

**GEOTECHNICAL INVESTIGATION**  
**Proposed 3-Story Apartment Building On-Grade**  
**Tract: 337; Lot: 43**  
**116 – 120 W. 87<sup>th</sup> Place**  
**Los Angeles, California**

June 5, 2023  
Project No. 33-6471-00

**Prepared for:**

General Investments LA, LLC  
Attn: Mr. Effi Bainvoll  
3674 E. Sunset Rd. #100  
Las Vegas, NV 89120



**A. G. I. G E O T E C H N I C A L, I N C.**

16555 Sherman Way, Suite A - Van Nuys, CA 91406 - Office: (818) 785-5244 - Facsimile: (818) 785-6251

June 5, 2023

Project No. 33-6471-00

General Investments LA, LLC  
3674 E. Sunset Rd. #100  
Las Vegas, NV 89120

Attention: Mr. Effi Bainvoll


Subject: **GEOTECHNICAL INVESTIGATION**  
Proposed 3-Story Apartment Building On-Grade  
APN: 6040-021-018  
Tract: 337; Lot: 43  
116 - 120 W. 87<sup>th</sup> Place  
Los Angeles, California

Dear Mr. Bainvoll:

This report presents the results of the geotechnical investigation for the proposed 3-story apartment building. The purpose of this investigation was to assess the geotechnical conditions of the site and provide design recommendations for the proposed development. The investigation consisted of field exploration, laboratory testing, engineering analyses of field and laboratory data, and preparation of this report. *The scope of geotechnical services provided did not include an environmental site assessment for the presence of hazardous/toxic materials in the on-site soils and is beyond the scope of this investigation.*

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

Respectfully submitted,  
A.G.I. GEOTECHNICAL, INC.

  
Bruce Smith, R.G.E. 2673  
Senior Engineer

MBS:wb



Distribution: (3) General Investments LA, LLC

Enclosures: Location Map (Figure 1)  
Site Plan (Figure 2)  
Plot Plan (Figure 3)  
Boring Log  
Laboratory Test Results  
U.S. Seismic Design Map  
USGS Deaggregations  
Liquefaction Analyses  
Bearing Capacity Analyses  
Slot Cut Stability Analysis  
Quadrangle Location Map  
Groundwater Map



## TABLE OF CONTENTS

|  |           |
|--|-----------|
| <b>INTRODUCTION .....</b>                                | <b>1</b>  |
| SITE CONDITIONS .....                                    | 1         |
| PROPOSED DEVELOPMENT .....                               | 1         |
| FIELD EXPLORATION .....                                  | 1         |
| SUBSURFACE CONDITIONS.....                               | 2         |
| Soil Profile.....  | 2         |
| Groundwater .....  | 2         |
| SEISMIC HAZARDS AND SEISMIC DESIGN CRITERIA .....        | 2         |
| Surface Rupture.....                                     | 2         |
| Liquefaction .....                                       | 3         |
| Landslides.....  | 4         |
| California Building Code Seismic Parameters .....        | 4         |
| <b>LABORATORY TESTING .....</b>                          | <b>5</b>  |
| CLASSIFICATION .....                                     | 5         |
| LOAD CONSOLIDATION TEST (ASTM:D-2435) .....              | 5         |
| DIRECT SHEAR TESTS (ASTM:D-3080).....                    | 5         |
| GRAIN SIZE DISTRIBUTION (ASTM:D-422-63(2002)).....       | 6         |
| ATTERBERG LIMITS (ASTM:D-4318) .....                     | 6         |
| MAXIMUM DENSITY/OPTIMUM MOISTURE (ASTM:D-1557) .....     | 6         |
| EXPANSION TEST (ASTM:D-4829).....                        | 6         |
| <b>CONCLUSIONS AND RECOMMENDATIONS .....</b>             | <b>6</b>  |
| GENERAL.....   | 6         |
| SITE PREPARATION .....                                   | 7         |
| FILL PLACEMENT.....                                      | 7         |
| FOUNDATION DESIGN .....                                  | 8         |
| Type of Foundation .....                                 | 8         |
| Soil Bearing Pressures .....                             | 8         |
| Settlement.....  | 8         |
| SLABS-ON-GRADE.....                                      | 9         |
| LATERAL RESISTANCE .....                                 | 9         |
| RETAINING WALLS .....                                    | 9         |
| ON-SITE INFILTRATION FACILITIES.....                     | 10        |
| PAVEMENT SECTIONS.....                                   | 10        |
| CONSTRUCTION CUTS .....                                  | 11        |
| EXCAVATION OBSERVATIONS .....                            | 11        |
| BACKFILL.....  | 11        |
| DRAINAGE .....   | 12        |
| REVIEW.....  | 12        |
| REGULATORY AGENCY REVIEW AND ADDITIONAL CONSULTING ..... | 12        |
| <b>COMMENTS.....</b>                                     | <b>13</b> |



## INTRODUCTION

### SITE CONDITIONS

The subject site is located at 116-120 West 87<sup>th</sup> Place in the city of Los Angeles, California and encompasses an area of approximately 5,400 square feet. The site is currently occupied by a 1-story fourplex, hardscape features, and landscaped areas. The site is bound by West 87<sup>th</sup> Place to the north, by an alley to the east, and by residential properties to the west and south. Drainage at the site occurs either by infiltration into vegetated areas or by sheet flow towards the adjacent street and alley. The topography at and in the vicinity of the site is relatively level with minor changes in ground surface elevations across the property. The location of the site is shown on the enclosed Location Map, (Figure 1).

### PROPOSED DEVELOPMENT

The proposed development consists of a 12-unit 3-story 100% affordable housing apartment building on-grade. Structural loads are estimated to range from 10 to 15 kips per linear foot for continuous footings and 100 to 150 kips for column footings. Miscellaneous improvements including new permeable pavement driveways, walkways, and landscaped areas are anticipated as part of the development. The existing structures will be demolished to prepare the site for construction. The layout of the proposed development is shown on the enclosed Site Plan, (Figure 2).

### FIELD EXPLORATION

Subsurface conditions were explored by drilling one exploratory boring at the location shown on the enclosed Plot Plan, (Figure 3). The boring was drilled to a maximum depth of 51.5 feet below existing grade with Standard Penetration Tests (SPT) performed at selected depths. The boring was drilled using a truck mounted drill rig equipped with 8-inch diameter hollow stem augers.

Drilling of the boring was supervised by our field geologist who classified and logged the in-situ materials. Undisturbed and bulk samples were collected at depths appropriate to the investigation. Undisturbed samples were sealed immediately in watertight containers for shipment to our laboratory. Soil samplers used in our investigation included a 2.50-inch I.D. split barrel sampler lined with 1-inch brass rings (Modified California Sampler, MC) and a 1.5-inch I.D. Standard Penetration Test (SPT) split spoon sampler which were driven to a depth of 18 inches with a 140-pound hammer falling from a height of 30 inches. The number of blows to drive the samplers 18 inches in three six-inch increments is reported on the enclosed Boring Log.



## SUBSURFACE CONDITIONS

### Soil Profile

The materials encountered during field exploration consisted of native alluvial soils. The alluvium comprises stiff to hard lean clays and silts or medium dense to very dense clayey sands, poorly graded sands, and silty sands. The moisture condition of the soil ranged from damp to moist. No fill materials were identified in the boring. For a more detailed description of the subsurface materials encountered in the exploratory boring, please refer to the Boring Log enclosed with this report.

### Groundwater

No groundwater was encountered in the exploratory boring to the maximum depth explored of 51.5 feet below the existing ground surface. According to the Seismic Hazard Zone Report of the Inglewood 7.5-Minute Quadrangle (CDMG, 1998), the historically highest groundwater level within the vicinity of the site is approximately 15 feet below the ground surface. Groundwater conditions below any given site fluctuate due to various factors including seasonal precipitation, local irrigation, stormwater recharge, and pumping.

## SEISMIC HAZARDS AND SEISMIC DESIGN CRITERIA

The subject site is situated within a seismically active region. The primary seismic hazard is moderate to strong ground shaking caused by an earthquake on local or regional faults. The potential for other seismically-induced hazards have been evaluated and are discussed below.

### Surface Rupture

The Alquist-Priolo Earthquake Fault Zoning Act requires the California Geological Survey (CGS) to zone "active faults" within the State of California. "Active" faults, as defined by CGS, have exhibited surface displacement within the last 11,000 years. It is this recent fault movement that the CGS considers a characteristic for faults that have a relatively high potential for ground rupture in the future.

CGS policy is to delineate a boundary from 200 to 500 feet wide on each side of the known fault trace based on the location precision, the complexity, or the regional significance of the fault. If a site lies within an Earthquake Fault Zone, a geologic fault rupture investigation must be performed that demonstrates that the proposed building is not threatened by surface displacement from the fault before development permits may be issued.

Review of the Earthquake Zones of Required Investigation for the Inglewood Quadrangle indicates that the subject site is **not** located within an Alquist-Priolo Earthquake Fault Zone. Based on this data, the potential for surface rupture resulting from the movement of nearby faults is low.



### Liquefaction

Liquefaction is the sudden decrease in the strength and stiffness of unconsolidated, saturated cohesionless soils typically resulting from seismic ground shaking. For soils to liquefy, the intensity and duration of the seismically induced cyclic loading must be enough to increase the excess pore water pressures to such an extent that the effective stresses on the soil particles reduces to zero. If liquefaction is initiated, the saturated soils behave temporarily as a viscous fluid and consequently lose their capacity to support the structures founded on them. The potential for liquefaction decreases with increasing clay and gravel content. Liquefaction potential has been found to be the greatest where the groundwater level and loose cohesionless soils occur within 50 feet of the ground surface.

According to the State of California Seismic Hazard Zones Map for the Inglewood Quadrangle (CDMG, 1998), the site is in a liquefiable area. This determination is based on groundwater depth records, soil type and distance to a fault capable of producing a substantial earthquake.

To assess the potential for liquefaction, two site-specific liquefaction analyses were performed in accordance with the City of Los Angeles Information Bulletin / Public Building Code P/BC 2020-151.

The first analysis used a peak ground acceleration (PGA) corresponding to two-thirds of the site-modified Maximum Considered Earthquake-Geometric Mean ( $MCE_G$ ) peak ground acceleration ( $PGA_M$ ). The predominant earthquake magnitude correlated to a seismic event of 10% probability of exceedance in 50 years (475-year return period). The potential seismic-induced settlements were determined based on a factor of safety against liquefaction less than 1.1.

The second analysis used a peak ground acceleration (PGA) corresponding to the full  $PGA_M$ . The predominant earthquake magnitude correlated to a seismic event of 2% probability of exceedance in 50 years (2,475-year return period). The potential seismic-induced settlements were determined based on a factor of safety against liquefaction less than 1.0.

Liquefaction settlement calculations are enclosed. Results of the liquefaction evaluations are summarized below:

| Return Period | Peak Ground Acceleration <sup>(1)</sup> | Moment Mean Magnitude $M_w$ <sup>(2)</sup> | Factor of Safety | Total Liquefaction Settlement |
|---------------|---|--|------------------|-------------------------------|
| 475 years     | 0.581g                                  | 6.66                                       | 1.1              | 0.66"                         |
| 2,475 years   | 0.872g                                  | 6.80                                       | 1.0              | 1.09"                         |

NOTES: 1) From U.S. Seismic Design Maps website: <https://seismicmaps.org/>

2) From USGS Deaggregation website: <https://earthquake.usgs.gov/hazards/interactive/>

The seismically induced settlements from the 475-year return period is the design value and was calculated to be 0.66 inches. Because one boring was used to evaluate the potential for liquefaction, the estimated seismic-induced differential settlement was taken as two-thirds of the total seismic settlement, yielding approximately 0.44 inches.



Landslides

Seismically induced slope instability, mainly in the form of landslides, are common occurrences during or soon after earthquakes. Review of the Seismic Hazard Zones Map of the Inglewood Quadrangle indicates that the site is **not** located in a designated earthquake-induced landslide zone. In the absence of significant ground slopes near the subject site, the potential for seismically induced landslides to affect the proposed development site is low.

California Building Code Seismic Parameters

Based on information derived from the subsurface exploration, the subject site is classified as **Site Class D**, which corresponds to a "Stiff Soil" Profile, in accordance with the 2019 California Building Code (2019 CBC), the Los Angeles Building Code (2020), and ASCE 7-16.

Site class information and site coordinates were input into the U.S. Seismic Design Map web resource (<https://seismicmaps.org>) to calculate the ground motions associated with the risk-targeted maximum considered earthquake ( $MCE_R$ ). The seismic design parameters are provided in the table below:

**2020 LABC/2019 CBC Seismic Design Parameters (Site Class D)**

| Site Location (Latitude, Longitude): (33.9576 N, 118.2745 W) |                           |   |                  |                                 |
|--|---------------------------|---|------------------|---------------------------------|
| Spectral Period, T (Seconds)                                 | $MCE_R$ Ground Motion (g) | Site-Modified Spectral Acceleration (g) |                  | Seismic Design Acceleration (g) |
| 0.2  | $S_S = 1.847$             | $F_a = 1.0$                             | $S_{MS} = 1.847$ | $S_{DS} = 1.231$                |
| 1.0  | $S_1 = 0.652$             | $*F_v = 1.7$                            | $S_{M1} = 1.108$ | $S_{D1} = 0.739$                |
| Site Modified Peak Ground Acceleration $PGA_M = 0.872g$      |                           |   |                  |                                 |
| Long Period Transition Period $T_L = 8$ Seconds              |                           |   |                  |                                 |
| Seismic Design Category = D                                  |                           |   |                  |                                 |

\*Per Section 11.4.8 of ASCE 7-16, a Long Period Site Coefficient ( $F_v$ ) of 1.7 may be applied for structures on Site Class D provided the Seismic Response Coefficient  $C_s$  is determined by Eq. (12.8-2) for values of  $T \leq 1.5 T_s$ , and taken as 1.5 times the value computed in accordance with Eq. (12.8-3) for  $T_L \geq T > 1.5 T_s$ , or as 1.5 times the value computed in accordance with Eq. 37.5 (12.8-4) for  $T > T_L$  where:

T = the fundamental period of the building

$T_s = S_{D1}/S_{DS}$

$T_L$  = long-period transition period



Present building codes and construction practices, and the recommendations presented in this report, are intended to minimize structural damage to buildings and prevent loss of life due to a moderate or a major earthquake; they are not intended to completely prevent damage to structures, graded slopes, and natural hillsides. While it may be possible to design structures and graded slopes to withstand strong ground motion, the construction costs associated with such designs are usually prohibitive, and the design restrictions may be severely limiting. Earthquake insurance is often the only economically feasible form of protection for your property against major earthquake damage. Damage to sidewalks, steps, decks, patios, and similar exterior improvements can be expected as these are not normally controlled by the Building Code.

### LABORATORY TESTING

Laboratory tests were conducted on representative soil samples for the purpose of classification and evaluation of pertinent engineering properties. The quantity and selection of tests were based on the geotechnical requirements of the project.

#### CLASSIFICATION

Soils were classified visually according to the Unified Soil Classification System. Unit weight and moisture determinations were performed for each undisturbed sample. Results of density and moisture determinations, together with classifications, are shown on the enclosed Boring Log.

#### LOAD CONSOLIDATION TEST (ASTM:D-2435)

To investigate the vertical displacement response (settlement) of the on-site soils to the anticipated applied pressure from the proposed foundations, consolidation testing was performed on a representative undisturbed sample. Axial stresses were conservatively carried to a maximum of 9,400psf which far exceeds the degree of stress that the soils will likely be subjected to from the structural loads of the proposed development. To expedite consolidation, assess collapse potential, and simulate possible adverse field conditions, water was added at an applied stress of 2,350psf. Compressibility of the soils within the zone of significant stress was investigated and the result considered in our engineering analyses. A graphic plot of the load consolidation curve has been enclosed in this report.

#### DIRECT SHEAR TESTS (ASTM:D-3080)

In order to determine the shear strength of the soils, direct shear tests were performed on undisturbed and remolded samples of the on-site soils. The remolded sample was tested at 90% of the maximum dry density. To simulate possible adverse field conditions, the samples were saturated prior to shearing. Graphic summaries of the test results, including moisture content at the time of shearing, are included in this report.



GRAIN SIZE DISTRIBUTION (ASTM:D-422-63(2002))

To aid in classification, sieve analyses and a hydrometer test were performed on representative samples of the surficial on-site soils. Results of the tests, along with fines percentages, are shown on the enclosed Grain Size Distribution Charts and Boring Log.

ATTERBERG LIMITS (ASTM:D-4318)

To characterize the fine-grained fractions of the on-site soils, the liquid limits, plastic limits, and plasticity indexes, known as the Atterberg Limits, was determined. These values are utilized to correlate with various engineering properties of fine-grained soils. Results from Atterberg Limits testing are shown on the enclosed Boring Log.

MAXIMUM DENSITY/OPTIMUM MOISTURE (ASTM:D-1557)

Maximum dry density/optimum moisture content relationship test was performed on a representative bulk sample of the surficial on-site soils. The test was conducted in accordance with the ASTM:D-1557 laboratory procedure. A graphic summary of the test results is enclosed.

EXPANSION TEST (ASTM:D-4829)

An expansion test was performed on a representative sample of the on-site soils in accordance with ASTM:D-4829 to evaluate its volume change with increasing moisture conditions. The surficial materials exhibited very low expansion potential. The result is provided in the table below:

| Location | Depth (ft.) | Soil Description     | Expansion Index | Expansion Potential |
|----------|-------------|----------------------|-----------------|---------------------|
| B-1      | 0-5         | Sandy Lean CLAY (CL) | 16              | Very Low            |

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on the findings from field exploration, laboratory testing, and engineering analyses, the site is considered suitable for construction of the proposed apartment building from a geotechnical engineering standpoint provided the conclusions and recommendations contained in this report are implemented during design and construction.



The subsurface materials underlying the site consist of native alluvial soils. The alluvium comprises stiff to hard lean clays and silts or medium dense to very dense clayey sands, poorly graded sands, and silty sands. The moisture condition of the soil ranged from damp to moist. No fill materials were identified. No groundwater was encountered during exploration at a depth of 51.5 feet below existing grade. The surficial on-site soils exhibited very low expansion potential.

### SITE PREPARATION

Prior to the start of construction, areas which will be supporting new structures or improvements shall have all existing fill materials, vegetation, and soils disturbed during demolition removed until firm, competent native soils have been exposed. The on-site materials should be excavatable with conventional earth moving equipment. Site preparation for the proposed development will require removal of certain existing structures. Deleterious materials, organics, and all debris generated during preparation should be exported from the site.

Any existing or abandoned utilities located within the footprint of the proposed grading should be removed or relocated as appropriate. All excavations resulting from removal of existing obstructions (e.g., foundations, tree roots) should be backfilled with soil compacted to at least 90% of the maximum dry density as determined by ASTM:D-1557.

If any cesspools or seepage pits are encountered during grading, these underground structures should be backfilled with vibrated gravel or slurry mix to five feet below finish grade. The upper five feet should be backfilled with compacted fill.

It is recommended that the proposed building be supported on conventional foundations bearing on newly compacted fill. For placement of the fill, all materials within the footprint of the building shall be removed and recompacted to a minimum depth of 18 inches below the bottom of the foundations. The fill pad shall extend horizontally a minimum of three feet beyond the edge of the foundations, or a distance equivalent to the thickness of compacted fill placed below the foundations, whichever is greater. All conventional foundations for the structure should bear in the same material.

### FILL PLACEMENT

The on-site soils may be re-used for placement of newly compacted fill. Fill soils should be cleared of organic materials and oversized debris such as concrete/brick pieces and rocks (larger than six inches) before placing as compacted fill. All fill should be placed in horizontal lifts of six to eight inches, moisture conditioned to near optimum moisture content, and compacted to at least 90% of the maximum dry density as determined by ASTM:D-1557. Volume shrinkage of less than 5% is estimated for the on-site soils as a result of compaction. **Imported fill should be tested and approved by the geotechnical engineer or his/her representative** and should have an expansion index (EI) less than 20.

**All exposed excavated bottoms should be observed by a geotechnical engineer or his/her representative prior to placement of fill.** Following observation of the excavation bottoms, the exposed surfaces should be scarified to a depth of at least eight inches, moisture-conditioned to near optimum moisture, and recompacted to at least 90% of the maximum dry density as determined by ASTM:D-1557.



If soft or loose soil conditions are encountered at any excavation bottom, deeper excavations shall be performed until a firm bottom is reached.

**The placement of compacted fill is to be performed under the observation and testing of a representative of this office to confirm that the required degree of compaction has been obtained.** Where compaction is less than specified, additional compaction effort should be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.

## FOUNDATION DESIGN

### Type of Foundation

The proposed building may be supported on conventional foundations bearing on newly compacted fill. It is recommended that all continuous and isolated footings be embedded at least 24 inches below lowest adjacent grade. If any soft or loose soils are exposed at the bottom of the excavations, the soils shall be properly compacted or penetrated by the proposed foundations. Continuous and isolated footings should be designed with a minimum width of 16 inches and 24 inches, respectively. The minimum reinforcement in continuous footings should consist of four No. 4 bars: two placed about four inches from the top and two placed about four inches from the bottom. Reinforcement for isolated footings should be designed by the project structural engineer.

### Soil Bearing Pressures

Conventional foundations founded on compacted fill may be designed for an allowable soil bearing pressure of 4,000psf. A factor of safety of 3 was used to determine the allowable bearing pressures. The bearing pressures indicated are for the total of dead and frequently applied live loads and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces.

### Settlement

The settlement of a structure will depend on the actual footing dimensions and the imposed vertical loads. Based on the allowable soil bearing pressures presented above, the total static settlement of the recommended conventional foundations bearing in newly compacted fill is not expected to exceed 0.50 inch. Differential settlement is not expected to exceed 0.25 inch in a 30-foot span. The total and differential seismically induced settlements for the 475-year design event were calculated to be 0.66 and 0.44 inches, respectively. The cumulative effects of static and seismic loading may yield a total settlement of 1.2 inches and differential settlement of 0.7 inches. As a result, the overall anticipated settlements are considered acceptable for the recommended conventional foundations.



### SLABS-ON-GRADE

Concrete floor slabs-on-grade thickness and reinforcement should reflect the anticipated use of the slabs and be designed by the structural engineer. Concrete floor slabs-on-grade should be a minimum of four inches (full) thick with minimum reinforcement consisting of No. 4 deformed bars spaced a maximum of 16 inches each way. Concrete slabs-on-grade should be underlain by four inches of ½ inch or larger clean aggregate base. In areas where floor coverings or equipment that are sensitive to moisture are contemplated a 10-mil moisture barrier membrane (e.g. Visqueen) should be placed on the granular base in direct contact with the concrete slab. Cracking of reinforced concrete is a relatively common occurrence. Some cracking of reinforced concrete, including slabs, can be anticipated. Irregularities in new slabs are also common. If cracking of slabs cannot be tolerated, heavily reinforced structural slabs are an option.

The recommendations presented above are intended to reduce the potential for random cracking to which concrete flatwork is often prone. Judicious spacing of crack control joints has proven effective in further reducing random cracking. A structural engineer may recommend the desirable spacing. Usually crack control joints are placed 12 to 15 feet apart in each direction. Factors influencing cracking of concrete flatwork, (other than expansion, settlement, and creep of soils), and which should be avoided, include: poor-quality concrete, excessive time passing between the mixing and placement of the concrete (concrete should be rejected if this time interval exceeds two hours), temperature, and wind conditions at the time of placement, curing, and workmanship. Concrete should be maintained in a moist condition (curing) for at least the first seven days after placement. During hot weather, proper attention should be given to the ingredients, production methods, handling, placement, protection, and curing to prevent excessive concrete temperature or water evaporation. In hot weather and windy conditions, water evaporates more rapidly from the surface of the concrete flatwork. This requires more frequent moistening of the concrete during the curing period or the use of a protective chemical film to prevent evaporation.

### LATERAL RESISTANCE

An allowable lateral bearing of 300psf per foot of depth may be assumed up to a maximum of 4,500psf. A coefficient of friction between soil and concrete of 0.4 may be used.

### RETAINING WALLS

There are no retaining walls proposed. Backfill for retaining walls, if any, should consist of granular, free-draining material. Cantilevered retaining walls should be designed to resist an active pressure of 30pcf equivalent fluid pressure (EFP). Restrained walls should be designed for an earth pressure of 45pcf EFP. Walls subject to surcharge loads should be designed to include the additional lateral pressure. Walls should have adequate drainage to prevent build-up of hydrostatic pressure.



ON-SITE INFILTRATION FACILITIES

The site soil consists primarily of alluvium comprising lean clays, silts, clayey sands, poorly graded sands, and silty sands. These soils are potentially collapsible or expansive and are unsuitable for on-site infiltration of stormwater. **We recommend that capture and reuse be selected as the method of stormwater management for this project.**

PAVEMENT SECTIONS

New pavement sections are anticipated to be constructed as part of the proposed development. The pavement often consists of permeable sections which may comprise pervious concrete, porous asphalt or concrete pavers as the surface layer. These designs are intended to collect incidental rainfall, prevent ponding, and usually drain to the street; they are not intended to collect significant stormwater discharge. As an alternative, the pavement may comprise flexible (asphalt cement) or rigid (Portland cement) concrete sections. For areas where new paving is to be placed, the subgrade should be scarified to a depth of 12 inches, moistened as required to near optimum moisture content, and recompact to 90% of the maximum dry density as determined by ASTM:D-1557. The client should be aware that removal of all existing fill in the area of new paving is not required; however, pavement constructed in this manner might have a shorter design life and increased maintenance costs.

The following pavement design sections are based on an assumed "R" Value of 30. Once site grading has begun, an "R" Value should be obtained by laboratory testing to confirm the properties of the subgrade soils prior to placing pavement. Traffic loading is anticipated to be primarily light vehicles. The Traffic Indices used for the pavement design sections provided below are estimates and should be verified by the project civil engineer.

| PAVEMENT DESIGN SECTIONS                          |  |                                   |
|---|--|-----------------------------------|
| Vehicular Service<br>Estimated Traffic Index (TI) | Asphalt Concrete Thickness<br>(Inches) | Base Course Thickness<br>(Inches) |
| Parking Lot, Driveways<br>(TI = 4)                | 3                                      | 4                                 |

Where rigid concrete paving will be implemented, it is recommended that the concrete be at least four inches thick underlain by a minimum of four inches of compacted base material. This rigid concrete pavement section is based on a minimum 28-day Modulus of Rupture of 550psi and a compressive strength of 3,000psi. The third point method of testing beams should be used to evaluate Modulus of Rupture. The modulus of subgrade reaction may be set at 125 pounds per square inch per inch. Transverse expansion/contraction joints should not be spaced more than ten feet and should be cut to a depth of one-quarter the thickness of the slab.



Base materials which underlie flexible or rigid pavements should be compacted to a minimum of 95% of the maximum dry density as determined by California 216-F (Cal Impact). Base materials shall conform to requirements for Crushed Miscellaneous Base (CMB) or equivalent and should be placed in accordance with the requirements of the Standard Specifications for Public Works Construction (SSPWC, latest edition). Asphaltic materials should conform to Section 203-1, "Paving Asphalt," of the SSPWC and should be placed in accordance with Section 302-5, "Asphalt Concrete Pavement," of the SSPWC.

The performance of pavement is highly dependent upon providing positive surface drainage away from the edges. Ponding water on or adjacent to pavement can result in saturation of the subgrade materials and subsequent pavement distress. If planter islands are planned, the perimeter curb should extend a minimum of 12 inches below the bottom of the base course.

#### CONSTRUCTION CUTS

Construction cuts up to five feet high may be excavated vertically for their entire length and height provided they do not undermine adjacent buildings or property line; otherwise, the construction cuts will need to be excavated using the 'A, B, C' slot-cutting method. If the slot-cutting method is used, the cut should be opened at a gradient of 1:1 first, then each slot opened, and the removed soils replaced as engineered compacted fill before the subsequent slot is opened. The slots should not exceed 8 feet in width and 12 feet in height. If the construction cuts are to remain open for more than two weeks or if rain is expected while they are open, they should be covered by a plastic membrane kept in place by holding blocks or driven re-bars at the top and bottom of the membrane. No equipment or personnel should stand closer than ten feet from the top of the temporary cut. **A Deputy Grading inspector from this office should examine the construction cuts periodically to verify performance.** All construction cuts should comply with the State of California Construction Safety Orders (CAL/OSHA).

#### EXCAVATION OBSERVATIONS

**The bottoms of excavations are to be examined and approved by the geotechnical engineer or his/her representative before fill is placed. All footing excavations should be observed by a representative of this office and the City Inspector prior to placement of steel or concrete to confirm the bearing materials meet the requirements set by this report.** Footing excavations should be kept moist, and concrete should be placed as soon as possible after excavations are completed, observed, and approved by a representative of this office and the City Inspector.

#### BACKFILL

All backfill of walls, footings, or trenches should be compacted to 90% of the maximum dry density as determined by ASTM:D-1557 **and is to be tested by the geotechnical engineer or his/her representative.**



## DRAINAGE

Adequate drainage is essential to the performance of the project. Saturation of soils can cause a reduction in shear strength and increase in compressibility, resulting in a change in the designed engineering properties of the soils. Proper site drainage should be continuously maintained and conducted away from any structures to prevent ponding and to reduce infiltration of water into the bearing soils.

All pad and roof drainage should be collected and transferred to an adjacent street/alleyway or an approved area in non-erosive drainage devices. Drainage should not be allowed to descend upon any slope in a concentrated manner. The installation of roof gutters and downspouts which deposit water into a buried drain system should be installed instead of discharging surface water onto planter areas adjacent to structures.

We recommend all drainage adjacent to footings be conducted away from structures by a minimum 3-foot-wide apron measured perpendicular to the face of the wall and sloped at a minimum 2% gradient into an approved non-erosive device. Alternatively, we recommend a minimum 5% slope away from the face of the building wall for a minimum horizontal distance of ten feet (where space permits).

Where new planters or landscaped areas will be placed immediately adjacent to the buildings, provisions for drainage should include bottom impermeable liners, catch basins, or area drains to minimize infiltration into the subgrade soils.

## REVIEW

The geotechnical engineer shall review and sign all applicable plans and specifications.

## REGULATORY AGENCY REVIEW AND ADDITIONAL CONSULTING

All geotechnical and/or engineering geologic aspects of the proposed development are subject to review and approval by the authority having jurisdiction. The government reviewing agency may approve or deny any portion of the proposed development which may require additional geotechnical services by this office. Additional geotechnical services may include review responses, supplemental letters, plan reviews, construction/site observations, meetings, etc. The fees for generating additional reports, letters, exploration, analyses, etc. will be billed on a time and material basis.



### COMMENTS

The conclusions and recommendations presented in this report are based on research, site observations, and limited subsurface information. The conclusions and recommendations presented are based on the supposition that subsurface conditions do not vary significantly from those indicated. Although no significant variations in subsurface conditions are anticipated, the possibility of significant variations cannot be ruled out. If such conditions are encountered, our office should be contacted immediately to determine if the design recommendations contained in this report need to be modified.

This report was prepared for the exclusive use of General Investments LA, LLC and their design consultants for the specific project outlined herein. This report may not be suitable for use by other parties or other uses. This report is subject to review by regulatory agencies and these agencies may require their approval before the project can proceed. No guarantee that the regulatory public agency or agencies will approve the project is intended, expressed or implied.

One of the purposes of this report is to provide the client with advice regarding geotechnical conditions at the site. It is important to recognize that other consultants could arrive at different conclusions and recommendations. No warranties of future site performance are intended, expressed or implied.





**FIGURE 1**

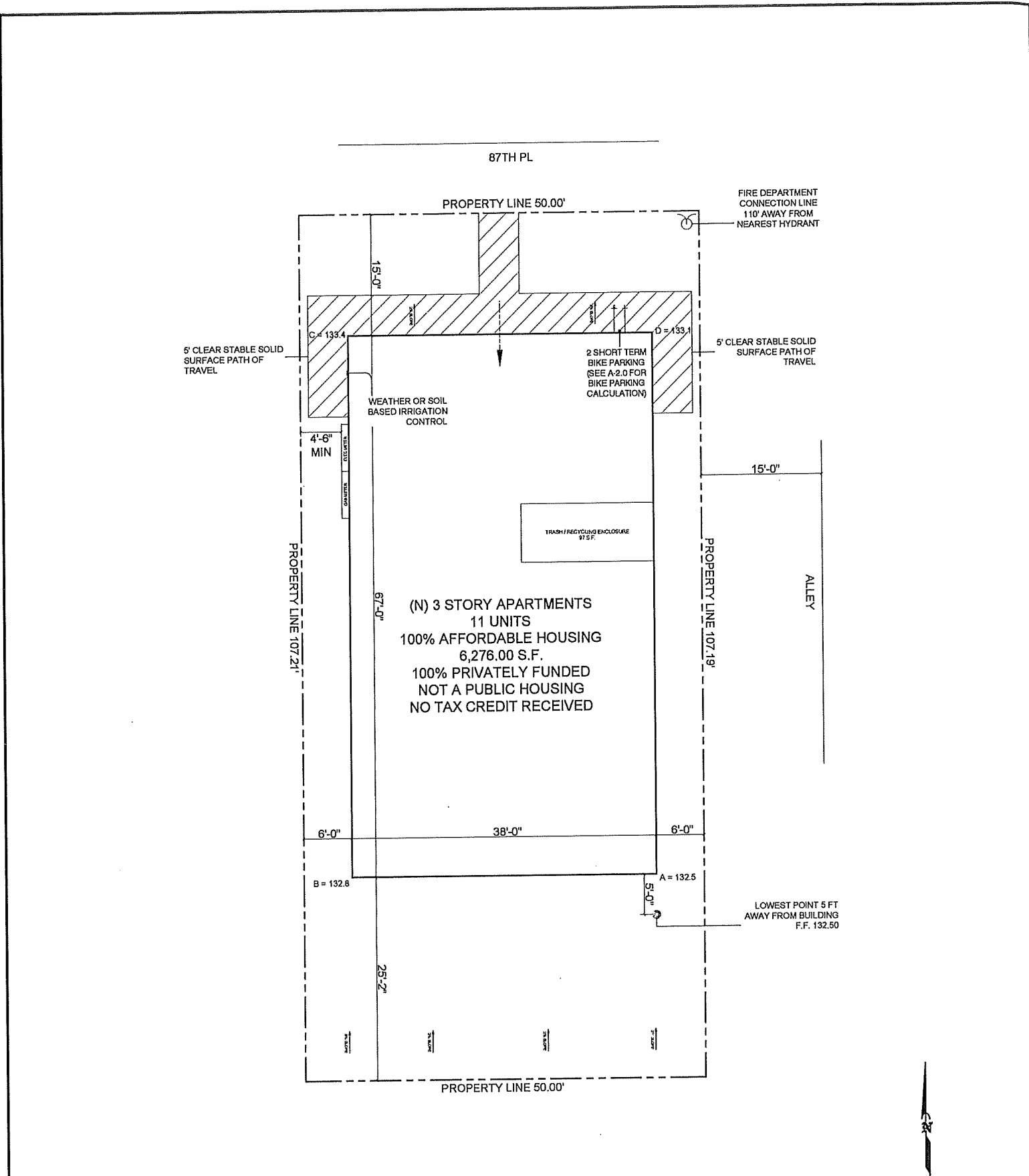
|             |            |
|-------------|------------|
| PROJECT NO. | 33-6471-00 |
| DATE        | 4-2023     |
| PREPARED BY | AM         |
| APPROVED BY | MBS        |

# LOCATION MAP

## 116-120 W. 87th Pl., Los Angeles



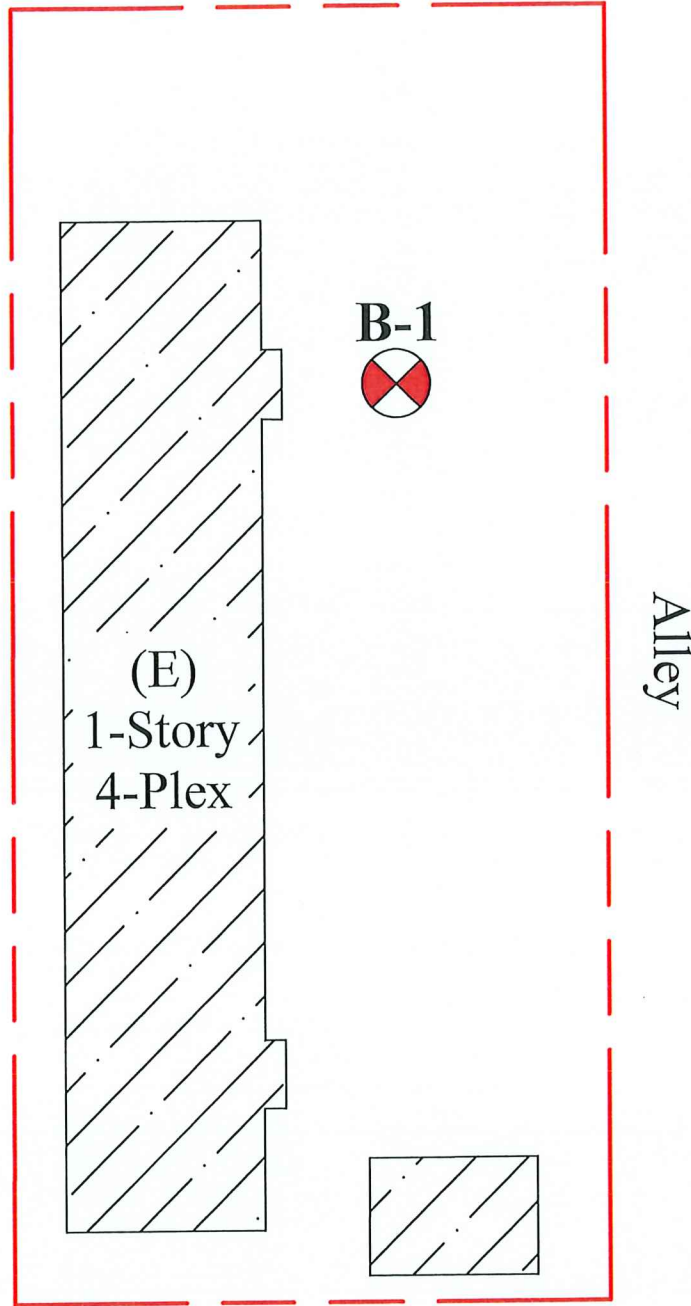
**AGI. GEOTECHNICAL, INC.**  
 Engineering Geology • Geotechnical Engineering  
 11655 Sherman Way, Ste. A • Van Nuys, CA 91409  
 (818) 785-9344 • Fax (818) 785-6251



Scale 1" = 16'  
**FIGURE 2**

|             |            |
|-------------|------------|
| PROJECT NO. | 33-6471-00 |
| DATE        | 06-2023    |
| PREPARED BY | WFB        |
| APPROVED BY | MBS        |

W. 87th Place



**EXPLANATION**

**B-1** Approximate Location  
of Exploratory Boring

Scale 1" = 16'  
**FIGURE 3**



**A.G.I. GEOTECHNICAL, INC.**

Engineering Geology • Geotechnical Engineering

16555 Sherman Way, Ste. A • Van Nuys, CA 91406  
(818) 785-5244 • Fax (818) 785-6251


**PLOT PLAN**


116-120 W. 87th Place, Los Angeles



|             |            |
|-------------|------------|
| PROJECT NO. | 33-6471-00 |
| DATE        | 05-2023    |
| PREPARED BY | WFB        |
| APPROVED BY | MBS        |

# BORING LOGS

## LEGEND

 Ring Sample, or Bulk Sample

 Standard Penetration Test (SPT)

  
 Ground Water Level

| SOIL SIZE             |            |
|-----------------------|------------|
| COMPONENT             | SIZE RANGE |
| Boulders              | Above 12"  |
| Cobbles               | 3"-12"     |
| Gravel                | #4 - 3"    |
| coarse                | 3/4" - 3"  |
| fine                  | #4 - 3/4"  |
| Sand                  | #200-#4    |
| coarse                | #10-#4     |
| medium                | #40-#10    |
| fine                  | #200-#40   |
| Fines (Silt or Clays) | Below #200 |

| PLASTICITY OF FINE GRAINED SOILS |                         |
|----------------------------------|-------------------------|
| PLASTICITY INDEX                 | VOLUME CHANGE POTENTIAL |
| 0-15                             | Probably Low            |
| 15-30                            | Probably Moderate       |
| 30 or more                       | Probably High           |

| WATER CONTENT                          |  |
|--|--|
| Dry: No feel of moisture               |  |
| Damp: Much less than normal moisture   |  |
| Moist: Normal moisture                 |  |
| Wet: Much greater than normal moisture |  |
| Saturated: At or near saturation       |  |

| RELATIVE DENSITY |                |
|------------------|----------------|
| SANDS & GRAVELS  | BLOWS PER FOOT |
| Very loose       | 0-4            |
| Loose            | 4-10           |
| Medium dense     | 10-30          |
| Dense            | 30-50          |
| Very dense       | Over 50        |

| CONSISTENCY   |                |
|---------------|----------------|
| CLAYS & SILTS | BLOWS PER FOOT |
| Very soft     | 0-2            |
| Soft          | 2-4            |
| Firm          | 4-8            |
| Stiff         | 8-15           |
| Very stiff    | 15-30          |
| Hard          | Over 30        |

|  | GROUP SYMBOLS                            | DESCRIPTIONS  | DIVISIONS   |   |
|--|--|---|---|---|
| COARSE-GRAINED SOILS (Less than 50% Fines) | GW                                       | Well-graded gravels or gravel-sand mixtures, less than 5% fines                                   | GRAVELS<br>More than half of coarse fraction is larger than No. 4 sieve size  |   |
|  | GP                                       | Poorly-graded gravels or gravel-sand mixtures, less than 5% fines                                 |   |   |
|  | GM                                       | Silty gravels, gravel-sand silt mixtures, more than 12% fines                                     |   |   |
|  | GC                                       | Clayey gravels, gravel-sand-clay mixtures, more than 12% fines                                    |   |   |
|  | FINE-GRAINED SOILS (More than 50% Fines) | SW  | Well-graded sands or gravelly sands, less than 5% fines                       | SANDS<br>More than half of coarse fraction is smaller than No. 4 sieve size |
|  |  | SP  | Poorly-graded sands or gravelly sands, less than 5% fines                     |   |
|  |  | SM  | Silty sands, sand-silt mixtures, more than 12% fines                          |   |
|  |  | SC  | Clayey sands, sand-clay mixtures, more than 12% fines                         |   |
| FINE-GRAINED SOILS (More than 50% Fines)   | ML                                       | Inorganic silt, very fine sands, rock flour, silty or clayey fine sands                           | SILTS AND CLAYS<br>Liquid limit less than 50                                  |   |
|  | CL                                       | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |   |   |
|  | OL                                       | Organic silts or organic silt-clays of low plasticity   |   |   |
|  | FINE-GRAINED SOILS (More than 50% Fines) | MH  | Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts | SILTS AND CLAYS<br>Liquid limit less than 50                                |
|  |  | CH  | Inorganic clays of high plasticity, fat clays                                 |   |
|  |  | OH  | Organic clays of medium to high plasticity                                    |   |
|  | PT                                       | Peat, mulch, and other highly organic soils   | HIGHLY ORGANIC SOILS  |   |





A.G.I. GEOTECHNICAL, INC.

A.G.I. Geotechnical, Inc. 16555 Sherman Way, Unit A Van Nuys, California 91406 Telephone: (818) 785-5244 Fax: (818) 785-6251

CLIENT: General Investments LA, LLC PROJECT NAME: Proposed 3-Story Apartment Building On-Grade

PROJECT NUMBER: 33-6471-00 PROJECT LOCATION: 116-120 W. 87th Place, Los Angeles

DATE STARTED: 04/25/2023 COMPLETED: 04/25/2023 GROUND ELEVATION: N/A BORING DIAMETER: 8"

EXCAVATION METHOD: 8" Hollow Stem Auger GROUND WATER LEVELS: Not Encountered

DRILLING CONTRACTOR: Choice Drilling SAMPLING METHOD: Autohammer, 140 lb., 30" Drop

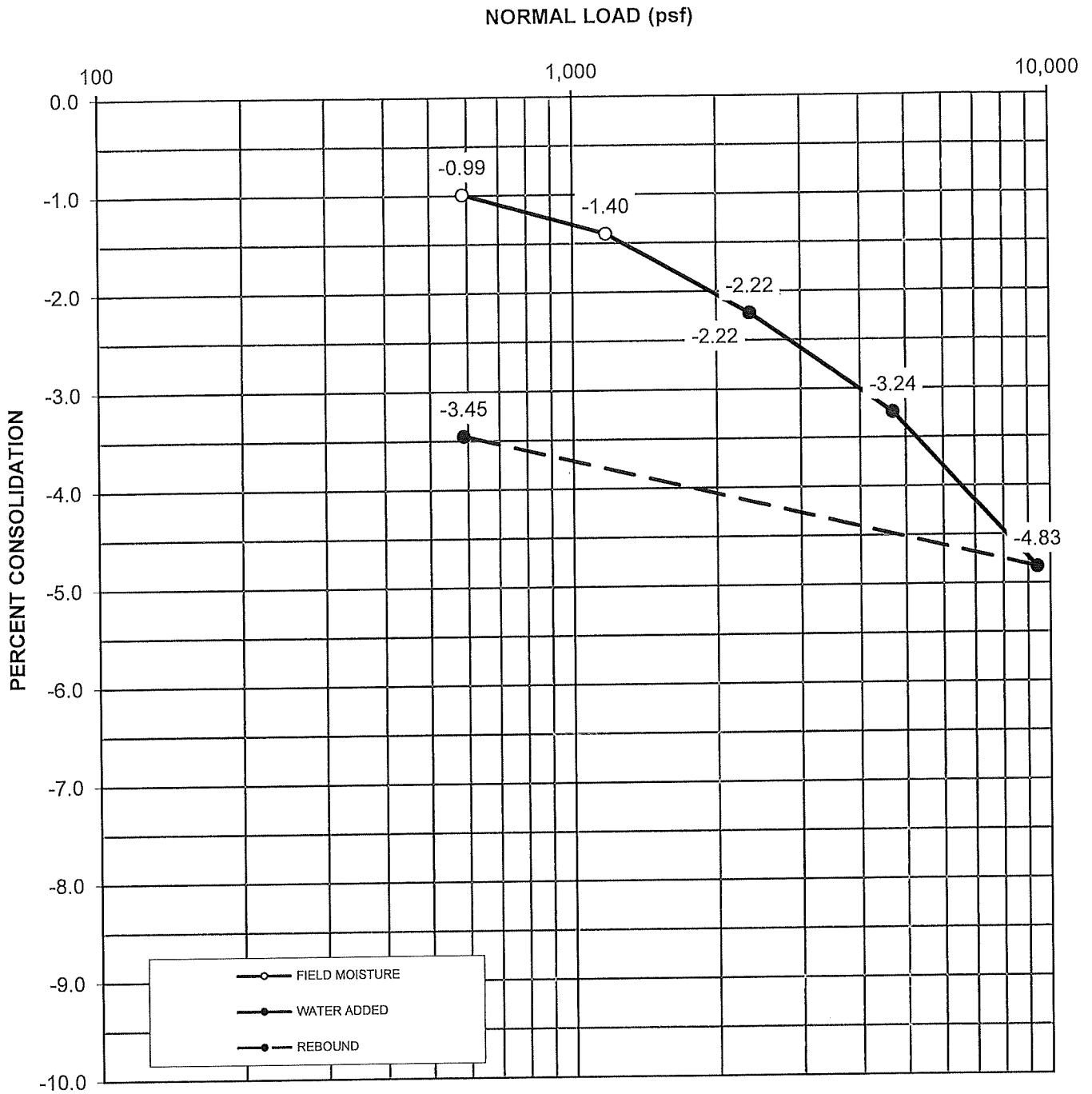
LOGGED BY: CWL CHECKED BY: WFB

| DEPTH (ft)  | DRIVE SAMPLE | (N VALUE) | BULK SAMPLE | MOISTURE CONTENT (%) | DRY UNIT WT. (pcf) | Wet UNIT WT. (pcf) | SAT. MOISTURE CONTENT (%) | ATTERBERG LIMITS |               |                  | MATERIAL DESCRIPTION  | <200 | D 50 | Classification |
|---|--------------|-----------|-------------|----------------------|--------------------|--------------------|---------------------------|------------------|---------------|------------------|---|------|------|----------------|
|   |              |           |             |                      |                    |                    |                           | LIQUID LIMIT     | PLASTIC LIMIT | PLASTICITY INDEX |   |      |      |                |
| 35  |              | 11/13/22  |             | 10.8                 |                    |                    |                           |                  |               |                  |   |      |      | SM             |
| 40  |              | 10/18/21  |             | 8.6                  |                    |                    |                           |                  |               |                  |   |      |      |                |
| 45  |              | 6/10/14   |             | 22.7                 |                    |                    |                           | 30               | 25            | 5                | Sandy SILT<br>(Brown to light brown, moist, very stiff to hard) | 63   |      | ML             |
| 50  |              | 9/16/24   |             | 17.9                 |                    |                    |                           |                  |               |                  |   |      |      |                |
| 55  |              |           |             |                      |                    |                    |                           |                  |               |                  |   |      |      |                |
| 60  |              |           |             |                      |                    |                    |                           |                  |               |                  |   |      |      |                |
| 65  |              |           |             |                      |                    |                    |                           |                  |               |                  |   |      |      |                |
| Total Depth: 51.5'<br>Groundwater Not Encountered |              |           |             |                      |                    |                    |                           |                  |               |                  |   |      |      |                |

# LABORATORY TEST RESULTS



A.G.I. GEOTECHNICAL, INC.



PROJECT NO. 33-6471-00

BORING NO. B-1

DEPTH (FT) 7.5

REPRESENTATIVE FOR Alluvium  
 SOIL TYPE AND DESCRIPTION Sandy Lean CLAY (CL)

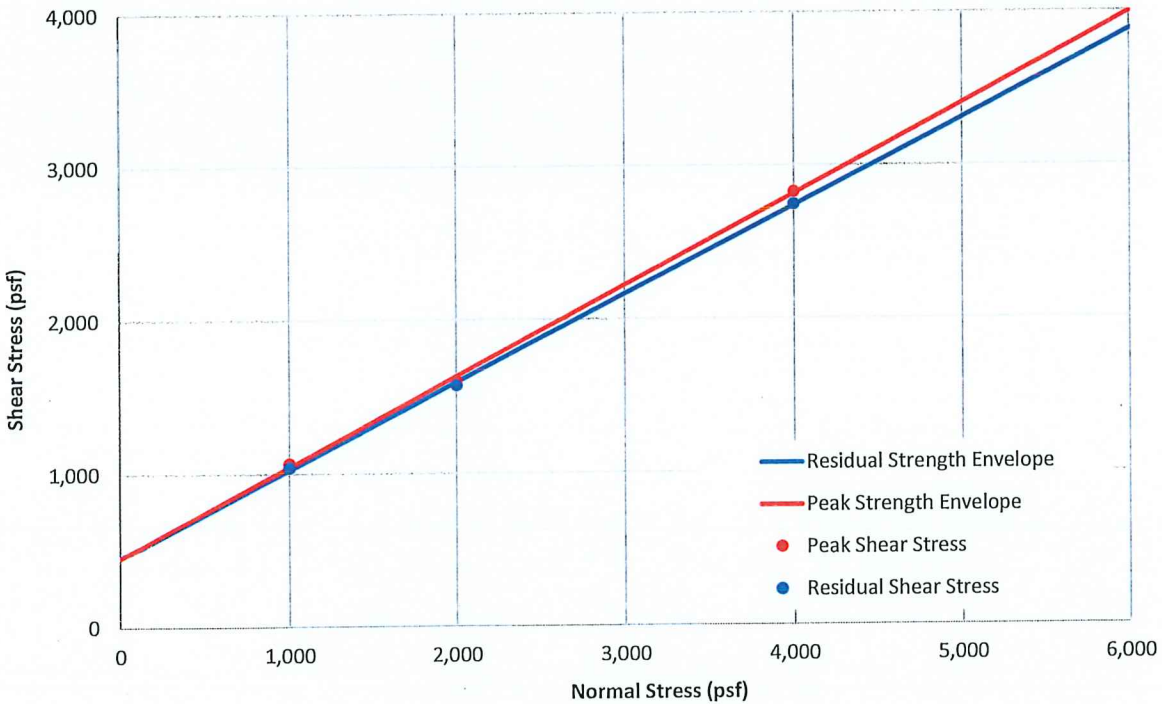
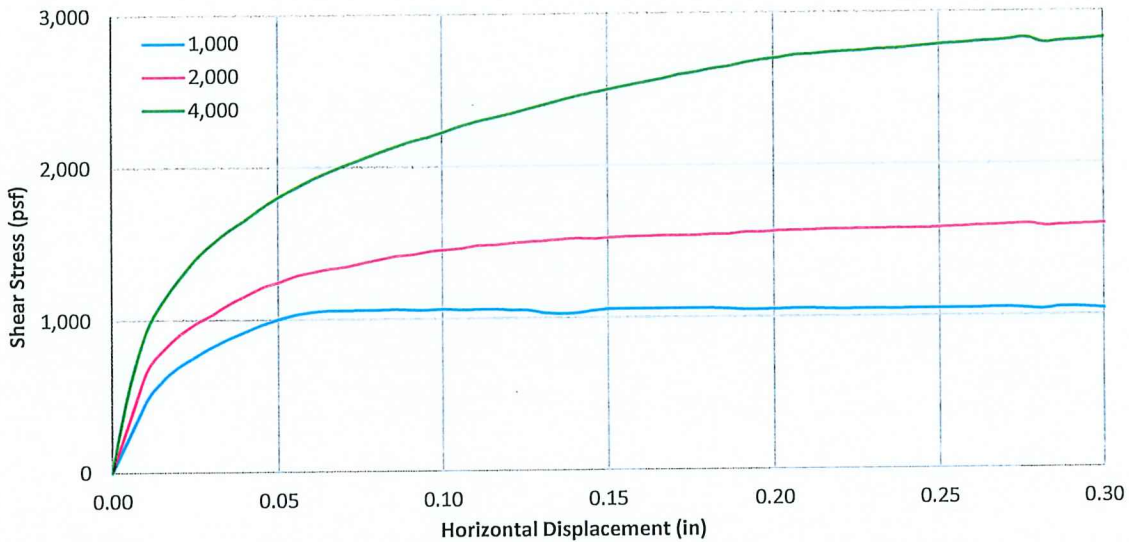
HYDROCONSOLIDATION (%) 0.00



A.G.I. GEOTECHNICAL, INC.

## REMOLDED SATURATED DIRECT SHEAR TEST (ASTM:D-3080)

|                 |                      |                 |                   |                  |                                      |                                      |
|-----------------|----------------------|-----------------|-------------------|------------------|--------------------------------------|--------------------------------------|
| Boring:         | B-1                  | <u>Specimen</u> | <u>Load (psf)</u> | <u>Water (%)</u> | <u>Dry <math>\gamma</math> (pcf)</u> | <u>Wet <math>\gamma</math> (pcf)</u> |
| Depth (ft):     | 0-5                  | 1               | 1,000             | 28.2             | 93.7                                 | 120.1                                |
| Geology:        | Alluvium             | 2               | 2,000             | 29.7             | 93.1                                 | 120.8                                |
| Classification: | Sandy Lean CLAY (CL) | 3               | 4,000             | 27.0             | 92.9                                 | 118.0                                |



| Normal Stress (psf) | Peak Shear Stress (psf) | Residual Shear Stress (psf) | Peak Cohesion (psf)     | Peak Friction (deg)     |
|---------------------|-------------------------|-----------------------------|-------------------------|-------------------------|
| 1,000               | 1,065                   | 1,039                       | 454                     | 30.5                    |
| 2,000               | 1,602                   | 1,573                       | Residual Cohesion (psf) | Residual Friction (deg) |
| 4,000               | 2,824                   | 2,744                       |                         |                         |



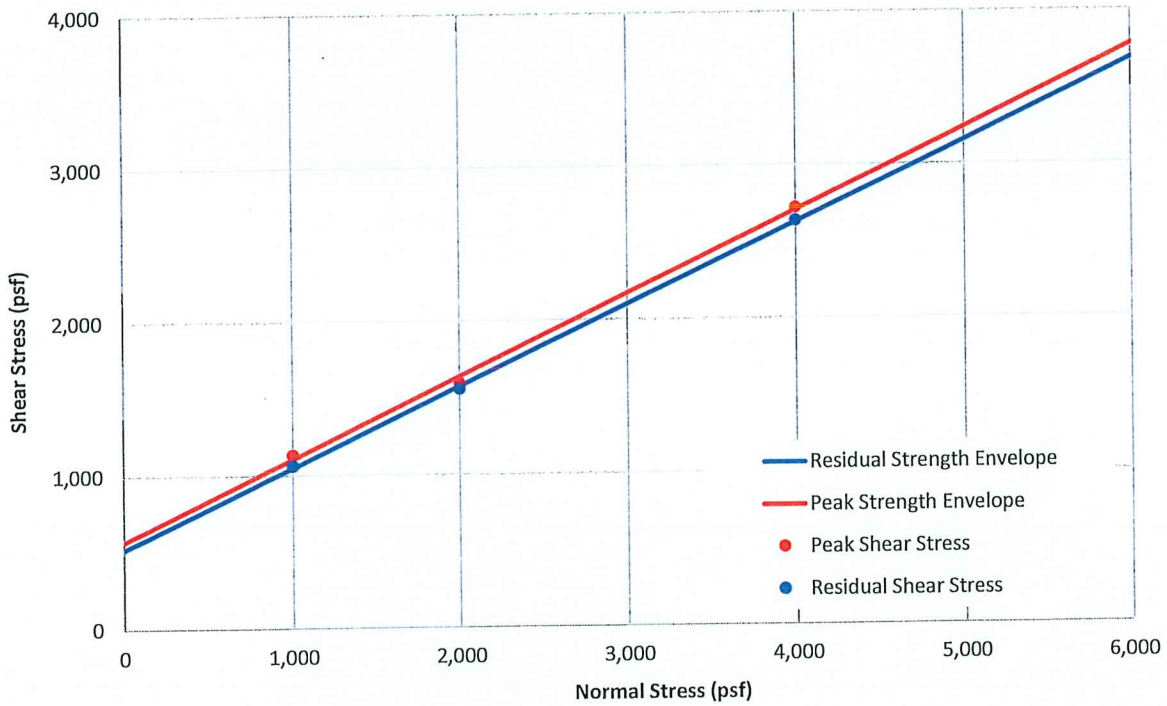
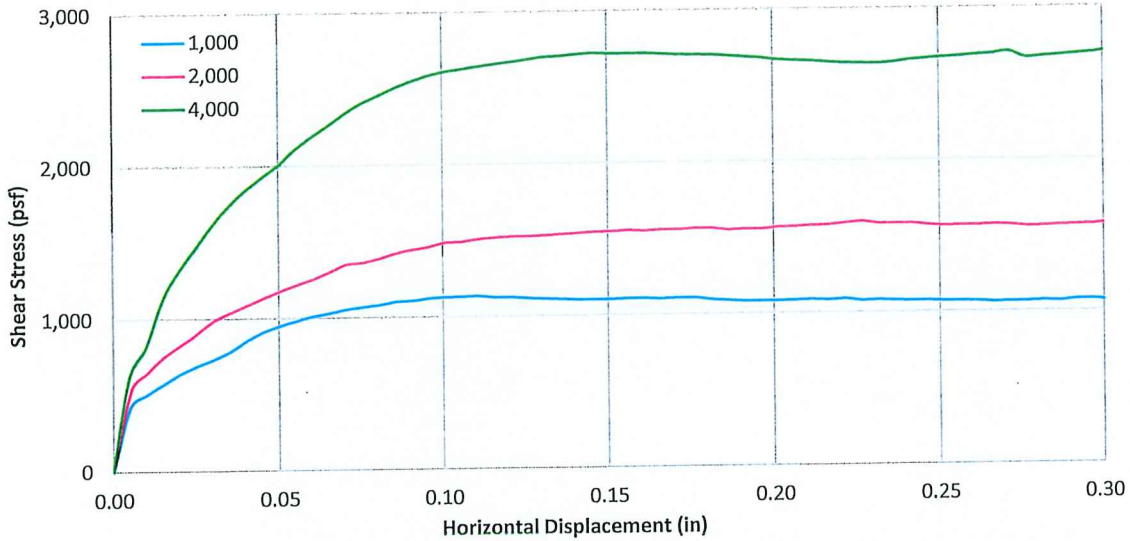
AGI GEOTECHNICAL, INC.

16555 Sherman Way, Van Nuys, California, Ph (818) 785-5244, Fax (818) 785-6251

|            |                                    |       |          |
|------------|------------------------------------|-------|----------|
| Proj. No.: | 33-6471-00                         | Date: | May 2023 |
| Project:   | 116-120 W. 87th Place, Los Angeles |       |          |
| Calc. By:  | WFB                                |       |          |

## UNDISTURBED SATURATED DIRECT SHEAR TEST (ASTM:D-3080)

|                                      |                 |                   |                  |                                      |                                      |
|--------------------------------------|-----------------|-------------------|------------------|--------------------------------------|--------------------------------------|
| Boring: B-1                          | <u>Specimen</u> | <u>Load (psf)</u> | <u>Water (%)</u> | <u>Dry <math>\gamma</math> (pcf)</u> | <u>Wet <math>\gamma</math> (pcf)</u> |
| Depth (ft): 2.5                      | 1               | 1,000             | 19.6             | 108.7                                | 130.0                                |
| Geology: Alluvium                    | 2               | 2,000             | 19.1             | 108.4                                | 129.2                                |
| Classification: Sandy Lean CLAY (CL) | 3               | 4,000             | 19.6             | 107.4                                | 128.4                                |



| Normal Stress (psf) | Peak Shear Stress (psf) | Residual Shear Stress (psf) | Peak Cohesion (psf)     | Peak Friction (deg)     |
|---------------------|-------------------------|-----------------------------|-------------------------|-------------------------|
| 1,000               | 1,134                   | 1,062                       | 572                     | 28.1                    |
| 2,000               | 1,596                   | 1,556                       | Residual Cohesion (psf) | Residual Friction (deg) |
| 4,000               | 2,720                   | 2,636                       |                         |                         |



AGI GEOTECHNICAL, INC.

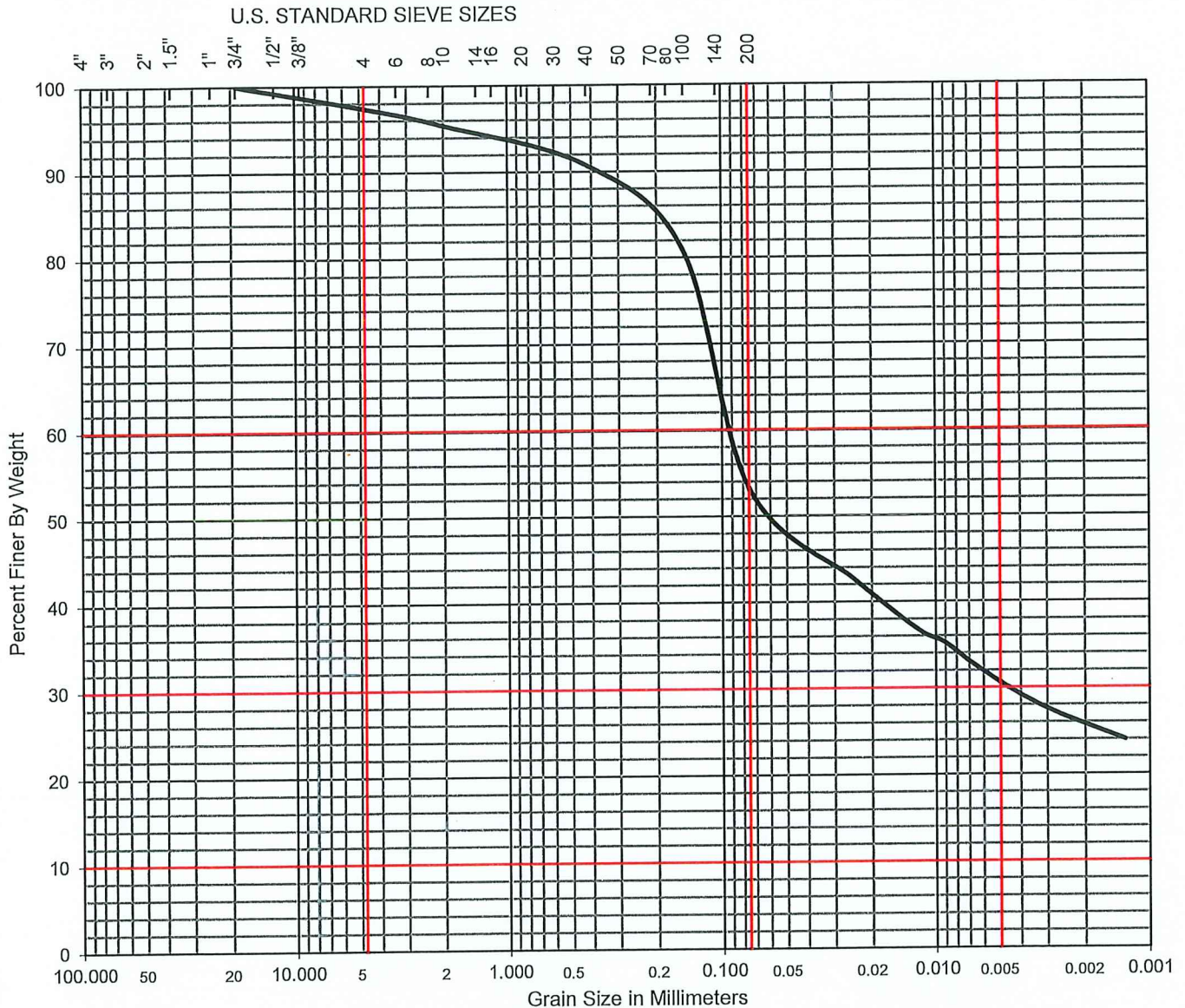
16555 Sherman Way, Van Nuys, California, Ph (818) 785-5244, Fax (818) 785-6251

|   |                |
|---|----------------|
| Proj. No.: 33-6471-00                       | Date: May 2023 |
| Project: 116-120 W. 87th Place, Los Angeles |                |
| Calc. By: WFB                               |                |

# GRAIN SIZE DISTRIBUTION

|                               |                               |   |
|-------------------------------|-------------------------------|---|
| PROJECT NO. <u>33-6471-00</u> | BORING NO. <u>B-1</u>         | DEPTH (feet) <u>0-5</u>                                     |
| Liquid Limit (LL) <u>27</u>   | Plastic Limit (PL) <u>20</u>  | Plasticity Index (PI) <u>7</u>                              |
| Gravel (%) <u>2.6</u>         | Sand (%) <u>44.2</u>          | % Silt & Clay (<#200) <u>53.2</u>                           |
| D <sub>10</sub> (mm) <u>-</u> | D <sub>30</sub> (mm) <u>-</u> | D <sub>60</sub> (mm) <u>-</u> D <sub>50</sub> (mm) <u>-</u> |
| C <sub>u</sub> <u>-</u>       | C <sub>c</sub> <u>-</u>       | % (< 0.005 mm) <u>30</u>                                    |

REPRESENTATIVE FOR Alluvium  
 SOIL TYPE AND DESCRIPTION Sandy Lean CLAY (CL)



|        |      |        |        |      |             |
|--------|------|--------|--------|------|-------------|
| GRAVEL |      | SAND   |        |      | SILT & CLAY |
| Coarse | Fine | Coarse | Medium | Fine |             |



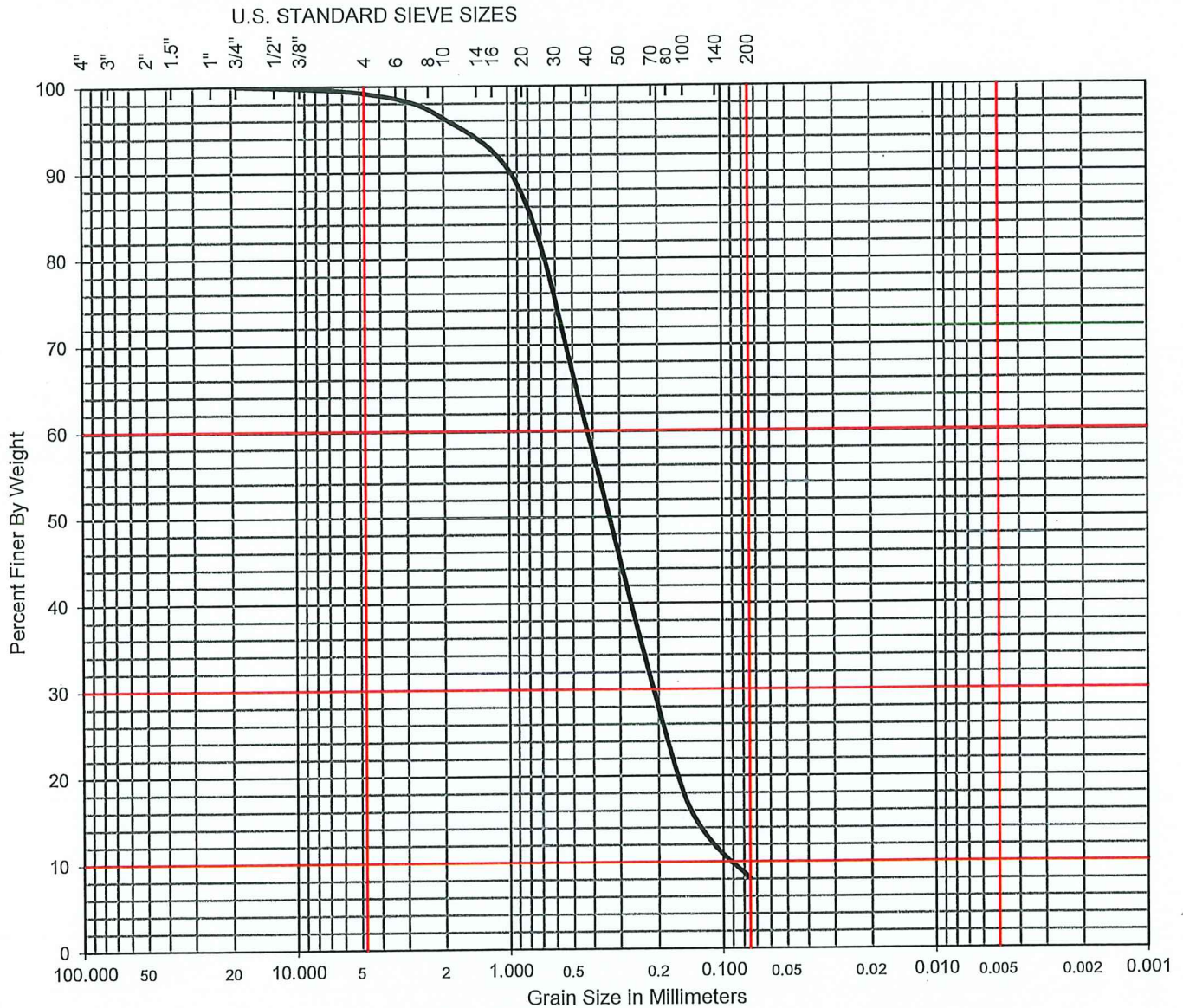
**A.G.I. GEOTECHNICAL, INC.**

Project: 116-120 W. 87th Place  
 Date: May 2023

# GRAIN SIZE DISTRIBUTION

|                                  |                                  |   |
|----------------------------------|----------------------------------|---|
| PROJECT NO. <u>33-6471-00</u>    | BORING NO. <u>B-1</u>            | DEPTH (feet) <u>27.5</u>  |
| Liquid Limit (LL) <u>-</u>       | Plastic Limit (PL) <u>-</u>      | Plasticity Index (PI) <u>-</u>                                    |
| Gravel (%) <u>0.8</u>            | Sand (%) <u>91.1</u>             | % Silt & Clay (<#200) <u>8.1</u>                                  |
| D <sub>10</sub> (mm) <u>0.09</u> | D <sub>30</sub> (mm) <u>0.22</u> | D <sub>60</sub> (mm) <u>0.43</u> D <sub>50</sub> (mm) <u>0.34</u> |
| C <sub>u</sub> <u>4.78</u>       | C <sub>c</sub> <u>1.25</u>       | % (< 0.005 mm) <u>NA</u>  |

REPRESENTATIVE FOR Alluvium  
 SOIL TYPE AND DESCRIPTION Poorly Graded SAND with Silt (SP-SM)



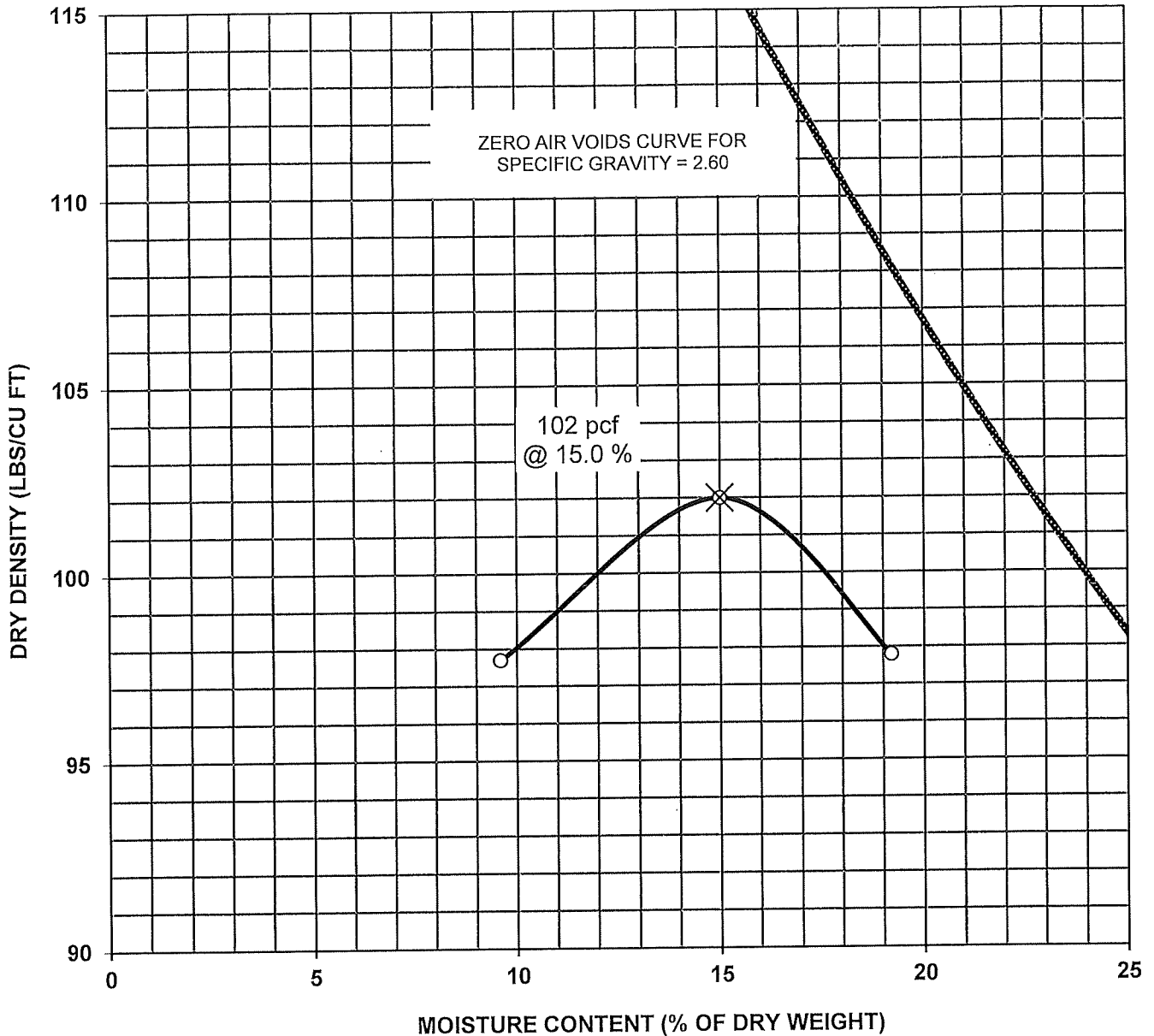
|        |      |        |        |      |             |
|--------|------|--------|--------|------|-------------|
| GRAVEL |      | SAND   |        |      | SILT & CLAY |
| Coarse | Fine | Coarse | Medium | Fine |             |



**A.G.I. GEOTECHNICAL, INC.**

Project: 116-120 W. 87th Place  
 Date: May 2023

# MAXIMUM DRY DENSITY CURVE



PROJECT NO. 33-6471-00

BORING NO. B-1

DEPTH (FT) 0-5

REPRESENTATIVE FOR Alluvium  
 SOIL TYPE AND DESCRIPTION Sandy Lean CLAY (CL); EI=16, Very Low

MAXIMUM DRY DENSITY (LBS/CU FT) 102.0

OPTIMUM MOISTURE CONTENT (% OF DRY WEIGHT) 15.0

METHOD OF COMPACTION  
 ASTM:D-1557



# U.S. SEISMIC DESIGN MAP



A.G.I. GEOTECHNICAL, INC.



# 116 - 120 W. 87th Pl., Los Angeles; 33-6471-00

Latitude, Longitude: 33.9576, -118.2745



|                                |                        |
|--------------------------------|------------------------|
| Date                           | 6/13/2023, 11:33:11 AM |
| Design Code Reference Document | ASCE7-16               |
| Risk Category                  | II                     |
| Site Class                     | D - Stiff Soil         |

| Type            | Value                    | Description   |
|-----------------|--------------------------|---|
| S <sub>S</sub>  | 1.847                    | MCE <sub>R</sub> ground motion. (for 0.2 second period) |
| S <sub>1</sub>  | 0.652                    | MCE <sub>R</sub> ground motion. (for 1.0s period)       |
| S <sub>MS</sub> | 1.847                    | Site-modified spectral acceleration value               |
| S <sub>M1</sub> | null -See Section 11.4.8 | Site-modified spectral acceleration value               |
| S <sub>DS</sub> | 1.231                    | Numeric seismic design value at 0.2 second SA           |
| S <sub>D1</sub> | 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 <sub>a</sub>    | 1                        | Site amplification factor at 0.2 second   |
| F <sub>v</sub>    | null -See Section 11.4.8 | Site amplification factor at 1.0 second   |
| PGA               | 0.793                    | MCE <sub>G</sub> peak ground acceleration   |
| F <sub>PGA</sub>  | 1.1                      | Site amplification factor at PGA  |
| PGA <sub>M</sub>  | 0.872                    | Site modified peak ground acceleration  |
| T <sub>L</sub>    | 8                        | Long-period transition period in seconds  |
| SsRT              | 1.847                    | Probabilistic risk-targeted ground motion. (0.2 second)                                   |
| SsUH              | 2.039                    | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration  |
| SsD               | 2.441                    | Factored deterministic acceleration value. (0.2 second)                                   |
| S1RT              | 0.652                    | Probabilistic risk-targeted ground motion. (1.0 second)                                   |
| S1UH              | 0.722                    | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration. |
| S1D               | 0.82                     | Factored deterministic acceleration value. (1.0 second)                                   |
| PGAd              | 0.986                    | Factored deterministic acceleration value. (Peak Ground Acceleration)                     |
| PGA <sub>UH</sub> | 0.793                    | Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration        |
| C <sub>RS</sub>   | 0.906                    | Mapped value of the risk coefficient at short periods                                     |
| C <sub>R1</sub>   | 0.903                    | Mapped value of the risk coefficient at a period of 1 s                                   |
| C <sub>V</sub>    | 1.469                    | Vertical coefficient  |

U.S. Geological Survey - Earthquake Hazards Program

# Unified Hazard Tool

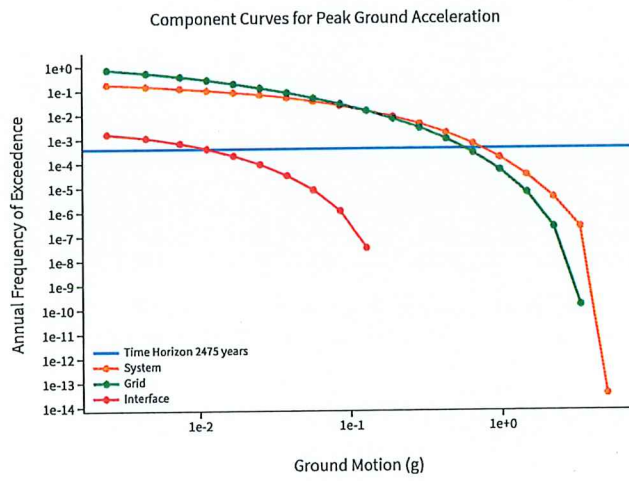
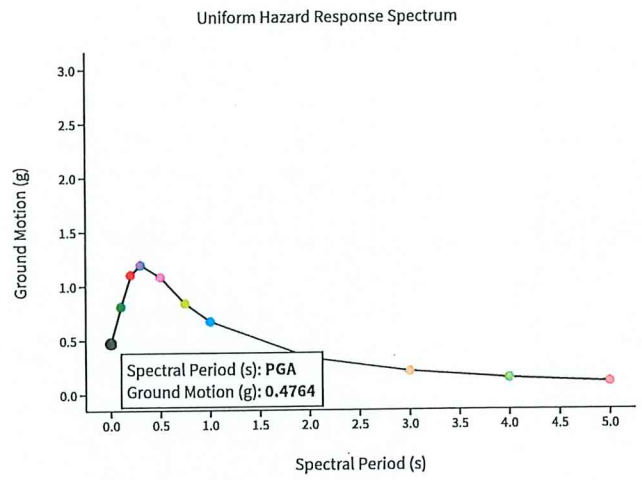
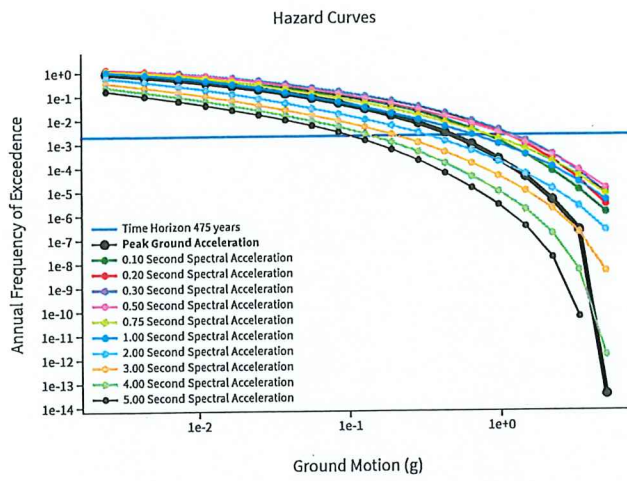
Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

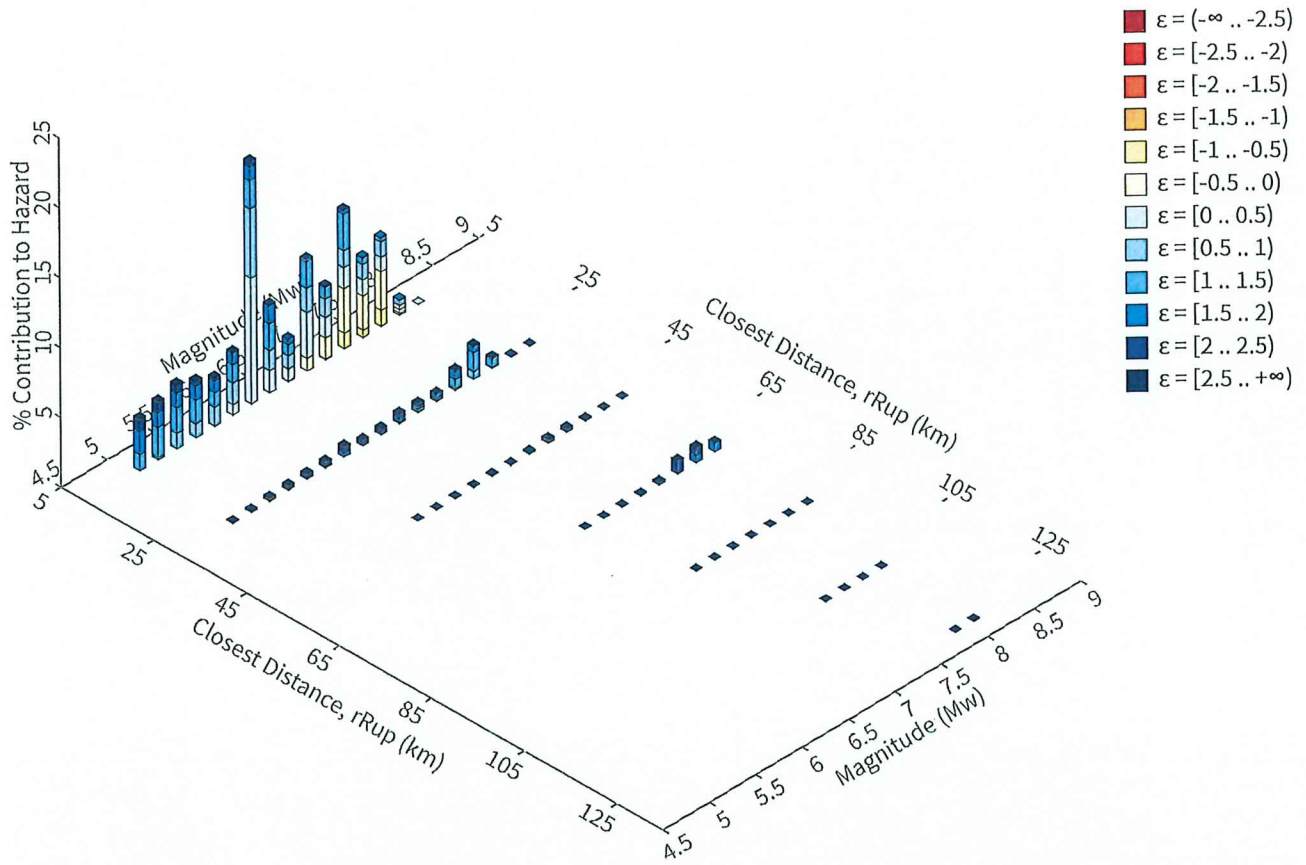
^ Input

|  |  |
|--|--|
| <b>Edition</b><br>Dynamic: Conterminous U.S. 2014 (update...)                            | <b>Spectral Period</b><br>Peak Ground Acceleration   |
| <b>Latitude</b><br>Decimal degrees<br>33.9576  | <b>Time Horizon</b><br>Return period in years<br>475 |
| <b>Longitude</b><br>Decimal degrees, negative values for western longitudes<br>-118.2745 |  |
| <b>Site Class</b><br>259 m/s (Site class D)  |  |

### ^ Hazard Curve



[View Raw Data](#)



## Summary statistics for, Deaggregation: Total

### Deaggregation targets

**Return period:** 475 yrs  
**Exceedance rate:** 0.0021052632 yr<sup>-1</sup>  
**PGA ground motion:** 0.47644708 g

### Recovered targets

**Return period:** 509.06761 yrs  
**Exceedance rate:** 0.0019643756 yr<sup>-1</sup>

### Totals

**Binned:** 100 %  
**Residual:** 0 %  
**Trace:** 0.14 %

### Mean (over all sources)

**m:** 6.66  
**r:** 13.42 km  
**ε<sub>0</sub>:** 0.87 σ

### Mode (largest m-r bin)

**m:** 6.35  
**r:** 7.1 km  
**ε<sub>0</sub>:** 0.64 σ  
**Contribution:** 17.33 %

### Mode (largest m-r-ε<sub>0</sub> bin)

**m:** 6.36  
**r:** 4.74 km  
**ε<sub>0</sub>:** 0.31 σ  
**Contribution:** 8.98 %

### Discretization

**r:** min = 0.0, max = 1000.0, Δ = 20.0 km  
**m:** min = 4.4, max = 9.4, Δ = 0.2  
**ε:** min = -3.0, max = 3.0, Δ = 0.5 σ

### Epsilon keys

**ε0:** [-∞ .. -2.5)  
**ε1:** [-2.5 .. -2.0)  
**ε2:** [-2.0 .. -1.5)  
**ε3:** [-1.5 .. -1.0)  
**ε4:** [-1.0 .. -0.5)  
**ε5:** [-0.5 .. 0.0)  
**ε6:** [0.0 .. 0.5)  
**ε7:** [0.5 .. 1.0)  
**ε8:** [1.0 .. 1.5)  
**ε9:** [1.5 .. 2.0)  
**ε10:** [2.0 .. 2.5)  
**ε11:** [2.5 .. +∞]

### Deaggregation Contributors

| Source Set           | Source                              | Type   | r     | m    | $\epsilon_0$ | lon       | lat      | az     | %     |
|----------------------|-------------------------------------|--------|-------|------|--------------|-----------|----------|--------|-------|
| UC33brAvg_FM31       |                                     | System |       |      |              |           |          |        | 34.14 |
|                      | Newport-Inglewood alt 1 [7]         |        | 4.91  | 6.36 | 0.44         | 118.316°W | 33.933°N | 234.58 | 6.68  |
|                      | Newport-Inglewood alt 1 [6]         |        | 4.39  | 7.31 | -0.13        | 118.306°W | 33.931°N | 225.19 | 6.31  |
|                      | Elysian Park (Upper) [1]            |        | 14.40 | 6.65 | 1.23         | 118.231°W | 34.076°N | 16.91  | 3.21  |
|                      | Compton [2]                         |        | 10.91 | 7.25 | -0.22        | 118.344°W | 33.840°N | 206.25 | 2.74  |
|                      | Puente Hills [4]                    |        | 10.69 | 7.15 | 0.55         | 118.217°W | 34.023°N | 36.23  | 2.48  |
|                      | Palos Verdes [13]                   |        | 18.47 | 7.16 | 1.29         | 118.439°W | 33.863°N | 235.36 | 2.37  |
|                      | San Andreas (Mojave S) [8]          |        | 65.73 | 8.06 | 2.06         | 117.956°W | 34.487°N | 26.37  | 1.29  |
| UC33brAvg_FM32       |                                     | System |       |      |              |           |          |        | 32.60 |
|                      | Newport-Inglewood alt 2 [7]         |        | 4.15  | 6.37 | 0.36         | 118.305°W | 33.933°N | 225.87 | 5.21  |
|                      | Newport-Inglewood alt 2 [6]         |        | 4.15  | 7.30 | -0.14        | 118.305°W | 33.933°N | 225.87 | 5.20  |
|                      | Compton [2]                         |        | 10.91 | 7.32 | -0.24        | 118.344°W | 33.840°N | 206.25 | 3.03  |
|                      | Puente Hills (LA) [1]               |        | 7.14  | 7.16 | 0.26         | 118.236°W | 34.004°N | 34.64  | 2.97  |
|                      | Elysian Park (Upper) [1]            |        | 14.40 | 7.09 | 0.98         | 118.231°W | 34.076°N | 16.91  | 2.73  |
|                      | Palos Verdes [13]                   |        | 18.47 | 7.20 | 1.28         | 118.439°W | 33.863°N | 235.36 | 2.24  |
|                      | Puente Hills (Santa Fe Springs) [1] |        | 12.72 | 7.06 | 0.70         | 118.144°W | 33.926°N | 106.05 | 2.21  |
|                      | San Andreas (Mojave S) [8]          |        | 65.73 | 8.06 | 2.07         | 117.956°W | 34.487°N | 26.37  | 1.29  |
| UC33brAvg_FM32 (opt) |                                     | Grid   |       |      |              |           |          |        | 16.73 |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.32  | 5.70 | 0.93         | 118.275°W | 34.007°N | 0.00   | 2.15  |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.32  | 5.70 | 0.93         | 118.275°W | 34.007°N | 0.00   | 2.15  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 8.03  | 5.69 | 1.04         | 118.275°W | 34.016°N | 0.00   | 1.52  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 8.03  | 5.69 | 1.04         | 118.275°W | 34.016°N | 0.00   | 1.52  |
|                      | PointSourceFinite: -118.275, 34.034 |        | 9.35  | 5.77 | 1.18         | 118.275°W | 34.034°N | 0.00   | 1.08  |
|                      | PointSourceFinite: -118.275, 34.034 |        | 9.35  | 5.77 | 1.18         | 118.275°W | 34.034°N | 0.00   | 1.08  |
| UC33brAvg_FM31 (opt) |                                     | Grid   |       |      |              |           |          |        | 16.52 |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.32  | 5.70 | 0.93         | 118.275°W | 34.007°N | 0.00   | 2.04  |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.32  | 5.70 | 0.93         | 118.275°W | 34.007°N | 0.00   | 2.04  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 8.03  | 5.70 | 1.04         | 118.275°W | 34.016°N | 0.00   | 1.58  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 8.03  | 5.70 | 1.04         | 118.275°W | 34.016°N | 0.00   | 1.58  |

U.S. Geological Survey - Earthquake Hazards Program

# Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new [USGS Earthquake Hazard Toolbox](#) for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

## ^ Input

Edition

Dynamic: Conterminous U.S. 2014 (update...

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.9576

Time Horizon

Return period in years

2475

Longitude

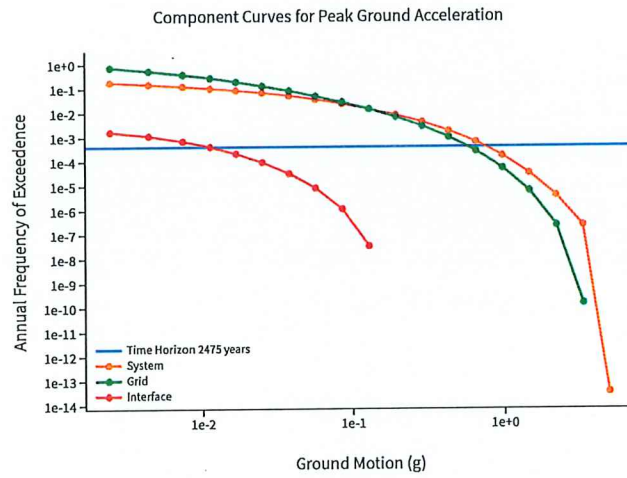
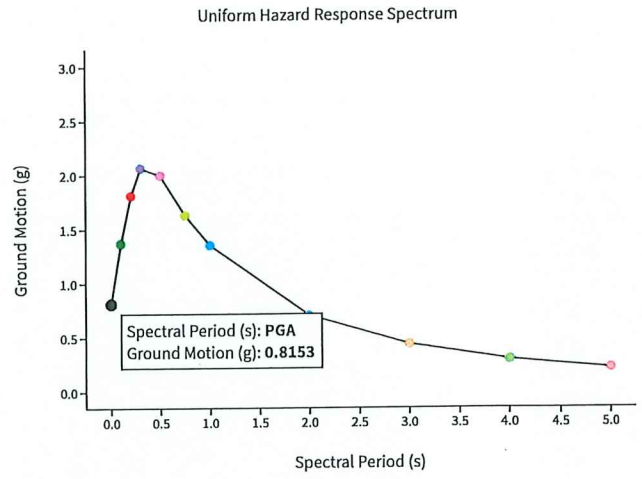
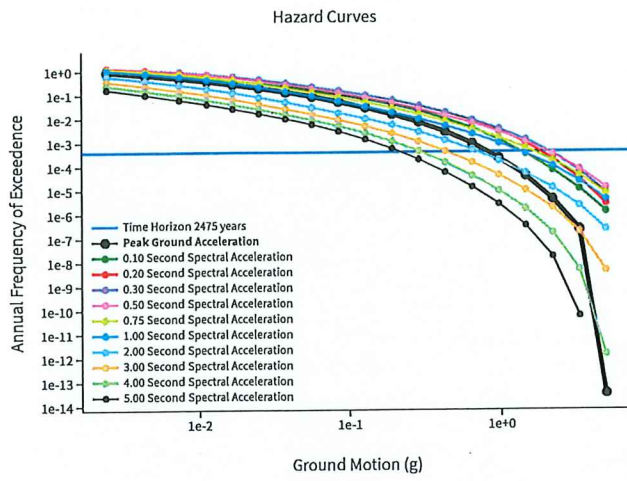
Decimal degrees, negative values for western longitudes

-118.2745

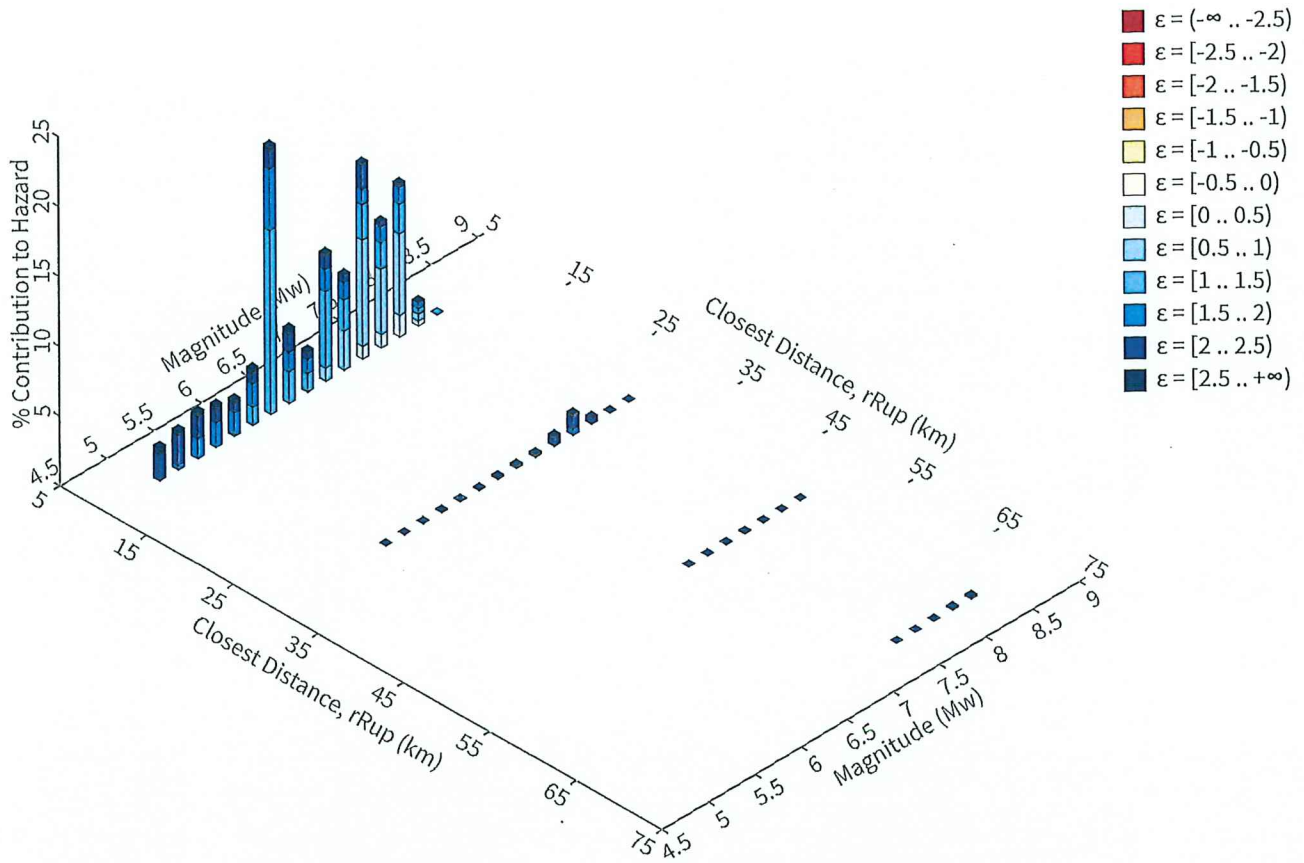
Site Class

259 m/s (Site class D)

### ^ Hazard Curve



[View Raw Data](#)



## Summary statistics for, Deaggregation: Total

### Deaggregation targets

**Return period:** 2475 yrs  
**Exceedance rate:** 0.0004040404 yr<sup>-1</sup>  
**PGA ground motion:** 0.81533749 g

### Recovered targets

**Return period:** 2923.1821 yrs  
**Exceedance rate:** 0.00034209296 yr<sup>-1</sup>

### Totals

**Binned:** 100 %  
**Residual:** 0 %  
**Trace:** 0.04 %

### Mean (over all sources)

**m:** 6.8  
**r:** 9.13 km  
**ε<sub>0</sub>:** 1.42 σ

### Mode (largest m-r bin)

**m:** 6.35  
**r:** 5.78 km  
**ε<sub>0</sub>:** 1.47 σ  
**Contribution:** 19.13 %

### Mode (largest m-r-ε<sub>0</sub> bin)

**m:** 6.36  
**r:** 4.77 km  
**ε<sub>0</sub>:** 1.29 σ  
**Contribution:** 13.14 %

### Discretization

**r:** min = 0.0, max = 1000.0, Δ = 20.0 km  
**m:** min = 4.4, max = 9.4, Δ = 0.2  
**ε:** min = -3.0, max = 3.0, Δ = 0.5 σ

### Epsilon keys

- ε0:** [-∞ .. -2.5)
- ε1:** [-2.5 .. -2.0)
- ε2:** [-2.0 .. -1.5)
- ε3:** [-1.5 .. -1.0)
- ε4:** [-1.0 .. -0.5)
- ε5:** [-0.5 .. 0.0)
- ε6:** [0.0 .. 0.5)
- ε7:** [0.5 .. 1.0)
- ε8:** [1.0 .. 1.5)
- ε9:** [1.5 .. 2.0)
- ε10:** [2.0 .. 2.5)
- ε11:** [2.5 .. +∞]

### Deaggregation Contributors

| Source Set           | Source                              | Type   | r     | m    | $\epsilon_0$ | lon       | lat      | az     | %     |
|----------------------|-------------------------------------|--------|-------|------|--------------|-----------|----------|--------|-------|
| UC33brAvg_FM31       |                                     | System |       |      |              |           |          |        | 38.02 |
|                      | Newport-Inglewood alt 1 [6]         |        | 4.39  | 7.36 | 0.85         | 118.306°W | 33.931°N | 225.19 | 11.51 |
|                      | Newport-Inglewood alt 1 [7]         |        | 4.91  | 6.36 | 1.41         | 118.316°W | 33.933°N | 234.58 | 8.30  |
|                      | Compton [2]                         |        | 10.91 | 7.26 | 0.81         | 118.344°W | 33.840°N | 206.25 | 5.25  |
|                      | Puente Hills [4]                    |        | 10.69 | 7.19 | 1.51         | 118.217°W | 34.023°N | 36.23  | 2.78  |
|                      | Elysian Park (Upper) [1]            |        | 14.40 | 6.73 | 2.13         | 118.231°W | 34.076°N | 16.91  | 2.04  |
|                      | Palos Verdes [13]                   |        | 18.47 | 7.22 | 2.17         | 118.439°W | 33.863°N | 235.36 | 1.40  |
|                      | San Pedro Escarpment [0]            |        | 9.82  | 7.63 | 0.65         | 118.450°W | 33.782°N | 219.75 | 1.19  |
| UC33brAvg_FM32       |                                     | System |       |      |              |           |          |        | 37.14 |
|                      | Newport-Inglewood alt 2 [6]         |        | 4.15  | 7.34 | 0.85         | 118.305°W | 33.933°N | 225.87 | 9.51  |
|                      | Newport-Inglewood alt 2 [7]         |        | 4.15  | 6.37 | 1.34         | 118.305°W | 33.933°N | 225.87 | 6.84  |
|                      | Compton [2]                         |        | 10.91 | 7.33 | 0.78         | 118.344°W | 33.840°N | 206.25 | 5.91  |
|                      | Puente Hills (LA) [1]               |        | 7.14  | 7.18 | 1.25         | 118.236°W | 34.004°N | 34.64  | 4.08  |
|                      | Puente Hills (Santa Fe Springs) [1] |        | 12.72 | 7.10 | 1.65         | 118.144°W | 33.926°N | 106.05 | 2.20  |
|                      | Elysian Park (Upper) [1]            |        | 14.40 | 7.17 | 1.90         | 118.231°W | 34.076°N | 16.91  | 2.16  |
|                      | Palos Verdes [13]                   |        | 18.47 | 7.31 | 2.13         | 118.439°W | 33.863°N | 235.36 | 1.35  |
| UC33brAvg_FM32 (opt) |                                     | Grid   |       |      |              |           |          |        | 12.54 |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.18  | 5.79 | 1.71         | 118.275°W | 34.007°N | 0.00   | 2.28  |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.18  | 5.79 | 1.71         | 118.275°W | 34.007°N | 0.00   | 2.28  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 7.86  | 5.78 | 1.81         | 118.275°W | 34.016°N | 0.00   | 1.48  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 7.86  | 5.78 | 1.81         | 118.275°W | 34.016°N | 0.00   | 1.48  |
| UC33brAvg_FM31 (opt) |                                     | Grid   |       |      |              |           |          |        | 12.30 |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.18  | 5.78 | 1.71         | 118.275°W | 34.007°N | 0.00   | 2.16  |
|                      | PointSourceFinite: -118.275, 34.007 |        | 7.18  | 5.78 | 1.71         | 118.275°W | 34.007°N | 0.00   | 2.16  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 7.86  | 5.78 | 1.81         | 118.275°W | 34.016°N | 0.00   | 1.54  |
|                      | PointSourceFinite: -118.275, 34.016 |        | 7.86  | 5.78 | 1.81         | 118.275°W | 34.016°N | 0.00   | 1.54  |

# LIQUEFACTION ANALYSES



A.G.I. GEOTECHNICAL, INC.

# SPT Liquefaction & Seismic Settlement Evaluation



A.G.I. GEOTECHNICAL, INC.  
 18555 Sherman Way  
 Van Nuys, CA 91406  
 (818) 785-5244 Fax (818) 785-6251

Project: 116-120 W. 87th Place  
 Job No: 33-6471-00  
 Boring: B-1

Earthquake Magnitude, M: 6.66  
 Design PGA: 0.581  
 Magnitude Scaling Factor,  $r_m$ : 0.874  
 Factor,  $\epsilon_{c,N} / \epsilon_{c,N=15}$ : 0.801

Return Period: 475 years  
 Lat: 33.9576  
 PGAM: 0.872 g  
 Long: -118.2745  
 F.O.S: 1.1

SPT N-Value Correction Factors  
 Energy Ratio,  $C_E$ : 1.30  
 Borehole Diameter,  $C_B$ : 1.15  
 Rod Length,  $C_R$ : 1.20  
 Sampler Type,  $C_S$ : 1.20  
 Overall Correction,  $C_{ES}$ : 1.79

Boring Water Level (Below Orig), ft: 52.0  
 Design Water Level (Below Orig), ft: 15.0  
 Removal Depth (Below Orig), ft: 4.0  
 Surcharge Fill Height (Above Orig), ft: 0.0  
 Surcharge Fill Unit Weight  $\gamma$ , pcf: 133

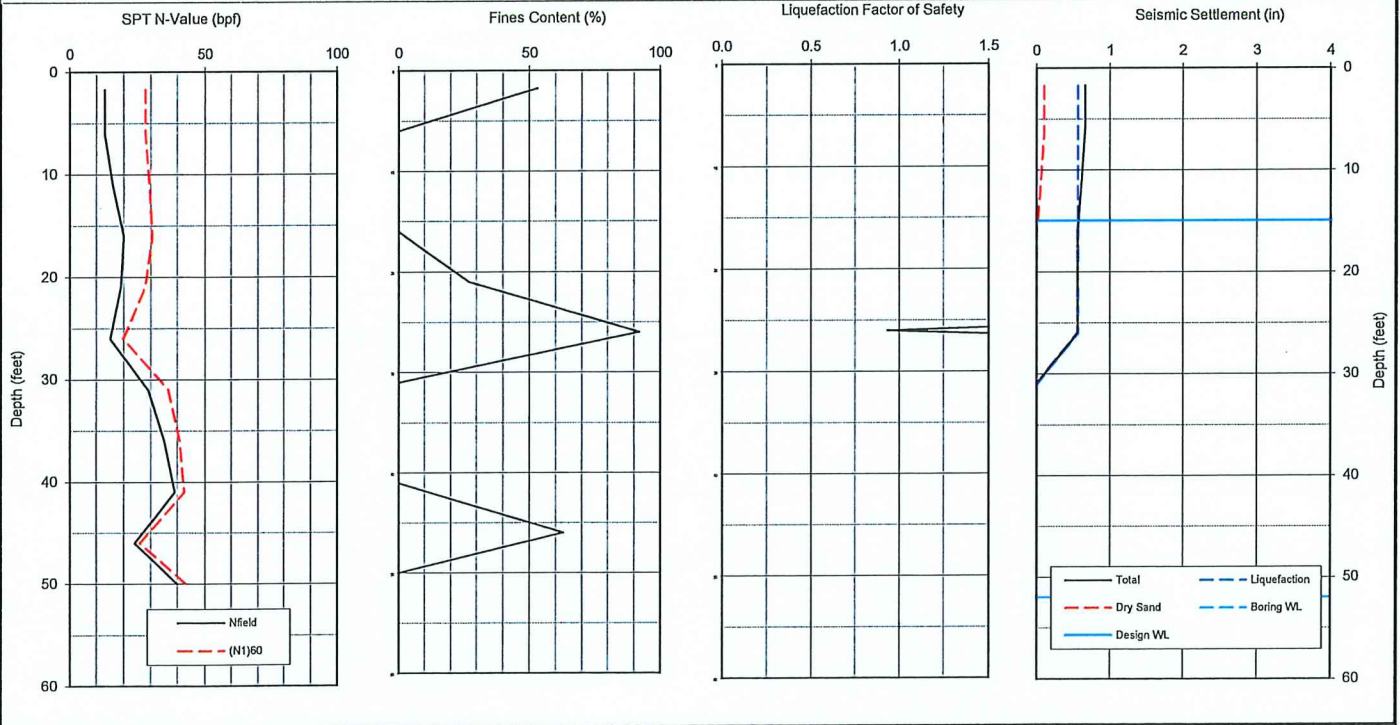
LIQUEFACTION SETTLEMENT (in): 0.56  
 DRY SAND SETTLEMENT (in): 0.10  
 TOTAL SEISMIC SETTLEMENT (in): 0.66

| Layer | Layer Base, z (ft) | Total Unit Weight $\gamma$ (pcf) | SPT $N_{field}$ | Fines (%) | Incl? (Y/N) | Layer Thickness t (ft) | Layer Midheight $z_o$ (ft) | Design Total Stress $\sigma_o$ (psf) | Design Effective Stress $\sigma'_o$ (psf) | Boring Effective Stress $\sigma'_b$ (psf) | Overburden Correction $C_N$ | Rod Length Corr. $C_R$ | SPT Fines Corr $\delta(N_1)_{60}$ | SPT $(N_1)_{60}$ | Dry Sett $(N_1)_{60cs}$ | $r_d$ | CSR = $\tau_{ave} / \sigma'_o$ |
|-------|--------------------|----------------------------------|-----------------|-----------|-------------|------------------------|----------------------------|--------------------------------------|---|---|-----------------------------|------------------------|-----------------------------------|------------------|-------------------------|-------|--------------------------------|
| 1     | 3.5                | 125                              | 13              | 53        | Y           | 3.50                   | 1.75                       | 219                                  | 219                                       | 219                                       | 1.60                        | 0.750                  | 4.1                               | 28.0             | 32.1                    | 0.996 | 0.329                          |
| 2     | 8.5                | 125                              | 13              | 0         | Y           | 5.00                   | 6.00                       | 750                                  | 750                                       | 750                                       | 1.60                        | 0.750                  | 0.0                               | 28.0             | 28.0                    | 0.988 | 0.326                          |
| 3     | 13.5               | 123                              | 16              | 0         | Y           | 5.00                   | 11.00                      | 1,370                                | 1,370                                     | 1,370                                     | 1.21                        | 0.850                  | 0.0                               | 29.5             | 29.4                    | 0.977 | 0.323                          |
| 4     | 18.5               | 132                              | 20              | 0         | Y           | 5.00                   | 16.00                      | 2,008                                | 1,945                                     | 2,008                                     | 1.00                        | 0.850                  | 0.0                               | 30.4             | 30.4                    | 0.964 | 0.329                          |
| 5     | 23.5               | 144                              | 19              | 27        | Y           | 5.00                   | 21.00                      | 2,698                                | 2,323                                     | 2,698                                     | 0.86                        | 0.950                  | 2.3                               | 27.9             | 30.2                    | 0.949 | 0.364                          |
| 6     | 28.5               | 133                              | 15              | 92        | Y           | 5.00                   | 26.00                      | 3,390                                | 2,704                                     | 3,390                                     | 0.77                        | 0.950                  | 5.7                               | 19.6             | 25.3                    | 0.930 | 0.385                          |
| 7     | 33.5               | 137                              | 29              | 0         | Y           | 5.00                   | 31.00                      | 4,065                                | 3,067                                     | 4,065                                     | 0.70                        | 1.000                  | 0.0                               | 36.5             | 36.5                    | 0.908 | 0.397                          |
| 8     | 38.5               | 137                              | 35              | 0         | Y           | 5.00                   | 36.00                      | 4,750                                | 3,440                                     | 4,750                                     | 0.65                        | 1.000                  | 0.0                               | 40.7             | 40.7                    | 0.881 | 0.402                          |
| 9     | 43.5               | 137                              | 39              | 0         | Y           | 5.00                   | 41.00                      | 5,435                                | 3,813                                     | 5,435                                     | 0.61                        | 1.000                  | 0.0                               | 42.4             | 42.4                    | 0.850 | 0.400                          |
| 10    | 48.5               | 137                              | 24              | 63        | Y           | 5.00                   | 46.00                      | 6,120                                | 4,186                                     | 6,120                                     | 0.60                        | 1.000                  | 4.6                               | 25.8             | 30.4                    | 0.815 | 0.394                          |
| 11    | 51.5               | 137                              | 40              | 0         | Y           | 3.00                   | 50.00                      | 6,668                                | 4,484                                     | 6,668                                     | 0.60                        | 1.000                  | 0.0                               | 43.1             | 43.0                    | 0.785 | 0.386                          |

| LYR | $\alpha$ | $\beta$ | Liq FS SPT $(N_1)_{60cs}$ | $K_C$ | CRR <sub>M</sub> | Liq FS | Vol Strain (%) | Liq Sett $\Delta s$ (in) | Sum Liq Sett $\Delta s$ (in) | Mean Stress $\sigma'_m$ (psf) | $G_{max}$ (ksf) | $\gamma_{eff}(G_{eff}/G_{max})$ | $\gamma_{eff}$ (%) | $\epsilon_{c,M=7.5}$ (%) | Dry Sett $\Delta s$ (in) | Sum Dry Sett $\Delta s$ (in) | Sum Total Sett (in) |
|-----|----------|---------|---------------------------|-------|------------------|--------|----------------|--------------------------|------------------------------|-------------------------------|-----------------|---------------------------------|--------------------|--------------------------|--------------------------|------------------------------|---------------------|
| 1   | 5.00     | 1.20    | 38.6                      | 1.000 | 9.999            | 9.999  | 0.00           | Above WL                 | 0.56                         | 146                           | 767             | 0.000107                        | 0.0288             | 0.0160                   | Removed                  | 0.10                         | 0.66                |
| 2   | 0.00     | 1.00    | 28.0                      | 1.000 | 9.999            | 9.999  | 0.00           | Above WL                 | 0.56                         | 500                           | 1,357           | 0.000206                        | 0.0720             | 0.0498                   | 0.05                     | 0.10                         | 0.66                |
| 3   | 0.00     | 1.00    | 29.5                      | 1.000 | 9.999            | 9.999  | 0.00           | Above WL                 | 0.56                         | 913                           | 1,867           | 0.000271                        | 0.0875             | 0.0554                   | 0.05                     | 0.05                         | 0.62                |
| 4   | 0.00     | 1.00    | 30.4                      | 1.000 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.56                         | 1,338                         | 2,284           | 0.000320                        | 0.0980             | 0.0586                   | Below WL                 | 0.00                         | 0.56                |
| 5   | 4.48     | 1.13    | 36.0                      | 1.000 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.56                         | 1,798                         | 2,642           | 0.000366                        | 0.1083             | 0.0652                   | Below WL                 | 0.00                         | 0.56                |
| 6   | 5.00     | 1.20    | 28.6                      | 1.000 | 0.359            | 0.933  | 0.94           | 0.56                     | 0.56                         | 2,260                         | 2,791           | 0.000427                        | 0.1328             | 0.1045                   | Below WL                 | 0.00                         | 0.56                |
| 7   | 0.00     | 1.00    | 36.5                      | 0.999 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 2,710                         | 3,452           | 0.000404                        | 0.1011             | 0.0421                   | Below WL                 | 0.00                         | 0.00                |
| 8   | 0.00     | 1.00    | 40.7                      | 0.980 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 3,167                         | 3,872           | 0.000408                        | 0.0933             | 0.0296                   | Below WL                 | 0.00                         | 0.00                |
| 9   | 0.00     | 1.00    | 42.4                      | 0.962 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 3,623                         | 4,198           | 0.000416                        | 0.0890             | 0.0253                   | Below WL                 | 0.00                         | 0.00                |
| 10  | 5.00     | 1.20    | 36.0                      | 0.945 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 4,080                         | 3,988           | 0.000473                        | 0.1093             | 0.0650                   | Below WL                 | 0.00                         | 0.00                |
| 11  | 0.00     | 1.00    | 43.1                      | 0.932 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 4,445                         | 4,673           | 0.000423                        | 0.0814             | 0.0222                   | Below WL                 | 0.00                         | 0.00                |

References: 1) Tokimatsu, K., and Seed, H. (1987). "Evaluation of Settlements in Sands Due to Earthquake Shaking." Journal of Geotechnical Engineering, ASCE, 113(8), 861-878. 2) Youd, T.L., and Idriss, I.M. (1997). "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils". Technical Report NCEER-97-0022, FHWA.



# SPT Liquefaction & Seismic Settlement Evaluation



A.G.I. GEOTECHNICAL, INC.  
 16555 Sherman Way  
 Van Nuys, CA 91406  
 (818) 785-5244 Fax (818) 785-6251

Project: 116-120 W. 87th Place  
 Job No: 33-6471-00  
 Boring: B-1

Earthquake Magnitude, M: 6.80  
 Design PGA: 0.872  
 Magnitude Scaling Factor,  $r_m$ : 0.898  
 Factor,  $\epsilon_{c,N} / \epsilon_{c,N=15}$ : 0.839

Return Period: 2475 years  
 Lat: 33.9576  
 PGA<sub>M</sub>: 0.872 g  
 Long: -118.2745  
 F.O.S: 1.0

SPT N-Value Correction Factors  
 Energy Ratio,  $C_E$ : 1.30  
 Borehole Diameter,  $C_B$ : 1.15  
 Rod Length,  $C_R$ : ~~1.0~~  
 Sampler Type,  $C_S$ : 1.20  
 Overall Correction,  $C_{EBS}$ : 1.79

Boring Water Level (Below Orig), ft: 52.0  
 Design Water Level (Below Orig), ft: 15.0  
 Removal Depth (Below Orig), ft: 4.0  
 Surcharge Fill Height (Above Orig), ft: 0.0  
 Surcharge Fill Unit Weight  $\gamma$ , pcf: 133

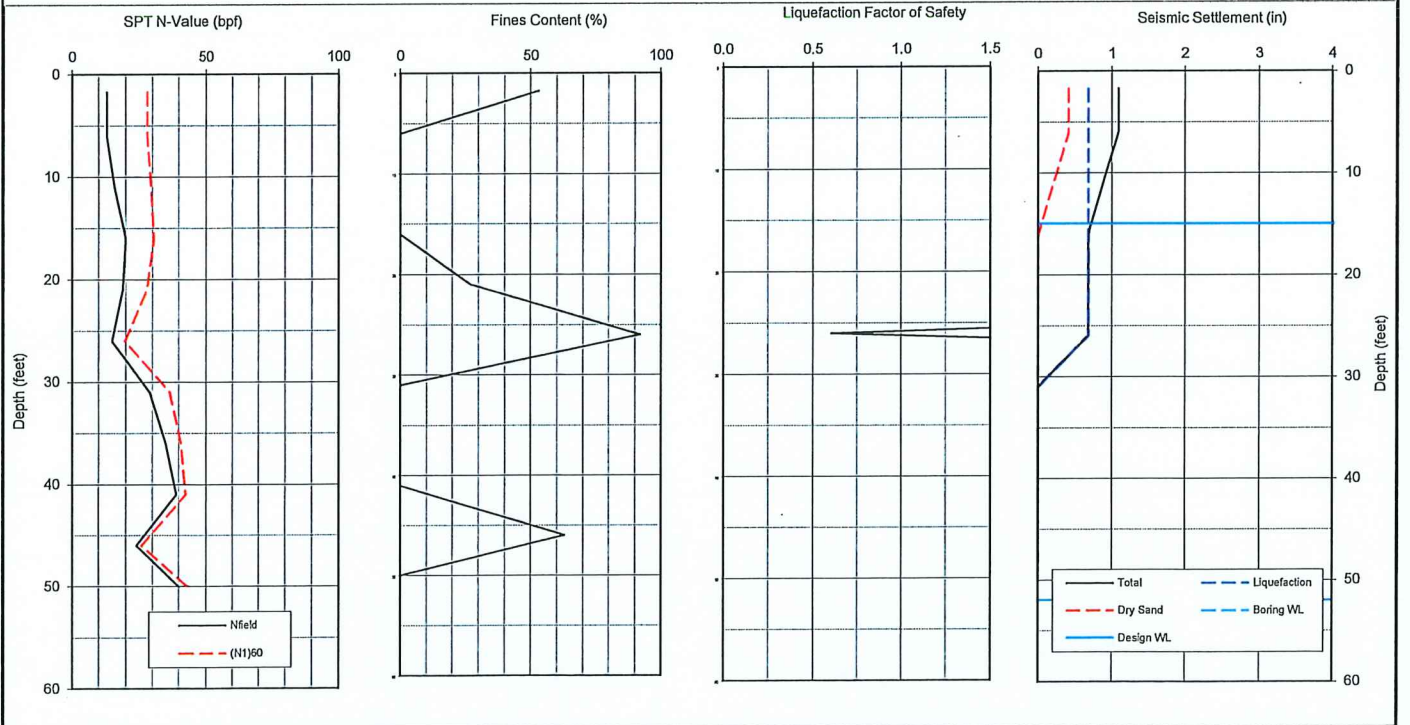
LIQUEFACTION SETTLEMENT (in): 0.68  
 DRY SAND SETTLEMENT (in): 0.41  
 TOTAL SEISMIC SETTLEMENT (in): 1.09

| Layer | Layer Base, z (ft) | Total Unit Weight $\gamma$ (pcf) | SPT $N_{field}$ | Fines (%) | Incl? (Y/N) | Layer Thickness t (ft) | Layer Midheight $z_o$ (ft) | Design Total Stress $\sigma_o$ (psf) | Design Effective Stress $\sigma_o'$ (psf) | Boring Effective Stress $\sigma_b'$ (psf) | Overburden Correction $C_N$ | Rod Length Corr. $C_R$ | SPT Fines Corr $\delta(N_1)_{60}$ | SPT $(N_1)_{60}$ | Dry Sett $(N_1)_{60cs}$ | $r_d$ | CSR = $\tau_{ave} / \sigma_o'$ |
|-------|--------------------|----------------------------------|-----------------|-----------|-------------|------------------------|----------------------------|--------------------------------------|---|---|-----------------------------|------------------------|-----------------------------------|------------------|-------------------------|-------|--------------------------------|
| 1     | 3.5                | 125                              | 13              | 53        | Y           | 3.50                   | 1.75                       | 219                                  | 219                                       | 219                                       | 1.60                        | 0.750                  | 4.1                               | 28.0             | 32.1                    | 0.996 | 0.507                          |
| 2     | 8.5                | 125                              | 13              | 0         | Y           | 5.00                   | 6.00                       | 750                                  | 750                                       | 750                                       | 1.60                        | 0.750                  | 0.0                               | 28.0             | 28.0                    | 0.988 | 0.503                          |
| 3     | 13.5               | 123                              | 16              | 0         | Y           | 5.00                   | 11.00                      | 1,370                                | 1,370                                     | 1,370                                     | 1.21                        | 0.850                  | 0.0                               | 29.5             | 29.4                    | 0.977 | 0.497                          |
| 4     | 18.5               | 132                              | 20              | 0         | Y           | 5.00                   | 16.00                      | 2,008                                | 1,945                                     | 2,008                                     | 1.00                        | 0.850                  | 0.0                               | 30.4             | 30.4                    | 0.964 | 0.506                          |
| 5     | 23.5               | 144                              | 19              | 27        | Y           | 5.00                   | 21.00                      | 2,698                                | 2,323                                     | 2,698                                     | 0.86                        | 0.950                  | 2.3                               | 27.9             | 30.2                    | 0.949 | 0.561                          |
| 6     | 28.5               | 133                              | 15              | 92        | Y           | 5.00                   | 26.00                      | 3,390                                | 2,704                                     | 3,390                                     | 0.77                        | 0.950                  | 5.7                               | 19.6             | 25.3                    | 0.930 | 0.593                          |
| 7     | 33.5               | 137                              | 29              | 0         | Y           | 5.00                   | 31.00                      | 4,065                                | 3,067                                     | 4,065                                     | 0.70                        | 1.000                  | 0.0                               | 36.5             | 36.5                    | 0.908 | 0.612                          |
| 8     | 38.5               | 137                              | 35              | 0         | Y           | 5.00                   | 36.00                      | 4,750                                | 3,440                                     | 4,750                                     | 0.65                        | 1.000                  | 0.0                               | 40.7             | 40.7                    | 0.881 | 0.619                          |
| 9     | 43.5               | 137                              | 39              | 0         | Y           | 5.00                   | 41.00                      | 5,435                                | 3,813                                     | 5,435                                     | 0.61                        | 1.000                  | 0.0                               | 42.4             | 42.4                    | 0.850 | 0.617                          |
| 10    | 48.5               | 137                              | 24              | 63        | Y           | 5.00                   | 46.00                      | 6,120                                | 4,186                                     | 6,120                                     | 0.60                        | 1.000                  | 4.6                               | 25.8             | 30.4                    | 0.815 | 0.607                          |
| 11    | 51.5               | 137                              | 40              | 0         | Y           | 3.00                   | 50.00                      | 6,668                                | 4,484                                     | 6,668                                     | 0.60                        | 1.000                  | 0.0                               | 43.1             | 43.0                    | 0.785 | 0.594                          |

| LYR | $\alpha$ | $\beta$ | Liq FS SPT $(N_1)_{60cs}$ | $K_q$ | CRR <sub>M</sub> | Liq FS | Vol Strain (%) | Liq Sett $\Delta s$ (in) | Sum Liq Sett $\Delta s$ (in) | Mean Stress $\sigma_m'$ (psf) | $G_{max}$ (ksf) | $\gamma_{eff}(G_{eff}/G_{max})$ | $\gamma_{eff}$ (%) | $\epsilon_{c,M=7.5}$ (%) | Dry Sett $\Delta s$ (in) | Sum Dry Sett $\Delta s$ (in) | Sum Total Sett (in) |
|-----|----------|---------|---------------------------|-------|------------------|--------|----------------|--------------------------|------------------------------|-------------------------------|-----------------|---------------------------------|--------------------|--------------------------|--------------------------|------------------------------|---------------------|
| 1   | 5.00     | 1.20    | 38.6                      | 1.000 | 9.999            | 9.999  | 0.00           | Above WL                 | 0.68                         | 146                           | 767             | 0.000161                        | 0.1855             | 0.0984                   | Removed                  | 0.41                         | 1.09                |
| 2   | 0.00     | 1.00    | 28.0                      | 1.000 | 9.999            | 9.999  | 0.00           | Above WL                 | 0.68                         | 500                           | 1,357           | 0.000309                        | 0.3092             | 0.2015                   | 0.20                     | 0.41                         | 1.09                |
| 3   | 0.00     | 1.00    | 29.5                      | 1.000 | 9.999            | 9.999  | 0.00           | Above WL                 | 0.68                         | 913                           | 1,867           | 0.000406                        | 0.3464             | 0.2062                   | 0.21                     | 0.21                         | 0.89                |
| 4   | 0.00     | 1.00    | 30.4                      | 1.000 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.68                         | 1,338                         | 2,284           | 0.000480                        | 0.3649             | 0.2050                   | Below WL                 | 0.00                         | 0.68                |
| 5   | 4.48     | 1.13    | 36.0                      | 1.000 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.68                         | 1,798                         | 2,642           | 0.000549                        | 0.3856             | 0.2182                   | Below WL                 | 0.00                         | 0.68                |
| 6   | 5.00     | 1.20    | 28.6                      | 1.000 | 0.359            | 0.605  | 1.13           | 0.68                     | 0.68                         | 2,260                         | 2,791           | 0.000640                        | 0.4944             | 0.3612                   | Below WL                 | 0.00                         | 0.68                |
| 7   | 0.00     | 1.00    | 36.5                      | 0.999 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 2,710                         | 3,452           | 0.000606                        | 0.3026             | 0.1199                   | Below WL                 | 0.00                         | 0.00                |
| 8   | 0.00     | 1.00    | 40.7                      | 0.980 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 3,167                         | 3,872           | 0.000613                        | 0.2609             | 0.0793                   | Below WL                 | 0.00                         | 0.00                |
| 9   | 0.00     | 1.00    | 42.4                      | 0.962 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 3,623                         | 4,198           | 0.000624                        | 0.2386             | 0.0651                   | Below WL                 | 0.00                         | 0.00                |
| 10  | 5.00     | 1.20    | 36.0                      | 0.945 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 4,080                         | 3,988           | 0.000709                        | 0.3048             | 0.1731                   | Below WL                 | 0.00                         | 0.00                |
| 11  | 0.00     | 1.00    | 43.1                      | 0.932 | 9.999            | 9.999  | 0.00           | 0.00                     | 0.00                         | 4,445                         | 4,673           | 0.000635                        | 0.2065             | 0.0545                   | Below WL                 | 0.00                         | 0.00                |

References: 1) Tokimatsu, K., and Seed, H. (1987). "Evaluation of Settlements in Sands Due to Earthquake Shaking." Journal of Geotechnical Engineering, ASCE, 113(8), 861-878. 2) Youd, T.L., and Idriss, I.M. (1997). "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils". Technical Report NCEER-97-0022, FHWA.

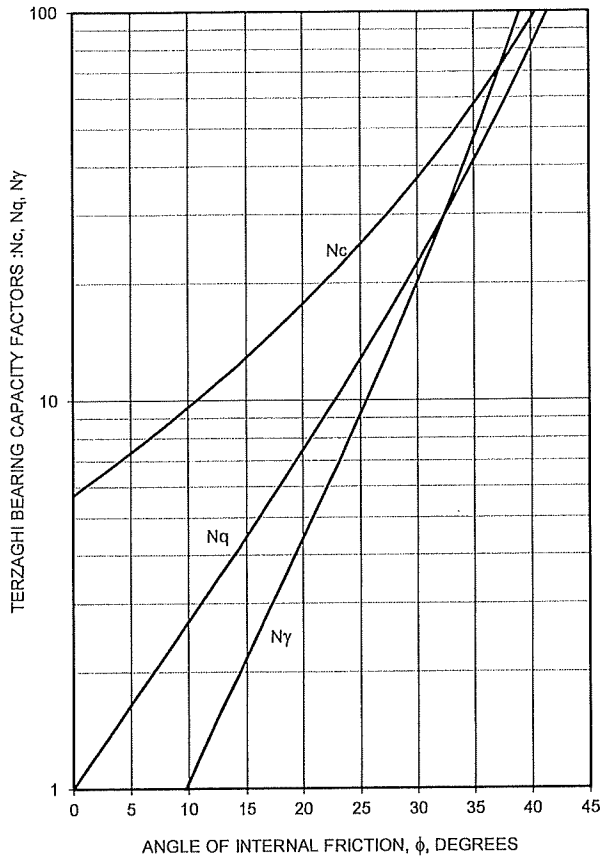


# BEARING CAPACITY ANALYSES



A.G.I. GEOTECHNICAL, INC.

# BEARING CAPACITY OF CONTINUOUS FOOTING FOUNDATION



SOIL DESCRIPTION : COMPACTED SANDY LEAN CLAY

ULTIMATE BEARING CAPACITY =  $q_{ult}$

$$q_{ult} = cN_c + \gamma DN_q + 0.5 \gamma BN_\gamma$$

ALLOWABLE BEARING PRESSURE =  $q_{allow} = q_{ult}/FOS$

## BEARING CAPACITY FACTORS

$$N_q = \frac{e^{2\pi(0.75-\phi/360)\tan\phi}}{2\cos^2(45+\phi/2)}$$

$$N_c = \frac{N_q - 1}{\tan\phi}$$

$$N_\gamma = \frac{2(N_q + 1)\tan\phi}{1 + 0.4\sin 4\phi}$$

### SOIL PROPERTIES:

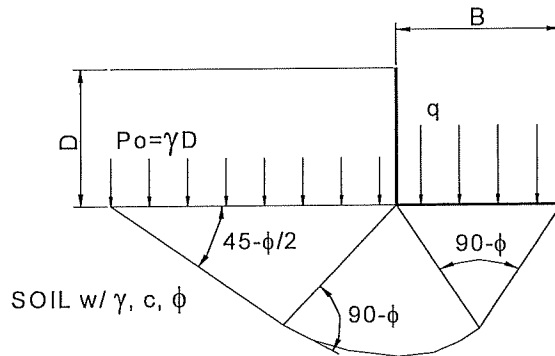
|                              |      |
|------------------------------|------|
| UNIT WEIGHT, $\gamma$ (pcf)  | 125  |
| COHESION, $c$ , (psf)        | 454  |
| FRICTION ANGLE, $\phi$ (deg) | 29.7 |

### FOUNDATION PROPERTIES:

|                       |      |
|-----------------------|------|
| WIDTH, $B$ (feet)     | 1.33 |
| DEPTH, $D$ (feet)     | 2    |
| FACTOR OF SAFETY, FOS | 3    |

### BEARING CAPACITY FACTORS:

|            |       |
|------------|-------|
| $N_q$      | 21.68 |
| $N_c$      | 36.25 |
| $N_\gamma$ | 19.16 |



SOIL w/  $\gamma, c, \phi$

ULTIMATE BEARING CAPACITY,  $q_{ult}$  : 23,471 psf

ALLOWABLE BEARING PRESSURE,  $q_{allow}$  : 7,824 psf

RECOMMENDED BEARING PRESSURE,  $q$  : 4,000 psf

#### References:

- Coduto, Donald (2001), Foundation Design, Prentice-Hall, ISBN 0-13-589706-8
- Das, Braja (2007), Principles of Foundation Engineering (6th ed.), Stamford, CT: Cengage Publisher
- Das, Braja (1999), Bearing Capacity and Settlement, Boca Raton, FL: CRC Press LLC

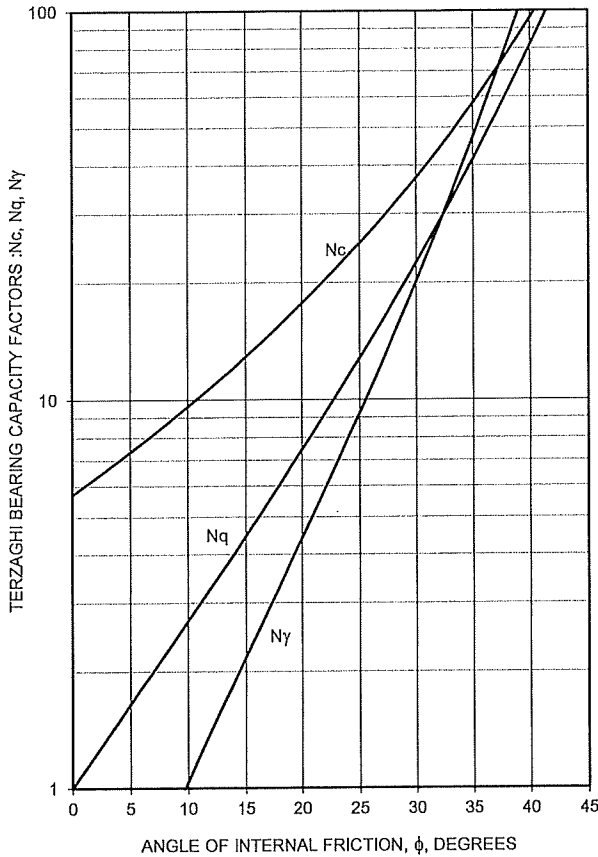


AGI GEOTECHNICAL, INC.

16555 Sherman Way, Van Nuys, California, Ph (818) 785-5244, Fax (818) 785-6251

|            |                                    |       |           |
|------------|------------------------------------|-------|-----------|
| Proj. No.: | 33-6471-00                         | Date: | June 2023 |
| Project:   | 116-120 W. 87th Place, Los Angeles |       |           |
| Calc. By:  | WFB                                |       |           |

# BEARING CAPACITY OF SQUARE FOOTING FOUNDATION



SOIL DESCRIPTION : COMPACTED SANDY LEAN CLAY

ULTIMATE BEARING CAPACITY =  $q_{ult}$

$$q_{ult} = 2.6cN_c + \gamma DN_q + 0.4 \gamma BN_\gamma + \gamma D$$

ALLOWABLE BEARING PRESSURE =  $q_{allow} = q_{ult}/FOS$

## BEARING CAPACITY FACTORS

$$N_q = \frac{e^{2\pi(0.75-\phi/360)\tan\phi}}{2\cos^2(45+\phi/2)}$$

$$N_c = \frac{N_q - 1}{\tan\phi}$$

$$N_\gamma = \frac{2(N_q + 1)\tan\phi}{1 + 0.4\sin 4\phi}$$

### SOIL PROPERTIES:

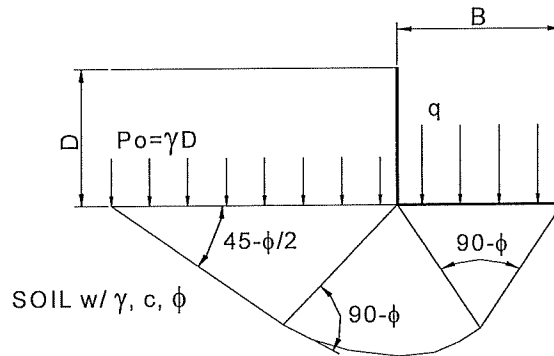
|                              |      |
|------------------------------|------|
| UNIT WEIGHT, $\gamma$ (pcf)  | 125  |
| COHESION, $c$ , (psf)        | 454  |
| FRICTION ANGLE, $\phi$ (deg) | 29.7 |

### FOUNDATION PROPERTIES:

|                       |   |
|-----------------------|---|
| WIDTH, $B$ (feet)     | 2 |
| DEPTH, $D$ (feet)     | 2 |
| FACTOR OF SAFETY, FOS | 3 |

### BEARING CAPACITY FACTORS:

|            |       |
|------------|-------|
| $N_q$      | 21.68 |
| $N_c$      | 36.25 |
| $N_\gamma$ | 19.16 |



SOIL w/  $\gamma, c, \phi$

ULTIMATE BEARING CAPACITY,  $q_{ult}$  : 50,129 psf

ALLOWABLE BEARING PRESSURE,  $q_{allow}$  : 16,710 psf

RECOMMENDED BEARING PRESSURE,  $q$  : 4,000 psf

#### References:

- Coduto, Donald (2001), Foundation Design, Prentice-Hall, ISBN 0-13-589706-8
- Das, Braja (2007), Principles of Foundation Engineering (6th ed.), Stamford, CT: Cengage Publisher
- Das, Braja (1999), Bearing Capacity and Settlement, Boca Raton, FL: CRC Press LLC



AGI GEOTECHNICAL, INC.

16555 Sherman Way, Van Nuys, California, Ph (818) 785-5244, Fax (818) 785-6251

|            |                                    |       |           |
|------------|------------------------------------|-------|-----------|
| Proj. No.: | 33-6471-00                         | Date: | June 2023 |
| Project:   | 116-120 W. 87th Place, Los Angeles |       |           |
| Calc. By:  | WFB                                |       |           |

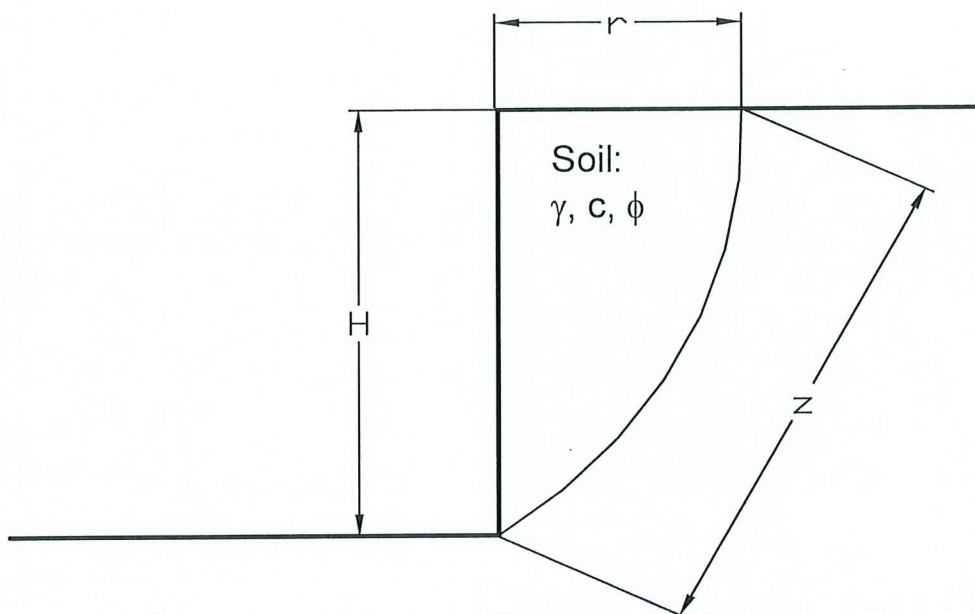
# SLOT CUT STABILITY ANALYSIS



A.G.I. GEOTECHNICAL, INC.

## SLOT CUT STABILITY ANALYSIS

SOIL TYPE: SANDY LEAN CLAY



| Description                 | Value |
|-----------------------------|-------|
| Unit Weight, $\gamma$ (pcf) | 127   |
| Friction, $\phi$ (deg)      | 27.8  |
| Cohesion, $c$ (psf)         | 523   |

|                              |      |
|------------------------------|------|
| Cut Height, $H$ (ft)         | 12.0 |
| Failure Radius, $r$ (ft)     | 4.0  |
| Failure Width, $B = 2r$ (ft) | 8.0  |

|  |        |
|--|--------|
| Volume, $V = \pi r^2 H / 4$ (ft <sup>3</sup> ) | 151    |
| Weight, $W = V\gamma$ (lb)                     | 19,127 |
| Surcharge, $Q$ (lb)                            | 10,000 |
| Weight+Surcharge, $W + Q$ , (lb)               | 29,127 |

|   |        |
|---|--------|
| Surface Area, $A = 0.5236r ((r^2+4H^2)^{3/2} - r^3)$ (ft <sup>2</sup> ) | 104    |
| Driving Force, $F_D = WH / (r^2+H^2)^{1/2}$ (lb)                        | 27,632 |
| Normal Force, $F_N = Wr / (r^2+H^2)^{1/2}$ (lb)                         | 9,211  |
| Frictional Resistance, $R_F = F_N \tan\phi$ (lb)                        | 4,856  |
| Cohesive Resistance, $R_C = A c$ (lb)                                   | 54,392 |
| Total Resistance, $R = R_F + R_C$ (lb)                                  | 59,248 |
| Factor of Safety, $FS = R / F_D$  | 2.14   |



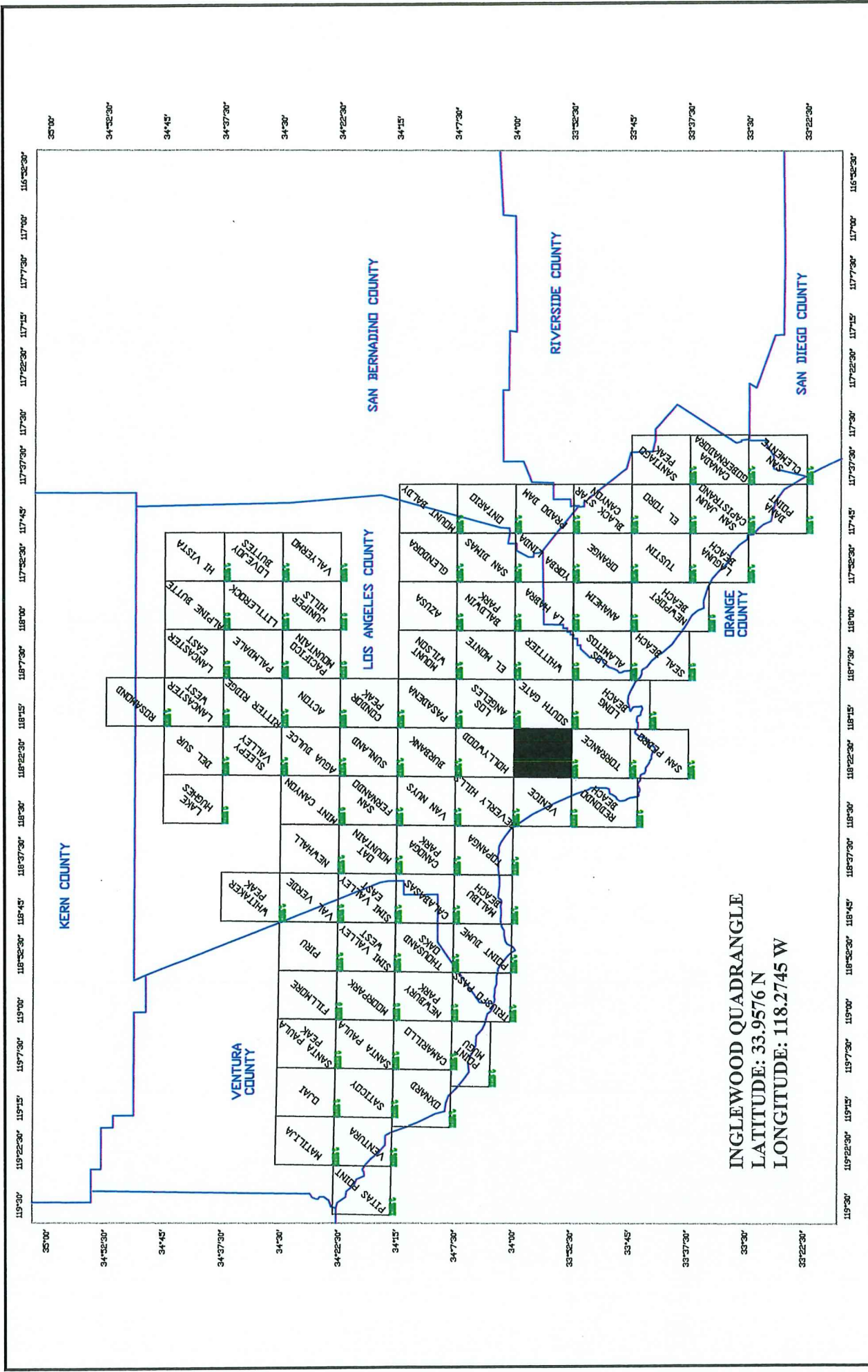
A.G.I. GEOTECHNICAL, INC.

|            |                                  |                 |
|------------|----------------------------------|-----------------|
| Proj. No.: | 33-6471-00                       | Date: June 2023 |
| Project:   | 116-120 W. 87th Pl., Los Angeles |                 |
| Calc. By:  | WFB                              |                 |

# QUADRANGLE LOCATION MAP



A.G.I. GEOTECHNICAL, INC.



|             |            |
|-------------|------------|
| PROJECT NO. | 33-6471-00 |
| DATE        | 04-2023    |
| PREPARED BY | WFB        |
| APPROVED BY | MBS        |

## QUADRANGLE LOCATION MAP

116-120 W. 87th Place,  
 Los Angeles

**AGI. GEOTECHNICAL, INC.**

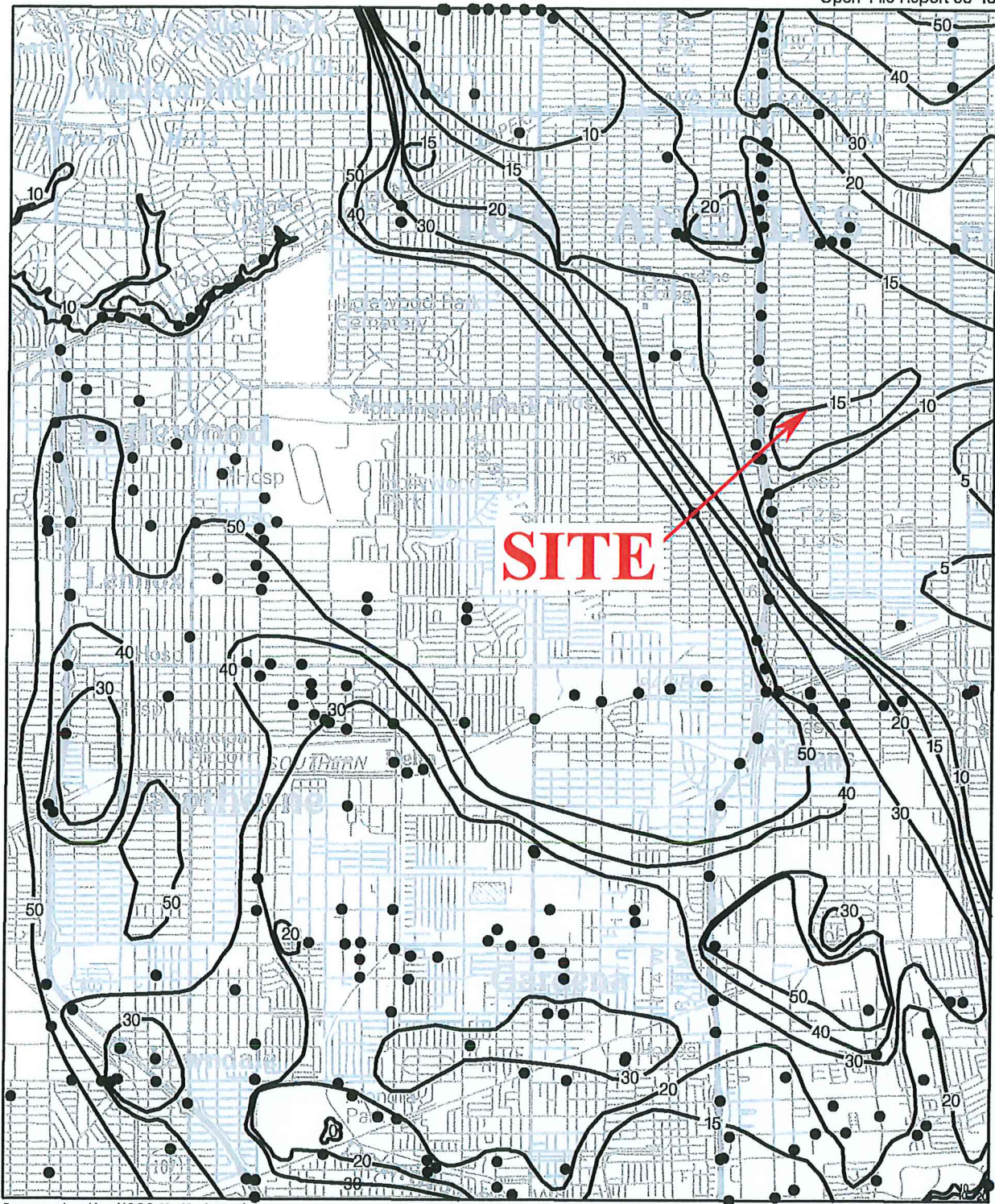
Engineering Geology • Geotechnical Engineering

16555 Sherman Way, Unit A • Van Nuys, CA 91406  
 (818) 785-5244 • Fax (818) 785-6251

# GROUNDWATER MAP



A.G.I. GEOTECHNICAL, INC.



Base map enlarged from U.S.G.S. 30 x 60-minute series

Plate 1.2 Historically Highest Ground Water Contours and Borehole Log Data Locations, Inglewood Quadrangle.

● Borehole Site      — 30 — Depth to ground water in feet

ONE MILE  
SCALE

Lat.: 33.9576 Long.: -118.2745

|             |            |
|-------------|------------|
| PROJECT NO. | 33-6471-00 |
| DATE        | 04-2023    |
| PREPARED BY | WFB        |
| APPROVED BY | MBS        |