Appendix G

Geotechnical and Paleontological Resources Documentation

G-1 Preliminary Geotechnical Report

CITY OF LOS ANGELES

CALIFORNIA

ERIC GARCETTI
MAYOR

DEPARTMENT OF
BUILDING AND SAFETY
201 NORTH FIGUEROA STREET
LOS ANGELES, CA 90012

OSAMA YOUNAN, P.E.
GENERAL MANAGER
SUPERINTENDENT OF BUILDING

JOHN WEIGHT
EXECUTIVE OFFICER

SOILS REPORT APPROVAL LETTER

December 8, 2020

LOG # 115284
SOILS/GEOLOGY FILE - 2
LIQ

Harvard-Westlake School
3700 Coldwater Canyon Avenue
Studio City, CA 91604

TRACT: TR 19437
LOT: LT 1
LOCATION: 12630 W. Valley Spring Lane (a.k.a. 4141 N. Whitsett Avenue)

CURRENT REFERENCE REPORT/LETTER(S)	REPORT No.	DATE OF DOCUMENT	PREPARED BY
Soils Report	21796	06/19/2020	Geotechnologies, Inc.
Oversized Docs.	ʻʻ	ʻʻ	ʻʻ

The Grading Division of the Department of Building and Safety has reviewed the referenced report that provides recommendations for the proposed gymnasium, an underground parking garage to be overlain by athletic fields, an underground water storage tank to be overlain by tennis courts, and a swimming pool complex, as described on page 2 and shown on the Site Plan and Cross Sections A & B in the 06/19/2020 report.

26 borings, six CPT's and one test pit were performed during the current and prior investigations. The borings and CPT's extend to depths ranging from 30 to about 66 feet. The earth materials at the subsurface exploration locations consist of up to 7 feet of uncertified fill underlain by native soils and shale, siltstone, sandstone and mudstone of the Miocene Monterey formation bedrock. Bedrock was encountered at depths of about 42 to 56 feet. According to the consultants, groundwater was encountered at depths ranging from 24.5 to 49.5 feet below the surface, and historically highest groundwater level is at the ground surface. The site is roughly level.

The consultants recommend to support the proposed structures on mat foundations bearing on a blanket of properly placed fill a minimum of 3 feet thick below the bottom of the foundations. The consultants recommend for the at-grade portion of the proposed gymnasium and pool structure, that the soils located within the building area be removed and recompacted to a minimum depth of 15 feet below the existing grade to reduce the anticipated settlement (see pg. 14 in the 06/19/2020 report).

According to the consultants, the basement walls and mat foundations shall be designed for the effects of hydrostatic pressure and uplift, respectively, based on the historically highest groundwater level, which is at the ground surface (pg. 15 in the 06/19/2020 report).

The site is located in a designated liquefaction hazard zone as shown on the Seismic Hazard Zones map issued by the State of California. The Liquefaction study included as a part of the 06/19/2020 report demonstrates that the site soils are subject to liquefaction. The earthquake induced total and differential settlements are calculated to be 2.77 and 1.39 inches, respectively. To mitigate the earthquake induced settlements it is proposed to use a mat foundation and remove and recompact the existing upper soils, as described on page 14 of the 06/19/2020 report. The requirements of the 2020 City of Los Angeles Building Code have been satisfied.

The referenced report is acceptable, provided the following conditions are complied with during site development:

(Note: Numbers in parenthesis ( ) refer to applicable sections of the 2020 City of LA Building Code. P/BC numbers refer the applicable Information Bulletin. Information Bulletins can be accessed on the internet at LADBS.ORG.)

1. In the event additional uplift capacities for the mat foundations are needed to resist buoyancy pressures, then updated recommendations shall be provided to the Department for review, that may include conventional drilled piles. Pressure grouted anchors that are recommended on page 26 of the 06/19/2020 report are <u>not approved</u> in this letter.

2. This letter does not approve the use of lime for reducing moisture as discussed on page 23 of the 06/19/2020 report.

3. The soils located within the building area for the at-grade portion of the proposed gymnasium and pool structure shall be removed and recompacted to a minimum depth of 15 feet below the existing grade, as recommended (pg. 14 of the 06/19/2020 report).

4. The entire site shall be made to conform to the provisions of Chapter 70 and Chapter 18 of the Code (7005.9).

5. In the event tie-back anchors are utilized for shoring purposes, then provide a notarized letter from all adjoining property owners allowing tie-back anchors on their property (7006.6).

6. The soils engineer shall review and approve the detailed plans prior to issuance of any permit. This approval shall be by signature on the plans that clearly indicates the soils engineer has reviewed the plans prepared by the design engineer; and, that the plans included the recommendations contained in their reports (7006.1).

7. All recommendations of the report that are in addition to or more restrictive than the conditions contained herein shall be incorporated into the plans.

8. A copy of the subject and appropriate referenced reports and this approval letter shall be attached to the District Office and field set of plans (7006.1). Submit one copy of the above reports to the Building Department Plan Checker prior to issuance of the permit.

9. A grading permit shall be obtained for all structural fill and retaining wall backfill (106.1.2).

10. All man-made fill shall be compacted to a minimum 90 percent of the maximum dry density of the fill material per the latest version of ASTM D 1557. Where cohesionless soil having less than 15 percent finer than 0.005 millimeters is used for fill, it shall be compacted to a minimum of 95 percent relative compaction based on maximum dry density. Placement of gravel in lieu of compacted fill is only allowed if complying with LAMC Section 91.7011.3.

11. If import soils are used, no footings shall be poured until the soils engineer has submitted a compaction report containing in-place shear test data and settlement data to the Grading Division of the Department; and, obtained approval (7008.2).

12. Compacted fill shall extend beyond the footings a minimum distance equal to the depth of the fill below the bottom of footings or a minimum of three feet, whichever is greater (7011.3).

13. Existing uncertified fill shall not be used for support of footings, concrete slabs or new fill (1809.2, 7011.3).

14. Drainage in conformance with the provisions of the Code shall be maintained during and subsequent to construction (7013.12).

15. Grading shall be scheduled for completion prior to the start of the rainy season, or detailed temporary erosion control plans shall be filed in a manner satisfactory to the Grading Division of the Department and the Department of Public Works, Bureau of Engineering, B-Permit Section, for any grading work in excess of 200 cubic yards (7007.1).

    6262 Van Nuys Blvd. Ste 351, Van Nuys (818) 374-4605

16. The applicant is advised that the approval of this report does not waive the requirements for excavations contained in the General Safety Orders of the California Department of Industrial Relations (3301.1).

17. Temporary excavations that remove lateral support to the public way, adjacent property, or adjacent structures shall be supported by shoring, as recommended. Note: Lateral support shall be considered to be removed when the excavation extends below a plane projected downward at an angle of 45 degrees from the bottom of a footing of an existing structure, from the edge of the public way or an adjacent property. (3307.3.1)

18. Where any excavation, not addressed in the approved reports, would remove lateral support (as defined in 3307.3.1) from a public way, adjacent property or structures, a supplemental report shall be submitted to the Grading Division of the Department containing recommendations for shoring, underpinning, and sequence of construction. Shoring recommendations shall include the maximum allowable lateral deflection of shoring system to prevent damage to adjacent structures, properties and/or public ways. Report shall include a plot plan and cross-section(s) showing the construction type, number of stories, and location of adjacent structures, and analysis incorporating all surcharge loads that demonstrate an acceptable factor of safety against failure. (7006.2 & 3307.3.2)

19. Prior to the issuance of any permit that authorizes an excavation where the excavation is to be of a greater depth than are the walls or foundation of any adjoining building or structure and located closer to the property line than the depth of the excavation, the owner of the subject site shall provide the Department with evidence that the adjacent property owner has been given a 30-day written notice of such intent to make an excavation (3307.1).

20. The soils engineer shall review and approve the shoring plans prior to issuance of the permit (3307.3.2).

21. Prior to the issuance of the permits, the soils engineer and/or the structural designer shall evaluate the surcharge loads used in the report calculations for the design of the retaining walls and shoring. If the surcharge loads used in the calculations do not conform to the actual surcharge loads, the soil engineer shall submit a supplementary report with revised recommendations to the Department for approval.

22. Unsurcharged temporary excavation may be cut vertical up to 5 feet, as recommended. Excavations over 5 feet to a maximum depth of 35 feet shall be trimmed back at a uniform gradient not exceeding 1:1, from top to bottom of excavation, as recommended.

23. Shoring shall be designed for the lateral earth pressures specified in the section titled "Lateral Pressures" starting on page 39 of the 06/19/2020 report; all surcharge loads shall be included into the design. Total lateral load on shoring piles shall be determined by multiplying the recommended EFP by the pile spacing.

24. Shoring shall be designed for a maximum lateral deflection of 1 inch, provided there are no structures within a 1:1 plane projected up from the base of the excavation. Where a structure is within a 1:1 plane projected up from the base of the excavation, shoring shall be designed for a maximum lateral deflection of ½ inch, or to a lower deflection determined by the consultant that does not present any potential hazard to the adjacent structure.

25. A shoring monitoring program shall be implemented to the satisfaction of the soils engineer.

26. In the event shoring soldier beams/piles are installed using vibrating/driving equipment in the vicinity of existing structures, the following conditions shall be complied with:

    a. Ground vibrations shall be monitored during pile shoring installation adjacent to the pile driving operation.

    b. Peak particle velocities (PPV) shall be within the shaded area on the graph presented on page 38 of the 06/19/2020 report, and shall not exceed ½ inch/second. In the event any PPV is measured outside the shaded area on the graph or higher than ½ inch/second, pile driving shall be stopped and the installation procedure shall be modified to reduce the values to be within the acceptable range.

    c. A settlement monitoring program shall be implemented until completion of pile installation.

    d. In the event any PPV is measured above the specified threshold (½ inch/second) or any settlement is measured/detected, pile driving shall be stopped and corrective actions shall be submitted to the Department for review before resuming pile driving.

27. In the event predrilling is needed for shoring pile installation:

    a. The diameter of the predrilled holes shall not exceed 75 percent of the depth of the web of the I-beam.

    b. The depth of the predrilled holes shall not exceed the planned excavation depth.

    c. The auger shall be backspun out of the pilot holes, leaving the soils in place.

28. All foundations shall derive entire support from a blanket of properly placed fill a minimum of 3 feet thick, as recommended and approved by the soils engineer by inspection.

29. Footings for miscellaneous small outlying structures, such as property line walls and trash enclosures, not to be tied-in to the proposed building, shall derive entire support from native undisturbed soils or properly placed fill soils, as recommended on pages 26 and 27 of the 06/16/2020 report.

30. This letter approves exclusively the option in which the structure is designed to withstand hydrostatic pressures, as a measure to control groundwater under permanent conditions.

31. The structures shall be supported on a mat foundation designed to resist uplift hydrostatic pressures that would develop due to the historic high groundwater level conditions, which is at the ground surface, as recommended on page 15 of the 06/19/2020 report. The below grade building walls

shall be designed to resist the hydrostatic pressure that would develop if the groundwater level rose to the ground surface, as recommended on page 15 of the 06/19/2020 report.

32. The building design shall incorporate provisions for total anticipated differential settlements of 1.64 inches, which include 0.25 and 1.39 inches for static and seismic-induced loads, respectively. (1808.2)

33. Special provisions such as flexible or swing joints shall be made for buried utilities and drain lines to allow for differential vertical displacement.

34. Slabs placed on approved compacted fill shall be at least 3½ inches thick and shall be reinforced with ½-inch diameter (#4) reinforcing bars spaced a maximum of 16 inches on center each way.

35. Concrete floor slabs placed on expansive soil shall be placed on a 4-inch fill of coarse aggregate or on a moisture barrier membrane.

36. The seismic design shall be based on a Site Class D, as recommended. All other seismic design parameters shall be reviewed by LADBS building plan check. According to ASCE 7-16 Section 11.4.8, the long period coefficient (Fv) may be selected per Table 11.4-2 in ASCE 7-16, provided that the value of the Seismic Response Coefficient (Cs) is determined by Equation 12.8-2 for values of the fundamental period of the building (T) less than or equal to 1.5Ts, and taken as 1.5 times the value computed in accordance with either Equation 12.8-3 for T greater than 1.5Ts and less than or equal to TL or Equation 12.8-4 for T greater than TL. Alternatively, a supplemental report containing a site-specific ground motion hazard analysis in accordance with ASCE 7-16 Section 21.2 shall be submitted for review and approval.

37. Retaining walls shall be designed for the lateral earth pressures specified in the section titled "Retaining Wall Design" starting on page 28 of the 06/19/2020 report. All surcharge loads shall be included into the design.

38. Retaining walls higher than 6 feet shall be designed for lateral earth pressure due to earthquake motions as specified on page 30 of the 06/19/2020 report (1803.5.12).

39. Basement walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure as specified on page 30 of the 06/19/2020 report (1610.1). All surcharge loads shall be included into the design.

40. All retaining walls shall be provided with a standard surface backdrain system and all drainage shall be conducted in a non-erosive device to the street in an acceptable manner (7013.11).

41. With the exception of retaining walls designed for hydrostatic pressure, all retaining walls shall be provided with a subdrain system to prevent possible hydrostatic pressure behind the wall. Prior to issuance of any permit, the retaining wall subdrain system recommended in the soils report shall be incorporated into the foundation plan which shall be reviewed and approved by the soils engineer of record (1805.4).

42. Installation of the subdrain system shall be inspected and approved by the soils engineer of record and the City grading/building inspector (108.9).

43. Basement walls and floors shall be waterproofed/damp-proofed with an LA City approved "Below-grade" waterproofing/damp-proofing material with a research report number (104.2.6).

44. Prefabricated drainage composites (Miradrain, Geotextiles) may be only used in addition to traditionally accepted methods of draining retained earth.

45. Where the ground water table is lowered and maintained at an elevation not less than 6 inches below the bottom of the lowest floor, or where hydrostatic pressures will not occur, the floor and basement walls shall be damp-proofed. Where a hydrostatic pressure condition exists, and the design does not include a ground-water control system, basement walls and floors shall be waterproofed. (1803.5.4, 1805.1.3, 1805.2, 1805.3)

46. The pool shall be designed for expansive soil conditions in accordance with Information Bulletin P/BC 2017-014.

47. The proposed swimming pool shall be designed for a freestanding condition.

48. Pool deck drainage shall be collected and conducted to an approved location via a non-erosive device (7013.10).

49. The structure shall be connected to the public sewer system per P/BC 2020-027.

50. All roof, pad and deck drainage shall be conducted to the street in an acceptable manner in non-erosive devices or other approved location in a manner that is acceptable to the LADBS and the Department of Public Works (7013.10).

51. An on-site storm water infiltration system at the subject site shall not be implemented, as recommended.

52. All concentrated drainage shall be conducted in an approved device and disposed of in a manner approved by the LADBS (7013.10).

53. In the event dewatering is needed, the area shall be de-watered under the direction of the consultants prior to beginning the excavation below the groundwater level. Note: Permits from the State of California Regional Water Quality Control Board and Department of Public Works shall be obtained to discharge water into a storm drain.

    6262 Van Nuys Blvd. Ste 351, Van Nuys (818) 374-4605
    320 W. 4th Street, Suite 200 (213) 576-6600 (LARWQB)

54. The Upper Los Angeles River Area (ULARA) Watermaster office shall be notified whenever dewatering is proposed in the City of Los Angeles portion of the San Fernando Basin. More information can be obtained at the web site: http://ularawatermaster.com/.

55. The soils engineer shall inspect all excavations to determine that conditions anticipated in the report have been encountered and to provide recommendations for the correction of hazards found during grading (7008, 1705.6 & 1705.8).

56. Prior to pouring concrete, a representative of the consulting soils engineer shall inspect and approve the footing excavations. The representative shall post a notice on the job site for the LADBS Inspector and the Contractor stating that the work inspected meets the conditions of the report. No concrete shall be poured until the LADBS Inspector has also inspected and approved the footing excavations. A written certification to this effect shall be filed with the Grading Division of the Department upon completion of the work. (108.9 & 7008.2)

57. Prior to excavation an initial inspection shall be called with the LADBS Inspector. During the initial inspection, the sequence of construction; shoring; protection fences; and, dust and traffic control will be scheduled (108.9.1).

58. Installation of shoring shall be performed under the inspection and approval of the soils engineer and deputy grading inspector (1705.6, 1705.8).

59. The installation and testing of tie-back anchors shall comply with the recommendations included in the report or the standard sheets titled "Requirement for Tie-back Earth Anchors", whichever is more restrictive. [Research Report #23835]

60. Prior to the placing of compacted fill, a representative of the soils engineer shall inspect and approve the bottom excavations. The representative shall post a notice on the job site for the LADBS Inspector and the Contractor stating that the soil inspected meets the conditions of the report. No fill shall be placed until the LADBS Inspector has also inspected and approved the bottom excavations. A written certification to this effect shall be included in the final compaction report filed with the Grading Division of the Department. All fill shall be placed under the inspection and approval of the soils engineer. A compaction report together with the approved soil report and Department approval letter shall be submitted to the Grading Division of the Department upon completion of the compaction. In addition, an Engineer's Certificate of Compliance with the legal description as indicated in the grading permit and the permit number shall be included (7011.3).

61. No footing/slab shall be poured until the compaction report is submitted and approved by the Grading Division of the Department.

GLEN RAAD
Geotechnical Engineer I

Log No. 115284
213-482-0480

cc: Geotechnologies, Inc., Project Consultant
VN District Office

CITY OF LOS ANGELES
DEPARTMENT OF BUILDING AND SAFETY
Grading Division

District VN	Log No. 115284

APPLICATION FOR REVIEW OF TECHNICAL REPORTS

INSTRUCTIONS

A. Address all communications to the Grading Division, LADBS, 201 N. Figueroa St., 3rd Fl., Los Angeles, CA 90012
Telephone No. (213)482-0480.
B. Submit two copies (three for subdivisions) of reports, one "pdf" copy of the report on a CD-Rom or flash drive, and one copy of application with items "1" through "10" completed.
C. Check should be made to the City of Los Angeles.

1. LEGAL DESCRIPTION
Tract: 19437
Block: ______ Lots: 1

2. PROJECT ADDRESS: 12630 W. Valley Spring Ln.
(aka 4141 Whitsett Avenue, Studio City)

3. OWNER: Harvard Westlake School
Address: 3700 Coldwater Canyon Avenue
City: Studio City, Ca Zip: 91604
Phone (Daytime):

4. APPLICANT Geotechnologies, Inc.
Address: 439 Western Avenue
City: Glendale, CA Zip: 91201
Phone (Daytime): (818) 240-9600
E-mail address: aalcocer@geoteq.com

5. Report(s) Prepared by: Geotechnologies, Inc. (21796)

6. Report Date(s): 07/02/2019 Revised 06/19/20

7. Status of project: ☑ Proposed ☐ Under Construction ☐ Storm Damage

8. Previous site reports? ☐ YES if yes, give date(s) of report(s) and name of company who prepared report(s)

9. Previous Department actions? ☐ YES if yes, provide dates and attach a copy to expedite processing.
Dates:

10. Applicant Signature: [signature] Position: Engineer

(DEPARTMENT USE ONLY)

REVIEW REQUESTED	FEES	REVIEW REQUESTED	FEES
☒ Soils Engineering	363.00	No. of Lots	
☐ Geology		No. of Acres	
☐ Combined Soils Engr. & Geol.		☐ Division of Land	
☐ Supplemental		Other	
☐ Combined Supplemental		☒ Expedite	181.50
☐ Import-Export Route		☐ Response to Correction	
Cubic Yards:		☐ Expedite ONLY	
		Sub-total	544.50
		One-Stop Surcharge	129.80
		TOTAL FEE	674.30

Fee Due: 674.30
Fee Verified By: ATM Date: 11/13/2020
(Cashier Use Only)

Los Angeles Department of Building and Safety
Metro 4th Floor 11/16/2020 2:31:23 PM
User ID: athomas
Receipt Ref Nbr: 2020321001-101
Transaction ID: 2020321001-101-1
GRADING REPORT $363.00
SYSTEMS DEV SURCH $32.67
GEN PLAN MAINT SURCH $38.12
DEV SERV CENTER SURCH $16.34
CITY PLAN SURCH $32.67
PLAN APPROVAL FEE $181.50
MISC OTHER $10.00
Amount Paid: $674.30
PCIS Number: N/A
Job Address: 4141 WHITSETT AVE
Owners Name: HARVARD WESTLAKE SCHOOL
Grading Section Log Number: 115284

ACTION BY:

THE REPORT IS: ☐ NOT APPROVED

☐ APPROVED WITH CONDITIONS ☐ BELOW ☐ ATTACHED

For Geology ______ Date ______

For Soils ______ Date ______

Geotechnologies, Inc.
Consulting Geotechnical Engineers

439 Western Avenue
Glendale, California 91201-2837
818.240.9600 • Fax 818.240.9675

July 2, 2019
Revised June 19, 2020
File Number 21796

Harvard-Westlake School
3700 Coldwater Canyon Avenue
Studio City, California 91604

Attention: David Weil

Subject: Geotechnical Engineering Investigation
Proposed Academic and Athletic Development
4141 Whitsett Avenue, Studio City, California

Dear Mr. Weil:

This letter transmits the Geotechnical Engineering Investigation for the subject site prepared by Geotechnologies, Inc. This report provides geotechnical recommendations for the development of the site, including earthwork, seismic design, retaining walls, excavations, shoring and foundation design. Engineering for the proposed project should not begin until approval of the geotechnical investigation is granted by the local building official. Significant changes in the geotechnical recommendations may result due to the building department review process.

The validity of the recommendations presented herein is dependent upon review of the geotechnical aspects of the project during construction by this firm. The subsurface conditions described herein have been projected from limited subsurface exploration and laboratory testing. The exploration and testing presented in this report should in no way be construed to reflect any variations which may occur between the exploration locations or which may result from changes in subsurface conditions.

Should you have any questions please contact this office.

Respectfully submitted,
GEOTECHNOLOGIES, INC.

REGISTERED PROFESSIONAL ENGINEER
GREGORIO VARELA
No. 81201
Exp. 9/30/21
CIVIL
STATE OF CALIFORNIA

GREGORIO VARELA
R.C.E. 81201

GV:km

Distribution: (3) Addressee

Email to: [DWeil@hw.com]

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GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED ACADEMIC AND ATHLETIC DEVELOPMENT
4141 WHITSETT AVENUE
STUDIO CITY, CALIFORNIA

INTRODUCTION

This report presents the results of the geotechnical engineering investigation performed on the subject site. The purpose of this investigation was to identify the distribution and engineering properties of the earth materials underlying the site, and to provide geotechnical recommendations for the design of the proposed development.

This investigation included excavation of five exploratory borings and four Cone Penetration Test soundings (CPT's), collection of representative samples, laboratory testing, engineering analysis, review of published geologic data, review of available geotechnical engineering information and the preparation of this report. The exploratory excavation locations are shown on the enclosed Site Plan. The results of the exploration and the laboratory testing are presented in the Appendix of this report.

This office had previously performed geotechnical investigations at the subject site, as part of previously proposed developments. A total of twenty two exploratory excavations were performed in 2000, 2007 and 2016, as part of these previous investigations. Information obtained from these previous exploratory excavations has been considered in the preparation of this report. The location of these previous exploratory excavations is shown in the enclosed Site Plan; logs of the previous excavations may be found in the Appendix of this report.

PROPOSED DEVELOPMENT

Information concerning the proposed development was furnished by the client. In addition, the Entitlement Application Project Design Package, dated March 5, 2019, was reviewed for the preparation of this investigation.

The proposed development consists of the construction of a gymnasium, an underground parking garage to be overlain by athletic fields, an underground water storage tank to be overlain by tennis courts, and a swimming pool complex. In addition to the proposed structures, miscellaneous spectator bleachers, walkways and athletic fields, are also being proposed.

The majority of the proposed gymnasium structure will be built over a subterranean basement, while the rest of this structure will be built at-grade. The finished floor elevation of the proposed basement will be elevation 609 feet. Similarly, the finished floor elevation of the subterranean parking garage will also be elevation 609 feet. The bottom of the proposed underground water storage tank is expected to extend to elevation 610 feet. The bottom of the proposed pool is expected to extend to elevation 614 feet. The enclosed Site Plan and Cross Section A-A' and B-B' show the anticipated location, alignment, and depth of the proposed development.

It is anticipated that grading will consist of excavations to depths ranging between 15 and 22 feet for construction of the proposed subterranean basement and parking level, underground water storage tank, foundation elements, and for the recommended removal and recompaction.

Any changes in the design of the project or location of any structure, as outlined in this report, should be reviewed by this office. The recommendations contained in this report should not be considered valid until reviewed and modified or reaffirmed, in writing, subsequent to such review.

SITE CONDITIONS

The subject site consists of the Weddington Golf and Tennis complex, located at 4141 Whitsett Avenue, in the Studio City area of the City of Los Angeles, California. The subject site is bounded by Valley Spring Lane to the north, Whitsett Avenue to the east, and the Los Angeles River flood control channel to the south and west. The subject site is shown relative to nearby topographic features in the enclosed Vicinity Map.

The majority of the subject site is roughly level, with a total relief of approximately 6 feet. South of the site, a 10 to 15 foot high, 2:1 slope descends towards the Los Angeles River channel. There is an existing level area approximately 25 feet wide adjacent to the vertical channel walls. The site's topography is illustrated in the enclosed Cross Sections.

Vegetation on the site consists of grasses, shrubs and trees in landscaped areas. Drainage is by sheetflow along the existing contours generally southward, or towards area drains.

GEOTECHNICAL EXPLORATION

FIELD EXPLORATION

The site was explored on May 8 and 9, and June 3, 2019 by excavating five exploratory borings and performing four Cone Penetration Test sounding (CPT). The borings were excavated to depths ranging between 55 and 65 feet below grade with the aid of a drilling machine using 8-inch diameter hollowstem augers. The CPT's were conducted to depths between 56.76 and 64.94 feet below grade. The borings and CPT's locations are shown on the enclosed Site Plan, and interpretation of the geologic materials encountered is provided in the enclosed Boring Logs, A-Plates, and CPT Data Logs in the Appendix. For continuity purposes, the borings were labeled Borings B7 through B11.

This firm had previously conducted three geotechnical explorations at the site, on March 30 and 31, 2000, on June 4, 6, and 12, 2007 (our File No. 20255), and on September 29 and 30, 2016 (our File No. 21311). A total of Twenty one exploratory borings, one test pit, and two CPT's were excavated as part of the previous explorations. The borings varied in depth from 30 to 65 feet below the existing site grade, and the test pit was excavated to a depth of 6 feet. The CPT's were conducted to a depth of 57.41 and 50.20 feet below grade. These previous excavation locations are also shown in the enclosed Site Plan. The logs of these previous excavations are also included in the Appendix for reference.

The location of exploratory excavations was determined from hardscape features shown on the attached Site Plan. The location of the exploratory excavations should be considered accurate only to the degree implied by the method used.

GEOLOGIC MATERIALS

Fill Material

Fill materials were encountered during exploration to depths between zero and 7 feet below the existing ground surface. The fill consists of sandy silt, silty sand, sandy clay and clayey sand, which range from light brown to dark brown in color, and are slightly moist to moist, medium dense to dense, and fine to coarse grained.

Native Soils

The native soils underlying the site consist of silty sand, clayey silt, silty clay, clayey sand, sandy silt and sand, which range from light brown to grey to dark brown, and are slightly moist to wet, medium to very dense, or medium firm to stiff, and fine to coarse grained. The native earth materials consist of alluvial sediments deposited by river and stream action typical to this area of the San Fernando Valley.

Bedrock

Bedrock was encountered below the native soils in some of the exploratory borings, at depths ranging from approximately 42½ to 56½ feet below the existing site grade. The bedrock consists of shale, siltstone, sandstone and mudstone of the Miocene Monterey formation. The bedrock is light brown to gray to grayish-green to black, moist to very moist, and moderately hard to very hard. More detailed profiles of the earth materials may be obtained from the individual boring logs.

Groundwater

Groundwater was encountered during exploration, to depths ranging between 24½ and 49½ feet below grade. The historically highest groundwater level for the site was established by review of California Geological Survey Seismic Hazard Zone Report of the Van Nuys Quadrangle, Plate 1.2 entitled "Historically Highest Ground Water Contours" (2005). Review of this plate indicates that the historically highest groundwater level at the site is at the ground surface. A copy of this plate has been enclosed herein.

Fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time of the measurements reported herein. Fluctuations also may occur across the site. High groundwater levels can result in changed conditions.

Caving

Caving could not be directly observed during excavation of the borings due to the type of excavation equipment utilized. Caving was not experienced during excavation of the test pit. Based on the experience of this firm, large diameter excavations below the groundwater table may experience caving.

SEISMIC EVALUATION

REGIONAL GEOLOGIC SETTING

The subject property is located in the Transverse Ranges Geomorphic Province. The Transverse Ranges are characterized by roughly east-west trending mountains and the northern and southern boundaries are formed by reverse fault scarps. The convergent deformational features of the Transverse Ranges are a result of north-south shortening due to plate tectonics. This has resulted in local folding and uplift of the mountains along with the propagation of thrust faults (including blind thrusts). The intervening valleys have been filled with sediments derived from the bordering mountains.

REGIONAL FAULTING

Based on criteria established by the California Division of Mines and Geology (CDMG) now called California Geologic Survey (CGS), Faults may be categorized as Holocene-active, Pre-Holocene faults, and Age-undetermined faults. Holocene-active faults are those which show evidence of surface displacement within the last 11,700 years. Pre-Holocene faults are those that have not moved in the past 11,700 years. Age-undetermined faults are faults where the recency of fault movement has not been determined.

Buried thrust faults are faults without a surface expression but are a significant source of seismic activity. They are typically broadly defined based on the analysis of seismic wave recordings of hundreds of small and large earthquakes in the southern California area. Due to the buried nature of these thrust faults, their existence is usually not known until they produce an earthquake. The risk for surface rupture potential of these buried thrust faults is inferred to be low (Leighton, 1990). However, the seismic risk of these buried thrusts faults in terms of recurrence and maximum potential magnitude is not well established. Therefore, the potential for surface rupture on these surface-verging splays at magnitudes higher than 6.0 cannot be precluded.

SEISMIC HAZARDS AND DESIGN CONSIDERATIONS

The primary geologic hazard at the site is moderate to strong ground motion (acceleration) caused by an earthquake on any of the local or regional faults. The potential for other earthquake-induced hazards was also evaluated including surface rupture, liquefaction, dynamic settlement, inundation and landsliding.

Surface Rupture

In 1972, the Alquist-Priolo Special Studies Zones Act (now known as the Alquist-Priolo Earthquake Fault Zoning Act) was passed into law. As revised in 2018, The Act defines "Holocene-active" Faults utilizing the same aging criteria as that used by California Geological Survey (CGS). However, established state policy has been to zone only those faults which have direct evidence of movement within the last 11,700 years. It is this recency of fault movement that the CGS considers as a characteristic for faults that have a relatively high potential for ground rupture in the future.

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

Ground rupture is defined as surface displacement which occurs along the surface trace of the causative fault during an earthquake. Based on research of available literature and results of site reconnaissance, no known Holocene-active or Pre-Holocene faults underlie the subject site. In addition, the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Based on these considerations, the potential for surface ground rupture at the subject site is considered low.

Liquefaction

Liquefaction is a phenomenon in which saturated silty to cohesionless soils below the groundwater table are subject to a temporary loss of strength due to the buildup of excess pore pressure during cyclic loading conditions such as those induced by an earthquake. Liquefaction-related effects include loss of bearing strength, amplified ground oscillations, lateral spreading, and flow failures.

Liquefaction typically occurs in areas where groundwater is less than 50 feet from the surface, and where the soils are composed of poorly consolidated, fine to medium-grained sand. In addition to the necessary soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to initiate liquefaction.

The Seismic Hazards Zone Map of the Van Nuys Quadrangle by the State of California (CDMG, 1998), indicates that the subject site is located within an area designated as “Liquefiable.” This determination is based on groundwater depth records, soil type and distance to a fault capable of producing a substantial earthquake. A copy of this map is provided in the Appendix.

Liquefaction analyses were performed utilizing Standard Penetration Test (SPT) data collected in Borings B7, B8, B9, B10 and B11, laboratory test data, and CPT’s 1 through 6. The CPT’s were performed adjacent to the borings, for the purpose of comparison and correlation of soil data.

Groundwater was encountered in the borings at depths between 24½ and 49½ feet below the ground surface. According to the Seismic Hazard Zone Report of Van Nuys 7½-Minute Quadrangle (CDMG, 2005), the historic high groundwater level for the subject site was at the surface. The enclosed liquefaction analyses take into consideration the historically highest groundwater level at the ground surface (depth = 0), as well as a current groundwater level of 24½ feet.

Section 11.8.3 of ASCE 7-16 indicates that the potential for liquefaction shall be evaluated utilizing an acceleration consistent with the MCE_G PGA. Utilizing the OSHPD seismic utility program, this corresponds to a PGA_M of 0.95g. The USGS Probabilistic Seismic Hazard Deaggregation program (USGS, 2014) indicates a PGA of 0.87g (2 percent in 50 years ground motion) and a modal magnitude of 6.9 for the site. The liquefaction potential evaluations were performed by utilizing a magnitude 6.9 earthquake, and a peak horizontal acceleration of 0.95g.

Standard Penetration Test (SPT) – Liquefaction Analysis

Site-specific liquefaction analyses were performed following the Recommended Procedures for Implementation of CDMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California (Martin and Lew, 1999). Recommendations provided in CGS Special Publication 117A were also incorporated in to the analysis (CDMG, 2008), as were recommendations from EERI Monograph (MNO-12) by (Idriss and Boulanger, 2008).

The enclosed "Liquefaction Evaluation" analyses are based on Borings B7, B8, B9, B10 and B11. Standard Penetration Test (SPT) data were collected at 5-foot intervals. Samples of the collected materials were conveyed to the laboratory for testing and analysis. The percent passing a Number 200 sieve, Atterberg Limits, and the plasticity index (PI) of representative samples of the soils encountered in the exploratory borings are presented on the enclosed E-Plates and F-Plates.

Based on CGS Special Publication 117A (CDMG, 2008) and (Bray and Sancio, 2006), the vast majority of liquefaction hazards are associated with sandy soils and silty soils of low plasticity. Furthermore, soils having a PI greater than 18 exhibit clay-like behavior, and the liquefaction potential of these soils are considered to be low. The results of Atterberg Limits testing (shown on Plate F) indicate that some of soil layers below the subject site have PI greater than 18. Therefore, these soils are not considered prone to liquefaction, and the analysis of these soil layers was turned off in the liquefaction susceptibility columns.

The liquefaction analyses indicate that factors of safety against liquefaction are below 1.3 for some of the soil layers and/or lenses encountered in borings B7, B8, B9, B10 and B11. These potentially liquefiable layers occur from 0 to 20 feet, and 27½ to 50 feet. The factor of safety against liquefaction is defined as the ratio of the cyclic stress ratio to cause liquefaction to the earthquake-induced cyclic stress ratio. Therefore, the liquefaction analyses indicate these soil layers and/or lenses may liquefy in the event of an earthquake on a local or regional fault.

The liquefaction analyses are based on SPT data and in-situ samples collected every 5 feet. Therefore, the liquefaction potential of soils between sample points is not well defined. Cone Penetration Testing (CPT) provides a continuous profiling of the underlying earth materials based on correlations between cone tip resistance and friction ratio. Liquefaction analyses based on the three CPTs are discussed in the following section.

Cone Penetration Test (CPT) – Liquefaction Analysis

CPT data were analyzed utilizing the liquefaction assessment software CLiq v.2.0.0.6.92 (Geologismiki, 2006). The analyses are based on published articles by (Robertson and Wride, 1998) and (Youd et al. 2001). The program estimates the grain characteristics directly from the CPT data and incorporates the interpreted results into an evaluation of their resistance to cyclic loading.

The liquefaction analyses of the CPTs indicate some of the soil layers and/or lenses at varying depths below the ground surface would be susceptible to liquefaction. Based on the analyses, the potentially liquefiable soils occur throughout the soil column. The shallowest potentially liquefiable soils would occur at a depth just below the ground surface, while the deepest encountered at a depth of approximately 65 feet. The potentially liquefiable layers and/or lenses are between approximately a few inches and 3 feet in thickness. It is noted the basement excavation is considered in the CPT liquefaction analyses. Therefore, shallower liquefiable layers and/or lenses may exist.

Dynamic Settlement

Liquefaction settlement analyses have been performed utilizing the results of the liquefaction analysis based on SPT blow count data and the CPT sounding. The settlement analyses take into account the grading recommendations provided in following sections.

Based on the enclosed SPT liquefaction settlement analyses, total settlement at the existing ground surface due to liquefaction could be expected to range between 1.60 and 2.77 inches. Utilizing the CPT data, total settlement at the existing ground surface due to liquefaction could be expected to range between 0.54 to 2.71 inches.

According to (Martin and Lew, 1999), the differential settlement used in foundation design should be up to two-thirds of the total settlement. However, where at least two site-specific liquefaction analyses are conducted, the City of Los Angeles permits that the differential seismically induced settlement be taken as no less than one half of the maximum total calculated settlement, or 1.39 inches. The differential settlement would be expected to occur over a distance of 30 feet.

Surface Manifestation

It has been shown in studies by O’Rourke and Pease (1997) and Youd and Garris (1995), building upon work by Ishihara (1985), that the visible effects of liquefaction on the ground surface are only manifested if the relative and absolute thicknesses of liquefiable soils to overlying non-liquefiable surface material fall within a certain range. Surface manifestations of liquefaction include phenomena such as sand boils.

The liquefaction analyses indicate relative thicknesses of liquefiable to non-liquefiable soils that are within the bounds where surface manifestations have been observed during past earthquakes. According to (Boulanger and Idriss, 2008), “damage from liquefaction is seldom, however, due to sand boils themselves, but rather due to the loss of strength and stiffness in the soils that have liquefied and the associated ground deformations that ensue.”

The potentially liquefiable soils below the site occur in layers and/or lenses that are not laterally extensive throughout the site. Provided the recommendations presented herein are implemented during design and construction of the proposed structure, the potential for surface manifestations of liquefaction affecting the proposed structure is considered to be low.

Lateral Spreading

Lateral spreading is the most pervasive type of liquefaction-induced ground failure. During lateral spread, blocks of mostly intact, surficial soil displace downslope or towards a free face along a shear zone that has formed within the liquefied sediment. According to the procedure provided by Bartlett, Hansen, and Youd, “Revised Multilinear Regression Equations for Prediction of Lateral Spread Displacement”, ASCE, Journal of Geotechnical Engineering, Vol. 128, No. 12, December 2002, when the saturated cohesionless sediments with $(N_1)_{60} > 15$, significant displacement is not likely for $M < 8$ earthquakes.

The saturated cohesionless sediments underlying the site have corrected $(N_1)_{60}$ value greater than 15. According to the USGS Probabilistic Seismic Hazard Deaggregation program (USGS, 2008), the modal predominant earthquake magnitude (M_W) for the site is 6.9. In addition, the potentially liquefiable layer consists of a stratified layer, which is not expected to be continuous throughout the site. Therefore, the potential for lateral spread is considered to be remote for the subject site.

Tsunamis, Seiches and Flooding

Tsunamis are large ocean waves generated by sudden water displacement caused by a submarine earthquake, landslide, or volcanic eruption. The site is high enough and far enough from the ocean to preclude being prone to hazards of a tsunami.

Seiches are oscillations generated in enclosed bodies of water which can be caused by ground shaking associated with an earthquake. Review of the County of Los Angeles Flood and Inundation Hazards Map, Leighton (1990), indicates the site lies within mapped inundation boundaries due to a seiche or a breached upgradient reservoir. A determination of whether a higher site elevation would remove the site from the potential inundation zones is beyond the scope of this investigation.

Landsliding

The probability of seismically-induced landslides occurring on the site is considered to be low due to the general lack of elevation difference across or adjacent to the site.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the exploration, laboratory testing, and research, it is the finding of Geotechnologies, Inc. that construction of the proposed structures is considered feasible from a geotechnical engineering standpoint provided the advice and recommendations presented herein are followed and implemented during construction.

During exploration, fill materials were observed to extend up to a depth of 7 feet. The existing fill materials are unsuitable for support of new foundations, but may be reused for the preparation of a compacted fill pad. Groundwater was observed during exploration to depths ranging between 24½ and 49½ feet below the existing grade. The historically highest groundwater level for the site is reported to be at the ground surface.

The proposed structures will be subject to static and seismically induced settlement. Based on the enclosed SPT and CPT liquefaction analyses, seismically induced settlement is anticipated from the ground surface. Removal and recompaction of the existing upper soils layer will be required to reduce the anticipated settlement to a level which will be suitable for a mat foundation system. For the at-grade portion of the proposed gymnasium, and also for the pool structure, the soils located within the building area shall be removed and recompacted to a minimum depth of 15 feet below the existing grade. In addition, the compacted fill should extend horizontally beyond the edge of the foundation for a distance of 3 feet.

For the proposed subterranean garage, the subterranean basement below the gymnasium, and for the underground stormwater retention tank, the soils located within their building area shall be removed and recompacted to a depth of 3 feet below the bottom of the foundations. For these subterranean structures, a horizontal over-excavation beyond the edge of the proposed foundations is not necessary.

If the soils removal and recompaction recommended above are performed, it is anticipated that seismically induced settlement between 0.54 and 2.77 inches could potentially occur as a result of liquefaction. Such settlements are typically most damaging when the settlements are differential in nature across the length of structures. Seismically induced differential settlement is anticipated to be on the order of up to 1.39 inches. Additionally, the structures will be subject to static settlement. The total static settlement is not expected to exceed ½-inch, while the static differential settlement is not expected to exceed ¼-inch. The static and seismically-induced settlements are additive. Based on the anticipated settlement, it is recommended that the proposed structures be supported on a mat foundation system, bearing in a newly placed compacted fill pad.

In accordance with the City of Los Angeles requirements, where elements of a proposed development extend below the historically highest groundwater level, these structural elements should either be designed to resist potential hydrostatic forces, or a permanent dewatering system should be installed so that external water pressure does not develop against the proposed retaining walls and mat footing.

At the site, the historically highest groundwater level has been determined to be at the ground surface. This firm recommends that the elements of the proposed structure which will extend below the existing ground surface, such as retaining walls and foundation systems, be designed to resist the potential hydrostatic forces. This will require that the proposed subterranean retaining walls are designed for hydrostatic pressure, and the mat foundations are designed to resist hydrostatic uplift. The hydrostatic pressure and uplift shall be based on the historically highest groundwater level, which is at the ground surface.

Foundations for small outlying structures that are not intended for human occupancy, such as privacy walls, bleachers, canopies and trash enclosures, which will not be tied-in to the proposed structures may be supported on conventional foundations bearing in native alluvial soils and/or properly placed compacted fill.

The validity of the conclusions and design recommendations presented herein is dependent upon review of the geotechnical aspects of the proposed construction by this firm. The subsurface conditions described herein have been projected from excavations on the site as indicated and should in no way be construed to reflect any variations which may occur between these excavations or which may result from changes in subsurface conditions. Any changes in the design, as outlined in this report, should be reviewed by this office. The recommendations contained herein should not be considered valid until reviewed and modified or reaffirmed subsequent to such review.

2019 CALIFORNIA BUILDING CODE SEISMIC PARAMETERS

According to Table 20.3-1 presented in ASCE 7-16, the subject site is classified as Site Class F due to the liquefiable nature of the underlying soils. For Site Class F soils, ASCE 7-16 requires that a site-specific response spectrum evaluation be conducted. However, according to Section 20.3.1 of ASCE 7-16 (site class definition for Site Class F) the following exception is provided under Site Classification F:

EXCEPTION: *For structures having fundamental periods of vibration equal to or less than 0.5 s, site-response analysis is not required to determine spectral accelerations for liquefiable soils. Rather, a site class is permitted to be determined in accordance with Section 20.3 and the corresponding values of F_a and F_v determined from Tables 11.4-1 and 11.4-2.*

The soils underlying the subject site do not fall under any other characteristics of Site Class F, but fall within the characteristics of Site Class D. In addition, it is anticipated that the proposed structures will have a fundamental period of vibration of less than 0.5 second. Therefore, the subject site may be classified as Site Class D, which corresponds to a "Stiff Soil" Profile in accordance with the ASCE 7 standard.

2019 CALIFORNIA BUILDING CODE SEISMIC PARAMETERS	
Site Class	D ***(Limited to structures with a fundamental period of vibration equal or less than 0.5 second)***
Mapped Spectral Acceleration at Short Periods (S_S)	2.059g
Site Coefficient (F_a)	1.0
Maximum Considered Earthquake Spectral Response for Short Periods (S_{MS})	2.059g
Five-Percent Damped Design Spectral Response Acceleration at Short Periods (S_{DS})	1.373g
Mapped Spectral Acceleration at One-Second Period (S_1)	0.737g
Site Coefficient (F_v)	1.7*
Maximum Considered Earthquake Spectral Response for One-Second Period (S_{M1})	1.253g*
Five-Percent Damped Design Spectral Response Acceleration for One-Second Period (S_{D1})	0.835g*

* *According to ASCE 7-16, a Long Period Site Coefficient (F_v) of 1.7 may be utilized provided that the value of the Seismic Response Coefficient (C_s) is determined by Equation 12.8-2 for values of $T \leq 1.5T_s$ and taken as equal to 1.5 times the value computed in accordance with either Equation 12.8-3 for $T_L \geq T > 1.5T_s$ or equation 12.8-4 for $T > T_L$. Alternatively, a site-specific ground motion hazard analysis may be performed in accordance with ASCE 7-16 Section 21.1 and/or a ground motion hazard analysis in accordance with ASCE 7-16 Section 21.2 to determine ground motions for any structure.*

EXPANSIVE SOILS

The onsite geologic materials are in the very low to low expansion range. The Expansion Index was found to be between 17 and 35 for representative bulk samples.

WATER-SOLUBLE SULFATES

The Portland cement portion of concrete is subject to attack when exposed to water-soluble sulfates. Usually the two most common sources of exposure are from soil and marine environments.

The sources of natural sulfate minerals in soils include the sulfates of calcium, magnesium, sodium, and potassium. When these minerals interact and dissolve in subsurface water, a sulfate concentration is created, which will react with exposed concrete. Over time sulfate attack will destroy improperly proportioned concrete well before the end of its intended service life.

The water-soluble sulfate content of the onsite geologic materials was tested by California Test 417. The water-soluble sulfate content was determined to be less than 0.1% percentage by weight for the soils tested. Based on American Concrete Institute (ACI) Standard 318-08, the sulfate exposure is considered to be negligible for geologic materials with less than 0.1% and Type I cement may be utilized for concrete foundations in contact with the site soils.

DEWATERING

Groundwater was observed during exploration to depths ranging between 24½ and 49½ feet below the existing grade. The bottom of the proposed structures, including their foundations elements, is not anticipated to extend below a depth of 19 feet below grade, with soils removals extending 3 feet below this depth. Based on this consideration, implementation of a dewatering program is not anticipated to be needed during construction.

The historically highest groundwater level for the site is reported to be at the ground surface. The City of Los Angeles, Department of Building and Safety, requires that this historically highest groundwater level be considered when designing the underground portion of the proposed structures. In lieu of installing a permanent dewatering system, this firm recommends that the subterranean elements of the proposed structure are designed for an undrained condition with full hydrostatic pressure.

METHANE ZONES

Based on review of the NavigateLA Website, developed by the City of Los Angeles, Bureau of Engineering, Department of Public Works, the subject site is not located within the limits of a City of Los Angeles Methane Zone or Methane Buffer Zone.

GRADING GUIDELINES

Site Preparation

- A thorough search should be made for possible underground utilities and/or structures. Any existing or abandoned utilities or structures located within the footprint of the proposed grading should be removed or relocated as appropriate.

- All vegetation, existing fill, and soft or disturbed geologic materials should be removed from the areas to receive controlled fill. All existing fill materials and any disturbed geologic materials resulting from grading operations shall be completely removed and properly recompacted prior to foundation excavation.

- Any vegetation or associated root system located within the footprint of the proposed structures should be removed during grading.

- Subsequent to the indicated removals, the exposed grade shall be scarified to a depth of six inches, moistened to optimum moisture content, and recompacted in excess of the minimum required comparative density.

- The excavated areas shall be observed by the geotechnical engineer prior to placing compacted fill.

Recommended Overexcavation

In order to reduce the potential seismically-induced settlement, it is recommended that the existing upper soils be removed and recompacted for support of the proposed structures. For the at-grade portion of the proposed gymnasium, and also for the pool structure, the soils located within these building areas shall be removed to a minimum depth of 15 feet below the existing grade. In addition, the removal should extend horizontally beyond the edge of the foundation, for a distance of 3 feet.

For the proposed subterranean garage, the subterranean basement below the gymnasium, and for the underground stormwater retention tank, the soils located within their building area shall be removed to a depth of 3 feet below the bottom of the foundations. A horizontal over-excavation beyond the edge of the proposed foundations is not necessary.

It is very important that the position of the proposed structures is accurately located so that the limits of the graded area are accurate and the grading operation proceeds efficiently. Since the site grading will result in a net export, it is recommended that the dryer, sandier or more granular materials be segregated and utilized for the preparation of the recommended compacted fill pad. The more clayey, wetter and/or expansive materials should be exported. It is recommended that the soils to be utilized for the preparation of a compacted fill pad are well blended to reduce their overall expansion index and moisture.

Compaction

All fill should be mechanically compacted in layers not more than 8 inches thick. The City of Los Angeles Department of Building and Safety requires a minimum comparative compaction of 95 percent of the laboratory maximum density where the soils to be utilized in the fill have less than 15 percent finer than 0.005 millimeters. Fill materials having more than 15 percent finer than 0.005 millimeters may be compacted to a minimum of 90 percent of the maximum density. Comparative compaction is defined, for purposes of these guidelines, as the ratio of the in-place density to the maximum density as determined by applicable ASTM testing.

Field observation and testing shall be performed by a representative of the geotechnical engineer during grading to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compactive effort shall be made with adjustment of the moisture content, as necessary, until a minimum of 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) compaction is obtained.

Acceptable Materials

The excavated onsite materials are considered satisfactory for reuse in the controlled fills as long as any debris and/or organic matter is removed. Any imported materials shall be observed and tested by the representative of the geotechnical engineer prior to use in fill areas. Imported materials should contain sufficient fines so as to be relatively impermeable and result in a stable subgrade when compacted. Any required import materials should consist of geologic materials with an expansion index of less than 50. The water-soluble sulfate content of the import materials should be less than 0.1% percentage by weight.

Imported materials should be free from chemical or organic substances which could affect the proposed development. A competent professional should be retained in order to test imported materials and address environmental issues and organic substances which might affect the proposed development.

Utility Trench Backfill

Utility trenches should be backfilled with controlled fill. The utility should be bedded with clean sands at least one foot over the crown. The remainder of the backfill may be onsite soil compacted to 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) of the laboratory maximum density. Utility trench backfill should be tested by representatives of this firm in accordance with the most recent revision of ASTM D-1557.

Wet Soils

At the time of exploration, the soils which will be exposed at the bottom of the excavations, and some of the soils to be used for the creation of a compacted fill pad, were well above optimum moisture content. It is anticipated that the excavated material to be placed as compacted fill, and the materials exposed at the bottom of excavated plane will require drying and aeration prior to recompaction.

Pumping (yielding or vertical deflection) of the high-moisture content soils at the bottom of the excavation planes may occur during operation of heavy equipment. Where pumping is encountered, angular minimum ¾-inch gravel should be placed and worked into the subgrade. The exact thickness of the gravel would be a trial and error procedure, and would be determined in the field. It would likely be on the order of 1 to 2 feet thick.

The gravel will help to densify the subgrade as well as function as a stabilization material upon which heavy equipment may operate. It is not recommended that rubber tire construction equipment attempt to operate directly on the pumping subgrade soils prior to placing the gravel. Direct operation of rubber tire equipment on the soft subgrade soils will likely result in excessive disturbance to the soils, which in turn will result in a delay to the construction schedule since those disturbed soils would then have to be removed and properly recompacted. Extreme care should be utilized to place gravel as the subgrade becomes exposed.

The simplest method to reduce the moisture content of the on-site soils would involve spreading out the soils in order to dry them naturally while the weather is warm and sunny. As an alternative, dry soils could be imported and used for one of two purposes. The existing saturated soils could be replaced by the dry soils, or the dry soils could be blended with the onsite soils in order to reduce the overall moisture content.

The use of lime or cement is also an acceptable method of reducing moisture content in soils. Lime or cement should be added to the soils at a minimum rate of 5 percent by weight. The lime or cement shall be thoroughly mixed and blended with the soils to be treated. A uniform distribution of the lime or cement within the treated soil is critical. If lime or cement will be utilized for the drying of soils near the subgrade of the structure, it is recommended that the entire building subgrade is treated in order to achieve a uniform and stable subgrade. This recommendation is intended to prevent the effects of possible hard versus soft areas.

The entire mixing operation should be completed within 72 hours of the initial use of lime or cement. The treated soil should be compacted to a minimum relative compaction of 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) of the laboratory maximum density for the mixed material. Final compaction should be completed within 36 hours of final mixing.

Shrinkage

Shrinkage results when a volume of soil removed at one density is compacted to a higher density. A shrinkage factor between 10 and 20 percent should be anticipated when excavating and recompacting the existing fill and underlying native geologic materials on the site to an average comparative compaction of 92 percent.

Weather Related Grading Considerations

When rain is forecast all fill that has been spread and awaits compaction shall be properly compacted prior to stopping work for the day or prior to stopping due to inclement weather. These fills, once compacted, shall have the surface sloped to drain to an area where water can be removed.

Temporary drainage devices should be installed to collect and transfer excess water to the street in non-erosive drainage devices. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope.

Work may start again, after a period of rainfall, once the site has been reviewed by a representative of this office. Any soils saturated by the rain shall be removed and aerated so that the moisture content will fall within three percent of the optimum moisture content.

Surface materials previously compacted before the rain shall be scarified, brought to the proper moisture content and recompacted prior to placing additional fill, if considered necessary by a representative of this firm.

Geotechnical Observations and Testing During Grading

Geotechnical observations and testing during grading are considered to be a continuation of the geotechnical investigation. It is critical that the geotechnical aspects of the project be reviewed by representatives of Geotechnologies, Inc. during the construction process. Compliance with the design concepts, specifications or recommendations during construction requires review by this firm during the course of construction. Any fill which is placed should be observed, tested, and verified if used for engineered purposes. Please advise this office at least twenty-four hours prior to any required site visit.

FOUNDATION DESIGN

Mat Foundation

Based on the anticipated static and seismically-induced settlement, it is the recommendation of this firm that the proposed structures are supported on a mat foundation system, bearing in a newly placed compacted fill pad.

It is anticipated that the proposed structures will have an average bearing pressure of less than 1,000 pounds per square foot. Foundation bearing pressure will vary across the mat footings, with the highest concentrated loads located at the central cores of the mat foundations.

Given the size of the proposed mat foundation, an average bearing pressure of 1,000 pounds per square foot is well below the allowable bearing pressures, with factor of safety well exceeding 3. For design purposes, an allowable bearing pressure of 2,000 pounds per square foot, with locally higher pressures up to 5,000 pounds per square foot may be utilized in the mat foundation design. The mat foundation may be designed utilizing a modulus of subgrade reaction of 250 pounds per cubic inch. This value is a unit value for use with a one-foot square footing. The modulus should be reduced in accordance with the following equation when used with larger foundations.

$$K = K_1 * [(B + 1) / (2 * B)]^2$$

where K = Reduced Subgrade Modulus
K1 = Unit Subgrade Modulus
B = Foundation Width (feet)

The bearing values indicated above are for the total of dead and frequently applied live loads, and may be increased by one third for short duration loading, which includes the effects of wind or seismic forces. Since the recommended bearing value is a net value, the weight of concrete in the foundations may be taken as 50 pounds per cubic foot and the weight of the soil backfill may be neglected when determining the downward load on the foundations.

Hydrostatic Considerations for Mat Foundations

The proposed mat foundation shall be waterproofed and designed to withstand the hydrostatic uplift pressure based on the historically highest water level, which is considered to be at the ground surface. The uplift pressure to be used in design should be 62.4(H) pounds per square foot. Since the historically highest groundwater level at the site is considered to be at the ground surface, “H” is the vertical distance between the bottom of the mat and the ground surface. The installation of uplift anchors may be necessary to provide resistance against the anticipated hydrostatic uplift pressures acting on the recommended mat foundations.

If necessary, uplift anchors may be designed to provide resistance against the anticipated hydrostatic uplift pressures acting on the recommended mat foundations. Uplift anchors should be a minimum of 12 inches in diameter, and should be embedded a minimum of 20 feet into the underlying native soils and/or bedrock. Preliminarily, it is assumed that pressure grouted anchors will be utilized. Uplift anchors may be designed using a frictional capacity of 2 kips per lineal foot.

Miscellaneous Conventional Foundations

The use of conventional foundations is limited to miscellaneous structures not intended for human occupancy, such as privacy walls, trash enclosures, canopies and bleachers, which will not be rigidly connected to the proposed structures. Miscellaneous conventional foundations may bear in properly compacted fill, or may be deepened through any existing fill to bear in undisturbed native alluvial soils. Miscellaneous continuous foundations may be designed for a bearing capacity of 1,500 pounds per square foot, and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade and 18 inches into the recommended bearing material. No bearing capacity increases are recommended.

Since the recommended bearing capacity is a net value, the weight of concrete in the foundations may be taken as 50 pounds per cubic foot and the weight of the soil backfill may be neglected when determining the downward load on the foundations.

All continuous foundations should be reinforced with a minimum of four #4 steel bars. Two should be placed near the top of the foundation, and two should be placed near the bottom.

The recommendations provided herein for these miscellaneous structures are not intended to mitigate the effects of liquefaction. The client should be aware that a liquefaction event on the subject site could result in damage to these miscellaneous structures.

Lateral Design for Mat Foundation and Miscellaneous Conventional Foundations

Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure. An allowable coefficient of friction of 0.3 may be used with the dead load forces.

Passive geologic pressure for the sides of foundations poured against undisturbed or recompacted soil may be computed as an equivalent fluid having a density of 200 pounds per cubic foot with a maximum earth pressure of 2,000 pounds per square foot.

The passive and friction components may be combined for lateral resistance without reduction. A one-third increase in the passive value may be used for short duration loading such as wind or seismic forces.

Mat Foundation Settlement

Settlement of a mat foundation is expected to occur on application of loading. The maximum settlement is expected to occur below the central portion of the mat, and would not be expected to exceed ½-inch. The settlement along the edges of the mat is expected to be on the order of ¼-inch. Therefore, the differential settlement anticipated across the mat is not expected to exceed ¼-inch.

In addition to static settlement, the maximum total seismic settlement due to a major seismic event is expected to be up to 2.77 inches, and the anticipated seismically induced differential settlement is anticipated to be up to 1.39 inches. The differential settlement would be expected to occur over a distance of 30 feet. The static and seismic settlement reported herein are additive.

RETAINING WALL DESIGN

It is anticipated that retaining walls up to 15½ feet in height may be required for the proposed subterranean parking garage, subterranean basement, swimming pool and underground stormwater storage tank. As a precautionary measure, recommendations to aid in the design of retaining walls up to a height of 17 feet are provided herein. Retaining walls may be designed as indicated below, depending on whether the walls will be restrained or cantilevered. Retaining wall foundations may be designed in accordance with the provisions of the "Foundation Design" section of this report.

The historically highest groundwater level for the site is reported to be at the ground surface. Therefore, retaining wall extending below the ground surface shall be designed for an undrained condition with full hydrostatic pressure.

Additional pressure should be added for a surcharge condition due to vehicular traffic or adjacent structures. Based on review of the enclosed Site Plan, it is not anticipated that the proposed retaining walls will be surcharged by existing structures. However, vehicular traffic is expected in the vicinity of the proposed underground parking structure. For traffic surcharge, the upper 10 feet of any retaining wall adjacent to streets, driveways or parking areas should be designed to resist a uniform lateral pressure of 100 pounds per square foot, acting as a result of an assumed 300 pounds per square foot traffic surcharge. If the traffic is more than 10 feet from the retaining walls, the traffic surcharge may be neglected.

Cantilever Retaining Walls

Cantilever retaining walls supporting a level backslope may be designed utilizing a triangular distribution of active earth pressure. In addition, cantilever retaining walls extending below the ground surface shall be designed for an undrained condition with full hydrostatic pressure. Miscellaneous cantilever retaining walls to be built above grade, such as planter walls, do not require to be designed for an undrained condition, provided that a subdrain system is installed at their base. Cantilever retaining walls may be designed utilizing the following tables:

Height of Retaining Wall	Cantilever Retaining Wall **Below** the Ground Surface **without** Wall Subdrain System Triangular Distribution of At-Rest Earth Pressure
Up to 17 feet	93 pcf (including hydrostatic pressure)

Height of Retaining Wall	Miscellaneous Cantilever Retaining Wall **Above** the Ground Surface Level **with** Wall Subdrain System Triangular Distribution of At-Rest Earth Pressure
Up to 5 feet	30 pcf

For these equivalent fluid pressures to be valid, walls which are to be restrained at the top should be backfilled prior to the upper connection being made. Additional active pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent structures.

Restrained Retaining Walls

Restrained subterranean retaining walls supporting a level back slope may be designed to resist a triangular distribution of earth pressure. It is recommended the walls be designed to resist the greater of the at-rest pressure, or the active pressure plus the seismic pressure, as discussed in the "Dynamic (Seismic) Earth Pressure" section below. Wall pressures are provided in the following table for hydrostatic design. Pressures for drained conditions are also provided for designs that incorporate a subdrain above the historic high water level.

RESTRAINED BASEMENT WALLS *(HYDROSTATIC DESIGN)*		
Height of Retaining Wall (feet)	**AT-REST EARTH PRESSURE (Pounds per Cubic Foot) Includes Hydrostatic Pressure of 62.4 pcf**	**ACTIVE EARTH PRESSURE *(To be Combined with Dynamic Seismic Earth Pressure) Includes Hydrostatic Pressure of 62.4 pcf**
Up to 17 feet	94	93

Additional active pressure should be added for a surcharge condition due to vehicular traffic, slopes, or adjacent structures.

Dynamic (Seismic) Earth Pressure

Retaining walls exceeding 6 feet in height shall be designed to resist the additional earth pressure caused by seismic ground shaking. A triangular pressure distribution should be utilized for the additional seismic loads, with an equivalent fluid pressure of 25 pounds per cubic foot. When using the load combination equations from the building code, the seismic earth pressure should be combined with the lateral active earth pressure for analyses of restrained basement walls under seismic loading condition. The dynamic earth pressure may be omitted where the retaining wall is 6 feet in height or less.

Surcharge from Adjacent Structures

The following surcharge equation provided in the LADBS Information Bulletin Document No. P/BC 2014-83, may be utilized to determine the surcharge loads on basement walls and shoring system from existing and proposed structures located within the 1:1 (h:v) surcharge influence zone of the excavation and basement.

Resultant lateral force: $R = (0.3*P*h^2)/(x^2+h^2)$

Location of lateral resultant: $d = x*[(x^2/h^2+1)*\tan^{-1}(h/x)-(x/h)]$

where:

R	=	resultant lateral force measured in pounds per foot of wall width.
P	=	resultant surcharge loads of continuous or isolated footings measured in pounds per foot of length parallel to the wall.
x	=	distance of resultant load from back face of wall measured in feet.
h	=	depth below point of application of surcharge loading to top of wall footing measured in feet.
d	=	depth of lateral resultant below point of application of surcharge loading measure in feet.
$\tan^{-1}(h/x)$	=	the angle in radians whose tangent is equal to h/x.

The structural engineer and shoring engineer may use this equation to determine the surcharge loads based on the loading of the adjacent structures located within the surcharge influence zone.

Retaining Wall Drainage

The installation of a retaining wall drainage system will only be necessary for miscellaneous cantilever retaining walls to be built above grade, such as planter walls. A drainage system is not required for retaining walls extending below grade, because they will be designed to resist hydrostatic pressure.

Retaining wall subdrains may consist of four-inch diameter perforated pipes, placed with perforations facing down. The pipe shall be encased in at least one-foot of gravel around the pipe, wrapped in filter fabric. The gravel may consist of three-quarter inch to one inch crushed rocks. As an alternative to the standard perforated subdrain pipe and gravel drainage system, the use of gravel pockets and weepholes is an acceptable drainage method. Weepholes shall be a minimum of 2 inches in diameter, placed at 8 feet on center along the base of the wall. Gravel pockets shall be a minimum of 1 cubic foot in dimension, and may consist of three-quarter inch to one inch crushed rocks, wrapped in filter fabric. A collector pipe shall be installed to direct collected waters to a suitable location.

Certain types of subdrain pipe are not acceptable to the various municipal agencies, it is recommended that prior to purchasing subdrainage pipe, the type and brand is cleared with the proper municipal agencies. Subdrainage pipes should outlet to an acceptable location. Some municipalities do not allow the use of flat-drainage products, such as Miradrain. The use of such a product should be researched with the building official. The City of Los Angeles only allows the use of flat drainage products when in conjunction with a conventional perforated subdrain pipe and gravel, or gravel pockets and weepholes.

Waterproofing

Moisture effecting retaining walls is one of the most common post construction complaints. Poorly applied or omitted waterproofing can lead to efflorescence or standing water inside the building. Efflorescence is a process in which a powdery substance is produced on the surface of the concrete by the evaporation of water. The white powder usually consists of soluble salts such as gypsum, calcite, or common salt. Efflorescence is common to retaining walls and does not affect their strength or integrity.

It is recommended that retaining walls be waterproofed. Waterproofing design and inspection of its installation is not the responsibility of the geotechnical engineer. A qualified waterproofing consultant should be retained in order to recommend a product or method which would provide protection to below grade walls.

Retaining Wall Backfill

Any required backfill should be mechanically compacted in layers not more than 8 inches thick, to at least 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) relative compaction, obtainable by the most recent revision of ASTM D 1557 method of compaction. Flooding should not be permitted. Compaction within 5 feet, measured horizontally, behind a retaining structure should be achieved by use of light weight, hand operated compaction equipment.

Proper compaction of the backfill will be necessary to reduce settlement of overlying walks and paving. Some settlement of required backfill should be anticipated, and any utilities supported therein should be designed to accept differential settlement, particularly at the points of entry to the structure.

TEMPORARY EXCAVATIONS

Excavations on the order of 15 to 22 feet in height may be anticipated for construction of the proposed subterranean retaining walls, mat foundations, and recommended grading. The excavations are expected to expose fill and dense native soils, which are suitable for vertical excavations up to 5 feet where not surcharged by adjacent traffic or structures. Vertical excavations exceeding 5 feet, or excavations which will be surcharged by adjacent traffic or structures should be shored.

Where sufficient space is available, temporary unsurcharged embankments could be cut at a uniform 1:1 (horizontal:vertical) slope gradient to a maximum depth of 25 feet. A uniform sloped excavation is sloped from bottom to top and does not have a vertical component.

Where sloped embankments are utilized, the tops of the slopes should be barricaded to prevent vehicles and storage loads near the top of slope within a horizontal distance equal to the depth of the excavation. If the temporary construction embankments are to be maintained during the rainy season, berms are strongly recommended along the tops of the slopes to prevent runoff water from entering the excavation and eroding the slope faces. Water should not be allowed to pond on top of the excavation nor to flow towards it.

Excavation Observations

It is critical that the soils exposed in the cut slopes are observed by a representative of Geotechnologies, Inc. during excavation so that modifications of the slopes can be made if variations in the geologic material conditions occur. Many building officials require that temporary excavations should be made during the continuous observations of the geotechnical engineer. All excavations should be stabilized within 30 days of initial excavation.

SHORING DESIGN

The following information on the design and installation of the shoring is as complete as possible at this time. It is suggested that a review of the final shoring plans and specifications be made by this office prior to bidding or negotiating with a shoring contractor be made.

The recommended method of shoring consists of steel soldier piles, placed in drilled holes and backfilled with concrete. As discussed below vibrating methods may also be utilized. The soldier piles may be designed as cantilevers or laterally braced utilizing drilled tie-back anchors or raker braces.

Soldier Piles – Drilled

Drilled cast-in-place soldier piles should be placed no closer than 2 diameters on center. The minimum diameter of the piles is 18 inches. Structural concrete should be used for the soldier piles below the excavation; lean-mix concrete may be employed above that level. As an alternative, lean-mix concrete may be used throughout the pile where the reinforcing consists of a wideflange section. The slurry must be of sufficient strength to impart the lateral bearing pressure developed by the wideflange section to the earth materials. For design purposes, an allowable passive value for the earth materials below the bottom plane of excavation may be assumed to be 500 pounds per square foot per foot. To develop the full lateral value, provisions should be implemented to assure firm contact between the soldier piles and the undisturbed earth materials.

The frictional resistance between the soldier piles and retained earth material may be used to resist the vertical component of the anchor load. The coefficient of friction may be taken as 0.3 based on uniform contact between the steel beam and lean-mix concrete and retained earth. The portion of soldier piles below the plane of excavation may also be employed to resist the downward loads. The downward capacity may be determined using a frictional resistance of 500 pounds per square foot. The minimum depth of embedment for shoring piles is 5 feet below the bottom of the footing excavation, or 7 feet below the bottom of excavated plane, whichever is deeper.

Groundwater was encountered during exploration at depths ranging between 24½ and 49½ feet below the existing site grade. If the piles will extend below the groundwater level, caving of the saturated earth materials below the groundwater level may occur during drilling of piles. Casing or polymer drilling fluid may be required during drilling in order to maintain open shafts. If casing is used, extreme care should be employed so that the pile is not pulled apart as the casing is withdrawn. At no time should the distance between the surface of the concrete and the bottom of the casing be less than 5 feet.

Piles placed below the water level will require the use of a tremie to place the concrete into the bottom of the hole. A tremie shall consist of a water-tight tube having a diameter of not less than 10 inches with a hopper at the top. The tube shall be equipped with a device that will close the discharge end and prevent water from entering the tube while it is being charged with concrete. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of the work to prevent water entering the tube and shall be entirely sealed at all times, except when the concrete is being placed. The tremie tube shall be kept full of concrete. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous. The tip of the tremie tube shall always be kept about five feet below the surface of the concrete and definite steps and safeguards should be taken to insure that the tip of the tremie tube is never raised above the surface of the concrete.

A special concrete mix should be used for concrete to be placed below water. The design shall provide for concrete with strength of 1,000 psi over the initial job specification. An admixture that reduces the problem of segregation of paste/aggregates and dilution of paste shall be included. The slump shall be commensurate to any research report for the admixture, provided that it shall also be the minimum for a reasonable consistency for placing when water is present.

Soldier Piles – Vibration Method of Installation

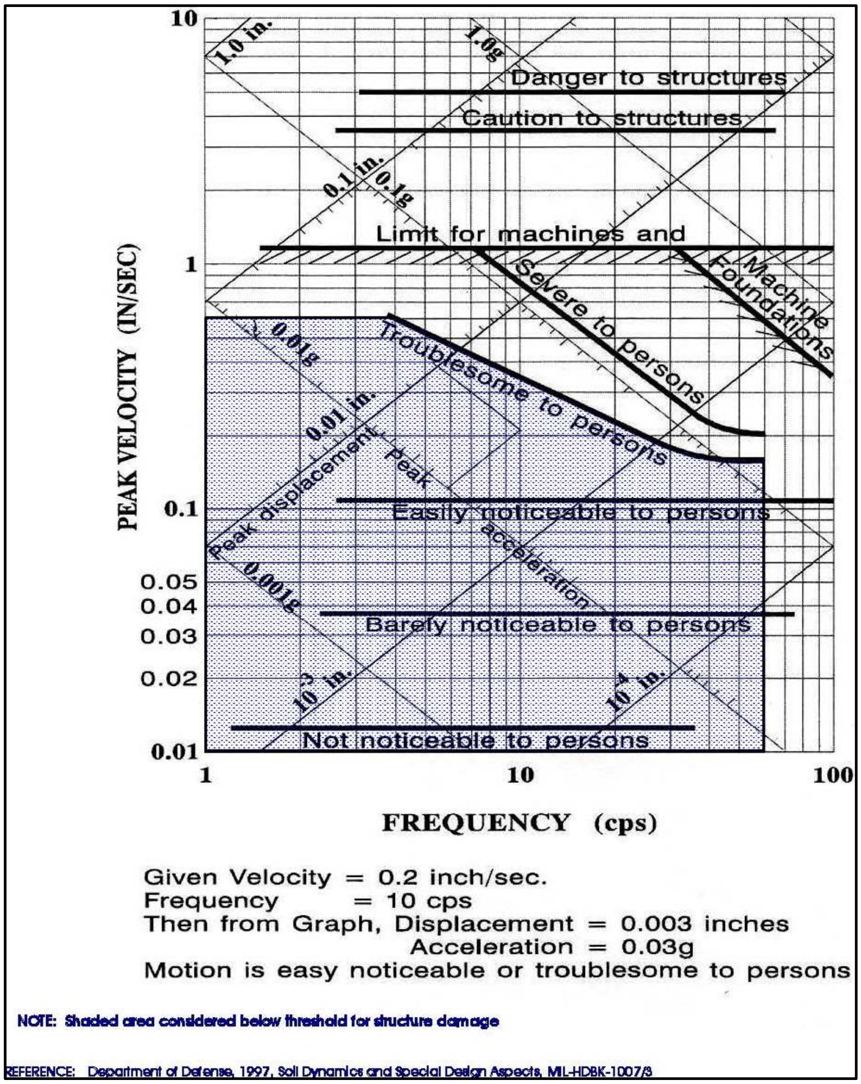
The vibration method of shoring pile installation is acceptable to this firm from a geotechnical standpoint provided the recommendations presented herein are implemented. When using the vibration method of installing the soldier beams, the minimum embedment depth shall be 10 feet below the lowest excavated plane. The available passive resistance of the pile may be determined using the diagonal length from the outer edges of opposite flange sections.

Predrilling may be utilized by the shoring contractor in order to vibrate and install the shoring beams to the design depths. However, the depth of the predrilled holes should not exceed the planned excavation depth, which for the project is expected to be a maximum of 22 feet below grade. In addition, it is recommended that the diameter of the predrilled holes does not exceed 75 percent of the depth of the web of the I-beam. When predrilling, the auger shall be backspun out of the pilot holes, leaving the soils in place. All shoring (predrilling, installation of shoring piles, and lagging) shall be performed under the continuous inspections by a deputy grading inspector of this firm.

It should be noted that Bedrock of the Monterey Formation was encountered at depths ranging between 42½ to 56½ feet below the existing grade. The shoring designer and contractor should be aware that, where the soldier beams will extend into this moderately hard to hard layer, predrilling will not be permitted at this depth. Vibrating soldier beams into the undisturbed Modelo Formation bedrock may be challenging.

The allowable level of vibration that results from the installation of the piles should not exceed a threshold where occupants of the nearby structures are disturbed, despite higher vibration tolerances that a building may endure without deformation. There is a relationship between particle velocity and vibration frequency that will occur due to the installation. A range of tolerable particle peak velocity and frequency of vibration is shown in the graph below. The shaded area on the graph is considered within acceptable limits to avoid damage to nearby structures. The acceptable limits should be measured at the neighboring structures.

The vibrations should be monitored with a seismograph during pile installation to detect the magnitude of vibration and oscillation experienced by the adjacent structure. The results should be recorded and provided to the owner. If, during installation, the vibrations exceed the range shown on the graph below, the shoring contractor should modify the installation procedure to reduce the values to the acceptable range.



Lagging

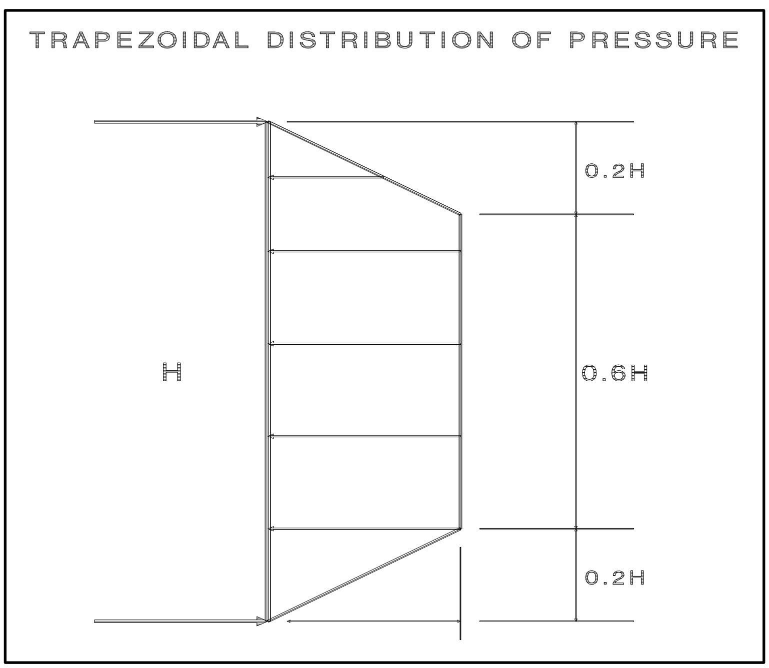
Soldier piles and anchors should be designed for the full anticipated pressures. Lagging will be required throughout the entire depth of the excavation. Due to arching in the geologic materials, the pressure on the lagging will be less. It is recommended that the lagging should be designed for the full design pressure but be limited to a maximum of 400 pounds per square foot. It is recommended that a representative of this firm observe the installation of lagging to insure uniform support of the excavated embankment.

Lateral Pressures

A triangular distribution of lateral earth pressure should be utilized for the design of cantilevered shoring system. A trapezoidal distribution of lateral earth pressure would be appropriate where shoring is to be restrained at the top by bracing or tie backs. The design of trapezoidal distribution of pressure is shown in the diagram below. Equivalent fluid pressures for the design of cantilevered and restrained shoring are presented in the following table:

Height of Shoring (feet)	Cantilever Shoring System Equivalent Fluid Pressure (pcf) Triangular Distribution of Pressure	Restrained Shoring System Lateral Earth Pressure (psf)* Trapezoidal Distribution of Pressure
Up to 20	30 pcf	19H psf
20 to 25	35 pcf	22H psf

*Where H is the height of the shoring in feet.



Where a combination of sloped embankment and shoring is utilized, the pressure will be greater and must be determined for each combination. Additional active pressures should be applied where the shoring will be surcharged by adjacent traffic or structures.

The upper ten feet of the retaining wall adjacent to streets, driveways or parking areas should be designed to resist a uniform lateral pressure of 100 pounds per square foot, acting as a result of an assumed 300 pounds per square foot surcharge behind the walls due to normal street traffic. If the traffic is kept back at least ten feet from the retaining walls, the traffic surcharge may be neglected.

Tied-Back Anchors

Tied-back anchors may be used to resist lateral loads. Friction anchors are recommended. For design purposes, it may be assumed that the active wedge adjacent to the shoring is defined by a plane drawn 35 degrees with the vertical through the bottom plane of the excavation. Friction anchors should extend a minimum of 20 feet beyond the potentially active wedge.

Drilled friction anchors may be designed for a skin friction of 350 pounds per square foot. Pressure grouted anchor may be designed for a skin friction of 2,000 pounds per square foot. Where belled anchors are utilized, the capacity of belled anchors may be designed by assuming the diameter of the bonded zone is equivalent to the diameter of the bell. Only the frictional resistance developed beyond the active wedge would be effective in resisting lateral loads.

It is recommended that at least 3 of the initial anchors have their capacities tested to 200 percent of their design capacities for a 24-hour period to verify their design capacity. The total deflection during this test should not exceed 12 inches. The anchor deflection should not exceed 0.75 inches during the 24 hour period, measured after the 200 percent load has been applied.

All anchors should be tested to at least 150 percent of design load. The total deflection during this test should not exceed 12 inches. The rate of creep under the 150 percent test load should not exceed 0.1 inch over a 15 minute period in order for the anchor to be approved for the design loading.

After a satisfactory test, each anchor should be locked-off at the design load. This should be verified by rechecking the load in the anchor. The load should be within 10 percent of the design load. Where satisfactory tests are not attained, the anchor diameter and/or length should be increased or additional anchors installed until satisfactory test results are obtained. The installation and testing of the anchors should be observed by the geotechnical engineer. Minor caving during drilling of the anchors should be anticipated.

Anchor Installation

Tied-back anchors may be installed between 20 and 45 degrees below the horizontal. Caving of the anchor shafts, particularly within sand deposits, should be anticipated and the following provisions should be implemented in order to minimize such caving. The anchor shafts should be filled with concrete by pumping from the tip out, and the concrete should extend from the tip of the anchor to the active wedge. In order to minimize the chances of caving, it is recommended that the portion of the anchor shaft within the active wedge be backfilled with sand before testing the anchor. This portion of the shaft should be filled tightly and flush with the face of the excavation. The sand backfill should be placed by pumping; the sand may contain a small amount of cement to facilitate pumping.

Deflection

It is difficult to accurately predict the amount of deflection of a shored embankment. It should be realized that some deflection will occur. It is estimated that the deflection could be on the order of one inch at the top of the shored embankment. If greater deflection occurs during construction, additional bracing may be necessary to minimize settlement of adjacent buildings and utilities in adjacent street and alleys. If desired to reduce the deflection, a greater active pressure could be used in the shoring design. Where internal bracing is used, the rakers should be tightly wedged to minimize deflection. The proper installation of the raker braces and the wedging will be critical to the performance of the shoring.

The City of Los Angeles Department of Building and Safety requires limiting shoring deflection to ½ inch at the top of the shored embankment where a structure is within a 1:1 (h:v) plane projected up from the base of the excavation. A maximum deflection of 1-inch has been allowed provided there are no structures within a 1:1 (h:v) plane drawn upward from the base of the excavation.

Monitoring

Because of the depth of the excavation, some mean of monitoring the performance of the shoring system is suggested. The monitoring should consist of periodic surveying of the lateral and vertical locations of the tops of all soldier piles and the lateral movement along the entire lengths of selected soldier piles. Also, some means of periodically checking the load on selected anchors will be necessary, where applicable. Some movement of the shored embankments should be anticipated as a result of the anticipated excavations.

Shoring Observations

It is critical that the installation of shoring is observed by a representative of Geotechnologies, Inc. Many building officials require that shoring installation should be performed during continuous observation of a representative of the geotechnical engineer. The observations insure that the recommendations of the geotechnical report are implemented and so that modifications of the recommendations can be made if variations in the geologic material or groundwater conditions warrant. The observations will allow for a report to be prepared on the installation of shoring for the use of the local building official, where necessary.

SLABS ON GRADE

Outdoor Concrete Slabs

Outdoor concrete flatwork should be a minimum of 4 inches in thickness. Outdoor concrete flatwork should be cast over undisturbed alluvial soils or properly controlled fill materials. Any geologic materials loosened or over-excavated should be removed from the site or properly compacted to 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) of the maximum dry density.

Outdoor flatwork should be reinforced with a minimum of #3 steel bars on 24-inch centers each way.

Design of Slabs That Receive Moisture-Sensitive Floor Coverings

Geotechnologies, Inc. does not practice in the field of moisture vapor transmission evaluation and mitigation. Therefore, it is recommended that a qualified consultant be engaged to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. The qualified consultant should provide recommendations for mitigation of potential adverse impacts of moisture vapor transmission on various components of the structure.

Where dampness would be objectionable, it is recommended that the floor slabs should be waterproofed. A qualified waterproofing consultant should be retained in order to recommend a product or method which would provide protection for concrete slabs-on-grade.

Concrete Crack Control

The recommendations presented in this report are intended to reduce the potential for cracking of concrete slabs-on-grade due to settlement. However, even where these recommendations have been implemented, foundations, stucco walls and concrete slabs-on-grade may display some cracking due to minor soil movement and/or concrete shrinkage. The occurrence of concrete cracking may be reduced and/or controlled by limiting the slump of the concrete used, proper concrete placement and curing, and by placement of crack control joints at reasonable intervals, in particular, where re-entrant slab corners occur.

For standard control of concrete cracking, a maximum crack control joint spacing of 12 feet should not be exceeded. Lesser spacings would provide greater crack control. Joints at curves and angle points are recommended. The crack control joints should be installed as soon as practical following concrete placement. Crack control joints should extend a minimum depth of one-fourth the slab thickness. Construction joints should be designed by a structural engineer.

Complete removal of the existing fill soils beneath outdoor flatwork such as walkways or patio areas, is not required. However, due to the rigid nature of concrete, some cracking, a shorter design life and increased maintenance costs should be anticipated. In order to provide uniform support beneath the flatwork it is recommended that a minimum of 12 inches of the exposed subgrade beneath the flatwork be scarified and recompacted to 90 percent (or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) relative compaction.

PAVEMENTS

Prior to placing paving, the existing grade should be scarified to a depth of 12 inches, moistened as required to obtain optimum moisture content, and recompacted to 90 percent(or 95 percent for cohesionless soils having less than 15 percent finer than 0.005 millimeters) of the maximum dry density as determined by the most recent revision of ASTM D 1557. The client should be aware that removal of all existing fill in the area of new paving is not required. However, by not removing and recompacting all existing fill, the pavement could potentially have a shorter design life and increased maintenance costs. The following pavement sections are recommended:

Asphalt Paving Sections:

Service	Asphalt Pavement Thickness (Inches)	Base Course (Inches)
Passenger Vehicles	3	5
Light to Medium Trucks	4	7
Heavy Trucks and Fire Trucks	6	9

Concrete Paving Sections:

Service	Concrete Pavement Thickness (Inches)	Base Course (Inches)
Passenger Vehicles and Light to Medium Trucks	6	4
Heavy Trucks and Fire Trucks	7½	6

Aggregate base should be compacted to a minimum of 95 percent of the most recent revision of ASTM D 1557 laboratory maximum dry density. Base materials should conform to Sections 200-2.2 or 200-2.4 of the “Standard Specifications for Public Works Construction”, (Green Book), latest edition.

For standard crack control maximum expansion joint spacing of 12 feet should not be exceeded. Lesser spacings would provide greater crack control. Joints at curves and angle points are recommended. Concrete paving should be reinforced with a minimum of #3 steel bars on 24-inch centers each way.

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

SITE DRAINAGE

Proper surface drainage is critical to the future performance of the project. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Proper site drainage should be maintained at all times.

All site drainage, with the exception of any required to disposed of onsite by stormwater regulations, should be collected and transferred to the street in non-erosive drainage devices. The proposed structure should be provided with roof drainage. Discharge from downspouts, roof drains and scuppers should not be permitted on unprotected soils within five feet of the building perimeter. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope. Planters which are located within a distance equal to the depth of a retaining wall should be sealed to prevent moisture adversely affecting the wall. Planters which are located within five feet of a foundation should be sealed to prevent moisture affecting the earth materials supporting the foundation.

STORMWATER DISPOSAL

Recently regulatory agencies have been requiring the disposal of a certain amount of stormwater generated on a site by infiltration into the site soils. Increasing the moisture content of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. This means that any overlying structure, including buildings, pavements and concrete flatwork, could sustain damage due to saturation of the subgrade soils. Structures serviced by subterranean levels could be adversely impacted by stormwater disposal by increasing the design fluid pressures on retaining walls and causing leaks in the walls. Proper site drainage is critical to the performance of any structure in the built environment.

Groundwater was encountered below the subject site at depths between 24½ and 49½ feet below grade. It is the opinion of this firm that this is water is perched on top of the underlying clay soils and bedrock, which are relatively impervious layers. On-site filtration of stormwater would acute the existing perched water condition. In addition, the native alluvial site soils are prone to liquefaction when saturated. Based on these considerations, it is the opinion of this firm that on-site stormwater infiltration is not feasible at the subject site.

Where infiltration of stormwater into the subgrade soils is not feasible, most Building Officials have allowed the stormwater to be filtered through soils in planter areas. Once the water has been filtered through a planter it may be released into the storm drain system. It is recommended that overflow pipes are incorporated into the design of the discharge system in the planters to prevent flooding. In addition, the planters shall be sealed and waterproofed to prevent leakage. Please be advised that adverse impact to landscaping and periodic maintenance may result due to excessive water and contaminants discharged into the planters.

It is recommended that the design team (including the structural engineer, waterproofing consultant, plumbing engineer, and landscape architect) be consulted in regards to the design and construction of filtration systems.

DESIGN REVIEW

Engineering of the proposed project should not begin until approval of the geotechnical report by the Building Official is obtained in writing. Significant changes in the geotechnical recommendations may result during the building department review process.

It is recommended that the geotechnical aspects of the project be reviewed by this firm during the design process. This review provides assistance to the design team by providing specific recommendations for particular cases, as well as review of the proposed construction to evaluate whether the intent of the recommendations presented herein are satisfied.

CONSTRUCTION MONITORING

Geotechnical observations and testing during construction are considered to be a continuation of the geotechnical investigation. It is critical that this firm review the geotechnical aspects of the project during the construction process. Compliance with the design concepts, specifications or recommendations during construction requires review by this firm during the course of construction. All foundations should be observed by a representative of this firm prior to placing concrete or steel. Any fill which is placed should be observed, tested, and verified if used for engineered purposes. Please advise Geotechnologies, Inc. at least twenty-four hours prior to any required site visit.

If conditions encountered during construction appear to differ from those disclosed herein, notify Geotechnologies, Inc. immediately so the need for modifications may be considered in a timely manner.

It is the responsibility of the contractor to ensure that all excavations and trenches are properly sloped or shored. All temporary excavations should be cut and maintained in accordance with applicable OSHA rules and regulations.

EXCAVATION CHARACTERISTICS

The exploration performed for this investigation is limited to the geotechnical excavations described. Direct exploration of the entire site would not be economically feasible. The owner, design team and contractor must understand that differing excavation and drilling conditions may be encountered based on boulders, gravel, oversize materials, groundwater and many other conditions. Fill materials, especially when they were placed without benefit of modern grading codes, regularly contain materials which could impede efficient grading and drilling. Southern California sedimentary bedrock is known to contain variable layers which reflect differences in depositional environment. Such layers may include abundant gravel, cobbles and boulders. Similarly bedrock can contain concretions. Concretions are typically lenticular and follow the bedding. They are formed by mineral deposits. Concretions can be very hard. Excavation and drilling in these areas may require full size equipment and coring capability. The contractor should be familiar with the site and the geologic materials in the vicinity.

CLOSURE AND LIMITATIONS

The purpose of this report is to aid in the design and completion of the described project. Implementation of the advice presented in this report is intended to reduce certain risks associated with construction projects. The professional opinions and geotechnical advice contained in this report are sought because of special skill in engineering and geology and were prepared in accordance with generally accepted geotechnical engineering practice. Geotechnologies, Inc. has a duty to exercise the ordinary skill and competence of members of the engineering profession. Those who hire Geotechnologies, Inc. are not justified in expecting infallibility, but can expect reasonable professional care and competence.

The scope of the geotechnical services provided did not include any environmental site assessment for the presence or absence of organic substances, hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere, or the presence of wetlands.

Proper compaction is necessary to reduce settlement of overlying improvements. Some settlement of compacted fill should be anticipated. Any utilities supported therein should be designed to accept differential settlement. Differential settlement should also be considered at the points of entry to the structure.

If corrosion sensitive improvements are planned, it is recommended that a comprehensive corrosion study should be commissioned. The study will develop recommendations to avoid premature corrosion of buried pipes and concrete structures in direct contact with the soils.

GEOTECHNICAL TESTING

Classification and Sampling

The soil is continuously logged by a representative of this firm and classified by visual examination in accordance with the Unified Soil Classification system. The field classification is verified in the laboratory, also in accordance with the Unified Soil Classification System. Laboratory classification may include visual examination, Atterberg Limit Tests and grain size distribution. The final classification is shown on the excavation logs.

Samples of the geologic materials encountered in the exploratory excavations were collected and transported to the laboratory. Undisturbed samples of soil are obtained at frequent intervals. Unless noted on the excavation logs as an SPT sample, samples acquired while utilizing a hollow-stem auger drill rig are obtained by driving a thin-walled, California Modified Sampler with successive 30-inch drops of a 140-pound hammer. The soil is retained in brass rings of 2.50 inches outside diameter and 1.00 inch in height. The central portion of the samples are stored in close fitting, waterproof containers for transportation to the laboratory. Samples noted on the excavation logs as SPT samples are obtained in accordance with the most recent revision of ASTM D 1586. Samples are retained for 30 days after the date of the geotechnical report.

Moisture and Density Relationships

The field moisture content and dry unit weight are determined for each of the undisturbed soil samples, and the moisture content is determined for SPT samples by the most recent revision of ASTM D 4959 or ASTM D 4643. This information is useful in providing a gross picture of the soil consistency between exploration locations and any local variations. The dry unit weight is determined in pounds per cubic foot and shown on the “Excavation Logs”, A-Plates. The field moisture content is determined as a percentage of the dry unit weight.

Direct Shear Testing

Shear tests are performed by the most recent revision of ASTM D 3080 with a strain controlled, direct shear machine manufactured by Soil Test, Inc. or a Direct Shear Apparatus manufactured by GeoMatic, Inc. The rate of deformation is approximately 0.025 inches per minute. Each sample is sheared under varying confining pressures in order to determine the Mohr-Coulomb shear strength parameters of the cohesion intercept and the angle of internal friction. Samples are generally tested in an artificially saturated condition. Depending upon the sample location and future site conditions, samples may be tested at field moisture content. The results are plotted on the "Shear Test Diagram," B-Plates.

The most recent revision of ASTM 3080 limits the particle size to 10 percent of the diameter of the direct shear test specimen. The sheared sample is inspected by the laboratory technician running the test. The inspection is performed by splitting the sample along the sheared plane and observing the soils exposed on both sides. Where oversize particles are observed in the shear plane, the results are discarded and the test run again with a fresh sample.

Consolidation Testing

Settlement predictions of the soil's behavior under load are made on the basis of the consolidation tests using the most recent revision of ASTM D 2435. The consolidation apparatus is designed to receive a single one-inch high ring. Loads are applied in several increments in a geometric progression, and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore fluid. Samples are generally tested at increased moisture content to determine the effects of water on the bearing soil. The normal pressure at which the water is added is noted on the drawing. Results are plotted on the "Consolidation Test," C-Plates.

Expansion Index Testing

The expansion tests performed on the remolded samples are in accordance with the Expansion Index testing procedures, as described in the most recent revision of ASTM D 4829. The soil sample is compacted into a metal ring at a saturation degree of 50 percent. The ring sample is then placed in a consolidometer, under a vertical confining pressure of 1 lbf/square inch and inundated with distilled water. The deformation of the specimen is recorded for a period of 24 hour or until the rate of deformation becomes less than 0.0002 inches/hour, whichever occurs first. The expansion index, EI, is determined by dividing the difference between final and initial height of the ring sample by the initial height, and multiplied by 1,000. Results are presented on Plate D of this report.

Laboratory Compaction Characteristics

The maximum dry unit weight and optimum moisture content of a soil are determined by use of the most recent revision of ASTM D 1557. A soil at a selected moisture content is placed in five layers into a mold of given dimensions, with each layer compacted by 25 blows of a 10 pound hammer dropped from a distance of 18 inches subjecting the soil to a total compactive effort of about 56,000 pounds per cubic foot. The resulting dry unit weight is determined. The procedure is repeated for a sufficient number of moisture contents to establish a relationship between the dry unit weight and the water content of the soil. The data when plotted represent a curvilinear relationship known as the compaction curve. The values of optimum moisture content and modified maximum dry unit weight are determined from the compaction curve. Results are presented on Plate D of this report.

Grain Size Distribution

These tests cover the quantitative determination of the distribution of particle sizes in soils. Sieve analysis is used to determine the grain size distribution of the soil larger than the Number 200 sieve. The most recent revision of ASTM D 422 is used to determine particle sizes smaller than the Number 200 sieve. A hydrometer is used to determine the distribution of particle sizes by a sedimentation process. The grain size distributions are plotted on the E-Plates presented in the Appendix of this report.

Atterberg Limits

Depending on their moisture content, cohesive soils can be solid, plastic, or liquid. The water contents corresponding to the transitions from solid to plastic or plastic to liquid are known as the Atterberg Limits. The transitions are called the plastic limit and liquid limit. The difference between the liquid and plastic limits is known as the plasticity index. ASTM D 4318 is utilized to determine the Atterberg Limits. The results are shown on the enclosed F-Plates.

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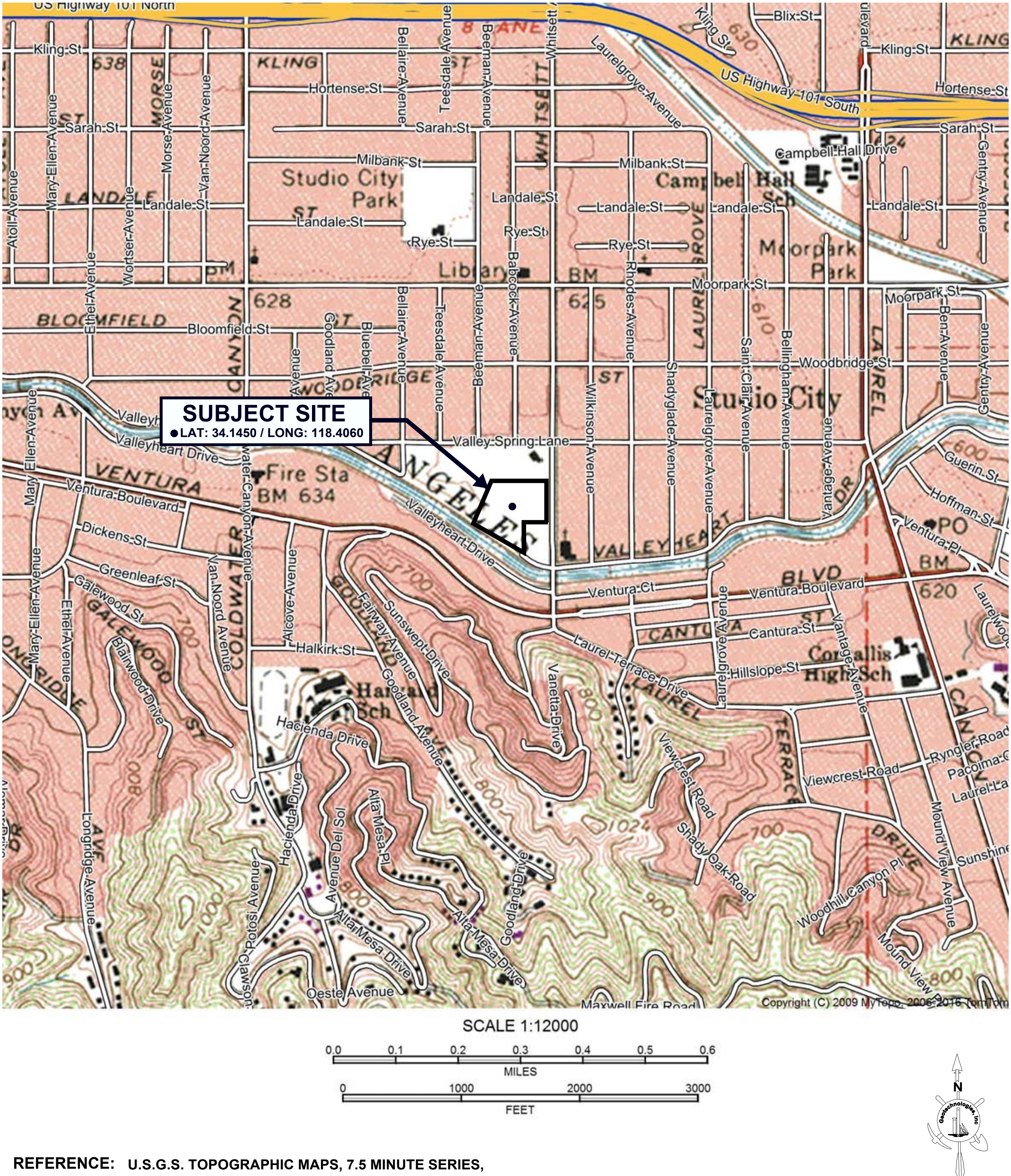


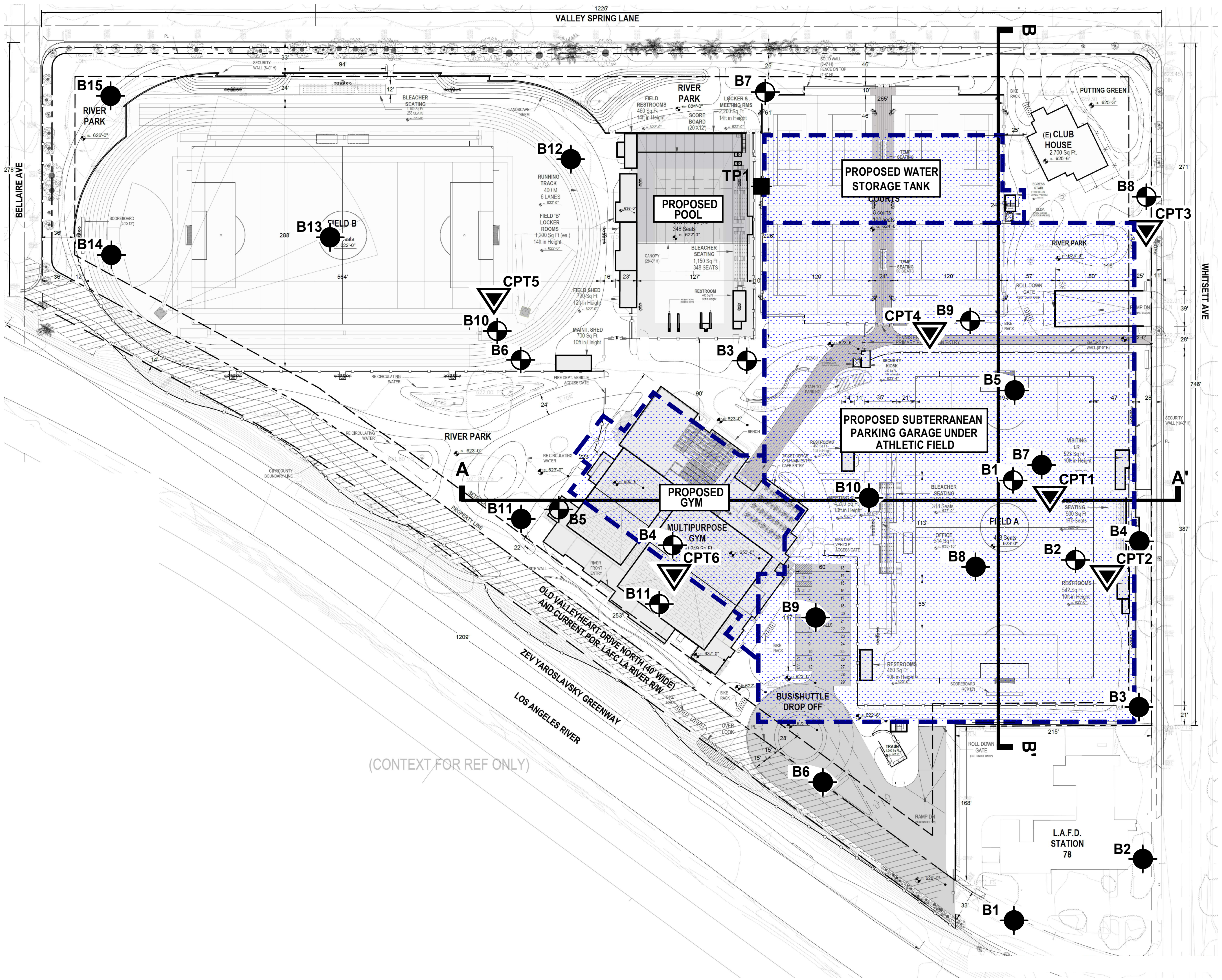
REFERENCE: U.S.G.S. TOPOGRAPHIC MAPS, 7.5 MINUTE SERIES, VAN NUYS, CA QUADRANGLE

VICINITY MAP

Geotechnologies, Inc.
Consulting Geotechnical Engineers

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796



LEGEND

B7-11 LOCATION & NUMBER OF BORINGS (THIS INVESTIGATION)

B1-6 LOCATION & NUMBER OF BORINGS (PREVIOUS INVESTIGATION, FILE NO. 21311)

CPT2 LOCATION & NUMBER OF CONE PENETROMETER TEST (FILE NO. 21311)

B-15 LOCATION AND NUMBER OF BORING (PREVIOUS INVESTIGATION, FILE NO. 20255)

TP1 LOCATION AND NUMBER OF TEST PIT (PREVIOUS INVESTIGATION, FILE NO. 20255)

B B' LOCATION OF CROSS SECTION

ANTICIPATED LIMITS OF PROPOSED SUBTERRANEAN STRUCTURE

REFERENCE: SITE PLAN BY GENSLER NOT DATED

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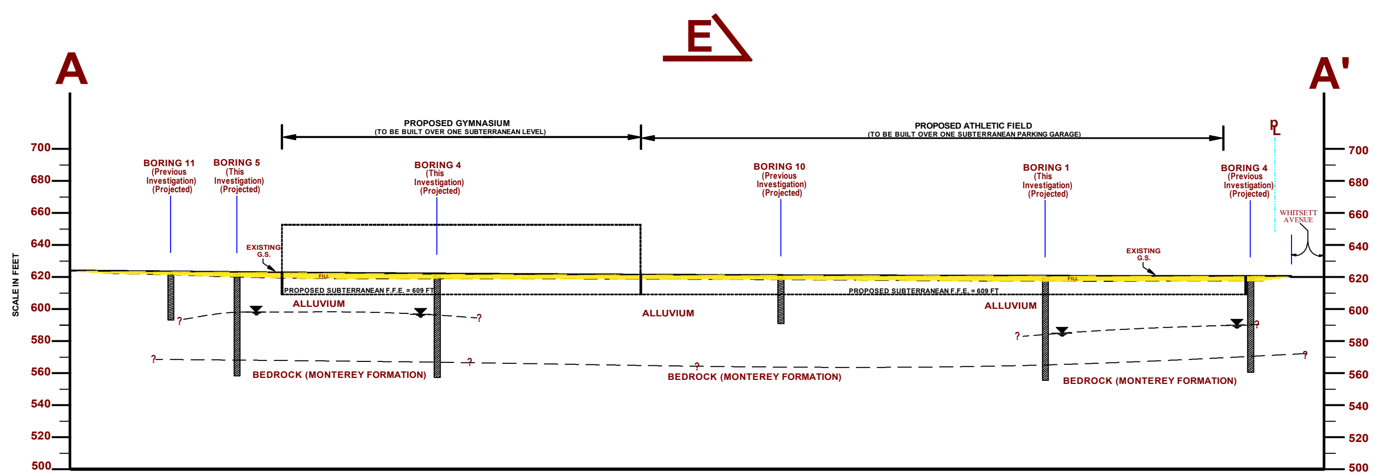
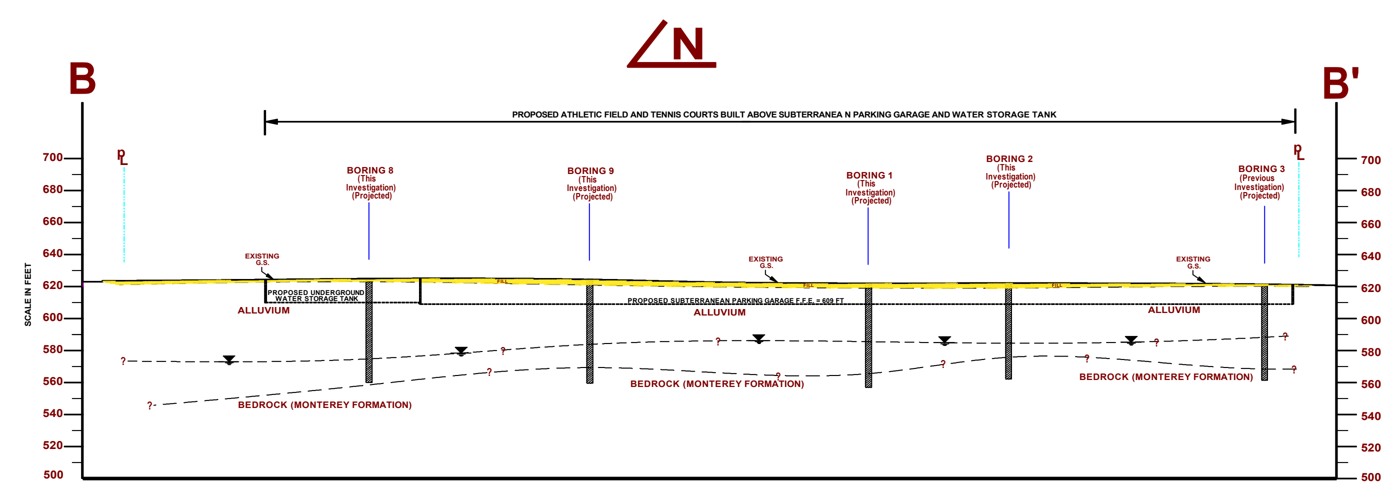
SITE PLAN

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVENUE, STUDIO CITY

File No.: 21796

Date: April 2020





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CROSS SECTIONS

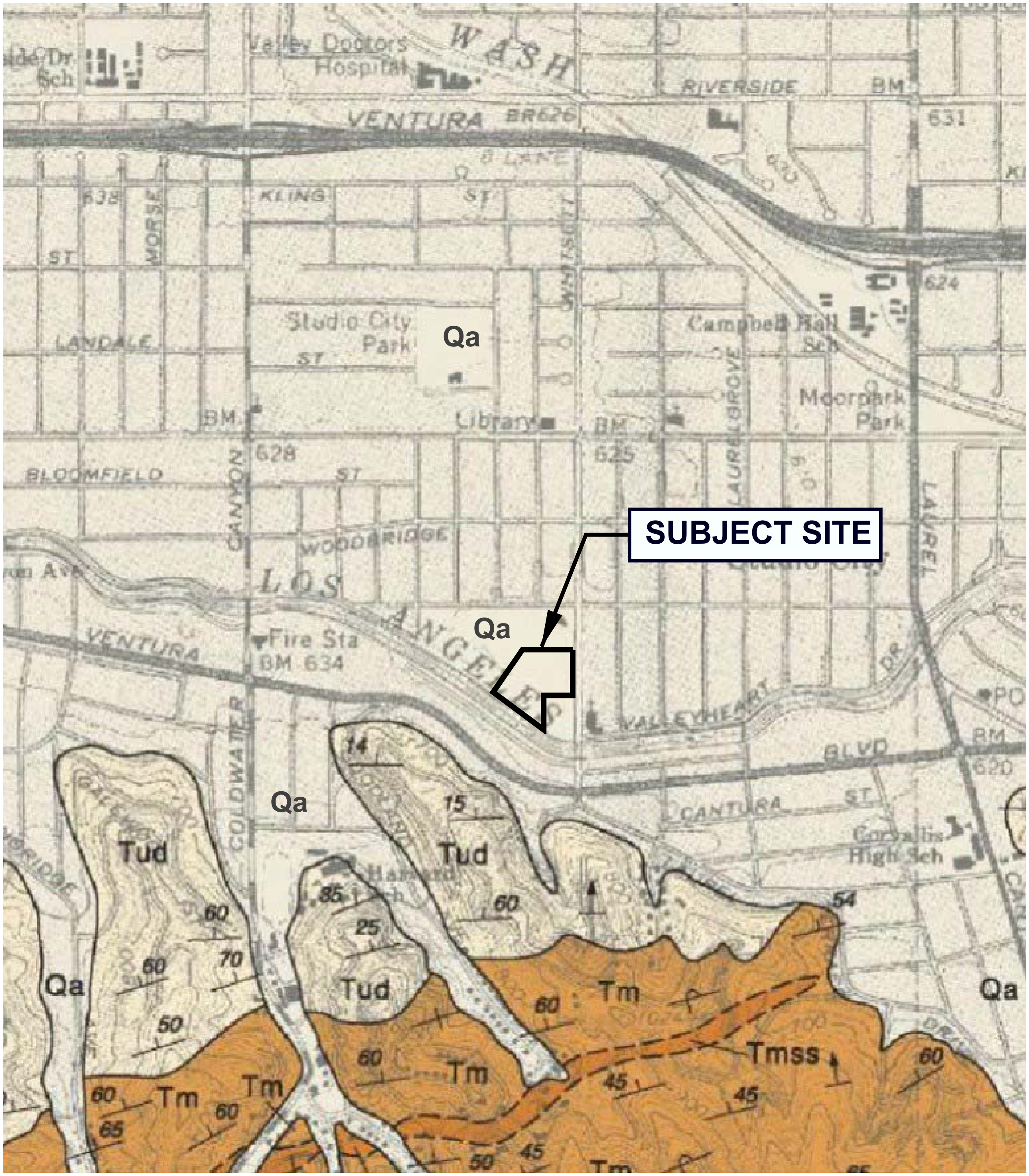
HARVARD-WESTLAKE SCHOOL

4141 WHITSETT AVENUE, STUDIO CITY

File No.: 21796

Date: April 2020

REFERENCE: SURVEY PLAN BY IACOBELLIS AND ASSOCIATES, INC. DATED AUGUST 31, 2016



LEGEND

Qa: Surficial Sediments - Alluvium. Clay, sand and gravel
Tud: Bedrock - Unnamed Shale
Tm: Bedrock - Modelo Formation
Tmss: Bedrock - Modelo Formation

REFERENCE: DIBBLEE, T.W., (1991), GEOLOGIC MAP OF THE HOLLYWOOD AND SOUTH 1/2 BURBANK QUADRANGLES, MAP #DF-30

LOCAL GEOLOGIC MAP

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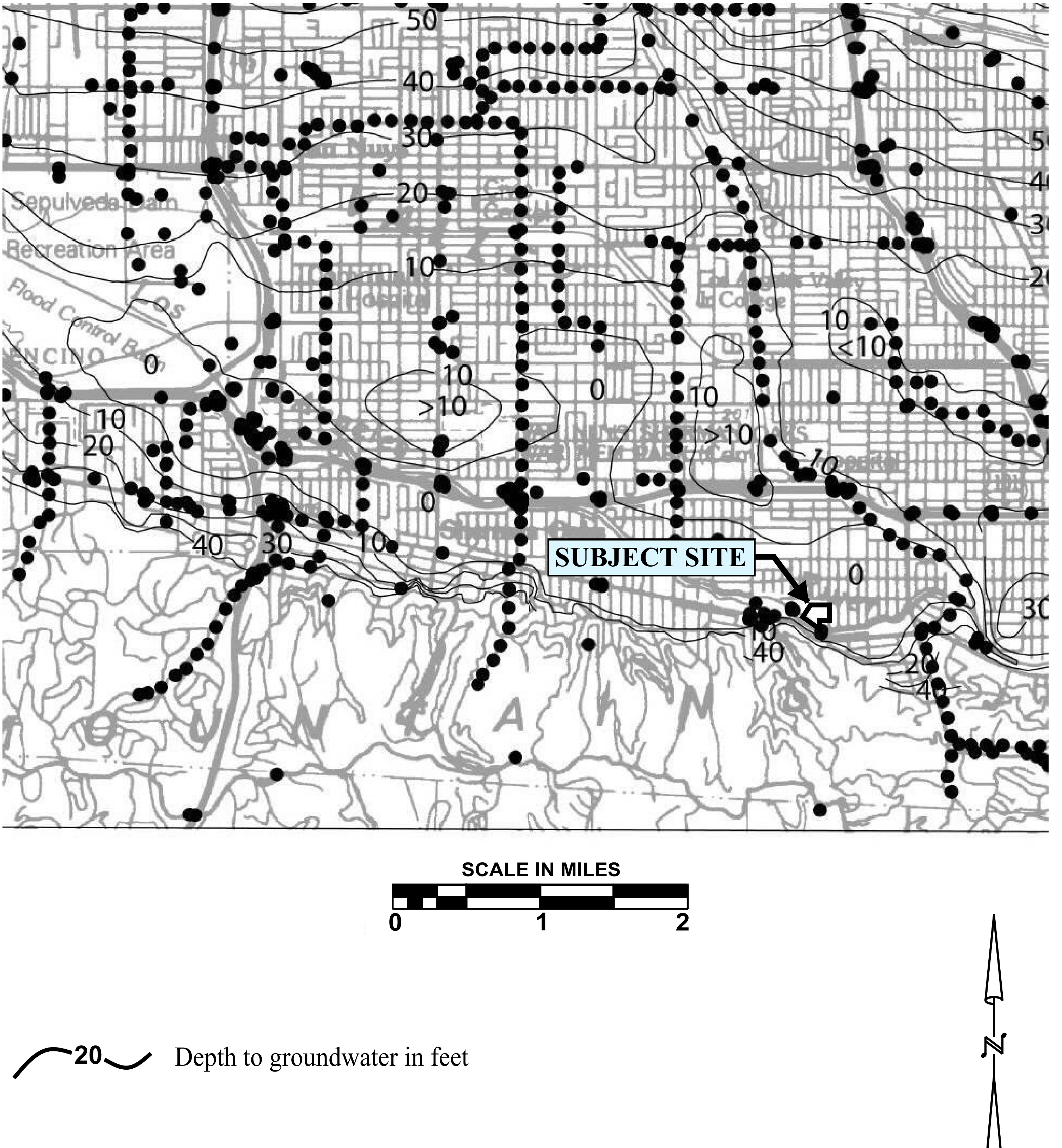
HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE No. 21796



REFERENCE: PLATE 1.2, GROUNDWATER MAP, SEISMIC HAZARD EVALUATION REPORT, SHZR08 7.5 MINUTE QUADRANGLES, VUN NUYS, CA QUADRANGLE

HISTORICALLY HIGHEST GROUNDWATER LEVELS

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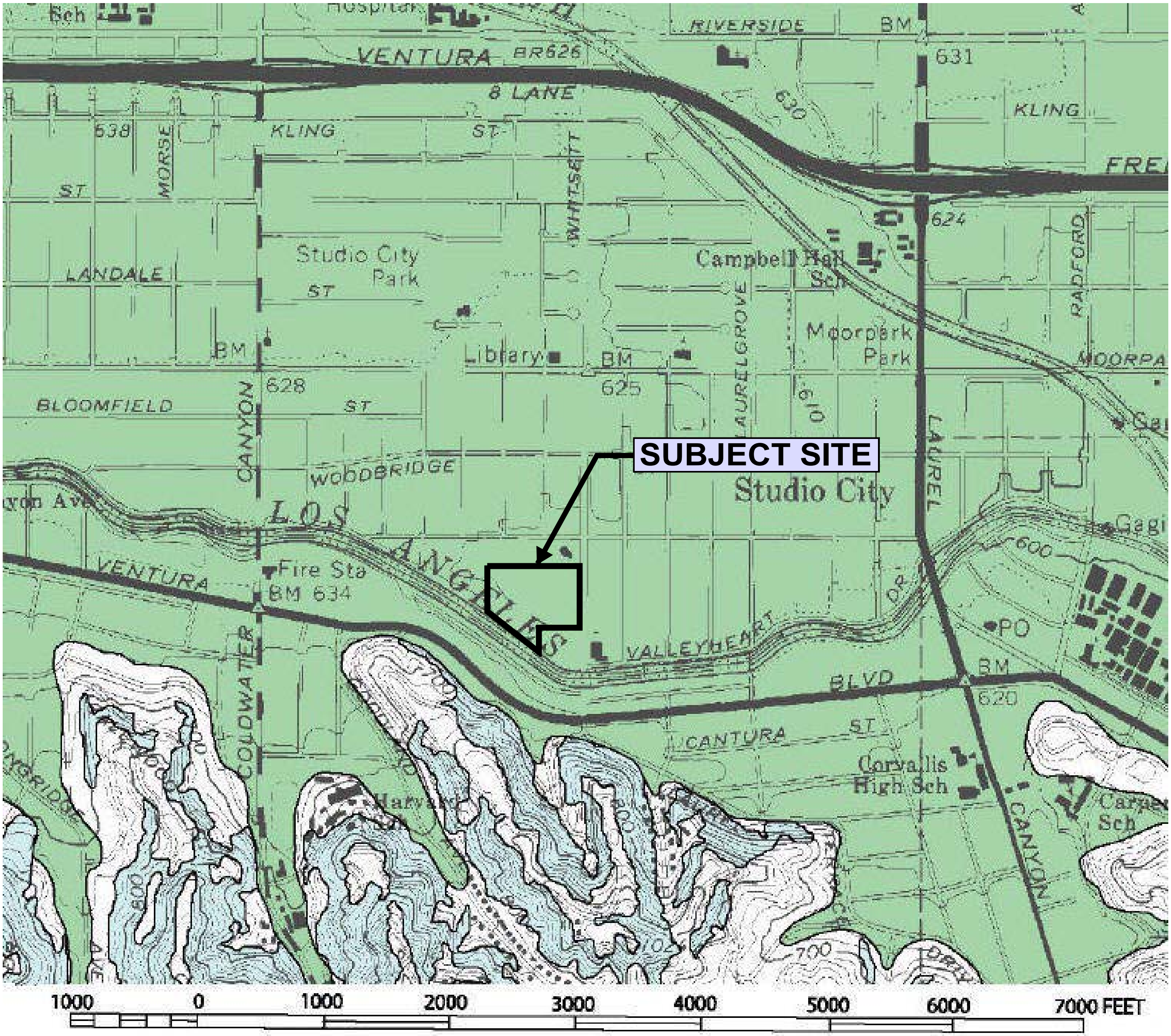
FILE No. 21796



LIQUEFACTION AREA

EARTHQUAKE-INDUCED LANDSLIDE AREA

REFERENCE: **SEISMIC HAZARD ZONES, VAN NUYS QUADRANGLE OFFICIAL MAP (CDMG, 1998)**

SEISMIC HAZARD ZONE MAP

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HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796

BORING LOG NUMBER 1

Harvard Westlake School **Date: 09/29/16** **Elevation: 620.3'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

km

*Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt
				0 --		3-inch Asphalt, No Base
				-		
				1 --		FILL: Silty Sand to Sandy Silt, dark brown, moist, medium dense, fine grained
				-		
				2 --		
2.5	12	17.0	98.2	-		
				3 --		
				-	ML	NATIVE SOILS: Silty Sand, dark brown, moist, stiff
				4 --		
				-		
5	6	11.8	SPT	5 --		- - - - - - - - - - -
				-		medium brown to dark brown
				6 --		
				-		
				7 --		
7.5	15	19.5	98.8	-		
				8 --		
				-		
				9 --		
				-		
10	12	15.3	SPT	10 --		
				-	CL	Sandy Clay, dark yellowish brown, moist, stiff
				11 --		
				-		
				12 --		
12.5	24	16.4	100.5	-		
				13 --		
				-		
				14 --		
				-		
15	13	18.2	SPT	15 --		
				-	ML/CL	Sandy Silt to Sandy Clay, dark brown, moist, stiff
				16 --		
				-		
				17 --		
17.5	20	18.7	107.9	-		
				18 --		
				-		
				19 --		
				-		
20	7	30.1	SPT	20 --		
				-	CL	Silty Clay, dark brown, moist, stiff
				21 --		
				-		
				22 --		
22.5	24	17.7	104.6	-		
				23 --		
				-		
				24 --		
				-		
25	9	23.3	SPT	25 --		
				-		

BORING LOG NUMBER 1

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
27.5	14	25.5	97.3	-		
				28 --		
				-		
				29 --		
				-		
30	12	27.5	SPT	30 --		
				-		Sandy Clay
				31 --		
				-		
				32 --		
32.5	14	24.8	101.0	-		
				33 --		
				-		
				34 --		
				-		
35	14	22.1	SPT	35 --		
				-	ML/CL	Sandy Silt to Sandy Clay, dark brown, moist, stiff
				36 --		
				-		
				37 --		
37.5	32	22.7	104.5	-		
				38 --		
				-		
				39 --		
				-		
40	10	26.7	SPT	40 --		
				-	CL	Silty Clay, dark brown, moist, stiff
				41 --		
				-		
				42 --		
42.5	20	35.4	87.5	-		
				43 --		
				-		
				44 --		
				-		
45	8	30.5	SPT	45 --		
				-		dark yellowish brown
				46 --		
				-		
				47 --		
47.5	22	28.2	97.9	-		
				48 --		
				-		
				49 --		
				-		
50	10	30.7	SPT	50 --		
				-		dark gray

BORING LOG NUMBER 1

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52		
52.5	16	29.1	91.7			
				53		
				54		
55	9	25.2	SPT	55		
				56		
				57		BEDROCK: Siltstone, yellow and grayish brown, moist, moderately hard
57.5	25 50/4"	22.4	104.2			
				58		Siltstone to Sandstone, yellow and grayish brown, moist, moderately hard
				59		
60	42	35.4	SPT	60		
				61		
				62		
				63		
				64		
65	67 50/5"	24.5	102.0	65		
				66		Total Depth 65 feet Water at 36½ feet Fill to 3 feet
				67		
				68		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				69		
				70		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				71		
				72		SPT=Standard Penetration Test
				73		
				74		
				75		

BORING LOG NUMBER 2

Harvard Westlake School **Date: 09/29/16** **Elevation: 621.0'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

km *Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt
				0 --		1-inch Asphalt, No Base
				1 --		FILL: Clayey Sand, dark brown, moist, medium dense, fine grained
				2 --		
2.5	12	13.3	111.7			
				3 --	SC/CL	NATIVE SOILS: Clayey Sand to Sandy Clay, dark brown, moist, medium dense, stiff, fine grained
				4 --		
5	9	19.5	SPT	5 --	CL	Sandy Clay, dark brown, moist, stiff
				6 --		
				7 --		
7.5	16	21.3	102.2			
				8 --		
				9 --		
10	13	11.8	SPT	10 --	ML	Sandy Silt, yellow and dark brown, moist, stiff
				11 --		
				12 --		
12.5	17	21.1	98.8			
				13 --	CL	Silty Clay, dark brown, moist, stiff
				14 --		
15	10	21.8	SPT	15 --		
				16 --		
				17 --		
17.5	13	25.1	96.4			
				18 --		
				19 --		
20	13	15.9	SPT	20 --		dark yellowish brown
				21 --		
				22 --		
22.5	20	20.4	103.0			
				23 --		
				24 --		
25	8	26.8	SPT	25 --		dark brown

BORING LOG NUMBER 2

Harvard Westlake School

File No. 21796
km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
27.5	12	25.8	95.2	-		
				28 --		
				-		
				29 --		
				-		
30	10	20.6	SPT	30 --		
				-		very moist
				31 --		
				-		
				32 --		
32.5	20	18.1	110.6	-		
				33 --		
				-		
				34 --		
				-		
35	12	21.1	SPT	35 --		
				-		
				36 --		
				-		
				37 --		
37.5	43	14.4	113.0	-		
				38 --	SP/SW	Sand to Gravelly Sand, dark brown, wet, medium dense, fine to coarse grained
				-		
				39 --		
				-		
40	25	12.0	SPT	40 --		
				-		
				41 --		
				-		
				42 --		
42.5	57	10.5	118.7	-		
				43 --		
				-		
				44 --		
				-		
45	26	24.3	SPT	45 --		
				-		
				46 --		
				-		BEDROCK: Siltstone, dark yellowish brown, moist, moderately hard
				47 --		
47.5	35 50/4"	31.6	86.6	-		
				48 --		Siltstone to Sandstone, yellow and grayish brown, moist, moderately hard to hard
				-		
				49 --		
				-		
50	24 50/3"	41.8	76.5	50 --		
				-		

BORING LOG NUMBER 2

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
				-		
				53 --		
				-		
				54 --		
				-		
55	45	43.5	75.7	55 --		
	50/2"			-		
				56 --		
				-		
				57 --		
				-		
				58 --		
				-		
				59 --		
				-		
60	28	36.6	76.6	60 --		
	50/3"			-		Total Depth 60 feet
				61 --		Water at 37½ feet
				-		Fill to 3 feet
				62 --		
				-		
				63 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual.
				64 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				65 --		140-lb. Automatic Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				66 --		
				-		SPT=Standard Penetration Test
				67 --		
				-		
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 3

Harvard Westlake School **Date: 09/30/16** **Elevation: 623.2'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

km

***Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16**

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Clayey Sand, dark brown, moist, medium dense, fine grained
				-		
				1 --		
				-		
				2 --		
				-		
3	16	11.7	106.6	3 --		
				-	CL/SC	NATIVE SOILS: Sandy Clay to Clayey Sand, dark brown, moist, medium dense, fine grained
				4 --		
				-		
				5 --		
				-		
				6 --		
				-		
				7 --		
				-		
				8 --		
				-		
				9 --		
				-		
10	36	22.3	102.5	10 --		
				-	CL	Sandy Clay, dark yellowish brown, moist, stiff
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
				15 --		
				-		
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	26	23.6	102.3	20 --		
				-		dark brown
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
				25 --		
				-		

BORING LOG NUMBER 3

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	14	23.6	101.6	30 --		
				-		
				31 --		
				-		
				32 --		
				-		
				33 --		
				-		
				34 --		
				-		
				35 --		
				-		
				36 --		
				-		
				37 --		
				-		
				38 --		
				-		
				39 --		
				-		
40	33	14.6	111.3	40 --		
				-	SP/SW	Sand to Gravelly Sand, dark brown, wet, medium dense, fine to coarse grained
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
50	63	31.9	90.3	50 --		
				-		BEDROCK: Siltstone, yellow and grayish brown, moist, moderately hard

BORING LOG NUMBER 3

Harvard Westlake School

File No. 21796
km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
				-		
				53 --		
				-		
				54 --		
				-		
				55 --		
				-		
				56 --		
				-		
				57 --		
				-		
				58 --		
				-		
				59 --		
				-		
60	35	31.9	87.5	60 --		
	50/4"			-		Total Depth 60 feet
				61 --		Water at 40 feet
				-		Fill to 3 feet
				62 --		
				-		
				63 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual.
				64 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				65 --		140-lb. Automatic Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				66 --		
				-		
				67 --		
				-		
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 4

Harvard Westlake School | **Date: 09/30/16** | **Elevation: 622.1'***

File No. 21796 | **Method: 8-inch diameter Hollow Stem Auger**

km

*Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Clayey Sand to Sandy Clay, dark brown, moist, medium dense, stiff, fine grained
				-		
				1 --		
				-		
				2 --		
				-		
3	12	20.1	101.8	3 --		
				-	CL	NATIVE SOILS: Sandy Clay, dark brown, moist, stiff
				4 --		
				-		
5	15	17.4	106.8	5 --		
				-		
				6 --		
				-		
				7 --		
				-		
				8 --		
				-		
				9 --		
				-		
				10 --		
				-		
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	16	26.2	91.9	15 --		
				-	CL/SC	Sandy Clay to Clayey Sand, dark brown, moist, stiff, medium dense, fine grained
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
				20 --		
				-		
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	13	32.0	85.8	25 --		
				-	CL	Silty Clay, dark brown, moist, stiff

BORING LOG NUMBER 4

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
				28		
				29		
				30		
				31		
				32		
				33		
				34		
35	18	26.0	97.3	35		
						Sandy Clay, dark grayish brown
				36		
				37		
				38		
				39		
				40		
				41		
				42		
				43		
				44		
45	56 50/5"	22.9	102.6	45	SP	Sand, dark brown, wet, very dense, fine grained
				46		
				47		
				48		
				49		
				50		

BORING LOG NUMBER 4

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
				-		
				53 --		
				-		
				54 --		
				-		
55	47	33.2	93.6	55 --		
	50/2"			-		BEDROCK: Siltstone to Sandstone, gray and dark gray, moist,
				56 --		hard
				-		
				57 --		
				-		
				58 --		
				-		
				59 --		
				-		
60	35	No Recovery		60 --		
	50/4"			-		
				61 --		
				-		
				62 --		
				-		
				63 --		
				-		
				64 --		
				-		
65	44	43.3	83.9	65 --		
	50/5"			-		Total Depth 65 feet
				66 --		Water at 25½ feet
				-		Fill to 3 feet
				67 --		
				-		
				68 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual.
				69 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				70 --		140-lb. Automatic Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 5

Harvard Westlake School **Date: 09/30/16** **Elevation: 623.0'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

km

*Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Clayey Sand to Sandy Clay, dark brown, moist, medium dense, fine grained
				-		
				1 --		
				-		
				2 --		
				-		
3	15	16.0	97.8	3 --		
				-	CL	NATIVE SOILS: Sandy Clay, dark yellowish brown, moist, stiff
				4 --		
				-		
				5 --		
				-		
				6 --		
				-		
				7 --		
				-		
				8 --		
				-		
				9 --		
				-		
10	22	17.4	106.6	10 --		
				-	CL/SC	Sandy Clay to Clayey Sand, dark yellowish brown, moist, stiff, medium dense, fine grained
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
				15 --		
				-		
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	32	19.6	98.9	20 --		
				-	CL	Sandy Clay, dark yellowish brown, moist, stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
				25 --		
				-		

BORING LOG NUMBER 5

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	18	24.5	101.0	30 --		
				-		Silty Clay, dark grayish brown
				31 --		
				-		
				32 --		
				-		
				33 --		
				-		
				34 --		
				-		
				35 --		
				-		
				36 --		
				-		
				37 --		
				-		
				38 --		
				-		
				39 --		
				-		
40	15	28.6	96.1	40 --		
				-		dark brown
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
50	31	9.3	126.9	50 --		
	50/3"			-	SP/SW	Sand to Gravelly Sand, dark brown, wet, very dense, fine to coarse grained

BORING LOG NUMBER 5

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
				-		
				53 --		
				-		
				54 --		
				-		
55	118	27.2	95.8	55 --		
	50/3"			-		BEDROCK: Siltstone, gray, moist, hard
				56 --		
				-		
				57 --		
				-		
				58 --		
				-		
				59 --		
				-		
				60 --		
				-		
				61 --		
				-		
				62 --		
				-		
				63 --		
				-		
				64 --		
				-		
65	88	29.9	89.4	65 --		
				-		Total Depth 65 feet
				66 --		Water at 24½ feet
				-		Fill to 3 feet
				67 --		
				-		
				68 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual.
				69 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				70 --		140-lb. Automatic Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 6

Harvard Westlake School **Date: 09/30/16** **Elevation: 623.8'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

km *Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Bare Ground
				0 --		FILL: Clayey Sand, dark brown, moist, medium dense, fine grained
				1 --		
				2 --		
				3 --	ML	NATIVE SOILS: Sandy Silt, dark brown, moist, stiff
				4 --		
5	16	14.3	108.0	5 --	CL	Sandy Clay, dark brown, moist, stiff
				6 --		
				7 --		
				8 --		
				9 --		
				10 --		
				11 --		
				12 --		
				13 --		
				14 --		
15	26	19.0	100.0	15 --	CL/SC	Sandy Clay to Clayey Sand, dark brown, moist, stiff, medium dense, fine grained
				16 --		
				17 --		
				18 --		
				19 --		
				20 --		
				21 --		
				22 --		
				23 --		
				24 --		
25	28	17.4	104.7	25 --	CL	Sandy to Silty Clay, dark brown, moist, stiff

BORING LOG NUMBER 6

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
				30 --		
				-		
				31 --		
				-		
				32 --		
				-		
				33 --		
				-		
				34 --		
				-		
35	16	21.4	101.4	35 --		
				-		very moist
				36 --		
				-		
				37 --		
				-		
				38 --		
				-		
				39 --		
				-		
				40 --		
				-		
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
45	62	16.4	115.2	45 --		
	50/1"			-	SP	Sand, dark brown, wet, very dense, fine to coarse grained
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
				50 --		
				-		

BORING LOG NUMBER 6

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51 --		
				52 --		
				53 --		
				54 --		
55	128 50/3"	39.9	74.9	55 --		
				56 --		BEDROCK: Siltstone, gray, moist, hard
				57 --		
				58 --		
				59 --		
				60 --		
				61 --		
				62 --		
				63 --		
				64 --		
65	35 50/2"	34.5	80.3	65 --		
				66 --		Total Depth 65 feet Water at 34½ feet Fill to 3 feet
				67 --		
				68 --		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				69 --		
				70 --		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				71 --		
				72 --		
				73 --		
				74 --		
				75 --		

BORING LOG NUMBER 7

Harvard Westlake School **Date: 06/03/19** **Elevation: 625'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

ae/km *Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn
				0 --		FILL: Silty Sand, dark brown, moist, medium dense, fine grained
				1 --		
				2 --		
2.5	8	8.9	96.8			
				3 --	SM	NATIVE SOILS: Silty Sand, dark brown, moist, medium dense, fine grained
				4 --		
5	3	21.9	SPT	5 --	SM/ML	Silty Sand to Sandy Silt, dark brown, moist, medium dense, fine grained
				6 --		
				7 --		
7.5	20	15.7	115.6			
				8 --	ML/CL	Sandy Silt to Sandy Clay, dark brown, moist, stiff
				9 --		
10	8	13.4	SPT	10 --		- - - - - - - - - - -
						dark yellowish brown
				11 --		
				12 --		
12.5	42	17.0	103.9			
				13 --		
				14 --		
15	23	12.0	SPT	15 --		
				16 --		
				17 --		
17.5	32	12.4	110.9		CL	Sandy Clay, dark yellowish brown, moist, stiff
				18 --		
				19 --		
20	10	16.9	SPT	20 --		
				21 --		
				22 --		
22.5	32	23.1	100.1			- - - - - - - - - - -
				23 --		dark brown
				24 --		
25	14	16.8	SPT	25 --		

BORING LOG NUMBER 7

Harvard Westlake School

File No. 21796

ae/km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
27.5	29	6.4	95.5	-		
				28 --	ML	Sandy Silt, dark yellowish brown, moist, stiff
				-		
				29 --		
				-		
30	9	28.6	SPT	30 --		
				-	CL	Silty Clay, dark brown, moist, stiff
				31 --		
				-		
				32 --		
32.5	22	20.5	103.6	-		
				33 --		
				-		
				34 --		
				-		
35	9	32.2	SPT	35 --		
				-		
				36 --		
				-		
				37 --		
37.5	26	19.7	108.3	-		
				38 --		
				-		
				39 --		
				-		
40	17	26.2	SPT	40 --		
				-	SM	Silty Sand, dark gray, moist, medium dense, fine grained
				41 --		
				-		
				42 --		
42.5	48	18.5	111.2	-		
				43 --		
				-		
				44 --		
				-		
45	14	21.6	SPT	45 --		
				-	ML/CL	Clayey Silt to Silty Clay, dark brown, moist, stiff
				46 --		
				-		
				47 --		
47.5	14	31.8	91.5	-		
				48 --		
				-		
				49 --		
				-		
50	10	28.6	SPT	50 --		
				-	CL	Silty Clay, dark brown, moist to wet, stiff

BORING LOG NUMBER 7

Harvard Westlake School

File No. 21796

ae/km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
52.5	36	26.9	95.1	-		
				53 --	SM	Silty Sand, dark brown, wet, medium dense, fine grained
				-		
				54 --		
				-		
55	27	25.9	SPT	55 --		
				-		
				56 --		
				-		
				57 --		
57.5	42	23.2	102.4	-		
				58 --	SM/ML	Silty Sand to Sandy Silt, dark gray to gray, moist to wet, medium dense, fine grained, stiff
				-		
				59 --		Silty Sand to Sand, gray to dark gray, wet, medium dense, fine grained
				-	SM/SP	
60	28	26.1	SPT	60 --		
				-		Total Depth 60 feet
				61 --		Water at 44 feet
				-		Fill to 3 feet
				62 --		
				-		
				63 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual.
				64 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				65 --		140-lb. Automatic Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				66 --		
				-		SPT=Standard Penetration Test
				67 --		
				-		
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 8

Harvard Westlake School **Date: 05/08/19** **Elevation: 623.0'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

km *Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt Parking Lot
				0		3½-inch Asphalt, No Base
				1		FILL: Silty Sand, medium to reddish brown, moist, medium dense, fine grained, organics
2.5	18	5.5	100.3	2–3	SM	ALLUVIUM: Silty Sand, medium to reddish brown, moist, medium dense, fine grained
				4		
5	11	12.8	SPT	5	ML	Sandy Silt, medium brown, moist, stiff
				6		
7.5	63	11.2	104.3	7–8		dark brown
				9		
10	9	8.3	SPT	10	SM	Silty Sand, olive brown, moist, medium dense
				11		
12.5	64	9.3	96.7	12–13		
				14		
15	22	10.6	SPT	15		dark brown
				16		
17.5	59	19.0	107.4	17–18	CL	Sandy Clay, olive to dark brown, moist, stiff
				19		
20	12	22.0	SPT	20		
				21		
22.5	60	12.6	103.9	22–23		
				24		
25	24	25.7	SPT	25	CL	Silty Clay, olive brown, moist, stiff

BORING LOG NUMBER 8

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				- 26 -- - 27 --		
27.5	27	22.4	103.2	- 28 -- - 29 -- -	CL/SC	Sandy Clay to Clayey Sand, dark grayish brown, moist, stiff, medium dense, fine grained
30	16	19.8	SPT	30 -- - 31 -- - 32 --		
32.5	32	33.7	80.6	- 33 -- - 34 -- -		
35	11	21.3	SPT	35 -- - 36 -- - 37 --	CL	Sandy Clay, dark grayish brown, moist, stiff
37.5	29	29.3	95.4	- 38 -- - 39 -- -		
40	16	18.3	SPT	40 -- - 41 -- - 42 --		
42.5	72	21.1	108.7	- 43 -- - 44 -- -	ML/SM	Sandy Silt to Silty Sand with Clay, dark to olive brown, moist to very moist, very stiff, medium dense, fine to medium grained
45	18	26.5	SPT	45 -- - 46 -- - 47 --	CL	Sandy Clay, dark brown, very moist, stiff
47.5	43	29.2	92.9	- 48 -- - 49 -- -	CL/SC	Sandy Clay to Clayey Sand, dark to olive brown, very moist, stiff, medium dense, fine to medium grained
50	30	23.0	SPT	50 -- -	SW	Gravelly Sand, medium brown, wet, medium dense, medium to coarse grained

BORING LOG NUMBER 8

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52		
52.5	82	8.6	124.7			
				53		
				54		
55	29	21.4	SPT	55		
				56		
				57		
57.5	57	24.3	98.8		SP	Sand, light olive brown, wet, medium dense, fine to medium grained
				58		
				59		
60	32	21.8	SPT	60		
				61		
				62		
62.5	78 50/3"	16.4	107.1			
				63		light gray
				64		
65	33	15.7	SPT	65		
						Total Depth 65 feet Water at 49½ feet Fill to 1½ feet
				66		
				67		
				68		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				69		
						Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				70		
				71		
						SPT=Standard Penetration Test
				72		
				73		
				74		
				75		

BORING LOG NUMBER 9

Harvard Westlake School **Date: 05/08/19** **Elevation: 624.0'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

km *Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Asphalt Parking Lot
				0 --		2-inch Asphalt, No Base
				-		
				1 --		FILL: Sandy Silt to Sandy Clay, dark brown, moist, stiff
				-		
				2 --		
2.5	12	15.7	97.8	-		
				3 --		
				-	SC	NATIVE SOILS: Clayey Sand, dark brown, moist, firm, fine grained
				4 --		
				-		
5	6	15.6	SPT	5 --		
				-		
				6 --		
				-		
				7 --		
7.5	19	22.7	94.8	-	CL/SC	Sandy Clay to Clayey Sand, dark brown, moist, stiff
				8 --		
				-		
				9 --		
				-		
10	8	22.3	SPT	10 --		
				-		dark olive brown
				11 --		
				-		
				12 --		
12.5	22	28.9	94.2	-	ML	Sandy Silt, dark grayish brown, moist, stiff
				13 --		
				-		
				14 --		
				-		
15	12	17.9	SPT	15 --		
				-		
				16 --		
				-		
				17 --		
17.5	30	23.0	100.5	-		
				18 --		
				-		
				19 --		
				-		
20	9	25.2	SPT	20 --		
				-	CL	Sandy Clay, dark brown, moist, medium stiff
				21 --		
				-		
				22 --		
22.5	30	18.9	106.1	-		
				23 --		
				-		
				24 --		
				-		
25	9	24.6	SPT	25 --		
				-		

BORING LOG NUMBER 9

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
27.5	26	27.8	92.9			- - - - - - - - - - - -
				28		dark grayish brown
				29		
30	8	26.7	SPT	30		
				31		
				32		
32.5	21	26.9	92.4		CL	Silty Clay, light olive brown to dark brown, moist, stiff
				33		
				34		
35	14	23.9	SPT	35		- - - - - - - - - - - -
						Sandy Clay, dark brown
				36		
				37		
37.5	36	22.7	102.4		SM	Silty Sand, light olive brown to light brown, wet, medium dense, fine to medium grained
				38		
				39		
40	15	25.4	SPT	40		
				41		
				42		
42.5	16	27.3	96.6		CL	Sandy Clay, dark grayish brown, wet, stiff
				43		
				44		
45	6	25.4	SPT	45		
				46		
				47		
47.5	22	32.2	90.7			
				48		
				49		
50	7	34.1	SPT	50		

BORING LOG NUMBER 9

Harvard Westlake School

File No. 21796

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52		
52.5	19	25.8	95.2			
				53	ML/CL	Sandy Silt to Sandy Clay, dark grayish brown, wet, stiff
				54		
55	26	30.8	SPT	55		
				56		BEDROCK: Clayey Siltstone, light yellowish brown, moist, soft to moderately hard, weathered, massive
				57		
57.5	64	29.4	91.5			Sandstone
				58		
				59		
60	28	34.9	SPT	60		
				61		
				62		
62.5	30 50/5"	37.1	87.0	63		Siltstone to Sandstone, dark to reddish brown, moist to very moist, moderately hard
				64		Clayey Siltstone, light olive brown
65	43 50/5"	30.8	SPT	65		
				66		Total Depth 65 feet Water at 40½ feet Fill to 3 feet
				67		
				68		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				69		
				70		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				71		SPT=Standard Penetration Test
				72		
				73		
				74		
				75		

BORING LOG NUMBER 10

Harvard Westlake School | **Date: 05/09/19** | **Elevation: 625.0'***

File No. 21796 | **Method: 8-inch diameter Hollow Stem Auger**

ae/km

*Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Field
				0 --		FILL: Silty Sand to Sandy Silt, medium to grayish brown, slightly moist to moist, medium dense, stiff, fine grained, few gravel
				-		
				1 --		
				-		
				2 --		
2.5	8	16.2	95.3	-	ML/CL	NATIVE SOILS: Sandy Silt to Sandy Clay, medium to dark brown, moist, medium stiff, rootlets, some clay present, fine gravel
				3 --		
				-		
				4 --		
				-		
5	6	22.9	SPT	5 --		
				-	CL	Sandy Clay, dark grayish brown to very dark brown, moist, stiff
				6 --		
				-		
				7 --		
7.5	25	18.4	105.4	-		
				8 --		
				-		
				9 --		
				-		
10	10	19.2	SPT	10 --		
				-	ML	Sandy to Clayey Silt, olive yellow, moist, stiff
				11 --		
				-		
				12 --		
12.5	23	5.8	105.0	-	SM	Silty Sand, medium brown, moist, medium dense, fine grained
				13 --		
				-		
				14 --		
				-		
15	9	17.0	SPT	15 --		
				-	CL	Sandy Clay, medium to dark brown, moist, stiff
				16 --		
				-		
				17 --		
17.5	26	26.2	93.3	-		dark yellowish brown
				18 --		
				-		
				19 --		
				-		
20	10	21.7	SPT	20 --		
				-		
				21 --		
				-		
				22 --		
22.5	26	22.4	101.6	-	CH	Sandy Clay, dark grayish brown to medium brown, moist, stiff
				23 --		
				-		
				24 --		
				-		
25	12	21.1	SPT	25 --		
				-		yellowish brown

BORING LOG NUMBER 10

Harvard Westlake School

File No. 21796

ae/km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
27.5	33	28.4	92.1			
				28		
				29		
30	11	25.3	SPT	30		
						medium brown
				31		
				32		
32.5	34	17.3	110.9		ML	Sandy Silt, medium to dark yellowish brown, moist, medium dense, fine grained
				33		
				34		
35	12	21.5	SPT	35		
					CL	Sandy Clay, dark grayish brown, moist, stiff
				36		
				37		
37.5	33	21.2	105.0		SM	Silty Sand, yellowish brown, wet, medium dense, fine grained
				38		
				39		
40	15	22.2	SPT	40		
				41		
				42		
42.5	47	16.0	108.5			pale brown to light gray
				43		
				44		
45	32	15.1	SPT	45		
					SP	Sand, yellowish brown, wet, dense, fine grained
				46		
				47		
47.5	50/4"	9.6	116.9		SW/ML	Sand to Sand Silt, light gray to light brownish gray, wet, dense, very stiff, fine to coarse grained, some gravel
				48		
				49		
50	46	44.5	SPT	50		
						BEDROCK: Interbedded Siltstone and Sandstone, greenish gray to light gray, moist, moderately hard, well-bedded, fine grained

BORING LOG NUMBER 10

Harvard Westlake School

File No. 21796

ae/km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
52.5	50/2"	48.6	74.5	-		
				53 --		
				-		
				54 --		
				-		pale green
55	50/5"	55.4	SPT	55 --		
				-		Total Depth 55 feet by refusal
				56 --		Water at 31½ feet
				-		Fill to 2 feet
				57 --		
				-		
				58 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual.
				59 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				60 --		140-lb. Automatic Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				61 --		
				-		SPT=Standard Penetration Test
				62 --		
				-		
				63 --		
				-		
				64 --		
				-		
				65 --		
				-		
				66 --		
				-		
				67 --		
				-		
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 11

Harvard Westlake School **Date: 05/09/19** **Elevation: 623.0'***

File No. 21796 **Method: 8-inch diameter Hollow Stem Auger**

ae/km *Reference: Survey Plan by Iacobellis & Assoc., Inc., dated 8/31/16

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Field
				0 --		FILL: Silty Sand to Sandy Silt, pale brown, moist, medium dense, stiff, fine grained, gravel, few cobbles
				-		
				1 --		
				-		
				2 --		
2.5	11	18.6	95.2	-	ML	NATIVE SOILS: Sandy Silt with Gravels, medium to dark brown, moist, stiff
				3 --		
				-		
				4 --		
				-		
5	4	22.4	SPT	5 --		
				-	ML/CL	Sandy Silt to Silty Clay, light brown to very dark brown, moist, soft, few gravels
				6 --		
				-		
				7 --		
7.5	16	24.0	98.4	-		Silty Clay
				8 --		
				-		
				9 --		
				-		
10	10	27.2	SPT	10 --		
				-	CL/SC	Silty Clay to Clayey Sand, medium to yellowish brown, moist, medium dense, stiff, fine grained
				11 --		
				-		
				12 --		
12.5	13	23.6	97.9	-	CL	Sandy Clay, dark brown, moist, stiff
				13 --		
				-		
				14 --		
				-		
15	8	24.8	SPT	15 --		
				-		
				16 --		
				-		
				17 --		
17.5	16	29.9	91.5	-		yellowish brown
				18 --		
				-		
				19 --		
				-		
20	8	30.1	SPT	20 --		
				-		
				21 --		
				-		
				22 --		
22.5	15	28.7	92.8	-		
				23 --		
				-		
				24 --		
				-		
25	10	30.7	SPT	25 --		
				-		Silty Clay, yellowish to olive brown

BORING LOG NUMBER 11

Harvard Westlake School

File No. 21796

ae/km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
27.5	13	28.1	94.3	-		very moist
				28 --		
				-		
				29 --		
				-		
30	9	23.4	SPT	30 --		
				-	SC	Clayey Sand, dark yellowish brown, wet, loose, fine grained
				31 --		
				-		
				32 --		
32.5	19	23.9	97.7	-	CL	Sandy Clay, dark grayish brown, wet, medium stiff
				33 --		
				-		
				34 --		
				-		
35	11	19.3	SPT	35 --		
				-	SC	Clayey Sand, dark yellowish brown, wet, medium dense, fine to medium grained, some rock fragments
				36 --		
				-		
				37 --		
37.5	20	12.1	113.6	-		medium brown, fine to coarse grained
				38 --		
				-		
				39 --		
				-		
40	10	21.7	SPT	40 --		
				-		grayish brown
				41 --		
				-		
				42 --		
42.5	54	18.4	111.0	-	SC/SP	Clayey Sand to Sand, dark yellowish brown to medium brown, wet, medium dense, fine to medium grained
				43 --		
				-		
				44 --		
				-		
45	36	10.4	SPT	45 --		
				-	SW	Gravelly Sand, light gray, wet, medium dense, fine to coarse grained
				46 --		
				-		
				47 --		
47.5	51	37.1	87.9	-		pale brown, rock fragments
				48 --		
				-		
				49 --		
				-		
50	36	30.4	SPT	50 --		
				-		

BORING LOG NUMBER 11

Harvard Westlake School

File No. 21796

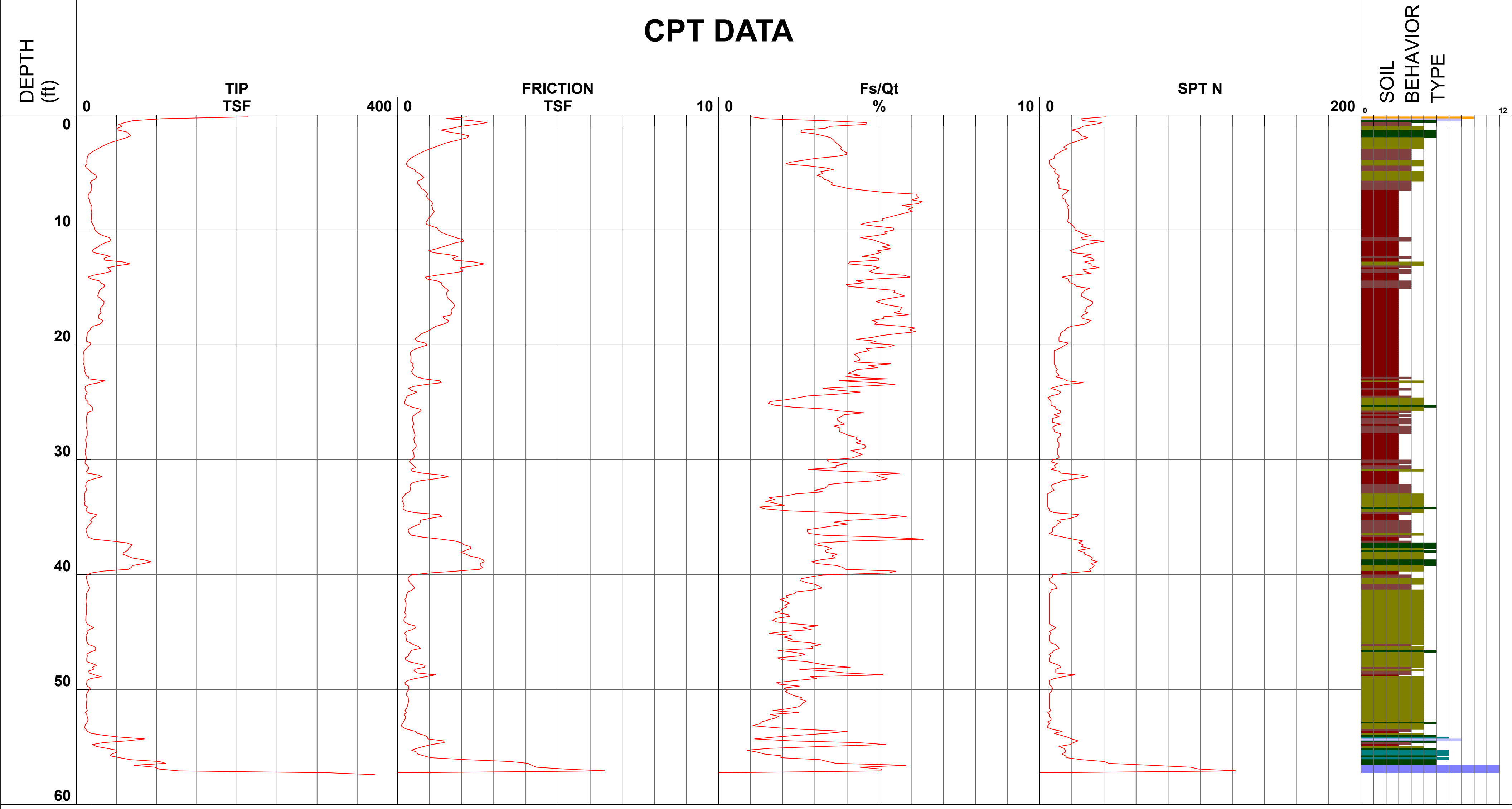
ae/km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52		
52.5	50/3"	27.9	93.9			BEDROCK: Interbedded Siltstone and Sandstone, greenish gray with yellowish orange mottling, moist, moderately hard, fine grained, slightly weathered
				53		
				54		
						well bedded, light gray
55	50/5"	32.3	SPT	55		
						Total Depth 55 feet by refusal Water at 33 feet Fill to 2 feet
				56		
				57		
				58		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual.
				59		
				60		Used 8-inch diameter Hollow-Stem Auger 140-lb. Automatic Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				61		SPT=Standard Penetration Test
				62		
				63		
				64		
				65		
				66		
				67		
				68		
				69		
				70		
				71		
				72		
				73		
				74		
				75		

Geotechnologies Inc

Project	Proposed Sports & Residential Developme	Operator	DG-RC	Filename	SDF(159).cpt
Job Number	21311	Cone Number	DDG1281	GPS	
Hole Number	CPT-01	Date and Time	10/10/2016 7:43:42 AM	Maximum Depth	57.41 ft
EST GW Depth During Test		38.00 ft			

Net Area Ratio .8



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

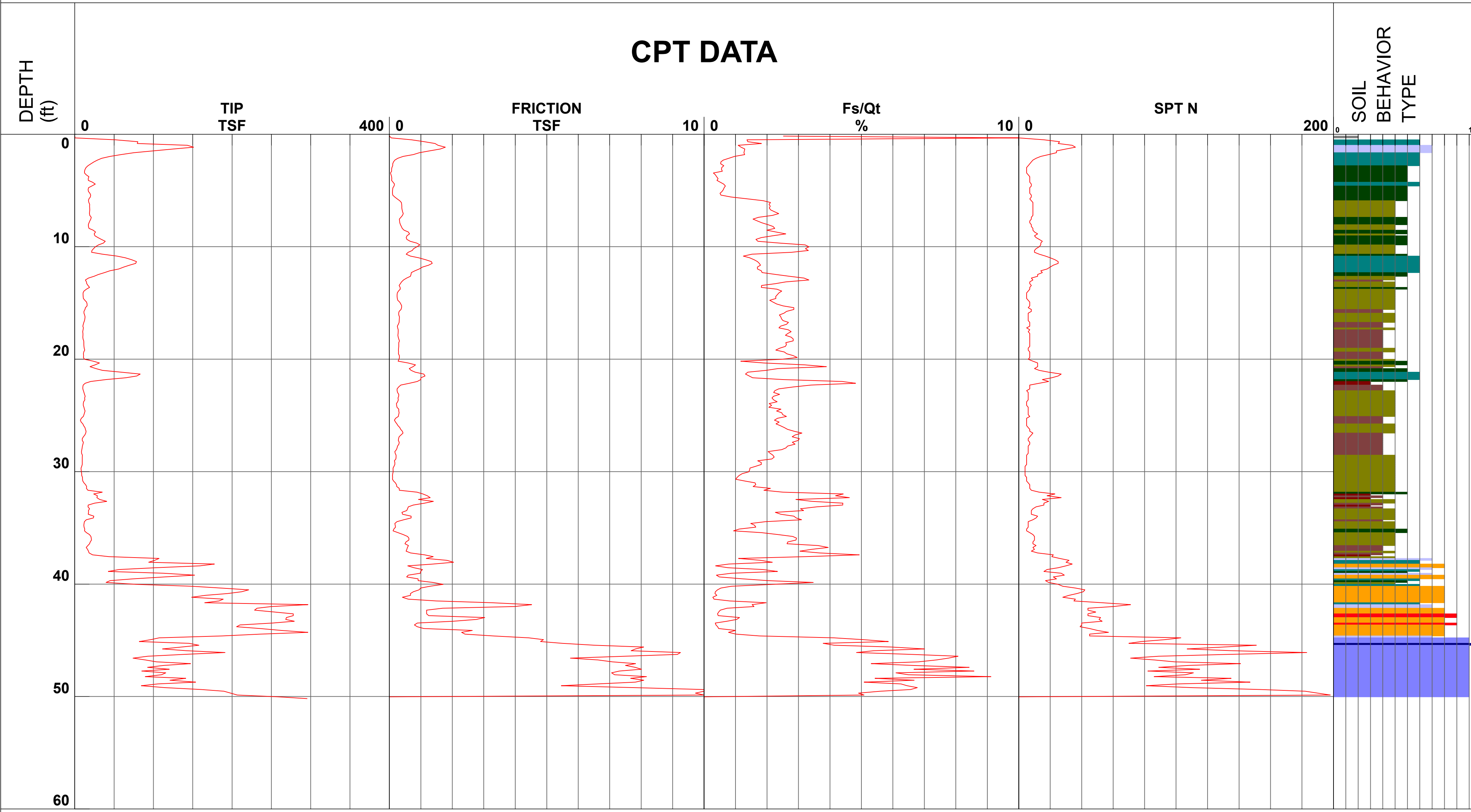
Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Geotechnologies Inc

Project	Proposed Sports & Residential Developme	Operator	DG-RC	Filename	SDF(158).cpt
Job Number	21311	Cone Number	DDG1281	GPS	
Hole Number	CPT-02	Date and Time	10/10/2016 7:01:17 AM	Maximum Depth	50.20 ft
EST GW Depth During Test		38.00 ft			

Net Area Ratio .8



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

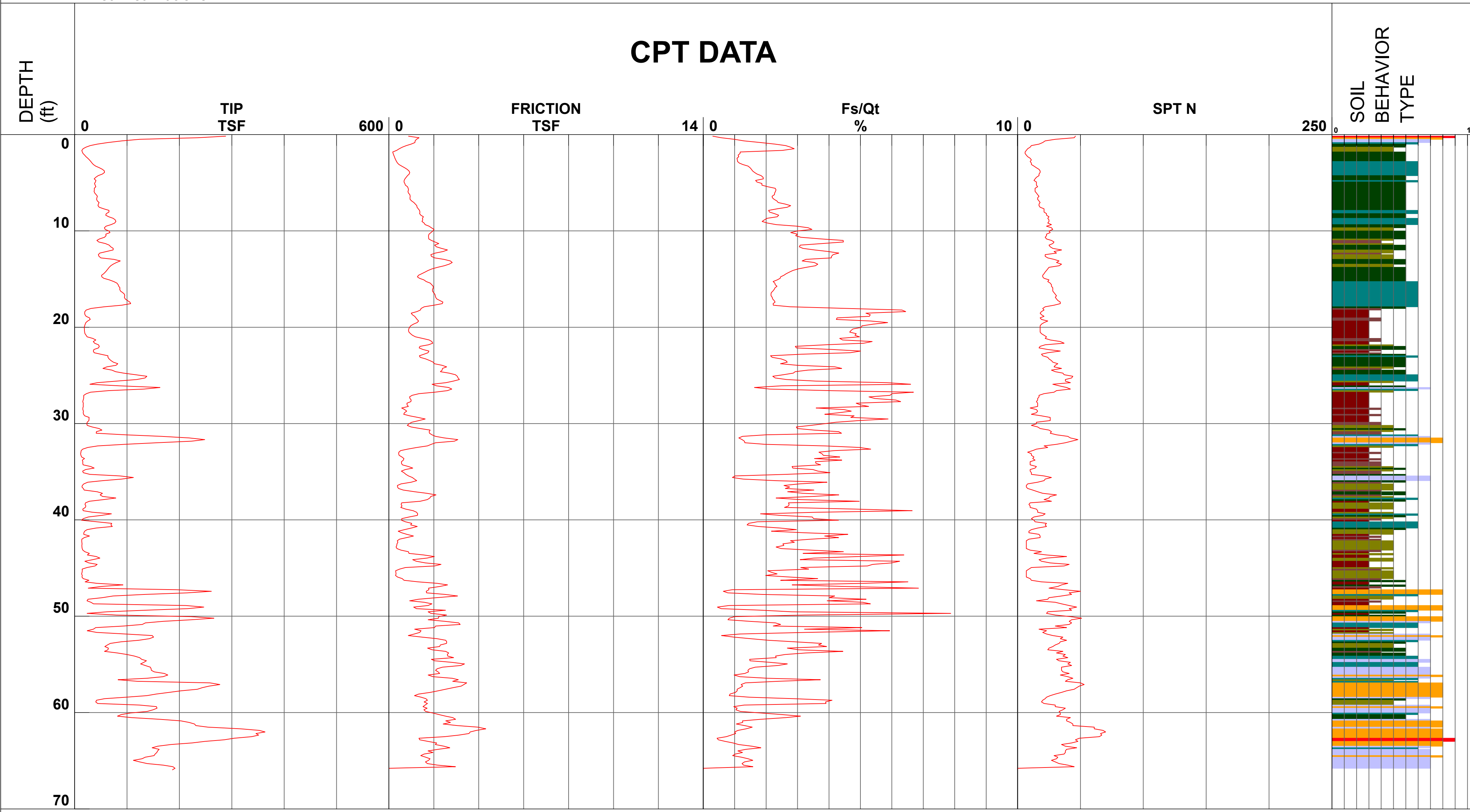
Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Geotechnologies Inc.

Project	Harvard Westlake	Operator	RC AS	Filename	SDF(651).cpt
Job Number	21796	Cone Number	DDG1379	GPS	
Hole Number	CPT-03	Date and Time	5/8/2019 11:42:19 AM	Maximum Depth	65.94 ft
EST GW Depth During Test		30.00 ft			

Net Area Ratio .8



- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

Cone Size 10cm squared

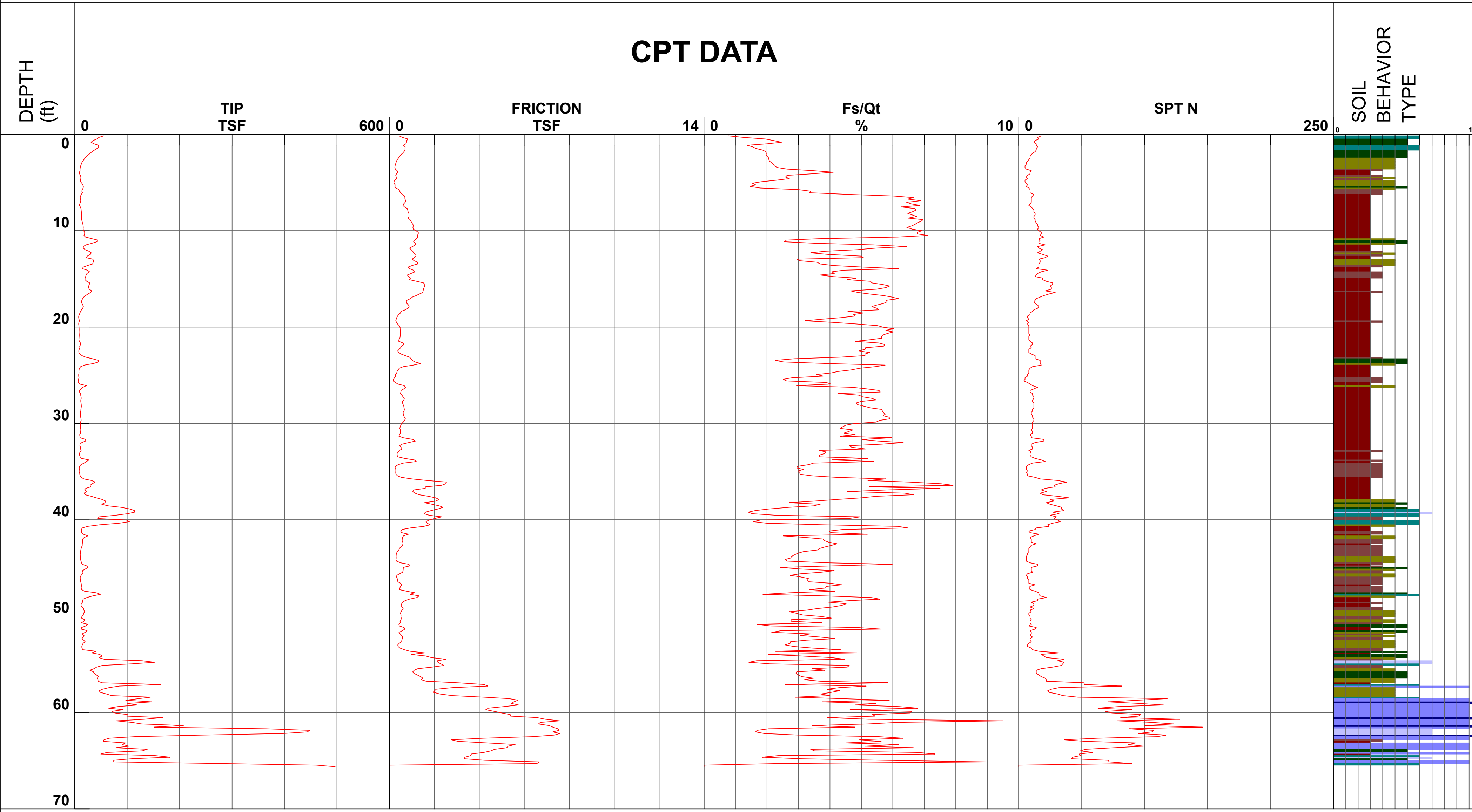
S*Soil behavior type and SPT based on data from UBC-1983

Geotechnologies Inc.

Project	Harvard Westlake	Operator	RC AS	Filename	SDF(648).cpt
Job Number	21796	Cone Number	DDG1379	GPS	
Hole Number	CPT-04	Date and Time	5/8/2019 7:26:25 AM	Maximum Depth	65.62 ft
EST GW Depth During Test		33.90 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

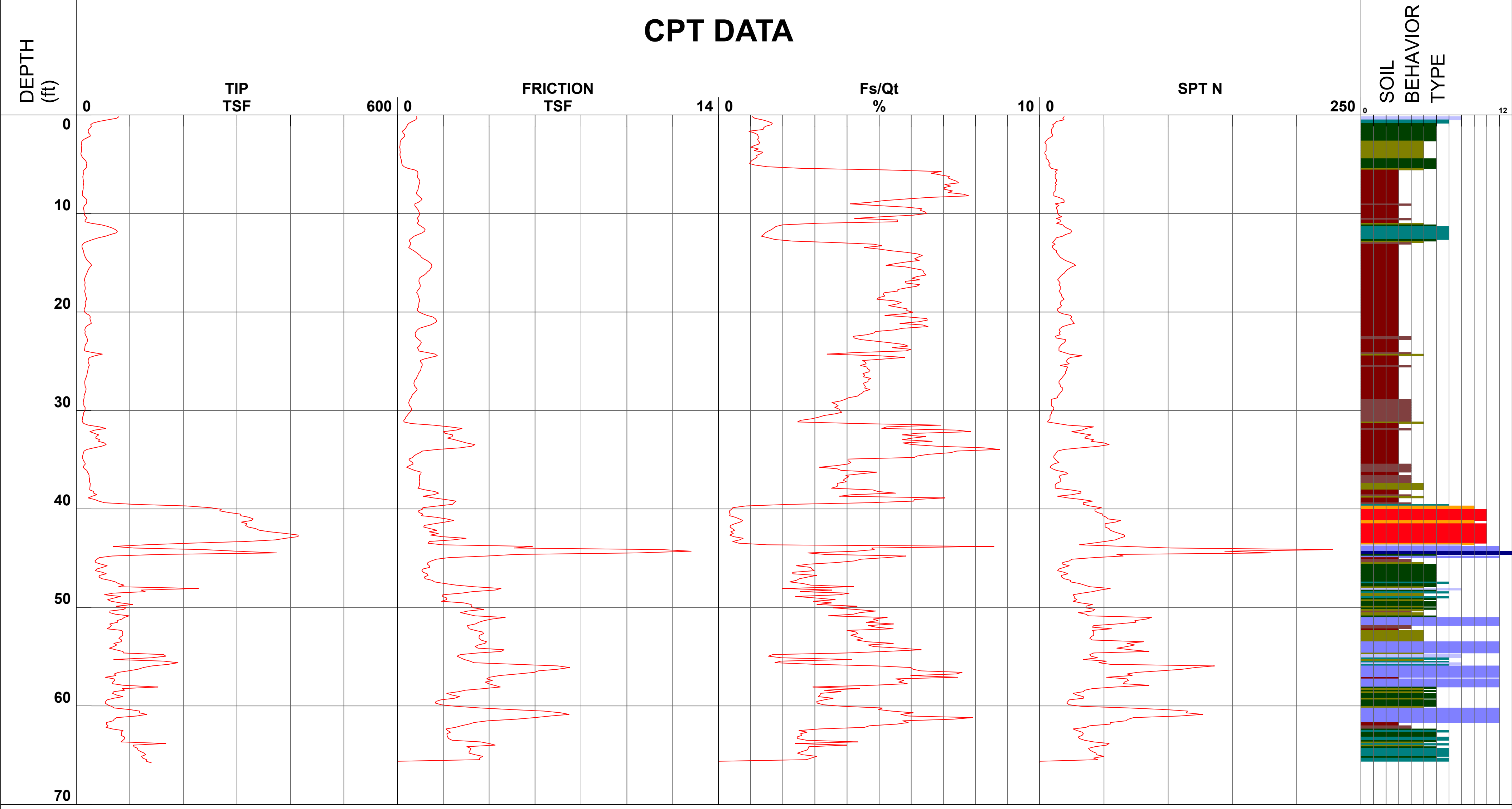
S*Soil behavior type and SPT based on data from UBC-1983

Geotechnologies Inc.

Project	Harvard Westlake	Operator	RC AS	Filename	SDF(650).cpt
Job Number	21796	Cone Number	DDG1379	GPS	
Hole Number	CPT-05	Date and Time	5/8/2019 10:26:12 AM	Maximum Depth	65.78 ft
EST GW Depth During Test		30.00 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

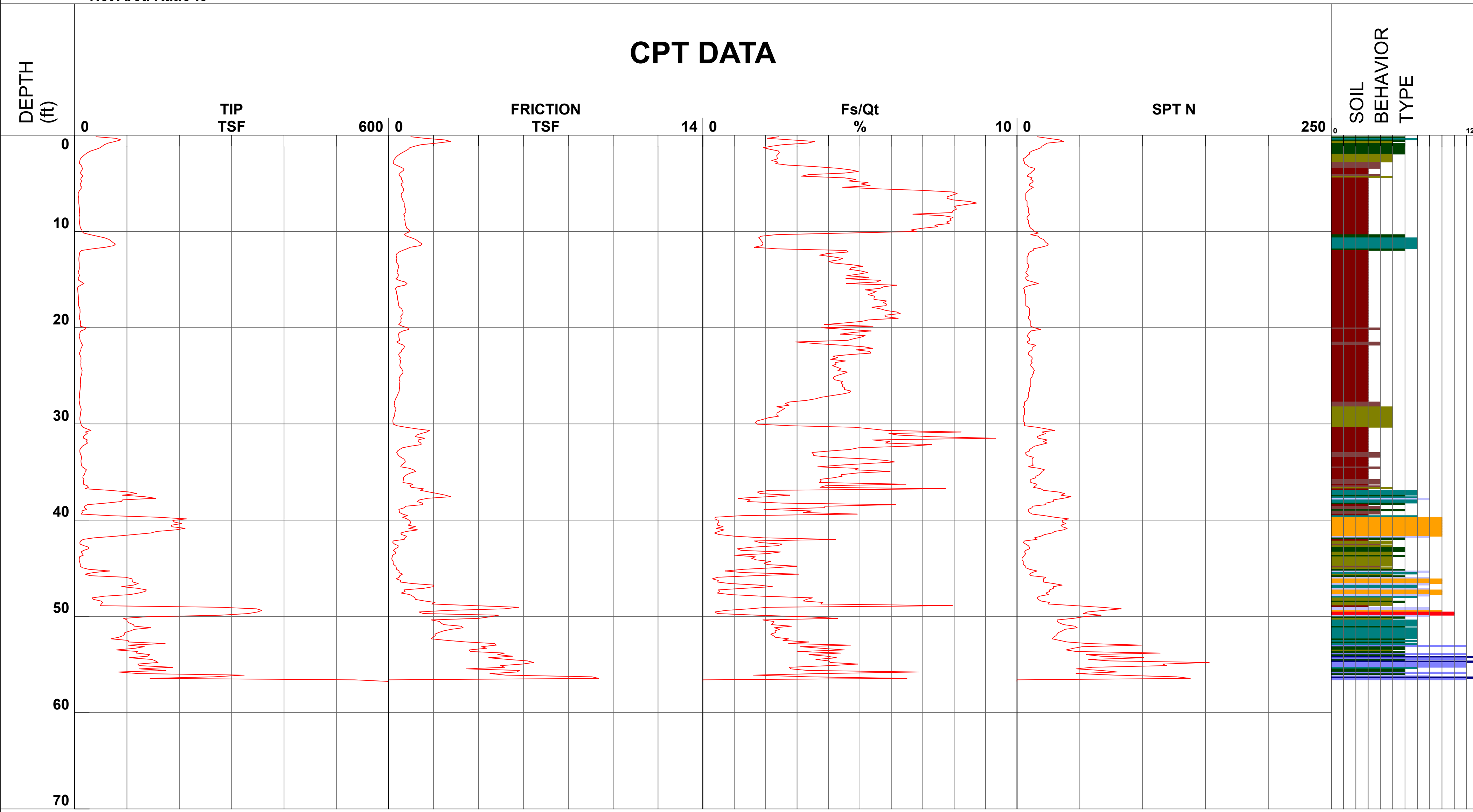
S*Soil behavior type and SPT based on data from UBC-1983

Geotechnologies Inc.

Project	Harvard Westlake	Operator	RC AS	Filename	SDF(649).cpt
Job Number	21796	Cone Number	DDG1379	GPS	
Hole Number	CPT-06	Date and Time	5/8/2019 8:59:02 AM	Maximum Depth	56.76 ft
EST GW Depth During Test		29.20 ft			

Net Area Ratio .8

CPT DATA



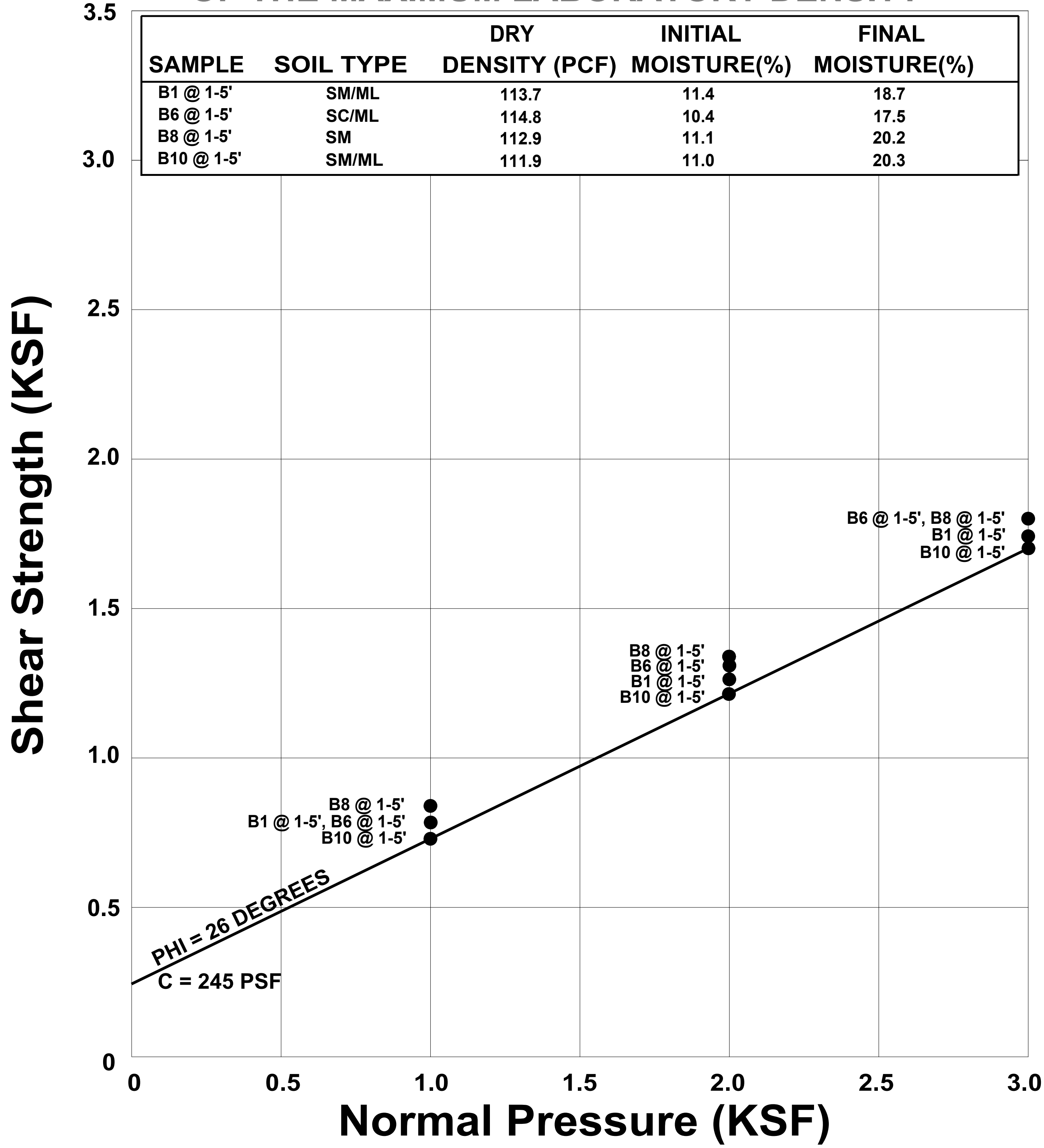
1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

BULK SAMPLE REMOLDED TO 90 PERCENT OF THE MAXIMUM LABORATORY DENSITY

SAMPLE	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE(%)	FINAL MOISTURE(%)
B1 @ 1-5'	SM/ML	113.7	11.4	18.7
B6 @ 1-5'	SC/ML	114.8	10.4	17.5
B8 @ 1-5'	SM	112.9	11.1	20.2
B10 @ 1-5'	SM/ML	111.9	11.0	20.3



● Direct Shear, Saturated

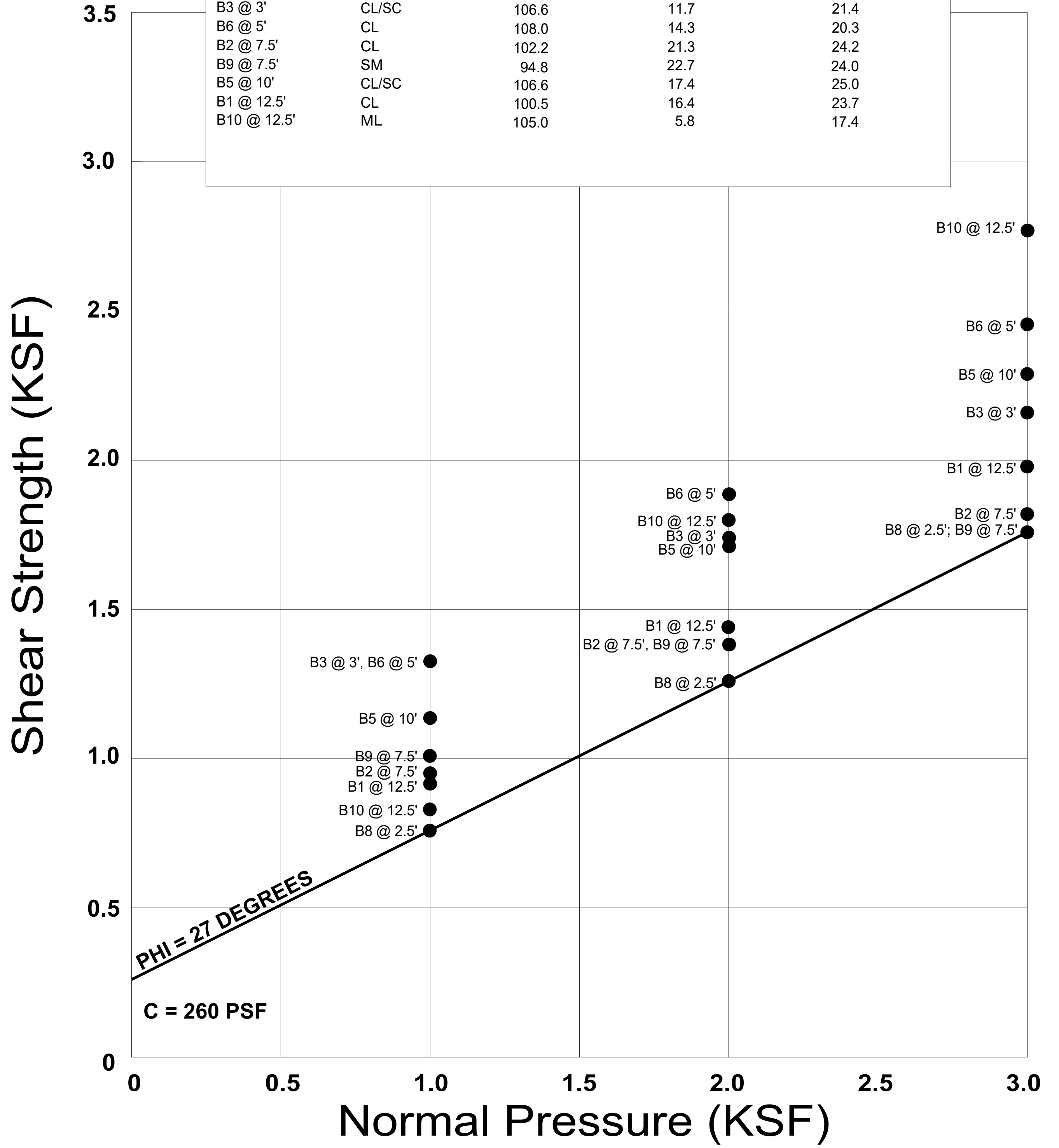
SHEAR TEST DIAGRAM

Geotechnologies, Inc.
Consulting Geotechnical Engineers

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796 | **PLATE: B-1**

SAMPLE	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE(%)	FINAL MOISTURE(%)
B8 @ 2.5'	SM	100.3	5.5	21.9
B3 @ 3'	CL/SC	106.6	11.7	21.4
B6 @ 5'	CL	108.0	14.3	20.3
B2 @ 7.5'	CL	102.2	21.3	24.2
B9 @ 7.5'	SM	94.8	22.7	24.0
B5 @ 10'	CL/SC	106.6	17.4	25.0
B1 @ 12.5'	CL	100.5	16.4	23.7
B10 @ 12.5'	ML	105.0	5.8	17.4



● Direct Shear, Saturated

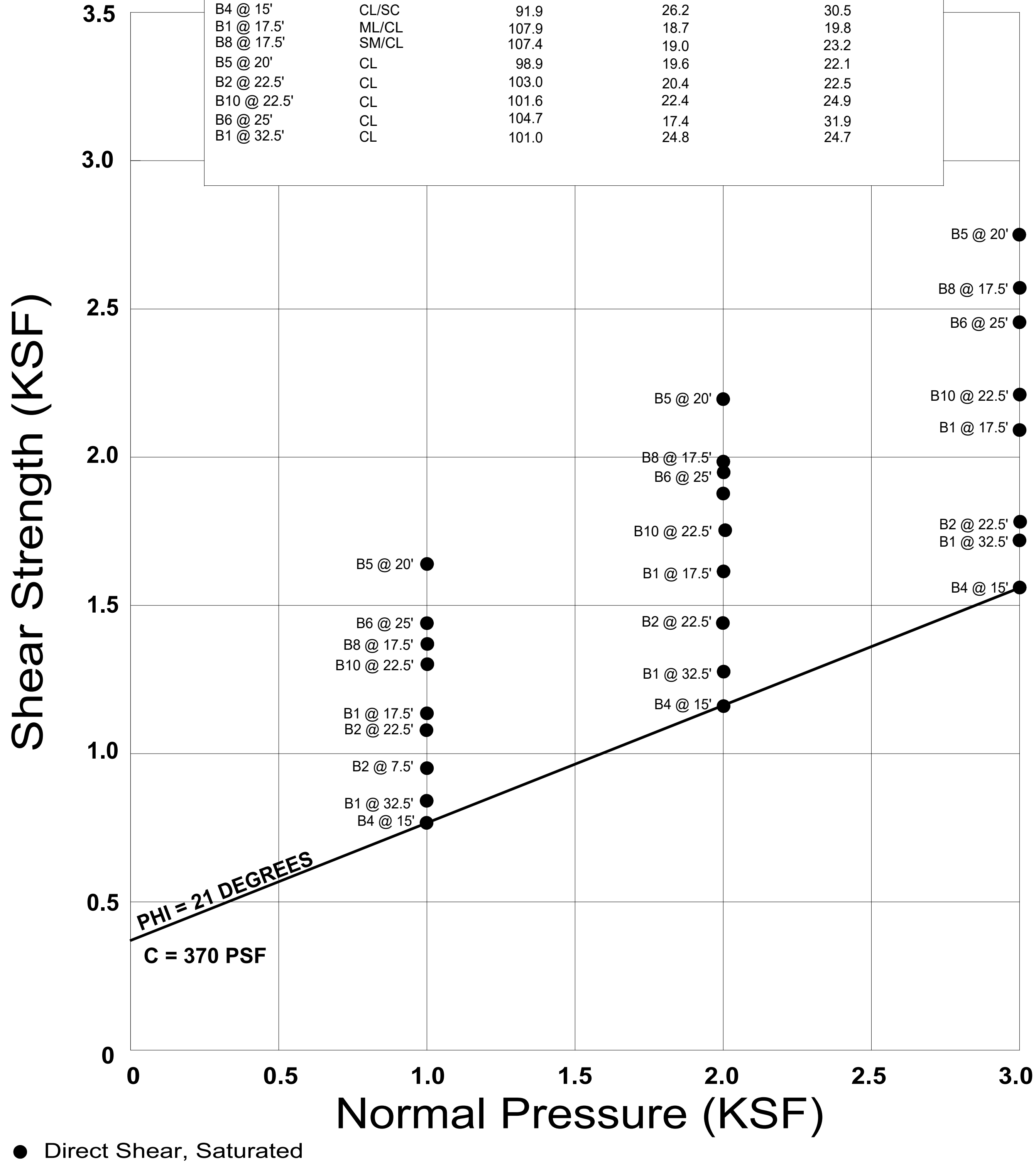
SHEAR TEST DIAGRAM

Geotechnologies, Inc.
Consulting Geotechnical Engineers

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796 | **PLATE: B-2**

SAMPLE	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE(%)	FINAL MOISTURE(%)
B4 @ 15'	CL/SC	91.9	26.2	30.5
B1 @ 17.5'	ML/CL	107.9	18.7	19.8
B8 @ 17.5'	SM/CL	107.4	19.0	23.2
B5 @ 20'	CL	98.9	19.6	22.1
B2 @ 22.5'	CL	103.0	20.4	22.5
B10 @ 22.5'	CL	101.6	22.4	24.9
B6 @ 25'	CL	104.7	17.4	31.9
B1 @ 32.5'	CL	101.0	24.8	24.7



SHEAR TEST DIAGRAM

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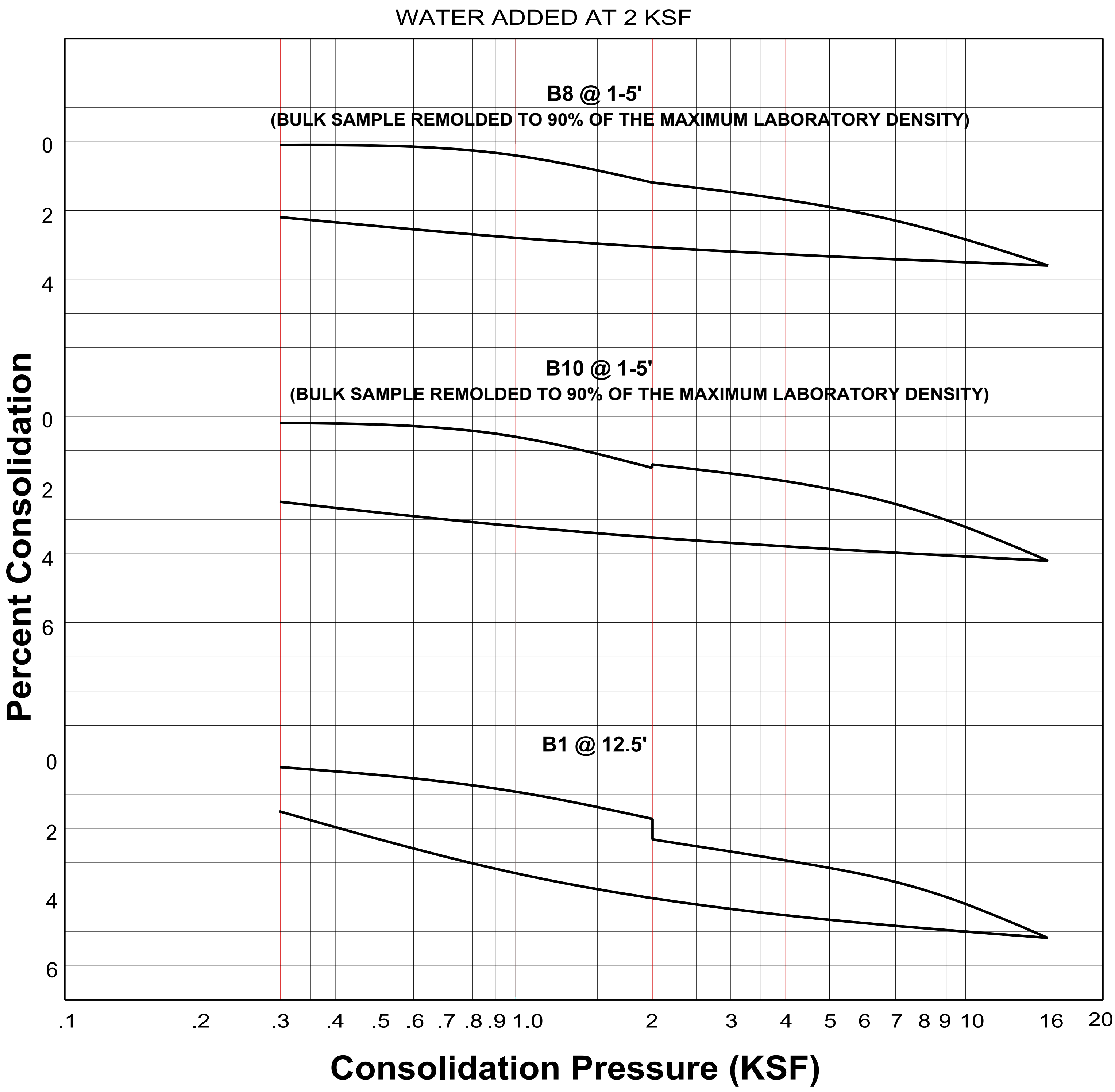
Consulting Geotechnical Engineers

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796 | **PLATE: B-3**



CONSOLIDATION TEST

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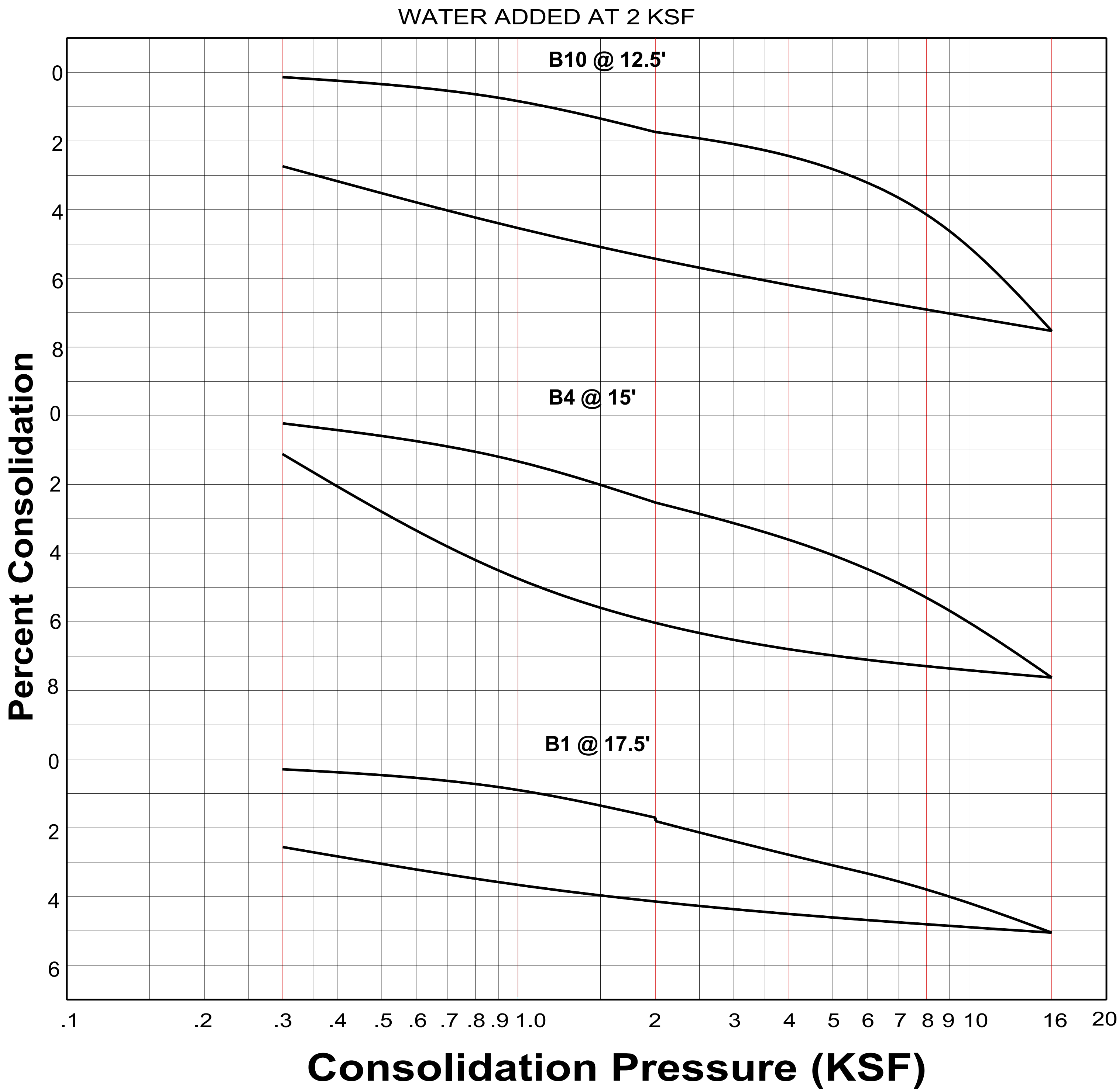
FILE NO. 21796 | **PLATE: C-1**



CONSOLIDATION TEST

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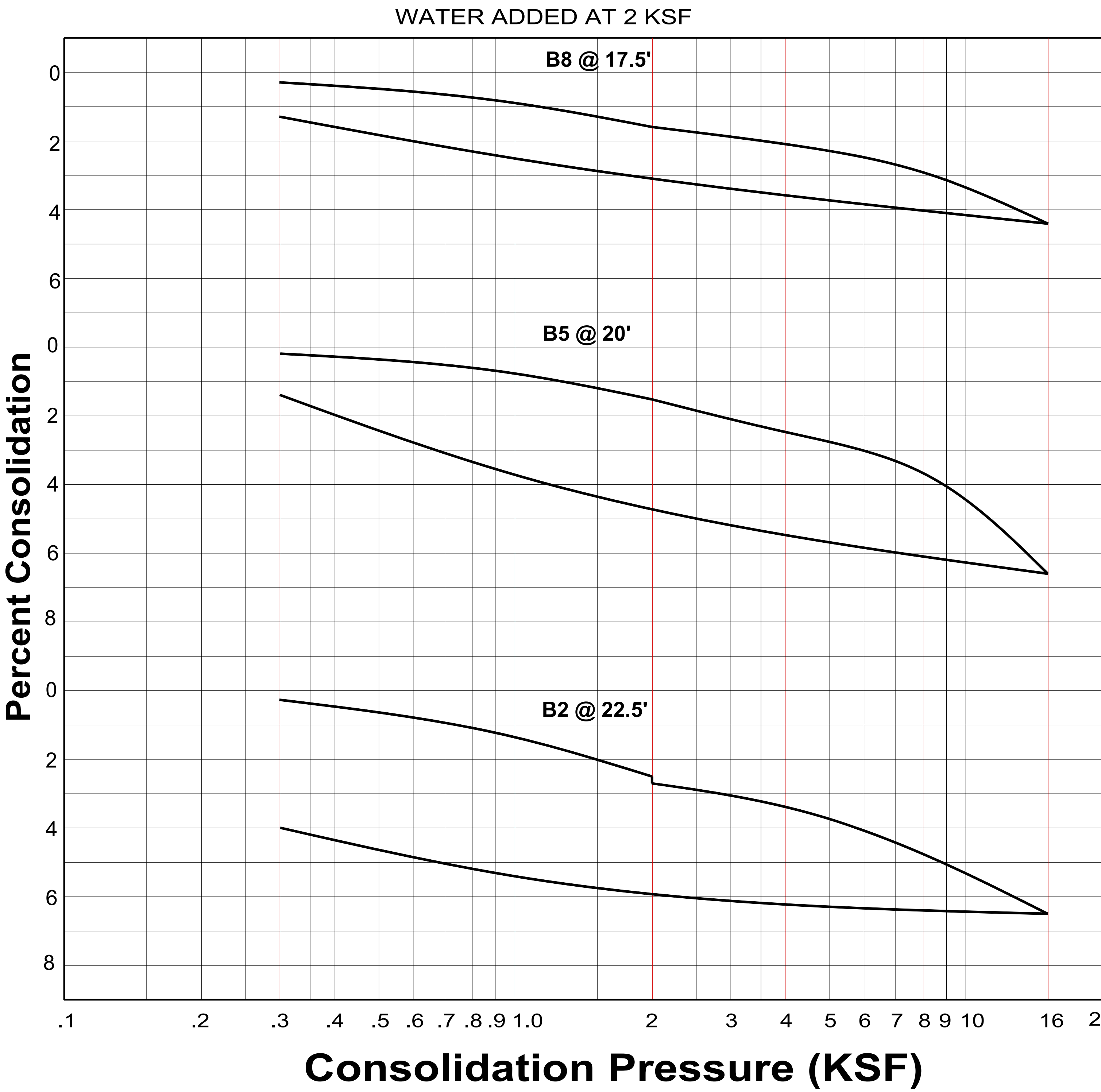
FILE NO. 21796 | **PLATE: C-2**



CONSOLIDATION TEST

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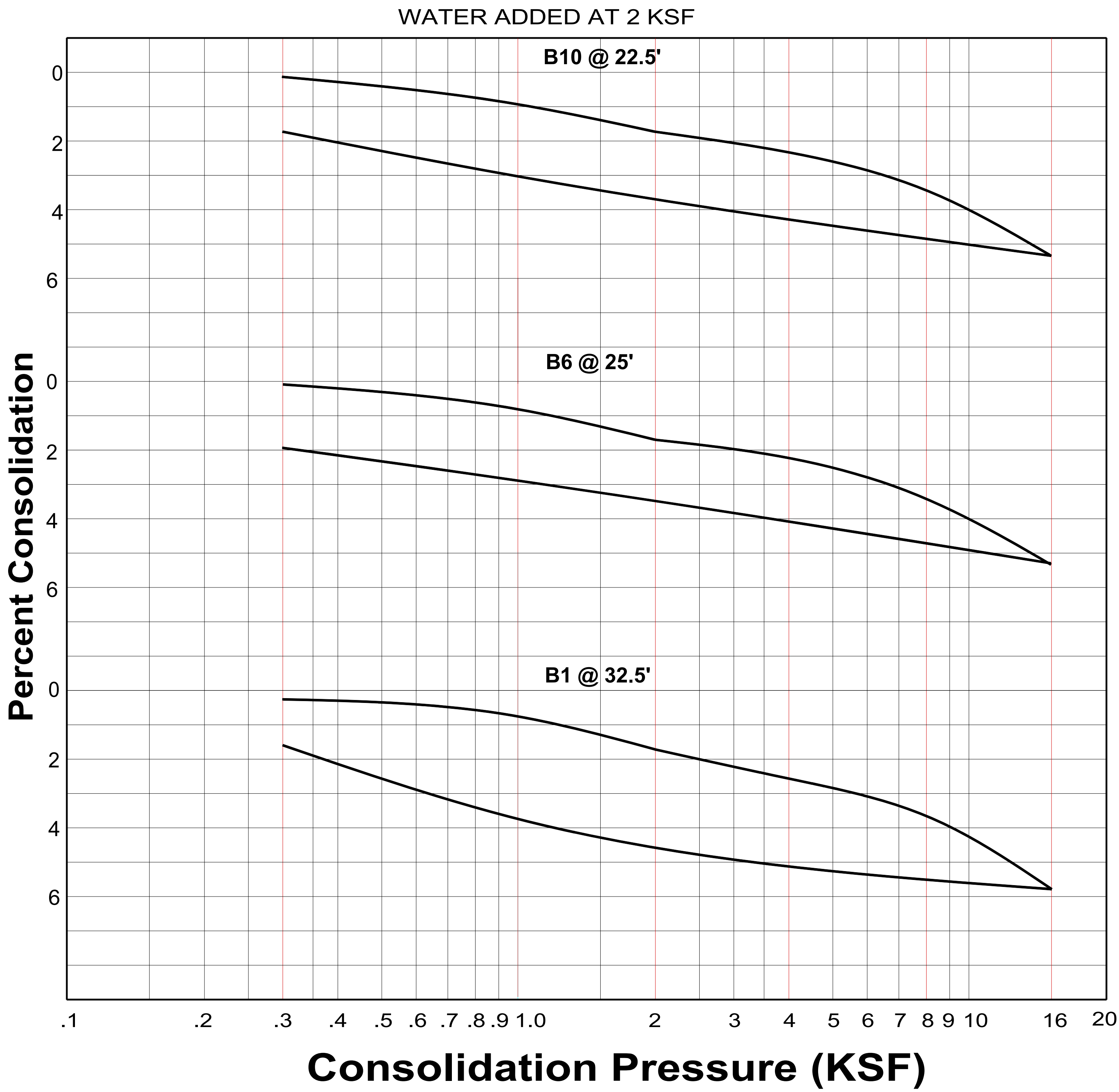
FILE NO. 21796 | **PLATE: C-3**



CONSOLIDATION TEST

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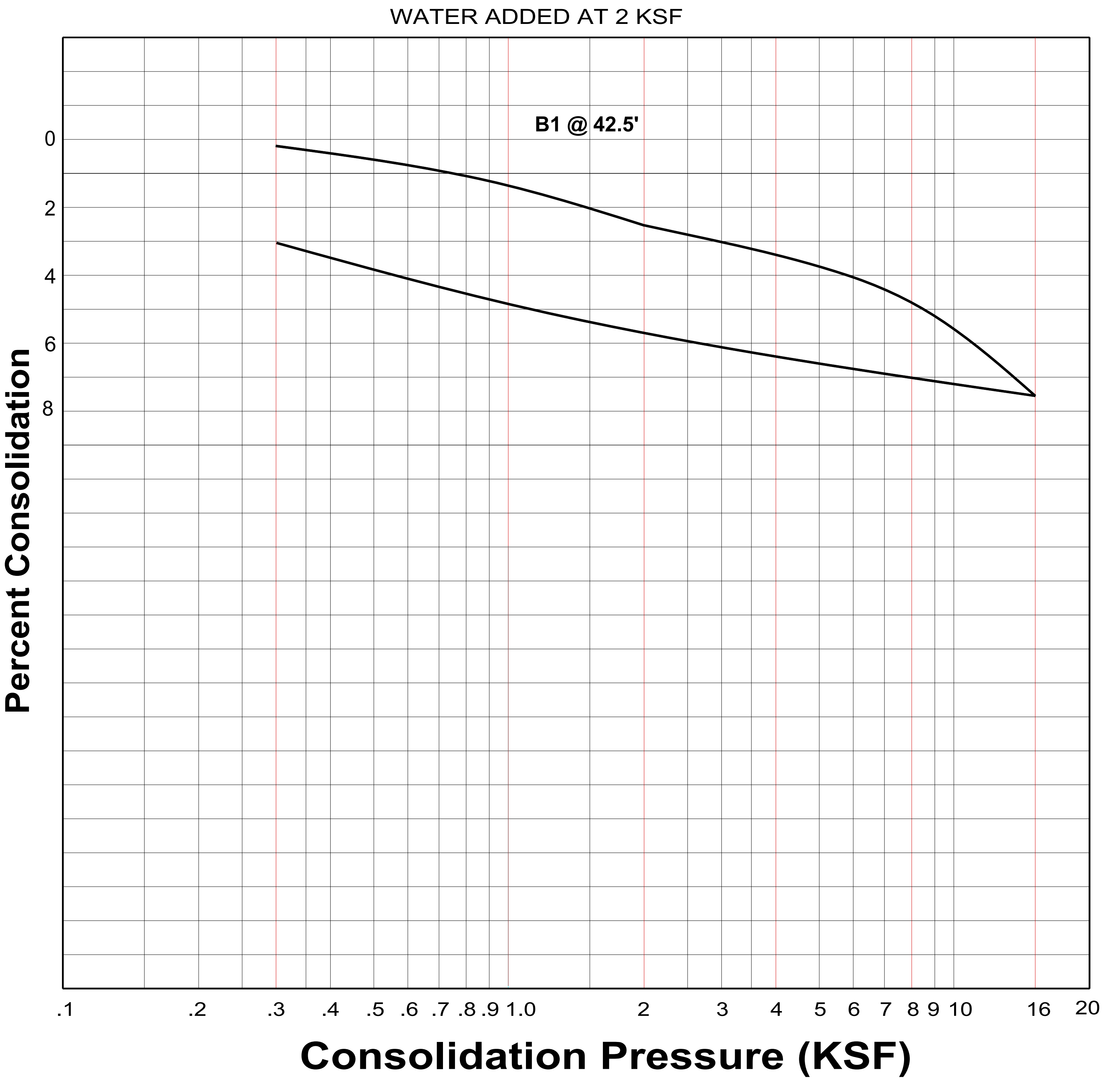
FILE NO. 21796 | **PLATE: C-4**



CONSOLIDATION TEST

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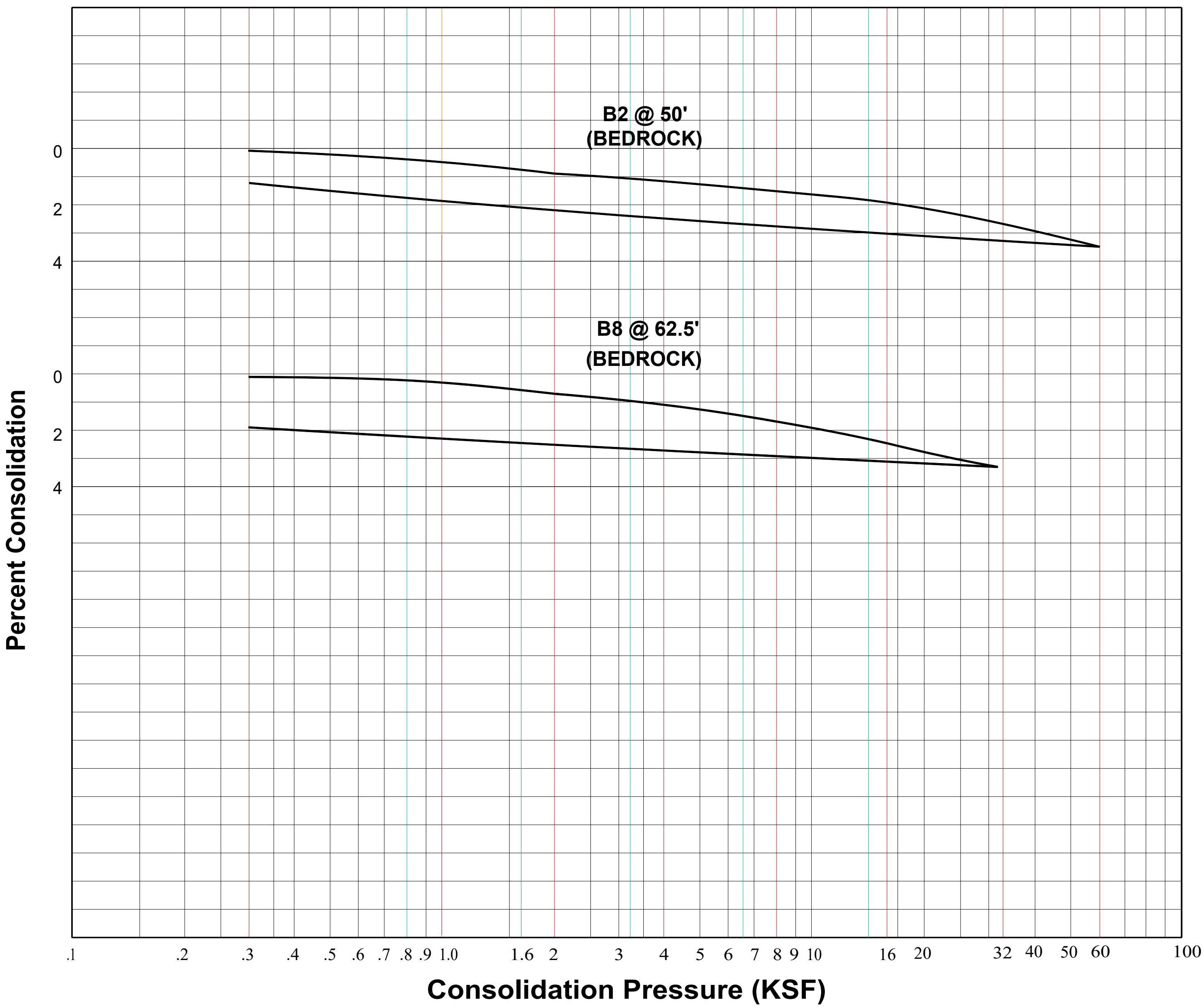
FILE NO. 21796 **PLATE: C-5**

(WATER ADDED AT 2 KSF)



CONSOLIDATION TEST

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FILE NO. 21796

PLATE: C-6

ASTM D-1557

SAMPLE	B1 @ 1-5'	B6 @ 1-5'	B8 @ 1-5'	B10 @ 1-5'
SOIL TYPE:	SM/ML	SC/ML	SM	SM
MAXIMUM DENSITY pcf.	126.3	127.6	125.4	124.3
OPTIMUM MOISTURE %	11.4	10.4	11.1	11.0

ASTM D 4829

SAMPLE	B1 @ 1-5'	B6 @ 1-5'	B8 @ 1-5'	B10 @ 1-5'
SOIL TYPE:	SM/ML	SC/ML	SM	SM
EXPANSION INDEX UBC STANDARD 18-2	20	35	17	35
EXPANSION CHARACTER	LOW	LOW	VERY LOW	LOW

SULFATE CONTENT

SAMPLE	B1 @ 1-5'	B6 @ 1-5'	B8 @ 1-5'	B10 @ 1-5'
SULFATE CONTENT: (percentage by weight)	< 0.1%	< 0.1%	< 0.10%	< 0.10%

COMPACTION/EXPANSION/SULFATE DATA SHEET

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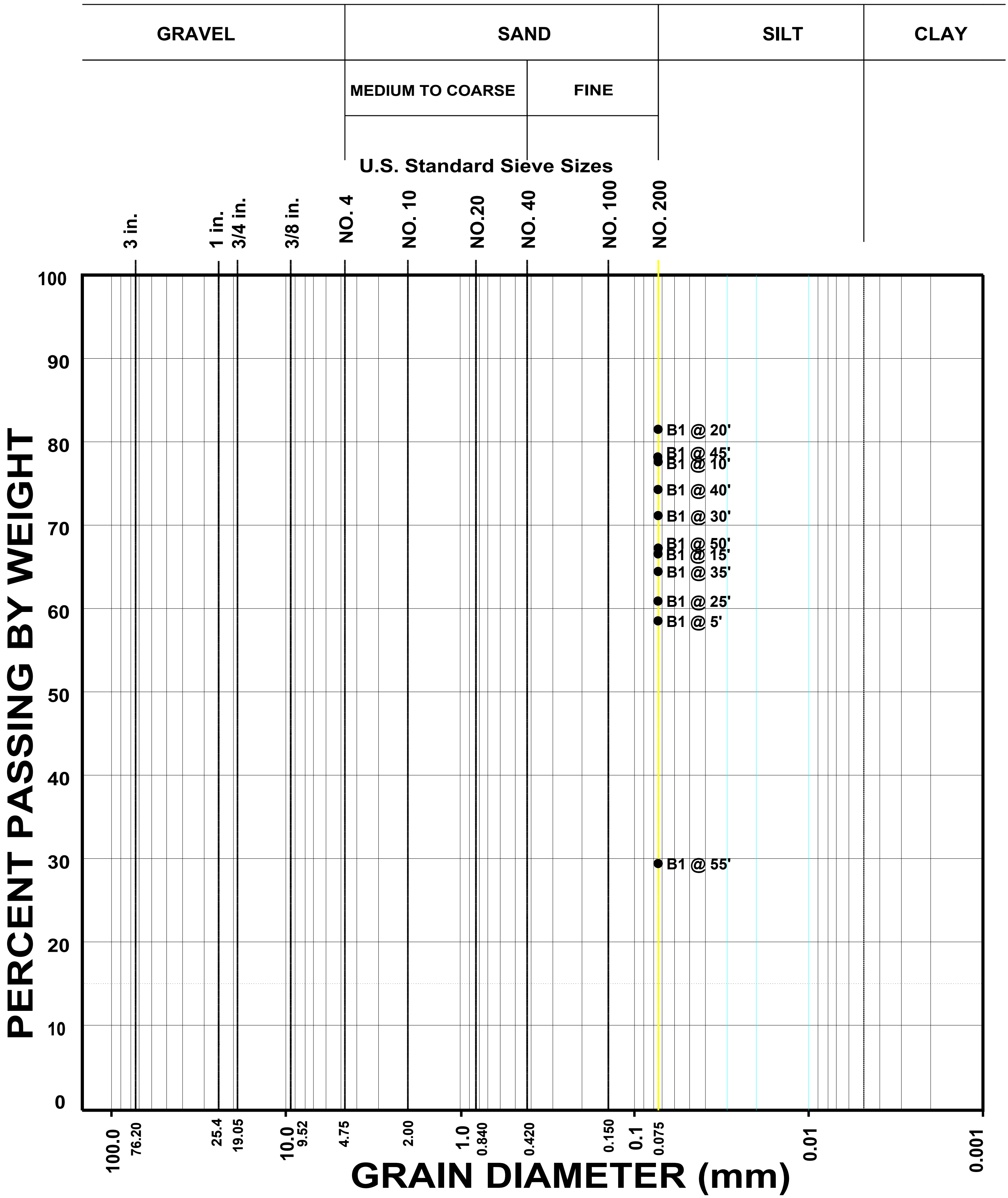
FILE NO. 21796 | PLATE: D



GRAIN SIZE DISTRIBUTION

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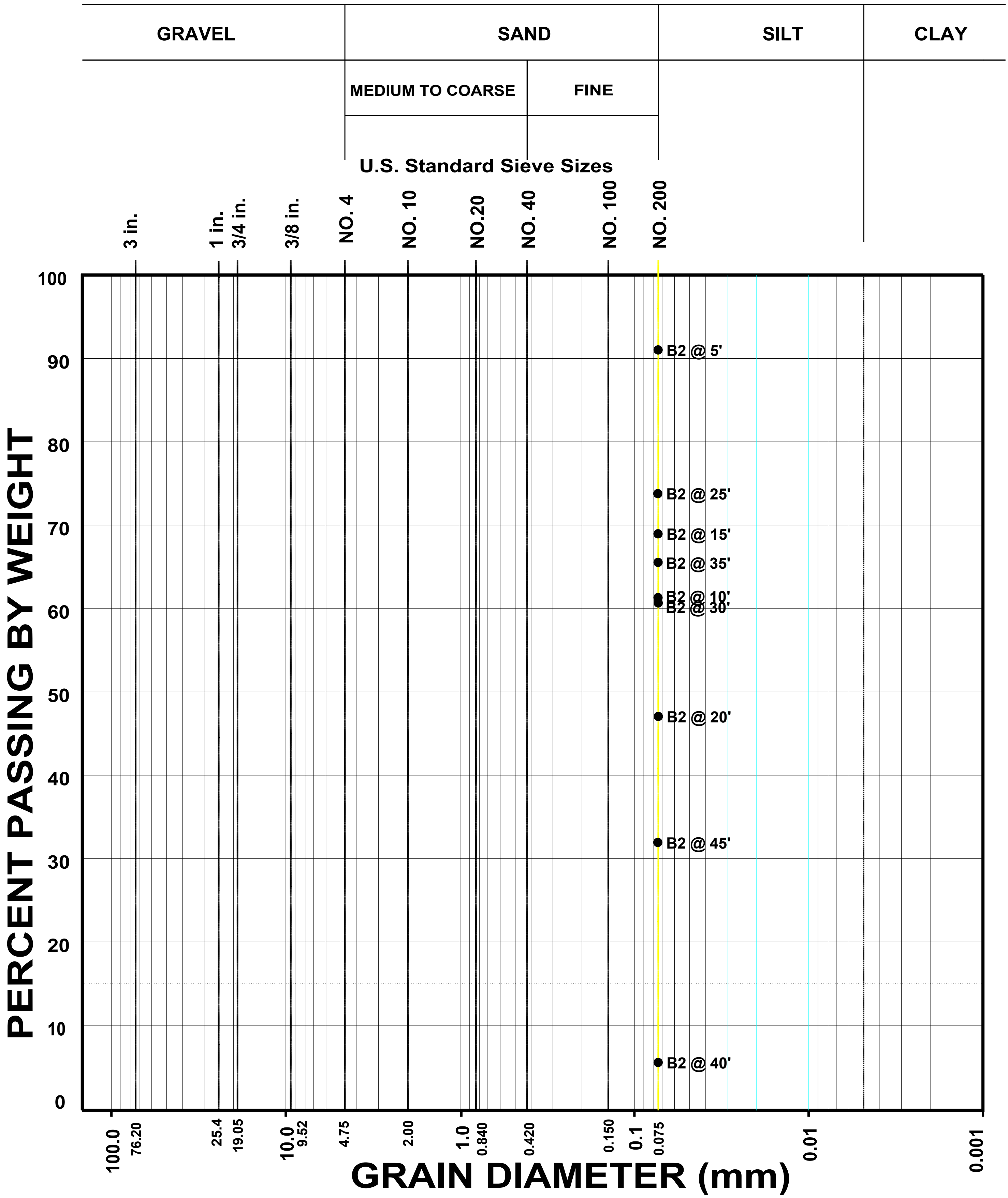
FILE NO. 21796 | PLATE: E-1



GRAIN SIZE DISTRIBUTION

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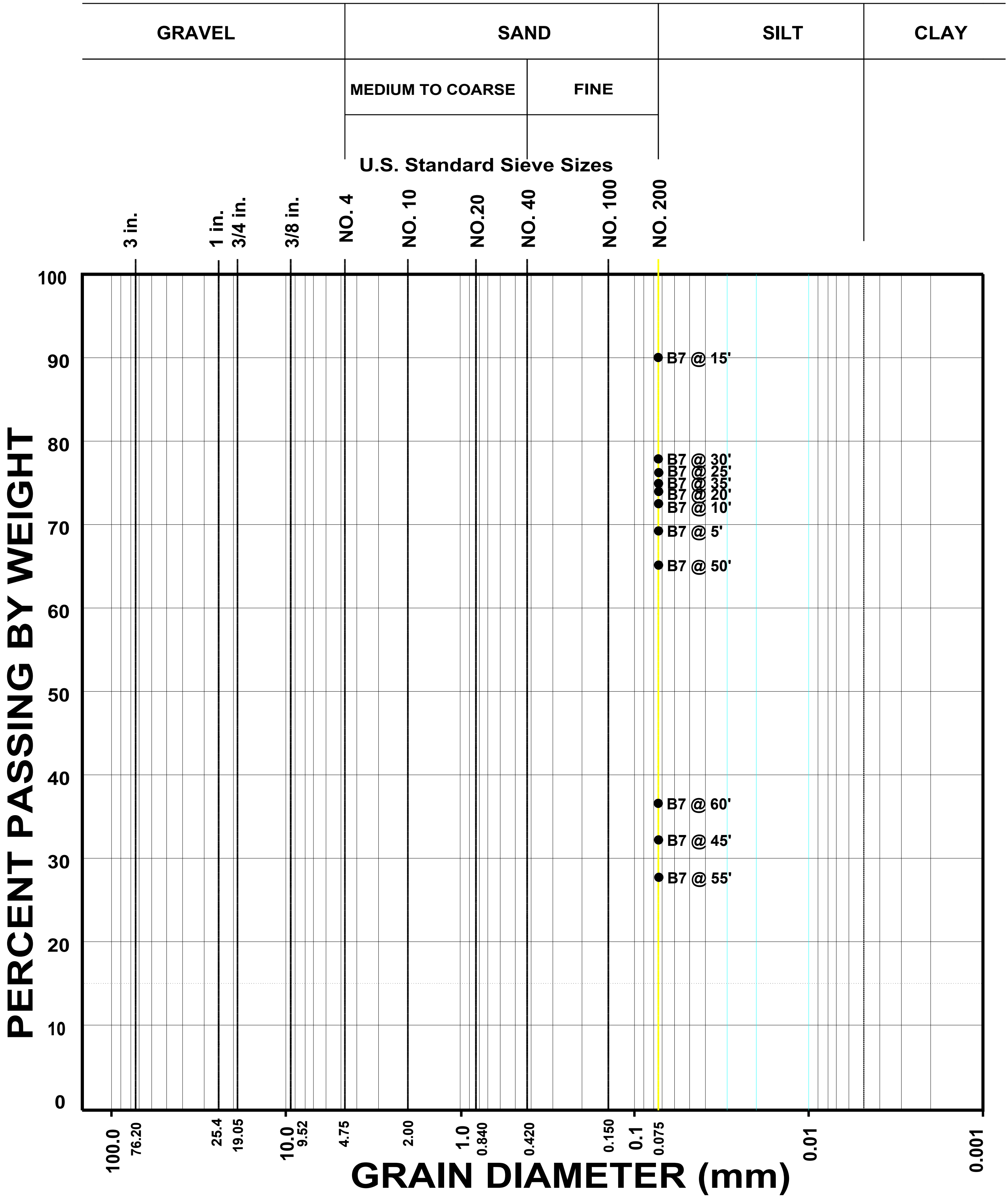
FILE NO. 21796

PLATE: E-2



GRAIN SIZE DISTRIBUTION

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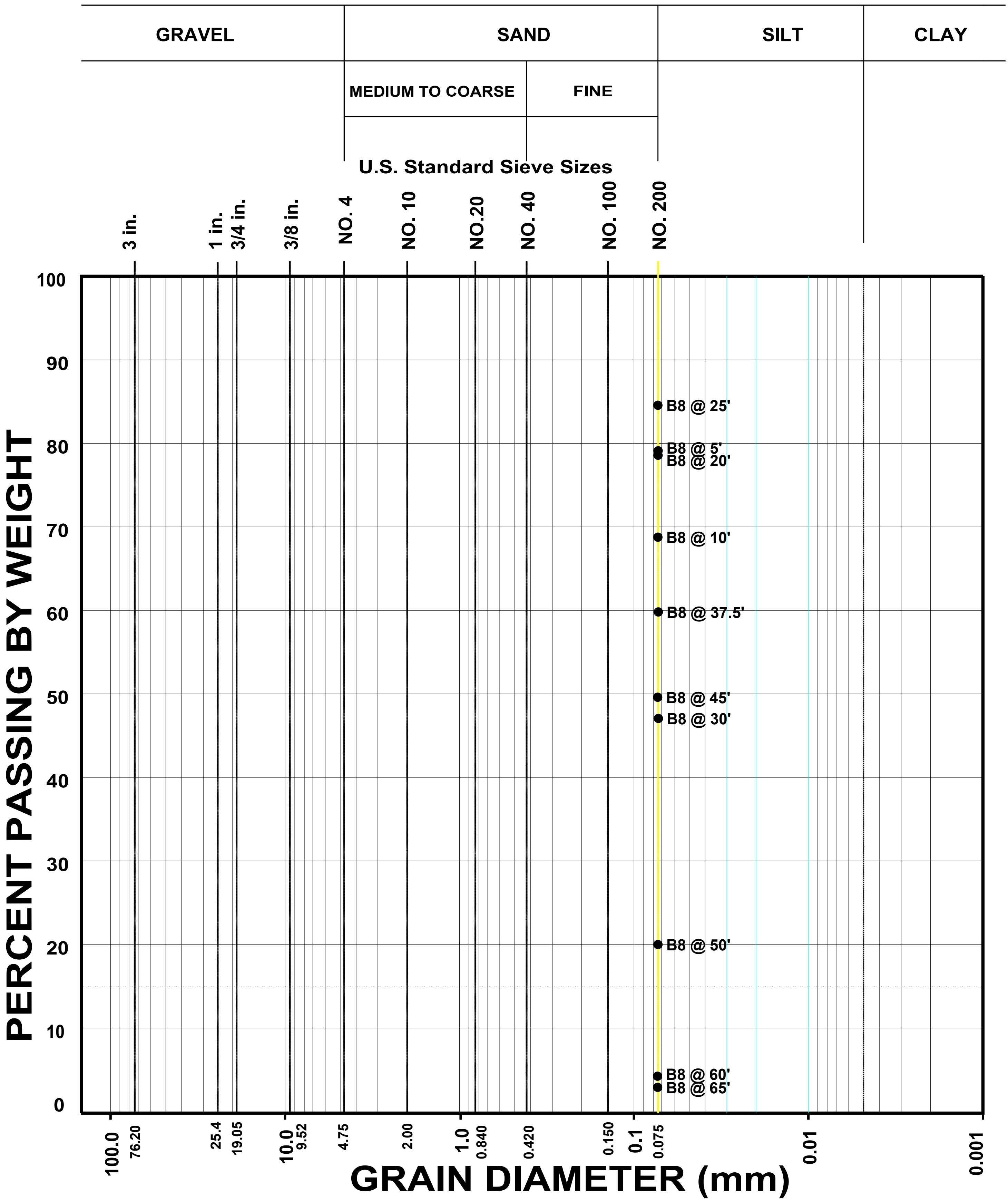
FILE NO. 21796 | **PLATE: E-3**



GRAIN SIZE DISTRIBUTION

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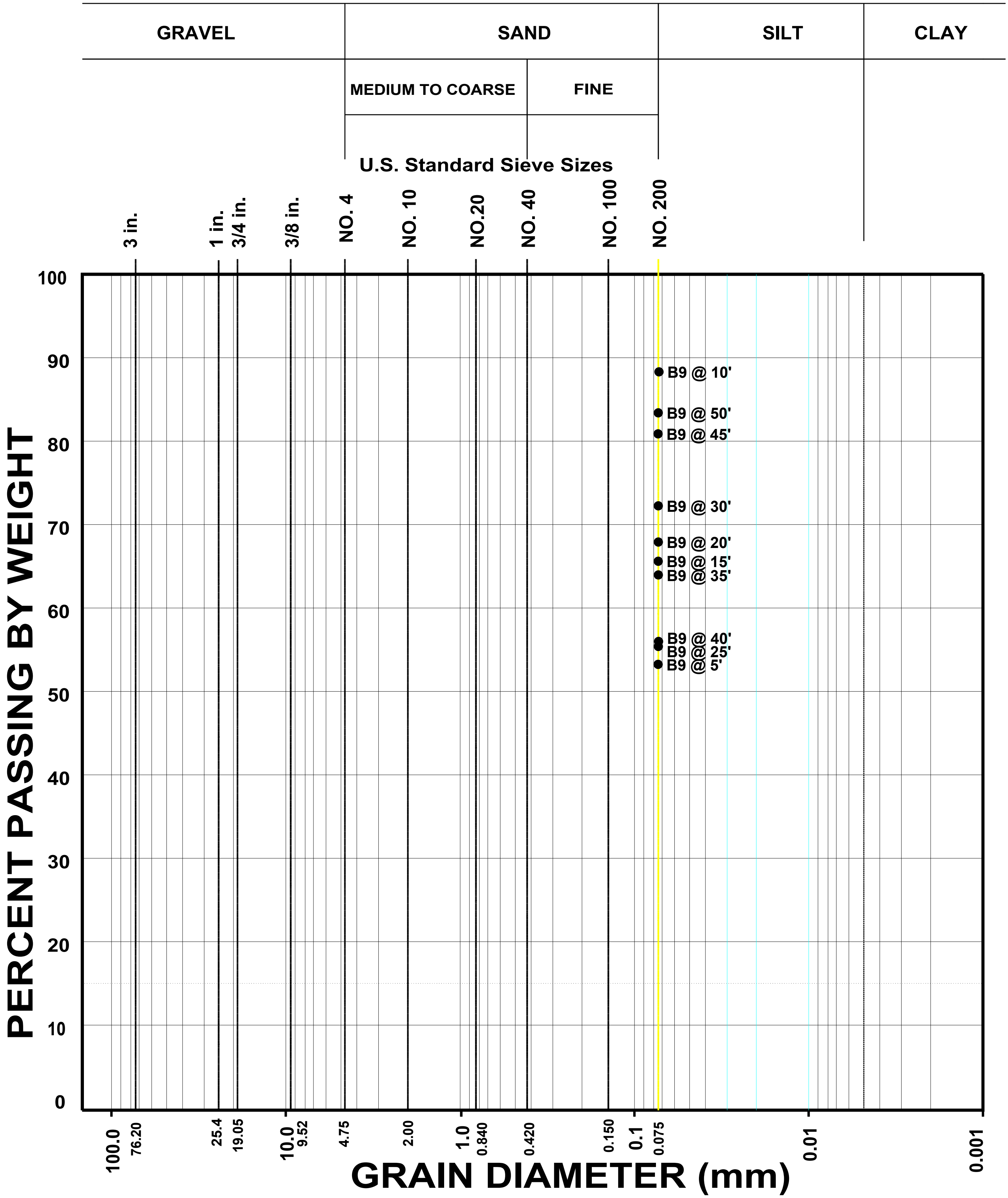
FILE NO. 21796 | **PLATE: E-4**



GRAIN SIZE DISTRIBUTION

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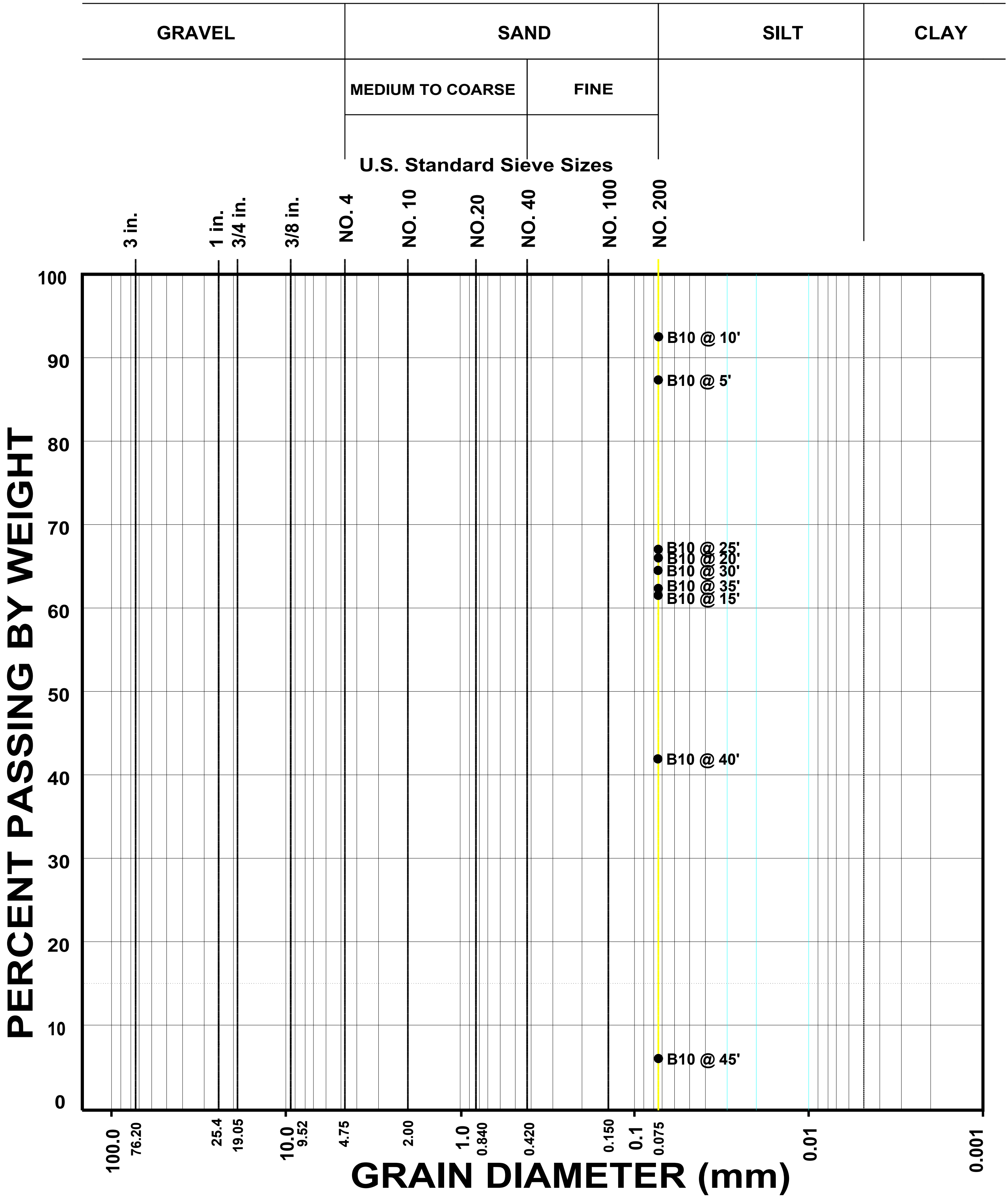
FILE NO. 21796 | **PLATE: E-5**



GRAIN SIZE DISTRIBUTION

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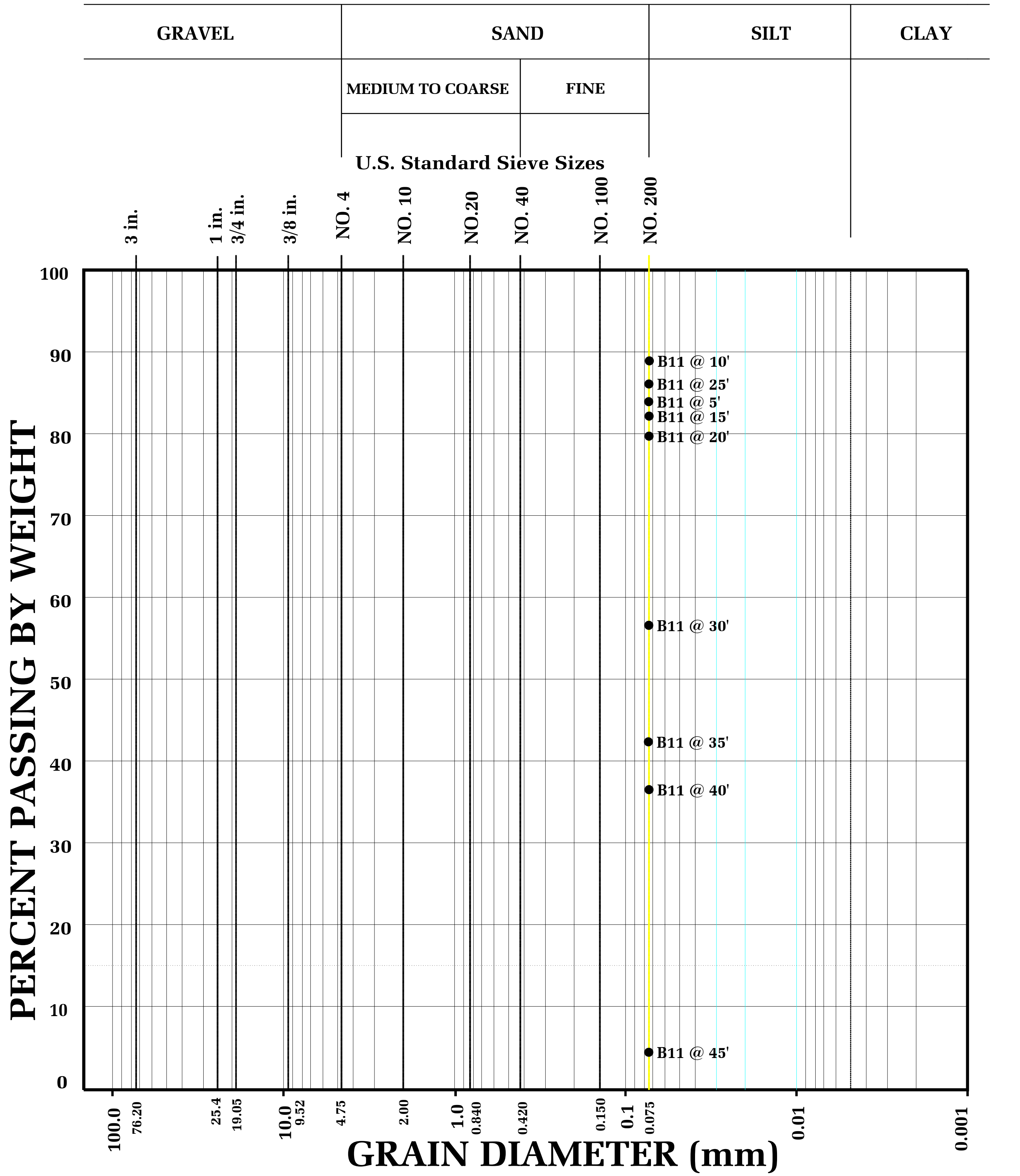
FILE NO. 21796 | **PLATE: E-6**



GRAIN SIZE DISTRIBUTION

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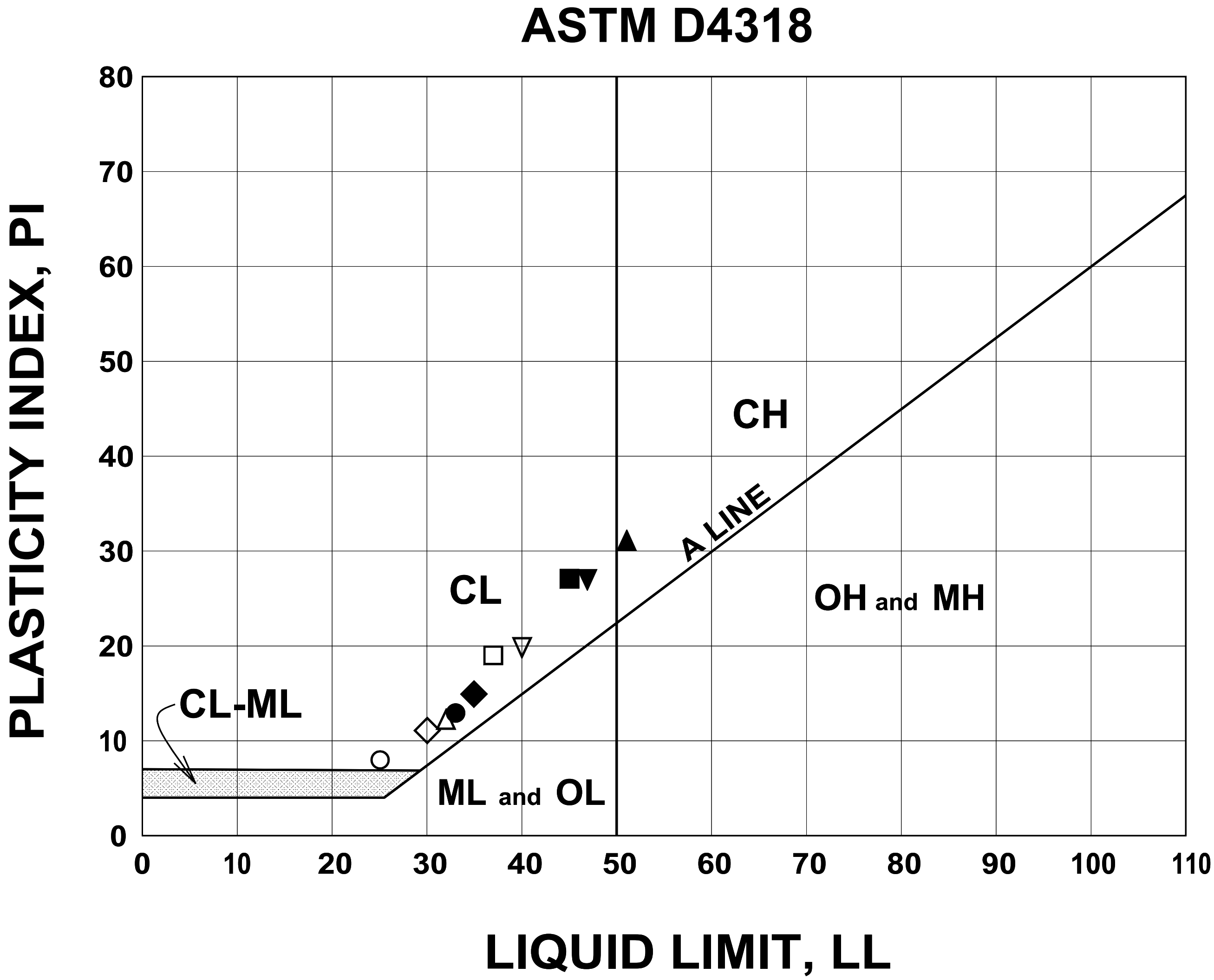
FILE NO. 21796 | **PLATE: E-7**



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B1	5	○	25	17	8	CL
B1	10	●	33	20	13	CL
B1	15	△	32	20	12	CL
B1	20	▲	51	20	31	CH
B1	25	□	37	18	19	CL
B1	30	■	45	18	27	CL
B1	35	◇	30	19	11	CL
B1	40	◆	35	20	15	CL
B1	45	▽	40	20	20	CL
B1	50	▼	47	20	27	CL

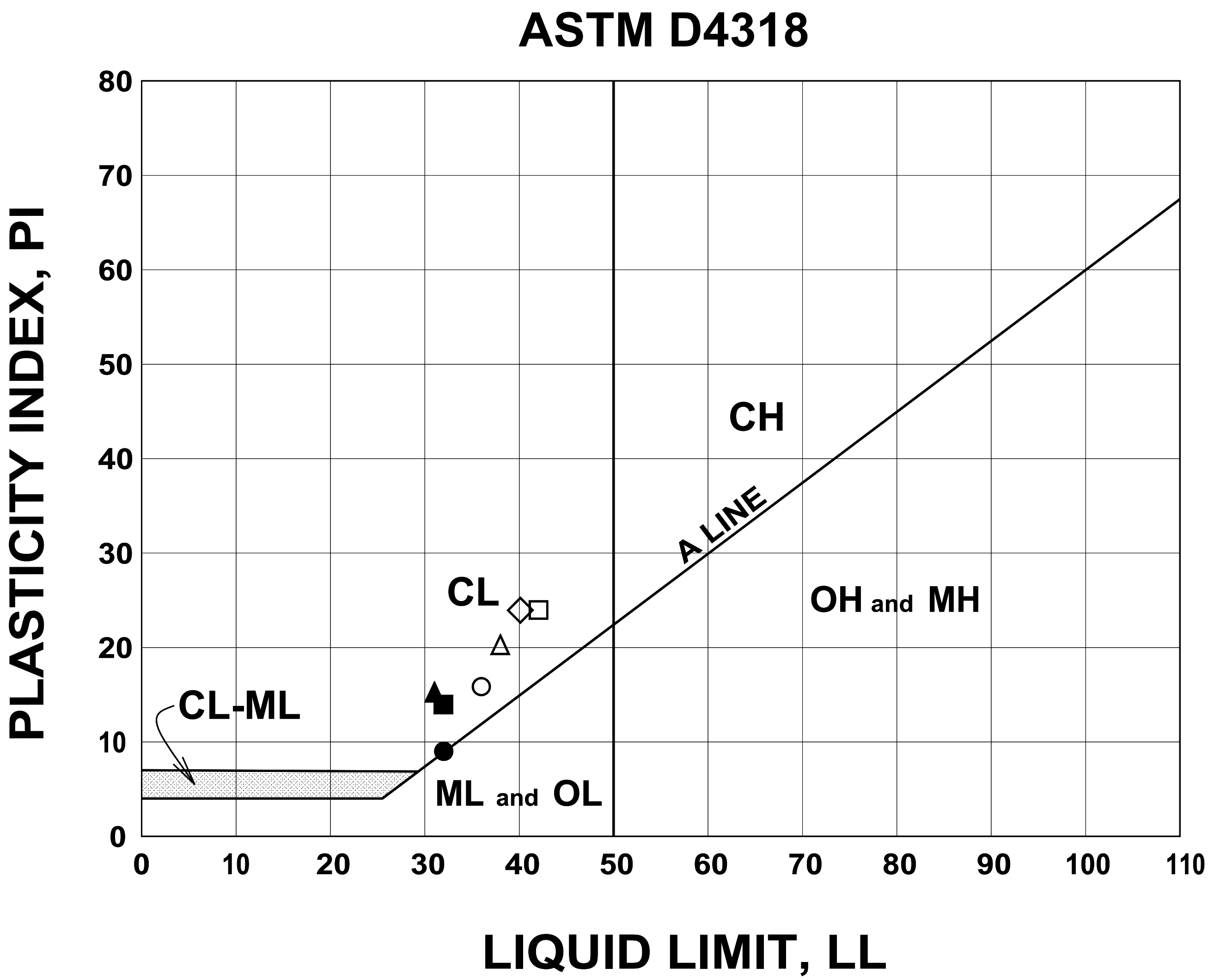
ATTERBERG LIMITS DETERMINATION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796

PLATE: F-1



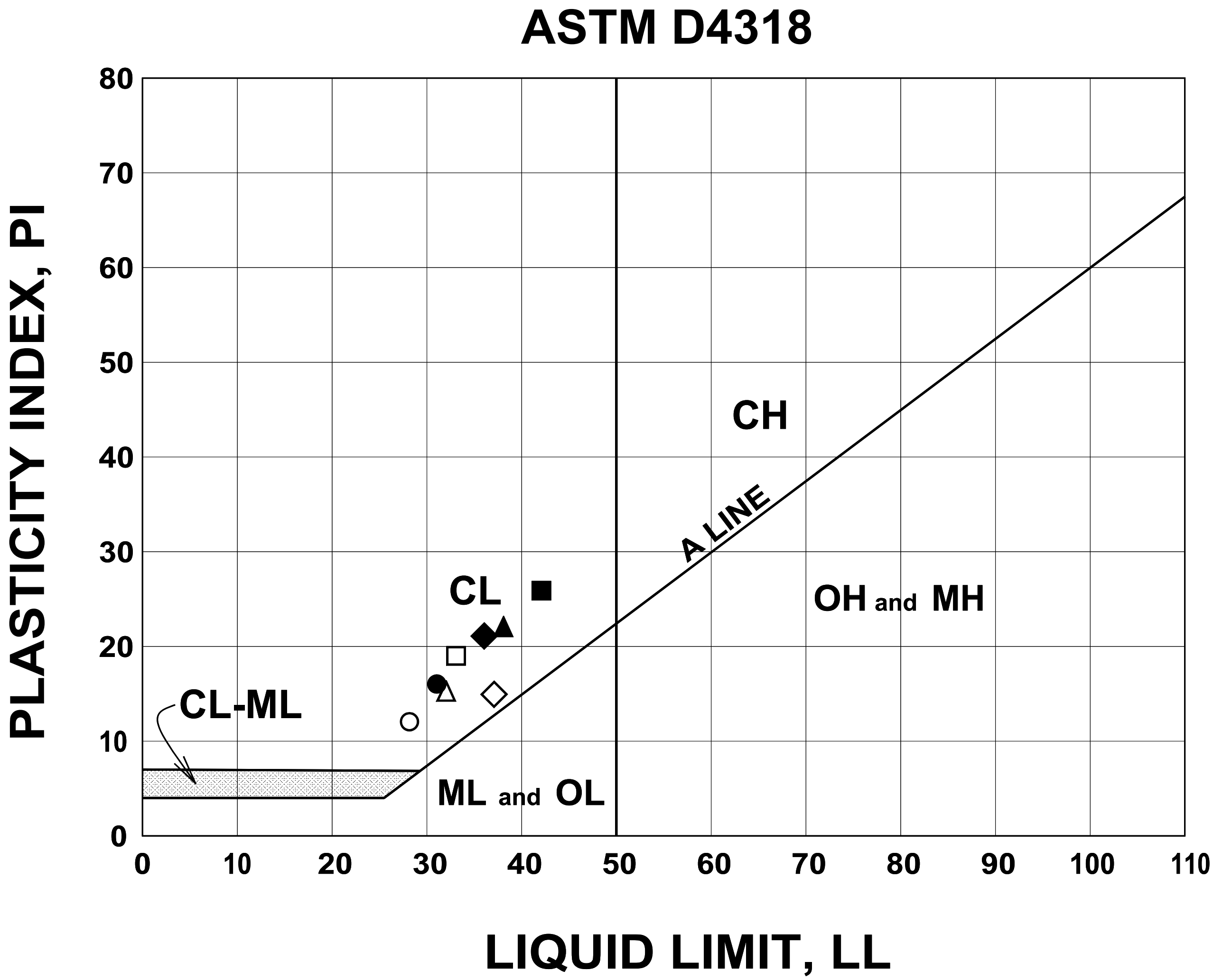
BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B2	5	○	36	20	16	CL
B2	10	●	32	23	9	CL
B2	15	△	38	18	20	CL
B2	20	▲	31	16	15	CL
B2	25	□	42	18	24	CL
B2	30	■	32	18	14	CL
B2	35	◇	40	16	24	CL

ATTERBERG LIMITS DETERMINATION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796 | PLATE: F-2



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B7	5	○	28	16	12	CL
B7	10	●	31	15	16	CL
B7	15	△	32	17	15	CL
B7	20	▲	38	16	22	CL
B7	25	□	33	14	19	CL
B7	30	■	42	16	26	CL
B7	35	◇	37	15	22	CL
B7	50	◆	36	15	21	CL

ATTERBERG LIMITS DETERMINATION

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HARVARD-WESTLAKE SCHOOL
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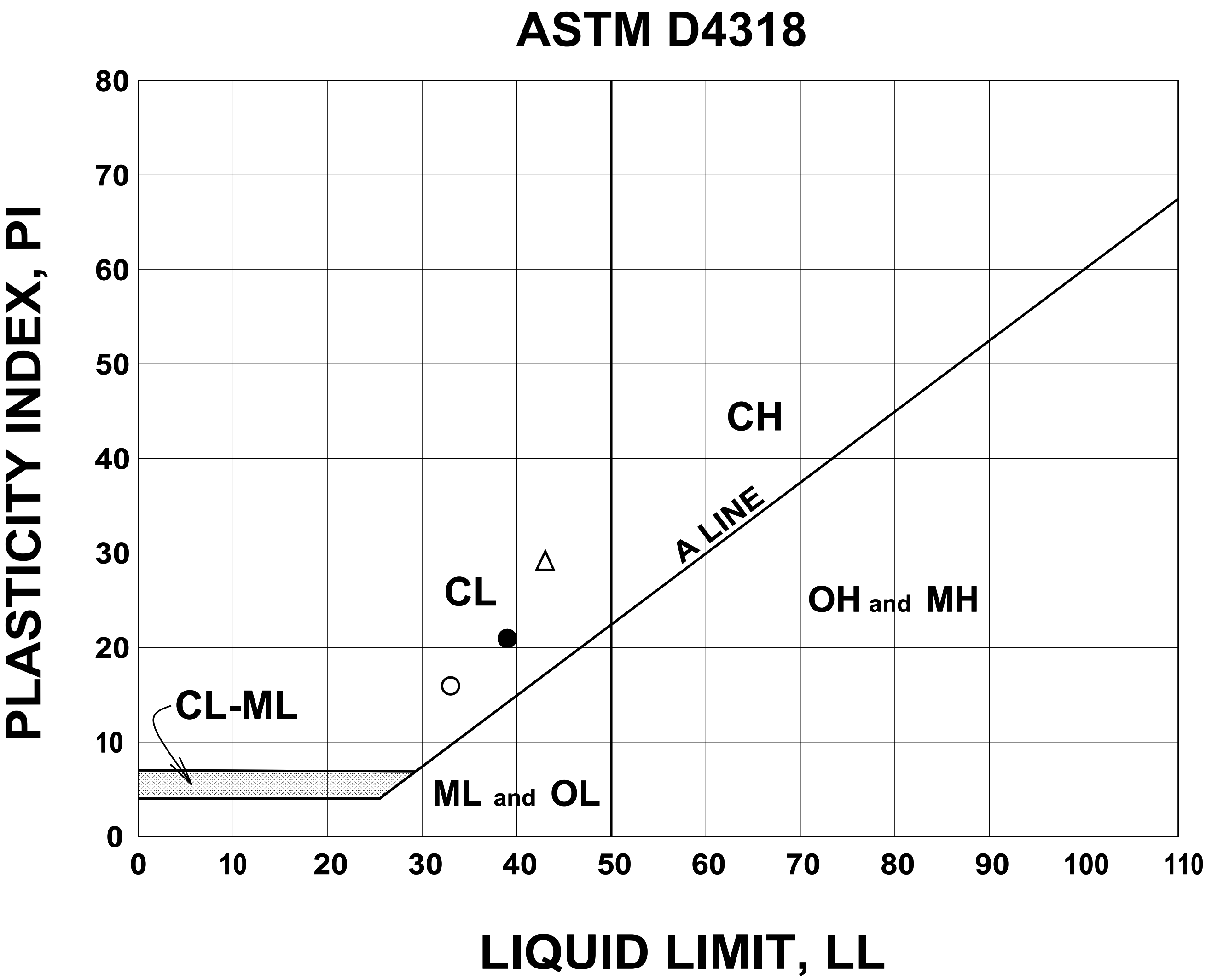
FILE NO. 21796 | **PLATE: F-3**



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B8	5	○	33	18	16	CL
B8	20	●	39	18	21	CL
B8	37.5	△	43	14	29	CL

ATTERBERG LIMITS DETERMINATION

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HARVARD-WESTLAKE SCHOOL
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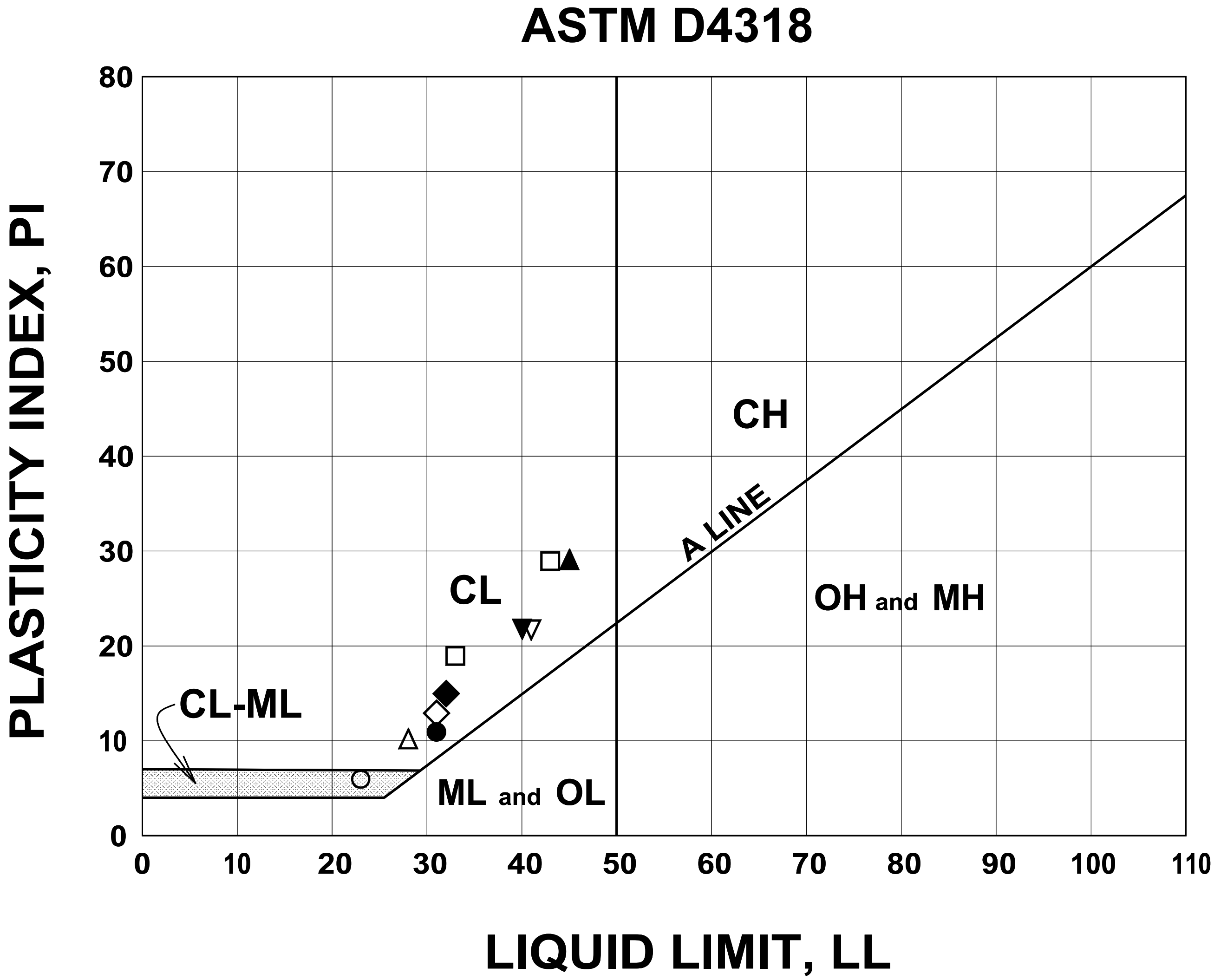
FILE NO. 21796

PLATE: F-4



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B9	5	○	23	17	6	CL-ML
B9	10	●	31	20	11	CL
B9	15	△	28	18	10	CL
B9	20	▲	45	16	29	CL
B9	25	□	33	14	19	CL
B9	30	■	43	14	29	CL
B9	35	◇	31	18	13	CL
B9	40	◆	32	17	15	CL
B9	45	▽	41	19	22	CL
B9	50	▼	40	18	22	CL

ATTERBERG LIMITS DETERMINATION

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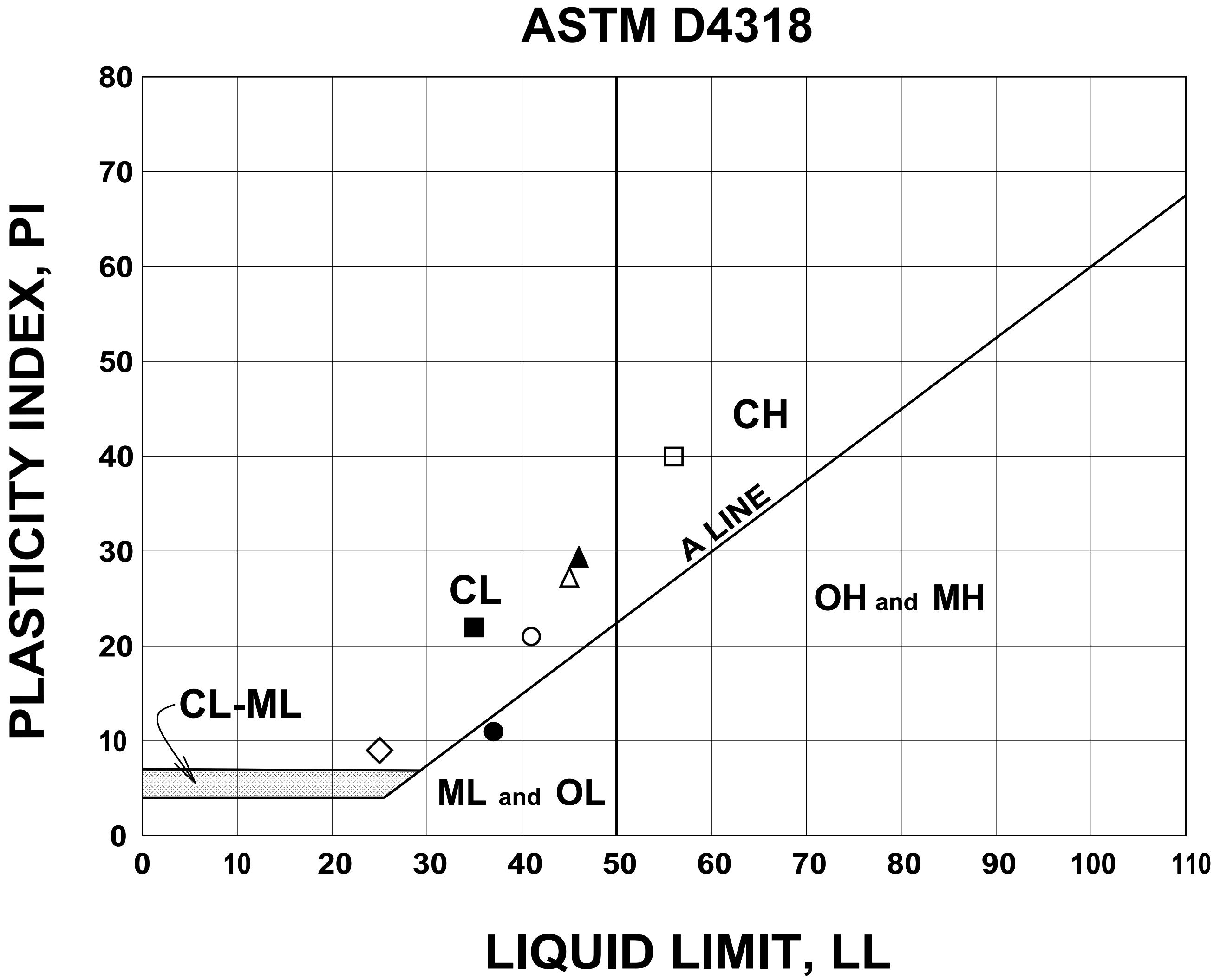
HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796 | **PLATE: F-5**



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B10	5	○	41	20	21	CL
B10	10	●	37	26	11	ML
B10	15	△	45	18	27	CL
B10	20	▲	46	17	29	CL
B10	25	□	56	16	40	CH
B10	30	■	35	13	22	CL
B10	35	◇	25	16	9	CL

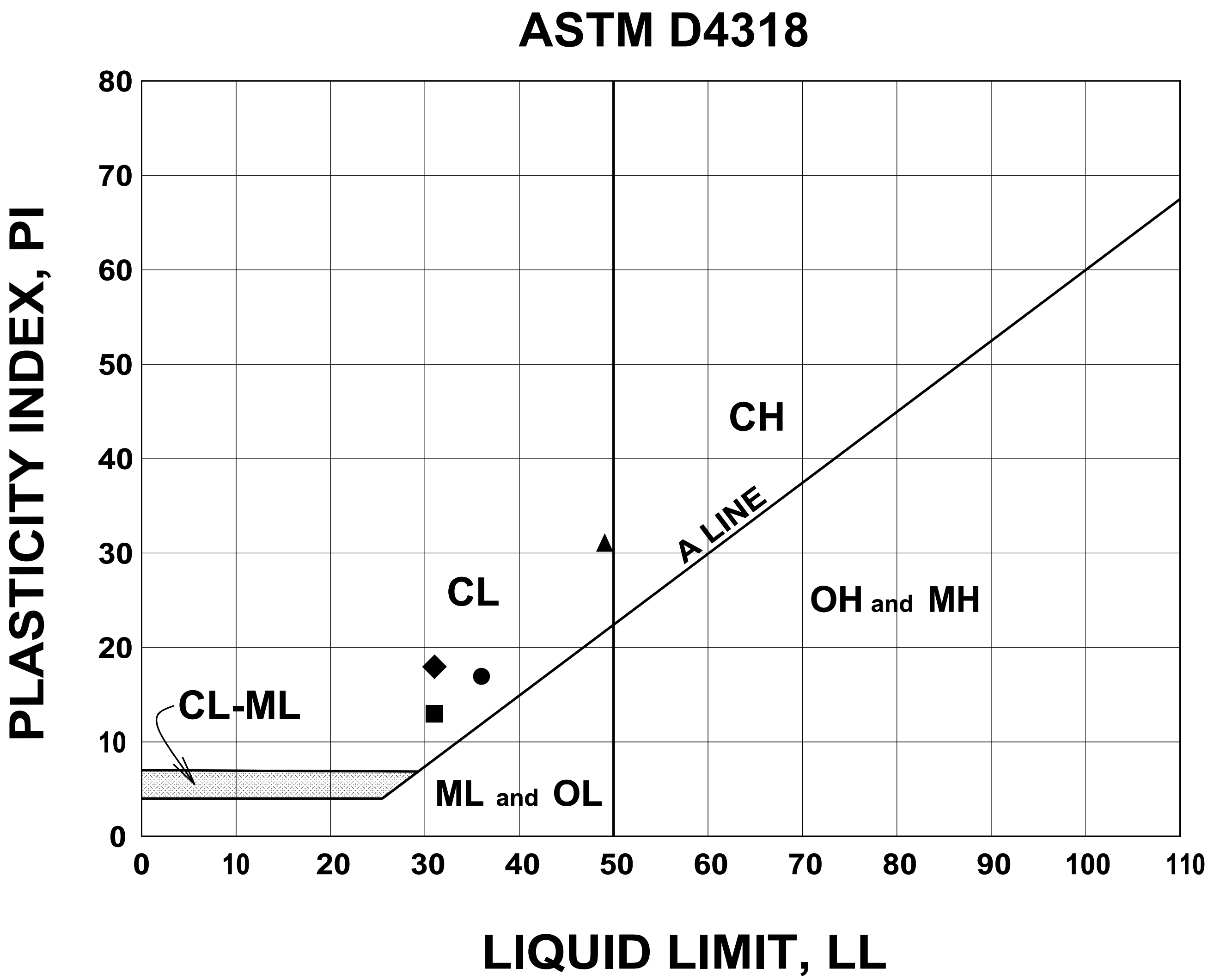
ATTERBERG LIMITS DETERMINATION

Geotechnologies, Inc.
Consulting Geotechnical Engineers

HARVARD-WESTLAKE SCHOOL
4141 WHITSETT AVE., STUDIO CITY

FILE NO. 21796

PLATE: F-6



BORING NUMBER	DEPTH (FEET)	TEST SYMBOL	LL	PL	PI	DESCRIPTION
B11	5	○	34	17	17	CL
B11	10	●	36	19	17	CL
B11	15	△	42	17	25	CL
B11	20	▲	49	18	31	CL
B11	25	□	65	16	49	CH
B11	30	■	31	18	13	CL
B11	35		34	14	20	CL
B11	40	◆	31	13	18	CL

ATTERBERG LIMITS DETERMINATION

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FILE NO. 21796 | **PLATE: F-7**

Geotechnologies, Inc.

Project: Harvard-Westlake School
File No.: 21796
Description: Liquefaction Analysis
Boring No: 7

LIQUEFACTION EVALUATION (Idriss & Boulanger, EERI NO 12)

EARTHQUAKE INFORMATION:

Earthquake Magnitude (M):	6.9
Peak Ground Horizontal Acceleration, PGA (g):	0.95
Calculated Mag.Wtg.Factor:	1.171

GROUNDWATER INFORMATION:

Current Groundwater Level (ft):	24.5
Historically Highest Groundwater Level* (ft):	0.0
Unit Weight of Water (pcf):	62.4

* Based on California Geological Survey Seismic Hazard Evaluation Report

BOREHOLE AND SAMPLER INFORMATION:

Borehole Diameter (inches):	8
SPT Sampler with room for Liner (Y/N):	Y

LIQUEFACTION BOUNDARY:

Plastic Index Cut Off (PI):	18
Minimum Liquefaction FS:	1.3

Depth to Base Layer (feet)	Total Unit Weight (pcf)	Current Water Level (feet)	Historical Water Level (feet)	Field SPT Blowcount N	Depth of SPT Blowcount (feet)	Fines Content #200 Sieve (%)	Plastic Index (PI)	Vetical Stress σ_{vc}, (psf)	Effective Vert. Stress σ_{vc}', (psf)	Fines Corrected $(N_1)_{60\text{-}cs}$	Stress Reduction Coeff, r_d	Cyclic Shear Ratio CSR	Cyclic Resistance Ratio (CRR)	Factor of Safety CRR/CSR (F.S.)	Liquefaction Settlment ΔS_i (inches)
1	105.4	Unsaturated	Saturated	3	5	69.2	0	105.4	43.0	11.6	1.00	1.520	0.167	0.1	REMOVED
2	105.4	Unsaturated	Saturated	3	5	69.2	0	210.8	86.0	11.6	1.00	1.515	0.167	0.1	REMOVED
3	105.4	Unsaturated	Saturated	3	5	69.2	0	316.2	129.0	11.6	1.00	1.511	0.167	0.1	REMOVED
4	105.4	Unsaturated	Saturated	3	5	69.2	0	421.6	172.0	11.6	0.99	1.506	0.167	0.1	REMOVED
5	105.4	Unsaturated	Saturated	3	5	69.2	0	527.0	215.0	12.0	0.99	1.500	0.171	0.1	REMOVED
6	105.4	Unsaturated	Saturated	3	5	69.2	0	632.4	258.0	12.0	0.99	1.495	0.171	0.1	REMOVED
7	105.4	Unsaturated	Saturated	3	5	69.2	0	737.8	301.0	12.0	0.98	1.489	0.171	0.1	REMOVED
8	133.7	Unsaturated	Saturated	8	10	72.5	0	871.5	372.3	21.7	0.98	1.417	0.295	0.2	REMOVED
9	133.7	Unsaturated	Saturated	8	10	72.5	0	1005.2	443.6	21.6	0.98	1.366	0.292	0.2	REMOVED
10	133.7	Unsaturated	Saturated	8	10	72.5	0	1138.9	514.9	20.6	0.97	1.328	0.271	0.2	REMOVED
11	121.5	Unsaturated	Saturated	8	10	72.5	0	1260.4	574.0	19.8	0.97	1.313	0.255	0.2	REMOVED
12	121.5	Unsaturated	Saturated	8	10	72.5	0	1381.9	633.1	19.2	0.96	1.299	0.242	0.2	REMOVED
13	121.5	Unsaturated	Saturated	23	15	90.0	0	1503.4	692.2	45.9	0.96	1.287	2.000	1.6	0.00
14	121.5	Unsaturated	Saturated	23	15	90.0	0	1624.9	751.3	45.0	0.95	1.275	2.000	1.6	0.00
15	121.5	Unsaturated	Saturated	23	15	90.0	0	1746.4	810.4	48.6	0.95	1.264	2.000	1.6	0.00
16	121.5	Unsaturated	Saturated	23	15	90.0	0	1867.9	869.5	47.8	0.95	1.254	2.000	1.6	0.00
17	121.5	Unsaturated	Saturated	23	15	90.0	0	1989.4	928.6	47.0	0.94	1.245	2.000	1.6	0.00
18	124.7	Unsaturated	Saturated	10	20	73.9	22	2114.1	990.9	21.1	0.94	1.233	0.257	Non-Liq.	0.00
19	124.7	Unsaturated	Saturated	10	20	73.9	22	2238.8	1053.2	20.6	0.93	1.222	0.248	Non-Liq.	0.00
20	124.7	Unsaturated	Saturated	10	20	73.9	22	2363.5	1115.5	20.1	0.93	1.211	0.239	Non-Liq.	0.00
21	124.7	Unsaturated	Saturated	10	20	73.9	22	2488.2	1177.8	19.7	0.92	1.201	0.232	Non-Liq.	0.00
22	124.7	Unsaturated	Saturated	10	20	73.9	22	2612.9	1240.1	19.3	0.92	1.191	0.225	Non-Liq.	0.00
23	123.1	Unsaturated	Saturated	14	25	76.2	19	2736.0	1300.8	25.5	0.91	1.182	0.338	Non-Liq.	0.00
24	123.1	Unsaturated	Saturated	14	25	76.2	19	2859.1	1361.5	25.0	0.90	1.174	0.323	Non-Liq.	0.00
25	123.1	Saturated	Saturated	14	25	76.2	19	2982.2	1422.2	24.7	0.90	1.165	0.313	Non-Liq.	0.00
26	123.1	Saturated	Saturated	14	25	76.2	19	3105.3	1482.9	24.5	0.89	1.156	0.307	Non-Liq.	0.00
27	123.1	Saturated	Saturated	14	25	76.2	19	3228.4	1543.6	24.2	0.89	1.148	0.301	Non-Liq.	0.00
28	101.6	Saturated	Saturated	14	25	76.2	19	3330.0	1582.8	25.3	0.88	1.147	0.326	Non-Liq.	0.00
29	101.6	Saturated	Saturated	14	25	76.2	19	3431.6	1622.0	25.2	0.88	1.146	0.322	Non-Liq.	0.00
30	101.6	Saturated	Saturated	14	25	76.2	19	3533.2	1661.2	25.0	0.87	1.145	0.318	Non-Liq.	0.00
31	101.6	Saturated	Saturated	9	30	77.9	26	3634.8	1700.4	17.0	0.87	1.144	0.193	Non-Liq.	0.00
32	101.6	Saturated	Saturated	9	30	77.9	26	3736.4	1739.6	16.9	0.86	1.141	0.192	Non-Liq.	0.00
33	124.8	Saturated	Saturated	9	30	77.9	26	3861.2	1802.0	16.7	0.85	1.131	0.190	Non-Liq.	0.00
34	124.8	Saturated	Saturated	9	30	77.9	26	3986.0	1864.4	16.6	0.85	1.121	0.188	Non-Liq.	0.00
35	124.8	Saturated	Saturated	9	30	77.9	26	4110.8	1926.8	16.5	0.84	1.111	0.187	Non-Liq.	0.00
36	124.8	Saturated	Saturated	9	35	74.9	22	4235.6	1989.2	16.4	0.84	1.101	0.185	Non-Liq.	0.00
37	124.8	Saturated	Saturated	9	35	74.9	22	4360.4	2051.6	16.3	0.83	1.092	0.184	Non-Liq.	0.00
38	129.7	Saturated	Saturated	9	35	74.9	22	4490.1	2118.9	16.2	0.83	1.081	0.183	Non-Liq.	0.00
39	129.7	Saturated	Saturated	9	35	74.9	22	4619.8	2186.2	16.1	0.82	1.070	0.181	Non-Liq.	0.00
40	129.7	Saturated	Saturated	9	35	74.9	22	4749.5	2253.5	16.0	0.81	1.060	0.180	Non-Liq.	0.00
41	129.7	Saturated	Saturated	17	40	0.0	0	4879.2	2320.8	22.5	0.81	1.050	0.257	0.2	0.25
42	129.7	Saturated	Saturated	17	40	0.0	0	5008.9	2388.1	22.3	0.80	1.040	0.253	0.2	0.25
43	131.7	Saturated	Saturated	17	40	0.0	0	5140.6	2457.4	22.1	0.80	1.030	0.249	0.2	0.25
44	131.7	Saturated	Saturated	17	40	0.0	0	5272.3	2526.7	21.8	0.79	1.020	0.245	0.2	0.26
45	131.7	Saturated	Saturated	17	40	0.0	0	5404.0	2596.0	21.6	0.79	1.010	0.241	0.2	0.26
46	120.5	Saturated	Saturated	14	45	32.2	0	5524.5	2654.1	22.1	0.78	1.002	0.248	0.2	0.25
47	120.5	Saturated	Saturated	14	45	32.2	0	5645.0	2712.2	22.0	0.77	0.995	0.245	0.2	0.26
48	120.5	Saturated	Saturated	14	45	32.2	0	5765.5	2770.3	21.8	0.77	0.988	0.243	0.2	0.26
49	120.5	Saturated	Saturated	14	45	32.2	0	5886.0	2828.4	21.7	0.76	0.980	0.240	0.2	0.26
50	120.5	Saturated	Saturated	14	45	32.2	0	6006.5	2886.5	21.6	0.76	0.973	0.238	0.2	0.26
51	120.5	Saturated	Saturated	10	50	65.1	21	6127.0	2944.6	16.2	0.75	0.966	0.178	Non-Liq.	0.00
52	120.5	Saturated	Saturated	10	50	65.1	21	6247.5	3002.7	16.1	0.75	0.958	0.177	Non-Liq.	0.00
53	120.8	Saturated	Saturated	27	55	27.7	0	6368.3	3061.1	44.8	0.74	0.951	1.805	1.9	0.00
54	120.8	Saturated	Saturated	27	55	27.7	0	6489.1	3119.5	44.6	0.73	0.944	1.797	1.9	0.00
55	120.8	Saturated	Saturated	27	55	27.7	0	6609.9	3177.9	44.3	0.73	0.937	1.788	1.9	0.00
56	120.8	Saturated	Saturated	27	55	27.7	0	6730.7	3236.3	44.1	0.72	0.930	1.779	1.9	0.00
57	120.8	Saturated	Saturated	27	55	27.7	0	6851.5	3294.7	43.9	0.72	0.923	1.771	1.9	0.00
58	126.2	Saturated	Saturated	27	55	27.7	0	6977.7	3358.5	43.6	0.71	0.915	1.762	1.9	0.00
59	126.2	Saturated	Saturated	27	55	27.7	0	7103.9	3422.3	43.4	0.71	0.908	1.753	1.9	0.00
60	126.2	Saturated	Saturated	28	60	36.6	0	7230.1	3486.1	45.7	0.70	0.900	1.744	1.9	0.00

Total Liquefaction Settlement, S =	**2.56 inches**

Geotechnologies, Inc.

Project: Harvard-Westlake School
File No.: 21796
Description: Liquefaction Analysis
Boring No: 8

LIQUEFACTION EVALUATION (Idriss & Boulanger, EERI NO 12)

EARTHQUAKE INFORMATION:

Earthquake Magnitude (M):	6.8
Peak Ground Horizontal Acceleration, PGA (g):	0.95
Calculated Mag.Wtg.Factor:	1.203

GROUNDWATER INFORMATION:

Current Groundwater Level (ft):	24.5
Historically Highest Groundwater Level* (ft):	0.0
Unit Weight of Water (pcf):	62.4

* Based on California Geological Survey Seismic Hazard Evaluation Report

BOREHOLE AND SAMPLER INFORMATION:

Borehole Diameter (inches):	8
SPT Sampler with room for Liner (Y/N):	Y

LIQUEFACTION BOUNDARY:

Plastic Index Cut Off (PI):	18
Minimum Liquefaction FS:	1.3

Depth to Base Layer (feet)	Total Unit Weight (pcf)	Current Water Level (feet)	Historical Water Level (feet)	Field SPT Blowcount N	Depth of SPT Blowcount (feet)	Fines Content #200 Sieve (%)	Plastic Index (PI)	Vetical Stress σ_{vc}, (psf)	Effective Vert. Stress σ_{vc}', (psf)	Fines Corrected $(N_1)_{60-cs}$	Stress Reduction Coeff, r_d	Cyclic Shear Ratio CSR	Cyclic Resistance Ratio (CRR)	Factor of Safety CRR/CSR (F.S.)	Liquefaction Settlment ΔS_i (inches)
1	105.8	Unsaturated	Saturated	11	5	79.1	0	105.8	43.4	29.8	1.00	1.512	0.623	0.4	REMOVED
2	105.8	Unsaturated	Saturated	11	5	79.1	0	211.6	86.8	29.8	1.00	1.507	0.623	0.4	REMOVED
3	105.8	Unsaturated	Saturated	11	5	79.1	0	317.4	130.2	29.8	1.00	1.502	0.623	0.4	REMOVED
4	105.8	Unsaturated	Saturated	11	5	79.1	0	423.2	173.6	29.8	0.99	1.497	0.623	0.4	REMOVED
5	105.8	Unsaturated	Saturated	11	5	79.1	0	529.0	217.0	31.7	0.99	1.491	0.811	0.5	REMOVED
6	105.8	Unsaturated	Saturated	11	5	79.1	0	634.8	260.4	30.4	0.99	1.486	0.678	0.5	REMOVED
7	105.8	Unsaturated	Saturated	11	5	79.1	0	740.6	303.8	29.2	0.98	1.480	0.579	0.4	REMOVED
8	116.0	Unsaturated	Saturated	11	5	79.1	0	856.6	357.4	27.8	0.98	1.449	0.498	0.3	REMOVED
9	116.0	Unsaturated	Saturated	11	5	79.1	0	972.6	411.0	27.9	0.97	1.425	0.504	0.4	REMOVED
10	116.0	Unsaturated	Saturated	11	5	79.1	0	1088.6	464.6	26.8	0.97	1.404	0.450	0.3	REMOVED
11	116.0	Unsaturated	Saturated	9	10	68.7	0	1204.6	518.2	22.1	0.97	1.387	0.304	0.2	REMOVED
12	116.0	Unsaturated	Saturated	9	10	68.7	0	1320.6	571.8	21.3	0.96	1.372	0.286	0.2	REMOVED
13	105.7	Unsaturated	Saturated	22	15	68.7	0	1426.3	615.1	44.9	0.96	1.371	2.000	1.5	0.00
14	105.7	Unsaturated	Saturated	22	15	68.7	0	1532.0	658.4	44.1	0.95	1.369	2.000	1.5	0.00
15	105.7	Unsaturated	Saturated	22	15	68.7	0	1637.7	701.7	47.6	0.95	1.366	2.000	1.5	0.00
16	105.7	Unsaturated	Saturated	22	15	68.7	0	1743.4	745.0	46.9	0.94	1.362	2.000	1.5	0.00
17	105.7	Unsaturated	Saturated	22	15	68.7	0	1849.1	788.3	46.2	0.94	1.358	2.000	1.5	0.00
18	127.8	Unsaturated	Saturated	12	20	78.5	21	1976.9	853.7	25.3	0.93	1.334	0.360	Non-Liq.	0.00
19	127.8	Unsaturated	Saturated	12	20	78.5	21	2104.7	919.1	24.6	0.93	1.312	0.339	Non-Liq.	0.00
20	127.8	Unsaturated	Saturated	12	20	78.5	21	2232.5	984.5	24.1	0.92	1.291	0.321	Non-Liq.	0.00
21	127.8	Unsaturated	Saturated	12	20	78.5	21	2360.3	1049.9	23.5	0.92	1.273	0.306	Non-Liq.	0.00
22	127.8	Unsaturated	Saturated	12	20	78.5	21	2488.1	1115.3	23.0	0.91	1.256	0.293	Non-Liq.	0.00
23	116.9	Unsaturated	Saturated	12	20	78.5	21	2605.0	1169.8	22.6	0.91	1.246	0.282	Non-Liq.	0.00
24	116.9	Unsaturated	Saturated	12	20	78.5	21	2721.9	1224.3	22.2	0.90	1.236	0.273	Non-Liq.	0.00
25	116.9	Saturated	Saturated	12	20	78.5	21	2838.8	1278.8	21.9	0.89	1.227	0.267	Non-Liq.	0.00
26	116.9	Saturated	Saturated	24	25	84.5	0	2955.7	1333.3	44.0	0.89	1.217	2.000	1.6	0.00
27	116.9	Saturated	Saturated	24	25	84.5	0	3072.6	1387.8	43.7	0.88	1.208	2.000	1.7	0.00
28	126.3	Saturated	Saturated	16	30	47.1	0	3198.9	1451.7	29.5	0.88	1.194	0.509	0.4	0.12
29	126.3	Saturated	Saturated	16	30	47.1	0	3325.2	1515.6	29.2	0.87	1.181	0.491	0.4	0.13
30	126.3	Saturated	Saturated	16	30	47.1	0	3451.5	1579.5	29.0	0.87	1.169	0.475	0.4	0.13
31	126.3	Saturated	Saturated	16	30	47.1	0	3577.8	1643.4	28.7	0.86	1.156	0.460	0.4	0.14
32	126.3	Saturated	Saturated	16	30	47.1	0	3704.1	1707.3	28.5	0.85	1.145	0.446	0.4	0.14
33	107.7	Saturated	Saturated	16	30	47.1	0	3811.8	1752.6	28.3	0.85	1.139	0.437	0.4	0.15
34	107.7	Saturated	Saturated	16	30	47.1	0	3919.5	1797.9	28.1	0.84	1.134	0.428	0.4	0.15
35	107.7	Saturated	Saturated	11	35	59.8	29	4027.2	1843.2	19.7	0.84	1.129	0.228	Non-Liq.	0.00
36	107.7	Saturated	Saturated	11	35	59.8	29	4134.9	1888.5	19.6	0.83	1.123	0.226	Non-Liq.	0.00
37	107.7	Saturated	Saturated	11	35	59.8	29	4242.6	1933.8	19.5	0.82	1.117	0.224	Non-Liq.	0.00
38	123.4	Saturated	Saturated	11	35	59.8	29	4366.0	1994.8	19.3	0.82	1.106	0.222	Non-Liq.	0.00
39	123.4	Saturated	Saturated	11	35	59.8	29	4489.4	2055.8	19.2	0.81	1.096	0.220	Non-Liq.	0.00
40	123.4	Saturated	Saturated	11	35	59.8	29	4612.8	2116.8	19.0	0.81	1.085	0.218	Non-Liq.	0.00
41	123.4	Saturated	Saturated	16	40	49.6	0	4736.2	2177.8	26.8	0.80	1.075	0.369	0.3	0.19
42	123.4	Saturated	Saturated	16	40	49.6	0	4859.6	2238.8	26.6	0.79	1.065	0.362	0.3	0.19
43	131.6	Saturated	Saturated	16	40	49.6	0	4991.2	2308.0	26.4	0.79	1.053	0.354	0.3	0.20
44	131.6	Saturated	Saturated	16	40	49.6	0	5122.8	2377.2	26.2	0.78	1.041	0.346	0.3	0.21
45	131.6	Saturated	Saturated	16	40	49.6	0	5254.4	2446.4	26.0	0.78	1.030	0.339	0.3	0.21
46	131.6	Saturated	Saturated	18	45	49.6	0	5386.0	2515.6	29.2	0.77	1.019	0.462	0.5	0.13
47	131.6	Saturated	Saturated	18	45	49.6	0	5517.6	2584.8	29.0	0.76	1.008	0.449	0.4	0.13
48	120.1	Saturated	Saturated	18	45	49.6	0	5637.7	2642.5	28.8	0.76	1.000	0.439	0.4	0.14
49	120.1	Saturated	Saturated	18	45	49.6	0	5757.8	2700.2	28.6	0.75	0.992	0.429	0.4	0.14
50	120.1	Saturated	Saturated	18	45	49.6	0	5877.9	2757.9	28.5	0.75	0.984	0.420	0.4	0.14
51	120.1	Saturated	Saturated	30	50	20.0	0	5998.0	2815.6	50.8	0.74	0.976	1.892	1.9	0.00
52	120.1	Saturated	Saturated	30	50	20.0	0	6118.1	2873.3	50.7	0.74	0.968	1.883	1.9	0.00
53	135.4	Saturated	Saturated	30	50	20.0	0	6253.5	2946.3	50.5	0.73	0.957	1.871	2.0	0.00
54	135.4	Saturated	Saturated	30	50	20.0	0	6388.9	3019.3	50.2	0.72	0.947	1.860	2.0	0.00
55	135.4	Saturated	Saturated	30	50	20.0	0	6524.3	3092.3	50.0	0.72	0.937	1.849	2.0	0.00
56	135.4	Saturated	Saturated	29	55	0.0	0	6659.7	3165.3	43.4	0.71	0.927	1.837	2.0	0.00
57	135.4	Saturated	Saturated	29	55	0.0	0	6795.1	3238.3	43.1	0.71	0.917	1.826	2.0	0.00
58	122.8	Saturated	Saturated	32	60	4.2	0	6917.9	3298.7	48.1	0.70	0.910	1.817	2.0	0.00
59	122.8	Saturated	Saturated	32	60	4.2	0	7040.7	3359.1	47.9	0.70	0.902	1.809	2.0	0.00
60	122.8	Saturated	Saturated	32	60	4.2	0	7163.5	3419.5	47.8	0.69	0.895	1.800	2.0	0.00
61	122.8	Saturated	Saturated	32	60	4.2	0	7286.3	3479.9	47.6	0.69	0.888	1.791	2.0	0.00
62	122.8	Saturated	Saturated	32	60	4.2	0	7409.1	3540.3	47.5	0.68	0.881	1.783	2.0	0.00
63	124.6	Saturated	Saturated	33	65	4.2	0	7533.7	3602.5	48.8	0.68	0.873	1.774	2.0	0.00
64	124.6	Saturated	Saturated	33	65	4.2	0	7658.3	3664.7	48.7	0.67	0.866	1.766	2.0	0.00
65	124.6	Saturated	Saturated	33	65	2.9	0	7782.9	3726.9	48.5	0.67	0.859	1.757	2.0	0.00
											Total Liquefaction Settlement, S =			**2.64 inches**	

Geotechnologies, Inc.

Project:	Harvard-Westlake School
File No.:	21796
Description:	Liquefaction Analysis
Boring No:	9

LIQUEFACTION EVALUATION (Idriss & Boulanger, EERI NO 12)

EARTHQUAKE INFORMATION:

Earthquake Magnitude (M):	6.9
Peak Ground Horizontal Acceleration, PGA (g):	0.95
Calculated Mag.Wtg.Factor:	1.171

GROUNDWATER INFORMATION:

Current Groundwater Level (ft):	24.5
Historically Highest Groundwater Level* (ft):	0.0
Unit Weight of Water (pcf):	62.4

* Based on California Geological Survey Seismic Hazard Evaluation Report

BOREHOLE AND SAMPLER INFORMATION:

Borehole Diameter (inches):	8
SPT Sampler with room for Liner (Y/N):	Y

LIQUEFACTION BOUNDARY:

Plastic Index Cut Off (PI):	18
Minimum Liquefaction FS:	1.3

Depth to Base Layer (feet)	Total Unit Weight (pcf)	Current Water Level (feet)	Historical Water Level (feet)	Field SPT Blowcount N	Depth of SPT Blowcount (feet)	Fines Content #200 Sieve (%)	Plastic Index (PI)	Vetical Stress σ_{vc}, (psf)	Effective Vert. Stress σ_{vc}', (psf)	Fines Corrected $(N_1)_{60-cs}$	Stress Reduction Coeff, r_d	Cyclic Shear Ratio CSR	Cyclic Resistance Ratio (CRR)	Factor of Safety CRR/CSR (F.S.)	Liquefaction Settlment ΔS_i (inches)
1	113.2	Unsaturated	Saturated	6	5	53.3	0	113.2	50.8	17.8	1.00	1.382	0.234	0.2	REMOVED
2	113.2	Unsaturated	Saturated	6	5	53.3	0	226.4	101.6	17.8	1.00	1.378	0.234	0.2	REMOVED
3	113.2	Unsaturated	Saturated	6	5	53.3	0	339.6	152.4	17.8	1.00	1.373	0.234	0.2	REMOVED
4	113.2	Unsaturated	Saturated	6	5	53.3	0	452.8	203.2	17.8	0.99	1.369	0.234	0.2	REMOVED
5	113.2	Unsaturated	Saturated	6	5	53.3	0	566.0	254.0	18.7	0.99	1.364	0.246	0.2	REMOVED
6	113.2	Unsaturated	Saturated	6	5	53.3	0	679.2	304.8	18.7	0.99	1.359	0.246	0.2	REMOVED
7	113.2	Unsaturated	Saturated	6	5	53.3	0	792.4	355.6	18.3	0.98	1.354	0.241	0.2	REMOVED
8	116.3	Unsaturated	Saturated	8	10	88.3	0	908.7	409.5	21.3	0.98	1.343	0.288	0.2	REMOVED
9	116.3	Unsaturated	Saturated	8	10	88.3	0	1025.0	463.4	21.4	0.98	1.333	0.288	0.2	REMOVED
10	116.3	Unsaturated	Saturated	8	10	88.3	0	1141.3	517.3	20.5	0.97	1.324	0.270	0.2	REMOVED
11	116.3	Unsaturated	Saturated	8	10	88.3	0	1257.6	571.2	19.8	0.97	1.316	0.255	0.2	REMOVED
12	116.3	Unsaturated	Saturated	8	10	88.3	0	1373.9	625.1	19.1	0.96	1.308	0.242	0.2	REMOVED
13	121.4	Unsaturated	Saturated	12	15	65.6	0	1495.3	684.1	25.6	0.96	1.295	0.379	0.3	REMOVED
14	121.4	Unsaturated	Saturated	12	15	65.6	0	1616.7	743.1	24.9	0.95	1.283	0.351	0.3	REMOVED
15	121.4	Unsaturated	Saturated	12	15	65.6	0	1738.1	802.1	26.6	0.95	1.271	0.405	0.3	REMOVED
16	121.4	Unsaturated	Saturated	12	15	65.6	0	1859.5	861.1	25.9	0.95	1.261	0.376	0.3	0.22
17	121.4	Unsaturated	Saturated	12	15	65.6	0	1980.9	920.1	25.3	0.94	1.251	0.352	0.3	0.23
18	123.6	Unsaturated	Saturated	12	15	65.6	0	2104.5	981.3	24.7	0.94	1.239	0.331	0.3	0.23
19	123.6	Unsaturated	Saturated	12	15	65.6	0	2228.1	1042.5	24.1	0.93	1.229	0.314	0.3	0.24
20	123.6	Unsaturated	Saturated	12	15	65.6	0	2351.7	1103.7	23.6	0.93	1.218	0.300	0.2	0.24
21	123.6	Unsaturated	Saturated	9	20	67.9	29	2475.3	1164.9	18.2	0.92	1.208	0.213	Non-Liq.	0.00
22	123.6	Unsaturated	Saturated	9	20	67.9	29	2598.9	1226.1	17.8	0.92	1.198	0.208	Non-Liq.	0.00
23	126.1	Unsaturated	Saturated	9	20	67.9	29	2725.0	1289.8	17.5	0.91	1.188	0.203	Non-Liq.	0.00
24	126.1	Unsaturated	Saturated	9	20	67.9	29	2851.1	1353.5	17.2	0.90	1.177	0.198	Non-Liq.	0.00
25	126.1	Saturated	Saturated	9	20	67.9	29	2977.2	1417.2	16.9	0.90	1.167	0.195	Non-Liq.	0.00
26	126.1	Saturated	Saturated	9	25	55.4	19	3103.3	1480.9	16.8	0.89	1.157	0.193	Non-Liq.	0.00
27	126.1	Saturated	Saturated	9	25	55.4	29	3229.4	1544.6	16.7	0.89	1.147	0.191	Non-Liq.	0.00
28	118.8	Saturated	Saturated	8	30	72.2	29	3348.2	1601.0	15.8	0.88	1.141	0.182	Non-Liq.	0.00
29	118.8	Saturated	Saturated	8	30	72.2	29	3467.0	1657.4	15.7	0.88	1.134	0.181	Non-Liq.	0.00
30	118.8	Saturated	Saturated	8	30	72.2	29	3585.8	1713.8	15.6	0.87	1.127	0.180	Non-Liq.	0.00
31	118.8	Saturated	Saturated	8	30	72.2	29	3704.6	1770.2	15.5	0.87	1.120	0.178	Non-Liq.	0.00
32	118.8	Saturated	Saturated	8	30	72.2	29	3823.4	1826.6	15.4	0.86	1.112	0.177	Non-Liq.	0.00
33	117.3	Saturated	Saturated	8	30	72.2	29	3940.7	1881.5	15.3	0.85	1.106	0.176	Non-Liq.	0.00
34	117.3	Saturated	Saturated	8	30	72.2	29	4058.0	1936.4	15.2	0.85	1.099	0.175	Non-Liq.	0.00
35	117.3	Saturated	Saturated	8	30	72.2	29	4175.3	1991.3	15.1	0.84	1.092	0.174	Non-Liq.	0.00
36	117.3	Saturated	Saturated	14	35	64.0	0	4292.6	2046.2	23.9	0.84	1.085	0.286	0.3	0.24
37	117.3	Saturated	Saturated	14	35	64.0	0	4409.9	2101.1	23.7	0.83	1.078	0.282	0.3	0.24
38	125.6	Saturated	Saturated	15	40	56.0	0	4535.5	2164.3	25.2	0.83	1.069	0.313	0.3	0.23
39	125.6	Saturated	Saturated	15	40	56.0	0	4661.1	2227.5	25.0	0.82	1.060	0.308	0.3	0.23
40	125.6	Saturated	Saturated	15	40	56.0	0	4786.7	2290.7	24.8	0.81	1.051	0.303	0.3	0.23
41	125.6	Saturated	Saturated	15	40	56.0	0	4912.3	2353.9	24.6	0.81	1.042	0.298	0.3	0.23
42	125.6	Saturated	Saturated	15	40	56.0	0	5037.9	2417.1	24.5	0.80	1.033	0.293	0.3	0.23
43	123.0	Saturated	Saturated	6	45	80.9	22	5160.9	2477.7	12.0	0.80	1.025	0.146	Non-Liq.	0.00
44	123.0	Saturated	Saturated	6	45	80.9	22	5283.9	2538.3	12.0	0.79	1.017	0.145	Non-Liq.	0.00
45	123.0	Saturated	Saturated	6	45	80.9	22	5406.9	2598.9	11.9	0.79	1.009	0.144	Non-Liq.	0.00
46	123.0	Saturated	Saturated	6	45	80.9	22	5529.9	2659.5	11.9	0.78	1.001	0.144	Non-Liq.	0.00
47	123.0	Saturated	Saturated	6	45	80.9	22	5652.9	2720.1	11.8	0.77	0.993	0.143	Non-Liq.	0.00
48	120.0	Saturated	Saturated	7	50	83.4	22	5772.9	2777.7	12.9	0.77	0.986	0.151	Non-Liq.	0.00
49	120.0	Saturated	Saturated	7	50	83.4	22	5892.9	2835.3	12.8	0.76	0.979	0.150	Non-Liq.	0.00
50	120.0	Saturated	Saturated	7	50	83.4	22	6012.9	2892.9	12.8	0.76	0.972	0.150	Non-Liq.	0.00
51	120.0	Saturated	Saturated	7	50	83.4	22	6132.9	2950.5	12.7	0.75	0.965	0.149	Non-Liq.	0.00
52	120.0	Saturated	Saturated	7	50	83.4	22	6252.9	3008.1	12.6	0.75	0.958	0.148	Non-Liq.	0.00
53	119.8	Saturated	Saturated	7	50	83.4	22	6372.7	3065.5	12.6	0.74	0.951	0.148	Non-Liq.	0.00
54	119.8	Saturated	Saturated	7	50	83.4	22	6492.5	3122.9	12.5	0.73	0.944	0.147	Non-Liq.	0.00
55	119.8	Saturated	Saturated	26	55	0.0	0	6612.3	3180.3	36.9	0.73	0.937	1.512	1.6	0.00

BEDROCK

Total Liquefaction Settlement, S = 2.77 inches

Geotechnologies, Inc.

Project: Harvard-Westlake School
File No.: 21796
Description: Liquefaction Analysis
Boring No: 10

LIQUEFACTION EVALUATION (Idriss & Boulanger, EERI NO 12)

EARTHQUAKE INFORMATION:

Earthquake Magnitude (M):	6.9
Peak Ground Horizontal Acceleration, PGA (g):	0.95
Calculated Mag.Wtg.Factor:	1.171

GROUNDWATER INFORMATION:

Current Groundwater Level (ft):	24.5
Historically Highest Groundwater Level* (ft):	0.0
Unit Weight of Water (pcf):	62.4

* Based on California Geological Survey Seismic Hazard Evaluation Report

BOREHOLE AND SAMPLER INFORMATION:

Borehole Diameter (inches):	8
SPT Sampler with room for Liner (Y/N):	Y

LIQUEFACTION BOUNDARY:

Plastic Index Cut Off (PI):	18
Minimum Liquefaction FS:	1.3

Depth to Base Layer (feet)	Total Unit Weight (pcf)	Current Water Level (feet)	Historical Water Level (feet)	Field SPT Blowcount N	Depth of SPT Blowcount (feet)	Fines Content #200 Sieve (%)	Plastic Index (PI)	Vetical Stress σ_{vc}, (psf)	Effective Vert. Stress σ_{vc}', (psf)	Fines Corrected $(N_1)_{60\text{-}cs}$	Stress Reduction Coeff, r_d	Cyclic Shear Ratio CSR	Cyclic Resistance Ratio (CRR)	Factor of Safety CRR/CSR (F.S.)	Liquefaction Settlment ΔS_i (inches)
1	110.8	Unsaturated	Saturated	6	5	87.3	21	110.8	48.4	17.7	1.00	1.420	0.233	Non-Liq.	0.00
2	110.8	Unsaturated	Saturated	6	5	87.3	21	221.6	96.8	17.7	1.00	1.415	0.233	Non-Liq.	0.00
3	110.8	Unsaturated	Saturated	6	5	87.3	21	332.4	145.2	17.7	1.00	1.411	0.233	Non-Liq.	0.00
4	110.8	Unsaturated	Saturated	6	5	87.3	21	443.2	193.6	17.7	0.99	1.406	0.233	Non-Liq.	0.00
5	110.8	Unsaturated	Saturated	6	5	87.3	21	554.0	242.0	18.6	0.99	1.401	0.245	Non-Liq.	0.00
6	110.8	Unsaturated	Saturated	6	5	87.3	21	664.8	290.4	18.6	0.99	1.396	0.245	Non-Liq.	0.00
7	110.8	Unsaturated	Saturated	6	5	87.3	21	775.6	338.8	18.4	0.98	1.391	0.241	Non-Liq.	0.00
8	124.9	Unsaturated	Saturated	6	5	87.3	21	900.5	401.3	17.5	0.98	1.358	0.230	Non-Liq.	0.00
9	124.9	Unsaturated	Saturated	6	5	87.3	21	1025.4	463.8	17.4	0.98	1.333	0.226	Non-Liq.	0.00
10	124.9	Unsaturated	Saturated	6	5	87.3	21	1150.3	526.3	16.7	0.97	1.312	0.215	Non-Liq.	0.00
11	124.9	Unsaturated	Saturated	10	10	92.5	0	1275.2	588.8	23.4	0.97	1.295	0.323	0.2	REMOVED
12	124.9	Unsaturated	Saturated	10	10	92.5	0	1400.1	651.3	22.6	0.96	1.279	0.300	0.2	REMOVED
13	111.0	Unsaturated	Saturated	10	10	92.5	0	1511.1	699.9	21.9	0.96	1.279	0.284	0.2	REMOVED
14	111.0	Unsaturated	Saturated	10	10	92.5	0	1622.1	748.5	21.3	0.95	1.278	0.271	0.2	REMOVED
15	111.0	Unsaturated	Saturated	10	10	92.5	0	1733.1	797.1	22.7	0.95	1.276	0.295	0.2	REMOVED
16	111.0	Unsaturated	Saturated	9	15	61.5	27	1844.1	845.7	20.5	0.95	1.273	0.252	Non-Liq.	0.00
17	111.0	Unsaturated	Saturated	9	15	61.5	27	1955.1	894.3	20.0	0.94	1.270	0.243	Non-Liq.	0.00
18	117.8	Unsaturated	Saturated	9	15	61.5	27	2072.9	949.7	19.5	0.94	1.261	0.235	Non-Liq.	0.00
19	117.8	Unsaturated	Saturated	9	15	61.5	27	2190.7	1005.1	19.1	0.93	1.253	0.228	Non-Liq.	0.00
20	117.8	Unsaturated	Saturated	9	15	61.5	27	2308.5	1060.5	18.7	0.93	1.245	0.221	Non-Liq.	0.00
21	117.8	Unsaturated	Saturated	10	20	66.0	29	2426.3	1115.9	19.9	0.92	1.236	0.236	Non-Liq.	0.00
22	117.8	Unsaturated	Saturated	10	20	66.0	29	2544.1	1171.3	19.6	0.92	1.228	0.229	Non-Liq.	0.00
23	124.3	Unsaturated	Saturated	12	25	67.0	40	2668.4	1233.2	22.4	0.91	1.216	0.271	Non-Liq.	0.00
24	124.3	Unsaturated	Saturated	12	25	67.0	40	2792.7	1295.1	22.0	0.90	1.205	0.261	Non-Liq.	0.00
25	124.3	Saturated	Saturated	12	25	67.0	40	2917.0	1357.0	21.7	0.90	1.194	0.255	Non-Liq.	0.00
26	124.3	Saturated	Saturated	12	25	67.0	40	3041.3	1418.9	21.5	0.89	1.184	0.251	Non-Liq.	0.00
27	124.3	Saturated	Saturated	12	25	67.0	40	3165.6	1480.8	21.3	0.89	1.173	0.248	Non-Liq.	0.00
28	118.3	Saturated	Saturated	12	25	67.0	40	3283.9	1536.7	22.1	0.88	1.165	0.260	Non-Liq.	0.00
29	118.3	Saturated	Saturated	12	25	67.0	40	3402.2	1592.6	21.9	0.88	1.158	0.256	Non-Liq.	0.00
30	118.3	Saturated	Saturated	12	25	67.0	40	3520.5	1648.5	21.8	0.87	1.150	0.253	Non-Liq.	0.00
31	118.3	Saturated	Saturated	11	30	64.5	22	3638.8	1704.4	20.0	0.87	1.142	0.228	Non-Liq.	0.00
32	118.3	Saturated	Saturated	11	30	64.5	22	3757.1	1760.3	19.9	0.86	1.134	0.225	Non-Liq.	0.00
33	130.1	Saturated	Saturated	11	30	64.5	22	3887.2	1828.0	19.7	0.85	1.123	0.222	Non-Liq.	0.00
34	130.1	Saturated	Saturated	11	30	64.5	22	4017.3	1895.7	19.5	0.85	1.111	0.220	Non-Liq.	0.00
35	130.1	Saturated	Saturated	11	30	64.5	22	4147.4	1963.4	19.4	0.84	1.100	0.217	Non-Liq.	0.00
36	130.1	Saturated	Saturated	12	35	62.3	0	4277.5	2031.1	20.7	0.84	1.089	0.234	0.2	0.27
37	130.1	Saturated	Saturated	12	35	62.3	0	4407.6	2098.8	20.6	0.83	1.079	0.231	0.2	0.27
38	127.2	Saturated	Saturated	15	40	41.9	0	4534.8	2163.6	25.2	0.83	1.069	0.313	0.3	0.23
39	127.2	Saturated	Saturated	15	40	41.9	0	4662.0	2228.4	25.0	0.82	1.060	0.307	0.3	0.23
40	127.2	Saturated	Saturated	15	40	41.9	0	4789.2	2293.2	24.8	0.81	1.050	0.302	0.3	0.23
41	127.2	Saturated	Saturated	15	40	41.9	0	4916.4	2358.0	24.6	0.81	1.041	0.297	0.3	0.23
42	127.2	Saturated	Saturated	15	40	41.9	0	5043.6	2422.8	24.4	0.80	1.032	0.292	0.3	0.23
43	125.9	Saturated	Saturated	15	40	41.9	0	5169.5	2486.3	24.2	0.80	1.023	0.288	0.3	0.23
44	125.9	Saturated	Saturated	15	40	41.9	0	5295.4	2549.8	24.1	0.79	1.015	0.283	0.3	0.24
45	125.9	Saturated	Saturated	15	40	41.9	0	5421.3	2613.3	23.9	0.79	1.006	0.279	0.3	0.24
46	125.9	Saturated	Saturated	32	45	6.0	0	5547.2	2676.8	49.9	0.78	0.998	1.866	1.9	0.00
47	125.9	Saturated	Saturated	32	45	6.0	0	5673.1	2740.3	49.7	0.77	0.990	1.855	1.9	0.00
48	128.2	Saturated	Saturated	32	45	6.0	0	5801.3	2806.1	49.5	0.77	0.981	1.845	1.9	0.00
49	128.2	Saturated	Saturated	32	45	6.0	0	5929.5	2871.9	49.3	0.76	0.973	1.834	1.9	0.00
50	128.2	Saturated	Saturated	46	50	0.0	0	6057.7	2937.7	70.6	0.76	0.964	1.824	1.9	0.00

BEDROCK

Total Liquefaction Settlement, S = 2.39 inches

Geotechnologies, Inc.

Project: Harvard-Westlake School
File No.: 21796
Description: Liquefaction Analysis
Boring No: 11

LIQUEFACTION EVALUATION (Idriss & Boulanger, EERI NO 12)

EARTHQUAKE INFORMATION:

Earthquake Magnitude (M):	6.9
Peak Ground Horizontal Acceleration, PGA (g):	0.95
Calculated Mag.Wtg.Factor:	1.171

GROUNDWATER INFORMATION:

Current Groundwater Level (ft):	24.5
Historically Highest Groundwater Level* (ft):	0.0
Unit Weight of Water (pcf):	62.4

* Based on California Geological Survey Seismic Hazard Evaluation Report

BOREHOLE AND SAMPLER INFORMATION:

Borehole Diameter (inches):	8
SPT Sampler with room for Liner (Y/N):	Y

LIQUEFACTION BOUNDARY:

Plastic Index Cut Off (PI):	18
Minimum Liquefaction FS:	1.3

Depth to Base Layer (feet)	Total Unit Weight (pcf)	Current Water Level (feet)	Historical Water Level (feet)	Field SPT Blowcount N	Depth of SPT Blowcount (feet)	Fines Content #200 Sieve (%)	Plastic Index (PI)	Vetical Stress σ_{vc}, (psf)	Effective Vert. Stress σ_{vc}', (psf)	Fines Corrected $(N_1)_{60-cs}$	Stress Reduction Coeff, r_d	Cyclic Shear Ratio CSR	Cyclic Resistance Ratio (CRR)	Factor of Safety CRR/CSR (F.S.)	Liquefaction Settlment ΔS_i (inches)
1	112.9	Unsaturated	Saturated	4	5	83.9	0	112.9	50.5	13.6	1.00	1.386	0.186	0.1	REMOVED
2	112.9	Unsaturated	Saturated	4	5	83.9	0	225.8	101.0	13.6	1.00	1.382	0.186	0.1	REMOVED
3	112.9	Unsaturated	Saturated	4	5	83.9	0	338.7	151.5	13.6	1.00	1.378	0.186	0.1	REMOVED
4	112.9	Unsaturated	Saturated	4	5	83.9	0	451.6	202.0	13.6	0.99	1.373	0.186	0.1	REMOVED
5	112.9	Unsaturated	Saturated	4	5	83.9	0	564.5	252.5	14.1	0.99	1.368	0.192	0.1	REMOVED
6	112.9	Unsaturated	Saturated	4	5	83.9	0	677.4	303.0	14.1	0.99	1.364	0.192	0.1	REMOVED
7	112.9	Unsaturated	Saturated	4	5	83.9	0	790.3	353.5	14.1	0.98	1.358	0.192	0.1	REMOVED
8	122.0	Unsaturated	Saturated	4	5	83.9	0	912.3	413.1	13.7	0.98	1.337	0.185	0.1	REMOVED
9	122.0	Unsaturated	Saturated	4	5	83.9	0	1034.3	472.7	13.6	0.98	1.319	0.182	0.1	REMOVED
10	122.0	Unsaturated	Saturated	4	5	83.9	0	1156.3	532.3	13.1	0.97	1.304	0.175	0.1	REMOVED
11	122.0	Unsaturated	Saturated	10	10	88.9	0	1278.3	591.9	23.4	0.97	1.291	0.323	0.2	REMOVED
12	122.0	Unsaturated	Saturated	10	10	88.9	0	1400.3	651.5	22.6	0.96	1.279	0.301	0.2	REMOVED
13	121.5	Unsaturated	Saturated	8	15	82.1	25	1521.8	710.6	18.4	0.96	1.269	0.229	Non-Liq.	0.00
14	121.5	Unsaturated	Saturated	8	15	82.1	25	1643.3	769.7	17.9	0.95	1.259	0.221	Non-Liq.	0.00
15	121.5	Unsaturated	Saturated	8	15	82.1	25	1764.8	828.8	18.9	0.95	1.249	0.232	Non-Liq.	0.00
16	121.5	Unsaturated	Saturated	8	15	82.1	25	1886.3	887.9	18.4	0.95	1.240	0.224	Non-Liq.	0.00
17	121.5	Unsaturated	Saturated	8	20	79.7	31	2007.8	947.0	18.0	0.94	1.232	0.217	Non-Liq.	0.00
18	118.9	Unsaturated	Saturated	8	20	79.7	31	2126.7	1003.5	17.6	0.94	1.225	0.210	Non-Liq.	0.00
19	118.9	Unsaturated	Saturated	8	20	79.7	31	2245.6	1060.0	17.2	0.93	1.218	0.205	Non-Liq.	0.00
20	118.9	Unsaturated	Saturated	8	20	79.7	31	2364.5	1116.5	16.9	0.93	1.211	0.200	Non-Liq.	0.00
21	118.9	Unsaturated	Saturated	8	20	79.7	31	2483.4	1173.0	16.6	0.92	1.204	0.195	Non-Liq.	0.00
22	118.9	Unsaturated	Saturated	8	20	79.7	31	2602.3	1229.5	16.3	0.92	1.197	0.191	Non-Liq.	0.00
23	119.5	Unsaturated	Saturated	8	20	79.7	31	2721.8	1286.6	16.0	0.91	1.189	0.188	Non-Liq.	0.00
24	119.5	Unsaturated	Saturated	8	20	79.7	31	2841.3	1343.7	15.8	0.90	1.182	0.184	Non-Liq.	0.00
25	119.5	Saturated	Saturated	8	20	79.7	31	2960.8	1400.8	15.6	0.90	1.174	0.182	Non-Liq.	0.00
26	119.5	Saturated	Saturated	8	25	86.1	49	3080.3	1457.9	15.5	0.89	1.167	0.180	Non-Liq.	0.00
27	119.5	Saturated	Saturated	10	25	86.1	49	3199.8	1515.0	18.1	0.89	1.159	0.207	Non-Liq.	0.00
28	120.7	Saturated	Saturated	10	25	86.1	49	3320.5	1573.3	18.7	0.88	1.151	0.213	Non-Liq.	0.00
29	120.7	Saturated	Saturated	10	25	86.1	49	3441.2	1631.6	18.6	0.88	1.143	0.211	Non-Liq.	0.00
30	120.7	Saturated	Saturated	10	25	86.1	49	3561.9	1689.9	18.5	0.87	1.135	0.209	Non-Liq.	0.00
31	120.7	Saturated	Saturated	9	30	56.6	0	3682.6	1748.2	16.9	0.87	1.127	0.192	0.2	0.32
32	120.7	Saturated	Saturated	9	30	56.6	0	3803.3	1806.5	16.8	0.86	1.119	0.190	0.2	0.32
33	121.0	Saturated	Saturated	9	30	56.6	0	3924.3	1865.1	16.7	0.85	1.111	0.189	0.2	0.32
34	121.0	Saturated	Saturated	9	30	56.6	0	4045.3	1923.7	16.6	0.85	1.103	0.188	0.2	0.32
35	121.0	Saturated	Saturated	9	30	56.6	0	4166.3	1982.3	16.5	0.84	1.095	0.186	0.2	0.32
36	121.0	Saturated	Saturated	11	35	42.3	40	4287.3	2040.9	19.2	0.84	1.087	0.214	Non-Liq.	0.00
37	121.0	Saturated	Saturated	11	35	42.3	40	4408.3	2099.5	19.1	0.83	1.079	0.212	Non-Liq.	0.00
38	127.3	Saturated	Saturated	11	35	42.3	40	4535.6	2164.4	18.9	0.83	1.069	0.210	Non-Liq.	0.00
39	127.3	Saturated	Saturated	11	35	42.3	40	4662.9	2229.3	18.8	0.82	1.059	0.208	Non-Liq.	0.00
40	127.3	Saturated	Saturated	11	35	42.3	40	4790.2	2294.2	18.6	0.81	1.050	0.206	Non-Liq.	0.00
41	127.3	Saturated	Saturated	10	40	36.5	19	4917.5	2359.1	17.0	0.81	1.041	0.189	Non-Liq.	0.00
42	127.3	Saturated	Saturated	10	40	36.5	19	5044.8	2424.0	16.9	0.80	1.032	0.188	Non-Liq.	0.00
43	131.4	Saturated	Saturated	10	40	36.5	19	5176.2	2493.0	16.8	0.80	1.022	0.186	Non-Liq.	0.00
44	131.4	Saturated	Saturated	10	40	36.5	19	5307.6	2562.0	16.7	0.79	1.012	0.185	Non-Liq.	0.00
45	131.4	Saturated	Saturated	10	40	36.5	19	5439.0	2631.0	16.6	0.79	1.003	0.183	Non-Liq.	0.00
46	131.4	Saturated	Saturated	36	45	4.4	0	5570.4	2700.0	56.0	0.78	0.994	1.862	1.9	0.00
47	131.4	Saturated	Saturated	36	45	4.4	0	5701.8	2769.0	55.8	0.77	0.984	1.851	1.9	0.00
48	120.5	Saturated	Saturated	36	45	4.4	0	5822.3	2827.1	55.6	0.77	0.977	1.842	1.9	0.00
49	120.5	Saturated	Saturated	36	45	4.4	0	5942.8	2885.2	55.4	0.76	0.970	1.832	1.9	0.00
50	120.5	Saturated	Saturated	36	45	4.4	0	6063.3	2943.3	55.2	0.76	0.963	1.823	1.9	0.00
51	120.5	Saturated	Saturated	36	50	0.0	0	6183.8	3001.4	55.0	0.75	0.956	1.814	1.9	0.00
52	120.5	Saturated	Saturated	36	50	0.0	0	6304.3	3059.5	54.8	0.75	0.949	1.806	1.9	0.00
53	120.5	Saturated	Saturated	36	50	0.0	0	6424.8	3117.6	54.7	0.74	0.942	1.797	1.9	0.00

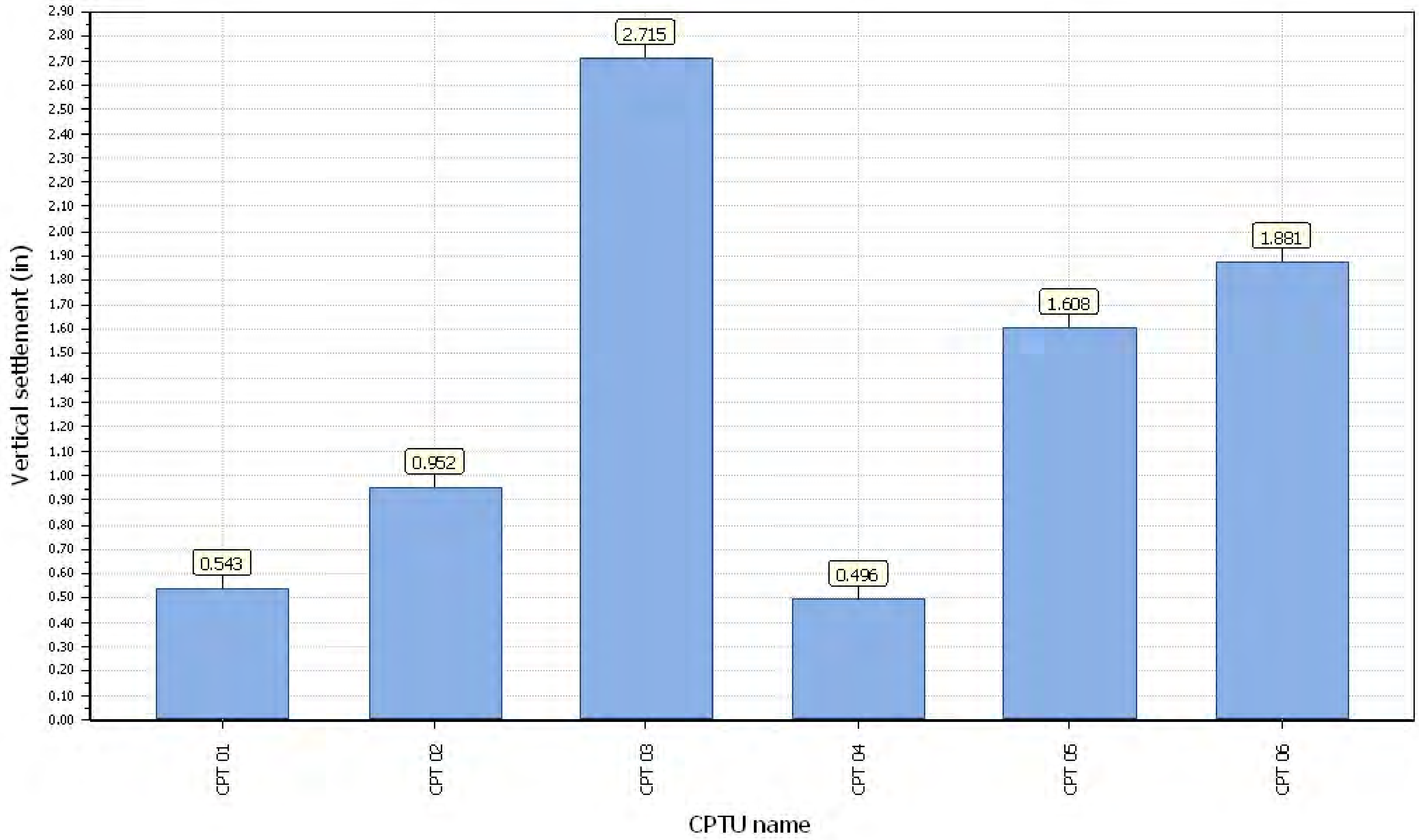
BEDROCK

Total Liquefaction Settlement, S = 1.60 inches

Project title : File No. 21796 Harvard-Westlake School

Location :

Overall vertical settlements report



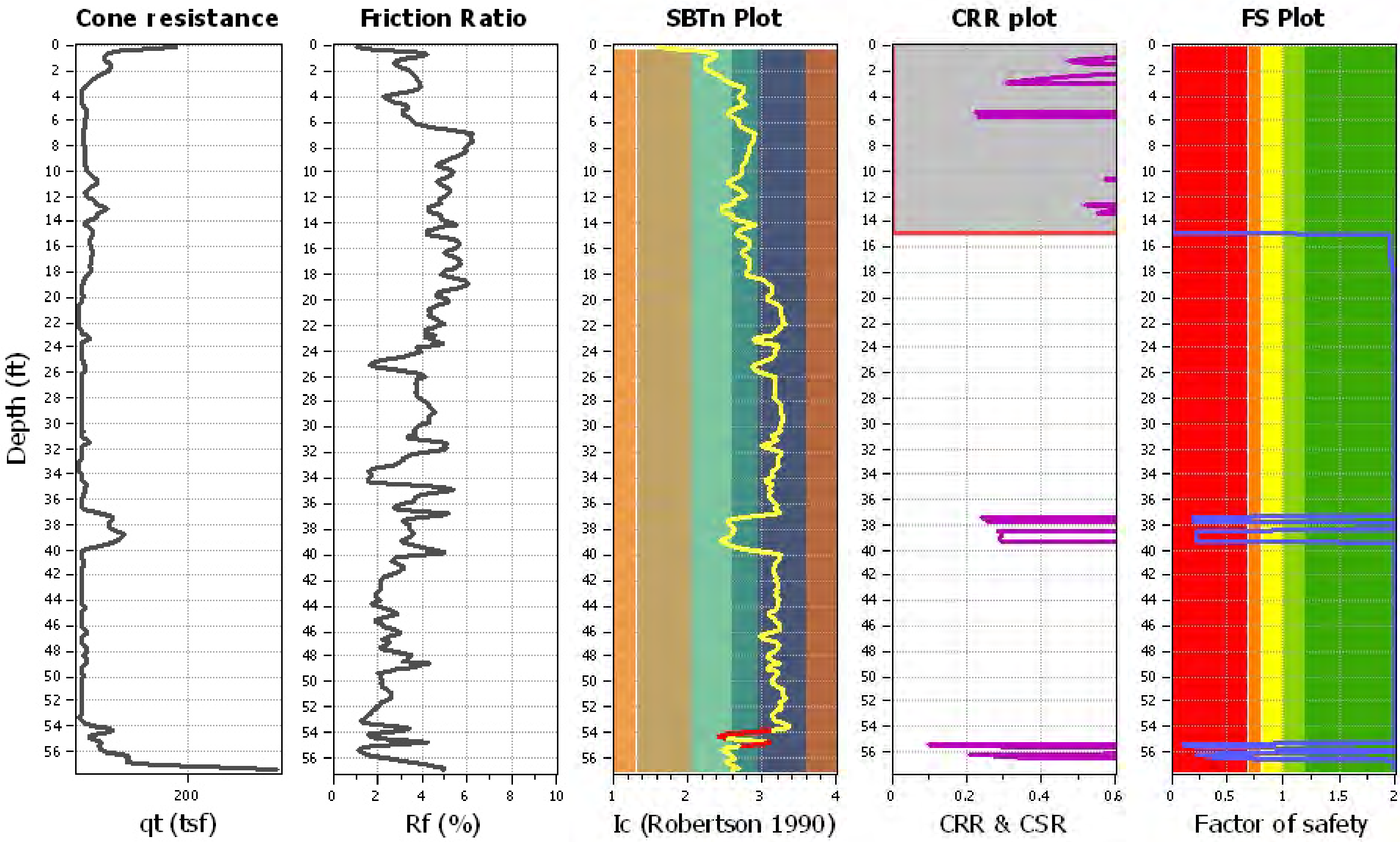
LIQUEFACTION ANALYSIS REPORT

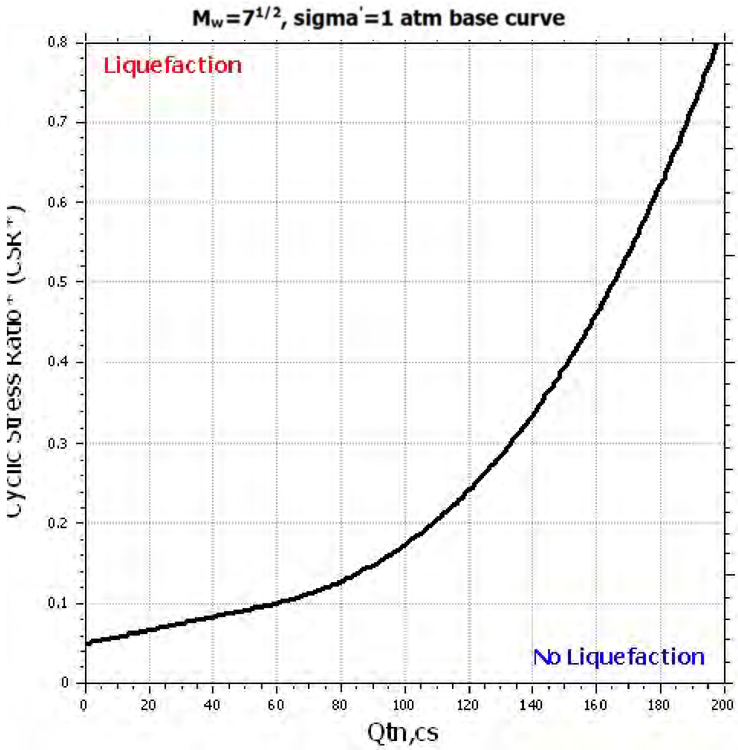
Project title : File No. 21796 Harvard-Westlake School **Location :**

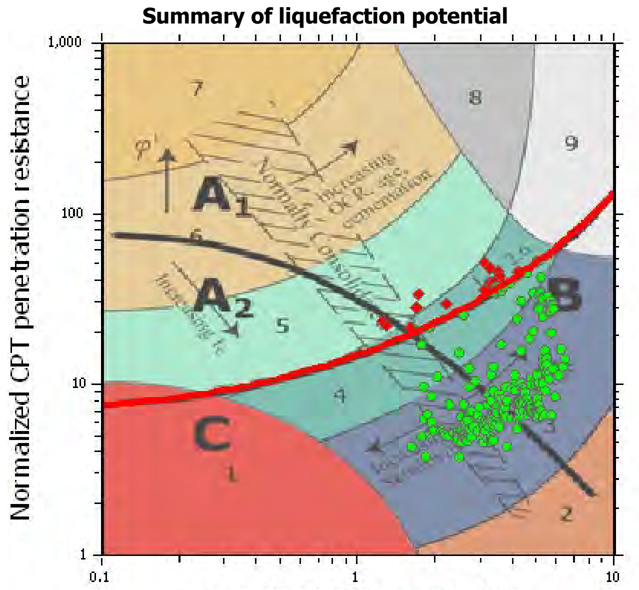
CPT file : CPT 01

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	24.50 ft	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 ft	Excavation depth:	15.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 tsf	Limit depth:	N/A
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.95	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

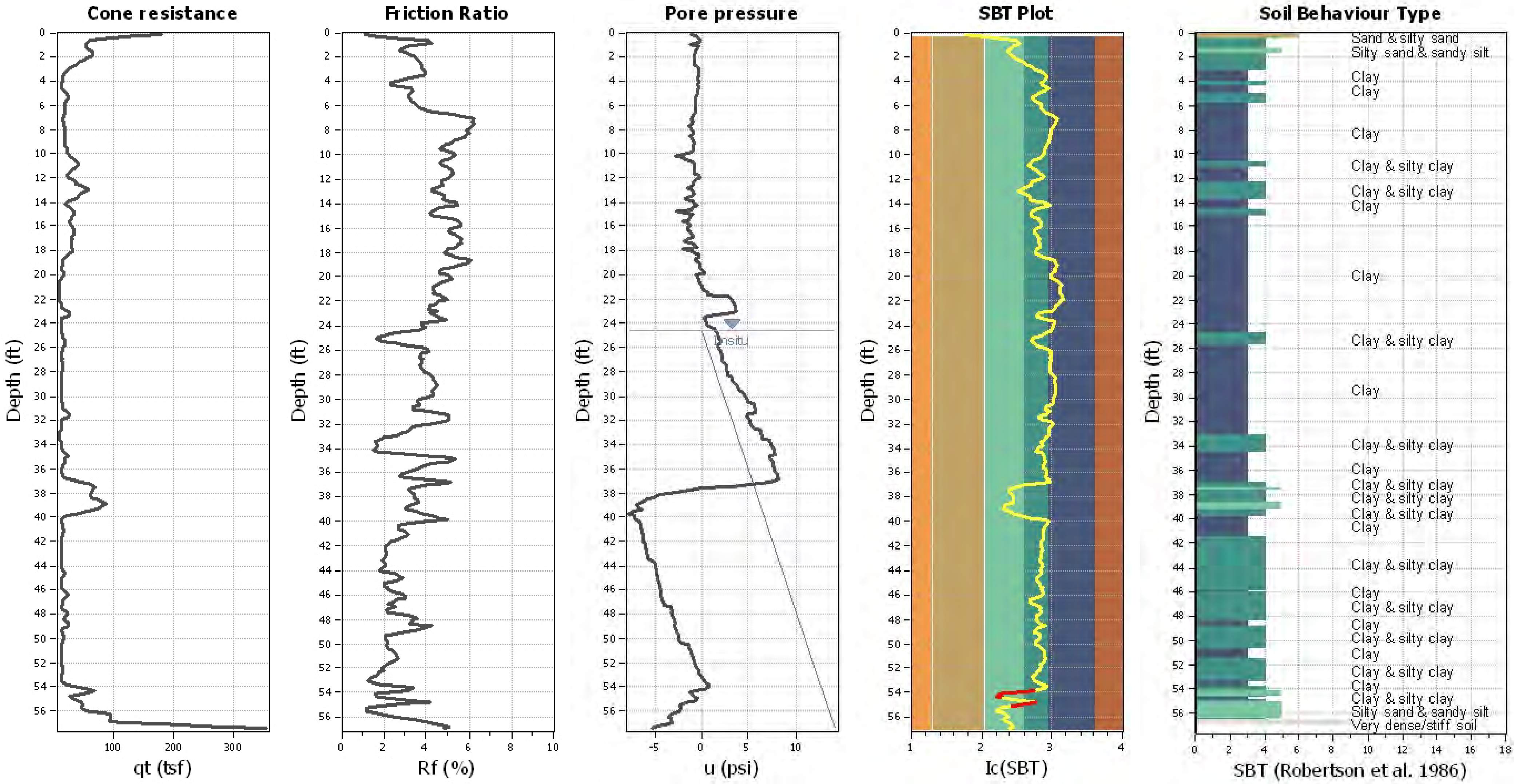






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plc



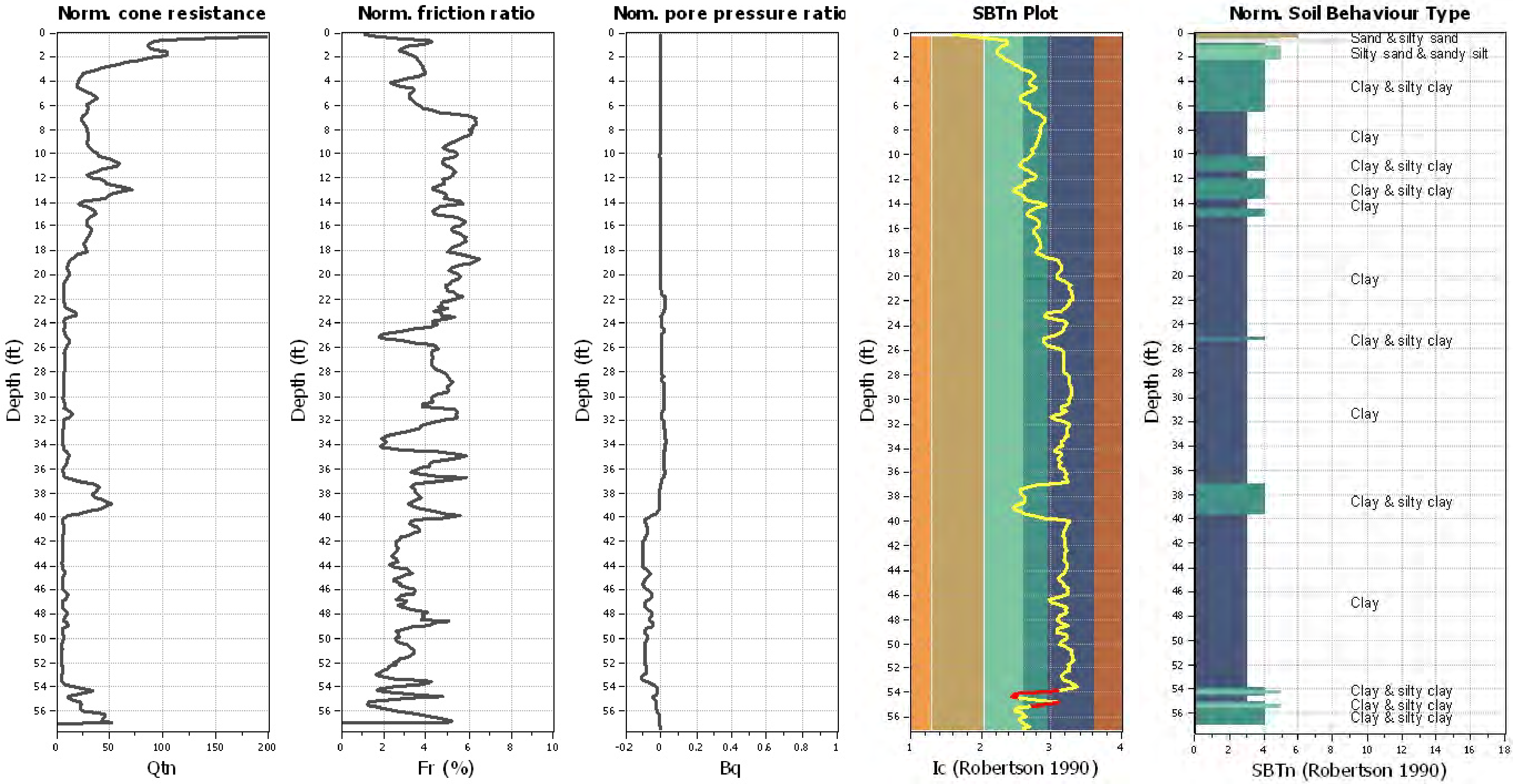
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

CPT basic interpretation plots (normaliz



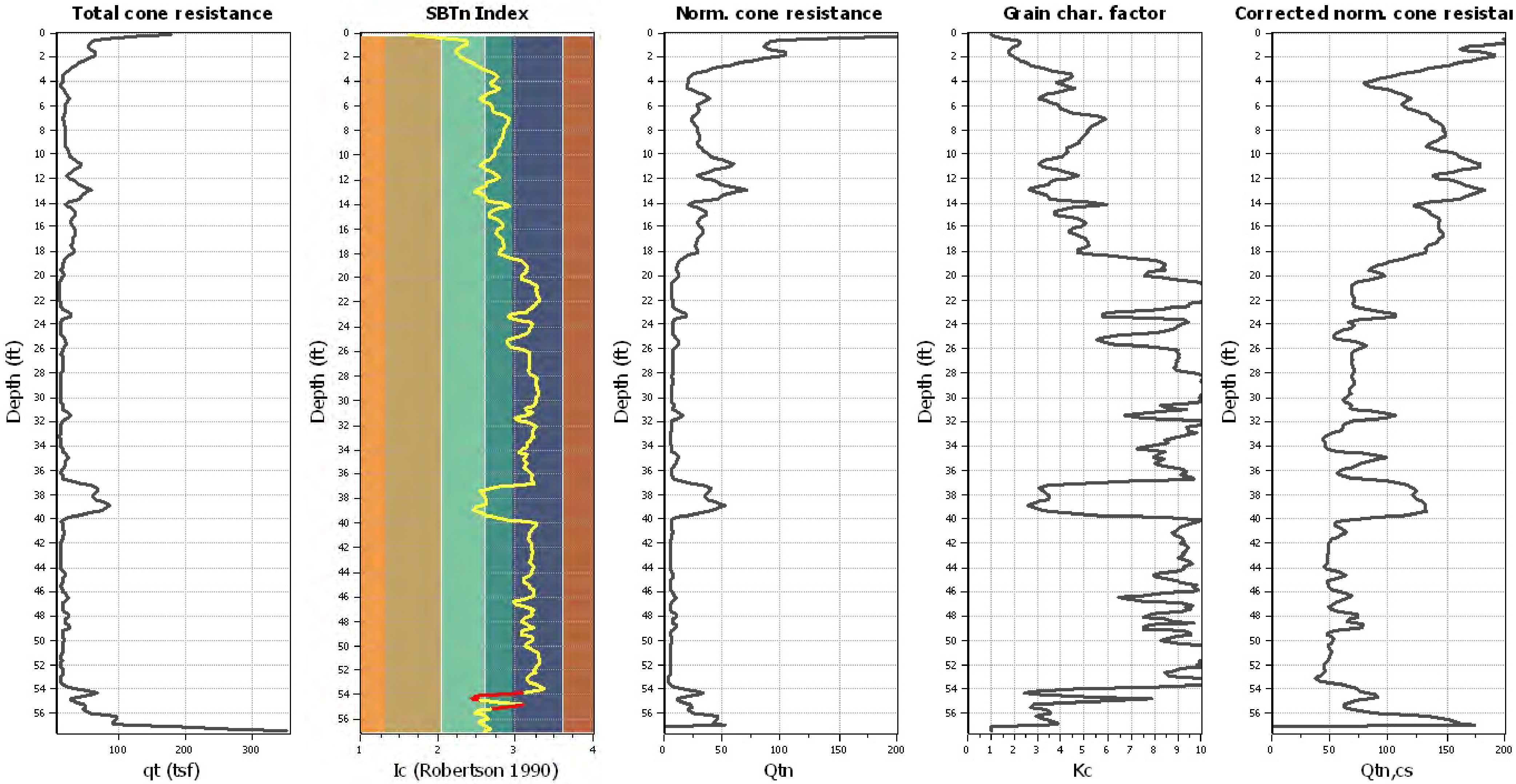
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

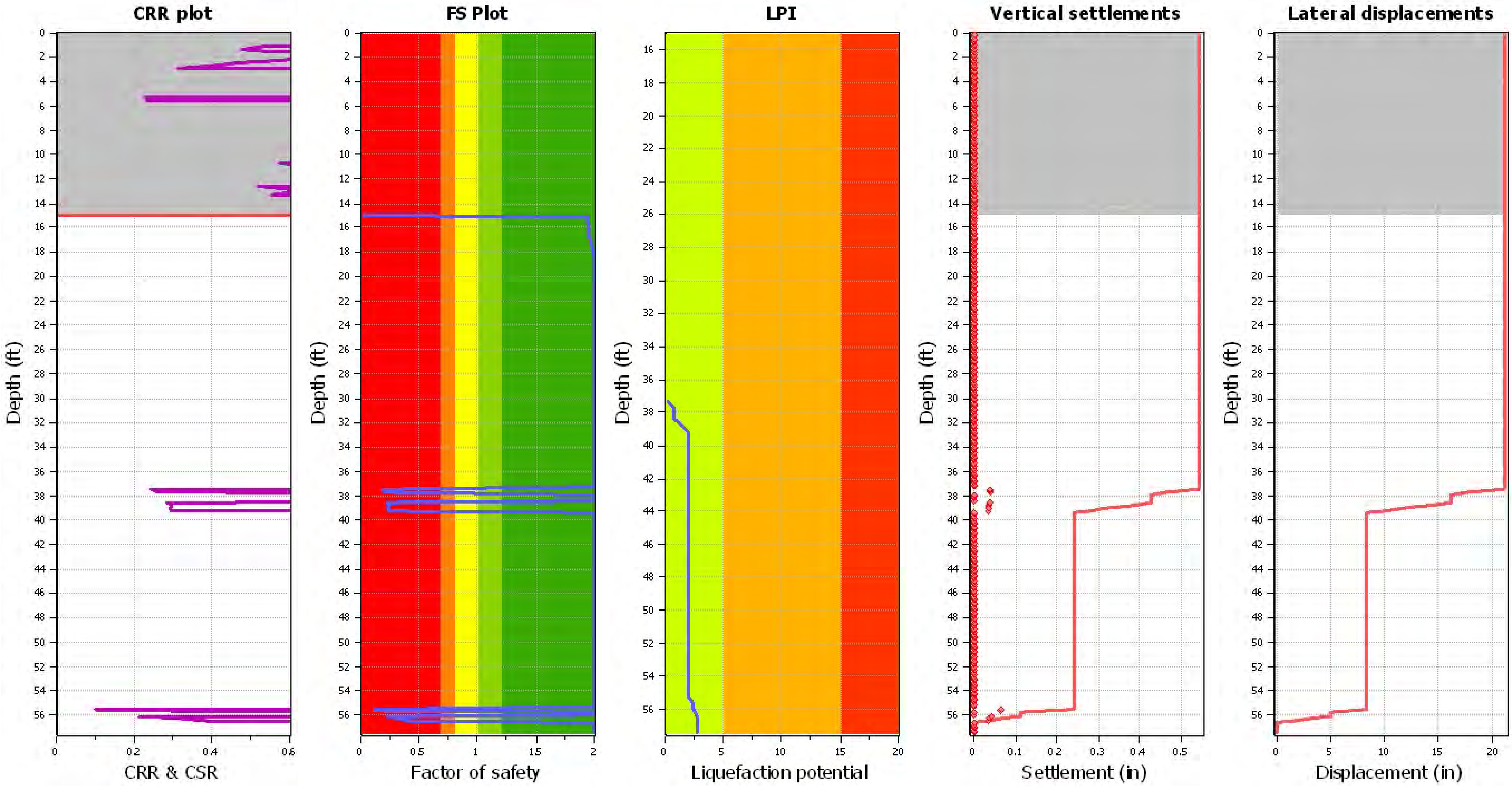
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

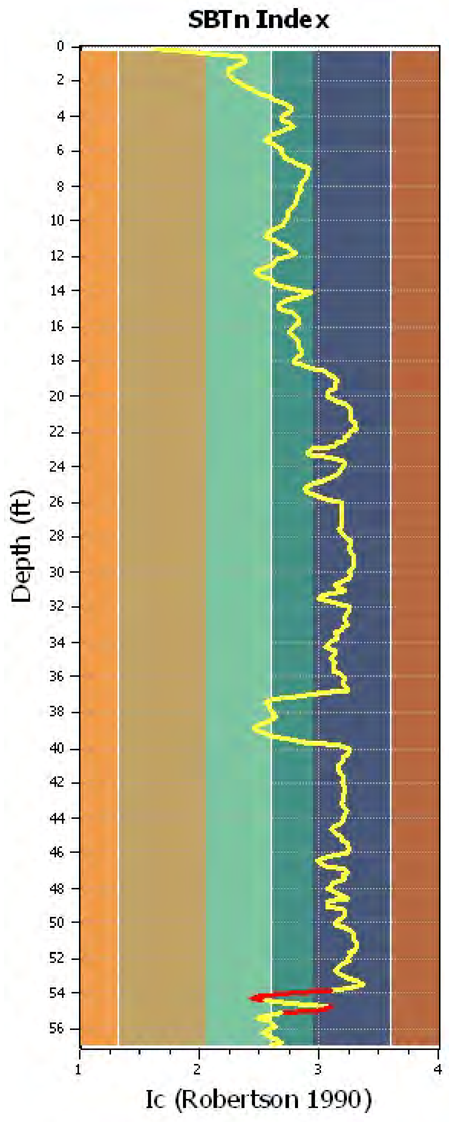
- Very high risk
- High risk
- Low risk

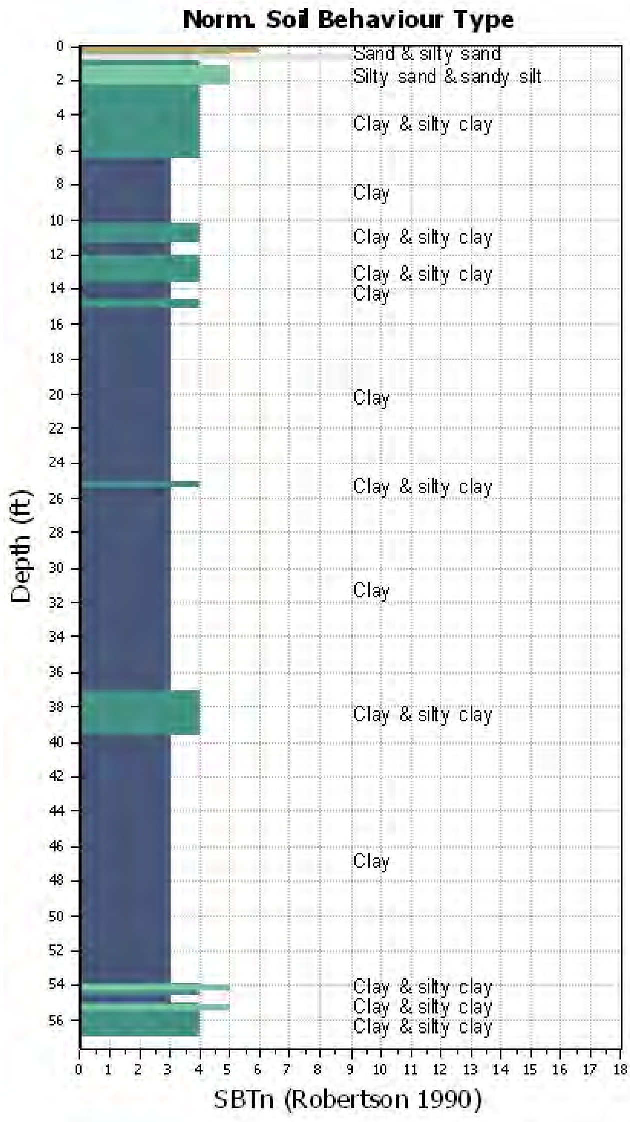
TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





Transition layer algorithm properties

I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0250
Minimum number of points in layer:	3

General statistics

Total points in CPT file:	350
Total points excluded:	9
Exclusion percentage:	2.57%
Number of layers detected:	3

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
92	15.09	31.88	1.52	-1.28	41.46	121.73
93	15.26	28.78	1.58	-1.34	44.68	121.72
94	15.42	28.21	1.54	-1.48	46.84	121.62
95	15.58	27.30	1.53	-2.13	47.81	121.51
96	15.75	26.75	1.55	-1.44	47.85	121.57
97	15.91	28.79	1.57	-1.21	46.46	121.82
98	16.08	31.67	1.62	-1.56	44.08	122.27
99	16.24	34.71	1.70	-1.56	42.91	122.67
100	16.40	34.25	1.75	-1.35	43.02	122.94
101	16.57	33.38	1.78	-1.30	44.76	122.91
102	16.73	30.70	1.75	-0.95	46.37	122.74
103	16.90	30.02	1.70	-0.95	47.71	122.49
104	17.06	29.54	1.67	-1.51	47.60	122.39
105	17.22	30.87	1.69	-1.96	48.41	122.30
106	17.39	28.26	1.67	-1.19	48.53	121.87
107	17.55	27.53	1.41	-0.74	48.97	121.43
108	17.72	28.26	1.45	-0.57	46.66	121.44
109	17.88	33.28	1.59	-2.11	45.72	121.80
110	18.04	31.74	1.57	-1.04	45.37	121.78
111	18.21	29.31	1.42	-0.82	49.07	120.82
112	18.37	21.39	1.21	-0.40	54.38	119.52
113	18.54	18.07	1.10	-0.29	60.78	118.22
114	18.70	17.19	1.02	-0.63	64.81	117.22
115	18.86	14.77	0.91	-0.66	67.05	116.11
116	19.03	13.60	0.76	-0.20	68.64	114.93
117	19.19	13.52	0.69	-0.17	68.54	113.81
118	19.36	12.74	0.61	-0.12	67.70	112.94
119	19.52	12.68	0.55	0.01	68.36	112.62
120	19.69	12.63	0.62	0.12	64.56	113.92
121	19.85	18.29	0.86	0.20	63.68	115.45
122	20.01	17.10	0.94	-0.59	63.51	115.91
123	20.18	14.10	0.75	-0.44	67.34	114.73
124	20.34	12.49	0.57	-0.35	71.96	112.57
125	20.51	9.85	0.46	-0.30	75.65	110.61
126	20.67	9.07	0.40	-0.17	78.63	109.47
127	20.83	9.65	0.41	-0.11	78.38	109.22
128	21.00	9.75	0.42	-0.01	77.90	109.40
129	21.16	9.63	0.42	0.08	78.71	109.42
130	21.33	9.43	0.41	0.28	78.63	109.41
131	21.49	9.88	0.42	0.53	80.99	109.76
132	21.65	9.14	0.49	0.55	80.97	110.06
133	21.82	9.90	0.46	2.88	81.92	110.55
134	21.98	10.18	0.51	3.19	78.26	110.63
135	22.15	11.04	0.47	3.26	77.17	110.55
136	22.31	10.45	0.44	3.40	74.53	110.45
137	22.47	11.53	0.47	3.46	74.00	110.78
138	22.64	11.96	0.53	3.54	69.27	111.95
139	22.80	15.46	0.61	3.58	68.23	113.71

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
140	22.97	15.86	0.83	3.64	55.08	117.24
141	23.13	35.23	1.32	3.38	52.40	119.42
142	23.29	27.88	1.36	1.01	52.68	119.55
143	23.46	16.27	0.89	0.20	63.63	116.78
144	23.62	11.51	0.50	0.28	72.94	112.55
145	23.79	10.86	0.35	0.37	74.11	109.93
146	23.95	11.40	0.42	0.46	72.59	110.60
147	24.11	13.55	0.60	0.48	71.95	111.35
148	24.28	12.61	0.48	0.92	70.91	110.77
149	24.44	11.21	0.31	1.42	69.75	108.63
150	24.61	10.98	0.27	1.49	66.65	106.88
151	24.77	12.01	0.26	1.60	60.70	106.36
152	24.93	14.45	0.23	1.66	55.91	106.10
153	25.10	14.38	0.22	1.78	51.62	106.82
154	25.26	17.18	0.30	1.84	50.82	109.02
155	25.43	19.89	0.46	1.95	52.18	112.22
156	25.59	20.71	0.70	1.94	54.85	114.25
157	25.75	19.69	0.74	1.79	61.07	114.62
158	25.92	13.92	0.63	1.70	66.04	113.70
159	26.08	13.87	0.54	1.81	71.60	112.24
160	26.25	12.55	0.48	1.97	71.15	111.46
161	26.41	12.88	0.47	2.02	71.90	111.04
162	26.57	12.70	0.47	2.09	71.59	111.15
163	26.74	13.01	0.50	2.14	71.87	111.38
164	26.90	13.17	0.52	2.17	71.30	111.46
165	27.07	13.29	0.48	2.20	71.61	111.35
166	27.23	12.68	0.48	2.31	71.17	111.33
167	27.40	13.49	0.51	2.58	71.23	111.53
168	27.56	13.69	0.52	2.62	70.72	111.88
169	27.72	13.73	0.54	2.65	71.18	112.09
170	27.89	13.63	0.55	2.66	73.31	112.07
171	28.05	12.27	0.53	2.69	75.72	111.80
172	28.22	11.82	0.51	2.81	78.22	111.55
173	28.38	11.83	0.52	3.12	78.04	111.59
174	28.54	12.49	0.53	3.18	77.63	111.99
175	28.71	12.77	0.58	3.29	77.21	112.28
176	28.87	12.63	0.58	3.40	78.31	112.25
177	29.04	11.86	0.54	3.76	79.08	111.68
178	29.20	11.47	0.47	3.82	79.77	111.24
179	29.36	11.62	0.50	3.82	80.25	111.09
180	29.53	11.43	0.51	3.98	79.97	111.38
181	29.69	12.13	0.52	4.33	79.05	111.49
182	29.86	12.34	0.51	4.47	77.00	110.97
183	30.02	11.82	0.40	4.67	76.86	110.06
184	30.18	10.86	0.37	4.76	78.09	109.52
185	30.35	10.95	0.44	4.89	76.54	110.29
186	30.51	13.84	0.51	5.01	72.57	111.61
187	30.68	15.55	0.57	5.50	67.45	111.74

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
188	30.84	14.97	0.42	5.54	68.84	111.48
189	31.00	12.33	0.47	5.69	73.81	112.35
190	31.17	13.75	0.78	5.77	68.88	116.27
191	31.33	27.53	1.35	5.65	61.31	119.62
192	31.50	31.52	1.58	4.95	58.31	120.65
193	31.66	22.45	1.18	4.85	63.07	118.99
194	31.82	14.47	0.71	4.89	72.07	115.42
195	31.99	12.19	0.49	5.02	77.33	111.99
196	32.15	11.97	0.41	5.13	77.38	110.18
197	32.32	11.59	0.39	5.21	76.12	109.68
198	32.48	12.21	0.41	5.29	73.79	109.71
199	32.64	13.43	0.40	5.62	74.09	109.50
200	32.81	11.12	0.36	6.13	74.09	108.37
201	32.97	10.57	0.25	6.32	76.09	106.65
202	33.14	10.10	0.21	6.40	72.92	104.55
203	33.30	10.22	0.16	6.47	71.53	103.58
204	33.46	10.21	0.18	6.55	68.32	102.93
205	33.63	11.07	0.16	7.20	68.74	103.31
206	33.79	10.47	0.19	7.29	69.28	103.86
207	33.96	10.61	0.22	7.39	64.99	104.31
208	34.12	14.20	0.18	7.45	62.54	104.33
209	34.28	12.18	0.18	7.54	61.70	105.10
210	34.45	12.37	0.27	7.68	68.42	108.44
211	34.61	14.72	0.54	7.78	67.53	114.69
212	34.78	25.40	1.30	7.82	66.26	118.25
213	34.94	23.64	1.38	7.34	65.62	119.41
214	35.10	19.37	1.00	7.32	68.14	117.86
215	35.27	17.69	0.72	7.42	66.71	115.92
216	35.43	19.75	0.71	7.51	66.10	114.84
217	35.60	17.24	0.69	7.53	66.76	114.10
218	35.76	15.32	0.54	7.60	70.73	112.57
219	35.93	13.12	0.42	7.67	72.75	110.47
220	36.09	11.96	0.33	7.77	73.84	109.06
221	36.25	12.42	0.34	7.87	72.75	108.81
222	36.42	13.44	0.38	7.97	72.42	109.63
223	36.58	13.54	0.44	8.07	75.01	112.23
224	36.75	15.28	0.80	8.19	75.37	116.12
225	36.91	21.36	1.36	8.22	60.79	120.29
226	37.07	42.92	1.79	7.46	45.70	123.35
227	37.24	62.68	1.99	6.02	36.24	125.08
228	37.40	69.20	2.07	3.41	33.16	125.98
229	37.57	67.75	2.27	-0.04	33.52	126.34
230	37.73	65.14	2.29	-0.87	34.55	126.33
231	37.89	63.92	2.12	-2.60	35.40	125.91
232	38.06	59.18	1.98	-3.97	36.39	125.64
233	38.22	57.99	2.14	-4.73	36.77	125.80
234	38.39	64.06	2.26	-5.30	36.20	126.54
235	38.55	69.66	2.53	-5.87	33.25	127.38

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
236	38.71	83.72	2.67	-6.35	30.25	128.10
237	38.88	93.26	2.70	-6.65	28.71	128.29
238	39.04	84.09	2.58	-7.07	30.16	128.08
239	39.21	70.23	2.58	-6.78	33.36	127.78
240	39.37	68.50	2.65	-6.37	36.30	127.55
241	39.53	65.21	2.57	-7.38	41.78	126.32
242	39.70	33.19	1.83	-7.81	51.20	123.51
243	39.86	18.88	1.00	-7.25	68.56	118.40
244	40.03	13.39	0.43	-7.13	77.27	113.07
245	40.19	12.41	0.36	-7.05	76.68	109.27
246	40.35	12.82	0.33	-6.70	75.11	108.67
247	40.52	13.44	0.34	-6.59	73.14	108.99
248	40.68	14.17	0.39	-6.53	72.48	109.81
249	40.85	14.67	0.44	-6.50	71.69	110.88
250	41.01	15.95	0.50	-6.46	70.86	111.77
251	41.17	16.55	0.53	-6.42	70.18	111.88
252	41.34	15.51	0.45	-6.39	70.60	110.89
253	41.50	13.76	0.33	-6.32	72.16	109.24
254	41.67	12.57	0.30	-6.26	72.51	107.75
255	41.83	13.01	0.27	-6.24	72.96	107.19
256	41.99	12.71	0.27	-6.19	72.20	106.62
257	42.16	12.28	0.23	-6.15	73.22	106.33
258	42.32	12.06	0.25	-6.10	74.00	106.26
259	42.49	12.22	0.27	-6.05	73.68	106.61
260	42.65	12.99	0.27	-6.00	73.59	106.76
261	42.81	12.37	0.26	-5.96	72.73	106.56
262	42.98	12.52	0.25	-5.92	72.95	106.31
263	43.14	12.56	0.24	-5.85	71.72	105.92
264	43.31	12.63	0.22	-5.80	72.56	106.12
265	43.47	12.33	0.27	-5.75	74.12	106.28
266	43.64	11.93	0.26	-5.10	75.25	106.15
267	43.80	11.88	0.22	-5.05	74.55	105.42
268	43.96	11.81	0.20	-5.00	72.97	104.99
269	44.13	12.30	0.22	-4.96	73.16	106.28
270	44.29	13.53	0.33	-4.90	71.95	109.32
271	44.46	17.27	0.54	-4.88	66.48	111.76
272	44.62	21.36	0.56	-4.84	65.64	112.57
273	44.78	16.20	0.47	-4.83	66.51	111.03
274	44.95	13.16	0.27	-4.75	69.73	108.47
275	45.11	14.10	0.22	-4.68	71.62	106.56
276	45.28	12.05	0.27	-4.63	72.04	106.42
277	45.44	12.75	0.26	-4.56	76.11	106.89
278	45.60	12.43	0.29	-4.52	75.18	106.92
279	45.77	12.66	0.27	-4.50	76.42	108.11
280	45.93	13.78	0.39	-4.46	75.40	109.78
281	46.10	15.70	0.50	-4.40	68.86	112.37
282	46.26	22.57	0.65	-4.40	62.91	114.19
283	46.42	24.24	0.71	-4.36	56.85	114.23

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
284	46.59	23.51	0.43	-4.33	58.18	112.92
285	46.75	17.09	0.40	-4.26	63.01	110.54
286	46.92	13.15	0.35	-4.20	72.40	109.49
287	47.08	13.82	0.35	-4.12	75.10	108.12
288	47.24	13.17	0.24	-4.07	73.53	107.33
289	47.41	12.99	0.26	-3.35	74.82	107.42
290	47.57	13.21	0.36	-3.27	72.23	110.42
291	47.74	19.82	0.61	-3.22	66.63	113.92
292	47.90	25.41	0.86	-3.26	65.04	115.88
293	48.06	20.37	0.84	-3.19	63.22	115.74
294	48.23	21.67	0.55	-3.12	68.38	114.12
295	48.39	15.42	0.52	-3.03	70.55	113.06
296	48.56	15.97	0.63	-2.92	75.40	115.50
297	48.72	23.20	1.19	-2.88	64.92	117.19
298	48.88	31.06	0.89	-2.99	63.08	117.05
299	49.05	17.94	0.55	-2.98	63.16	113.76
300	49.21	13.40	0.32	-2.85	73.16	109.57
301	49.38	13.18	0.24	-2.74	74.85	106.89
302	49.54	12.72	0.24	-2.68	74.80	107.13
303	49.70	13.82	0.35	-2.60	71.16	108.33
304	49.87	17.45	0.35	-2.54	68.63	109.39
305	50.03	16.53	0.36	-2.46	67.38	109.06
306	50.20	14.27	0.30	-2.40	71.61	108.34
307	50.36	13.08	0.29	-2.29	76.22	107.55
308	50.52	12.39	0.29	-1.48	79.17	107.78
309	50.69	12.95	0.34	-1.38	79.79	108.22
310	50.85	13.39	0.34	-1.30	80.21	108.71
311	51.02	12.92	0.35	-1.25	80.69	108.67
312	51.18	12.69	0.33	-1.15	81.92	108.46
313	51.35	12.47	0.32	-1.07	82.14	108.08
314	51.51	12.34	0.31	-1.00	80.83	107.64
315	51.67	12.82	0.28	-0.92	76.76	106.99
316	51.84	13.87	0.23	-0.87	77.90	106.73
317	52.00	11.39	0.28	-0.79	76.20	106.08
318	52.17	12.95	0.21	-0.67	77.39	106.25
319	52.33	13.47	0.25	-0.60	72.26	106.08
320	52.49	14.23	0.25	-0.52	70.49	106.35
321	52.66	14.55	0.22	-0.43	68.44	105.67
322	52.82	13.90	0.19	-0.31	69.14	104.39
323	52.99	11.98	0.15	-0.19	71.50	102.58
324	53.15	10.88	0.12	-0.06	77.37	102.32
325	53.31	10.60	0.18	0.09	82.77	104.50
326	53.48	11.88	0.31	0.20	87.03	108.77
327	53.64	14.10	0.56	0.29	81.36	111.76
328	53.81	18.34	0.62	0.73	65.10	114.91
329	53.97	32.94	0.84	0.70	46.44	117.27
330	54.13	52.61	0.94	0.31	30.15	119.42
331	54.30	84.77	0.95	-0.82	27.63	121.26

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
332	54.46	63.07	1.43	-1.21	32.67	122.08
333	54.63	33.57	1.46	-1.00	50.08	121.21
334	54.79	20.36	1.06	-0.77	65.16	119.01
335	54.95	25.29	0.81	-0.52	57.39	117.00
336	55.12	37.90	0.61	-0.73	39.64	115.64
337	55.28	49.93	0.44	-1.67	31.10	115.26
338	55.45	50.41	0.60	-2.37	29.83	115.50
339	55.61	44.55	0.64	-2.39	34.15	116.81
340	55.77	41.86	0.81	-2.27	35.86	118.32
341	55.94	54.13	1.05	-2.30	37.21	122.12
342	56.10	67.49	2.14	-2.89	33.88	126.66
343	56.27	103.39	3.50	-3.31	32.18	129.94
344	56.43	111.21	4.07	-3.55	34.75	131.38
345	56.59	71.90	4.19	-3.24	36.59	131.83
346	56.76	97.98	4.33	-3.36	39.22	132.41
347	56.92	103.12	5.23	-3.19	35.41	133.98
348	57.09	127.74	6.46	-3.56	N/A	137.28
349	57.25	316.42	-234377.62	-4.96	N/A	137.28
350	57.41	372.29	-234377.62	-5.40	N/A	137.28

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

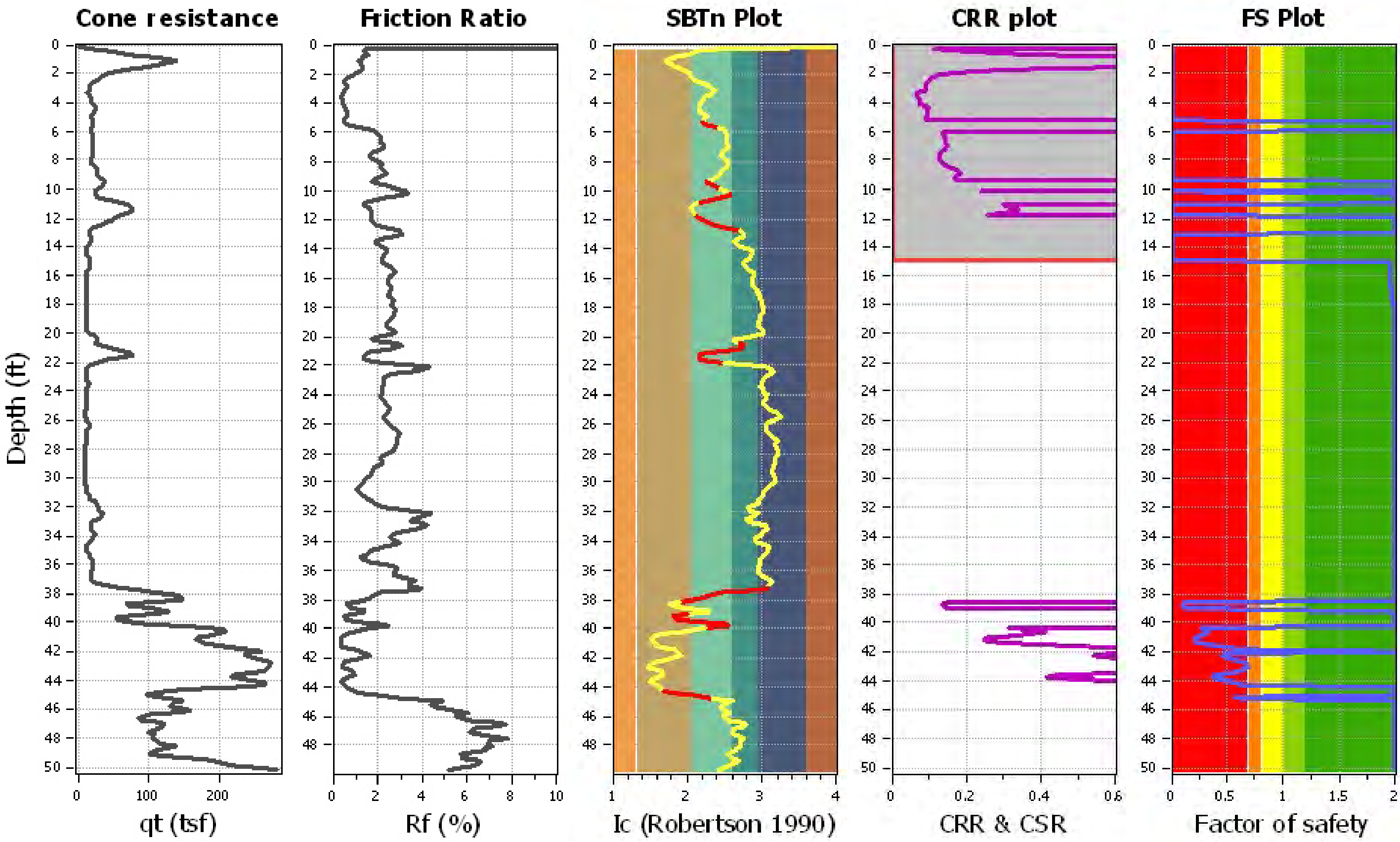
LIQUEFACTION ANALYSIS REPORT

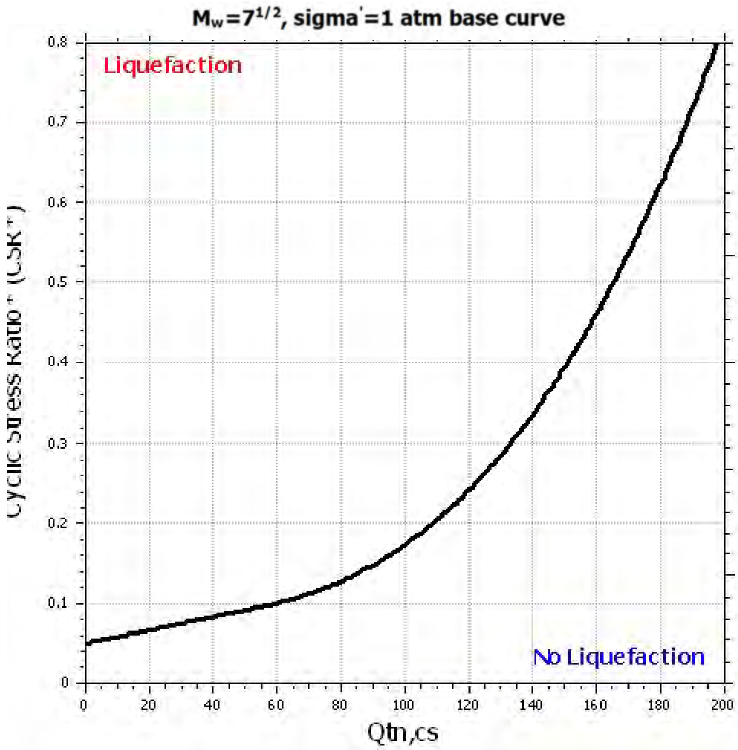
Project title : File No. 21796 Harvard-Westlake School **Location :**

CPT file : CPT 02

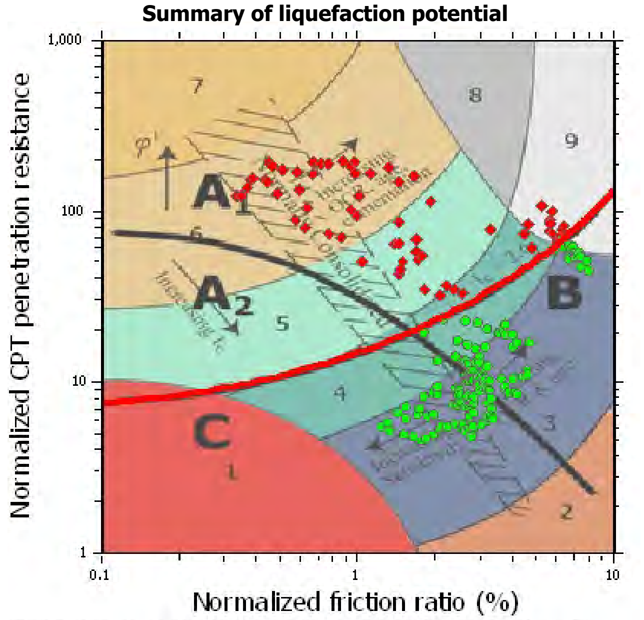
Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	24.50 ft	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 ft	Excavation depth:	15.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 tsf	Limit depth:	N/A
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.95	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



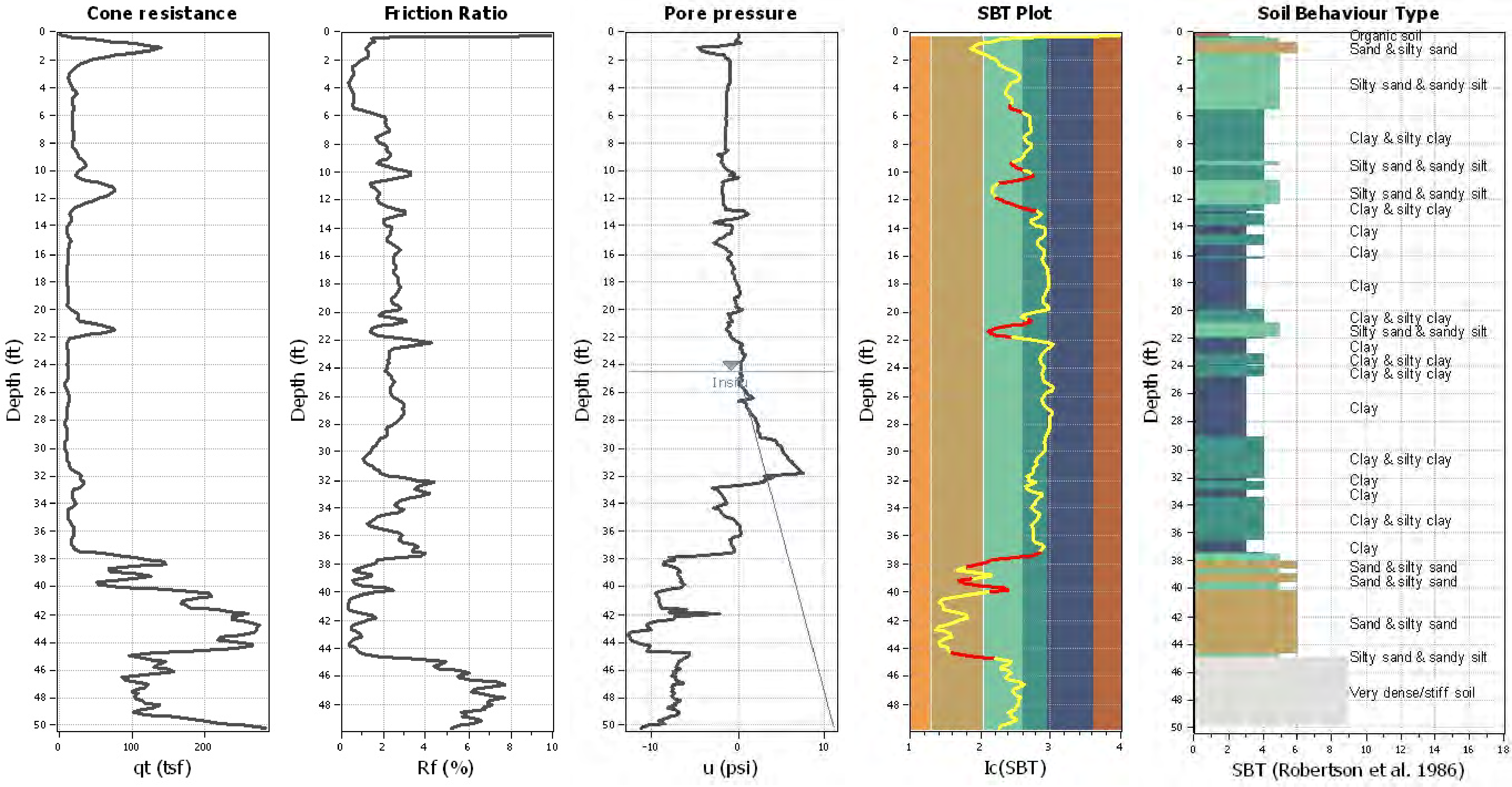


Summary of liquefaction potential



Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plo



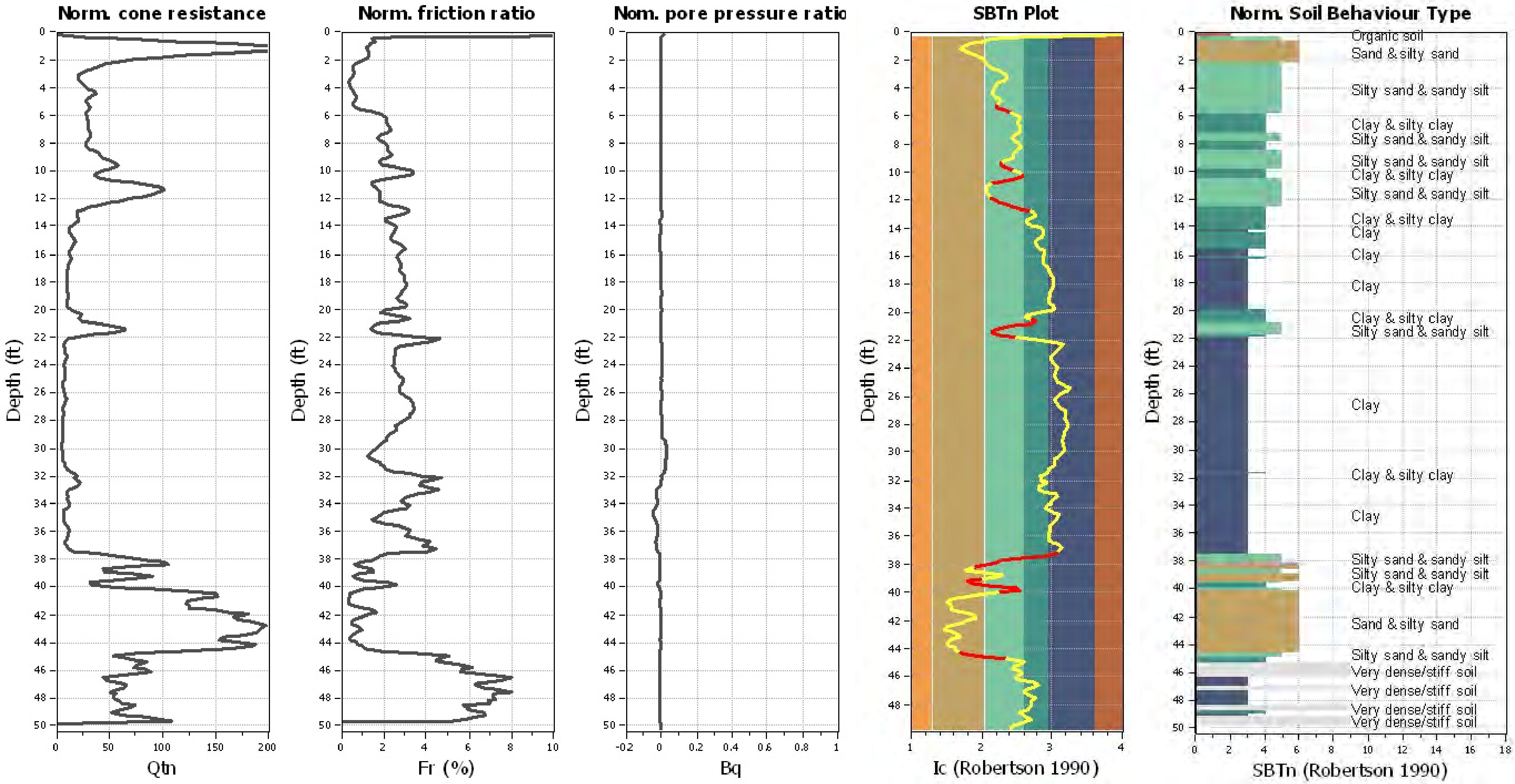
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normaliz



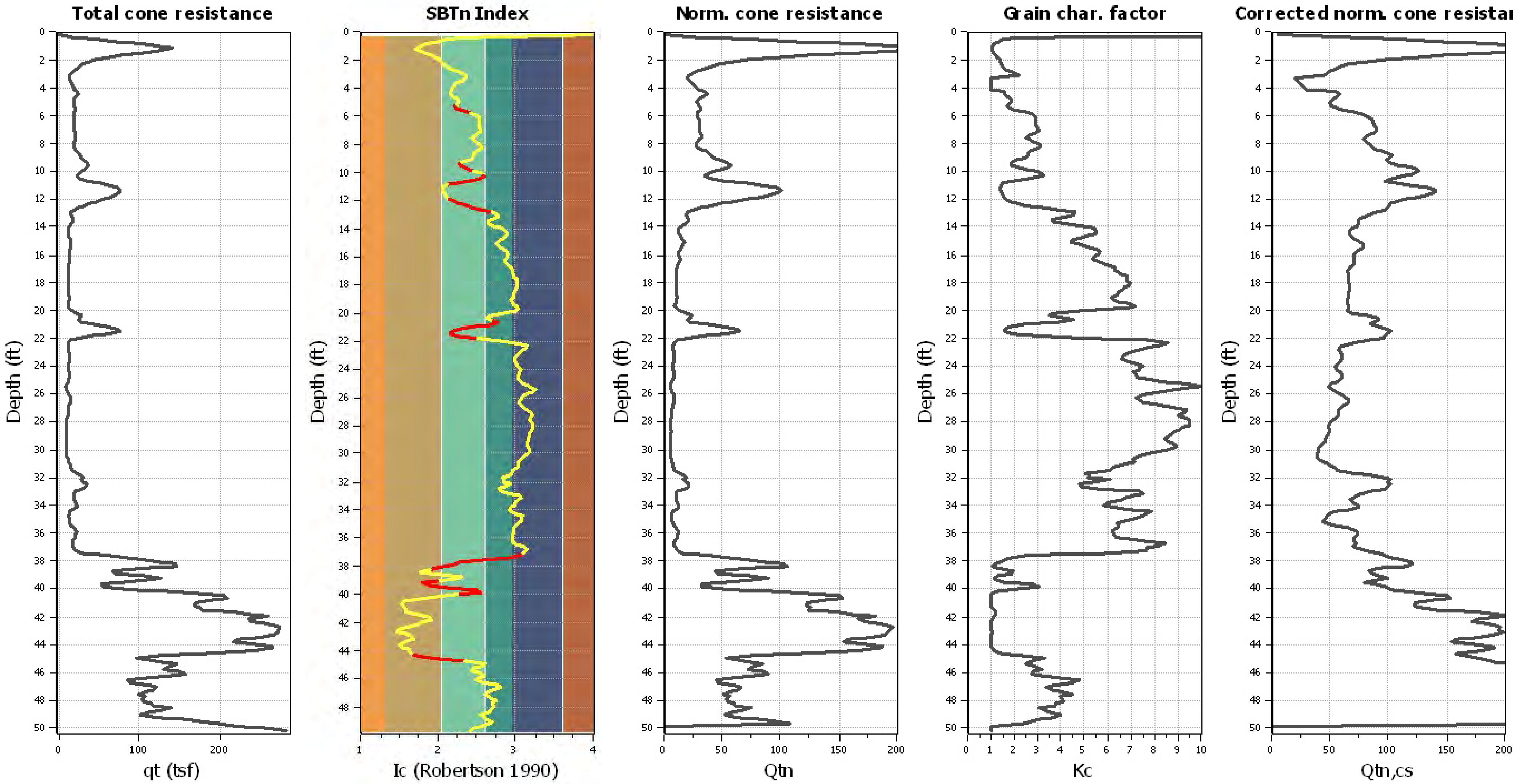
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

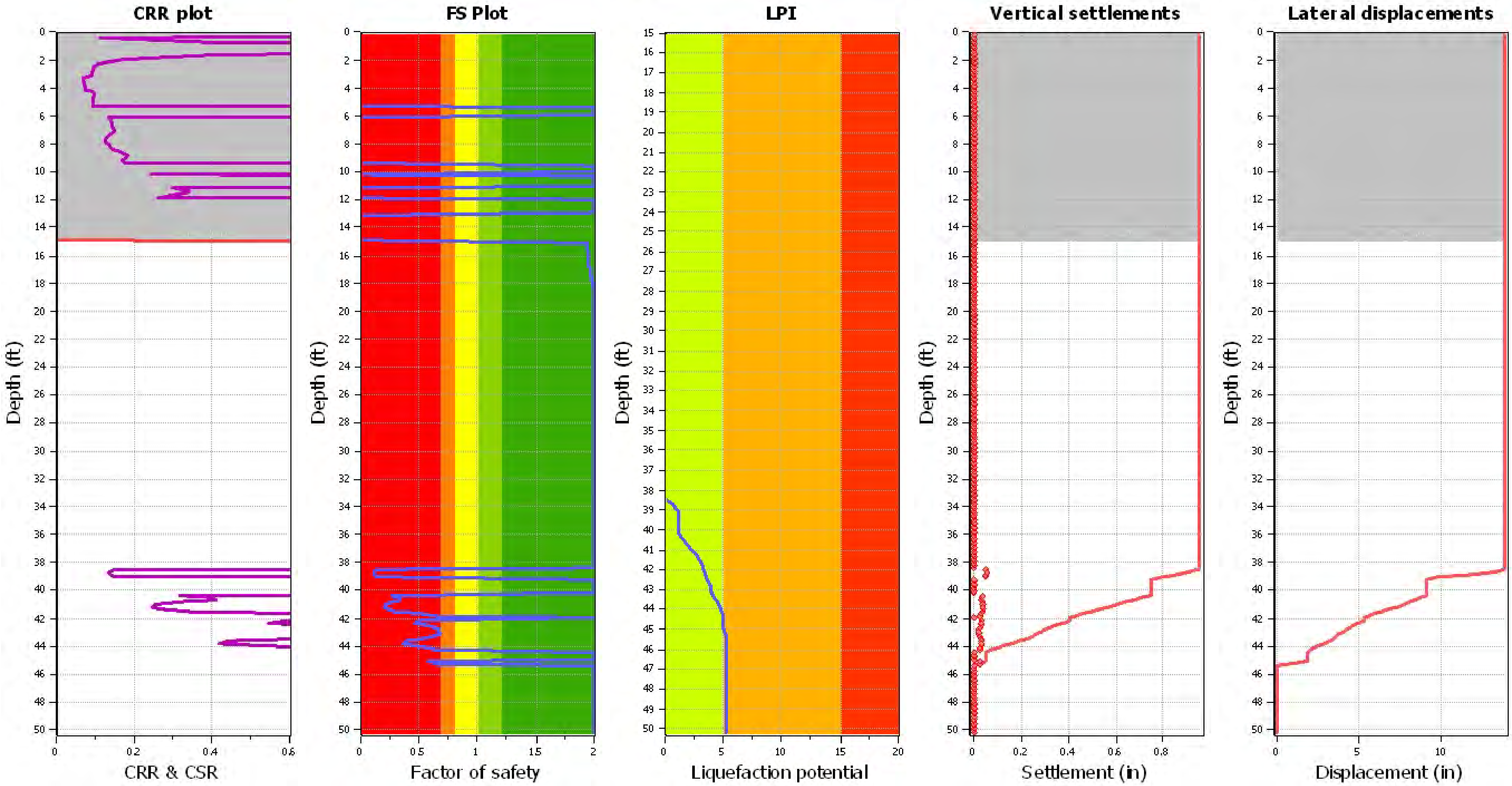
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

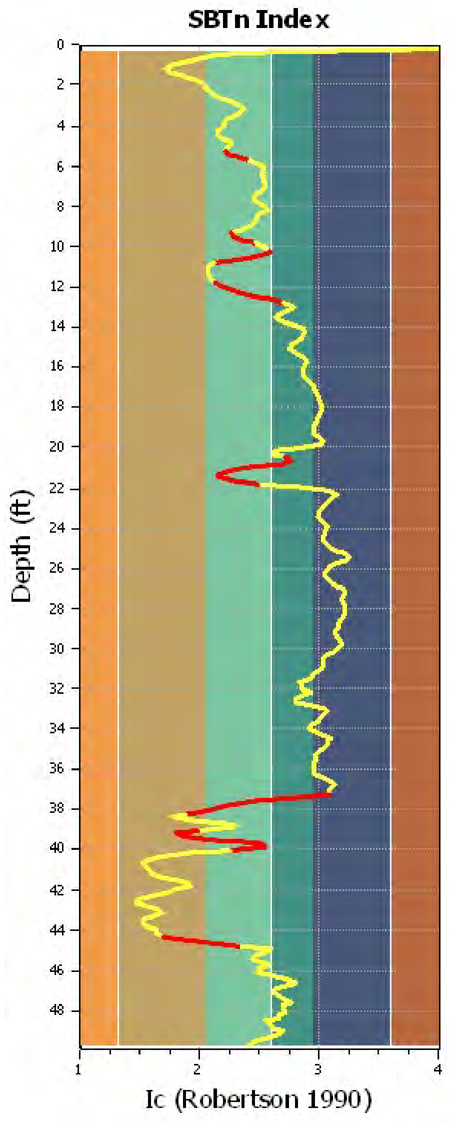
- Very high risk
- High risk
- Low risk

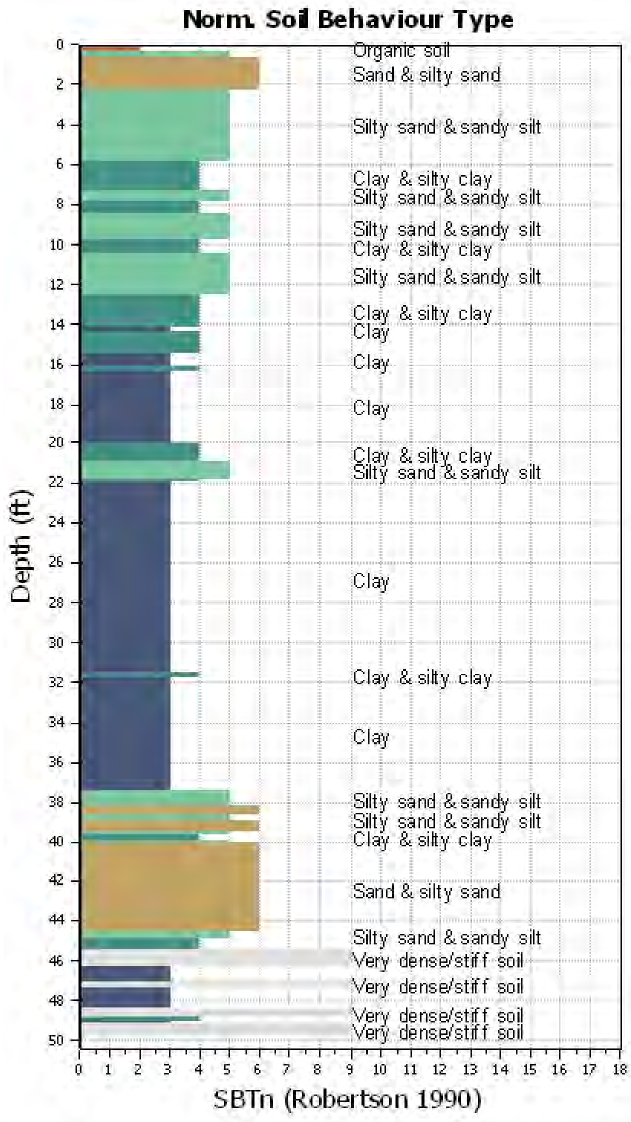
TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





Transition layer algorithm properties		**General statistics**	
I_c minimum check value:	1.70	Total points in CPT file:	306
I_c maximum check value:	3.00	Total points excluded:	48
I_c change ratio value:	0.0250	Exclusion percentage:	15.69%
Minimum number of points in layer:	3	Number of layers detected:	10

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
92	15.09	15.69	0.36	-2.49	43.57	109.48
93	15.26	15.64	0.39	-2.73	45.61	109.80
94	15.42	13.60	0.39	-1.91	48.20	109.71
95	15.58	12.99	0.37	-1.21	50.94	108.92
96	15.75	11.78	0.31	-1.19	51.86	108.12
97	15.91	11.61	0.29	-0.77	51.42	107.55
98	16.08	12.58	0.30	-0.78	50.42	107.74
99	16.24	13.11	0.32	-1.05	49.76	107.97
100	16.40	12.80	0.32	-1.01	50.27	108.06
101	16.57	12.49	0.31	-0.84	51.98	107.88
102	16.73	11.55	0.31	-0.76	53.91	107.51
103	16.90	10.85	0.28	-0.56	55.70	106.85
104	17.06	10.36	0.25	-0.49	55.71	106.39
105	17.22	11.05	0.26	-0.58	56.30	106.34
106	17.39	10.56	0.28	-0.61	57.43	106.58
107	17.55	10.13	0.28	-0.35	58.85	106.65
108	17.72	10.41	0.28	-0.35	59.05	106.53
109	17.88	10.42	0.27	-0.25	59.20	106.57
110	18.04	10.24	0.28	0.00	59.64	106.79
111	18.21	10.61	0.30	-0.07	59.53	107.31
112	18.37	11.38	0.32	0.11	58.25	107.54
113	18.54	11.57	0.30	0.09	57.33	107.60
114	18.70	11.50	0.30	0.33	56.82	107.45
115	18.86	11.66	0.30	0.33	56.27	107.40
116	19.03	12.06	0.29	0.13	54.88	107.39
117	19.19	12.68	0.29	-0.34	55.18	107.30
118	19.36	11.47	0.29	-0.27	56.68	107.22
119	19.52	11.00	0.29	-0.22	59.27	107.36
120	19.69	11.28	0.32	-0.15	60.85	107.56
121	19.85	10.89	0.32	-0.26	59.48	107.80
122	20.01	12.42	0.31	0.58	46.35	108.20
123	20.18	23.57	0.28	-0.19	37.34	111.02
124	20.34	31.40	0.60	-1.04	36.33	114.14
125	20.51	25.83	0.83	-0.93	41.69	115.82
126	20.67	19.36	0.75	-0.88	44.25	115.79
127	20.83	26.89	0.63	-0.55	39.21	115.62
128	21.00	35.15	0.69	-1.09	27.83	116.83
129	21.16	59.02	0.82	-0.98	20.64	119.19
130	21.33	83.22	1.09	-1.24	17.49	120.87
131	21.49	78.99	1.13	-1.25	17.55	121.35
132	21.65	64.81	1.00	-0.98	21.92	120.61
133	21.82	39.81	1.00	-0.91	31.08	119.09
134	21.98	20.28	0.89	-0.78	47.05	116.81
135	22.15	13.28	0.64	-0.59	63.68	113.47
136	22.31	10.71	0.36	-0.03	69.15	110.08
137	22.47	10.35	0.29	0.54	67.22	107.21
138	22.64	10.34	0.24	0.37	64.64	106.21
139	22.80	10.96	0.25	0.28	62.03	106.00

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
140	22.97	11.77	0.26	0.54	60.44	106.67
141	23.13	12.48	0.30	0.67	58.56	107.25
142	23.29	13.33	0.29	0.89	57.99	107.40
143	23.46	12.60	0.27	0.78	57.46	107.30
144	23.62	12.88	0.28	0.64	59.47	106.90
145	23.79	11.32	0.26	0.50	61.03	106.31
146	23.95	10.77	0.22	0.49	63.03	105.63
147	24.11	10.76	0.23	0.38	62.16	105.44
148	24.28	11.74	0.24	0.46	62.03	106.30
149	24.44	12.20	0.30	0.41	60.66	107.08
150	24.61	13.02	0.30	0.31	61.08	107.70
151	24.77	12.51	0.31	0.58	61.68	107.62
152	24.93	11.73	0.29	0.33	64.33	107.35
153	25.10	10.86	0.28	0.66	68.24	106.07
154	25.26	8.50	0.20	0.03	73.53	104.32
155	25.43	7.19	0.16	0.06	77.02	102.99
156	25.59	8.21	0.20	0.35	74.05	103.67
157	25.75	10.36	0.24	0.67	69.16	105.29
158	25.92	11.29	0.27	1.03	64.72	106.93
159	26.08	12.97	0.33	1.14	62.81	108.15
160	26.25	13.57	0.36	1.55	61.40	109.34
161	26.41	14.44	0.41	1.75	61.91	110.05
162	26.57	13.98	0.43	0.02	63.03	110.08
163	26.74	12.82	0.37	0.96	65.75	109.21
164	26.90	11.06	0.31	1.04	69.62	107.90
165	27.07	9.59	0.29	1.11	73.57	106.97
166	27.23	9.54	0.28	1.18	73.66	106.98
167	27.40	11.09	0.31	1.35	72.48	107.16
168	27.56	10.46	0.30	1.40	71.72	106.94
169	27.72	9.70	0.26	1.96	73.45	106.22
170	27.89	9.37	0.24	2.07	74.38	105.35
171	28.05	9.06	0.22	2.13	74.56	104.37
172	28.22	8.61	0.17	2.23	74.30	103.60
173	28.38	8.73	0.18	2.36	72.58	103.54
174	28.54	9.79	0.21	2.31	71.82	104.12
175	28.71	9.63	0.21	2.31	71.02	104.42
176	28.87	9.50	0.20	2.43	70.27	103.75
177	29.04	9.46	0.16	2.53	69.42	103.18
178	29.20	9.46	0.17	2.63	68.51	102.73
179	29.36	9.49	0.17	4.24	69.21	102.43
180	29.53	8.83	0.14	4.42	70.31	101.40
181	29.69	7.96	0.12	4.60	71.24	100.28
182	29.86	8.11	0.12	4.86	71.11	99.76
183	30.02	8.48	0.12	5.03	68.91	99.66
184	30.18	8.83	0.11	5.16	66.54	99.34
185	30.35	8.93	0.10	5.34	63.30	99.07
186	30.51	9.85	0.10	5.55	61.26	98.97
187	30.68	9.85	0.10	5.75	60.55	99.86

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
188	30.84	10.27	0.13	6.00	60.81	101.72
189	31.00	11.79	0.19	6.24	59.07	103.97
190	31.17	13.91	0.23	6.47	55.92	105.52
191	31.33	15.07	0.23	6.68	55.30	106.93
192	31.50	14.81	0.31	6.97	54.27	107.86
193	31.66	16.63	0.32	7.36	47.67	112.79
194	31.82	34.99	0.88	7.54	48.90	116.08
195	31.99	24.15	1.07	3.01	48.53	118.87
196	32.15	28.79	1.20	4.08	54.36	119.58
197	32.32	28.04	1.29	3.17	49.90	119.49
198	32.48	31.66	0.92	3.06	45.88	120.20
199	32.64	40.67	1.40	0.76	46.21	119.76
200	32.81	25.35	1.12	-2.99	52.03	119.00
201	32.97	17.18	0.76	-2.45	62.09	116.15
202	33.14	16.87	0.60	-2.10	63.12	114.06
203	33.30	18.82	0.58	-1.90	60.96	113.25
204	33.46	17.44	0.55	-1.80	58.26	112.36
205	33.63	17.59	0.40	-1.66	57.96	111.49
206	33.79	17.15	0.42	-1.51	54.12	112.51
207	33.96	24.30	0.69	-1.29	52.84	114.05
208	34.12	23.64	0.69	-2.00	54.96	114.12
209	34.28	14.79	0.46	-2.82	59.94	111.53
210	34.45	12.25	0.24	-2.16	65.09	107.50
211	34.61	11.90	0.18	-1.85	63.56	104.55
212	34.78	11.56	0.18	-1.68	62.97	103.98
213	34.94	11.91	0.20	-1.48	60.99	103.56
214	35.10	12.70	0.14	-0.42	57.93	102.60
215	35.27	12.46	0.12	-0.26	56.52	103.94
216	35.43	14.92	0.27	-0.05	56.62	107.50
217	35.60	18.63	0.44	0.18	56.26	111.13
218	35.76	20.52	0.58	0.25	55.41	113.14
219	35.93	21.09	0.62	0.29	55.34	114.03
220	36.09	21.32	0.62	0.38	55.47	113.79
221	36.25	19.79	0.53	0.17	55.96	113.18
222	36.42	18.88	0.50	-0.34	59.46	112.92
223	36.58	16.77	0.61	-0.94	64.83	112.89
224	36.75	14.54	0.57	-0.80	68.30	113.01
225	36.91	16.24	0.56	-0.70	66.86	112.71
226	37.07	17.41	0.53	-0.56	64.21	113.31
227	37.24	18.33	0.67	-0.50	63.73	115.64
228	37.40	22.70	1.12	-0.35	52.88	118.85
229	37.57	43.34	1.40	-0.83	29.20	121.67
230	37.73	107.12	1.17	-4.75	21.36	123.87
231	37.89	101.65	1.83	-7.89	18.61	125.32
232	38.06	94.09	2.04	-7.33	14.75	126.14
233	38.22	177.53	1.39	-8.46	10.13	124.51
234	38.39	159.17	0.58	-8.70	7.53	121.82
235	38.55	102.55	0.78	-7.75	11.63	120.06

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
236	38.71	56.26	1.05	-6.89	22.39	120.10
237	38.88	42.68	0.99	-6.62	21.88	120.72
238	39.04	113.00	0.98	-7.01	12.67	120.45
239	39.21	152.48	0.60	-6.82	8.21	119.57
240	39.37	113.89	0.55	-6.57	9.61	119.06
241	39.53	74.15	0.91	-6.37	17.55	119.18
242	39.70	44.94	0.91	-6.53	30.57	120.44
243	39.86	39.80	1.38	-6.09	32.84	122.12
244	40.03	77.94	1.71	-6.42	20.43	123.98
245	40.19	148.70	1.29	-7.80	10.99	124.37
246	40.35	185.61	0.99	-9.13	5.52	123.54
247	40.52	221.11	0.94	-9.53	3.65	122.49
248	40.68	212.24	0.76	-9.29	3.08	121.59
249	40.85	194.32	0.67	-9.18	3.50	120.48
250	41.01	166.22	0.67	-9.05	4.00	118.86
251	41.17	148.65	0.41	-8.96	3.97	118.53
252	41.34	188.80	0.60	-9.02	5.00	121.50
253	41.50	183.46	1.49	-8.75	9.02	127.14
254	41.67	165.27	3.26	-5.93	10.35	131.62
255	41.83	296.51	4.52	-7.98	10.76	133.60
256	41.99	250.09	3.97	-2.05	8.29	132.77
257	42.16	231.73	1.69	-7.22	6.82	129.64
258	42.32	228.69	1.18	-7.43	4.00	125.83
259	42.49	254.15	1.18	-9.36	2.90	125.00
260	42.65	277.78	1.18	-10.42	2.44	125.29
261	42.81	277.78	1.25	-10.48	3.94	128.36
262	42.98	269.07	3.03	-10.26	5.35	130.19
263	43.14	268.31	2.76	-9.94	5.96	130.96
264	43.31	279.06	2.03	-12.47	4.46	128.56
265	43.47	251.57	0.89	-12.64	3.35	125.26
266	43.64	210.14	0.79	-12.47	2.97	122.33
267	43.80	205.74	0.89	-12.30	3.46	122.83
268	43.96	235.59	1.09	-11.99	4.82	126.74
269	44.13	262.62	2.63	-11.22	4.85	128.98
270	44.29	296.34	2.29	-10.20	5.97	130.42
271	44.46	235.72	2.40	-10.29	7.84	130.81
272	44.62	187.46	3.30	-10.46	14.90	131.80
273	44.78	107.33	4.43	-5.60	24.32	132.66
274	44.95	96.93	4.89	-5.56	35.23	132.72
275	45.11	82.01	4.80	-5.90	32.50	133.56
276	45.28	145.26	5.50	-6.49	28.98	134.73
277	45.44	157.78	6.52	-6.77	28.01	136.35
278	45.60	135.69	8.08	-6.93	32.11	136.95
279	45.77	111.64	7.82	-7.10	34.19	137.23
280	45.93	142.59	7.68	-6.66	30.97	137.28
281	46.10	191.05	9.25	-7.42	30.15	137.28
282	46.26	138.07	9.15	-7.18	33.44	137.28
283	46.42	92.82	7.49	-7.57	41.80	136.25

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
284	46.59	74.04	5.75	-7.20	45.99	134.95
285	46.75	89.67	6.62	-7.12	44.00	134.90
286	46.92	103.89	7.08	-6.26	37.28	136.23
287	47.08	147.34	7.82	-7.50	35.80	136.69
288	47.24	113.32	7.50	-7.62	37.47	136.85
289	47.41	92.67	7.81	-7.47	40.46	136.71
290	47.57	120.05	8.01	-7.67	43.64	136.43
291	47.74	85.24	7.31	-7.30	40.32	136.37
292	47.90	115.75	7.06	-7.57	40.73	136.01
293	48.06	110.33	7.16	-7.29	41.02	136.33
294	48.23	89.61	8.17	-6.67	38.82	136.72
295	48.39	141.19	7.67	-7.33	38.53	137.08
296	48.56	121.07	8.08	-7.17	32.81	137.28
297	48.72	153.72	7.82	-8.06	34.91	136.82
298	48.88	105.48	6.61	-7.33	36.10	135.67
299	49.05	84.67	5.46	-6.82	40.27	135.36
300	49.21	114.76	7.78	-7.01	37.82	137.11
301	49.38	161.20	10.58	-7.84	33.02	137.28
302	49.54	189.67	10.63	-8.63	29.22	137.28
303	49.70	198.16	9.72	-9.04	26.98	137.28
304	49.87	206.63	10.50	-8.48	N/A	137.28
305	50.03	258.75	-234377.62	-10.31	N/A	137.28
306	50.20	295.40	-234377.62	-11.10	N/A	137.28

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

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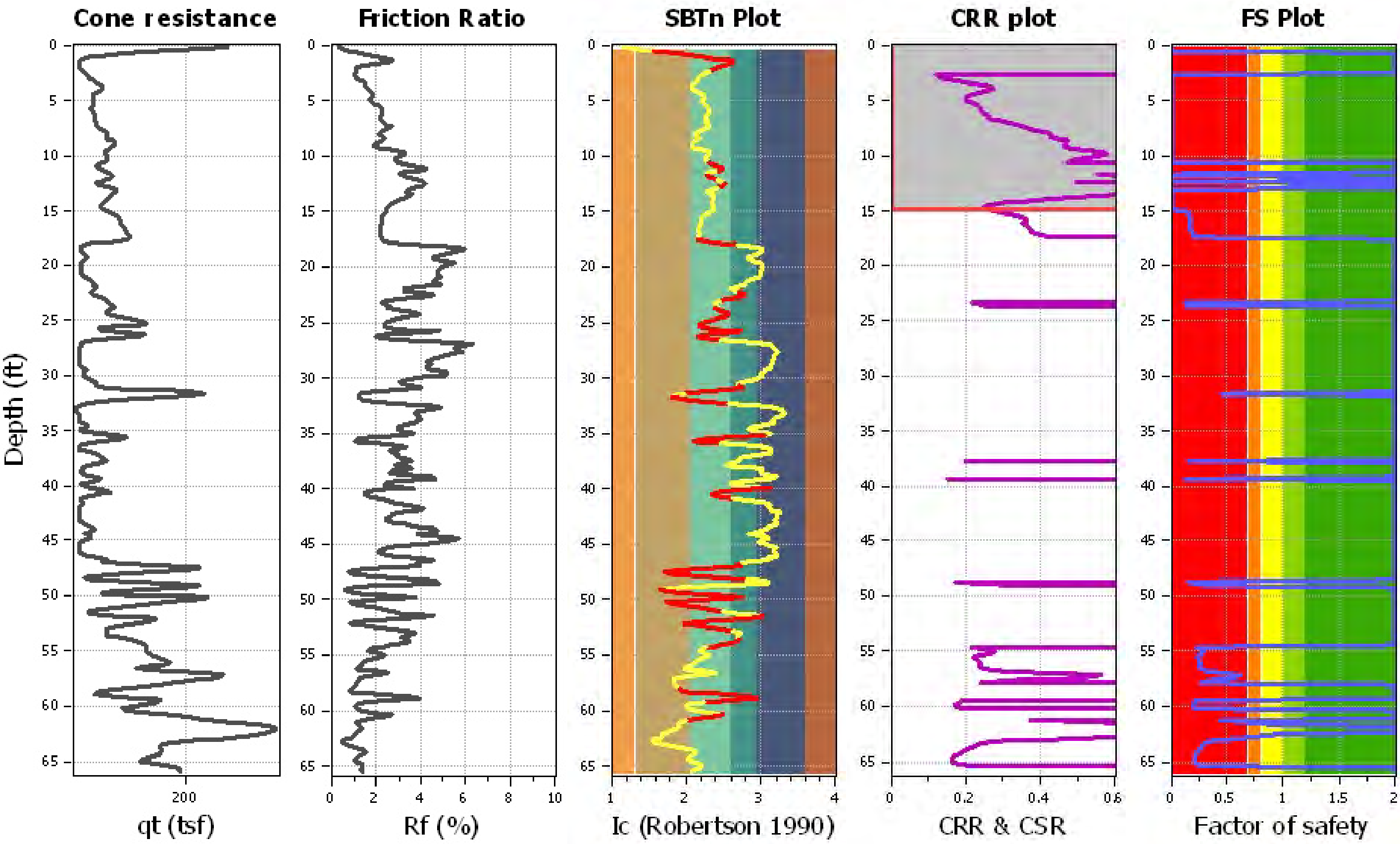
LIQUEFACTION ANALYSIS REPORT

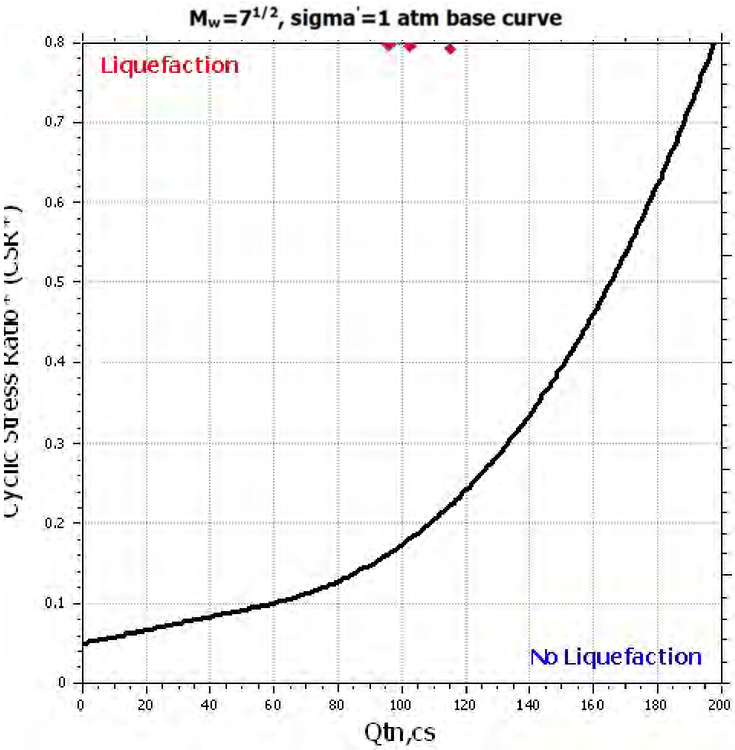
Project title : File No. 21796 Harvard-Westlake School **Location :**

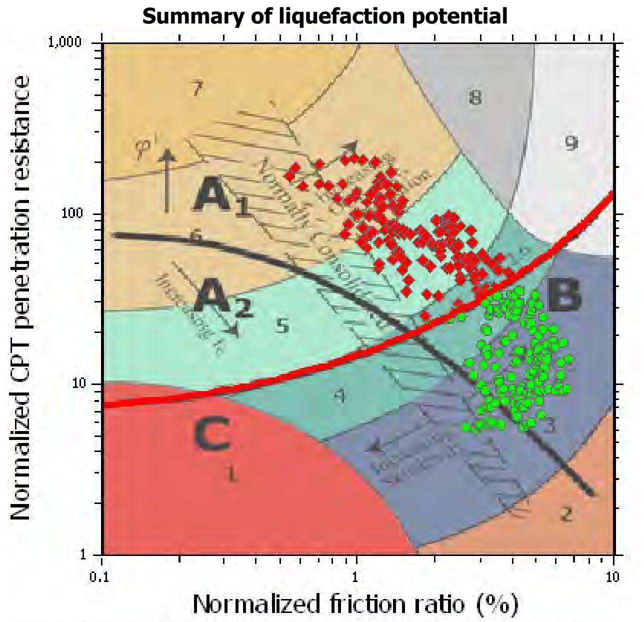
CPT file : CPT 03

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	24.50 ft	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 ft	Excavation depth:	15.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 tsf	Limit depth:	N/A
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.95	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

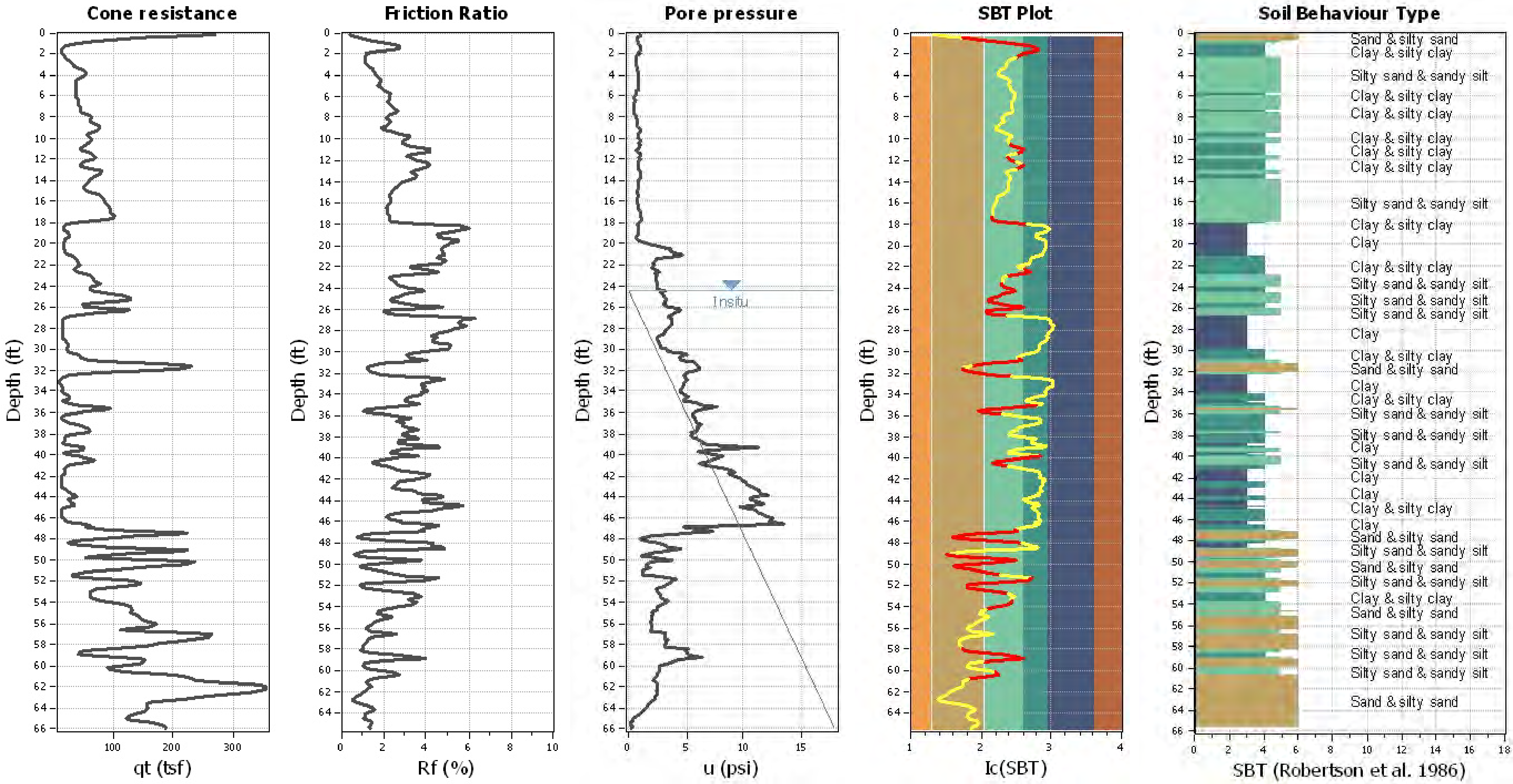






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



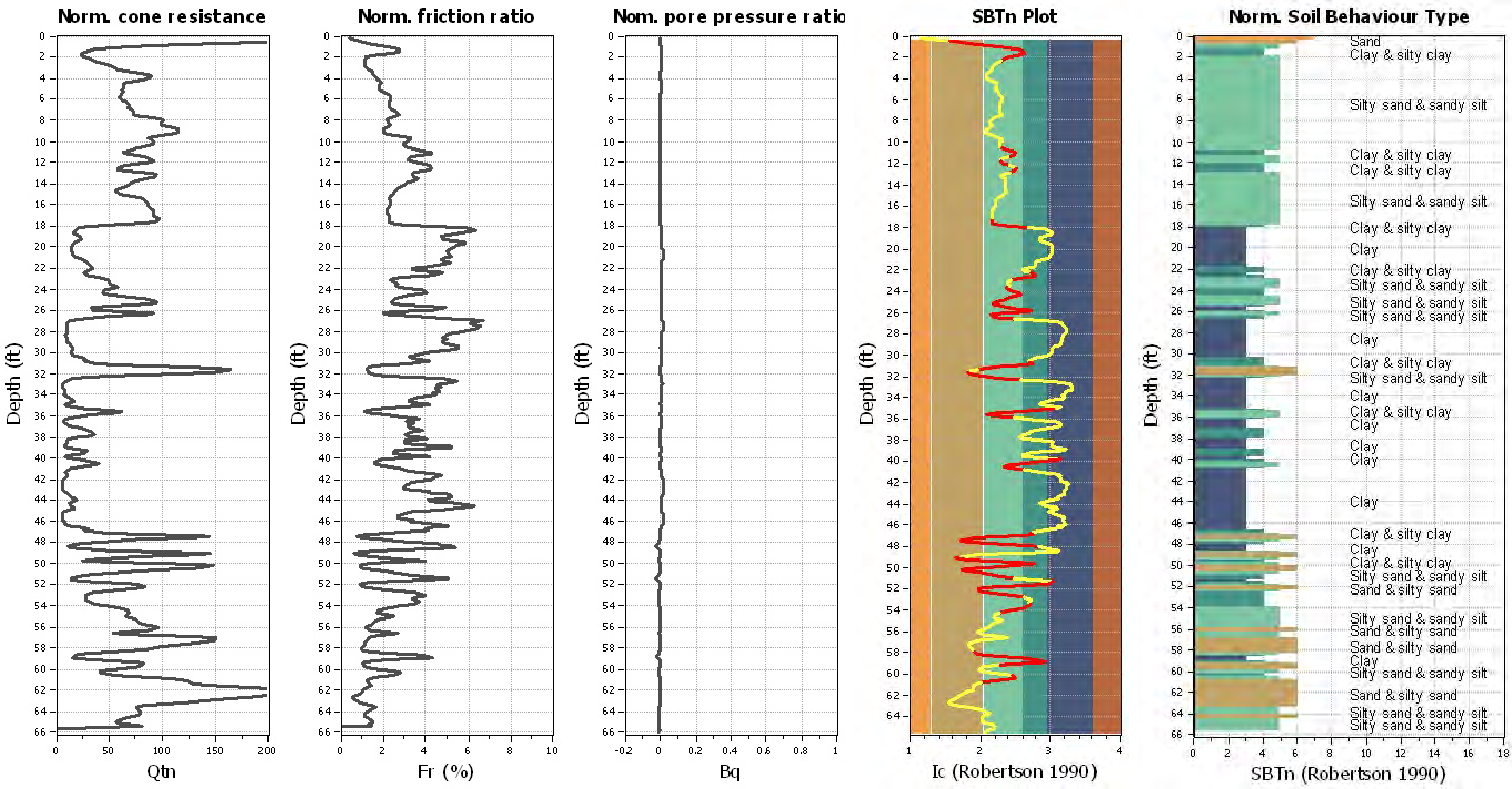
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normaliz



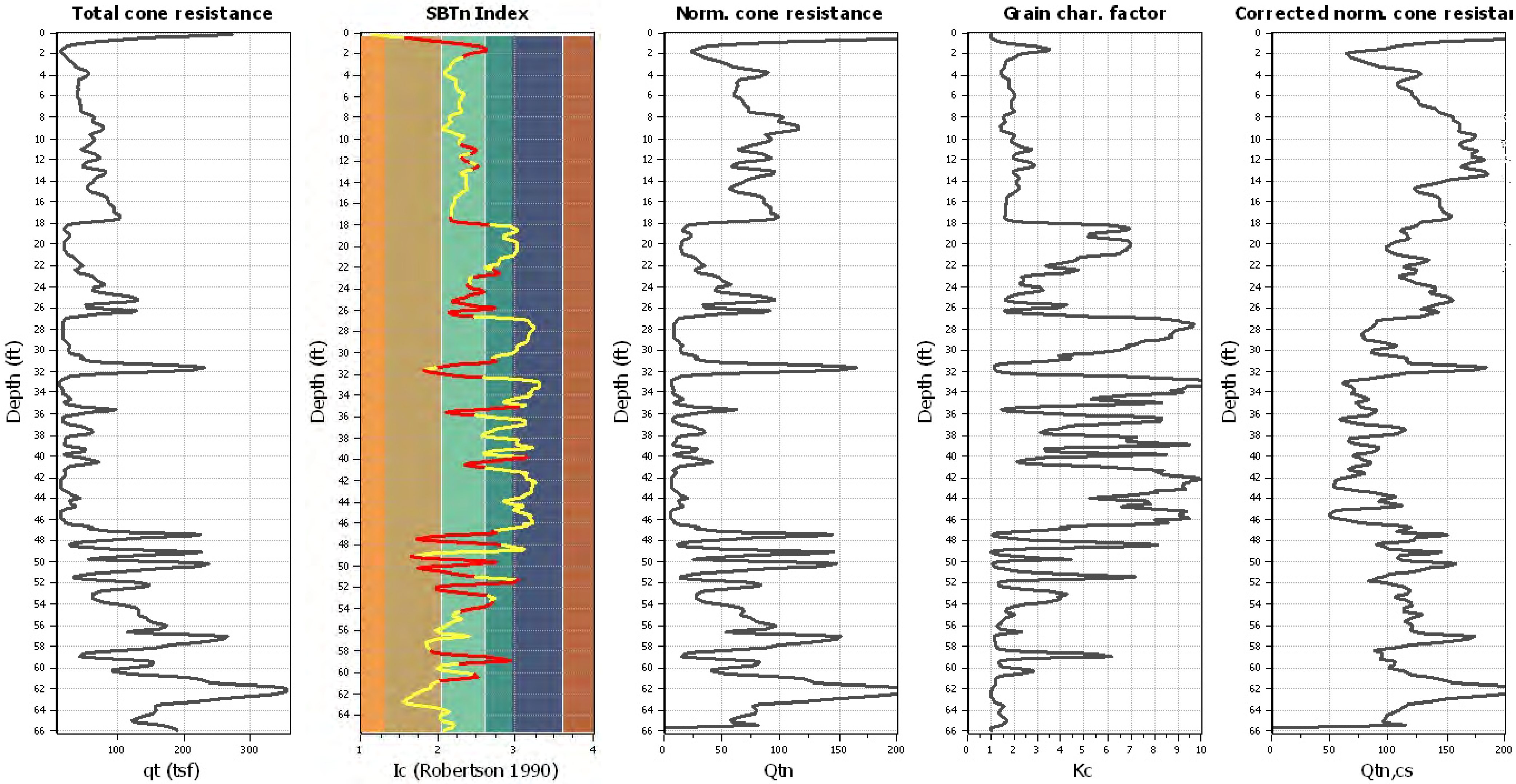
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBTn legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to
- 9. Very stiff fine grained

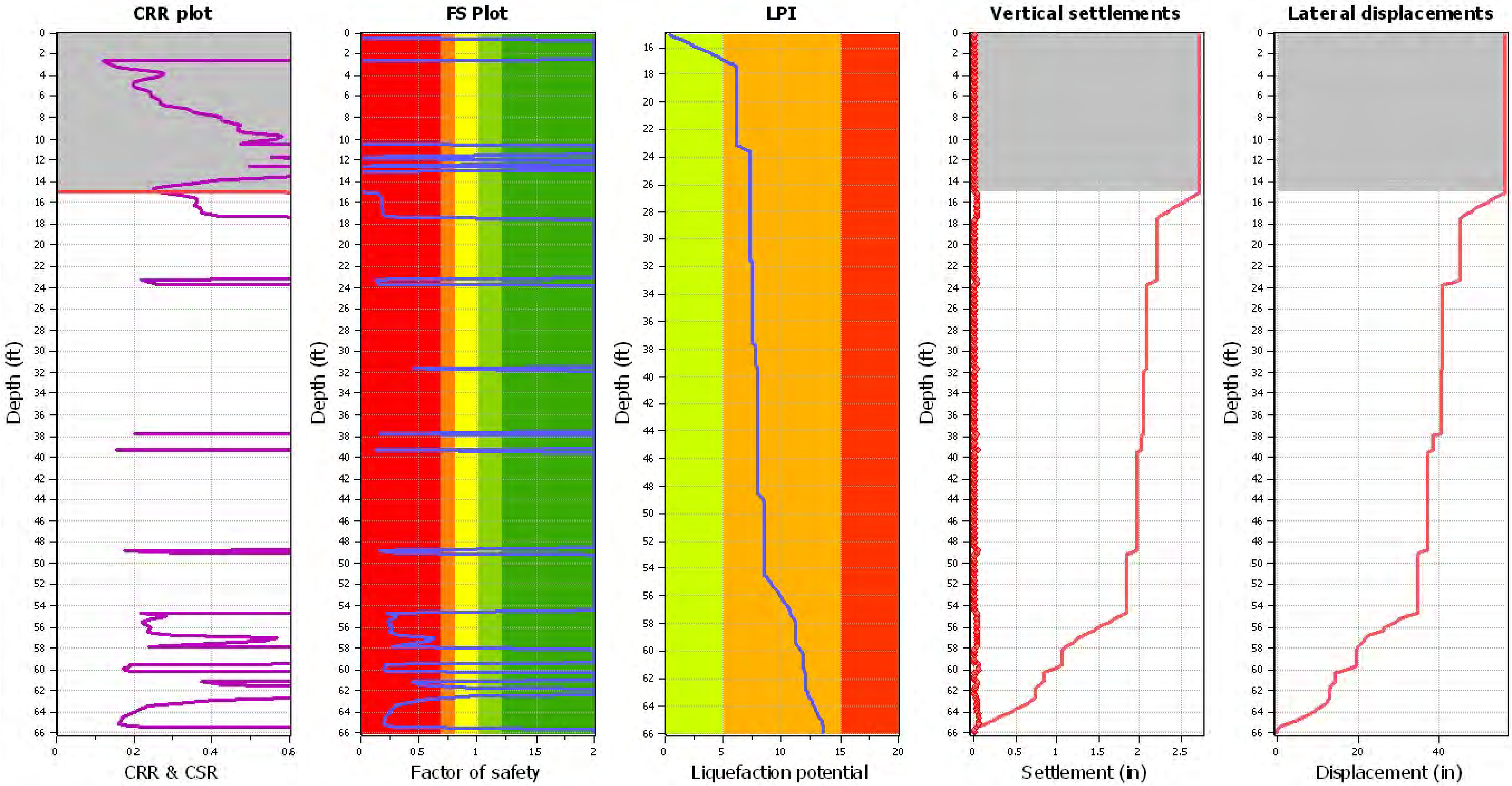
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

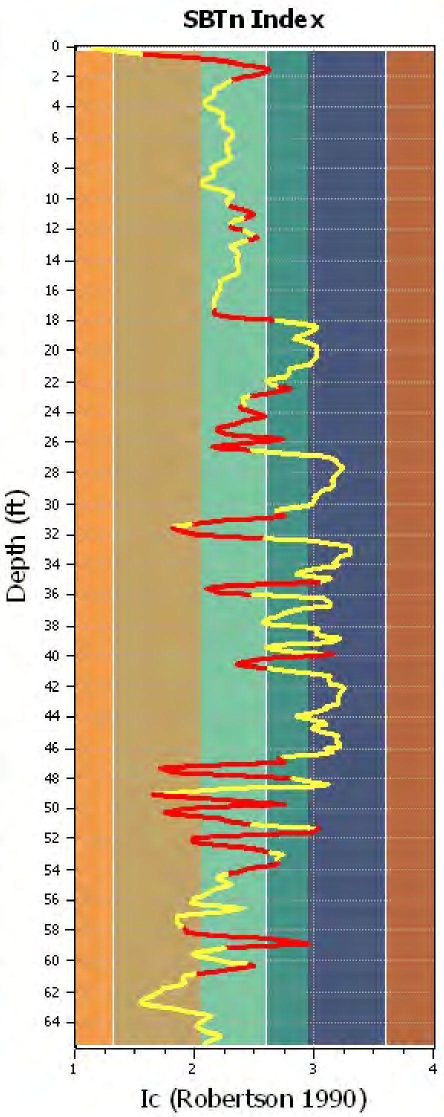
- Very high risk
- High risk
- Low risk

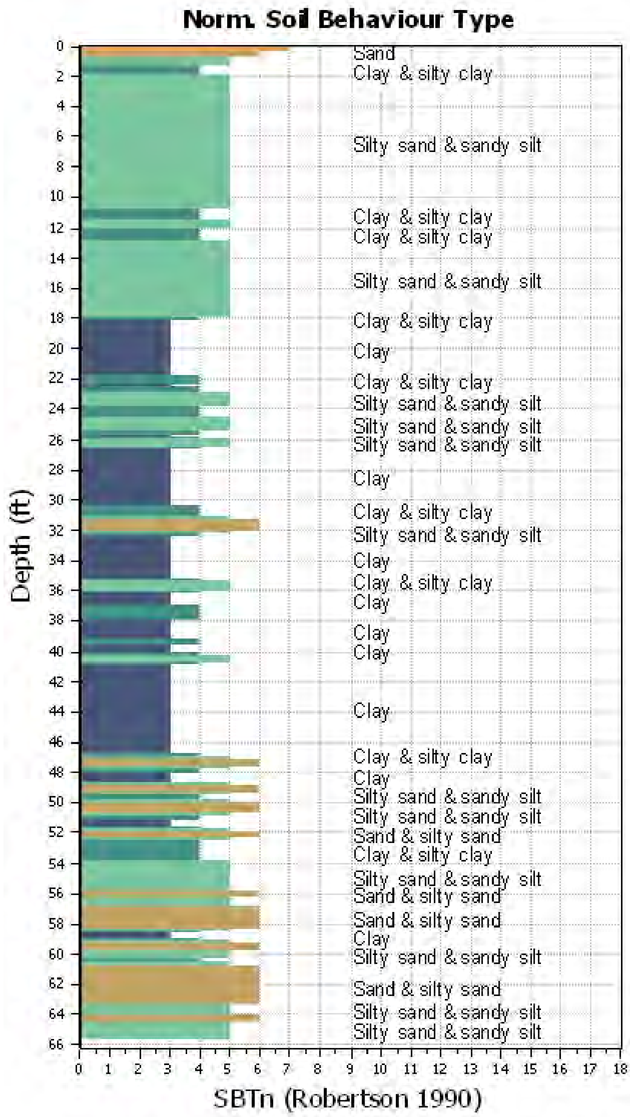
TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





Transition layer algorithm properties		**General statistics**	
I_c minimum check value:	1.70	Total points in CPT file:	402
I_c maximum check value:	3.00	Total points excluded:	136
I_c change ratio value:	0.0250	Exclusion percentage:	33.83%
Minimum number of points in layer:	3	Number of layers detected:	30

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
92	15.09	66.13	1.56	0.80	21.91	123.56
93	15.26	74.72	1.66	0.82	20.43	124.58
94	15.42	80.81	1.84	0.85	19.65	125.25
95	15.58	83.18	1.91	0.82	19.51	125.76
96	15.75	84.18	1.97	0.80	19.37	125.99
97	15.91	86.42	1.97	0.76	19.28	126.06
98	16.08	86.14	1.94	0.77	19.02	126.05
99	16.24	87.65	1.94	0.78	18.70	126.12
100	16.40	91.86	1.99	0.83	18.28	126.33
101	16.57	95.15	2.05	0.90	17.98	126.55
102	16.73	95.74	2.06	0.92	17.99	126.69
103	16.90	94.86	2.08	0.96	18.09	126.80
104	17.06	96.56	2.13	0.97	18.15	127.07
105	17.22	100.51	2.27	1.01	18.02	127.51
106	17.39	105.24	2.41	1.07	17.78	127.86
107	17.55	107.00	2.38	1.12	18.15	127.49
108	17.72	89.94	2.00	1.13	20.52	126.11
109	17.88	56.74	1.57	1.00	27.07	123.97
110	18.04	31.10	1.43	0.86	39.56	121.86
111	18.21	22.17	1.40	0.82	53.83	120.30
112	18.37	19.40	1.25	0.86	59.51	119.02
113	18.54	19.10	0.99	0.86	59.57	118.16
114	18.70	19.63	1.04	0.90	57.44	118.03
115	18.86	21.76	1.15	0.87	52.92	118.85
116	19.03	28.26	1.20	0.88	48.80	119.63
117	19.19	29.72	1.26	0.77	48.32	120.06
118	19.36	24.84	1.32	0.64	52.17	119.96
119	19.52	21.43	1.26	0.71	57.13	119.31
120	19.69	20.23	1.09	0.94	59.28	118.34
121	19.85	19.09	0.96	1.16	59.75	117.42
122	20.01	18.26	0.92	1.93	59.84	116.81
123	20.18	18.55	0.88	2.49	59.79	116.55
124	20.34	18.61	0.88	3.01	59.10	116.52
125	20.51	19.12	0.89	3.62	58.90	116.79
126	20.67	19.77	0.96	3.56	57.92	117.37
127	20.83	21.73	1.05	4.10	56.68	118.24
128	21.00	23.78	1.18	4.65	51.20	119.87
129	21.16	34.45	1.50	4.46	46.37	121.71
130	21.33	40.44	1.79	3.12	44.95	123.09
131	21.49	35.50	1.91	2.35	45.33	123.79
132	21.65	38.25	1.95	2.40	43.86	123.85
133	21.82	45.23	1.76	2.21	39.08	123.35
134	21.98	47.16	1.38	2.27	35.50	122.56
135	22.15	45.53	1.35	2.20	36.78	122.00
136	22.31	36.93	1.52	1.97	41.49	122.43
137	22.47	35.55	1.78	2.22	45.65	122.84
138	22.64	37.22	1.74	2.67	41.88	123.17
139	22.80	49.76	1.56	2.31	33.84	123.04

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
140	22.97	63.41	1.35	2.47	28.19	122.86
141	23.13	63.45	1.39	2.41	26.13	123.19
142	23.29	65.89	1.63	2.42	26.64	124.01
143	23.46	69.43	1.82	2.44	26.79	124.96
144	23.62	73.77	1.97	2.47	25.73	125.66
145	23.79	82.43	2.02	2.54	25.83	126.41
146	23.95	79.07	2.36	2.55	28.55	126.94
147	24.11	61.39	2.57	2.52	33.33	126.97
148	24.28	54.09	2.38	2.48	34.73	126.88
149	24.44	71.20	2.37	3.21	31.59	126.80
150	24.61	78.15	2.29	2.82	27.18	127.53
151	24.77	93.65	2.68	2.93	23.83	128.51
152	24.93	115.93	2.96	3.00	20.47	129.64
153	25.10	137.84	3.05	3.18	18.55	130.24
154	25.26	134.49	3.08	3.24	18.65	130.40
155	25.43	118.62	3.14	3.22	22.06	129.88
156	25.59	80.26	2.87	3.10	29.63	128.65
157	25.75	43.42	2.54	3.04	42.11	126.40
158	25.92	29.15	1.92	3.43	39.23	125.68
159	26.08	85.11	2.12	4.29	22.98	127.19
160	26.25	162.91	2.65	4.60	17.21	128.86
161	26.41	132.84	2.80	4.41	19.06	129.18
162	26.57	64.77	2.60	4.05	29.65	127.48
163	26.74	30.49	2.04	3.65	48.84	124.28
164	26.90	22.39	1.34	3.42	65.47	120.80
165	27.07	17.36	1.03	3.68	69.57	118.14
166	27.23	17.34	0.91	3.77	71.81	116.93
167	27.40	17.14	0.94	3.82	72.82	116.77
168	27.56	16.18	0.99	3.75	75.29	116.85
169	27.72	15.59	0.98	3.61	75.10	116.47
170	27.89	16.48	0.80	3.53	73.77	115.97
171	28.05	16.15	0.81	3.47	72.00	115.68
172	28.22	16.45	0.86	3.32	70.82	114.92
173	28.38	15.77	0.57	3.10	70.43	114.55
174	28.54	15.74	0.70	3.02	69.47	114.31
175	28.71	16.79	0.79	2.65	70.40	114.77
176	28.87	16.14	0.70	2.57	68.75	114.68
177	29.04	17.01	0.66	2.58	67.57	115.25
178	29.20	19.33	0.93	2.57	62.63	117.43
179	29.36	27.56	1.29	2.62	61.24	119.91
180	29.53	27.49	1.62	2.63	58.85	120.90
181	29.69	27.06	1.34	2.76	59.57	120.30
182	29.86	24.08	1.02	2.83	58.32	118.70
183	30.02	23.27	0.89	3.30	57.11	117.32
184	30.18	23.95	0.82	3.43	51.66	117.52
185	30.35	33.23	0.98	4.62	44.30	119.37
186	30.51	46.34	1.39	5.04	39.85	121.98
187	30.68	52.13	1.84	4.53	40.51	123.41

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
188	30.84	41.61	1.79	4.45	43.31	123.90
189	31.00	41.08	1.81	4.55	33.83	124.70
190	31.17	96.03	1.92	5.63	20.10	126.36
191	31.33	166.16	2.08	5.82	11.97	128.27
192	31.50	218.43	2.47	5.99	8.91	130.14
193	31.66	248.19	3.07	6.13	8.44	131.12
194	31.82	223.10	2.92	6.20	9.46	130.55
195	31.99	157.21	2.08	5.80	12.74	128.70
196	32.15	95.77	1.88	5.25	20.49	126.15
197	32.32	44.37	1.71	4.90	34.86	123.56
198	32.48	25.11	1.25	4.78	56.60	120.15
199	32.64	15.57	0.83	4.96	71.74	116.25
200	32.81	12.52	0.52	5.06	79.84	112.83
201	32.97	11.93	0.44	5.04	81.18	110.73
202	33.14	11.43	0.43	4.97	81.35	110.31
203	33.30	11.87	0.45	4.87	81.16	111.15
204	33.46	13.36	0.58	4.80	73.69	112.69
205	33.63	18.88	0.67	4.74	72.60	113.63
206	33.79	14.66	0.65	4.55	69.97	113.65
207	33.96	15.61	0.56	4.59	72.64	113.03
208	34.12	15.52	0.56	4.54	70.63	112.89
209	34.28	16.01	0.60	4.75	60.11	114.77
210	34.45	30.60	0.86	5.24	50.68	117.13
211	34.61	37.21	1.06	4.91	49.15	117.65
212	34.78	21.04	0.73	4.75	55.46	116.29
213	34.94	15.21	0.56	4.81	67.67	114.16
214	35.10	16.64	0.67	5.84	61.19	114.59
215	35.27	28.91	0.76	6.47	32.59	117.56
216	35.43	86.64	0.87	7.76	19.51	119.98
217	35.60	112.18	1.04	6.91	15.62	121.53
218	35.76	89.95	1.14	6.27	19.23	122.06
219	35.93	53.94	1.24	5.86	30.00	120.94
220	36.09	25.12	0.99	5.61	46.90	118.14
221	36.25	17.54	0.54	5.50	63.84	114.14
222	36.42	14.68	0.38	5.72	67.89	110.82
223	36.58	13.99	0.39	5.80	67.77	110.12
224	36.75	16.36	0.43	5.84	67.58	111.75
225	36.91	18.11	0.64	5.95	53.04	115.98
226	37.07	42.83	1.15	6.32	44.34	120.23
227	37.24	53.22	1.69	6.17	41.11	123.38
228	37.40	48.70	2.10	5.95	40.82	124.54
229	37.57	53.32	1.87	6.04	35.89	125.08
230	37.73	78.71	1.82	5.96	33.69	124.66
231	37.89	55.42	1.71	5.46	37.21	123.63
232	38.06	27.98	1.39	5.54	49.33	120.40
233	38.22	20.94	0.57	5.48	61.18	116.57
234	38.39	19.72	0.54	5.57	59.10	113.46
235	38.55	21.42	0.58	6.22	59.16	113.26

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
236	38.71	20.40	0.53	6.46	64.74	113.96
237	38.88	15.44	0.75	6.44	74.37	115.47
238	39.04	16.23	1.08	6.80	67.50	117.95
239	39.21	34.02	1.23	8.86	43.45	120.61
240	39.37	70.28	1.28	11.30	35.00	121.59
241	39.53	51.44	1.26	6.99	35.53	120.80
242	39.70	26.07	0.90	6.01	49.39	118.02
243	39.86	16.39	0.58	6.66	68.72	114.57
244	40.03	12.97	0.56	7.46	54.90	114.55
245	40.19	42.47	0.73	8.17	35.51	117.49
246	40.35	70.88	1.02	7.51	26.16	119.57
247	40.52	69.27	0.96	7.26	24.14	121.23
248	40.68	71.82	1.26	6.86	28.38	120.80
249	40.85	40.62	1.00	6.24	36.55	119.48
250	41.01	23.66	0.70	6.45	50.68	115.82
251	41.17	19.09	0.41	7.88	61.60	113.39
252	41.34	17.73	0.57	8.55	68.14	113.53
253	41.50	17.32	0.80	9.03	66.23	116.29
254	41.67	28.38	1.10	9.27	67.47	116.93
255	41.83	18.33	0.79	8.69	67.94	115.86
256	41.99	13.82	0.47	9.29	76.14	112.52
257	42.16	13.56	0.38	9.60	77.01	110.28
258	42.32	13.77	0.40	9.87	74.76	109.58
259	42.49	14.15	0.36	10.03	74.27	109.41
260	42.65	13.66	0.35	10.20	72.87	108.89
261	42.81	13.89	0.32	10.40	72.58	108.90
262	42.98	14.41	0.36	10.60	73.12	110.23
263	43.14	15.61	0.54	10.85	73.53	113.24
264	43.31	19.50	0.87	11.10	65.87	115.76
265	43.47	28.00	0.89	11.37	66.55	118.75
266	43.64	24.27	1.55	11.51	59.97	121.57
267	43.80	40.97	2.02	12.12	54.51	123.25
268	43.96	48.08	1.69	10.95	48.93	122.74
269	44.13	34.38	1.06	10.62	54.02	120.93
270	44.29	19.52	1.22	10.62	64.26	120.26
271	44.46	27.17	1.63	11.43	65.03	122.56
272	44.62	43.06	2.32	11.72	58.92	124.10
273	44.78	38.98	2.04	10.83	57.32	122.85
274	44.95	23.76	0.74	9.72	63.50	118.79
275	45.11	14.29	0.48	10.27	68.55	112.29
276	45.28	14.62	0.30	10.94	73.60	109.36
277	45.44	14.16	0.31	11.24	71.93	108.12
278	45.60	13.44	0.32	11.66	71.85	108.04
279	45.77	14.59	0.29	11.91	73.67	108.61
280	45.93	13.88	0.38	12.10	74.52	110.57
281	46.10	16.25	0.59	12.56	65.88	113.11
282	46.26	27.34	0.67	12.22	69.01	116.61
283	46.42	20.03	1.30	12.77	61.49	120.90

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
284	46.59	42.01	2.15	13.50	44.83	125.04
285	46.75	92.30	2.61	9.35	40.45	126.56
286	46.92	50.80	2.27	4.86	43.05	125.93
287	47.08	25.81	1.77	6.65	25.52	126.10
288	47.24	193.99	1.78	7.39	11.61	126.69
289	47.41	260.91	1.66	5.35	6.46	127.38
290	47.57	215.22	1.68	4.10	8.63	128.11
291	47.74	134.11	2.50	2.02	17.16	128.78
292	47.90	73.11	3.06	0.97	30.58	128.03
293	48.06	53.03	2.12	1.09	47.45	125.50
294	48.23	25.48	1.32	1.62	57.56	121.62
295	48.39	23.47	0.92	2.51	66.53	120.04
296	48.56	31.00	1.57	3.05	63.38	121.40
297	48.72	36.01	1.92	3.44	23.65	125.39
298	48.88	212.32	1.74	4.56	10.58	126.10
299	49.05	246.42	1.10	3.73	5.21	125.72
300	49.21	215.86	1.23	2.94	7.82	126.70
301	49.38	135.02	2.52	1.93	15.15	126.71
302	49.54	62.11	1.75	1.15	32.89	125.99
303	49.70	23.76	1.87	2.25	43.57	125.33
304	49.87	79.24	2.56	2.91	22.76	127.52
305	50.03	221.71	2.22	3.78	11.36	129.24
306	50.20	265.88	2.21	1.95	6.99	128.88
307	50.36	222.94	1.75	1.58	8.38	129.01
308	50.52	169.30	2.49	1.58	13.13	129.43
309	50.69	135.10	3.10	1.95	19.01	130.25
310	50.85	129.08	3.18	1.49	23.19	129.43
311	51.02	93.63	2.08	1.27	30.16	127.68
312	51.18	40.26	2.03	1.31	40.28	124.22
313	51.35	35.70	1.15	1.28	60.72	121.98
314	51.51	24.14	1.43	2.69	57.07	120.90
315	51.67	42.15	1.37	3.46	37.33	122.00
316	51.84	96.57	1.13	4.13	18.78	122.23
317	52.00	148.26	0.86	3.75	12.41	123.24
318	52.17	150.78	1.48	3.56	12.41	125.39
319	52.33	142.42	2.15	3.31	16.43	127.56
320	52.49	122.52	2.53	3.18	22.05	128.36
321	52.66	88.09	2.58	2.65	29.41	128.20
322	52.82	68.19	2.57	2.42	36.98	127.37
323	52.99	62.45	2.29	2.54	41.88	126.69
324	53.15	57.56	2.26	2.66	40.55	125.71
325	53.31	64.38	1.72	2.81	39.39	125.29
326	53.48	63.47	1.93	2.78	40.32	125.60
327	53.64	56.83	2.52	2.90	39.47	126.85
328	53.81	81.09	2.66	3.40	35.01	127.92
329	53.97	99.95	2.60	3.23	28.31	128.54
330	54.13	114.17	2.62	3.05	24.81	129.07
331	54.30	124.04	2.88	2.83	21.61	128.59

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
332	54.46	127.98	1.89	2.59	19.22	128.13
333	54.63	136.93	2.04	2.48	18.66	128.10
334	54.79	131.91	2.81	2.10	21.03	129.53
335	54.95	125.85	3.36	1.99	22.82	130.49
336	55.12	134.57	3.20	2.14	21.47	130.23
337	55.28	144.44	2.39	2.03	18.67	129.29
338	55.45	145.90	2.15	1.98	16.44	128.20
339	55.61	146.38	2.08	2.01	15.80	128.02
340	55.77	152.00	2.19	1.95	14.84	128.28
341	55.94	170.97	2.26	1.90	13.11	128.06
342	56.10	177.86	1.75	1.98	12.21	127.88
343	56.27	168.76	1.97	1.98	14.27	128.37
344	56.43	137.79	2.82	1.98	21.12	129.21
345	56.59	82.97	3.09	1.85	26.08	129.64
346	56.76	119.39	2.84	1.96	19.12	130.90
347	56.92	258.40	3.46	3.21	12.12	131.95
348	57.09	277.25	3.34	3.15	9.25	132.70
349	57.25	256.71	3.22	3.15	9.07	132.19
350	57.41	243.63	2.85	3.21	9.27	131.39
351	57.58	234.37	2.52	3.37	9.51	130.27
352	57.74	202.91	2.19	3.32	10.01	128.98
353	57.91	180.40	1.84	3.23	10.78	127.17
354	58.07	155.44	1.32	3.21	11.37	125.26
355	58.23	137.84	1.14	3.14	14.21	124.06
356	58.40	97.91	1.44	5.13	21.58	123.94
357	58.56	57.24	1.65	4.99	35.29	123.91
358	58.73	41.79	1.71	5.08	49.63	123.27
359	58.89	40.34	1.57	5.18	54.65	123.12
360	59.06	43.87	1.71	5.58	33.75	124.20
361	59.22	124.02	1.61	6.46	20.61	125.19
362	59.38	156.03	1.51	5.03	13.90	125.90
363	59.55	157.33	1.70	4.13	12.71	125.95
364	59.71	149.89	1.55	3.51	13.69	126.05
365	59.88	138.37	1.64	3.01	16.72	126.12
366	60.04	106.10	1.96	2.71	22.08	126.61
367	60.20	88.82	2.23	2.67	29.24	127.20
368	60.37	81.69	2.53	2.61	30.77	128.13
369	60.53	108.42	2.84	2.60	25.04	129.38
370	60.70	162.67	2.97	2.57	17.62	130.11
371	60.86	202.74	2.53	2.49	13.17	130.52
372	61.02	218.45	2.74	2.40	10.63	130.27
373	61.19	228.89	2.41	2.27	10.43	130.84
374	61.35	231.36	3.04	2.09	10.71	131.98
375	61.52	254.36	3.96	2.38	10.31	133.62
376	61.68	316.90	4.32	2.47	8.68	134.50
377	61.84	352.63	3.90	2.58	6.87	134.56
378	62.01	363.56	3.62	2.53	6.05	134.15
379	62.17	346.06	3.56	2.53	5.60	133.60

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
380	62.34	351.27	3.11	2.37	5.18	132.68
381	62.50	337.94	2.48	2.51	4.19	130.54
382	62.66	304.44	1.33	2.55	3.58	128.26
383	62.83	285.33	1.37	2.46	3.91	126.88
384	62.99	249.08	1.73	2.32	5.82	127.83
385	63.16	223.90	2.13	2.29	8.66	128.39
386	63.32	183.81	2.06	2.04	12.06	128.87
387	63.48	158.51	2.45	1.89	15.71	129.13
388	63.65	147.84	2.71	1.72	16.91	129.14
389	63.81	161.47	2.19	1.67	15.92	128.39
390	63.98	158.31	1.74	1.53	14.40	127.57
391	64.14	157.04	1.96	1.39	13.75	126.72
392	64.30	153.82	1.57	1.29	13.50	126.21
393	64.47	151.56	1.42	1.15	13.92	125.60
394	64.63	134.84	1.64	0.97	15.65	125.86
395	64.80	128.60	1.83	0.64	18.60	126.13
396	64.96	112.27	1.77	0.40	19.30	126.04
397	65.12	124.03	1.63	0.35	18.44	125.94
398	65.29	138.49	1.71	0.32	16.00	126.83
399	65.45	169.12	2.17	0.18	15.15	128.77
400	65.62	187.89	2.97	0.09	N/A	137.28
401	65.78	191.62	-235954.17	0.42	N/A	137.28
402	65.94	186.56	-235954.17	0.31	N/A	137.28

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

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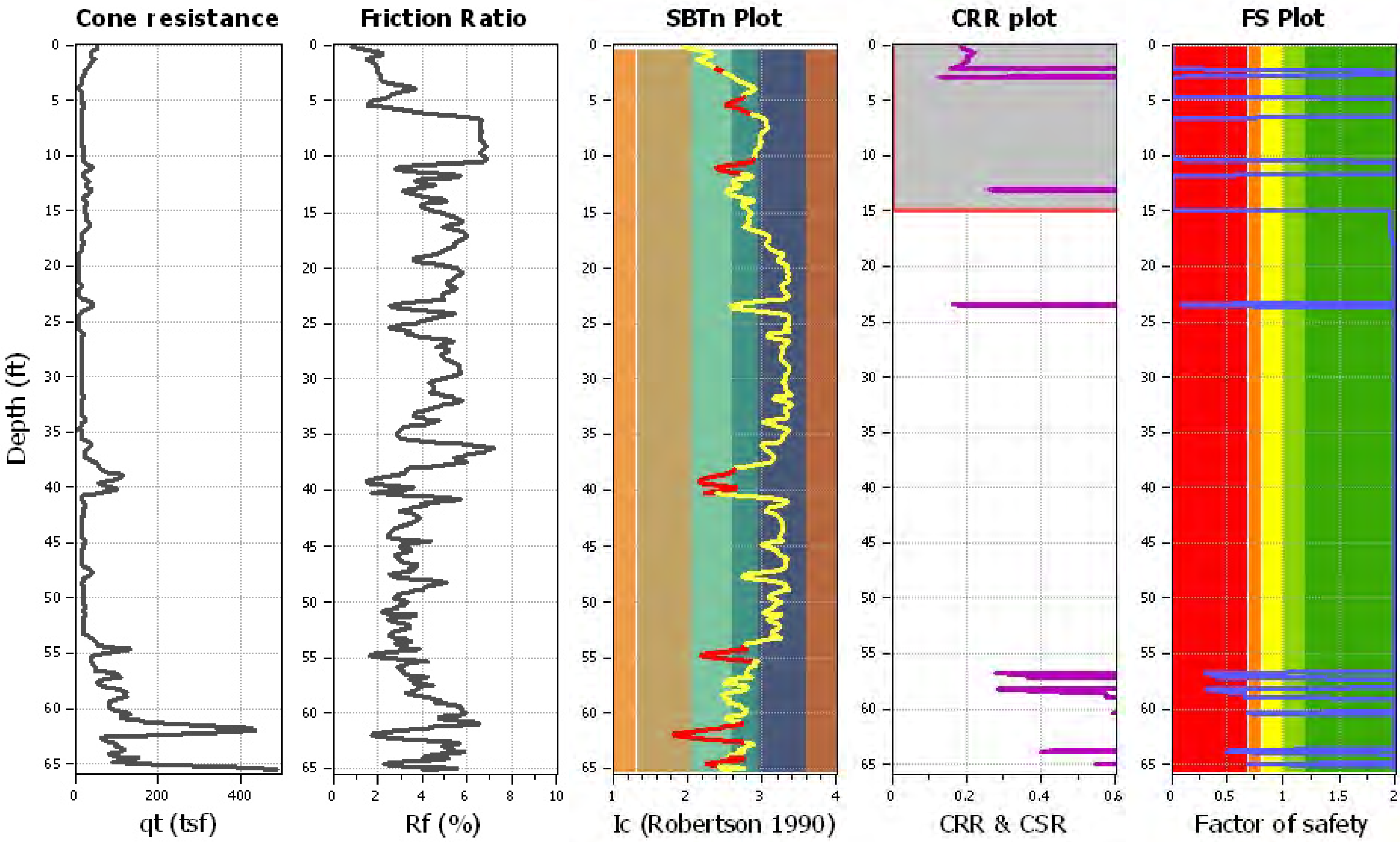
LIQUEFACTION ANALYSIS REPORT

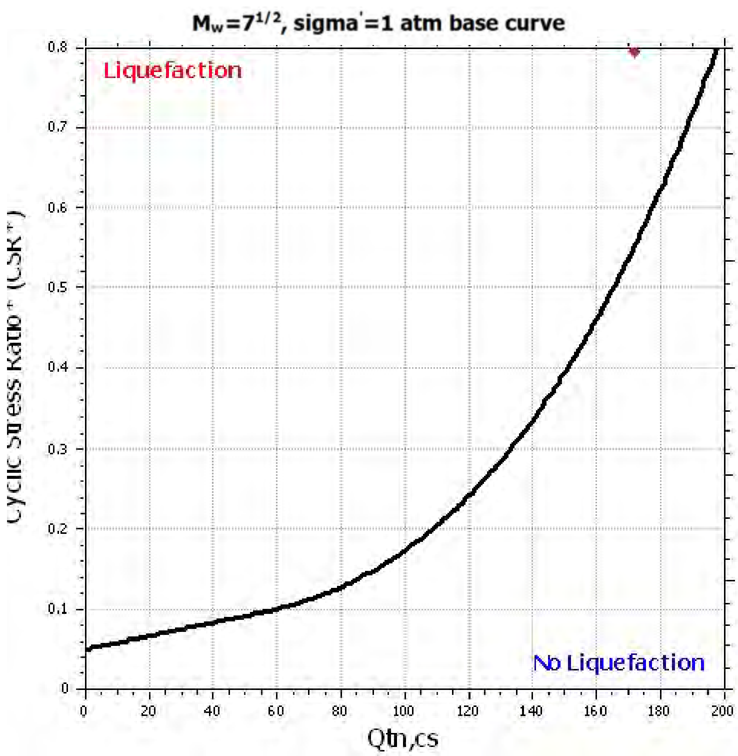
Project title : File No. 21796 Harvard-Westlake School **Location :**

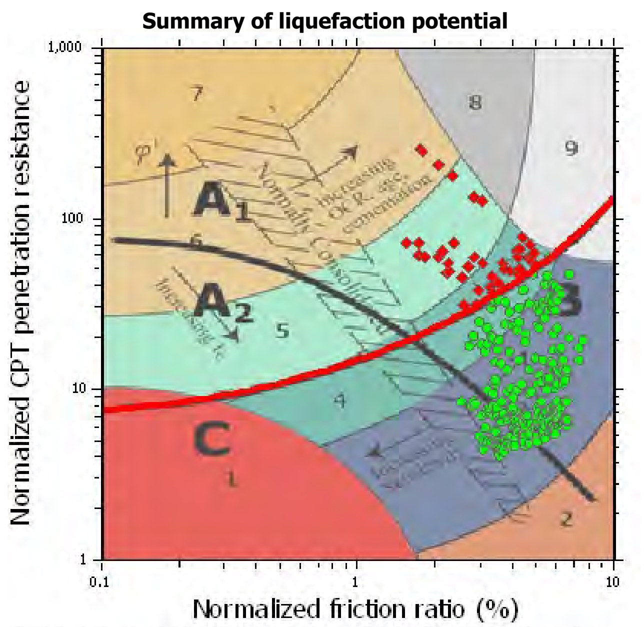
CPT file : CPT 04

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	24.50 ft	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 ft	Excavation depth:	15.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 tsf	Limit depth:	N/A
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.95	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

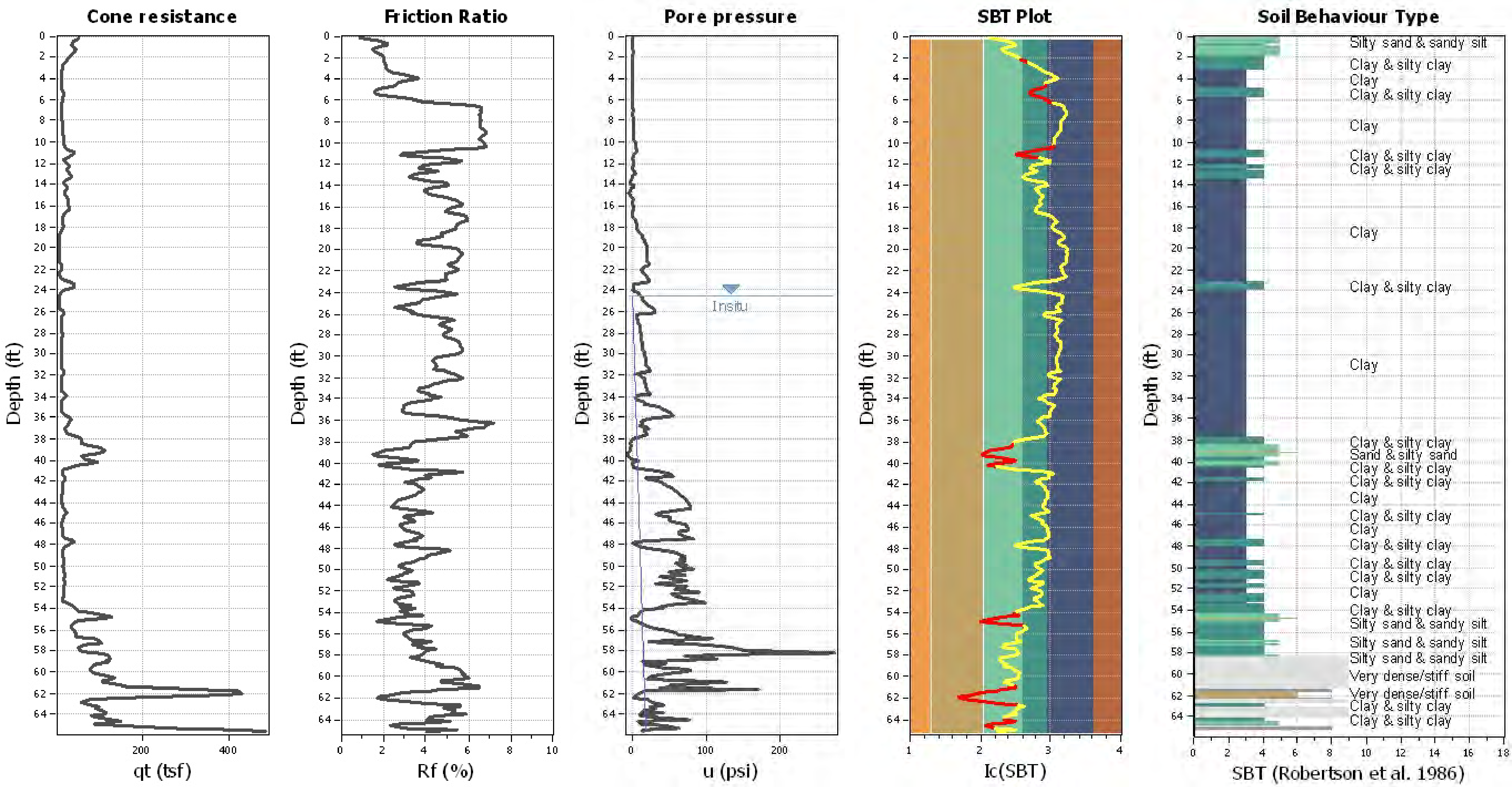






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plo



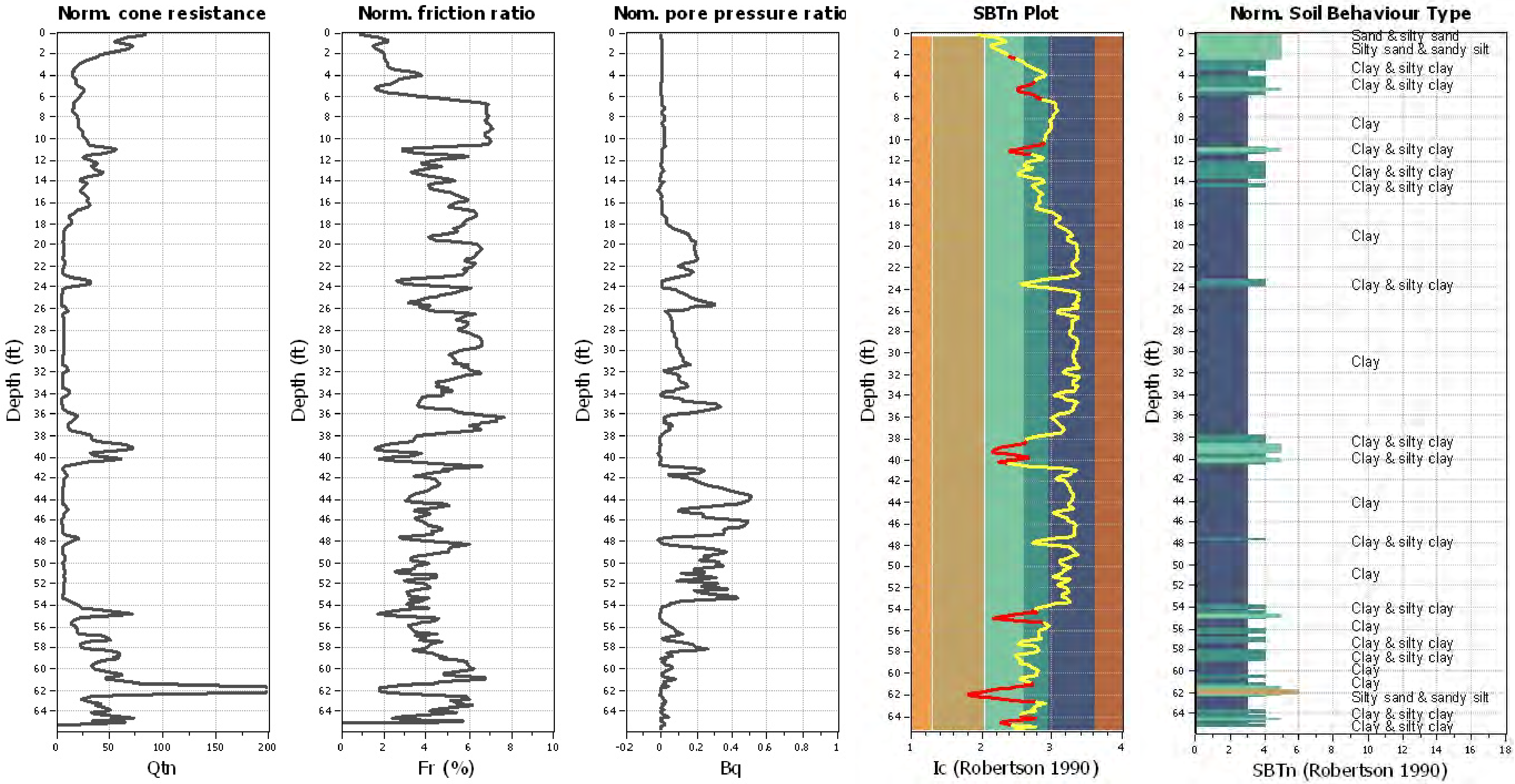
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normaliz



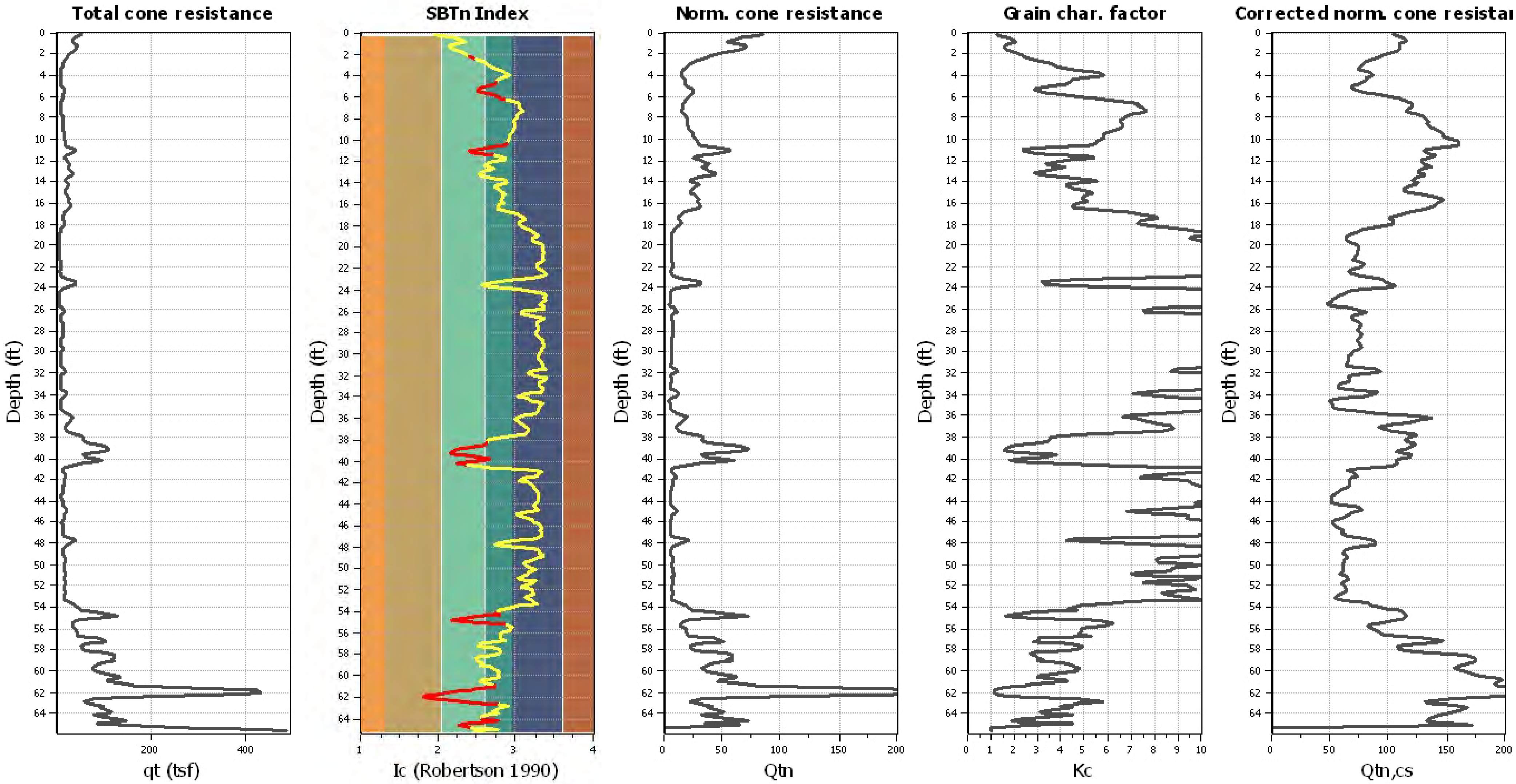
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBTn legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to
- 9. Very stiff fine grained

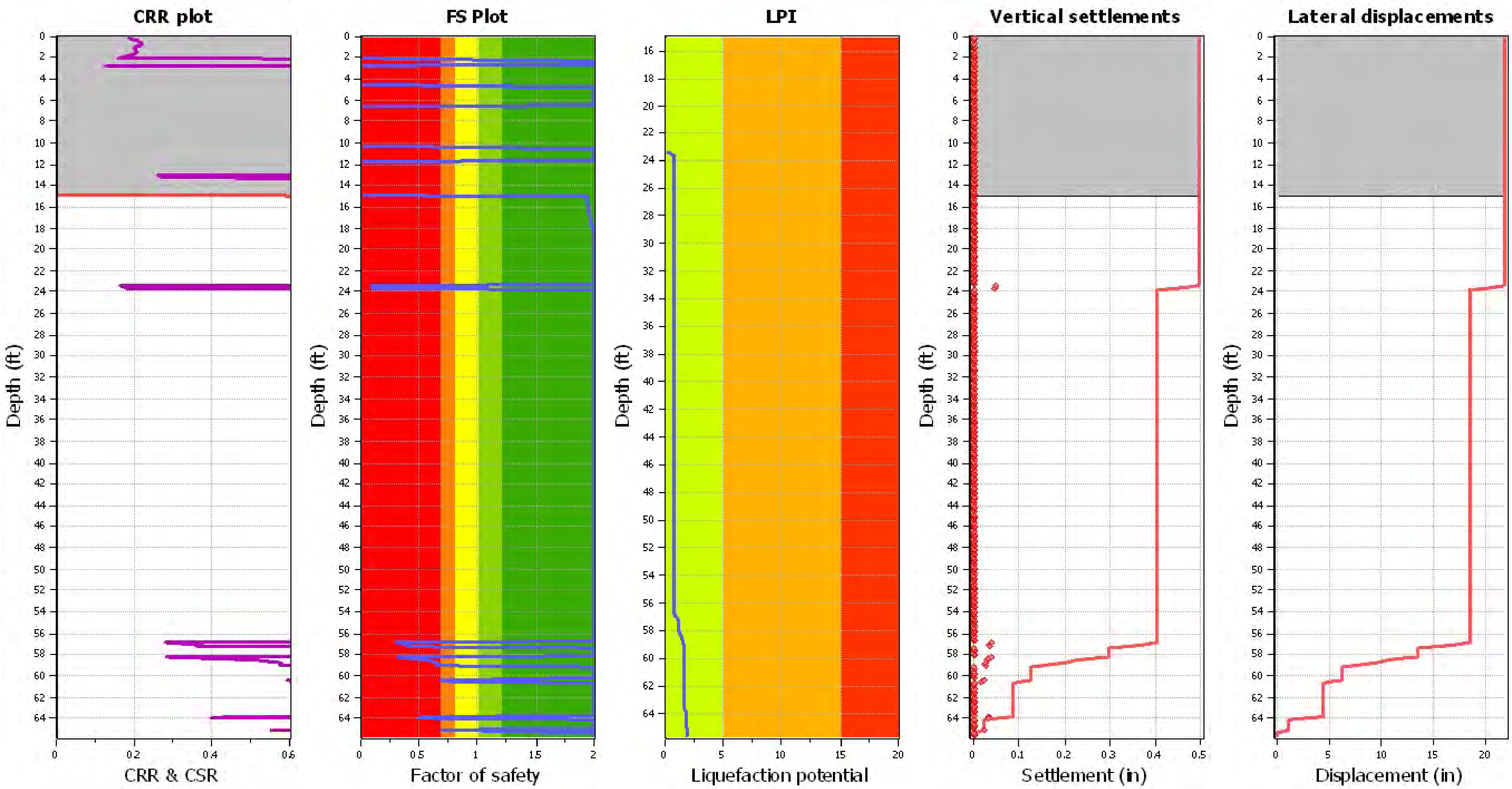
Liquefaction analysis overall plots (intermediate resı



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

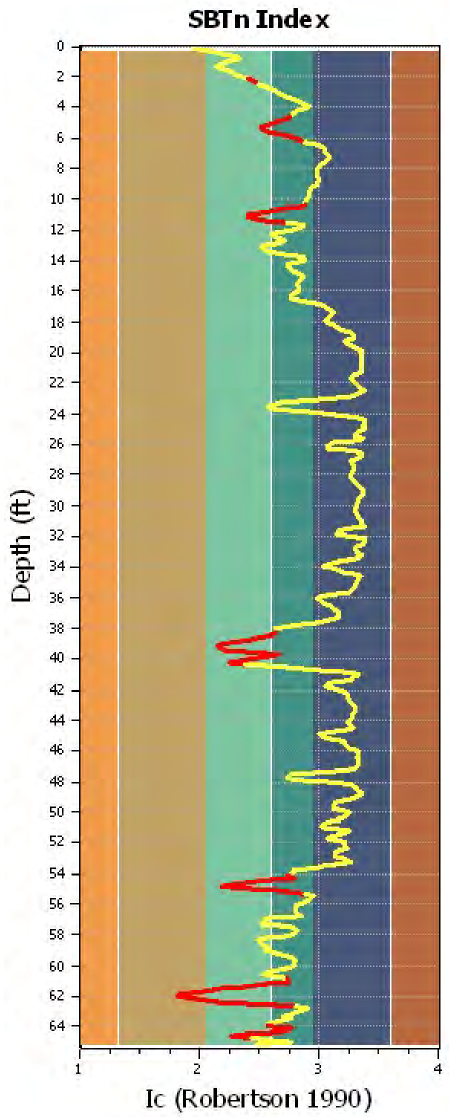
- Very high risk
- High risk
- Low risk

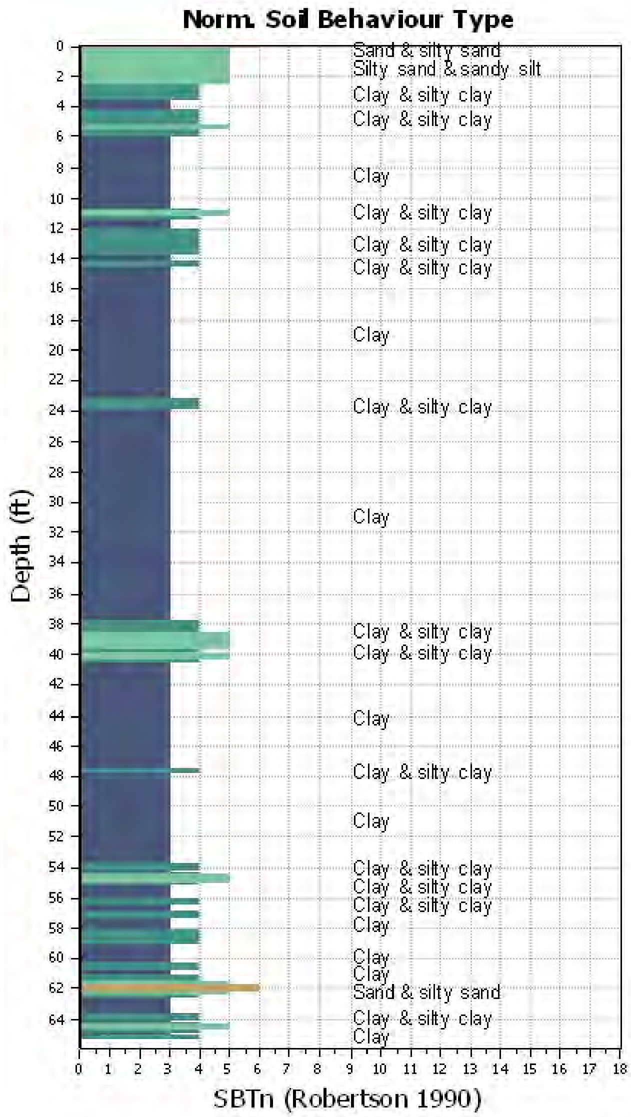
TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





Transition layer algorithm properties

I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0250
Minimum number of points in layer:	3

General statistics

Total points in CPT file:	400
Total points excluded:	66
Exclusion percentage:	16.50%
Number of layers detected:	15

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
92	15.09	19.36	0.88	-3.02	49.76	117.75
93	15.26	22.94	1.21	-1.70	47.88	119.34
94	15.42	28.50	1.52	1.53	46.97	120.92
95	15.58	27.90	1.58	0.05	46.92	121.60
96	15.75	26.53	1.56	0.08	48.03	121.58
97	15.91	26.62	1.54	1.20	48.09	121.46
98	16.08	27.59	1.51	1.97	45.55	121.53
99	16.24	32.23	1.50	2.92	44.03	121.55
100	16.40	30.38	1.49	1.67	44.41	121.19
101	16.57	25.37	1.33	1.09	48.36	120.29
102	16.73	20.83	1.19	1.06	53.73	118.95
103	16.90	17.22	1.03	0.91	59.18	117.62
104	17.06	15.00	0.93	0.77	63.35	116.25
105	17.22	13.52	0.78	1.98	66.06	115.23
106	17.39	12.92	0.75	3.40	66.57	114.70
107	17.55	13.65	0.78	4.86	65.05	115.04
108	17.72	15.51	0.85	5.72	62.51	115.62
109	17.88	16.48	0.88	6.00	61.65	115.86
110	18.04	15.20	0.83	5.74	63.47	115.29
111	18.21	12.78	0.71	6.51	66.37	113.79
112	18.37	11.23	0.51	7.39	70.26	112.12
113	18.54	9.78	0.49	8.04	73.07	110.47
114	18.70	8.79	0.42	12.55	77.89	109.34
115	18.86	7.56	0.36	13.50	79.98	108.10
116	19.03	7.55	0.33	14.84	79.34	107.27
117	19.19	8.21	0.31	15.50	74.90	106.82
118	19.36	8.88	0.28	16.41	74.37	106.78
119	19.52	7.82	0.32	17.20	77.26	107.16
120	19.69	7.53	0.36	18.31	82.78	108.14
121	19.85	7.92	0.44	19.11	84.64	109.11
122	20.01	8.27	0.47	19.54	85.12	110.00
123	20.18	8.45	0.51	19.23	85.04	110.29
124	20.34	8.40	0.48	19.54	85.74	110.42
125	20.51	8.28	0.50	19.49	85.94	110.28
126	20.67	8.30	0.48	20.29	85.75	110.33
127	20.83	8.63	0.49	20.37	85.24	110.24
128	21.00	8.47	0.48	20.62	85.42	110.15
129	21.16	8.22	0.47	20.62	85.95	109.75
130	21.33	8.07	0.42	21.30	84.63	109.46
131	21.49	8.71	0.42	22.04	81.25	110.45
132	21.65	10.90	0.61	22.40	78.73	111.73
133	21.82	11.19	0.64	17.05	79.52	112.26
134	21.98	9.38	0.54	12.36	80.69	111.72
135	22.15	9.77	0.50	14.69	83.34	110.55
136	22.31	8.57	0.44	14.79	84.76	109.56
137	22.47	7.64	0.38	16.51	87.94	108.89
138	22.64	7.88	0.41	18.64	85.58	109.51
139	22.80	10.16	0.52	20.29	78.39	111.65

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
140	22.97	13.72	0.70	21.11	66.50	114.36
141	23.13	20.69	0.90	22.05	51.71	116.76
142	23.29	33.47	0.96	17.46	39.60	118.52
143	23.46	45.13	1.02	3.26	33.83	119.64
144	23.62	44.99	1.14	2.12	35.25	120.62
145	23.79	35.61	1.39	1.49	43.72	120.13
146	23.95	18.51	1.06	1.23	57.91	117.98
147	24.11	11.43	0.62	2.16	75.98	114.04
148	24.28	9.03	0.45	8.76	85.06	110.51
149	24.44	8.28	0.39	10.29	87.96	108.67
150	24.61	8.05	0.34	12.06	87.85	107.82
151	24.77	8.15	0.33	13.43	87.32	106.86
152	24.93	7.48	0.27	14.29	87.62	106.31
153	25.10	7.42	0.28	15.46	84.80	105.45
154	25.26	8.22	0.23	20.84	82.75	104.62
155	25.43	7.34	0.18	22.78	81.69	103.27
156	25.59	6.46	0.17	25.10	86.42	103.64
157	25.75	6.97	0.27	27.60	85.97	105.87
158	25.92	9.43	0.38	29.18	66.50	110.51
159	26.08	22.34	0.66	29.52	63.13	113.13
160	26.25	15.35	0.72	5.46	63.27	114.28
161	26.41	12.39	0.64	5.56	77.78	113.01
162	26.57	9.32	0.52	5.40	86.01	111.69
163	26.74	9.11	0.51	6.79	85.72	110.91
164	26.90	11.48	0.49	8.57	82.37	111.27
165	27.07	11.37	0.56	9.23	78.64	111.91
166	27.23	12.00	0.60	9.88	79.29	112.72
167	27.40	12.48	0.66	10.13	79.82	113.05
168	27.56	11.68	0.64	10.25	80.24	112.95
169	27.72	11.66	0.58	10.62	80.09	112.59
170	27.89	12.03	0.58	11.00	78.47	112.55
171	28.05	12.57	0.61	11.48	77.84	112.85
172	28.22	12.60	0.64	11.94	78.25	113.16
173	28.38	12.37	0.65	12.29	80.11	113.30
174	28.54	11.79	0.67	12.51	82.01	113.29
175	28.71	11.56	0.66	13.12	84.40	113.02
176	28.87	10.73	0.61	13.38	85.88	112.75
177	29.04	10.68	0.61	13.69	86.43	112.65
178	29.20	11.21	0.64	14.00	86.04	112.92
179	29.36	11.38	0.67	14.35	84.86	113.37
180	29.53	12.03	0.71	14.74	83.82	113.58
181	29.69	12.15	0.68	14.99	83.50	113.39
182	29.86	11.27	0.62	15.70	82.63	112.73
183	30.02	11.47	0.55	16.34	82.07	111.96
184	30.18	11.28	0.51	16.68	80.93	111.33
185	30.35	10.94	0.48	17.12	81.14	110.87
186	30.51	10.72	0.46	17.48	82.62	110.71
187	30.68	10.37	0.49	18.15	83.30	110.75

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
188	30.84	10.72	0.49	18.56	83.39	110.88
189	31.00	10.90	0.49	18.81	84.67	110.64
190	31.17	9.46	0.46	20.62	85.45	110.22
191	31.33	9.81	0.42	21.94	88.62	110.85
192	31.50	10.38	0.62	22.27	76.93	114.05
193	31.66	20.77	1.04	23.83	70.87	116.82
194	31.82	20.96	1.16	7.07	69.79	117.56
195	31.99	13.63	0.86	9.41	77.90	115.80
196	32.15	10.05	0.57	13.04	87.63	112.79
197	32.32	9.83	0.45	15.15	88.07	111.12
198	32.48	11.01	0.52	16.24	86.08	111.21
199	32.64	11.08	0.57	16.82	81.77	111.35
200	32.81	12.17	0.45	17.27	81.55	110.69
201	32.97	10.19	0.40	17.25	81.79	109.27
202	33.14	9.02	0.34	18.47	85.69	108.37
203	33.30	9.36	0.34	19.50	85.11	108.29
204	33.46	10.33	0.38	20.32	82.85	110.58
205	33.63	13.04	0.68	21.43	67.90	114.82
206	33.79	27.28	1.11	23.54	64.16	117.67
207	33.96	22.24	1.20	5.37	60.60	117.71
208	34.12	17.89	0.62	3.77	67.99	115.04
209	34.28	11.93	0.40	7.17	72.82	110.35
210	34.45	9.01	0.27	14.81	82.11	107.18
211	34.61	8.45	0.25	16.08	85.78	106.01
212	34.78	9.08	0.29	16.99	84.11	106.28
213	34.94	9.65	0.29	38.00	82.43	106.67
214	35.10	9.26	0.28	40.47	80.87	106.79
215	35.27	9.57	0.29	43.26	80.67	107.41
216	35.43	10.40	0.36	47.04	79.00	109.41
217	35.60	12.61	0.53	51.40	76.68	113.35
218	35.76	17.31	1.00	54.40	65.80	118.24
219	35.93	32.19	1.68	42.52	59.59	122.63
220	36.09	39.07	2.54	22.67	57.74	124.87
221	36.25	33.33	2.51	13.32	61.08	125.47
222	36.42	29.38	2.33	11.35	62.37	124.25
223	36.58	30.50	1.60	13.64	65.75	122.80
224	36.75	21.30	1.60	10.48	67.27	120.61
225	36.91	18.70	1.09	19.85	70.00	119.32
226	37.07	22.96	1.04	21.99	70.15	118.23
227	37.24	17.84	1.14	15.83	70.71	118.78
228	37.40	19.87	1.32	18.51	67.79	120.43
229	37.57	31.81	1.74	19.45	58.32	122.58
230	37.73	41.33	2.06	15.09	48.67	124.48
231	37.89	52.34	2.21	8.10	42.10	125.33
232	38.06	59.01	2.07	1.08	37.25	124.98
233	38.22	57.65	1.56	-2.16	36.65	124.57
234	38.39	51.56	1.90	-3.60	36.21	124.82
235	38.55	63.51	2.21	-0.61	32.99	126.21

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
236	38.71	88.10	2.38	-2.24	26.65	127.06
237	38.88	105.18	2.16	-3.29	21.40	127.11
238	39.04	114.04	1.86	-4.42	18.17	126.37
239	39.21	114.46	1.61	-5.01	17.31	125.49
240	39.37	100.97	1.54	-5.33	19.76	125.08
241	39.53	77.75	1.78	-5.46	28.14	125.43
242	39.70	46.85	2.33	-5.22	38.70	125.30
243	39.86	43.71	2.01	-1.61	34.72	125.57
244	40.03	98.45	1.76	7.68	25.22	125.33
245	40.19	104.10	1.63	0.07	20.67	125.25
246	40.35	84.56	1.68	-0.21	25.78	124.85
247	40.52	47.72	1.82	0.01	38.24	123.71
248	40.68	24.86	1.53	2.49	59.55	121.12
249	40.85	14.60	0.94	15.95	78.10	117.36
250	41.01	12.74	0.56	31.92	83.91	113.72
251	41.17	12.63	0.50	42.19	80.30	112.03
252	41.34	13.38	0.54	49.51	78.35	113.46
253	41.50	16.31	0.85	54.73	66.74	114.49
254	41.67	24.84	0.63	17.12	63.50	114.85
255	41.83	18.15	0.59	22.00	62.21	113.75
256	41.99	15.19	0.57	33.89	70.72	113.10
257	42.16	14.95	0.57	40.45	74.05	113.02
258	42.32	15.11	0.60	45.22	75.21	113.13
259	42.49	14.40	0.61	49.25	75.97	113.15
260	42.65	14.32	0.58	52.84	77.34	112.66
261	42.81	13.16	0.51	54.50	78.21	111.83
262	42.98	12.24	0.45	59.55	79.91	110.84
263	43.14	11.56	0.42	62.54	80.62	109.85
264	43.31	11.15	0.35	64.41	80.95	108.90
265	43.47	10.63	0.32	68.09	80.43	108.05
266	43.64	10.58	0.30	71.55	79.95	107.61
267	43.80	10.74	0.30	73.54	78.93	107.54
268	43.96	11.01	0.30	74.56	77.38	107.49
269	44.13	11.31	0.29	76.92	75.71	107.72
270	44.29	11.99	0.32	77.43	76.61	109.27
271	44.46	12.80	0.50	78.47	80.36	112.50
272	44.62	14.43	0.86	77.88	74.43	115.28
273	44.78	22.40	0.93	52.35	64.54	116.16
274	44.95	25.56	0.62	37.84	58.96	115.57
275	45.11	20.37	0.62	32.27	61.90	114.13
276	45.28	14.74	0.61	39.85	70.09	113.61
277	45.44	15.91	0.59	51.72	74.15	112.66
278	45.60	14.85	0.45	49.83	73.71	111.19
279	45.77	12.10	0.33	54.04	76.96	109.28
280	45.93	10.49	0.32	61.91	81.80	108.29
281	46.10	10.52	0.35	70.60	84.02	108.45
282	46.26	11.00	0.36	73.16	83.19	108.94
283	46.42	11.40	0.38	75.58	82.69	109.94

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
284	46.59	12.19	0.49	75.06	83.30	111.08
285	46.75	12.61	0.55	63.09	83.19	111.72
286	46.92	12.74	0.50	62.56	83.21	111.62
287	47.08	12.22	0.47	65.28	80.52	111.15
288	47.24	13.30	0.45	73.65	75.87	112.79
289	47.41	18.56	0.77	81.78	57.99	116.29
290	47.57	40.59	1.12	37.97	44.40	118.56
291	47.74	49.08	0.92	6.32	42.28	120.20
292	47.90	34.73	1.33	0.16	49.28	120.03
293	48.06	22.85	1.22	9.18	66.29	119.08
294	48.23	15.96	0.89	14.40	78.43	116.87
295	48.39	15.22	0.70	26.20	81.88	114.66
296	48.56	14.91	0.59	41.75	82.73	113.23
297	48.72	12.14	0.55	54.43	84.78	112.34
298	48.88	11.94	0.52	64.95	85.80	112.15
299	49.05	13.67	0.56	71.09	79.17	112.72
300	49.21	17.00	0.61	70.59	73.24	113.18
301	49.38	17.30	0.57	65.06	67.37	113.25
302	49.54	19.10	0.52	70.44	66.47	112.71
303	49.70	16.84	0.49	58.90	66.58	112.45
304	49.87	16.54	0.52	73.34	72.19	112.18
305	50.03	13.75	0.51	65.17	76.99	112.16
306	50.20	13.07	0.53	73.14	74.19	112.30
307	50.36	18.80	0.52	82.48	70.06	112.31
308	50.52	17.42	0.48	48.47	70.00	112.07
309	50.69	12.93	0.48	55.77	63.07	111.84
310	50.85	25.06	0.42	70.83	59.97	111.77
311	51.02	20.88	0.44	38.11	61.68	112.65
312	51.18	13.39	0.65	49.31	77.29	113.28
313	51.35	12.28	0.69	72.56	75.40	113.95
314	51.51	23.59	0.58	55.08	66.83	113.32
315	51.67	19.89	0.43	32.26	63.19	112.40
316	51.84	14.13	0.48	52.01	67.94	112.00
317	52.00	17.77	0.55	73.36	73.68	112.63
318	52.17	16.08	0.59	56.50	74.96	113.05
319	52.33	13.78	0.57	73.04	75.66	113.07
320	52.49	17.10	0.56	90.42	71.02	113.07
321	52.66	20.01	0.55	52.72	67.62	112.53
322	52.82	15.98	0.44	55.63	68.30	111.49
323	52.99	14.53	0.37	69.79	72.86	110.26
324	53.15	13.51	0.39	83.59	75.75	110.37
325	53.31	13.71	0.47	88.06	78.25	112.02
326	53.48	15.46	0.67	97.78	59.59	115.31
327	53.64	40.45	0.92	59.09	56.96	118.99
328	53.81	32.45	1.58	37.27	45.44	120.38
329	53.97	47.56	0.97	40.96	44.96	121.94
330	54.13	52.39	1.62	15.51	42.33	122.66
331	54.30	46.07	1.87	14.32	45.29	124.99

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
332	54.46	56.47	2.53	9.25	32.21	126.56
333	54.63	128.19	2.14	9.01	22.02	127.80
334	54.79	151.91	2.16	0.30	18.17	127.89
335	54.95	109.23	2.28	-1.16	24.00	127.68
336	55.12	52.67	2.43	0.55	36.85	126.34
337	55.28	41.72	1.90	7.10	51.45	124.06
338	55.45	36.96	1.27	14.90	55.41	121.60
339	55.61	28.89	1.11	18.66	53.96	119.83
340	55.77	35.45	1.04	24.79	52.76	119.46
341	55.94	37.29	1.09	31.75	48.17	120.04
342	56.10	41.47	1.24	43.12	46.38	120.96
343	56.27	44.90	1.39	59.94	46.20	121.83
344	56.43	42.97	1.49	61.46	45.94	122.19
345	56.59	44.28	1.41	74.50	47.00	122.59
346	56.76	44.40	1.64	87.22	49.40	124.93
347	56.92	52.30	3.06	107.33	33.16	129.14
348	57.09	163.51	4.21	22.00	32.79	131.45
349	57.25	84.90	4.38	48.59	31.16	131.39
350	57.41	65.31	2.81	94.22	42.58	128.85
351	57.58	53.13	2.08	117.79	45.11	126.22
352	57.74	46.81	2.02	134.82	46.88	125.02
353	57.91	48.54	1.96	150.56	45.03	125.37
354	58.07	60.79	2.25	226.86	41.46	126.58
355	58.23	69.94	2.79	272.83	31.57	129.60
356	58.40	144.28	4.20	129.01	30.03	132.17
357	58.56	122.18	5.33	70.38	31.19	133.90
358	58.73	97.22	5.73	114.35	32.41	134.53
359	58.89	147.19	5.54	66.14	34.68	134.42
360	59.06	99.63	5.43	15.08	32.78	134.57
361	59.22	119.52	5.75	46.13	39.08	133.90
362	59.38	82.25	5.10	18.19	42.41	133.13
363	59.55	64.80	4.40	42.49	44.63	132.13
364	59.71	92.44	4.29	72.84	45.88	131.79
365	59.88	70.74	4.67	79.76	44.73	132.24
366	60.04	76.50	5.00	66.62	44.99	132.86
367	60.20	100.50	5.37	49.15	41.85	133.46
368	60.37	99.23	5.40	26.38	33.59	134.84
369	60.53	167.79	6.56	22.54	32.38	135.68
370	60.70	132.93	6.94	19.77	35.85	136.36
371	60.86	79.81	7.57	77.31	41.84	136.02
372	61.02	109.20	6.72	128.02	42.16	135.88
373	61.19	127.70	6.64	50.78	30.35	136.53
374	61.35	207.24	7.10	69.41	28.18	136.94
375	61.52	151.54	7.27	37.28	18.53	137.28
376	61.68	365.43	7.50	171.21	13.00	137.28
377	61.84	448.19	7.55	15.47	8.69	137.28
378	62.01	443.33	7.27	8.93	8.39	137.28
379	62.17	397.75	7.58	6.28	10.98	137.28

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
380	62.34	245.00	7.34	2.19	17.43	137.28
381	62.50	114.81	6.38	2.99	29.98	135.43
382	62.66	65.97	4.18	19.06	45.60	131.83
383	62.83	55.80	2.76	26.62	52.45	129.03
384	62.99	54.35	3.06	35.88	45.82	129.55
385	63.16	96.70	4.35	41.20	44.30	131.72
386	63.32	90.62	5.60	24.74	40.23	133.33
387	63.48	103.19	5.29	31.59	43.88	133.57
388	63.65	78.34	5.21	13.66	36.79	133.53
389	63.81	138.16	4.68	41.17	33.37	133.34
390	63.98	128.74	4.52	9.40	33.83	132.68
391	64.14	61.78	4.20	10.02	44.00	131.33
392	64.30	49.66	3.65	23.21	38.70	131.03
393	64.47	153.72	3.62	77.66	25.56	131.38
394	64.63	181.47	3.36	8.08	21.38	131.50
395	64.80	109.12	3.32	10.18	27.62	131.45
396	64.96	74.42	4.25	11.88	44.04	132.54
397	65.12	74.46	6.68	43.38	29.62	135.29
398	65.29	282.02	6.56	63.08	N/A	137.28
399	65.45	460.36	-235954.15	13.56	N/A	137.28
400	65.62	496.53	-235954.15	13.40	N/A	137.28

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_c: Measured cone resistance (tsf)
f_s: Sleeve friction resistance (tsf)
u: Pore pressure (tsf)
Fines content: Percentage of fines in soil (%)
Unit weight: Bulk soil unit weight (pcf)

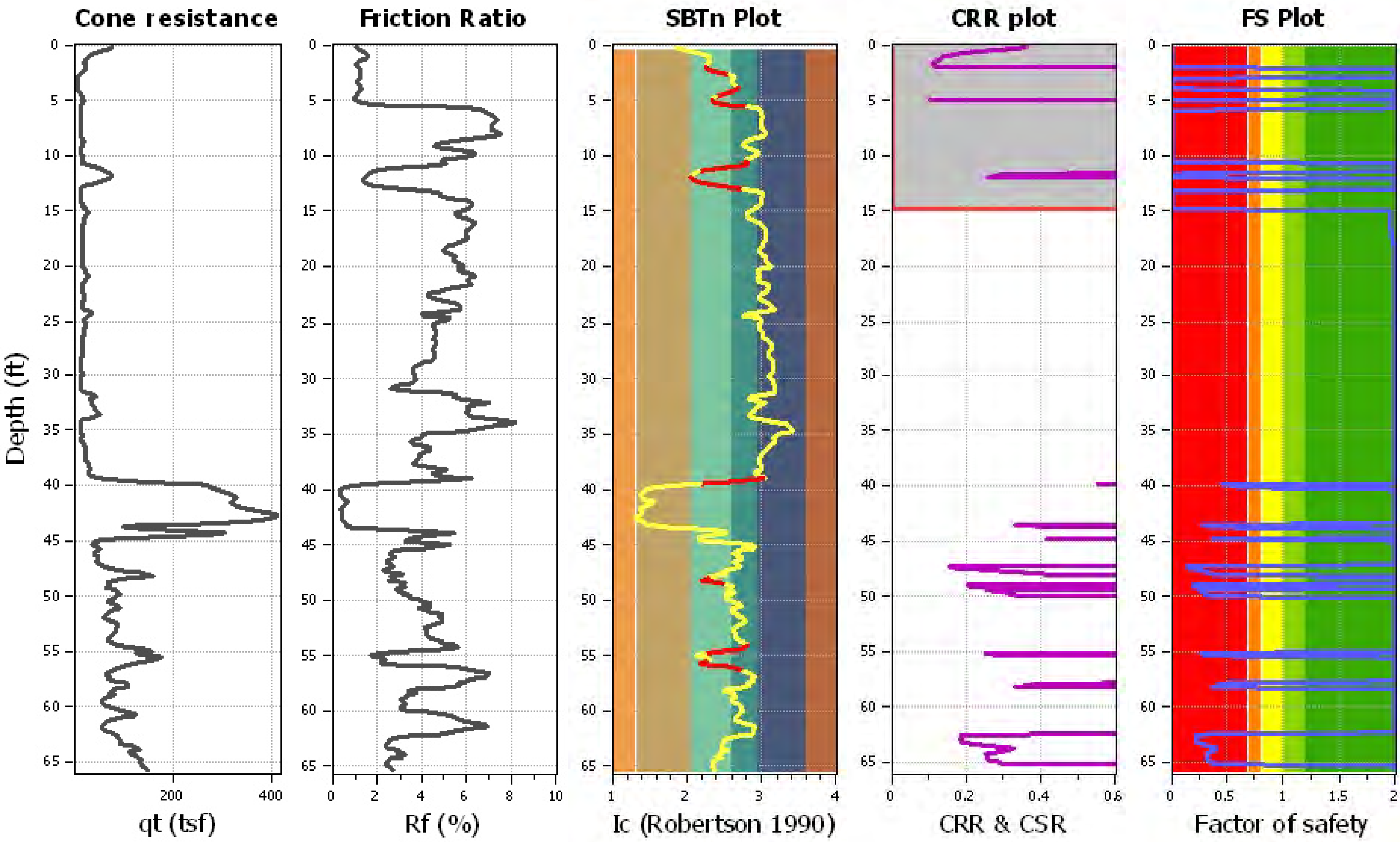
LIQUEFACTION ANALYSIS REPORT

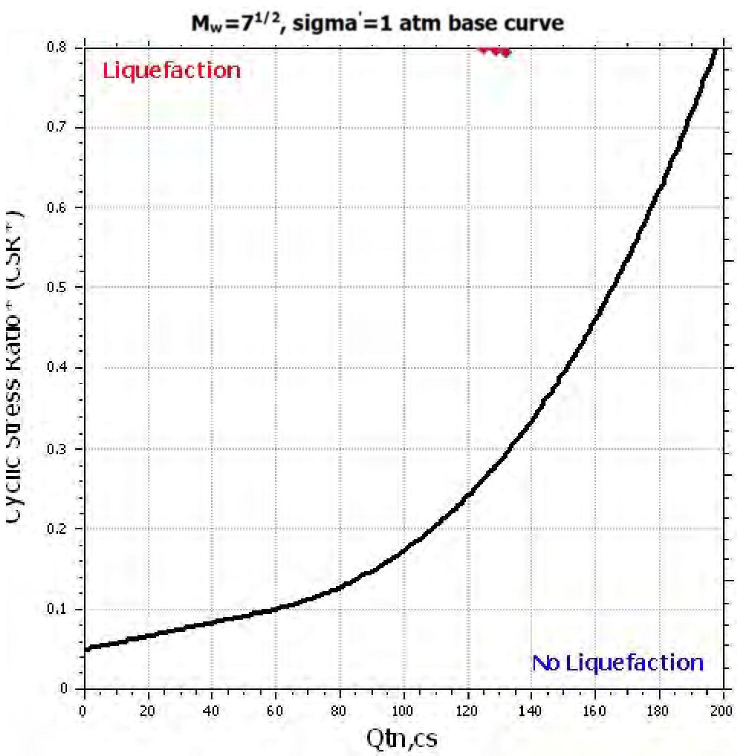
Project title : File No. 21796 Harvard-Westlake School **Location :**

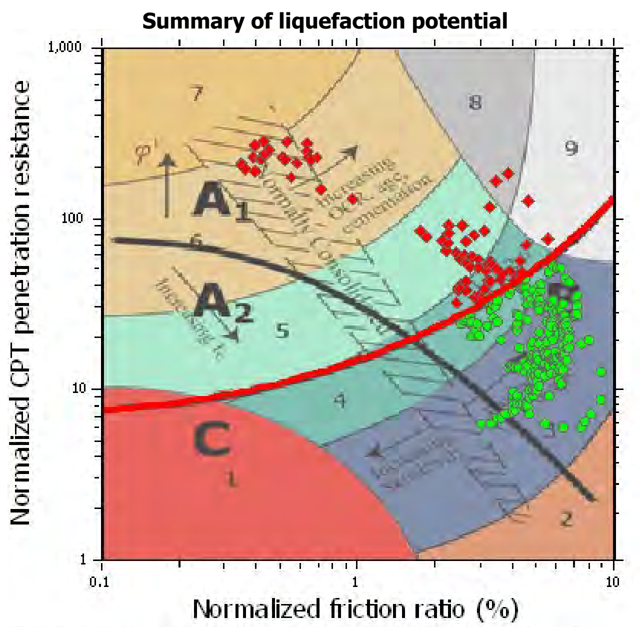
CPT file : CPT 05

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	24.50 ft	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 ft	Excavation depth:	15.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 tsf	Limit depth:	N/A
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.95	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

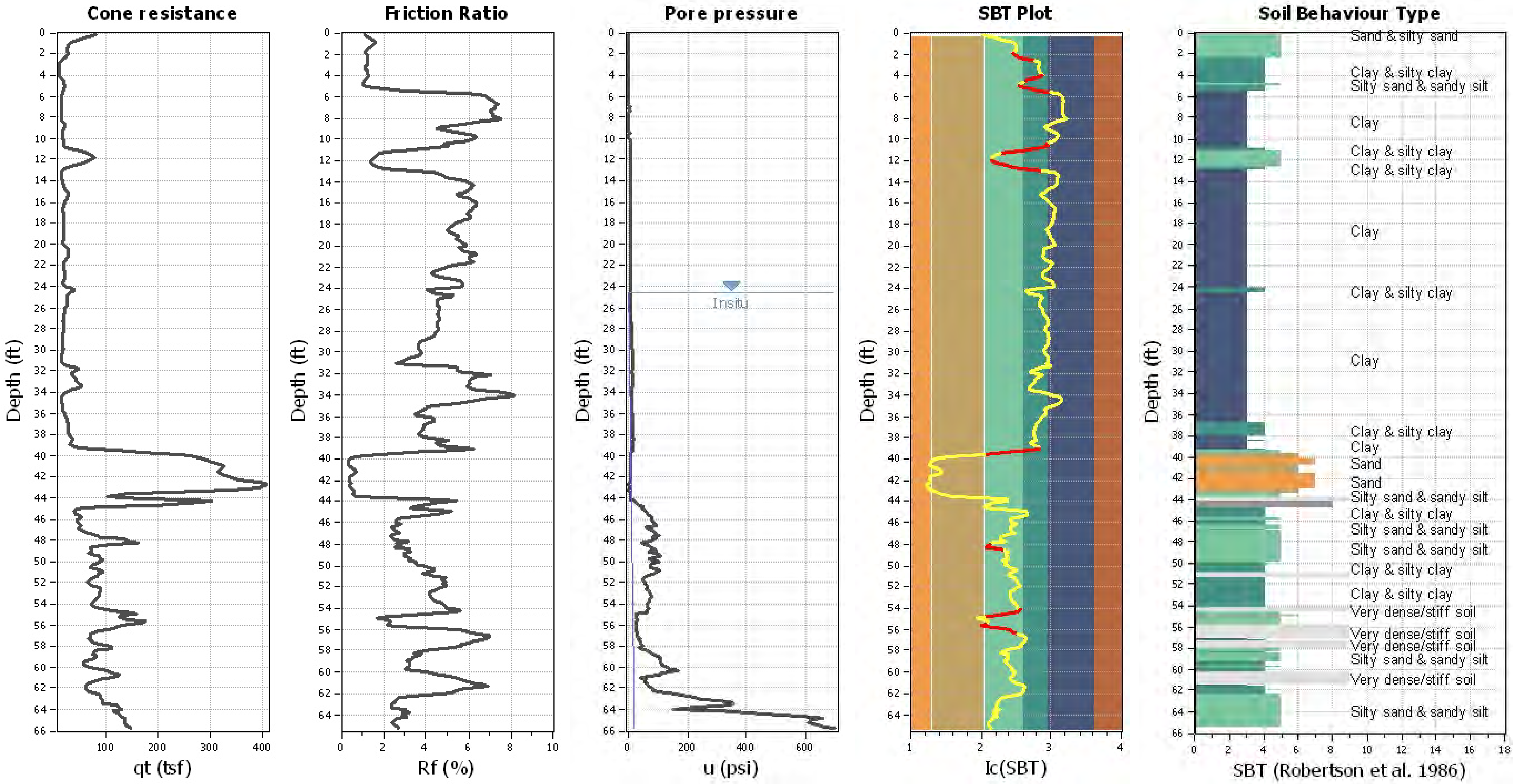






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plo



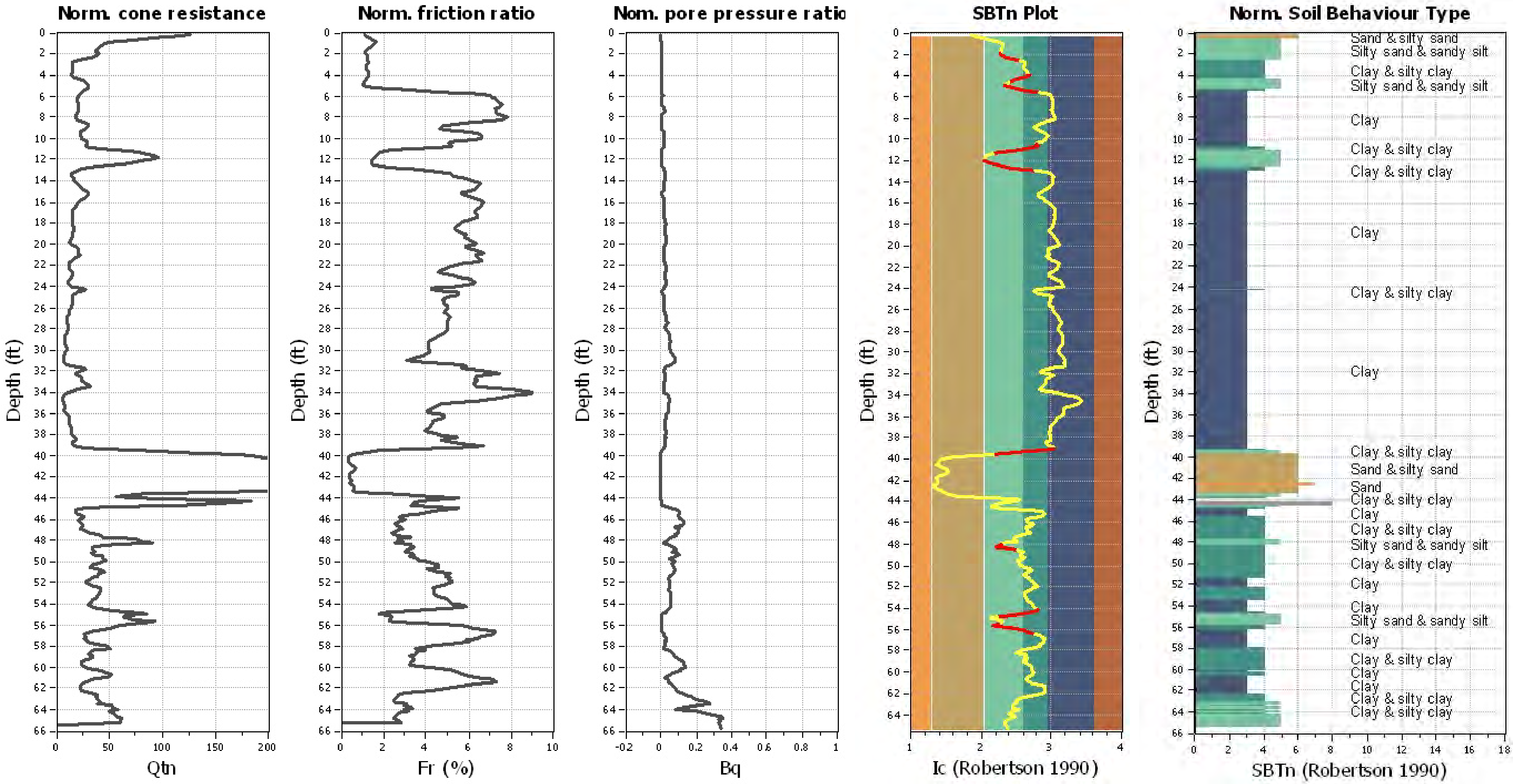
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBT legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to
- 9. Very stiff fine grained

CPT basic interpretation plots (normaliz



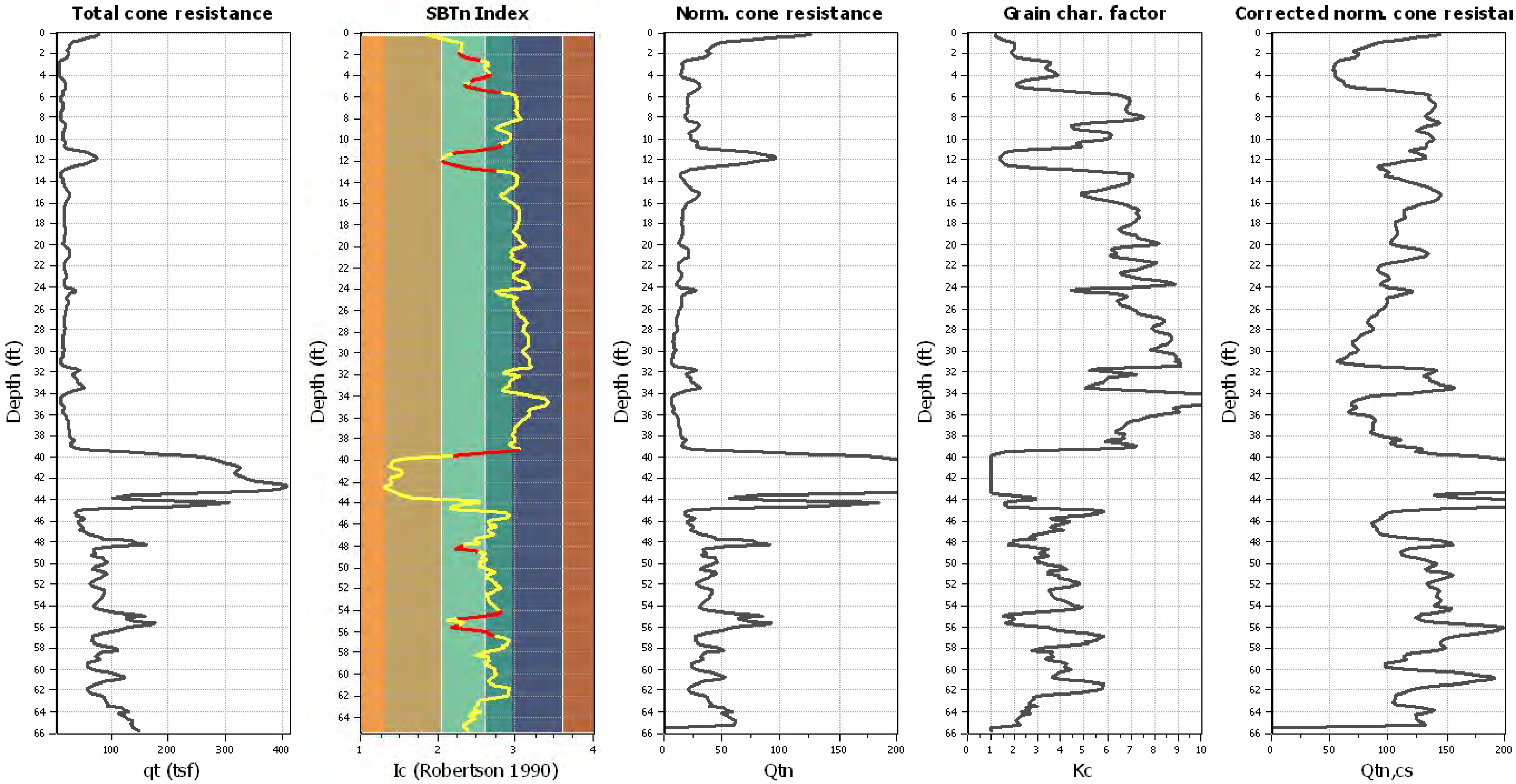
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

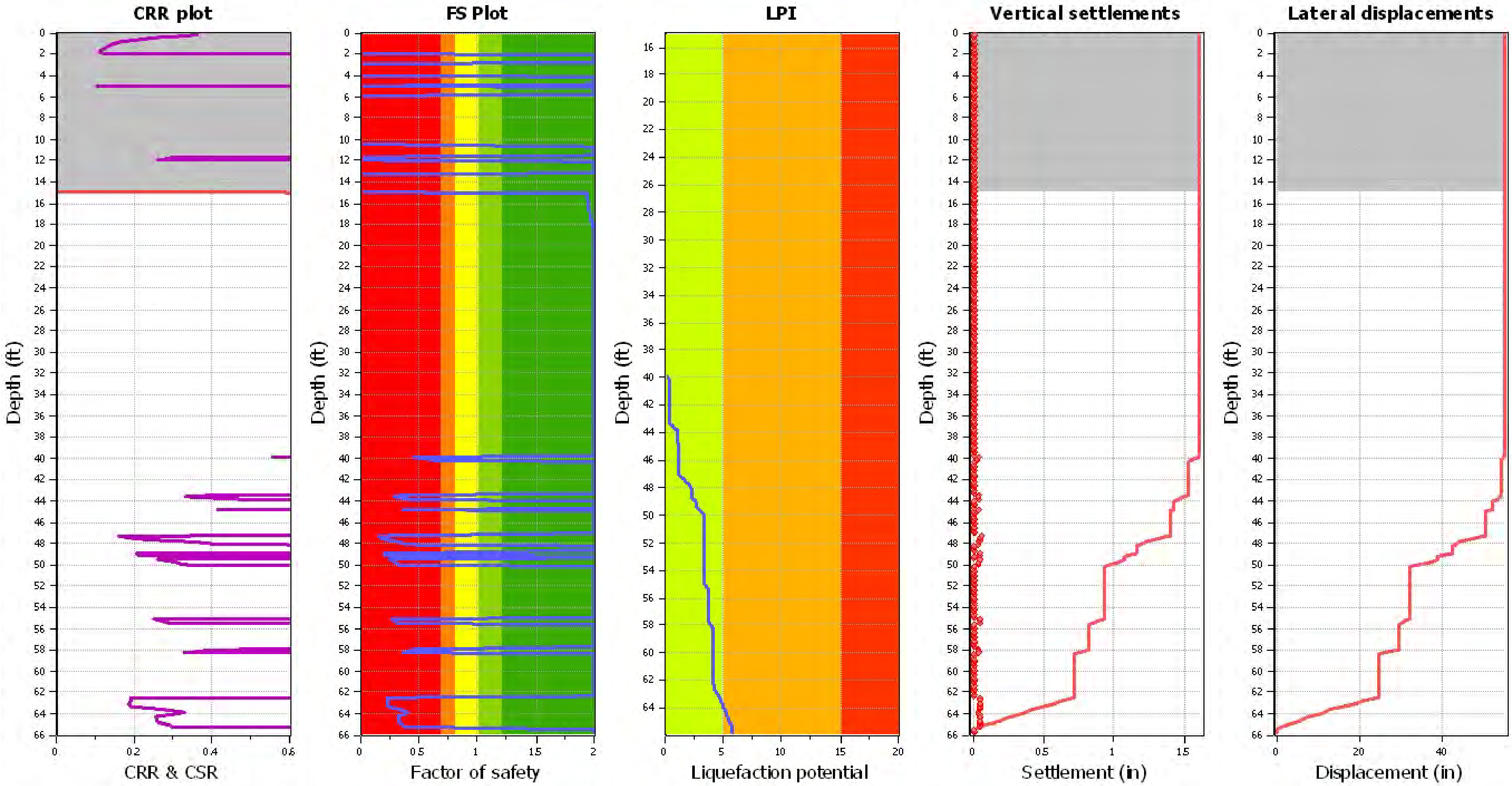
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

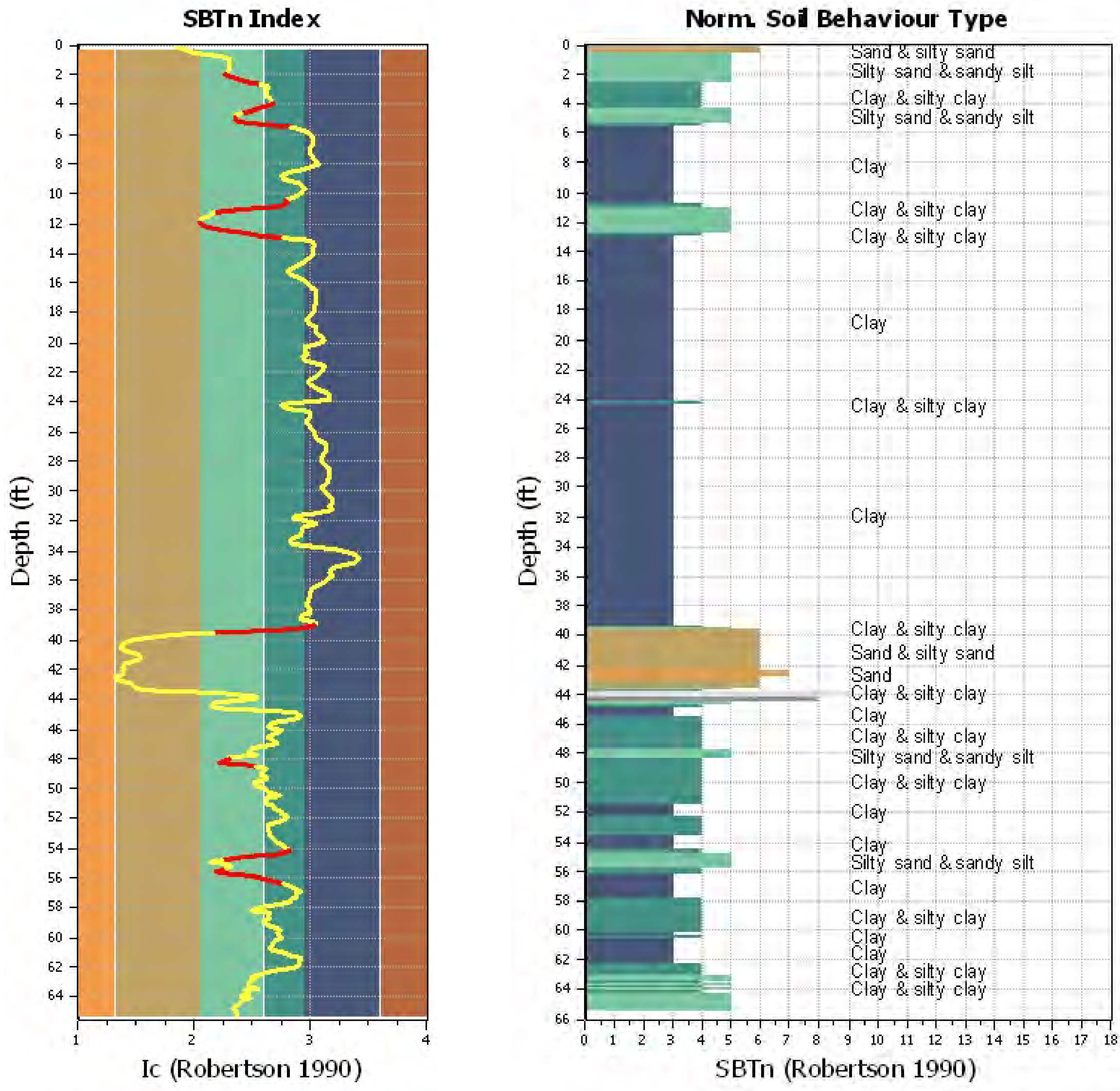
- Very high risk
- High risk
- Low risk

TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.



Transition layer algorithm properties

I_c minimum check value:	1.70
I_c maximum check value:	3.00
I_c change ratio value:	0.0250
Minimum number of points in layer:	3

General statistics

Total points in CPT file:	401
Total points excluded:	48
Exclusion percentage:	11.97%
Number of layers detected:	9

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
92	15.09	26.60	1.47	3.30	46.59	120.94
93	15.26	28.75	1.50	3.15	46.26	121.23
94	15.42	25.80	1.50	3.13	47.66	121.11
95	15.58	23.77	1.45	3.17	50.79	120.75
96	15.75	22.21	1.41	3.12	53.12	120.25
97	15.91	20.64	1.32	3.10	55.05	119.76
98	16.08	19.65	1.26	3.13	56.90	119.15
99	16.24	18.13	1.17	3.12	58.47	118.43
100	16.40	16.93	1.04	3.13	60.03	117.60
101	16.57	15.89	0.96	3.54	61.55	116.90
102	16.73	15.06	0.94	3.55	61.83	116.58
103	16.90	16.11	0.94	3.53	61.56	116.62
104	17.06	16.46	0.96	3.57	61.42	116.78
105	17.22	15.82	0.99	3.52	62.04	116.93
106	17.39	16.16	1.00	3.54	62.17	117.00
107	17.55	16.73	0.98	4.44	61.29	116.86
108	17.72	16.49	0.92	5.29	61.13	116.51
109	17.88	15.62	0.87	5.31	60.77	116.09
110	18.04	16.21	0.83	5.74	59.95	116.07
111	18.21	17.43	0.90	5.60	58.73	116.28
112	18.37	17.61	0.91	5.02	57.60	116.66
113	18.54	18.67	0.93	5.69	56.69	116.90
114	18.70	19.40	0.96	6.02	57.16	117.06
115	18.86	17.78	0.97	5.64	59.10	117.01
116	19.03	16.61	0.94	5.65	61.39	116.82
117	19.19	16.77	0.93	6.59	61.49	116.70
118	19.36	17.57	0.93	6.75	61.71	116.61
119	19.52	16.37	0.91	6.21	63.31	116.34
120	19.69	14.77	0.87	6.04	65.80	116.04
121	19.85	14.88	0.87	5.71	66.97	116.13
122	20.01	15.82	0.96	5.00	64.53	116.98
123	20.18	19.21	1.11	4.84	59.09	118.40
124	20.34	24.90	1.29	4.61	55.55	119.98
125	20.51	26.22	1.55	4.42	54.67	121.12
126	20.67	25.43	1.65	4.37	55.89	121.81
127	20.83	26.18	1.70	4.37	56.07	122.07
128	21.00	27.39	1.71	4.36	54.63	122.06
129	21.16	28.06	1.58	4.36	55.63	121.55
130	21.33	22.62	1.44	4.15	58.83	120.43
131	21.49	18.43	1.20	4.12	63.88	118.82
132	21.65	16.69	0.95	4.13	66.37	117.27
133	21.82	15.96	0.87	4.16	65.45	116.19
134	21.98	16.70	0.82	5.13	64.87	115.64
135	22.15	16.03	0.77	5.56	63.38	115.41
136	22.31	16.94	0.78	6.32	61.40	115.43
137	22.47	18.81	0.79	6.31	58.78	115.85
138	22.64	20.13	0.85	6.32	57.03	116.42
139	22.80	20.86	0.92	6.51	57.33	117.14

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
140	22.97	20.88	1.02	6.41	59.18	117.60
141	23.13	19.54	1.04	6.32	62.52	117.64
142	23.29	17.35	1.00	5.66	66.30	117.28
143	23.46	16.18	0.95	5.67	68.57	116.68
144	23.62	16.07	0.87	5.72	70.31	116.35
145	23.79	15.26	0.91	5.41	70.86	116.18
146	23.95	15.49	0.90	5.33	61.49	117.87
147	24.11	29.96	1.29	6.33	46.99	120.50
148	24.28	48.90	1.65	6.54	43.49	122.41
149	24.44	34.84	1.75	4.28	45.90	122.54
150	24.61	24.94	1.45	3.50	55.37	121.11
151	24.77	22.64	1.18	3.61	59.01	119.33
152	24.93	22.28	1.00	3.87	58.38	118.33
153	25.10	22.36	1.02	3.82	57.35	118.14
154	25.26	23.50	1.08	3.90	56.56	118.41
155	25.43	24.46	1.08	4.00	56.60	118.47
156	25.59	22.66	1.05	4.07	57.19	118.31
157	25.75	22.19	1.03	4.10	58.77	118.05
158	25.92	21.54	1.02	4.08	59.74	117.78
159	26.08	20.64	0.97	4.18	60.42	117.42
160	26.25	20.30	0.91	5.28	61.07	117.04
161	26.41	19.70	0.90	5.49	61.67	116.67
162	26.57	18.92	0.85	5.85	63.39	116.32
163	26.74	17.53	0.83	6.88	65.35	115.78
164	26.90	16.34	0.76	6.82	67.41	115.27
165	27.07	15.83	0.74	6.82	68.20	114.82
166	27.23	15.86	0.71	7.09	68.20	114.72
167	27.40	16.17	0.73	8.32	67.67	114.85
168	27.56	16.64	0.76	8.46	66.39	115.33
169	27.72	18.24	0.83	8.86	65.61	115.82
170	27.89	18.23	0.86	7.42	65.09	115.98
171	28.05	17.70	0.80	7.44	66.07	115.62
172	28.22	16.45	0.74	8.87	67.50	114.84
173	28.38	15.08	0.66	9.36	69.34	114.07
174	28.54	14.48	0.63	9.84	69.89	113.47
175	28.71	14.81	0.60	9.87	70.20	112.94
176	28.87	13.84	0.55	9.85	70.07	112.43
177	29.04	13.64	0.52	10.59	69.87	111.91
178	29.20	14.02	0.49	10.73	69.46	111.73
179	29.36	13.86	0.51	10.84	68.92	111.84
180	29.53	14.30	0.53	10.98	67.43	112.42
181	29.69	16.38	0.59	11.21	65.97	113.03
182	29.86	16.40	0.61	11.47	65.04	113.43
183	30.02	16.07	0.61	12.34	66.90	113.11
184	30.18	14.13	0.54	12.56	68.93	112.36
185	30.35	13.29	0.48	13.22	70.46	111.34
186	30.51	13.10	0.43	13.53	71.18	110.28
187	30.68	11.85	0.37	13.98	71.36	109.33

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
188	30.84	11.68	0.34	13.87	72.15	108.14
189	31.00	10.88	0.28	14.12	70.94	107.48
190	31.17	11.68	0.29	14.38	72.28	109.55
191	31.33	14.03	0.61	14.70	72.34	115.62
192	31.50	22.55	1.56	14.92	59.91	121.20
193	31.66	43.60	2.28	14.51	49.97	125.15
194	31.82	55.43	2.82	15.96	48.88	126.40
195	31.99	34.67	2.56	11.26	54.30	125.78
196	32.15	25.54	2.01	11.42	61.34	124.50
197	32.32	33.62	2.08	12.42	57.63	124.50
198	32.48	41.94	2.40	12.83	54.22	125.19
199	32.64	37.08	2.39	12.76	53.63	125.36
200	32.81	36.23	2.19	13.05	53.34	125.49
201	32.97	43.63	2.50	13.32	52.88	125.94
202	33.14	41.31	2.75	13.05	49.80	127.01
203	33.30	52.35	3.00	13.85	48.39	127.96
204	33.46	55.91	3.38	12.89	47.85	128.44
205	33.63	47.60	3.24	10.62	52.81	127.91
206	33.79	32.99	2.73	9.21	62.25	125.76
207	33.96	19.91	1.74	9.20	74.52	122.40
208	34.12	14.71	1.09	9.89	84.61	118.83
209	34.28	13.57	0.98	10.32	88.01	116.41
210	34.45	12.62	0.82	10.46	89.64	115.24
211	34.61	11.72	0.72	10.55	91.12	114.12
212	34.78	11.01	0.67	10.72	87.83	112.96
213	34.94	12.47	0.50	10.89	82.61	112.36
214	35.10	13.54	0.55	11.03	75.33	112.59
215	35.27	15.89	0.66	11.73	71.86	113.58
216	35.43	17.00	0.69	11.82	70.70	113.58
217	35.60	14.52	0.53	11.79	71.53	112.36
218	35.76	12.82	0.40	11.88	72.02	111.78
219	35.93	15.58	0.58	12.14	68.70	113.04
220	36.09	19.68	0.75	12.43	66.74	115.70
221	36.25	21.08	1.04	12.60	64.08	117.28
222	36.42	23.06	1.02	12.80	62.30	117.96
223	36.58	24.16	0.96	13.03	60.13	117.87
224	36.75	23.76	0.96	13.21	58.87	117.80
225	36.91	24.67	0.97	13.38	58.62	117.81
226	37.07	24.67	0.96	13.65	58.29	117.88
227	37.24	24.59	0.98	13.82	57.49	117.89
228	37.40	25.98	0.96	14.07	56.90	117.94
229	37.57	25.86	0.96	14.26	56.17	117.89
230	37.73	25.66	0.95	14.50	56.16	117.70
231	37.89	25.39	0.89	14.68	58.11	118.30
232	38.06	25.23	1.21	14.97	57.90	119.99
233	38.22	32.77	1.63	17.09	58.37	121.79
234	38.39	32.66	1.80	17.36	54.08	122.68
235	38.55	38.13	1.58	17.22	53.37	121.84

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
236	38.71	29.89	1.13	15.95	57.24	121.20
237	38.88	22.32	1.57	15.52	61.38	121.93
238	39.04	34.46	2.10	16.96	60.68	124.16
239	39.21	42.13	2.56	16.17	51.68	125.79
240	39.37	52.73	2.46	16.51	35.61	127.18
241	39.53	107.11	2.41	15.96	18.04	127.79
242	39.70	205.67	1.76	6.19	8.40	127.17
243	39.86	249.70	1.11	4.41	3.78	125.68
244	40.03	270.93	1.08	4.00	2.18	124.12
245	40.19	267.91	0.92	3.29	1.69	123.83
246	40.35	284.54	0.94	2.97	1.40	123.99
247	40.52	306.62	1.11	3.03	1.21	124.42
248	40.68	307.31	1.05	3.11	1.56	126.10
249	40.85	322.57	1.69	3.12	2.17	127.89
250	41.01	330.55	2.13	3.33	3.02	129.82
251	41.17	327.55	2.47	3.49	3.41	130.21
252	41.34	308.42	2.07	3.41	3.18	129.60
253	41.50	318.91	1.62	3.15	2.34	127.85
254	41.67	316.49	1.18	2.66	1.52	126.34
255	41.83	321.31	1.15	2.73	1.25	126.01
256	41.99	335.49	1.43	2.69	1.48	127.06
257	42.16	341.88	1.71	2.57	1.36	127.55
258	42.32	362.50	1.38	2.61	1.23	128.22
259	42.49	390.74	1.78	2.65	0.63	127.97
260	42.65	414.60	1.45	2.29	0.68	128.90
261	42.81	414.29	1.94	2.13	1.36	130.44
262	42.98	391.34	2.99	2.90	2.18	131.41
263	43.14	372.48	2.43	2.37	2.58	130.64
264	43.31	317.74	1.40	1.89	3.03	128.16
265	43.47	212.12	1.33	4.06	5.81	126.68
266	43.64	130.07	1.95	3.59	19.56	130.44
267	43.80	68.61	5.88	3.40	32.21	132.24
268	43.96	106.86	5.10	3.51	31.88	137.04
269	44.13	238.28	11.55	5.74	23.76	137.28
270	44.29	299.42	12.81	21.85	18.02	137.28
271	44.46	374.64	10.42	23.94	17.51	137.28
272	44.62	156.51	5.18	32.97	20.06	136.89
273	44.78	66.88	3.90	51.27	34.56	130.96
274	44.95	42.93	2.25	43.12	49.77	126.86
275	45.11	38.33	1.70	54.21	53.02	123.57
276	45.28	35.01	1.48	58.63	51.98	122.08
277	45.44	36.32	1.33	64.07	47.24	121.60
278	45.60	46.59	1.31	68.56	40.04	121.87
279	45.77	57.79	1.39	78.50	37.24	122.22
280	45.93	49.14	1.41	76.98	38.44	121.76
281	46.10	38.53	1.12	76.47	43.17	120.73
282	46.26	35.79	1.07	80.24	41.93	120.13
283	46.42	48.90	1.13	90.75	37.84	120.84

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
284	46.59	56.23	1.30	91.98	37.16	121.50
285	46.75	43.67	1.33	58.86	39.09	121.49
286	46.92	42.28	1.18	69.83	41.02	121.17
287	47.08	47.97	1.21	76.60	36.94	121.84
288	47.24	62.65	1.52	86.63	32.37	123.08
289	47.41	73.27	1.63	86.92	30.05	124.76
290	47.57	78.54	2.06	105.80	29.09	126.38
291	47.74	89.30	2.56	83.68	31.83	128.21
292	47.90	79.19	3.34	93.42	22.35	131.31
293	48.06	228.15	4.52	70.84	22.40	132.61
294	48.23	121.00	4.26	45.00	19.75	132.83
295	48.39	128.93	3.27	55.74	28.30	130.72
296	48.56	68.69	2.79	68.38	31.93	128.31
297	48.72	52.58	1.98	76.26	35.93	126.53
298	48.88	82.36	1.97	93.10	34.19	125.82
299	49.05	70.29	2.16	68.74	33.60	126.08
300	49.21	58.76	2.13	89.72	36.31	125.82
301	49.38	65.26	1.93	105.61	35.93	126.81
302	49.54	82.68	2.90	109.37	31.64	128.35
303	49.70	105.22	3.22	68.97	32.83	129.52
304	49.87	74.59	3.22	85.53	32.35	129.93
305	50.03	92.71	3.31	102.80	35.27	130.17
306	50.20	88.57	3.76	80.43	36.68	129.96
307	50.36	62.98	3.08	72.22	40.48	129.22
308	50.52	62.60	2.75	73.97	41.92	128.50
309	50.69	73.28	3.07	96.02	36.51	129.15
310	50.85	98.94	3.38	105.27	35.99	130.82
311	51.02	89.51	4.70	95.31	36.00	131.59
312	51.18	85.58	4.12	89.58	39.73	131.60
313	51.35	76.02	3.78	60.16	39.98	130.77
314	51.51	77.14	3.55	55.44	42.75	130.05
315	51.67	62.41	3.40	47.40	43.46	129.41
316	51.84	65.50	3.05	49.55	45.50	128.88
317	52.00	62.70	3.08	53.85	46.01	128.61
318	52.17	57.50	3.13	58.44	42.82	129.11
319	52.33	84.64	3.39	62.61	39.83	129.84
320	52.49	86.74	3.71	62.63	36.64	130.57
321	52.66	86.57	3.76	61.11	36.65	130.73
322	52.82	87.18	3.59	68.13	36.97	130.59
323	52.99	82.83	3.56	71.84	37.66	130.40
324	53.15	79.55	3.57	72.42	38.11	130.41
325	53.31	84.66	3.64	77.13	38.51	130.64
326	53.48	84.03	3.89	72.06	40.35	130.72
327	53.64	70.27	3.83	68.03	41.64	130.56
328	53.81	75.85	3.53	68.41	43.23	130.07
329	53.97	70.16	3.39	65.15	44.27	129.76
330	54.13	61.97	3.52	65.50	46.71	130.48
331	54.30	73.63	4.65	65.22	45.35	131.36

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
332	54.46	87.35	4.52	68.91	41.15	131.62
333	54.63	87.91	3.50	56.81	28.32	131.17
334	54.79	163.03	2.75	65.23	20.19	130.24
335	54.95	167.50	2.60	25.76	16.58	129.88
336	55.12	140.45	2.75	24.98	21.99	129.49
337	55.28	70.16	2.91	22.76	23.15	129.94
338	55.45	162.70	3.17	28.30	20.79	130.71
339	55.61	190.15	3.33	22.54	18.25	132.82
340	55.77	172.36	5.19	22.44	22.72	134.80
341	55.94	141.67	6.99	26.07	30.03	136.21
342	56.10	125.44	7.51	26.21	35.98	136.51
343	56.27	115.32	6.98	22.90	39.58	135.91
344	56.43	97.59	6.14	26.29	43.70	134.99
345	56.59	78.86	5.98	24.24	48.45	133.89
346	56.76	70.92	5.25	29.01	50.52	132.91
347	56.92	74.46	4.46	28.11	52.90	131.64
348	57.09	53.83	4.01	30.57	50.79	130.88
349	57.25	70.56	3.89	37.44	50.87	130.65
350	57.41	71.78	4.14	35.45	47.55	130.72
351	57.58	68.30	3.83	39.74	48.34	130.73
352	57.74	67.55	3.97	38.58	45.37	130.97
353	57.91	88.12	4.23	50.05	34.52	132.13
354	58.07	152.83	4.48	36.81	32.40	132.16
355	58.23	85.75	3.77	40.25	30.57	131.39
356	58.40	90.19	2.97	56.80	37.45	129.40
357	58.56	69.89	2.67	70.18	37.00	127.84
358	58.73	67.61	2.15	81.41	38.09	127.11
359	58.89	75.35	2.38	92.77	35.38	127.34
360	59.06	87.09	2.70	106.97	35.75	127.71
361	59.22	69.95	2.50	105.44	37.48	127.04
362	59.38	57.65	1.90	106.37	40.92	125.51
363	59.55	54.93	1.68	109.38	41.92	124.21
364	59.71	54.08	1.66	113.16	41.76	124.24
365	59.88	58.48	1.91	123.84	41.96	125.56
366	60.04	66.00	2.58	134.12	43.29	127.81
367	60.20	71.04	3.62	140.02	41.68	130.62
368	60.37	100.00	4.98	165.62	39.70	133.24
369	60.53	118.50	6.38	109.78	38.29	135.13
370	60.70	117.46	7.12	109.95	37.59	136.26
371	60.86	131.82	7.48	67.20	38.51	136.32
372	61.02	112.97	6.67	41.91	42.11	135.61
373	61.19	75.63	5.99	60.79	48.15	134.21
374	61.35	70.73	5.16	56.20	52.69	132.54
375	61.52	68.75	3.94	65.67	52.74	130.91
376	61.68	56.51	3.34	66.52	52.42	129.40
377	61.84	56.15	3.11	69.67	52.41	128.42
378	62.01	59.28	2.79	76.62	50.75	127.74
379	62.17	55.67	2.53	84.01	45.53	126.98

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
380	62.34	67.33	2.11	111.04	38.30	126.72
381	62.50	87.46	2.19	152.47	33.23	126.80
382	62.66	83.98	2.31	176.79	30.93	127.03
383	62.83	84.53	2.16	213.64	31.22	126.98
384	62.99	83.66	2.17	248.09	30.04	126.92
385	63.16	89.87	2.19	309.15	29.29	127.08
386	63.32	90.73	2.23	347.34	29.22	127.36
387	63.48	87.20	2.39	356.79	32.73	128.71
388	63.65	83.42	3.62	343.33	28.04	130.71
389	63.81	167.32	4.00	198.29	29.15	132.07
390	63.98	106.83	4.26	153.90	26.54	131.85
391	64.14	107.69	3.03	327.61	29.61	130.98
392	64.30	114.73	3.20	389.56	26.97	130.27
393	64.47	115.10	3.18	461.03	25.81	130.47
394	64.63	120.32	3.13	612.22	24.51	130.51
395	64.80	127.25	3.13	659.10	23.66	130.78
396	64.96	129.54	3.39	616.37	24.36	131.22
397	65.12	121.84	3.72	614.29	25.22	131.52
398	65.29	124.25	3.58	613.56	25.35	131.67
399	65.45	131.34	3.60	646.14	N/A	137.28
400	65.62	131.14	-235954.19	660.64	N/A	137.28
401	65.78	140.33	-235954.19	700.49	N/A	137.28

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

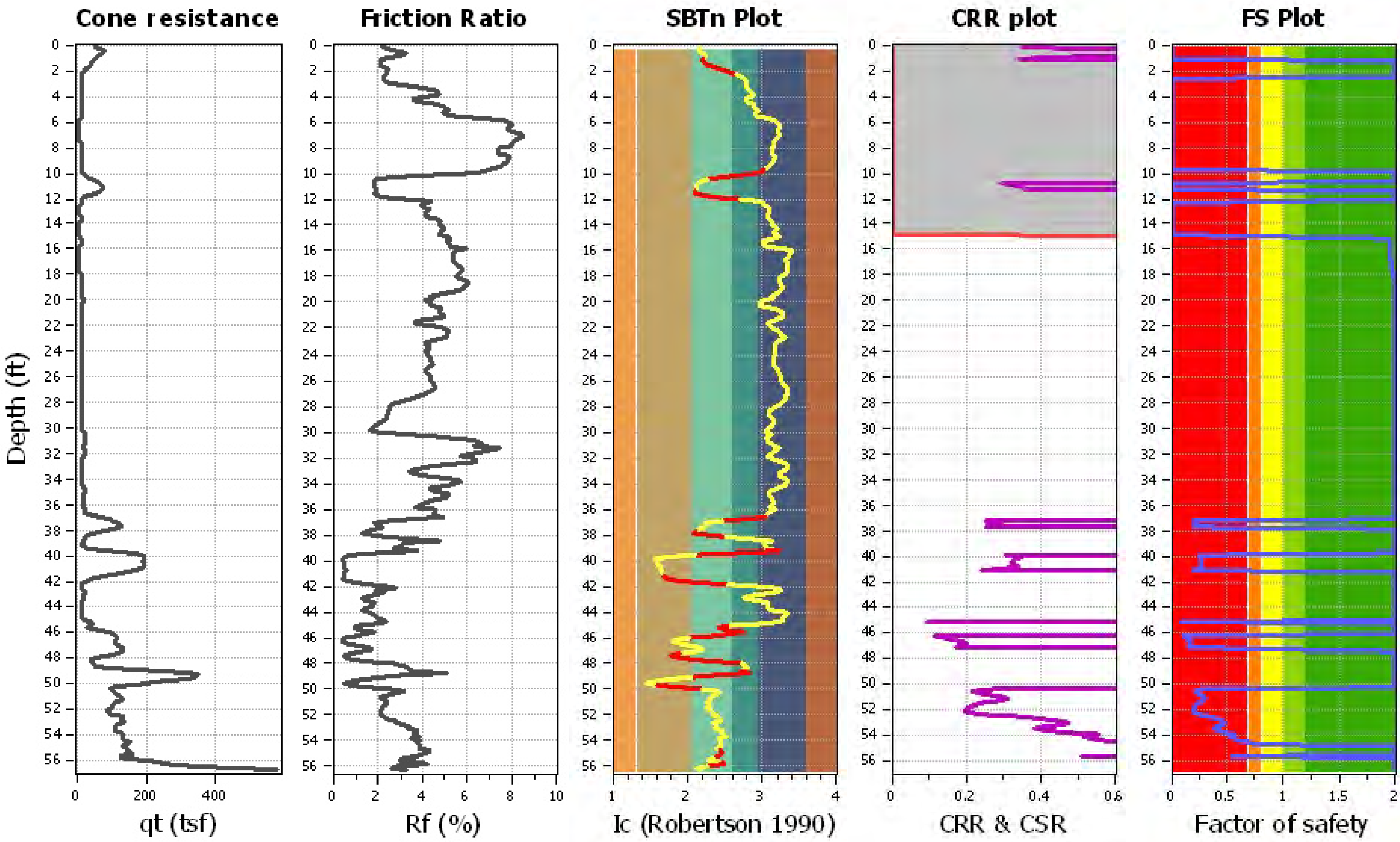
LIQUEFACTION ANALYSIS REPORT

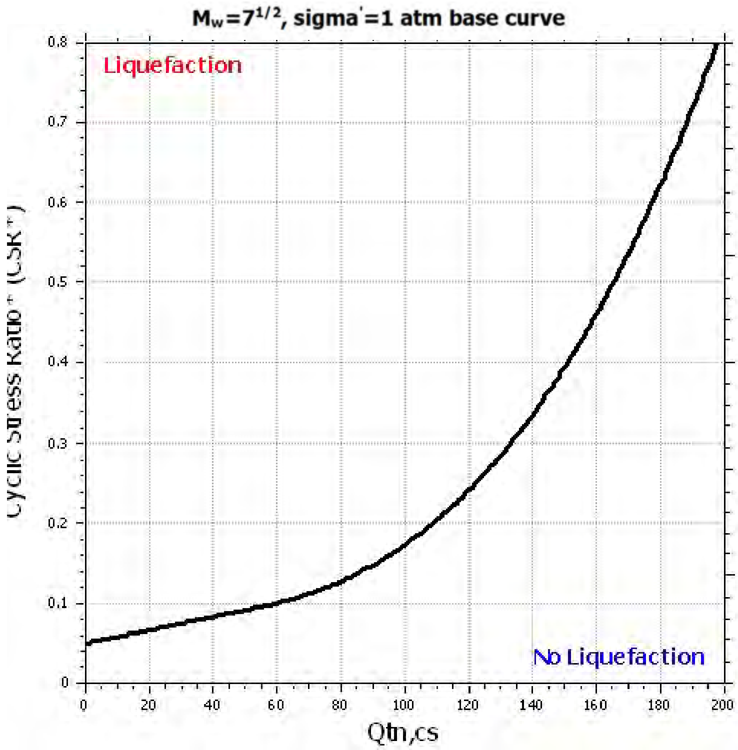
Project title : File No. 21796 Harvard-Westlake School **Location :**

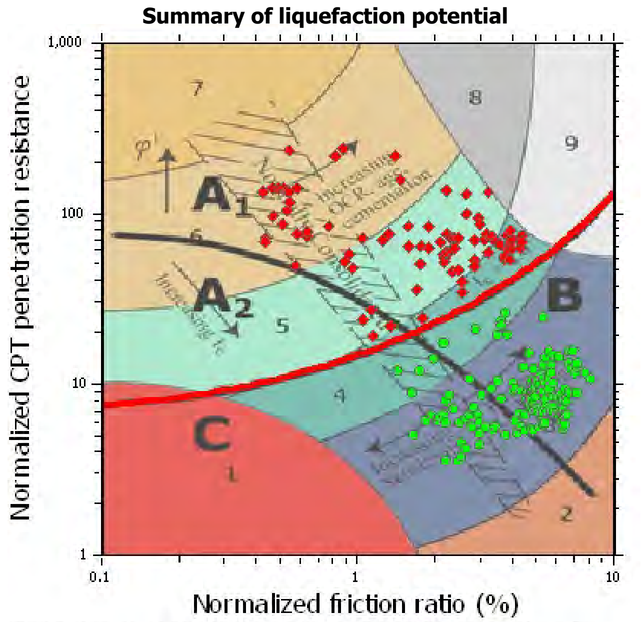
CPT file : CPT 06

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	24.50 ft	Excavation:	Yes	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.00 ft	Excavation depth:	15.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Footing load:	500.00 tsf	Limit depth:	N/A
Earthquake magnitude M_w:	6.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.95	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

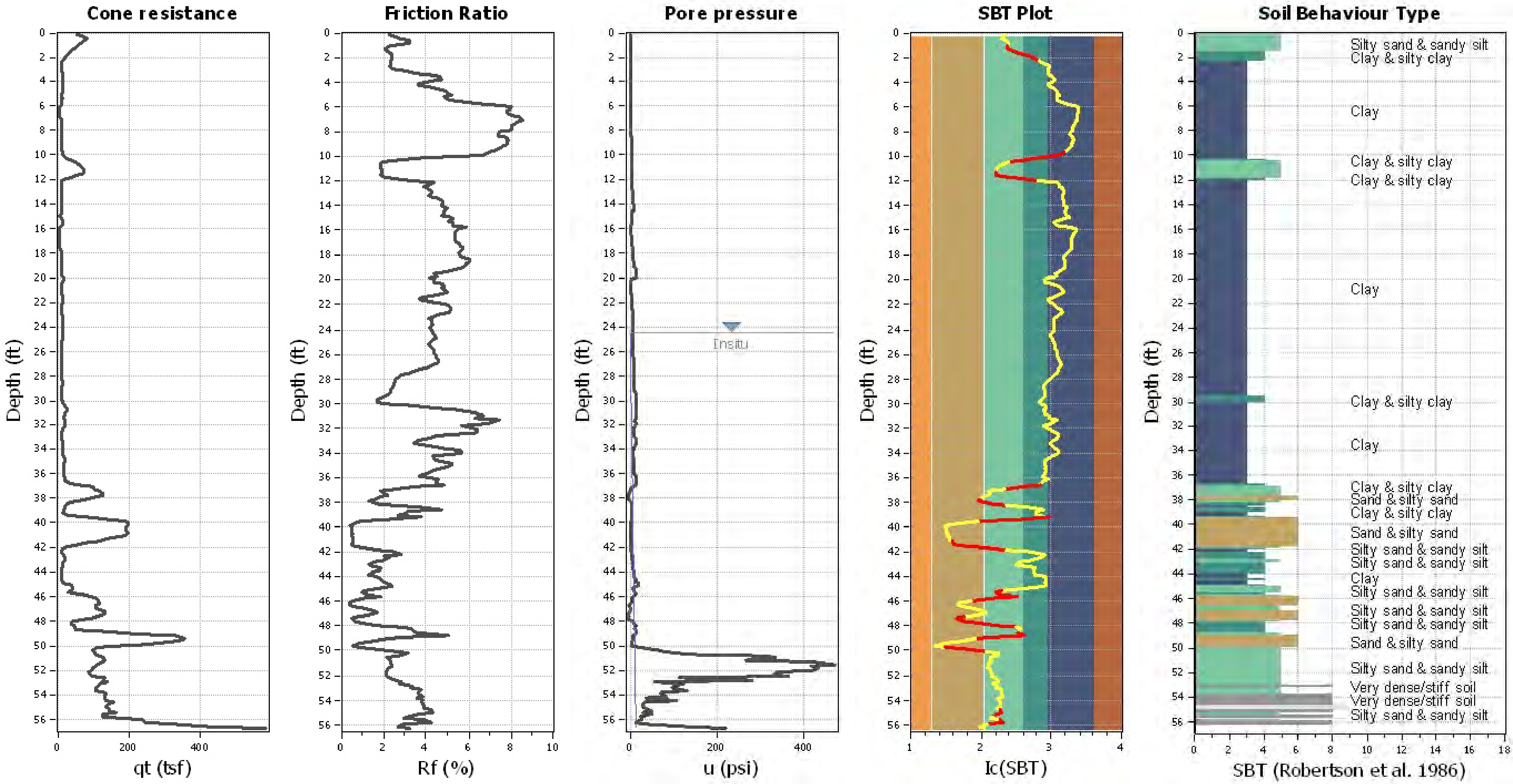






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plc



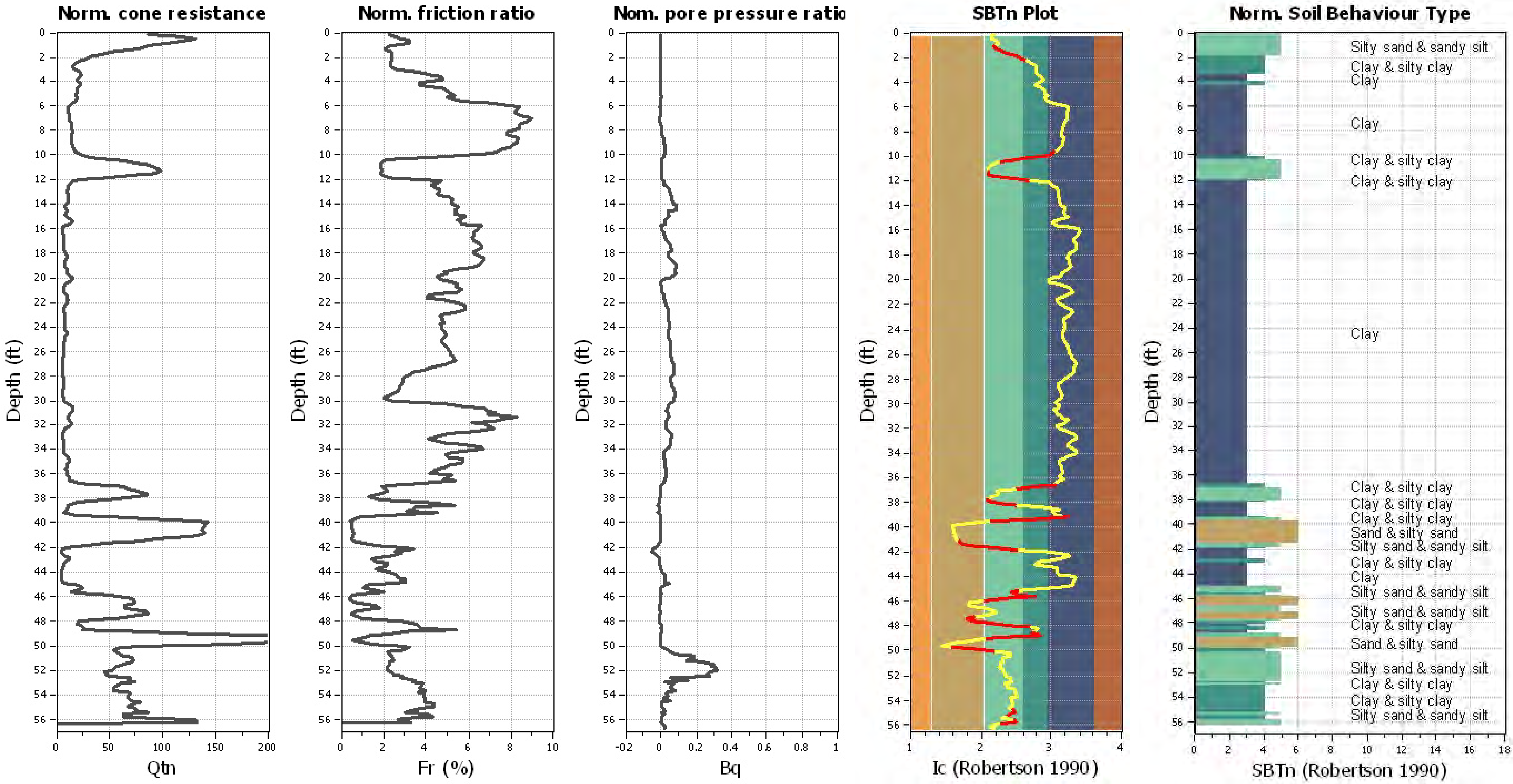
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_{σ} applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

CPT basic interpretation plots (normaliz



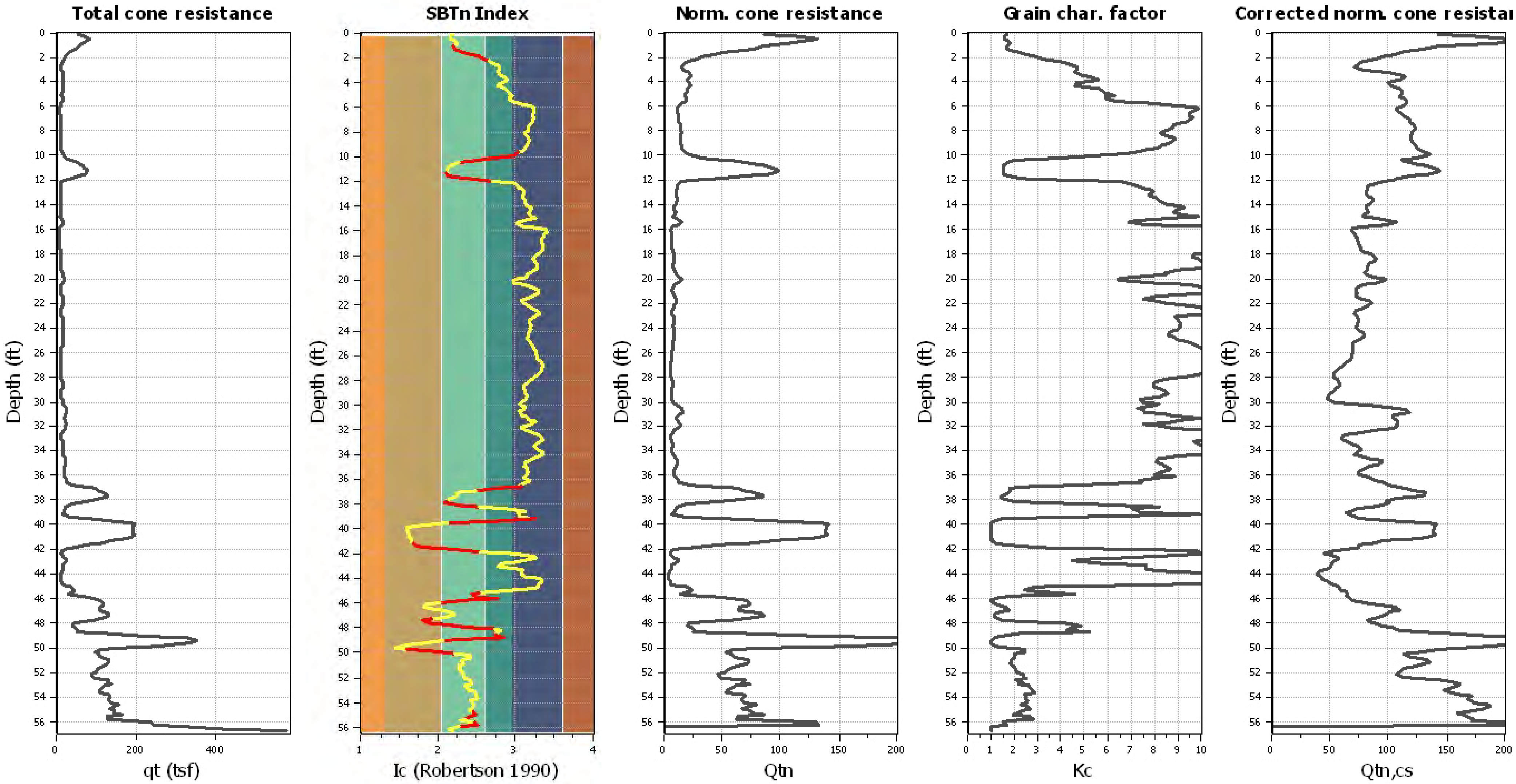
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

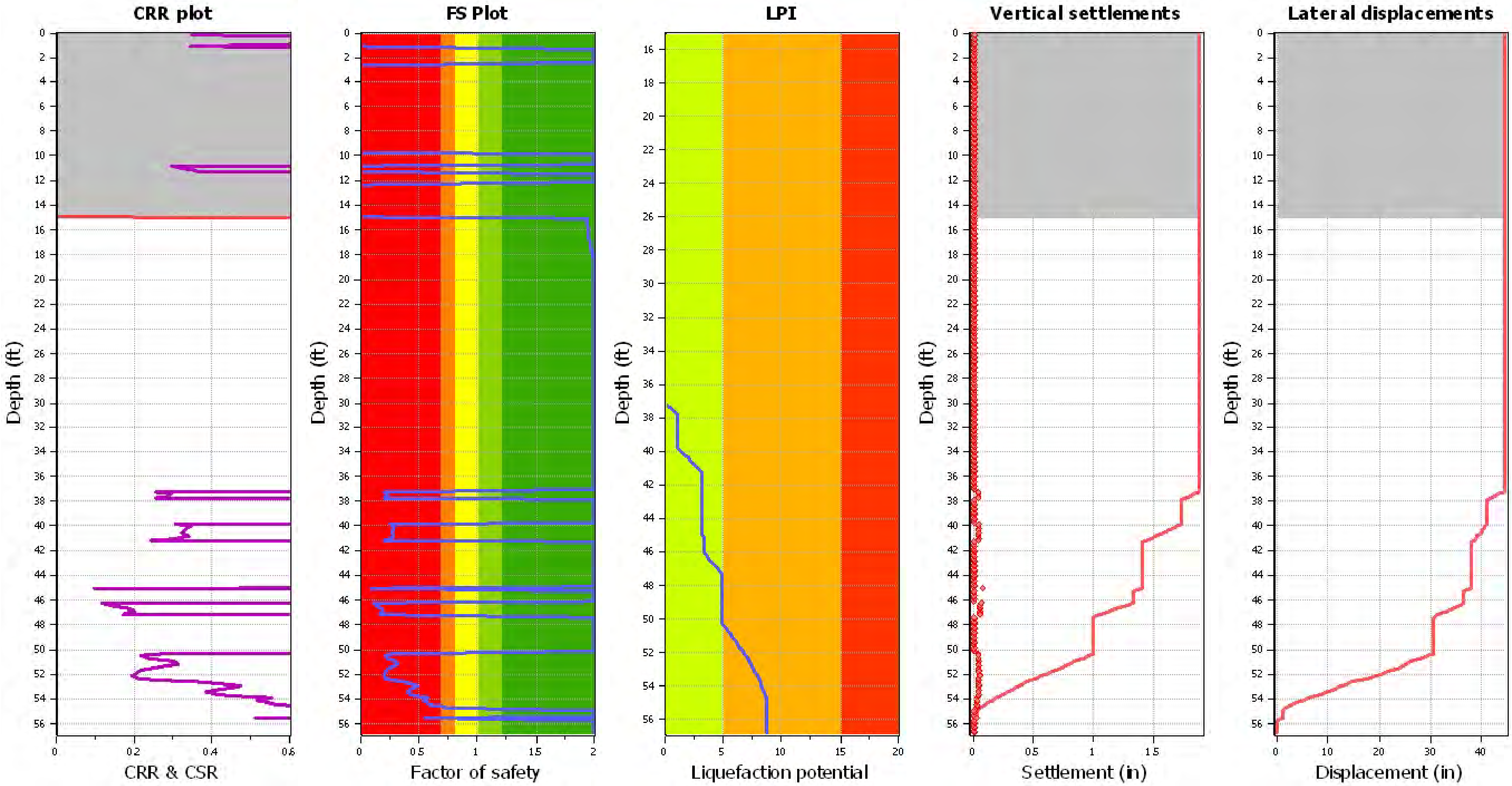
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	0.00 ft	Footing load:	500.00 tsf
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.95	Excavation:	Yes	Limit depth applied:	No
Depth to water table (insitu):	24.50 ft	Excavation depth:	15.00 ft	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

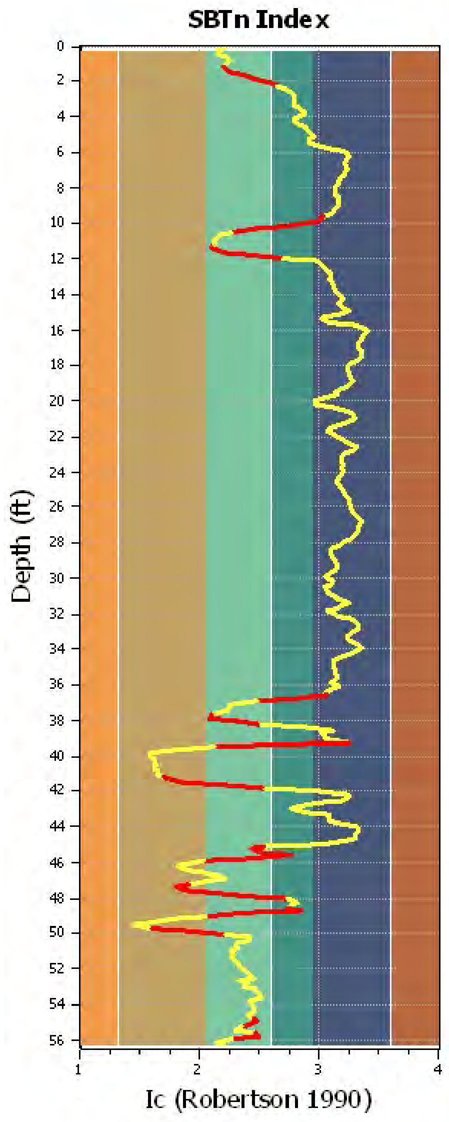
- Very high risk
- High risk
- Low risk

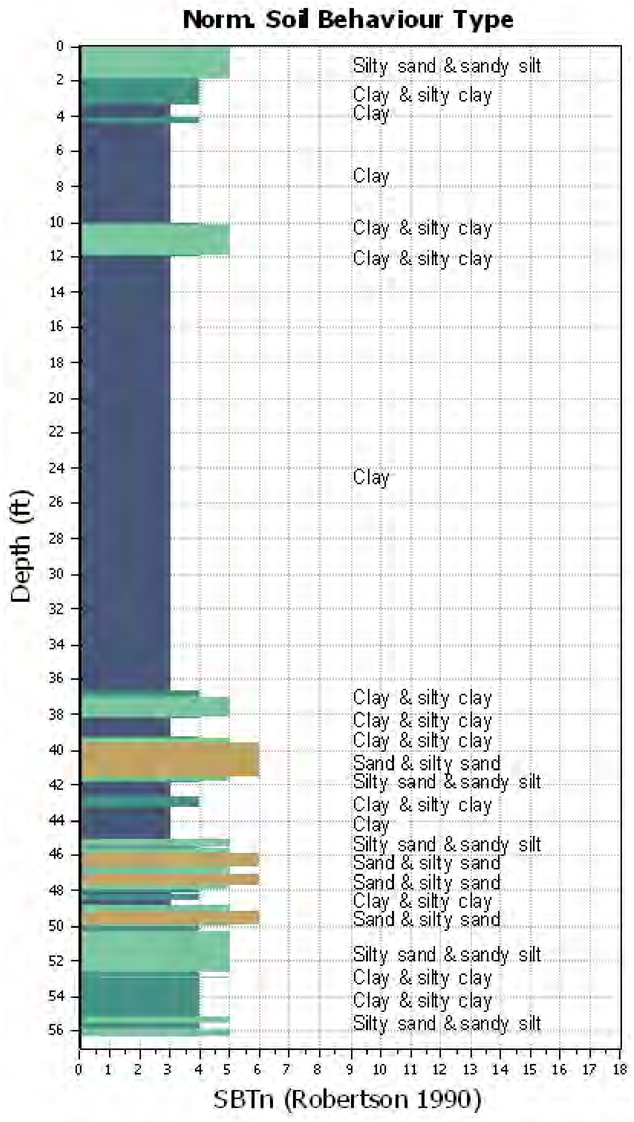
TRANSITION LAYER DETECTION ALGORITHM REPORT
Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c. Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





Transition layer algorithm properties		**General statistics**	
I_c minimum check value:	1.70	Total points in CPT file:	346
I_c maximum check value:	3.00	Total points excluded:	61
I_c change ratio value:	0.0250	Exclusion percentage:	17.63%
Minimum number of points in layer:	3	Number of layers detected:	14

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
92	15.09	8.07	0.46	4.51	70.47	110.69
93	15.26	13.22	0.73	3.81	60.79	113.61
94	15.42	17.94	0.82	4.30	59.47	114.75
95	15.58	11.81	0.73	3.23	63.93	113.21
96	15.75	6.93	0.40	-0.29	79.56	109.92
97	15.91	5.31	0.30	0.10	88.49	106.74
98	16.08	6.08	0.31	0.49	89.81	106.28
99	16.24	6.31	0.35	0.84	87.43	106.76
100	16.40	6.39	0.34	1.25	86.04	107.25
101	16.57	6.97	0.37	1.65	84.66	107.67
102	16.73	7.19	0.39	1.96	83.49	108.09
103	16.90	7.26	0.40	2.35	83.61	108.30
104	17.06	7.23	0.39	3.23	84.53	108.42
105	17.22	7.09	0.41	4.03	84.87	108.64
106	17.39	7.45	0.43	4.54	85.12	108.95
107	17.55	7.54	0.44	5.32	84.61	109.15
108	17.72	7.55	0.44	5.94	81.90	109.62
109	17.88	9.00	0.48	6.49	78.29	110.60
110	18.04	10.29	0.58	4.84	75.35	111.61
111	18.21	10.41	0.61	5.51	75.09	112.40
112	18.37	10.45	0.65	6.31	76.32	112.57
113	18.54	10.03	0.63	7.80	77.14	112.38
114	18.70	9.81	0.57	8.81	78.38	111.81
115	18.86	9.13	0.53	9.68	79.53	111.46
116	19.03	9.12	0.57	10.57	78.62	111.36
117	19.19	10.18	0.54	10.92	75.73	111.61
118	19.36	10.97	0.55	11.48	71.48	111.54
119	19.52	11.39	0.51	11.78	68.39	111.23
120	19.69	11.63	0.45	12.24	68.90	111.52
121	19.85	11.28	0.61	12.72	59.74	113.60
122	20.01	22.38	0.84	13.11	56.73	115.56
123	20.18	19.84	0.90	2.42	56.79	115.66
124	20.34	11.89	0.64	0.00	65.66	113.85
125	20.51	10.26	0.49	0.03	74.39	111.25
126	20.67	9.87	0.43	0.40	77.65	110.08
127	20.83	8.76	0.45	0.63	79.89	109.77
128	21.00	8.99	0.45	0.84	80.72	110.01
129	21.16	9.92	0.47	1.06	77.84	110.36
130	21.33	10.61	0.49	1.44	71.17	110.11
131	21.49	12.16	0.36	2.02	66.43	110.38
132	21.65	13.32	0.48	2.35	63.21	111.61
133	21.82	15.19	0.67	4.09	65.44	113.21
134	21.98	13.74	0.70	4.11	68.70	113.85
135	22.15	12.32	0.67	4.21	72.19	113.34
136	22.31	11.96	0.58	4.43	75.40	112.60
137	22.47	10.65	0.57	4.59	78.88	111.56
138	22.64	8.96	0.48	4.71	81.78	110.72
139	22.80	9.55	0.45	5.05	79.10	110.32

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
140	22.97	11.44	0.47	5.39	74.27	110.81
141	23.13	12.21	0.52	5.76	71.10	111.23
142	23.29	12.19	0.49	6.05	71.57	111.56
143	23.46	11.81	0.54	6.30	71.57	111.55
144	23.62	12.33	0.52	6.52	72.40	111.55
145	23.79	11.82	0.50	6.64	71.93	111.34
146	23.95	11.88	0.49	6.74	72.36	111.34
147	24.11	12.19	0.52	6.89	71.67	111.78
148	24.28	13.14	0.58	7.01	70.14	112.48
149	24.44	14.28	0.61	7.10	69.48	113.09
150	24.61	13.96	0.64	7.18	69.33	113.27
151	24.77	13.70	0.61	7.24	70.56	112.95
152	24.93	12.86	0.56	7.31	71.67	112.23
153	25.10	11.95	0.50	7.36	73.35	111.39
154	25.26	11.27	0.47	7.63	74.83	110.88
155	25.43	11.24	0.47	7.72	75.97	110.86
156	25.59	11.34	0.50	7.80	76.67	110.96
157	25.75	11.11	0.49	7.84	77.51	111.00
158	25.92	10.91	0.49	7.86	77.99	110.89
159	26.08	10.97	0.49	7.92	78.79	110.81
160	26.25	10.65	0.48	7.95	79.32	110.73
161	26.41	10.59	0.48	7.97	81.03	110.56
162	26.57	9.96	0.47	8.23	82.74	110.29
163	26.74	9.54	0.45	8.36	84.64	109.81
164	26.90	9.20	0.41	8.41	84.82	109.24
165	27.07	9.22	0.38	8.47	83.61	108.67
166	27.23	9.42	0.35	8.54	83.17	107.93
167	27.40	8.57	0.31	8.60	82.74	107.17
168	27.56	8.60	0.28	8.79	81.09	106.33
169	27.72	9.20	0.25	8.89	77.81	105.88
170	27.89	9.47	0.25	9.04	74.90	105.91
171	28.05	9.98	0.27	9.25	71.71	106.12
172	28.22	11.05	0.26	9.44	68.86	106.95
173	28.38	12.17	0.32	9.61	65.86	107.54
174	28.54	12.71	0.32	10.49	65.46	107.81
175	28.71	11.78	0.29	10.70	65.61	107.39
176	28.87	11.47	0.27	10.93	66.59	106.83
177	29.04	11.33	0.27	11.13	67.84	106.42
178	29.20	10.51	0.25	11.33	68.78	105.73
179	29.36	10.07	0.21	11.59	69.31	104.81
180	29.53	9.94	0.19	11.79	67.44	103.97
181	29.69	10.55	0.18	12.06	64.88	103.80
182	29.86	11.35	0.19	12.29	62.32	104.20
183	30.02	12.06	0.21	12.57	63.02	106.40
184	30.18	13.25	0.37	12.98	66.88	110.88
185	30.35	16.11	0.78	13.42	65.90	115.62
186	30.51	23.32	1.25	13.92	61.50	119.81
187	30.68	31.21	1.82	14.13	63.06	121.54

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
188	30.84	20.70	1.70	12.20	63.37	121.86
189	31.00	24.29	1.44	12.81	68.58	120.54
190	31.17	19.80	1.23	12.28	69.44	119.47
191	31.33	16.40	1.19	12.60	76.96	119.48
192	31.50	17.22	1.60	13.14	73.17	119.83
193	31.66	24.41	1.32	11.13	69.17	120.27
194	31.82	22.07	1.31	11.74	63.06	120.24
195	31.99	24.74	1.44	12.09	66.97	120.30
196	32.15	19.76	1.44	11.09	71.03	119.37
197	32.32	14.74	0.96	9.93	78.30	117.04
198	32.48	12.40	0.61	10.39	82.73	113.72
199	32.64	10.39	0.49	10.62	84.30	111.06
200	32.81	9.81	0.40	10.96	84.51	109.52
201	32.97	10.29	0.36	11.31	81.33	109.03
202	33.14	11.24	0.40	11.59	77.29	109.48
203	33.30	12.50	0.44	11.85	75.46	110.74
204	33.46	13.28	0.54	11.99	76.82	112.15
205	33.63	12.83	0.67	12.06	80.47	113.29
206	33.79	12.37	0.72	11.17	84.70	113.94
207	33.96	12.11	0.74	8.62	85.19	113.91
208	34.12	12.65	0.66	7.19	82.60	113.41
209	34.28	13.08	0.57	6.95	76.66	112.75
210	34.45	14.59	0.53	7.30	71.69	114.19
211	34.61	19.07	0.94	7.86	66.75	116.34
212	34.78	22.72	1.10	9.36	66.72	118.28
213	34.94	20.29	1.21	9.40	66.38	118.39
214	35.10	19.88	0.98	9.62	68.13	117.52
215	35.27	18.33	0.81	9.73	68.36	116.00
216	35.43	16.01	0.71	9.91	69.77	114.78
217	35.60	15.70	0.65	10.24	69.08	114.25
218	35.76	17.76	0.66	10.72	67.51	114.03
219	35.93	16.96	0.64	10.91	66.05	114.03
220	36.09	17.08	0.63	11.26	71.01	115.42
221	36.25	16.71	1.08	11.54	66.80	116.61
222	36.42	24.07	0.94	11.96	62.05	117.90
223	36.58	26.52	0.99	11.56	62.66	119.07
224	36.75	20.03	1.55	11.83	44.69	121.17
225	36.91	66.95	1.42	12.71	29.88	123.81
226	37.07	104.18	1.80	5.84	20.43	125.74
227	37.24	119.35	2.19	-0.07	20.65	127.30
228	37.40	91.25	2.53	-1.96	20.13	128.53
229	37.57	134.13	2.77	-3.05	17.34	128.32
230	37.73	154.75	1.74	-3.69	15.61	127.02
231	37.89	91.63	1.38	-2.87	15.41	124.54
232	38.06	89.32	1.26	-2.07	22.30	123.34
233	38.22	59.61	1.51	-1.82	31.77	122.75
234	38.39	24.44	1.50	1.36	48.44	120.56
235	38.55	19.35	0.75	2.14	67.18	117.56

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
236	38.71	18.29	0.71	2.58	60.01	114.32
237	38.88	23.28	0.45	3.02	61.97	112.94
238	39.04	13.67	0.47	3.30	62.41	111.68
239	39.21	14.96	0.48	3.87	76.73	111.96
240	39.37	12.67	0.62	4.02	41.52	115.50
241	39.53	67.29	0.84	4.51	16.22	118.26
242	39.70	158.35	0.62	3.76	6.75	120.41
243	39.86	213.71	0.82	1.56	4.16	121.24
244	40.03	187.54	0.92	1.07	4.17	122.42
245	40.19	190.47	0.98	1.50	4.54	122.75
246	40.35	204.21	0.96	0.08	4.52	122.61
247	40.52	185.16	0.87	-0.36	4.93	123.15
248	40.68	185.54	1.20	-0.52	4.72	123.01
249	40.85	210.93	0.89	-1.34	5.21	124.05
250	41.01	192.94	1.30	-1.73	5.18	122.98
251	41.17	156.77	0.79	-1.18	6.07	121.76
252	41.34	145.49	0.54	-0.67	5.00	118.97
253	41.50	112.48	0.58	-0.85	9.80	118.49
254	41.67	77.64	0.80	-1.81	17.63	118.22
255	41.83	37.41	0.72	-1.66	32.84	117.27
256	41.99	16.36	0.69	-0.76	55.66	113.21
257	42.16	11.60	0.19	0.91	76.12	108.91
258	42.32	10.17	0.18	2.07	77.04	104.70
259	42.49	10.34	0.26	3.04	72.18	107.44
260	42.65	17.82	0.43	3.78	57.61	110.09
261	42.81	27.01	0.42	4.39	46.54	110.90
262	42.98	26.48	0.29	4.51	44.03	109.34
263	43.14	17.23	0.21	4.87	52.35	107.75
264	43.31	12.13	0.30	6.08	63.91	107.26
265	43.47	14.62	0.30	7.08	63.69	106.85
266	43.64	16.74	0.17	7.27	63.79	105.19
267	43.80	9.47	0.16	7.95	67.37	102.64
268	43.96	8.86	0.14	9.13	82.22	101.73
269	44.13	8.81	0.15	9.82	84.18	102.41
270	44.29	9.36	0.20	10.54	82.90	103.41
271	44.46	10.29	0.20	11.01	80.49	104.52
272	44.62	10.96	0.23	11.52	81.08	105.87
273	44.78	10.64	0.32	11.96	76.09	107.43
274	44.95	14.73	0.34	18.32	59.20	109.28
275	45.11	26.83	0.35	19.70	31.96	112.07
276	45.28	66.69	0.47	6.06	27.64	113.22
277	45.44	36.06	0.46	5.68	31.35	114.47
278	45.60	20.14	0.62	8.70	44.53	113.68
279	45.77	29.30	0.49	12.52	26.37	115.05
280	45.93	97.15	0.47	9.08	13.74	114.75
281	46.10	109.81	0.33	3.49	5.00	115.75
282	46.26	110.08	0.54	3.51	5.00	116.15
283	46.42	111.27	0.52	3.64	10.41	119.25

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
284	46.59	121.67	1.04	-0.41	14.02	123.09
285	46.75	112.52	1.99	-2.01	18.51	125.46
286	46.92	89.91	1.99	-1.92	19.62	126.18
287	47.08	120.81	1.56	-1.50	15.41	124.37
288	47.24	137.12	0.67	-1.84	10.49	122.07
289	47.41	134.59	0.73	-2.04	8.00	119.07
290	47.57	122.45	0.56	-2.06	9.98	119.81
291	47.74	105.78	0.94	-2.10	15.29	120.26
292	47.90	57.38	1.07	-2.42	26.33	120.91
293	48.06	33.54	1.17	6.27	41.83	120.40
294	48.23	36.20	1.19	10.78	46.49	121.33
295	48.39	50.35	1.61	13.80	43.68	123.20
296	48.56	53.95	2.06	11.14	42.20	124.45
297	48.72	50.99	1.91	12.44	48.83	126.94
298	48.88	48.94	3.89	14.27	24.80	131.96
299	49.05	278.24	5.79	11.46	14.55	135.17
300	49.21	347.69	5.15	7.61	7.62	135.44
301	49.38	357.82	2.62	7.60	4.27	132.70
302	49.54	349.53	1.34	6.12	2.19	128.98
303	49.70	331.97	1.54	2.85	4.44	131.30
304	49.87	277.88	4.88	2.26	10.05	133.21
305	50.03	138.16	4.53	2.16	19.49	133.76
306	50.20	93.44	4.01	19.35	27.19	130.88
307	50.36	99.81	1.90	62.98	27.20	128.82
308	50.52	100.28	2.27	78.22	23.13	127.24
309	50.69	104.81	2.33	135.35	22.83	127.95
310	50.85	112.15	2.45	303.96	23.03	129.01
311	51.02	114.30	3.23	335.42	21.50	130.14
312	51.18	145.74	3.32	268.95	21.74	130.44
313	51.35	114.19	2.78	418.08	21.08	129.76
314	51.51	106.66	2.45	471.78	22.79	128.44
315	51.67	96.02	2.22	416.85	23.05	127.55
316	51.84	95.34	2.06	433.71	23.66	127.02
317	52.00	92.50	2.08	421.52	24.30	126.59
318	52.17	84.44	1.95	336.39	26.74	126.14
319	52.33	69.31	1.89	331.27	26.92	126.85
320	52.49	102.26	2.60	365.82	28.20	128.53
321	52.66	103.05	3.47	113.13	23.78	131.51
322	52.82	173.07	4.72	282.38	26.64	132.83
323	52.99	102.03	4.80	56.63	25.28	133.39
324	53.15	133.21	4.14	122.20	29.38	132.80
325	53.31	115.53	4.35	98.58	29.89	131.95
326	53.48	79.46	3.58	97.32	30.45	131.55
327	53.64	120.72	3.64	129.31	31.35	132.06
328	53.81	117.75	5.17	72.96	27.44	133.21
329	53.97	143.78	4.86	69.56	28.05	134.26
330	54.13	139.20	5.51	83.23	28.38	133.83
331	54.30	104.66	4.45	37.45	28.52	134.09

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
332	54.46	147.94	5.32	107.67	28.16	134.49
333	54.63	154.29	6.18	31.72	26.39	135.66
334	54.79	159.40	6.46	28.39	28.73	135.77
335	54.95	120.78	5.97	28.69	29.92	135.10
336	55.12	123.25	4.99	37.30	26.83	134.70
337	55.28	187.20	5.16	50.95	24.32	133.47
338	55.45	123.43	3.46	29.84	22.25	134.19
339	55.61	174.69	5.83	48.73	29.42	133.88
340	55.77	83.34	5.72	24.74	30.69	134.36
341	55.94	121.20	4.51	26.89	21.10	134.88
342	56.10	324.16	5.22	26.75	16.78	137.03
343	56.27	265.80	9.05	14.68	18.84	137.28
344	56.43	144.06	9.36	25.83	N/A	137.28
345	56.59	534.57	-235954.20	137.33	N/A	137.28
346	56.76	598.60	-235954.20	219.82	N/A	137.28

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_c: Measured cone resistance (tsf)
f_s: Sleeve friction resistance (tsf)
u: Pore pressure (tsf)
Fines content: Percentage of fines in soil (%)
Unit weight: Bulk soil unit weight (pcf)

Geotechnologies, Inc.

Project:	Harvard-Westlake	**UNDRAINED RESTRAINED RETAINING WALL**
File No.:	21796	

Soil Weight	γ	57.6 pcf	**(Buoyant)**
Internal Friction Angle	ϕ	27 degrees	
Cohesion	c	0 psf	
Height of Retaining Wall	H	17 feet	

Restrained Retaining Wall Design based on At Rest Earth Pressure

$\sigma'_h = K_o\sigma'_v$

$K_o = 1 - \sin\phi$	0.546
$\sigma'_v = \gamma H$	979.2 psf

$\sigma'_h =$ 534.7 psf

EFP = 31.5 pcf

$P_o =$ 4544.5 lbs/ft (based on a triangular distribution of pressure)

Design wall for an EFP of 94 pcf **(Includes Hydrostatic Pressure)**

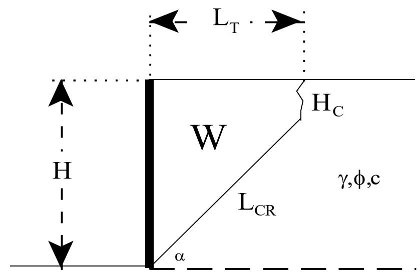
Geotechnologies, Inc.

Project: Harvard-Westlake School
File No.: 21796
Description: Undrained Catilever Retaining Wall (Designed for Hydrostatic Pressure)

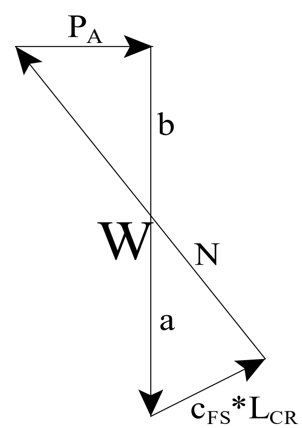
Retaining Wall Design with Level Backfill
(Vector Analysis)

Input:

Retaining Wall Height	(H)	17.00 feet	
Unit Weight of Retained Soils	(γ)	57.6 pcf	**(Buoyant)**
Friction Angle of Retained Soils	(ϕ)	27.0 degrees	
Cohesion of Retained Soils	(c)	260.0 psf	
Factor of Safety	(FS)	1.50	
Factored Parameters:	(ϕ_{FS})	18.8 degrees	
	(c_{FS})	173.3 psf	



Failure Angle (α) degrees	Height of Tension Crack (H_C) feet	Area of Wedge (A) $feet^2$	Weight of Wedge (W) lbs/lineal foot	Length of Failure Plane (L_{CR}) feet	a lbs/lineal foot	b lbs/lineal foot	Active Pressure (P_A) lbs/lineal foot
40	10.3	109	6300.5	10.5	4745.0	1555.5	604.5
41	10.0	109	6277.7	10.7	4643.0	1634.6	668.4
42	9.7	108	6223.3	10.9	4527.1	1696.2	728.3
43	9.5	107	6144.0	11.0	4402.2	1741.8	784.2
44	9.3	105	6045.1	11.1	4272.2	1772.8	835.7
45	9.1	103	5930.6	11.2	4139.8	1790.8	882.7
46	9.0	101	5803.9	11.2	4006.9	1796.9	925.0
47	8.8	98	5667.4	11.2	3874.9	1792.5	962.7
48	8.7	96	5523.3	11.1	3744.7	1778.6	995.6
49	8.6	93	5373.2	11.1	3616.9	1756.3	1023.8
50	8.5	91	5218.3	11.0	3491.9	1726.5	1047.2
51	8.5	88	5059.9	11.0	3370.0	1689.9	1065.8
52	8.4	85	4898.6	10.9	3251.3	1647.3	1079.6
53	8.4	82	4735.2	10.7	3135.7	1599.5	1088.6
54	8.4	79	4570.1	10.6	3023.2	1546.9	1092.8
55	8.4	76	4403.9	10.5	2913.6	1490.2	1092.2
56	8.4	74	4236.7	10.3	2806.8	1429.9	1086.9
57	8.5	71	4068.9	10.2	2702.5	1366.4	1076.7
58	8.5	68	3900.5	10.0	2600.5	1300.1	1061.8
59	8.6	65	3731.8	9.8	2500.4	1231.4	1042.0
60	8.6	62	3562.7	9.6	2402.0	1160.7	1017.5
61	8.7	59	3393.3	9.4	2304.9	1088.4	988.2
62	8.9	56	3223.5	9.2	2208.8	1014.7	954.1
63	9.0	53	3053.2	9.0	2113.2	940.0	915.3
64	9.2	50	2882.4	8.7	2017.7	864.7	871.9
65	9.3	47	2710.8	8.5	1921.8	789.0	823.8



Design Equations (Vector Analysis):

$a = c_{FS}*L_{CR}*\sin(90+\phi_{FS})/\sin(\alpha-\phi_{FS})$

$b = W-a$

$P_A = b*\tan(\alpha-\phi_{FS})$

$EFP = 2*P_A/H^2$

Maximum Active Pressure Resultant

$P_{A,\ max}$ 1092.8 lbs/lineal foot

Equivalent Fluid Pressure (per lineal foot of wall)

$EFP = 2*P_A/H^2$

EFP 7.6 pcf

Design Wall for an Equivalent Fluid Pressure: **93 pcf** **(Includes Hydrostatic Pressure)**

Geotechnologies, Inc.

Project: Harvard-Westlake School

File No.: 21311

Seismically Induced Lateral Soil Pressure on Retaining Wall

Input:

Height of Retaining Wall:	(H)	15.0	feet
Retained Soil Unit Weight:	(γ)	120.0	pcf
Horizontal Ground Acceleration:	(k_h)	0.31	g

Seismic Increment (ΔP_{AE}):

$\Delta P_{AE} = (0.5*\gamma*H^2)*(0.75*k_h)$

$\Delta P_{AE} =$ 3138.8 lbs/ft

Force applied at 0.6H above the base of the wall
Transfer load to 2/3 of the height of the wall

$T*(2/3)*H = \Delta P_{AE}*0.6*H$

T = 2824.9 lbs/ft

$EFP = 2*T/H^2$

EFP = 25 pcf

triangular distribution of pressure

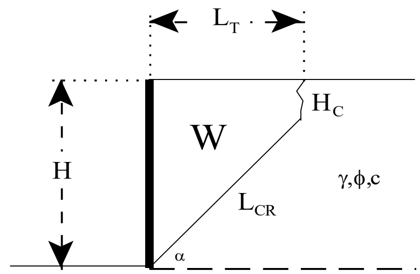
Geotechnologies, Inc.

Project: Harvard-Westlake School
File No.: 21796
Description: Temporary Shoring Walls (Up to 20 feet in height)

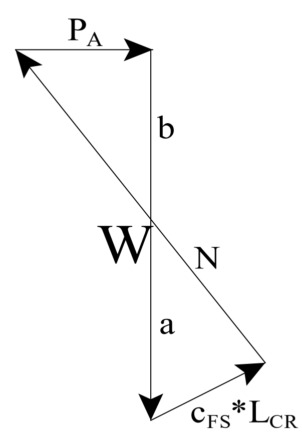
Shoring Design with Level Backfill
(Vector Analysis)

Input:

Shoring Height	(H)	20.00	feet
Unit Weight of Retained Soils	(γ)	120.0	pcf
Friction Angle of Retained Soils	(ϕ)	27.0	degrees
Cohesion of Retained Soils	(c)	260.0	psf
Factor of Safety	(FS)	1.25	
Factored Parameters:	(ϕ_{FS})	22.2	degrees
	(c_{FS})	208.0	psf



Failure Angle (α) degrees	Height of Tension Crack (H_C) feet	Area of Wedge (A) $feet^2$	Weight of Wedge (W) lbs/lineal foot	Length of Failure Plane (L_{CR}) feet	a lbs/lineal foot	b lbs/lineal foot	Active Pressure (P_A) lbs/lineal foot
40	6.8	210	25251.2	20.5	12878.1	12373.1	3978.1
41	6.6	205	24609.8	20.4	12200.8	12409.1	4230.0
42	6.4	200	23951.5	20.4	11570.4	12381.2	4463.2
43	6.2	194	23284.4	20.3	10984.5	12299.8	4678.0
44	6.0	188	22614.2	20.2	10440.6	12173.6	4874.8
45	5.9	183	21945.2	20.0	9935.4	12009.8	5054.2
46	5.7	177	21280.4	19.9	9466.1	11814.3	5216.4
47	5.6	172	20621.9	19.7	9029.7	11592.2	5362.0
48	5.5	166	19971.3	19.5	8623.6	11347.7	5491.4
49	5.4	161	19329.6	19.3	8245.2	11084.4	5604.8
50	5.4	156	18697.3	19.1	7892.0	10805.3	5702.6
51	5.3	151	18075.0	18.9	7562.0	10512.9	5785.1
52	5.2	146	17462.6	18.7	7253.2	10209.4	5852.4
53	5.2	141	16860.3	18.5	6963.8	9896.5	5904.9
54	5.2	136	16267.9	18.3	6692.0	9575.9	5942.7
55	5.2	131	15685.2	18.1	6436.3	9248.9	5965.8
56	5.2	126	15112.0	17.9	6195.4	8916.6	5974.4
57	5.2	121	14548.0	17.7	5968.0	8579.9	5968.4
58	5.2	117	13992.7	17.5	5752.9	8239.8	5947.8
59	5.2	112	13445.9	17.3	5548.9	7897.0	5912.7
60	5.2	108	12907.1	17.0	5355.1	7552.0	5862.8
61	5.3	103	12375.8	16.8	5170.5	7205.4	5798.1
62	5.3	99	11851.8	16.6	4994.1	6857.6	5718.3
63	5.4	94	11334.4	16.4	4825.2	6509.2	5623.2
64	5.5	90	10823.3	16.1	4662.8	6160.5	5512.6
65	5.6	86	10317.9	15.9	4506.2	5811.7	5386.1



Design Equations (Vector Analysis):

$a = c_{FS}*L_{CR}*\sin(90+\phi_{FS})/\sin(\alpha-\phi_{FS})$

$b = W-a$

$P_A = b*\tan(\alpha-\phi_{FS})$

$EFP = 2*P_A/H^2$

Maximum Active Pressure Resultant

$P_{A,\,max}$ 5974.4 lbs/lineal foot

Equivalent Fluid Pressure (per lineal foot of shoring)

$EFP = 2*P_A/H^2$

EFP 29.9 pcf

Design Shoring for an Equivalent Fluid Pressure: 30 pcf

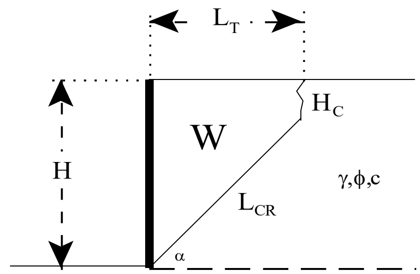
Geotechnologies, Inc.

Project: Harvard-Westlake School
File No.: 21796
Description: Temporary Shoring Walls (Up to 25 feet in height)

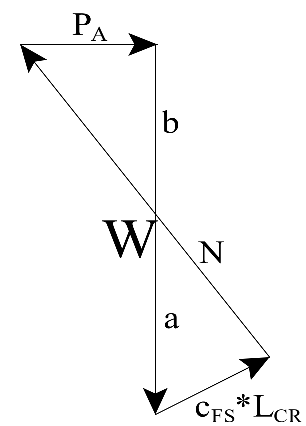
Shoring Design with Level Backfill
(Vector Analysis)

Input:

Shoring Height	(H)	25.00	feet
Unit Weight of Retained Soils	(γ)	120.0	pcf
Friction Angle of Retained Soils	(ϕ)	27.0	degrees
Cohesion of Retained Soils	(c)	260.0	psf
Factor of Safety	(FS)	1.25	
Factored Parameters:	(ϕ_{FS})	22.2	degrees
	(c_{FS})	208.0	psf



Failure Angle (α) degrees	Height of Tension Crack (H_C) feet	Area of Wedge (A) $feet^2$	Weight of Wedge (W) lbs/lineal foot	Length of Failure Plane (L_{CR}) feet	a lbs/lineal foot	b lbs/lineal foot	Active Pressure (P_A) lbs/lineal foot
40	6.8	344	41339.8	28.2	17773.1	23566.7	7577.0
41	6.6	334	40139.8	28.1	16750.5	23389.3	7972.9
42	6.4	325	38944.8	27.8	15814.5	23130.3	8338.0
43	6.2	315	37761.3	27.6	14956.9	22804.4	8673.2
44	6.0	305	36593.8	27.3	14170.0	22423.9	8979.4
45	5.9	295	35445.2	27.1	13446.7	21998.5	9257.8
46	5.7	286	34317.2	26.8	12780.7	21536.5	9509.1
47	5.6	277	33210.9	26.5	12166.4	21044.5	9734.3
48	5.5	268	32126.8	26.2	11598.7	20528.1	9933.9
49	5.4	259	31065.0	25.9	11073.1	19991.9	10108.8
50	5.4	250	30025.2	25.7	10585.6	19439.6	10259.4
51	5.3	242	29007.0	25.4	10132.5	18874.5	10386.3
52	5.2	233	28009.9	25.1	9710.7	18299.3	10489.9
53	5.2	225	27033.2	24.8	9317.2	17716.0	10570.6
54	5.2	217	26076.2	24.5	8949.5	17126.7	10628.6
55	5.2	209	25138.0	24.2	8605.3	16532.7	10664.1
56	5.2	202	24217.9	23.9	8282.4	15935.5	10677.2
57	5.2	194	23315.0	23.7	7978.9	15336.0	10668.0
58	5.2	187	22428.5	23.4	7693.2	14735.3	10636.5
59	5.2	180	21557.5	23.1	7423.5	14134.0	10582.5
60	5.2	173	20701.3	22.8	7168.6	13532.8	10505.9
61	5.3	165	19859.0	22.5	6926.9	12932.1	10406.3
62	5.3	159	19029.9	22.3	6697.3	12332.6	10283.6
63	5.4	152	18213.0	22.0	6478.6	11734.4	10137.2
64	5.5	145	17407.7	21.7	6269.7	11138.0	9966.6
65	5.6	138	16613.1	21.4	6069.5	10543.6	9771.4



Design Equations (Vector Analysis):

$a = c_{FS}*L_{CR}*\sin(90+\phi_{FS})/\sin(\alpha-\phi_{FS})$

$b = W-a$

$P_A = b*\tan(\alpha-\phi_{FS})$

$EFP = 2*P_A/H^2$

Maximum Active Pressure Resultant

$P_{A,\ max}$ 10677.2 lbs/lineal foot

Equivalent Fluid Pressure (per lineal foot of shoring)

$EFP = 2*P_A/H^2$

EFP 34.2 pcf

Design Shoring for an Equivalent Fluid Pressure: 35 pcf

BORING LOG NUMBER 1

Drilling Date: 03/31/00 **Elevation: 617'**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: 3-inch Asphalt, No Base
				0 --		FILL: Sandy Silt, light brown, slightly moist, stiff
				-		
1	15	8.9	87.9	1 --		
				-		Silty Sand, medium brown, moist, medium dense, fine grained
				2 --		
				-		
3	38	4.0	103.3	3 --		
				-		trace medium coarse grained sand
				4 --		
				-		
5	30	5.0	97.5	5 --		
				-		
				6 --		
				-		
7	32	11.5	92.2	7 --		
				-	SM	Silty Sand, brown, slightly moist, medium dense, fine grained, few decayed roots
				8 --		
				-		
				9 --		
				-		
10	32	15.2	81.3	10 --		
				-	ML	Clayey Silt, light brown with mottled dark brown, slightly moist, medium firm, few decayed roots
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	35	13.0	105.0	15 --		
				-		firm, dark brown
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	49	18.7	108.3	20 --		
				-		caliche, grades more clayey
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-	CL	Silty Clay, gray-brown, moist, firm
25	40	26.2	94.2	25 --		
				-		

BORING LOG NUMBER 1

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		Water
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	17	23.3	102.3	30 --		
				-		very moist to wet
				31 --		
				-		
				32 --		
				-		
				33 --		
				-		
				34 --		
				-		
35	22	22.8	104.7	35 --		
				-	SC	Clayey Sand, brown, wet, medium dense, fine grained
				36 --		
				-		
				37 --		
37.5	41	10.7	Disturbed	-		Sandy lenses, occasional small gravel
				38 --		
				-		
				39 --		
				-		
40	21	22.7	SPT	40 --		
				-		light brown to reddish-brown, interbedded clayey silt lenses
				41 --		
				-		
				42 --		
42.5	24	47.4	72.8	-		
	50/5"			43 --		BEDROCK: Shale bedded, light brown to black, very moist, hard, slightly weathered
				-		
				44 --		
				-		
45	50	18.5	93.1	45 --		
	50/3"			-		very hard
				46 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual
				47 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				48 --		140-lb. Slide Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				49 --		
				-		SPT=Standard Penetration Test
50	44	50.9	71.4	50 --		
	50/2"			-		Total depth: 50 feet; Water at 26 feet; Fill to 7 feet

BORING LOG NUMBER 2

Drilling Date: 03/30/00 **Elevation: 617.5'**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Grass Lawn
				0		FILL: Silty Sand, medium brown, slightly moist to moist, dense, fine grained
				1		
2	22	19.2	79.4	2	ML	Sandy Silt, medium brown, moist, medium firm, slightly porous, caliche
				3		
4	31	17.9	100.2	4	ML	Clayey Silt, dark brown, slightly moist, medium firm, porous, caliche
				5		
				6		
7	40	17.7	96.9	7		firm
				8		
				9		
10	65	15.9	89.4	10	SM	Silty Sand, light gray, slightly moist, medium dense, fine grained
				11	SC	Clayey Sand, medium brown, moist, dense, fine grained
12	67	20.1	99.9	12		medium to dark brown
				13		
				14		
15	64	27.6	91.5	15	ML	Clayey Silt, medium brown, moist, firm
				16		
				17		
				18		
				19		
20	46	17.4	101.2	20	SM	Silty Sand, orange-brown and medium brown, medium dense, fine grained
				21		
				22		
				23		
				24		
25	38	29.0	93.6	25	ML	Clayey Silt, mottled medium brown and gray, moist to very moist, medium firm, fine grained

BORING LOG NUMBER 2

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
				28		
				29		
30	26	23.7	102.5	30		medium brown, wet to saturated
				31		
				32		
				33		
				34		
35	66	16.6	116.6	35	SC	Clayey Sand, medium brown, very moist, dense, fine to medium grained
				36		
				37		
				38		
				39		
40	45	23.4	105.3	40		tan to brown, saturated, medium dense
				41		
				42		
42.5	60/6"	No Recovery				
				43		BEDROCK: Shale, black, moist, hard, weakly bedded, slightly weathered
				44		
				45		
				46		
				47		
47.5	12 50/3"	38.6	79.6			
				48		
				49		
				50		

BORING LOG NUMBER 2

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
52.5	150/6"	44.8	69.5	-		- - - - - - - - - -
				53 --		gray to black
				-		
				54 --		
				-		
				55 --		
				-		
				56 --		
				-		
				57 --		
57.5	30/6"	43.7	73.1	-		- - - - - - - - - -
	200/5"			58 --		less weathered
				-		
				59 --		
				-		
				60 --		
				-		Total depth: 60 feet
				61 --		Water at 30½ feet
				-		Fill to 2 feet
				62 --		
				-		
				63 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual
				64 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				65 --		140-lb. Slide Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				66 --		
				-		SPT=Standard Penetration Test
				67 --		
				-		
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 3

Drilling Date: 03/30/00 **Elevation: 617.5'**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Grass Lawn
				0		FILL: Silty Sand, medium brown, slightly moist, dense, fine grained
1	18	16.0	94.9	1		
					SM	Silty Sand, dark brown, moist, medium dense, fine grained
				2		
3	19	12.4	82.9	3		
					ML	Sandy Silt, brown, slightly moist, firm, slightly porous
				4		
5	45	15.5	85.1	5		
						slight clay binder, slightly sandier
				6		
7	55	19.6	91.1	7		
						brown and light gray, moist, some rootlets, slightly porous
				8		
				9		
10	55	14.6	87.8	10	SM	Silty Sand, tan, slightly moist, dense, fine grained
				11	ML	Sandy Silt, mottled tan and light gray, slightly moist, firm
				12		
				13		
				14		
15	40	22.5	93.0	15		
					SC	Clayey Sand, brown, moist, medium dense, fine grained, caliche
				16		
				17		
18	40	22.1	90.7	18		mottled brown and light gray
				19		
20	36	16.5	96.3	20		
					SM	Clay binder, medium brown, tract rootlets, Silty Sand, brown, slightly moist, medium dense, fine grained
				21		
				22		
				23		
				24		
25	36	26.7	93.4	25		
					ML	Clayey Silt, brown, moist, medium firm

BORING LOG NUMBER 3

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26 --		
				27 --		
				28 --		
				29 --		
30	26	33.9	91.6	30 --		very moist to wet
				31 --		
				32 --		
				33 --		water
				34 --		
35	36	15.8	119.4	35 --	SC	Clayey Sand, dark brown, very moist to wet, medium dense, fine to coarse grained, some gravel
				36 --		
				37 --		
				38 --		
				39 --		
40	42	25.9	Disturbed	40 --		
				41 --		
				42 --		
42.5	46	33.9	89.2	43 --	ML	Clayey Silt, medium to dark brown, very moist, medium firm
				44 --		
				45 --		
				46 --		
				47 --		
47.5	58	33.6	86.8	48 --	ML	Sandy to Clayey Silt, gray and orange-brown, saturated, firm, fine grained
				49 --		
				50 --		

BORING LOG NUMBER 3

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				51		
				52		
52.5	1508	35.4	87.0			
				53		BEDROCK: (MONTEREY FORMATION): Shale, black, moist, hard, Weakley bedded, bedding is sub horizontal
				54		
				55		
				56		
				57		
57.5	1503	16.7	110.0			
				58		interbeds of greenish-gray mudstone, moist, hard, massive
				59		
				60		
				61		Total depth: 60 feet Water at 33 feet Fill to 1 foot
				62		
				63		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual
				64		
				65		Used 8-inch diameter Hollow-Stem Auger 140-lb. Slide Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				66		
				67		SPT=Standard Penetration Test
				68		
				69		
				70		
				71		
				72		
				73		
				74		
				75		

BORING LOG NUMBER 4

Drilling Date: 03/31/00 **Elevation: 618.5'**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: 3-inch Asphalt, No Base
				0 --		FILL: Silty Sand, black, slightly moist to moist, dense, fine grained
				-		
				1 --		
				-		
2	20	19.5	104.8	2 --		
				-	ML	Clayey Silt, dark brown, moist, medium firm
				3 --		
				-		
				4 --		
				-		
5	25	16.3	97.0	5 --		
				-	ML	Sandy Silt, light brown, moist, medium firm
				6 --		
				-		
7	33	17.0	98.8	7 --		
				-		caliche
				8 --		
				-		
				9 --		
				-		
10	27	14.2	98.2	10 --		
				-		grades less sandy
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	18	23.4	100.7	15 --		
				-	ML	Clayey Silt, dark brown, very moist, firm
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	18	29.1	92.6	20 --		
				-		grades more clayey
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	18	29.9	93.7	25 --		
				-		very moist to wet

BORING LOG NUMBER 4

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
				28		
				29		
30	15	28.7	95.5	30		water
				31		
				32		
				33		
				34		
35	16	21.1	SPT	35	SC	Clayey Sand, medium brown, wet, medium dense, fine to coarse grained sand
				36		
				37		
37.5	31	7.7	112.7	38	SW	Sand, light to medium brown, wet, medium dense, fine to coarse grained, some gravel
				39		
40	54	16.6	SPT	40		dense, fine grained
				41		
				42		
42.5	62	16.3	110.9	43		
				44		
45	56	No Recovery		45		
				46		
				47		
47.5	58	12.9	123.0	48		fine to coarse grained, some gravel
				49		
50	93/3"	41.9	SPT	50		BEDROCK: Siltstone, gray-green, very moist, hard, trace carbonate

BORING LOG NUMBER 4

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
				-		
				53 --		
				-		
				54 --		
				-		
55	88/4"	61.6	68.7	55 --		
				-		
				56 --		
				-		
				57 --		
				-		
				58 --		
				-		
				59 --		
				-		
60	90/5"	45.3	75.0	60 --		
				-		Total depth: 60 feet
				61 --		Water at 30 feet
				-		Fill to 2 feet
				62 --		
				-		
				63 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual
				64 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				65 --		140-lb. Slide Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				66 --		
				-		SPT=Standard Penetration Test
				67 --		
				-		
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 5

Drilling Date: 03/31/00 **Elevation: 621.5'**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: 3-inch Asphalt, No Base
				0 --		FILL: Silty Sand, black to dark brown, moist, dense, fine grained
				-		
				1 --		
				-		
2	11	17.9	93.8	2 --		
				-		
				3 --		
				-		
4	17	15.3	104.2	4 --		
				-	SM	Silty Sand, brown, slightly moist, medium dense, fine grained
				5 --		
				-		
				6 --		
				-		
7	18	20.8	100.5	7 --		
				-	ML	Sandy to Clayey Silt, brown to dark brown, slightly moist, medium firm
				8 --		
				-		
				9 --		
				-		
10	19	21.3	103.5	10 --		
				-		grades sandier, light brown, moist
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	22	21.3	106.6	15 --		
				-		
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	17	34.3	89.7	20 --		
				-	ML	Clayey Silt, dark brown, very moist, medium firm
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	21	24.3	102.4	25 --		
				-	ML	Sandy to Clayey Silt, medium to dark brown, very moist, medium firm

BORING LOG NUMBER 5

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26 --		
				27 --		
				28 --		
				29 --		
30	19	29.5	93.2	30 --		
					ML	Clayey Silt, olive-brown, very moist, medium firm
				31 --		
				32 --		
				33 --		
				34 --		
35	31	25.0	103.4	35 --		
						some fine sand
				36 --		
				37 --		
				38 --		
				39 --		
40	18	30.7	SPT	40 --		
				41 --		
				42 --		
42.5	29	28.3	96.6			
				43 --		
				44 --		
45	13	38.7	SPT	45 --		
					CL	Silty Clay, olive-brown, very moist, soft, caliche
				46 --		
				47 --		
47.5	32	36.3	88.6			
				48 --		
				49 --		
50	11	34.0	SPT	50 --		slightly sandy
						Total depth: 50 feet; Water at 30 feet; Fill to 4 feet

NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual

Used 8-inch diameter Hollow-Stem Auger
140-lb. Slide Hammer, 30-inch drop
Modified California Sampler used unless otherwise noted

SPT=Standard Penetration Test

BORING LOG NUMBER 6

Drilling Date: 03/31/00 **Elevation: 618.5'**

Project: File No.20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: 3-inch Asphalt, No Base
						FILL: Sandy Silt, medium brown, moist, firm, fine sand
1	11	21.7	96.5	1		
				2		
3	10	18.5	98.9	3		-----
						medium brown
				4		
5	11	24.6	98.2	5		
					ML	Clayey Silt, black, moist, firm, caliche
				6		
7	19	23.8	99.2	7		-----
						olive-brown, very moist
				8		
				9		
10	16	23.2	95.6	10		
					SM	Silty Sand, medium brown, moist, medium dense, very fine grained
				11		
				12		
				13		
				14		
15	15	29.1	93.6	15		
					ML	Clayey Silt, brown, very moist, stiff
				16		
				17		
				18		
				19		
20	27	29.1	92.1	20		-----
						dark brown, trace fine sand
				21		
				22		
				23		
				24		
25	25	29.7	91.7	25		-----
						dark brown to black

BORING LOG NUMBER 6

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26 --		
				27 --		
				28 --		
				29 --		
30	17	26.3	99.7	30 --		wet
				31 --		
				32 --		
				33 --		
				34 --		
35	14	24.2	SPT	35 --		wet, stiff, some fine grained sand
				36 --		
				37 --		
37.5	82	22.9	106.9			
				38 --	SW	Sand, medium brown, wet, dense, fine to coarse grained, some silt, some clayey sand
				39 --		
40	63	28.2	SPT	40 --	SC	Clayey Sand, brown, wet, dense, fine to medium grained
				41 --		
				42 --		
42.5	50/5"	47.5	72.9			
				43 --		BEDROCK (MONTEREY FORMATION): Siltstone, gray-green to black, moist, hard
				44 --		
45	76	43.6	SPT	45 --		
				46 --		
				47 --		
				48 --		
				49 --		
50	90/3"	40.6	78.8	50 --		

BORING LOG NUMBER 6

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
				-		
				53 --		
				-		
				54 --		
				-		
55	83/2"	No Recovery		55 --		
				-		Total depth: 55 feet
				56 --		Water at 29 feet
				-		Fill to 5 feet
				57 --		
				-		
				58 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual
				59 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				60 --		140-lb. Slide Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				61 --		
				-		SPT=Standard Penetration Test
				62 --		
				-		
				63 --		
				-		
				64 --		
				-		
				65 --		
				-		
				66 --		
				-		
				67 --		
				-		
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 7

Drilling Date: 06/04/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, medium brown to yellowish-brown, slightly moist to moist, medium dense, fine grained
1	19	5.7	85.2	1 --		
				2 --	SM	Silty Sand, yellowish-brown, moist, medium dense, fine grained
3	20	8.4	86.0	3 --		moist
				4 --		slight porous, moist
5	32	9.6	93.2	5 --		moist
				6 --	SC	Clayey Sand, medium brown, moist, medium dense, fine grained, medium stiff
7	22	13.9	97.1	7 --		
				8 --	SM	Silty Sand, yellowish-brown with dark brown and light gray mottling to yellowish-brown with medium brown mottling, moist, medium dense, fine grained, slight Clay
				9 --		
10	29	15.9	101.2	10 --	SM/ML	Silty Sand to Sandy Silt, yellowish-brown with light gray mottling, moist, medium dense, fine grained
				11 --		
				12 --		
				13 --		
				14 --		
15	26	25.6	96.9	15 --	SC	Clayey Sand, yellowish-brown with light gray and brown mottling to medium brown with yellowish-brown mottling, moist, medium dense, fine grained, medium stiff
				16 --		
				17 --		
				18 --		
				19 --		
20	25	23.1	92.3	20 --	CL	Sandy Clay, medium brown with yellowish-brown mottling, moist, medium stiff
				21 --		
				22 --		
				23 --		
				24 --		
25	20	23.0	96.7	25 --	CL/SC	Sandy Clay to Clayey Sand, medium brown with yellowish-brown mottling, moist, medium dense, fine grained, medium stiff

BORING LOG NUMBER 7

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	38	27.3	93.1	30 --	CL	Sandy Clay, medium brown with yellowish-brown and light gray mottling, moist, medium stiff
				-		
				31 --		
				-		Total depth: 30 feet
				32 --		No Water
				-		Fill to 1½ feet
				33 --		
				-		
				34 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual
				35 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				36 --		140-lb. Slide Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				37 --		
				-		SPT=Standard Penetration Test
				38 --		
				-		
				39 --		
				-		
				40 --		
				-		
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
				50 --		
				-		

BORING LOG NUMBER 8

Drilling Date: 06/04/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, dark brown to yellowish-brown, moist, medium dense, fine grained
				-		
				1 --		
				-		
2	12	15.7	98.0	2 --	SM	Silty Sand, medium brown, slightly porous, moist, medium dense, fine grained
				-		
				3 --		
				-		moist
4	16	14.7	102.9	4 --		
				-	SM/SC	Silty to Clayey Sand, medium brown to brown, moist, medium dense, fine grained, medium stiff
				5 --		
				-		
				6 --		
				-		
7	27	25.8	93.8	7 --		
				-	SC/SM	Clayey to Silty Sand, dark brown with medium brown mottling to yellowish-brown with light gray mottling, moist, medium dense, fine grained, medium stiff
				8 --		
				-		
				9 --		
				-		
10	35	6.1	101.3	10 --		
				-	SM/SP	Silty Sand to Sand, yellowish-brown with light gray mottling, moist, medium dense, fine grained
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	25	22.3	95.7	15 --		
				-	CL	Sandy Clay, medium brown with dark brown and light gray mottling, moist, medium stiff
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	27	29.9	89.4	20 --		
				-		yellowish-brown with medium brown and light gray mottling, moist, medium stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	32	24.0	97.2	25 --		
				-		yellowish-brown with light gray mottling, moist, medium stiff

BORING LOG NUMBER 8

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	27	22.5	99.7	30 --		moist
				-		
				31 --		Total depth: 30 feet
				-		No Water
				32 --		Fill to 1½ feet
				-		
				33 --		
				-		NOTE: The stratification lines represent the approximate
				34 --		boundary between earth types; the transition may be gradual
				-		
				35 --		Used 8-inch diameter Hollow-Stem Auger
				-		140-lb. Slide Hammer, 30-inch drop
				36 --		Modified California Sampler used unless otherwise noted
				-		
				37 --		SPT=Standard Penetration Test
				-		
				38 --		
				-		
				39 --		
				-		
				40 --		
				-		
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
				50 --		
				-		

BORING LOG NUMBER 9

Drilling Date: 06/04/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, medium brown, moist, medium dense, fine grained
				-		
1	30	7.9	90.0	1 --		yellowish-brown, moist
				-		
				2 --		medium brown, slightly porous, moist, medium dense, fine grained
				-		
3	24	7.4	81.1	3 --	SM	Silty Sand, yellowish-brown, moist, medium dense, fine grained
				-		
				4 --		yellowish-brown to yellowish-brown with medium brown mottling, slightly porous, moist, medium dense, fine grained
				-		
5	28	12.3	84.8	5 --		
				-	SM/SC	Silty Sand to Clayey Sand, light gray with yellowish-brown mottling, slight caliche, slightly porous, moist, medium dense, fine grained, medium stiff
				6 --		
				-		
7	37	15.3	103.0	7 --		
				-	SC	Clayey Sand, medium brown with gray mottling, moist, medium dense, fine grained, medium stiff
				8 --		
				-		
				9 --		
				-		
10	45	16.3	105.1	10 --		
				-	ML/SM	Clayey Silt to Silty Sand, medium brown with gray mottling to medium brown, moist, medium dense, fine grained, medium stiff
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	43	18.3	106.7	15 --		
				-	SC	Clayey Sand, dark brown to medium brown, moist, medium dense, fine grained, medium stiff
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	50	24.0	98.9	20 --		
				-	CL	Sandy Clay, medium brown, moist, medium stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	55	25.5	95.2	25 --		medium brown with gray mottling to medium brown with gray and yellowish-brown mottling, moist, stiff
				-		

BORING LOG NUMBER 9

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		medium brown with gray mottling, moist, medium stiff
30	29	22.9	97.2	30 --		
				-		Total depth: 30 feet
				31 --		No Water
				-		Fill to 1½ feet
				32 --		
				-		
				33 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual
				34 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				35 --		140-lb. Slide Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				36 --		
				-		SPT=Standard Penetration Test
				37 --		
				-		
				38 --		
				-		
				39 --		
				-		
				40 --		
				-		
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
				50 --		
				-		

BORING LOG NUMBER 10

Drilling Date: 06/12/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, yellowish-brown, moist, medium dense, fine grained
				-		
				1 --		
				-		
2	65	5.0	104.7	2 --		
				-		moist
				3 --		
				-	SM	Silty Sand, yellowish-brown, porous, moist, dense, fine grained
4	34	7.1	100.3	4 --		
				-		moist
				5 --		
				-		
				6 --		
				-		
7	46	10.3	96.9	7 --		
				-		slightly Clayey, yellowish-brown with light gray mottling, slightly porous, moist, medium dense, fine grained
				8 --		
				-		
				9 --		
				-		
10	60	7.6	109.5	10 --		
				-		yellowish-brown with light gray mottling, moist, dense, fine grained
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	41	17.3	104.9	15 --		
				-	CL/SC	Sandy Clay to Clayey Sand, medium brown to yellowish-brown, moist, medium dense, fine grained, medium stiff
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	38	21.3	100.8	20 --		
				-	CL	Sandy Clay, yellowish-brown, caliche, moist, medium stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		Sandy Clay to Clayey Sand, medium brown with light gray mottling to yellowish-brown with light gray mottling, moist, medium dense, fine grained, medium stiff
25	36	18.8	107.4	25 --		
				-	CL/SC	

BORING LOG NUMBER 10

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26 --		
				27 --		
				28 --		
				29 --		
30	33	23.1	98.7	30 --	CL	Sandy Clay, yellowish-brown with light gray mottling, moist, medium stiff
				31 --		
				32 --		Total depth: 30 feet No Water Fill to 2½ feet
				33 --		
				34 --		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual
				35 --		
				36 --		Used 8-inch diameter Hollow-Stem Auger 140-lb. Slide Hammer, 30-inch drop Modified California Sampler used unless otherwise noted
				37 --		
				38 --		SPT=Standard Penetration Test
				39 --		
				40 --		
				41 --		
				42 --		
				43 --		
				44 --		
				45 --		
				46 --		
				47 --		
				48 --		
				49 --		
				50 --		

BORING LOG NUMBER 11

Drilling Date: 06/12/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, yellowish-brown, moist, medium dense, fine grained
				-		
				1 --		
				-		
2	33	6.5	97.6	2 --	SM	Silty Sand, yellowish-brown, moist, medium dense, fine grained
				-		
				3 --		medium brown with yellowish-brown mottling, moist, medium dense, fine grained
				-		
4	36	10.8	100.2	4 --		
				-		yellowish-brown with white and light gray mottling, moist, medium dense, fine grained
				5 --		
				-		
				6 --		
				-		
7	28	13.1	103.6	7 --		
				-		slightly Clayey, yellowish-brown to medium brown with gray mottling, moist, medium dense, fine grained
				8 --		
				-	SC	
				9 --		Clayey Sand, medium brown with light gray, gray and white mottling, moist, medium dense, fine grained, medium stiff
				-		
10	29	13.7	100.3	10 --		
				-	SM	Silty Sand, yellowish-brown with light gray and medium brown mottling, moist, medium dense, fine grained
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	32	11.0	109.8	15 --		
				-	SP/SM	Sand to Silty Sand with slight Clayey, yellowish-brown with light gray mottling to medium brown with slight caliche, moist, medium dense, fine grained
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	50	18.1	104.1	20 --		
				-	SM/CL	Silty Sand to Sandy Clay, medium brown to medium brown with light gray and white mottling, moist, medium dense, fine grained, medium stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	50	22.3	98.1	25 --		Sandy Clay, medium brown with gray and yellowish-brown mottling, slight caliche, moist, medium stiff
				-	CL	

BORING LOG NUMBER 11

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				26		
				27		
				28		
				29		
30	57	27.2	90.9	30		medium brown with yellowish-brown and light gray mottling, moist, stiff
				31		
				32		Total depth: 30 feet No Water Fill to 1½ feet
				33		
				34		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual Used 8-inch diameter Hollow-Stem Auger 140-lb. Slide Hammer, 30-inch drop Modified California Sampler used unless otherwise noted SPT=Standard Penetration Test
				35		
				36		
				37		
				38		
				39		
				40		
				41		
				42		
				43		
				44		
				45		
				46		
				47		
				48		
				49		
				50		

BORING LOG NUMBER 12

Drilling Date: 06/04/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, yellowish-brown, moist, medium dense, fine grained
				-		
				1 --		
				-		
2	15	5.9	88.9	2 --	SM	Silty Sand, medium brown, moist, medium dense, fine grained
				-		
				3 --		light olive-brown, moist
				-		
4	20	9.2	87.7	4 --		
				-		yellowish-brown, slightly porous, moist, medium dense, fine grained
				5 --		
				-		
				6 --		
				-		
7	40	8.5	107.2	7 --		
				-		yellowish-brown to medium brown with light gray mottling, moist, medium dense, fine grained, slightly Clayey
				8 --		
				-		
				9 --		
				-		
10	50	19.2	101.8	10 --		
				-	ML	Sandy to Clayey Silt, yellowish-brown with brown and light gray mottling, moist, medium dense, fine grained, medium stiff
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	44	9.8	93.4	15 --		
				-	SP/SM	Sand to Silty Sand, yellowish-brown, moist, medium dense, fine grained
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	36	21.5	95.1	20 --		
				-	CL	Sandy Clay, medium brown with yellowish-brown mottling, moist, medium stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	36	23.6	99.5	25 --		
				-		moist

BORING LOG NUMBER 12

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	57	27.2	90.9	30 --		medium brown with yellowish-brown and light gray mottling, moist, stiff
				-		
				31 --		
				-		Total depth: 30 feet No Water Fill to 1½ feet
				32 --		
				-		
				33 --		
				-		
				34 --		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual Used 8-inch diameter Hollow-Stem Auger 140-lb. Slide Hammer, 30-inch drop Modified California Sampler used unless otherwise noted SPT=Standard Penetration Test
				-		
				35 --		
				-		
				36 --		
				-		
				37 --		
				-		
				38 --		
				-		
				39 --		
				-		
				40 --		
				-		
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
				50 --		
				-		

BORING LOG NUMBER 13

Drilling Date: 06/12/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, medium brown, moist, medium dense, fine grained
				-		
1	22	8.6	98.4	1 --		
				-	SC/SM	Clayey to Silty Sand, yellowish-brown to olive-brown, moist, medium dense, fine grained, medium stiff
				2 --		
				-		
3	24	8.3	106.9	3 --		
				-	SM/SC	Silty to Clayey Sand, olive-brown with yellowish-brown mottling, moist, medium dense, fine grained, medium stiff
				4 --		
				-		
5	30	15.0	SPT	5 --		
				-	SC/SM	Clayey to Silty Sand, olive-brown with light gray mottling to yellowish-brown, moist, medium dense, fine grained, medium stiff
				6 --		
				-	SC	
				7 --		Clayey Sand, olive-brown with light gray and white mottling, slight caliche, moist, medium dense, fine grained, medium stiff
7.5	32	18.2	102.8	-		
				8 --		
				-	SM/SC	Silty to Clayey Sand, medium brown with light gray and yellowish-brown mottling, slightly porous, moist, medium dense, fine grained, medium stiff
				9 --		
				-		
10	15	17.8	SPT	10 --		
				-	CL	Sandy Clay, yellowish-brown, moist, firm
				11 --		
				-		
				12 --		
12.5	52	18.7	99.7	-		
				13 --		olive-brown with light gray mottling, moist, stiff
				-		
				14 --		
				-		
15	18	13.3	SPT	15 --		
				-	SC	Clayey Sand, medium brown, moist, medium dense, fine grained
				16 --		
				-		
				17 --		
17.5	29	27.4	92.6	-		
				18 --		slight caliche, moist, medium dense, fine grained
				-		
				19 --		
				-		
20	33	25.8	SPT	20 --		
				-	CL/SC	Sandy Clay to Clayey Sand, yellowish-brown with light gray mottling, slight caliche, moist, medium dense, fine grained, medium stiff
				21 --		
				-		
				22 --		
22.5	58 50/6"	26.4	94.0	-		
				23 --	CL	Sandy Clay, medium brown with gray and light gray mottling, caliche, moist, very stiff
				-		
				24 --		
				-		
25	31	24.7	SPT	25 --		yellowish-brown with gray mottling, caliche, moist, medium stiff, slight gravel
				-		

BORING LOG NUMBER 13

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
27.5	43	27.9	92.9	-		
				28 --		yellowish-brown with light gray mottling, moist, medium stiff
				-		
				29 --		
				-		
30	13	26.3	SPT	30 --		
				-		medium brown with light gray mottling to yellowish-brown with light gray mottling, slight caliche, moist, medium stiff
				31 --		
				-		
				32 --		
32.5	47	18.5	108.0	-		
				33 --		yellowish-brown with light gray mottling, moist, medium stiff
				-		
				34 --		
				-		
35	19	22.4	SPT	35 --		
				-		moist
				36 --		
				-		
				37 --		
37.5	33	19.7	106.6	-		
				38 --		yellowish-brown with olive-brown mottling to yellowish-brown, moist, medium stiff
				-		
				39 --		
				-		
40	14	26.3	SPT	40 --		
				-	CL	Sandy Clay, yellowish-brown with light gray mottling, very moist, medium dense, fine grained, medium stiff
				41 --		
				-		
				42 --		
42.5	36	24.8	99.5	-		
				43 --	SM	Silty Sand, yellowish-brown with light gray mottling, wet, medium dense, fine grained
				-		
				44 --		
				-		
45	25	22.2	SPT	45 --		
				-		yellowish-brown with reddish-brown, wet, medium dense, fine to medium grained
				46 --		
				-		
				47 --		
47.5	58 50/6"	6.3	125.6	-		
				48 --		yellowish-brown, wet, very dense, fine to coarse grained, abundant gravel
				-		
				49 --		
				-		
50	30	12.2	SPT	50 --		
				-		yellowish-brown, wet, medium dense, fine to coarse grained, abundant gravel
				-		

BORING LOG NUMBER 13

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				51 --		
				-		
				52 --		
52.5	35	10.1	122.2	-		
	50/6"			53 --		wet, very dense, fine to coarse grained, more gravel
				-		
				54 --		
				-		
55	50/6"	45.4	SPT	55 --		
				-	SM	Silty Sand, gray with white and greenish-gray layered, moist,
				56 --		dense, fine grained
				-		
				57 --		
57.5	75/7"	No Recovery		-		
				58 --		
				-		
				59 --		
				-		
60	28	55.1	SPT	60 --	SM/ML	Silty Sand to Sandy Silt, gray with light and white layers, moist,
	50/5"			-		very dense, fine grained
				61 --		
				-		Total depth: 60 feet
				62 --		Water at 34 feet
				-		Fill to 1 foot
				63 --		
				-		
				64 --		NOTE: The stratification lines represent the approximate
				-		boundary between earth types; the transition may be gradual
				65 --		
				-		Used 8-inch diameter Hollow-Stem Auger
				66 --		140-lb. Slide Hammer, 30-inch drop
				-		Modified California Sampler used unless otherwise noted
				67 --		
				-		SPT=Standard Penetration Test
				68 --		
				-		
				69 --		
				-		
				70 --		
				-		
				71 --		
				-		
				72 --		
				-		
				73 --		
				-		
				74 --		
				-		
				75 --		
				-		

BORING LOG NUMBER 14

Drilling Date: 06/12/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, yellowish-brown, moist, medium dense, fine grained
				-		
				1 --		
				-	SM	Silty Sand, medium brown, moist, medium dense, fine grained
				2 --		
				-		slightly porous, moist, medium dense, fine grained
				3 --		
				-		
4	16	9.5	99.3	4 --		
				-		medium brown with yellowish-brown mottling to yellowish-brown, moist, medium dense, fine grained
				5 --		
				-		
				6 --		
				-		
7	23	11.7	106.9	7 --		
				-	SC	Clayey Sand, medium brown with gray mottling, moist, medium dense, fine grained, medium stiff
				8 --		
				-		
				9 --		
				-		
10	40	18.3	106.8	10 --		
				-	SM	Silty Sand, yellowish-brown with gray mottling to yellowish-brown with light gray mottling, moist, medium dense, fine grained
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	43	16.7	102.8	15 --		
				-	CL	Sandy Clay, olive-brown with gray and yellowish-brown mottling to medium brown with gray and yellowish-brown mottling, moist, medium stiff
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	36	28.5	87.0	20 --		
				-		medium brown with gray mottling to yellowish-brown, moist, medium stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	47	22.7	94.9	25 --		medium brown with light gray and yellowish-brown mottling, moist, medium stiff
				-		

BORING LOG NUMBER 14

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	35	27.4	92.6	30 --		yellowish-brown with light gray mottling to medium brown with light gray mottling, moist, medium stiff
				-		
				31 --		
				-		Total depth: 30 feet No Water Fill to 1 foot
				32 --		
				-		
				33 --		
				-		
				34 --		NOTE: The stratification lines represent the approximate boundary between earth types; the transition may be gradual Used 8-inch diameter Hollow-Stem Auger 140-lb. Slide Hammer, 30-inch drop Modified California Sampler used unless otherwise noted SPT=Standard Penetration Test
				-		
				35 --		
				-		
				36 --		
				-		
				37 --		
				-		
				38 --		
				-		
				39 --		
				-		
				40 --		
				-		
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
				50 --		
				-		

BORING LOG NUMBER 15

Drilling Date: 06/04/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
				0 --		FILL: Silty Sand, medium brown to yellowish-brown, moist, medium dense, fine grained with minor bedrock fragments
				-		
				1 --		
				-		
2	19	6.1	93.2	2 --	SM	Silty Sand, yellowish-brown, moist, medium dense, fine grained
				-		
				3 --		medium brown to yellowish-brown, moist, medium dense, fine grained
				-		
4	20 50/6"	8.8	100.8	4 --		
				-		medium brown with yellowish-brown mottling, moist, dense, fine grained, slightly Clayey
				5 --		
				-		
				6 --		
				-		
7	42	12.5	100.4	7 --		
				-		yellowish-brown with gray mottling, slightly porous, moist, medium dense, fine grained
				8 --		
				-		
				9 --		
				-		
10	50	14.4	82.5	10 --		
				-	ML	Sandy Silt, yellowish-brown with light gray mottling, moist, medium dense, fine grained
				11 --		
				-		
				12 --		
				-		
				13 --		
				-		
				14 --		
				-		
15	30	25.5	90.8	15 --		
				-	CL	Sandy Clay, medium brown with yellowish-brown mottling, moist, medium stiff
				16 --		
				-		
				17 --		
				-		
				18 --		
				-		
				19 --		
				-		
20	30 50/5"	18.3	96.7	20 --		
				-	SC/CL	Clayey Sand to Sandy Clay, yellowish-brown, caliche, moist, very dense, fine grained, very stiff
				21 --		
				-		
				22 --		
				-		
				23 --		
				-		
				24 --		
				-		
25	20 50/5"	24.1	95.8	25 --		Sandy Clay, yellowish-brown with gray mottling, caliche, moist, very stiff
				-	CL	

BORING LOG NUMBER 15

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Blows per ft.	Moisture content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description
				-		
				26 --		
				-		
				27 --		
				-		
				28 --		
				-		
				29 --		
				-		
30	46	23.8	94.8	30 --		moist
				-		
				31 --		Total depth: 30 feet
				-		No Water
				32 --		Fill to 1½ feet
				-		
				33 --		
				-		NOTE: The stratification lines represent the approximate
				34 --		boundary between earth types; the transition may be gradual
				-		
				35 --		Used 8-inch diameter Hollow-Stem Auger
				-		140-lb. Slide Hammer, 30-inch drop
				36 --		Modified California Sampler used unless otherwise noted
				-		
				37 --		SPT=Standard Penetration Test
				-		
				38 --		
				-		
				39 --		
				-		
				40 --		
				-		
				41 --		
				-		
				42 --		
				-		
				43 --		
				-		
				44 --		
				-		
				45 --		
				-		
				46 --		
				-		
				47 --		
				-		
				48 --		
				-		
				49 --		
				-		
				50 --		
				-		

LOG OF TEST PIT NUMBER 1

Drilling Date: 06/06/07 **Elevation:**

Project: File No. 20255 **Planning Associates, Inc.**

km

Sample Depth ft.	Moisture Content %	Dry Density p.c.f.	Depth in feet	USCS Class.	Description Surface Conditions: Lawn Area
			0 --		NO FILL
			-		Silty Sand, yellowish-brown, slightly porous, moist, medium
			1 --		dense, fine grained
			-		
			2 --		
			-		
			3 --		
			-		
			4 --		yellowish-brown with medium brown mottling, moist, medium
			-		dense, fine grained
			5 --		
			-		
			6 --		
			-		Total depth: 6 feet
			7 --		No Water
			-		No Fill
			8 --		
			-		
			9 --		NOTE: The stratification lines represent the approximate
			-		boundary between earth types; the transition may be gradual.
			10 --		
			-		Used 4-inch diameter Hand-Augering Equipment; Hand Sampler
			11 --		
			-		
			12 --		
			-		
			13 --		
			-		
			14 --		
			-		
			15 --		
			-		
			16 --		
			-		
			17 --		
			-		
			18 --		
			-		
			19 --		
			-		
			20 --		
			-		
			21 --		
			-		
			22 --		
			-		
			23 --		
			-		
			24 --		
			-		
			25 --		
			-		

G-2 Paleontological Resources Assessment Report

Public Version

Harvard-Westlake River Park Project, Studio City, Los Angeles, California

Paleontological Resources Assessment Report

Prepared for

Harvard-Westlake School
3700 North Coldwater Canyon Avenue
Studio City, CA 91604

February 2021

Public Version

Harvard-Westlake River Park Project, Studio City, Los Angeles, California

Paleontological Resources Assessment Report

Prepared for:
Harvard-Westlake School
3700 North Coldwater Canyon Avenue
Studio City, CA 91604

February 2021

Prepared by:
ESA
626 Wilshire Blvd. Suite 1100
Los Angeles, CA 90017

Project Director:
Monica Strauss, M.A., RPA

Principal Investigator and Author:
Russell Shapiro, Ph.D.

Project Location:
Van Nuys (CA) USGS 7.5-minute Topographic Quad
Township 1 North, Range 15 West, Unsectioned

Acreage: Approx. 17.2 acres

Assessor Parcel Numbers (APN): 2375-018-020 and Portion of APN 2375-018-903
Los Angeles River Parcel 276

626 Wilshire Boulevard
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EXECUTIVE SUMMARY

Harvard-Westlake River Park Project - Paleontological Resources Assessment Report

Harvard-Westlake School (Applicant or School) has retained Environmental Science Associates to conduct a paleontological resources assessment for the Harvard-Westlake River Park Project (Project) in support of an Environmental Impact Report (EIR) being prepared pursuant to the California Environmental Quality Act (CEQA).

The Project proposes the redevelopment of the existing Weddington Golf & Tennis facility (Club) for use as an athletic and recreational facility for Harvard-Westlake students, employees and the general public (Project). The Project would include the construction of two athletic fields, a gym building, pool, tennis courts, trails (including a connection to the existing Los Angeles River trail), an underground parking structure, surface parking, and various landscaped and infrastructure improvements, including a below ground stormwater capture and reuse system. The City of Los Angeles (City) is the lead agency pursuant to the CEQA.

Collectively, the Project Site encompasses 17.2 acres and is currently occupied with a privately-owned nine-hole, 27-par golf course and tennis facility. The Project Site includes a 16.1-acre parcel owned by the School located at 4141 Whitsett Avenue, as well as a 1.1-acre parcel located between the Club and the Los Angeles River which the School leases from Los Angeles County (Leased Property). The Project also involves off-site improvements to Valleyheart Drive, located primarily to the south of Los Angeles Fire Department (LAFD) Fire Station 78, and to portions of the Zev Yaroslavsky Los Angeles River Greenway (Zev Greenway), an improved public trail along the north edge of the Los Angeles River.

Geologic mapping indicates the surface of the Project mapped as Holocene-age (11,650 years ago to present) alluvium, and include units Qay1 and Qay2, which presumably overlie Pleistocene-age (2,580,000 to 11,700 years ago) Quaternary alluvium (Qao) and the Miocene-age (23.03 to 5.333 million years ago) Modelo formation (Tmd). The Qay1 alluvial unit was deposited from 1,000-10,000 year ago, whereas the Qay2 alluvial unit was deposited less than 1,000 year ago. The Pleistocene-age alluvial deposits are not mapped at surface in the Project Site but, based on similar geological settings throughout the Los Angeles Basin, it is presumed the Holocene-age Qay1 alluvium overlies the older early Holocene to Pleistocene alluvium at a depth ranging from 5-20 feet. In addition, geotechnical testing undertaken for the Project indicates the surface of the Project Site is comprised of fill material. The geotechnical testing indicates the fill material extends from the surface to between 2-7 feet in depth, and overlies alluvium that extends from between 2-7 feet to 42.5-54.6 feet in depth, and the Modelo formation extending from depths ranging below 42.5 feet to 54.6 feet.

On October 9, 2020, ESA requested a database search from the Natural History Museum of Los Angeles County (LACM) for records of fossil localities in and around the Project Site. The LACM database search indicates four fossil localities (LACM IP 5094, LACM IP 4888, LACM IP 163, and LACM VP 1282, 4502, 4504,4505, 4507, 4457) originating from the Miocene-age Modelo Formation (Tmd) have been previously identified within distances ranging from 465 feet to 1.10 miles from the Project Site. These fossil localities include specimens of scallops (LACM IP 5094), unspecified invertebrates (LACM IP 4888 and LACM IP 163), and fish (LACM VP 1282, 4502, 4504,4505, 4507, 4457). Although not included as part of LACM records search conducted for this Project, records searches conducted for other projects in the vicinity of the Project Site and within the San Fernando Valley indicate a number of fossil localities in the region originating from Pleistocene-age alluvial sediments, which are presumed to underlie the Qay1 alluvial deposits. These fossil localities include specimens of Pleistocene megafauna and were recovered from depths ranging from 14 feet to 100 feet below the ground surface.

The Holocene-age alluvial unit, Qay1, was deposited between 1,000 and 10,000 years ago, encompassing the Society for Vertebrate Paleontology’s age threshold of 5,000 years old for what constitute fossil resources, and, therefore, its basal layers may be of appropriate age to contain fossil specimens. As such, this unit has a low-to-high paleontological potential with increasing depth. The underlying Pleistocene-age alluvium is of appropriate age and has produced a number of fossil specimens in the San Fernando Valley, and, therefore has high paleontological sensitivity. The fill material has no paleontological potential and the Qay2 Holocene-age alluvial unit is too young to contain fossil specimens, and therefore has low potential.

Ground disturbing activities associated with the Project would extend to depths of approximately 21 feet, thus disturbing sediments associated with the Qay1 alluvial unit and Pleistocene-age alluvium, presumed to underlie the Qay1 unit. Therefore, Project-related ground disturbing activities could encounter paleontological resources. However, the City has established a standard condition of approval to address inadvertent discovery of paleontological resources. Should paleontological resources be inadvertently encountered, the condition of approval provides for temporary halting construction activities near the encounter so the find can be evaluated by a qualified paleontologist. With implementation of the City’s established condition of approval to address any inadvertent discovery of paleontological resources, Project impacts would be less than significant and no mitigation measures are required.

Harvard-Westlake River Park Project

Paleontological Resources Assessment Report

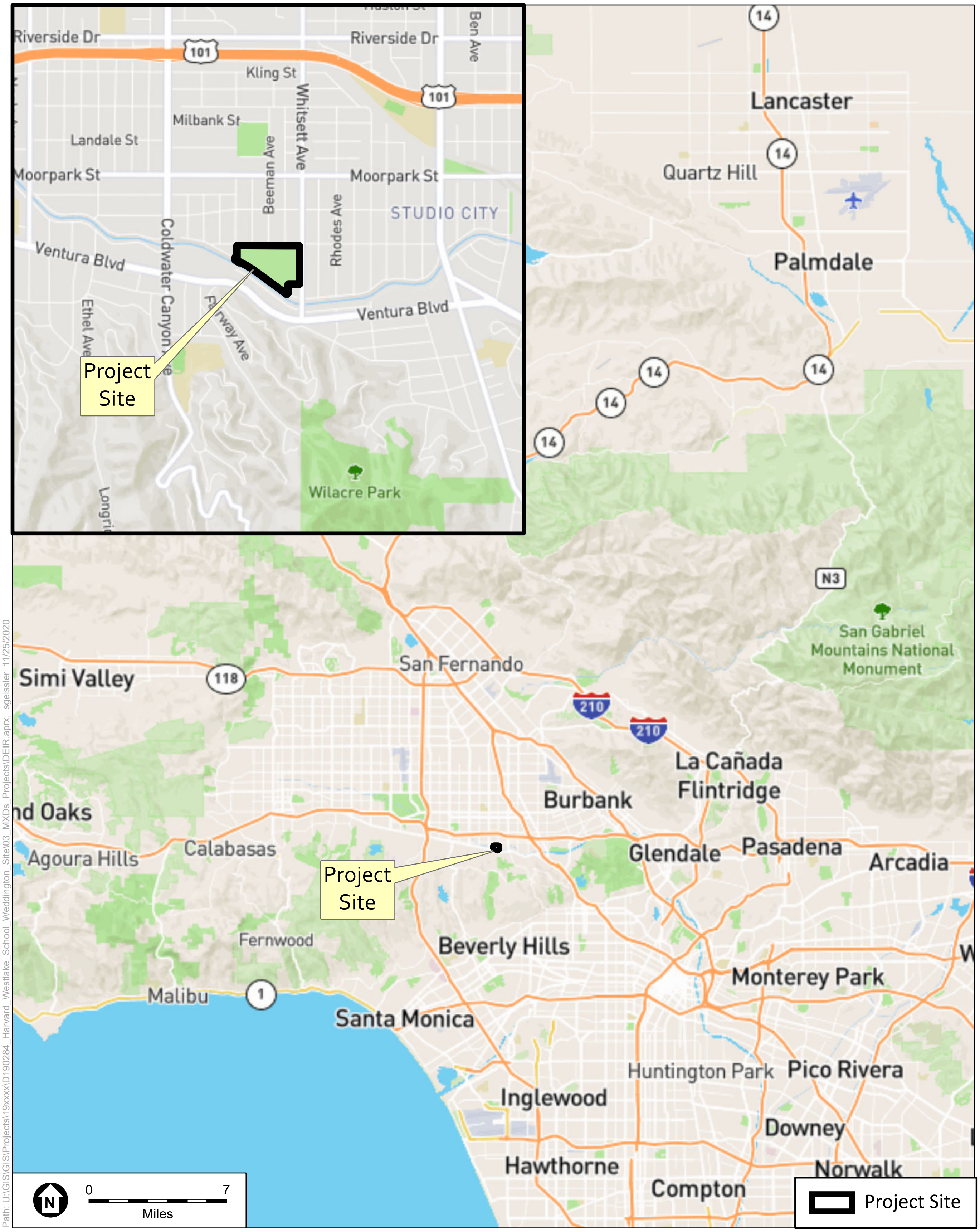
Introduction

Harvard-Westlake School (Applicant or School) has retained Environmental Science Associates (ESA) to conduct a paleontological resources assessment for the Harvard-Westlake River Park Project (Project) in support of an Environmental Impact Report (EIR) being prepared pursuant to the California Environmental Quality Act (CEQA). The Project proposes the redevelopment of the existing Weddington Golf & Tennis facility site for use as an athletic and recreational facility for Harvard-Westlake students, employees and the general public. The Project would include the construction of two athletic fields, a gym building, pool, tennis courts, trails (including a connection to the existing Los Angeles River trail), an underground parking structure, surface parking, and various landscaped and infrastructure improvements, including a 1-million-gallon underground stormwater capture and reuse system. The City of Los Angeles (City) is the lead agency pursuant to the CEQA.

ESA personnel involved in the preparation of this report are as follows: Monica Strauss, M.A., RPA., Project Director; Russell Shapiro, Ph.D., Principal Investigator and report author; Michael Vader, B.A., report contributor; and Jason Nielson, GIS specialist. Resumes of key personnel are included in **Appendix A**.

Project Location

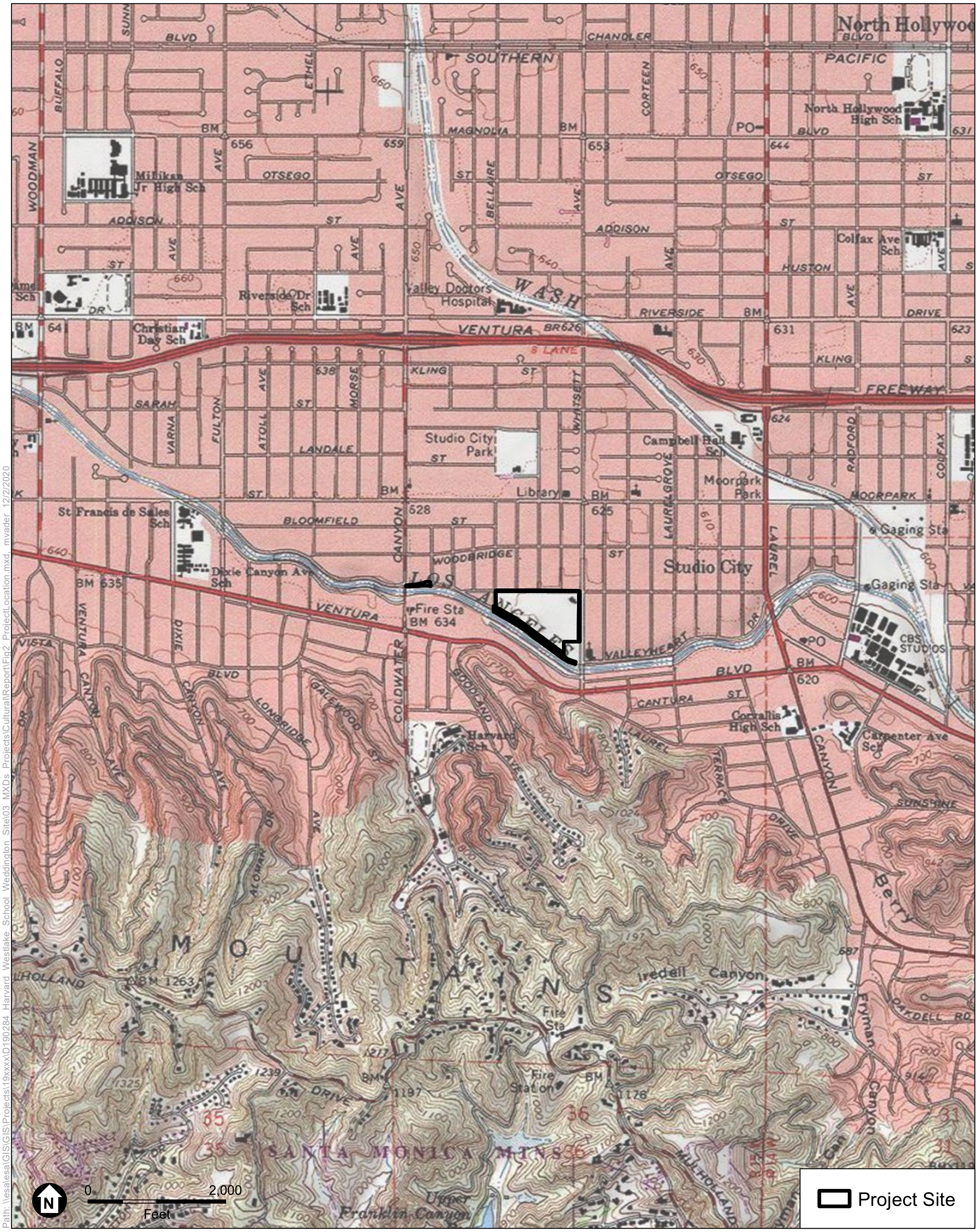
The 17.2-acre Project Site is within the Studio City neighborhood of Los Angeles in the southern San Fernando Valley (**Figure 1**). The Project Site is located within unsectioned portions of Township 1 North, Range 15 West on the Van Nuys, CA 7.5-minute United States Geologic Survey (USGS) topographic quadrangle (**Figure 2).** Collectively, the Project Site encompasses 17.2 acres including the existing Club which is a privately-owned nine-hole, 27-par golf course and tennis facility situated on a 16.1-acre parcel owned by the School located at 4141 Whitsett Avenue, as well as a 1.1-acre parcel located between the Club and the Los Angeles River which the School leases from Los Angeles County (Leased Property). The 16.1-acre Property consists of one parcel in the City of Los Angeles (City) generally bounded by Bellaire Avenue to the west, Valley Spring Lane to the north, the Los Angeles River to the south, and Whitsett Avenue to the east. Los Angeles Fire Department Station 78 is located immediately south of the Project Site along Whitsett Ave. The Project Site is within Assessor Parcel Numbers (APNs) 2375-018-020 and 2375-018-903 (**Figure 3**). The Project also involves off-site improvements to Valleyheart Drive, located primarily to the south of LAFD Fire Station 78, and to portions of the Zev Yaroslavsky Los Angeles River Greenway (Zev Greenway), an improved public trail along the north edge of the Los Angeles River.



SOURCE: Open Street Map; ESA, 2020.

Harvard-Westlake River Park Project

Figure 1
Regional and Local Map



TOPO QUAD: Van Nuys, CA 7.5-minute

Harvard Westlake River Park Project

Figure 2
Project Location - USGS Map

ESA

SOURCE: ESA, 2020.

Harvard-Westlake River Park Project

Figure 3
Existing Project Site

Project Description

Harvard-Westlake School is proposing to repurpose a 17.2-acre Project Site for use by the School as an athletic and recreational facility, while also providing for access and recreational use by the public (**Figure 4).** The Project also involves off-site improvements to Valleyheart Drive, located primarily to the south of Fire Station 78, and to portions of the Zev Greenway. The Project would implement an extensive tree and landscaping program.

The Project includes two athletic fields, with Field A located in proximity to Whitsett Avenue in the southeast sector of the Project Site, and Field B, located in proximity to Valley Spring Lane and Bellaire Avenue, in the west sector of the Project Site. Field houses for maintenance and storage are proposed at each field.

The Project would include an 80,249-square-foot multi-purpose gymnasium, located in the south sector of the Project Site, and a 52-meter swimming pool with additional supporting locker and meeting room space. The pool would be located in the north-central sector of the Project Site to the west of eight tennis courts with seating. Other new development would include security kiosks and a below-grade parking structure (one subterranean–level) with approximately 503 automobile parking spaces. Access to the parking structure would be via a two-way driveway on Whitsett Avenue. Another point of access to the Project Site and below-grade parking structure would be via a drop-off and roundabout from Valleyheart Drive at the southeast corner of the Project Site. This vehicle entrance area would also accommodate 29 surface parking spaces. In addition, the Project would include a stormwater capture and reuse system for water conservation and treatment purposes, with 1-million-gallons of storage capacity below ground. The Project would also provide approximately 5.4 acres of publicly-accessible open space and landscaped trails connecting to the adjacent Zev Greenway and on-site landscaped areas, water features, and recreational amenities.

The original, on-site Weddington Golf & Tennis clubhouse, including its café, would remain as part of the Project and would continue to be open to the public. An existing putting green to the northeast of the clubhouse, five existing "golf ball" light fixtures and poles, and the low brick retaining wall along the northwest edge of the property would also remain.

Construction of the Project is anticipated to begin in 2022 pending Project consideration and approval, and is estimated to be completed in 2025 with construction occurring for approximately two and a half years (approximately 30 months). Construction is expected to take place in a single construction phase. Project development would disturb a majority of the Project Site (746,532 square feet) and require excavation and grading to a maximum depth of approximately 21 feet for construction of the below-grade parking facility, gymnasium basement, and the stormwater capture and reuse system. Unadjusted rough grading cut volumes would be approximately 251,836 cubic yards (unadjusted) and the fill volume would be approximately 1,836 cubic yards, for a net cut/fill volume of approximately 250,000 cubic yards. Because cut soils would exceed fill soils, export and disposal off-site would be required. Construction would be consistent with the allowable hours per the LAMC Chapter IV, Section 41.40.

SOURCE: Gensler, 2020

Figure 4
Harvard-Westlake School Athletic and Recreational Facilities Conceptual Site Plan

Regulatory Framework

Society for Vertebrate Paleontology Standard Guidelines

The Society for Vertebrate Paleontology (SVP) has established standard guidelines[1] that outline professional protocols and practices for conducting paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. The Paleontological Resources Preservation Act (PRPA) of 2009 calls for uniform policies and standards that apply to fossils on all federal public lands. All federal land management agencies are required to develop regulations that satisfy the stipulations of the PRPA. As defined by the SVP[2], significant nonrenewable paleontological resources are:

> *Fossils and fossiliferous deposits here are restricted to vertebrate fossils and their taphonomic and associated environmental indicators. This definition excludes invertebrate or paleobotanical fossils except when present within a given vertebrate assemblage. Certain invertebrate and plant fossils may be defined as significant by a project paleontologist, local paleontologist, specialists, or special interest groups, or by lead agencies or local governments.*

As defined by the SVP,[3] significant fossiliferous deposits are:

> *A rock unit or formation which contains significant nonrenewable paleontologic resources, here defined as comprising one or more identifiable vertebrate fossils, large or small, and any associated invertebrate and plant fossils, traces, and other data that provide taphonomic, taxonomic, phylogenetic, ecologic, and stratigraphic information (ichnites and trace fossils generated by vertebrate animals, e.g., trackways, or nests and middens which provide datable material and climatic information). Paleontologic resources are considered to be older than recorded history and/or older than 5,000 years BP [before present]*.

Based on the significance definitions of the SVP[4], all identifiable vertebrate fossils are considered to have significant scientific value. This position is adhered to because vertebrate fossils are relatively uncommon, and only rarely will a fossil locality yield a statistically significant number of specimens of the same genus. Therefore, every vertebrate fossil found has the potential to provide significant new information on the taxon it represents, its paleoenvironment, and/or its distribution. Furthermore, all geologic units in which vertebrate fossils have previously been

1 Society of Vertebrate Paleontology, Standard procedures for the assessment and mitigation of adverse impacts to paleontologicalresources,2010,http://vertpaleo.org/Membership/Member-Ethics/SVP_Impact_Mitigation_Guidelines.aspx. Accessed February 8, 2021.

2 Society of Vertebrate Paleontology, Assessment and mitigation of adverse impacts to nonrenewable paleontologic resources: standard guidelines, Society of Vertebrate Paleontology News Bulletin 163:22-27, 1995.

3 Society of Vertebrate Paleontology, Assessment and mitigation of adverse impacts to nonrenewable paleontologic resources.

4 Society of Vertebrate Paleontology, Assessment and mitigation of adverse impacts to nonrenewable paleontologic resources.

found are considered to have high sensitivity. Identifiable plant and invertebrate fossils are considered significant if found in association with vertebrate fossils or if defined as significant by project paleontologists, specialists, or local government agencies

State Regulations

California Penal Code Section 622.5

California Penal Code Section 622.5 provides the following: "Every person, not the owner thereof, who willfully injures, disfigures, defaces, or destroys any object or thing of archeological or historical interest or value, whether situated on private lands or within any public park or place, is guilty of a misdemeanor."

California PRC Section 5097.5

California PRC Section 5097.5 provides protection for paleontological resources on public lands, where Section 5097.5(a) states, in part, that:

No person shall knowingly and willfully excavate upon, or remove, destroy, injure, or deface, any historic or prehistoric ruins, burial grounds, paleontological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, rock art, or any other paleontological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over the lands

Local

City of Los Angeles General Plan

Conservation Element

The City's General Plan Conservation Element recognizes paleontological resources in Section 3: "Archeological and Paleontological" (II-3), specifically the La Brea Tar Pits, and identifies protection of paleontological resources as an objective (II-5). The General Plan identifies site protection as important, stating, "Pursuant to CEQA, if a land development project is within a potentially significant paleontological area, the developer is required to contact a bonafide paleontologist to arrange for assessment of the potential impact and mitigation of potential disruption of or damage to the site. Section 3 of the Conservation Element, adopted in September 2001, includes policies for the protection of paleontological resources. As stated therein, it is the City's policy that paleontological resources be protected for historical, cultural research, and/or educational purposes. Section 3 sets as an objective the identification and protection of significant paleontological sites and/or resources known to exist or that are identified during "land development, demolition, or property modification activities." Section 5 of the Conservation Element recognizes the City's responsibility for identifying and protecting its cultural and historical heritage. The Conservation Element establishes the policy to continue to protect historic and cultural sites and/or resources potentially affected by proposed land development, demolition, or property modification activities, with the related objective to protect important cultural and historical sites and resources for historical, cultural, research, and community educational purposes.[5]

Methods and Results

The Project Site was the subject of thorough background research and analysis to assess its paleontological sensitivity. The research included a paleontological records search conducted by the Natural History Museum of Los Angeles County (LACM), as well as geologic map and literature reviews conducted by ESA Principal Paleontologist, Russell Shapiro, Ph.D.

Geologic Setting

The Project is situated in the southeast San Fernando Valley, just west of the Cahuenga Pass, adjacent to the north slope of the Santa Monica Mountains. The triangular-shaped San Fernando Valley is well known for active tectonics, including major earthquakes in 1971, 1987, and 1994 (Morton and Yerkes, 1987; Lagenheim et al., 2011). The Santa Monica Mountains are one of several linear chains comprising the Transverse Ranges. Like the rest of the Transverse Ranges, the Santa Monica Mountains are a site of active tectonism with the bedrock folded into a series of anticlines atop buried thrust faults. Mapping by Dibblee and Ehrenspeck (1991) shows that the Santa Monica Mountains are composed of bedrock of quartz diorite intrusions overlain by fault-bound basins filled with Miocene-age marine formations. A more recent map compiled by Yerkes (1996) confirms the earlier boundaries but divides the surficial units of the valley into older (Qay1) and younger (Qay2) alluvium.

Geologic Map and Literature Review

Geologic mapping by Yerkes (1996) indicates that the surface of the Project is mapped as Holocene-age (11,650 years ago to present) alluvium, including units Qay1 and Qay2, which presumably overlie Pleistocene-age (2,580,000 to 11,700 years ago) Quaternary alluvium (Qao) and the Miocene-age (23.03 to 5.333 million years ago) Modelo formation (Tmd) (**Figure 5**). In addition, geotechnical testing undertaken for the Project indicates the surface of the Project Site is comprised of fill (Geotechnologies, 2020). These geologic units are summarized in **Table 1** and discussed in detail following the table.

5 City of Los Angeles General Plan, Conservation Element, pages II-6 to II-9.

TABLE 1 SUMMARY OF GEOLOGIC UNITS WITHIN AND IMMEDIATELY ADJACENT TO PROJECT

Geologic Unit	Map Unit Symbol	Age	Description	Depth	Paleo Sensitivity
Fill Material	-	-	Sandy silt, silty sand, sandy clay and clayey sand, which range from light brown to dark brown in color	Surface to 2-7 feet deep	Low
Holocene-age Alluvium	Qay1	Holocene (1,000-10,000 years ago);	Alluvial gravel, sand and silt-clay; includes gravel and sand of stream channels. Unconsolidated	2-7 feet deep to 42.5-56.5 feet deep	Low to High
Holocene-age Alluvium	Qay2	Late Holocene (less than 1,000 years ago)	Alluvial gravel, sand and silt-clay; includes gravel and sand of stream channels. Unconsolidated	2-7 feet deep to 42.5-56.5 feet deep	Low
Pleistocene-age Alluvium	Qao	Pleistocene (2,580,000 to 11,700 years ago)	Gray to light brown pebble-gravel, sand, silt and clay derived from Santa Monica Mountains	5-20 feet deep	High
Upper Modelo Formation	Tmd	Late Miocene	White-weathering diatomaceous shale and diatomite, locally bentonitic, interlayered with find grained sandstone	42.5-56.5 feet deep	High

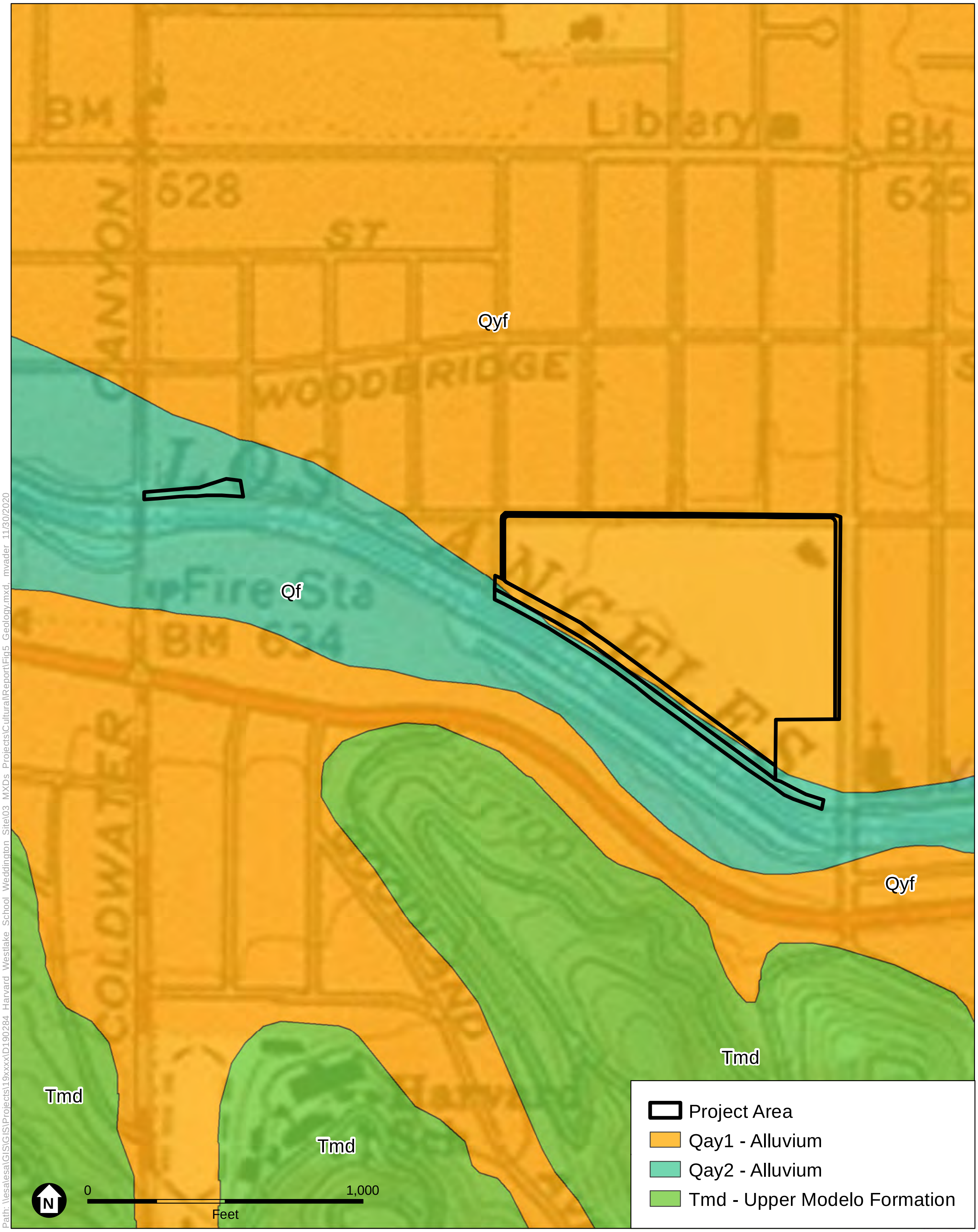
SOURCE: GeoTechnologies 2019; Yerkes, 1996

Fill Material. The geotechnical work conducted for the Project indicates fill material is present at surface within the Project Site extending from the surface to depths ranging from 2 to 7 feet deep. The fill material is comprised of sandy silt, silty sand, sandy clay and clayey sand, which range from light brown to dark brown in color, and are slightly moist to moist, medium dense to dense, and fine to coarse grained (Geotechnologies, 2020).

Holocene-age Alluvium (Qay1 and Qay2): Geologic mapping indicates much of the Project is mapped at surface as consisting of older Holocene Quaternary alluvium (Qay1) with the exception of the proposed ADA compliant accessible pedestrian ramp leading to the Zev Greenway at Coldwater Canyon Avenue, which is mapped as younger Holocene Quaternary alluvium (Qay2) (Yerkes, 1996).

- **Qay1:** This older Holocene Quaternary alluvium infilled the San Fernando valley floor adjacent to the uplifting mountains and was deposited between 1,000 and 10,000 years ago, encompassing almost the entirety of the Holocene (Yerkes, 1996).

- **Qay2:** This younger Holocene Quaternary alluvium underlies portions of the Los Angeles River Channel subject to historic flooding and has been deposited within the past 1,000 years. (Yerkes, 1996).



SOURCE: Yerkes, 1996

Harvard Westlake River Park Project

Figure 5
Geology

Geotechnical testing indicates native alluvial sediments consisting of silty sand, clayey silt, silty clay, clayey sand, sandy silt and sand, underlie the fill material. These materials consist of alluvial sediments deposited as alluvial fans and river and stream action typical to this area of the San Fernando Valley and extend from depths of 2-7 feet deep to 42.5-56.5 feet deep (Geotechnologies, 2020).

Pleistocene-age Alluvium (Qao): Older alluvial fan deposits are not mapped at surface in the Project Site but are shown on the cross-section by Dibblee and Ehrenspeck (1991b) and are anticipated to occur throughout the Los Angeles basin below the Holocene-age alluvium. Based on similar geological settings, the younger alluvium overlies Pleistocene-age alluvium at a depth ranging from 5-20 feet. Elsewhere in the Los Angeles Basin, Pleistocene sediments have a rich fossil history (e.g., Hudson and Brattstrom, 1977; Jefferson, 1991a and b; Miller, 1941, 1971; Scott and Cox, 2008; Dooley et al., 2019). The most common Pleistocene terrestrial mammal fossils include the bones of mammoth, bison, deer, and small mammals, but other taxa, including horse, lion, cheetah, wolf, camel, antelope, peccary, mastodon, capybara, and giant ground sloth, have been reported (Graham and Lundelius, 1994), as well as reptiles such as frogs, salamanders, and snakes (Hudson and Brattstrom, 1977). In addition to illuminating the striking differences between Southern California in the Pleistocene and today, this abundant fossil record has been vital in studies of extinction (e.g. Sandom et al., 2014; Barnosky et al., 2004), ecology (e.g. Connin et al., 1998), and climate change (e.g. Roy et al., 1996).

Modelo Formation (Tmd): Geologic mapping indicates bedrock of the mountains adjacent to the Project is underlain by the uppermost formation of the Miocene series, the Modelo Formation (Tmd). The Modelo Formation is equivalent to the Sisquoc Formation of Dibblee (1989) to the west in the Ventura Basin. The Modelo Formation comprises a thick sequence of soft, white-weathering diatomaceous shale and diatomite (Hoots, 1931). Based on large scale mapping, the Modelo Formation was primarily deposited as submarine fans in fault-bound restricted basins (Rumelhart and Ingersoll, 1997; Gordon, 2014). Recently dated by tuff chronology to younger than 8.99 million years old (Martinez et al., 2020). This places the age within the upper Mohnian stage (13.5-7.5 million years ago).

The Modelo Formation is well-known for both its invertebrate fossils as well as the preservation of fish. Reports of invertebrate fossils in a pair of graduate theses at the California Institute of Technology date to the late 1940s and 1950s (Buffinton, 1947; Wright, 1951).

Vertebrate faunas are well-described from the Modelo Formation and generally consist of fish scales (e.g., Pierce, 1956). While a significant diversity of fish has been described, nearly all inhabited deep water environments (David, 1943). More recent work has shed light on specific groups such as teleost fish (Stewart, 1995), sunfishes (Hakel and Stewart, 2002), and lanternfish (Denton, 2013)—the latter paper describing complete articulated specimens, not merely scales. In addition to the diverse fish fauna, marine mammals have also been recovered from the Modelo, including dolphins (Barnes, 1985) and whales (Bussino and Barnes, 1984). The author of this report has collected articulated whales from the Modelo Formation north of the Project Site in the Simi Hills.

A search of the holdings of the University of California Museum of Paleontology (UCMP) yielded a rich record of both microfossils and fish. The fish belong to four different species of osteichthyans (*Rixator*, *Syngnathus*, *Scomberesus*, and *Lampanyctus*) representing such diverse forms as pipefish and lanternfish. Interestingly, there was also a fossil cormorant (*Phalacrocorax*) collected from the Modelo.

Geotechnical testing indicates bedrock consists of shale, siltstone, sandstone and mudstone of the Modelo formation underlies the alluvium at depths ranging from 42.5 to 54.6 feet (Geotechnologies, 2020).

LACM Records Search

On October 9, 2020, ESA requested a database search from the LACM for records of fossil localities in and around the Project Site. The purpose of the museum records search was to: (1) determine whether any previously recorded fossil localities occur in the Project Site, (2) assess the potential for disturbance of these localities during construction, and (3) evaluate the paleontological sensitivity within the Project Site and vicinity. The LACM records search indicates a number of fossil localities have been previously recovered from the Modelo Formation (Tmd) in the vicinity of the Project Site (Bell 2020). These localities are summarized in **Table 2**. The LACM records search results are included in **Appendix B.**

TABLE 2 SUMMARY OF LACM FOSSIL SPECIMEN LOCALITIES

Locality No.	Formation	Taxa	Depth	Distance from Project
LACM IP 5094	Modelo Formation	Scallops (*Pecten*)	Unknown	465 feet south
LACM IP 4888	Modelo Formation	Unspecified invertebrates	Unknown	560 feet south
LACM IP 163	Modelo Formation	Unspecified invertebrates	Unknown	0.60 miles south
LACM VP 1282, 4502, 4504,4505, 4507, 4457	Modelo Formation	Fish (*Teleosts, Osteichthyes*)	Surface	1.10 miles southeast

SOURCE: Bell, 2020

Although not included as part of LACM records search conducted for this Project, records searches conducted for other projects in the vicinity of the Project Site and within the San Fernando Valley indicate a number fossil localities in the region originating from Pleistocene-age alluvial sediments, which are presumed to underlie the Qay1 alluvial deposits mapped at surface throughout much of the Project Site (McLeod, 2013 and 2019). These fossil localities include the following:

- **LACM 6970:** This locality produced an assemblage of Pleistocene megafauna including fossil camel (*Camelops hersternus*), bison (*Bison antiquus*), and ground sloth (*Glossotherium harlani*), between 60 and 80 feet below ground surface, approximately 1.15 miles northeast of the Project Site.

- **LACM 3822:** This locality produced fossil specimens of extinct peccary (*Platygonus*), camel (*Camelops*), and bison (*Bison*) from depths of 75-100 feet below the ground surface, approximately 2.5 miles northwest of the Project Site.

- **LACM 3263 and 6208:** These localities produced fossil specimens of horse (*Equus*) fossils at 14 feet below the ground surface and extinct bison (*Bison*) at 20 feet below the ground surface, respectively, approximately 3.5 miles northwest of the Project Site.

Paleontological Sensitivity Analysis

The literature and geologic mapping review, as well as the records search results, were used to assign paleontological sensitivity to the geologic units at surface and underlying the Project Site, following the guidelines of the SVP (2010):

Fill Material: As indicated by geotechnical testing, fill material is present at the surface of the Project Site. It is unclear as to where the fill material came from and so assigning an age is impossible. Given the relative age of the fill it is unlikely to contain intact fossiliferous deposits. Therefore, this unit is assigned **No Potential** to contain paleontological resources.

Qay1: This Holocene alluvium mapped within much of the Club portion of the Project Site dates to the Holocene from a period of 1,000-10,000 years ago. Fossil specimens have not been identified within nearby Holocene-age sediments; however, SVP guidelines indicate that fossils can be as young as 5,000 years old, a time frame encompassing the age of these sediments. While excavation into the uppermost (or more recent) layers of these Holocene deposits would not impact fossils, deeper excavations into Holocene-age soils could encounter paleontological resources per the SVP's minimum age threshold (e.g. 5,000 years) for what may constitute a fossil. Therefore, this unit is assigned a **Low-to-High Potential** to contain paleontological resources, increasing with depth.

Qay2: This Holocene alluvium is mapped as overlapping the southern margin of the clubhouse portion of the Project Site, as well as the ADA compliant accessible pedestrian ramp portion of the Project Site dates to the Holocene from a period of 1,000 years ago to the present. Given its age, this alluvium is too young to contain fossil specimens and, therefore, has **Low Potential** to contain paleontological resources**.**

Pleistocene Alluvium: Although not mapped at surface within the Project Site, these Pleistocene-age sediments presumably overlie the Holocene-age Qay1 alluvium at depths ranging from 5-20 feet below the ground surface. A wide variety of Ice Age fossils have been found in these sediments across the Los Angeles Basin, as reviewed above, including multiple localities known from within one to several miles of the Project Site (Jefferson, 1991a and b; McLeod, 2019). Given the available evidence, this geologic unit is assigned a **High Potential** to contain paleontological resources.

Modelo Formation (Tmd): The Modelo Formation has produced important vertebrate fossils in the Los Angeles Basin, including localities near the Project Site. Recent discoveries of articulated fish as well as significant improvements in the age dating of the formation expand the sensitivity of the formation. Based on the available evidence, the Modelo Formation is assigned a **High Potential** to contain paleontological resources.

Conclusions and Recommendations

Project ground disturbing activities will include grading and excavations extending to depths of 21 feet. Geotechnical testing indicates a layer of fill materials extends from the surface to depths between 2-7 feet. Artificial fill has no paleontological potential, therefore excavations in this unit will not impact paleontological resources. The fill is underlain by alluvial sediments dating to the Holocene (Qay1 [1,000-10,000 years old] and Qay2 [less than 1,000 years old]) and to the Pleistocene. The Pleistocene-age alluvium is presumed to underlie the Qay1 alluvium at depths ranging from 5-20 feet. The Qay2 alluvial unit is too young to contain fossil specimens and has low paleontological potential, but the Qay1 alluvial unit is may contain fossil specimens meeting SVP's age threshold of older than 5,000 years, and, therefore has a low-to-high and high paleontological potential increasing with depth. The underlying Pleistocene-age alluvium is of appropriate age to contain paleontological resources and has produced a number of fossil specimens in the San Fernando Valley. Therefore, the Pleistocene-age alluvium has high paleontological sensitivity. Additionally, the Miocene-age Modelo Formation, which has high paleontological potential, may underlie the Project Site at depths ranging below 42.5-56.5 feet deep.

Ground disturbing activities associated with the Project would extend to depths of approximately 21 feet thus disturbing sediments associated with the Qay1 alluvial unit and the Pleistocene-age alluvium, which extend beyond the 2 to 7-foot depth of fill material and have low to high and high sensitivity, respectively. Therefore, Project-related ground disturbing activities could encounter paleontological resources. The City has established a standard condition of approval to address inadvertent discovery of paleontological resources. Should paleontological resources be inadvertently encountered, the condition of approval provides for temporary halting of construction activities near the encounter so the find can be evaluated. A paleontologist would temporarily divert or redirect grading and excavation activities in the area of the exposed material to facilitate evaluation and, if necessary, salvage. The paleontologist would then assess the discovered material(s) and prepare a survey, study or report evaluating the impact. Harvard-Westlake School would then comply with the recommendations of the evaluating paleontologist, and a copy of the paleontological survey report would be submitted to the Los Angeles County Natural History Museum and the Department of City Planning. Ground-disturbing activities may resume once the paleontologist's recommendations have been implemented to the satisfaction of the paleontologist. In accordance with the condition of approval, all activities would be conducted in accordance with regulatory requirements.

With implementation of the City's established condition of approval to address any inadvertent discovery of paleontological resources, Project impacts would be less than significant.

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APPENDIX A
Personnel

Monica Strauss, RPA

Director, Southern California Cultural Resources Group

EDUCATION

MA, Archaeology, California State University, Northridge

BA, Anthropology, California State University, Northridge

AA, Humanities, Los Angeles Pierce College

23 YEARS OF EXPERIENCE

SPECIALIZED EXPERIENCE

Treatment of Historic and Prehistoric Human Remains

Archaeological Monitoring

Complex Shell Midden Sites

Groundstone Analysis

PROFESSIONAL AFFILIATIONS

Register of Professional Archaeologists (RPA), #12805

Society for California Archaeology (SCA)

Society for American Archaeology (SAA)

QUALIFICATIONS

Exceeds Secretary of Interior's Qualifications Standards for Archaeology

Meets Caltrans PQS for Principal Investigator

CA State BLM Permitted

NV State BLM Permitted

Monica provides senior oversight to a multi-disciplinary team of cultural resources specialists throughout Southern California, including archaeologists, architectural historians, historians, and paleontologists. During her 23 years of practice, Monica has successfully directed hundreds of cultural resources projects meeting local, state, and/or federal regulatory requirements. Monica's strength lies in assisting clients in navigating complex cultural resources issues in the contexts of the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), and Section 106 of the National Historic Preservation Act (NHPA). Monica's experience ranges from large infrastructure projects that are controversial and multi-jurisdictional to smaller development projects that are important to local agencies and stakeholders. She has excellent experience working with agencies to develop creative mitigation to address challenging cultural resources impacts. She directs a staff who conduct Phase 1 archaeological/ paleontological and historic architectural surveys, construction monitoring, Native American outreach, archaeological testing and treatment, historic resource significance evaluations, and large-scale data recovery programs. Monica is expert in the area of Assembly Bill 52 and routinely provides training to her clients as well as being a workshop content author and session presenter for the Association of Environmental Professionals on the topic.

Relevant Experience

Los Angeles Department of Water and Power (LADWP) Foothill Trunk Line Project. City of Los Angeles, CA. *Cultural Resources Senior Reviewer.* ESA archaeologists have prepared a Phase I cultural resources study and EIR cultural resources section for the Los Angeles Department of Water and Power (LADWP) Trunk Line Project, located in the City of Los Angeles, CA. The proposed project includes the replacement of 16,600 feet of existing 24-inch-, 26-inch-, and 36-inch-diameter welded steel pipe and 30-inch-diameter riveted steel pipe with a 54-inch-diameter welded steel pipe along Foothill Boulevard within the districts of Pacoima and Sylmar. Monica served as the Senior Reviewer for the Phase I cultural resources study and EIR section.

Santa Clarita Valley Sanitation District, Facilities Plan Update EIR, Los Angeles County, CA. *Cultural Resources Senior Reviewer.* Monica is currently serving as senior reviewer for the Phase I cultural resources study for the project. The study identified 23 cultural resources within or adjacent to the project, including the historical San Fernando Road. The resources were documented and evaluated for their eligibility to the California Register in a technical report and the results were incorporated into the EIR. The project includes installation of an approximately 35-mile recycled water pipeline from the Santa Clarita Valley to east Los Angeles.

Santa Susana Field Laboratory, Ventura County, CA. *Cultural Resources Project Director.* The Santa Susana Field Laboratory is a former rocket engine test, nuclear, and liquid metals research facility located on a 2,849- acre portion of the Simi Hills in Simi Valley, California. The uses of hazardous substances such as trichloroethylene and other solvents, heavy metals, and radioactive material at the field laboratory have resulted in soil and/or groundwater contamination. The field laboratory is currently the focus of a comprehensive environmental investigation and cleanup program conducted by Boeing, the U.S. Department of Energy (DOE), and the National Aeronautics and Space Administration (NASA) and overseen by the Department of Toxic Substances Control (DTSC). ESA is preparing a Program EIR that will evaluate soil and groundwater remediation activities. Because there are multiple responsible parties with separate cleanup actions, the Program EIR will provide a framework for tiered environmental documents to be prepared to address the development and refinement of remediation approaches and actions. Monica is overseeing a team of specialists who are conducting a geoarcheological and archaeological district studies for use in addressing impacts to archaeological resources in the EIR. Monica provides strategic guidance to DTSC on cultural resources-related issues, including Tribal outreach, approach to the Traditional Cultural Property, resource evaluations, and treatment of cultural resources on a project and program level.

California Department of Water Resources (DWR), Perris Dam Remediation Program, Riverside County, CA. *Cultural Resources Project Director*. Monica managed the preparation of a Historic Resource Evaluation Report for the DWR Perris Remediation Project. The Project would provide greater seismic stability for Perris Dam and its associated outlet works, as well as adding a new emergency outlet extension channel, thereby increasing public safety in the event of a high-magnitude earthquake. The project involved the U.S. Army Corps of Engineers, requiring compliance with Section 106 of the NHPA The study concluded that the dam is not individually eligible for the National Register or California Register, but is considered a contributing element of the California Aqueduct. The project would not affect the eligibility or integrity of the California Aqueduct and a finding of no adverse effect were recommended.

City of Los Angeles Recreation and Parks, Hansen Dam Skate Park Project, Los Angeles County, CA. *Cultural Resources Principal Investigator*. ESA prepared a joint EA and IS/MND for the Los Angeles Department of Recreation and Parks in coordination with the U.S. Army Corps of Engineers (Corps) for a proposed skate park facility within the Hansen Dam Recreation Area. Monica managed a Phase I Cultural resources Study, coordinated with the Army Corps of Engineers and provided senior review for the EA/IS/MND cultural resources section.

City of Los Angeles, Bielenson Special Needs Ball Field IS/MND and EA/FONSI, Los Angeles, CA. *Cultural Resources Project Director*. ESA prepared a joint EA/FONSI and IS/MND and for the U.S. Army Corps of Engineers and Los Angeles Department of Recreation and Parks, in partnership with the Los Angeles Dodgers Dream Foundation, for a proposed wheelchair accessible softball field within the Sepulveda Basin Recreation Area, Anthony C. Beilenson Park, in Los Angeles, California. The proposed action would include a 50-foot softball field with backstop, dugouts, and field fencing.

Russell S. Shapiro, PhD

Principal Investigator

EDUCATION

Ph.D., Geological Sciences, University of California, Santa Barbara, 1998
B.S., Geology, Humboldt State University, 1992

25 YEARS EXPERIENCE

CERTIFICATIONS/ REGISTRATION

U.S. Fish and Wildlife Cultural Resources Use Permit
U.S. Forest Service Cultural Resources Use Permit
Bureau of Land Management Cultural Resources Use Permit
Wilderness and Remote First Aid (Red Cross Certified)

PROFESSIONAL AFFILIATIONS

Geobiology Society; Treasurer
Society for Sedimentary Geology (SEPM); Vice-President
Society for Vertebrate Paleontology

As a Principal Investigator, Dr. Shapiro has been involved in review of paleontological resource reports and evaluating proposed mitigation plans. Dr. Shapiro researches and prepares environmental impact reports regarding cultural resources (fossils), conducts field (geological and paleontological) surveys, and oversees ground disturbance at construction sites for Environmental Quality compliance (CEQA, NEPA, and the Paleontological Resources Preservation Act). As a Qualified Paleontologist, Dr. Shapiro has also reviewed resource planning documents for several counties in California and was the lead on the Bureau of Land Management's assessment of fossil resources of Northern California.

In his academic role as Professor of Geology, Dr. Shapiro teaches several paleontology courses including "Applied Paleontology" which is a modified "Cultural Resources" course, focusing on budgeting, CEQA and NEPA regulations, field surveys, GIS projections, fossil recovery, and curation. He also teaches in the annual Field Camp courses and manages the rock preparation lab and maintains the microscopes.

Relevant Experience

ReneSola Gentry Solar Project, Paleontological Resource Assessment Report, Lincoln, California. *Principal Investigator, Mapping*. Literature, geological map, and museum review for fossil resources. Field mapping of entire property. Final product included a mitigation and monitoring plan.

Paleontological Sensitivity Analysis Report, Elk Grove, California; Pacific Gas and Electric. *Principal Investigator*. Literature, geological map, and air photo archival report on the potential fossil yield for a proposed pipeline. Recommendations based on searches of museum collections of relevant geological formations. Deliverables consisted of a sensitivity report and appendix of known fossil occurrences by taxa and location.

Mojave Solar Project Cultural Services; San Bernardino County, California; CH2M Hill. *Principal Investigator.* Reviewed technical report; advised on scientific analyses.

El Camino Real Bridge Replacement Environmental Services; San Luis Obispo County, California, Quincy Engineering. *Principal Investigator*. Reviewed technical report for CEQA/NEPA documentation, technical studies, and permitting, for the replacement of the El Camino Real bridge over Santa Margarita Creek in Atascadero.

San Bernardino County General Plan Update: Paleontological Resources Technical Report. *Primary Reviewer***.** External reviewer for general plan update. Involved assessing all geological formations in San Bernardino County and museum records of significant fossils.

Recent Significant Excavations

Miocene Vertebrates of the Sheldon Wildlife National Refuge. Oversaw operations to conduct significant collection of Miocene-age fossils from volcanic sediments for the U.S. Fish and Wildlife Service. Duties included field collection and high-resolution GPS mapping, fossil preparation and identification, curation at the Gateway Science Museum.

Eocene Horses from Black Butte Lake Reservoir. Field jacketing and preparation of fossil horse skull material from the reservoir under the direction of the U.S. Army Corps of Engineers. Fossils were prepared, identified, and returned to the Army Corps for public display.

Pleistocene Camelid from Nevada. This project grew out of a paleontological resource assessment field survey. During the survey, a semi-articulated rear leg of a late Pleistocene camelid was collected and prepared. A manuscript was published in 2016.

Publications and Presentations

Shapiro, R. S., 2016, Camelid record of Mesquite Lake, California: impact of earliest Holocene climate change in Reynolds, R. E., ed., Going LOCO investigations along the Lower Colorado River, 2016 Desert Symposium Field Guide and Proceedings, p 41-47.

Shapiro, R. S. and Konhauser, K. O., 2014, Hematite-coated microfossils: Ecological fingerprint or taphonomic oddity of the Paleoproterozoic? Geobiology, v. 13, p. 209-224.

Shapiro, R. S. and Spangler, E., 2009, Bacterial fossil record in whale falls: relation of taphonomy and paleoecology to depositional environment: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 274, p. 196-203.

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Shapiro, R. S., 1998, Paleogene-Early Neogene macrofossils of southwestern Santa Cruz Island in Weigand, P. W., ed., Contributions to the Geology of the Northern Channel Islands, Southern California: Pacific Section, American Association of Petroleum Geologists, MP-45, p. 123-132.

Michael Vader

Senior Associate

EDUCATION

BA, Physical Anthropology, University of California, Santa Barbara

M.A., Applied Archaeology (In Progress), California State University San Bernardino

13 YEARS OF EXPERIENCE

PROFESSIONAL AFFILIATIONS

Society for California Archaeology (SCA)

Society for American Archaeology (SAA)

Pacific Coast Archaeological Society (PCAS)

SPECIALIZED EXPERIENCE

Analysis of faunal remains including fish and shellfish species

Archaeological Monitoring

Paleontological Monitoring

Environmental Compliance Monitoring

Human osteology and bioarchaeology

Michael is cultural resources specialist with experience working on survey, data recovery, and monitoring projects. Michael has experience with project management, has led crews on multiple surveys and excavations, and is familiar with environmental compliance documents. He has worked on a variety of energy and water infrastructure projects throughout California, including projects in Riverside, San Diego, Imperial, San Bernardino, Los Angeles, Orange, Santa Barbara, San Luis Obispo, Kern, Fresno, Madera, and Inyo Counties, as well as in Clark County Nevada. Michael regularly works as part of a team, coordinating with field staff and agency leads.

Relevant Experience

San Gabriel Coastal Spreading Grounds Levee Retrofit Project, Pico Rivera, CA. *Archaeologist.* The Los Angeles County Department of Public Works retained ESA to prepare a cultural resources assessment for the San Gabriel Coastal Spreading Grounds (SGCSG) Levee Retrofit Project at the request of the Army Corps of Engineers in support of a 404 permit. The project will improve the stability and imperviousness of the SGCSG main levee, which is older than 50 years. ESA evaluated the levee for inclusion in the National Register and prepared an effects determination as part of the cultural resources assessment. Michael managed cultural resources staff and co-authored the cultural resources assessment.

Ventura Water Supply Projects, Ventura County, CA. *Project Manager.* The City of San Buenaventura (City) Water and Wastewater Department (Ventura Water) retained Environmental Science Associates to conduct a cultural resources assessment for the proposed Ventura Water Supply Projects in support of an Environmental Impact Report. The City is proposing to develop reliable potable water supplies for the population of the Ventura Water service area while at the same time complying with the Consent Decree among the City, Wishtoyo Foundation/Ventura Coastkeeper, and Heal the Bay. Michael managed cultural resources staff, led the survey, and authored the cultural resources assessment report.

Owens River Water Trail Project - Cultural Resources Assessment, Inyo County, CA. *Field Director.* The Water Department of Inyo County has retained Environmental Science Associates to prepare a cultural resources assessment for the Owens River Water Trail Project in support of an Environmental Impact Report. The proposed project would develop a recreational water trail along an approximately 6-mile-long stretch of the Owens River located east of Lone Pine Michael directed the cultural resources survey, and authored the cultural resources assessment report, and the Cultural Resources and Tribal Cultural Resources sections of the EIR.

DWR Pyramid Lake Maintenance Projects, Angeles National Forest, Los Angeles County, CA. *Archaeologist*. ESA was retained by the California Department of Water Resources to conduct a cultural resources study for improvements and repairs at three locations within the Pyramid Lake area in the Angeles National Forest. The Project includes the installation of a warning siren north of Frenchman's Flat Day Use Area, repairs to an existing bathroom at the Emigrant Landing swim beach, and revegetation at Los Alamos Campground Loops 3 and 4. Michael coordinated the cultural resources survey and prepared the archaeological resources report.

San Gabriel River Confluence with Cattle Canyon Improvements Project, Los Angeles National Forest, Los Angeles County, CA. *Archaeologist*. ESA has been retained by BlueGreen Consultants to prepare a joint EIS/R for the San Gabriel River Confluence with Cattle Canyon Improvements Project. The Project consists of recreational improvements and ecological restoration opportunities to address resource management challenges resulting from high public use of a 2.5-mile reach of the East Fork of the San Gabriel River, near its confluence with Cattle Canyon Creek in the Angeles National Forest. Michael led the cultural resources survey and prepared the Phase I cultural resources study report in support of the EIS/R.

DWR Castaic Lake Drawdown Project, Los Angeles County, CA. *Archaeologist.* DWR has drawn down the water level at Castaic Lake from its mean level at the 1,495-foot elevation contour to the 1,380-foot elevation contour as a result of State Water Project contractors borrowing water to meet their needs. Mitigation mandates the preparation of a Phase I cultural resources investigation if contractors borrow enough water to drawdown Castaic Lake to half its capacity. As such ESA was retained by DWR to conduct a Phase I cultural resources survey for the Castaic Lake Drawdown Project. Michael led the Phase I survey of the exposed shoreline around the lake and prepared the cultural resources survey report.

City of Los Angeles Department of Water and Power, Haskell Canyon Switching Station, Los Angeles County, CA. *Archaeologist.* ESA has prepared a Phase I cultural resources study for the Los Angeles Department of Water and Power (LADWP) Haskell Canyon Switching Station Project, located in Los Angeles County, CA. The proposed project includes the construction of the Haskell Canyon Switching Station on LADWP owned and private property south of the Angeles National Forest. Construction of the switching station would consist of clearing and upgrading of access roads, site grading and development, and installation of electrical conduits, structures, and equipment. Michael led the cultural resources survey and assisted in the preparation of the technical report.

Santa Clarita Valley Sanitation District, Chloride TMDL Facilities Plan Project, Santa Clarita, CA. *Archaeologist.* ESA archaeologists have prepared a Phase I cultural resources assessment and EIR cultural resources section for the Santa Clarita Valley Sanitation District Chloride TMDL Facilities Plan Project. The proposed project includes the construction of wastewater facilities, as well as pipeline expansions and upgrades within Los Angeles and Ventura Counties. Michael conducted archival research, facilitated Native American outreach, performed an archaeological survey of the project site, and contributed to the technical report and EIR cultural resources section.

APPENDIX B (CONFIDENTIAL – BOUND SEPERATELY)

LACM Records Search