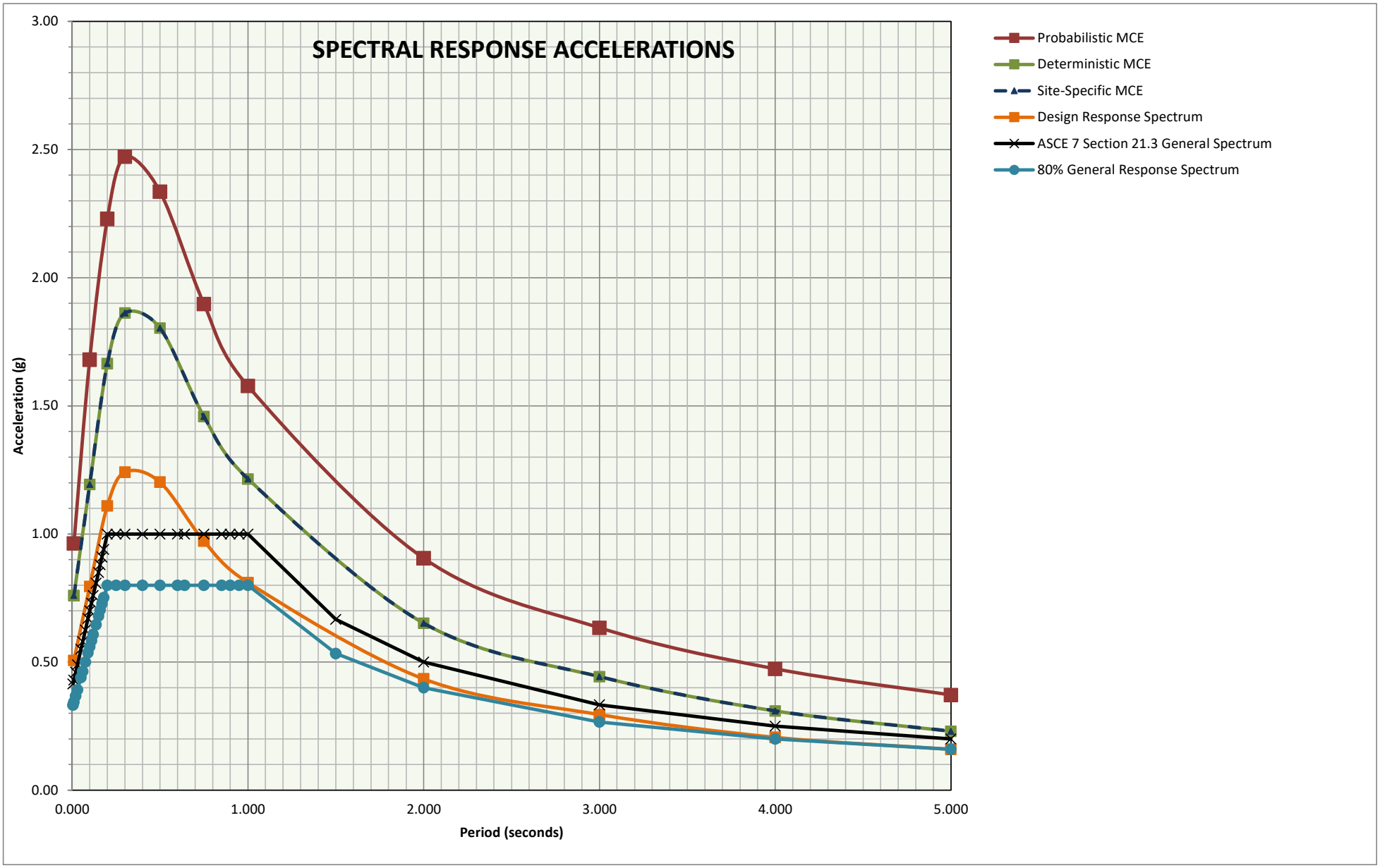
ASCE 7-16: Section 21.4
Site Specific

	Calculated Value	Design Value
SDS:	1.117	1.117
SD1:	0.887	0.887
SMS:	1.676	1.676
SM1:	1.330	1.330
Site Specific PGAm:	0.638	0.638
Site Class:	D measured	

Seismic Design Category - Short* D
Seismic Design Category - 1s* D
* Risk Categories I, II, or III

Period	ASCE 7 SECTION 21.3 General Spectrum	80% General Response Spectrum
0.005	0.415	0.332
0.010	0.430	0.344
0.020	0.460	0.368
0.030	0.490	0.392
0.050	0.550	0.440
0.060	0.580	0.464
0.075	0.625	0.500
0.090	0.670	0.536
0.100	0.700	0.560
0.110	0.730	0.584
0.120	0.760	0.608
0.136	0.808	0.646
0.150	0.850	0.680
0.160	0.880	0.704
0.170	0.910	0.728
0.180	0.940	0.752
0.200	1.000	0.800
0.250	1.000	0.800
0.300	1.000	0.800
0.400	1.000	0.800
0.500	1.000	0.800
0.600	1.000	0.800
0.640	1.000	0.800
0.750	1.000	0.800
0.850	1.000	0.800
0.900	1.000	0.800
0.950	1.000	0.800
1.000	1.000	0.800
1.500	0.667	0.533
2.000	0.500	0.400
3.000	0.333	0.267
4.000	0.250	0.200
5.000	0.200	0.160

Project No: 34019.1



Project No: 34019.1