FINAL EIR APPENDIX E
GEOTECHNICAL INVESTIGATION

GEOTECHNICAL INVESTIGATION
LOS ANGELES STATE HISTORIC PARK
LOS ANGELES, CALIFORNIA

Prepared for

State of California
DEPARTMENT OF PARKS AND RECREATION
Southern Service Center
8885 Rio San Diego Drive
San Diego, CA 92108

Prepared by

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GDC Project No. L-938
March 28, 2011

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Forensic Services

March 28, 2011

State of California
Department Of Parks and Recreation
Southern Service Center
8885 Rio San Diego Drive
San Diego, CA 92108

Attention: Mr. Jeff Brown, RLA
Project Manager

Subject: Geotechnical Investigation
Los Angeles State Historic Park
Los Angeles, California
Group Delta Project No. L-938
Master Services Agreement No. C08E0061

Dear Jeff:

Group Delta Consultants, Inc. (GDC) is pleased to submit this report providing geotechnical recommendations for the subject project. Our work was performed in general accordance with our proposal dated October 19, 2010, our Master Services Agreement C08E0061, your work order 61-014678-08 dated December 13, 2010.

We appreciate the opportunity to provide our services for this important project. If you have any questions or require additional information, please give us a call at (310) 320-5100 or (949) 450-2100.

Sincerely,
GROUP DELTA CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER THOMAS D. SWANTKO No. 813 GEOTECHNICAL STATE OF CALIFORNIA

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LOS ANGELES, CALIFORNIA

1.0 INTRODUCTION

1.1 Project Site Description and Background

The Los Angeles State Historic Park site consists of approximately 32 acres located within a half mile from El Pueblo de Los Angeles Historical Monument and Los Angeles City Hall in the heart of downtown Los Angeles. The park is on a historical site known as "The Cornfield," a site of remarkable social, historical, and cultural significance and the last vast open space in downtown Los Angeles. The northern end of the site is located approximately 150 feet from the Los Angeles River and the southern end is located approximately 150 feet from the Chinatown Gold Line commuter train station. The northern site boundary is the Metro Gold Line rail tracks, and the southern site boundary is North Spring Street. The site location and aerial photograph are shown in Figures 1A and 1B, and more detailed site topographic plans are shown in Figures 2A through 2D.

1.2 Project Description

California Department of Parks and Recreation (DPR) is proposing to develop the full 32 acres of the park in phases. The major structural components of the park will consist of a Welcome Pavilion and Restroom Building, a Park Operations and Restroom Building, Roundhouse Plaza, Turntable Stage and Pedestrian Bridge. The Roundhouse Bridge will be the terminus of an anticipated future span over the existing railroad tracks and connect to a development planned along North Broadway at the intersection of Bishop Road. Future plans may connect the park to the adjacent Los Angeles River. Other improvements include a maintenance building, concession stand, parking lots, story telling center, pathways, hardscape, earthen mounds, grass and other landscaping.

1.3 Purpose

The purpose of our study was to conduct a geotechnical engineering investigation of the site and subsurface conditions to provide geotechnical information and recommendations for design and construction of the proposed improvements. In addition, a preliminary review was made of available environmental data for the site, and a methane soil gas investigation was performed. The results of our environmental review and methane studies are provided separately as Appendix D and Appendix E of this report.

1.4 Scope of Work

Our scope of work included the following:

- Review of available geologic and seismic information;
- Site reconnaissance;
- Marking and clearing utilities through State Park personnel and DigAlert;
- Coordination with State Parks archaeological and maintenance staff;
- Performing subsurface investigation including nine hollow-stem auger borings and 11 Cone Penetration Tests;
- Performing laboratory testing on samples recovered from the borings;
- Performing engineering analyses and developing geotechnical recommendations for project design;
- Perform a preliminary environmental review and methane soil gas investigation;
- Preparing a letter report summarizing the findings and conclusions of the environmental review (see Appendix D);
- Preparing an LADBS Certificate of Compliance for Methane Test Data, Form 1, and a report to summarize the methane gas investigation and mitigation requirements for the proposed new construction (see Appendix E);
- Presenting the data, conclusions, and recommendations of our geotechnical investigation in this report.

Our scope of work did not include environmental site investigation.

2.0 FIELD AND LABORATORY INVESTIGATION

2.1 Field Investigation

Our field program consisted of site reconnaissance and subsurface explorations performed between February 22nd and 25th, 2011. Our subsurface exploration included drilling nine hollow-stem auger borings (B-1 through B-9) to depths of 6 to 51 feet below ground surface (bgs), and advancing 11 Cone Penetration Tests (CPTs C-1 through C-11) to practical refusal at depths of 10 to 50 feet bgs. Downhole shear wave velocity measurements were made in CPT C-3. The boring and CPT locations are shown in Figures 2A-2D.Explorations were approximately located in the field by tape measure from the nearest existing structure or edge of parking lot curb and with hand-held Global Positioning System (GPS), and boring elevations were estimated using the topographic plan in Figures 2B-2D. The borings were backfilled with bentonite to 5 feet above the groundwater, with the remainder backfilled with soil cuttings. A detailed description of the field investigation and the boring logs are presented in Appendix A.

2.2 Laboratory Testing

Our laboratory testing program consisted of:

- Moisture content and dry density;
- Grain size distribution and percent passing No. 200 sieve;
- Atterberg Limits;
- Soil Corrosivity (pH, Sulfate, Chlorides, Minimum Resistivity);
- R-Value;
- Expansion Index.

Selected test results are presented on the boring logs in Appendix A. Detailed descriptions of the laboratory tests and results are presented in Appendix B.

2.3 Exploration Notes

A layer of black tar-like material was encountered at 36 ft depth in Boring B-5. Samples at 40 and 45 feet were observed to have a strong Hydrogen Sulfide (rotten egg) odor. The boring was terminated at 46 feet and grouted with bentonite. No evidence of contamination was detected in other borings.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The site is approximately 3,800 feet long and up to about 500 feet wide in the central portion (Figures 1A, 1B, 2A), and is bounded on the northwest by Metro Gold Line rail tracks and the Elysian Hills, and on the southeast by North Spring Street. The southwestern and northeastern ends of the site are adjacent to the Chinatown Viaduct and the Los Angeles River, respectively. The site is relatively level, with grades sloping gradually from about El. 312 ft on the northeast end to about El. 290 ft on the southwest end. A paved driveway and parking lot with roundabouts is present along the southeastern edge. The current surface is mostly grass, with other landscaping and decomposed granite pathways around the perimeter and in portions of the site interior. Selected photographs are shown in Appendix C.

3.2 Subsurface Conditions

3.2.1 Geology

A regional geologic map is shown in Figure 3, which illustrates the geologic units exposed at the surface in the project area. Geologically the site is located within young Holocene Alluvial Fan Deposits (Qf) associated with Los Angeles River, and is overlain locally by shallow man-made fills. These fan deposits are primarily sands and gravels. The LA River alluvial fan is surrounded on the east and west by Pleistocene Old Alluvial Fan (Qof) and Old Alluvial Terrace Deposits (Qoa), and outcrops of Tertiary sedimentary rock of the Puente Formation (Tpna, Tpnz) and Fernando Formation (Tf). The Elysian Hills just northwest of the site are composed of sandstone and siltstone of the Puente Formation.

3.2.2 Soil Conditions

A soil profile through the site is illustrated in Figure 4. From an engineering standpoint, the soil profile has two layers: 1) shallow near surface fills and more weathered alluvial soils, and 2) Dense sandy alluvial fan deposits of the LA River. Shallow fills are known to exist at least locally, for example, an archeological excavation was open and was observed at the time of our site reconnaissance (see Appendix C photos). This excavation was subsequently backfilled. Bedrock was not encountered to a depth of 50 feet. A description of the soil layers is provided in the following sections.

Layer 1: Fill and Upper Alluvium

The upper soil horizon at the site is less consolidated and locally contains clayey topsoil and shallow undocumented fills. This layer is typically on the order of 5 feet thick. Clayey topsoil was encountered in some borings to a depth of up to 2 feet. The Layer 1 soils consist of interbedded stiff to hard lean clays and silts (Cl, ML), and medium dense to dense sands (SP, SP-SM, SW-SM), silty sands (SM), and clayey sands (SC). Localized zones of cobbles were observed, particularly in the roundhouse area (see archeological excavation photos in Appendix C). Since the shallow fill and upper alluvial soils are difficult to differentiate, for simplicity we have labeled this layer as Fill on the boring logs.

Standard Penetration Test (SPT) penetration resistance or blowcount (N_{60}) from borings and CPT correlations in sandy layers ranges from 16 to more than 50 blows per foot (average 35). Undrained shear strength from CPT interpretation ranges from 1.2 to more than 4 ksf (average more than 3 ksf). Percent passing No. 200 sieve ranges from 3 to 66% (average 24%). Mixtures of clay and silt collected from blended auger cuttings in the upper 5 ft had tested Expansion Index (EI) of 7 to 10 (very low expansion potential). A sample of Sandy Lean Clay (CL) topsoil in the upper 2 feet was collected and tested and had 66% passing No. 200 sieve, EI of 57 (medium expansion potential), Liquid Limit of 44, and Plasticity Index of 25. A sample of near surface soil had R-Value of 81.

Layer 2: Alluvium

Alluvial soils below Layer 1 generally consist of dense to very dense mixtures of sand, gravel, and silt (SP, SP-SM, SW-SM, SM) with occasional lenses of hard silts (ML) and hard lean clays with sand (CL).

SPT N_{60} in granular layers generally ranges from 30 to more than 100 blows per foot (average >50). Cohesive layers generally have undrained shear strength of 2 to greater than 4 ksf (average >4). Tested percent passing No. 200 sieve in the sands ranges from 3 to 40% (average 15%). A layer of Lean Clay (CL) was tested and had 74% passing No. 200 sieve, Liquid Limit of 33, and Plasticity Index of 12.

3.2.3 Groundwater

Highest historical groundwater levels at the site as reported by California Geological Survey Seismic Hazard Zone Report for the Los Angeles 7.5-minute Quadrangle is at a depth of about 20 feet, as shown in Figure 5A. More recent data from our investigation (Figure 4) indicated groundwater depths of 33.5 to 34 feet in Borings B-1 and B-2. Prior to our investigation, monitoring wells were installed at the site by others (ERM West, October 2006, Figure 5B) as part of an environmental investigation, and groundwater levels were monitored for a six year period between 2000 and 2006. The well data generally show the highest permanent groundwater levels during this period ranged from a depth of about 25 to 35 feet below the site grades, with a flow gradient following the natural topography towards the southwest. Groundwater levels may fluctuate with water levels in the adjacent river, but would not be expected to rise above a depth of 20 feet. Locally shallower perched groundwater could be present due to seepage from upslope or man-made sources such as leaking utilities.

4.0 ANALYSES AND RECOMMENDATIONS

4.1 Geologic and Seismic Hazards

Potential geologic and seismic hazards for any site include ground rupture, seismic shaking, liquefaction, seismic compaction and settlement, expansive soils, collapsible soils, slope instability, lateral spreading, ground lurching, subsidence, and tsunamis / flooding.

The site is located in a seismically active area. Ground shaking due to nearby and distant earthquakes should be anticipated during the life of the project. The seismic hazards are discussed in the following paragraphs.

4.1.1 Ground Surface Rupture

The site is located in close proximity to a number of active earthquake faults including the Upper Elysian Park Blind Thrust (Moment Magnitude Mw=6.5 reverse (R) fault), Puente Hills Blind Thrust (Mw=7.3, R), Hollywood and Raymond Faults (Mw=6.6, left lateral strike slip (LLSS) faults), Newport-Inglewood Fault Zone (Mw=7.5, right lateral strike slip (RLSS) fault), and Whittier-Elsinore Fault Zone (Mw=7.6, RLSS) as shown in Figure 6. The site is not located within a mapped Alquist Priolo Earthquake Fault Zone, and no active or potentially active faults capable of fault rupture are known to cross the site. The Upper Elysian Park and Puente Hills Blind Thrust Faults are located directly below the site, but the depth to rupture surface is at least 3 km. Therefore, potential for fault rupture is considered remote.

4.1.2 Deterministic and Probabilistic Seismic Hazard Analysis

The site is located at the following approximate coordinates:

Latitude: 34.0685 degrees North
Longitude: -118.2323 degrees West

Shear wave velocity was measured downhole in Cone Penetration Test C-3 to a depth of 20 feet where the CPT reached refusal. These measurements indicated shear wave velocity in the upper 20 feet ranging from 1340 to 1520 feet per second. To determine shear wave velocity in the upper 100 feet or 30 meters (Vs_{30}), we used published correlations and data from CPT C-1 extrapolated to 100 ft depth. The estimated Vs_{30} value is 1365 feet per second (416 meters per second), and therefore the site classifies as Site Class C (very dense soil) in accordance with California Building Code (CBC) 2010.

We performed a deterministic seismic hazard analysis using the 2009 Caltrans method and Caltrans ARS Online using soil Type C with average shear wave velocity of 416 meters per second. Deterministic Peak Ground Acceleration (PGA) is computed as 0.75 g, controlled by Puente Hills Blind Thrust Fault, a Magnitude 7.3 Reverse Fault.

Probabilistic Seismic Hazard Analysis (PSHA) was performed using the 2008 USGS Interactive Deaggregation (Beta) website, using site Type C with average shear wave velocity of 416 meters per second. Estimated PGA versus average return period is listed below:

Exceedence Probability in 50 years	Average Return Period (years)	PGA (g's)
1%	4975	1.28
2%	2475	1.05
5%	975	0.76
10%	475	0.56
20%	225	0.39
50%	72	0.20

4.1.3 2010 CBC Seismic Design Parameters

Design ground motion parameters and response spectrum were developed in accordance with the 2010 California Building Code (CBC) and ASCE 7-05. The USGS computer program "Earthquake Ground Motion Parameters, Version 5.1.0 – 02/10/2011," was used to determine the mapped Maximum Considered Earthquake (MCE) bedrock spectral acceleration parameters, and developed the site modified MCE and Design site response spectra for Site Class C. The ground motion parameters are tabulated and the MCE and Design spectra for the site are plotted in Table 1. The resulting MCE and Design PGA are 0.88g and 0.59g, respectively.

4.1.4 Liquefaction

Liquefaction involves the sudden loss in strength of a saturated, cohesionless soil caused by the build-up of pore water pressure during cyclic loading, such as produced by an earthquake, and where it occurs its effects can include vertical and lateral ground displacements, slope instability and lateral spreading, and bearing failure. For liquefaction to occur, all of the following must be present:

- Liquefaction susceptible soils (loose to medium dense cohesionless soils);
- Groundwater within 50 feet of the surface;
- Strong Shaking, such as caused by an earthquake.

Due to location in an area of Holocene alluvium and relatively shallow groundwater, the site is located in a mapped State of California Seismic Hazard Zone for Liquefaction (see Figure 7), and is also in the "Areas Susceptible to Liquefaction" map in the City of LA Safety Element.

Highest historical groundwater levels are reported at a depth of about 20 feet (Figure 5A) and current groundwater levels appear to be at a depth of 25 to 35 feet (Figure 5B). However, site specific investigation shows that the alluvial soils below the highest groundwater levels are very dense sands and hard clays and silts, which are generally considered non-liquefiable. To verify this, we performed liquefaction calculations using data from CPT C-1, a high groundwater depth of 20 feet, earthquake magnitude of Mw=6.6 from USGS probabilistic deaggregation, and code maximum considered PGA of 0.88g. The analysis indicates that liquefaction potential is negligible with calculated liquefaction settlements of 0.05 inches (see Figure 8). On this basis, liquefaction has negligible impact to the design and requires no mitigation.

4.1.5 Expansive Soils

The proposed building areas of the site typically have a surface layer of up to about 2 feet of clay topsoil, underlain by sands and silty sands. Two samples consisting of a blend of auger cuttings (including the clay and silty sand) in the upper 5 feet were tested for Expansion Index (EI) in accordance with ASTM D 4829, and had EI values of 7 and 10. A sample of just the clay material was obtained from Boring B-2 and test results indicated an EI of 57. ASTM D 4829 defines expansion potential qualitatively in terms of the Expansion Index (EI) as follows:

EI	Expansion Potential
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

The samples consisting of a blend of material in the upper 5 feet classify as "Very Low" expansion potential, and the near surface clayey topsoil classifies as "Medium" expansion potential. When expansive soils become wet they can expand, resulting in damage to structures, slabs, pavements, and retaining walls. Potential for expansion should be considered as recommended later in this report.

4.1.6 Other Geologic and Seismic Hazards

Seismic shaking can also cause soil compaction and ground settlement without liquefaction occurring, including settlement of dry clean sands above the water table. Due to density of granular soils at the building sites seismic compaction hazard is negligible. The site is fairly level in the vicinity of the structures; therefore, static or seismic slope instability or lateral spreading or ground lurching is not considered a significant hazard for the building sites. In the City of LA Safety Element the site is not located on the "Landslide Inventory and Hillside Area" map. Due to its high elevation, the site is not subject to hazards from tsunamis; however, a portion of the site is within a "potential inundation area" from dam failure or seiche as shown on the "Inundation & Tsunami Hazard Areas" map in City of LA Safety Element. The site is not mapped in a 100-yr or 500-yr flood area. A portion of the site is mapped within the LA City Oil Field, as shown in the "Oil Field and Oil Drilling Areas" in the City of LA Safety Element. The site is located within a City methane zone; refer to Section 4.2.4 for mitigation.

4.2 Foundation Recommendations

4.2.1 Foundation Type

No foundation loads are available, and structure locations have not been finalized. The anticipated buildings are single story light frame structures. The pedestrian bridge may have higher loads than the buildings, but loads are anticipated to be moderate. The proposed building structures may be supported on shallow spread footings with slab on grade, and the pedestrian bridge may be supported on shallow spread footings, provided that the foundation design and site preparation work are performed as recommended herein.

4.2.2 Expansive Soil Considerations for Footings, Slabs, & Hardscape

Concrete floor slabs and hardscape should be installed on a properly prepared subgrade and should be designed for the expansion potential of the supporting subgrade, as discussed in the following sections.

Since "Medium" expansive soils appear to be limited to the upper 2 feet in the building areas, it is recommended that these clayey materials be removed from the area within and extending 5 feet outside the building footprint and used in non-structural areas. It may also be desirable to remove surficial clayey soils in area of proposed hardscape features. All backfill of clayey soil removals should have EI less than 20, and the building foundations, slabs, and hardscape may be designed for "Very Low" expansion potential.

If surficial clayey soils are left in place or recompacted and used as fills below structural elements, any foundations, slabs, or hardscape supported on these materials should be designed for "Medium" expansion potential.

4.2.2.1 Low to Very Low Expansion Potential

If footings, slabs, and hardscape are designed for Low to Very Low Expansion Potential, then any clayey materials (typically the upper 2 feet) should be removed as described above, and all backfill below these elements should have EI=20 or less.

The local standard of practice for the design and construction of foundations, slabs, and hardscape supported on soils with a low to very low expansion potential is provided below. A low expansion potential corresponds to an Expansion Index (EI) of 21 to 50 and a very low expansion potential corresponds to an Expansion Index (EI) of 0 to 20. Structural design requirements may require greater thickness and/or more reinforcing than indicated, and should evaluated by the structural engineer.

- Footings should be founded at least 12 inches below lowest adjacent grade.
- Footings should have minimum reinforcement of one #4 bar top and bottom.

- The concrete slabs and panels should be at least 4 inches thick and should be reinforced with a minimum 6" x 6" – 10/10 mesh.

- Prior to placing concrete, the subgrade should be kept lightly watered to prevent drying out.

- Concrete slabs and hardscape should have a maximum joint spacing of 10 feet; #3 bars dowels should be considered at construction joints.

- The adjacent area should be sloped at 2 percent, or greater, to drain away from slabs and pavements.

- Bushes and trees should be kept sufficiently away from the edges of foundations and hardscape to prevent damage from roots.

4.2.2.2 Medium Expansion Potential

Unless all clayey topsoils are removed, foundations, slabs, and hardscape should be designed for "Medium" expansion potential.

The local standard of practice for the design and construction of foundations, slabs, and hardscape supported on soils with a medium expansion potential is provided below. A medium expansion potential corresponds to an Expansion Index (EI) between 51-90. Structural design requirements may require greater thickness and/or more reinforcing than indicated, and should evaluated by the structural engineer

- Footings should be founded at least 18 inches below lowest adjacent grade.

- Footings should be reinforced with one #4 bar top and bottom.

- The concrete slabs and panels should be at least 4 inches thick and should be reinforced with a 6" x 6" – 10/10 mesh, or #3 bars at 24 inches center to center, both ways.

- Prior to placing concrete, the subgrade should be pre-saturated to 120 percent of optimum to a depth of at least 12 inches below the bottom of footing/slab.

- Concrete slabs and hardscape should have a maximum joint spacing of 10 feet; #3 bars dowels at construction joints; and, the outside edge should be deepened to a thickness of 12 inches. One #3 bar should be used to reinforce the flared edge.

- The adjacent area should be slope at 2 percent, or greater, to drain away from slabs and pavements.

- For additional protection, consideration should also be given to removing the upper 6 inches of expansive soils below slabs and paving and replacing it with non-expansive sandy soil having an EI of not more than 20.

- Bushes, trees and irrigation pipes and valves should be kept sufficiently way from the edges of foundations and hardscape to prevent root damage, and/or moisture changes in the supporting subgrade.

- The area within 10 feet of buildings should preferably be paved to reduce potential for moisture infiltration.

4.2.3 Slab-on-Grade Moisture Barrier

To reduce the potential for moisture transmission through slabs and where moisture sensitive covering will be installed, we recommend that a vapor retarder or vapor barrier shall be used. In accordance with ACI 302.2R-06, the material must comply with the requirements of ASTM E 1745, "Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs," and have a permeance of less than 0.01 perms per ASTM E96. The installation of the moisture barrier should comply with ASTM E 1643-09. Care shall be taken not to puncture the vapor retarder during construction. Any utility stub-outs should be properly wrapped and sealed.

Concerning whether to place 2 inches of sand over the retarder, reference is made to ACI 302.2R, Section 7.2, which states that the anticipated benefits and risks associated with the location of the vapor retarder should be reviewed on a case by case basis with all appropriate parties, considering anticipated project conditions and the potential effects of concrete curing, cracking, curling.

4.2.4 Methane Mitigation System

The site is within a City of LA methane zone or methane buffer zone. A methane soil gas investigation was performed by our subconsultant Terra-Petra, and an LADBS Certificate of Compliance for Methane Test Data-Form 1 was prepared, and is included as Appendix E. Note that all properties within the City's methane zone require some level of mitigation Based on the results of the investigation, the site has been classified as Level I, which requires the lowest level of methane protection. The Level I mitigation typically includes a vapor barrier, granular soil layers, and other elements typically within the upper 12 inches below the building slab. A methane consult should be contracted to provide final details and recommendations for the methane mitigation system.

4.2.5 Spread Footings

4.2.5.1 Bearing Capacity

Shallow spread footings for single story structures and minor retaining walls on properly prepared subgrade (Section 4.3.3) may be designed for an allowable bearing capacity of 2,000 psf. Minimum footing width should be 12 inches and minimum footing depth should be 12 inches, or as dictated by expansive soil requirements (Section 4.2.2).

If higher bearing capacity is needed for other minor structures, allowable bearing capacity may be increased by 500 psf for each 1 ft increase in footing width and by 500 psf for each 1 ft increase in footing depth, not to exceed 4,000 psf. Minimum footing depth should be at least ½ the footing width.

For heavier loads foundations should be supported in dense native soils. For preliminary design of the pedestrian bridge, shallow foundations should be supported in native materials at a depth of at least 5 ft below existing grade and may be designed for an allowable bearing capacity of 5,000 psf. We recommend that GDC be contacted once foundation locations and loads have been determined to confirm or modify this recommendation as appropriate.

Allowable bearing capacity may be increased by 1/3 for wind or seismic loads.

4.2.5.2 Lateral Resistance

Concrete bearing on existing site soils may be designed for an ultimate soil-to-concrete sliding friction coefficient of 0.45. If footings include a key, an ultimate sliding friction coefficient of 0.6 (soil-to-soil) may be used for the sliding resistance in front of the key. Passive resistance for footings cast against competent native materials or backfilled with compacted fill may be taken as an equivalent fluid pressure of 350 pcf. Sliding and passive may be combined without reduction. Sliding factor of safety should not be less than 1.5 for static and 1.1 for seismic loading conditions. Resistance to overturning is adequate if resultant on the base of footing falls within the middle third.

4.2.5.3 Settlement

Total estimated footing settlements are less than ½ inch for footings supporting light frame single story structures. For large footings or heavier loads settlements are estimated at 1 inch or less. Differential settlement of footings may be taken as 1/2 inch over 30 feet.

4.2.5.4 Footing Observation

Spread footing subgrade should be prepared in accordance with Section 4.3.3. The footing excavations should be observed and accepted by GDC prior to placing steel or concrete. Any unsuitable materials found below footings should be removed and recompacted to not less than 95%.

4.2.6 Retaining Walls

Recommendations in Section 4.2.5 may be used for design of spread footings for retaining walls.

We recommend that all retaining walls be backfilled with low-expansive granular soils (minimum Sand Equivalent of 20). On-site clayey soils should not be used for wall backfill. A 2-ft thick cap consisting of onsite clayey material should be used to minimize infiltration of surface water. Heavy compaction equipment operating adjacent to retaining walls can cause excessively high lateral soil pressures to be exerted on the wall. Therefore, soils within 5 ft of the wall should either be compacted with hand operated equipment or designed to withstand compaction pressure from heavy equipment. All walls should be constructed with a properly designed drainage system to prevent buildup of hydrostatic pressures behind the wall. Basement walls or walls with architectural facades or coverings should be properly waterproofed to minimize moisture transmission through the walls.

Cantilever walls, which are free to move laterally at least ½ in. for each 10 ft height (active condition), with level backfill may be designed for an equivalent fluid pressure of 36 pcf above the water table. If walls designed for active condition retain 2:1 (horizontal: vertical) sloping backfill, they should be designed for an equivalent fluid pressure of 45 pcf. Temporary shoring or walls restrained at the top should be designed for a uniform lateral pressure of 25H psf, where H=wall height in feet.

Walls designed for static loads have historically performed well during seismic events. If walls are to be designed for seismic lateral pressures, we recommend an additional lateral equivalent fluid pressure of 15 pcf as an inverted triangular distribution in addition to the static pressures.

4.3 Site Preparation and Grading

4.3.1 Clearing and Grubbing

The site is currently covered by pavements, grass, shrubs, and trees, and contains other existing improvements. Prior to general site grading, clearing and grubbing should be performed in accordance with the current edition of Standard Specifications for Public Works Construction (SSPWC, a.k.a. "Greenbook"), Section 300-1. Any debris, existing building foundations, basements, septic tanks, pavements, rubble, existing undocumented fill, loose soil, vegetation, or other deleterious items should be removed and disposed of outside the construction limits. All active or inactive utilities within the construction limits should be identified for relocation, abandonment, or protection prior to grading. Any pipes greater than 2 inches in diameter to be abandoned in-place should be filled with sand/cement slurry. The adequacy of existing backfill around utilities to remain in place under new structures should be evaluated; loose or dumped trench backfill should be removed and replaced with properly compacted backfill.

4.3.2 Excavation

Excavation should be readily accomplished using conventional heavy duty grading equipment.

4.3.3 Subgrade Preparation

The near surface medium expansion potential clayey soils should be removed from the building areas in accordance with Section 4.2.2.

In general the soils in the upper 5 feet include localized clayey topsoils, variable density sandy soils, and localized undocumented fills; soils below 5 feet soils are generally dense native materials.

Footings founded at a depth of 5 feet or more below existing ground may be supported directly in competent on-site native materials. The foundation area should be cleaned of all loose debris and observed / accepted by GDC prior to placing steel or concrete. If unsuitable soils are encountered below the foundation level they should be treated as recommended in the following paragraph.

To provide uniform support for building or wall footings and slabs founded at a depth of less than 5 feet below existing grades, we recommend excavating the entire building footprint to a minimum of 2 ft (or one footing width, whichever is greater) below the bottom of footing level, and that the bottom be proof-rolled under GDC's observation. It is recommended that all undocumented fill, loose, pumping, wet, or otherwise unsuitable soil be excavated to the limits and depth recommended by GDC in the field based on observation of the bottom and proof-rolling. Any soils that cannot be recompacted should be removed from the site. Excavated soils that are suitable for re-use as fill should be recompacted. We estimate that removals to a depth of up to about 5 feet below existing grades could be required due to presence of potentially loose and undocumented fills. The excavations should extend a minimum of 5 ft outside the building footprint. The bottom should then be scarified and recompacted. The area should be uniformly backfilled with native granular soils or imported fill. Imported or on-site fill, if placed in the foundation area, shall have an expansion index of less than 20.

In pavement or flatwork areas clayey topsoils should be removed, and the pavement or flatwork area should be excavated to a minimum of 1 ft below existing grade or subgrade level (whichever is deeper) and proof-rolled. Unsuitable materials should be further removed to the depth and limits recommended by GDC in the field.

Where new fills are placed on existing ground, following clearing and grubbing, the bottom should be proof rolled and any areas of loose soil excavated and recompacted. If the subgrade is stable under proof rolling, the surface should be scarified, brought to near optimum moisture content, and compacted prior to placing new fills.

All foundation excavations and footing subgrade should be observed and accepted by GDC prior to placing steel, concrete, and pavement structural section.

4.3.4 Fills

Preliminary plans (Figures 2B through 2D) shown that minor fills may be placed to create grassy knolls up to about 10 feet high or approaches to the pedestrian bridge. Placement of fills is expected to cause settlements of 1 inch or less, and the settlements will be completed within 2 weeks of fill placement.

General compacted fills should be compacted to not less than 90% relative compaction. Compacted fills placed below foundations, slabs, or pavements should be compacted to not less than 95% relative compaction. All compaction control should follow the standard test method ASTM D 1557, and be performed within 2% of the optimum moisture content. A sufficient number of field density and laboratory compaction tests should be performed during construction to verify minimum compaction requirements.

We recommend that any imported fills have Expansion Index less than 50, have less than 40% passing No. 200 sieve, and have a maximum particle size not to exceed 3 inches. All on-site fills and imported soils should be tested and accepted by GDC.

4.3.5 Earthwork Grading Factors

Native materials or existing fills of similar composition to the native materials may be excavated and compacted, or excavated and removed from the site. Imported fills may be brought in and compacted. Shrinkage or bulking may occur. Grading factors are defined as the original volume divided by the final volume. The following earthwork grading factors are recommended for the project:

- On site fill or alluvial soils excavated and placed at 90% compaction: 0.90-0.95
- On site fill or alluvial soils excavated and placed at 95% compaction: 0.85-0.90
- Import fill trucked in loose condition and compacted on site: 0.75-0.80
- Export material excavated on-site & trucked out in loose condition: 1.25 to 1.33

Grading factors may require adjustment during construction, and should consider the processing of material, wasting of spoil, and actual rather than specified placement percent compaction. The compaction characteristics of the materials from the borrow site excavation should be tested for density control during construction.

4.3.6 Permanent Slopes

Any permanent graded slopes should be 2h:1v or flatter, and planted with suitable vegetation. Runoff should not be allowed to discharge over the top of slopes.

4.4 Temporary Excavation and Shoring

Near soils generally classify as OSHA Type C; temporary excavations should comply with 29 CFR – 1926 Subpart P. The designated competent person on site should observe all excavations to verify they are stable or recommend laying back or shoring the excavation if necessary.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 ft from the top of the slopes, whichever is greater, unless the cut is shored. Excavations that extend below an imaginary plane inclined at 1h:1v below the edge of any adjacent existing site foundations or roadways should be properly shored to maintain support of the adjacent structures. The contractor will be responsible for the design of the shoring.

If space is not available for excavation, shoring may be used. For restrained shoring such as trench shields a uniform rectangular earth pressure lateral pressure of 25H psf (H=retained height in feet) plus 50 percent of any surcharge or traffic loads should be included as a uniform rectangular loading on the shoring.

4.5 Utility Trenches

4.5.1 Bedding

Bedding zone shall be defined as the area containing the material specified that is supporting, surrounding, and extending to 1 foot above the top of pipe. The bedding shall satisfy the requirements of Standard Specifications for Public Works Construction (SSPWC) Section 306-1.2.1. There shall be 4-inch minimum of bedding below the pipe and 1 inch minimum clearance below a projecting bell.

There shall be a minimum side clearance of 6 inches on each side of the pipe. Bedding material shall be sand, gravel, crushed aggregate, or native free-draining material having a Sand Equivalent of not less than 30, or other material approved by the engineer. We recommend that the materials used for the bedding zone be placed, and compacted with mechanical means. Jetting shall not be allowed.

4.5.2 Backfill

Backfill shall be considered as starting 12-inches above the pipe. Any boulders or cobbles larger than 3 inches in any dimensions should be removed before backfilling. We recommend that all backfill should be placed in lifts not exceeding six to eight inches in thickness and be compacted to at least 90 percent of maximum dry density as determined by the ASTM D-1557. The upper 12 inches below pavement should be compacted to at least 95 percent of maximum dry density. Mechanical compaction will be required to accomplish compaction above the bedding zone; jetting shall not be allowed.

In backfill areas, where mechanical compaction of soil backfill is impractical due to space constraints, sand-cement slurry may be substituted for compacted backfill. The slurry should contain one sack of cement per cubic yard and have a maximum slump of 5-inches. When set, such a mix typically has the consistency of hard compacted soil, and allows for future excavation.

4.6 Soil Corrosivity

Laboratory corrosivity test results showed a pH of 8.0 to 8.2, soluble chlorides of 100 ppm or less, soluble sulfates of 100 to 690 ppm, and minimum resistivity values of 1478 to 2023 ohm-cm for the near-surface soils.

Based on the test results, the potential for sulfate attack on concrete is negligible and no special type of cement or mix design is required for sulfate resistance. The tested level of chlorides in soil is not expected to have an adverse effect on reinforced concrete. To evaluate the corrosion potential of near-surface soils on buried metals, we used the following correlation between electrical resistivity and corrosion potential:

Elect. Resistivity, Ohm-cm	Corrosion Potential
Less than 1,000	Severe
1,000-2,000	Corrosive
2,000-10,000	Moderate
Greater than 10,000	Mild

Based on these data, it is our opinion that general onsite near-surface soils have a corrosive potential for buried metal. This should be considered in design of any buried metal elements, and a corrosion expert should be consulted for mitigation measures if required. Laboratory corrosion test results from the site are presented in Appendix B.

4.7 Pavement Design

Asphalt pavement sections should be designed based on this design R-value and an appropriate Traffic Index (TI). The Caltrans Highway Design Manual was used for design of the recommended Asphalt Concrete (AC) over Aggregate Base (AB) pavement sections. Based on testing of the near surface granular soils, we used an R-Value of 50 for the subgrade. The following AC pavement sections are recommended for Traffic Index (TI) values of 5, 6, and 7:

R-value 50

Traffic Index	Section Thickness AC Over AB (feet)
5	0.25 AC/0.35 AB
6	0.30 AC/0.35 AB
7	0.35 AC/0.35 AB

Minimum traffic Index of 5 is recommended for car parking and non-truck driveways, and 6 or higher may be used for truck areas or access driveways. The upper 12-inches of subgrade supporting pavements should be moisture conditioned to near optimum and compacted to at least 95 percent relative compaction within 2% of optimum moisture (ASTM D1557). AB should be Class 2 or Crushed Miscellaneous Base in accordance with Caltrans or Greenbook and be compacted to not less than 95% relative compaction.

If needed, bus pads may be designed following Section 626.4 of Caltrans Highway Design Manual. The minimum pavement structure for bus pads should be 0.85 foot Jointed Plain Concrete Pavement (JPCP) with dowel bars at transverse joints on top of 0.5 foot lean concrete base or Type A hot mix asphalt. Relative slab dimensions for bus pads should be approximately 1:1 to 1:1.25, transverse-to longitudinal. The width of the bus pad should be no less than the width of the bus plus 4 feet. The minimum length of the bus pad should be 1.5 times the length of the bus(es) that will use the pad at any given time.

5.0 LIMITATIONS

This investigation was performed in accordance with generally accepted geotechnical engineering principles and practice. The professional engineering work and judgments presented in this report meet the standard of care of our profession at this time. No other warranty, expressed or implied, is made.

The recommendations for this project are, to a high degree dependent upon proper quality control of grading and foundation construction. Consequently, the recommendations are made contingent on the opportunity of GDC to observe grading operations, mat foundation installation, and subgrade/base preparation. If parties other than GDC are engaged to provide such services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the recommendations in this report or provide alternate recommendations as deemed appropriate.

6.0 REFERENCES

2010 California Building Code

California Department of Conservation, Division of Mines and Geology, "State of California Special Study Zones.

Caltrans Highway Design Manual, 2010.

Caltrans, ARS Online website.

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Yerkes, R.F, and Campbell, R.H., "Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, Version 1.0, 2005.

Ziony, J.I., editor, "Evaluating Earthquake Hazards in the Los Angeles Region-An Earth Science Perspective," USGS Professional Paper 1360, 1985.

TABLES

TABLE 1
CBC 2007 / ASCE 7-05 ACCELERATION RESPONSE SPECTRA

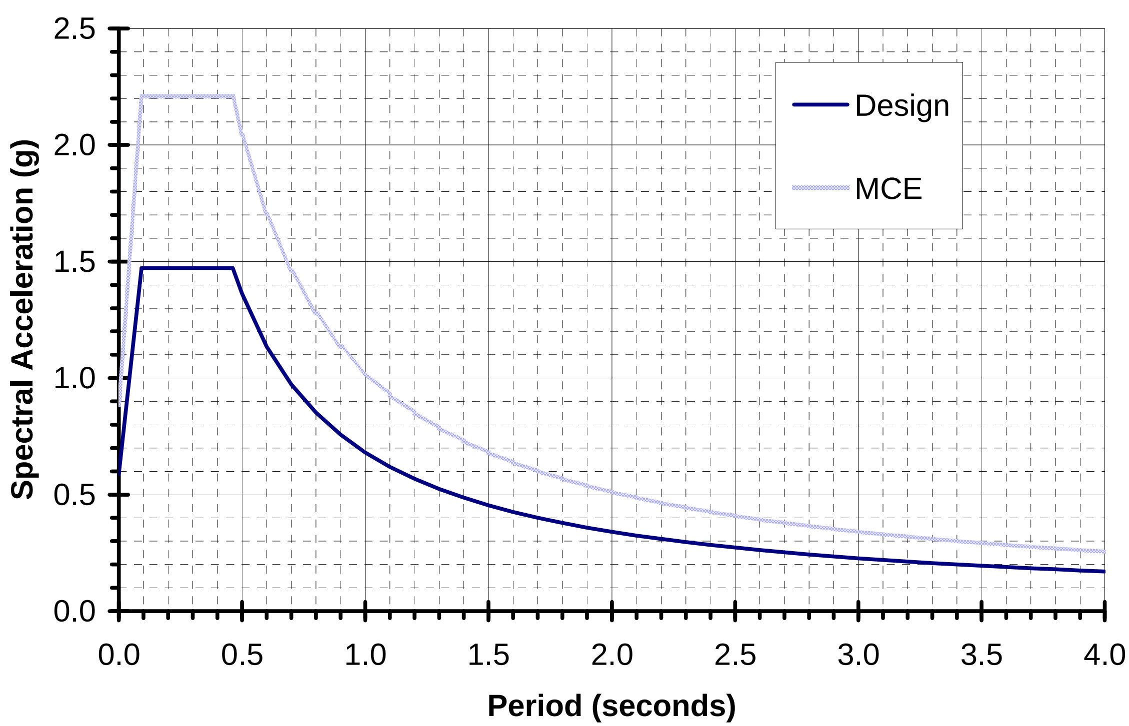
GDC PROJECT NO. L-938 Los Angeles State Historic Park

Site Latitude: 34.0685 **Site Longitude: -118.2323**

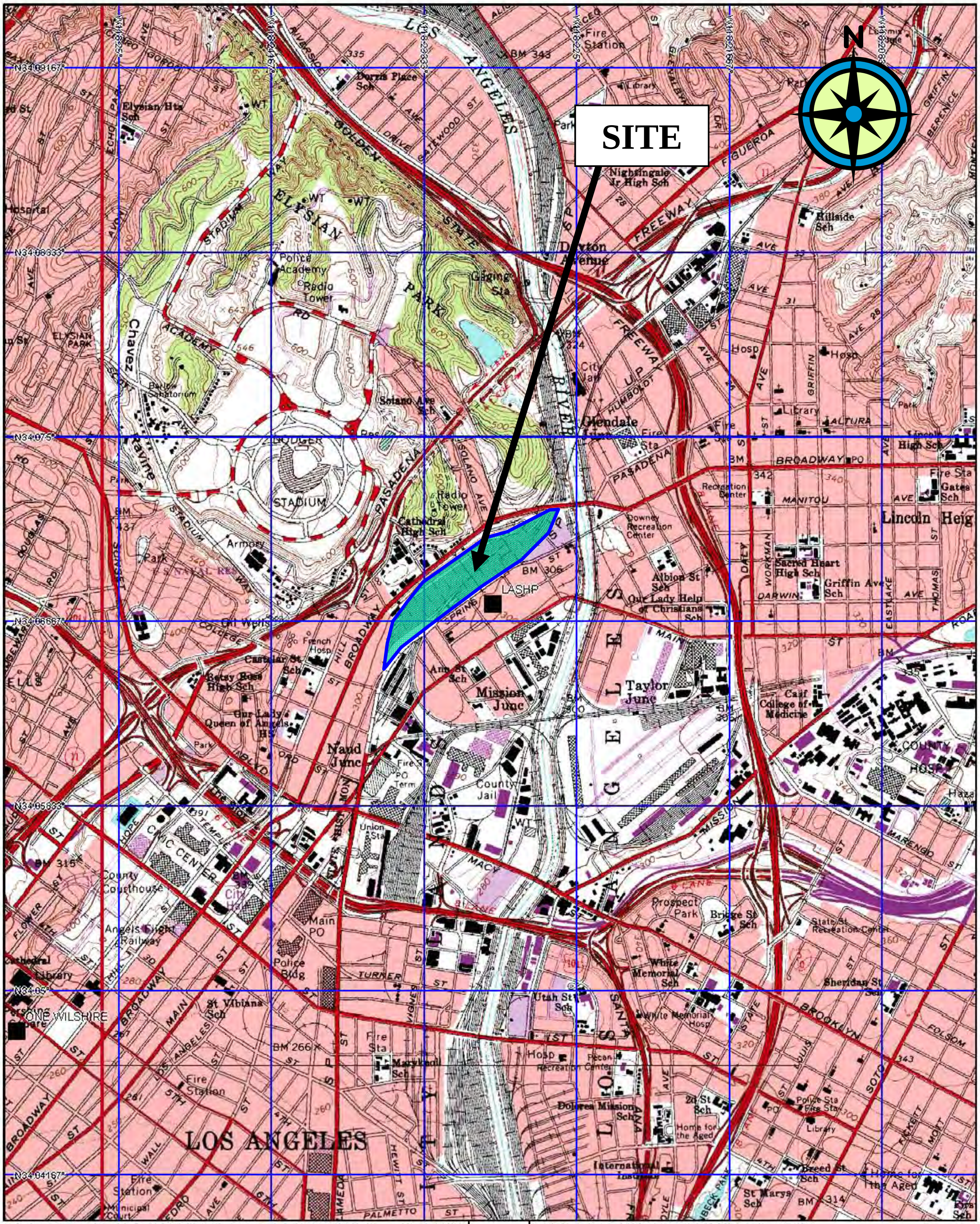
INPUT	S_S=	2.209	g = short period (0.2 sec) mapped spectral response acceleration MCE Site Class B (**CBC 2007 Fig. 1613.5(3) or USGS Ground Motion Calculator**)
	S_1=	0.786	g = 1.0 sec period mapped spectral response acceleration MCE Site Class B (**CBC 2007 Fig. 1613.5(4) or USGS Ground Motion Calculator)**
	Site Class=	C	= Site Class definition based on **CBC 2007 Table 1613.5.2**
	F_a=	1.00	= Site Coefficient applied to S_s to account for soil type (**CBC 2007 Table 1613.5.3(1)**)
	F_v=	1.30	= Site Coefficient applied to S_1 to account for soil type (**CBC 2007 Table 1613.5.3(2)**)
	T_L=	8.00	sec = Long Period Transition Period (**ASCE 7-05 Figure 22-16**)
OUTPUT	S_{MS}=	2.209	= site class modified short period (0.2 sec) MCE spectral response acceleration = F_a x S_s (**CBC 2007 Eqn. 16-37**)
	S_{M1}=	1.022	= site class modified 1.0 sec period MCE spectral response acceleration = F_v x S_1 (**CBC 2007 Eqn. 16-38**)
	S_{DS}=	1.473	= site class modified short period (0.2 sec) Design spectral response acceleration = 2/3 x S_{MS} (**CBC 2007 Eqn. 16-39**)
	S_{D1}=	0.681	= site class modified 1.0 sec period Design spectral response acceleration = 2/3 x S_{M1} (**CBC 2007 Eqn. 16-40**)
	T_0=	0.093	sec = 0.2 S_{D1}/S_{DS} = Control Period (left end of peak) for ARS Curve (Section 11.4.5 ASCE 7-05)
	T_S=	0.463	sec = S_{D1}/S_{DS} = Control Period (right end of peak) for ARS Curve (Section 11.4.5 ASCE 7-05)

SPECTRUM CALCULATION

T (seconds)	Design Sa (g)	MCE Sa (g)
0.000	0.589	0.884
0.093	1.473	2.209
0.463	1.473	2.209
0.500	1.362	2.044
0.600	1.135	1.703
0.700	0.973	1.460
0.800	0.852	1.277
0.900	0.757	1.135
1.000	0.681	1.022
1.100	0.619	0.929
1.200	0.568	0.852
1.300	0.524	0.786
1.400	0.487	0.730
1.500	0.454	0.681
1.600	0.426	0.639
1.700	0.401	0.601
1.800	0.378	0.568
1.900	0.359	0.538
2.000	0.341	0.511
2.100	0.324	0.487
2.200	0.310	0.464
2.300	0.296	0.444
2.400	0.284	0.426
2.500	0.272	0.409
2.600	0.262	0.393
2.700	0.252	0.378
2.800	0.243	0.365
2.900	0.235	0.352
3.000	0.227	0.341
3.100	0.220	0.330
3.200	0.213	0.319
3.300	0.206	0.310
3.400	0.200	0.301
3.500	0.195	0.292
3.600	0.189	0.284
3.700	0.184	0.276
3.800	0.179	0.269
3.900	0.175	0.262
4.000	0.170	0.255



FIGURES



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS 1000 ft Scale: 1 : 25,000 Detail: 13-0 Datum: WGS84

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GDC Project No. L-938

Los Angeles State Historic Park
Los Angeles, CA

Vicinity Map

Figure 1A

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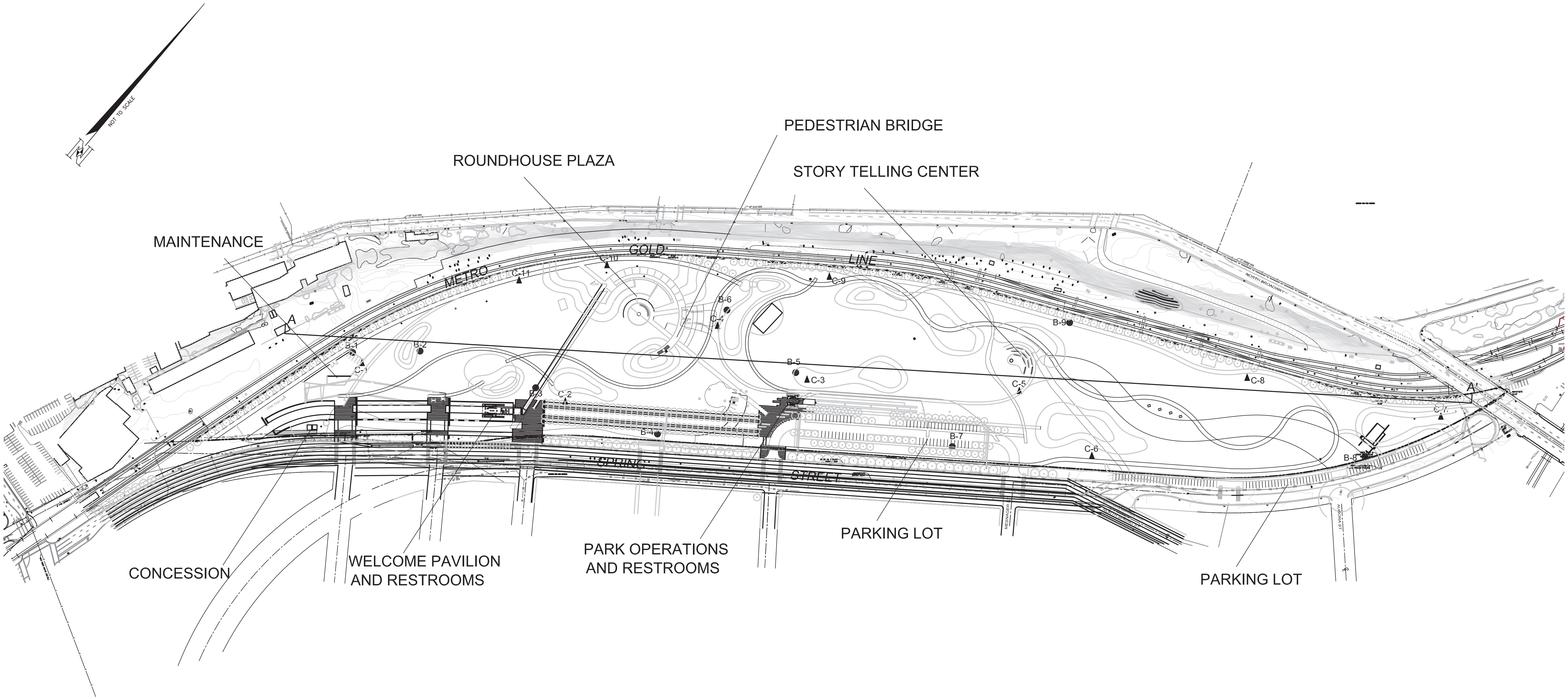
GDC Project No. L-938

Los Angeles State Historic Park
Los Angeles, CA

Aerial Photograph

Figure 1B



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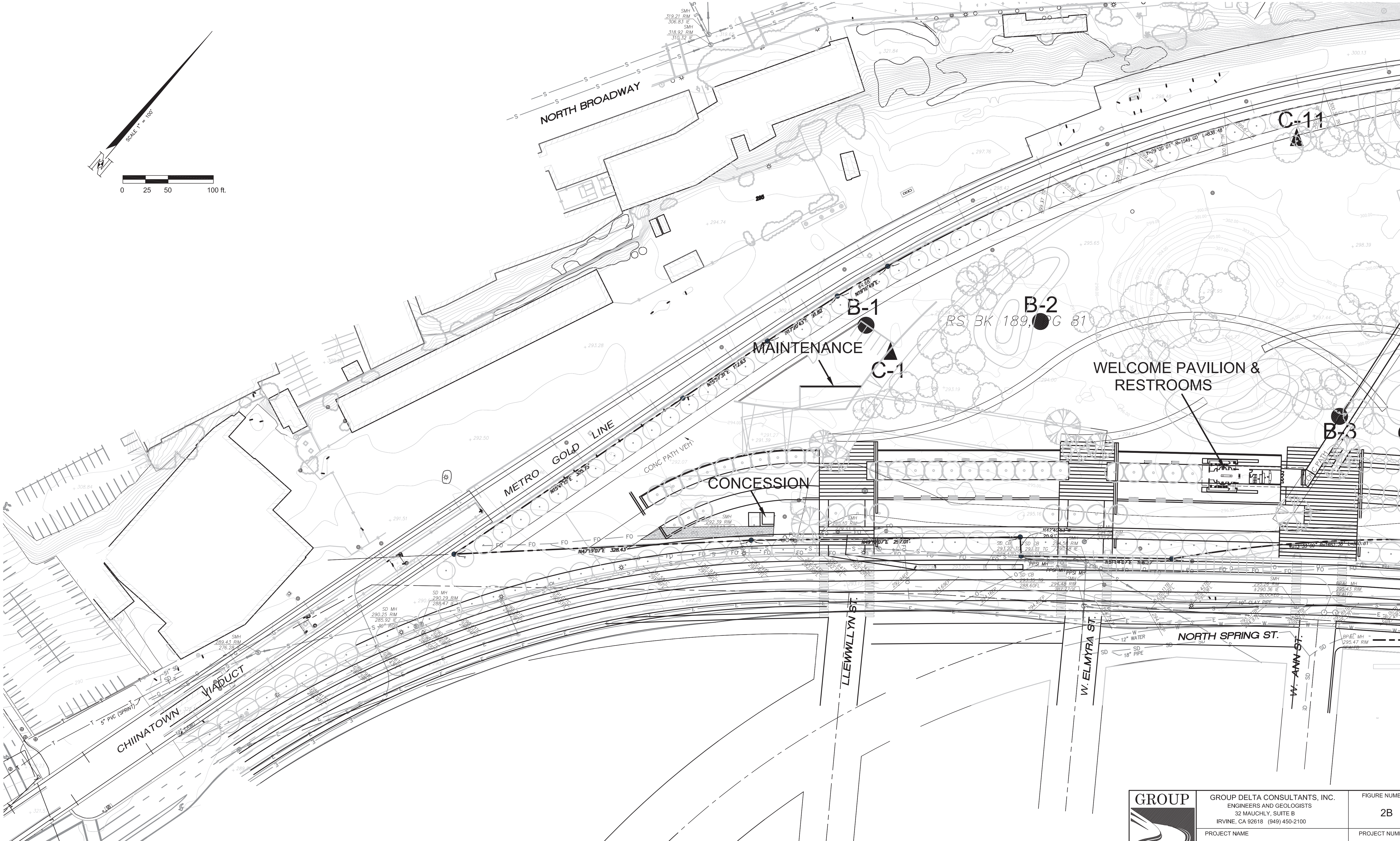
GROUP DELTA CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS
32 MAUCHLY, SUITE B
IRVINE, CA 92618 (949) 450-2100

FIGURE NUMBER
2A

PROJECT NAME
Los Angeles State Historic Park
Los Angeles, California

PROJECT NUMBER
L-938

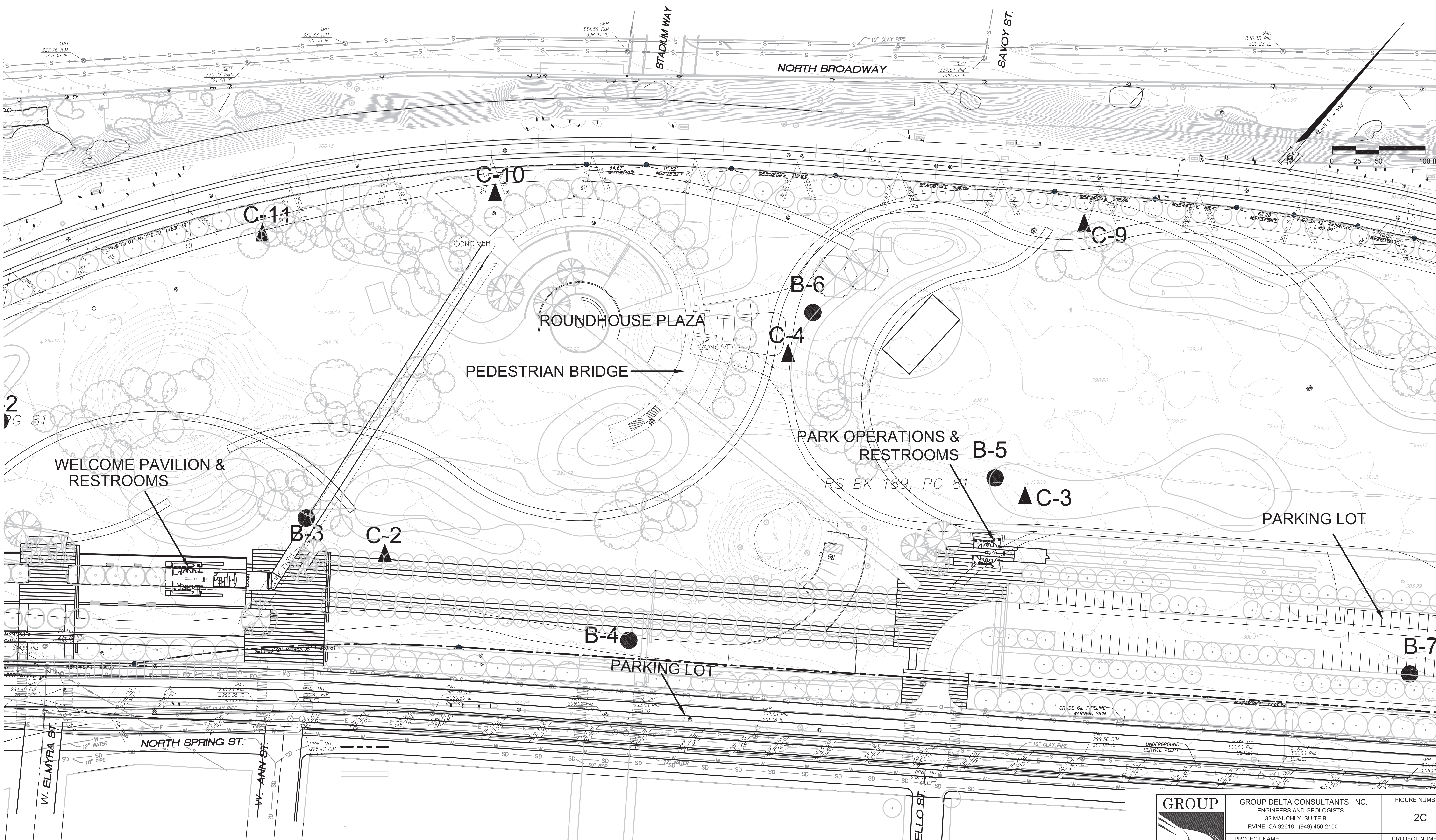
EXPLORATION LOCATION PLAN



LEGEND

- ● LOCATION OF BORING
- ▲ LOCATION OF CPT

GROUP DELTA CONSULTANTS	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	FIGURE NUMBER 2B
	PROJECT NAME Los Angeles State Historic Park Los Angeles, California	PROJECT NUMBER L-938
	EXPLORATION LOCATION PLAN	



LEGEND

● LOCATION OF BORING

▲ LOCATION OF CPT

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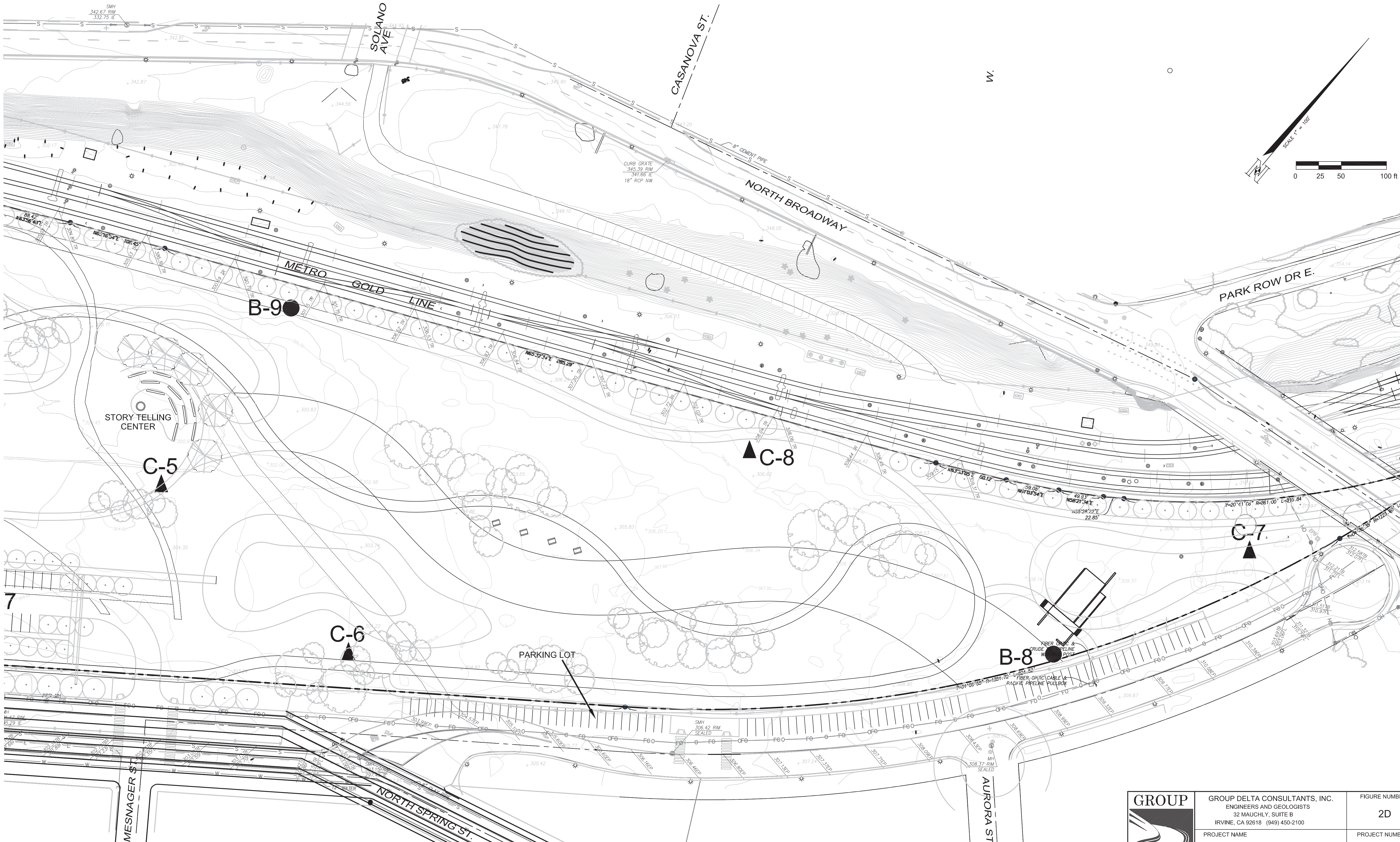
FIGURE NUMBER
2C

PROJECT NAME
Los Angeles State Historic Park
Los Angeles, California

PROJECT NUMBER
L-938

EXPLORATION LOCATION PLAN



LEGEND

● LOCATION OF BORING

▲ LOCATION OF CPT

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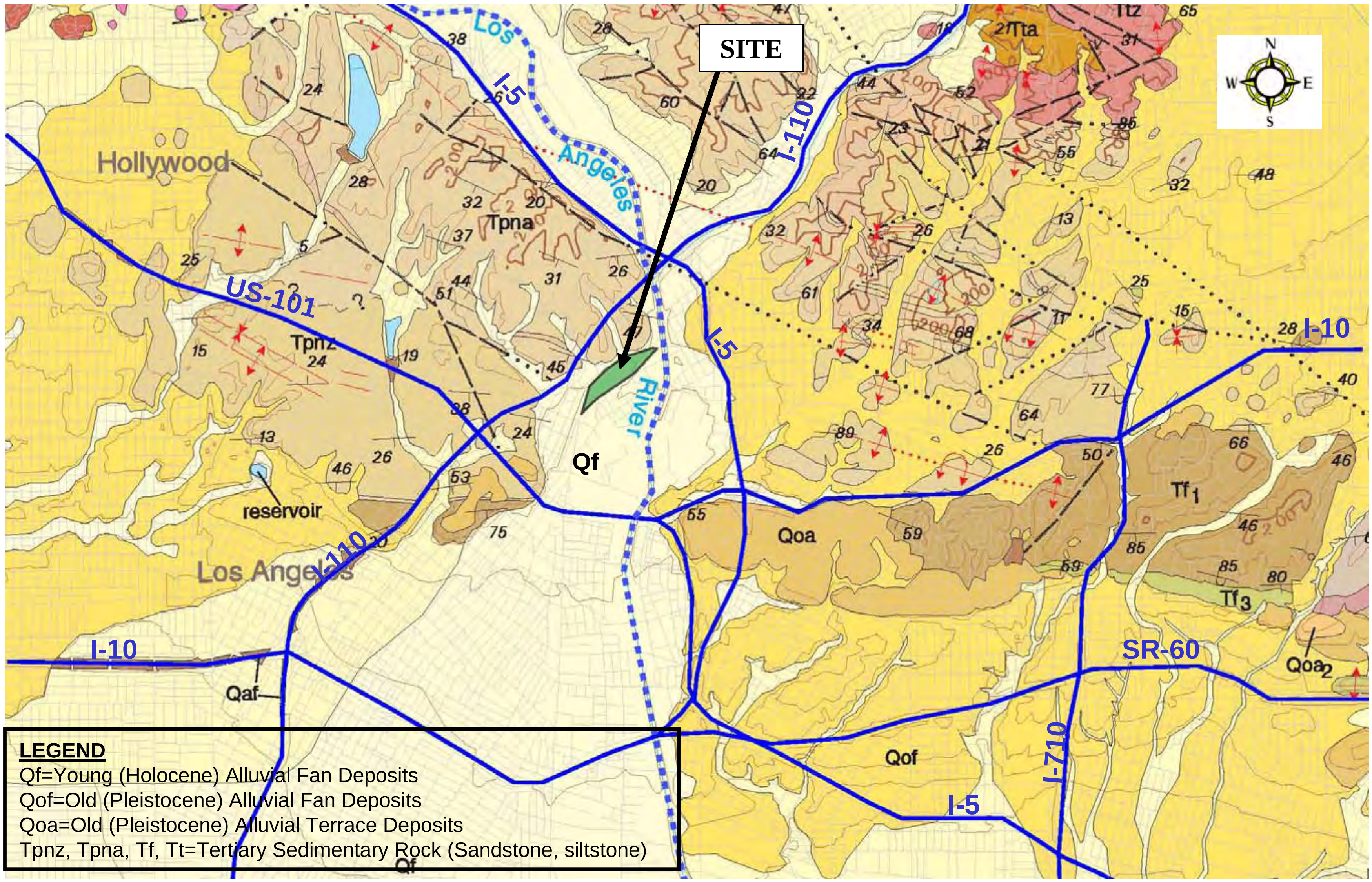
FIGURE NUMBER	2D
PROJECT NAME	Los Angeles State Historic Park, Los Angeles, California
PROJECT NUMBER	L-938

EXPLORATION LOCATION PLAN



Reference:

Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, Southern California Version 1.0, 2005, By Robert F. Yerkes and Russell H. Campbell, Version 1.0 digital preparation by Rachel Alvarez and Kelly Bovard

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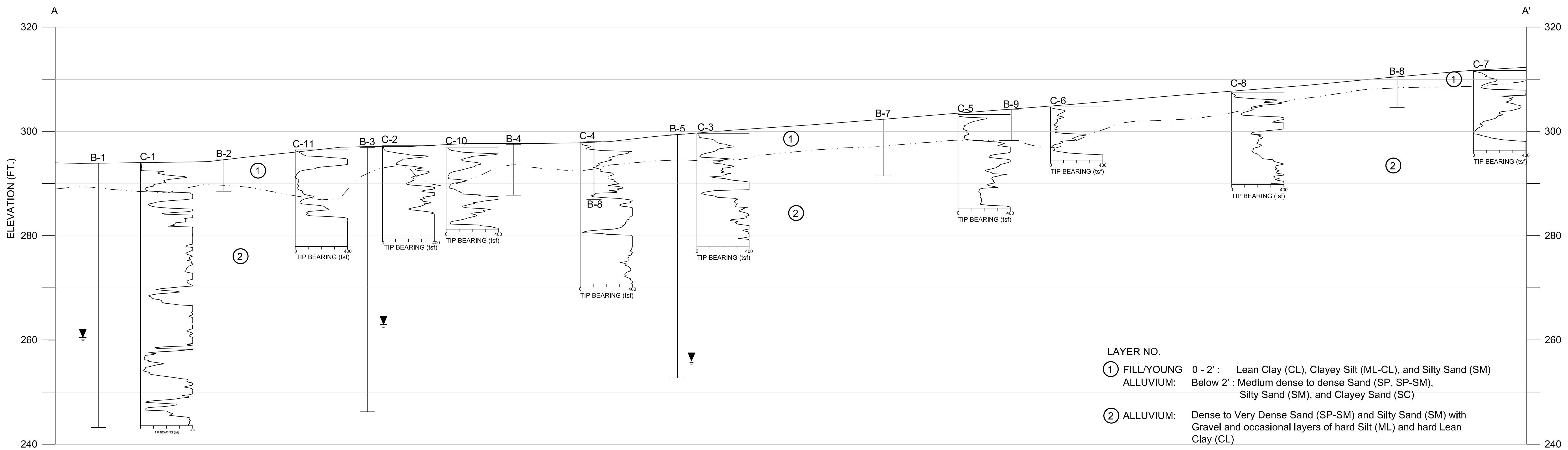
GDC Project No. L-938

Los Angeles State Historic Park
Los Angeles, CA

Regional Geologic Map

Figure 3



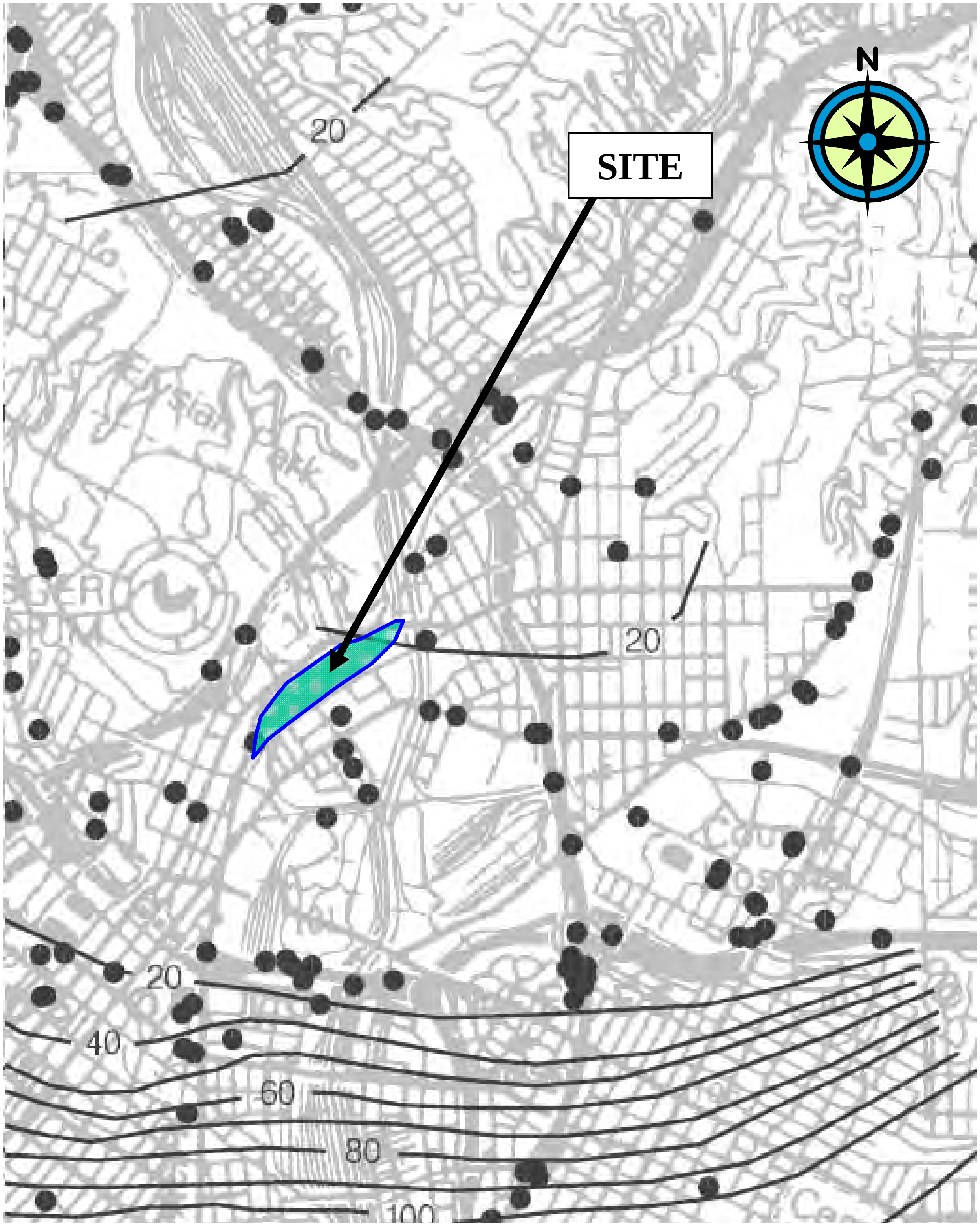
LAYER NO.

1 FILL/YOUNG ALLUVIUM: 0 - 2' : Lean Clay (CL), Clayey Silt (ML-CL), and Silty Sand (SM)
Below 2' : Medium dense to dense Sand (SP, SP-SM), Silty Sand (SM), and Clayey Sand (SC)

2 ALLUVIUM: Dense to Very Dense Sand (SP-SM) and Silty Sand (SM) with Gravel and occasional layers of hard Silt (ML) and hard Lean Clay (CL)

Groundwater at time of drilling

GROUP DELTA CONSULTANTS	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 32 MAUCHLY, SUITE B IRVINE, CA 92618 (949) 450-2100	FIGURE NUMBER 4
	PROJECT NAME LA STATE HISTORICAL PARK LOS ANGELES, CALIFORNIA	PROJECT NUMBER L-938
	CROSS SECTION A- A'	



Historically Highest Ground Water Contours and Borehole Log Data Locations, Los Angeles Quadrangle.

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

SEISMIC HAZARD ZONE REPORT FOR THE LOS ANGELES 7.5-MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA

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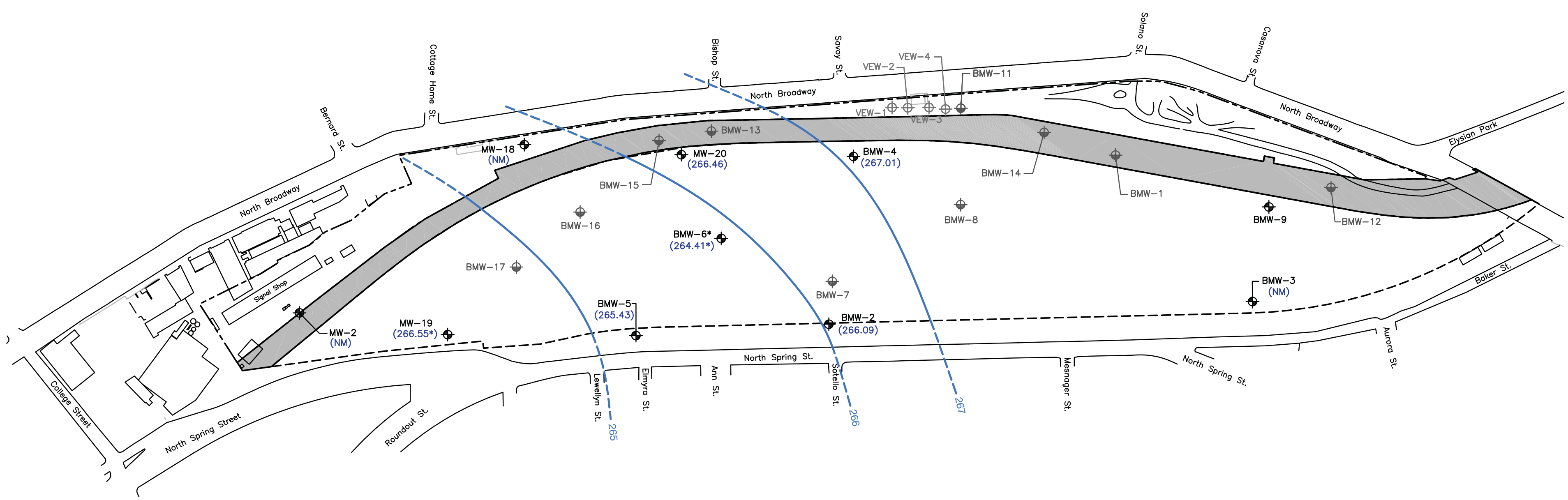
GDC Project No. L-938

Los Angeles State Historic Park
Los Angeles, CA

Historically Highest Groundwater Map

Figure 5A

CAD File: F:\0020562\640\0020562640-07.dwg
Drawn By: C. Tallada
Date: 09/21/06
Project No. 0020562.640



LEGEND

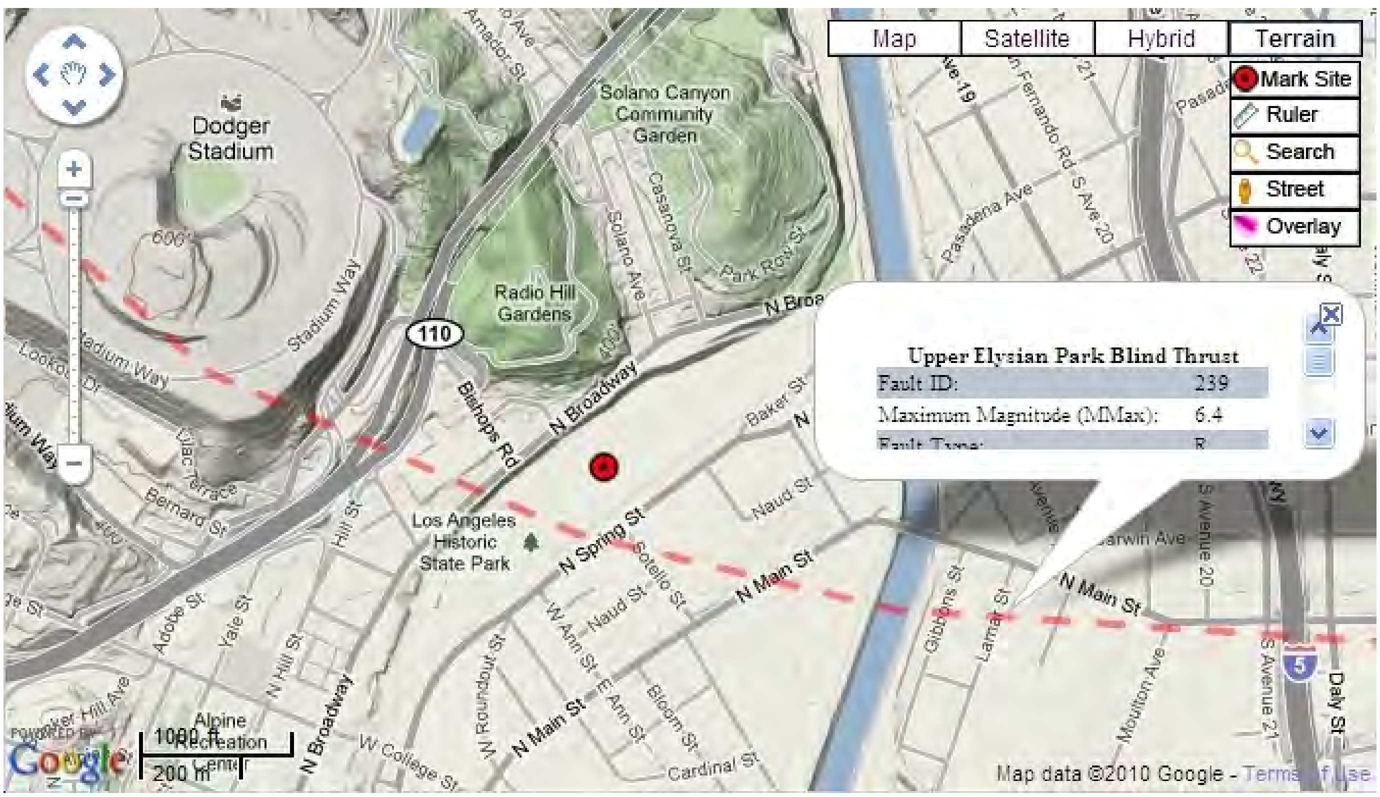
BMW-5	Groundwater Monitoring Well Location
VEW-4	Abandoned Vapor Extraction Well Location
BMW-12	Abandoned Groundwater Monitoring Well Location
	8-Acre Parcel
	32-Acre Parcel
	MTA Easement
	Line of Equal Groundwater Elevation (Dashed where Estimated)
(266.55)	Groundwater Elevation, in Feet Above Mean Sea Level
(NM)	Well Not Monitored
*	Well Not Used For Contouring

0 150' 300' 600'
SCALE IN FEET

Figure 5B

Groundwater Elevation Contours
August 2006
Union Pacific Former Cornfield Yard
Los Angeles, California

ERM 09/06



Reference: Caltrans ARS Online

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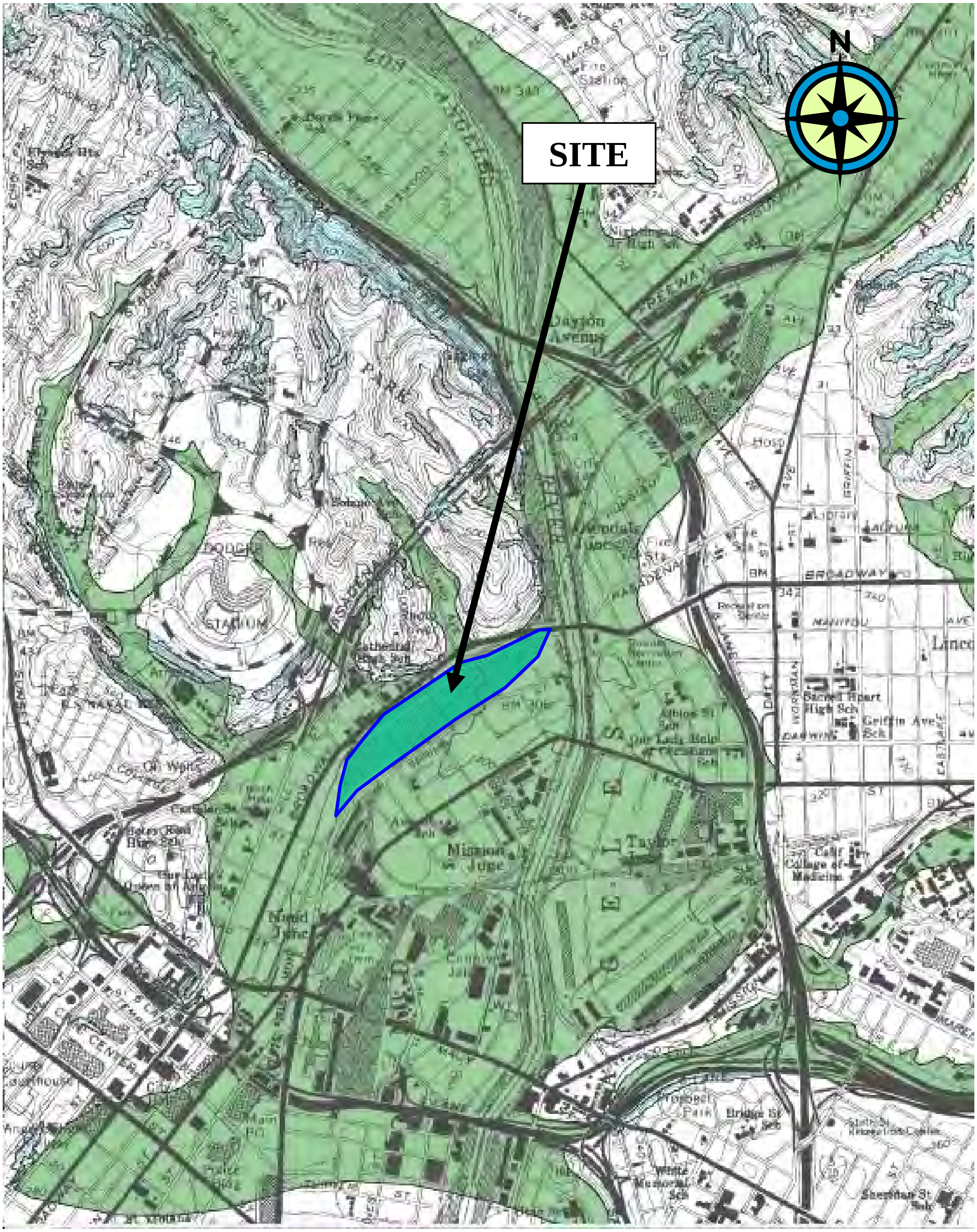
GDC Project No. L-938

Los Angeles State Historic Park
Los Angeles, CA

Fault Map

Figure 6



STATE OF CALIFORNIA

SEISMIC HAZARD ZONES

Delineated in compliance with
Chapter 7.8, Division 2 of the California Public Resources Code
(Seismic Hazards Mapping Act)

LOS ANGELES QUADRANGLE

OFFICIAL MAP
Released: March 25, 1999

GROUP DELTA CONSULTANTS

GDC Project No. L-938

Los Angeles State Historic Park
Los Angeles, CA

Liquefaction Zone Map

Figure 7

EVALUATION OF LIQUEFACTION POTENTIAL AND EARTHQUAKE-INDUCED SETTLEMENTS USING CPT DATA (METHOD 2)

(Engineer: Curt Scheyhing)

PROJECT INFORMATION	
Project Name	LA State Historical Park
Project No.	L-938
Location	Los Angeles, CA
Exploration No.	C-1

GENERAL INPUT DATA	
Ground Surf. Elev. During Test	293.50 ft
GWT Elev. During Test	260.00 ft
GWT Elev. For Design	273.50 ft
Total Soil Unit Weight, γ_t	125.00 pcf
Earthquake Magnitude, M_{eq}	6.60
Peak Ground Acceleration, A_{max}	0.88 g
Required Factor of Safety	1.30

REFERENCES

\+ Liquefaction Resistance of Soils: Summary Report From the 1996 NCEER and 1998 NCEER/NSF Workshops (Edited by: T.L. Youd and I.M. Idriss, 2001)

++ CSR = 0.65 A_{max} (σ_v/σ_v') r_d

+++ FS = $(CRR_{7.5}/CSR)$ MSF K_σ $K_{\alpha\text{—>>}}$ where $CRR_{7.5}$ is evaluated from direct CPT data, K_α =1.0 and MSF = 1.39

* Residual strength values of liquefied soils are evaluated from converted SPT blow counts using the median curve by Seed & Harder (1990)

** Ground settlements are evaluated from converted SPT blow counts using the method developed by Tokimatsu and Seed (1987).

Note: This analysis asssumes level ground condition and depth of liquefiable soils does not change.

GWT Depth During Test, Zw =	33.50 ft below ground surface
GWT Depth For Design, Zwd =	20.00 ft below ground surface

***** SUMMARY OF RESULTS *****

Total Thickness of Liquefiable Soils =	4.00 feet	
Earthquake-Induced Settlements:		
- Liquefaction-Induced Settlement =	0.05 inches	<--- Saturated Sands
- Seismic Compaction Settlement =	0.00 inches	<--- Dry or Unsaturated Sands
Total:	0.05 inches	

INPUT SOIL PROFILE (CPT DATA)

Soil Depth During Test (ft)	Average Cone Tip Resistance $q_{t\text{-}avg}$ (tsf)	Average Sleeve Friction $f_{s\text{-}avg}$ (tsf)	Average Friction Ratio $R_{f\text{-}avg}$ (%)	Soil Behavior Type (Robertson et al., 1983)
0.50	8.50	0.51	6.05	clay
1.50	80.26	3.15	3.93	clayey silt to silty clay
2.50	265.63	5.65	2.13	sand to silty sand
3.50	188.61	3.12	1.65	sand to silty sand
4.50	77.23	2.73	3.53	sandy silt to clayey silt
5.50	187.88	3.86	2.05	silty sand to sandy silt
6.50	495.27	5.24	1.06	sand
7.50	171.48	1.44	0.84	sand
8.50	169.15	4.81	2.84	silty sand to sandy silt
9.50	316.06	7.40	2.34	silty sand to sandy silt
10.50	418.62	9.39	2.24	sand to silty sand
11.50	291.03	4.82	1.66	sand to silty sand
12.50	437.74	5.77	1.32	sand
13.50	429.41	7.17	1.67	sand to silty sand
14.50	500.41	6.40	1.28	sand
15.50	433.04	5.01	1.16	sand
16.50	426.39	5.92	1.39	sand
17.50	368.84	4.54	1.23	sand
18.50	377.96	4.52	1.20	sand
19.50	388.21	5.36	1.38	sand
20.50	351.99	5.82	1.66	sand to silty sand
21.50	491.60	7.01	1.43	sand
22.50	392.85	5.90	1.50	sand
23.50	352.43	4.24	1.21	sand
24.50	209.23	4.17	2.00	sand to silty sand
25.50	90.24	2.76	3.08	sandy silt to clayey silt
26.50	154.75	3.71	2.40	silty sand to sandy silt
27.50	510.85	9.34	1.83	sand to silty sand
28.50	448.49	6.36	1.42	sand
29.50	397.15	4.00	1.01	sand
30.50	422.47	4.77	1.13	sand
31.50	395.27	3.63	0.92	sand
32.50	379.19	4.52	1.19	sand
33.50	422.14	5.49	1.30	sand
34.50	447.30	3.89	0.87	gravelly sand to sand
35.50	252.88	5.33	2.11	sand to silty sand
36.50	116.52	4.10	3.53	sandy silt to clayey silt
37.50	37.92	1.69	4.52	silty clay to clay
38.50	121.99	3.68	3.02	sandy silt to clayey silt
39.50	38.80	1.84	4.80	silty clay to clay
40.50	87.35	2.34	2.69	sandy silt to clayey silt
41.50	316.50	6.16	1.95	sand to silty sand
42.50	382.52	6.31	1.65	sand to silty sand
43.50	418.90	5.78	1.38	sand
44.50	380.87	4.89	1.29	sand
45.50	160.31	3.05	1.90	silty sand to sandy silt
46.50	197.11	2.98	1.51	sand to silty sand
47.50	126.83	2.98	2.36	silty sand to sandy silt
48.50	284.17	5.75	2.03	sand to silty sand
49.50	376.63	8.65	2.30	sand to silty sand
50.50	371.51	9.39	2.53	sand to clayey sand (*)
				#N/A
				#N/A
				#N/A
				#N/A
				#N/A
				#N/A
				#N/A
				#N/A
				#N/A
				#N/A

SOIL LIQUEFACTION POTENTIAL ANALYSIS (1996 NCEER & 1998 NCEER/NSF WORKSHOPS) +															RESIDUAL STRENGTH *			GROUND SETTLEMENT **				
Bottom of Layer Elevation (ft)	Thin Layer Correction Factor (Lunne, et al., 1997)	Equiv. SPT Blow Count N_{60}(blows/ft)	Total Vert. Stress σ_v (psf)	Effective Vert. Stress (Design) $\sigma_{v'}$ (psf)	Effective Vert. Stress (Test) $\sigma_{v'}$ (psf)	Soil Behavior Type Index I_c	Fines Correction Factor K_c	Corrected Tip Resistance q_{c1Ncs}	Shear Stress Reduction Coeff. r_d	Correction for High Overburden Stress K_σ	Cyclic Stress Ratio ++ CSR	Cyclic Res. Ratio $CRR_{7.5}$	Factor of Safety Against Liqefaction +++ FS	Liquefy ?	SPT Blow Count Correction $N_{corr.}$	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Residual Shear Strength S_r (psf)	Fines Corrected SPT Blow Count $(N_1)_{60cs}$	Cyclic Shear Strain γ_c (%)	Vol. Strain ε_v (%)	Layer Settlement S_i (in.)	Cumulative Settlement Profile (in.)
292.5	1.00	9	63	63	63	2.45	2.53	289.44	0.999	N/A	0.571	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.05
291.5	1.00	40	188	188	188	2.10	1.45	379.97	0.997	N/A	0.570	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.05
290.5	1.00	66	313	313	313	1.68	1.02	686.38	0.994	N/A	0.569	N/A	N/A	NO	N/A	N/A	N/A	120.8	1.655	0.000	0.00	0.05
289.5	1.66	78	438	438	438	1.38	1.00	667.71	0.992	N/A	0.567	N/A	N/A	NO	N/A	N/A	N/A	141.6	1.607	0.000	0.00	0.05
288.5	1.00	31	563	563	563	2.20	1.67	242.85	0.990	N/A	0.566	N/A	N/A	NO	N/A	N/A	N/A	68.0	N/A	N/A	N/A	0.05
287.5	1.00	63	688	688	688	1.81	1.11	357.26	0.987	N/A	0.565	N/A	N/A	NO	N/A	N/A	N/A	132.8	1.617	0.000	0.00	0.05
286.5	1.66	164	813	813	813	1.09	1.00	1,286.58	0.985	N/A	0.563	N/A	N/A	NO	N/A	N/A	N/A	257.3	1.273	0.000	0.00	0.05
285.5	1.00	34	938	938	938	1.57	1.00	250.46	0.983	N/A	0.562	N/A	N/A	NO	N/A	N/A	N/A	50.1	2.150	0.000	0.00	0.05
284.5	1.00	56	1,063	1,063	1,063	2.01	1.31	303.71	0.980	N/A	0.561	N/A	N/A	NO	N/A	N/A	N/A	97.8	1.680	0.000	0.00	0.05
283.5	1.00	105	1,188	1,188	1,188	1.81	1.11	455.85	0.978	N/A	0.559	N/A	N/A	NO	N/A	N/A	N/A	169.1	1.367	0.000	0.00	0.05
282.5	1.00	105	1,313	1,313	1,313	1.74	1.07	551.70	0.976	N/A	0.558	N/A	N/A	NO	N/A	N/A	N/A	137.9	1.429	0.000	0.00	0.05
281.5	1.00	73	1,438	1,438	1,438	1.72	1.05	360.11	0.973	N/A	0.557	N/A	N/A	NO	N/A	N/A	N/A	92.4	1.595	0.000	0.00	0.05
280.5	1.00	88	1,563	1,563	1,563	1.55	1.00	495.25	0.971	N/A	0.555	N/A	N/A	NO	N/A	N/A	N/A	99.0	1.523	0.000	0.00	0.05
279.5	1.00	107	1,688	1,688	1,688	1.65	1.00	469.24	0.969	N/A	0.554	N/A	N/A	NO	N/A	N/A	N/A	125.0	1.378	0.000	0.00	0.05
278.5	1.00	100	1,813	1,813	1,813	1.52	1.00	525.65	0.966	N/A	0.553	N/A	N/A	NO	N/A	N/A	N/A	105.1	1.427	0.000	0.00	0.05
277.5	1.00	87	1,938	1,938	1,938	1.53	1.00	439.97	0.964	N/A	0.551	N/A	N/A	NO	N/A	N/A	N/A	88.0	1.482	0.000	0.00	0.05
276.5	1.00	85	2,063	2,063	2,063	1.61	1.00	419.88	0.962	N/A	0.550	N/A	N/A	NO	N/A	N/A	N/A	84.0	1.474	0.000	0.00	0.05
275.5	1.00	74	2,188	2,188	2,188	1.60	1.00	352.68	0.959	N/A	0.549	N/A	N/A	NO	N/A	N/A	N/A	70.5	1.530	0.000	0.00	0.05
274.5	1.00	76	2,313	2,313	2,313	1.59	1.00	351.49	0.957	N/A	0.547	N/A	N/A	NO	N/A	N/A	N/A	70.3	1.502	0.000	0.00	0.05
273.5	1.00	78	2,438	2,438	2,438	1.65	1.00	351.72	0.955	N/A	0.546	N/A	N/A	NO	N/A	N/A	N/A	70.3	1.472	0.000	0.00	0.05
272.5	1.00	88	2,563	2,531	2,563	1.74	1.06	332.95	0.952	0.910	0.551	N/A	N/A	NO	N/A	N/A	N/A	84.0	N/A	0.000	0.00	0.05
271.5	1.00	98	2,688	2,594	2,688	1.61	1.00	431.66	0.950	0.901	0.563	N/A	N/A	NO	N/A	N/A	N/A	84.8	N/A	0.000	0.00	0.05
270.5	1.00	79	2,813	2,657	2,813	1.68	1.03	349.92	0.948	0.893	0.574	N/A	N/A	NO	N/A	N/A	N/A	66.3	N/A	0.000	0.00	0.05
269.5	1.00	70	2,938	2,719	2,938	1.64	1.00	302.26	0.945	0.884	0.584	N/A	N/A	NO	N/A	N/A	N/A	58.2	N/A	0.000	0.00	0.05
268.5	1.66	87	3,063	2,782	3,063	1.64	1.00	293.27	0.943	0.876	0.594	N/A	N/A	NO	N/A	N/A	N/A	75.9	N/A	0.000	0.00	0.05
267.5	1.00	36	3,188	2,844	3,188	2.34	2.08	157.30	0.941	0.869	0.603	0.442	0.883	YES	2.8	31.4	1,200	39.3	N/A	0.011	0.00	0.05
266.5	1.00	52	3,313	2,907	3,313	2.10	1.46	187.67	0.938	0.861	0.612	N/A	N/A	NO	N/A	N/A	N/A	53.1	N/A	0.000	0.00	0.05
265.5	1.00	128	3,438	2,970	3,438	1.71	1.04	437.52	0.936	0.854	0.620	N/A	N/A	NO	N/A	N/A	N/A	104.6	N/A	0.000	0.00	0.05
264.5	1.00	90	3,563	3,032	3,563	1.65	1.00	364.64	0.934	0.847	0.627	N/A	N/A	NO	N/A	N/A	N/A	67.2	N/A	0.000	0.00	0.05
263.5	1.00	79	3,688	3,095	3,688	1.56	1.00	319.27	0.931	0.840	0.635	N/A	N/A	NO	N/A	N/A	N/A	58.5	N/A	0.000	0.00	0.05
262.5	1.00	84	3,813	3,157	3,813	1.59	1.00	336.24	0.926	0.833	0.639	N/A	N/A	NO	N/A	N/A	N/A	61.2	N/A	0.000	0.00	0.05
261.5	1.00	79	3,938	3,220	3,938	1.54	1.00	311.52	0.918	0.827	0.642	N/A	N/A	NO	N/A	N/A	N/A	56.3	N/A	0.000	0.00	0.05
260.5	1.00	76	4,063	3,283	4,063	1.64	1.00	295.98	0.909	0.820	0.644	N/A	N/A	NO	N/A	N/A	N/A	53.2	N/A	0.000	0.00	0.05
259.5	1.00	84	4,188	3,345	4,188	1.64	1.00	325.97	0.901	0.814	0.645	N/A	N/A	NO	N/A	N/A	N/A	58.3	N/A	0.000	0.00	0.05
258.5	1.00	75	4,313	3,408	4,250	1.49	1.00	342.67	0.893	0.808	0.647	N/A	N/A	NO	N/A	N/A	N/A	51.1	N/A	0.000	0.00	0.05
257.5	1.66	105	4,438	3,470	4,313	1.64	1.00	317.22	0.885	0.802	0.647	N/A	N/A	NO	N/A	N/A	N/A	77.2	N/A	0.000	0.00	0.05
256.5	1.66	77	4,563	3,533	4,375	2.03	1.34	194.68	0.877	0.796	0.648	N/A	N/A	NO	N/A	N/A	N/A	67.6	N/A	0.000	0.00	0.05
255.5	1.00	25	4,688	3,596	4,438	2.82	N/A	N/A	0.869	N/A	0.648	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.05
254.5	1.66	81	4,813	3,658	4,501	1.97	1.26	188.79	0.861	0.785	0.648	N/A	N/A	NO	N/A	N/A	N/A	69.6	N/A	0.000	0.00	0.05
253.5	1.00	26	4,938	3,721	4,563	2.84	N/A	N/A	0.852	N/A	0.647	N/A	N/A	NO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.05
252.5	1.00	35	5,063	3,783	4,626	2.35	2.13	135.32	0.844	0.795	0.646	0.310	0.530	YES	2.8	25.8	1,200	32.6	N/A	0.286	0.03	0.02
251.5	1.00	79	5,187	3,846	4,688	1.88	1.17	266.62	0.836	0.770	0.645	N/A	N/A	NO	N/A	N/A	N/A	56.7	N/A	0.000	0.00	0.02
250.5	1.00	96	5,312	3,908	4,751	1.77	1.09	297.47	0.828	0.765	0.644	N/A	N/A	NO	N/A	N/A	N/A	67.5	N/A	0.000	0.00	0.02
249.5	1.00	84	5,437	3,971	4,813	1.69	1.03	306.23	0.820	0.760	0.642	N/A	N/A	NO	N/A	N/A	N/A	54.0	N/A	0.000	0.00	0.02
248.5	1.66	126	5,562	4,034	4,876	1.38	1.00	444.05	0.812	0.755	0.640	N/A	N/A	NO	N/A	N/A	N/A	80.8	N/A	0.000	0.00	0.02
247.5	1.00	53	5,687	4,096	4,939	2.07	1.40	157.29	0.804	0.751	0.638	0.442	0.721	YES	2.8	36.8	1,200	45.8	N/A	0.000	0.00	0.02
246.5	1.00	49	5,812	4,159	5,001	1.94	1.23	167.73	0.795	0.746	0.636	N/A	N/A	NO	N/A	N/A	N/A	35.2	N/A	0.081	0.01	0.01
245.5	1.00	42	5,937	4,221	5,064	2.21	1.70	148.64	0.787	0.749	0.633	0.385	0.632	YES	2.8	29.4	1,200	36.9	N/A	0.052	0.01	0.00
244.5	1.00	71	6,062	4,284	5,126	1.93	1.22	237.38	0.779	0.737	0.631	N/A	N/A	NO	N/A	N/A	N/A	49.0	N/A	0.000	0.00	0.00
243.5	1.00	94	6,187	4,347	5,189	1.91	1.20	305.68	0.771	0.733	0.628	N/A	N/A	NO	N/A	N/A	N/A	63.8	N/A	0.000	0.00	0.00
242.5	1.00	186	6,312	4,409	5,252	1.95	1.24	309.58	0.763	0.729	0.625	N/A	N/A	NO	N/A	N/A	N/A	122.6	N/A	0.000	0.00	0.00

max=	1,200
min=	1,200
avg=	1,200

FIGURE 8

CPT LIQ Method 2_C-1 high hist water code MCE.XLS

Output Sheet

APPENDIX A
FIELD EXPLORATION

APPENDIX A
FIELD EXPLORATION

A.1 Introduction

Group Delta Consultants, Inc. (GDC) investigated the subsurface conditions at the Los Angeles State Historical Park project site by performing nine hollow-stem auger soil borings (B-1 through B-9) and eleven Cone Penetration Tests (C-1 through C-11) at the site on February 22nd through February 25th, 2011. The borings were drilled to depths ranging from 6 ft to 51 ft below ground surface (bgs). The CPT's were advanced to depths ranging from 10 ft to 50 feet bgs. Locations of the borings and CPT's are presented in Figures 2A through 2D of the main report. Exploration summary information is presented in Table A-1.

A.2 Soil Drilling and Sampling

The boring was advanced by 8-inch diameter hollow stem auger utilizing a hybrid Mobile B-61/CME-85 drill rig with CME 85 automatic hammer operated by our subcontractor Choice Drilling Inc. of Canoga Park, CA. The borings were performed under the continuous technical supervision of a GDC field engineer, who visually inspected the soil samples, maintained detailed logs of the borings, and visually classified the soils in accordance with the Unified Soil Classification System (USCS). A key for soil classification and boring log legend are presented in Figures A-1a and A-1b, respectively. A summary of the field explorations is presented in Table A-1, and the boring logs are presented in Figures A-2a through A-10.

Bulk samples of the near-surface soils were obtained from auger cuttings and sealed in plastic bags. Drive samples were collected from the borings at a typical interval of five (5) feet. The sampling utilized Standard Penetration Test (SPT) and Modified California samplers. SPT drive samples were obtained in accordance with ASTM D1586 using a 2-inch outside diameter and 1.38-inch inside diameter split-spoon sampler without lining. The soil recovered from the SPT sampling was sealed in plastic bags to retain the natural moisture content. The California sampler is a 3-inch outside diameter split barrel sampler lined with a 2.42-inch inside diameter metal rings. Compared to the SPT, the California sampler provides relatively undisturbed samples. California samples were removed from the sampler, retained in the metal rings and placed in sealed plastic canisters to prevent loss of moisture.

At each sampling interval, the drive samplers were fitted onto a sampling rod, lowered to the bottom of the boring, and driven into the soil a depth of 18-inches or refusal (more than 50 blows per 6 inches) by repeated blows of a 140-lb CME automatic hammer free-falling a height of 30-inches. SPT blow counts are often used as an index of the relative density and resistance of the sampled materials. The number of blows to drive the sampler each 6-inch increment into the soil was recorded on the boring logs and it was used to estimate relative soil density or consistency. For purposes of estimating relative densities or consistency, California drive sampler blow counts can be approximately converted to equivalent SPT blow counts by multiplying the field blow counts by a factor of 0.67 to correct for larger sampler end-area. The CME Automatic hammer has a hammer efficiency of about 80%. An energy correction factor of 1.33 (=80/60) may be used to adjust to 60 percent efficiency for relative density classification. Drive sample blow counts and corresponding density/consistency classifications are presented on the boring logs.

Groundwater recorded at the time of drilling is indicated on the boring logs in Figures A-2a through A-10. Water-bentonite slurry was added into the hollow-stem when groundwater was encountered to mitigate the heaving of sand into the auger stem and to provide better blowcount and samples. Upon withdrawal of the auger, bentonite chips were added up to 5 feet above the groundwater table. The remaining depth was backfilled with soil cuttings. Excess cuttings and fluids were placed in 55-gallon drums, tested for chemicals, and disposed of off-site.

Geotechnical samples were sealed in plastic bags to prevent moisture loss, and transported to the geotechnical laboratory for further inspection and geotechnical testing. The soils were classified in the field and further examined in the laboratory in accordance with the Unified Soil Classification System (see Figure A-1a). Field classifications were modified where necessary on the basis of laboratory test results. Detailed logs of the soil borings including blow count data, percent passing the No. 200 sieve, Atterberg Limits, in-situ moisture content and dry density are presented in Figures A-2a through A-10. Additional laboratory tests performed (other than those where results are shown on the logs) are indicated on the boring logs in the column labeled "Other Tests". Figure A-1b lists abbreviations used on the logs for "Other Tests". Descriptions of the laboratory tests performed and a summary of the results are presented in Appendix B.

A.3 Cone Penetration Testing

The CPT soundings were performed by Middle Earth Geo Testing Inc. A 10-cm^2 cone penetrometer was deployed using a 25-ton CPT rig. Parameters measured nearly continuously during the CPT are soil bearing resistance at the cone tip (q_c), soil frictional resistance along the cylindrical friction sleeve (f_s), and pore water pressure directly behind the cone tip (U). These measured values are then used to estimate the type and engineering properties of soils being penetrated using relationships between q_c, f_s, and U (Robertson et al., 1986). Downhole shear wave velocities are measured in CPT C-3. The CPT soundings were backfilled with bentonite pellets.

The CPT data in graphical form and accompanying CPT data interpretation are presented in on Figures A-11a through A-21b, and shear wave measurement is included in Figure A-22.

A.4 List of Attached Tables and Figures

The following figures are attached and complete this appendix:

TABLE A-1
FIELD INVESTIGATION SUMMARY TABLE

Exploration No.	Approximate Surface Elevation (ft)	Total Depth (ft)	Groundwater		Notes
			Depth (ft)	Elevation (ft)	
B-1	294	51	33.5	260.5	
B-2	294.5	6.5	Not Encountered	Not Encountered	
B-3	297	50.5	34	263	Drill rig lifting off jacks at 46 ft.
B-4	297.5	11	Not Encountered	Not Encountered	
B-5	300	46	44	256	Encountered black sand layer with slight tar odor and a green shimmer at 36 ft. Strong sulfer odor at 40 ft. Boring abandoned at 46 ft due to odor.
B-6	298.5	10.5	Not Encountered	Not Encountered	
B-7	302	11.5	Not Encountered	Not Encountered	
B-8	309	6	Not Encountered	Not Encountered	
B-9	304	6.5	Not Encountered	Not Encountered	
CPT-1	293.5	50	Not Measured	Not Measured	Hand augered first 1.5 ft Hole caved at 20 ft
CPT-2	296	20	Not Encountered	Not Encountered	Hand augered first 1.5 ft
CPT-3	300	22	Not Encountered	Not Encountered	Hand augered first 1.5 ft
CPT-4	298	27	Not Encountered	Not Encountered	Hand augered first 1.5 ft
CPT-5	303.5	18	Not Encountered	Not Encountered	
CPT-6	304	10	Not Encountered	Not Encountered	
CPT-7	311	15	Not Encountered	Not Encountered	
CPT-8	307	18	Not Encountered	Not Encountered	
CPT-9	302	15	Not Encountered	Not Encountered	
CPT-10	300	16	Not Encountered	Not Encountered	Hand augered first 1.5 ft
CPT-11	299.5	19	Not Encountered	Not Encountered	Hand augered first 1.5 ft

Note: Elevations estimated to nearest 0.5 ft from topographic contours in Figure 2.

KEY FOR SOIL CLASSIFICATION

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE-GRAINED SOILS (< 50% fines content)	GRAVEL (% GRAVEL > % SAND)	CLEAN GRAVEL (Less than 5% fines)	GW	Well-graded gravel, gravel with sand, little or no fines
			GP	Poorly-graded gravel, gravel with sand, little or no fines
		"DIRTY" GRAVEL (More than 12% fines)	GM	Silty gravel, silty gravel with sand, silty or non-plastic fines
			GC	Clayey gravel, clayey gravel with sand, clayey or plastic fines
	SAND (% SAND ≥ % GRAVEL)	CLEAN SAND (Less than 5% fines)	SW	Well-graded sand, sand with gravel, little or no fines
			SP	Poorly-graded sand, sand with gravel, little or no fines
		"DIRTY" SAND (More than 12% fines)	SM	Silty sand, silty sand with gravel, silty or non-plastic fines
			SC	Clayey sand, clayey sand with gravel, clayey or plastic fines
FINE-GRAINED SOILS (> 50% fines content)	SILTS AND CLAYS (Liquid Limit less than 50)		ML	Inorganic silt, sandy silt, gravelly silt, or clayey silt with low plasticity
			CL	Inorganic clay of low to medium plasticity, sandy clay, gravelly clay, silty clay, Lean Clay
			OL	Low to medium plasticity Silt or Clay with significant organic content (vegetative matter)
	SILTS AND CLAYS (Liquid Limit 50 or more)		MH	Inorganic elastic silt, sandy silt, gravelly silt, or clayey silt of medium to high plasticity
			CH	Inorganic clay of high plasticity, Fat Clay
			OH	Medium to high plasticity Silt or Clay with significant organic content (vegetative matter)
HIGHLY ORGANIC SOILS			PT	Peat or other highly organic soils

Note: Dual symbols are used for coarse grained soils with 5 to 12% fines (ex: SP-SM), and for soils with Atterberg Limits falling in the CL-ML band in the Plasticity Chart

Borderline classifications between groups may be indicated by two symbols separated by a slash (ex: CL/CH, SW/GW).

CONSISTENCY CLASSIFICATION

COARSE GRAINED SOILS		FINE GRAINED SOILS		
Blowcount SPT[1] (CAL)[2]	Relative Density	Blowcount[3] SPT[1] (CAL)[2]	Consistency	Undrained Shear Strength[3], S_u
0-4 (0-6)	Very Loose	<2 (<3)	Very Soft	< 12 kPa *< 250 psf*
		2-4 (3-6)	Soft	12 - 24 kPa *250 - 500 psf*
5-10 (7-15)	Loose	5-8 (7-12)	Firm	24 - 48 kPa *500 - 1000 psf*
11-30 (16-45)	Med. Dense	9-15 (13-22)	Stiff	48 - 96 kPa *1000 - 2000 psf*
31-50 (46-75)	Dense	16-30 (23-45)	Very Stiff	96 -192 kPa *2000 - 4000 psf*
>50 (>75)	Very Dense	>31 (>45)	Hard	> 192 kPa *> 4000 psf*

MOISTURE CLASSIFICATION

DRY - Absence of moisture, dusty, dry to the touch
MOIST- Damp but no visible water
WET - Visible free water, usually soil is below water table

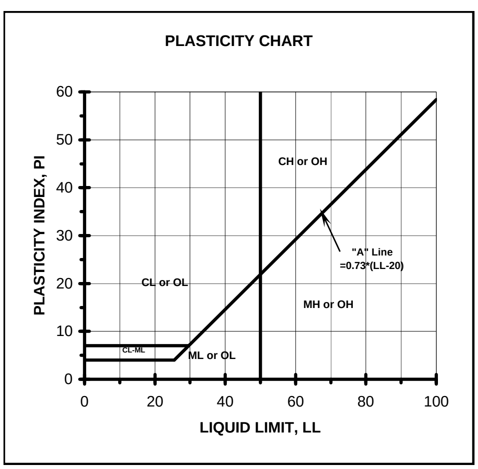
CONSISTENCY NOTES:

1. Number of blows of a 63.5 kg (140-lb.) hammer falling 762 mm (30 in.) to drive a 50.8mm (2 in.) O.D. (34.925mm [1.375 in.] I.D.) **SPT Sampler** [ASTM D-1585] the final 304.8mm (12 in.) of driving
2. Number of blows of a 63.5 kg (140 lb.) hammer falling 762 mm (30 in.) to drive a 76.2mm (3 in.) O.D. (61.468 mm [2.42 in.] I.D.) **California Ring Sampler** the final 304.8mm (12 in.) of driving.
3. Undrained shear strength of cohesive soils predicted from field blowcounts is generally unreliable. Where possible, consistency should be based on S_u data from pocket penetrometer, torvane, or laboratory testing.

CLASSIFICATION CRITERIA BASED ON LABORATORY TESTS

Grain Size Classification

CLAY AND SILT	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		
US Std Sieve → **No. 200**	**No. 40**	**No. 10**	**No. 4**	**3/4"**	**3"**	**12"**	
Grain Size (mm) → 0.075	0.425	2	4.75	19.1	76.2	304.8	



Classification of earth materials shown on the logs is based on field inspection and should not be construed to imply laboratory analysis unless so stated.

Granular Soil Gradation Parameters

Coefficient of Uniformity: $C_u = D_{60} / D_{10}$

Coefficient of Curvature: $C_C = (D_{30})^2 / (D_{10} \times D_{60})$

D_{10}= 10% of the soil is finer than this diameter

D_{30}= 30% of the soil is finer than this diameter

D_{60}= 60% of the soil is finer than this diameter

Group Symbol	Gradation or Plasticity Requirement
SW	C_u>6 and C_c between 1 and 3
GW	C_u>4 and C_c between 1 and 3
GP or SP	Clean gravel or sand not meeting requirement for GW or SW
GM or SM	Plots below "A" Line on Plasticity Chart or PI < 4
GC or SC	Plots above "A" Line on Plasticity Chart and PI > 7

BORING RECORD

PROJECT NAME: Los Angeles State Historical Park		PROJECT NUMBER: L-938		BORING: **LEGEND**
SITE LOCATION: Los Angeles, California	START: 2/24/2010	FINISH: 5/24/2010		SHEET NO.: 1 of 1
DRILLING COMPANY: Choice Drilling	DRILLING METHOD: Hollow Stem Auger	LOGGED BY: S. Prenovost		CHECKED BY: C. Scheyhing
DRILLING EQUIPMENT: CME 85	BORING DIA. (in): 8	TOTAL DEPTH (ft): 25	GROUND ELEV (ft):	DEPTH/*ELEV.* GROUND WATER (ft): ▼ / *na*
SAMPLING METHOD: Hammer: 140 lbs., Drop: 30 in.	NOTES: Hammer Efficiency = 80%			

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
												GRAB, CAL, SPT - Refers to the sampling method as described below
5		GRAB	1									GRAB - Refers to collecting sample by method of placing disturbed soil cuttings into a plastic bag
10		CAL	2									CAL (CALIFORNIA MODIFIED) - A 3.0" o.d. split tube sampler lined with 2.42" i.d. metal sample rings generally driven into the soil by a free falling hammer
15		SPT	3									SPT (STANDARD PENETRATION TEST) - A 2.0" o.d. split spoon sampler with a 1.375" i.d. generally driven into the soil with a 140# hammer free falling a height of 30"
												PP = POCKET PENETROMETER READING (TSF)
20												ABBREVIATIONS FOR OTHER TESTS: CR = Corrosivity; EI = Expansion Index; PA = Particle Size Analysis; PI = Plasticity Index; R = R-Value

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FIGURE A-1b

GDC_LOG_BORING_MMX_SOIL LASHP.GPJ GDCLOG.GDT 3/17/11

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	**B-1**

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/24/2011	2/24/2011	1 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	51	294	▼ 33.5 / *260.5*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	DESCRIPTION AND CLASSIFICATION
		B-0						CR EI		**FILL:** CLAYEY SILT (ML/CL); light brown; moist; some fine to coarse GRAVEL; low plasticity.
		R-1	24 20 20	40	36	11.9	116	PA	34	SILTY SAND (SM); dense; dark brown; moist; 64% SAND, fine to coarse; 34% fines; 2% GRAVEL.
	290									
5		S-2	10 12 20	32	43	14.1		PA	40	**ALLUVIUM:** SILTY SAND (SM); dense; grayish brown; moist; 54% SAND, fine to coarse; 40% fines; 6% GRAVEL.
	285									
10		R-3	14 15 17	32	28	3.0	136			Medium dense; light grayish brown, micaceous.
	280									
15		S-4	15 17 21	38	51	7.6		PA	16	Very dense; 78% SAND, fine to medium; 16% fines; 6% GRAVEL.
	275									
20		R-5	28 50/6"	REF	REF	3.9	109			Poorly-graded SAND with SILT and GRAVEL (SP-SM); very dense; light yellowish brown; moist.
	270									

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	**B-1**

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/24/2011	2/24/2011	2 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	51	294	▼ 33.5 / *260.5*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			S-6	15 20 28	48	64	4.4		PA	10		Poorly-graded SAND with SILT and GRAVEL (SP-SM); (continued) 68% SAND, fine to coarse; 22% GRAVEL; 10% fines.
	265											
30			R-7	50\6"	REF	REF	10.2	117	PA	7		Well-graded SAND with SILT (SW-SM); very dense; light yellowish brown; moist to wet; 82% SAND, fine to coarse; 11% GRAVEL; 7% fines.
	260										▼	
35			S-8	17 30 50\6"	80	107						Orangish/reddish brown; wet; fine to medium SAND; GRAVEL laminations.
	255											
40			R-9	28 50/5"	REF	REF	11.7	122	PA	7		Poorly-graded SAND with SILT and GRAVEL (SP-SM); very dense; grayish brown; wet; 70% SAND, fine to coarse; 23% GRAVEL, fine subangular GRAVEL; 7% fines.
	250											
45			S-10	28 50/6"	REF	REF						Carbonate vein
	245											

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	B-1

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/24/2011	2/24/2011	3 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	51	294	▼ 33.5 / *260.5*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-11	30 50/6"	REF	REF	20.4	107	PA	25		SILTY SAND (SM); very dense, dark gray; wet; 65% SAND, fine to medium; 25% fines; 10% GRAVEL.
												Groundwater encountered at 33.5 feet Bore hole filled with bentonite chips up to 5 feet above water table and soil cuttings.
	240											
55												
	235											
60												
	230											
65												
	225											
70												
	220											

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FIGURE A-2 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	B-2

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/25/2011	2/25/2011	1 of 1

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	6.5	294.5	▼ Not Encountered / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			B-1A				22		PA PI EI	66		**FILL:** SANDY lean CLAY (CL); light grayish brown; moist; 66% fines; 24% SAND; 10% GRAVEL; medium plasticity.
												LL=44; PL=19; PI=25
			R-1	19 14 15	29	26	11.9	111	PA	39		SILTY to CLAYEY SAND (SM/SC); medium dense; dark brown; moist; 54% SAND, fine; 39% fines; 7% GRAVEL.
	290		B-1B									
5			S-2	4 5 7	12	16						Brown
												ALLUVIUM: SILTY SAND (SM); medium dense; brown; moist; fine SAND.
												Groundwater not encountered. Bore hole backfilled with soil cuttings.
10	285											
15	280											
20	275											
	270											

GDC_LOG_BORING_MMX_SOIL LASHP.GPJ GDCLOG.GDT 3/25/11

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FIGURE A-3

BORING RECORD

PROJECT NAME Los Angeles State Historical Park	**PROJECT NUMBER** L-938	**BORING** B-3	
SITE LOCATION Los Angeles, California	**START** 2/24/2011	**FINISH** 2/24/2011	**SHEET NO.** 1 of 3
DRILLING COMPANY Choice Drilling	**DRILLING METHOD** Hollow Stem Auger	**LOGGED BY** EMH	**CHECKED BY** C. Scheyhing
DRILLING EQUIPMENT CME 85	**BORING DIA. (in)** 8	**TOTAL DEPTH (ft)** 50.5	**GROUND ELEV (ft)** 297
DEPTH/*ELEV.* GROUND WATER (ft) ⊻ 34.0 / *263.0*			
SAMPLING METHOD Hammer: 140 lbs., Drop: 30 in. (Automatic)	**NOTES** Hammer Efficiency = 80%		

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
												FILL: CLAYEY SILT (CL/ML); tan; moist; low plasticity.
			B-0						EI CR			Well-graded SAND with SILT (SW-SM); dense; light brown; moist; 82% SAND, fine to coarse; 10% GRAVEL, fine to coarse; 8% fines.
	295											
			R-1	33 30 18	48	43	5.7	126	PA	8		
5			S-2	17 19 19	38	51						**ALLUVIUM:** Poorly-graded SAND with SILT (SP-SM); very dense; dark brown; laminations of SANDY SILT.
	290											
												Dense; light brown; moist; 88% SAND, fine to medium; 7% GRAVEL; 5% fines.
10			R-3	15 18 30	48	43	5.4	114	PA	5		
	285											
15			S-4	7 7 18	25	33	16		PA	33		SILTY SAND (SM); dense; reddish brown; moist; 58% SAND, fine to coarse; 33% fines; 9% GRAVEL
	280											
20			R-5	45 50/3"	REF	REF	4.7	115	PA	5		Poorly-graded SAND with GRAVEL (SP); very dense; light brown; moist; 55% SAND, medium to coarse; 40% GRAVEL, subangular; 5% fines.
	275											

GDC_LOG_BORING_MMX_SOIL LASHP.GPJ GDCLOG.GDT 3/25/11

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FIGURE

A-4 a

BORING RECORD

PROJECT NAME	Los Angeles State Historical Park
PROJECT NUMBER	L-938
BORING	B-3
SITE LOCATION	Los Angeles, California
START	2/24/2011
FINISH	2/24/2011
SHEET NO.	2 of 3
DRILLING COMPANY	Choice Drilling
DRILLING METHOD	Hollow Stem Auger
LOGGED BY	EMH
CHECKED BY	C. Scheyhing
DRILLING EQUIPMENT	CME 85
BORING DIA. (in)	8
TOTAL DEPTH (ft)	50.5
GROUND ELEV (ft)	297
DEPTH/*ELEV.* GROUND WATER (ft)	▼ 34.0 / *263.0*
SAMPLING METHOD	Hammer: 140 lbs., Drop: 30 in. (Automatic)
NOTES	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
												Poorly-graded SAND with GRAVEL (SP) (continued)
			S-6	10 14 20	34	45						Dense; medium to coarse SAND; some fine GRAVEL.
	270											
30			R-7	32 50/6"	REF	REF	23.2	97	PA PI	74		Lean CLAY with SAND (CL); hard; reddish brown and dark gray; moist; 74% fines; 26% SAND, fine; low plasticity; PP=4.5+
	265											LL=33; PL=21; PI=12
												SANDY SILT (ML); dense; olive gray; wet; nonplastic.
35			S-8	9 11 20	31	41						
	260											Hard drilling
												Poorly-graded SAND with SILT (SP-SM); very dense; olive gray; wet; SAND, from fine to coarse; gray SILT laminations.
40			R-9	40 50/3"	REF	REF	14.4	121				
	255											Very hard drilling
45			S-10	25 50/6"	REF	REF	12.3		PA	12		87% SAND, fine to medium; 12% fines; 1% GRAVEL.
	250											Hard drilling, rig lifting off jacks.

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	B-3

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/24/2011	2/24/2011	3 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	50.5	297	⊻ 34.0 / *263.0*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-11	50/6"	REF	REF	13.1	121				Poorly-graded SAND with SILT (SP-SM); (continued).
												Groundwater encountered at 34ft. Boring hole backfilled with bentonite chips up to 5 feet above water table and soil cuttings.
	245											
55												
	240											
60												
	235											
65												
	230											
70												
	225											

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FIGURE A-4 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	**B-4**

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/25/2011	2/25/2011	1 of 1

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	11	297.5	⊻ Not Encountered / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
												FILL: SILTY SAND with GRAVEL (SM); very dense; dark brown; moist.
	295		S-1	9 17 50/5"	67/11"	REF	5.1		PA	17		62% SAND, fine to coarse; 21% GRAVEL, fine; 17% fines.
5			R-2	20 23 40	63	56	2.8	105				
												ALLUVIUM: Poorly-graded SAND with SILT (SP-SM); very dense; tannish brown; moist.
	290											
10			S-3	35 50/6"	REF	REF						
												Groundwater not encountered. Boring hole filled with soil cuttings.
	285											
15												
	280											
20												
	275											

GDC_LOG_BORING_MMX_SOIL LASHP.GPJ GDCLOG.GDT 3/25/11

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-5

BORING RECORD

PROJECT NAME: Los Angeles State Historical Park		**PROJECT NUMBER**: L-938		**BORING**: **B-5**
SITE LOCATION: Los Angeles, California	**START**: 2/24/2011	**FINISH**: 2/24/2011		**SHEET NO.**: 1 of 2
DRILLING COMPANY: Choice Drilling	**DRILLING METHOD**: Hollow Stem Auger	**LOGGED BY**: EMH		**CHECKED BY**: C. Scheyhing
DRILLING EQUIPMENT: CME 85	**BORING DIA. (in)**: 8	**TOTAL DEPTH (ft)**: 46	**GROUND ELEV (ft)**: 300	**DEPTH/*ELEV.* GROUND WATER (ft)**: ▼ 44.0 / *256.0*
SAMPLING METHOD: Hammer: 140 lbs., Drop: 30 in. (Automatic)	**NOTES**: Hammer Efficiency = 80%			

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200
		S-1	11 7 9	16	21			PA CR	9
5	295	R-2	17 18 22	40	36	8	96	PA	6
10	290	S-3	15 13 10	23	31	16.6		PA	40
15	285	R-4	34 50/6"	REF	REF	3.7	116	PA	4
20	280	S-5	16 20 28	48	64				

DESCRIPTION AND CLASSIFICATION

Depth (feet)	Description
0	**FILL:** SILTY CLAY (CL); light brown; moist; with roots.
2	Poorly-graded SAND with SILT (SP-SM); medium dense; light brown; moist; fine to medium SAND, trace coarse SAND; 9% fines; trace coarse GRAVEL.
6	**ALLUVIUM:** Poorly-graded SAND with SILT (SP-SM); dense; light brown; moist; 94% SAND, fine to medium; 6% fines.
10	SILTY SAND (SM); dense; brown; moist; 54% SAND, fine to coarse; 40% fines; 6% GRAVEL, fine to medium.
15	Poorly-graded SAND with GRAVEL (SP); very dense; light grayish brown; moist; 72% SAND, fine to coarse; 24% GRAVEL, fine to coarse; 4% fines.
20	Tannish brown.

GDC_LOG_BORING_MMX_SOIL LASHP.GPJ GDCLOG.GDT 3/25/11

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	**B-5**

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/24/2011	2/24/2011	2 of 2

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	46	300	▼ 44.0 / *256.0*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-6	50/6"	REF	REF	5.8	117				Poorly-graded SAND with GRAVEL (SP) (continued). GRAVEL layer about 1 to 3 feet.
30	270		S-7	18 32 40	72	96	11.1		PA	23		SILTY SAND (SM); very dense; olive gray; moist; 71% SAND, fine; 23% fines; 6% GRAVEL; minor clay laminations.
35	265		R-8	50/6"	REF	REF	12.1	108	PA	10		Poorly-graded SAND with SILT (SP-SM); very dense; grayish brown; moist; 80% SAND, fine to coarse; 10% GRAVEL; 10% fines. A thin layer of black SAND with faint tar odor and green shimmer at 36 feet.
40	260		S-9	38 50/6"	REF	REF						Fine to medium SAND; very strong sulfer dioxide smell(H2SO4) noted.
45	255		R-10	40 50/5	REF	REF	14	118		10		Gray to black; wet; fine to coarse SAND; very strong sulfer dioxide (H2SO4) odo.

Boring terminated due to odor.
Ground water encountered approximately at 44 feet.
Boring hole backfilled with bentonite chips up to 5 feet above ground water and soil cuttings.

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FIGURE
A-6 b

BORING RECORD

PROJECT NAME	Los Angeles State Historical Park
PROJECT NUMBER	L-938
BORING	**B-6**
SITE LOCATION	Los Angeles, California
START	2/25/2011
FINISH	2/25/2011
SHEET NO.	1 of 1
DRILLING COMPANY	Choice Drilling
DRILLING METHOD	Hollow Stem Auger
LOGGED BY	EMH
CHECKED BY	C. Scheyhing
DRILLING EQUIPMENT	CME 85
BORING DIA. (in)	8
TOTAL DEPTH (ft)	10.5
GROUND ELEV (ft)	298.5
DEPTH/*ELEV.* GROUND WATER (ft)	Not Encountered / *na*
SAMPLING METHOD	Hammer: 140 lbs., Drop: 30 in. (Automatic)
NOTES	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	298.5											**FILL:** SILTY SAND (SM) with GRAVEL and COBBLES; brown; moist; fine to coarse SAND; fine to coarse GRAVEL.
												Poorly-graded SAND with GRAVEL (SP); dense; light brown; moist; 68% SAND, medium to coarse; 29% GRAVEL, fine; 3% fines.
	295		R-1	19 20 25	45	40	5.1	119		3		
5												SILTY SAND (SM); medium dense; brown; moist; 78% SAND, fine; 15% fines; 7% GRAVEL.
			S-2	6 7 10	17	23	8.3		PA	15		
												ALLUVIUM: Poorly-graded SAND with SILT (SP-SM); medium dense; mostly fine SAND.
	290											
10			R-3	50/6"	REF	REF	5.2	115				Very dense; subangular GRAVEL.
												Groundwater not encountered. Boring hole backfilled with soil cuttings.
	285											
15												
	280											
20												
	275											

GDC_LOG_BORING_MMX_SOIL LASHP.GPJ GDCLOG.GDT 3/25/11

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE
A-7

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Los Angeles State Historical Park	L-938	B-7

SITE LOCATION	START	FINISH	SHEET NO.
Los Angeles, California	2/25/2011	2/25/2011	1 of 1

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Choice Drilling	Hollow Stem Auger	EMH	C. Scheyhing

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	8	11.5	302	⊻ Not Encountered / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in. (Automatic)	Hammer Efficiency = 80%

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
												FILL: SILTY SAND (SM); medium dense; brown to tannish brown; moist; fine to coarse SAND; some fine GRAVEL; chunks of charcoal.
	300											
			R-1	12 15 17	32	28	11.9	117				
5												**ALLUVIUM:** Poorly-graded SAND (SP); medium dense; tannish brown; moist; mostly fine to medium SAND; few fine GRAVELS.
			S-2	5 6 6	12	16						
	295											
10												Very dense; 86% SAND; 11% GRAVEL; 3% fines.
			R-3	15 18 42	60	53	4.0	106	PA	3		
	290											Groundwater not encountered. Boring hole backfilled with soil cuttings.
15												
	285											
20												
	280											

GDC_LOG_BORING_MMX_SOIL LASHP.GPJ GDCLOG.GDT 3/25/11

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-8

BORING RECORD

PROJECT NAME Los Angeles State Historical Park		**PROJECT NUMBER** L-938		**BORING** B-8
SITE LOCATION Los Angeles, California	**START** 2/25/2011	**FINISH** 2/25/2011		**SHEET NO.** 1 of 1
DRILLING COMPANY Choice Drilling	**DRILLING METHOD** Hollow Stem Auger	**LOGGED BY** EMH		**CHECKED BY** C. Scheyhing
DRILLING EQUIPMENT CME 85	**BORING DIA. (in)** 8	**TOTAL DEPTH (ft)** 6	**GROUND ELEV (ft)** 309	**DEPTH/*ELEV.* GROUND WATER (ft)** ▼ Not Encountered / *na*
SAMPLING METHOD Hammer: 140 lbs., Drop: 30 in. (Automatic)	**NOTES** Hammer Efficiency = 80%			

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			B-0						R			**FILL:** SILTY SAND (SM); dark brown; moist; fine to coarse SAND; fine GRAVEL.
	305		S-1	14 19 24	43	57						**ALLUVIUM:** Poorly-graded SAND with SILT and GRAVEL (SP-SM); very dense; brown; moist.
5			R-2	28 50/6"	REF	REF	2.2	117	PA	11		60% SAND, fine to medium; 29% GRAVEL, fine to coarse; 11% fines.
												Groundwater not encountered. Boring holebackfilled with soil cuttings.
	300											
10												
	295											
15												
	290											
20												
	285											

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-9

BORING RECORD

PROJECT NAME: Los Angeles State Historical Park	PROJECT NUMBER: L-938	BORING: **B-9**		
SITE LOCATION: Los Angeles, California	START: 2/25/2011	FINISH: 2/25/2011	SHEET NO.: 1 of 1	
DRILLING COMPANY: Choice Drilling	DRILLING METHOD: Hollow Stem Auger	LOGGED BY: EMH	CHECKED BY: C. Scheyhing	
DRILLING EQUIPMENT: CME 85	BORING DIA. (in): 8	TOTAL DEPTH (ft): 6.5	GROUND ELEV (ft): 304	DEPTH/*ELEV.* GROUND WATER (ft): Not Encountered / *na*
SAMPLING METHOD: Hammer: 140 lbs., Drop: 30 in. (Automatic)	NOTES: Hammer Efficiency = 80%			

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	SPT N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	% PASSING #200	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	304											**FILL:** SILTY SAND (SM); dark brown; moist; fine to coarse SAND; some fine GRAVEL.
												Very dense.
	300		R-1	12 20 50/6"	70	62	6.3	112				
5			S-2	14 10 9	19	25	13.9		PA	20		**ALLUVIUM:** SILTY to CLAYEY SAND with GRAVEL (SM/SC); medium dense; dark brown; slightly moist; 63% SAND, fine; 20% fines; 17% GRAVEL.
												Groundwater not encountered. Boring hole backfilled with soil cuttings.
	295											
10												
	290											
15												
	285											
20												
	280											

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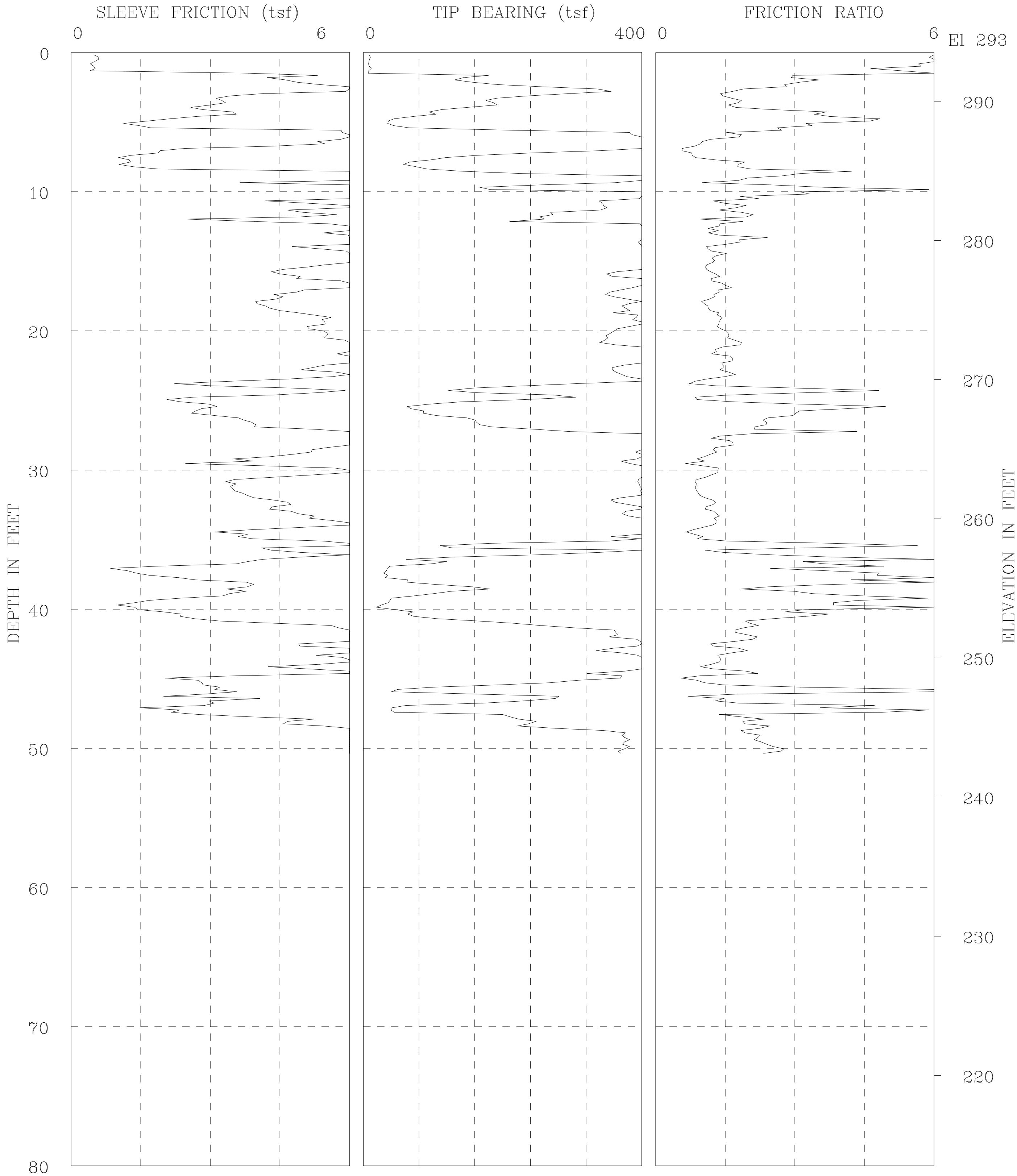
THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-10



C-1	L-938 Los Angeles State Historical Parks
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 11a

GROUP DELTA CONSULTANTS

Engineer : Eric Holliday
On Site Loc: C-1
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-22-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<< HAND AUGERED TO 1.5 FT DEPTH >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								
0.60	2	80.26	3.15	3.93	0.09	clayey silt to silty clay	UNDFND	UNDFD	38	5.3
0.95	3	261.38	5.33	2.04	0.15	sand to silty sand	>90	>48	>50	UNDEFINED
1.25	4	168.01	3.02	1.80	0.22	sand to silty sand	>90	>48	40	UNDEFINED
1.55	5	64.35	2.45	3.81	0.28	clayey silt to silty clay	UNDFND	UNDFD	31	4.2
1.85	6	257.12	5.02	1.95	0.33	sand to silty sand	>90	>48	>50	UNDEFINED
2.15	7	477.03	4.21	0.88	0.39	gravelly sand to sand	>90	>48	>50	UNDEFINED
2.45	8	124.31	1.29	1.04	0.45	sand to silty sand	80-90	44-46	30	UNDEFINED
2.75	9	245.81	6.35	2.59	0.51	silty sand to sandy silt	>90	46-48	>50	UNDEFINED
3.05	10	298.64	7.83	2.62	0.57	silty sand to sandy silt	>90	46-48	>50	UNDEFINED
3.35	11	419.47	8.81	2.10	0.63	sand to silty sand	>90	>48	>50	UNDEFINED
3.65	12	291.03	4.82	1.66	0.69	sand to silty sand	>90	46-48	>50	UNDEFINED
3.95	13	437.74	5.77	1.32	0.75	sand	>90	>48	>50	UNDEFINED
4.25	14	429.41	7.17	1.67	0.81	sand to silty sand	>90	46-48	>50	UNDEFINED
4.55	15	500.41	6.40	1.28	0.87	sand	>90	>48	>50	UNDEFINED
4.85	16	433.04	5.01	1.16	0.93	sand	>90	46-48	>50	UNDEFINED
5.15	17	426.39	5.92	1.39	0.98	sand	>90	46-48	>50	UNDEFINED
5.45	18	368.84	4.54	1.23	1.04	sand	>90	46-48	>50	UNDEFINED
5.75	19	377.96	4.52	1.20	1.10	sand	>90	46-48	>50	UNDEFINED
6.05	20	388.21	5.36	1.38	1.16	sand	>90	46-48	>50	UNDEFINED
6.40	21	351.99	5.82	1.65	1.23	sand to silty sand	>90	44-46	>50	UNDEFINED
6.70	22	491.59	7.01	1.43	1.29	sand	>90	46-48	>50	UNDEFINED
7.00	23	392.85	5.90	1.50	1.35	sand to silty sand	>90	44-46	>50	UNDEFINED
7.35	24	324.71	4.31	1.33	1.41	sand	>90	44-46	>50	UNDEFINED
7.65	25	206.21	3.77	1.83	1.48	sand to silty sand	80-90	42-44	49	UNDEFINED
7.95	26	84.31	2.89	3.42	1.54	sandy silt to clayey silt	UNDFND	UNDFD	32	5.5
8.25	27	178.16	4.06	2.28	1.59	silty sand to sandy silt	70-80	40-42	>50	UNDEFINED
8.55	28	567.61	10.10	1.78	1.65	sand to silty sand	>90	46-48	>50	UNDEFINED
8.85	29	418.90	5.45	1.30	1.71	sand	>90	44-46	>50	UNDEFINED
9.15	30	404.41	4.29	1.06	1.77	sand	>90	44-46	>50	UNDEFINED
9.45	31	413.26	4.35	1.05	1.83	sand	>90	44-46	>50	UNDEFINED
9.75	32	395.08	3.65	0.92	1.89	sand	>90	44-46	>50	UNDEFINED
10.05	33	379.19	4.52	1.19	1.93	sand	>90	42-44	>50	UNDEFINED
10.35	34	422.14	5.49	1.30	1.96	sand	>90	44-46	>50	UNDEFINED
10.65	35	447.29	3.89	0.87	1.99	gravelly sand to sand	>90	44-46	>50	UNDEFINED
10.95	36	252.88	5.33	2.11	2.02	sand to silty sand	80-90	40-42	>50	UNDEFINED
11.25	37	116.52	4.10	3.52	2.05	sandy silt to clayey silt	UNDFND	UNDFD	45	7.6
11.55	38	37.92	1.69	4.47	2.08	silty clay to clay	UNDFND	UNDFD	24	2.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

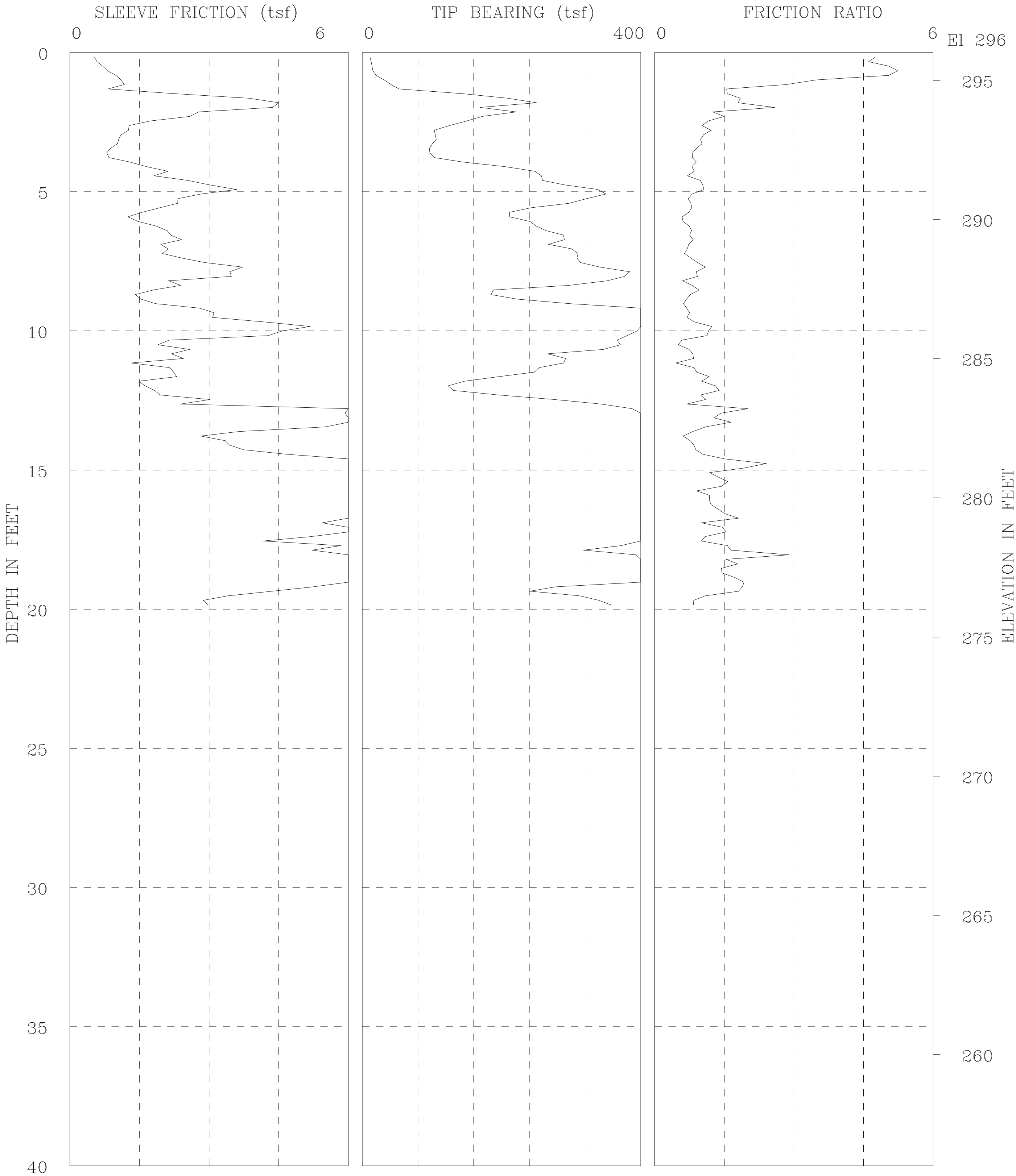
Engineer : Eric Holliday   On Site Loc: C-1   Page No. 2

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	121.99	3.68	3.01	2.10	sandy silt to clayey silt	UNDFND	UNDFD	47	7.9
12.15	40	38.80	1.84	4.75	2.13	silty clay to clay	UNDFND	UNDFD	25	2.4
12.45	41	87.35	2.34	2.68	2.16	sandy silt to clayey silt	UNDFND	UNDFD	33	5.6
12.80	42	316.50	6.16	1.95	2.19	sand to silty sand	80-90	42-44	>50	UNDEFINED
13.10	43	382.52	6.31	1.65	2.22	sand to silty sand	>90	42-44	>50	UNDEFINED
13.40	44	418.90	5.78	1.38	2.25	sand	>90	42-44	>50	UNDEFINED
13.75	45	370.49	4.59	1.24	2.28	sand	>90	42-44	>50	UNDEFINED
14.05	46	136.07	3.07	2.26	2.31	silty sand to sandy silt	60-70	38-40	43	UNDEFINED
14.35	47	176.97	2.75	1.55	2.34	sand to silty sand	70-80	38-40	42	UNDEFINED
14.65	48	161.21	3.51	2.18	2.37	silty sand to sandy silt	60-70	38-40	>50	UNDEFINED
14.95	49	304.85	6.37	2.09	2.40	sand to silty sand	80-90	42-44	>50	UNDEFINED
15.25	50	377.14	8.99	2.38	2.42	sand to clayey sand (*)	UNDFND	UNDFD	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 15

(*) overconsolidated or cemented

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C−2	L−938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 12a

GROUP DELTA CONSULTANTS

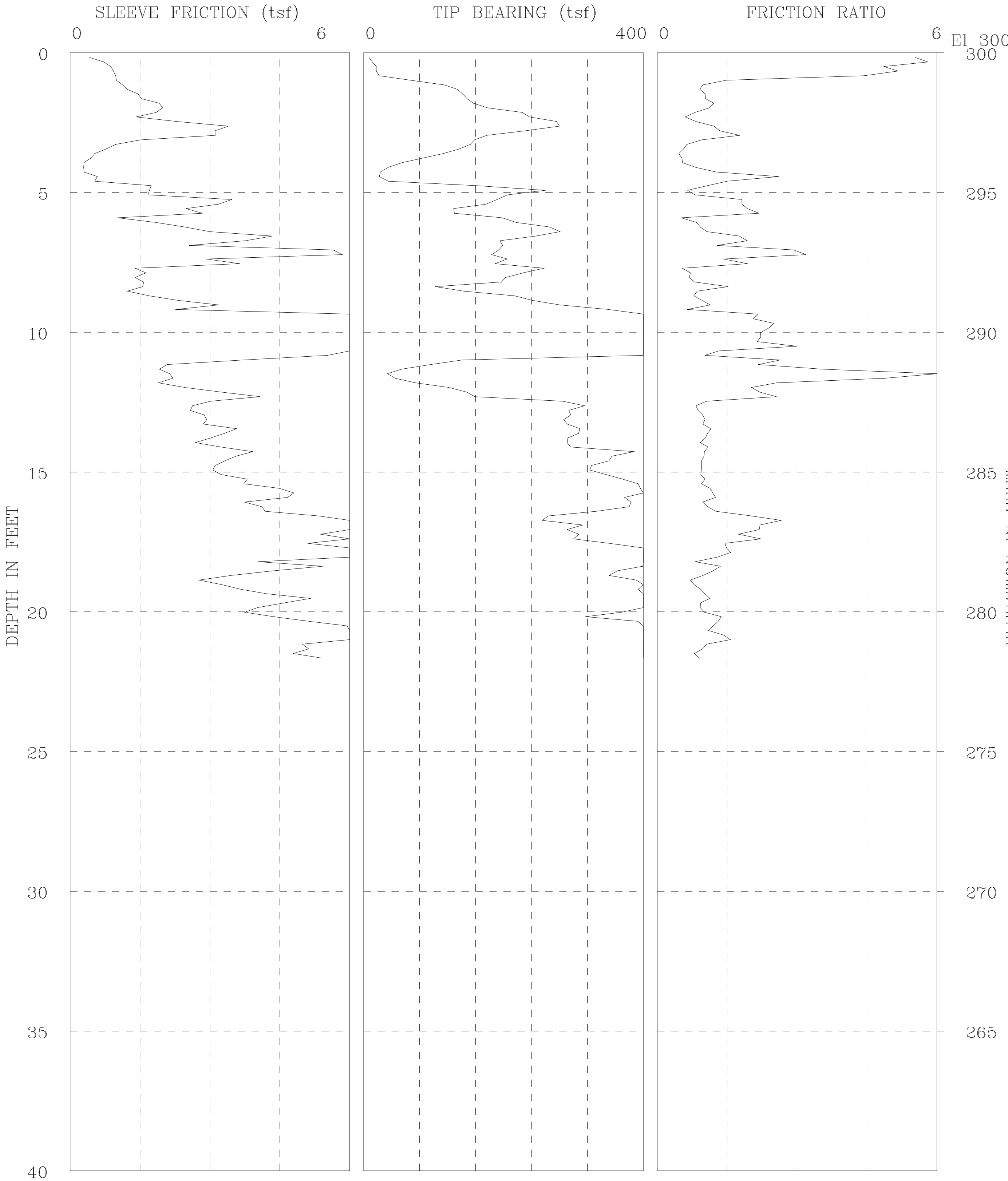
Engineer : Eric Holliday
On Site Loc: C-2
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-22-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<< HAND AUGERED TO 1.5 FT DEPTH >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>								
0.60	2	144.26	2.83	1.96	0.09	silty sand to sandy silt	>90	>48	46	UNDEFINED
0.95	3	140.53	1.68	1.20	0.15	sand to silty sand	>90	>48	34	UNDEFINED
1.25	4	124.64	1.08	0.87	0.22	sand to silty sand	>90	>48	30	UNDEFINED
1.55	5	290.66	2.65	0.91	0.28	sand	>90	>48	>50	UNDEFINED
1.85	6	254.50	1.81	0.71	0.33	sand	>90	>48	49	UNDEFINED
2.15	7	276.90	2.10	0.76	0.39	sand	>90	>48	>50	UNDEFINED
2.45	8	338.97	2.99	0.88	0.45	sand	>90	>48	>50	UNDEFINED
2.75	9	256.87	1.85	0.72	0.51	sand	>90	46-48	49	UNDEFINED
3.05	10	427.56	3.82	0.89	0.57	gravelly sand to sand	>90	>48	>50	UNDEFINED
3.35	11	336.98	2.59	0.77	0.63	sand	>90	46-48	>50	UNDEFINED
3.65	12	209.45	1.85	0.88	0.69	sand	>90	44-46	40	UNDEFINED
3.95	13	291.72	3.82	1.31	0.75	sand	>90	46-48	>50	UNDEFINED
4.25	14	489.93	5.20	1.06	0.81	sand	>90	>48	>50	UNDEFINED
4.55	15	474.07	7.10	1.50	0.87	sand	>90	>48	>50	UNDEFINED
4.85	16	595.62	7.46	1.25	0.93	sand	>90	>48	>50	UNDEFINED
5.15	17	573.52	7.68	1.34	0.98	sand	>90	>48	>50	UNDEFINED
5.45	18	448.64	6.18	1.38	1.04	sand	>90	46-48	>50	UNDEFINED
5.75	19	546.87	9.50	1.74	1.10	sand to silty sand	>90	46-48	>50	UNDEFINED
6.05	20	352.17	5.02	1.42	1.16	sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-3	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 13a

GROUP DELTA CONSULTANTS

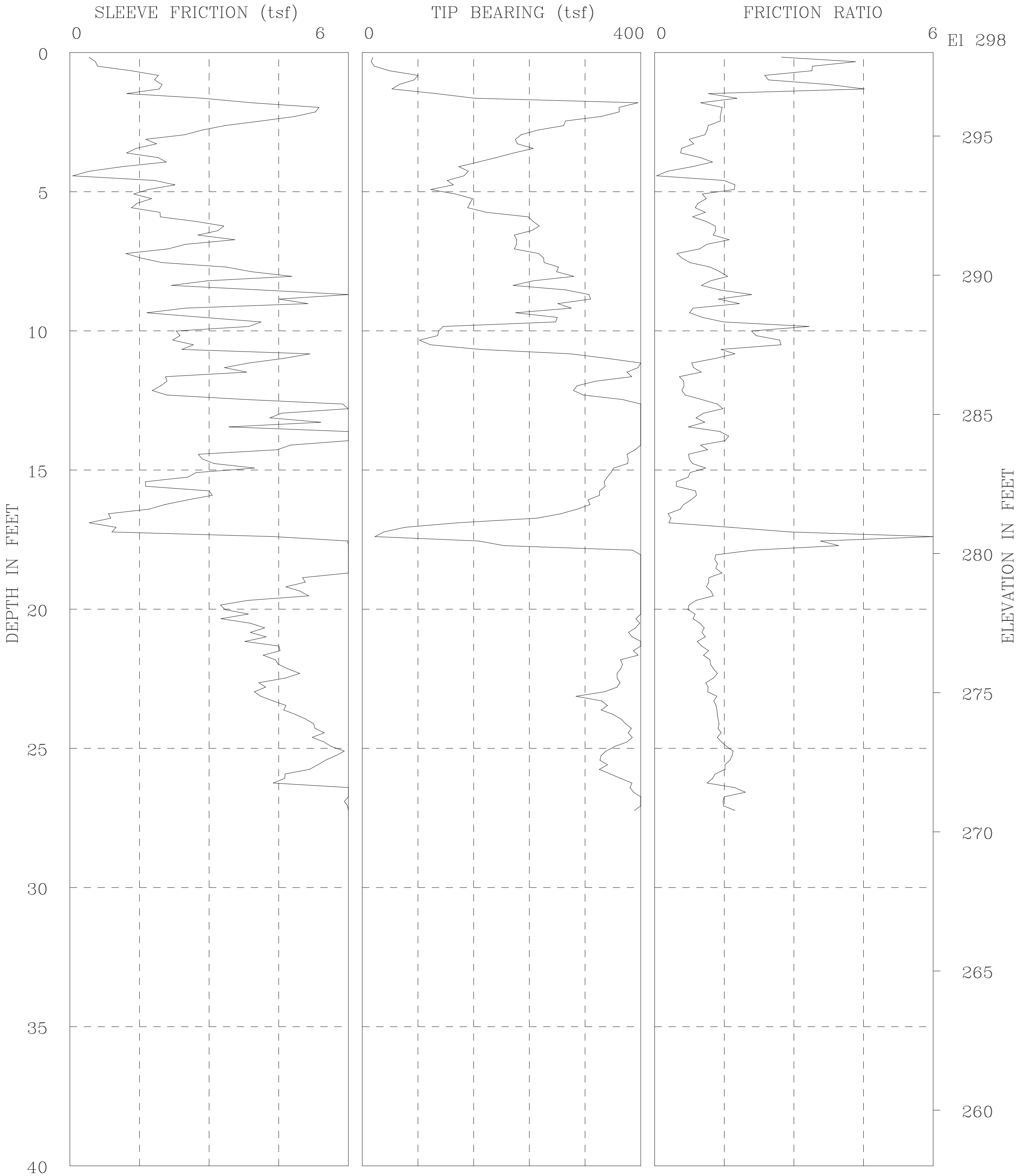
Engineer : Eric Holliday
On Site Loc: C-3
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-22-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<< HAND AUGERED TO 1.5 FT DEPTH >>								
0.60	2	145.53	1.54	1.06	0.09	sand to silty sand	>90	>48	35	UNDEFINED
0.95	3	226.60	2.38	1.05	0.15	sand	>90	>48	43	UNDEFINED
1.25	4	96.01	0.55	0.57	0.22	sand to silty sand	80-90	46-48	23	UNDEFINED
1.55	5	118.06	1.09	0.92	0.28	sand to silty sand	80-90	46-48	28	UNDEFINED
1.85	6	173.51	2.47	1.43	0.33	sand to silty sand	>90	46-48	42	UNDEFINED
2.15	7	229.98	3.63	1.58	0.39	sand to silty sand	>90	>48	>50	UNDEFINED
2.45	8	210.88	2.80	1.33	0.45	sand to silty sand	>90	46-48	>50	UNDEFINED
2.75	9	196.72	1.93	0.98	0.51	sand	>90	46-48	38	UNDEFINED
3.05	10	473.74	9.78	2.06	0.57	sand to silty sand	>90	>48	>50	UNDEFINED
3.35	11	492.59	9.78	1.98	0.63	sand to silty sand	>90	>48	>50	UNDEFINED
3.65	12	70.85	2.12	2.99	0.69	sandy silt to clayey silt	UNDFND	UNDFD	27	4.6
3.95	13	249.62	3.07	1.23	0.75	sand	>90	46-48	48	UNDEFINED
4.25	14	296.24	3.06	1.03	0.81	sand	>90	46-48	>50	UNDEFINED
4.55	15	339.78	3.37	0.99	0.87	sand	>90	46-48	>50	UNDEFINED
4.85	16	380.38	4.12	1.08	0.93	sand	>90	46-48	>50	UNDEFINED
5.15	17	321.43	5.18	1.61	0.98	sand to silty sand	>90	46-48	>50	UNDEFINED
5.45	18	354.44	6.16	1.74	1.04	sand to silty sand	>90	46-48	>50	UNDEFINED
5.75	19	411.66	4.36	1.06	1.10	sand	>90	46-48	>50	UNDEFINED
6.05	20	433.22	4.15	0.96	1.16	sand	>90	46-48	>50	UNDEFINED
6.40	21	439.24	5.64	1.28	1.23	sand	>90	46-48	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-4	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 14a

GROUP DELTA CONSULTANTS

Engineer : Eric Holliday
On Site Loc: C-4
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

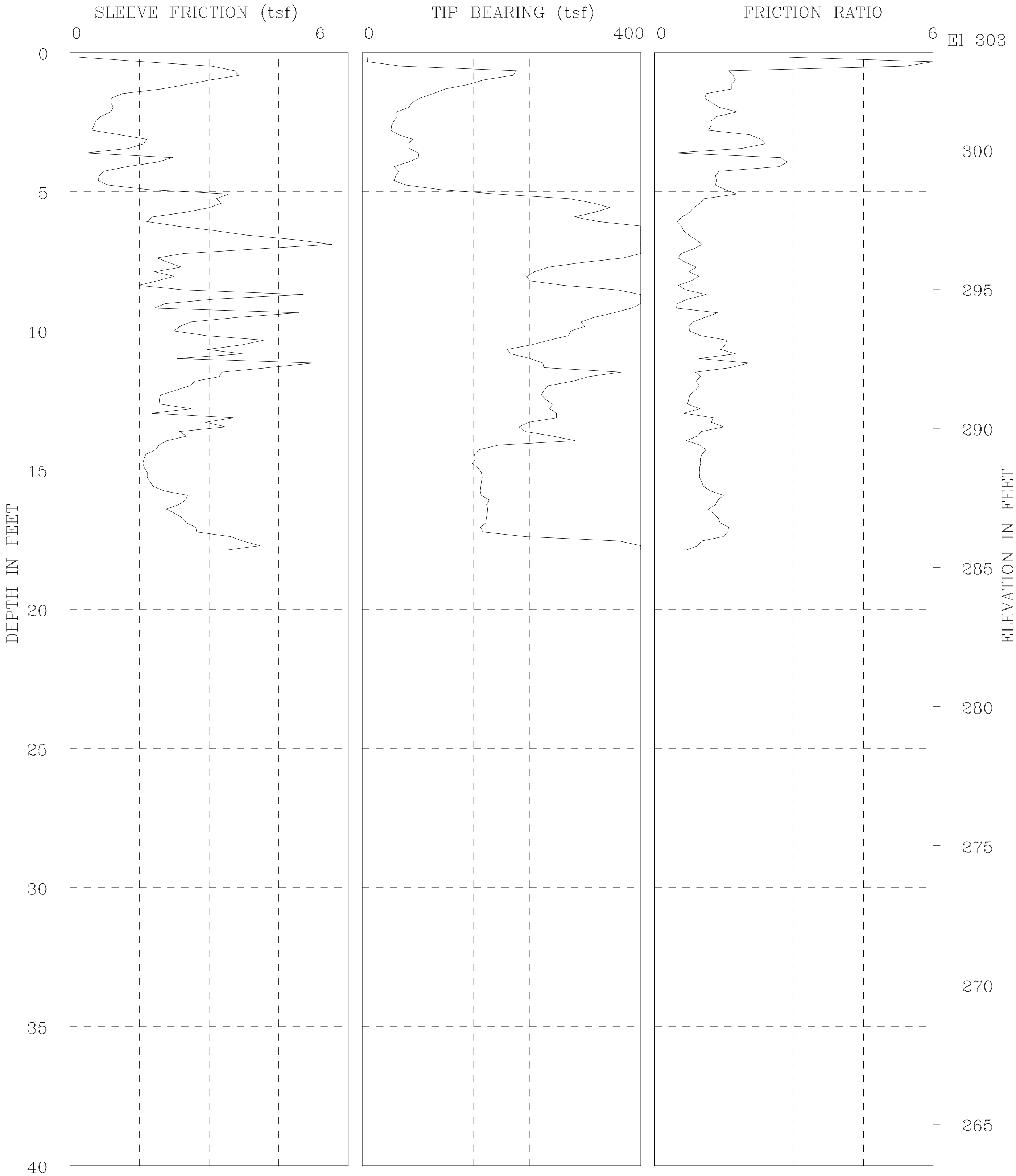
CPT Date : 02-23-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<< HAND AUGERED TO 1.5 FT DEPTH >>								
0.60	2	188.09	2.88	1.53	0.09	sand to silty sand	>90	>48	45	UNDEFINED
0.95	3	284.68	3.51	1.23	0.15	sand	>90	>48	>50	UNDEFINED
1.25	4	197.34	1.60	0.81	0.22	sand	>90	>48	38	UNDEFINED
1.55	5	130.67	1.27	0.97	0.28	sand to silty sand	>90	46-48	31	UNDEFINED
1.85	6	187.92	1.86	0.99	0.33	sand	>90	>48	36	UNDEFINED
2.15	7	229.51	2.90	1.27	0.39	sand	>90	>48	44	UNDEFINED
2.45	8	273.27	2.80	1.02	0.45	sand	>90	>48	>50	UNDEFINED
2.75	9	281.65	4.28	1.52	0.51	sand to silty sand	>90	>48	>50	UNDEFINED
3.05	10	217.44	2.89	1.33	0.57	sand to silty sand	>90	46-48	>50	UNDEFINED
3.35	11	184.93	3.24	1.75	0.63	sand to silty sand	>90	44-46	44	UNDEFINED
3.65	12	381.72	2.85	0.75	0.69	gravelly sand to sand	>90	>48	>50	UNDEFINED
3.95	13	394.83	4.26	1.08	0.75	sand	>90	46-48	>50	UNDEFINED
4.25	14	502.92	6.11	1.21	0.81	sand	>90	>48	>50	UNDEFINED
4.55	15	396.38	3.66	0.92	0.87	sand	>90	46-48	>50	UNDEFINED
4.85	16	347.89	2.43	0.70	0.93	sand	>90	46-48	>50	UNDEFINED
5.15	17	272.34	1.40	0.52	0.98	sand	>90	44-46	>50	UNDEFINED
5.45	18	144.95	4.76	3.29	1.04	sandy silt to clayey silt	UNDFND	UNDFD	>50	9.5
5.75	19	503.13	6.64	1.32	1.10	sand	>90	46-48	>50	UNDEFINED
6.05	20	422.97	4.49	1.06	1.16	sand	>90	46-48	>50	UNDEFINED
6.40	21	408.95	3.81	0.93	1.23	sand	>90	46-48	>50	UNDEFINED
6.70	22	397.57	4.32	1.09	1.29	sand	>90	44-46	>50	UNDEFINED
7.00	23	364.61	4.43	1.21	1.35	sand	>90	44-46	>50	UNDEFINED
7.35	24	351.02	4.71	1.34	1.41	sand	>90	44-46	>50	UNDEFINED
7.65	25	374.91	5.50	1.47	1.48	sand	>90	44-46	>50	UNDEFINED
7.95	26	350.75	5.17	1.47	1.54	sand to silty sand	>90	44-46	>50	UNDEFINED
8.25	27	400.68	6.18	1.54	1.59	sand to silty sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

Figure 14b



C-5	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 15a

GROUP DELTA CONSULTANTS

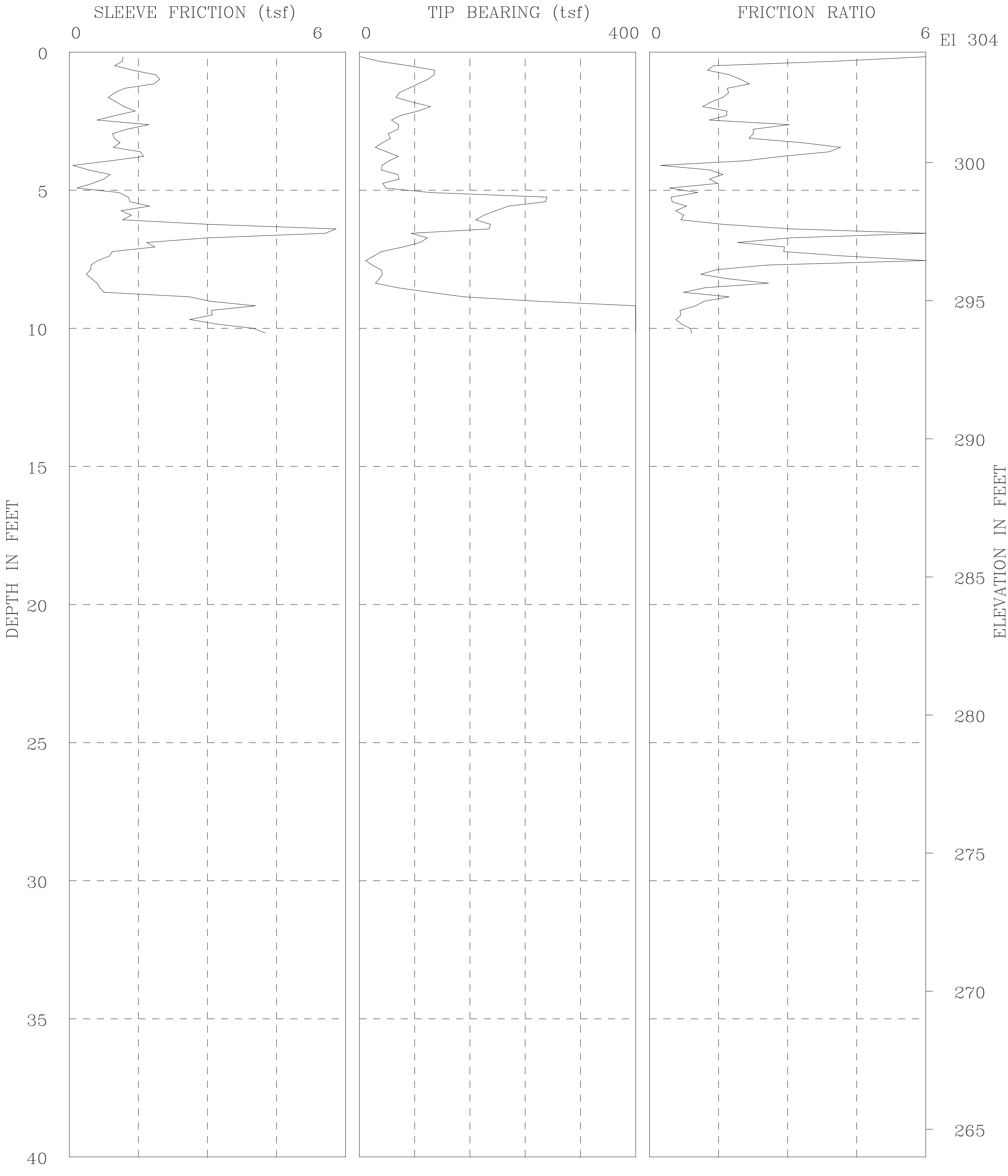
Engineer : Eric Holliday
On Site Loc: C-5
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-23-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	113.90	2.51	2.21	0.03	silty sand to sandy silt	>90	>48	36	UNDEFINED
0.60	2	99.10	1.39	1.40	0.09	sand to silty sand	>90	>48	24	UNDEFINED
0.95	3	50.52	0.83	1.65	0.15	silty sand to sandy silt	70-80	46-48	16	UNDEFINED
1.25	4	68.13	1.42	2.09	0.22	silty sand to sandy silt	70-80	44-46	22	UNDEFINED
1.55	5	85.26	1.31	1.54	0.28	silty sand to sandy silt	80-90	44-46	27	UNDEFINED
1.85	6	327.27	2.56	0.78	0.33	sand	>90	>48	>50	UNDEFINED
2.15	7	500.77	3.97	0.79	0.39	gravelly sand to sand	>90	>48	>50	UNDEFINED
2.45	8	311.88	2.16	0.69	0.45	sand	>90	>48	>50	UNDEFINED
2.75	9	368.50	2.67	0.73	0.51	gravelly sand to sand	>90	>48	>50	UNDEFINED
3.05	10	335.76	2.93	0.87	0.57	sand	>90	>48	>50	UNDEFINED
3.35	11	245.23	3.30	1.35	0.63	sand	>90	46-48	47	UNDEFINED
3.65	12	297.54	3.55	1.19	0.69	sand	>90	46-48	>50	UNDEFINED
3.95	13	267.19	2.08	0.78	0.75	sand	>90	46-48	>50	UNDEFINED
4.25	14	259.56	2.80	1.08	0.81	sand	>90	44-46	50	UNDEFINED
4.55	15	168.69	1.70	1.01	0.87	sand	80-90	42-44	32	UNDEFINED
4.85	16	170.86	1.90	1.11	0.93	sand to silty sand	80-90	42-44	41	UNDEFINED
5.15	17	179.41	2.36	1.31	0.98	sand to silty sand	80-90	42-44	43	UNDEFINED
5.45	18	314.32	3.35	1.07	1.04	sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-6	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 16a

GROUP DELTA CONSULTANTS

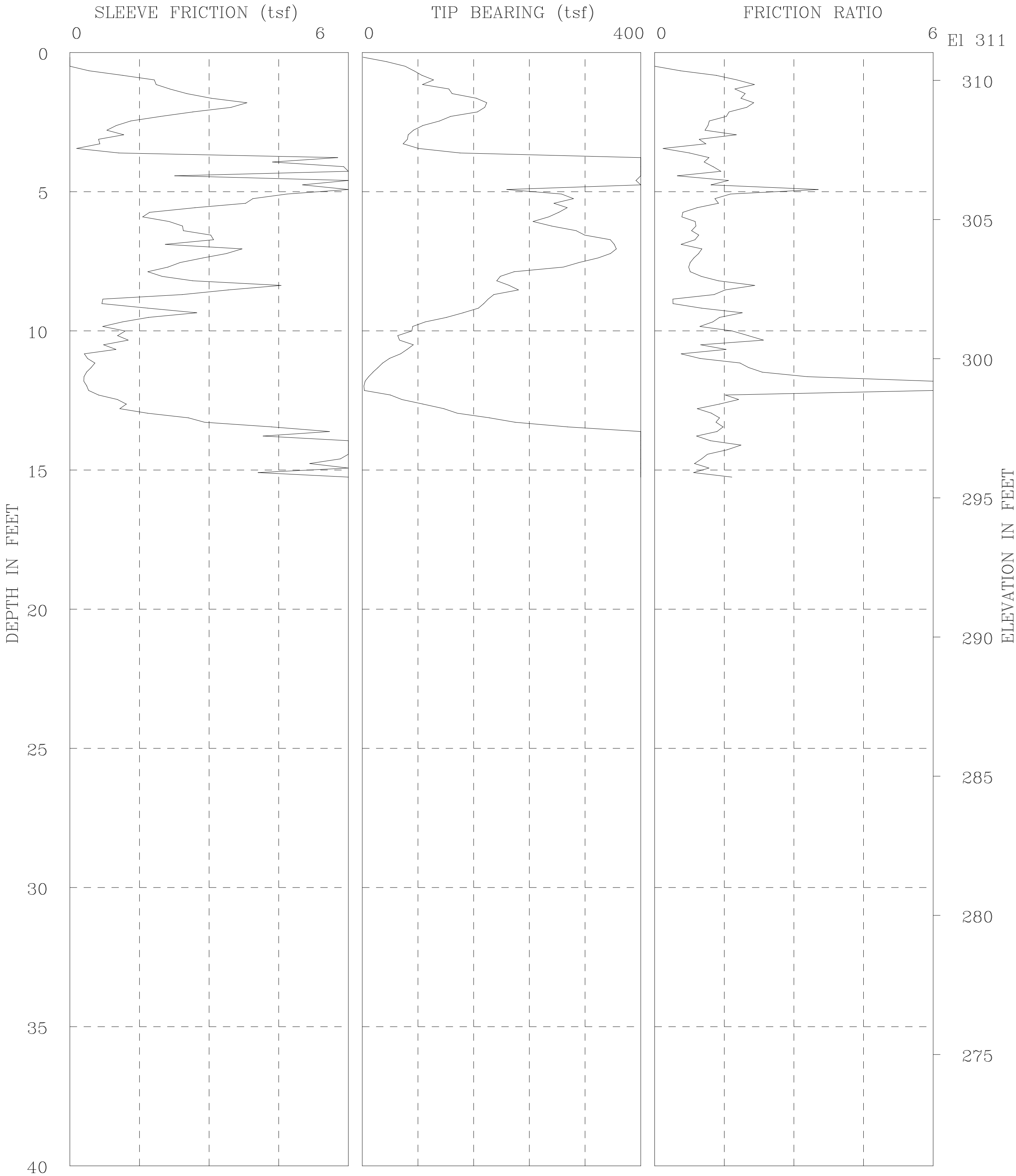
Engineer : Eric Holliday
On Site Loc: C-6
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-22-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	69.57	1.42	2.04	0.03	silty sand to sandy silt	>90	>48	22	UNDEFINED
0.60	2	74.32	1.18	1.59	0.09	silty sand to sandy silt	>90	>48	24	UNDEFINED
0.95	3	55.78	1.13	2.03	0.15	sandy silt to clayey silt	UNDFND	UNDFD	21	3.7
1.25	4	38.02	1.03	2.72	0.22	sandy silt to clayey silt	UNDFND	UNDFD	15	2.5
1.55	5	53.26	0.63	1.19	0.28	silty sand to sandy silt	60-70	42-44	17	UNDEFINED
1.85	6	217.11	1.33	0.61	0.33	sand	>90	>48	42	UNDEFINED
2.15	7	117.07	3.48	2.98	0.39	sandy silt to clayey silt	UNDFND	UNDFD	45	7.7
2.45	8	24.26	0.62	2.57	0.45	clayey silt to silty clay	UNDFND	UNDFD	12	1.5
2.75	9	103.21	1.36	1.32	0.51	sand to silty sand	70-80	44-46	25	UNDEFINED
3.05	10	447.82	3.34	0.75	0.57	gravelly sand to sand	>90	>48	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-7	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 17a

GROUP DELTA CONSULTANTS

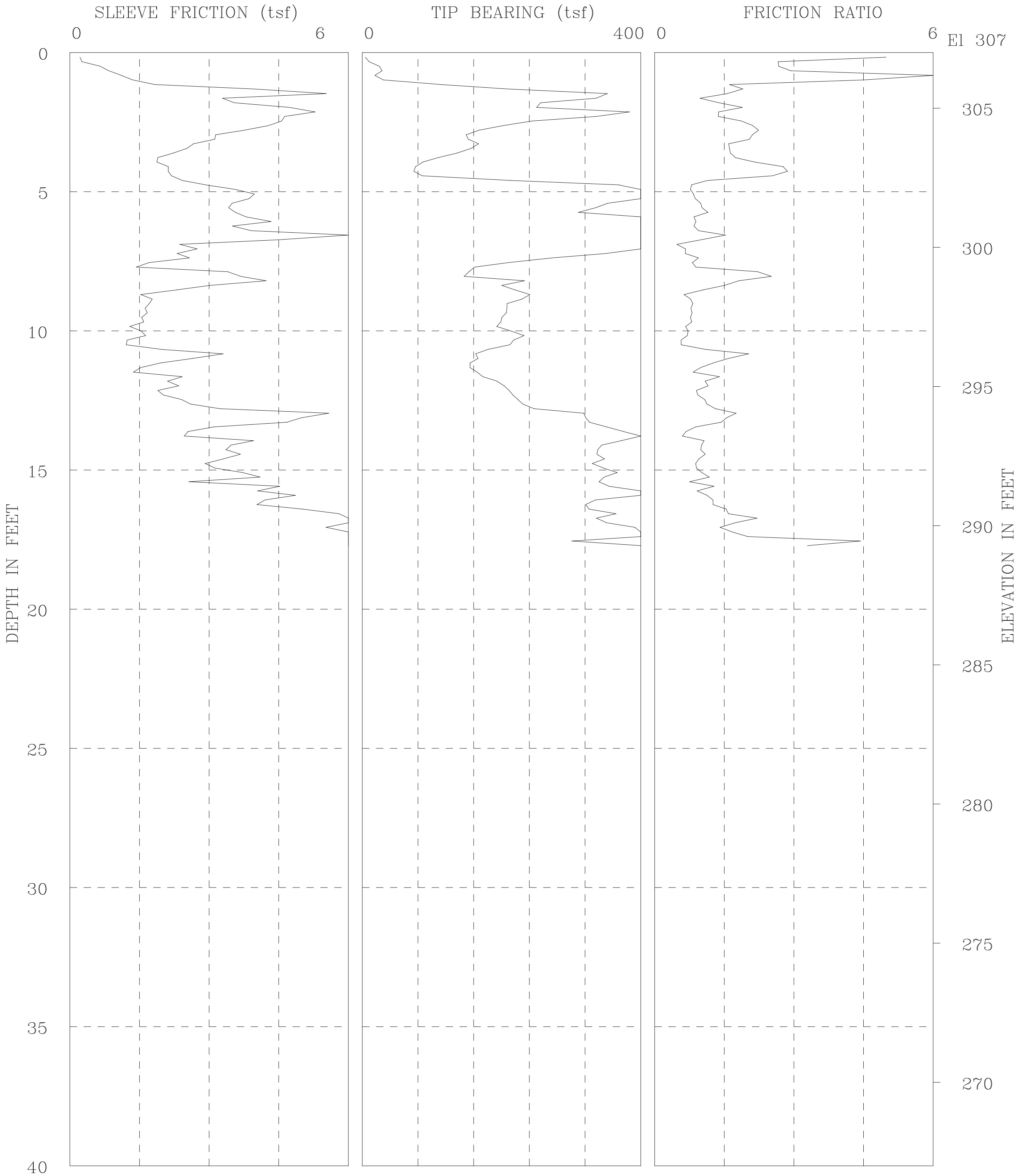
Engineer : Eric Holliday
On Site Loc: C-7
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-22-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	DEPTH (feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	60.11	0.55	0.91	0.03	silty sand to sandy silt	>90	>48	19	UNDEFINED
0.60	2	143.06	2.81	1.96	0.09	silty sand to sandy silt	>90	>48	46	UNDEFINED
0.95	3	99.23	1.36	1.37	0.15	sand to silty sand	>90	>48	24	UNDEFINED
1.25	4	274.96	2.98	1.08	0.22	sand	>90	>48	>50	UNDEFINED
1.55	5	373.40	5.40	1.44	0.28	sand	>90	>48	>50	UNDEFINED
1.85	6	278.09	2.64	0.95	0.33	sand	>90	>48	>50	UNDEFINED
2.15	7	330.30	2.80	0.85	0.39	sand	>90	>48	>50	UNDEFINED
2.45	8	285.32	2.40	0.84	0.45	sand	>90	>48	>50	UNDEFINED
2.75	9	195.48	2.41	1.23	0.51	sand	>90	46-48	37	UNDEFINED
3.05	10	111.21	1.52	1.37	0.57	sand to silty sand	70-80	42-44	27	UNDEFINED
3.35	11	56.05	0.78	1.40	0.63	silty sand to sandy silt	50-60	40-42	18	UNDEFINED
3.65	12	13.92	0.39	2.79	0.69	clayey silt to silty clay	UNDFND	UNDFD	7	.8
3.95	13	73.48	1.00	1.36	0.75	silty sand to sandy silt	60-70	40-42	23	UNDEFINED
4.25	14	356.71	4.39	1.23	0.81	sand	>90	46-48	>50	UNDEFINED
4.55	15	603.07	7.66	1.27	0.87	sand	>90	>48	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-8	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 18a

GROUP DELTA CONSULTANTS

Engineer : Eric Holliday
On Site Loc: C-8
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

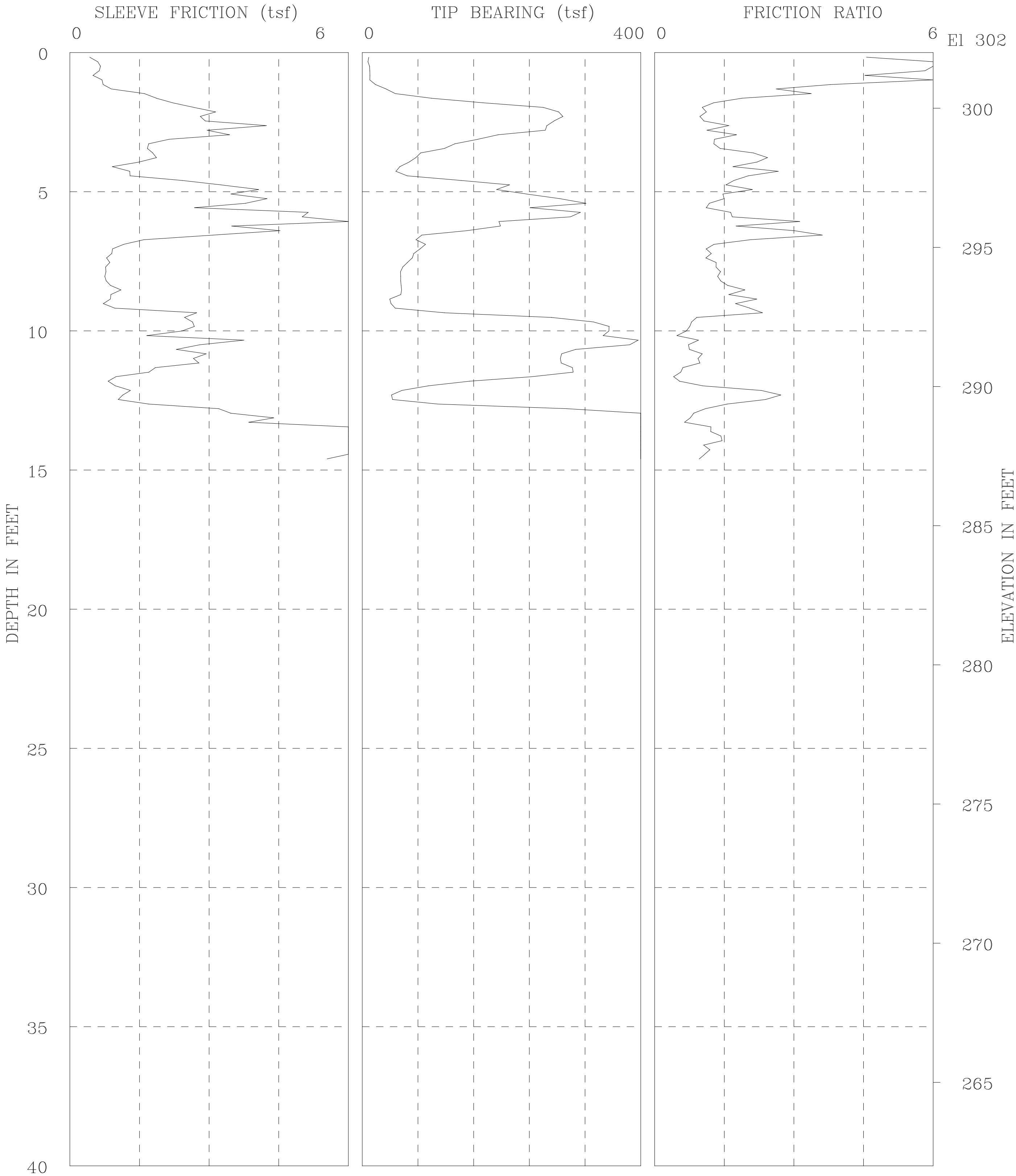
CPT Date : 02-22-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	19.23	0.74	3.84	0.03	silty clay to clay	UNDFND	UNDFD	12	1.2
0.60	2	252.74	3.81	1.51	0.09	sand to silty sand	>90	>48	>50	UNDEFINED
0.95	3	233.85	4.11	1.76	0.15	sand to silty sand	>90	>48	>50	UNDEFINED
1.25	4	122.20	2.22	1.82	0.22	silty sand to sandy silt	>90	>48	39	UNDEFINED
1.55	5	280.36	2.87	1.02	0.28	sand	>90	>48	>50	UNDEFINED
1.85	6	395.27	3.75	0.95	0.33	sand	>90	>48	>50	UNDEFINED
2.15	7	439.40	4.00	0.91	0.39	sand	>90	>48	>50	UNDEFINED
2.45	8	215.60	2.52	1.17	0.45	sand	>90	46-48	41	UNDEFINED
2.75	9	221.85	2.43	1.09	0.51	sand	>90	46-48	43	UNDEFINED
3.05	10	203.55	1.54	0.76	0.57	sand	>90	46-48	39	UNDEFINED
3.35	11	195.25	2.00	1.03	0.63	sand	>90	44-46	37	UNDEFINED
3.65	12	174.24	1.95	1.12	0.69	sand to silty sand	80-90	44-46	42	UNDEFINED
3.95	13	241.03	2.96	1.23	0.75	sand	>90	44-46	46	UNDEFINED
4.25	14	359.88	3.62	1.01	0.81	sand	>90	46-48	>50	UNDEFINED
4.55	15	340.70	3.31	0.97	0.87	sand	>90	46-48	>50	UNDEFINED
4.85	16	380.41	3.97	1.04	0.93	sand	>90	46-48	>50	UNDEFINED
5.15	17	338.95	5.43	1.60	0.98	sand to silty sand	>90	46-48	>50	UNDEFINED
5.45	18	429.02	10.77	2.51	1.04	sand to clayey sand (*)	UNDFND	UNDFD	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 15

(*) overconsolidated or cemented

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-9	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 19a

GROUP DELTA CONSULTANTS

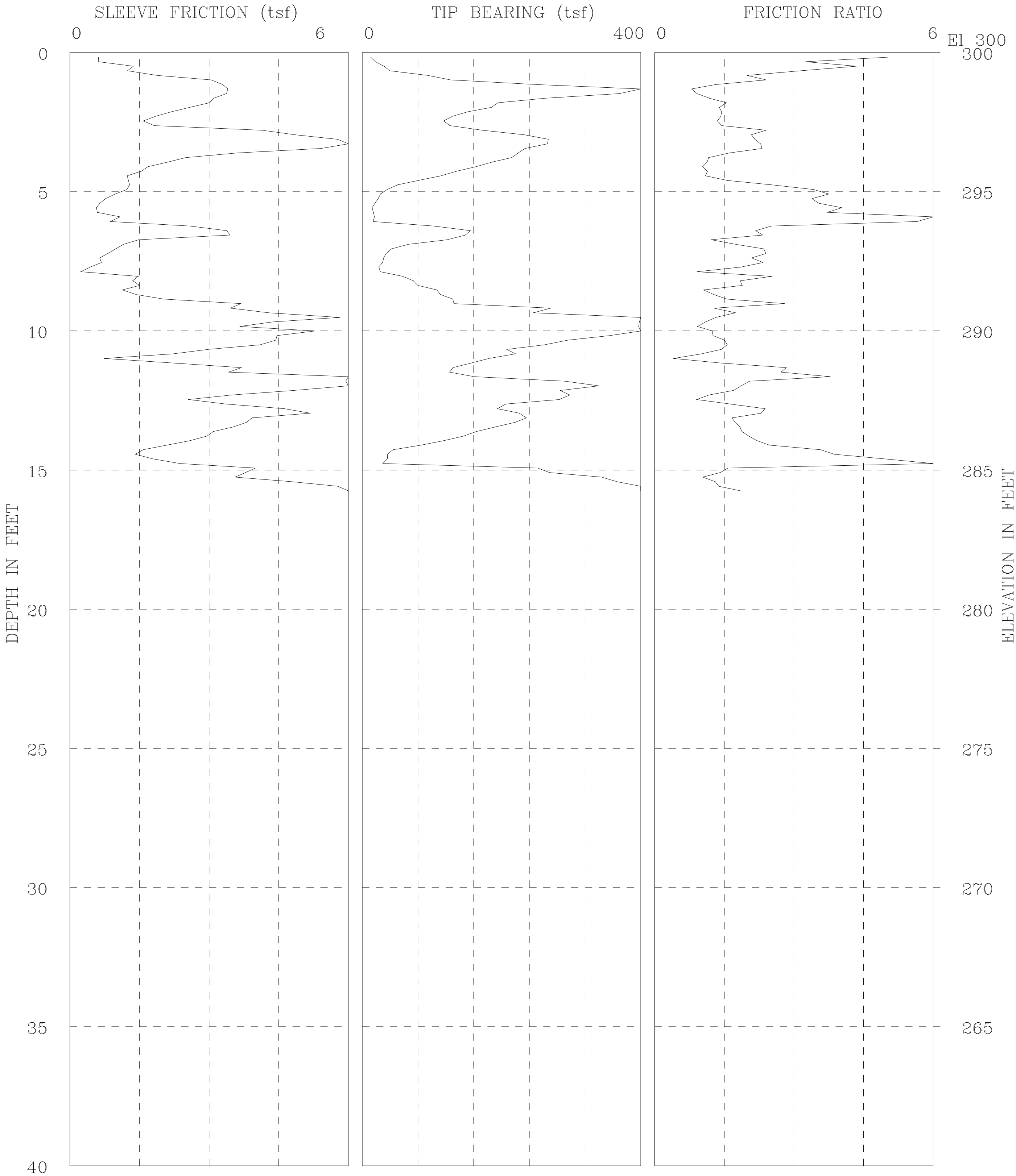
Engineer : Eric Holliday
On Site Loc: C-9
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-23-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	10.14	0.59	5.77	0.03	clay	UNDFND	UNDFD	10	.6
0.60	2	105.55	1.66	1.57	0.09	silty sand to sandy silt	>90	>48	34	UNDEFINED
0.95	3	247.90	3.09	1.25	0.15	sand	>90	>48	47	UNDEFINED
1.25	4	88.98	1.57	1.77	0.22	silty sand to sandy silt	80-90	46-48	28	UNDEFINED
1.55	5	149.23	2.63	1.76	0.28	sand to silty sand	>90	>48	36	UNDEFINED
1.85	6	275.82	4.50	1.63	0.33	sand to silty sand	>90	>48	>50	UNDEFINED
2.15	7	114.28	2.46	2.16	0.39	silty sand to sandy silt	80-90	44-46	36	UNDEFINED
2.45	8	63.17	0.81	1.28	0.45	silty sand to sandy silt	60-70	42-44	20	UNDEFINED
2.75	9	50.64	0.87	1.72	0.51	silty sand to sandy silt	50-60	40-42	16	UNDEFINED
3.05	10	246.30	2.32	0.94	0.57	sand	>90	46-48	47	UNDEFINED
3.35	11	334.02	2.68	0.80	0.63	sand	>90	46-48	>50	UNDEFINED
3.65	12	230.59	1.52	0.66	0.69	sand	>90	46-48	44	UNDEFINED
3.95	13	159.21	1.98	1.24	0.75	sand to silty sand	80-90	44-46	38	UNDEFINED
4.25	14	538.57	5.88	1.09	0.81	sand	>90	>48	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-10	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 20a

GROUP DELTA CONSULTANTS

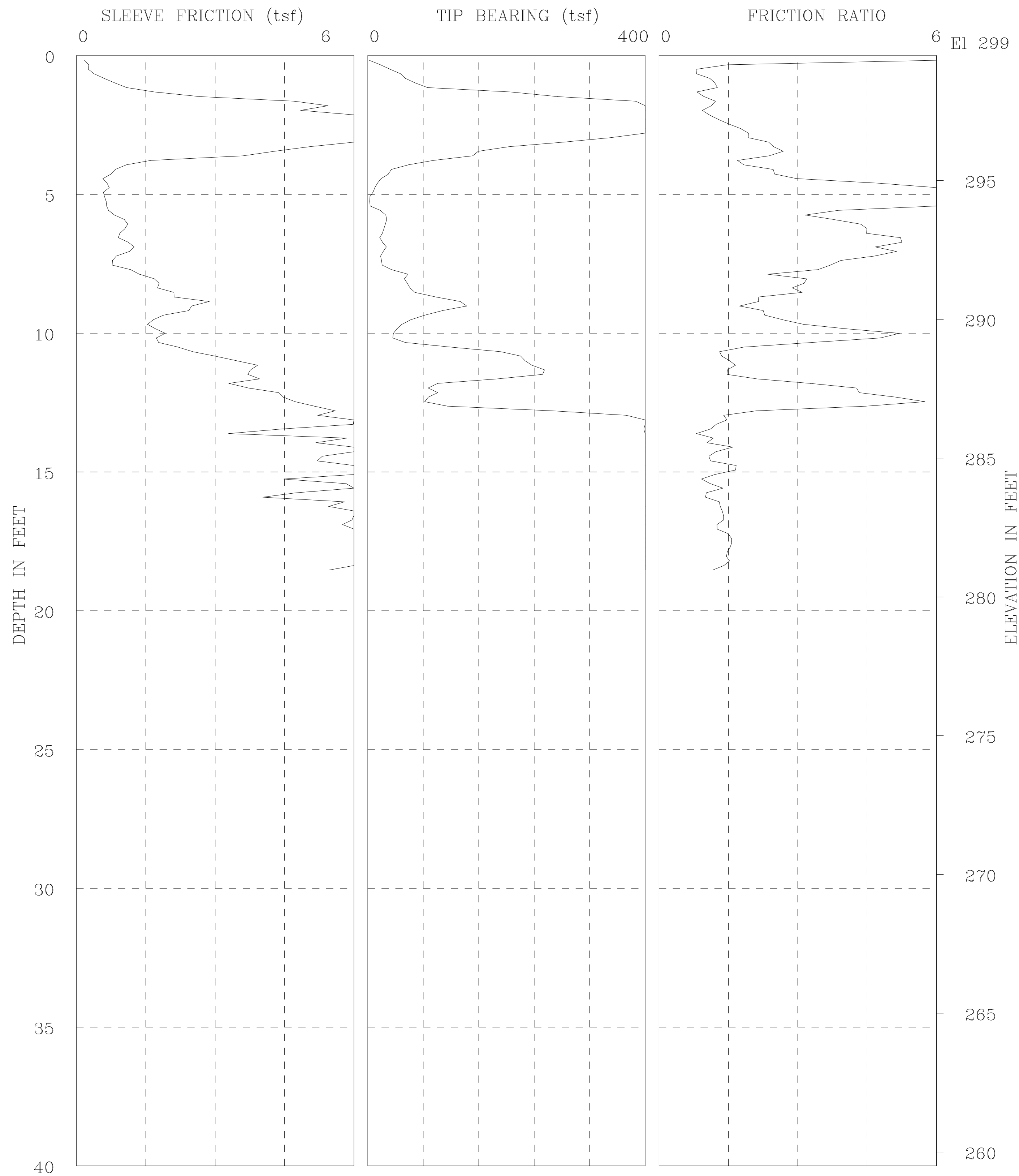
Engineer : Eric Holliday
On Site Loc: C-10
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-23-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<< HAND AUGERED TO 1.5 FT DEPTH >>								
0.60	2	281.92	3.13	1.11	0.09	sand	>90	>48	>50	UNDEFINED
0.95	3	170.72	3.17	1.86	0.15	sand to silty sand	>90	>48	41	UNDEFINED
1.25	4	214.89	3.57	1.66	0.22	sand to silty sand	>90	>48	>50	UNDEFINED
1.55	5	73.63	1.26	1.70	0.28	silty sand to sandy silt	70-80	44-46	24	UNDEFINED
1.85	6	17.36	0.76	4.35	0.33	clay	UNDFND	UNDFD	17	1.1
2.15	7	106.09	2.17	2.05	0.39	silty sand to sandy silt	80-90	44-46	34	UNDEFINED
2.45	8	33.70	0.72	2.12	0.45	sandy silt to clayey silt	UNDFND	UNDFD	13	2.2
2.75	9	105.79	1.86	1.75	0.51	silty sand to sandy silt	70-80	44-46	34	UNDEFINED
3.05	10	362.96	4.48	1.23	0.57	sand	>90	>48	>50	UNDEFINED
3.35	11	253.76	3.16	1.24	0.63	sand	>90	46-48	49	UNDEFINED
3.65	12	200.71	4.62	2.30	0.69	silty sand to sandy silt	>90	44-46	>50	UNDEFINED
3.95	13	248.56	4.00	1.61	0.75	sand to silty sand	>90	46-48	>50	UNDEFINED
4.25	14	179.05	3.32	1.85	0.81	sand to silty sand	80-90	44-46	43	UNDEFINED
4.55	15	80.59	2.21	2.74	0.87	sandy silt to clayey silt	UNDFND	UNDFD	31	5.3
4.85	16	381.70	5.03	1.32	0.93	sand	>90	46-48	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



C-11	L-938 Los Angeles State Historical Park
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

Figure 21a

GROUP DELTA CONSULTANTS

Engineer : Eric Holliday
On Site Loc: C-11
Job No. : L-938 LASHP
Tot. Unit Wt. (avg) : 120 pcf

CPT Date : 02-22-11
Cone Used : Middle Earth 25-ton rig
Water table (feet) : 32

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<< HAND AUGERED TO 1.5 FT DEPTH >>>								
0.60	2	325.04	3.41	1.05	0.09	sand	>90	>48	>50	UNDEFINED
0.95	3	472.33	7.62	1.61	0.15	sand to silty sand	>90	>48	>50	UNDEFINED
1.25	4	117.03	2.74	2.34	0.22	silty sand to sandy silt	>90	>48	37	UNDEFINED
1.55	5	14.05	0.65	4.61	0.28	clay	UNDFND	UNDFD	13	.9
1.85	6	17.18	0.83	4.81	0.33	clay	UNDFND	UNDFD	16	1.1
2.15	7	22.00	1.07	4.86	0.39	clay	UNDFND	UNDFD	21	1.4
2.45	8	34.00	1.11	3.25	0.45	clayey silt to silty clay	UNDFND	UNDFD	16	2.2
2.75	9	93.44	2.19	2.34	0.51	silty sand to sandy silt	70-80	42-44	30	UNDEFINED
3.05	10	63.49	1.86	2.93	0.57	sandy silt to clayey silt	UNDFND	UNDFD	24	4.1
3.35	11	141.40	2.45	1.73	0.63	sand to silty sand	80-90	44-46	34	UNDEFINED
3.65	12	186.39	3.73	2.00	0.69	silty sand to sandy silt	80-90	44-46	>50	UNDEFINED
3.95	13	170.73	4.92	2.88	0.75	silty sand to sandy silt	80-90	44-46	>50	UNDEFINED
4.25	14	455.69	5.22	1.15	0.81	sand	>90	>48	>50	UNDEFINED
4.55	15	503.91	6.94	1.38	0.87	sand	>90	>48	>50	UNDEFINED
4.85	16	488.90	5.47	1.12	0.93	sand	>90	46-48	>50	UNDEFINED
5.15	17	453.34	6.08	1.34	0.98	sand	>90	46-48	>50	UNDEFINED
5.45	18	513.93	7.61	1.48	1.04	sand	>90	46-48	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

Group Delta Consultants

Location	LA STATE HISTORIC PARK	Operator	RS/BH		
Job Number	L-938	Cone Number	DSG1104	GPS	
Hole Number	C-3	Date and Time	2/22/2011 12:22:14 PM		

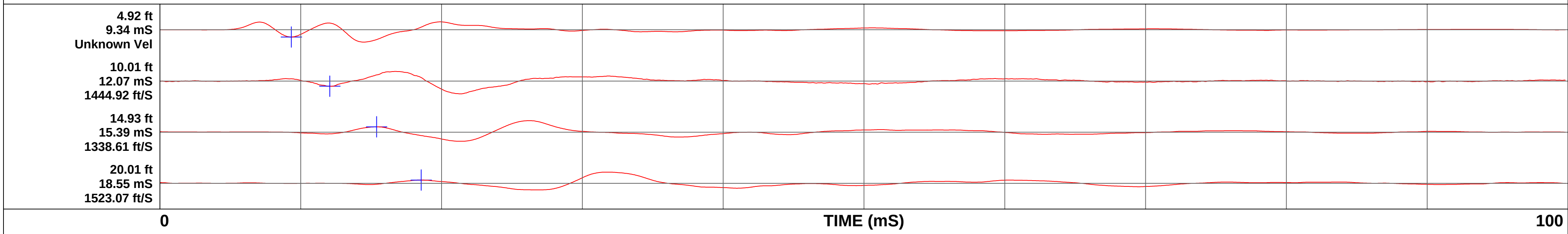


Figure A-22

APPENDIX B
LABORATORY TESTING

APPENDIX B
LABORATORY TESTING

B.1 General

Laboratory testing was performed to aid in the classification of soils encountered in the borings and to evaluate their physical properties and engineering characteristics. The laboratory testing was performed by Group Delta Consultants Laboratories. The investigation included the following tests:

- Visual / Manual Soil Classification, ASTM D 2488
- In situ moisture content and dry unit weight, ASTM D 2216 / 2937
- Atterberg limits, ASTM D 4318
- Grain Size Distribution, ASTM D 422
- Percent passing No. 200 sieve, ASTM D 1140
- Corrosivity CTM 643, 422, 417
- Expansion Index ASTM D 4829
- R-Value CTM 301

Descriptions of these tests are given below.

B.2 Soil Classification

The subsurface materials were classified visually in the field using the Unified Soil Classification System (USCS), in accordance with ASTM Test Methods D 2487 and D 2488. Soil classifications were modified as necessary based on further inspection and testing in the laboratory. The soil classification system is presented on the key for soil classification, and field / laboratory classifications are presented on the boring logs, Figures A-2a through A-10 of Appendix A.

B.3 Moisture Content and Dry Unit Weight

The field moisture and dry unit weight of each relatively undisturbed sample were determined in general accordance with ASTM D 2216 and D 2937, respectively. Results of these tests are presented on the boring logs in Figures A-2a through A-10 of Appendix A.

B.4 Atterberg Limits

Characterization of the fine-grained fractions of the encountered soils was evaluated using the Atterberg Limits. This test includes Liquid Limit and Plastic Limit tests to determine the Plasticity Index in accordance with ASTM D 4318. Results of these tests are presented on the boring logs in Figures A-2a through A-10 of Appendix A and in Figure B-1of this Appendix.

B.5 Percent Passing No. 200 Sieve and Grain Size Distribution

Representative samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. The portion of the material retained on the No. 200 sieve was oven-dried in accordance with ASTM D 1140. The portion retained on #200 was passed through a #4 sieve to determine the % gravel, % sand, and % passing the + 200 sieve. For selected samples, the portion retained on #200 sieve was passed through a standard set of sieves and the grain size distribution was determined in accordance with ASTM D 422. The percentage of gravel, sand, and fines (i.e., soil passing #200 sieve) is presented on the boring logs in Figures A-2a through A-10 of Appendix A. Grain size distribution of selected samples is plotted in Figure B-2 of this appendix.

B.6 Soil Corrosivity

Tests were performed in order to determine corrosion potential of site soils on concrete and ferrous metals. Corrosivity testing included soil pH (Caltrans method 643), water-soluble chlorides (Caltrans Test method 422), water-soluble sulfates (Caltrans Test Method 417) and minimum electrical resistivity (Caltrans Test method 643). The test results are summarized below in Table B-1.

TABLE B-1:
SUMMARY OF CORROSION TEST RESULTS

BORING NO	SAMPLE NO	DEPTH (feet)	SOIL TYPE	PH CALTRANS 643	CHLORIDE CONTENT CALTRANS 422 (ppm)	SULFATE CONTENT CALTRANS 417 (ppm)	MINIMUM RESISTIVITY CALTRANS 643 (ohm-cm)
B-1	B-0	0-5	ML/CL + SM	8.0	<100	690	1478
B-3	B-0	0-5	ML/CL +SW-SM	8.24	<100	<100	2023
B-5	S-1	2.5-4	SP-SM	8.03	100	310	Not tested

B.7 R-Value

A Resistance or R-Value test was performed on a selected bulk sample of the subgrade soils encountered under proposed pavement widen locations. The test was conducted in general accordance with CTM 301. The test results are summarized in Table B-2 of this appendix.

TABLE B-2:
SUMMARY OF R-VALUE TEST RESULTS

Boring No.	Sample No.	Depth (ft)	USCS Soil Type	R-Value
B-8	B-0	0-5	SM + SP-SM	81

B.8 Expansion Index

Selected samples were tested for expansion potential in accordance with ASTM D 4829. The results are shown in Table B-3.

TABLE B-3:
SUMMARY OF EXPANSION INDEX TEST RESULTS

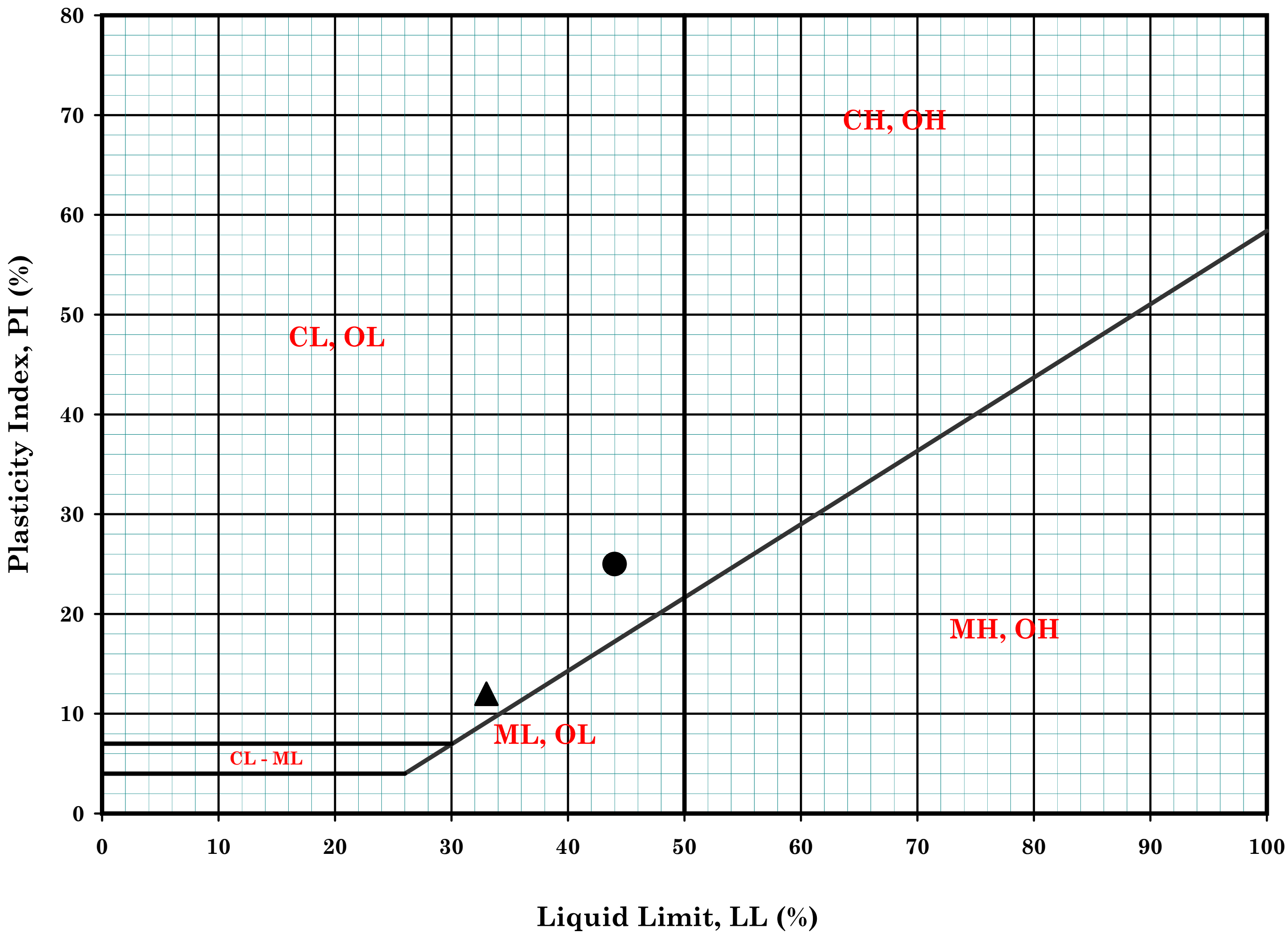
Boring No.	Sample No.	Depth (ft)	USCS Soil Type	Expansion Index
B-1	B-0	0-5	ML/CL + SM	7
B-2	B-1A	0-2	CL	56
B-3	B-0	0-5	ML/CL + SW-SM	10

B.9 Additional Figures

The following figures are attached and complete this appendix:

Figure B-1 Atterberg Limits Test Results
Figure B-2 Grain Size Distribution Test Result

PLASTICITY CHART



Symbol	Boring No.	Sample No.	Depth (ft)		Depth (m)		MC	LL	PL	PI	LI	Description
							(%)					
●	*B-2*	*B-1A*	*0.0*	*2.0*	*0.0*	*0.6*	*21.92*	*44*	*19*	*25*	*0.12*	*Light Grayish Brown Lean CLAY w/Sand (CL)*
▲	*B-3*	*R-7*	*30.0*	*31.0*	*9.2*	*9.5*	*23.20*	*33*	*21*	*12*	*0.18*	*Dark Gray Lean CLAY w/ Sand (CL)*
◆												
■												
○												
△												
◇												
□												

Remarks :

GROUP DELTA CONSULTANTS

LASHP

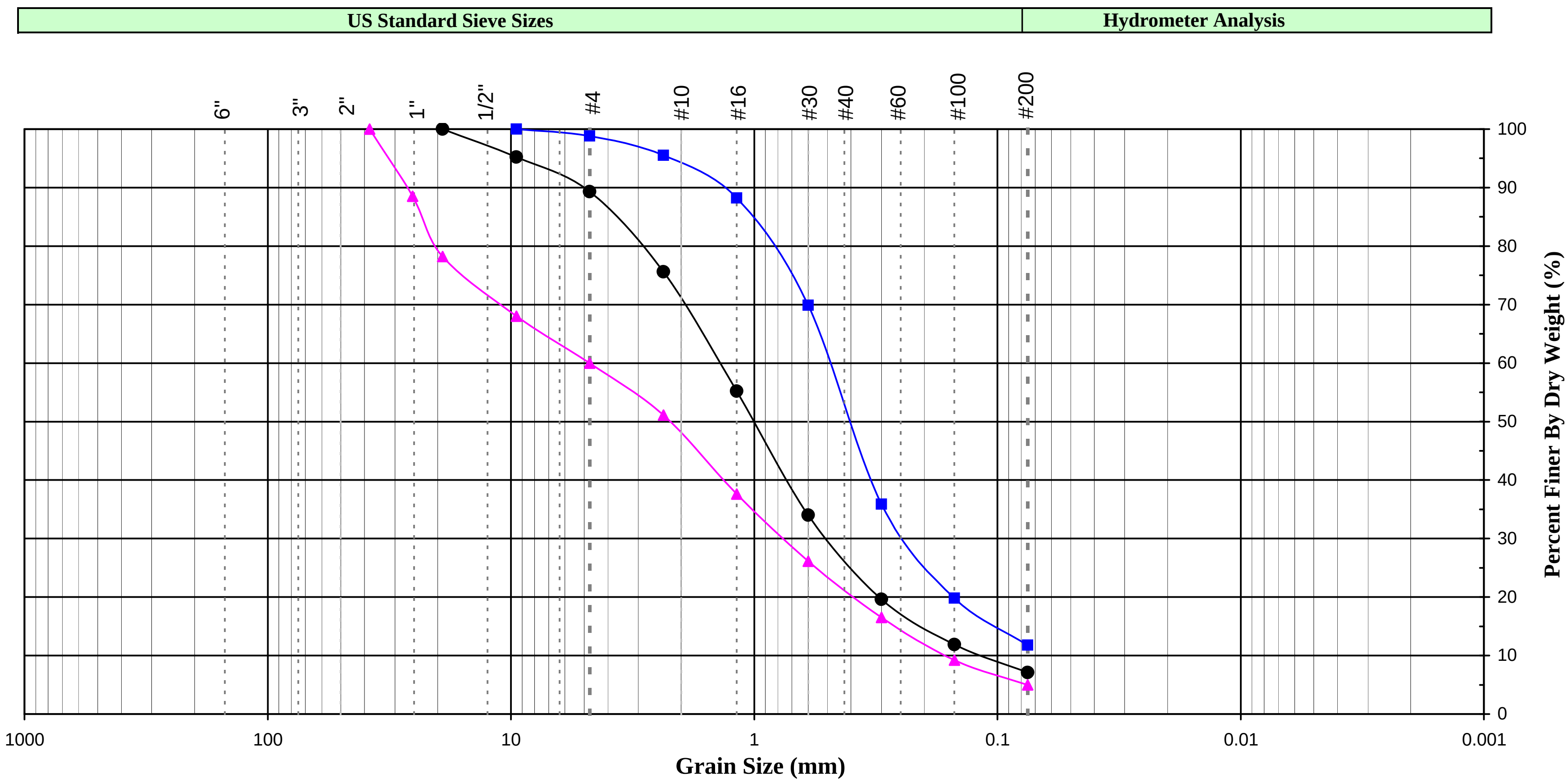
Project No. : *L-938*

Date : *03/04/11*

ATTERBERG LIMITS

(ASTM D-4318 / CT-204 / T-89)

Figure No. : B-1



Boulders	Cobbles	Gravel		Sand			Fines (Silt / Clay)
		Coarse	Fine	Coarse	Medium	Fine	

Symbol	Boring Number	Sample Number	Sample Depth [from/to] (ft)		(m)		Grain Size Percentage Gravel	Sand	Fines	Atterberg Limits LL	PI	Soil Description	U.S.C.S.
●	B-1	R-7	30.0	30.5	9.14	9.30	11	82	7			Well Graded SAND w/Silt and	SW-SM
▲	B-3	R-5	20.0	20.5	6.10	6.25	40	55	5			Poorly Graded SAND w/ Gravel	SP
■	B-3	S-10	45.0	46.0	13.72	14.02	1	87	12			Poorly Graded SAND w/ Silt	SP-SM
◆													
+													

GROUP DELTA

LASHP

Project No. : L-938 | **Date :** 03/04/11

GRAIN SIZE ANALYSIS

(ASTM D-422)

Figure No. : B-2

APPENDIX C
SITE PHOTOGRAPHS


Archaeological excavation of Roundhouse


Archaeological excavation of Roundhouse


Looking South toward Los Angeles


Archaeological excavation of Roundhouse


Archaeological excavation of Roundhouse

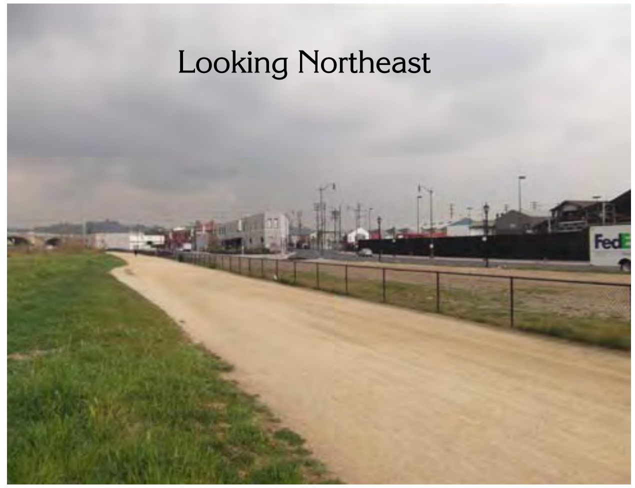

Looking West from Nothern part of site


Archaeological excavation of Roundhouse


Archaeological excavation of Roundhouse


Archaeological excavation of Roundhouse

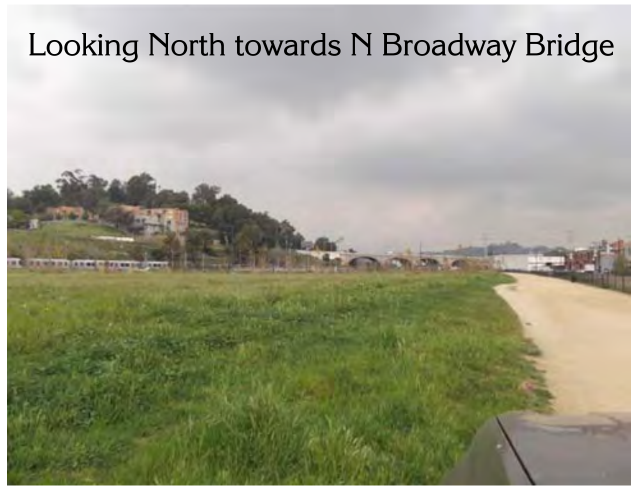
Looking North near Southern end of project



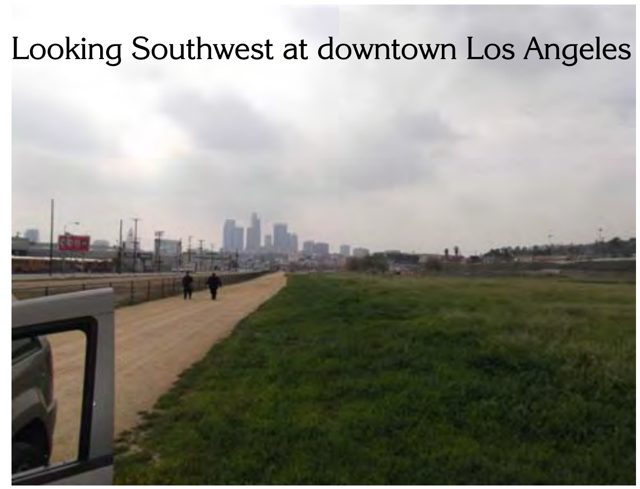
Looking Northeast

N Broadway Bridge over Metro line

Looking West



Looking North towards N Broadway Bridge



Looking Southwest at downtown Los Angeles

Looking North at Southern part of project

Looking West

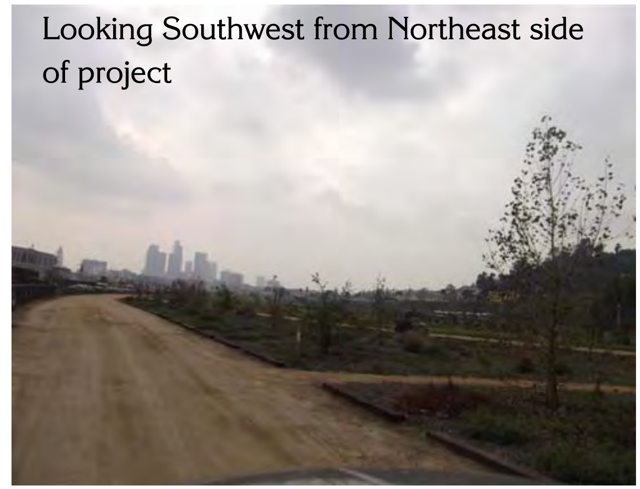

Looking Southeast


Metro line on Northwest side of site


Looking Southwest from Northeast side of project


Metro line on Northwest side of site


Metro line on Northwest side of site


Looking Southwest from Northeast side of project


Metro line on Northwest side of site


Metro line on Northwest side of site


Metro line on Northwest side of site

APPENDIX D
ENVIRONMENTAL REVIEW LETTER

GROUP DELTA CONSULTANTS
Certified MBE
Geotechnical Engineering
Geology
Hydrogeology
Earthquake Engineering
Materials Testing & Inspection
Forensic Services

March 28, 2011

State of California Department of Parks and Recreation
Southern Service Center
8885 Rio San Diego Drive, #270
San Diego, CA 92108

Attention: Mr. Jeff Brown, RLA
Project Manager

**SUBJECT: DOCUMENT REVIEW FOR ENVIRONMENTAL CONDITIONS
LOS ANGELES STATE HISTORICAL PARK
LOS ANGELES, CALIFORNIA
GROUP DELTA PROJECT NO. L-938
MASTER SERVICES AGREEMENT NO. C08E0061**

Dear Mr. Brown:

As requested by you, Group Delta Consultants, Inc. (GDC) has reviewed the two reports that were provided to us to evaluate potential environmental conditions at the site — previously the Cornfield Yard operation of Union Pacific Railroad Company (UPRC). The area is being studied for improvement to a park area and this review is intended to review site conditions to the extent that these may in some manner impact the proposed improvements. It is understood that the proposed park area is a smaller portion of UPRCs operational area that was investigated over many years for environmental conditions and impacts under California regulatory oversight (CA/EPA Department of Toxic Substances Control or DTSC).

The two documents reviewed are:

- Removal Action Completion Report, 32-acre parcel of the former Cornfield Rail Yard, 1245 Spring Street, Los Angeles, California by Shaw Environmental, Inc. dated February 2003

- Additional Site Investigation Summary and Groundwater Monitoring Report, Former Cornfield Yard, 1245 N. Spring Street, Los Angeles, California by ERM-West, Inc. dated October 2006.

The reports were provided and reviewed in electronic PDF format.

32 Mauchly, Suite B ▲ Irvine, California 92618-2336 ▲ (949) 450-2100 voice ▲ (949) 450-2108 fax
Torrance, California (310) 320-5100 ▲ San Diego, California (858) 524-1500
www.GroupDelta.com

SITE DESCRIPTION

The Los Angeles State Historic Park site consists of approximately 32 acres located within a half mile from El Pueblo de Los Angeles Historical Monument and Los Angeles City Hall in the heart of downtown Los Angeles. The park is on a historical site known as "The Cornfield," a site of remarkable social, historical, and cultural significance and the last vast open space in downtown Los Angeles. The northern end of the site is located approximately 150 feet from the Los Angeles River and the southern end is located approximately 150 feet from the Chinatown Gold Line commuter train station. DPR is proposing to develop the full 32 acres of the park in phases. The major structural components of the proposed park will consist of a Welcome Station, a Ranger operations building, Roundhouse Pedestrian Bridge, and Turntable Stage. The Roundhouse Bridge will be the terminus of an anticipated future span of the existing railroad tracks and connect to a development planned along North Broadway at the intersection of Bishop Road. Future plans may connect the park to the adjacent Los Angeles River, resulting in a potential rise in groundwater levels.

The Site Vicinity Map and Aerial Photograph are shown in Figures 1A and 1B, and a Site Plan is shown in Figures 2A-2D. The park is located south of the Gold Line railroad right-of-way and north of Spring Street and Baker Street. The park area extends about 3,800 feet along the southern part of the railroad right-of-way to the crossing with Broadway.

BACKGROUND

Southern Pacific Transportation Company (SPTC) ·owned and operated the property from at least 1888 through 1998 (Burns & McDonnell, 2000). In February 1998, SPTC merged with the Union Pacific Railroad Company (UPRC), and UPRC divided the former Cornfield Rail Yard property into three areas: the 8-acre parcel, Metropolitan Transportation Authority (MTA) Easement, and the 32-acre parcel. The latter is the subject site: it is currently owned by the Department of Parks and Recreation (DPR). Transaction details, including due diligence undertaken at the time the land was transferred to DPR is not known and the reporting for that transaction was not reviewed for this evaluation. It has been reported that the groundwater beneath the Cornfield site is impacted and is being investigated/remediated by the previous owner, UPRC. The groundwater investigations are being completed under the oversight of the Los Angeles Regional Water Quality Control Board (RWQCB).

Removal Action Completion Report (Shaw, 2003)

IT Corporation, subsequently known as Shaw Environmental, has served as the environmental consultant to the Trust for Public Land (TPL) since 2002. A Preliminary Endangerment Assessment (PEA) report was prepared by IT Corporation in January 2002 to describe the Cornfield site's environmental conditions. A Final Site Characterization letter report (Shaw, June 2002) was also prepared to further describe the extent of site contamination. These investigations determined that soil at the site contained chemical constituents (heavy metals — arsenic and lead, and total petroleum hydrocarbons [TPH]) that posed a potential human health hazard and risk. Results indicated that localized areas within the site contained arsenic and lead at concentrations exceeding the DTSC screening concentrations for arsenic [10 milligrams per kilogram (mg/kg) and lead (255 mg/kg). Two areas also contained total petroleum hydrocarbons (TPH) at concentrations exceeding a commonly used screening concentration of 1,000 mg/kg. A Removal Action Work Plan (RAW) was subsequently prepared and approved by the DTSC on the basis of which remedial action was undertaken at the site. The February 2003 report by Shaw describes the remedial action taken at that time.

The removal action reported by Shaw and completed in late 2002 consisted of the excavation of impacted soil from site areas identified in the RAW. The planned boundaries and depths of the identified excavation areas were used as a basis for defining the field action. It was discovered that in some areas Metropolitan Transportation Authority has already removed soil during their use of the site as a Gold Line construction staging area. In other areas, over-excavation was necessary to achieve the remediation goals. A total of 5,238 tons of impacted soil was removed during remediation and disposed off-site. The following are the main features of the remediation as reported by Shaw (2003):

- Thirteen locations were over-excavated in order to meet clean up objectives;

- Seven locations contained brick foundation and railroad artifacts that obstructed complete excavation. Excavation activities at these locations were continued to remove as much of the impacted soil as possible without risking damage to the buried feature. The volume of impacted soil that was left in-place at these locations is not estimated or reported by Shaw.

- At two locations (Locations G-66 and G-111) excavations were incomplete because of the presence of fiber optic cables at these locations. The volume of impacted soil that was left in-place at these locations is not estimated or reported by Shaw.

- Archeological findings in a number of excavation areas delayed scheduled completion time due to the time required by archeologist to document uncovered features. Archeological findings are separately reported and were not available for this review.

- At two locations (Locations G-50 and G-99) no excavation was made because it was determined that during the construction of the MTA Gold Line contaminated soil at these locations was already removed. Confirmation samples taken in these areas verified that the RAW clean up goals were met.

It is assumed that the DTSC approved the remedial action undertaken at the site and reported in the Shaw (2003) report. Such approval letter was not part of the reporting or available for review.

Additional Site Investigation Summary and Groundwater Monitoring Report (ERM-West, 2006)

ERM-West is groundwater consultant to UPRC and this report is part of on-going groundwater monitoring that is being conducted at the site. At least 10 of the monitoring wells that are being periodically sampled are located on the site. This report also discusses the results of an investigation around well BMW-4 consisting of groundwater sampling at seven locations to study the nature of groundwater impact in that area.

Groundwater is typically reported at a depth of between 30 and 35 feet below adjacent ground surface at the site. Groundwater beneath the Site is reported to flow toward the southwest at a general flow gradient of approximately 0.0017 feet per foot.

Groundwater samples are analyzed for VOCs using EPA Test Method 8260 and total fuel hydrocarbons using EPA Test Method 8015M. High concentrations of BTEX – gasoline based contaminants are reported in the groundwater. Also, 1,2-dichloroethane, a volatile compound is reported in excess of its Maximum Contamination Level (MCL). It is reported that the observed gasoline impacts to groundwater have been defined and are confined to a limited, interior portion of the Site. This conclusion is based on non-detectable constituent concentrations in three down-gradient wells. The report does not contain sufficient information to independently interpret this conclusion. The well where the maximum concentrations have been reported was abandoned and re-installed.

Almost 5 years have elapsed since the report that was reviewed. Current reporting covering the period since 2006 is needed for further assessment and evaluation.

OBSERVATION AND RECOMMENDATIONS

Based on GDC review of the reports, our general interpretation of the reported conditions, and our experience working in the downtown Los Angeles area, we are able to make the following observations and recommendations. These are made assuming that there will be limited near-surface earthwork during construction of the proposed improvements at the park. It is our understanding that buildings to be constructed are light single-story construction and that earthwork is likely limited to shallow excavation and backfill for foundations, pavements, hardscape, and utility construction.

1. The investigation and remedial action described used an approach where the locations of the impacted soil were identified on the basis of sampling and pot-hole excavations in these areas were deemed sufficient removal. Because of the inherent uncertainties in the sampling and the unknowns regarding past operational use, it is possible that additional soil with metals and TPH-impact are present at the site. Although there is no requirement to look for these materials, if such materials are identified either by visual or olfactory clues during construction, the soil will need to be stockpiled, sampled and properly managed on the basis of sampling results. The same approach is recommended for any soil that is excavated to be surplus at the site and requires off-site disposal.

2. The high BTEX concentrations in the groundwater lead to a concern regarding presence of volatiles in the soil vapor. The reports indicate that a vapor recovery system was operated at the site. It is not know whether this remediated conditions to the point that further action is not necessary and there is no concern for protection of from these volatiles making their way into the building areas or enclosed spaces at the park. Further investigation may be necessary to evaluate exposure risk from these chemicals to indoor air. If preventative measures are being taken for methane mitigation, such measures may also mitigate VOC exposure risk. It is recommended that either this risk be independently assessed or be assessed concurrent with assessment for methane risk.

3. Contaminants reported in the groundwater are not a direct concern to surface use of the site. To the extent that there is unknown fuel contamination source in the soil contributing to groundwater contamination

or the existing groundwater contamination is off-gassing to the soil vapor, it will need to be assessed as part of item 2 above.

We hope this review meets project needs at this time. Please contact us at 949.450.2100 at your convenience if there are questions regarding this letter.

REFERENCES

Burns & McDonnell. 2000, Site-wide Investigation Report for the Former UPRR Cornfield Yard, 1245 N. Spring Street, Los Angeles, California (not reviewed).

ERM-West, Inc. 2006, Additional Site Investigation Summary and Groundwater Monitoring Report, Former Cornfield Yard, 1245 N. Spring Street, Los Angeles, California

Shaw Environmental, Inc., 2002, Final Site Characterization Sampling Results for the 32-Acre Parcel of the Former Cornfield Rail Yard, Los Angeles, California, June 17(not reviewed).

Shaw Environmental, Inc., 2002, Final Removal Action Workplan for the 32-Acre Parcel of the Former Cornfield Rail Yard, Los Angeles, California, November 2002 (not reviewed).

Shaw Environmental, Inc., 2003, Removal Action Completion Report, 32-acre parcel of the former Cornfield Rail Yard, 1245 Spring Street, Los Angeles, California.

We appreciate your selection of Group Delta Consultants, Inc. for this project and look forward to assisting you further on this and other projects. If you have any questions, please do not hesitate to contact us.

Sincerely,
GROUP DELTA CONSULTANTS, INC.

Curt Scheyhing

Curt Scheyhing, P.E., G.E.
Senior Engineer

Opjit S. Ghuman, P.E.
Associate

GROUP DELTA CONSULTANTS

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APPENDIX E
LADBS CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

TERRA-PETRA

Form 1 Certificate of Compliance for Methane Test Data

City of Los Angeles Methane Soil Gas Investigation

3 proposed new park facility structures

Parcel Area: 1,451,701.9 sq ft.

Effective Testing Area: 194,700 sq ft.

Los Angeles State Historic Park

1279-1501 N. North Spring St.

1279-1501 North Spring St.

Tract: Freight Depot Tract

Lot: FR-A

Block: None

Methane Zone Property

FORM 1 - CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

Part 1: Certification Sheet

Site Address: 1279-1501 N. NORTH SPRING ST. & 1279-1501 N. SPRING ST.
Legal Description: Tract: FREIGHT DEPOT TRACT Lot: Block:
Building Use: PARK FACILITIES

Name of Architect, Engineer, or Geologist: TERRA-PETRA Mailing Address: 415 W. FOOTHILL BLVD SUITE 301 CLAREMONT CA 91711 Telephone: 213 458-0494	Architect's, Engineer's or Geologist's Stamp: REGISTERED PROFESSIONAL ENGINEER JOHNNY RAY CONAWAY NO. C 19,689 exp. 9/30/09 CIVIL STATE OF CALIFORNIA
Name of Testing Laboratory: NATIONAL TESTING STANDARDS INC. City Test Lab License #: 10173 Telephone: 714 991-5520	

I hereby certify that I have tested the above site for the purpose of methane mitigation and that all procedures were conducted by a City of Los Angeles licensed testing agency in conformity with the requirements of the LADBS Information Bulletin P/BC 2002-101. Where the inspection and testing of all or part of the work above is delegated, full responsibility shall be assumed by the architect, engineer or geologist whose signature is affixed thereon.

Signed: Johnny Conaway date 3-7-11

Required Data:

- Project is in the (Methane Zone) or ~~Methane Buffer Zone~~.
- Depth of ground water observed during testing: > 20 feet below the Impervious Membrane.
- Depth of Historical High Ground Water Table Elevation*: UNK feet below the Impervious Membrane.
- Design Methane Concentration**: 0-100 parts per million in volume (ppmv).
- Design Methane Pressure***: < 2 inches of water column.
- Site Design Level: (Level I), ~~Level II, Level III, Level IV, Level V~~ with < 2 inches of water column.

De-watering:

- De-watering ~~(is)~~ (is not) required per Section 91.7104.3.7.
- Pump discharge rate ______ cubic feet per minute per reference geology or soil report: ______ dated ______.

Additional Investigation:

- Additional investigation ~~(was)~~ (was not) conducted.

Latest Grading on Site:

- Date of last grading on site (was) ~~(was not)~~ more than 30 days before Site Testing.
- See Attached explanation of the effect on soil gas survey results by grading operations.

Notes:

* Historical High Ground Water Table Elevation shall mean the highest recorded elevation of ground water table based on historical records and field investigations as determined by the engineer for the methane mitigation system.

** Design Methane Concentration shall mean the highest recorded measured methane concentration from either Shallow Soil Gas Test or any Gas Probe Set on the site.

*** Design Methane Pressure shall mean the highest total pressure measured from any Gas Probe Set on the site.

FORM 1 (CONTINUED) - CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

Part 2: Test Data - Shallow Soil Gas Test and Gas Probe Test

Site Address: 1279-1501 N. NORTH SPRING ST. & 1279-1501 N. SPRING ST.

Description of Gas Analysis Instrument(s): INFRA-RED

Instrument Name and Model: CES LANDTEC GEM 2000 Instrument Accuracy: ± 1,000 ppmv.

City of Los Angeles Testing License #: 10224

Date	Time	Probe Set #	Concentration (ppmv)	Pressure (inches water column)	Probe Depth (feet)	Description / Probe Location
2-22-11	1200	SP-1	ND*	0.02	5.0	AREA-1 SEE
		SP-2		0.00	5.0	ATTACHED SITE
		SP-3		0.00	5.0	PLANS
		SP-4		0.00	5.0	
		SP-5		0.01	5.0	
		SP-6		0.01	5.0	
		SP-7		0.02	5.0	
		DP-1		0.00	5.0	
		" "		0.01	10.0	
		" "		0.02	20.0	
		DP-2		0.01	5.0	
		" "		0.01	10.0	
		" "		0.02	20.0	
		DP-3		0.01	5.0	
		" "		0.02	10.0	
		" "		0.01	20.0	
		DP-4		0.01	5.0	
		" "		0.00	10.0	
↓	↓	" "	↓	0.00	20.0	↓
2-23-11	1100	DP-1	ND	0.01	5.0	AREA-1
		" "		0.01	10.0	
↓	↓	" "	↓	0.00	20.0	↓

ND* = NON DETECTABLE

FORM 1 (CONTINUED) - CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

Part 2: Test Data - Shallow Soil Gas Test and Gas Probe Test

Site Address: 1279-1501 N. NORTH SPRING ST. & 1279-1501 N. SPRING ST.
Description of Gas Analysis Instrument(s): INFRA-RED
Instrument Name and Model: CES LANDTEC GEM 2000 Instrument Accuracy: ± 1000 ppmv.
City of Los Angeles Testing License #: 10224

Date	Time	Probe Set #	Concentration (ppmv)	Pressure (inches water column)	Probe Depth (feet)	Description / Probe Location
2-23-11	1100	DP-2	*ND	0.00	5.0	AREA 1
↓	↓	" "	↓	0.01	10.0	↓
↓	↓	" "	↓	0.02	20.0	↓
↓	↓	DP-3	↓	0.00	5.0	↓
↓	↓	" "	↓	0.00	10.0	↓
↓	↓	" "	↓	0.00	20.0	↓ **
↓	↓	DP-4	↓	0.00	5.0	↓
↓	↓	" "	↓	0.00	10.0	↓
↓	↓	" "	↓	0.01	20.0	↓ **
2-22-11	1200	SP-1	*ND	0.00	5.0	AREA-2
↓	↓	SP-2	↓	0.00	5.0	↓
↓	↓	SP-3	↓	0.01	5.0	↓
↓	↓	SP-4	↓	0.00	5.0	↓
↓	↓	SP-5	↓	0.00	5.0	↓
↓	↓	SP-6	↓	0.01	5.0	↓
↓	↓	SP-7	↓	0.01	5.0	↓
↓	↓	SP-8	↓	0.00	5.0	↓
↓	↓	DP-1	↓	0.02	5.0	↓
↓	↓	" "	↓	0.01	10.0	↓
↓	↓	" "	↓	0.00	20.0	↓
↓	↓	DP-2	↓	0.01	5.0	↓
↓	↓	" "	↓	0.02	10.0	↓
↓	↓	" "	↓	0.02	20.0	↓

* ND = NON DETECTABLE

** = SEE ATTACHED REPORT NO. 30473-1

FORM 1 (CONTINUED) - CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

Part 2: Test Data - Shallow Soil Gas Test and Gas Probe Test

Site Address: 1279-1501 N. NORTH SPRING ST. & 1279-1501 N. SPRING ST.

Description of Gas Analysis Instrument(s): INFRA-RED

Instrument Name and Model: CES LANDTEC GEM 2000 Instrument Accuracy: ± 1,000 ppmv.

City of Los Angeles Testing License #: 10224

Date	Time	Probe Set #	Concentration (ppmv)	Pressure (inches water column)	Probe Depth (feet)	Description / Probe Location
2-22-11	1200	DP-3	* ND	0.00	5.0	AREA-2
↓	↓	" "	↓	0.01	10.0	
↓	↓	" "	↓	0.00	20.0	
2-23-11	1100	DP-1	*ND	0.00	5.0	
		" "		0.00	10.0	
		" "		0.01	20.0	
		DP-2		0.01	5.0	
		" "		0.01	10.0	
		" "		0.00	20.0	
		DP-3		0.00	5.0	
		" "		0.01	10.0	
		" "		0.00	20.0	**
		DP-4		0.00	5.0	
		" "		0.02	10.0	
		" "	↓	0.00	20.0	
2-24-11	0900	DP-4	ND*	0.01	5.0	
↓	↓	" "	↓	0.01	10.0	
↓	↓	" "	↓	0.01	20.0	↓
2-23-11	1100	SP-1	ND*	0.00	5.0	AREA-3
↓	↓	SP-2		0.00	5.0	
↓	↓	SP-3		0.01	5.0	
↓	↓	SP-4		0.01	5.0	
↓	↓	SP-5		0.00	5.0	
↓	↓	SP-6	↓	0.01	5.0	↓

*ND = NON DETECTABLE

** = SEE ATTACHED REPORT NO. 30473-1

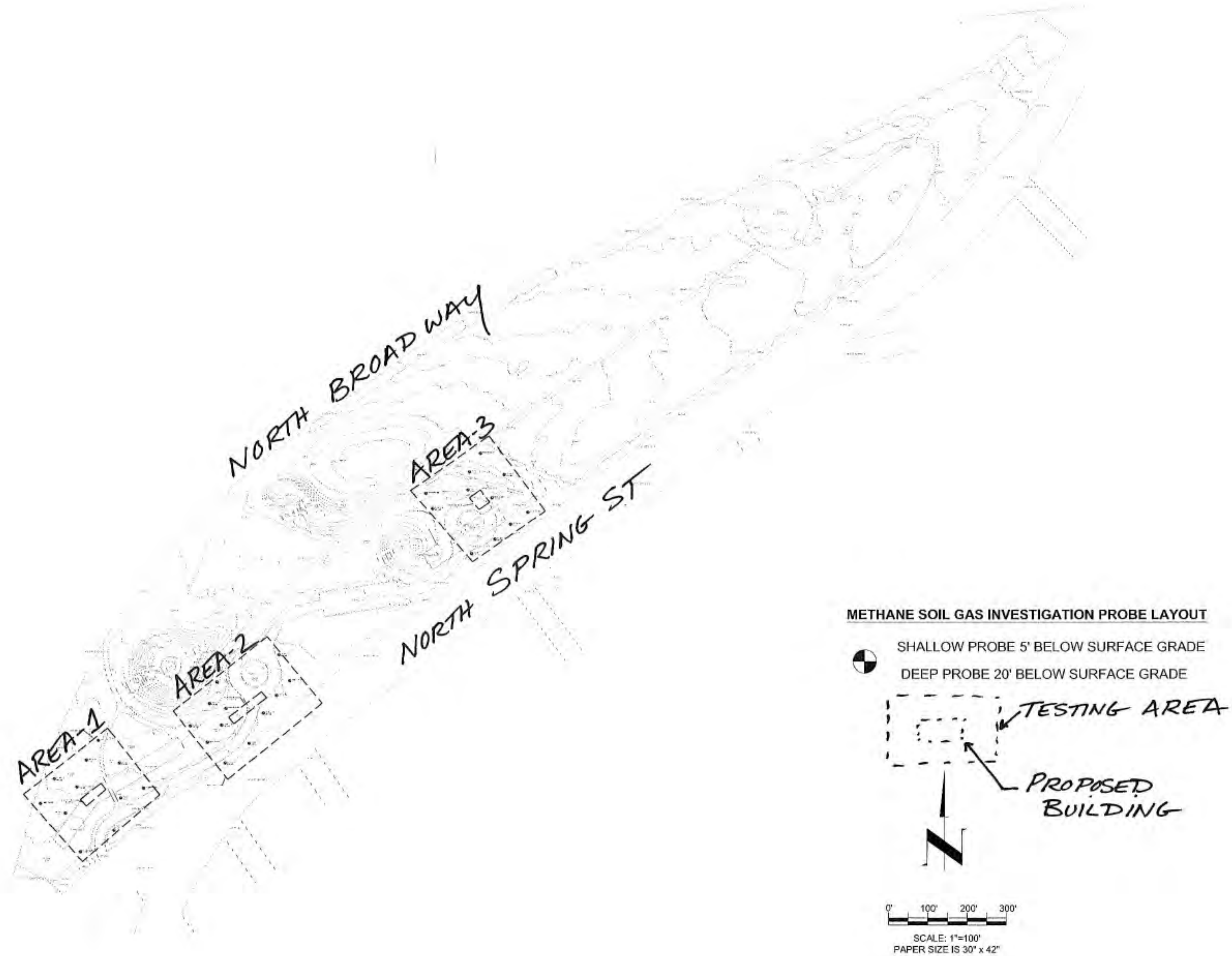
FORM 1 (CONTINUED) - CERTIFICATE OF COMPLIANCE FOR METHANE TEST DATA

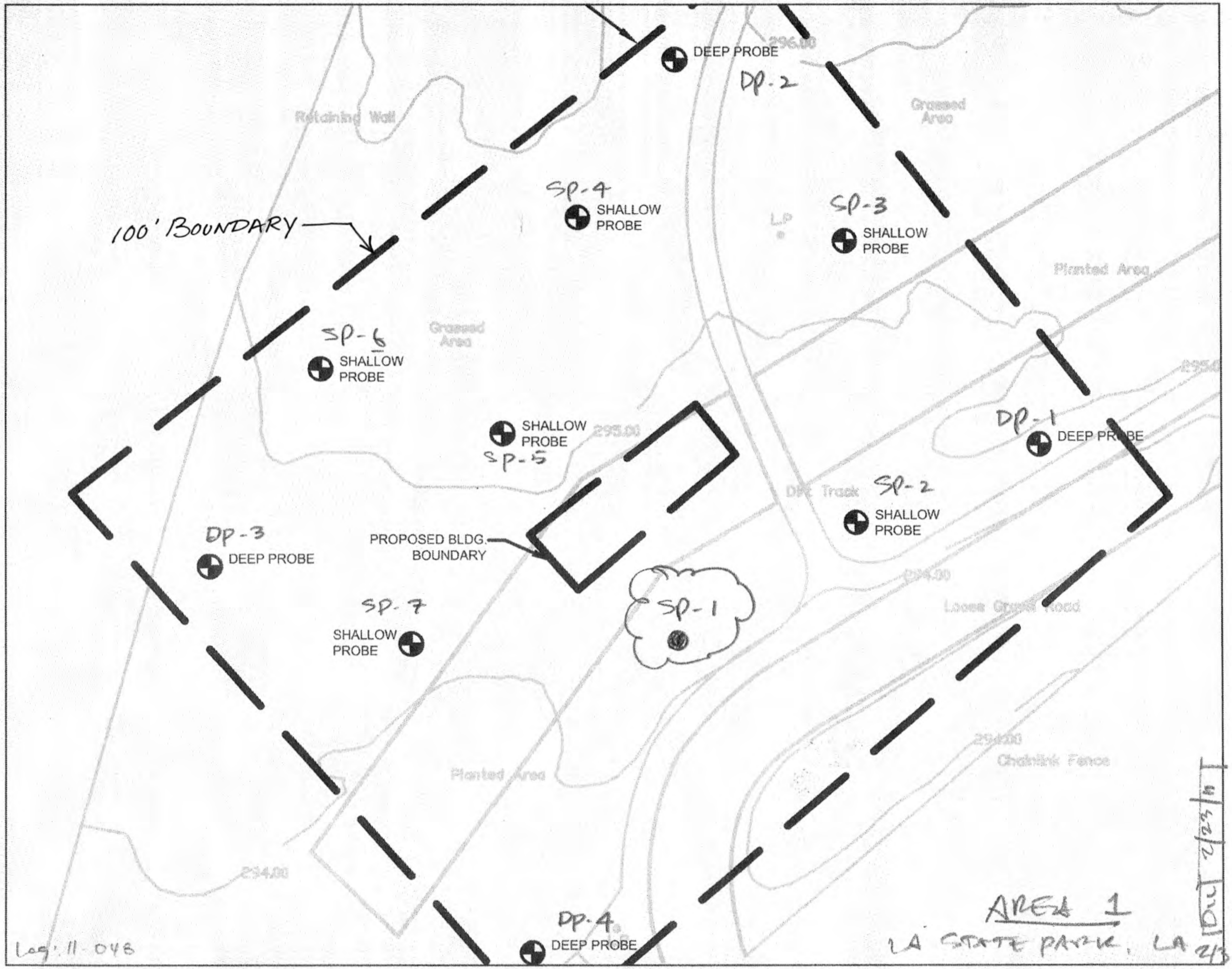
Part 2: Test Data - Shallow Soil Gas Test and Gas Probe Test

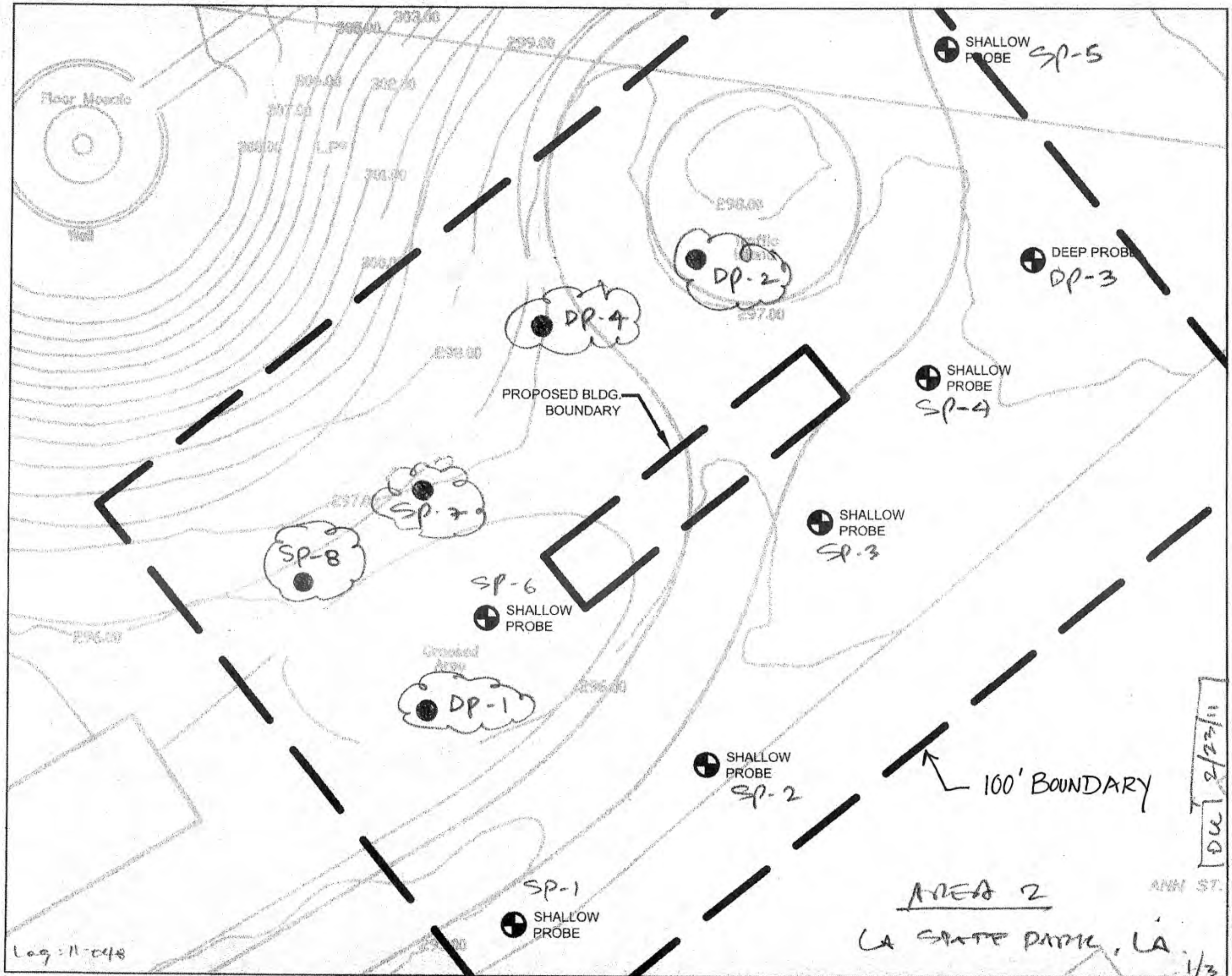
Site Address: 1279-1501 N. NORTH SPRING ST. & 1279-1501 N. SPRING ST
Description of Gas Analysis Instrument(s): INFRA-RED
Instrument Name and Model: CES LANDTEC GEM 2000 Instrument Accuracy: ± 1000 ppmv.
City of Los Angeles Testing License #: 10224

Date	Time	Probe Set #	Concentration (ppmv)	Pressure (inches water column)	Probe Depth (feet)	Description / Probe Location
2-23-11	1100	SP-7	*ND	0.00	5.0	AREA-3
		DP-1		0.01	5.0	
		" "		0.00	10.0	
		" "		0.00	20.0	
		DP-2		0.00	5.0	
		" "		0.01	10.0	
		" "		0.00	20.0	
		DP-3		0.00	5.0	
		" "		0.00	10.0	
		" "		0.02	20.0	
		DP-4		0.00	5.0	
		" "		0.02	10.0	
↓	↓	" "	↓	0.01	20.0	
2-24-11	0900	DP-1	*ND	0.00	5.0	
		" "		0.00	10.0	
		" "		0.01	20.0	**
		DP-2		0.00	5.0	
		" "		0.00	10.0	
		" "		0.00	20.0	**
		DP-3		0.00	5.0	
		" "		0.00	10.0	
		" "		0.00	20.0	
		DP-4		0.01	5.0	
		" "		0.00	10.0	
↓	↓	" "	↓	0.00	20.0	↓

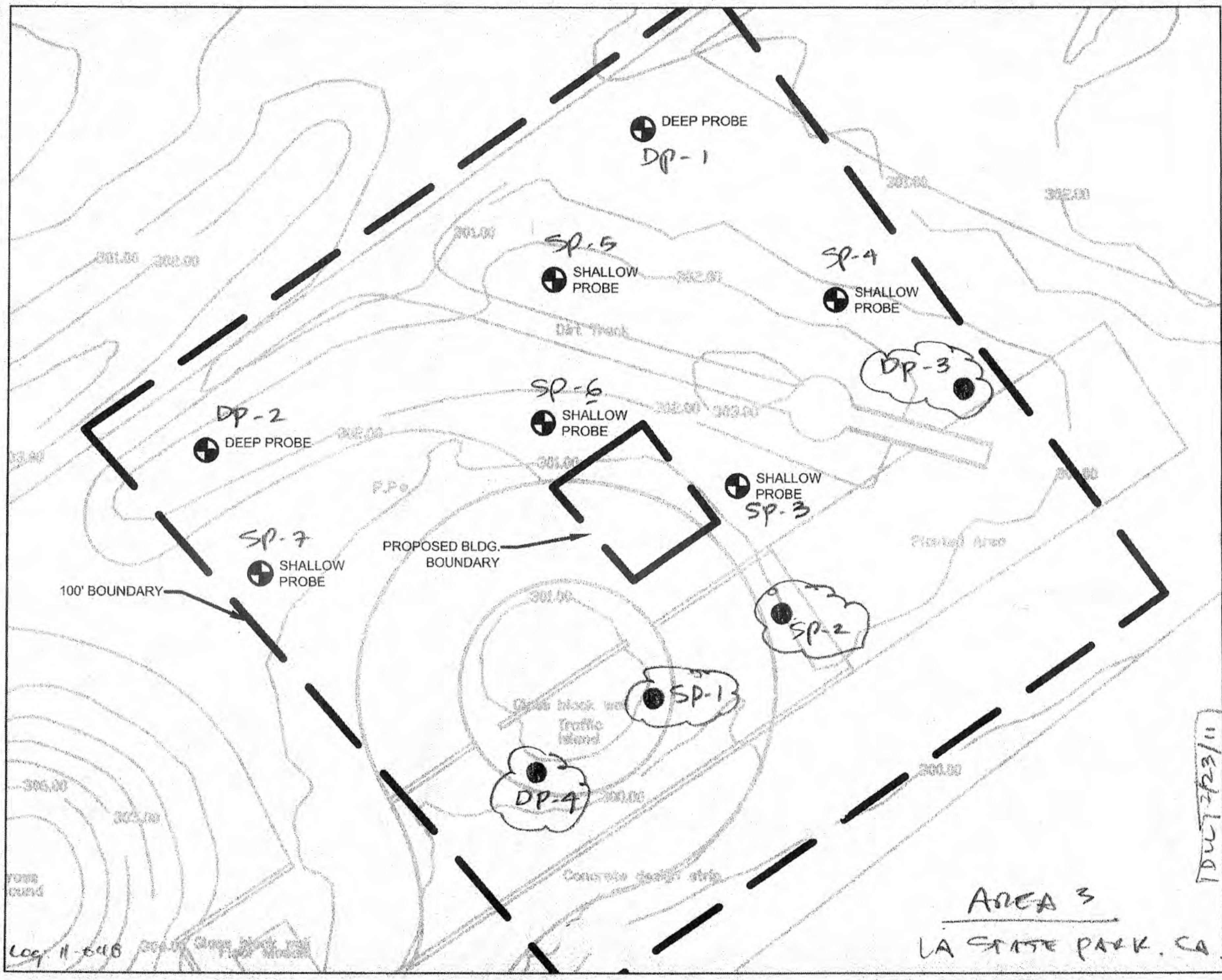
* ND = NON DETECTABLE
** = SEE ATTACHED REPORT NO. 30473-2


NORTH BROADWAY
NORTH SPRING ST
AREA-1
AREA-2
AREA-3
METHANE SOIL GAS INVESTIGATION PROBE LAYOUT
SHALLOW PROBE 5' BELOW SURFACE GRADE
DEEP PROBE 20' BELOW SURFACE GRADE
TESTING AREA
PROPOSED BUILDING
N
0' 100' 200' 300'
SCALE: 1"=100'
PAPER SIZE IS 30" x 42"


DEEP PROBE
DP-2
296.00
Retaining Wall
Grassed Area
SP-4
SHALLOW PROBE
SP-3
SHALLOW PROBE
LP
100' BOUNDARY
Planted Area
SP-6
SHALLOW PROBE
Grassed Area
295.00
DP-1
DEEP PROBE
SHALLOW PROBE
295.00
SP-5
Dirt Track
SP-2
SHALLOW PROBE
DP-3
DEEP PROBE
PROPOSED BLDG. BOUNDARY
294.00
Loose Gravel Road
SP-7
SHALLOW PROBE
SP-1
294.00
Chainlink Fence
Planted Area
294.00
DP-4
DEEP PROBE
AREA 1
LA STATE PARK, LA
Log. 11-048



Floor Mosaic
SHALLOW PROBE SP-5
DEEP PROBE DP-3
DP-2
DP-4
SHALLOW PROBE SP-4
PROPOSED BLDG. BOUNDARY
SP-7
SP-8
SHALLOW PROBE SP-3
SP-6 SHALLOW PROBE
DP-1
SHALLOW PROBE SP-2
100' BOUNDARY
SP-1 SHALLOW PROBE
AREA 2
LA STATE PARK, LA.
1/3
DW 2/23/11
Log: 11-048


DEEP PROBE
DP-1
SP-5
SHALLOW PROBE
SP-4
SHALLOW PROBE
Dirt Track
DP-3
SP-6
SHALLOW PROBE
DP-2
DEEP PROBE
SHALLOW PROBE
SP-3
SP-7
SHALLOW PROBE
PROPOSED BLDG. BOUNDARY
100' BOUNDARY
SP-2
SP-1
Traffic Island
DP-4
Concrete design strip
AREA 3
LA STATE PARK. CA
Log 11-648
3/3

NATIONAL TESTING STANDARDS INC.
RESEARCH AND TESTING LABORATORIES

Report No. 30473-1

March 4, 2011

Client: Terra-Petra, Inc.
415 W. Foothill Blvd., Suite 301
Claremont, CA 91711-2777

Reference: Justin Conaway
Purchase Order No. Verbal

Subject: Methane Gas Concentration Analysis.

Sample Description:

Three clear plastic bladders were submitted by the Client and identified as air samples dated February 23, 2011 from Cornfield, L.A., CA.

The individual bladders were further identified as listed in the "Results" section of this report.

Request:

Determine the concentration of methane gas in the air samples contained in each of the submitted bladders.

Method:

An aliquot of air from each of the submitted air samples was individually analyzed for methane content in accordance with the procedures set forth in method 18 appendix A part 60 volume 40 of Code of Federal Regulations.

Results:

Sample	Time	Methane Concentration (Vppm)
Area 1 DP-3, 20'	0830	N/D*
Area 1 DP-4, 20'	0905	N/D
Area 2 DP-3, 20'	0920	N/D

*N/D = none detected

NATIONAL TESTING STANDARDS

Lewis F. West

by Lewis F. West

Report No. 30473-2

March 4, 2011

Client: Terra-Petra, Inc.
415 W. Foothill Blvd., Suite 301
Claremont, CA 91711-2777

Reference: Justin Conaway
Purchase Order No. Verbal

Subject: Methane Gas Concentration Analysis.

Sample Description:

Three clear plastic bladders were submitted by the Client and identified as air samples dated February 24, 2011 from Cornfield, L.A., CA.

The individual bladders were further identified as listed in the "Results" section of this report.

One of the submitted bladders lost all of it's contents prior to testing and is noted below.

Request:

Determine the concentration of methane gas in the air samples contained in each of the submitted bladders.

Method:

An aliquot of air from each of the submitted air samples was individually analyzed for methane content in accordance with the procedures set forth in method 18 appendix A part 60 volume 40 of Code of Federal Regulations.

Results:

Sample	Time	Methane Concentration (Vppm)
Area 2 DP-4, 20'	0905	bag leaked, not tested
Area 3 DP-1, 20'	0935	N/D*
Area 3 DP-2, 20'	0920	N/D

*N/D = none detected

NATIONAL TESTING STANDARDS

Lewis F. West

by Lewis F. West

Table 1A - MITIGATION REQUIREMENTS FOR METHANE ZONE (See notes)

1279-1501 N. NORTH SPRING ST.
1279-1501 NORTH SPRING ST.

System	Subsystem	Component	Level I ≤ 2"	Level I > 2"	Level II ≤ 2"	Level II > 2"	Level III ≤ 2"	Level III > 2"	Level IV ≤ 2"	Level IV > 2"	Level V All Pressure
Site Design Level			Level I		Level II		Level III		Level IV		Level V
Design Methane Concentration (ppmv)			0 - 100		101 - 1,000		1,001 - 5,000		5,001 - 12,500		> 12,500
Design Methane Pressure (See note 1) (inches of water column)			≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	≤ 2"	> 2"	All Pressure
PASSIVE SYSTEM		De-watering System	X	X	X	X	X	X	X	X	X
PASSIVE SYSTEM	Sub-Slab Vent System	Perforated Horizontal Pipes	X	X	X	X	X	X	X	X	X
PASSIVE SYSTEM	Sub-Slab Vent System	Gravel Blanket Thickness Under Impervious Membrane	2"	2"	2"	3"	2"	3"	2"	4"	4"
PASSIVE SYSTEM	Sub-Slab Vent System	Gravel Thickness Surrounding Perforated Horizontal Pipes	2"	2"	2"	3"	2"	3"	2"	4"	4"
PASSIVE SYSTEM	Sub-Slab Vent System	Vent Risers	X	X	X	X	X	X	X	X	X
PASSIVE SYSTEM		Impervious Membrane	X	X	X	X	X	X	X	X	X
ACTIVE SYSTEM	Sub-Slab System	Mechanical Extraction System (See note 2)								X	X
ACTIVE SYSTEM	Lowest Occupied Space System	Gas Detection System (See note 3)		X		X	X	X	X	X	X
ACTIVE SYSTEM	Lowest Occupied Space System	Mechanical Ventilation (See notes 3, 4, 5)		X		X	X	X	X	X	X
ACTIVE SYSTEM	Lowest Occupied Space System	Alarm System		X		X	X	X	X	X	X
ACTIVE SYSTEM		Control Panel		X		X	X	X	X	X	X
MISC. SYSTEM		Trench Dam	X	X	X	X	X	X	X	X	X
MISC. SYSTEM		Conduit or Cable Seal Fitting	X	X	X	X	X	X	X	X	X
MISC. SYSTEM		Additional Vent Risers (See note 5)									X

NOTES FOR TABLES 1A AND 1B:

"x" = Indicates a required mitigation component

1. De-watering is not required when the maximum Historical High Ground Water Table Elevation, or projecterd post-construction ground water level, is more than 12 inches below the bottom of the Perforated Horizontal Pipes.
2. The Mechanical Extraction System shall be capabale of providing an equivalent of a complete change of air 20 minutes of the total volume of the Gravel Blanket.
3. The mechanical ventilation system shall be capable of providing an equivalent of one complete change of the lowest occupied space every 15 minutes.
4. Vent openings to comply with Item IV.B.4 on sheet 1 may be used in lieu of mechanical ventilation.
5. The total quantity of the installed Vent Risers shall be increased to twice the rate for the Passive System.