

GEOTECHNICAL INVESTIGATION
THE COURT
AR-3 DEVELOPMENT
APN'S 3091-161-02 & 04
NWC SILICA ROAD & FIRST AVENUE
VICTORVILLE, CALIFORNIA

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Subject: Geotechnical Investigation

Project: The Court – AR-3 Development
APN's 3091-161-02 & 04
NWC Silica Road & First Avenue
Victorville, California

Sladden Engineering is pleased to present the results of the geotechnical investigation performed for the The Court – AR-3 Development (99-Unit Townhome Condos) proposed for the subject property (APN's 3091-161-02 & 04) located on the northwest corner of Silica Road and First Avenue in the City of Victorville, California. Our services were completed in accordance with our revised proposal for geotechnical engineering services dated November 16, 2023, and your authorization to proceed with the work. The purpose of our investigation was to explore the subsurface conditions at the site to provide recommendations for foundation design and the design of the various site improvements. Evaluation of environmental issues and hazardous wastes was not included within the scope of services provided.

The opinions, recommendations and design criteria presented in this report are based on our field exploration program, laboratory testing and engineering analyses. Based on the results of our investigation, it is our professional opinion that the proposed project should be feasible from a geotechnical perspective provided that the recommendations presented in this report are implemented in design and carried out through construction.

We appreciate the opportunity to provide service to you on this project. If you have any questions regarding this report, please contact the undersigned.

Respectfully submitted,
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GEOTECHNICAL INVESTIGATION
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INTRODUCTION

This report presents the results of the geotechnical investigation performed performed for the The Court – AR-3 Development (99-Unit Townhome Condos) proposed for the subject property (APN's 3091-161-02 & 04) located on the northwest corner of Silica Road and First Avenue in the City of Victorville, California. The site is located at approximately 34.4792 degrees north latitude and 117.2959 degrees west longitude. The approximate location of the site is indicated on the Site Location Map (Figure 1).

Our investigation was conducted to evaluate the engineering properties of the subsurface materials, to evaluate their *in-situ* characteristics, and to provide engineering recommendations and design criteria for site preparation, foundation design and the design of various site improvements. This study also includes a review of published and unpublished geotechnical and geological literature regarding seismicity at and near the subject site.

PROJECT DESCRIPTION

Based on the provided project plans (Twen Ma Architecture/Planning, 2023), it is our understanding that the project will consist of constructing a new "The Court – AR-3 Development" (99-Unit Townhome Condos) on the subject property. The new townhomes will consist of 3-story structures with either a 3- or 4-bedroom unit and attached 2-car garage. In addition, the development will have a multipurpose clubhouse, a new basketball and tennis court, 2 playgrounds, a managers office, and a dog park. New concrete flatwork, landscape areas, trash enclosures, parking lots and various associated site improvements are also anticipated. For our analyses we expect that the proposed condominiums will consist of a relatively lightweight wood-frame structures supported on conventional shallow spread footings and concrete slab-on-grade.

Sladden expects that grading will be limited to minor cuts and fills in order to accomplish the desired elevations and to provide adequate gradients for site drainage. This does not include the removal and re-compaction of the loose surface soil and primary foundation bearing soil within the proposed building pad area. Upon completion of precise grading plans, Sladden should be retained to verify that the recommendations presented within in this report are properly incorporated into the design of the proposed project.

Structural foundation loads were not available at the time of this report. Based on our experience with relatively lightweight multi-story wood-frame construction, we expect that isolated column loads will be less than 50 kips and continuous wall loads will be less than 5.0 kips per linear foot. If the actual loads vary significantly from these assumed loads, we should be consulted to verify the applicability of the recommendations provided.

SCOPE OF SERVICES

The purpose of our investigation was to determine specific engineering characteristics of the surface and near surface soil to develop foundation design criteria and recommendations for site preparation. Specifically, our site characterization consisted of the following tasks:

- Site reconnaissance to assess the existing surface conditions on and adjacent to the site.
- Advancing ten (10) exploratory boreholes to depths between approximately 5 & 51 feet bgs to characterize the subsurface soil conditions. Representative samples of the soil were classified in the field and retained for laboratory testing and engineering analyses.
- Performing laboratory testing on selected samples to evaluate their engineering characteristics.
- Reviewing geologic literature and discussing geologic hazards.
- Performing engineering analyses to develop recommendations for foundation design and site preparation.
- The preparation of this report summarizing our work at the site.

SITE CONDITIONS

The project site is located on the northwest corner of Silica Road and First Avenue in the City of Victorville, California. The site is formally identified by the County of San Bernardino as APN's 3091-161-02 and 3091-161-04 and occupies a total area of approximately 8.65 acres. At the time of our investigation, the subject property was undeveloped and covered by scattered vegetation. Various dirt roads transected the property. The subject property is near the elevation of the adjacent properties and roadways and is bounded by Silica Drive on the south, by a church on the north, by undeveloped parcels on the west and by 1st Avenue on the east.

Based on our review of the Hesperia 7.5-Minute Quadrangle Map (USGS, 2018), the site is situated at an elevation of approximately 3,000 feet above mean sea level (MSL). Surface gradients in the site vicinity descend to the north at an inclination of ten horizontal to one vertical (10H:1V) and less.

No natural ponding of water or surface seeps were observed at or near the site during our investigation conducted on January 31, 2024. Site drainage appears to be controlled via sheet flow and surface infiltration.

GEOLOGIC SETTING

The project site is located in the Transverse Ranges Physiographic Province of California. The Transverse Ranges are mountainous areas that extend from the southern edge of the California Coast Ranges to the eastern edge of the San Bernardino Mountains. The province is characterized by elongated, predominantly parallel east-west trending mountain ranges and valleys. Mountainous areas of the Transverse Ranges Physiographic Province generally consist of igneous, metasedimentary and metavolcanic rocks (Jahns, 1954).

The site has been mapped by Morton and Miller (2003) to be immediately underlain by very old alluvial fan deposits consisting of coarse-grained and to boulder alluvium (Qvof). The geologic setting for the site and site vicinity is illustrated on the Regional Geologic Map , Figure 2.

SUBSURFACE CONDITIONS

The subsurface conditions at the site were investigated by drilling ten (10) exploratory boreholes throughout the project site to depths between 5 and 51 feet below the existing ground surface (bgs). The approximate locations of the boreholes are illustrated on the Exploration Location Plan (Figure 3). The boreholes were advanced using a truck-mounted Mobile B-61 drill rig equipped with 8-inch outside diameter hollow stem augers. A representative of Sladden was present to log the materials encountered and retrieve samples for laboratory testing and engineering analysis.

During our field investigation disturbed soil was encountered to depths of approximately less than 3 feet bgs. Underlying the disturbed surface soil and extending the maximum depths explored, native alluvium was encountered. In general, the native earth materials consist of gravelly sand (SP/SW) and silty sand (SM) with isolated clayey silt (ML) and caliche layers encountered. In general, the granular horizons appeared yellowish brown, slightly moist and loose to very dense. Cohesive sediments appeared medium stiff to very stiff and exhibited low to medium plasticity characteristics.

The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and tests of the field samples. The final logs are included in Appendix A of this report. The stratification lines represent the approximate boundaries between soil types although the transitions may be gradual.

Groundwater was not encountered to a maximum explored depth of approximately 51 feet bgs during our field investigation. As such, it is our opinion that groundwater should not be a factor during construction of the proposed project.

SEISMICITY AND FAULTING

The southwestern United States is a tectonically active and structurally complex region, dominated by northwest trending dextral faults. The faults of the region are often part of complex fault systems, composed of numerous subparallel faults which splay or step from main fault traces. Strong seismic shaking could be produced by any of these faults during the design life of the proposed project.

We consider the most significant geologic hazard to the project to be the potential for moderate to strong seismic shaking that is likely to occur during the design life of the project. The proposed project is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active. An active fault is defined by the State of California as a “sufficiently active and well defined fault” that has exhibited surface displacement within the Holocene epoch (about the last 11,000 years). A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

Table 1 lists the closest known potentially active faults that was generated in part using the EQFAULT computer program (Blake, 2000), as modified using the fault parameters from The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al, 2003). This table does not identify the probability of reactivation or the on-site effects from earthquakes occurring on any of the other faults in the region.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Distance (Km)	Maximum Event
North Frontal Fault Zone	11.5	7.1
Helendale – S. Lockhardt	21.4	7.3
Cleghorn	20.9	6.5
Cucamonga	25.5	6.9
San Andreas – San Bernardino	27.3	8.2
San Andreas – Southern	27.3	8.2
San Andreas – Mojave	29.2	8.2
San Andreas – 1857 Rupture	29.2	8.2
San Jacinto – San Bernardino	32.9	6.7
Lenwood-Lockhardt-Old Woman Springs	44.4	7.5
Sierra Madre	46.5	7.2

SITE SPECIFIC GROUND MOTION PARAMETERS

Sladden has reviewed the 2022 California Building Code (CBC) and ASCE7-16 and developed site specific ground motion parameters for the subject site. The project site-specific ground motion parameters are summarized in the following table and included within Appendix C. The project Structural Engineer should verify that all design parameters provided are applicable for the subject project.

TABLE 2
GROUND MOTION PARAMETERS

Latitude / Longitude	34.4792/ -117.2959		
Risk Category	II		
Site Class	D		
Code Reference Documents	ASCE 7-16; Chapter 11 & 21		
Description	Type	Map Based	Site-Specific
MCE _R Ground Motion (0.2 second period)	S _s	1.231	---
MCE _R Ground Motion (1.0 second period)	S ₁	0.474	---
Site-Modified Spectral Acceleration Value	S _{MS}	1.240	1.557
Site-Modified Spectral Acceleration Value	S _{M1}	null	1.062
Numeric Seismic Design Value at 0.2 second SA	S _{DS}	0.827	1.038
Numeric Seismic Design Value at 1.0 second SA	S _{D1}	null	0.708
Site Amplification Factor at 0.2 second	F _a	1.008	1.0
Site Amplification Factor at 1.0 second	F _v	null	2.5
Site Peak Ground Acceleration	PGA _M	0.550	0.643

GEOLOGIC HAZARDS

The subject site is located in an active seismic zone and will likely experience strong seismic shaking during the design life of the proposed project. In general, the intensity of ground shaking will depend on several factors including: the distance to the earthquake focus, the earthquake magnitude, the response characteristics of the underlying materials, and the quality and type of construction. Geologic hazards and their relationship to the site are discussed below.

- I. Surface Rupture. Surface rupture is expected to occur along preexisting, known active fault traces. However, surface rupture could potentially splay or step from known active faults or rupture along unidentified traces. Based on our review of Jennings (1994), CGS (2024) and Morton and Miller (2003), known faults are not mapped on or projecting towards the site. In addition, no signs of active surface faulting were observed during our review of non-stereo digitized photographs of the site and site vicinity (Google Earth, 2024). Finally, no signs of active surface fault rupture or secondary seismic effects (lateral spreading, lurching etc.) were identified during our field investigation. Therefore, it is our opinion that risks associated with primary surface ground rupture should be considered "low".
- II. Ground Shaking. The site has been subjected to past ground shaking by faults that traverse through the region. Strong seismic shaking from nearby active faults is expected to produce strong seismic shaking during the design life of the proposed project. The site modified peak ground acceleration is estimated to be 0.643g.
- III. Liquefaction. Liquefaction is the process in which loose, saturated granular soil loses strength as a result of cyclic loading. The strength loss is a result of a decrease in granular sand volume and a positive increase in pore pressures. Generally, liquefaction can occur if all of the following conditions apply; liquefaction susceptible soil, groundwater within a depth of 50 feet or less, and strong seismic shaking.

Based on the dense nature of the underlying soil layers and the depth to groundwater (>100 ft. bgs) (CDWR, 2024), risks associated with liquefaction are considered “negligible”.

- IV. Tsunamis and Seiches. Because the site is situated at an inland location and is not immediately adjacent to any impounded bodies of water, risk associated with tsunamis and seiches is considered “negligible”.
- V. Slope Failure, Land Sliding, Rock Falls. No signs of slope instability in the form of landslides, rock falls, earthflows or slumps were observed at or near the subject site. The site is located on relatively level ground and not immediately adjacent to any hillsides. Based on our field observations of the site vicinity, risks associated with slope instability should be considered “negligible”.
- VI. Expansive Soil. Generally, the surface soil consists of granular soil. Based on the results of our laboratory testing (EI=5), the materials underlying the site are considered to have a “very low” expansion potential. The expansion potential of the surface soil should be reevaluated after grading.
- VII. Static Settlement. Static settlement resulting from the anticipated foundation loads should be tolerable provided that the recommendations included in this report are considered in foundation design and construction. The ultimate static settlement is expected to be less than 1 inch when using the recommended allowable bearing pressures. As a practical matter, differential static settlement between footings can be assumed as one-half of the total settlement.
- VIII. Subsidence. Land subsidence can occur in valleys where aquifer systems have been subjected to extensive groundwater pumping, such that groundwater pumping exceeds groundwater recharge. Generally, pore water reduction can result in a rearrangement of skeletal grains and could result in elastic (recoverable) or inelastic (unrecoverable) deformation of an aquifer system.

Locally, no fissures or other surficial evidence of subsidence were observed at or near the subject site. The potential for subsidence related settlement is considered “negligible”.
- IX. Debris Flows. Debris flows are viscous flows consisting of poorly sorted mixtures of sediment and water and are generally initiated on slopes steeper than approximately six horizontal to one vertical (6H:1V) (Boggs, 2001). Based on the flat nature of the site and the composition of the surface soil, we judge that the risks associated with debris flows should be considered “negligible”.
- X. Flooding and Erosion. No signs of flooding or erosion were observed during our field investigation. Risks associated with flooding and erosion should be evaluated and mitigated by the project design Civil Engineer.

CONCLUSIONS

Based on the results of our investigation, it is our professional opinion that the project should be feasible from a geotechnical perspective provided that the recommendations included in this report are incorporated into design and carried out through construction. The main geotechnical concerns are the presence of disturbed surface soil and the presence of loose and potentially compressible near-surface native soil.

We recommend that any remedial work within the proposed building areas include over-excavation and re-compaction of the primary foundation bearing soil. Specific recommendations for foundation area preparation are presented in the Earthwork and Grading section of this report.

Caving did occur to varying degrees within each of our exploratory bores and the surface soil may be susceptible to caving within deeper excavations. All excavations should be constructed in accordance with the normal CalOSHA excavation criteria. Based on our observations of the materials encountered, we anticipate that the subsoil will conform to that described by CalOSHA as Type C. Soil conditions should be verified in the field by a "Competent person" employed by the Contractor.

The following recommendations present more detailed design criteria that have been developed based on our field exploration and laboratory testing.

EARTHWORK AND GRADING

All earthwork including excavation, backfill and preparation of the primary foundation and/or slab bearing soil should be performed in accordance with the geotechnical recommendations presented in this report and portions of the local regulatory requirements, as applicable. All earthwork should be performed under the observation and testing of a qualified soil engineer. The following geotechnical engineering recommendations for the proposed project are based on observations from the field investigation program, laboratory testing and geotechnical engineering analyses.

- a. Site Clearing: Areas to be graded should be cleared of any existing vegetation, root systems, and any subsurface improvements encountered. All areas scheduled to receive fill should be cleared of old fills and any irreducible matter. The unsuitable materials should be removed off site. Voids left by obstructions should be properly backfilled in accordance with the compaction recommendations of this report.
- b. Preparation of Building Areas: To provide firm and uniform foundation bearing conditions, we recommend over-excavation and re-compaction throughout the proposed building areas. All artificial fill soil and low density near surface native soil should be removed to a depth of approximately 4 feet below existing grade or 3 feet below the bottom of the footings, whichever is deeper. Remedial grading should extend laterally a minimum of five feet beyond the building perimeter. The native soil exposed by over-excavation should be scarified, moisture conditioned to near optimum moisture content and compacted to at least 90 percent relative compaction prior to fill placement. The previously removed soil may then be replaced as engineered fill as recommended below.

- c. Compaction: Soil to be used as engineered fill should be free of organic material, debris, and other unsuitable material, and should not contain irreducible matter greater than six inches in maximum dimension. All fill materials should be placed in thin lifts, not exceeding six inches in a loose condition. If import fill is required, the material should be of a low to non-expansive nature and should meet the following criteria:

Plastic Index	Less than 12
Liquid Limit	Less than 35
Percent Soil Passing #200 Sieve	Between 15% and 35%
Maximum Aggregate Size	3 inches

The subgrade soil and all fill material should be compacted with acceptable compaction equipment to at least 90 percent relative compaction. The exposed subgrade soil should be observed by a representative of Sladden Engineering prior to fill placement. Compaction testing should be performed on all lifts in order to ensure proper placement of the fill materials. Table 4 provides a summary of the excavation and compaction recommendations.

TABLE 3
SUMMARY OF RECOMMENDATIONS

*Remedial Grading	Over-excavation and re-compaction within the building envelope and extending laterally 5 feet beyond the building limits and to a minimum depth of 4 feet below existing grade or 3 feet below the bottom of the footings, whichever is deeper.
Native / Import Engineered Fill	Place in thin lifts not exceeding 6 inches in a loose condition, compact to a minimum of 90 percent relative compaction within 2 percent of the optimum moisture content.

*Actual depth may vary and should be determined by a representative of Sladden Engineering in the field during construction.

- d. Shrinkage and Subsidence: Volumetric shrinkage of the material that is excavated and replaced as controlled compacted fill should be anticipated. We expect that this shrinkage should be between 10 and 15 percent. Subsidence of the surfaces that are scarified and compacted is expected to be between 1 tenth and 2 tenths of a foot. This will vary depending upon the type of equipment used, the moisture content of the soil at the time of grading and the actual degree of compaction attained.

CONVENTIONAL SHALLOW SPREAD FOOTINGS

Conventional shallow spread footings are expected to provide adequate support for the proposed 3-story townhomes. All footings should be founded upon properly compacted engineered fill soil and should have a minimum embedment depth of 18 inches measured from the lowest adjacent finished grade. Continuous footings and isolated pad footings should have minimum widths of 12 inches and 24 inches, respectively. Continuous footings and isolated pad footings supported upon properly compacted engineered fill soil may be designed using allowable bearing pressures of 1800 and 2000 pounds per square foot (psf), respectively. Allowable increases of 200 psf for each additional 1 foot of width and 250 psf for each additional 6 inches of depth may be used if desired. The maximum allowable bearing pressure should be 3,000 psf. The allowable bearing pressures apply to combined dead and sustained live loads. The allowable bearing pressures may be increased by one-third when considering transient live loads, including seismic and wind forces.

Based on the recommended allowable bearing pressures, the total static settlement of the conventional shallow spread footings is anticipated to be less than one-inch provided that foundation area preparation conforms to the recommendations included in this report. Static differential settlement is anticipated to be approximately one-half of the total static settlement for similarly loaded footings spaced up to approximately 50 feet apart.

Lateral load resistance for the shallow spread footings will be developed by passive pressure against the sides of the footings below grade and by friction acting at the base of the footings. An allowable passive pressure of 250 psf per foot of depth may be used for design purposes. An allowable coefficient of friction 0.45 may be used for dead and sustained live loads to compute the frictional resistance of the footing placed directly on compacted fill. Under seismic and wind loading conditions, the passive pressure and frictional resistance may be increased by one-third.

All footing excavations should be observed by a representative of the project geotechnical consultant to verify adequate embedment depths prior to placement of forms, steel reinforcement or concrete. The excavations should be trimmed neat, level and square. All loose, disturbed, sloughed or moisture-softened soils and/or any construction debris should be removed prior to concrete placement. Excavated soil generated from footing and/or utility trenches should not be stockpiled within the building envelope or in areas of exterior concrete flatwork. All footings should be reinforced in accordance with the project Structural Engineer's recommendations.

SLABS-ON-GRADE

To provide uniform and adequate support, concrete slabs-on-grade should be placed on properly compacted engineered fill soil as outlined in the previous sections of this report. The slab subgrade should remain near optimum moisture content and should not be permitted to dry prior to concrete placement. Slab subgrades should be firm and unyielding. Disturbed soil should be removed and replaced with engineered fill soil compacted to a minimum of 90 percent relative compaction.

Slab thickness and reinforcement should be determined by the Structural Engineer. We recommend a minimum slab thickness of 4.0 inches and minimum reinforcement of #3 bars at 18 inches on center in both directions.. All slab reinforcement should be supported on concrete chairs to ensure that reinforcement is placed at slab mid-height. Final floor slab design and reinforcement should be determined by the Structural Engineer.

Slabs with moisture sensitive surfaces should be underlain with a moisture vapor retarder consisting of a polyvinyl chloride membrane such as 10-mil visqueen, or equivalent. All laps within the membrane should be sealed and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface can not be achieved by grading, consideration should be given to placing a thin leveling course of sand across the pad surface prior to placement of the membrane.

RETAINING WALLS

Minor retaining walls may be required to accomplish the proposed construction. Cantilever retaining walls may be designed using "active" pressures. Active pressures may be estimated using an equivalent fluid weight of 35 pcf for gently sloping (less than 3H:1V) native backfill soil acting in a triangular pressure distribution with drained backfill conditions. For steeper slopes up to 2 to 1, the active equivalent fluid pressure should be increased to 55 pcf. "At Rest" pressures should be utilized for restrained walls. At rest pressures may be estimated using an equivalent fluid weight of 55 pcf for native backfill soil with level drained backfill conditions. At rest pressures should be increased to 75 pcf for sloped (2 to 1) maximum backfill conditions.

We recommend that a back drain system be provided behind all retaining walls or that the walls be designed for full hydrostatic pressures. The back drains should consist of a heavy walled, four inch diameter, perforated pipe sloped to drain to outlets by gravity, and of clean, free-draining, three-quarter to one and one-half inch crushed rock or gravel. The crushed rock or gravel should extend to within one foot of the surface. The upper one foot should be backfilled with compacted, fine-grained soil to exclude surface water. A Mirafi 140N (or equivalent) filter cloth should be placed between the on-site native material and the drain rock.

We recommend that the ground surface behind retaining walls be sloped to drain. Under no circumstances should the surface water be diverted into back drains. Where migration of moisture through walls would be detrimental, the walls should be waterproofed.

PRELIMINARY PAVEMENT DESIGN

For preliminary pavement design an assumed R-Value of 50 and Traffic Indices (TI) of 5.0 and 6.5 were used for the light duty and heavy duty pavements, respectively. We assumed Asphalt Concrete (AC) over Class II Aggregate Base (AB). The preliminary flexible pavement layer thickness is as follows:

RECOMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS		
Pavement Material	Recommended Thickness	
	TI = 5.0	TI = 6.5
Asphalt Concrete Surface Course	3.0 inches	3.0 inches
Class II Aggregate Base Course	4.0 inches	6.0 inches
Compacted Subgrade Soil	12.0 inches	12.0 inches

Asphalt concrete and Class II aggregate base should conform to the latest editions of the Standard Specifications for Public Works Construction ("Greenbook") or CalTrans standard specifications. The aggregate base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Method D 1557.

We expect that concrete pavement may also be considered for on-site pavement areas. A concrete pavement section of 5.0 inches of Portland Cement Concrete (PCC) on compacted native soil should be adequate for the on-site concrete pavement limited to automobile and light truck traffic. In areas where heavy truck traffic is expected, the concrete pavement section should be increased to 6.0 inches of PCC on compacted native soil. Properly spaced and constructed control joints including expansion joints and contraction joints should be incorporated into concrete pavement design to accommodate temperature and shrinkage related cracking. Joint spacing and joint patterns should be established based upon Portland Cement Association (PCA) and American Concrete Institute (ACI) guidelines.

CORROSION SERIES

The soluble sulfate concentrations of the surface soil were determined to be 20 parts per million (ppm). The soil is considered to have a "negligible – S0" corrosion potential with respect to concrete. The use of Type V cement and special sulfate resistant concrete mixes should not be necessary.

The pH levels of the surface soil was determined to be 7.9. Based on soluble chloride concentration testing (50 ppm) the soil is considered to have a "negligible – C0" corrosion potential with respect to normal grade steel. The minimum resistivity of the surface soil was found to be 4,900 ohm-cm, that suggests the site soil is considered to have a "moderate" corrosion potential with respect to ferrous metal installations. A corrosion expert should be consulted regarding appropriate corrosion protection measures for corrosion sensitive installations.

UTILITY TRENCH BACKFILL

All utility trench backfill should be compacted to a minimum of 90 percent relative compaction. Trench backfill materials should be placed in lifts no greater than six inches in a loose condition, moisture conditioned (or air-dried) as necessary to achieve near optimum moisture content, and mechanically compacted in place to a minimum of 90 percent relative compaction. A representative of the project soil engineer should test the backfill to verify adequate compaction.

EXTERIOR CONCRETE FLATWORK

To minimize cracking of concrete flatwork, the subgrade soil below concrete flatwork areas should be compacted to a minimum of 90 percent relative compaction. A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soil prior to concrete placement.

DRAINAGE

All final grades should be provided with positive gradients away from foundations to provide rapid removal of surface water runoff to an adequate discharge point. No water should be allowed to be pond on or immediately adjacent to foundation elements. To reduce water infiltration into the subgrade soil, surface water should be directed away from building foundations to an adequate discharge point. Subgrade drainage should be evaluated upon completion of the precise grading plans and in the field during grading.

LIMITATIONS

The findings and recommendations presented in this report are based upon an interpolation of the soil conditions between the exploratory locations and extrapolation of these conditions throughout the proposed building areas. Should conditions encountered during grading appear different than those indicated in this report, this office should be notified.

The use of this report by other parties or for other projects is not authorized. The recommendations of this report are contingent upon monitoring of the grading operation by a representative of Sladden Engineering. All recommendations are considered to be tentative pending our review of the grading operation and additional testing, if indicated. If others are employed to perform any soil testing, this office should be notified prior to such testing in order to coordinate any required site visits by our representative and to assure indemnification of Sladden Engineering.

We recommend that a pre-job conference be held on the site prior to the initiation of site grading. The purpose of this meeting will be to assure a complete understanding of the recommendations presented in this report as they apply to the actual grading performed.

ADDITIONAL SERVICES

Once completed, final project plans and specifications should be reviewed by use prior to construction to confirm that the full intent of the recommendations presented herein have been applied to design and construction. Following review of plans and specifications, observation should be performed by the Soil Engineer during construction to document that foundation elements are founded on/or extend into the properly compacted soil, and that suitable backfill soil is placed upon competent materials and properly compacted at the recommended moisture content.

Tests and observations should be performed during grading by the Soil Engineer or his representative in order to verify that the grading is being performed in accordance with the project specifications. Field density testing shall be performed in accordance with acceptable ASTM test methods. The minimum acceptable degree of compaction should be 90 percent for engineered fill soil and 95 percent for Class II aggregate base as obtained by ASTM Test Method D1557. Where testing indicates insufficient density, additional compactive effort shall be applied until retesting indicates satisfactory compaction.

REFERENCES

- Blake, T., 2000, EQFAULT and EQSEARCH, Computer Programs for Deterministic and Probabilistic Prediction of Peak Horizontal Acceleration from Digitized California Faults.
- Boggs, S. Jr., 2001, "Principles of Sedimentology and Stratigraphy", Prentice Hall, third edition
- Building Seismic Safety Council (BSSC), 2014, Earthquake Scenario Event Set webpage; available at: <https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=14d2f75c7c4f4619936dac0d14e1e468>
- California Building Code (CBC), 2022, California Building Standards Commission.
- California Geological Survey (CGS) 2024, Earthquake Zones of Required Investigation.
- California Department of Water Resources (CDWR), 2024, Historical Data by Well-Map Interface, available at : <https://wdl.water.ca.gov/waterdatalibrary/>
- Cao T., Bryant, W.A., Rowshandel B., Branum D., Wills C.J., 2003, "The Revised 2002 California Probabilistic Seismic Hazard Maps".
- GoogleEarth.com, 2024, Vertical Aerial Photograph for the Victorville Area, California, Undated, Variable Scale.
- Jennings, Charles W. (Compiler), 1994, Fault Activity Map of California and Adjacent Areas, California Division of Mines and Geology, Geologic Data Map No. 6
- Morton D.M and Miller F.K, 2003, "Preliminary Geologic Map of the San Bernardino 30' x 60' Quadrangle, California", Scale 1:100,000
- Southern California Earthquake Data Center (SCEDC), 2024, Significant Earthquakes and Faults; available at: <https://scedc.caltech.edu/>
- Structural Engineer Association (SEA), 2024, Seismic Design Maps; available at: <https://seismicmaps.org/>
- Twen Ma Architecture/Planning, 2023, The Court – AR – 3 Development, Silica Drive and First Avenue, Site Plan.
- United States Geological Survey (USGS), 2012, Hesperia 7.5 Minute Quadrangle Map, 1:24000.
- United States Geological Survey (USGS), 2024a, Quaternary Fault and Fold Database; available at: <https://geohazards.usgs.gov/hazards/interactive/>

REFERENCES
(Continued)

United States Geological Survey (USGS), 2024b, Risk-Targeted Ground Motion Calculator; available at:
<https://earthquake.usgs.gov/designmaps/rtgm/>

United States Geological Survey (USGS), 2024c, Unified Hazard Tool; available at:
<https://earthquake.usgs.gov/hazards/interactive/>

FIGURES

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
EXPLORATION LOCATION PLAN



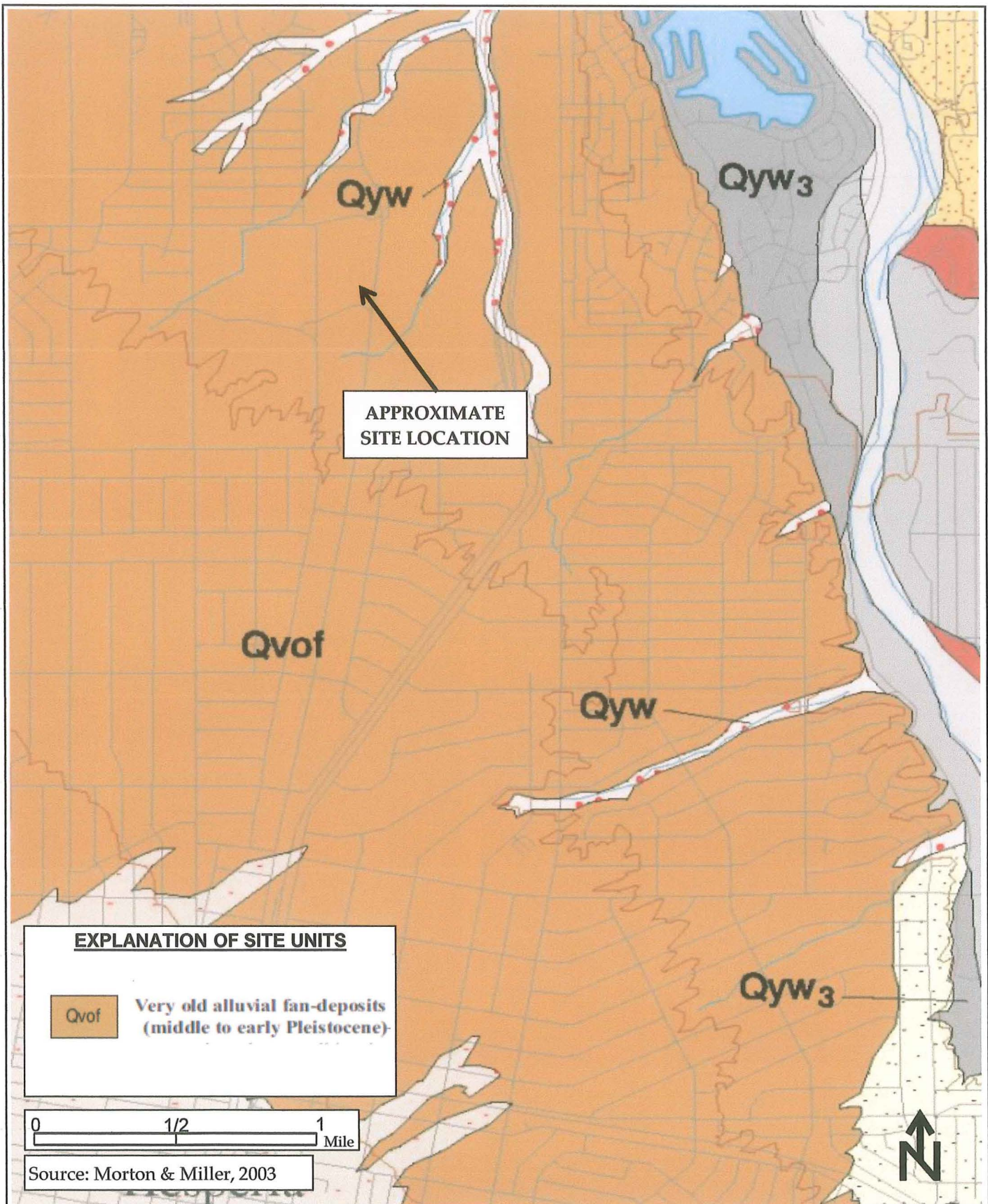
Sladden Engineering

SITE LOCATION MAP

Project Number:	644-24001
Report Number:	24-02-018
Date:	

FIGURE

1



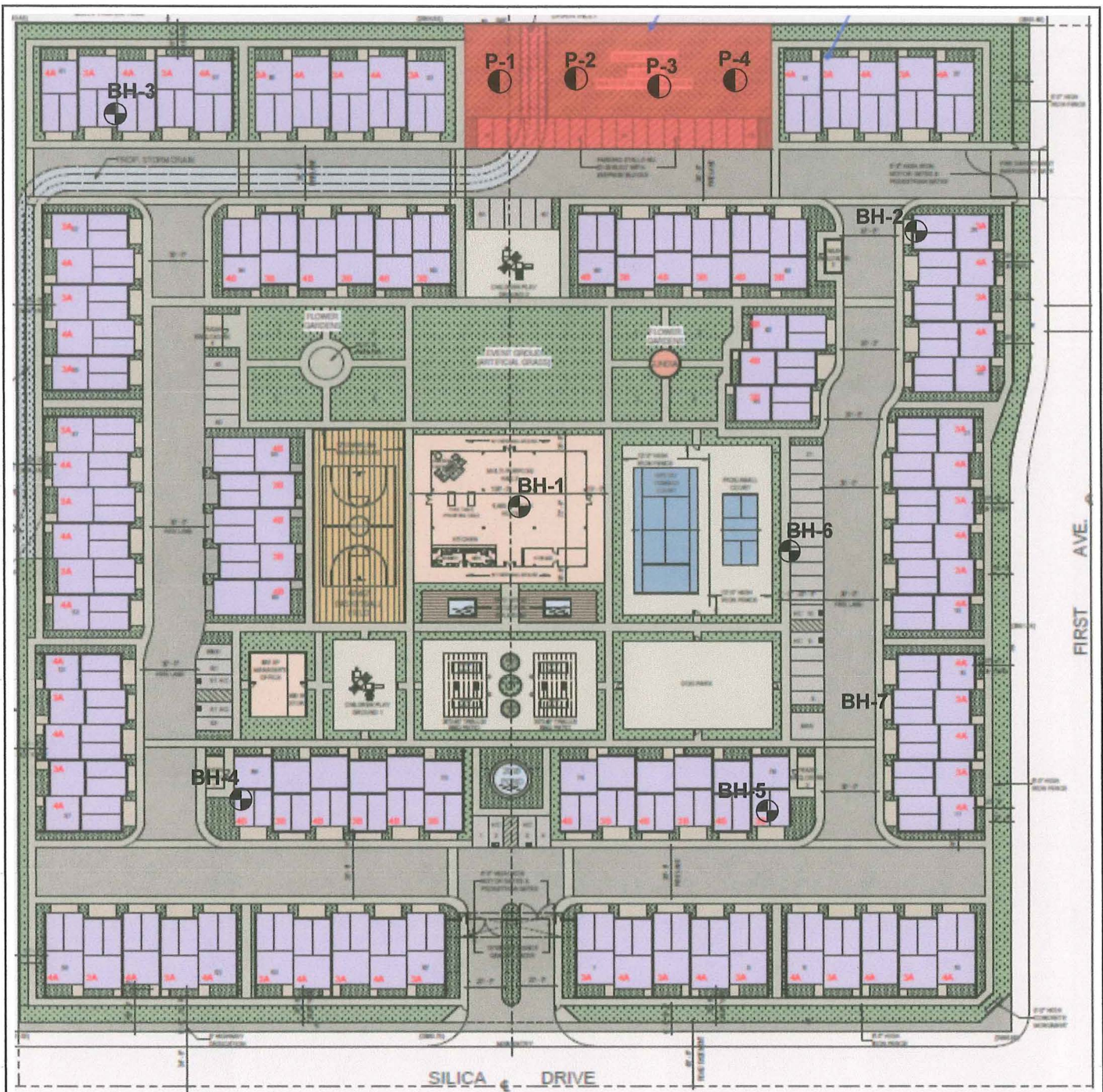
Sladden Engineering

REGIONAL GEOLOGIC MAP

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Date:	

FIGURE

2



LEGEND

- BH-6 Borehole Location
- P-4 Infiltration Test Location

Source: Twen Ma, 2023



Sladden Engineering

EXPLORATION LOCATION PLAN

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FIGURE

3

APPENDIX A
FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

For our field investigation, ten (10) exploratory bores were excavated on January 31, 2024 utilizing a truck-mounted drill rig equipped with 8 inch (O.D.) hollow-stem augers (Mobile B-61). Continuous logs of the materials encountered were made by a representative of Sladden Engineering. Materials encountered in the boreholes were classified in accordance with the Unified Soil Classification System which is presented in this appendix.

Representative undisturbed samples were obtained within our borings by driving a thin-walled steel penetration sampler (California split spoon sampler) or a Standard Penetration Test (SPT) sampler with a 140-pound automatic-trip hammer dropping approximately 30 inches (ASTM D1586). The number of blows required to drive the samplers 18 inches was recorded in 6-inch increments and blowcounts are indicated on the boring logs.

The California samplers are 3.0 inches in diameter, carrying brass sample rings having inner diameters of 2.5 inches. The standard penetration samplers are 2.0 inches in diameter with an inner diameter of 1.5 inches. Undisturbed samples were removed from the sampler and placed in moisture sealed containers in order to preserve the natural soil moisture content. Bulk samples were obtained from the excavation spoils and samples were then transported to our laboratory for further observations and testing.



SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Excavated:	1/31/2024
Elevation:	3000 ft (MSL)	Bore Hole:	BH-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description
	7/7/10	1	5	20.5	2.7	114.4	2		Silty Sand (SM); yellowish brown, slightly moist, medium dense, fine- to coarse-grained with gravel and caliche layers (Disturbed).
	5/5/6			8.5	1.8	107.4	4		Gravelly Sand (SP/SW); yellowish brown, slightly moist, loose, fine- to coarse-grained (Qvof).
							6		
	6/9/11			4.1	1.5		10		
							12		
	26/31/35			16.3	5.1	123.0	14		Silty Sand (SM); yellowish brown, slightly moist, very dense, fine- to coarse-grained with gravel (Qvof).
							16		
							18		
	10/13/16			10.8	4.2		20		
							22		Gravelly Sand (SP/SW); yellowish brown, slightly moist, dense, fine- to coarse-grained (Qvof).
							24		
	12/15/23			36.0	6.8	102.0	26		
							28		
	5/8/11			87.6	16.0		30		Clayey Silt (ML); olive brown, moist, very stiff, low to medium plasticity (Qvof).
							32		
							34		
	15/50-6"			42.5	9.4	113.2	36		
							38		Silty Sand (SM); yellowish brown, slightly moist, very dense, fine- to coarse-grained with gravel (Qvof).
							40		
	27/33/34			13.0	2.0		42		
							44		
	34/50-5"			3.0	1.2	113.3	46		Gravelly Sand (SP/SW); yellowish brown, slightly moist, very dense, fine- to coarse-grained (Qvof).
							48		
							50		
	22/23/25			6.9	1.6				

Completion Notes:

Terminated at ~ 51.5 Feet bgs

No Bedrock Encountered.

No Groundwater or Seepage Encountered.

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APN'S 3091-161-02 & 04 VICTORVILLE, CA

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SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Excavated:	1/31/2024
Elevation:	3000 ft (MSL)	Bore Hole:	BH-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel and caliche layers (Disturbed).
	6/6/7			6.4	2.0		4		
							6		Gravelly Sand (SP/SW); yellowish brown, slightly moist, loose, fine- to coarse-grained (Qvof).
	7/9/13			1.5	0.9		8		
							10		Gravelly Sand (SP/SW); yellowish brown, slightly moist, medium dense, fine- to coarse-grained (Qvof).
							12		
	18/21/25						14		
							16		No Recovery.
							18		
	26/50-6"			10.7	5.6	111.1	20		Gravelly Sand (SP/SW); yellowish brown, slightly moist, very dense, fine- to coarse-grained (Qvof).
							22		
							24		Terminated at ~ 21.5 Feet bgs
							26		No Bedrock Encountered
							28		No Groundwater or Seepage Encountered
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

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SLADDEN ENGINEERING

BORE LOG

Drill Rig: Mobil B-61

Date Excavated: 1/31/2024

Elevation: 3000 ft (MSL)

Bore Hole: BH-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description		
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Disturbed).		
	8/14/18			9.5	2.4	112.1	4		Gravelly Sand (SP/SW); yellowish brown, slightly moist, medium dense, fine- to coarse-grained (Qvof).		
							6				
							8				
	7/10/12			4.3	1.4		10				
							12				
							14				
	18/24/24			7.0	3.5	114.9	16				
							18				
							20				
	11/15/15			6.0	2.2		22				
							24				
	10/13/15			35.0	12.4		26		Silty Sand (SM); yellowish brown, slightly moist, medium dense, fine- to coarse-grained with gravel (Qvof).		
							28		Terminated at ~ 26.5 Feet bgs No Bedrock Encountered No Groundwater or Seepage Encountered		
							30				
							32				
							34				
							36				
							38				
							40				
							42				
							44				
							46				
							48				
							50				
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SLADDEN ENGINEERING

BORE LOG

Drill Rig: Mobil B-61

Date Excavated: 1/31/2024

Elevation: 3000 ft (MSL)

Bore Hole: BH-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description	
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Disturbed).	
	5/7/8			6.0	2.2		4		Gravelly Sand (SP/SW); yellowish brown, slightly moist, loose, fine- to coarse-grained (Qvof).	
	13/19/28			72.5	16.1	96.4	6			
							8			
							10			
							12		Clayey Silt (ML); olive brown, moist, medium stiff, low to medium plasticity (Qvof).	
							14			
	14/22/26			28.9	5.8		16			
							18		Silty Sand (SM); yellowish brown, slightly moist, dense, fine- to coarse-grained with gravel (Qvof).	
							20			
							22			
							24			
							26			
							28			
							30			
							32			
							34			
							36			
							38			
							40			
							42			
							44			
							46			
							48			
							50			
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 SLADDEN ENGINEERING								BORE LOG			
								Drill Rig:	Mobil B-61	Date Excavated:	1/31/2024
								Elevation:	3000 ft (MSL)	Bore Hole:	BH-5
Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description		
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Disturbed).		
	5/10/11			5.3	1.9	111.5	4		Gravelly Sand (SP/SW); yellowish brown, slightly moist, medium dense, fine- to coarse-grained (Qvof).		
	8/10/10			6.4	1.6		6				
							8				
							10		Gravelly Sand (SP/SW); yellowish brown, slightly moist, dense, fine- to coarse-grained (Qvof).		
	14/19/24						12				
							14				
							16		No Recovery.		
							18		Terminated at ~ 16.5 Feet bgs No Bedrock Encountered No Groundwater or Seepage Encountered		
							20				
							22				
							24				
							26				
							28				
							30				
							32				
							34				
							36				
							38				
							40				
							42				
							44				
							46				
							48				
							50				
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SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Excavated:	1/31/2024
Elevation:	3000 ft (MSL)	Bore Hole:	BH-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Disturbed).
	7/18/14			14.7	3.3		4		
							6		Silty Sand (SM); yellowish brown, slightly moist, dense, fine- to coarse-grained with gravel (Qvof).
	11/20/29			7.2	1.4		8		
							10		Gravelly Sand (SP/SW); yellowish brown, slightly moist, dense, fine- to coarse-grained (Qvof).
							12		
							14		Terminated at ~ 11.5 Feet bgs
							16		No Bedrock Encountered
							18		No Groundwater or Seepage Encountered
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

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SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Excavated:	1/31/2024
Elevation:	3000 ft (MSL)	Bore Hole:	P-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description			
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Disturbed).			
							4		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Qvof).			
							6		Terminated at ~ 5.0 Feet bgs No Bedrock Encountered No Groundwater or Seepage Encountered Borehole Cased with Perforated Pipe for Percolation Testing.			
						8						
						10						
						12						
						14						
						16						
						18						
						20						
						22						
						24						
						26						
						28						
						30						
						32						
						34						
						36						
						38						
						40						
						42						
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BORE LOG

Drill Rig: Mobil B-61

Date Excavated: 1/31/2024

Elevation: 3000 ft (MSL)

Bore Hole: P-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description	
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel and caliche layers (Disturbed).	
							4		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Qvof).	
							6		Gravelly Sand (SP/SW); yellowish brown, slightly moist, fine- to coarse-grained with caliche (Qvof).	
							8			
							10			
							12			
							14		Terminated at ~ 10.0 Feet bgs	
							16		No Bedrock Encountered	
							18		No Groundwater or Seepage Encountered	
							20		Borehole Cased with Perforated Pipe for Percolation Testing.	
							22			
							24			
							26			
							28			
							30			
							32			
							34			
							36			
							38			
							40			
							42			
							44			
							46			
							48			
							50			
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SLADDEN ENGINEERING

BORE LOG

Drill Rig: Mobil B-61

Date Excavated: 1/31/2024

Elevation: 3000 ft (MSL)

Bore Hole: P-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description								
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Disturbed).								
							4		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Qvof).								
							6		Terminated at ~ 5.0 Feet bgs No Bedrock Encountered No Groundwater or Seepage Encountered Borehole Cased with Perforated Pipe for Percolation Testing.								
						8											
						10											
						12											
						14											
						16											
						18											
						20											
						22											
						24											
						26											
						28											
						30											
						32											
						34											
						36											
						38											
						40											
						42											
						44											
						46											
						48											
						50											
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BORE LOG

Drill Rig:	Mobil B-61	Date Excavated:	1/31/2024
Elevation:	3000 ft (MSL)	Bore Hole:	P-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density, pcf	Depth (Feet)	Graphic Lithology	Description		
							2		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel and caliche layers (Disturbed).		
							4		Silty Sand (SM); yellowish brown, slightly moist, fine- to coarse-grained with gravel (Qvof).		
							6		Gravelly Sand (SP/SW); yellowish brown, slightly moist, fine- to coarse-grained with caliche (Qvof).		
							8				
							10				
							12				
							14				
							16		Terminated at ~ 10.0 Feet bgs No Bedrock Encountered No Groundwater or Seepage Encountered Borehole Cased with Perforated Pipe for Percolation Testing.		
							18				
							20				
							22				
							24				
							26				
							28				
							30				
							32				
							34				
							36				
							38				
							40				
							42				
							44				
							46				
							48				
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APPENDIX B
LABORATORY TESTING

APPENDIX B

LABORATORY TESTING

Representative bulk soil samples were obtained in the field and returned to our laboratory for additional observations and testing. Laboratory testing was generally performed in two phases. The first phase consisted of testing in order to determine the compaction of the existing natural soil and the general engineering classifications of the soils underlying the site. This testing was performed in order to estimate the engineering characteristics of the soil and to serve as a basis for selecting samples for the second phase of testing. The second phase consisted of soil mechanics testing. This testing including consolidation, shear strength and expansion testing was performed in order to provide a means of developing specific design recommendations based on the mechanical properties of the soil.

CLASSIFICATION AND COMPACTION TESTING

Maximum Density-Optimum Moisture Determinations: Representative soil types were selected for maximum density determinations. This testing was performed in accordance with the ASTM Standard D1557, Test Method A. Graphic representations of the results of this testing are presented in this appendix. The maximum densities are compared to the field densities of the soil in order to determine the existing relative compaction to the soil.

Classification Testing: Soil samples were selected for classification testing. This testing consists of mechanical grain size analyses. This provides information for developing classifications for the soil in accordance with the Unified Soil Classification System which is presented in the preceding appendix. This classification system categorizes the soil into groups having similar engineering characteristics. The results of this testing is very useful in detecting variations in the soil and in selecting samples for further testing.

SOIL MECHANIC'S TESTING

Expansion Testing: One (1) bulk sample was selected for Expansion testing. Expansion testing was performed in accordance with the UBC Standard 18-2. This testing consists of remolding 4-inch diameter by 1-inch thick test specimens to a moisture content and dry density corresponding to approximately 50 percent saturation. The samples are subjected to a surcharge of 144 pounds per square foot and allowed to reach equilibrium. At that point the specimens are inundated with distilled water. The linear expansion is then measured until complete.

Direct Shear Testing: One (1) bulk sample was selected for Direct Shear testing. This test measures the shear strength of the soil under various normal pressures and is used to develop parameters for foundation design and lateral design. Tests were performed using a recompacted test specimen that was saturated prior to tests. Tests were performed using a strain controlled test apparatus with normal pressures ranging from 800 to 2300 pounds per square foot.

Corrosion Series Testing: The soluble sulfate concentrations of the surface soil were determined in accordance with California Test Method Number (CA) 417. The pH and Minimum Resistivity were determined in accordance with CA 643. The soluble chloride concentrations were determined in accordance with CA 422.



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Maximum Density/Optimum Moisture

ASTM D698/D1557

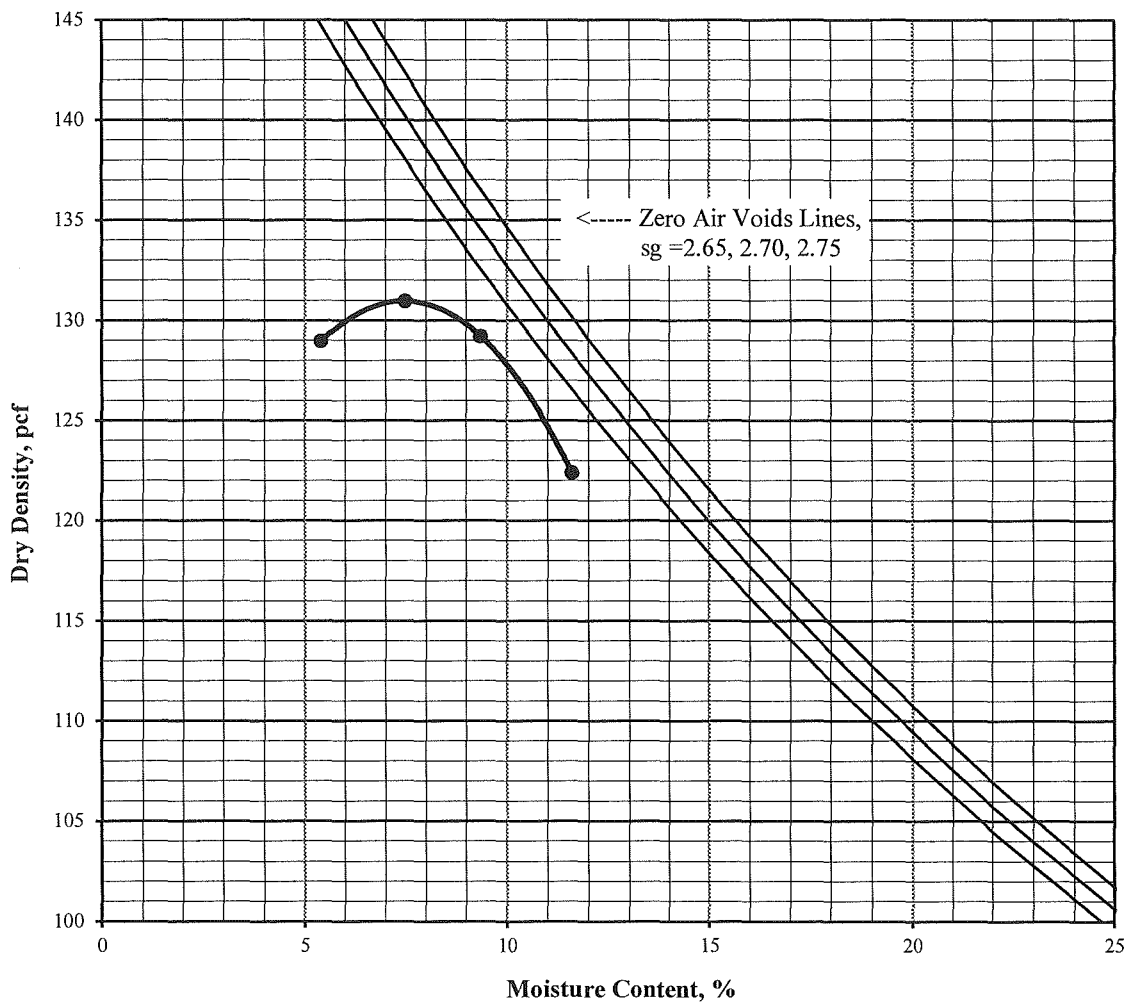
Project Number: 644-24001
Project Name: NWC Silica Road & First Avenue
Lab ID Number: LN6-24057
Sample Location: BH-1 Bulk 1 @ 0-5'
Description: Brown Silty Sand (SM)

February 16, 2024

ASTM D-1557 A
Rammer Type: Machine

Maximum Density: 131.5 pcf
Optimum Moisture: 8%

Sieve Size	% Retained
3/4"	
3/8"	
#4	3.8





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Expansion Index

ASTM D 4829

Job Number: 644-24001
Job Name: NWC Silica Road & First Avenue
Lab ID Number: LN6-24057
Sample ID: BH-1 Bulk 1 @ 0-5'
Soil Description: Brown Silty Sand (SM)

February 16, 2024

Wt of Soil + Ring:	607.3
Weight of Ring:	194.7
Wt of Wet Soil:	412.6
Percent Moisture:	7.0%
Sample Height, in	0.95
Wet Density, pcf:	132.0
Dry Denstiy, pcf:	123.4

% Saturation:	51.7
---------------	------

Expansion

Rack # 2

Date/Time	2/15/2024	10:10 AM
Initial Reading	0.0000	
Final Reading	0.0047	

Expansion Index

5

(Final - Initial) x 1000



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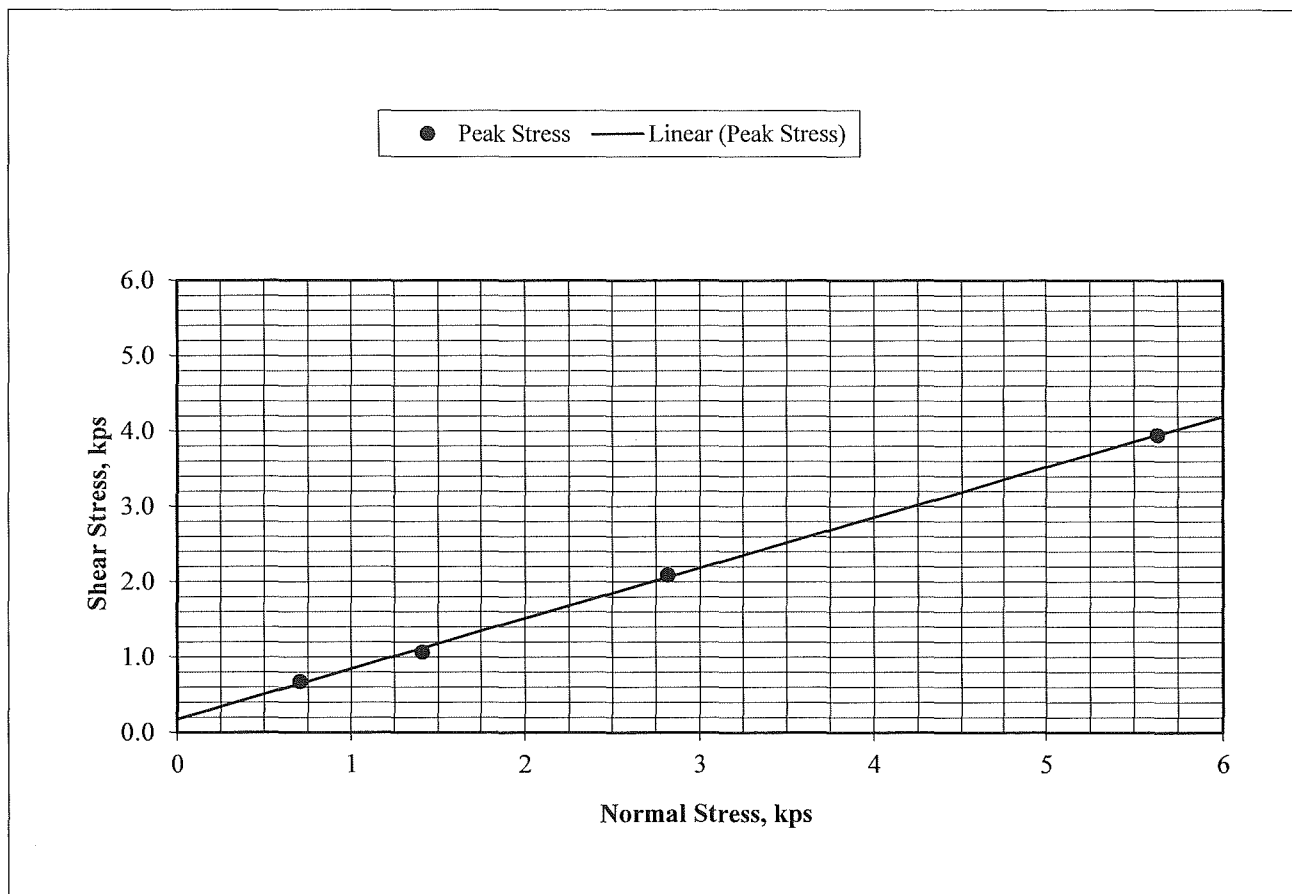
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Direct Shear ASTM D 3080-04 (modified for unconsolidated condition)

Job Number: 644-24001
Job Name NWC Silica Road & First Avenue
Lab ID No. LN6-24057
Sample ID BH-1 Bulk 1 @ 0-5'
Classification Brown Silty Sand (SM)
Sample Type Remolded @ 90% of Maximum Density

February 16, 2024
Initial Dry Density: 118.3 pcf
Initial Moisture Content: 8.1 %
Peak Friction Angle (ϕ): 34°
Cohesion (c): 180 psf

Test Results	1	2	3	4	Average
Moisture Content, %	13.0	13.0	13.0	13.0	13.0
Saturation, %	82.9	82.9	82.9	82.9	82.9
Normal Stress, kps	0.704	1.409	2.817	5.635	
Peak Stress, kps	0.676	1.068	2.093	3.946	



Job Number: 644-24001
Job Name: NWC Silica Road & First Avenue
Date: 2/16/2024

Moisture Adjustment	
Wt of Soil:	<u>1,000</u>
Moist As Is:	<u>3.2</u>
Moist Wanted:	<u>8.0</u>

Remolded Shear Weight	
Max Dry Density:	131.5
Optimum Moisture:	8.0

ml of Water to Add: 46.5

Wt Soil per Ring, g: 153.7

UBC



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Gradation

ASTM C117 & C136

Project Number: 644-24001

February 16, 2024

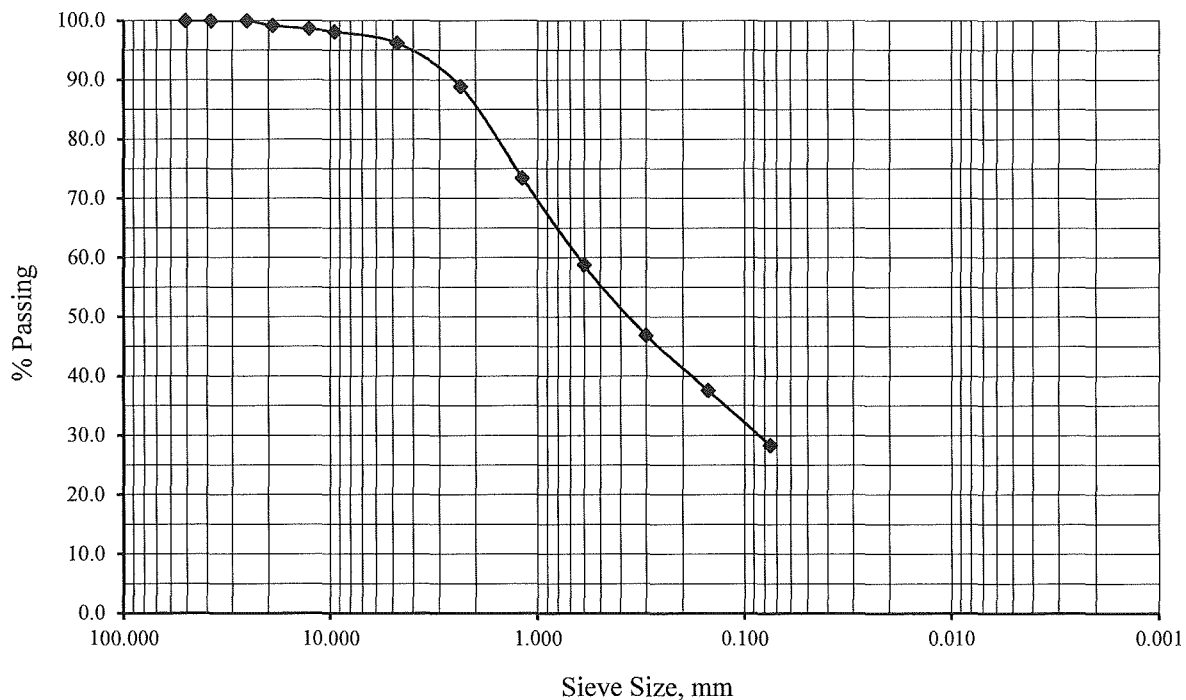
Project Name: NWC Silica Road & First Avenue

Lab ID Number: LN6-24057

Sample ID: BH-1 Bulk 1 @ 0-5'

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
2"	50.8	100.0
1 1/2"	38.1	100.0
1"	25.4	100.0
3/4"	19.1	99.2
1/2"	12.7	98.7
3/8"	9.53	98.2
#4	4.75	96.2
#8	2.36	88.9
#16	1.18	73.4
#30	0.60	58.8
#50	0.30	46.9
#100	0.15	37.6
#200	0.075	28.4





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Gradation

ASTM C117 & C136

Project Number: 644-24001

February 16, 2024

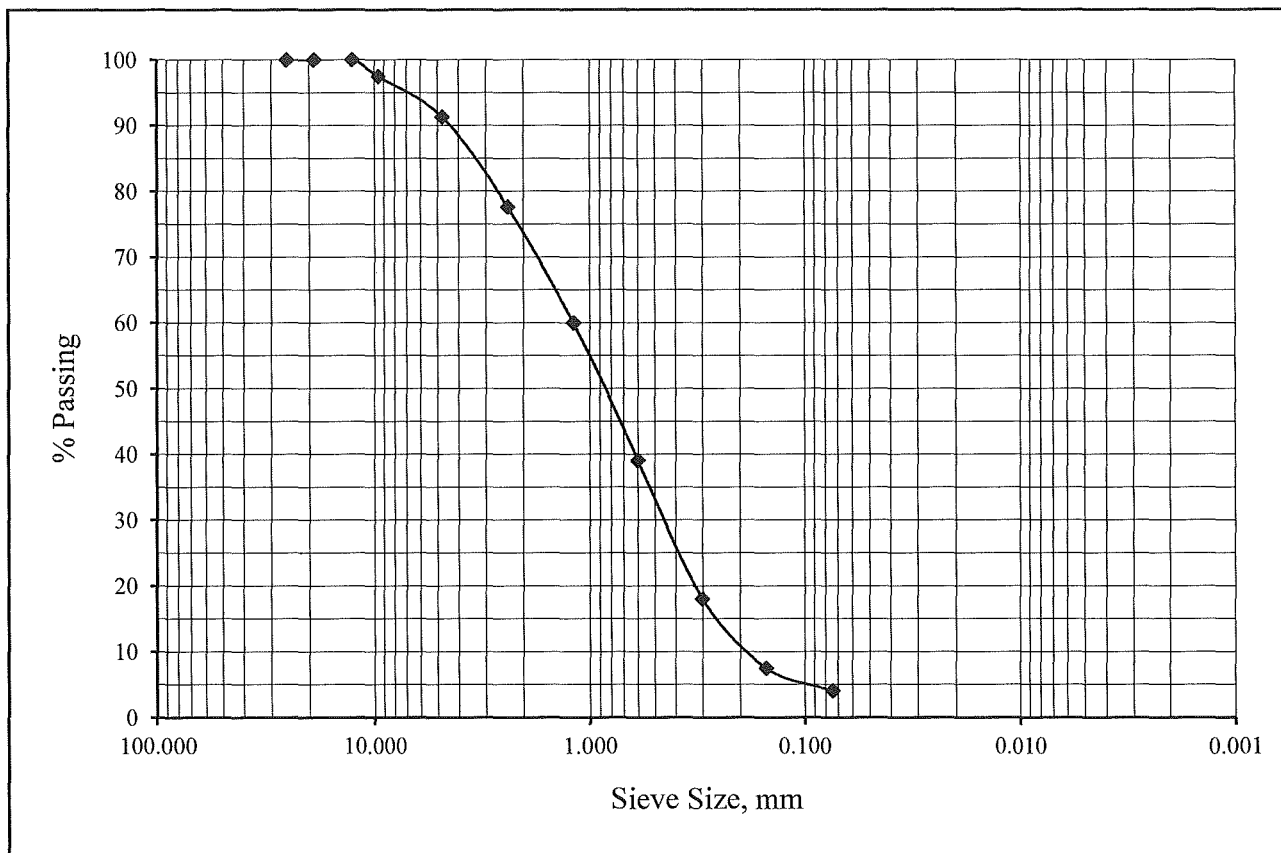
Project Name: NWC Silica Road & First Avenue

Lab ID Number: LN6-24057

Sample ID: BH-1 S-3 @ 10'

Soil Classification: SP

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	97.5
#4	4.75	91.3
#8	2.36	77.6
#16	1.18	60.0
#30	0.60	39.1
#50	0.30	18.0
#100	0.15	7.5
#200	0.074	4.1





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Project Number: 644-24001

February 16, 2024

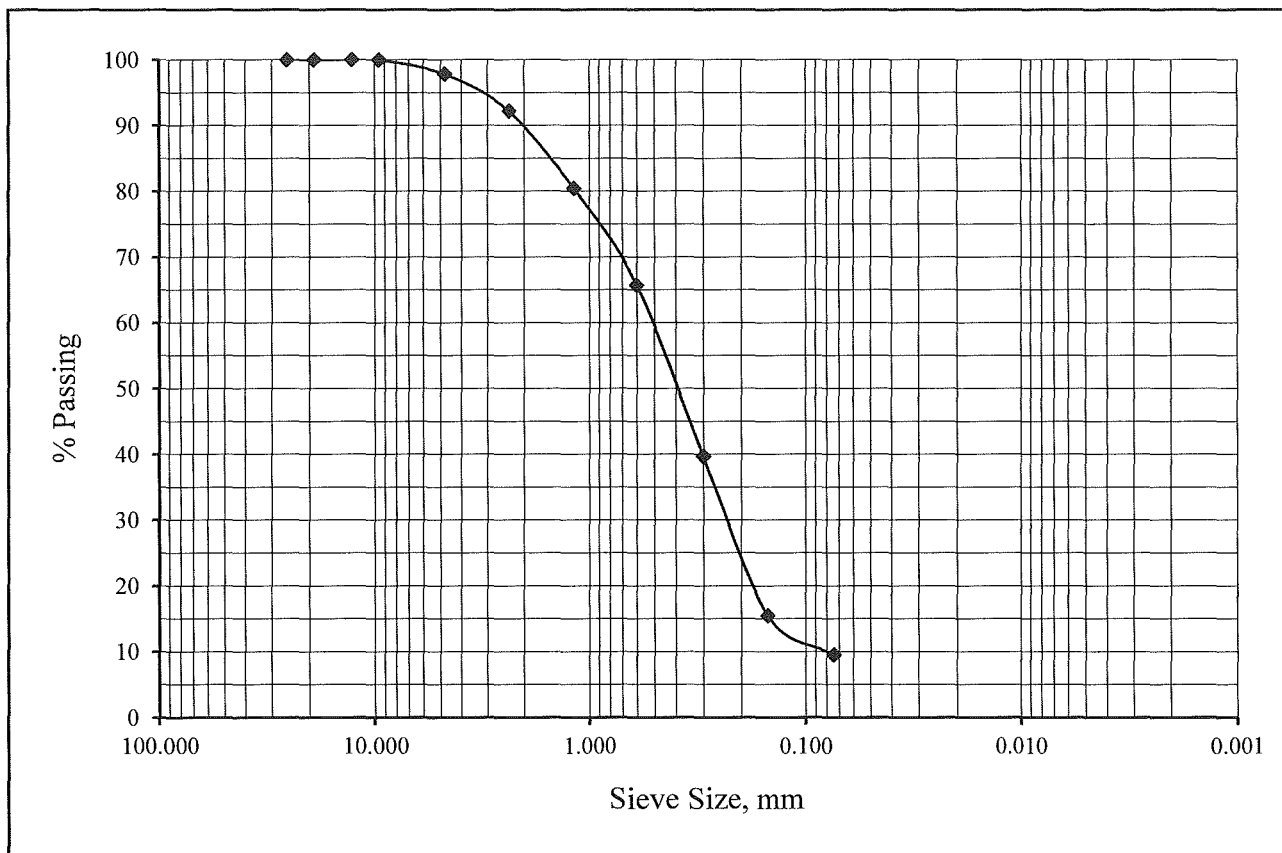
Project Name: NWC Silica Road & First Avenue

Lab ID Number: LN6-24057

Sample ID: BH-3 R-1 @ 5'

Soil Classification: SW-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	97.8
#8	2.36	92.2
#16	1.18	80.5
#30	0.60	65.7
#50	0.30	39.7
#100	0.15	15.5
#200	0.074	9.5





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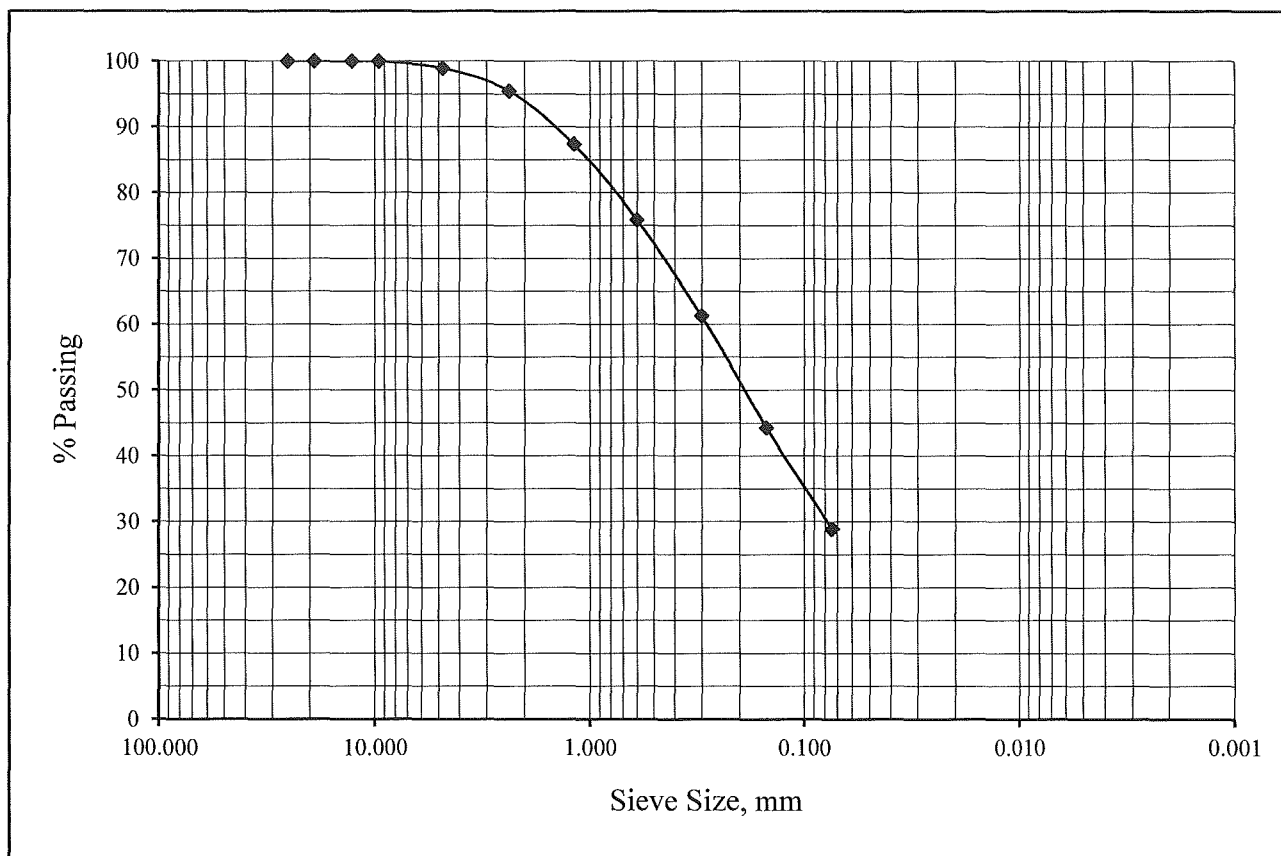
Project Name: NWC Silica Road & First Avenue

Lab ID Number: LN6-24057

Sample ID: BH-4 S-3 @ 15'

Soil Classification: SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	98.9
#8	2.36	95.5
#16	1.18	87.4
#30	0.60	75.9
#50	0.30	61.3
#100	0.15	44.3
#200	0.074	28.9





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Project Number: 644-24001

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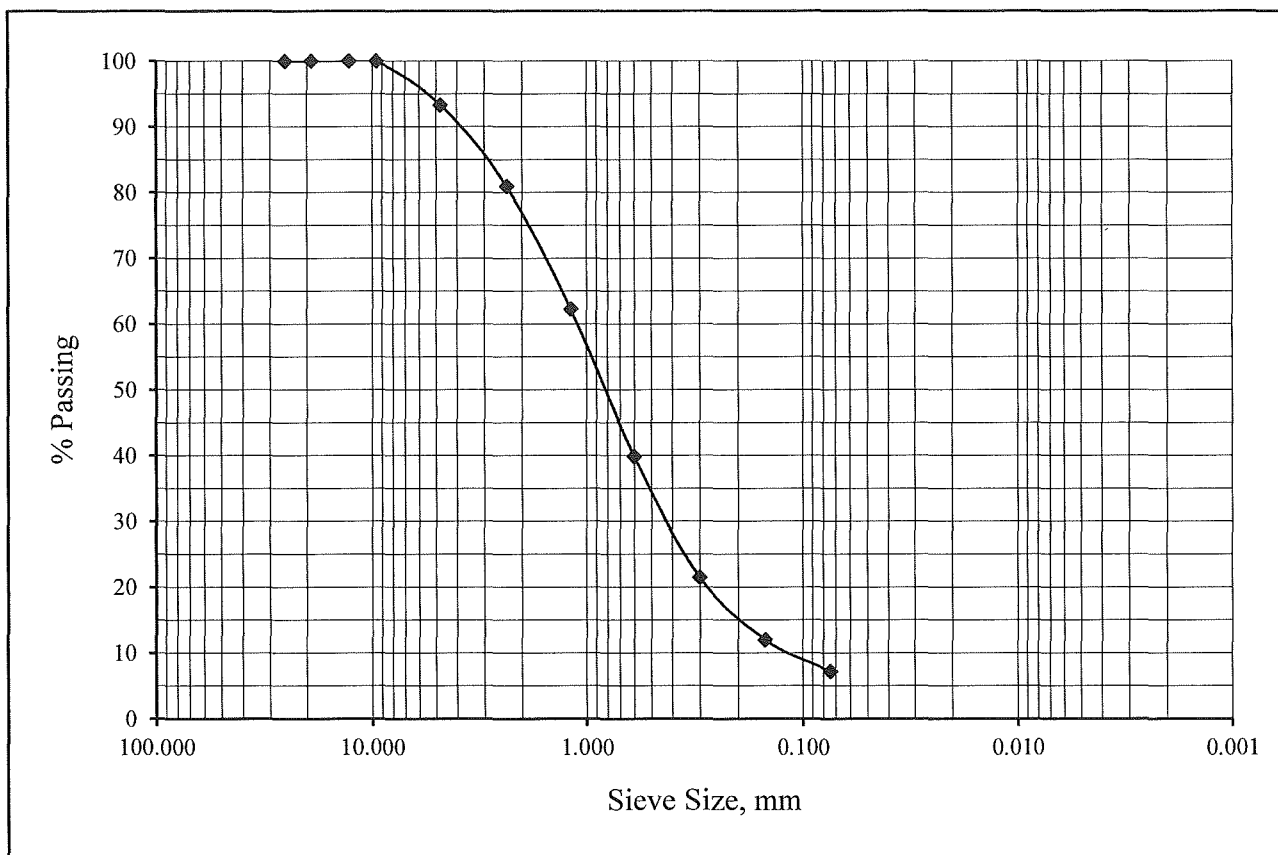
Project Name: NWC Silica Road & First Avenue

Lab ID Number: LN6-24057

Sample ID: BH-6 R-2 @ 10'

Soil Classification: SW-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	93.3
#8	2.36	80.9
#16	1.18	62.3
#30	0.60	39.8
#50	0.30	21.5
#100	0.15	12.0
#200	0.074	7.2





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One Dimensional Consolidation

ASTM D2435 & D5333

Job Number: 644-24001
Job Name: NWC Silica Road & First Avenue

February 16, 2024

Lab ID Number: LN6-24057

Sample ID: BH-3 R-1 @ 5'

Soil Description: Brown Sand w/Silt (SP-SM)

Initial Dry Density, pcf: 101.0

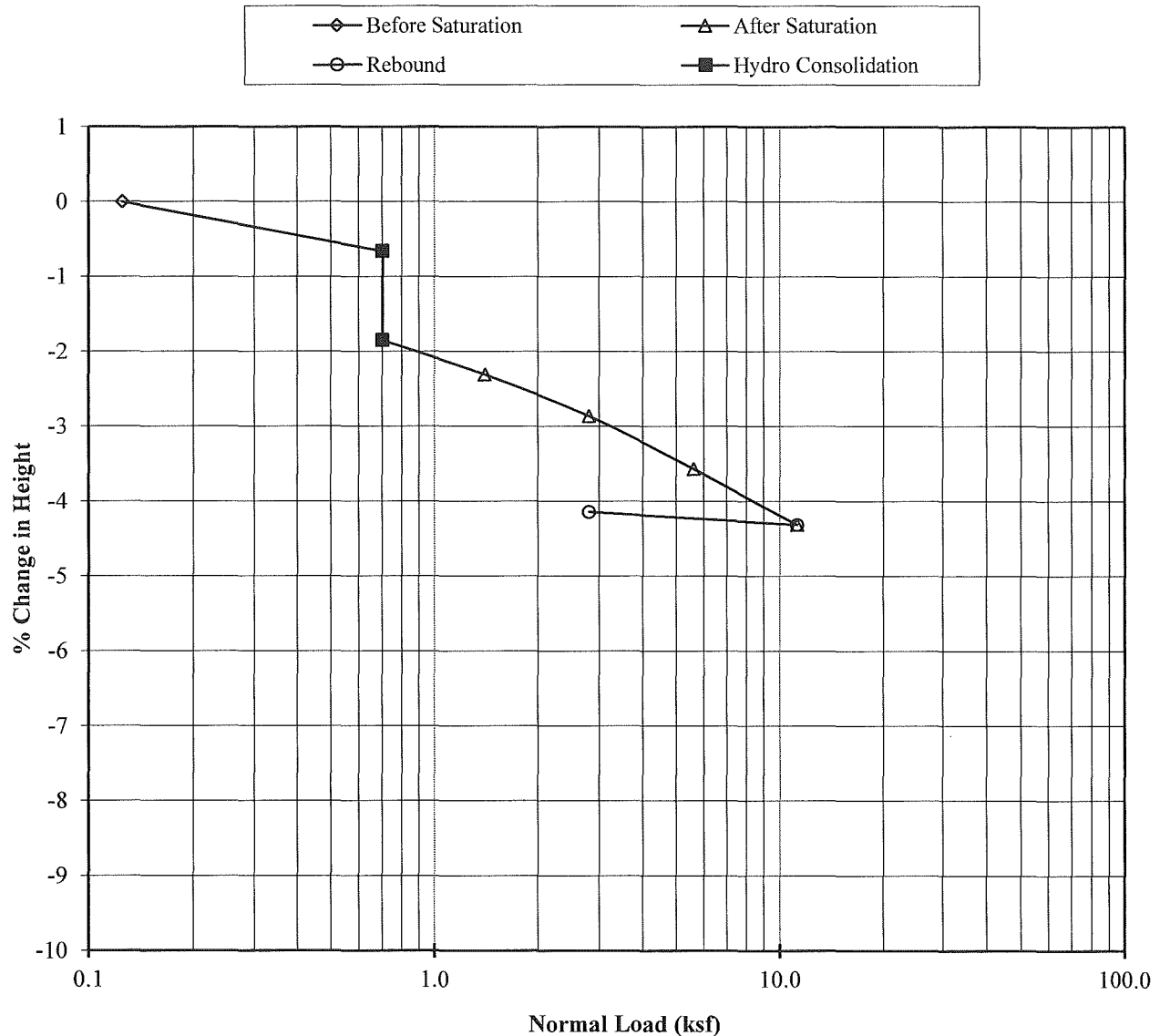
Initial Moisture, %: 2.4

Initial Void Ratio: 0.650

Specific Gravity: 2.67

Hydrocollapse: 1.2% @ 0.702 ksf

% Change in Height vs Normal Pressure Diagram





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One Dimensional Consolidation

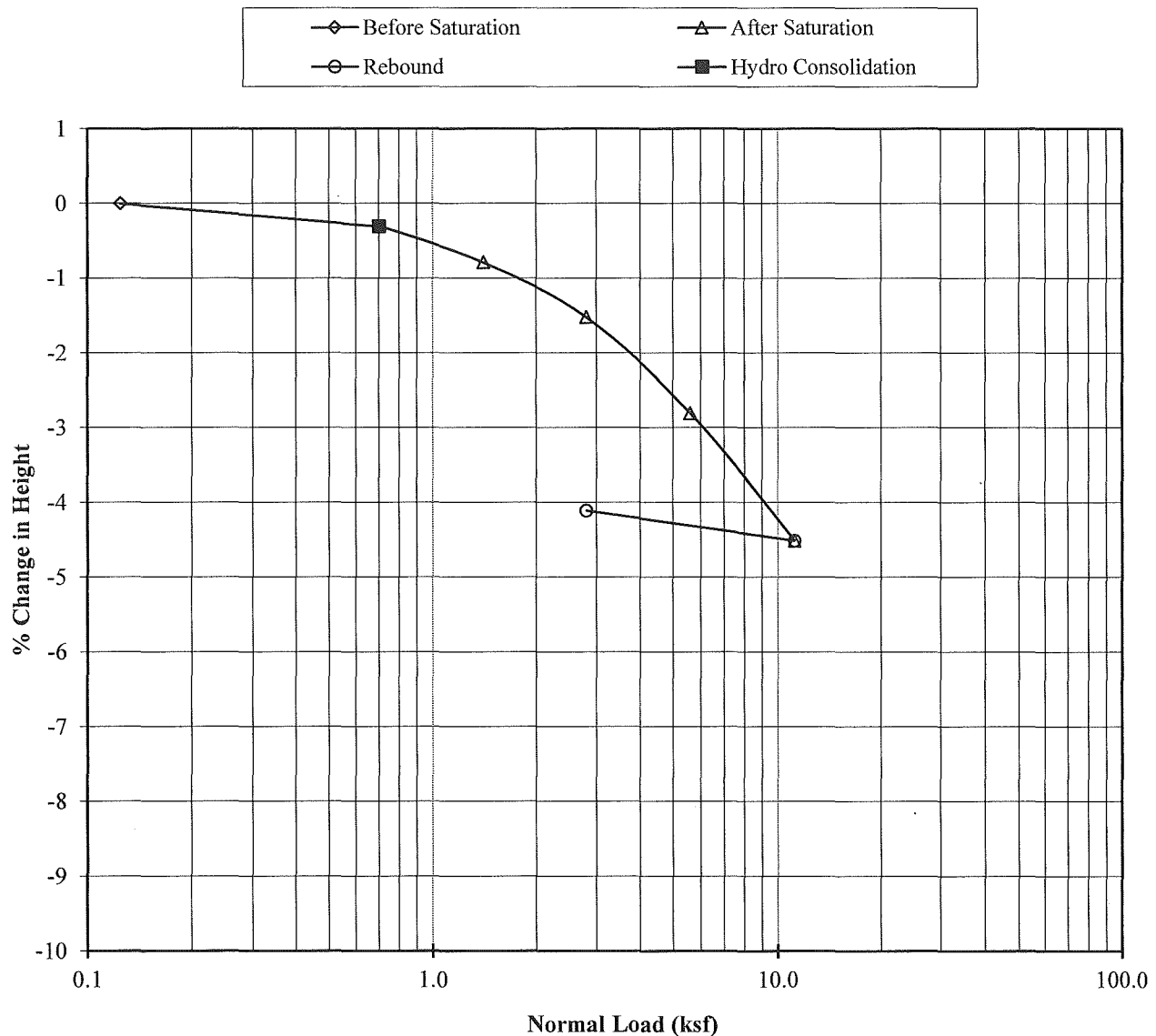
ASTM D2435 & D5333

Job Number: 644-24001
Job Name: NWC Silica Road & First Avenue
Lab ID Number: LN6-24057
Sample ID: BH-4 R-2 @ 10'
Soil Description: Light Brown Silt w/Sand (ML)

February 16, 2024

Initial Dry Density, pcf: 96.9
Initial Moisture, %: 16.1
Initial Void Ratio: 0.720
Specific Gravity: 2.67

% Change in Height vs Normal Pressure Diagram





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6782 Stanton Ave., Suite C, Buena Park, CA 90621 (714) 523-0952 Fax (714) 523-1369
45090 Golf Center Pkwy, Suite F, Indio, CA 92201 (760) 863-0713 Fax (760) 863-0847
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Date: February 16, 2024

Account No.: 644-24001

Customer: Twen Ma Architect

Location: APN's 3091-161-02 & 04, NWC Silica Road & First Avenue, Victorville

Analytical Report

Corrosion Series

	pH per CA 643	Soluble Sulfates per CA 417 ppm	Soluble Chloride per CA 422 ppm	Min. Resistivity per CA 643 ohm-cm
BH-1 @ 0-5'	7.9	20	50	4,900

APPENDIX C

SEISMIC DESIGN MAP AND REPORT SITE-SPECIFIC GROUND MOTION PARAMETERS

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

Project: APNs 3091-161-02 & 04
Project Number: 644-24001
Client: Twen Ma Architect
Site Lat/Long: 34.4792/-117.2959
Controlling Seismic Source: North Frontal

REFERENCE	NOTATION	VALUE	REFERENCE	NOTATION	VALUE	REFERENCE	NOTATION	VALUE
Site Class	C, D, D default, or E	D measured	F _v (Table 11.4-2)[Used for General Spectrum]	F _v	1.8			
Site Class D - Table 11.4-1	F _a	1.0	Design Maps	S _s	1.231	0.2*(S _{D1} /S _{DS})	T ₀	0.14*
Site Class D - 21.3(ii)	F _v	2.5	Design Maps	S ₁	0.474	S _{D1} /S _{DS}	T _s	0.698*
0.2*(S _{D1} /S _{DS})	T ₀	0.191	Equation 11.4-1 - F _A *S _s	S _{MS}	1.2404*	Equation 11.4-4 - 2/3*S _{M1}	S _{D1}	0.577*
S _{D1} /S _{DS}	T _s	0.955	Equation 11.4-3 - 2/3*S _{MS}	S _{DS}	0.827*	Equation 11.4-2 - F _v *S ₁	S _{M1}	0.8655*
Fundamental Period (12.8.2)	T	Period	Design Maps	PGA	0.5			
Seismic Design Maps or Fig 22-14	T _L	8	Table 11.8-1	F _{PGA}	1.1			
Equation 11.4-4 - 2/3*S _{M1}	S _{D1}	0.7900	Equation 11.8-1 - F _{PGA} *PGA	PGA _M	0.55*			
Equation 11.4-2 - F _v *S ₁ ¹	S _{M1}	1.1850	Section 21.5.3	80% of PGA _M	0.440			
¹ - F _v as determined by Section 21.3			Design Maps	C _{RS}	0.935			
			Design Maps	C _{R1}	0.918			
			<u>RISK COEFFICIENT</u>					
Cr - At Periods <=0.2, Cr=C _{RS}	C _{RS}	0.935				Cr - At Periods between 0.2 and 1.0 use trendline formula to complete	Period	Cr
Cr - At Periods >=1.0, Cr=C _{R1}	C _{R1}	0.918					0.200	0.935
							0.300	0.933
							0.400	0.931
							0.500	0.929
							0.600	0.927
							0.680	0.925
							1.000	0.918

* Code based design value. See accompanying data for Site Specific Design values.

Mapped values from <https://hazards.atcouncil.org/>
<https://www.seismicmaps.org/>



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PROBABILISTIC SPECTRA¹
2% in 50 year Exceedence

Project No: 644-24001

Period	UGHM	RTGM	Max Directional Scale Factor ²	Probabilistic MCE
0.010	0.643	0.621	1.19	0.739
0.100	1.103	1.093	1.19	1.301
0.200	1.489	1.469	1.20	1.763
0.300	1.640	1.596	1.22	1.947
0.500	1.560	1.477	1.23	1.817
0.750	1.256	1.175	1.24	1.457
1.000	1.036	0.956	1.24	1.185
2.000	0.579	0.524	1.24	0.650
3.000	0.397	0.354	1.25	0.443
4.000	0.297	0.263	1.25	0.329
5.000	0.231	0.205	1.26	0.258

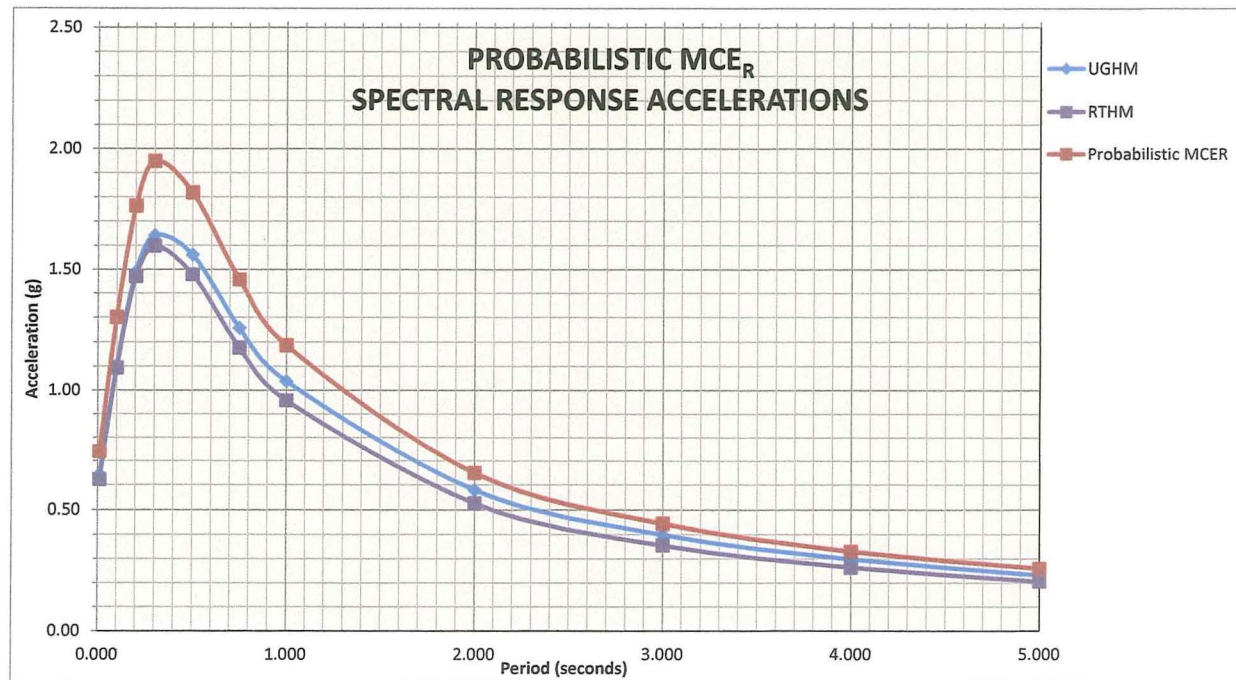
¹ Data Sources:

<https://earthquake.usgs.gov/hazards/interactive/>

<https://earthquake.usgs.gov/designmaps/rtgm/>

² Shahi-Baker RotD100/RotD50 Factors (2014)

Probabilistic PGA: 0.643
 Is Probabilistic $S_{a(max)} < 1.2F_a$? **NO**



DETERMINISTIC SPECTRUM

Largest Amplitudes of Ground Motions Considering All Sources Calculated using Weighted Mean of Attenuation Equations¹

Controlling Source: North Frontal

Is Probabilistic $S_{a(max)} < 1.2F_a$?

NO

Project No: 644-24001

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	0.747	1.19	0.888	0.888
0.020	0.746	1.19	0.888	0.888
0.030	0.650	1.19	0.773	0.773
0.050	0.722	1.19	0.859	0.859
0.075	0.862	1.19	1.026	1.026
0.100	0.933	1.19	1.111	1.111
0.150	1.174	1.20	1.409	1.409
0.200	1.296	1.20	1.555	1.555
0.250	1.380	1.21	1.670	1.670
0.300	1.418	1.22	1.730	1.730
0.400	1.396	1.23	1.717	1.717
0.500	1.320	1.23	1.623	1.623
0.750	1.034	1.24	1.282	1.282
1.000	0.845	1.24	1.048	1.048
1.500	0.582	1.24	0.721	0.721
2.000	0.428	1.24	0.531	0.531
3.000	0.272	1.25	0.340	0.340
4.000	0.182	1.25	0.227	0.227
5.000	0.130	1.26	0.164	0.164

Is Deterministic $S_{a(max)} < 1.5F_a$?

NO

Section 21.2.2 Scaling Factor:

N/A

Deterministic PGA:

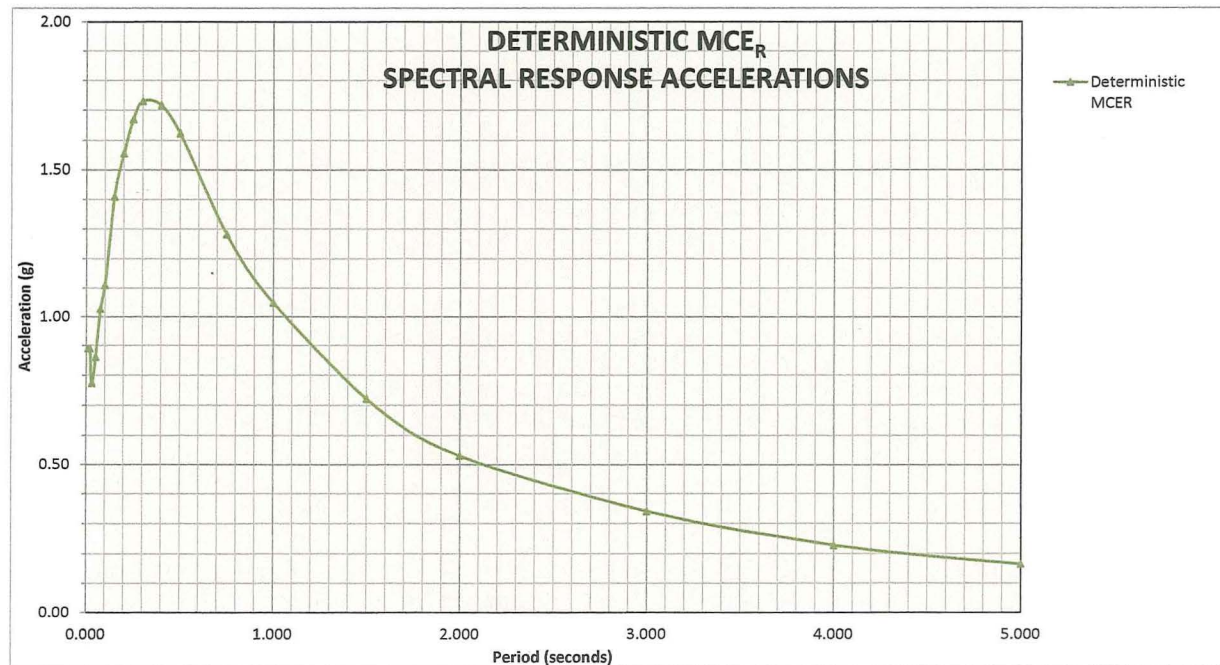
0.747

Is Deterministic PGA $\geq F_{PGA} \cdot 0.5$?

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	0.739	0.888	0.739	0.493
0.100	1.301	1.111	1.111	0.740
0.200	1.763	1.555	1.555	1.037
0.300	1.947	1.730	1.730	1.153
0.500	1.817	1.623	1.623	1.082
0.750	1.457	1.282	1.282	0.855
1.000	1.185	1.048	1.048	0.699
2.000	0.650	0.531	0.531	0.354
3.000	0.443	0.340	0.340	0.227
4.000	0.329	0.227	0.227	0.158
5.000	0.258	0.164	0.164	0.126

ASCE 7-16: Section 21.4

Site Specific

Calculated Value	Design Value
------------------	--------------

SDS:	1.038	1.038
SD1:	0.708	0.708
SMS:	1.557	1.557
SM1:	1.062	1.062
Site Specific PGAm:	0.643	0.643

Site Class: D measured

Seismic Design Category - Short*

D

Seismic Design Category - 1s*

D

* Risk Categories I, II, or III

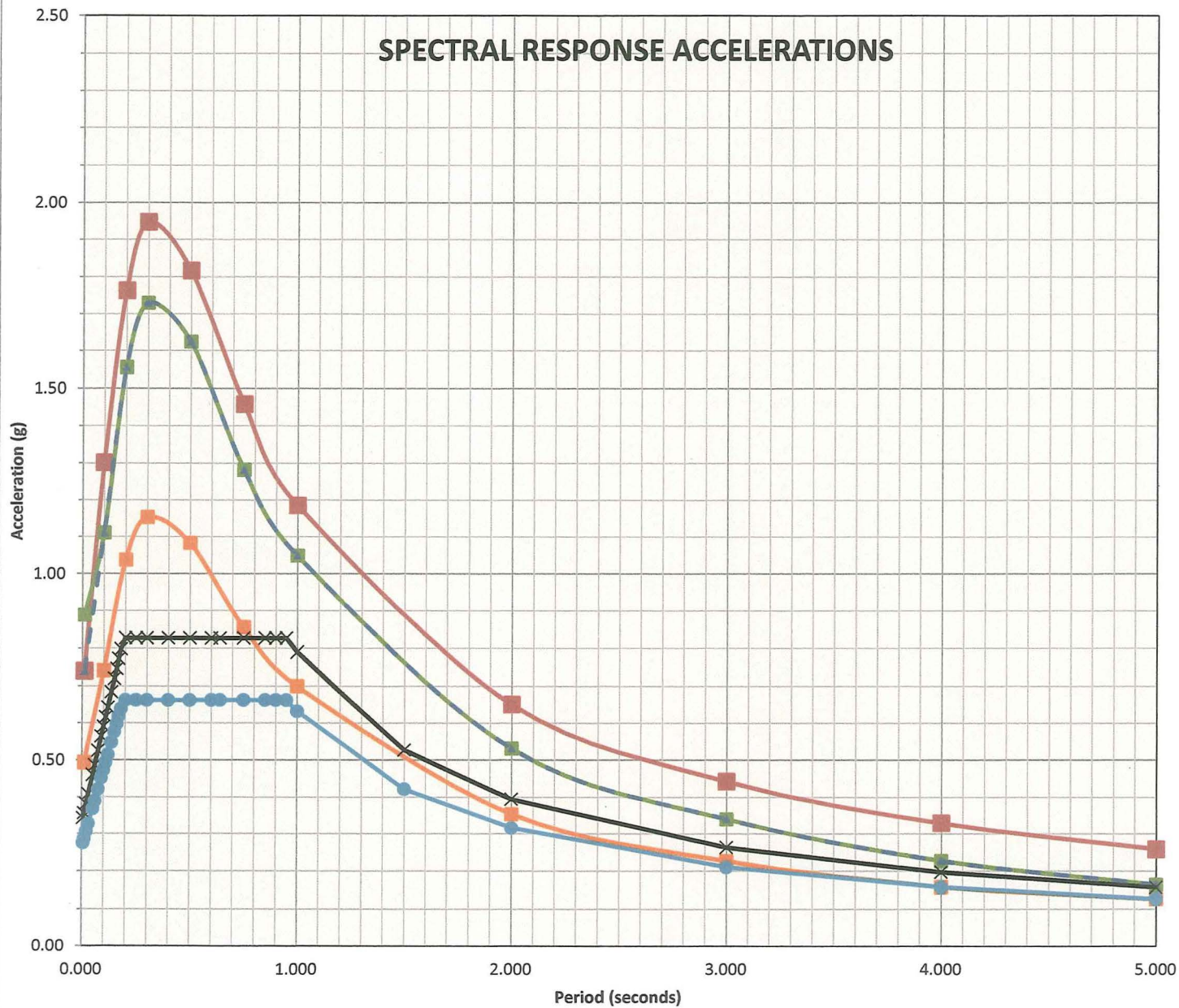
Period	ASCE 7 SECTION 21.3 General Spectrum	80% General Response Spectrum
0.005	0.344	0.275
0.010	0.357	0.285
0.020	0.383	0.306
0.030	0.409	0.327
0.050	0.461	0.368
0.060	0.487	0.389
0.075	0.526	0.420
0.090	0.564	0.452
0.100	0.590	0.472
0.110	0.616	0.493
0.120	0.642	0.514
0.136	0.684	0.547
0.150	0.720	0.576
0.160	0.746	0.597
0.170	0.772	0.618
0.180	0.798	0.639
0.200	0.827	0.662
0.250	0.827	0.662
0.300	0.827	0.662
0.400	0.827	0.662
0.500	0.827	0.662
0.600	0.827	0.662
0.640	0.827	0.662
0.750	0.827	0.662
0.850	0.827	0.662
0.900	0.827	0.662
0.950	0.827	0.662
1.000	0.790	0.632
1.500	0.527	0.421
2.000	0.395	0.316
3.000	0.263	0.211
4.000	0.198	0.158
5.000	0.158	0.126

Project No: 644-24001



SPECTRAL RESPONSE ACCELERATIONS

- Probabilistic MCE
- Deterministic MCE
- Site-Specific MCE
- Design Response Spectrum
- ASCE 7 Section 21.3 General Spectrum
- 80% General Response Spectrum

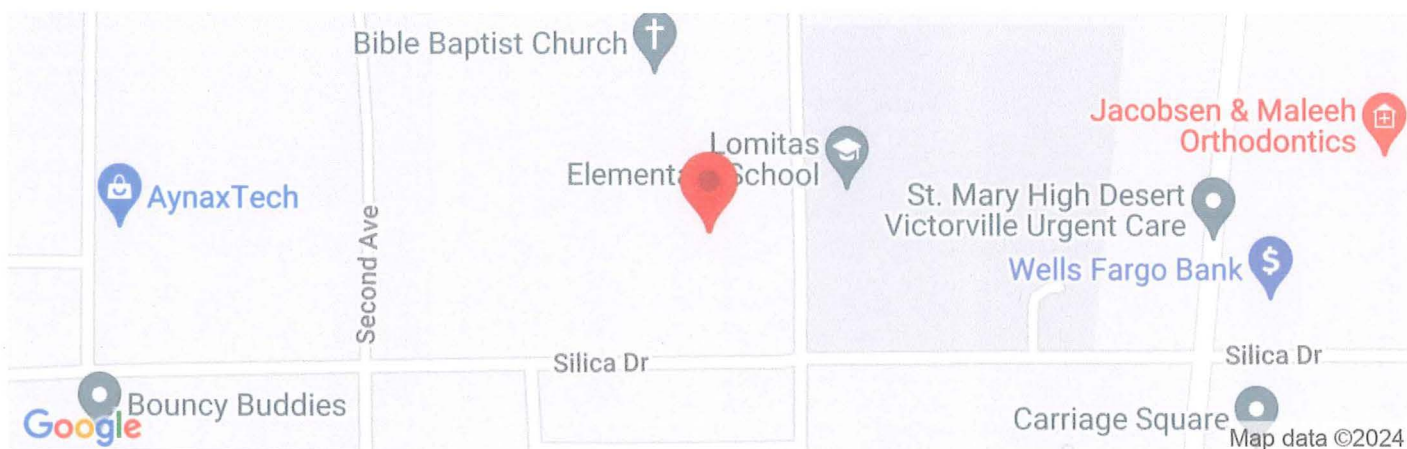


USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout error*.
USGS web services are now operational so this tool should work as expected.



OSHDP

Latitude, Longitude: 34.4792, -117.2959



Date	2/15/2024, 7:50:05 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.231	MCE_R ground motion. (for 0.2 second period)
S_1	0.474	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.24	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.827	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.008	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.55	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
S_{sRT}	1.231	Probabilistic risk-targeted ground motion. (0.2 second)
S_{sUH}	1.317	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
S_{sD}	1.5	Factored deterministic acceleration value. (0.2 second)
S_{1RT}	0.474	Probabilistic risk-targeted ground motion. (1.0 second)
S_{1UH}	0.517	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S_{1D}	0.6	Factored deterministic acceleration value. (1.0 second)
PGA_d	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.53	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.935	Mapped value of the risk coefficient at short periods

Type	Value	Description
C _{R1}	0.918	Mapped value of the risk coefficient at a period of 1 s
C _V	1.346	Vertical coefficient

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