Geotechnical Engineering Investigation

Proposed Industrial Warehouse Development
119 South Arrowhead Avenue
San Bernardino, California

Proficiency Capital, LLC
11777 San Vicente Blvd, No. 780
Los Angeles, California 90049

Attn: Matt Englhard

Project Number 22813-21
October 27, 2021

NorCal Engineering

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Attn: Matt Englhard

RE: **Geotechnical Engineering Investigation** - Proposed Industrial Warehouse Development - Located at 119 South Arrowhead Avenue, in the City of San Bernardino, California

Dear Mr. Englhard:

Pursuant to your request, this firm has performed a Geotechnical Engineering Investigation for the above referenced project in accordance with your approval of our proposal dated September 9, 2021. The purpose of this investigation is to evaluate the geotechnical conditions of the subject site and to provide recommendations for the proposed industrial warehouse development.

The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration and sampling; 3) laboratory testing; 4) soil infiltration testing; 5) engineering analysis of field and laboratory data; 6) preparation of a geotechnical engineering report. It is the opinion of this firm that the proposed development is feasible from a geotechnical standpoint provided that the recommendations presented in this report are followed in the design and construction of the project.

1.0 Project Description

It is proposed to construct an industrial warehouse development consisting of three (3) buildings totaling 211,621 square feet building on the 10.54-acre subject site as shown on the attached Site Plan (Figure 1). The proposed concrete tilt-up buildings will be supported by conventional slab-on-grade foundation systems with perimeter-spread footings and isolated interior footings. Other improvements will include site walls, asphalt and concrete pavement areas, hardscape and landscaping. This firm should have an opportunity to review plans once available to determine if any additional investigation will be necessary.

It is assumed that the proposed grading for the development will consist of minor cut and fill procedures on the order of a few feet to achieve finished grade elevations. Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 Site Description

The subject property is located within the 100 block and east side of South Arrowhead Avenue, bordered by West Rialto Avenue to the north, South Sierra Way to the east and railroad tracks to the south, in the City of San Bernardino. The site is currently undeveloped and contains some small vegetation scattered across the site. The generally rectangular shaped lot is elongated in an east to west direction with topography of the relatively level parcel descending gradually towards the roadways

3.0 Site Exploration

The investigation consisted of the placement of ten (10) subsurface exploratory borings by a truck mounted hollow stem auger and hand operated auger to depths ranging between 5 and 50 feet below current ground elevations. The explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached plan. The exploratory borings revealed the existing earth materials to consist of fill and natural soil. Each of our exploratory borings were backfilled with bentonite, a total of three 55-gallon drums were used to contain cuttings from each of our exploratory borings. These 55-gallon drums were labeled and left on site for proper disposal by others.

Detailed descriptions of the subsurface conditions are listed on the boring logs in Appendix A. It should be noted that the transition from one soil type to another as shown on the trench logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

> **Fill:** A fill soil classifying as a brown, silty fine to medium grained SAND with occasional gravel was encountered to a depth of 1 to 2 feet below ground surface. These soils were noted to be medium dense and dry. Minor amounts of concrete and asphalt debris were encountered in exploratory boring B-4.
>
> **Natural:** A natural undisturbed soil classifying as a brown, silty SAND to sandy SILT was encountered beneath the upper fill soils. The native soils were observed to be medium dense and damp to moist.

The overall engineering characteristics of the earth material were relatively uniform with each excavation. Groundwater was *not* encountered to the depth of our borings. However, a review with the State of California Water Data Library regarding measured groundwater depths from nearby wells was researched by this firm. Water wells situated less than a half mile from the project site have recorded groundwater depths to 14 feet below ground surface (1988). Slight caving did occur in the deeper cohesionless soils.

4.0 Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one-inch-long brass rings with an inside diameter of 2.42 inches into the undisturbed soils. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

Standard penetration tests were obtained by driving a steel sampler unlined with an inside diameter of 1.5 inches into the soils. This standard penetrometer sampler was driven a total of eighteen inches with blow counts tallied every six inches. Blow count data is given on the Boring Logs in Appendix A. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

4.1 **Field Moisture Content** (ASTM: D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

4.2 **Sieve analyses** (ASTM: D 422-63) and the percent by weight of soil finer than the No. 200 sieve (ASTM: 1140) were performed on selected soil samples. These results are shown later within the body of this report.

4.3 **Maximum Density tests** (ASTM: D 1557) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

4.4 **Expansion Index tests** (ASTM: D 4829) were performed on remolded samples of the upper soils to determine expansive characteristics. Results of these tests are provided on Table II.

4.5 **Atterberg Limits** (ASTM: D 4318) consisting of liquid limit, plastic limit and plasticity index were performed on representative soil samples. Results are shown on Table III.

4.6 **Corrosion tests** consisting of sulfate, pH, resistivity and chloride analysis to determine potential corrosive effects of soils on concrete and underground utilities. Test results are provided on Table IV.

4.7 **R-Value test** per California Test Method 301 was performed on a representative sample, which may be anticipated to be near subgrade to determine pavement design. Results are provided within the pavement design section of the report.

4.8 **Direct Shear tests** (ASTM: D 3080) were performed on undisturbed and/or remolded samples of the subsurface soils. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plate A-B.

4.9 **Consolidation tests** (ASTM: D 2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates C-D.

5.0 Seismicity Evaluation

The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered unlikely. The nearest fault is located approximately 4 kilometers from the site and is capable of producing a Magnitude 6.7 earthquake. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults.

The seismic design parameters are provided below and are based on the 2019 California Building Code (CBC) Standard ASCE/SEI 7-16. The data was obtained from the American Society of Civil Engineers (ASCE) website, https://asce7hazardtool.online/. The ASCE 7 Hazards Report is attached in Appendix C.

Seismic Design Acceleration Parameters

Latitude	34.100
Longitude	-117.289
Site Class	D
Risk Category	II
Mapped Spectral Response Acceleration	S_S = 2.237 S_1 = 0.893
Adjusted Maximum Acceleration	S_{MS} = 2.237
Design Spectral Response Acceleration Parameters	S_{DS} = 1.491
Peak Ground Acceleration	PGA_M = 1.037

Use of these values is dependent on requirements of ASCE 7-16, 11-4.8, Exception 2 that requires the value of the seismic response coefficient C_s be determined by Equation 12.8.2 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either 12.8-3 for $T_L \geq T \geq 1.5T_s$ or Equation 12.8-4 for $T > T_L$. Computations and verification of these conditions is referred to the structural engineer.

6.0 Liquefaction Evaluation

The site is expected to experience ground shaking and earthquake activity that is typical of the Southern California area. It is during severe shaking that loose, granular soils below the groundwater table can liquefy. Based on review of the *County of San Bernardino County Land Use Plan – General Plan – Geologic Hazard Overlays (2009)*, the site lies *within* a zone of "Suspected Liquefaction Susceptibility". A review with the State of California Department of Water Recourses of nearby water wells within ½ mile from the subject site revealed historical groundwater levels at a depth of about 14 feet below ground surface in 1988.

A review of the exploratory boring log and the laboratory test results on selected soil samples obtained indicate the following soil classifications, field blowcounts and amounts of fines passing through the No. 200 sieve.

Field Blowcount and Gradation Data

Boring No.	Classification	Blowcounts (blows/ft)	Relative Density	% Passing No. 200 Sieve
B-3 @ 5'	ML	12	Stiff	55
B-3 @ 10'	ML	7	Medium Stiff	52
B-3 @ 15'	SM	26	Very Dense	18
B-3 @ 20'	SM	25	Dense	8
B-3 @ 25'	SM	62	Very Dense	9
B-3 @ 30'	SM	47	Very Dense	8
B-3 @ 35'	SM	53	Very Dense	8
B-3 @ 40'	SM	>50	Very Dense	6
B-3 @ 45'	SM	>50	Very Dense	10
B-3 @ 50'	SM	>50	Very Dense	11

Our liquefaction evaluation utilized the nearest mode of predominate Magnitude 6.7 Mw earthquake in our earthquake in our calculations. The analysis indicates the potential for liquefaction at this site to be low based upon a historic groundwater depth of about 14 feet deep and a Peak Ground Acceleration (PGA_M) of 1.037g. The associated seismic-induced settlements would be on the order of ¾ inch and would occur rather uniformly across the site. Differential settlements would be on the order of ½ inch over a 50-foot (horizontal) distance.

7.0 Infiltration Characteristics

Infiltration tests within the site were performed to provide preliminary infiltration rates for the purpose of planning and design of an on-site water disposal system. A truck mounted Simco 2800 Drill Rig equipped with a hollow stem auger was used to excavate the exploratory borings to depths of 5 and 10 below existing ground surface. The borings consisted of eight-inch diameter test holes. A three-inch diameter perforated PVC casing with solid end cap was installed in the borings and then surrounded with gravel materials to prevent caving.

The infiltration holes were carefully filled with clean water and refilled after two initial readings. Based upon the initial rates of infiltration at each location, test measurements were measured at selected maximum intervals thereafter. Measurements were obtained by using an electronic tape measure with 1/16-inch divisions and timed with a stopwatch. The field infiltration rate was computed using a reduction factor – R_f based on the field measurements with our calculations given in Appendix E. Based upon the results of our testing, the soils encountered in the planned on-site drainage disposal system area exhibit the following infiltration rates.

Boring/Test No.	Depth	Soil Classification	Field Infiltration Rate
B-1	5'	Silty SAND	41.1 in/hr
B-2	10'	Silty SAND	22.9 in/hr

The correction factors CF_t, CF_v and CF_s are given below based on soils at 5 and 10 feet from our field tests.

a) $CF_t = Rf = 1.75$ and 1.31 for our two infiltration test holes.

b) $CF_v = 1.0$ based on uniform soils encountered in two borings for infiltration tests.

c) $CF_s = 2.0$ for long-term siltation, plugging and maintenance. The subsurface soils are likely to have some plugging and regular maintenance of storm water discharge devices is required.

Thus, the subsurface soils encountered in the proposed on-site drainage disposal system shall utilize the design infiltration rates based on a safety factor of 2.0 as required by the county standard. All systems must meet the latest county specifications and the California Regional Water Quality Control Board (CRWQCB) requirements.

It is recommended that foundations shall be setback a minimum distance of 10 feet from the drainage disposal system and the bottom of footing shall be a minimum of 10 feet from the expected zone of saturation. The boundary of the zone of saturation may be assumed to project downward from the top of the permeable portion of the disposal system at an inclination of 1 to 1 or flatter, as determined by the geotechnical engineer.

8.0 Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent structures.

The following recommendations are based upon soil conditions encountered in our field investigation; these near-surface soil conditions could vary across the site. Variations in the soil conditions may not become evident until the commencement of grading operations for the proposed development and revised recommendations from the soils engineer may be necessary based upon the conditions encountered.

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

8.1 Site Grading Recommendations

Any vegetation and/or demolition debris shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached *Specifications for Placement of Compacted Fill.*

8.1.1 Removal and Recompaction Recommendations

All disturbed soils and/or fill (about 1 to 2 feet below ground surface) shall be removed to competent native material, the exposed surface scarified to a depth of 12 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D 1557) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement. The upper 12 inches of soils beneath building slabs shall be compacted to a minimum of 95% relative compaction. Grading shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

It is possible that isolated areas of undiscovered fill not described in this report are present on site; if found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction.

Any imported fill material should be preferably soil similar to the upper soils encountered at the subject site. All soils shall be approved by this firm prior to importing at the site and will be subjected to additional laboratory testing to assure concurrence with the recommendations stated in this report.

If placement of slabs-on-grade and pavement is not completed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the soils engineer as to the suitability of the supporting soils may be needed.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

8.1.2 Fill Blanket Recommendations

Due to the potential for differential settlement of foundations placed on compacted fill and native materials, it is recommended that all foundations and floor slab areas be underlain by a uniform compacted fill blanket at least two feet in thickness. This fill blanket shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

8.2 Shrinkage and Subsidence

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 5 to 10% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.2 feet due to earthwork operations. The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements, or topographic approximations. Although these values are only approximate, they represent our best estimate of lost yardage, which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing the actual equipment and grading techniques should be conducted.

8.3 Temporary Excavations

Temporary *unsurcharged* excavations in the existing site materials may be made at vertical inclinations up to 4 feet in height unless cohesionless soils are encountered. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring or flatter excavations may be required. The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of the soils engineer, CAL-OSHA and other public agencies having jurisdiction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

8.4 Foundation Design

All foundations may be designed utilizing the following allowable bearing capacities for an embedded depth of 18 inches into approved engineered fill with the corresponding widths:

Allowable Bearing Capacity (psf)		
Width (feet)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2075	2575
4.0	2375	2875
6.0	2500	3000

The bearing value may be increased by 500 psf for each additional foot of depth in excess of the 18-inch minimum depth, up to a maximum of 4,000 psf. A one-third increase may be used when considering short-term loading and seismic forces. Any foundations located along property line or where lateral overexcavation is not possible may utilize an allowable bearing capacity of 1,500 psf embedded into competent native soils. All foundations shall be reinforced a minimum of two No. 4 bars, top and bottom. A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

8.5 **Settlement Analysis**

Resultant pressure curves for the consolidation tests are shown on Plates B to C. Computations utilizing these curves and the recommended allowable soil bearing capacities reveal that the foundations will experience settlements on the order of ¾ inch and differential settlements of less than ¼ inch.

8.6 **Lateral Resistance**

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.40
Equivalent Passive Fluid Pressure = 250 lbs./cu.ft.
Maximum Passive Pressure = 2,500 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils or competent native materials.

8.7 Retaining Wall Design Parameters

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. An equivalent fluid pressure of 45 pcf may be utilized for the restrained wall condition with a level grade behind the wall.

The seismic-induced lateral soil pressure for walls greater than 6 feet may be computed using a triangular pressure distribution with the maximum value at the top of the wall. The maximum lateral pressure of (20 pcf) H where H is the height of the retained soils above the wall footing should be used in final design of retaining walls. Sliding resistance values and passive fluid pressure values may be increased by 1/3 during short-term wind and seismic loading conditions.

All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system. The subsurface drainage system shall consist of a four-inch diameter perforated PVC pipe encased with gravel and wrapped with filter fabric. The granular backfill to be utilized immediately adjacent to retaining walls shall consist of an approved select granular soil with a sand equivalency greater than 30. This backfill zone of free draining material shall consist of a wedge beginning a minimum of one horizontal foot from the base of the wall extending upward at an inclination of no less than ¾ to 1 (horizontal to vertical).

8.8 **Slab Design**

Any new concrete slabs shall be a minimum of six inches in thickness in the proposed warehouse areas and four inches in office and hardscape both reinforced a minimum of No. 4 bars, sixteen inches in each direction and positioned in the center of slab and placed on approved subgrade soils. Additional reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon soils expansion potential and proposed loading conditions in the structures and should be evaluated further by the project engineers and/or architect. All subgrade soils shall be moisture conditioned to over optimum moisture content immediately prior to pouring concrete.

A vapor retarder (10-mil minimum thickness) should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs.* The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs.*

The moisture retarder may be placed directly upon compacted subgrade soils conditioned to near optimum moisture levels, although one to two inches of sand beneath the membrane is desirable. The subgrade upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

8.9 **Pavement Section Design**

The table below provides a preliminary pavement design based upon an R-Value of 74 for the subgrade soils for the proposed pavement areas. Final pavement design may need to be based on R-Value testing of the subgrade soils near the conclusion of site grading to assure that these soils are consistent with those assumed in this preliminary design. *The recommendations are based upon estimated traffic loads. Client should submit any other anticipated traffic loadings to the geotechnical engineer, if necessary, so that pavement sections may be reviewed to determine adequacy to support the proposed loadings.*

Type of Traffic	Traffic Index	Asphalt (in.)	Base Material (in.)
Automobile Parking Stalls	4.0	3.0	3.0
Light Vehicle Circulation Areas	5.5	3.0	4.0
Heavy Truck Access Areas	7.0	4.0	8.0

Any concrete slab-on-grade in pavement areas shall be a minimum of six inches in thickness and may be placed on approved subgrade soils.

All pavement areas shall have positive drainage toward an approved outlet from the site. Drain lines behind curbs and/or adjacent to landscape areas should be considered by client and the appropriate design engineers to prevent water from infiltrating beneath pavement. If such infiltration occurs, damage to pavement, curbs and flow lines, especially on sites with expansive soils, may occur during the life of the project.

Any approved base material shall consist of a Class II aggregate or equivalent and should be compacted to a minimum of 95% relative compaction. All pavement materials shall conform to the requirements set forth by the City of Fontana. The base material; and asphaltic concrete should be tested prior to delivery to the site and during placement to determine conformance with the project specifications. A pavement engineer shall designate the specific asphalt mix design to meet the required project specifications.

8.10 Utility Trench and Excavation Backfill

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded with clean sand having a sand equivalency rating of 30 or more. This bedding material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

8.11 Corrosion Design Criteria

Representative samples of the surficial soils, typical of the subgrade soils expected to be encountered within foundation excavations and underground utilities were tested for corrosion potential. The minimum resistivity value obtained for the samples tested is representative of an environment that may be severely corrosive to metals. The soil pH value was considered moderately alkaline and may not have a significant effect on soil corrosivity. Consideration should be given to corrosion protection systems for buried metal such as protective coatings, wrappings or the use of PVC where permitted by local building codes.

According to Table 4.3.1 of ACI 318 Building Code and Commentary, these contents revealed negligible sulfate concentrations. Therefore, a Type II cement according to latest CBC specifications may be utilized for building foundations at this time. It is recommended that additional sulfate tests be performed at the completion of site grading to assure that the as graded conditions are consistent with the recommendations stated in this design. Corrosion test results may be found on the attached Table III.

8.12 Expansive Soil

The upper on-site soils are very low in expansion potential (EI 0-20). When soils have an expansion index (EI) of 20 or more, special attention should be given to the project design and maintenance. The attached *Expansive Soil Guidelines* should be reviewed by the engineers, architects, owner, maintenance personnel and other interested parties and considered during the design of the project and future property maintenance.

9.0 Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D Tucker

Keith D. Tucker
Project Engineer
R.G.E. 841

KEITH D. TUCKER
No. 841
Exp. 12/31/2022

Mike Barone
Project Manager

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low-density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Geotechnical Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure.

Material for Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Geotechnical Engineering firm a minimum of 72 hours prior to importation of site.

Placement of Compacted Fill Soils

The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Geotechnical Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Geotechnical Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Geotechnical Engineering firm as deemed necessary. A 24-hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Geotechnical Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.

EXPANSIVE SOIL GUIDELINES

The following expansive soil guidelines are provided for your project. The intent of these guidelines is to inform you, the client, of the importance of proper design and maintenance of projects supported on expansive soils. ***You, as the owner or other interested party, should be warned that you have a duty to provide the information contained in the soil report including these guidelines to your design engineers, architects, landscapers and other design parties in order to enable them to provide a design that takes into consideration expansive soils.***

In addition, you should provide the soil report with these guidelines to any property manager, lessee, property purchaser or other interested party that will have or assume the responsibility of maintaining the development in the future.

Expansive soils are fine-grained silts and clays which are subject to swelling and contracting. The amount of this swelling and contracting is subject to the amount of fine-grained clay materials present in the soils and the amount of moisture either introduced or extracted from the soils. Expansive soils are divided into five categories ranging from "very low" to "very high". Expansion indices are assigned to each classification and are included in the laboratory testing section of this report. *If the expansion index of the soils on your site, as stated in this report, is 21 or higher, you have expansive soils.* The classifications of expansive soils are as follows:

Classification of Expansive Soil*

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

*From Table 18A-I-B of California Building Code (1988)

When expansive soils are compacted during site grading operations, care is taken to place the materials at or slightly above optimum moisture levels and perform proper compaction operations. Any subsequent excessive wetting and/or drying of expansive soils will cause the soil materials to expand and/or contract. These actions are likely to cause distress of foundations, structures, slabs-on-grade, sidewalks and pavement over the life of the structure. ***It is therefore imperative that even after construction of improvements, the moisture contents are maintained at relatively constant levels, allowing neither excessive wetting or drying of soils.***

Evidence of excessive wetting of expansive soils may be seen in concrete slabs, both interior and exterior. Slabs may lift at construction joints producing a trip hazard or may crack from the pressure of soil expansion. Wet clays in foundation areas may result in lifting of the structure causing difficulty in the opening and closing of doors and windows, as well as cracking in exterior and interior wall surfaces. In extreme wetting of soils to depth, settlement of the structure may eventually result. Excessive wetting of soils in landscape areas adjacent to concrete or asphaltic pavement areas may also result in expansion of soils beneath pavement and resultant distress to the pavement surface.

Excessive drying of expansive soils is initially evidenced by cracking in the surface of the soils due to contraction. Settlement of structures and on-grade slabs may also eventually result along with problems in the operation of doors and windows.

Projects located in areas of expansive clay soils will be subject to more movement and "hairline" cracking of walls and slabs than similar projects situated on non-expansive sandy soils. There are, however, measures that developers and property owners may take to reduce the amount of movement over the life the development. The following guidelines are provided to assist you in both design and maintenance of projects on expansive soils:

- Drainage away from structures and pavement is essential to prevent excessive wetting of expansive soils. Grades should be designed to the latest building code and maintained to allow flow of irrigation and rain water to approved drainage devices or to the street. Any “ponding” of water adjacent to buildings, slabs and pavement after rains is evidence of poor drainage; the installation of drainage devices or regrading of the area may be required to assure proper drainage. Installation of rain gutters is also recommended to control the introduction of moisture next to buildings. Gutters should discharge into a drainage device or onto pavement which drains to roadways.

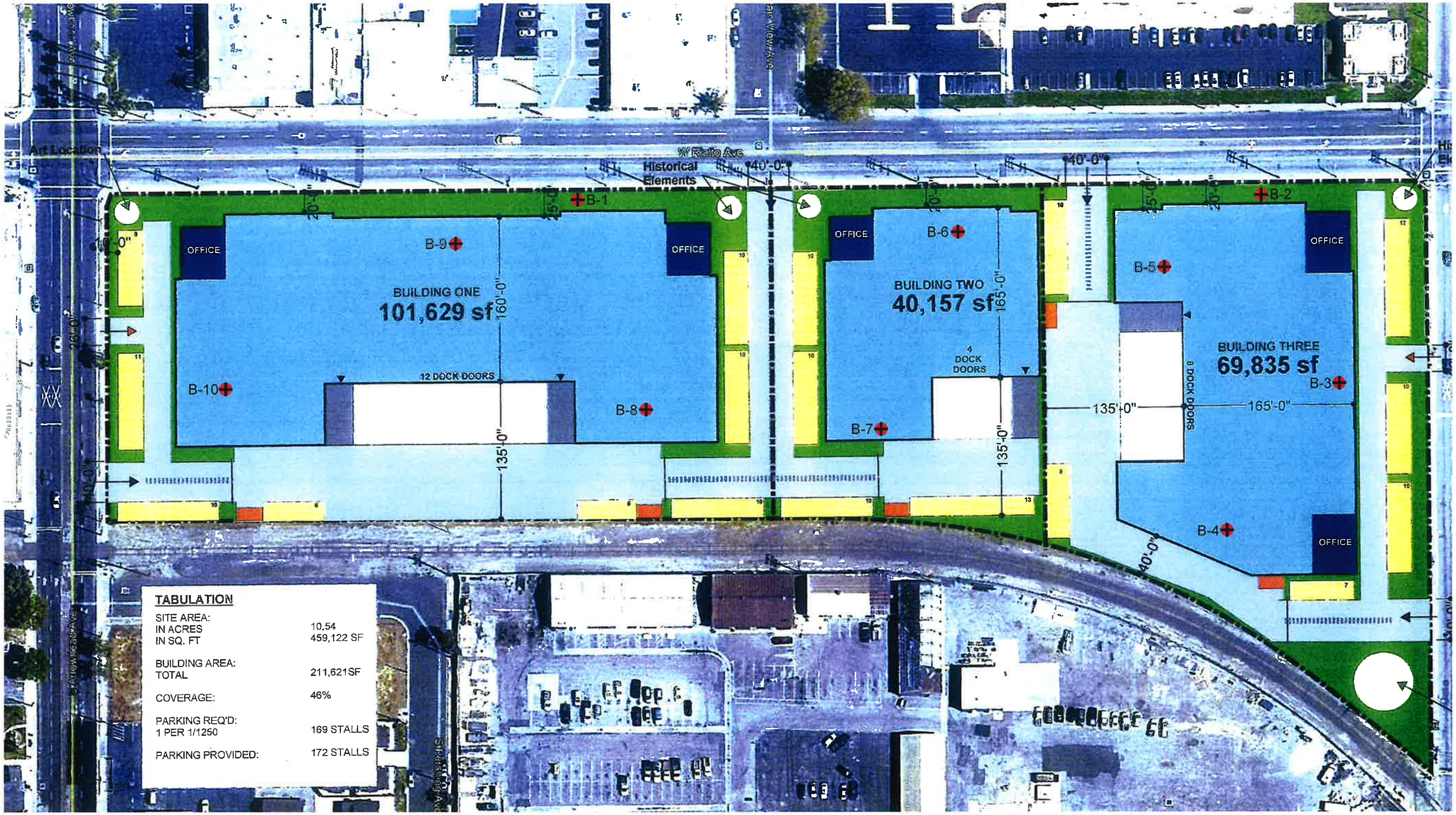
- Irrigation should be strictly controlled around building foundations, slabs and pavement and may need to be adjusted depending upon season. This control is essential to maintain a relatively uniform moisture content in the expansive soils and to prevent swelling and contracting. Over-watering adjacent to improvements may result in damage to those improvements. NorCal Engineering makes no specific recommendations regarding landscape irrigation schedules.

- Planting schemes for landscaping around structures and pavement should be analyzed carefully. Plants (including sod) requiring high amounts of water may result in excessive wetting of soils. Trees and large shrubs may actually extract moisture from the expansive soils, thus causing contraction of the fine-grained soils.

- Thickened edges on exterior slabs will assist in keeping excessive moisture from entering directly beneath the concrete. A six-inch thick or greater deepened edge on slabs may be considered. Underlying interior and exterior slabs with 6 to 12 inches or more of non-expansive soils and providing presaturation of the underlying clayey soils as recommended in the soil report will improve the overall performance of on-grade slabs.

- Increase the amount of steel reinforcing in concrete slabs, foundations and other structures to resist the forces of expansive soils. The precise amount of reinforcing should be determined by the appropriate design engineers and/or architects.

- Recommendations of the soil report should always be followed in the development of the project. Any recommendations regarding presaturation of the upper subgrade soils in slab areas should be performed in the field and verified by the Soil Engineer.



TABULATION

SITE AREA: IN ACRES IN SQ. FT	10.54 459,122 SF
BUILDING AREA: TOTAL	211,621SF
COVERAGE:	46%
PARKING REQ'D: 1 PER 1/1250	169 STALLS
PARKING PROVIDED:	172 STALLS

N

1" = 100'

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SOILS AND GEOTECHNICAL CONSULTANTS
PROFICIENCY CAPTIAL, LLC
PROJECT 22813-21
DATE OCTOBER 2021

SITE PLAN

FIGURE 1

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PROFICIENCY CAPITAL, LLC

PROJECT: 22813-21

DATE: OCTOBER 2021

VICINITY MAP

FIGURE 2

List of Appendices
(in order of appearance)

Appendix A – Log of Excavations

Log of Borings B-1 to B-8

Appendix B – Laboratory Tests

Table I – Maximum Dry Density
Table II – Expansion
Table III – Atterberg Limits
Table IV – Corrosion
Plate A - B – Direct Shear
Plates C - D - Consolidation

Appendix C – Liquefaction Analysis

Liquefaction Calculations

Appendix D –ASCE Seismic Hazards Report and Maps

ASCE Seismic Hazards Report

Appendix E – Soil Infiltration Data

Appendix A
Log of Excavations

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22813-21

Log of Boring B-1

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

Groundwater Depth: None Encountered

Drilling Method: Hand Auger

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory Fines Content %
0	GWT not encountered	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist	☒				
5		Boring completed at depth of 5'	☒		7.1		
10							
15							
20							
25							
30							
35							

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Log of Boring B-2

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

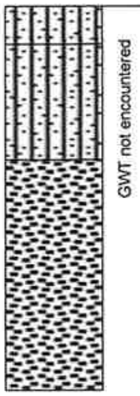
Groundwater Depth: None Encountered

Drilling Method: Hand Auger

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry					
	NATURAL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, damp	☒				
5	Slightly silty (fine to coarse grained) SAND with occasional gravel Light brown, medium dense, damp					
10	Boring completed at depth of 10'	☒		2.7		
15						
20						
25						
30						
35						

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\22813-21.log Date: 10/27/2021

Proficiency Capital, LLC
22813-21

Log of Boring B-3

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

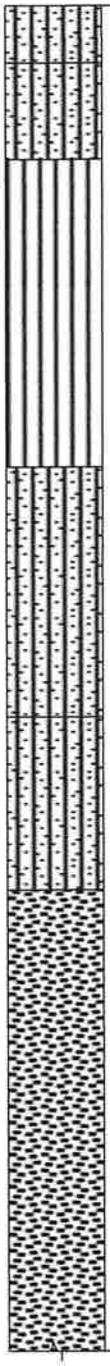
Groundwater Depth: None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

Surface Elevation: Not Measured



Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry					
			NATURAL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, moist					
5			Sandy SILT Light brown, medium dense, moist	☒	5/6/6	29.7		55
10				☒	2/4/3	21.1		52
			Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, moist					
15				☒	5/10/6	12.0		18
			Slightly silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, very moist					
20				☒	8/12/13	14.4		8
			Gravelly SAND, slightly silty with occasional rock Light brown, dense, moist					
25				☒	22/35/27	13.8		9
30				☒	17/25/22	12.1		8
35								

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Log of Boring B-3

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

Groundwater Depth: None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples Type	Blow Counts	Laboratory Moisture	Dry Density	Fines Content %
35	▨	Gravelly SAND, slightly silty with occasional rock Light brown, dense, moist	☒	16/23/30	15.7		8
40	▨		☒	23/50 for 5"	10.3		6
45	▨		☒	33/50 for 5"	10.9		10
50	▨		☒	50 for 4"	10.1		11
		Boring completed at depth of 51.5'					
55							
60							
65							
70							

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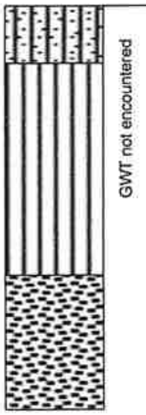
22813-21

Log of Boring B-4

Boring Location: 119 S Arrowhead, San Bernardino	
Date of Drilling: 10/18/2021	Groundwater Depth: None Encountered
Drilling Method: Hand Auger	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to medium grained) SAND with occasional gravel, concrete, asphaltic concrete Brown, medium dense, dry	▽ ■		 5.9	 87.1	
5	NATURAL Sandy SILT with occasional gravel Brown, medium stiff, damp	■		7.0	89.1	
10	Slightly silty (fine to coarse grained) SAND with occasional gravel Light brown, medium dense, damp	■		1.2	99.6	
	Boring completed at depth of 10.5'					
15						
20						
25						
30						
35						

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Log of Boring B-5

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

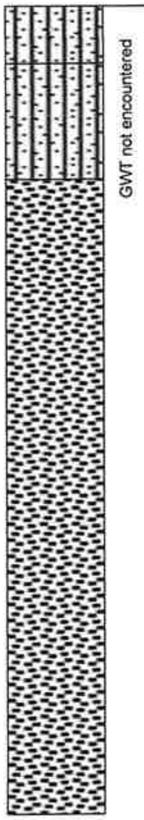
Groundwater Depth: None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry NATURAL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, damp					
5	Slightly silty (fine to ocarse grained) SAND with occasional gravel Light brown, dense, moist	■	7/11	6.3	119.7	
10		■	12/22	11.4	104.1	
15		■	14/23	10.3	107.3	
20		■	14/12	17.1	105.0	
25						
30						
35						

Boring completed at depth of 21'

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Log of Boring B-6

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

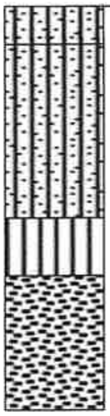
Groundwater Depth: None Encountered

Drilling Method: Hand Auger

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry					
5	NATURAL Slightly silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, moist	■		1.6	117.3	
	Sandy SILT Olive-brown, medium stiff, moist	■		4.1	98.5	
10	Slightly silty (fine to coarse grained) SAND with occasional gravel Light brown, medium dense, damp	■		0.7	104.5	
	Boring completed at depth of 10.5'					
15						
20						
25						
30						
35						

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Log of Boring B-7

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

Groundwater Depth: None Encountered

Drilling Method: Hand Auger

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨	GWT not encountered	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry	■		2.3	92.4	
	▨		NATURAL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, damp					
5			Boring completed at depth of 5'					
10								
15								
20								
25								
30								
35								

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Log of Boring B-8

Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021

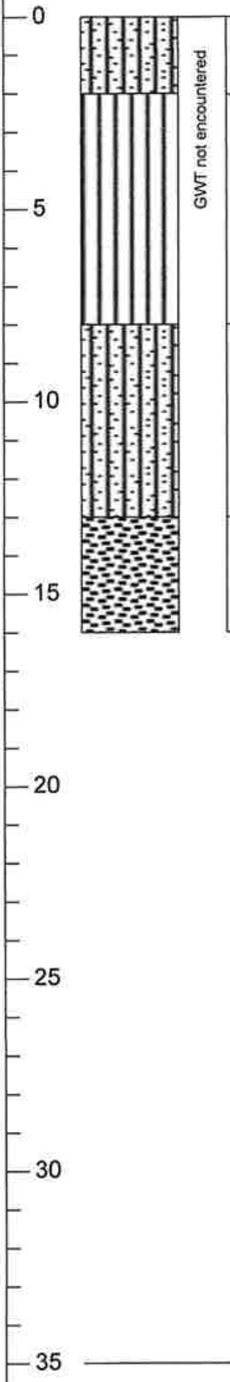
Groundwater Depth: None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

Surface Elevation: Not Measured



Material Description	Samples		Laboratory		
	Type	Blow Counts	Moisture	Dry Density	Fines Content %
FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry					
NATURAL Sandy SILT with occasional gravel Olive-brown, medium stiff, moist	■	8/13	17.5	103.7	
Silty (fine to medium grained) SAND Light brown, medium dense, moist	■	5/9	11.0	95.8	
Slightly silty (fine to coarse grained) SAND with occasional gravel Brown, medium dense, moist	■	19/27	8.6	114.9	

Boring completed at depth of 16'

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Log of Boring B-9

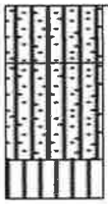
Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021 | **Groundwater Depth: None Encountered**

Drilling Method: Hand Auger

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith- ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	 GWT not encountered	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry	■		11.6	92.4	
		NATURAL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, moist					
5		Sandy SILT with occasional gravel Brown, medium stiff, moist					
		Boring completed at depth of 5'					
10							
15							
20							
25							
30							
35							

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Log of Boring B-10

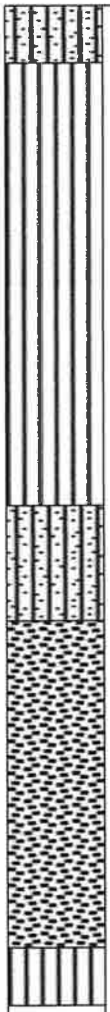
Boring Location: 119 S Arrowhead, San Bernardino

Date of Drilling: 10/18/2021 **Groundwater Depth:** None Encountered

Drilling Method: Drill Rig

Hammer Weight: 140 lbs **Drop:** 30"

Surface Elevation: Not Measured



GWT not encountered

		Samples		Laboratory		
Depth (feet)	Material Description	Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	FILL Silty (fine to medium grained) SAND with occasional gravel Brown, medium dense, dry					
	NATURAL Sandy SILT with occasional gravel Grey-brown, medium stiff, moist					
5		■	5/9	18.6	101.0	
10		■	5/12	27.8	84.6	
	Silty (fine to medium grained) SAND Grey-brown, medium dense, moist					
15		■	10/23	12.5	92.9	
	Slightly silty (fine to coarse grained) SAND with occasional gravel Grey-brown, dense, moist					
20		■	24/50	7.1	123.1	
25	Sandy SILT Dark grey, medium stiff, moist	■	8/21	14.8	107.7	
	Boring completed at depth of 26'					
30						
35						

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Appendix B
Laboratory Tests

TABLE I
MAXIMUM DENSITY TESTS

Sample	Classification	Optimum Moisture (%)	Maximum Dry Density (lbs/cu.ft)
B-2 @ 2'	Silty SAND	9.5	115.0

TABLE II
EXPANSION TESTS

Sample	Classification	Expansion Index
B-2 @ 2'	Silty SAND	3

TABLE III
ATTERBERG LIMITS

Sample	Liquid Limit	Plastic Limit	Plasticity Index
B-3 @ 5'	31	28	3
B-3 @ 10'	37	31	6

TABLE IV
CORROSION TESTS

Sample	pH	Electrical Resistivity	Sulfate (%)	Chloride (ppm)
B-4 @ 1.5'	7.9	8,552	0.0016	212

% by weight
ppm – mg/kg

PLASTICITY INDEX

ASTM D4318

Sample I.D.	B3@5'
% Retained on #40 Sieve	**1.0**
Wet	44.21
Dry	41.12
Tare	30.17
% Water	28.2
PL	**28**
Wet	39.74
Dry	37.44
Tare	30.20
% Water	31.8
# Blows	23
LL	**31**
PI	**3**

Sample I.D.	B3@10'
% Retained on #40 Sieve	**1.0**
Wet	41.20
Dry	38.57
Tare	30.13
% Water	31.2
PL	**31**
Wet	42.75
Dry	39.35
Tare	30.20
% Water	37.2
# Blows	24
LL	**37**
PI	**6**

Sample I.D.	
% Retained on #40 Sieve	
Wet	
Dry	
Tare	
% Water	
PL	
Wet	
Dry	
Tare	
% Water	
# Blows	
LL	
PI	

Sample I.D.	
% Retained on #40 Sieve	
Wet	
Dry	
Tare	
% Water	
PL	
Wet	
Dry	
Tare	
% Water	
# Blows	
LL	
PI	

Sample I.D.	
% Retained on #40 Sieve	
Wet	
Dry	
Tare	
% Water	
PL	
Wet	
Dry	
Tare	
% Water	
# Blows	
LL	
PI	

Sample I.D.	
% Retained on #40 Sieve	
Wet	
Dry	
Tare	
% Water	
PL	
Wet	
Dry	
Tare	
% Water	
# Blows	
LL	
PI	

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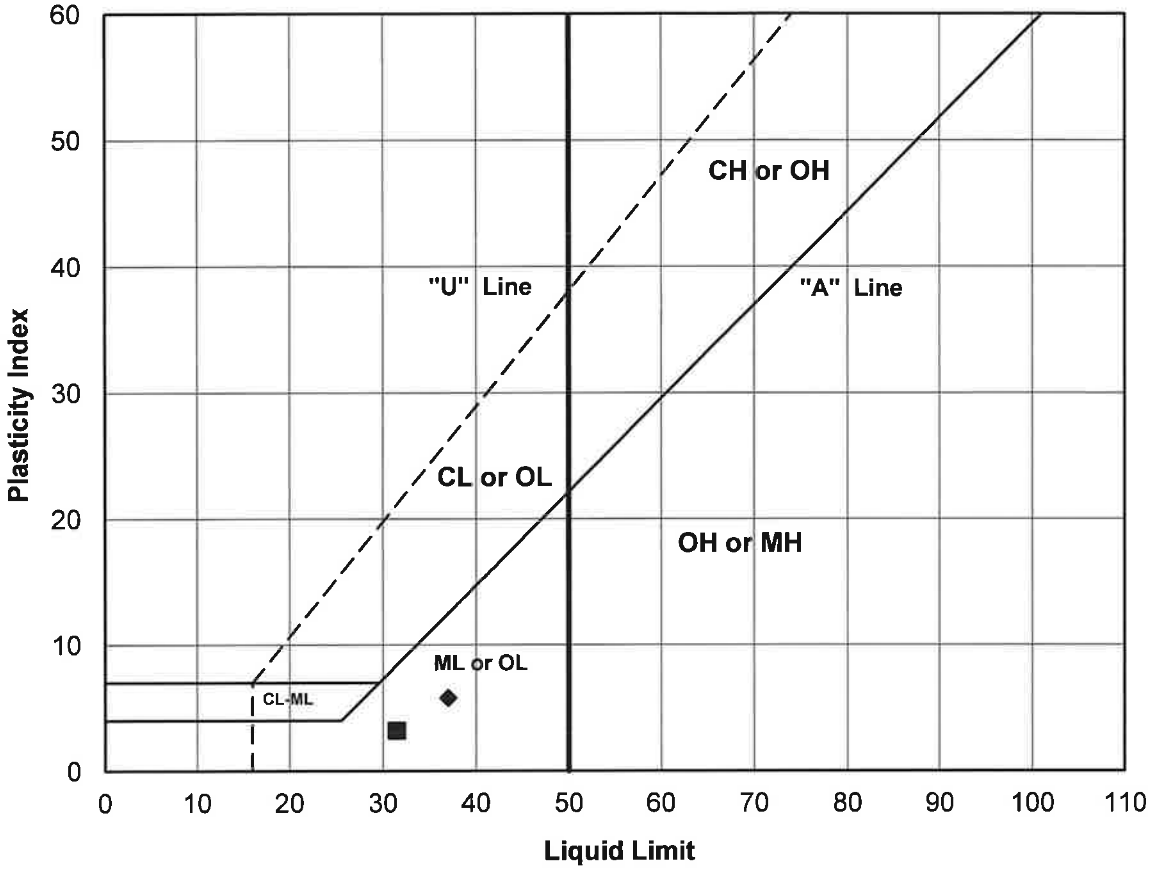
PLASTICITY INDEX

ASTM D4318

Revised 9-'17

PLASTICITY INDEX

ASTM D4318



Symbol	Sample	Depth	LL	PL	PI	USCS	Soil Description
■	B3	5'	**31**	**28**	**3**	ML	Silt
◆	B3	10'	**37**	**31**	**6**	ML	Silt
▲							
□							
◇							
△							

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PLASTICITY INDEX

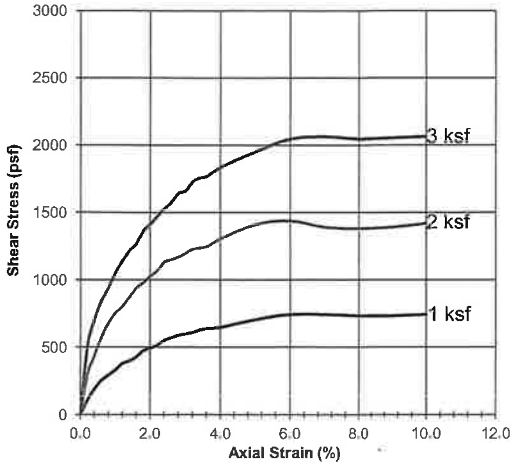
ASTM D4318

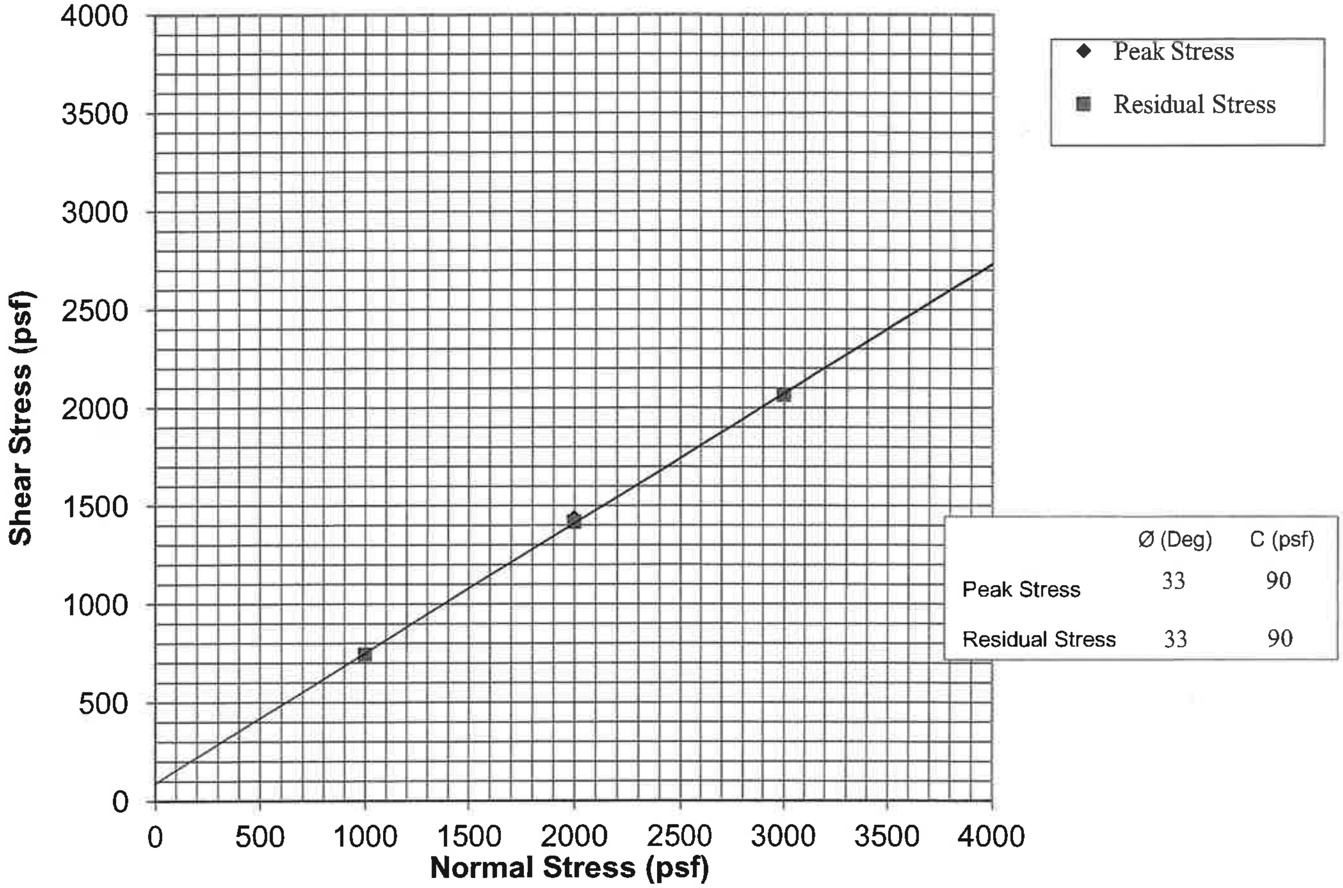
Sample No. B6@3'

Sample Type: Undisturbed-Saturated

Soil Description: Fine-Coarse Grained Sand w/ Some Silt & Gravel

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	743	1437	2064
Displacement	(in.)	0.150	0.150	0.175
Residual Stress	(psf)	743	1418	2064
Displacement	(in.)	0.250	0.250	0.250
Initial Dry Density	(pcf)	117.3	117.3	117.3
Initial Water Content	(%)	1.6	1.6	1.6
Strain Rate	(in./min.)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	33	90
Residual Stress	33	90

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PROJECT NUMBER: 22813-21

DATE: 10/26/2021

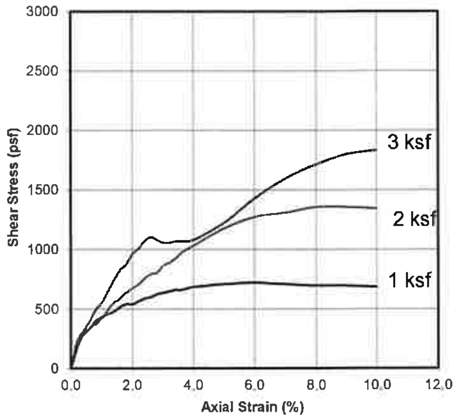
DIRECT SHEAR TEST

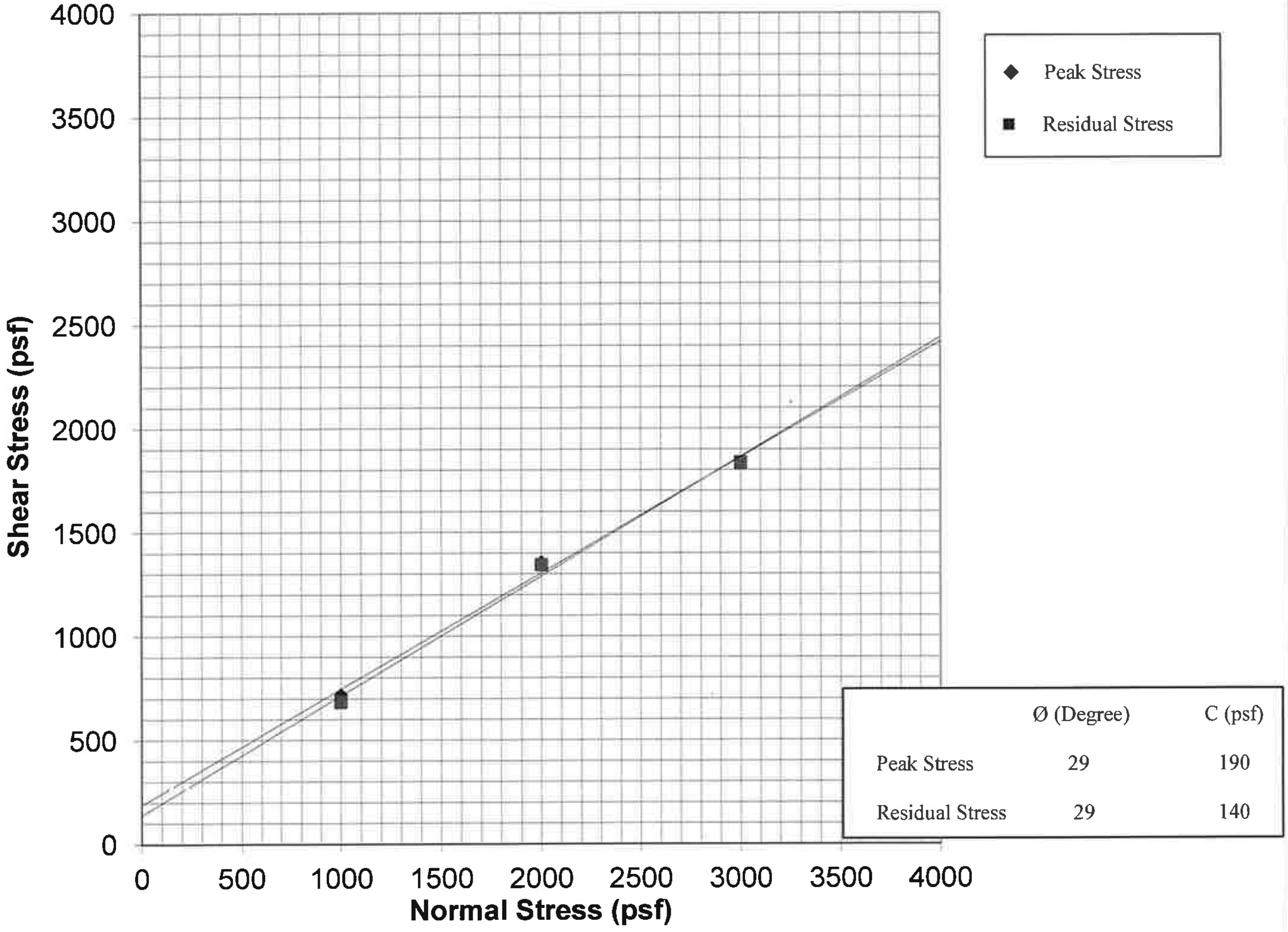
ASTM D3080

Plate A

Sample No. B9@2'
Sample Type: Undisturbed/Saturated
Soil Description: Silty Fine-Medium Grained Sand

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	720	1356	1836
Displacement	(in.)	0.150	0.200	0.250
Residual Stress	(psf)	684	1344	1836
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	92.4	92.4	92.4
In Situ Water Content	(%)	11.6	11.6	11.6
Saturated Water Content	(%)	30.5	30.5	30.5
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	29	190
Residual Stress	29	140

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DIRECT SHEAR TEST

ASTM D3080

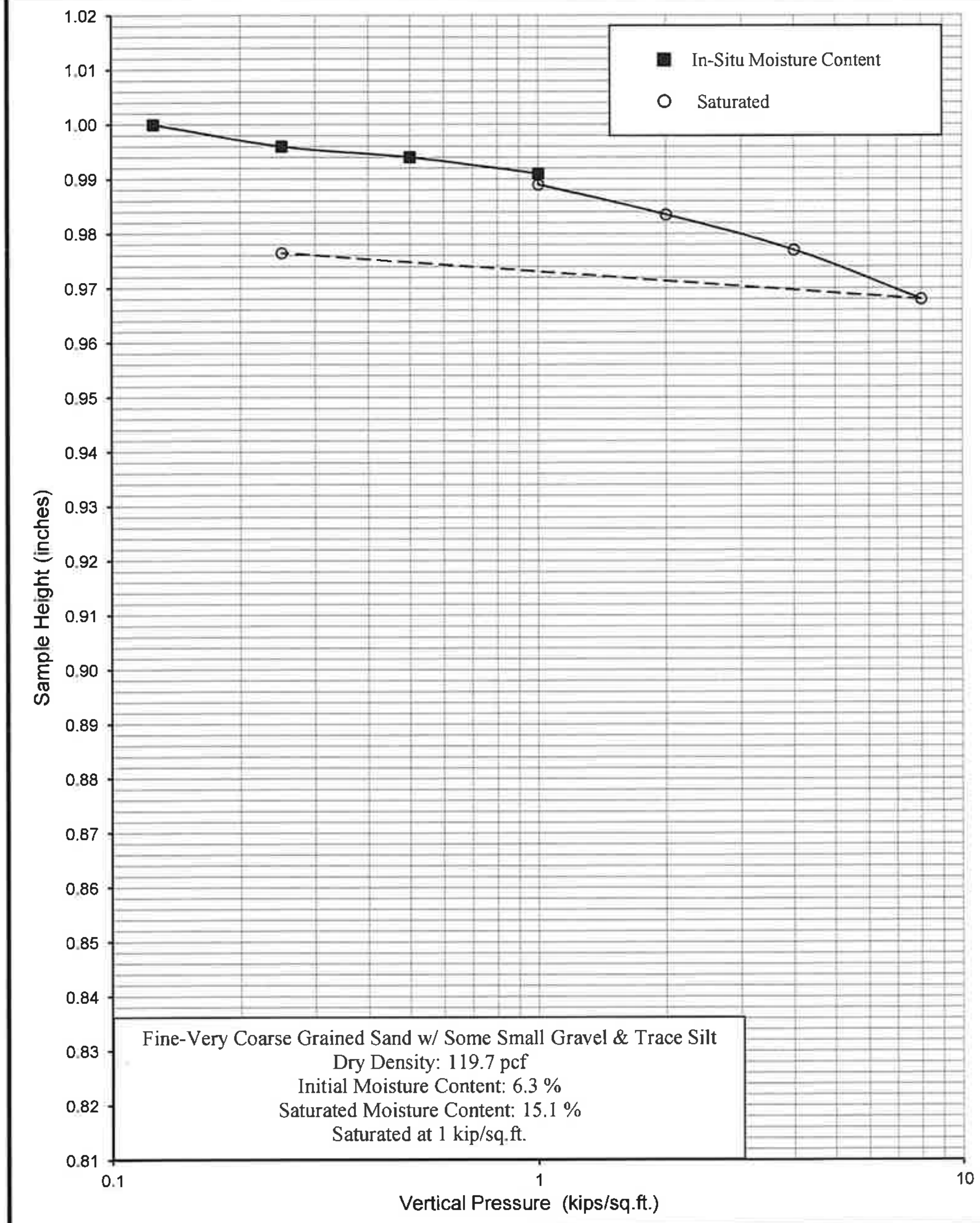
Plate B

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	Sample No.	B5	Depth	5'	Date	10/26/2021

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9960	0.4
0.5	0.9940	0.6
1	0.9910	0.9
1	0.9890	1.1
2	0.9835	1.7
4	0.9770	2.3
8	0.9680	3.2
0.25	0.9765	2.4

Saturated

Date Tested: 10/20/2021
Sample: B5
Depth: 5'



Fine-Very Coarse Grained Sand w/ Some Small Gravel & Trace Silt
Dry Density: 119.7 pcf
Initial Moisture Content: 6.3 %
Saturated Moisture Content: 15.1 %
Saturated at 1 kip/sq.ft.

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PROJECT NUMBER: 22813-21 DATE: 10/26/2021

CONSOLIDATION TEST

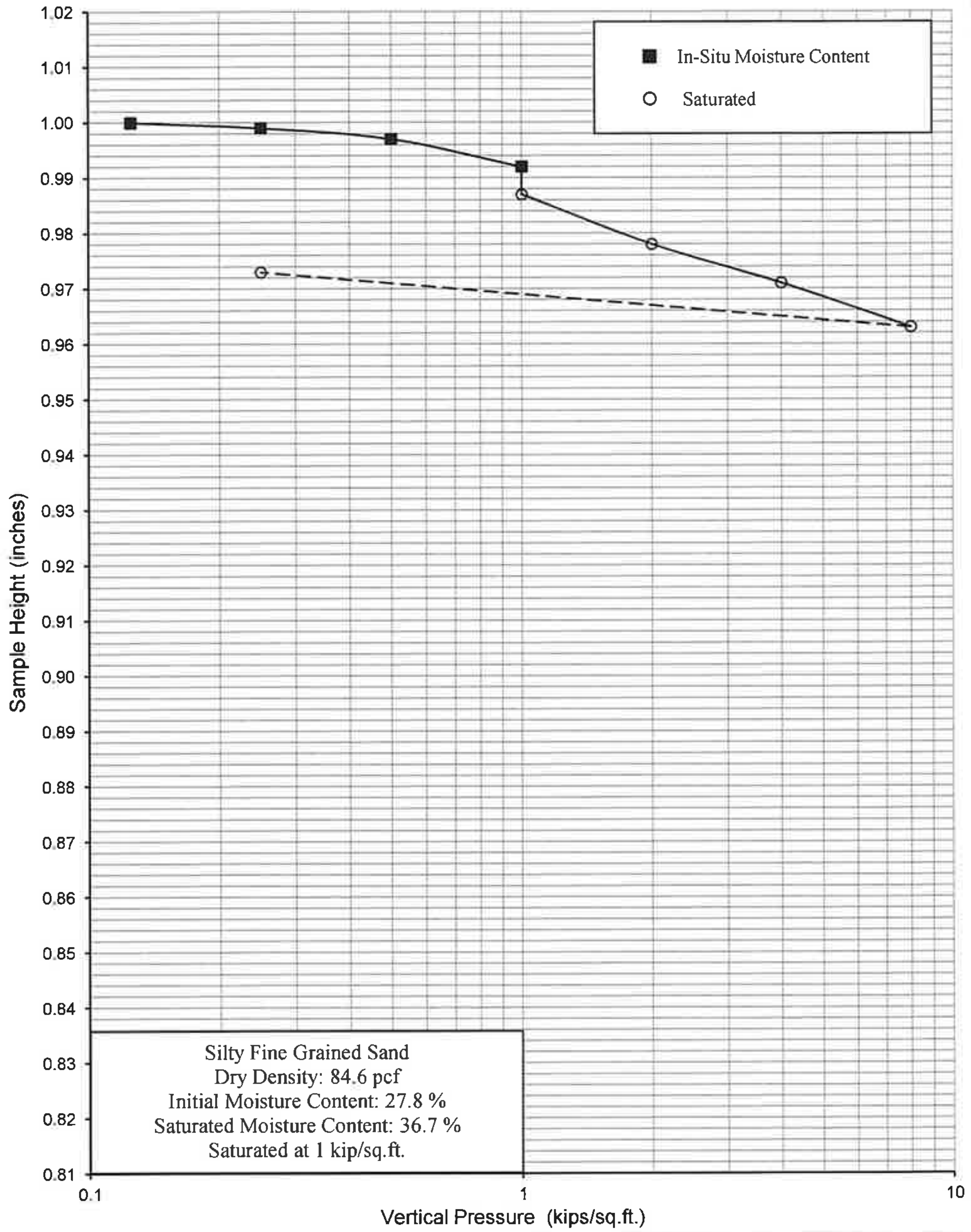
ASTM D2435

Plate C

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	Sample No.	B10	Depth 10'	Date 10/26/2021

0.125	1.0000	0.0	
0.25	0.9990	0.1	
0.5	0.9970	0.3	
1	0.9920	0.8	
1	0.9870	1.3	Saturated
2	0.9780	2.2	
4	0.9710	2.9	
8	0.9630	3.7	
0.25	0.9730	2.7	

Date Tested: 10/20/2021
Sample: B10
Depth: 10'



Silty Fine Grained Sand
Dry Density: 84.6 pcf
Initial Moisture Content: 27.8 %
Saturated Moisture Content: 36.7 %
Saturated at 1 kip/sq.ft.

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Proficiency Capital, LLC

PROJECT NUMBER: 22813-21 DATE: 10/26/2021

CONSOLIDATION TEST

ASTM D2435

Plate D

GMU

R-VALUE TEST REPORT

☑ CT-301 ☐ ASTM-D2844

PROJECT NAME: Norcal: Proficiency Capital LLC

SAMPLE LOCATION: 119 S. Arrohead Ave San Bernardino CA

SAMPLE DESCRIPTION: SILTY SAND (SM), brown

SAMPLED BY: Norcal: JS 10/18/21

PROJECT NUMBER: L-211001

SAMPLE NUMBER: B-1

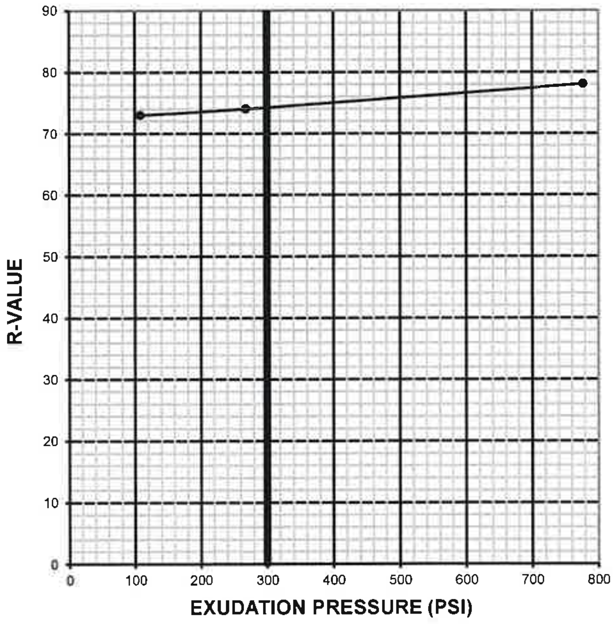
SAMPLE DEPTH: 2'

TESTED BY: JV

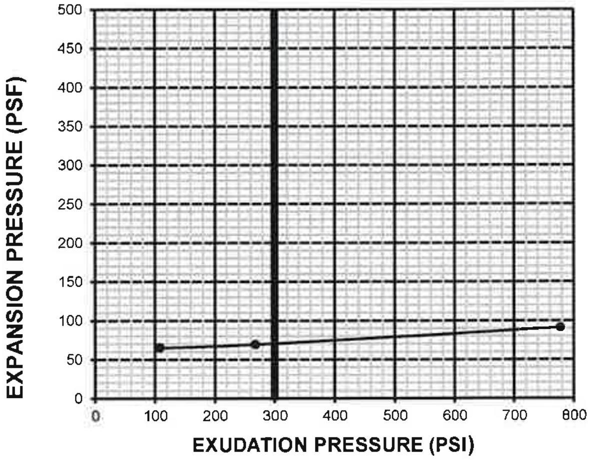
DATE TESTED: 10/19/2021

TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	11.4	9.5	13.0
WEIGHT OF SAMPLE, grams	1060	1075	1068
HEIGHT OF SAMPLE, Inches	2.55	2.59	2.58
DRY DENSITY, pcf	113.1	114.8	111.0
COMPACTOR AIR PRESSURE, psi	310	310	310
EXUDATION PRESSURE, psi	777	268	108
EXPANSION, Inches x 10exp-4	21	16	15
STABILITY Ph 2,000 lbs (160 psi)	21	25	26
TURNS DISPLACEMENT	4.78	4.88	5.09
R-VALUE UNCORRECTED	78	73	72
R-VALUE CORRECTED	78	74	73
EXPANSION PRESSURE (psf)	90.7	69.1	64.8

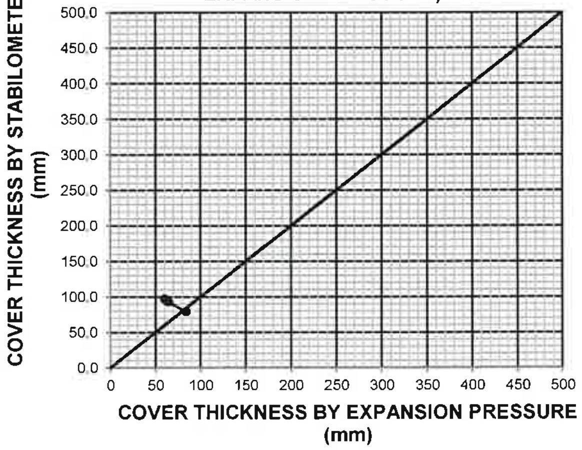
R-VALUE VS. EXUDATION PRESSURE



EXPANSION PRESSURE VS. EXUDATION PRESSURE



COVER THICKNESS (STABILOMETER BY EXPANSION PRESSURE)



R-VALUE AT EQUILIBRIUM:	74

R-VALUE BY EXUDATION PRESSURE:	74
R-VALUE BY EXPANSION PRESSURE:	78
EXPANSION PRESSURE AT 300 PSI EXUDATION:	70
TRAFFIC INDEX (Assumed):	5.5
GRAVEL FACTOR (Assumed):	1.5
UNIT MASS OF COVER MATERIAL, kg/m^3 (Assumed):	2100.0

Appendix C
Liquefaction Analysis

SITE LOCATION: ____________________

GEOTECHNICAL REPORT: ____________________

GEOLOGY REPORT: ____________________

DEPTH TO WATER TABLE = 14'

EARTHQUAKE MAGNITUDE = 6.7

PEAK GROUND ACCELERATION = 1.04g

DEPTH BELOW FINAL GRADE (FEET)	MOIST DENSITY (PCF)	σ_0 TOTAL STRESS (PSF)	$\bar{\sigma}_0$ EFFECTIVE STRESS (PSF)	$\sigma_0/\bar{\sigma}_0$ (-)	r_d (-)	① $\tau_h/\bar{\sigma}_0$ (-)	N VALUE (BLOWS/FT)	RELATIVE DENSITY (%)	C_N (-)	C_E (-)	C_B (-)	C_R (-)	C_S (-)	$(N_1)_{60}$ (Blows/ft)	FINES (%)	CRR M=7.5	MSF (-)	CRR M=6.7	LIQ. F.S.
5	100	500	Same	1.00	0.99	0.68	12	75	>1.6	1.00	1.05	0.70	1.20	>17	55	>0.29	1.5	>0.44	>0.6
10	105	1025	↓	↓	0.96	0.65	7	55	1.35	↓	↓	0.75	↓	9	52	>0.18	↓	>0.27	>0.4
15	120	1625	1563	1.04	0.92	0.65	26	85	1.10			0.85		30.5	18	>0.50		>0.75	>1.2
20	125	2250	1876	1.20	0.87	0.71	25	80	0.95			0.90		27	8	0.38		0.57	0.8
25	↓	2875	2189	1.31	0.80	0.71	62	>90	0.85			0.95		63	9	>0.50		>0.75	>1.1
30		3500	2502	1.40	0.74	0.70	47	>90	0.80			1.00		47	8	↓		↓	>1.1
35		4125	2815	1.47	0.68	0.68	53	>90	0.75			↓		50	8				>1.1
40		4750	3128	1.52	0.64	0.66	>50	85	0.70					>44	6				>1.1
45		5375	3441	1.56	0.61	0.65	>50	85	0.65					>41	10				>1.2
50		6000	3754	1.60	0.58	0.63	>50	80	0.62					>39	11				>1.2

① INDUCED CYCLIC STRESS RATIO = $\tau_{ave}/\bar{\sigma}_0 = 0.65 \cdot \frac{a_{max}}{g} \cdot \frac{\sigma_0}{\bar{\sigma}_0} \cdot r_d$

- C_E = Corr. - Energy Ratio = Energy Ratio/60%
- C_B = Corr. - Borehole Dia. = 1.15 for 8" dia. borehole
- C_R = Corr. - Rod Length
- C_S = Corr. - Sampling Method

Actual Energy Ratio = 0.67-1.17 (Safety Hammer)
= 0.50-1.00 (Donut Hammer)

Sampling Method = 1.0 Standard sampler
= 1.2 Sampler W/o Liners

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PROJECT ______ DATE ______

EVALUATION OF LIQUEFACTION POTENTIAL

SEISMIC SETTLEMENT EVALUATION → GWT @ 14',

EQ Magnitude = 6.7, Hor. Ground Acceleration = 1.04g

Depth (ft)	$N_{1,60}$ (Blows/ft)	Fines (%)	EQ CSR	M_{design} / $M_{7.5}$	Design CSR	Vert. Strain	Seismic Settle	Liquefaction F.S.
15-20'	27	8	0.71	1.5	0.47	1.1%	0.7"	0.8

Say $\Delta_{EQ} < 3/4"$ ←

NL - Non liquefiable soil layers with LL > 39%
PL > 18%

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DATE

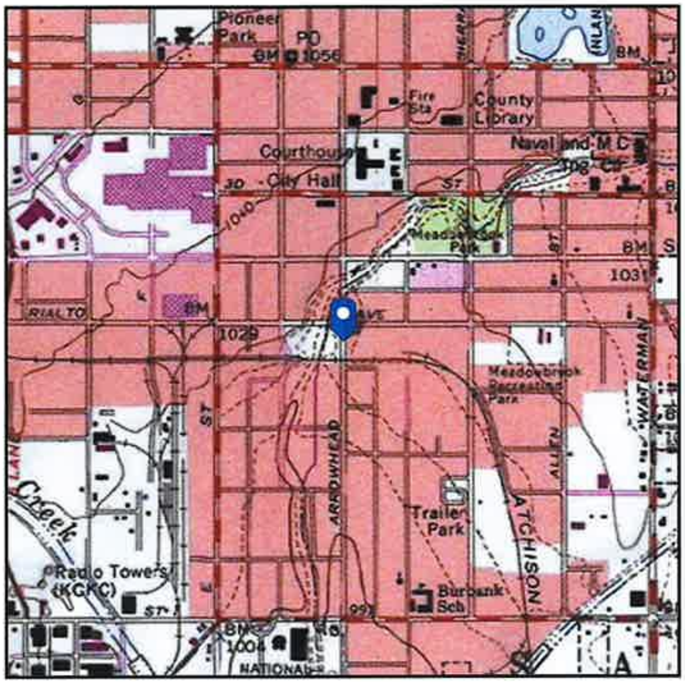
Appendix D
Seismic Hazards Report

ASCE 7 Hazards Report

Address:
119 S Arrowhead Ave
San Bernardino, California
92408

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Elevation: 1015.5 ft (NAVD 88)
Latitude: 34.10027
Longitude: -117.289593



Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	2.237	S_{D1} :	N/A
S_1 :	0.893	T_L :	8
F_a :	1	PGA :	0.943
F_v :	N/A	PGA_M :	1.037
S_{MS} :	2.237	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.491	C_v :	1.5

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Tue Oct 26 2021

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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Appendix E
Soil Infiltration Data

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PERCOLATION TEST DATA

Client: Proficiency Capital	**Tested By:** D.R.
Project No.: 22813-21	**Date Tested:** 10/18/2021
Test Hole: 1	**Caving:**
Depth of Test Hole: 5’	**Notes:**
Diameter of Test Hole: 8”	**Strata Peculiarities:**
Date Excavated: 10/18/2021	

Sandy Soil Criteria Test

TIME	TRIAL NO.	T1	H1	H2	D
9:22	1	4	0.0	60.0	60.0
9:26					
9:26	2	8	0.0	60.0	60.0
9:34					

____Soil Criteria

TIME	T1	TE	H1	H2	D
9:34	9	9	0.0	60.0	60.0
9:43					
9:43	10	19	0.0	58.0	58.0
9:53					
9:53	10	29	0.0	58.0	58.0
10:03					
10:03	10	39	0.0	57.0	57.0
10:13					
10:13	10	49	0.0	56.5	56.5
10:23					
10:23	10	59	0.0	55.5	55.5
10:33					
10:33	10	69	0.0	55.5	55.5
10:43					
10:43	10	79	0.0	54.0	54.0
10:53					
10:53	5	84	54.0	60.0	6.0
10:58					

T1 – Time Interval (min)
TE – Total Elapsed Time (min)
H1 – Initial Water Level
H2 – Final Water Level (in)
D – Change in H_2O Level (in)

PERCOLATION TEST DATA

Client: Proficiency Capital	**Tested By:** D.R.
Project No.: 22813-21	**Date Tested:** 10/18/2021
Test Hole: 2	**Caving:**
Depth of Test Hole: 10'	**Notes:**
Diameter of Test Hole: 8"	**Strata Peculiarities:**
Date Excavated: 10/18/2021	

Sandy Soil Criteria Test

TIME	TRIAL NO.	T1	H1	H2	D
7:36	1	5	0.0	120.0	120.0
7:41					
7:41	2	7	0.0	120.0	120.0
7:48					

____Soil Criteria

TIME	T1	TE	H1	H2	D
7:48	9	9	0.0	120.0	120.0
7:57					
7:57	10	19	0.0	120.0	120.0
8:07					
8:07	10	29	0.0	119.5	119.5
8:17					
8:17	10	39	0.0	119.5	119.5
8:27					
8:27	10	49	0.0	119.0	119.0
8:37					
8:37	10	59	0.0	118.5	118.5
8:47					
8:47	10	69	0.0	118.0	118.0
8:57					
8:57	10	79	0.0	117.5	117.5
9:07					
9:07	5	84	117.5	120.0	2.5
9:12					
	5				

T1 – Time Interval (min) **TE – Total Elapsed Time (min)** **H1 – Initial Water Level**
H2 – Final Water Level (in) **D – Change in H_2O Level (in)**

SOIL INFILTRATION RATE CALCS ⇒ Auger Boring

Location:	TH-1	TH-2
• Depth =	5.0'	10.0'
• Hole Dia. =	8"	8"
• Drop = Δd	6"	2.5"
• Time = Δt Interval	5 min	5 min
• Preadjusted Perc. Rate	72 in/hr	30 in/hr
• Initial Water Depth = d_1	6"	2.5"
• Reduction Factor = R_f	1.75	1.31
• INFILTRATION RATE	41.1 in/hr	22.9 in/hr

$$\text{Infiltration Rate} = \frac{\text{Preadjusted Perc. Rate}}{\text{Reduction Factor}}$$

$$\text{Reduction Factor} = R_f = \left[\frac{2 \cdot d_1 - \Delta d}{\text{Dia.}}\right] + 1$$

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