NMG Geotechnical, Inc.

February 19, 2025

Project No. 24073-01

To: Kingsbarn Realty Capital
2500 Sand Hill Road, Suite 320
Menlo Park, California 94025

Attention: Mr. John Stack

Subject: Geotechnical Review of Vesting Tentative Tract Map 19390, Cypress Grove Residential Development, Tract 19390, Tustin, California

EXECUTIVE SUMMARY

In accordance with your request and authorization, NMG Geotechnical, Inc. (NMG) has reviewed the Vesting Tentative Tract Map (VTTM) 19390 and the conceptual site plan for the proposed redevelopment, and performed a subsurface investigation for the subject site. The site is located at the southeast corner of the intersection of 17th Street and Prospect Avenue (Figure 1) and is currently an office development. The proposed redevelopment consists of the demolition of the existing office park and construction of 145 new residential homes. The VTTM was prepared by C&V Consulting, Inc. (C&V) and the Conceptual Site Plan was prepared by Kevin L. Crook Architect Inc.

This geotechnical study included a review of background reports and maps, review of a prior preliminary geotechnical report prepared by Langan (2024), field reconnaissance, drilling of three hollow-stem-auger borings, advancement of three cone penetrometer test (CPT) soundings, laboratory testing and geotechnical analysis of the collected data. Our study focused on evaluating the existing geotechnical conditions with respect to the proposed residential development. Information from the prior geotechnical study was also utilized in this study.

The site is underlain by deep Quaternary-aged older alluvial deposits, and prior undocumented fill up to 4 feet thick. The groundwater level is deep (in excess of 50 feet below existing grade). Between 5 and 20 feet, the alluvium consists primarily of damp, fine to coarse grained clayey sand with abundant gravel and cobbles. Below a depth of 20 feet, the alluvium consists of alternating coarse- and fine-grained soils. There are no mapped faults underlying the property and the closest seismically active fault is the Whittier fault located approximately 16.2 km (10.2 miles) to the north. The site is not mapped in a seismic hazard zone for potential liquefaction or earthquake-induced landslides (CDMG, 1997).

The main geotechnical issues impacting the project development include:

- Removal of the existing (undocumented) fill and unsuitable surficial soils to provide a uniform cap of certified engineered fill for the building pads. The demolition of existing structures and utilities may require deeper excavations and could result in additional loose, disturbed soil that will need to be recompacted as compacted fill.
- Deeper utility excavations into the native alluvium will encounter gravels and cobbles which may adversely impact trench stability. Some oversize materials may need to be removed from the site.
- Potential for strong seismic shaking during an earthquake on a regionally active fault.

This report presents our geotechnical findings, conclusions and preliminary recommendations for project planning and preliminary design. We have included a Boring Location Map (Plate 1) which depicts the boring locations by NMG and Langan (2024). The geotechnical boring logs and laboratory test data from our subsurface exploration and Langan are included in Appendices B and C, respectively. Appendix D includes the code-based seismic analysis. Appendix E includes NMG's general earthwork and grading specifications.

The proposed redevelopment of the site is considered geotechnically acceptable. The recommendations in this report are preliminary and final geotechnical recommendations will be provided based on review of the future grading, foundation, and improvement plans.

If you have any questions regarding this report, please contact us. We appreciate the opportunity to provide our services.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

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1.0 INTRODUCTION

1.1 Scope of Work

The purpose of our geotechnical study was to evaluate the existing subsurface conditions in light of the proposed redevelopment at the subject site. Our investigation and this report are based upon our review of the Vesting Tentative Tract Map provided by C&V and the conceptual site plan prepared by Kevin L. Crook Architect Inc.

Our scope of work included the following:

- Background review of available published and unpublished reports and maps (Appendix A).
- Review of available historic aerial photographs and topographic maps pertinent to the site and surrounding area.
- Drilling, logging, sampling, and backfilling of three hollow-stem-auger borings (H-1 to H-3) to depths of approximately 50.8 feet deep below ground surface (bgs). Approximate boring locations are shown on Plate 1, and the boring logs are included in Appendix B.
- Advancement of three CPT soundings (CPT-1 to CPT-2a). Approximate CPT locations are shown on Plate 1, and the CPT logs are included in Appendix B.
- Laboratory testing of relatively undisturbed ring and bulk soil samples. Test results are summarized in Appendix C.
- Geotechnical evaluation and analysis of the compiled data with respect to the proposed redevelopment.
- Preparation of this report including our findings, conclusions, recommendations, and accompanying illustrations.

1.2 Site Location and Existing Conditions

The project site is approximately 8.5 acres and located at the southeast corner of the intersection of Prospect Avenue and 17th Street the City of Tustin, California (Figure 1). There are five existing office buildings (two- and three-story) surrounded by surface parking areas located at 17772, 17862, 17822, 17782, and 17852 17th Street. The site is relatively flat with surface elevations ranging from approximately 162 to 165 feet above mean sea level (msl). The site has existing wet and dry utilities serving the office buildings. The drives and parking lots consist of asphalt cement pavements. There are limited hardscape improvements for the walks and curbs and gutters, etc. The existing landscape includes turf areas, planters, and trees. An existing block wall along the southern and eastern perimeter separates the site from existing single-family residences. We understand the existing walls and street improvements around the perimeter of the site will remain in place.

1.3 Site History

The earliest aerial photographs reviewed were taken in 1946. At that time, the subject site and surrounding areas were being utilized as orchards. The site had one structure in the northeast corner and farming dirt access roads where streets 17th and Prospect would later be constructed. This structure is depicted on topographic maps dating back to 1896. The residential development along the southern perimeter of the site was built between 1952 and 1960. The residential development along the eastern perimeter of the site was constructed between 1960 and 1962. By 1968 the site had been cleared of orchards, and the structure on the northeastern corner of the site was still visible. By 1972 the two current northern office buildings had been constructed, and the central and southern buildings were under construction. An image from 1977 shows all buildings constructed and the site in its current configuration. The site has remained relatively unchanged since 1977.

1.4 Prior Geotechnical Study

Prior to this study, Langan prepared a preliminary geotechnical report for the subject site (Langan, 2024). Langan's field investigation included drilling, logging and sampling of three geotechnical borings to depths ranging from 26.5 to 51.5 feet. Laboratory testing on samples included particle size analysis, moisture content and density, Atterberg limits, expansion index, R-value, and corrosion testing. Boring logs are presented in Appendix B. Laboratory test results are presented in Appendix C.

1.5 Proposed Development

The existing five buildings, asphalt pavement, existing utilities, and local concrete structures will be demolished during the initial phase of the redevelopment of the site. The proposed site will be graded to create new building pads with associated backbone infrastructure, and paved drives/parking areas. The residential development will consist of construction of 62 cluster homes, 83 townhomes, a recreation center, and associated interior roads, sidewalks, and parking areas. Utility and landscape improvements are also proposed for the redevelopment.

We reviewed the current conceptual site plan (dated January 9, 2025) prepared by Kevin L. Crook Architect Inc. The proposed residential buildings will consist of wood-framed three-story structures with enclosed garages. There are 44 surface parking spaces and 290 enclosed garage spaces. The plan also includes common open space, private open space, and a 0.19 acre recreation site.

1.6 Field Investigation

The subsurface exploration was conducted on January 24, 2025. The CPT, and boring locations were marked and cleared with DigAlert as required. Exploration consisted of three CPT soundings, and three hollow-stem-auger borings. The CPTs encountered refusal at 6.6 feet, 7.4 feet, and 10 feet bgs. The hollow-stem-auger borings were advanced 21.4 to 50.8 feet deep. The borings were geotechnically logged and sampled. The CPT and boring logs are included in Appendix B, and the approximate locations are depicted on Plate 1.

The three cone penetration tests (CPT-1 through CPT-2a) were performed by Kehoe Testing and Engineering, Inc. The CPTs use an integrated electronic cone system that measures and records tip resistance, sleeve friction, and friction ratio parameters at 5-cm depth intervals. These explorations were located across the site and encountered fill and alluvial materials with soil behavior types consisting of heterogeneous layers of clays, silts, and silty sands to sands. Due to refusal (on gravels or cobbles) within the upper 10 feet bgs, detailed subsurface CPT data below a depth of 10 feet bgs was not collected.

The hollow-stem-auger borings (H-1 through H-3) were drilled by 2R Drilling. Borings H-2 and H-3 were drilled approximately 20 feet away from Langan's LB-1 and LB-3. Relatively undisturbed soil ring samples were collected using a 2.5-inch-inside-diameter modified California split-spoon sampler. The samplers were driven with a 140-pound hammer, free-falling 30 inches. Most of the ring samples obtained were disturbed due to the significant gravel and cobbles encountered in the borings. Representative bulk samples of onsite soil were collected from the hollow-stem cuttings and used for additional soil identification purposes and laboratory testing. The sampling was used to assess soil types beneath the site as well as to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on the geotechnical boring logs). Borings were patched at the surface with concrete and dyed black to match existing pavement.

1.7 Laboratory Testing

The type of laboratory tests performed (including the prior soil testing by Langan) for the onsite soils are listed below. The laboratory tests were conducted on selected bulk soil samples of the existing fill in the upper 5 feet. The direct shear testing was conducted on samples remolded to 90 percent relative compaction. The laboratory test results are presented in Appendix C. In-situ moisture and dry density results are included on the geotechnical boring logs (Appendix B).

- In-situ moisture content and dry density.
- Maximum density and optimum moisture content.
- Grain-size distribution (sieve and/or hydrometer);
- Atterberg Limits;
- Direct shear (remolded);
- Expansion index;
- Maximum density;
- R-Value; and
- Corrosivity

2.0 GEOTECHNICAL FINDINGS

2.1 Geologic Conditions and Earth Units

The subject site is located on the eastern margins of the Los Angeles Basin, within the floodplains of Santiago Creek and the Santa Ana River. The site is located on an area of older alluvial fan material composed primarily of sands and gravels (Morton and Miller, 2006) as shown on Figure 3. The thickness of Quaternary material below the site is approximately 400 feet (CDMG, 1980). The older alluvial material is overlain by a thin veneer of undocumented fill, placed during construction of the current office buildings.

The existing artificial undocumented fill at the site is 3 to 5 feet thick. This material generally consists of brown to dark brown, sandy clay and clayey sand, that is damp to moist, and medium dense/stiff.

The Quaternary-aged older alluvium consists of a heterogeneous mixture of gravels, silts, clays, and sands. The upper 5 to 20 feet of alluvium site is primarily composed of sandy fine to coarse gravel that is damp, and very dense with little to no organics. The consistency of this gravel between each boring suggests the gravel is consistent across the site from depths of 5 to 20 feet and deeper. Between 20 and 50 feet bgs, there are layers of sandy gravels, silts and sandy clays that are damp, and dense to hard.

2.2 Regional Faulting and Seismicity

Faulting: The site is not located within a fault-rupture hazard zone as defined by the Alquist-Priolo Special Studies Zones Act, and no evidence of active faulting was observed during this investigation. Also, based on mapping by the State (California Geological Survey, 2010), there are no active faults mapped at the site at depth. Using the USGS computer program (USGS, 2024) and the site coordinates of 33.759 degrees north latitude and 117.821 degrees west longitude, the controlling fault at the site is the Whittier Fault located 16.2 kilometers (10.1 miles) north of the site. The maximum Moment Magnitude for the Controlling Fault is 7.59 Mw. The other faults noted that can produce strong ground shaking at the site include the Newport-Inglewood (Offshore), San Joaquin Hills and Elsinore (Glen Ivy) Faults. Based on review of published maps, historic aerial photographs and topographic maps, the potential for primary ground rupture due to an earthquake is considered very low.

Seismicity: Properties in southern California are subject to seismic hazards of varying degrees depending upon the proximity, degree of activity, and capability of nearby faults. These hazards can be primary (i.e., directly related to the energy release of an earthquake, such as surface rupture and ground shaking) or secondary (i.e., related to the effect of earthquake energy on the physical world, which can cause phenomena such as liquefaction and ground lurching). The site is not located in a seismic hazard zone for liquefaction potential (CDMG, 1997), as shown in Figure 2. Liquefaction potential is discussed further in Section 2.5. Secondary seismic hazards, such as tsunami and seiche, need not be considered since the site is located over 5 miles from the ocean or any confined bodies of water and at elevations well above mean sea level.

As with the majority of sites in Southern California, the primary seismic hazard for this site is ground shaking due to a future earthquake on one of the major regional active faults, such as the San Joaquin Hills Blind Thrust, Newport-Inglewood, Whittier, or the Elsinore-Glen Ivy Faults. The site is designated as Class D for the seismicity analysis based on the Vs(30) shear wave velocity per ASCE 7-16 Table 20.3-1and collected field and laboratory test results from this site investigation. The seismic design parameters are presented in the Conclusions and Recommendations section of this report. Seismic design parameters were calculated based on a computer program by the Structural Engineers Association/Office of Statewide Health Planning and Development (2024). The results are tabulated in Section 3.5 and the data is included in Appendix D.

2.3 Groundwater

Groundwater was not encountered during our subsurface exploration to a maximum depth of 50.8 feet bgs. Additionally, Langan did not encounter groundwater in any of their borings to a maximum depth of 51.5 feet. Historic high groundwater is in excess of 40 feet deep below the site (CDMG, 1997). The present groundwater table is estimated to be greater than 100 feet deep based on data from a remediation well located 0.4 miles to the west of the site (Arcadis, 2015). A groundwater monitoring well is located 1.3 miles to the northwest at Portola Park with current groundwater depths approximately 160 feet bgs.

2.4 Soil Conditions and Classification

Based on the borings at the site, the existing soil moisture content varies from 1.7 to 16.8 percent and in-place dry density ranged from approximately 110.3 to 128.7 pcf. The near-surface soils (upper 5 feet) are damp to moist, and the native soils at depth are damp. The grain size testing indicates 6 to 63 percent fines content (passing No 200 sieve). Most of the soils are non-plastic however, some soils are clayey and had Liquid Limits of 27 to 33 percent and Plasticity Index of 13 to 17 percent. Maximum density tests were performed on two bulk samples collected from the upper 5 to 10 feet that consisted of sand with clay and gravel. The maximum dry density test results ranged from 126 to 134 pcf with optimum moisture content of 8.0 to 11.5 percent.

Based on the USCS classification, the existing fill and alluvium consists of crudely layered GP, SP, SC, ML, and CL soils. Zones with abundant gravel and cobbles were encountered between 5 to 20 feet. The soil sample descriptions, classification (USCS group symbol), in-situ soil dry density and moisture content are presented on the boring logs (Appendix B).

Direct shear tests were performed on two samples remolded to 90 percent (based on ASTM Test Method D1557) to evaluate the strength of reworked onsite soils, to assess the strength of the future fill material. The selected sample was a silty material sampled in the upper 5 feet. The test result indicated cohesion of 175 to 800 psf and a soil friction angle of 27 degrees.

Expansion index tests were performed on selected bulk samples to evaluate the expansion potential of onsite soils. Based on the laboratory test results, the expansion index (EI) varies from 21 to 31 which corresponds to "Low" expansion potential.

2.5 Liquefaction Potential

The subject site is not located within a zone of liquefaction potential as mapped by the State (Figure 2). Historic high groundwater is in excess of 40 feet below ground surface and the current groundwater table is in excess of 100 feet deep. Liquefaction potential at the subject site is considered low due to the significant depth to groundwater.

2.6 Settlement Potential

We anticipate the future compacted fill and underlying native alluvium will consist of dense, granular soils with low compressibility. Based on the foundation soils, future design grading, and the light structural loads, we anticipate the soils will have only minor settlement. The potential settlement due to seismic shaking should also be minor.

2.7 Existing Asphalt Pavement

The existing asphalt encountered during our subsurface exploration varied from 2 to 3.5 inches of asphalt concrete (AC) over 2 to 4 inches of aggregate base (AB). The prior R-value testing by Langan indicated the pavement subgrade soil consists of sandy clay with an R-vaule of 24.

2.8 Corrosivity Testing

Corrosion testing was performed by NMG and Langan on samples in the upper 5 feet. The corrosion evaluation included electrical resistivity, pH, soluble sulfate, and chloride. The specific soil analysis lab test results are presented in Appendix C and summarized below.

Soil Corrosion Test	***Test Results***
Minimum Resistivity (ohm-cm)	2,043 -2710
pH	7.5-8.3
Sulfate Content (ppm)	37 – 59
Chloride Content (ppm)	22 - 27

Electrical resistivities were in the moderately corrosive category with the in-situ moisture content. When saturated, the resistivities are in the moderately to severely corrosive categories for ferrous metals. The moisture content has a significant effect on the corrosivity of the site soils. Sulfate contents are negligible and indicate that onsite soils are not corrosive to concrete. The chloride contents are also negligible. Soil pH values indicate slight to medium alkalinity.

2.9 Earthwork Factors

The loss or gain of volume (shrinkage or bulking, respectively) of excavated natural materials and re-compaction as fill varies according to earth material type and location. This volume change is represented as a percentage shrinkage (volume loss) and as a percentage bulking (volume gain) after re-compaction of a unit volume of cut in this same material in its natural state. We anticipate the undocumented fill materials and near-surface alluvium will shrink on the order of 1 to 2 percent. Due to prior site use, subsidence at the site is anticipated to be negligible.

3.0 CONCLUSION AND PRELIMINARY RECOMMENDATIONS

3.1 General Conclusion

Based on review of the VTTM and Conceptual Site Plan, the proposed residential redevelopment at the site is considered geotechnically feasible. The primary geotechnical impacts are the recommended remedial grading and potential to encounter gravelly soils during deep utility excavations. The extent of the underlying gravels and cobbles in the alluvium appears to be variable based on the current data. This report provides the collected site-specific subsurface information and preliminary recommendations that can be used for planning and initial design at the site. Specific geotechnical recommendations for design, grading, and construction will be provided in future reports based on review of the actual project plans.

Our subsurface investigation confirmed that the site has up to 4 feet of undocumented fill consisting of clay, sandy clay, and clayey sand, over relatively dense alluvium consisting of gravel, and sand, with varying amounts of silt and clay. Groundwater is in excess of 50 feet below ground surface and is not anticipated to impact the subject development.

3.2 Site Preparation and Earthwork

General earthwork and grading specifications are provided below and in Appendix E. Grading will also have to satisfy the requirements of the City of Tustin. Prior to grading, deleterious material (highly organic topsoil, vegetation, trash, construction debris), if any, should be cleared from the site and disposed of offsite. The existing structures to be demolished and the buried utilities within the site should be removed and the areas properly backfilled. The demolition operation should minimize disturbing/loosening existing soils and should protect existing improvements to remain.

We recommend a minimum of 5-foot-deep remedial removals for the site to provide a new, uniform compacted fill blanket. The demolition operation and local variations in soil conditions may result in the need for deeper removals. Some of the existing utility lines may be locally deeper than the recommended remedial removals; therefore, special excavation for these lines may be necessary if encountered. Gravel and cobbles should be anticipated during remedial removals and deeper utility excavations.

The Portland cement concrete and asphaltic concrete from the demolition operation will need to be exported or crushed to be used onsite as crushed miscellaneous base or as fill. This will need to be evaluated with overall site earthwork.

Onsite materials that are relatively free of deleterious material should be suitable for use as compacted fill. Prior to placement of fill, the removal bottoms should be scarified a minimum of 6 inches, moisture-conditioned as needed, and compacted to minimum 90 percent relative compaction. The relative compaction should be based upon ASTM Test Method D1557-91.

The moisture content of the fill soil should be over optimum moisture content and consideration should be given to placing fill at higher moisture contents to facilitate the future presoaking process for slab-on-grade foundations. Fill material should be placed in loose lifts no greater than 8 inches

in thickness and compacted prior to placement of the next lift. Ground sloping steeper than 5:1 (horizontal to vertical) should be prepared by benching into firm competent material as fill is placed.

3.3 Settlement Potential

For preliminary foundation design purposes, we estimate total consolidation (static) settlement would not exceed 1 inch and differential settlement on the order of 0.5 inch over a span of 40 feet. Additional evaluation of the settlement should be performed once grading has been completed and structural loads become available.

3.4 Foundation and Slab Design Guidelines

Slab-on-grade foundations will be acceptable for the subject development. The design of shallow footings and slab-on-grade foundations will require collaboration between the geotechnical and structural engineers based on the anticipated structural loading conditions and considering the requirements of the 2022 CBC. For expansive soils, the CBC requires slab-on-grade foundations to be designed in accordance with the Post-Tension Institute (PTI) or Wire Reinforcement Institute (WRI) methodology.

3.5 Seismic Design Guidelines

The following table summarizes the seismic design criteria for the subject site. The seismic design parameters are developed in accordance with 2022 CBC and ASCE 7-16, including Supplement Nos. 1 through 3.

Selected Seismic Design Parameters from 2022 CBC/ASCE 7-16	***Seismic Design Values***	***Reference***
Latitude	33.759North	
Longitude	117.821West	
Controlling Seismic Source	Whittier	USGS, 2024
Distance to Controlling Seismic Source	10.1 mi (16.2 km)	USGS, 2024
Site Class per Table 20.3-1 of ASCE 7-16	D	SEA/OSHPD, 2024
Ss, Spectral Acceleration for Short Periods	1.31 g	SEA/OSHPD, 2024
$\mathbf{S_1}$, Spectral Accelerations for 1-Second Periods	0.71 g	SEA/OSHPD, 2024
$\mathbf{F_a}$, Site Coefficient, Table 11.4-1 of ASCE 7-16	1.0	SEA/OSHPD, 2024
$\mathbf{F_v}$, Site Coefficient, Table 11.4-2 of ASCE 7-16	1.83	
$\mathbf{S_{DS}}$, Design Spectral Response Acceleration at Short Periods from Equation 11.4-3 of ASCE 7-16	0.87 g	SEA/OSHPD, 2024
$\mathbf{S_{D1}}$, Design Spectral Response Acceleration at 1-Second Period from Equation 11.4-4 of ASCE 7-16	0.86 g*	
$\mathbf{T_S}$, S_{D1}/S_{DS}, Section 11.4.6 of ASCE 7-16	0.98 sec*	
$\mathbf{T_L}$, Long-Period Transition Period	8 sec	SEA/OSHPD, 2024
$\mathbf{PGA_M}$, Peak Ground Acceleration Corrected for Site Class Effects from Equation 11.8-1 of ASCE 7-16	0.58 g	SEA/OSHPD, 2024
Seismic Design Category, Section 11.6 of ASCE 7-16	D	

**These values have been increased by 50% as outlined in Supplement No. 3 of ASCE 7-16 Chapter 11.4.8.*

3.6 Pavement Design

We anticipate the future subgrade soils for pavements will have a minimum R-value of 20. Final structural pavement sections should be based on R-value testing after the completion of grading. The following preliminary pavement sections are for the assumed traffic indices (TIs). The final structural pavement design should be based on final TIs and the actual subgrade soil once the grading and utilities are completed.

Minimum Structural Pavement Section (Preliminary)			
Location	***TI***	***Composite Section***	***Full-Depth Section***
Parking areas	4.5	0.25' AC over 0.35' AB	0.50' AC
Drives	5.5	0.35' AC over 0.60' AB	0.55' AC
AC = Asphalt Concrete; AB = Aggregate Base			

Asphalt concrete should also be compacted to a minimum relative compaction of 95 percent. Please note that for two-stage paving operations, the initial based asphalt pavement layer should be a minimum of 0.25-foot AC and the final cap should be a minimum of 0.10 foot thick.

Prior to construction of pavement sections, the subgrade soils should be scarified to a minimum depth of 6 inches, moisture-conditioned as needed, and recompacted in place to a minimum of 90 percent relative compaction per ASTM D1557. The full-depth pavement area will require subgrade to have a minimum of 95 percent relative compaction. Subgrade for the proposed pavements should be uniform, firm, and unyielding.

AB materials can be crushed aggregate base or crushed miscellaneous base in accordance with the Greenbook (Section 200-2). The materials should be free of any deleterious materials. Aggregate base materials should be placed in 6- to 8-inch-thick loose lifts, moisture-conditioned as necessary, and compacted to a minimum of 95 percent relative compaction (per ASTM D1557).

3.7 Exterior Concrete and Concrete Pavers

The recommendations provided below should be used for design and construction measures of the concrete pavements/hardscape. These recommendations are considered minimum and may be superseded by more stringent requirements/standards of the City of Tustin, the Standard Specifications for Public Work Construction "Greenbook" or other designers. The public pavements and other exterior concrete improvements (within the street right-of-way) should be constructed in accordance with City of Tustin standards.

The subgrade for the concrete pavement areas should be competent material that has been compacted and moisture-conditioned in accordance with the remedial grading recommendations for the site. The subgrade shall be compacted to a minimum of 90 percent relative compaction (as determined based on ASTM Test Method 1557). For reducing the potential effects of expansive soils, we recommend presaturation of the subgrade prior to placement of the hardscape concrete. The recommended presaturation is 1.2 times optimum moisture to a depth of 12 inches.

The nominal thickness for the concrete hardscape should be 4 inches. Pavements anticipated to have periodic vehicular traffic should be provided with the appropriate aggregate base, reinforcement and restraints. Note that City standards may govern the required minimum thicknesses for the public concrete pavements/sidewalks and exterior concrete elements in the right-of-way. We recommend that longitudinal and transverse joint spacing for the concrete pavement be no more than 10 feet apart to control cracking. The depth of jointing must be at least ¼ of the slab thickness. Expansion joints need to be incorporated into the concrete pavements to allow for soil and thermal expansion (no more than 50 feet apart).

Specific recommendations will be required if concrete paver or decorative concrete pavements are planned for the vehicular/road or pedestrian areas.

3.8 Soil Corrosivity and Cement Type

The soil soluble sulfates exposures at the site as found to be "negligible". The subject site may be classified as "S0" per Table 19.3.2.1 of ACI-318-14. The chloride levels within the soils are classified as Class C1.

Concrete mix requirements for structural concrete should be based on the "S0" exposure class of Table 19.3.2.1 in ACI-318-14 that lists the appropriate type of cement, maximum water-cement ratio, and minimum concrete compressive strength.

Structural concrete elements in contact with soil include footings and building slabs-on-grade. Concrete improvements for streets, sidewalk and hardscape typically are not considered structural elements. The onsite soils are moderately to ferrous metals.

3.9 Pipelines, Trench Excavations, Temporary Shoring, and Backfill

Excavations should conform to the latest edition of OSHA requirements (shoring or layback of trench or excavation walls). The near-surface soils across most of the site are anticipated to be classified as Type B in compacted fill soils (upper 5 feet) and Type C in native alluvial soils (below a depth of 5 feet) for CalOSHA trenching and shoring excavation requirements. Excavations deeper than approximately 5 feet below existing ground surface will likely encounter gravelly soils.

Except for cobbles, the native soils should generally be suitable for use as trench backfill. Backfill materials should not have rocks greater that 12 inches in the maximum dimension and should be compacted to a minimum relative compaction of 90 percent (per ASTM D1557). We recommend that moisture content of native backfill to be over optimum moisture content. Select backfill may be used in lieu of native soils.

If a high-density, polyethylene (HDPE) pipe is proposed for the development, then excavation, installation, bedding, shading, and backfilling should be in strict accordance with the project and manufacturer's requirements. HDPE pipe has specific requirements for the width of the trench excavation.

3.10 Additional Geotechnical Review and Evaluation

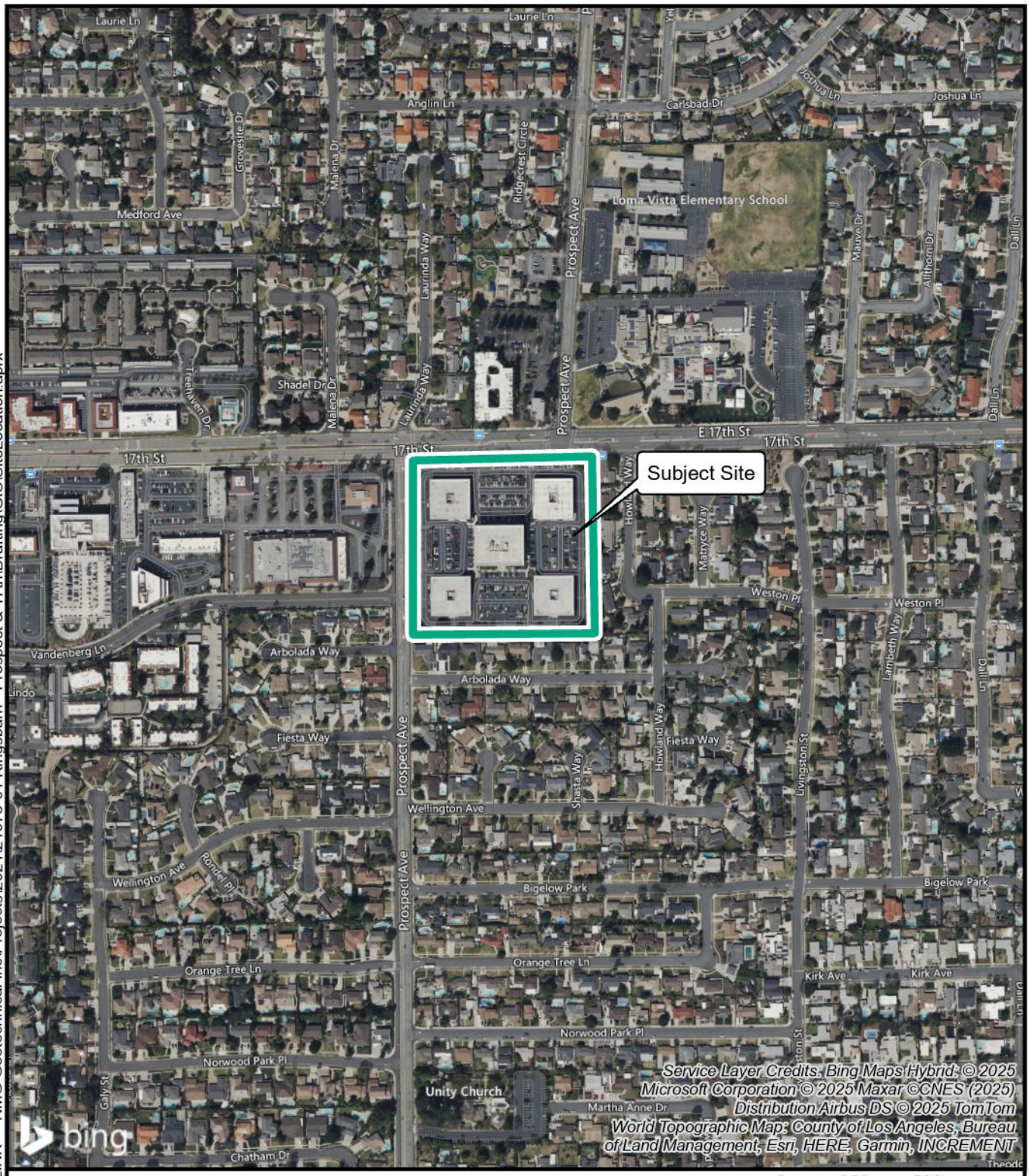
The future grading and improvement plan, and the building foundation plans should be reviewed and accepted by the geotechnical consultant prior to site grading and construction. Additional soil testing and analysis may be required for more detailed recommendations or may result in updated/revised recommendations.

4.0 LIMITATIONS

This report has been prepared for the exclusive use of our client, Kingsbarn Realty Capital, within the specific scope of services requested by them for the subject residential development in Tustin, California. This report or its contents should not be used or relied upon for other projects or purposes or by other parties without the written consent of NMG and the involvement of a geotechnical professional. The means and methods used by NMG for this study are based on local geotechnical standards of practice, care, and requirements of governing agencies. No warranty or guarantee, express or implied is given.

The findings, conclusions, and recommendations herein are professional opinions based on interpretations and inferences made from geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can vary from point to point, can be very different in between points, and can also change over time. Our conclusions and recommendations are subject to verification and/or modification during excavation and construction when more subsurface conditions are exposed.

NMG's expertise and scope of services did not include assessment of potential subsurface environmental contaminants or environmental health hazards.



0 250 500 Feet

1 inch =500 feet

N

SITE LOCATION MAP

CYPRESS GROVE RESIDENTIAL DEVELOPMENT
VTTM 19390, PROSPECT AND 17TH STREET
CITY OF TUSTIN, CALIFORNIA

Project Number: 24073-01 By: WG/KGM
Project Name: Kingsbarn - Prospect & 17th
Date: 2/19/2025 Figure 1

NMG

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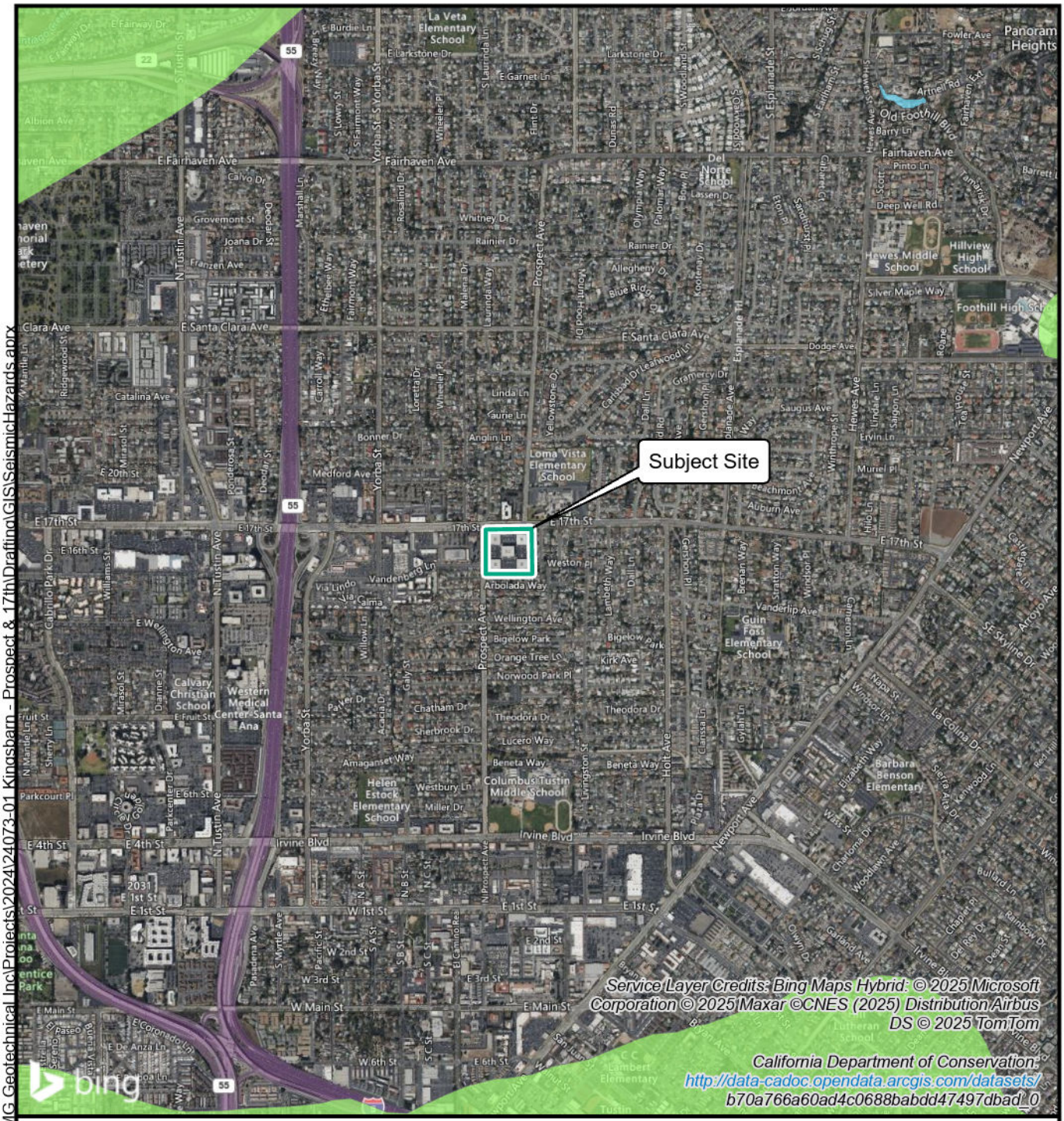


Legend

- Liquefaction Zones
- Earthquake-Induced Landslide Zones

0 1,000 2,000 Feet

1 inch =2,000 feet

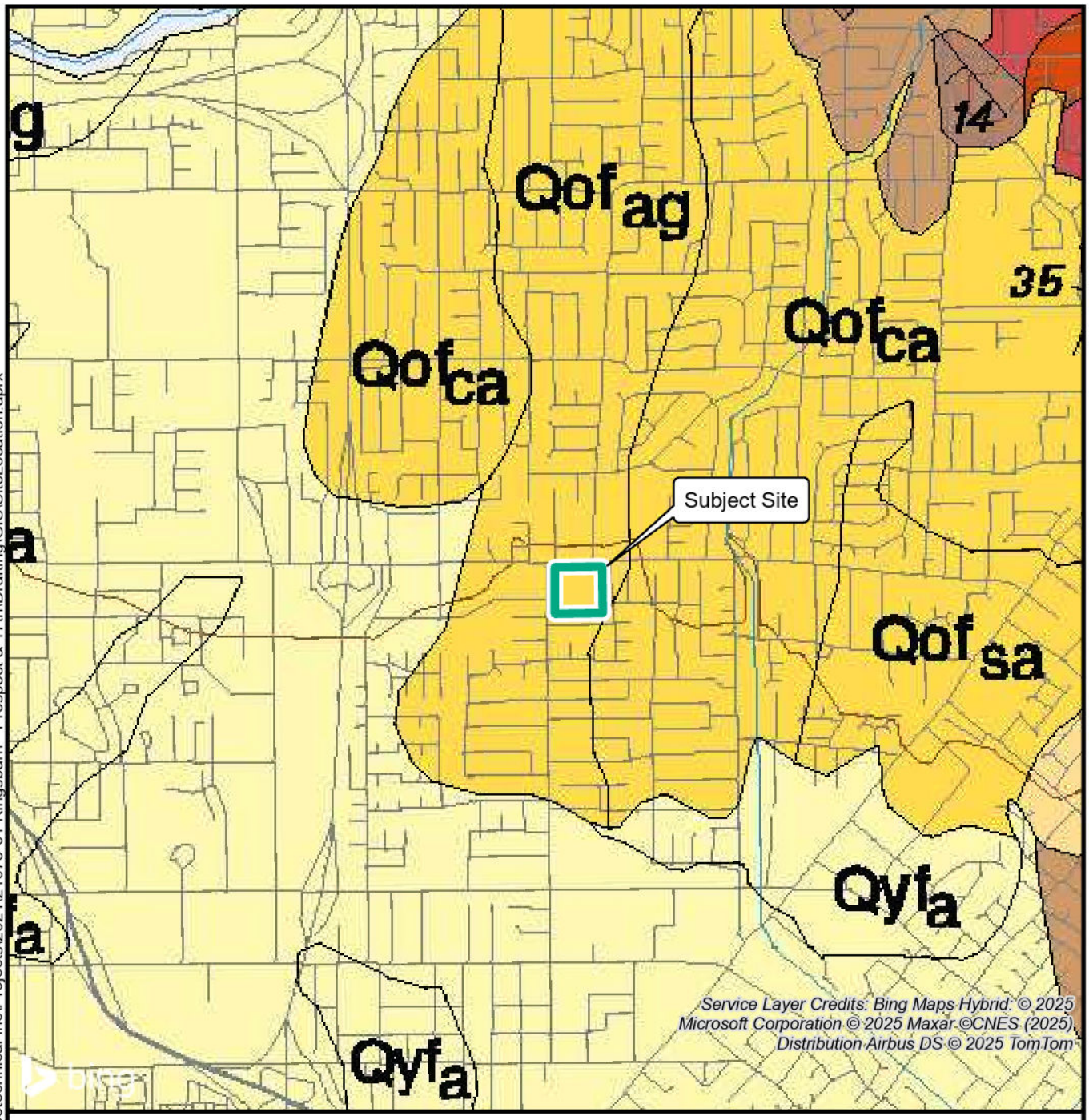
N

SEISMIC HAZARDS MAP

Base: California Geological Survey, Earthquake Zones of Required Investigation, Tustin Quadrangle
Dated: January 17, 2001

CYPRESS GROVE RESIDENTIAL DEVELOPMENT VTTM 19390, PROSPECT AND 17TH STREET CITY OF TUSTIN, CALIFORNIA	Project Number: 24073-01 By: WG/KGM Project Name: Kingsbarn - Prospect & 17th Date: 2/19/2025 Figure 2	NMG

<LINK>C:\Users\nmaguest\OneDrive</LINK> - NMG Geotechnical Inc\Projects\2024\24073-01 Kingsbarn - Prospect & 17th\Drafting\GIS\SeismicHazards.aprx



REGIONAL GEOLOGY MAP

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CYPRESS GROVE RESIDENTIAL DEVELOPMENT
VTTM 19390, PROSPECT AND 17TH STREET
CITY OF TUSTIN, CALIFORNIA

Project Number: 24073-01 By: WG/KGM
Project Name: Kingsbarn - Prospect & 17th
Date: 2/19/2025 Figure 3

NMG

<LINK>C:\Users\nmgguest\OneDrive</LINK> - NMG Geotechnical Inc\Projects\2024\24073-01 Kingsbarn - Prospect & 17th\Drafting\GIS\SiteLocation.aprx

LEGEND

LOCATIONS ARE APPROXIMATE

● H-3 T.D.21.4' Qalo@3'	HOLLOW-STEM AUGER BORING BY NMG, THIS INVESTIGATION SHOWING TOTAL DEPTH AND DEPTH TO EARTH UNITS
▲ CPT-2A T.D.7.5'	CONE PENETROMETER TEST BY NMG, THIS INVESTIGATION SHOWING TOTAL DEPTH
◑ LB-3 T.D.51.5'	HOLLOW STEM AUGER BORING BY LANGAN (2024), SHOWING TOTAL DEPTH

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.

BASEMAP: C&V CONSULTING

PLATE 1

BORING LOCATION MAP
CYPRESS GROVE, VTTM 19390
PROSPECT AND 17TH STREET
CITY OF TUSTIN, CALIFORNIA

Project No.: 24073-01 By: KGM/WG
Project Name: Kingsbarn/Prospect and 17th
Date: 2/19/2025 SCALE: 1" = 40'

NMG Geotechnical, Inc.

Drawing: C:\Users\vrodriguez\OneDrive - NMG Geotechnical Inc\Projects\2024\24073-01 Kingsbarn - Prospect & 17th\Drafting_WIP\24073-01 Boring location map.dwg Layout: Layout1 Last Saved: Mon Feb 17, 2025 - 4:15pm Last Plotted: Tue Feb 18, 2025 - 4:43pm By: vrodriguez

APPENDIX A

APPENDIX A

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APPENDIX A

REFERENCES (Cont'd)

U.S. Geological Survey, 2024, Unified Hazard Tool, NSHM 2014 Dynamic Deaggregation Program; web site address: https://earthquake.usgs.gov/hazards/interactive/; Date Accessed: January 31, 2025.

APPENDIX B

SOIL CLASSIFICATION CHART

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

NOTE: Dual symbols are used to indicate gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash indicate borderline soil classifications.

Sampler and Symbol Descriptions

- Modified California sample (D-#)
- Standard Penetration Test (S-#)
- Shelby tube sample (T-#)
- Large bulk sample (B-#)
- Small bulk sample (SB-#)
- Approximate depth of groundwater during drilling
- Approximate depth of static groundwater

Note: Number of blows required to advance driven sample 12 inches (or length noted).

Laboratory and Field Test Abbreviations

AL	Atterberg limits (plasticity)
CC	Chemical Testing incl. Soluble Sulfate
CN	Consolidation
DS	Direct Shear
EI	Expansion Index
GS	Grain Size Analysis (Sieve, Hydro. and/or -No. 200)
MD	Maximum Density and Optimum Moisture
RV	Resistance Value (R-Value)
SE	Sand Equivalent
UU	Unconsolidated Undrained Shear Strength

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System and include color, moisture, and relative density or consistency. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate. Bedrock descriptions are based on visual classification and include rock type, moisture, color, grain size, strength, and weathering.
2. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were drilled. They are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO LOG OF BORING

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

NMG Geotechnical, Inc.

Date(s) Drilled	**1/24/25**	Logged By	**SHC/DDK**
Drilling Company	**2R Drilling**	Drill Bit Size/Type	**8"**
Drill Rig Type	**CME 85**	Hammer Data	**140 lbs @ 30 inch drop**
Sampling Method(s)	**Modified California, Bulk**		
Approximate Groundwater Depth:	**No Groundwater Encountered**		
Comments			

H-1

Sheet 1 of 2

Total Depth Drilled (ft)	**26.3**
Approximate Ground Surface Elevation (ft)	**163.0 msl**

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0						Surface: Parking lot, 3.5" of Asphaltic concrete over 4" of aggregate base.			
			B-1			SC-CL	**Artificial Fill, Undocumented (Afu)** @ 1-2.5': Brown clayey medium SAND/sandy CLAY, moist, scattered gravel up to 1" in diameter.			B-1 @ 1-2.5', AL, CC, DS, GS, MD, EI
160							@ 2.5': No sample recovery.			
			D-1	13		GP	**Quaternary Old Alluvium (Qalo)**			
	5						@ 5': No sample recovery., large rock in tip.			B-2 @ 5-10', MD, EI
			D-2	14			@ 6': Drill rig chattering.			
			-1 & B-2							
			B-2							
			D-3	29			@ 7.5': No sample recovery, large rounded gravel up to 4" in diameter.	4.7		
	10						@ 10': No sample recovery, large rounded gravel up to 4" diameter in cuttings.			
			D-4	30			@ 12': Drill rig chattering.			
150										
	15						@ 15': Brown medium to coarse sandy GRAVEL, damp, very dense, large 4" diameter well rounded gravel in first two rings, no recovery in the tip, trace clay.	1.7	110.3	
			D-5	77						
	20						@ 20': Brown medium to coarse sandy GRAVEL, damp, very dense, rounded gravel up 2" in diameter.	2.4	120.4	
			D-6	81						
140										
	25									

LOG OF BORING

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

NMG

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	25		D-7	84/9"		GP	@ 25': Brown medium to coarse sandy GRAVEL, damp, very dense, rounded gravel up 2" in diameter.	3.7	128.7	
							Notes: Total Depth: 26.3 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped. Patched with Quickset-Concrete and Black Dye.			
	30									
130										
	35									
	40									
120										
	45									
	50									
110										
	55									

LOG OF BORING

Kingsbarn Prospect & 17th
Tustin, California

PROJECT NO. 24073-01

NMG

Date(s) Drilled	1/24/25	Logged By	SHC/DDK
Drilling Company	2R Drilling	Drill Bit Size/Type	8"
Drill Rig Type	CME 85	Hammer Data	140 lbs @ 30 inch drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	No Groundwater Encountered		
Comments			

H-2

Sheet 1 of 2

Total Depth Drilled (ft)	50.8
Approximate Ground Surface Elevation (ft)	162.0 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SC-CL	Surface: Parking lot, 2.5" of Asphaltic concrete over 3" of aggregate base.			
							Artificial Fill, Undocumented (Afu) @ 1': Large sandstone rock. @ 1-2.5': Brown sandy CLAY, damp, trace gravel.			B-1 @ 1-5', AL, CC, DS, EI, MD
160			B-1 D-1	19		GP	@ 2.5': Brown sandy CLAY/clayey SAND, damp, stiff, few scattered rounded gravel up to 1" in diameter, trace caliche, trace pinhole pores, trace organics.	7.3	116.3	
							Quaternary Old Alluvium (Qalo)			
	5		D-2	20			@ 5': No sample recovery, gravel.			B-2 @ 5-10'
							@ 6': Drill rig chattering.			
			B-2 D-3	53			@ 7.5': No sample recovery, well rounded gravel up to 2" in diameter, clayey sand. @ 8': Drill rig chattering.			
	10		D-4	81/10"			@ 10': No sample recovery, well rounded gravel up to 4" in diameter, scattered .5 to 1" gravel, grvel grading to finer grained from 10-15'. Drill rig chattering.			
150										
	15		D-5	57		CL	@ 15': Reddish brown medium sandy CLAY, hard, damp, trace mica, moderately plastic, scattered gravel.	8.7	120.6	
	20		D-6	58		ML	@ 20': Reddish brown fine sandy SILT, hard, dry, trace pinhole pores, trace pencil tip pores, trace coarse sand, trace organics.	7.8	120.8	
140										
	25									

LOG OF BORING

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

NMG

Elevation (ft)	Depth (ft)	Sample Type	Sample Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	25	D	7	50/6"		GP	@ 25': No sample recovery.			
	30	D	8	64/11"			@ 30': Brown clayey fine to medium sandy GRAVEL, damp, very dense. Drill rig chattering.	2.0		
130										
	35	D	9	66		CL	@ 35': Reddish brown fine sandy CLAY, dry, hard, scattered gravel, trace pinhole pores, trace lenses of coarse sand.	4.2	116.1	
	40	D	10	43		ML SM-GM	@ 40': Brown silty fine SAND/sandy GRAVEL, dry, dense, rounded gravel up to 1" in diameter. Drill rig chattering. Upper 4 rings: Reddish brown fine sandy SILT, dry, stiff, trace pinhole pores, micaceous, trace gravel.	2.8	111.1	
120										
	45	D	11	50/4"			@ 45': No sample recovery, bouncing on rock.			
	50	D	12	67/9"			@ 50': No sample recovery, bouncing on rock.			
110							Notes: Total Depth: 50.8 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped. Patched with Quickset-Concrete and Black Dye.			
	55									

LOG OF BORING

Kingsbarn Prospect & 17th
Tustin, California

PROJECT NO. 24073-01

NMG

Date(s) Drilled	1/24/25	Logged By	SHC/DDK
Drilling Company	2R Drilling	Drill Bit Size/Type	8"
Drill Rig Type	CME 85	Hammer Data	140 lbs @ 30 inch drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	No Groundwater Encountered		
Comments			

H-3

Sheet 1 of 1

Total Depth Drilled (ft)	21.4
Approximate Ground Surface Elevation (ft)	162.0 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					SC-CL	Surface: Parking lot, 2" of Asphaltic concrete over 2" of aggregate base.			
			B-1				**Artificial Fill, Undocumented (Afu)** @ 1-2.5': Dark brown fine sandy CLAY, moist, trace gravel.			B-1 @ 1-2.5'
160			D-1	16		GP	@ 2.5': Dark brown fine sandy CLAY/clayey SAND, medium dense/stiff, moist, scattered rouneded gravel up to 3", gravel in tip and first 2 rings.	11.8		
							Quaternary Old Alluvium (Qalo) @ 3-5': Gravel, rounded, 2-4" in diameter. Drill rig chattering.			
	5						@ 5': No sample recovery.			
							@ 6': Drill rig chattering.			
							@ 7.5': Gravel, rounded, up to 5" in diameter, minimal sand.			
	10		D-2	50/4"			@ 10': Brown fine to coarse sandy GRAVEL, damp to moist, very dense, rounded gravel up to 2" in diameter. Drill rig chattering.	3.1	127.8	
150										
	15		D-3	29		SC	@ 15': Reddish yellow clayey fine to coarse SAND, damp, medium dense, trace gravel up to 1" in diameter, trace pinhole pores.	5.9	117.4	
	20		D-4	93/11"		GP	@ 20': Reddish brown clayey fine to coarse sandy GRAVEL, moist, very dense, rounded gravel up to 2" in diameter.	6.1	124.5	
140							Notes: Total Depth: 21.4 Feet. No Groundwater Encountered. Backfilled with Cuttings and Tamped. Patched with Quickset-Concrete and Black Dye.			
	25									

LOG OF BORING

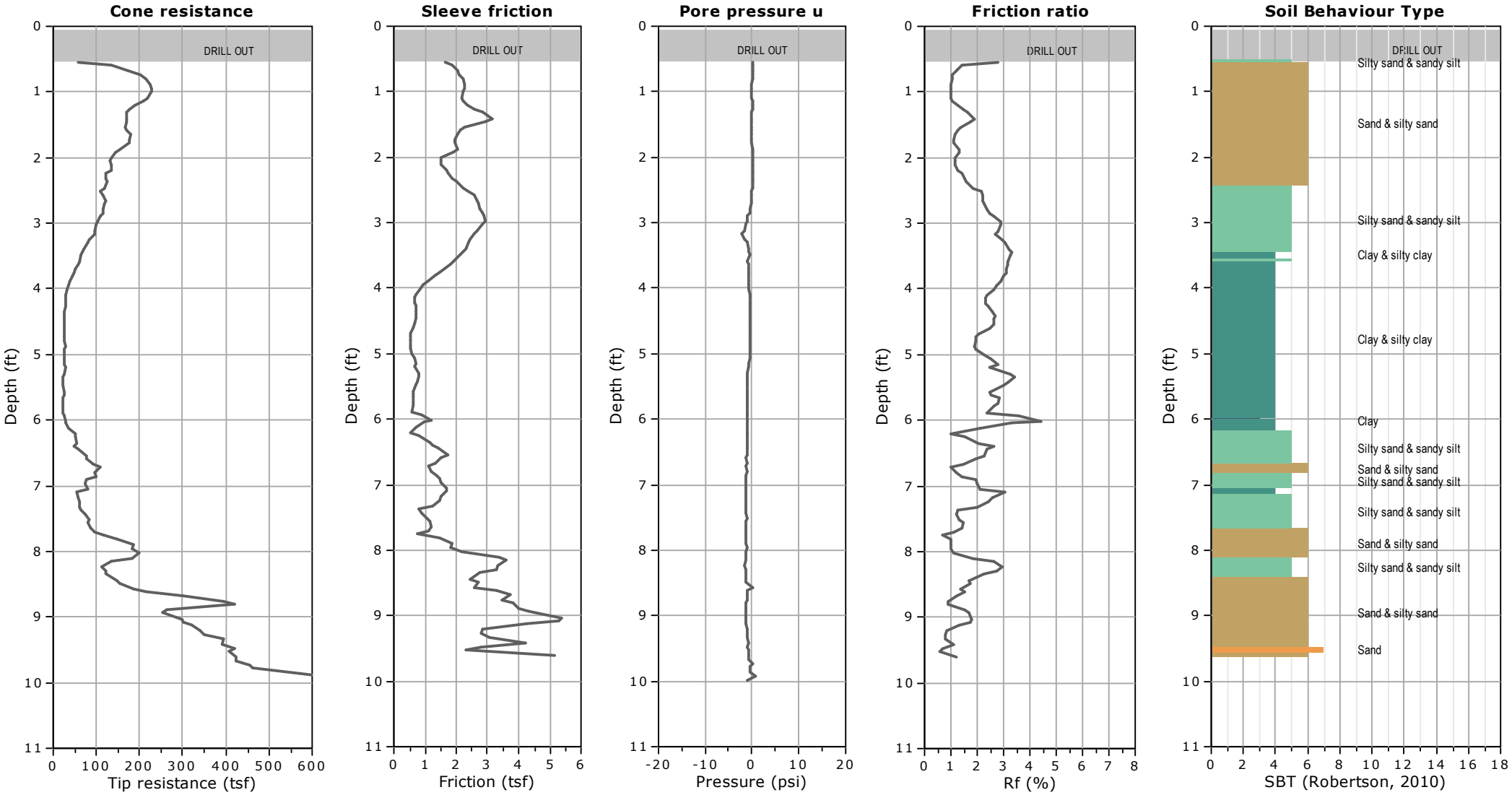
Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

NMG

Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **NMG Geotechnical / Kingsbarn - Prospect and 17th St**
Location: **17822 17th St, Tustin, CA**

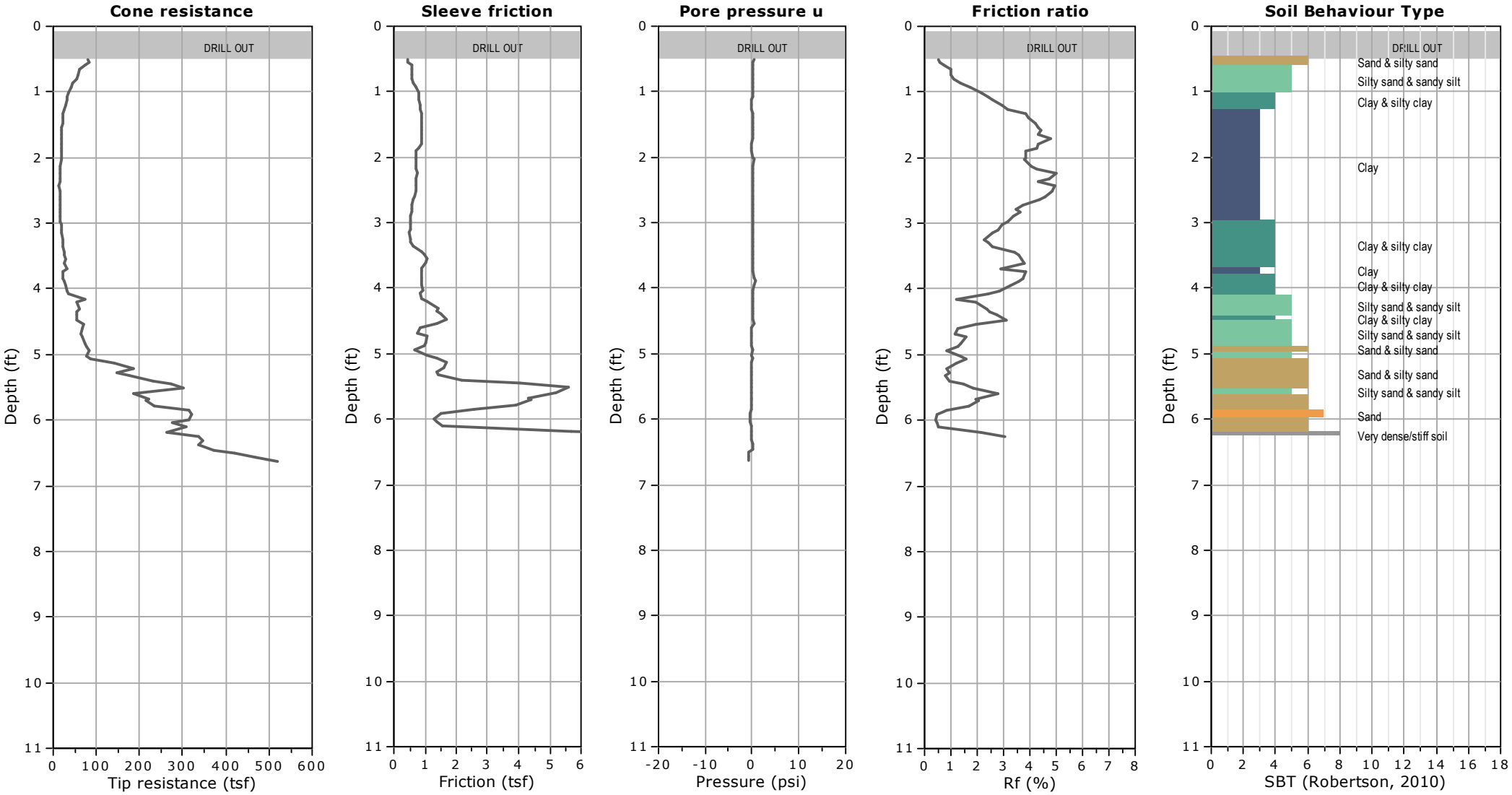
CPT-1
Total depth: 9.99 ft, Date: 1/24/2025



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **NMG Geotechnical / Kingsbarn - Prospect and 17th St**
Location: **17822 17th St, Tustin, CA**

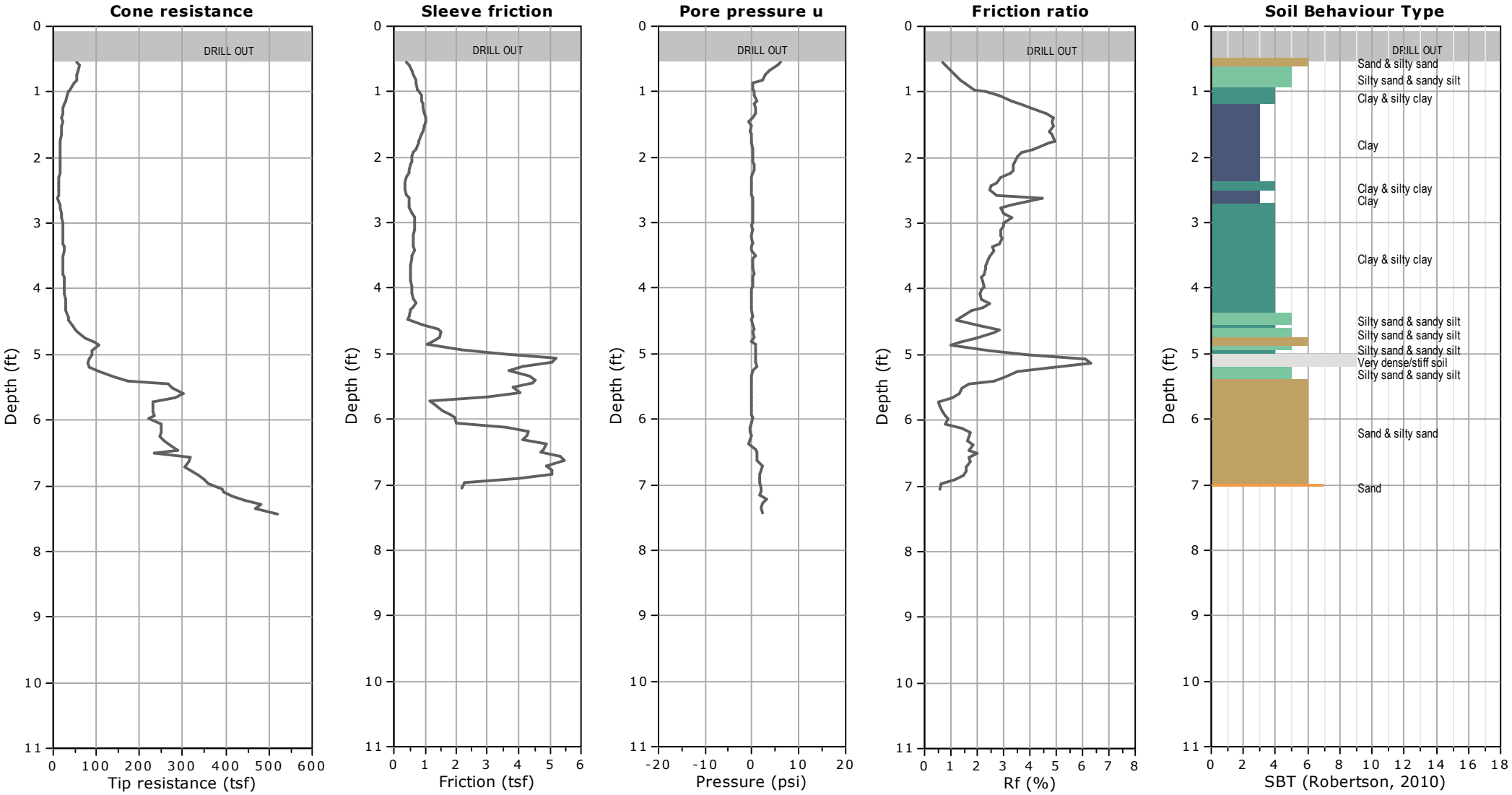
CPT-2
Total depth: 6.63 ft, Date: 1/24/2025



Kehoe Testing and Engineering
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

Project: **NMG Geotechnical / Kingsbarn - Prospect and 17th St**
Location: **17822 17th St, Tustin, CA**

CPT-2A
Total depth: 7.43 ft, Date: 1/24/2025



LANGAN

Log of Boring **LB-1** Sheet 1 of 3

Project: Prospect Avenue & 17th Street		Project No.: 700159001	
Location: Tustin, California		Elevation and Datum: 163.1 (NAVD88)	
Drilling Company: Martini Drilling Corporation		Date Started: 8/9/2024	Date Finished: 8/9/2024
Drilling Equipment: CME 75 Truck Mounted Drill Rig		Completion Depth: 51.5 ft	Rock Depth: Not Encountered
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger		Number of Samples: Disturbed 11	Undisturbed 0 / Core 0
Casing Diameter (in): N/A	Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A	Completion ▼ N/A / 24 HR. ▼ N/A
Casing Hammer: N/A	Weight (lbs): N/A / Drop (in): N/A	Drilling Foreman: Jeff Fraizer	
Sampler: 2-inch O.D. Split Spoon & 3-inch O.D. California Modified		Field Engineer: Vanessa Ramirez	
Sampler Hammer: Automatic	Weight (lbs): 140 / Drop (in): 30		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+163.1							10 20 30 40	
	+162.8		0						
	+162.4	4 inches of Asphalt Concrete							
		4 inches of Aggregate Base	1						
		Artificial Fill (af)	2						
		Brown to dark brown , CLAY, (CL), moist.	3						
	+159.1		4						
		Old Alluvial Fan Deposits (Qof)	5						EI = 21, See Appendix C
		Medium stiff, brown to dark brown, CLAY, some fine to coarse gravel, some fine to coarse sand, (CL), moist.	6	S-1	CR	18	4 9 8	• 17	
	+156.1		7						
		Dense, grayish, fine to coarse SAND with gravel, some cobbles, (SP), moist.	8	S-2	SS	12	10 28 26	• 54	
			9						
		Dense, grayish to brown, fine to coarse SAND with gravel, (SP), moist.	10						Rig chattering from 10 to 15 feet of drilling.
			11	S-3	SS	10	17 23 19	• 42	
	+150.1		12						
		Very stiff, brown, CLAY, some fine sand, (CL), moist.	13						
			14						
			15						
			16	S-4	SS	18	4 12 7	• 19	
	+145.1		17						
			18						
			19						
			20						

LANGAN

Log of Boring **LB-1** Sheet 2 of 3

Project	Project No.
Prospect Avenue & 17th Street	700159001
Location	**Elevation and Datum**
Tustin, California	Approx. el. 163.1 (NAVD 88)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+143.1	Medium dense, grayish to brown, fine to coarse SAND with gravel, some silt, (SP), moist.	20	S-5	CR	18	13 18 20	38	
			21						
			22						
			23						
			24						
		Medium dense to dense, brown, fine to coarse SAND with gravel, some cobbles , (SP), moist.	25	S-6	CR	18	29 40 19	59	
			26						
			27						
			28						
			29						
		Very dense, grayish to brown, fine to coarse SAND with gravel, (SP), moist.	30	S-7	SS	12	7 10 50/4"	50/4"	
			31						
			32						
			33						
			34						
		Dense, light gray to brown, fine to coarse SAND with gravel, (SP), moist.	35	S-8	SS	18	15 23 19	42	
			36						
			37						
			38						
			39						
		Dense, grayish white to brown, fine to coarse SAND with gravel, (SP), moist.	40	S-9	SS	18	13 22 25	47	
			41						
			42						
			43						
			44						
			45						

N-Value scale: 10 20 30 40

Template: Log-BH; Strip: BH-GEO no line; Printed on 09/05/2024

LANGAN

Log of Boring **LB-1** Sheet 3 of 3

Project	Project No.
Prospect Avenue & 17th Street	700159001
Location	**Elevation and Datum**
Tustin, California	Approx. el. 163.1 (NAVD 88)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+118.1	Very dense, grayish white to brown, fine to coarse SAND, trace fine gravel, (SP), moist.	45	S-10	SS	13	26 35	61	
			46						
			47						
			48						
			49						
		Very dense, grayish white to brown, fine to coarse SAND with gravel, (SP), moist.	50	S-11	SS	12	20 21 31	52	
	+111.6		51						
		End of Boring at 51.5ft.	52						End of boring. No groundwater encountered. Boring was backfilled with cement grout using the tremie method. Surface was patched with quickset concrete.
		DD = Dry Density pcf = pounds per cubic foot MC = Moisture Content EI = Expansion Index LL = Liquid Limit PI = Plasticity Index	53						
			54						
			55						
			56						
			57						
			58						
			59						
			60						
			61						
			62						
			63						
			64						
			65						
			66						
			67						
			68						
			69						
			70						

LANGAN

Log of Boring **LB-2** Sheet 1 of 2

Project: Prospect Avenue & 17th Street		Project No.: 700159001	
Location: Tustin, California		Elevation and Datum: 162.1 (NAVD88)	
Drilling Company: Martini Drilling Corporation		Date Started: 8/9/2024	Date Finished: 8/9/2024
Drilling Equipment: CME 75 Truck Mounted Drill Rig		Completion Depth: 26.5 ft	Rock Depth: Not Encountered
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger		Number of Samples: Disturbed 6	Undisturbed 0 / Core 0
Casing Diameter (in): N/A	Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A	Completion ▼ N/A / 24 HR. ▼ N/A
Casing Hammer: N/A	Weight (lbs): N/A / Drop (in): N/A	Drilling Foreman: Jeff Fraizer	
Sampler: 2-inch O.D. Split Spoon & 3-inch O.D. California Modified		Field Engineer: Vanessa Ramirez	
Sampler Hammer: Automatic	Weight (lbs): 140 / Drop (in): 30		

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+162.1		0						
	+161.8								
	+161.5	3 inches of Asphalt Concrete							Collected bag sample from 0.5 to 5 feet. At 0.5 to 5 feet: Sieve analysis, % Passing #200 = 45, see Appendix C
		4 inches of Aggregate Base	1						
		Artificial Fill (af)							
		Light brown to brown, clayey fine to coarse SAND, trace cobbles, (SC), moist.	2						
	+158.6		3						
		Old Alluvial Fan Deposits (Qof)	4						
		Dark brown, silty CLAY, (CL), moist.							
		soft to medium stiff, brown to dark brown, CLAY, some fine to coarse gravel, some fine to coarse sand, (CL), moist.	5	S-1	CR	18	2 3 7	• 10	DD = 114 pcf, MC = 13%, LL = 27, & PI = 13, see Appendix C
	+155.1		6						
		Medium dense, grayish to brown, fine to coarse SAND with silt and gravel, trace cobbles, (SW-SM), moist.	7	S-2	SS	10	7 12 8	• 20	Rig chattering from 7.5 to 10 feet of drilling. Sieve analysis, % Passing #200 = 6, see Appendix C
			8						
			9						
		Dense, light brown to brown, fine to coarse SAND with silt and gravel, (SW-SM), moist.	10	S-3	SS	10	10 15 23	38 •	
			11						
			12						
			13						
			14						
		Medium dense, brown to dark brown, fine to coarse SAND with silt and gravel, some cobbles, trace clay, (SW-SM), moist.	15	S-4A	CR	18	15 14 22	36 •	
	+146.3		16	S-4B					
		Very stiff , brown, CLAY, trace fine to coarse sand, trace cobbles, (CL), moist.	17						
			18						
			19						
			20						

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Log of Boring **LB-2** Sheet 2 of 2

Project	Project No.
Prospect Avenue & 17th Street	700159001
Location	**Elevation and Datum**
Tustin, California	Approx. el. 162.1 (NAVD 88)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+142.1	Stiff to very stiff, brown, CLAY, trace silt, (CL), moist.	20	S-5	SS	18	4 7 9	• 16	MC = 16.8%, LL = 33, PI = 17, see Appendix C
	+139.1	Dense, grayish to light brown, fine to coarse SAND, some fine to coarse gravel, trace silt, (SP), moist.	25	S-6	SS	12	12 19 12	31 •	
	+135.6	End of Boring at 26.5ft.	27						End of boring. No groundwater encountered. Boring was backfilled with cement grout using the tremie method. Surface was patched with quickset concrete.

DD = Dry Density
pcf = pounds per cubic foot
MC = Moisture Content
EI = Expansion Index
LL = Liquid Limit
PI = Plasticity Index

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Log of Boring **LB-3** Sheet 1 of 2

Project: Prospect Avenue & 17th Street	Project No.: 700159001
Location: Tustin, California	Elevation and Datum: 161.3 (NAVD88)
Drilling Company: Martini Drilling Corporation	Date Started: 8/9/2024 / Date Finished: 8/9/2024
Drilling Equipment: CME 75 Truck Mounted Drill Rig	Completion Depth: 26.4 ft / Rock Depth: Not Encountered
Size and Type of Bit: 8-inch O.D. Hollow Stem Auger	Number of Samples: Disturbed 6 / Undisturbed 0 / Core 0
Casing Diameter (in): N/A / Casing Depth (ft): N/A	Water Level (ft.): First ▽ N/A / Completion ▼ N/A / 24 HR. ▼ N/A
Casing Hammer: N/A / Weight (lbs): N/A / Drop (in): N/A	Drilling Foreman: Jeff Fraizer
Sampler: 2-inch O.D. Split Spoon & 3-inch O.D. California Modified	Field Engineer: Vanessa Ramirez
Sampler Hammer: Automatic / Weight (lbs): 140 / Drop (in): 30	

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft)	Remarks
	+161.3							10 20 30 40	(Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+161.0		0						
	+160.7	3 inches of Asphalt Concrete	1						Collected bag sample from 0.5 to 5 feet. At 0.5 to 5 feet: Sieve analysis, % Passing #200 = 42, see Appendix C
		4 inches of Aggregate Base							
		Artificial Fill (af)	2						
		Tannish-brown, fine to coarse SAND, some cobbles, some silt, (SP), moist.	3						
	+158.3								
		Old Alluvial Fan Deposits (Qof)	4						
		Brown, CLAY, some cobbles, some fine to coarse gravel, trace fine to coarse sand, (CL), moist.							
		Soft to medium stiff, brown, CLAY, some cobbles, some fine to coarse gravel, trace fine sand to medium sand, (CL), moist.	5	S-1	CR	18	3 4 6	10	
	+154.3		6						
		Medium dense, brown, fine to coarse SAND with gravel, some cobbles, (SP), moist.	7						
			8	S-2	SS	4	11 16 19	35	
		Dense, no recovery.	9						
			10	S-3	SS	0	11 22 28	50	Rig chattering from 10 to 15 feet of drilling.
			11						
			12						
			13						
			14						
		Medium dense, light brown, fine to coarse SAND with gravel, some clay, some cobbles, (SP), dry.	15	S-4	CR	6	50	50	
	+143.8		16						
			17						
			18						
			19						
			20						

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Log of Boring **LB-3** Sheet 2 of 2

Project	Project No.
Prospect Avenue & 17th Street	700159001
Location	**Elevation and Datum**
Tustin, California	Approx. el. 161.3 (NAVD 88)

Material Symbol	Elev. (ft)	Sample Description	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr-resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Casing Depth, Fluid Loss, Drilling Resistance, etc.)
	+141.3	Hard, brown, CLAY with fine to coarse gravel, some fine to coarse sand, some cobbles, (CL), dry.	20						
			21	S-5	CR	12	22 35 32	67	
			22						
	+138.3		23						
			24						
		Very dense, light gray to brown, fine to coarse SAND, some fine to coarse gravel, trace clay, (SP), dry.	25						
			26	S-6	SS	18	11 30 50/5"	50/5"	
	+134.9	End of Boring at 26.4ft.	27						End of boring. No groundwater encountered. Boring was backfilled with cement grout using the tremie method. Surface was patched with quickset concrete.
		DD = Dry Density pcf = pounds per cubic foot MC = Moisture Content EI = Expansion Index LL = Liquid Limit PI = Plasticity Index	28						
			29						
			30						
			31						
			32						
			33						
			34						
			35						
			36						
			37						
			38						
			39						
			40						
			41						
			42						
			43						
			44						
			45						

APPENDIX C

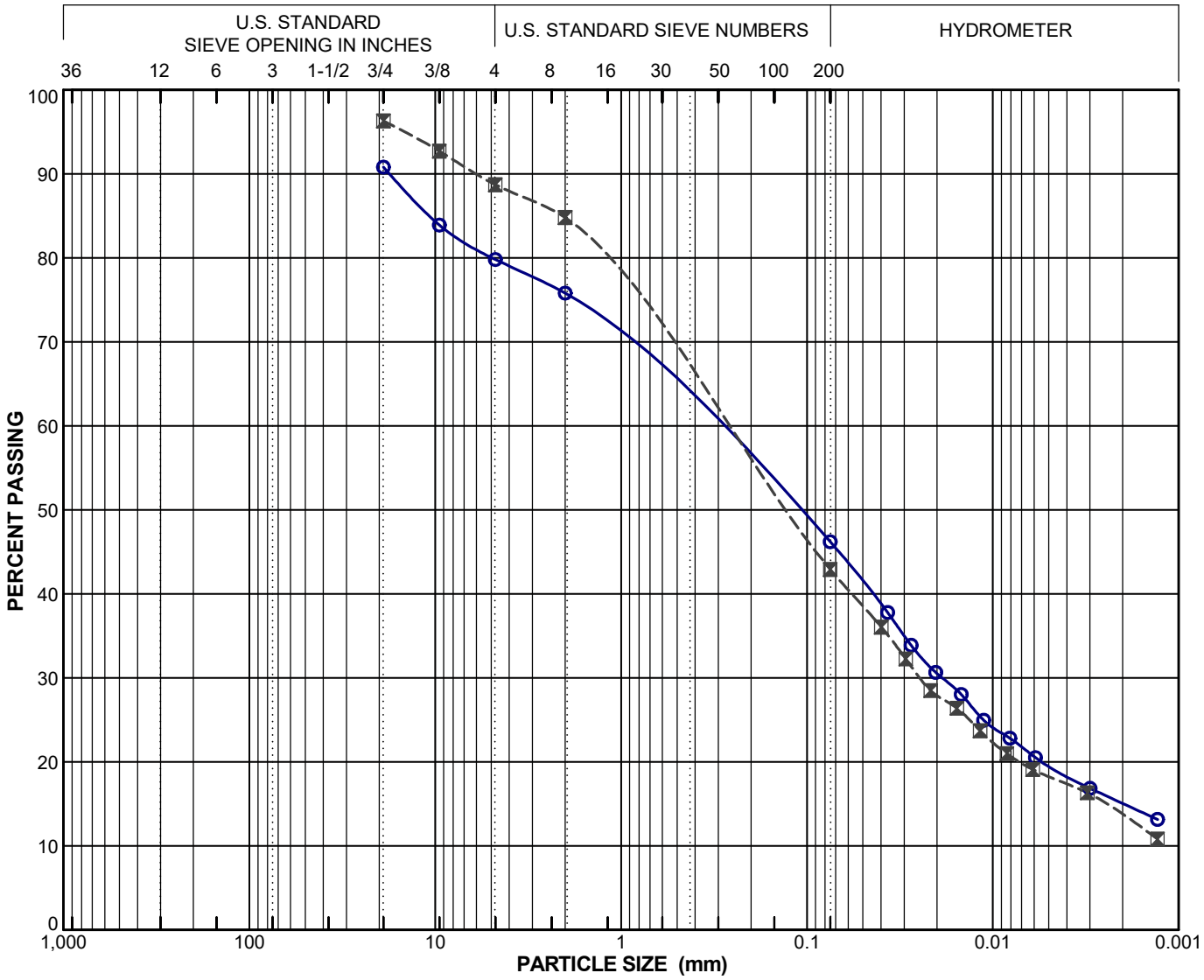
Kingsbarn Prospect & 17th
Project Number: 24073-01

APPENDIX C
SUMMARY OF SOIL LABORATORY DATA

Tustin, California

Boring/Sample Information						Field Wet Density (pcf)	Field Dry Density (pcf)	Field Moisture Content (%)	Degree of Sat. (%)	Sieve/ Hydrometer		Atterberg Limits		USCS Group Symbol	Direct Shear				Compaction		Expansion Index	R-Value	Soluble Sulfate Content (% by wt)	Remarks
															Ultimate		Peak							
Boring No.	Sample No.	Depth (feet)	End Depth (feet)	Elevation (feet)	Blow Count (N)					Fines Content (% pass. #200)	Clay Content (% pass. 2μ)	LL (%)	PI (%)		Cohesion (psf)	Friction Angle (°)	Cohesion (psf)	Friction Angle (°)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)				
H-1	B-1	1.0	2.5	162.0						46	15	27	10	SC	175	27	800	27.0						CC
H-1	B-1 & B-2	1.0	10.0	162.0										SC					134.0	8.0	32			
H-2	B-1	1.0	5.0	161.0						43	14	26	8	SC	175	27	475	27.0	126.0	11.0	21			CC
H-3	B-1	1.0	2.5	161.0																				

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

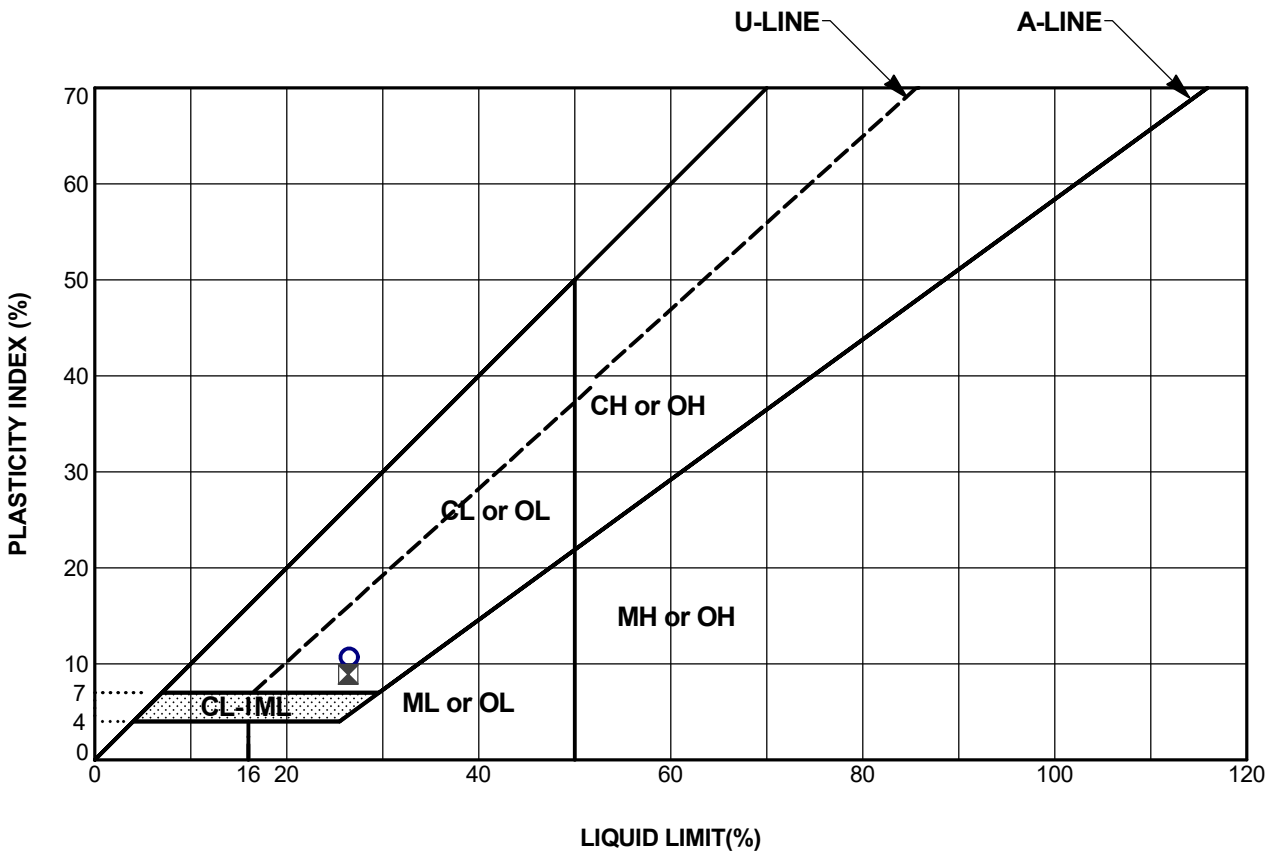


Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
O	H-1	B-1	1.0 - 2.5	17	27	10	0.67			46	15	SC
⊠	H-2	B-1	1.0 - 5.0	18	26	8	0.57			43	14	SC

PARTICLE SIZE DISTRIBUTION

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

NMG Geotechnical, Inc.



Symbol	Boring Number	Sample Number	Depth (feet)	Passing No. 200 Sieve (%)	LL	PI	USCS	Description
○	H-1	B-1	1.0 - 2.5	46	27	10	SC	(Afu) Dark yellowish brown clayey SAND
⊠	H-2	B-1	1.0 - 5.0	43	26	8	SC	(Afu) Light brown clayey SAND

PLASTICITY CHART

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

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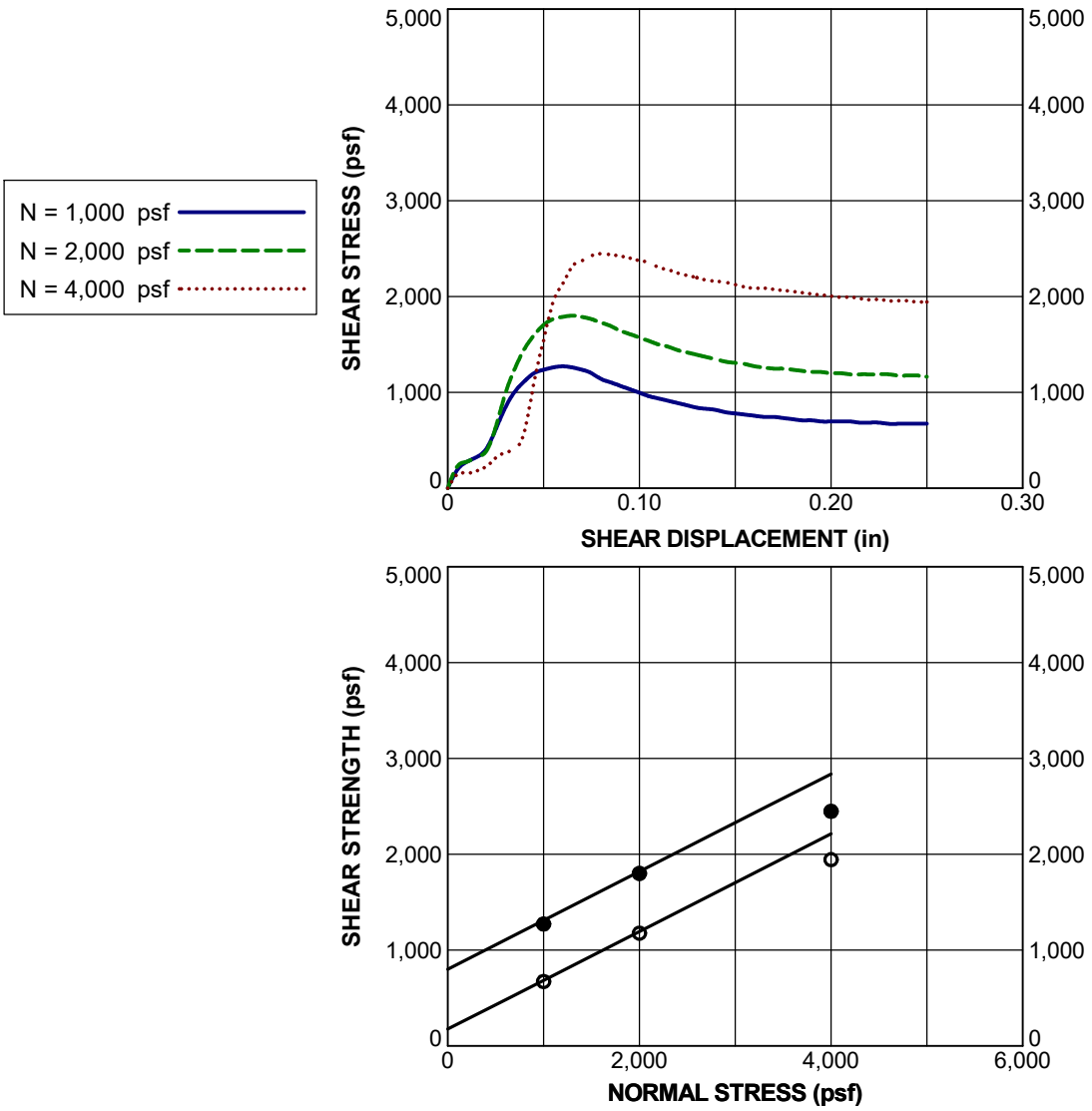

Boring No. H-1		**Sample No. B-1**		**Depth: 1.0 - 2.5 ft**	
Sample Description: (Afu) Dark yellowish brown clayey SAND				**USCS:** SC	
Liquid Limit:	27	**Plasticity Index:**	10	**Percent Passing No. 200 Sieve:**	46
Final Moisture Content (%):	17.2	**Final Dry Density (pcf):**	120.5	**Degree of Saturation (%):**	99
Sample Type:	Remolded to 90% RC	**Rate of Shear (in./min.):**	0.005		

SHEAR STRENGTH PARAMETERS

Parameter	Peak ●	Ultimate ○
Cohesion (psf)	800	175
Friction Angle (degrees)	27.0	27.0

DIRECT SHEAR TEST RESULTS

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

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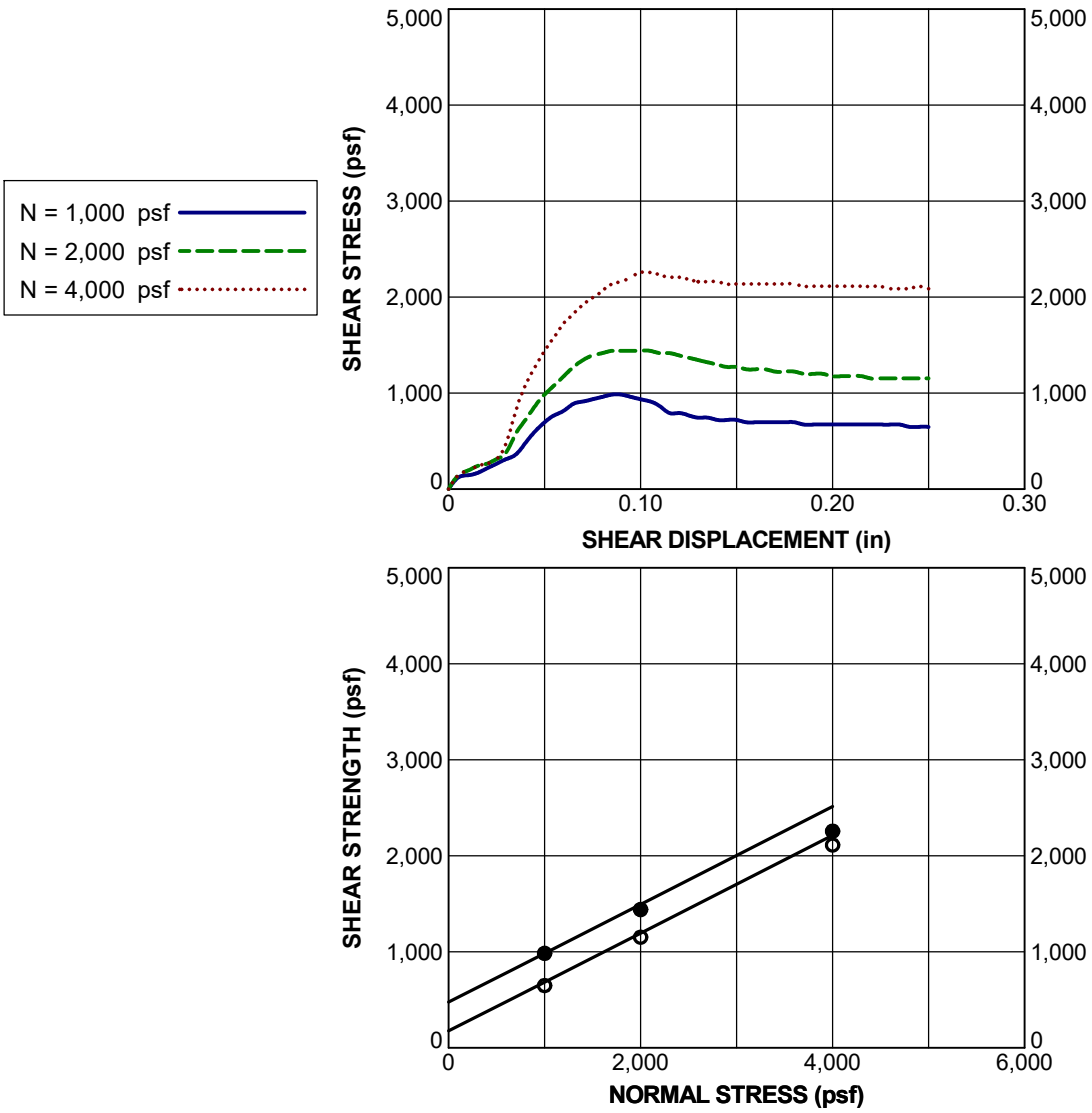

Boring No. H-2	Sample No. B-1	Depth: 1.0 - 5.0 ft
Sample Description: (Afu) Light brown clayey SAND		**USCS:** SC
Liquid Limit: 26	**Plasticity Index:** 8	**Percent Passing No. 200 Sieve:** 43
Final Moisture Content (%): 17.6	**Final Dry Density (pcf):** 113.4	**Degree of Saturation (%):** 98
Sample Type: Remolded to 90% RC	**Rate of Shear (in./min.):** 0.005	

SHEAR STRENGTH PARAMETERS

Parameter	Peak ●	Ultimate ○
Cohesion (psf)	475	175
Friction Angle (degrees)	27.0	27.0

DIRECT SHEAR TEST RESULTS

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

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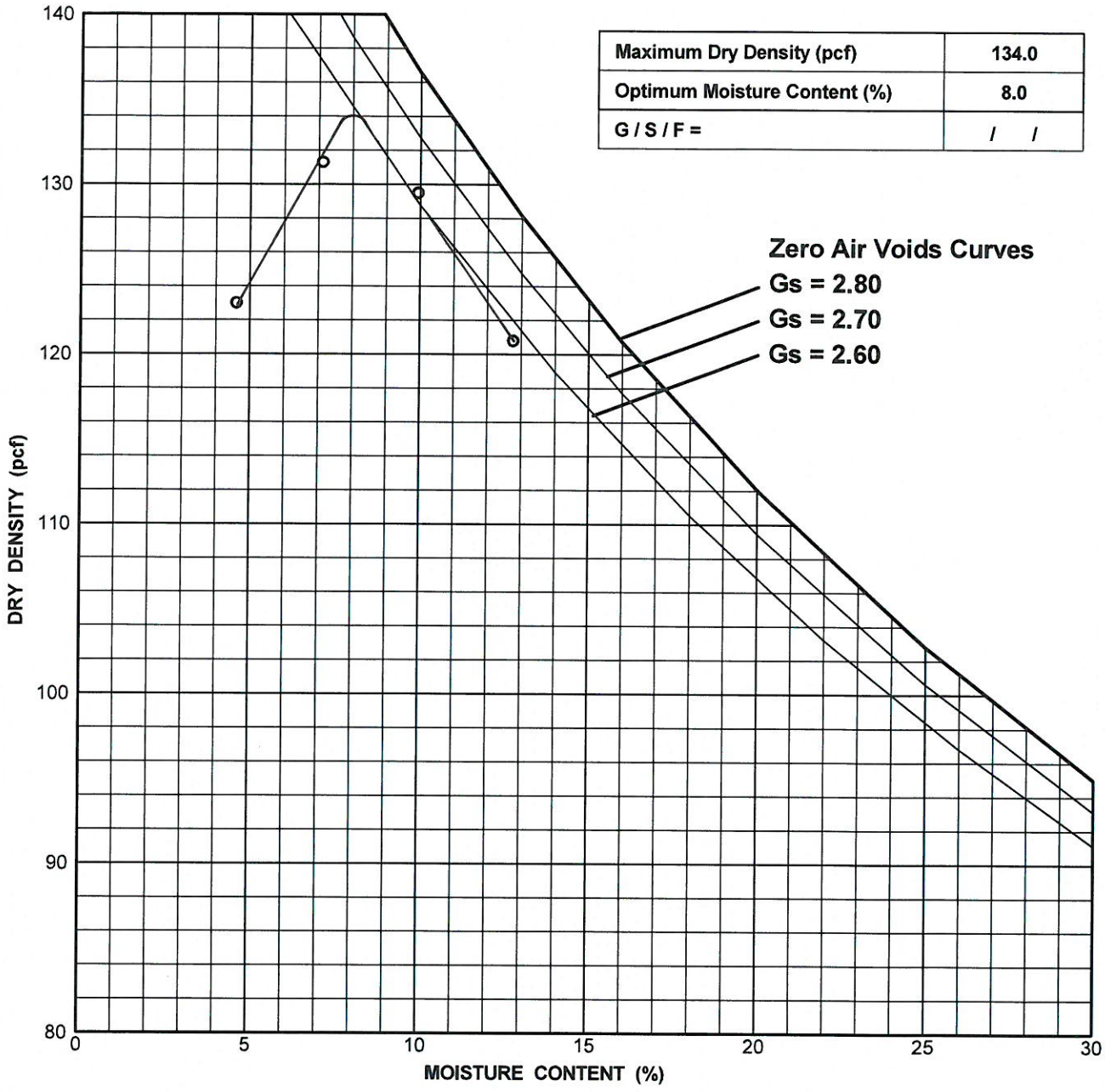


Maximum Dry Density (pcf)	134.0
Optimum Moisture Content (%)	8.0
G / S / F =	/ /

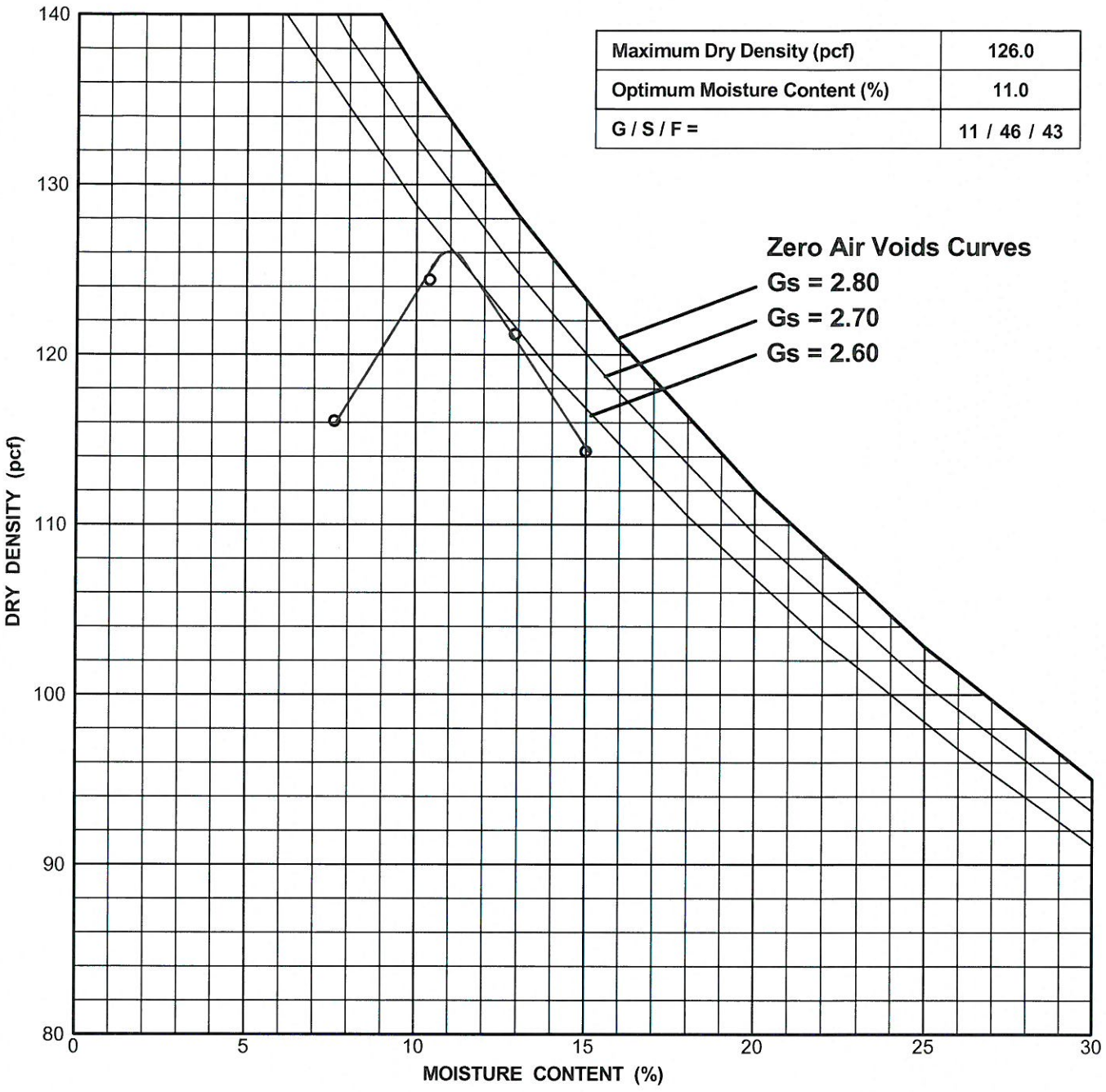
Boring No. H-1	**Sample No. B-1 & B-2**	**Depth: 1.0 - 10.0 ft**
Sample Description: (Afu, Qalo) Dark yellowish brown clayey SAND		**USCS:** SC
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:**
Comments: 1557C		

COMPACTION TEST RESULTS

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	126.0
Optimum Moisture Content (%)	11.0
G / S / F =	11 / 46 / 43



Boring No. H-2	**Sample No. B-1**	**Depth: 1.0 - 5.0 ft**
Sample Description: (Afu) Light brown clayey SAND		**USCS:** SC
Liquid Limit: 26	**Plasticity Index:** 8	**Percent Passing No. 200 Sieve:** 43
Comments: 1557C		

COMPACTION TEST RESULTS

Kingsbarn Prospect & 17th
Tustin, California
PROJECT NO. 24073-01

NMG Geotechnical, Inc.

Sample	Compacted Moisture (%)	Compacted Dry Density (pcf)	Final Moisture (%)	Volumetric Swell (%)	Expansion Index[1] Value/Method		Expansive Classification[2]	Soluble Sulfate (%)	Sulfate Exposure[3]
H-1 B-1 1-2.5'	8.0	116.3	15.9	31.9	32	A	Low	--	--
H-2 B-1 1-5'	10.0	108.0	20.0	2.09	21	A	Low	--	--

Test Method:
ASTM D4829

HACH SF-1 (Turbidimetric)

Notes:
1. Expansion Index (EI) method of determination*:*
   [A] E.I. determined by adjusting water content to achieve a 50 ±2% degree of saturation
   [B] E.I. calculated based on measured saturation within the range of 40% and 60%
2. ASTM D4829 *(Classification of Expansive Soil)*
3. ACI-318-14 Table 19.3.1.1 *(Requirement for Concrete Exposed to Sulfate-Containing Solutions)*

Expansion Index and Soluble Sulfate Test Results

(FRM001 Rev.5)

Project No. 24073-01

Project Name: Kingsbarn/ 17th

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MOISTURE AND DENSITY TEST RESULTS

ASTM D2216 and ASTM D7263 (Method B)

Client: Langan Engineering
Project Name: Prospect Ave & 17th Street
Project No.: 700159001

AP Lab No.: 24-0847
Test Date: 08/20/24

Boring No.	Sample No.	Sample Depth (ft.)	Moisture Content (%)	Dry Density (pcf)
LB-2	S-1	5	13.0	113.7
LB-2	S-5	20	16.8	NA

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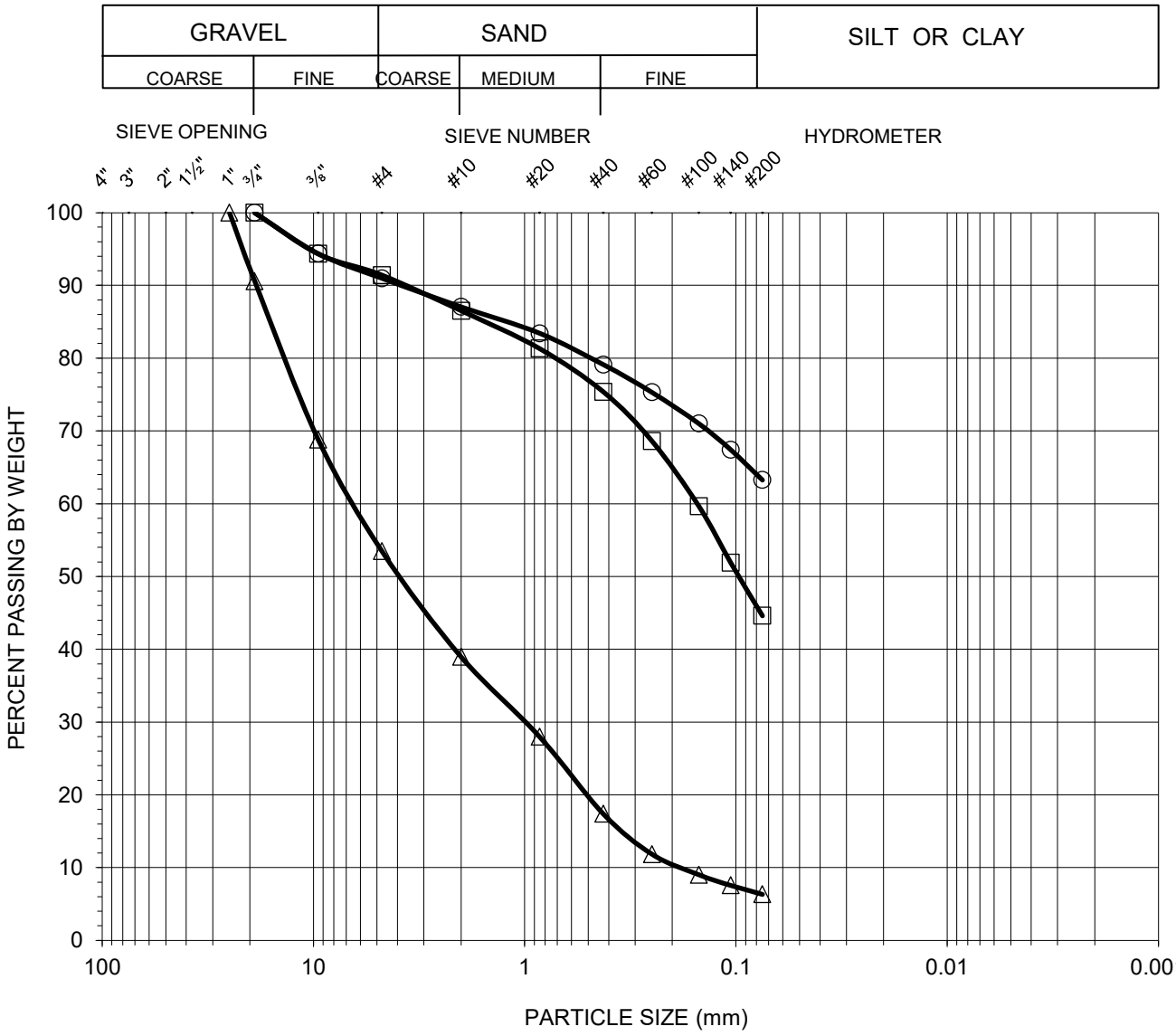
GRAIN SIZE DISTRIBUTION CURVE
ASTM D 6913

Client Name:	Langan Engineering	Tested by:	SM	Date:	08/22/24
Project Name:	Prospect Ave & 17th Street	Computed by:	JG	Date:	08/23/24
Project No.:	7E+08	Checked by:	AP	Date:	08/23/24



Symbol	Boring No.	Sample No.	Sample Depth (feet)	Percent			Atterberg Limits LL:PL:PI	Soil Type U.S.C.S
				Gravel	Sand	Silt & Clay		
○	LB-1	B-1	0-5	9	28	63	N/A	CL*
□	LB-2	B-1	0-5	9	46	45	N/A	SC*
△	LB-2	S-2	7-5	46	48	6	N/A	SW-SM

*Note: The plasticity is based on visual classification of sample

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GRAIN SIZE DISTRIBUTION CURVE
ASTM D 6913

Client Name:	Langan Engineering	Tested by:	SM	Date:	08/22/24
Project Name:	Prospect Ave & 17th Street	Computed by:	JG	Date:	08/23/24
Project No.:	7E+08	Checked by:	AP	Date:	08/23/24

Symbol	Boring No.	Sample No.	Sample Depth (feet)	Percent			Atterberg Limits LL:PL:PI	Soil Type U.S.C.S
				Gravel	Sand	Silt & Clay		
○	LB-3	B-1	0-5	13	45	42	N/A	SC*

*Note: The plasticity is based on visual classification of sample.

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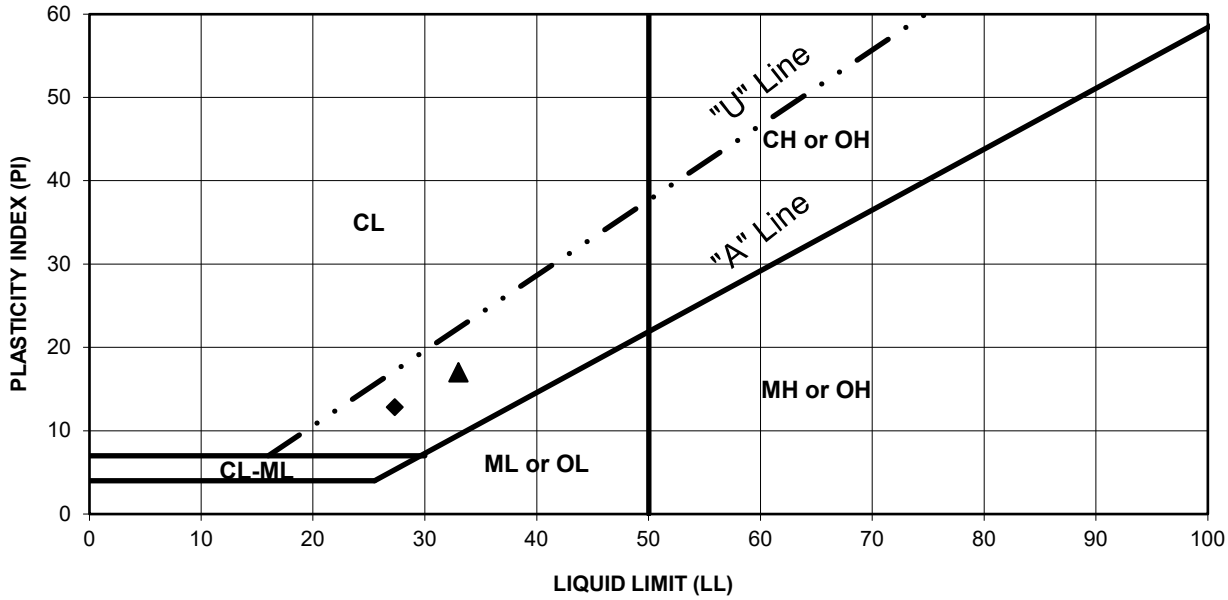
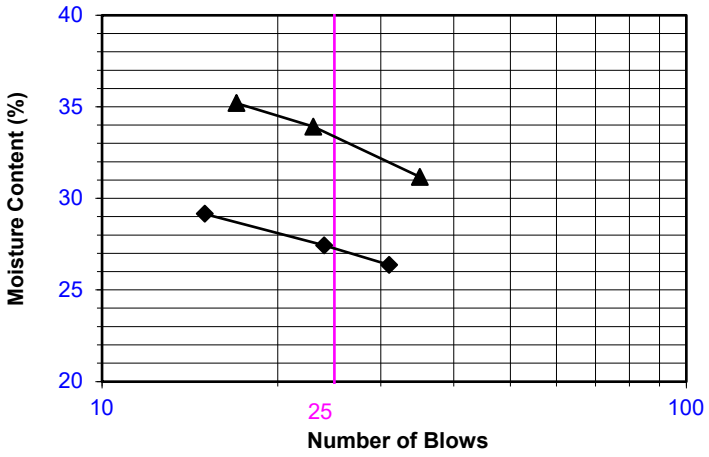
ATTERBERG LIMITS
ASTM D 4318

Client Name:	Langan Engineering	Tested By:	DK	Date:	08/21/24
Project Name:	Prospect Ave & 17th Street	Computed By:	JG	Date:	08/22/24
Project No.:	700159001	Checked By:	AP	Date:	08/23/24



PROCEDURE USED

- ☐ Wet Preparation
- ☒ Dry Preparation
- ☒ Procedure A Multipoint Test
- ☐ Procedure B One-point Test



Symbol	Boring Number	Sample Number	Depth (feet)	LL	PL	PI	Plasticity Chart Symbol
♦	LB-2	S-1	5	27	14	13	CL
▲	LB-2	S-5	20	33	16	17	CL

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EXPANSION INDEX TEST RESULTS

ASTM D 4829

Client Name: Langan Engineering
Project Name: Prospect Avenue & 17th Street
Project No.: 700159001

AP Job No.: 24-0847
Date: 08/21/24

Boring No.	Sample No.	Depth (ft)	Soil Description	Molded Dry Density (pcf)	Molded Moisture Content (%)	Init. Degree Saturation (%)	Measured Expansion Index	Corrected Expansion Index
LB-1& LB-2	S-1	5	Sandy Clay	119.5	7.7	50.8	21	21

ASTM EXPANSION CLASSIFICATION

Expansion Index	Classification
0-20	V. Low
21-50	Low
51-90	Medium
91-130	High
>130	V. High

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CORROSION TEST RESULTS

Client Name: Langan Engineering
Project Name: Prospect Avenue & 17th Street
Project No.: 700159001

AP Job No.: 24-0847
Date: 08/21/24

Boring No.	Sample No.	Depth (feet)	Soil Description	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
LB-1	B-1	0-5	Sandy Clay	2,043	8.3	43	27

NOTES: Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

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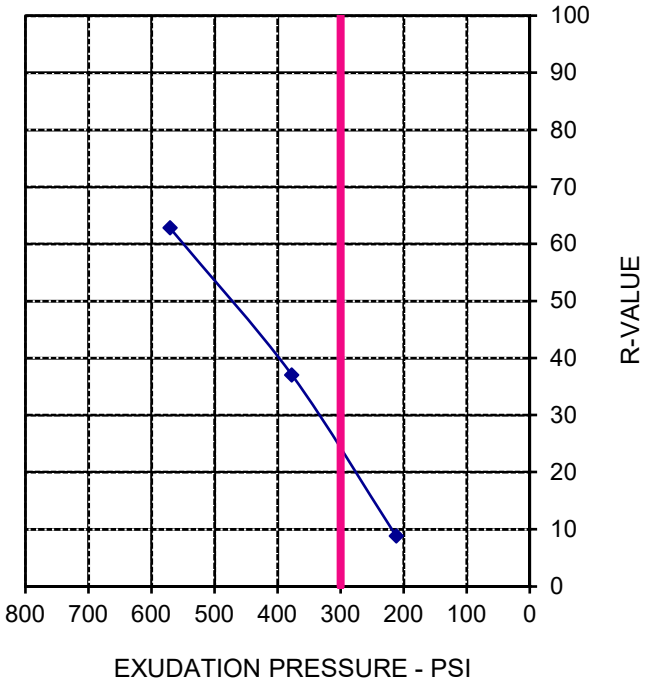
R-VALUE TEST DATA

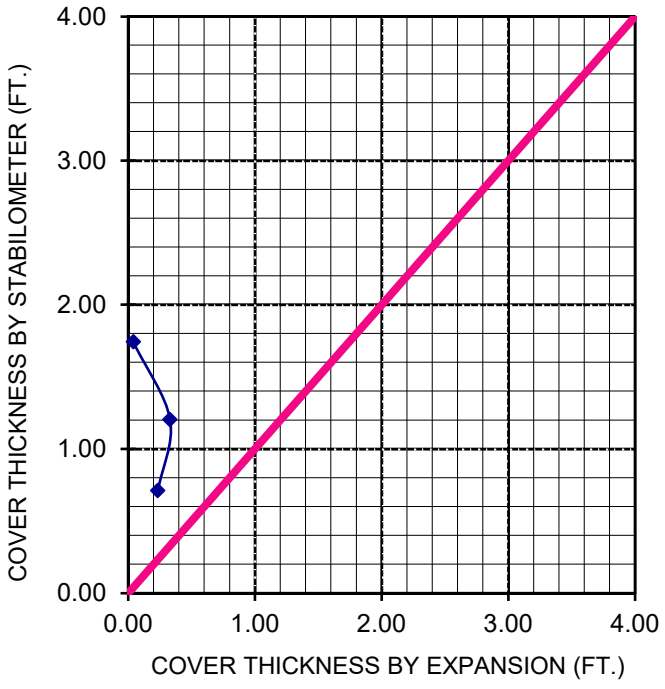
ASTM D2844

Project Name:	Prospect Ave & 17th Street		Tested By:	ST	Date: 08/16/24
Project Number:	700159001		Computed By:	KM	Date: 08/20/24
Source:	LB-1		Checked By:	AP	Date: 08/23/24
Sample No.:	B-1	Depth (ft.): 0-5			
Location:	N/A				
Soil Description:	Sandy Clay				

Mold Number	G	H	I	
Water Added, g	0	-29	-39	
Compact Moisture(%)	16.3	13.3	12.3	
Compaction Gage Pressure, psi	75	275	300	
Exudation Pressure, psi	212	377	570	
Sample Height, Inches	2.5	2.5	2.5	
Gross Weight Mold, g	2920	2932	2916	
Tare Weight Mold, g	1826	1836	1818	
Net Sample Weight, g	1094	1097	1098	
Expansion, inchesx10^{-4}	12	99	70	
Stability 2,000 (160 psi)	57/135	30/80	15/43	
Turns Displacement	4.80	4.25	4.03	
R-Value Uncorrected	9	37	63	
R-Value Corrected	9	37	63	
Dry Density, pcf	114.0	117.3	118.5	
Traffic Index	8.0	8.0	8.0	
G.E. by Stability	1.74	1.20	0.71	
G.E. by Expansion	0.04	0.33	0.23	

R-VALUE	By Exudation:	24
	By Expansion:	*N/A
	At Equilibrium: (by Exudation)	24
Remarks	Gf = 1.34, and 6.1 % Retained on the ¾" *Not Applicable	





APPENDIX D

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.

Earthquake Hazard and Probability Maps

Input

Edition

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

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.759

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

-117.821

2% in 50 years
(2,475 years)

5% in 50 years
(975 years)

10% in 50 years
(475 years)

Choose location using a map

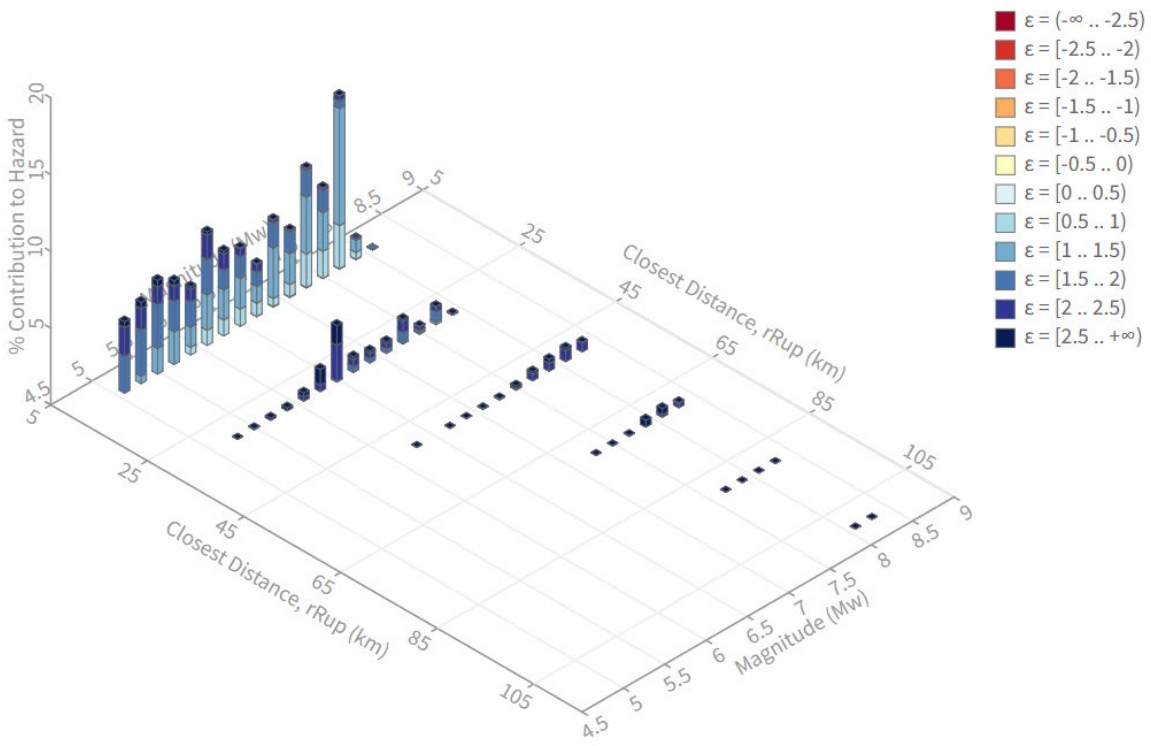
Site Class

259 m/s (Site class D)

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.65222781 g

Recovered targets

Return period: 3079.3612 yrs
Exceedance rate: 0.00032474268 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.06 %

Mean (over all sources)

m: 6.63
r: 15.31 km
ε_0: 1.62 σ

Mode (largest m-r bin)

m: 7.71
r: 14.42 km
ε_0: 1.2 σ
Contribution: 11.27 %

Mode (largest m-r-ε_0 bin)

m: 7.71
r: 15.64 km
ε_0: 1.3 σ
Contribution: 7.62 %

Discretization

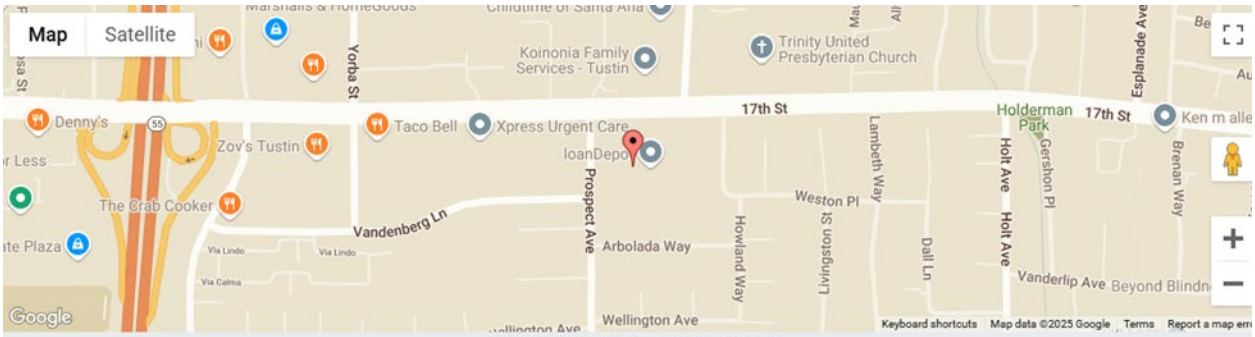
r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

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	ϵ_0	lon	lat	az	%
UC33brAvg_FM32	System							28.55
Whittier alt 2 [2]		16.20	7.59	1.44	117.737°W	33.886°N	28.58	4.22
San Joaquin Hills [1]		10.65	7.19	1.18	117.835°W	33.668°N	187.53	4.21
Compton [0]		17.72	7.28	1.18	118.043°W	33.702°N	253.05	2.60
Elsinore (Glen Ivy) rev [0]		22.76	6.58	2.41	117.590°W	33.829°N	69.93	2.34
Peralta Hills [0]		8.68	7.32	1.02	117.814°W	33.835°N	4.43	2.32
Newport-Inglewood alt 2 [1]		18.23	7.51	1.55	117.974°W	33.657°N	231.40	1.67
Chino alt 2 [2]		20.56	7.01	1.88	117.634°W	33.882°N	51.46	1.66
Anaheim [0]		12.47	6.94	1.22	117.943°W	33.780°N	281.85	1.33
Richfield [0]		14.57	6.38	1.98	117.837°W	33.885°N	354.19	1.32
UC33brAvg_FM31	System							28.08
Whittier alt 1 [2]		16.26	7.49	1.50	117.740°W	33.888°N	27.45	4.61
San Joaquin Hills [1]		10.65	7.54	1.00	117.835°W	33.668°N	187.53	3.48
Peralta Hills [0]		8.68	6.96	1.24	117.814°W	33.835°N	4.43	2.66
Compton [0]		17.72	7.23	1.20	118.043°W	33.702°N	253.05	2.43
Elsinore (Glen Ivy) rev [0]		22.76	6.60	2.40	117.590°W	33.829°N	69.93	2.31
Chino alt 1 [4]		17.64	6.79	1.91	117.629°W	33.876°N	53.66	1.96
Newport-Inglewood alt 1 [0]		18.31	7.49	1.56	117.976°W	33.658°N	231.96	1.77
Anaheim [0]		12.47	6.89	1.25	117.943°W	33.780°N	281.85	1.30
UC33brAvg_FM32 (opt)	Grid							21.71
PointSourceFinite: -117.821, 33.799		6.75	5.65	1.35	117.821°W	33.799°N	0.00	3.07
PointSourceFinite: -117.821, 33.799		6.75	5.65	1.35	117.821°W	33.799°N	0.00	3.07
PointSourceFinite: -117.821, 33.817		7.73	5.85	1.42	117.821°W	33.817°N	0.00	2.45
PointSourceFinite: -117.821, 33.817		7.73	5.85	1.42	117.821°W	33.817°N	0.00	2.45
PointSourceFinite: -117.821, 33.835		9.07	5.89	1.59	117.821°W	33.835°N	0.00	1.52
PointSourceFinite: -117.821, 33.835		9.07	5.89	1.59	117.821°W	33.835°N	0.00	1.52
PointSourceFinite: -117.821, 33.871		11.74	6.06	1.81	117.821°W	33.871°N	0.00	1.38
PointSourceFinite: -117.821, 33.871		11.74	6.06	1.81	117.821°W	33.871°N	0.00	1.38
PointSourceFinite: -117.821, 33.844		10.14	5.78	1.76	117.821°W	33.844°N	0.00	1.07
PointSourceFinite: -117.821, 33.844		10.14	5.78	1.76	117.821°W	33.844°N	0.00	1.07
UC33brAvg_FM31 (opt)	Grid							21.65
PointSourceFinite: -117.821, 33.799		6.75	5.65	1.35	117.821°W	33.799°N	0.00	2.98
PointSourceFinite: -117.821, 33.799		6.75	5.65	1.35	117.821°W	33.799°N	0.00	2.98
PointSourceFinite: -117.821, 33.817		7.72	5.86	1.41	117.821°W	33.817°N	0.00	2.43
PointSourceFinite: -117.821, 33.817		7.72	5.86	1.41	117.821°W	33.817°N	0.00	2.43
PointSourceFinite: -117.821, 33.835		9.06	5.89	1.58	117.821°W	33.835°N	0.00	1.56
PointSourceFinite: -117.821, 33.835		9.06	5.89	1.58	117.821°W	33.835°N	0.00	1.56
PointSourceFinite: -117.821, 33.871		11.71	6.07	1.81	117.821°W	33.871°N	0.00	1.42
PointSourceFinite: -117.821, 33.871		11.71	6.07	1.81	117.821°W	33.871°N	0.00	1.42
PointSourceFinite: -117.821, 33.844		10.07	5.81	1.74	117.821°W	33.844°N	0.00	1.13
PointSourceFinite: -117.821, 33.844		10.07	5.81	1.74	117.821°W	33.844°N	0.00	1.13



Lat: 33.75891313, Lng: -117.82164401

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

Search for Address or Coordinates

Reference: ASCE 7-16 | Risk Category: II | Site Class: D - Stiff Soil

Project Title (optional)

Address | Coords: 33.75891313, -117.82164401 Go

Latitude, Longitude: 33.75891313, -117.82164401 Print

Date	2/19/2025, 9:57:45 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.311	MCE_R ground motion. (for 0.2 second period)
S_1	0.468	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.311	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.874	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.529	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.582	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.311	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.402	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.468	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.504	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.529	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.547	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.935	Mapped value of the risk coefficient at short periods
C_{R1}	0.928	Mapped value of the risk coefficient at a period of 1 s
C_V	1.362	Vertical coefficient

Disclaimer

APPENDIX E

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 General

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

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

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

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

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

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

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

2.0 Preparation of Areas to be Filled

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

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

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

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

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

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

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

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

3.0 Fill Material

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

3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

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

4.0 Fill Placement and Compaction

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

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

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

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

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

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

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

5.0 Subdrain Installation

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

6.0 Excavation

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

7.0 Trench Backfills

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

7.2 Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum 90 percent of maximum from 1 foot above the top of the conduit to the surface, except in traveled ways (see Section 7.6 below).

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

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

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

7.6 Trench backfill in the upper foot measured from finish grade/subgrade within existing or future traveled way, shoulder, and other paved areas (or areas to receive pavement) should be placed to a minimum 95 percent relative compaction unless specified differently by the governing agency.