

GEOTECHNICAL FEASIBILITY REPORT, PROPOSED  
RESIDENTIAL DEVELOPMENT, 348 SOUTH HILL STREET,  
CITY OF LOS ANGELES, CALIFORNIA

Prepared for:

**EQUITY RESIDENTIAL**

26880 Aliso Viejo Parkway, Suite 200  
Aliso Viejo, California 92656

Project No. 10705.001

June 12, 2014



Leighton and Associates, Inc.

A LEIGHTON GROUP COMPANY



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To: Equity Residential  
26880 Aliso Viejo Parkway, Suite 200  
Aliso Viejo, California 92656

Attention: Mr. Dustin Smith

Subject: Geotechnical Feasibility Report, Proposed Residential Development, 348  
South Hill Street, City of Los Angeles, California

In response to your request and authorization, Leighton and Associates, Inc. (Leighton) has prepared this geotechnical feasibility report for the proposed residential development to be located at northeast corner of 4<sup>th</sup> Street and Hill Street in the city of Los Angeles, California. This report is issued as draft and may be revised accordingly based on the results of the ongoing laboratory testing.

The site is an approximately 0.7-acre parcel that will be developed for a 28-story building over a 3-level subterranean parking structure.

Artificial fill consisting predominantly of clayey sand and sandy clay with brick debris was encountered to depths of 5 to 10 feet below the existing grade. The fill is underlain by alluvium consisting mainly of very dense sand with gravel. Bedrock of the San Fernando Formation was encountered below the alluvium at depths of 15 to 20 feet. Groundwater was encountered at depths of 16 to 26 feet below existing grade in Borings LB-1 through LB-3. However, groundwater was not encountered in boring LB-4.

The subterranean levels of the proposed 28-story structure will be approximately 30 feet below existing grade. Based on the planned depth of subterranean levels, geotechnical aspects of the site that should be considered in planning and design include the presence of bedrock and groundwater, the need for relatively high permanent shoring systems, and the interactions of the proposed subterranean levels with the existing underground improvements associated with the adjacent Pershing Square Metro Station.

No known active or potentially active faults are mapped to cross the site, and the site is not located within an Alquist-Priolo Special Studies Zones. However, significant ground shaking should be anticipated at the site during the expected life of the proposed structure.

The proposed project is deemed feasible from a geotechnical standpoint. Conventional mat foundation established on undisturbed native soils or on engineered fill may be used to support the proposed structure.

Presented in this report are our findings and preliminary recommendations for the proposed project based on the reviewed geotechnical aspects of the site and the anticipated behavior of the soils during and after construction.

We appreciate the opportunity to be of service to you on this project. If you have any questions or if we can be of further service, please contact us at your convenience.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Djan Chandra, PE, GE 2376  
Senior Principal Engineer

SP/DJC/gv

Distribution: (1) Addressee

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## 1.0 INTRODUCTION

### 1.1 Site Description and Proposed Development

The site is an approximately 0.7-acre parcel, bordered by Hill Street to the west, 4<sup>th</sup> Street to the south, and existing buildings to the north and east (See Figure 1, Site Location Map). The site is relatively flat and currently used as a paved parking lot.

### 1.2 Proposed Development

Based on the information provided to us, we understand that the proposed development consists of a 28-story building with roof-top amenities and helipad over a 3-level subterranean parking structure. Level 1 will be developed for leasing office, lobby and retails, Level 2 through 6 will be used for residential parking garage, and Levels 7 through 28 will be occupied by approximately 367 units of studio, one-bedroom, and two-bedroom units. A portion of Level 3 through 6 along 4<sup>th</sup> Street will cantilever over Pershing Square Metro Station entrance.

### 1.3 Purpose and Scope

The purpose of our work was to evaluate the general geotechnical conditions of the site relative to the proposed development and provide preliminary geotechnical recommendations to aid in the project planning. The scope of this geotechnical evaluation included the following tasks:

- Background Review – In preparation of this report, we performed a background review of readily available, relevant, geotechnical and geological literature pertinent to the site. References used in preparation of this report are listed in Section 6.0.
- Field Exploration – Prior to performing subsurface exploration, a reconnaissance of the site was carried out by Leighton (Leighton) personnel. The locations of proposed explorations were marked on the ground surface and Underground Service Alert (USA) was notified to provide clearance for any underground utility lines.

Our field exploration was performed between May 21 and May 23, 2013, and consisted of four hollow-stem auger borings (LB-1 through LB-4) drilled to a

maximum depth of 81½ feet below existing grade. The approximate locations of the explorations are shown on Figure 2, *Geotechnical Exploration Map*. Soils encountered in the borings were continuously logged in the field by a Leighton representative and described in accordance with the Unified Soil Classification System (ASTM D 2488). During drilling, bulk and relatively undisturbed drive samples were obtained from the borings for geotechnical laboratory testing and evaluation. The relatively undisturbed samples were obtained utilizing a modified California drive sampler with 2<sup>3</sup>/<sub>8</sub>-inch I.D. (inside diameter) and 3-inch O.D. (outside diameter), driven 18 inches with a 140 pound automatic hammer dropping 30 inches in general accordance with ASTM Test Method D3550. Standard Penetration Tests (SPTs) were performed using a 24-inch-long, 1<sup>3</sup>/<sub>8</sub>-inch I.D. and 2-inch O.D. split spoon sampler driven 18 inches with a 140-pound hammer dropping 30 inches in general accordance with ASTM Test Method D1586. The number of blow counts per 6 inches of penetration was recorded on the boring logs. Logs of the boring are presented in Appendix A.

- Laboratory Testing – Geotechnical laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field exploration. The laboratory testing program was designed to evaluate the engineering characteristics of the onsite soil and included in situ moisture content and dry density, percent passing No. 200 sieve, Atterberg Limits, direct shear, consolidation, R-value, and Corrosivity (sulfate and chloride content, minimum resistivity, and pH). The laboratory tests are in progress and the results will be presented in Appendix B.
- Geophysical Testing – Geophysical surveys were performed using Electromagnetic (EM) and magnetic surveys to assess the presence of subsurface features, including utilities. The EM survey was conducted with a Geonics EM61 MK2 time domain instrument and the magnetic survey was performed with a Geometrics cesium vapor magnetometer. The EM61 can typically detect metal objects to depths of 11 feet depending on their size, and the magnetometer can detect ferromagnetic objects to greater depths, again depending on their size. Ground penetrating radar (GPR) and line tracers were also used to detect underground utilities. Results of the geophysical testing will be presented in Appendix C.
- Engineering Analysis – The data obtained from our background review and field exploration were evaluated and analyzed to develop the preliminary

geotechnical parameters and recommendations for the proposed development.

- Report Preparation – This report presents our findings, conclusions and preliminary recommendations for the proposed development. The recommendations should be reviewed and revised, if necessary, based on final development plans and additional geotechnical analyses during the design development phase.

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## 2.0 GEOTECHNICAL FINDINGS

### 2.1 Geologic Setting

The project site is situated within the Los Angeles basin, a deep structural sediment-filled trough located at the northern end of the Peninsular Ranges geomorphic province of southern California. The Peninsular Ranges extend approximately 900 miles southward from the Santa Monica Mountains to the tip of Baja California (Yerkes, et al., 1965). The province is characterized by elongated northwest-trending mountain ridges and sediment-floored valleys. The province includes numerous northwest trending fault zones, most of which either die out, merge with, or are terminated by faults that form the southern margin of the frontal mountain thrust faults, which mark the southern boundary of the east-west trending Transverse Ranges province. These northwest trending, seismically active fault zones include the San Jacinto, Whittier-Elsinore, Palos Verdes, and Newport-Inglewood faults.

The subject site is located west of the channelized Los Angeles River. For the past 15,000 years the Los Angeles River has been intermittently transporting material eroded from the upland areas to San Pedro Bay. The site is underlain by Quaternary-aged alluvium (Dibblee, 1991) generally consisting of interbedded sand, silt, and clay with varying amounts of gravel deposited as the ancestral Los Angeles River meandered across the floodplain of the Los Angeles basin. These deposits are underlain by a thick (several thousands of feet) sequence of Tertiary age, sedimentary rock formations locally intruded by igneous rocks of middle Miocene age overlying Cretaceous age basement rocks belonging to the Catalina Schist.

### 2.2 Subsurface Soil Conditions

The site is underlain by artificial fill (Af), Quaternary-aged alluvium (Qa), and bedrock. The artificial fill encountered in our borings generally ranges from 5 to 10 feet in thickness and consisted primarily of clayey sand and sandy clay with brick debris.

Below the artificial fill, Quaternary-aged alluvium was encountered in all of the borings to a depth of 15 to 20 feet below existing grade. The alluvium generally consisted of moist to very moist, dense to very dense sand with gravel and cobbles.



Below the Quaternary-aged alluvium, bedrock of San Fernando Formation was encountered in all of the borings, drilled to a maximum depth of 81½ feet. The bedrock generally consists of hard claystone and siltstone.

A detailed description of the subsurface soils encountered in the borings is presented in the boring logs (Appendix A). Some of the engineering properties of these soils are described in the following sections.

### 2.3 Expansive Soil Characteristics

Representative sample of the near surface soil was subjected to Expansion Index testing to evaluate the expansive potential. The results of the testing indicate the soils generally exhibit “low” expansion potential (EI < 50).

### 2.4 Soil Corrosivity

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates and/or pH values of less than 5.5. Soils with chloride content greater than 500 ppm per California Test 532 are considered corrosive to steel, either in the form of reinforcement protected by concrete cover or plain steel substructures, such as steel pipes. Additionally, soils with a minimum resistivity of less than 1,000 Ohm-cm are considered corrosive to ferrous metal.

Based on the laboratory test results, the subsurface soils have low soluble sulfate contents. Therefore, the potential for sulfate attack on concrete is considered low. However, the tested soils are considered to have severe corrosion potential to buried ferrous metal in direct contact with the soils.

### 2.5 Groundwater Conditions

Groundwater was encountered at depths of 16 to 26 feet below existing grade in Borings LB-1 through LB-3. However, groundwater was not encountered in Boring LB-4. Two 2-inch diameter, slotted PVC standpipe monitoring wells were installed at Boring LB-2 to monitor the groundwater level. One monitoring well was slotted at 10 to 20 feet deep and the other at 25 to 35 feet deep. To provide a preliminary assessment of the amount of groundwater, a portable pump was used to lower the water in the wells and the recharge rate was measured. In the first monitoring well where the slotted section is between 10 and 20 feet, the groundwater recharge rate was measured to be roughly one gallon per minute.

In the second monitoring well where the slotted section is between 25 and 35 feet, the water was lowered to 32 feet and no recharge was observed within the test period of two hours. The groundwater appears to be perched in the alluvium above the bedrock between approximately 15 to 20 feet.

The historically high groundwater level for this area, according to the California Geologic Survey (2001), is on the order of 20 to 40 feet below the ground surface.

## 2.6 Fault Rupture

No active faults are mapped or known to cross the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007).

## 2.7 Seismicity and Ground Shaking

The principal seismic hazard to the site is ground shaking resulting from an earthquake occurring along any of several major active and potentially active faults in southern California. Known regional active faults that could produce significant ground shaking at the site include the Elysian Park, Puente Hills Blind Thrust, Santa Monica, Hollywood, Raymond, and Newport-Inglewood faults. These faults are located approximately 1.4, 3.8, 4.5, 4.6, 5.1, and 7.3 miles, respectively, from the site.

The intensity of ground shaking at a given location depends primarily upon the earthquake magnitude, the distance from the source, and the site response characteristics. Peak Horizontal Ground Accelerations (PHGA) is generally used to evaluate the intensity of ground motion.

Using the United States Geological Survey (USGS) Seismic Design Maps (USGS, 2013), the peak ground acceleration for the Maximum Considered Earthquake ( $MCE_G$ ) adjusted for the Site Class effects ( $PGA_M$ ) is 0.91g. Based on the USGS online interactive deaggregation program (USGS, 2008), the modal seismic event is Moment Magnitude ( $M_W$ ) 6.6 at a distance of 2.6 miles.

## 2.8 Secondary Seismic Hazards

Secondary seismic hazards in the region could include soil liquefaction and associated surface manifestation, earthquake-induced landsliding and flooding,

seiches, and tsunamis. The potential for seismic hazards at the site is discussed below.

Liquefaction Potential – Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine-to-medium grained, cohesionless soils. As the shaking action of an earthquake progresses, the soil grains are rearranged and the soil densifies within a short period of time. Rapid densification of the soil results in a buildup of pore-water pressure. When the pore-water pressure approaches the overburden pressure, the soil reduces greatly in strength and temporarily behaves similarly to a fluid. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below structural foundations.

Review of the *Seismic Hazard Zone Report for the Los Angeles Quadrangle* (CGS, 1998, revised 2006) indicates the northern half of the subject site is located within an area that has been identified by the State of California as being potentially susceptible to the occurrence of liquefaction. However, our borings encountered bedrock consisting of claystone/siltstone at depths of 15 to 20 feet below existing grade (below the historically high groundwater table of 20 to 40 feet). The bedrock is hard and not considered susceptible to liquefaction. As such, liquefaction potential for the subject site is considered low.

Seismically-Induced Landslides – The site is relatively flat. Proposed slopes, if any, should be engineered and constructed at a gradient of 2:1 (horizontal:vertical) or flatter. The potential for seismically-induced landsliding is considered low.

Earthquake-Induced Flooding – Earthquake-induced flooding can be caused by failure of dams or other water-retaining structures as a result of earthquakes. Due to the absence of these structures near the site, we consider the potential for earthquake-induced flooding of the site in the near future to be low.

Seiches and Tsunamis – Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the absence of an enclosed water body near the site and the inland location of the site, seiche and tsunami risks at the site are considered negligible.

### 3.0 PRELIMINARY DESIGN RECOMMENDATIONS

Presented below are the preliminary geotechnical recommendations for planning purposes. A geotechnical investigation that includes additional subsurface exploration may be required once the final design and project plan become available. Design of the project in accordance with standard engineering practice, including requirements of the CBC, and the recommendations of the project civil and structural engineers, geotechnical consultant and others will reduce the potential for adverse geotechnical conditions impacting the proposed improvements.

Existing improvements that may be affected by the proposed project, including Pershing Square Metro Station and the associated improvements, should be identified and provided to Leighton for evaluation. As the project proceeds, the results of this and future geotechnical studies should be incorporated in the design and construction of the development.

#### 3.1 Site Grading

All site grading should be performed in accordance with the applicable local codes and in accordance with the project specifications that are prepared by the appropriate design professional.

Site Preparation – Prior to construction, the site should be cleared of any vegetation, trash and/or debris within the area of proposed grading. These materials should be removed from the site. Any underground obstructions onsite should be removed. Efforts should be made to locate any existing utility lines to be removed or rerouted where interfering with the proposed construction. Any resulting cavities should be properly backfilled and compacted. After the site is cleared, the soils should be carefully observed for the removal of all unsuitable deposits. All unsuitable deposits and undocumented fill should be excavated and removed from proposed building/structure footprint prior to fill placement.

Excavation – The planned excavation is anticipated to extend about 30 feet below existing grade. Accordingly, artificial fill encountered to a maximum depth of 10 feet and alluvium overlying the onsite bedrock will be removed by the excavation. The alluvial soils and bedrock can be excavated with conventional heavy construction equipment in good working condition. Oversize materials, such as gravel and cobbles, may be present within the alluvium that may require

special handling during excavation and export operations. The contractor should review our boring logs and select the proper equipment for the site grading.

*Building Pad* – At approximately 30 feet below existing grade, the proposed subterranean parking structure is expected to be supported on bedrock. After completion of the excavation, the exposed surface should be observed by Leighton. We recommend that a working surface be established at least 6 inches above the design basement subgrade to accommodate removal of disturbed materials prior to pouring concrete directly over the subgrade. Bedrock disturbed during excavation should be removed and recompacted to 95 percent relative compacted or replaced with 2-sack sand/cement slurry.

*Fill Placement and Compaction* – The onsite soils, to be used as compacted structural fill, should be free of organic material or construction debris. The soils may require air drying or mixing with drier materials prior to placement as compacted fill. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches, moisture-conditioned to at least 2 to 4 percent above optimum moisture content, and compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM Test Method D 1557, except where noted above for building pad.

### 3.2 Foundations

*Mat Foundation* – Following the site grading mentioned above, the proposed structure may be supported on a mat foundation system. The mat foundation may be designed using an allowable bearing capacity of 5,000 psf and a coefficient of vertical subgrade reaction of 150 pounds per cubic inch (pci). The recommended bearing value is a net value. The weight of concrete in the foundation can be taken as 150 pounds per cubic foot (pcf) and the weight of soil backfill can be neglected when determining the downward loads. The bearing capacity may be increased by one-third for wind or seismic loading. Total settlement of the mat foundation as recommended above is estimated to be less than one inch. Differential settlement of the mat foundation is expected to be on the order of ½ inch over a distance of 30 feet.

*Ancillary Structures* – Footings for ancillary structures established on engineered fill or undisturbed natural soils may be designed for an allowable bearing pressure of 3,000 pounds per square foot (psf). The footings should have a

minimum width of 12 inches and a minimum embedment of 18 inches. A one third increase in the bearing value for short duration loading, such as wind or seismic forces may be used.

*Lateral Load Resistance* – Lateral loads can be resisted by soil friction and by the passive resistance of the soils. A coefficient of friction of 0.30 can be used between the footings and the floor slab and the supporting soils. The passive pressure of undisturbed natural soils or engineered fill can be assumed as 350 psf per foot of depth to a maximum of 4,000 psf. These friction and passive pressure values may be used in combination without reduction. The above values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

*Pile Foundation for Cantilevered Floors* – A portion of Levels 3 through 6 along 4<sup>th</sup> Street will cantilever over Pershing Square Metro Station entrance and will be supported on a pile foundation system. An analysis was performed to develop axial pile capacities of a 24-inch diameter cast-in-place concrete pile. The analysis indicates an embedment depth of 30 feet will provide an allowable capacity of 120 kips. Information on the Pershing Square Metro Station entrance and associated improvements, including locations, dimensions and depth, are not currently available. Depending on the distance and surcharge load allowed on the existing improvements, an isolation casing may be required for a portion of the pile to separate it from the surrounding soils and reduce the potential for surcharging the existing improvements. The actual pile length should be determined when structural loads and the additional information on the subway structure becomes available.

### 3.3 Seismic Design Parameters

Strong ground shaking due to seismic activity is anticipated at the site. The following values may be used for the seismic design method based on the 2013 California Building Code (CBC).

**Table 1 – 2013 CBC Seismic Design Parameters**

Categorization/Coefficient	Design Value
Site Class	D
Short Period (0.2 sec) Site Coefficient, $F_a$	1.0
Long Period (1.0 sec) Site Coefficient, $F_v$	1.5
Design (5% damped) spectral response acceleration parameter at short period, $S_{DS}$	1.604
Design (5% damped) spectral response acceleration parameter at a period of 1 sec, $S_{D1}$	0.844g

### 3.4 Lateral Earth Pressures

The following lateral earth pressures may be used for the design of retaining walls with a level backfill.

**Table 2 – Lateral Earth Pressures**

Condition	Equivalent Fluid Unit Weight for Level Backfill (psf/ft)
Active	35
Seismic Increment	25
At-Rest	55
Passive	350
Coefficient of Friction	0.30

Retaining structures should be provided with a drainage system to prevent buildup of hydrostatic pressure behind the wall. Hydrostatic pressure should be included in the retaining wall design if a drainage system is not provided. The above values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, such as a basement wall, curved walls without joints or restrained-wall corners, the at-rest pressure

should be used. If tilting of wall segments are acceptable and construction joints are provided at all angle points and frequently along curved-wall segments, preferably not exceeding 20 feet, the active pressure may be used.

For sliding resistance, a friction coefficient of 0.30 may be used at the soil-concrete interface. The lateral passive resistance can be taken into account only if it is ensured that the soil against embedded structures will remain intact with time.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall shall be considered as lateral surcharge. For lateral surcharge conditions, we recommend utilizing a horizontal load equal to 50 percent of the vertical load, as a minimum. This horizontal load should be applied below the 1:1 projection plane. To minimize the surcharge load from an adjacent building, deepened building footings may be considered.

### 3.5 Cement Type and Corrosion Protection

Based on the results of laboratory testing, concrete structures in contact with the onsite soil are expected to have negligible exposure to water-soluble sulfates in the soil. Common Type II cement may be used for concrete construction onsite and the concrete should be designed in accordance with CBC requirements. However, concrete exposed to recycled water should be designed using Type V cement.

Based on our laboratory testing, the onsite soil is considered corrosive to ferrous metals. Ferrous pipe should be avoided by using high-density polyethylene (HDPE) or other non-ferrous pipe when possible. Ferrous pipe, if used, should be protected by polyethylene bags, tap or coatings, di-electric fittings or other means to separate the pipe from onsite soils.

### 3.6 Trench Backfill

Utility trenches can be backfilled with the onsite material, provided it is free of debris, organic material and oversized material (greater than 8 inches in diameter). Prior to backfilling the trench, pipes should be bedded in and covered with sand that exhibits a Sand Equivalent (SE) of 30 or greater. The pipe bedding should be densified in-place using mechanical compaction equipment



with care to not damage the pipe. The native backfill should be placed in lifts, moisture conditioned as necessary to achieve a moisture content 2 to 4 percentage points above optimum, and mechanically compacted using a minimum standard of 90 percent relative compaction. The maximum lift thickness should also be determined based on the compaction equipment used in accordance with the latest edition of the *Standard Specifications for Public Works Construction* (SSPWC). Where utility trenches cross underneath building footing, the trenches should be plugged by a minimum of 2 feet of onsite soil or sand/cement slurry to reduce the potential for water intrusion underneath the slab.

### 3.7 Future Geotechnical Evaluation

Geotechnical recommendations presented in this report are preliminary based on the information gained from review of available documents and limited field exploration. The nature of many sites is such that differing geotechnical or geological conditions can occur within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, additional field exploration may be required based on the final project plans and structural loads. Additionally, adjacent existing improvements that may be impacted by the proposed development should be evaluated and mitigation measures should be developed, where necessary.

The preliminary recommendations in this report should be revised, as necessary, based on the actual soil conditions and any modification of the current plans during the design development phase.

## 4.0 CONSTRUCTION CONSIDERATIONS

### 4.1 Temporary Excavation

All temporary excavations, including utility trenches and retaining wall excavations, should be performed in accordance with project plans, specifications and all OSHA requirements.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the slope, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structures.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

### 4.2 Temporary Shoring

Excavation for construction of the subterranean levels may be supported by several methods, including conventional soldier piles, sheet piles or tiebacks, to name a few. The choice should be left to the contractor's judgment since economic considerations and/or the individual contractor's construction experience may determine which method is more economical and/or appropriate. Support of all adjacent existing structures without distress is the contractor's responsibility. These shoring systems adjacent to existing structures should be designed by a California licensed civil or structural engineer.

Typical cantilever shoring should be designed based on the active fluid pressure presented for retaining walls in Section 3.4. If excavations are braced at the top and at specific design intervals, the active pressure may then be approximated by a rectangular soil pressure distribution with the pressure per foot of width equal to  $23H$ , where  $H$  is equal to the depth of the excavation being shored.

It should be the contractor's responsibility to undertake a pre-construction survey with benchmarks and photographs of the adjacent structure(s). The contractor should be aware of the granular nature of the soils, being careful to guard against potential for sloughing and caving of excavation sides. This is for both human safety and safety of the improvements being shored. The contractor and shoring designer should perform additional geotechnical studies as necessary to refine the means and methods of shoring construction.

#### 4.3 Temporary Dewatering

Temporary dewatering will be required during excavation for construction of the subterranean parking structure. Using a portable pump to lower the groundwater level in the monitoring wells, the groundwater inflow was measured at approximately one gallon per minute for the zone between 10 and 20 feet below grade. No groundwater recharge was measured for a test period of two hours in the zone between 25 and 35 feet. These test results are preliminary and intended to provide a rough assessment of the amount of groundwater. A pump test should be performed to evaluate the hydraulic conductivity of the soils, if desired. To minimize the potential for impacting the surrounding improvements during construction, we recommend using localized sump pumps within the excavation to remove the groundwater that enters the excavation. Due to the presence of soils with relatively low permeability, a well-point system will not be a viable option for dewatering. It is the responsibility of the contractor to design and install the dewatering system. The contractor should anticipate that continuous pumping of groundwater may be required during the excavation. Discharge of groundwater during excavation should comply with all environmental regulations.

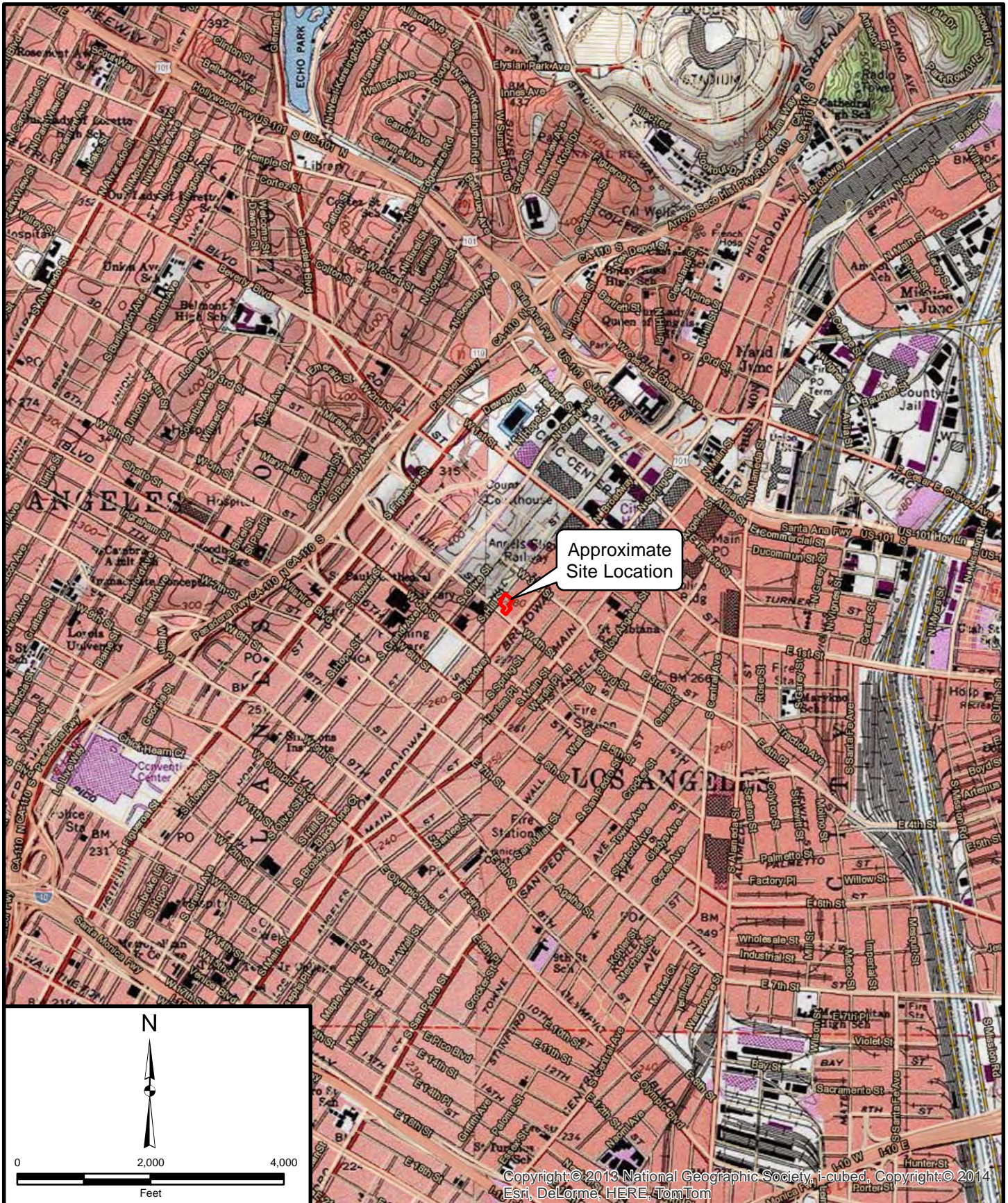
## 5.0 LIMITATIONS

Our professional services were performed in accordance with the prevailing standard of professional care as practiced by other geotechnical engineers in the area. We make no other warranty either expressed or implied. The report may not be used by others or for other projects without the expressed written consent of our client and our firm.

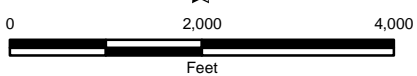
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Approximate Site Location



Project: 10705.001	Eng/Geol: DJC
Scale: 1" = 2,000'	Date: June 2014
Base Map: ESRI ArcGIS Online 2014	
Thematic Information: Leighton	
Author: Leighton Geomatics (mmurphy)	



# SITE LOCATION MAP

348 South Hill Street  
City of Los Angeles, California

Figure 1

Leighton

**Legend**

- LB-4** Approximate Location of Geotechnical Boring with Total Depth and Depth to Groundwater in feet
-  **T.D.81.5'**  
**No G.W.**
-  Approximate Site Boundary



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Project: 10705.001	Eng/Geol: DJC
Scale: 1" = 60'	Date: June 2014
Base Map: ESRI ArcGIS Online 2014 Thematic Information: Leighton Author: Leighton Geomatics (mmurphy)	

# BORING LOCATION MAP

348 South Hill Street  
City of Los Angeles, California

Figure 2



Leighton

# **APPENDIX A**



# GEOTECHNICAL BORING LOG LB-1

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-21-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 280'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
280	0	N S							@Surface: 6-inches Asphalt Concrete over 3-inches Aggregate Base SP-SC <b>Artificial fill, undocumented: (Afu)</b> @9-inches: SAND, with trace clay, brown, moist, fine grained, trace fine to coarse (3-inch minus) subangular gravels, brick fragments, rubble @1': Grades to Clayey SAND, reddish brown, moist	
275	5	N S		R-1 B-1 (5-10)	7 19 30	120	10	CL SP-GP	Quaternary alluvium: (Oa) @5': CLAY, very stiff, dark brown, moist, thin interbedded fine grained sand lenses, angular granitic gravels Quaternary older alluvium: (Ooa) @6': Becomes Clayey SAND with Gravel, dense, orange to olive brown, moist, abundant subangular gravels (1 to 2-inch)	
270	10	N S		R-2	40 50 50/3.5"	124	4	SC	@10': Hard drilling, Clayey SAND with Gravel, very dense, reddish brown to dark brown, abundant subangular gravels, weakly developed thin laminations, poor blocky structure	
265	15	N S		R-3	70 70/6"			SM	@15': Silty SAND, very dense, dark gray to olive brown, moist, fine grained, strong hydrocarbon odor, 4-inch rounded cobble wedged in sampler, trace clay	
260	20	N S		R-4	61 70/6"	83	58	SP-GP	@20': SAND with Gravel, very dense, olive gray to dark gray, wet-perched groundwater encountered, fine to coarse grained, abundant fine gravels (1-inch), subangular	
255	25	N S		R-5	13 30 53	100	25	Tfr	Fernando formation: (Tfr) @25': Clayey SILTSTONE, hard, dark bluish gray, very moist, massive, no laminations @26.1': Groundwater measured at 0950 Hours, 5/21/2014	
250	30	N S								

**SAMPLE TYPES:**

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

- 200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL

- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE

- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH



# GEOTECHNICAL BORING LOG LB-1

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-21-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 280'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.										
250	30	N S		R-6	13 39 49			Tfr	@30': Clayey SILTSTONE, hard, dark bluish gray, very moist, massive, no laminations, trace CaCO <sub>3</sub>	
245	35			R-7	25 43 50/5"	101	25		@35': Trace CaCO <sub>3</sub> stringers, trace dark brown clay nodules, moist	
240	40			SPT-1	10 12 18				@40': Trace very fine grained micaceous sand between pedogenic faces	
235	45			R-8	13 50/4"	101	24			
230	50			SPT-2	8 37 50/4"				@50': Trace angular fine gravels	
225	55			R-9	33 52/6"	98	26		@55': Sandy SILTSTONE, hard, dark bluish gray, moist, very fine grained sand, massive	
220	60									

- |   |  |   |  |
|---|--|---|--|
| <b>SAMPLE TYPES:</b><br>B BULK SAMPLE<br>C CORE SAMPLE<br>G GRAB SAMPLE<br>R RING SAMPLE<br>S SPLIT SPOON SAMPLE<br>T TUBE SAMPLE | <b>TYPE OF TESTS:</b><br>-200 % FINES PASSING<br>AL ATTERBERG LIMITS<br>CN CONSOLIDATION<br>CO COLLAPSE<br>CR CORROSION<br>CU UNDRAINED TRIAXIAL | DS DIRECT SHEAR<br>EI EXPANSION INDEX<br>H HYDROMETER<br>MD MAXIMUM DENSITY<br>PP POCKET PENETROMETER<br>RV R VALUE | SA SIEVE ANALYSIS<br>SE SAND EQUIVALENT<br>SG SPECIFIC GRAVITY<br>UC UNCONFINED COMPRESSIVE STRENGTH |
|---|--|---|--|



# GEOTECHNICAL BORING LOG LB-1

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-21-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 280'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
220	60			SPT-3	16 31 52/6"			Tfr	@60': Sandy SILTSTONE, hard, dark bluish gray, moist, very fine grained sand, massive, abundant CaCO <sub>3</sub> stringers and nodules	
215	65			SPT-4	13 22 50					
210	70			SPT-5	12 17 23					
205	75			SPT-6	16 24 32					
200	80			SPT-7	15 23 32					
195	85								Total Depth of Boring: 81.5 feet bgs Groundwater encountered at 26.1 feet bgs Soil cuttings from 0 to 30 feet bgs placed in DOT-approved drums and taken off site for disposal. Cuttings from 30-81.5 feet used to backfill boring; excess cuttings placed in DOT-approved drums and taken off site for disposal. Boring capped with 6-inches Cold Patch Mix Asphalt upon completion of backfill.	
190	90									

- |   |  |   |  |
|---|--|---|--|
| <b>SAMPLE TYPES:</b><br>B BULK SAMPLE<br>C CORE SAMPLE<br>G GRAB SAMPLE<br>R RING SAMPLE<br>S SPLIT SPOON SAMPLE<br>T TUBE SAMPLE | <b>TYPE OF TESTS:</b><br>-200 % FINES PASSING<br>AL ATTERBERG LIMITS<br>CN CONSOLIDATION<br>CO COLLAPSE<br>CR CORROSION<br>CU UNDRAINED TRIAXIAL | DS DIRECT SHEAR<br>EI EXPANSION INDEX<br>H HYDROMETER<br>MD MAXIMUM DENSITY<br>PP POCKET PENETROMETER<br>RV R VALUE | SA SIEVE ANALYSIS<br>SE SAND EQUIVALENT<br>SG SPECIFIC GRAVITY<br>UC UNCONFINED COMPRESSIVE STRENGTH |
|---|--|---|--|



# GEOTECHNICAL BORING LOG LB-2/MW-1

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-22-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 278'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
275	0							CL	@Surface: 6-inches Asphalt Concrete over 1.5 feet Rubble <b>Artificial fill, undocumented: (Afu)</b>	
270	5			R-1	5 3 2	76	18	SC	@2': Sandy CLAY, orange brown to dark brown, moist, trace brick fragments  @5': Clayey SAND, very loose, dark brown mottled with pockets of white fine grained sand, moist, trace fine subrounded gravels, trace brick fragments	
265	10			R-2 B-1 (10-15')	44 38 36	127	4	SP-GP	<b>Quaternary older alluvium: (Ooa)</b> @10': SAND with Gravel, dense, olive brown to dark brown to orange brown, mottled, moist, fine to coarse grained sand, fine weathered granitic gravels, trace coarse subrounded to rounded granitic gravels, trace clay	
260	15			R-3	32 42 50/5.5"	134	5		@15': Becomes wet, coarse grained sand and fine subangular to subrounded granitic gravels @16.2': Groundwater measured at 0924 Hours, 5/22/2014	
255	20			R-4	9 17 23	93	29	Tfr	<b>Fernando formation: (Tfr)</b> @20': Clayey SILTSTONE, very stiff, dark bluish gray, moist, fine grained, massive, trace CaCO <sub>3</sub> rock fragments	
250	25			R-5	19 37 50/6"	100	25		@25': Becomes hard, trace bi-valve shell fragments	
30	30									

**SAMPLE TYPES:**

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

- 200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL

- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE

- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH



# GEOTECHNICAL BORING LOG LB-2/MW-1

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-22-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 278'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	<b>SOIL DESCRIPTION</b>	Type of Tests
		N S							<i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>	
30				R-6	24 46 50/4"	101	24	Tfr	@30': Clayey SILTSTONE, hard, bluish gray, moist, trace CaCO <sub>3</sub> stringers, trace micaceous very fine sand grains between pedogenic faces, weak laminations	
245				SPT-1	3 9 13		26			
35										
240										
40				R-7	21 40 46					
235										
45				SPT-2	8 12 14		29		@45': Olive gray to bluish gray, CaCO <sub>3</sub> stringers, trace wood debris, trace fine grained tan clayey sand	
230										
50				R-8	29 50/5"					
225										
55				SPT-3	6 10 16		26		@55': Mollusc shell - in tact (<1/2-inch)	
220										
60										

**SAMPLE TYPES:**

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

- 200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL

- DS DIRECT SHEAR
- EI EXPANSION INDEX
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- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE

- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH



# GEOTECHNICAL BORING LOG LB-2/MW-1

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-22-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 278'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests	
		N S							This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.		
60		●		R-9	30 52/6"			Tfr	@60': Clayey SILTSTONE, hard, olive gray to bluish gray, moist, CaCO <sub>3</sub> stringers, trace wood fragments, interbedded dark and light gray laminations		
215		●		SPT-4	10 15 22						
65		●									
210		●		SPT-5	10 23 29				@70': Cross-bedding, well defined thin dark gray and light gray laminations, abundant CaCO <sub>3</sub> and sea shells		
70		●									
205		●		SPT-6	10 15 24				@75': Massive, no sea shells		
75		●									
200		●		SPT-7	10 12 24				@80': CaCO <sub>3</sub> stringers and nodules, sea shell fragments		
80		●									
195		●							Total Depth of Boring: 81.5 feet bgs Groundwater encountered at 16.2 feet bgs Soil cuttings from 0 to 30 feet bgs placed in DOT-approved drums and taken off site for disposal. Monitoring Wells MW-1a/1b installed with Traffic-Rated Well Cover in parking stall. Slotted screen for MW-1a at 35-25 feet bgs; for MW-1b at 20-10 feet bgs. Annulus filled with sand, cuttings, and bentonite plugs between screened intervals. Screened interval annulus filled with No. 3 Monterey Sand. Excess cuttings disposed of in DOT-approved drums and taken off site.		
85		●									
190		●									
90		●									
SAMPLE TYPES:		TYPE OF TESTS:									
B	BULK SAMPLE	-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS				
C	CORE SAMPLE	AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT				
G	GRAB SAMPLE	CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY				
R	RING SAMPLE	CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH				
S	SPLIT SPOON SAMPLE	CR	CORROSION	PP	POCKET PENETROMETER						
T	TUBE SAMPLE	CU	UNDRAINED TRIAXIAL	RV	R VALUE						



# GEOTECHNICAL BORING LOG LB-3

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-21-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 278'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
275	0	[Diagonal Hatching]		B-1 (2-5')				CL	@Surface: 4-inches Asphalt Concrete over 4-inches Sandy CLAY, 2-inches Previous Asphalt Surface, 14-inches Rubble <b>Artificial fill, undocumented: (Afu)</b> @4-inches: Sandy CLAY, olive brown to light orange brown, moist, fine to coarse grained sand, trace pebble sized gravels, strong asphaltic odor @2': CLAY, dark gray, moist, trace fine grained sand, poorly developed blocky structure	
270	5	[Diagonal Hatching]		R-1 B-2 (5-10')	8 15 22	117	15	CL	@5.5': Becomes Sandy CLAY, stiff, reddish brown, moist, very fine to fine grained sand, poorly developed blocky structure	
265	10	[Triangles]		R-2	12 42 50/4"			SP-GP	<b>Quaternary older alluvium: (Qoa)</b> @10': SAND with Gravel, very dense, olive gray brown to orange brown, moist, fine to coarse grained sand, with subrounded to subangular coarse sand grains and granitic gravels (weathered)	
260	15	[Dotted]		R-3	50/4" 50/3"	133	5		@15': SAND, olive brown, wet, trace fine subangular gravels, trace clay, poor recovery	
255	20	[Horizontal Lines]		R-4	9 15 19	92	30	Tfr	@19.5': Groundwater measured at 1558 Hours, 5/21/2014 <b>Fernando formation: (Tfr)</b> @20': SILTSTONE, bluish gray, moist, trace very fine grained micaceous sand, dark orange brown lamination at bottom of sample	
250	25	[Horizontal Lines]		R-5	20 34 50/6"	98	26			
30	30	[Horizontal Lines]								

**SAMPLE TYPES:**

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

- 200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL

- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE

- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH



# GEOTECHNICAL BORING LOG LB-3

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-21-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 278'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
30				R-6	24 40 50/5"			Tfr	@30': SILTSTONE, bluish gray, moist, trace very fine grained micaceous sand	
245				R-7	27 50/6"	97	27			
35				SPT-1	9 14 25				@40': CaCO <sub>3</sub> stringers	
240				R-8	29 50/5"	100	25		@45': Abundant CaCO <sub>3</sub>	
40				SPT-2	9 13 17				@50': Trace wood fragments, trace clay nodules, trace sea shells	
235									Total Depth of Boring: 51.5 feet bgs Groundwater encountered at 19.5 feet bgs Soil cuttings from 0 to 30 feet bgs placed in DOT-approved drums and taken off site for disposal. Cuttings from 30-51.5 feet used to backfill boring; excess cuttings placed in DOT-approved drums and taken off site for disposal. Boring capped with 6-inches Cold Patch Mix Asphalt upon completion of backfill.	
45										
230										
50										
225										
55										
220										
60										

**SAMPLE TYPES:**

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

- 200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL

- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE

- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH





# GEOTECHNICAL BORING LOG LB-4

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-23-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 275'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
275	0	N S							This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
275	0	N S						SC	@Surface: 4-inches Asphalt Concrete over 4.5-foot Rubble	
								GP	<b>Artificial fill, undocumented: (Afu)</b> @4-inches: Clayey SAND, brown, moist, with subrounded gravels, brick fragments, trash @2': GRAVEL, subangular to subrounded, dry, hard drilling	
270	5			R-1 B-1 (5-10')	5 4 7	84	11		@5': Brick fragments in sampler	
265	10			R-2	30 86/6"	127	2	SP-GP	<b>Quaternary older alluvium: (Qoa)</b> @10': SAND with Gravel, very dense, olive brown to dark brown to orange brown, moist, fine to coarse grained sand, fine to coarse (2-inch) subangular gravels @12': Sandy CLAY to Clayey SAND, olive brown, moist, fine grained sand	
260	15			R-3 B-2 (15-20')	15 25 34			Tfr	<b>Fernando formation: (Tfr)</b> @15': Clayey SILTSTONE, dark bluish gray, dark orange brown, mottled at top of environmental sample, moist, fine grained, weakly laminated thin beds, cuttings pebble sized clay pods	
255	20			R-4	21 32 50/5"	100	24		@20': Becomes dark bluish gray, massive, trace CaCO <sub>3</sub> stringers, trace shell fragments	
250	25			R-5	15 36 50/6"	95	28			
245	30									

- SAMPLE TYPES:**
- B BULK SAMPLE
  - C CORE SAMPLE
  - G GRAB SAMPLE
  - R RING SAMPLE
  - S SPLIT SPOON SAMPLE
  - T TUBE SAMPLE
- TYPE OF TESTS:**
- 200 % FINES PASSING
  - AL ATTERBERG LIMITS
  - CN CONSOLIDATION
  - CO COLLAPSE
  - CR CORROSION
  - CU UNDRAINED TRIAXIAL
  - DS DIRECT SHEAR
  - EI EXPANSION INDEX
  - H HYDROMETER
  - MD MAXIMUM DENSITY
  - PP POCKET PENETROMETER
  - RV R VALUE
  - SA SIEVE ANALYSIS
  - SE SAND EQUIVALENT
  - SG SPECIFIC GRAVITY
  - UC UNCONFINED COMPRESSIVE STRENGTH



# GEOTECHNICAL BORING LOG LB-4

**Project No.** 10705.001  
**Project** Equity Residential - 4th Street and Hill  
**Drilling Co.** 2R Drilling, Inc.  
**Drilling Method** Hollow Stem Auger - 140lb - Autohammer - 30" Drop  
**Location** See Figure 2 - Boring Location Map

**Date Drilled** 5-23-14  
**Logged By** JWJ  
**Hole Diameter** 8"  
**Ground Elevation** 275'  
**Sampled By** JWJ

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
<i>This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.</i>										
245	30	N S		R-6	12 43 50/5"	98	27	Tfr	@30': Clayey SILTSTONE, dark bluish gray, moist, fine grained, trace CaCO <sub>3</sub> stringers, trace shell fragments	
240	35			SPT-1	9 15 19		25			
235	40			R-7	10 23 50/6"					
230	45			SPT-2	50/4"		26		@45': Massive, waxy texture between clay faces	
225	50			R-8	27 50/6"					
220	55			SPT-3	8 13 18		26			
215	60									

**SAMPLE TYPES:**

- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

**TYPE OF TESTS:**

- 200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
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Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
215	60	N S		R-9	26 55/6"			Tfr	This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.  @60': Clayey SILTSTONE, dark bluish gray, moist, CaCO <sub>3</sub> nodules and stringers, trace sea shells	
210	65			SPT-4	8 14 16					
205	70			SPT-5	9 14 18					
200	75			SPT-6	8 12 16					
195	80			SPT-7	14 17 28				@80': Trace sea shells, trace charcoal	
190	85								Total Depth of Boring: 81.5 feet bgs No free groundwater encountered Soil cuttings from 0 to 30 feet bgs placed in DOT-approved drums and taken off site for disposal. Cuttings from 30-81.5 feet used to backfill boring; excess cuttings placed in DOT-approved drums and taken off site for disposal. Boring capped with 6-inches Cold Patch Mix Asphalt upon completion of backfill.	
185	90									

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|---|--|---|--|
| <b>SAMPLE TYPES:</b><br>B BULK SAMPLE<br>C CORE SAMPLE<br>G GRAB SAMPLE<br>R RING SAMPLE<br>S SPLIT SPOON SAMPLE<br>T TUBE SAMPLE | <b>TYPE OF TESTS:</b><br>-200 % FINES PASSING<br>AL ATTERBERG LIMITS<br>CN CONSOLIDATION<br>CO COLLAPSE<br>CR CORROSION<br>CU UNDRAINED TRIAXIAL | DS DIRECT SHEAR<br>EI EXPANSION INDEX<br>H HYDROMETER<br>MD MAXIMUM DENSITY<br>PP POCKET PENETROMETER<br>RV R VALUE | SA SIEVE ANALYSIS<br>SE SAND EQUIVALENT<br>SG SPECIFIC GRAVITY<br>UC UNCONFINED COMPRESSIVE STRENGTH |
|---|--|---|--|

