GEOTECHNICAL EVALUATION

Centerpoint Integrated Solutions
Proposed CarMax Auto Superstore Development
Southwest of Plaza Bonita and Sweetwater Road
National City, County of San Diego, California 91950

November 6, 2015

EEI Project No. CIS-72092.4

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Project Site Location:

Proposed CarMax Auto Superstore Development
Southwest of Plaza Bonita Road and Sweetwater Road
APN 564-471-11-00
National City, County of San Diego, California 91950

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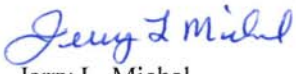

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this Geotechnical Evaluation was to provide preliminary geotechnical information to Centerpoint Integrated Solutions ("Client") regarding the subject property in the City of National City, San Diego County, California. The information gathered in this evaluation is intended to provide the Client with an understanding of the physical conditions of site-specific subsurface soils, groundwater, and the regional geologic setting which could affect the cost or design of the proposed development at the property (Site Location Map-**Figure 1**, Aerial Site Map-**Figure 2**).

This Geotechnical Evaluation has been conducted in general accordance with the accepted geotechnical engineering principles and in general conformance with the approved proposal and cost estimate for the project by EEI, dated February 9, 2015, revised September 3, 2015. We understand that the Client is planning to develop the property for a CarMax Auto Superstore development.

EEI conducted an onsite field exploration on October 2, 5, 6, 7 and 8, 2015, which included drilling and sampling of twenty-one (21) hollow stem auger geotechnical borings and four (4) Cone Penetrometer Test (CPT) soundings for the proposed development at the subject property. This Geotechnical Evaluation has been prepared for the sole use of Centerpoint Integrated Solutions. Other parties, without the express written consent of EEI and Centerpoint Integrated Solutions should not rely upon this Geotechnical Evaluation.

1.2 Project Description

Based on our review of the preliminary site plan exhibit prepared by Charles J. O'Brien Architects (2013), the subject property comprises a total of 14.81-acres, including the proposed residual area. The planned area for development is approximately 9.43-acres. An approximately 19,285 square-foot CarMax Auto dealership building (assumed one- to two-stories) is planned for the central portion of the property, and will include a sales area, service area, and a presentation area. Additionally, a car wash building of approximately 936 square feet is also planned. The remainder of the property is to be developed with paved parking and drive areas and other related improvements. No detailed grading plans were available at the time of our preparation of this proposal; however, grading at the property is anticipated to include fill of up to 10 feet to raise the existing site elevations (exclusive of any remedial work).

1.3 Scope of Services

The scope of our services included:

- A review of readily available data pertinent to the subject property, including published and unpublished geologic reports/maps, and soils data for the area (**References**).

- Conducting a geotechnical reconnaissance of the subject property and nearby vicinity.

- Coordination with Underground Service Alert and property personnel to identify the presence of underground utilities for clearance of proposed boring locations.

- Drilling and logging of twenty-one (21) small diameter exploratory borings in readily accessible areas of the subject property to depths of approximately 5 feet to 51.5 feet below the ground surface (bgs). The approximate locations of each of our borings are presented on **Figure 3** (Boring Location Map).

- The advancement of four (4) Cone Penetrometer Tests soundings to a depth of approximately 50 feet below existing ground surface elevations. The locations of our cone penetration (CPT) soundings are presented on **Figure 3** (Boring Location Map).

- The performance of five (5) field percolation tests at an approximate depth of 5 feet below the ground surface to provide preliminary information for stormwater design purposes. Testing was performed in accordance with County of San Diego DEH guidelines for percolation test methods.

- An evaluation of seismicity and geologic hazards to include an evaluation of faulting and liquefaction potential.

- Completion of laboratory testing of representative earth materials encountered onsite to ascertain their pertinent soils engineering properties, including corrosion potential (**Appendix B**).

- The preparation of this report which presents our preliminary findings, conclusions, and recommendations.

2.0 BACKGROUND

2.1 Subject Property Description

The subject property is located at the southwest corner of the intersection of Sweetwater Road and Plaza Bonita Road, in National City, County of San Diego, California (**Figure 2**). The property consists of a single, irregular-shaped parcel, identified by Assessor's Parcel Number (APN) 564-471-11-00, and encompasses approximately 15-acres of undeveloped land. According to a Client provided map, a CarMax Auto Superstore is proposed for future development of the property.

In general, the surrounding area and vicinity development includes a mix of residential, retail, and light commercial. The subject property is immediately bound by Highway 54 to the north, Sweetwater River to the south, Plaza Bonita Road and commercial-retail shopping center to the east, and Highway 805 to Highway 54 onramp to the west. Based on historical records such as aerial photographs, and topographic maps, the property was once used as a golf course which extended into adjacent properties.

The center of the subject property is approximately situated at 32.6587° north latitude and 117.0688° west longitude (GoogleEarth®, 2015).

2.2 Topography

The subject property is located on the United States Geological Survey (USGS), National City, 7.5-Minute Quadrangle (USGS, 2015). The property elevation ranges from approximately 25 feet above mean sea level (amsl) (southwestern portions) to approximately 40 feet amsl (northeastern portions). Based solely on topography, surface runoff generated on the property would flow towards the lower elevations in the southwestern portions of the property; eventually ending up in the Sweetwater River channel, located southwest of the property.

2.3 Geologic Setting

Regionally, the subject property lies within the Peninsular Ranges Geomorphic Province of southern California. This province consists of a series of ranges separated by northwest trending valleys; sub parallel to branches of the San Andreas Fault (CGS, 2002).

The Peninsular Ranges geomorphic province, one of the largest geomorphic units in western North America, extends from the Transverse Ranges geomorphic province and the Los Angeles Basin, south to Baja California. It is bound on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province. The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks (CGS, 2002). Major fault zones and subordinate fault zones found in the Peninsular Ranges Province typically trend in a northwest-southeast direction.

Regional geologic maps of the subject property and vicinity indicate the property is underlain by Quaternary-aged sedimentary deposits, consisting of Holocene and late Pleistocene-aged young alluvial flood-plain deposits. These alluvial deposits are described as consisting of poorly consolidated, poorly sorted, permeable flood-plain deposits of sandy, silty or clay-bearing alluvium.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 Field Exploration

Fieldwork for our Geotechnical Evaluation was conducted on October 2, 5, 6, 7 and 8, 2015. A total of twenty-one (21) hollow stem auger borings were drilled in readily accessible areas within the subject property boundaries. Boring depths ranged from approximately 5 feet to approximately 51.5 feet below the existing ground surface (bgs), and were logged and sampled under the supervision of a Professional Engineer with EEI. The subsurface exploration also included the advancement of a total of four (4) cone penetration test (CPT) soundings. The CPT soundings were each advanced to approximate depth of 50 feet below the existing ground surface (bgs). Additionally, field percolation testing was performed in five of the exploratory borings (B-4, B-8, B-19, B-20 and B-21) at approximate depths of 5 feet below the ground surface. Testing was performed in accordance with County of San Diego DEH guidelines for percolation test methods.

Blow count (N) values were determined utilizing a 140 pound automatic hammer, falling 30-inches onto a Standard Penetration Test (SPT) split-spoon sampler and a Modified California split-tube sampler. A truck-mounted Mobile Diedrich D-50 and track-mounted Fraste PL-G Hollow Stem Auger drill rigs were used during fieldwork. The blows per foot (N value) required to advance the 18-inch long Modified California split-tube samplers a distance of 18-inches and were measured at 2½-foot intervals. The N values were recorded on the boring logs, which are presented in **Appendix A** - Soil Classification Chart and Boring Logs. Relatively "undisturbed" samples were collected in a 2.42-inch (inside diameter) California Modified split-tube sampler for visual examination and laboratory testing. The soils were classified in accordance with the Unified Soil Classification System (ASTM, 2015). Representative bulk samples were also collected for appropriate laboratory testing. Borings were backfilled with bentonite and drill cuttings following completion of drilling, logging, and sampling.

The CPT soundings were performed by Middle Earth Geo Testing Inc., under the supervision of a representative of EEI. Cone penetration testing was conducted in general accordance with ASTM Test Method D3441. The CPT procedure includes pushing an electronic cone penetrometer, which records data including tip resistance, sleeve friction and dynamic pore pressure as it is advanced. A 25 ton CPT rig equipped with a 15 square centimeter cone was used to conduct the in-situ testing. The CPT data, along with Middle Earth Geo Testing Inc.'s interpretation of the data, are presented in **Appendix A**.

3.2 Subsurface Conditions

Subsurface conditions encountered in our exploratory borings and CPT soundings consisted of artificial fill and Holocene to late Pleistocene-aged young alluvial flood-plain deposits.

Fill materials were encountered in nearly half of the exploratory borings, and extended to depths ranging from approximately 2 to 8 feet below the ground surface across the subject property where encountered. In general, the fill was composed of loose to medium dense and medium stiff to very stiff, mottled red, yellow and brown mixed sands, clays and silts. The young alluvial flood-plain deposits were encountered underlying the fill. In general, the alluvial deposits consisted primarily of very loose to dense sands, silty-sands and clayey-sands, with interbedded layers of very soft to very stiff mixed silts and clays. Fine grained materials were generally encountered within the upper 30 feet of soil during our subsurface investigation. Practical refusal due to heaving sands was encountered in the exploratory borings B-6 and B-13 at depths ranging from 46.5 to 50 feet below the ground surface, respectively, but refusal was not encountered in any of the CPT soundings. Data obtained from the CPT soundings are consistent with materials logged and sampled during the subsurface exploration. Detailed descriptions of the encountered soils are provided on the boring logs and on the CPT logs included as **Appendix A**.

3.3 Groundwater

At the time of our subsurface exploration, groundwater was encountered at depths ranging from 6 to 16 feet below the ground surface. Additionally, standing water was observed for a large portion of the southeastern corner of the subject property. In general, groundwater is expected to follow the direction of surface topography; therefore, local groundwater flow is expected to be in a general westerly direction. It should be noted that variations in groundwater may result from fluctuations in the ground surface topography, subsurface stratification, rainfall, irrigation, and other factors that may not have been evident at the time of our subsurface exploration.

3.4 Laboratory Testing and Classification

Representative samples were selected for laboratory testing to check their field classification(s) and to evaluate their pertinent engineering characteristics. Field descriptions and soil classifications were visually classified according to the American Society for Testing and Materials (ASTM D2488) which classifies soils under the USCS. Representative soil samples were tested in the lab for grain size distribution to determine actual classifications by ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes in accordance with the USCS. Final classifications of soils can be found on the boring logs in **Appendix A** and the laboratory test data in **Appendix B**.

3.4.1 Moisture Content and Dry Density

The in-situ moisture content and dry density of soils was determined for soil samples obtained from the borings. In-place moisture content and dry density of soils help in the evaluation of engineering design parameters for foundations, retaining walls, and other engineering structures. The moisture content determination of soil samples was conducted in general accordance with ASTM D2216, and was recorded as a percentage. The determination of dry density of soil samples was conducted in accordance with ASTM 2937, and recorded in pounds per cubic foot. Moisture content and dry density for soil samples retrieved from the field can be found on the boring logs located in **Appendix A**.

3.4.2 Expansion Index

A bulk sample of soils obtained from within 5 feet of the existing grade from Boring B-7 and Boring B-10 and tested for its expansion potential. Our expansion index testing was conducted in general accordance to ASTM D4829. The results of our expansion index testing are presented in **Appendix B.**

3.4.3 Maximum Dry Density and Optimum Moisture Content

The maximum dry density and optimum moisture content was determined from a bulk soil sample obtained from boring B-3 within the upper five feet of existing grade. Our testing was performed in general accordance with ASTM D1557, Method A. Results of our testing are presented in **Appendix B**.

3.4.4 Grain Size Distribution

To help check field classifications of soils, the grain size distribution of representative soil samples was determined. In order to find the percentages of fine grained particles in a particular soil stratum, soils were tested in general accordance with ASTM D422-Standard Test Method for Particle-Size Analysis of Soils. Gradation results are presented in **Appendix B**.

3.4.5 Direct Shear

Direct shear testing was conducted on three representative samples at varying depths. The samples were remolded to 90 percent of their maximum density (based on ASTM D1557) to measure their shear strength characteristics for engineering purposes. The samples were inundated for at least 18 hours. The samples were placed in a shear box and a normal load was applied (loads of approximately 1,000, 1,700 and 3,000 psf weights were used). The samples were then sheared at a controlled strain rate in a direct shear apparatus that measures horizontal displacement and shear resistance. Shear testing was run in general accordance with ASTM D3080. The results of our testing are presented in **Appendix B**.

3.4.6 Sulfate/Corrosion

A representative sample of the encountered onsite earth material was collected for analysis at Clarkson Laboratory and Supply, Inc. located in Chula Vista, California for corrosion/soluble sulfate potential.

This corrosion testing included soil minimum resistivity and pH by California Test 643 sulfate by California Test 417, and chloride by California Test 422. Results of these tests are presented in **Appendix B**.

3.4.7 R-Value

One representative bulk sample was collected to test for R-Value. One (1) bulk sample was collected from boring B-10 at a depth between 0 and 5 feet below existing grade for the proposed paved drive and parking areas. The sample was sent to a Geosoils laboratory in Carlsbad, California for R-Value testing. EEI reviewed test results from Geosoils and concurs with the results as presented. Test procedures were conducted in general accordance with the Department of Transportation, State of California, Materials & Research Test Method No. 301. Results are provided in **Appendix B**.

4.0 GEOLOGIC HAZARDS

4.1 Regional Faulting and Seismicity

The portion of Southern California that includes the subject property is considered to be seismically active. Due to the proximity of the property area to several nearby active faults, strong ground shaking could occur at the property as a result of an earthquake on any one of the faults.

Our review indicates that there are no known active faults crossing the property and the property is not located within an Alquist-Priolo Earthquake Fault Zone as defined by the State of California (Hart and Bryant, 1997, CDMG, 2000). The closest active fault to the property is the Rose Canyon fault, located approximately 5.6 miles northwest of the property. Other faults in the region include the Coronado Bank (approximately 15.7 miles northwest), and the offshore segment of the Newport-Inglewood fault (approximately 40.3 miles north) (Blake, 2000; Jennings, 1994).

While the potential risk of ground rupture cannot be completely ruled out, it is our opinion that the likelihood of surface fault rupture at the subject property is relatively low and the risk is considered similar to other sites in the vicinity.

4.2 Seismic Parameters and Peak-Ground Acceleration

Maximum considered ground motion maps provided in the California Building Code (CBC, 2013) were utilized with coordinates of 32.6587° north latitude and 117.0688° west longitude, to determine the site seismic parameters. EEI utilized seismic design criteria provided in the CBC (2013) and ASCE 7-10. Final selection of the appropriate seismic design coefficients should be made by the structural consultant based on the local laws and ordinances, expected building response, and desired level of conservatism. The site coefficients and adjusted maximum considered earthquake spectral response accelerations in accordance with the 2013 California Building Code are presented in **Table 2**.

TABLE 1
Seismic Hazard Response Parameters and Design Parameters CBC (2013)

Seismic Parameter	Period (Sec)		Value
Mapped Spectral Acceleration Value, Site Class B	0.2	S_s	0.953g
Mapped Spectral Acceleration Value, Site Class B	1.0	S_1	0.362g
Site Coefficient, Subject Site Class D per 2013 CBC Table 1613.3.3	--	F_a	1.119
Site Coefficient, Subject Site Class D per 2013 CBC Table 1613.3.3	--	F_v	1.675
Adjusted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Site Class D	0.2	S_{MS}	1.066g
Adjusted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Site Class D	1.0	S_{M1}	0.607g
Design Spectral Response Acceleration Occupancy Category I-III per 2013 CBC Table 1604.5	0.2	S_{DS}	0.711g
Design Spectral Response Acceleration Occupancy Category I-III per 2013 CBC Table 1604.5	1.0	S_{D1}	0.405g
Peak Ground Acceleration Adjusted For Site Class Effects		PGA_M	0.434g

4.3 Ground Lurching or Shallow Ground Rupture

Based on the geography, topography and site-specific geotechnical conditions encountered during our preliminary geotechnical evaluation at the subject property, we consider the potential for ground lurching or shallow ground rupture at the property to be low; however, due to the active seismicity of California, this possibility cannot be completely ruled out. In light of this, the unlikely hazard of lurching or ground-rupture should not preclude consideration of "flexible" design for onsite utility lines and connections.

4.4 Liquefaction

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading.

Liquefaction and related phenomena have been responsible for substantial structural damage in historical earthquakes, and are a design concern under certain conditions. Liquefaction occurs in saturated soils that are soils in which the space between individual particles is completely filled with water. This pore water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together.

Prior to an earthquake, pore water pressure is typically low; however, earthquake motion can cause the pore water pressure to increase to the point where the soil particles can readily move with respect to each other. When liquefaction occurs; the strength of the soil decreases and the ability of a soil deposit to support structural loads are reduced.

Our evaluation of the subject property's susceptibility to liquefaction was performed in accordance with the procedure recommended by The National Center for Earthquake Engineering Research (Youd, et al., 2001). Our liquefaction evaluation utilizes the CLiq computer program developed by GeoLogismiki (2015) and incorporates the geotechnical data obtained from CPT soundings CPT-1 through CPT-4. It should be noted that the property is indicated to be within a storm water drainage basin (flood plain) that is considered susceptible to liquefaction based on a review of the Seismic Hazard Zones Map for the property vicinity (CDMG, 2001).

The liquefaction analyses were based on the adjusted peak-ground acceleration obtained from the USGS Seismic Design Maps and Equation 11.8-1 of ASCE 7-10. Based on this reference a peak-ground acceleration of 0.434g is obtained, which is the value used in our evaluation. Deaggregation of the probabilistic ground motion at the subject property was performed using the USGS interactive webpage which estimates the modal magnitude for a given probabilistic seismic ground motion. Results of our seismic hazard deaggregation (**Appendix C**) yielded a modal magnitude of 6.96, which is the magnitude used in our liquefaction analysis.

As previously discussed, our subsurface exploration encountered groundwater at depths ranging from 6 to 16 feet below the ground surface. Based on this information we assessed the liquefaction potential for the site utilizing a groundwater depth of 5 feet bgs for conservatism.

As noted in our exploratory borings, layers containing appreciable amounts of fine-grained soil were encountered at various depths. Our liquefaction evaluation included utilizing guidelines outlined by Robertson and Wride (1998) to determine whether these layers of fine-grained soil are susceptible to liquefaction.

Based on the results of our CLiq evaluation, we consider the subject property to be susceptible to considerable amounts of liquefaction. Generally, our evaluation indicates that potentially liquefiable soils consist of isolated and discontinuous thin lenses of saturated sands, silts and clays. The results of our liquefaction evaluation are included as **Appendix C**.

Cyclic mobility is a liquefaction phenomenon, triggered by cyclic loading, occurring in soil deposits with static shear stresses lower than the soil strength. Deformations due to cyclic mobility develop incrementally because of static and dynamic stresses that exist during an earthquake. Lateral spreading, a common result of cyclic mobility, can occur on gently sloping and on flat ground close to rivers and lakes. Due to the presence of a Sweetwater River channel located approximately 700 feet southwest of the proposed building locations, it appears that the subject property is susceptible to lateral spreading on the order of 1.68-inches in the event of the design earthquake.

4.5 Seismic Induced Settlement

Seismically induced settlement can occur due to reorientation of soil particles during strong shaking of unsaturated sands, as well as in response to liquefaction of saturated loose granular soils. The potential for seismically induced settlement within the upper alluvial deposit materials was estimated using the CLiq computer program (GeoLogismiki, 2015), which incorporates Robertson and Wrides's procedure (1998). Our evaluation was based on the aforementioned peak ground acceleration of 0.434g and a modal earthquake magnitude of 6.96. Our evaluation was performed on the CPT sounding data from CPT-1 through CPT-4. Based on our evaluation (**Appendix C**), we estimate the total maximum seismic-induced settlement to be on the order of 3.65-inches at isolated locations within the site. Differential earthquake induced settlements estimated to be on the order of 1.70-inches across a 50-foot span.

4.6 Tsunamis and Flooding

The subject property is not located within a mapped area on the State of California Tsunami Inundation Maps (Cal EMA, 2009); therefore, damage due to tsunamis is considered low.

EEI reviewed the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) online database to determine if the subject property was in a flood zone. According to FIRM Number FM06073C1912G, of Panel 1912 of 2375 (effective May 2012), the subject property is located within flood Zone AE and Zone X. FEMA defines Zone AE as an area subject to inundation by the 1-percent-annual-chance flood event with base flood elevations, while Zone X is described as area determined to be outside the 0.2 percent annual chance floodplain.

5.0 CONCLUSIONS

Based on our field exploration, laboratory testing and engineering and geologic analysis, it is our opinion that the subject property is suitable for the proposed retail development from a geotechnical engineering and geologic viewpoint.

However, there are existing geotechnical conditions associated with the subject property that will warrant mitigation and/or consideration during planning stages. The following conclusions take in consideration the assumption that the property is proposed for the construction of retail development and related improvements.

The CarMax building structure is proposed to have a footprint of approximately 19,285 square feet and is assumed to be one- to two-stories. Additionally, a car wash building of approximately 936 square feet is also planned. Furthermore, we understand that the existing site elevations are proposed to be raised on the order of 5 to 10 feet during grading operations for the proposed development. If site plans and/or the proposed building locations are revised, additional field studies may be warranted to address proposed site-specific conditions. As a result, EEI is providing the following conclusions:

- A total of twenty-one (21) exploratory hollow-stem auger borings were advanced within the subject property boundaries during this evaluation. Exploratory boring depths ranged from approximately 5 to 51 feet bgs. Additionally, field percolation testing was performed in five of the exploratory borings in accordance with County of San Diego DEH guidelines at depths of approximately 5 feet bgs. Overall, the property is underlain by artificial fill and Holocene to late Pleistocene-aged young alluvial flood-plain deposits. In general, the fill was encountered to a maximum depth of 8 feet bgs and was composed of loose to medium dense and medium stiff to very stiff, mottled red, yellow and brown mixed sands, clays and silts.

The young alluvial flood-plain deposits were encountered underlying the fill. In general, the alluvial deposits consisted primarily of very loose to dense sands, silty-sands and clayey-sands, with interbedded layers of very soft to very stiff mixed silts and clays.

- A total of four (4) exploratory Cone Penetrometer Test soundings (CPT), were advanced to an approximate depth of 50 feet below existing grade elevations. Data obtained from the CPT soundings are consistent with materials logged and sampled during the subsurface exploration.

- At the time of our subsurface exploration, groundwater was encountered at depths ranging from 6 to 16 feet below the ground surface.

- Laboratory test results performed on a sample of the upper soils obtained from the proposed building pad area indicate that the tested soils are slightly alkaline (tested pH value of 7.6) and are corrosive to extremely corrosive to ferrous metals with a tested minimum resistivity value of 300 ohm-cm. Laboratory testing also yielded soluble sulfate concentration of 0.105 percent within the tested sample, indicating a moderate potential for sulfate attack on concrete. A chloride concentration of 0.107 percent was detected within the sample of the upper soils, indicating that the upper soils possess a negligible potential for corrosion of steel reinforcement in concrete.

- The subject property is located within an area of southern California recognized as having a number of active and potentially-active faults located nearby. Our review indicates that there are no known active faults mapped as crossing the property and the property is not located within an Earthquake Fault Zone. The nearest active faults that could affect the property include the Rose Canyon fault located approximately 5.6 miles from the property. Other nearby seismic sources includes the Coronado Bank and the offshore segment of the Newport-Inglewood fault; each of these active faults is capable of generating severe ground shaking at the property.

- Based on EEI's evaluation, earth materials underlying the subject property are considered susceptible to considerable amounts of seismic induced liquefaction. Based on EEI's evaluation, the earth materials consisting of isolated and discontinuous lenses of saturated sands, silts and clays underlying the property of the proposed development appear to be susceptible to some seismically induced settlement on the order of 3.65-inches with differential settlements on the order of 1.70-inch over a 50-foot span. Additionally, it appears that the site is susceptible to lateral spreading on the order of 1.68-inches in the event of the design earthquake.

- There are several different methods that can be employed to mitigate the effects of liquefaction on proposed new structures or improvements (i.e., reduce the potential for structural collapse or risk of life and limb due to liquefaction at the subject property). Ground improvement and the use of deep foundations or other special foundation systems (stiff foundations, mat foundations etc.), and the utilization of geosynthetic fabric reinforcement, installed within fill soils that are placed in overexcavated areas within proposed new building areas. These methods can certainly mitigate or reduce the effects of liquefaction potential at the property.

- The results of our laboratory Expansion Index (EI) testing of a localized pocket of clayey materials sampled at a depth of 2 to 8 feet below the ground surface indicate an EI of 68, which represents a medium expansion potential for those soils. However, of the onsite soils encountered, the majority are anticipated to be very low to low expansive.

- EEI evaluated static settlement utilizing the CPT soundings data, results of laboratory testing and subsurface data to estimate settlement as a result of grading the pad(s) to a proposed finish slab grade.

Based upon our evaluation and our recommendations for remedial earthwork, the overburden loading from the proposed increase site grade, and a conventional or mat slab foundation system, EEI estimates total static settlement on the order of 4-inches within the building envelope. Differential settlement is estimated to be approximately 3-inches or less over a distance of 50 feet. Based on our experience in the immediate vicinity of the subject property, we consider the potential for these total static and differential settlements estimates to occur to be high. As such, we consider the installation of settlement monuments to be prudent after proposed building pad grades are achieved.

6.0 RECOMMENDATIONS

The recommendations presented herein should be incorporated into the planning and design phases of development. Guidelines for site preparation, earthwork, and onsite improvements are provided in the following sections.

As noted herein, our evaluation of the subject property reveals that the alluvial soils could experience seismic settlements on the order of 3.65-inches due to a design level earthquake, with differential settlements estimated to be approximately 1.70-inches and lateral spreading on the order of 1.68-inches in the event of the design earthquake.

There are several different methods that can be employed to mitigate the effects of seismic induced settlement and lateral spreading on the proposed improvements (i.e., reduce the potential for structural collapse or risk of life and limb due to seismic settlement at the subject property). While ground improvement and the use of deep foundations would certainly be expected to mitigate the seismic settlement at the property, these methods do not appear to be economically feasible, given the estimated magnitude of the settlement and the scope of the proposed project. As such, the recommendations provided in the following sections of this report are intended to be relatively economic measures to resist structural collapse as a result of seismic settlement at the property. It should be understood that the proposed improvements could experience some damage during a design seismic event.

We also recommend that the structural engineer evaluate whether the proposed building could tolerate the amount of seismic settlement estimated herein and whether the methods to reduce the potential for distress due to seismic settlement (described in the following sections of this report) are warranted.

6.1 General

Grading should conform to the guidelines presented in the 2013 California Building Code (CBC, 2013) and the requirements of the current edition of the County of San Diego Building Code and City of National City Grading Code. Additionally, general Earthwork and Grading Guidelines are provided herein as **Appendix D**.

During earthwork construction, removals and reprocessing of fill materials, as well as general grading procedures of the contractor should be observed and the fill placed selectively tested by representatives of the Geotechnical Engineer, EEI. If any unusual or unexpected conditions are exposed in the field, they should be reviewed by the Geotechnical Engineer and if warranted, modified and/or additional remedial recommendations will be offered. Specific guidelines and comments pertinent to the planned development are provided herein.

The recommendations presented herein have been completed using the information provided to us regarding site development.

If information concerning the proposed development is revised, or any changes in the design and location of the proposed property improvements are made, the conclusions and recommendations contained in this report should not be considered applicable unless the changes are reviewed and conclusions of this report modified or approved in writing by this office.

6.2 Site Preparation and Grading

Debris and other deleterious material, such as organic soils and/or environmentally impacted earth materials should be removed from the subject property prior to the start of grading. Areas to receive fill should be properly benched in accordance with current industry standards of practice and guidelines specified in the CBC (2013).

Existing utilities should be removed within the proposed building envelope. Abandoned trenches should be properly backfilled and tested. If unanticipated subsurface improvements (utility lines, septic systems, wells, utilities, etc.) are encountered during earthwork construction, the Geotechnical Engineer should be informed and appropriate remedial recommendations would then be provided.

6.3 Remedial Earthwork

The existing fill and upper alluvial materials appear to be relatively loose and are considered potentially compressible. As such, they are considered unsuitable for the support of settlement-sensitive structures or additional fill in their current condition. Additionally, our evaluation of the subject property (as described herein) indicates that liquefaction of the alluvial soils that underlie the property could result in settlements of approximately 3.65-inches and differential settlements on the orders of 1.70-inches. The estimated differential seismic settlements could adversely affect shallow foundations supporting the proposed building.

Therefore, where not already removed by the proposed subject property grading or disturbed during clearing and grubbing operations at the site, the existing fill materials should be completely removed in the area of the proposed building and other settlement-sensitive improvements. We anticipate that these removals will extend to depths of approximately 5-feet below the ground surface, or 36-inches below the bottoms of the proposed foundations, whichever is deeper. Reprocessing of the upper 12- inches of subgrade in pavement areas is also recommended.

Following removal of the upper soils, the bottom of the resulting excavation(s) should be observed by a representative of EEI to check that unsuitable materials have been sufficiently removed. It should be understood that based on the observations of our field representative, localized deeper removals may be recommended. The base of the removal area should be level to avoid differential fill thicknesses under proposed improvements. This remedial earthwork should extend at least 5 feet outside the proposed building limits and/or 5 feet beyond the area to receive fill. Note that vertical sides exceeding 5 feet in depth may be prone to sloughing and may require laying back to an inclination of 1:1 (horizontal to vertical) or flatter.

After removal of the upper soils and observation of the excavation bottoms, the over-excavated areas should be scarified to a minimum depth of 6-inches, moisture conditioned as needed to achieve at least optimum moisture content and re-compacted to at least 90 percent of the maximum dry density (based on ASTM D1557). The over-excavated areas should then be backfilled with suitable, approved onsite and/or imported soils that are placed and compacted as recommended herein until design finish grades are reached.

6.4 Fill Placement

Fill material should possess a low expansion potential (expansion index of less than 51 as determined by ASTM D4829), be free of organic matter (less than 3 percent organics by weight) and other deleterious material. Much of the onsite materials appear to be suitable for re-use as fill, provided they do not contain rocks greater than 6-inches in maximum dimension, organic debris and other deleterious materials. Rock fragments exceeding 6-inches in one dimension should be segregated and exported from the subject property, or utilized for landscaping.

If import soils are needed, the earthwork contractor should ensure that all proposed fill materials are approved by the geotechnical engineer prior to use. Representative soil samples should be made available for testing at least ten (10) working days prior to hauling to the subject property to allow for laboratory tests.

Fill materials should be placed in 6- to 8-inch loose lifts, moisture conditioned as necessary to at least optimum moisture and compacted to a minimum of 90 percent maximum dry density according to ASTM D1557. The upper 12-inches of pavement subgrade should be moisture conditioned to at least optimum moisture and compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Suitable heavy grading equipment should be utilized to properly mix, spread, moisture condition or dry, and compact each fill lift.

Earthwork may be affected by the existing soil moisture content exceeding optimum. Moist to very moist earth materials may be difficult to mix and compact in their native condition, and drying or mixing with drier soils may be warranted to achieve the recommended relative compaction.

Those areas to receive fill (including over-excavated areas) or surface improvements should be scarified at least 12-inches, moisture conditioned to at least optimum moisture content and recompacted to at least 90 percent of the maximum dry density (based on ASTM D1557).

To help mitigate the effects of liquefaction and seismic-induced settlement within the proposed building area, we recommend that following the removals and the scarification of the removal bottom, that a geogrid layer, such as Tensar TriAx, be placed across the bottom prior to backfilling the excavation with fill soils. The geogrid should extend beyond the building pad area a minimum of 5 feet on all sides and up the sides of the excavation approximately 5 feet. After placing and compacting an additional 2.5 feet of fill material, an additional layer of Geogrid should be placed, and so on for every additional 2.5 feet of fill placed before completing the building pad grading. This should provide at least 5 feet of geogrid reinforced fill to support the structure and will limit, to the extent feasible, the loss of bearing capacity of the supporting bearing soils the design earthquake occur. Care should also be taken to make sure that the reinforcement is placed at depths sufficient so that it does not interfere with installation of buried utilities. It is our opinion that the reinforced fill, if properly placed within engineered fill materials, can be expected to provide a relatively rigid soil layer to support the proposed building and to span across voids that may develop under these improvements due to differential settlement that occurs in response to a design seismic event.

6.5 Yielding Subgrade Conditions

The soils encountered at the subject property can exhibit “pumping” or yielding once they become saturated. This can often occur in response to periods of significant precipitation, such as during the winter rainy season. If this occurs and in order to help stabilize the yielding subgrade soils within the bottom of the removal areas, the contractor can consider as an option, the placement of Mirafi 600X stabilization fabric (or approved equivalent) over the yielding subgrade, and placement of uniform sized, ¾- to 2-inch crushed rock over the stabilization fabric.

The crushed rock should be properly tracked into the underlying soils. We expect that a 6- to 12-inch thick section of the crushed rock will be required. If significant voids are present in the crushed gravel, a filter fabric should be placed over the crushed gravel to prevent migration of fines and subsequent settlement from the overlying fill. Fill soils, which should be placed and compacted in accordance with the recommendations presented herein, should then be placed upon the fabric until design finish grades are reached. The gravel and stabilization fabric should extend at least 5 feet laterally beyond the limits of the "pumping" areas. These operations should be performed under the observation and testing of a representative of EEI in order to evaluate the effectiveness of these measures and to provide additional recommendations for mitigative measures, as warranted.

6.6 Shrinkage and Bulking

Several factors will impact earthwork balancing on the subject property, including shrinkage, bulking, subsidence, trench spoils from utilities and footing excavations, and final pavement section thickness as well as the accuracy of topography. Shrinkage, bulking and subsidence are primarily dependent upon the degree of compactive effort achieved during construction. Shrinkage, bulking and subsidence should be considered by the project civil engineer relative to final site balancing. It is recommended that the site development be planned to include an area that could be raised or lowered to accommodate final site balancing.

6.7 Grading Considerations

As previously discussed, the existing site grades are proposed to be raised on the order of 5 to 10 feet during grading operations for the proposed development. In order to assess the potential settlement due to the overburden loads that will be added during grading, we recommend the installation of settlement monuments on that building pad after rough grades have been established. The elevations of the settlement monuments should be surveyed after installation and at weekly intervals (minimum) after. Survey data from the settlement monuments should be provided to EEI in order to determine the settlement of the building pad, if any, due to the overburden loading.

7.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

7.1 General

In the event that plans concerning the proposed building structure are revised in the project design and/or location or loading conditions of the planned structure are made, conclusions and recommendations contained in this report should not be considered valid unless they are reviewed, revised and/or approved in writing by EEI. The foundation recommendations provided herein are based on the soil materials near finish grade possessing a low expansion potential (EI < 51).

7.2 Preliminary Foundation Design

In the event that plans concerning the proposed CarMax Auto Superstore building are revised in the project design and/or location or loading conditions of the planned structure are made, conclusions and recommendations contained in this report should not be considered valid unless they are reviewed, revised and/or approved in writing by EEI. The foundation recommendations provided herein are based on the soil materials near finish grade possessing a low expansion potential (EI < 51).

As discussed prior, we estimate that the subject property could experience seismic induced settlements on the order of 3.65-inches, with differential seismic settlements estimated to be approximately 1.70-inches.

We recommend that the structural engineer conduct an evaluation to see whether the proposed building can adequately tolerate the estimated seismic settlement without danger of collapse. We anticipate that an adequately designed and constructed mat foundation, together with the underlying reinforced fill layer (as recommended in **Section 6.4**) can provide sufficient rigidity to span over voids that may develop under the slab due to differential soil settlement resulting from a seismic event, thus further reducing the overall differential settlement across the proposed building. Based on the structural engineer's evaluation, additional geotechnical recommendations for the mitigation of the effects of liquefaction may be warranted.

7.2.1 Alternative 1 - Mat Foundations

A rigid mat foundation may be used for the support of the building at the subject property, provided the mat foundation is bearing within fill soils that are properly placed and compacted in accordance with the recommendations contained herein. When properly designed and constructed, a structural mat foundation system can be expected to support high structural loads and provide relatively uniform settlement across a structure, while being able to "bridge" over local areas of dynamic settlement. Mat foundations should be properly reinforced to form a relatively rigid structural unit in accordance with the structural engineers design. For designing a mat foundation, we recommend using an uncorrected modulus of subgrade reaction of 150 pounds per cubic inch (pci). For large foundations, the modulus is typically reduced by 75 percent. The mat foundation may also be designed for a maximum bearing pressure of 2,000 psf with a one third increase for transient loadings. Mat foundations should be reinforced in accordance with structural considerations.

7.2.2 Alternative 2 – Post-Tensioned Slab

A post-tensioned slab can be used for building support, provided it is bearing within reinforced fill soils that are placed and compacted in accordance with the recommendations contained in **Section 6.4** of this report. Perimeter thickened slab edges that are embedded at least 18-inches below finish grade can be designed for an allowable soil bearing value of 2,000 psf. This allowable soil bearing value can be increased by one-third for loads of short duration, including wind and seismic forces. Post-tensioned slabs should be designed by the structural engineer in accordance with the current guidelines of the post-tensioning institute. If this alternative foundation system is selected for building support, EEI would be pleased to provide additional geotechnical parameters for post-tensioned slab design.

7.2.3 Alternative 3 – Ground Improvement

Along with the two alternative foundation systems presented above, soil improvement can also be performed to mitigate the effects of liquefaction at the subject property. When performed properly, soil improvement can be expected to increase the property's resistance to liquefaction to the point where special foundation systems are not warranted. Those ground improvement methods that are often performed at sites, similar to the subject property, primarily involve in-place densification of soils. Based upon our analysis, ground improvement (such as rammed aggregate or stone columns) would need to be installed to a depth of at least 30 feet to minimize the potential seismic settlement to a tolerable level.

If the buildings experience seismically induced settlements that result in the structures being significantly out-of-plumb, the buildings could be subsequently re-leveled by pressure grouting or other methods in conjunction with other earthquake repairs.

Based on the information herein, we recommend that the project structural engineer evaluate whether a mat foundation system can be constructed to tolerate seismically induced ground shaking, liquefaction, and dynamic settlements estimated herein without structural collapse. If the structural engineer determines that mat foundations cannot be feasibly constructed for the seismic conditions at the property, then consideration should be given for the use of another foundation type for building support.

7.3 Foundation Design – Non Building Improvements

Non-building improvements can be supported on conventional continuous or isolated spread footings bearing upon at least 36-inches of properly compacted fill materials. In preparation for foundation construction, the earthwork contractor should ensure that the subject property has been prepared as recommended herein, and that field density tests have been performed to adequately document the relative compaction of the structural fill.

Conventional foundations can be designed to impose dead plus long term live load bearing pressures of 2,500 pounds per square foot (psf). The allowable foundation bearing pressure is for footings having a minimum width of 15-inches and a minimum depth of 18-inches embedment below the lowest adjacent finish grade. The allowable soil bearing pressure can be increased by one-third when considering transient loads of short duration, such as wind or earthquake loads. Based on the prevailing geotechnical conditions encountered during our subsurface exploration, we recommend that foundations be reinforced with at least two No. 4 bars, one placed at the top of the footing and one placed at the bottom.

7.4 Lateral Resistance of Foundations

Horizontal loads acting on foundations and stem walls cast in open excavations against undisturbed native soil or against properly placed and compacted fill will be resisted by friction acting along the base of the footing and by passive earth pressures against the side of the footing and stem wall. The frictional resistance acting along the base of footings founded on suitable foundation soils may be computed using a coefficient of friction equal to 0.25 with the normal dead load. Allowable passive earth pressures acting against the side of footings and stem walls may be assumed to be equivalent to a fluid weighing 250 pounds per cubic foot. Passive pressure in the upper 1-foot should be neglected unless confined by concrete slabs-on-grade or asphaltic pavement. The values given above may be increased by one-third for transient wind or seismic loads.

7.5 Footing Setbacks

All footings should maintain a minimum 7-foot horizontal setback from the base of the footing to any descending slope (if existing onsite). This distance is measured from the outside footing face at the bearing elevation. Footings should maintain a minimum horizontal setback of H/3 (H=slope height) from the base of the footing to the descending slope face and no less than 7 feet, or greater than 40 feet.

Footings adjacent to unlined drainage swales or underground utilities (if any) should be deepened to a minimum of 6-inches below the invert of the adjacent unlined swale or utilities. This distance is measured from the footing face at the bearing elevation. Footings for structures adjacent to retaining walls should be deepened so as to extend below a 1:1 projection from the heel of the wall. Alternatively, walls may be designed to accommodate structural loads from buildings or appurtenances.

7.6 Concrete Slabs on Grade

Interior slabs can be grade supported by native soil or structural fill whose placement/compaction is documented by the project soils engineer/engineer geologist as recommended herein.

The thickness of the slab should be in accordance with the structural engineer's design; however, based on geotechnical considerations, we recommend that concrete slabs be a minimum of 5-inches in thickness. Concrete slabs should be underlain by at least 2-inches of clean sand with a Sand Equivalent (SE) of at least 30.

Where moisture condensation is undesirable, concrete slabs should be underlain with a moisture/vapor retarder consisting of a minimum 10-mil, visqueen membrane, with all laps sealed. The membrane should be underlain by a 2-inch layer of clean sand. The visqueen moisture barrier should then be overlain by a 2-inch layer of clean sand to aid in concrete curing. To reduce the potential for buildup of hydrostatic pressures, the free draining material under the slabs should have positive drainage with no low lying areas (i.e., depressions) created.

Floor slabs should be suitably reinforced and jointed (in accordance with Structural Engineer's recommendations) so that a small amount of independent movement can occur without causing damage. Based on the encountered geotechnical conditions, we recommend that floor slabs be reinforced with minimum No. 4 bars spaced on 18-inch centers (each way). The contractor should take the appropriate precautions to make sure that the reinforcement is placed and maintained within the middle one-third of the slab.

Exterior slabs, such as walkways and driveways, can be adequately supported on documented structural fill that is at minimum 12-inches in thickness, and placed and compacted in accordance with the recommendations contained herein.

In preparation for slab or flatwork construction, the earthwork contractor should ensure that the onsite soils have been prepared as recommended and that field density tests have been performed to adequately document the relative compaction of the structural fill. Preparation of the native soils should be documented prior to placement of aggregate, structural components and/or fill.

Some minor cracking of slabs can be expected due to shrinkage. The potential for this slab cracking can be reduced by careful control of water/cement ratios in the concrete. The contractor should take appropriate curing precautions during the pouring of concrete in hot or windy weather to reduce the potential for cracking of slabs. We recommend that a slipsheet (or equivalent) be utilized if grouted fill, tile, or other crack-sensitive floor covering is planned directly on concrete slabs. All slabs should be designed in accordance with structural considerations.

All dedicated exterior flatwork should conform to standards provided by the governing agency including section composition, supporting material thickness and any requirements for reinforcing steel. Concrete mix proportions and construction techniques, including the addition of water and improper curing, can adversely affect the finished quality of the concrete and result in cracking and spalling of the slab. We recommend that all placement and curing be performed in accordance with procedures outlined by the American Concrete Institute and/or Portland Cement Association.

Special consideration should be given to concrete placed and cured during hot or cold weather conditions. Proper control joints should be provided to reduce the potential for damage resulting from shrinkage.

7.7 Corrosivity

Laboratory test results indicate that the upper materials contains a maximum soluble sulfate concentration of 0.105 percent, which indicate a moderate sulfate corrosion potential of concrete that will be in contact with the onsite soils. Our analysis also indicates maximum chloride concentrations of 0.107, which indicates a negligible corrosion potential to concrete due to chloride in the soils. As such, Type II cement can be used in concrete elements that will be in contact with the upper materials.

7.8 Retaining Walls (if proposed)

The design parameters provided herein assume that granular non-expansive soils (EI<21) are used to backfill any retaining walls. If expansive soils are used to backfill the proposed walls, increased active and at-rest earth pressures will need to be utilized for retaining wall design, and may be provided upon request. The foundation system for the retaining walls should be designed in accordance with the recommendations presented in the preceding sections of this report, as appropriate. Footings should be embedded at a minimum of 18-inches below adjacent grade (excluding 6-inch landscape layer). There should be no increase in bearing for footing width. Recommendations pertaining to "landscape" walls (i.e., Crib, Loffel, Earthstone, Geogrid, etc.) may vary from those provided herein, and should be provided upon request.

The design active earth pressure on a retaining wall may be considered equivalent to that produced by a fluid weighing 45 pounds per cubic foot (pcf). This design equivalent fluid pressure of 45 pcf is appropriate for cantilevered walls retaining non-expansive granular soils with a level ground surface, subject to lateral deflection at distances above grade due to lateral earth pressures. Restrained walls (i.e., basement walls and re-entrant corners within cantilevered walls) with a level granular backfill should be designed for an equivalent fluid pressure of 60 pcf for at-rest conditions. If backfill conditions (including the slope of the retained ground surface) differ from those assumed herein, EEI should be consulted to provide additional evaluation and/or recommendations as warranted. A safety factor for sliding and overturning of 1.5 is typically incorporated into the design of a cantilevered structure as described herein. All retaining structures should be fully free draining.

For resistance to lateral loads, an allowable coefficient of friction of 0.25 between the base of the foundation elements and underlying material is recommended. In addition, an allowable passive resistance equal to an equivalent fluid weighing 350 pcf acting against the foundation may be used to resist lateral forces. Passive pressure in the upper 1-foot should be neglected unless confined by concrete slabs-on-grade or asphaltic pavement. These values may be increased by $^1/_3$ for transient wind or seismic loads.

If required, the seismic earth pressures can be taken as equivalent to the pressure of a fluid weighing 5 pounds per cubic foot (pcf) for cantilever walls. This value is for level backfill conditions and does not include a factor of safety. Appropriate factors of safety should be incorporated into the design. This pressure is in addition to the un-factored static pressures. The allowable passive pressure and bearing capacity can be increased by one-third in determining the stability of the wall.

Adequate drainage should be provided behind all retaining walls. The drainage system should consist of a minimum of 4-inch diameter perforated PVC pipe (schedule 40 or approved equivalent) placed at the base of the retaining wall and surrounded by ¾-inch clean crushed rock wrapped in a Mirafi 140N filter fabric, or equivalent approved by the Geotechnical Engineer. The drain rock wrapped in fabric should be at least 12-inches wide and extend from the base of the wall to within 2 feet of the ground surface. The upper 2 feet of backfill should consist of compacted native soil. The retaining wall drainage system should be sloped to outfall to the storm drain system or other appropriate facility.

8.0 PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

Deleterious material, excessively wet or dry pockets, concentrated zones of oversized rock fragments, and any other unsuitable yielding materials encountered during grading should be removed. Once compacted fill and/or native soils are brought to the proposed pavement subgrade elevations, the subgrade should be proof-rolled in order to check for a uniform firm and unyielding surface. Representatives of the project geotechnical engineer should observe all grading and fill placement.

The upper 12-inches of pavement subgrade soils should be scarified; moisture conditioned to at least optimum moisture content and compacted to at least 95 percent of the laboratory standard (ASTM D1557), where not already replaced with compacted fill materials during rough grading of the site. If loose or yielding materials are encountered during subgrade preparation, evaluation should be performed by EEI.

Aggregate base materials should be properly prepared (i.e., processed and moisture conditioned) and compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Aggregate base materials should conform to Caltrans specifications for Class 2 aggregate base.

All pavement section changes should be properly transitioned. Although not anticipated, if adverse conditions are encountered during the preparation of subgrade materials, special construction methods may need to be employed. A representative of the project geotechnical engineer should be present for the preparation of subgrade and aggregate base.

For design purposes we have assumed a Traffic Index (TI) of 6.5 for the drive areas and 5.0 for the parking stalls at the subject property. This assumed TI should be verified as necessary by the Civil Engineer or Traffic Engineer. Based on the results of R-Value testing of the upper materials at the site, we have conservatively assumed a preliminary R-Value of 11 for the materials likely to be present at rough grades. The modulus of subgrade reaction (K-Value) was estimated at 70 pounds per square inch per inch (psi/in) for an R-Value of 11 (Caltrans, 1974). Pavement design was calculated for the parking lot structural section requirements for asphaltic concrete in accordance with the guidelines presented in the Caltrans Highway Design Manual. Rigid pavement sections were evaluated in general accordance with ACI 330R-08, based on an average daily truck traffic value of 10.

TABLE 2
Preliminary Pavement Design Recommendations

Traffic Index (TI)	Pavement Surface	Aggregate Base Material (1)
5.0 – Parking Stalls	4.0-inches Asphalt Concrete	7.0-inches
6.5 – Drive Areas	5.0-inches Asphalt Concrete	10.0-inches
Concrete Pavement - Entrance/Exit	5.5-inches Portland Cement Concrete (2)	4.0-inches
Concrete Pavement – Trash Apron	6.0-inches Portland Cement Concrete (2)	4.0-inches

(1) R-Value of 78 for Caltrans Class II aggregate base
(2) Reinforcement and control joints placed in accordance with the structural engineer's requirements

The recommended rigid pavement section provided herein is intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. If the ADT (average daily traffic) or ADTT (average daily truck traffic) increases beyond that intended, as reflected by the assumed traffic index used for design, increased maintenance and repair could be required for the pavement section. Final pavement design should be verified by testing of soils exposed at subgrade after grading has been completed. Thicker pavement sections could result if R-Value testing indicates lower values.

9.0 DEVELOPMENT RECOMMENDATIONS

9.1 Landscape Maintenance and Planting

Water is known to decrease the physical strength of earth materials, significantly reducing stability by high moisture conditions. Surface drainage away from foundations and graded slopes should be maintained. Only the volume and frequency of irrigation necessary to sustain plant life should be applied.

Consideration should be given to selecting lightweight, deep-rooted types of landscape vegetation which require low irrigation that are capable of surviving the local climate. From a soils engineering viewpoint, "leaching" of the onsite soils is not recommended for establishing landscaping. If landscape soils are processed for the addition of amendments, the processed soils should be re-compacted to at least 90 percent relative compaction (based on ASTM D1557).

9.2 Site Drainage

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled over slopes or the subject property. Runoff should be channeled away from slopes and structures and should not be allowed to pond and/or seep uncontrolled into the ground. Pad drainage should be directed toward an acceptable outlet. Although not required, roof gutters and down spouts may be considered to control roof drainage, discharging a minimum of 10 feet from proposed structures, or into a subsurface drainage system. Consideration should be given to eliminating open-bottom planters directly adjacent to proposed structures for a minimum distance of 10 feet. As an alternative, closed-bottom type planters could be utilized, with a properly designed drain outlet placed in the bottom of the planter.

9.3 Site Runoff Considerations - Stormwater Disposal Systems

It is EEI understanding that the Client is considering that runoff generated from the facility be disposed of in engineered subsurface features onsite.

9.3.1 Percolation Testing

Following the drilling of exploratory borings B-4, B-8, B-19, B-20 and B-21, a 3-inch diameter perforated polyvinyl chloride (PVC) pipe was placed in the hole and gravel was placed around the pipe. The test holes were presoaked in general accordance with County of San Diego DEH Guidelines. The total duration and measurement intervals of the tests were adjusted per the observed percolation rates for each hole. The readings obtained from the final interval were used to calculate the pre-adjusted percolation rate for each test hole. Upon conclusion of testing, the perforated pipe was removed from the test holes and the test excavations were backfilled.

We note that a soil profile's percolation rate is not the same as its infiltration rate. Therefore, the measured/calculated percolation rate was converted to an estimated infiltration rate. Therefore, the measured/calculated field percolation rate was converted to an estimated infiltration rate utilizing a reduction factor known as the Porchet method. **Table 4** presents the measured percolation rate and corresponding infiltration rate calculated for the test hole.

TABLE 3 Summary of Percolation Testing				
Location	**Depth (ft.)**	**Soil Type**	**Pre-Adjusted Percolation Rate (in/hr.)**	**Infiltration Rate (in/hr.)**
B-4 / P-1	~5	ML	0.53	0.03
B-8 / P-2	~5	CL (fill)	1.07	0.06
B-19 / P-3	~5	ML	3.36	0.45
B-20 / P-4	~5	SM	500+	233.5
B-21 / P-5	~5	SM	61.9	5.49

9.3.2 Summary of Findings

Based on the results of our field percolation testing, it appears that the percolation/infiltration rates presented herein range from conducive to not conductive to direct infiltration of surface stormwater for the preliminary design of subsurface storm water retention/disposal devices, based on the percolation tests performed at the specific locations and approximate depths at the subject property as listed in **Table 4**. It should be noted that groundwater was encountered within 6 feet (or 1-foot below test elevations) of the ground surface in numerous areas around the property.

9.3.3 Structural Setback from Retention Devices

It is recommended that retention/disposal devices be situated at least three times their depth, or a minimum of 15 feet (whichever is greater), from the outside bottom edge of structural foundations. Structural foundations include (but are not limited to) buildings, loading docks, retaining walls, and screen walls.

All stormwater disposal systems, including pervious pavement areas should be checked and maintained on regular intervals. Stormwater devices including bioswales that are located closer than 10 feet from any foundations/footings should be lined with an impermeable membrane to reduce the potential for saturation of foundation soils (also refer to **Section 7.6**).

9.4 Additional Site Improvements

Recommendations for additional grading, exterior concrete flatwork design and construction can be provided upon request. If in the future, additional property improvements were planned for the site, recommendations concerning the design and construction of improvements would be provided upon request.

9.5 Trenching

All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with OSHA guidelines and local safety codes. Temporary excavations over 4 feet in height should be evaluated by the project engineer, and could require shoring, sloping, or a combination thereof. Temporary excavations within the onsite materials should be stable at 1.5:1 inclinations for cuts less than 20 feet in height.

Footing trench excavations for structures and walls should be observed and approved by a representative of the project soils engineer prior to placing reinforcement. Footing trench spoil and excess soils generated from utility trench excavations should be compacted to a minimum relative compaction of 90 percent (based on ASTM D1557) if not removed from the subject property. All excavations should conform to OSHA and local safety codes.

9.6 Utility Backfill

Fill around the pipe should be placed in accordance with details shown on the drawings, and should be placed in layers not to exceed 8-inches loose (unless otherwise approved by the Geotechnical Engineer) and compacted to at least 90 percent of the maximum dry density as determined in accordance with ASTM D1557 (Modified Proctor).

The Geotechnical Engineer should approve all backfill material. Select material should be used when called for on the drawings, or when recommended by the Geotechnical Engineer. Care should be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill should be kept free from stones, chunks of highly plastic clay, or other objectionable material. Backfill soils should be non-expansive, non-corrosive, and compatible with native earth materials. Backfill materials and testing should be in accordance with the CBC 2013 and City specifications.

All pipe backfill areas should be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill. Flooding trench backfill is not recommended. Heavy equipment should not be operated over any pipe until it has been properly backfilled with a minimum 2 to 3 feet of cover. The utility trench should be systematically backfilled to allow maximum time for natural settlement. Backfill should not occur over porous, wet, or spongy subgrade surfaces. Should these conditions exist, the areas should be removed, replaced and recompacted.

10.0 PLAN REVIEW

Once the detailed and approved site and grading plans are available, they should be submitted to this office for review and comment, to reduce the potential for discrepancies between plans and recommendations presented herein. If conditions were found to differ substantially from those stated, appropriate recommendations would be provided. Additional field studies may be warranted once the final conceptual plans are produced.

11.0 LIMITATIONS

This Geotechnical Evaluation has been conducted in accordance with the generally accepted geotechnical engineering principles and practices. Findings provided herein have been derived in accordance with the current standards of practice, and no warranty is expressed or implied. Standards of practice are subject to change with time. This report has been prepared for the sole use of the Client, within a reasonable time from its authorization. Site conditions, land use (both onsite and offsite), or other factors may change as a result of manmade influences, and additional work may be required with the passage of time.

This Preliminary Geotechnical Evaluation should not be relied upon by other parties without the express written consent of EEI and the Client; therefore, any use or reliance upon this geotechnical evaluation by a party other than the Client should be solely at the risk of such third party and without legal recourse against EEI, its employees, officers, or directors, regardless of whether the action in which recovery of damages is brought or based upon contract, tort, statue, or otherwise.

The Client has the responsibility to see that all parties to the project, including the designer, contractor, subcontractor, and building official, etc. are aware of this report in its complete form. This report contains information that may be used in the preparation of contract specifications; however, the report is not designed as a specification document, and may not contain sufficient information for use without additional assessment. EEI assumes no responsibility or liability for work or testing performed by others. In addition, this report may be subject to review by the controlling authorities.

12.0 REFERENCES

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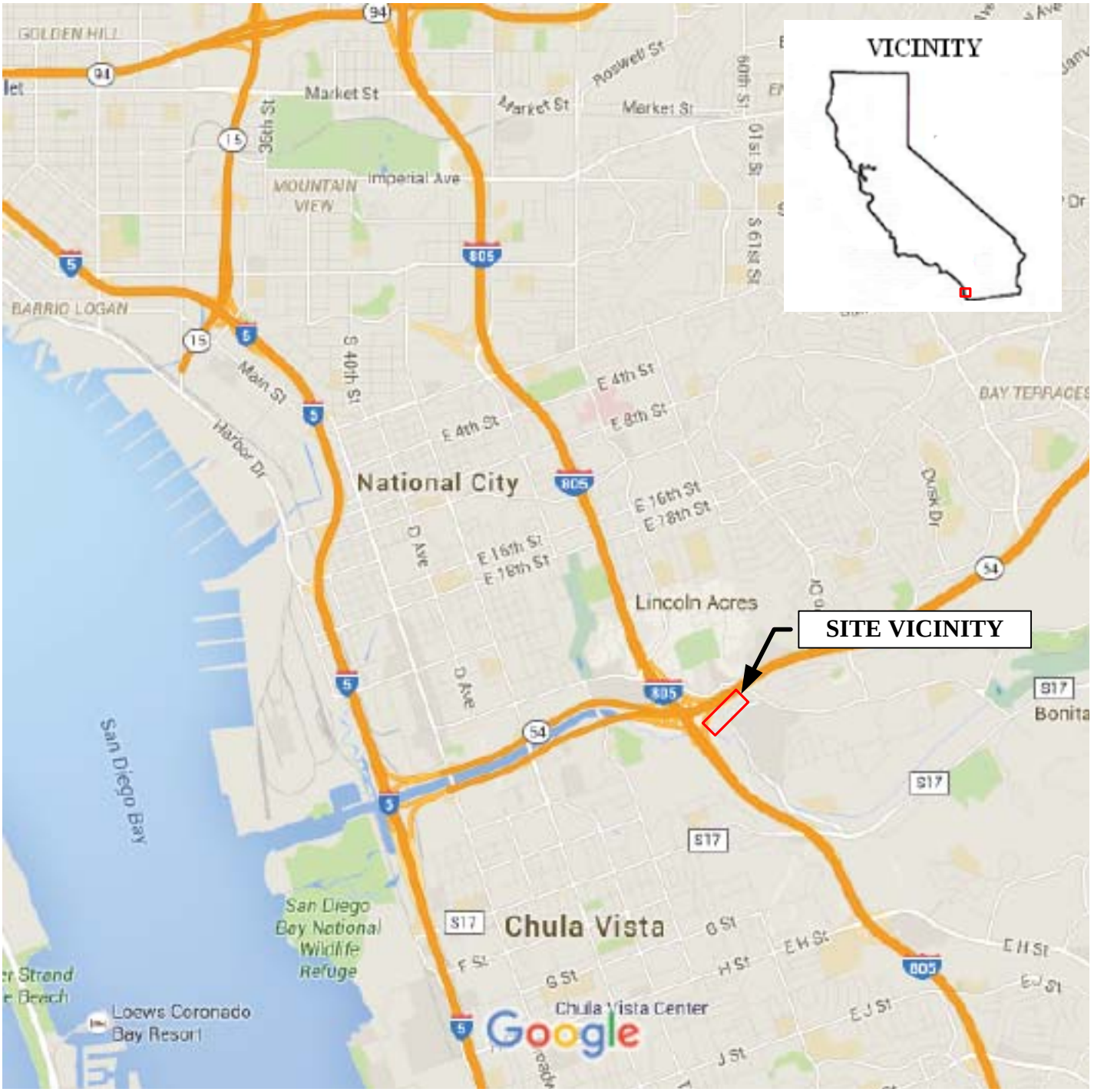
FIGURES



Map Source: Google Maps®; Accessed 2015

LEGEND

N

Scale: 1" = 1mi

0 1mi 2mi

Note: All Locations Are Approximate

SITE VICINITY MAP

CENTERPOINT INTEGRATED SOLUTIONS, LLC

Proposed CARmax of National City

National City, California

EEI Project No. CIS-72092.4

Created October 2015

EEI Geotechnical & Environmental Solutions

FIGURE 1

N

Scale: 1" = 300'

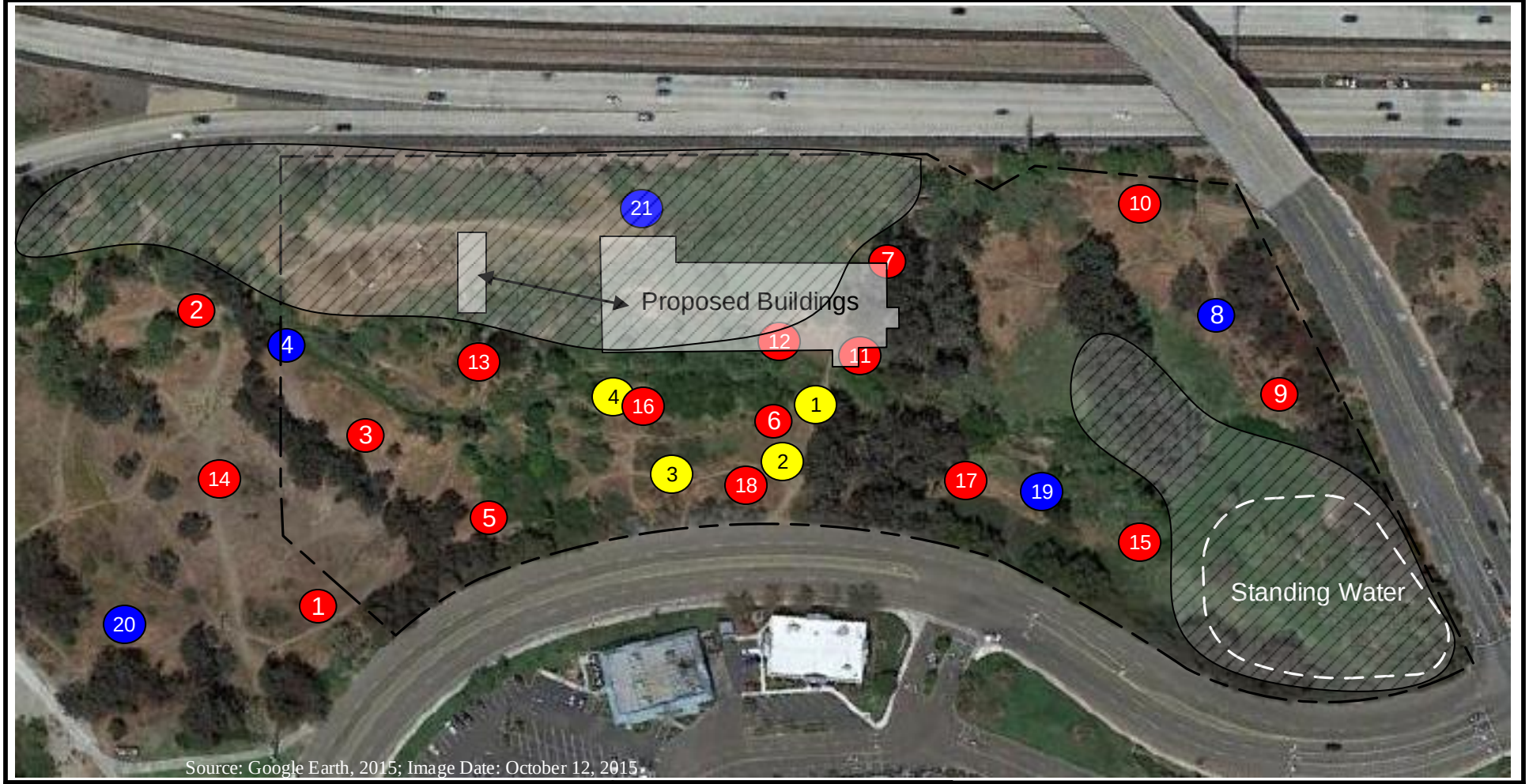
0 FT 300FT 600FT

AERIAL SITE MAP

CENTERPOINT INTEGRATED SOLUTIONS, LLC
Proposed CARmax of National City
National City, California
EEI Project No. CIS-72092.4
Created October 2015

EEI Geotechnical & Environmental Solutions

FIGURE 2



LEGEND

- 18 **Approximate Boring Locations**
- 21 **Approximate Boring/Percolation Locations**
- 4 **Approximate CPT Locations**
- **Area Inaccessible by Drill Rig**

Scale: 1" = 150'

0 FT 150FT 300FT

BORING LOCATION PLAN

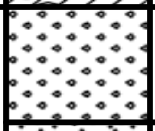
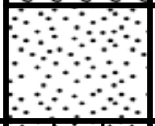
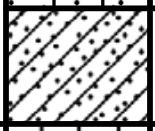
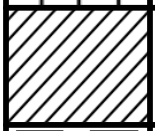
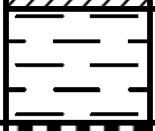
CENTERPOINT INTEGRATED SOLUTIONS, LLC
Proposed CARmax of National City
National City, California
EEI Project No. CIS-72092.4
Created October 2015

EEI Geotechnical & Environmental Solutions

FIGURE 3

APPENDIX A
SOIL CLASSIFICATION CHART AND BORING LOGS

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BOREHOLE LOG

Number: B-1

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/2/2015	10/2/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	MC	5 3 6	105	10	1–4	SM		**ALLUVIUM** SILTY-SAND, light brown, scattered gravels, damp to moist, loose; micaceous
	MC	7 10 11	103	5	5–6			@ 5' Becomes moist to very moist, coarse grained, medium dense
	MC	5 7 10	110	14	7–8			@ 7.5' Becomes saturated; heaving sands; groundwater encountered
	SPT	3 2 6			9–11			@ 10' Becomes loose
	SPT	9 11 14			12–15			@ 15' Becomes gray-brown, fine to medium grained, saturated, medium dense
	SPT	3 2 3			16–20			@ 20' Becomes loose
					21–31			Total depth: 21.5-feet Groundwater encountered at 8-feet Boring backfilled on 10/2/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-2

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/2/2015	10/2/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**ALLUVIUM**
					2			SILTY-SAND, light brown, scattered gravels, damp to moist, loose; micaceous
					3			
					4			
	MC	4 4 6	91	3	5			
					6			
					7			
					8			
					9			@ 9' Groundwater encountered
	MC	9 7 5	106	15	10	SM		@ 10' Becomes gray-brown, fine to medium grained, saturated; heaving sands
					11			
					12			
					13			
					14			
	SPT	5 6 6			15			@ 15' Becomes medium dense
					16			
					17			
					18			
					19			
	SPT	0 0 0			20			@ 20' Push with SPT Sampler, very loose
					21			
					22			Total depth: 21.5-feet Groundwater encountered at 9-feet Boring backfilled on 10/2/2015 with drilled cuttings
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			

BOREHOLE LOG

Number: B-3

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/2/2015	10/2/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**FILL** SANDY-SILT, orange-brown, scattered gravels, moist, medium dense
	MC	5 6 8	89	21	5	CL		@ 5' SANDY-CLAY, red-brown and yellow mottled, fine to medium grained, moist, stiff
	MC	5 5 8			8	CL		**ALLUVIUM** @ 8' SANDY-CLAY, dark brown to brown, fine grained, moist, stiff
	SPT	3 2 3			10			@ 10' Groundwater encountered; lost sample with Cal sampler; recovered with SPT
	SPT	8 10 12			15	SM		@ 15' SILTY-SAND, dark brown to gray, saturated, medium dense
	SPT	6 10 14			20			
					22			Total depth: 21.5-feet Groundwater encountered at 8-feet Boring backfilled on 10/2/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-4/P-1

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/2/2015	10/2/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**ALLUVIUM** SANDY-SILT, light brown, scattered gravels, damp to moist, medium dense; micaceous
					2			
					3			
					4			
					5			
					6			Total depth: 5-feet No groundwater encountered Percolation test performed Boring backfilled with drilled cuttings
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			

BOREHOLE LOG

Number: B-5

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/2/2015	10/2/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	MC	12 11 10	113	14	1–4	CL		**FILL** SANDY-CLAY, red-yellow-brown mottled, fine to medium grained, damp, very stiff
	SPT	3 2 3			5–6			@ 5' Becomes wet, medium stiff @ 6' Groundwater encountered
	SPT	1 1 1			8–14	SM		**ALLUVIUM** SILTY-SAND, dark gray, saturated, fine to medium grained, very loose; micaceous
	SPT	5 8 8			15–20			@ 15' Becomes medium dense
	SPT	5 7 5			21			
					22–31			Total depth: 21.5-feet Groundwater encountered at 8-feet Boring backfilled on 10/2/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-6

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 2

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/2/2015	10/2/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**FILL**
					2			SANDY-CLAY with GRAVEL, red-yellow-brown mottled, fine to medium grained
					3			with scattered gravels, moist, very stiff
					4	CL		
	MC	44 26 14			5			
					6			
					7			
	MC	12 11 13			8			@ 7.5' No sample recovered
					9			**ALLUVIUM**
					10			@ 10' CLAYEY-SAND, grayish-green, fine grained, very moist to wet, very loose
	MC	4 2 4	83	105	11	SC		
					12			@ 12' Groundwater encountered
					13			
					14			
					15			@ 15' SILTY-SAND, dark gray, fine grained, saturated, very loose
	SPT	2 1 1			16			
					17			
					18			
					19			
					20			@ 20' Becomes loose
	SPT	3 4 5			21			
					22	SM		
					23			
					24			
					25			
	SPT	2 4 3			26			
					27			
					28			
					29			
					30			
	SPT	8 11 14			31	SC		@ 30' CLAYEY-SAND, dark gray, fine grained, saturated, medium dense

BOREHOLE LOG

Number: B-6

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 2 of 2

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/2/2015	10/2/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					33	SC		*Boring B-6 continued...*
					34			
	SPT	10 15 20			35			@ 35' SILTY-SAND, dark gray, fine to medium grained, saturated, dense
					36			
					37	SM		
					38			
					39			
	SPT	7 7 12			40			@ 40' CLAYEY-SAND, dark gray, fine grained, saturated, medium dense
					41			
					42			
					43	SC		
					44			
	SPT	9 14 22			45			@ 45' Becomes dense; refusal heaving
					46			
					47			Total depth: 46.5-feet Groundwater encountered at 12-feet Boring backfilled on 10/2/2015 with bentonite chips
					48			
					49			
					50			
					51			
					52			
					53			
					54			
					55			
					56			
					57			
					58			
					59			
					60			
					61			
					62			
					63			

BOREHOLE LOG

Number: B-7

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 2

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/5/2015	10/5/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**FILL** SANDY-SILT, brown, damp, medium dense
	MC	1 3 4		13	3			**ALLUVIUM**
					4			@ 3' CLAYEY-SAND, light brown, fine grained, moist, loose
	MC	4 6 7	94	16	5 6	SC		
	MC	3 6 6	92	25	8			@ 7.5' Becomes dark gray, fine to medium grained, wet
					9		▽	@ 9' Groundwater encountered
	SPT	2 3 4		25	10			@ 10' SAND, brown, fine to medium grained, saturated, loose
					11			
					12			
					13			
					14			
	SPT	3 6 9		27	15	SP		
					16			
					17			
					18			
					19			
	SPT	3 4 3		26	20			@ 20' CLAYEY-SAND, dark gray, saturated, loose
					21			
					22	SC		
					23			
					24			
	SPT	1 0 0		28	25			@ 25' SANDY-CLAY, dark gray, saturated, very soft
					26			
					27			
					28	CL		
					29			
	SPT	0 3 4		25	30			@ 30' Becomes medium stiff
					31			

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-7

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 2 of 2

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/5/2015	10/5/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					33	CL		*Boring B-7 continued...*
	SPT	6 8 9		24	35			@ 35' SILTY-SAND, gray, fine to medium grained, saturated, medium dense
	SPT	7 12 13		24	40	SM		
	SPT	8 14 11		26	45			
	SPT	2 7 12		14	50			
					52			Total depth: 51.5-feet Groundwater encountered at 9-feet Boring backfilled on 10/5/2015 with bentonite chips

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-8/P-2

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/6/2015	10/6/2015	Truck-Mounted Diedrich D-50 / Hollow Stem Auger	8-inch

EEI Rep:	Project No.:
ML	CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1–5	CL		**FILL** SANDY-CLAY, dark brown to reddish brown, fine to medium grained, moist, medium stiff
					6–31			Total depth: 5-feet No groundwater encountered Percolation test performed Boring backfilled with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-9

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/6/2015	10/6/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	MC	2 6 7	88	14	1–4	ML		**ALLUVIUM** CLAYEY-SILT, dark borwn, damp, stiff; micaceous
	MC	2 3 4			5–6	ML		@ 5' Becomes moist, medium stiff
	MC	1 1 3			7–8	ML		@ 7.5' No sample recovered; blow counts indicate soft soil
					9	ML		@ 9' Groundwater encountered
	SPT	1 2 4			10–14	SM		@ 10' SILTY-SAND, brown, fine grained, loose, saturated
	SPT	3 4 5			15–19	SM		@ 15' Becomes fine to medium grained
	SPT	2 3 3			20–21	SM		
					22–31			Total depth: 21.5-feet Groundwater encountered at 9-feet Boring backfilled on 10/6/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-10

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/6/2015	10/6/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	MC	3 7 9	102	19	1–7	SC		**ALLUVIUM** CLAYEY-SAND, dark brown, fine grained, moist, loose
	MC	3 6 7	88	27				
	MC	3 5 8	90	21	8			@ 7.5' SILTY-SAND, dark brown to gray, fine grained, some clay, moist to wet, loose
	SPT	1 2 1			10			@ 10' Becomes very loose; groundwater encountered
					11–14	SM		
	SPT	0 0 2			15			@ 15' Becomes fine to medium grained
					16–19			
	SPT	2 3 3			20			@ 20' Becomes loose
					21			
					22–31			Total depth: 21.5-feet Groundwater encountered at 10-feet Boring backfilled on 10/6/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-11

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	EEI Rep:	Project No.:	Drill Rig/Sampling Method	Borehole Diameter:
10/6/2015	10/6/2015	ML	CIS-72092.4	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	MC	3 6 3	85	12	1–5	SM		**FILL** SILTY-SAND, dark brown, fine grained, moist, loose; micaceous
	MC	2 3 5	81	31	5–7	CL-ML		**ALLUVIUM** @ 2.5' SILTY-CLAY, dark brown, moist, medium stiff; micaceous @ 7' Groundwater encountered
	MC	3 6 7	90	29	7–8			@ 7.5' SILTY-SAND, dark gray, fine to medium grained, saturated, loose
	SPT	2 4 5			8–14			
	SPT	3 2 2			14–20	SM		
	SPT	2 3 2			20–21			
					22–31			Total depth: 21.5-feet Groundwater encountered at 8-feet Boring backfilled on 10/6/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-12

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/6/2015	10/6/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	MC	3 4 8	100	16	1			**ALLUVIUM** SILTY-SAND, light yellow-brown, scattered gravels, damp to moist, medium dense; micaceous
	MC	4 5 6	109	14	5			@ 5' Becomes moist to very moist
	MC	6 6 6			8			@ 8' Groundwater encountered
	SPT	2 2 3			10	SM		@ 10' Becomes gray-brown, fine to medium grained, saturated, loose
	SPT	1 1 2			15			
	SPT	3 2 2			20			@ 20' Becomes loose to medium dense
					22			Total depth: 21.5-feet Groundwater encountered at 8-feet Boring backfilled on 10/6/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-13

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 2

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/7/2015	10/7/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: BM

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**FILL** SANDY-SILT, orange-brown, scattered gravels, moist, medium dense
	MC	9 11 14	114	12	3			**ALLUVIUM** @ 3' SANDY-CLAY, dark brown to brown, fine grained, moist, very stiff
	MC	10 13 20	112	10	6			
	MC	2 3 4	107	11	8			@ 7.5' Becomes medium stiff
	SPT	3 6 5			10			@ 10' Becomes moist to very moist, stiff
					12	CL		@ 12' Groundwater encountered
	SPT	2 2 4			15			@ 15' Increase in silt content, becomes medium stiff
	SPT	3 9 15			20			@ 20' SILTY-SAND, gray, fine grained, saturated, medium dense
	SPT	4 2 2			25	SM		@ 25' Increase in clay content, becomes dark gray
					26			@ 26' SANDY-CLAY, dark gray, fine grained, saturated, stiff
	SPT	2 6 5			30	CL		

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-13

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 2 of 2

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/7/2015	10/7/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: BM

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					33			*Boring B-13 continued...*
					34			
					35			
	SPT	3 8 9			36	CL		@ 35' Becomes very stiff
					37			
					38			
					39			
					40			
	SPT	4 8 10			41			@ 40' SILTY-SAND, dark gray, fine grained, saturated, medium dense
					42			
					43			
					44			
					45			
	SPT	4 6 7			46	SM		
					47			
					48			
					49			
					50			
	SPT	7 11 17			51			@ 50' No sample recovered; heaving sand
					52			
					53			Total depth: 51.5-feet Groundwater encountered at 12-feet
					54			
					55			Boring backfilled on 10/7/2015 with bentonite chips
					56			
					57			
					58			
					59			
					60			
					61			
					62			
					63			

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-14

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/7/2015	10/7/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: BM

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
	MC	4 6 7	99	3	1			**ALLUVIUM** SILTY-SAND, light brown, scattered gravels, damp to moist, loose; micaceous
	MC	2 3 4	97	7	5			@ 5' Becomes moist to very moist, very loose
	MC	2 1 3			8			@ 7.5' No sample recovery
					9			@ 8' Groundwater encountered
	SPT	4 1 2			10	SM		@ 10' Becomes gray-brown, fine to medium grained, saturated
	SPT	6 4 4			15			@ 15' Becomes loose
	SPT	4 4 7			20			@ 20' Becomes medium dense
					22			Total depth: 21.5-feet Groundwater encountered at 8-feet Boring backfilled on 10/7/2015 with drilled cuttings

BOREHOLE LOG

Number: B-15

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/7/2015	10/7/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: BM

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**ALLUVIUM** CLAYEY-SILT, dark brown, moist, medium stiff
	MC	3 4 5	96	13	3	ML		@ 2.5' SILT, brown, moist, medium stiff; micaeous
	MC	3 5 7	98	5	5	SM		@ 5' SILTY-SAND, dark brown, moist, loose
	SPT	2 4 4	100	20	7			@ 7' Groundwater encountered
	SPT	2 2 3			10			
	SPT	2 3 5			15			
	SPT	1 1 3			20			
					22			Total depth: 21.5-feet Groundwater encountered at 7-feet Boring backfilled on 10/7/2015 with drilled cuttings
					31			

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-16

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 2

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/8/2015	10/8/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: BM

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1			**FILL**
					2	SM		SILTY-SAND, orange-brown, scattered gravels, moist, medium dense
	MC	4 11 12	106	16	3			
					4			
					5			**ALLUVIUM**
	MC	5 6 9	88	20	6			@ 4' SANDY-CLAY, brown, gray and orange, scattered gravels, very moist, stiff
					7	CL		
	MC	2 3 3			8			@ 7.5' Becomes medium stiff
					9			
					10			@ 10' CLAYEY-SAND, grayish-green, fine grained, very moist to wet, loose
	SPT	2 2 3	99	21	11			
					12			
					13	SC		
					14			
	SPT	1 2 3			15			
					16			@ 16' Groundwater encountered
					17			@ 17' SILTY-SAND, dark gray, fine grained, saturated, loose
					18			
					19			
	SPT	5 5 4			20			
					21			
					22			
					23	SM		
					24			
	SPT	3 2 2			25			
					26			
					27			
					28			
					29			
					30			
	SPT	1 4 6			31	SC		@ 30' CLAYEY-SAND, dark gray, fine grained, saturated, medium dense

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-16

Sheet: 2 of 2

Client: CenterPoint Intergrated Solutions, LLC

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	EEI Rep:	Project No.:	Drill Rig/Sampling Method	Borehole Diameter:
10/8/2015	10/8/2015	BM	CIS-72092.4	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

SAMPLE LOG | **BOREHOLE LOG**

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					33	SC		*Boring B-16 continued...*
	SPT	3 7 12			35	SM		@ 35' SILTY-SAND, dark gray, fine to medium grained, saturated, medium dense
	SPT	1 2 3			40	SC		@ 40' CLAYEY-SAND, dark gray, fine grained, saturated, loose
	SPT	2 4 7			45	SM		@ 45' SILTY-SAND, dark gray, fine to medium grained, saturated, medium dense
	SPT	2 9 12			51			
					52			Total depth: 51.5-feet Groundwater encountered at 16-feet Boring backfilled on 10/8/2015 with bentonite chips

BOREHOLE LOG

Number: B-17

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/8/2015	10/8/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: BM

Project No.: CIS-72092.4

Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**FILL** SILT, dark brown, moist, loose; organic rich sediments; micaceous
	MC	3 4 5	83	14	3	ML		**ALLUVIUM** @ 2.5' SILT, brown, moist, loose; micaceous
	MC	2 4 6	83	31	5			@ 5' Becomes very moist
	MC	2 5 6	87	27	8	SM		@ 7.5' SILTY-SAND, dark gray, fine grained, saturated, loose @ 8' Groundwater encountered at 8-feet
	MC	2 4 6	99	19	10			@ 10' Becomes fine to medium grained
	SPT	4 8 10			15			@ 15' Becomes medium dense
	SPT	4 4 4			20			@ 20' Becomes loose
					22			Total depth: 21.5-feet Groundwater encountered at 8-feet Boring backfilled on 10/8/2015 with drilled cuttings

BOREHOLE LOG CIS-72092.4.GPJ EEI.GDT 10/30/15

BOREHOLE LOG

Number: B-18

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/8/2015	10/8/2015	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

EEI Rep: BM

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**FILL** SILT, brown, abundant gravels, moist, loose; micaceous
	MC	2 7 7	78	10	3	CL		@ 3' SANDY-CLAY, orange and brown mottled, abundant gravels, moist, stiff
	MC	6 7 10	101	19	5			**ALLUVIUM** @ 5' SANDY-CLAY, brown, green and orange, scattered gravels, moist, stiff
	MC	2 6 6	95	20	8			
	MC	3 4 5	92	19	10			@ 10' Becomes medium stiff
					12	CL		
	SPT	1 2 3			15			@ 15' Groundwater encountered
	SPT	3 3 4			20	SM		@ 20' SILTY-SAND, dark gray, saturated, loose
					22			Total depth: 21.5-feet Groundwater encountered at 15-feet Boring backfilled on 10/8/2015 with drilled cuttings

BOREHOLE LOG

Number: B-19/P-3

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	EEI Rep:	Project No.:	Drill Rig/Sampling Method	Borehole Diameter:
10/8/2015	10/8/2015	BM	CIS-72092.4	Track-Mounted Fraste PL-G / Hollow Stem Auger	8-inch

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	ML		**FILL** SILT, dark brown, moist, loose; organic rich sediments; micaceous
					2 3 4 5	ML		**ALLUVIUM** @ 2.5' SANDY-SILT, brown, moist, loose; micaceous
					6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			Total depth: 5-feet No groundwater encountered Percolation test performed Boring backfilled on 10/8/2015 with drilled cuttings

BOREHOLE LOG

Number: B-20/P-4

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/7/2015	10/7/2015	Hand Auger	3-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	SM		**ALLUVIUM** SILTY-SAND, light yellow-brown, fine grained, damp, medium dense
					2			
					3			@ 3' Becomes fine to medium grained
					4			
					5			
					6			Total depth: 5-feet No groundwater encountered Percolation test performed Boring backfilled with drilled cuttings
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			

BOREHOLE LOG

Number: B-21/P-5

Client: CenterPoint Intergrated Solutions, LLC

Sheet: 1 of 1

Location: Proposed CarMax Auto Dealership
Sweetwater Road and Plaza Bonita Road, National City, California

Date Started:	Date Finished:	Drill Rig/Sampling Method	Borehole Diameter:
10/7/2015	10/7/2015	Hand Auger	3-inch

EEI Rep: ML

Project No.: CIS-72092.4

SAMPLE LOG								BOREHOLE LOG
Bulk	Sample Type	Blows Per 6"	Dry Unit Wt. (pcf)	Moisture (%)	Depth In Feet	USCS Symbol	Graphic Log	Geologic Description (SoilType, Color, Grain, Minor Soil Component, Moisture, Density, Odor, Etc.)
					1	SM		**ALLUVIUM** SILTY-SAND, reddish-brown, fine grained, damp, medium dense
					2			
					3			@ 2.5' Becomes brown, fine to medium grained
					4			
					5			
					6			Total depth: 5-feet No groundwater encountered Percolation test performed Boring backfilled with drilled cuttings
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			
					30			
					31			

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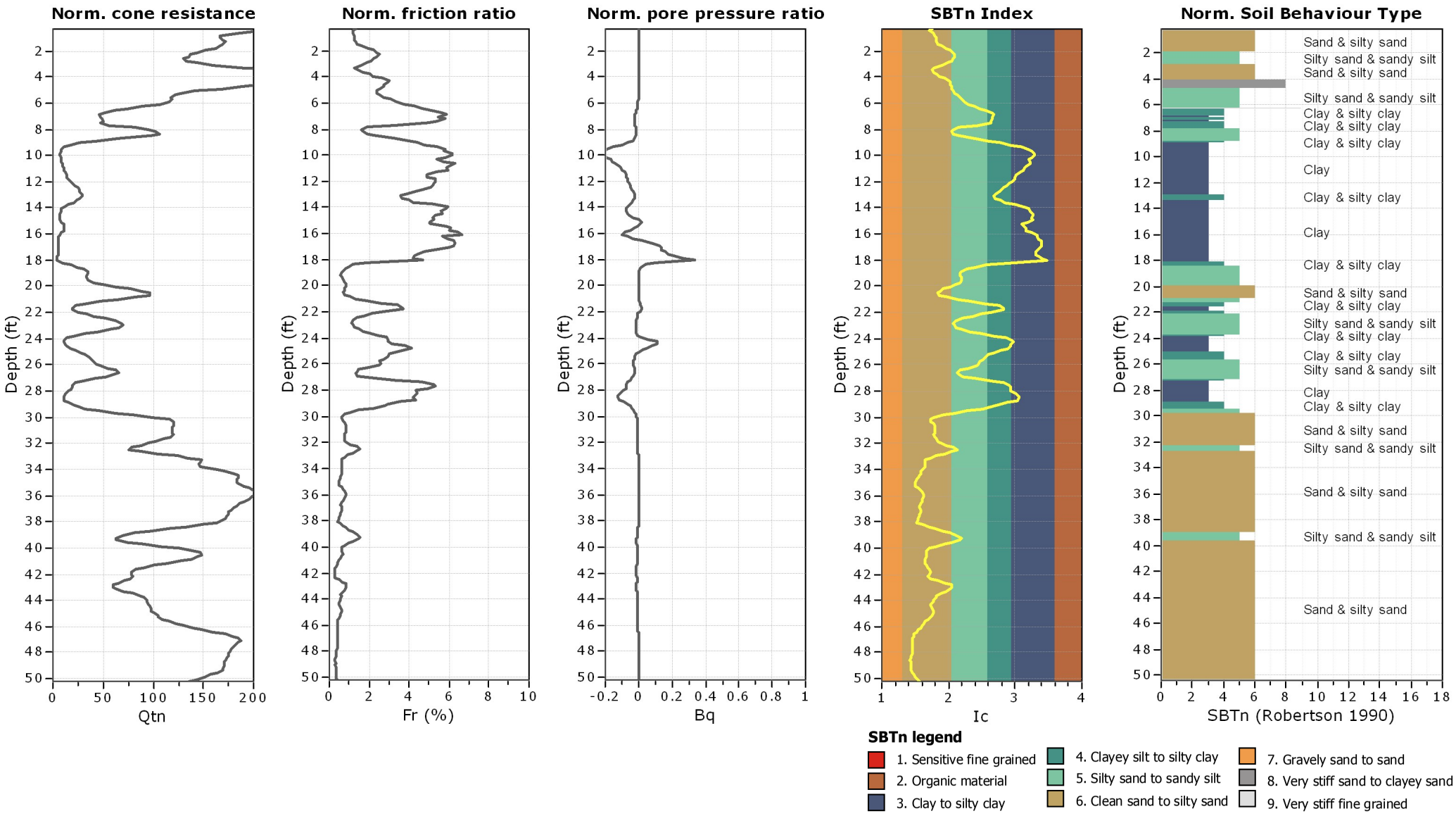
Project: **CIS-72092.4**
Location: **Proposed CarMax National City**

CPT: CPT-01
Total depth: 50.20 ft, Date: 10/29/2015



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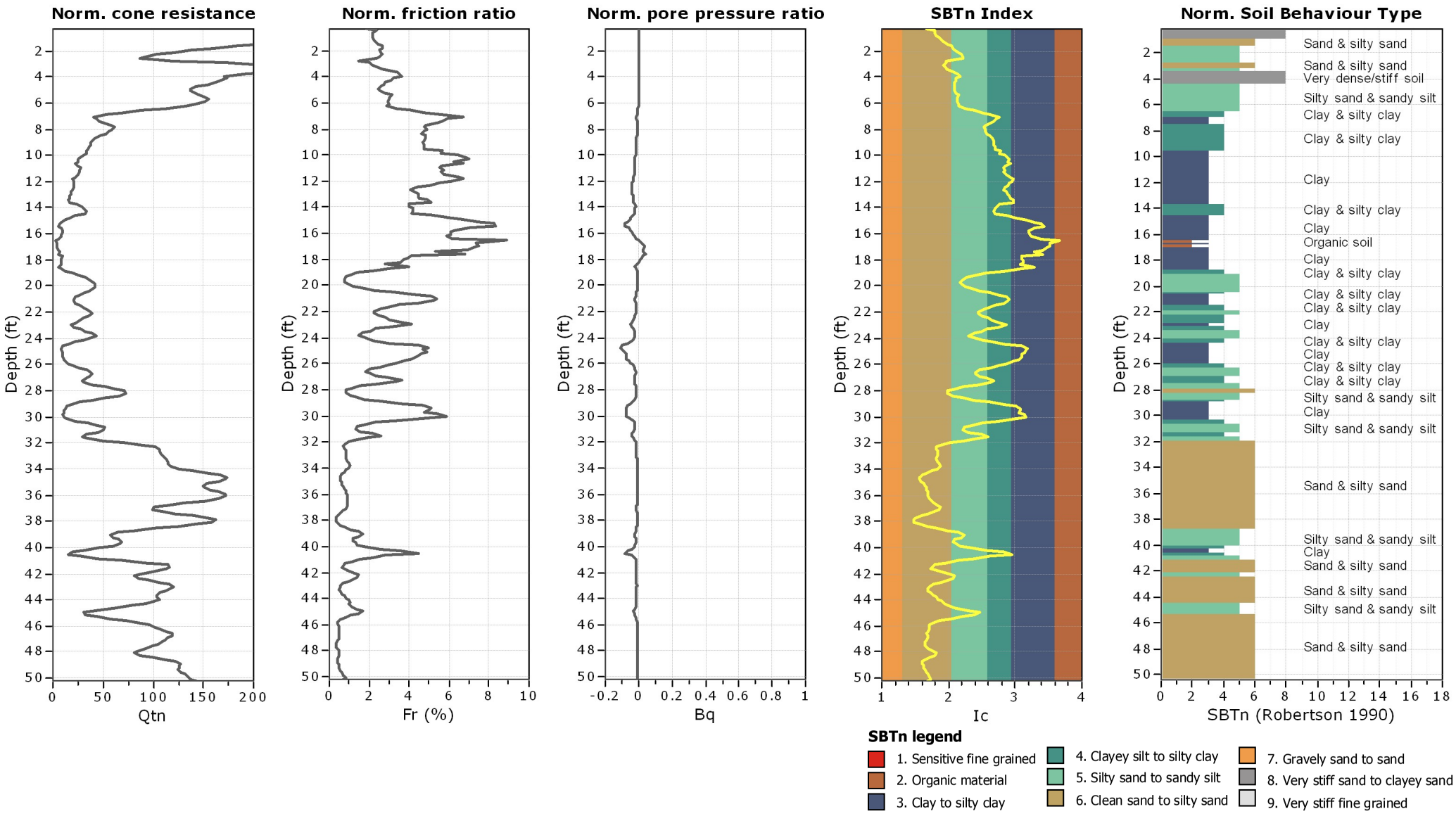
Project: **CIS-72092.4**
Location: **Proposed CarMax National City**

CPT: CPT-02
Total depth: 50.20 ft, Date: 10/29/2015



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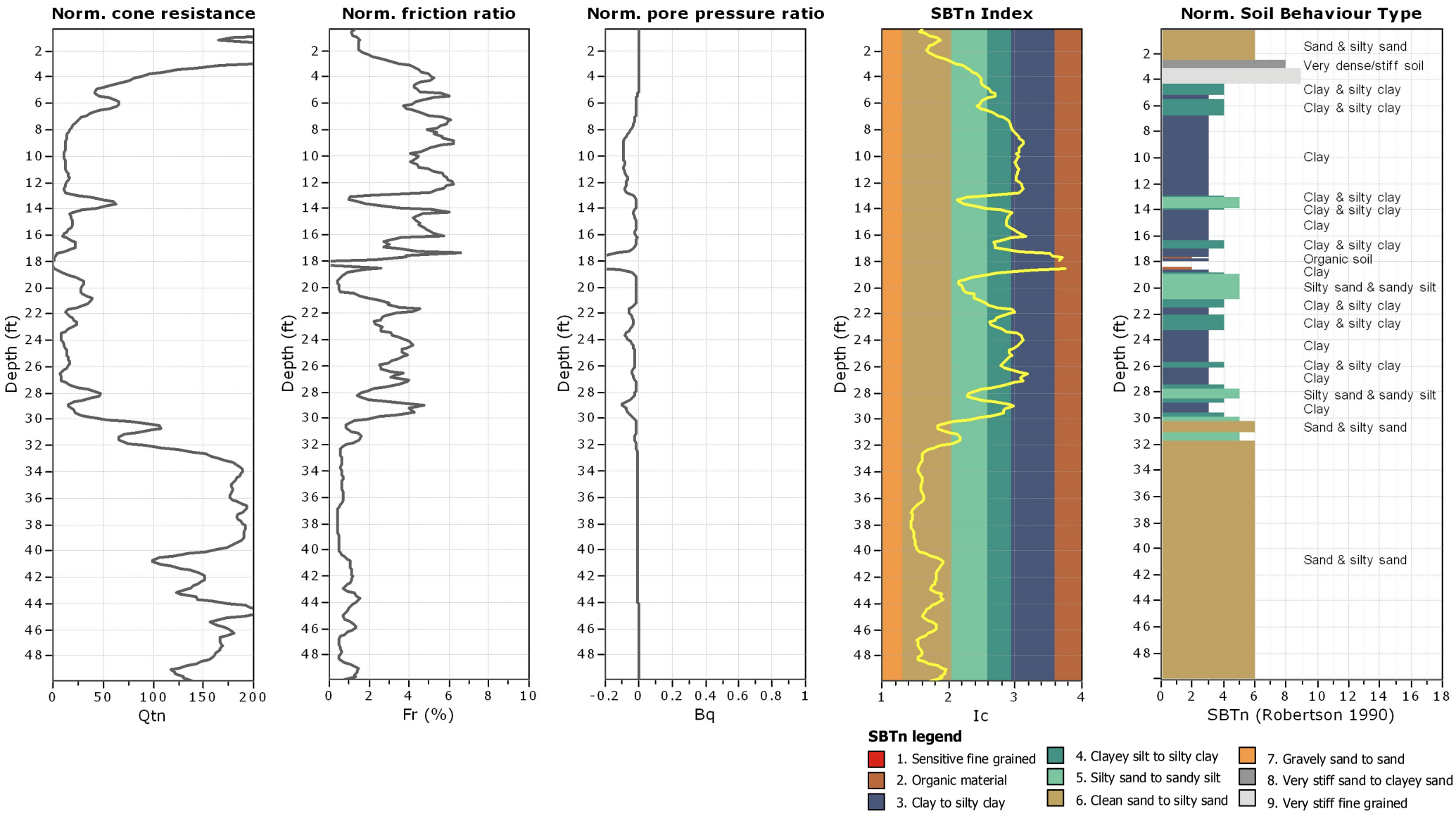
Project: **CIS-72092.4**
Location: **Proposed CarMax National City**

CPT: CPT-03
Total depth: 49.87 ft, Date: 10/29/2015



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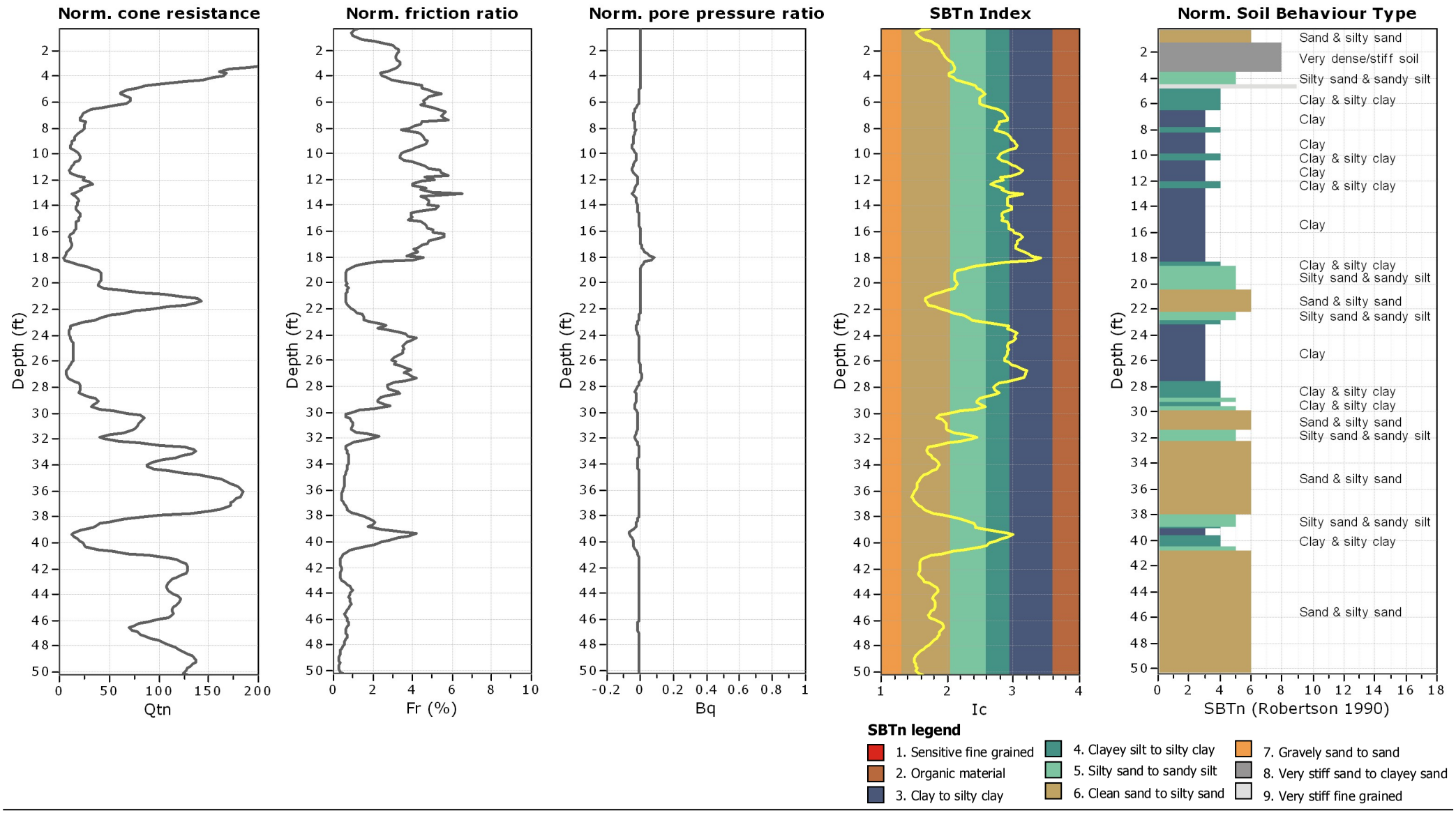
Project: **CIS-72092.4**
Location: **Proposed CarMax National City**

CPT: CPT-04
Total depth: 50.20 ft, Date: 10/29/2015



APPENDIX B
LABORATORY TEST DATA

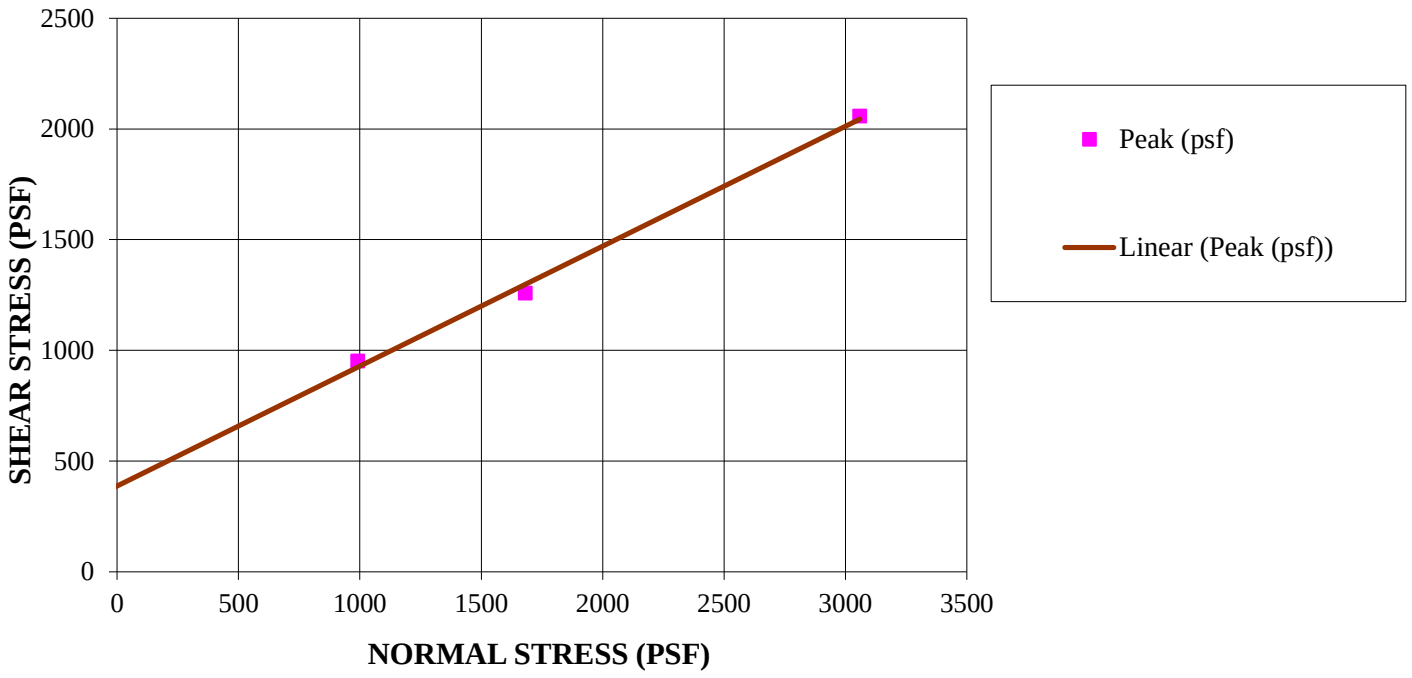
DIRECT SHEAR TEST ASTM D 3080

Job Data	
Job No.:	CIS-72092.4
Client:	Centerpoint Integrated Solutions
Date:	10/14/15
Sample Data	
Sample:	B-7 @ 2-5 ft.
Remolded:	90%
Remarks:	Sample innundated prior to testing
Soil Description:	Light Brown Clayey Sand

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

SHEAR TEST DIAGRAM



	Test Results			
	Phi		**Cohesion**	
Ultimate (psf)	28	degrees	387	psf

Average Initial Moisture	12.0%
Average Dry Density	108.5 pcf
Average Final Moisture	20.7%

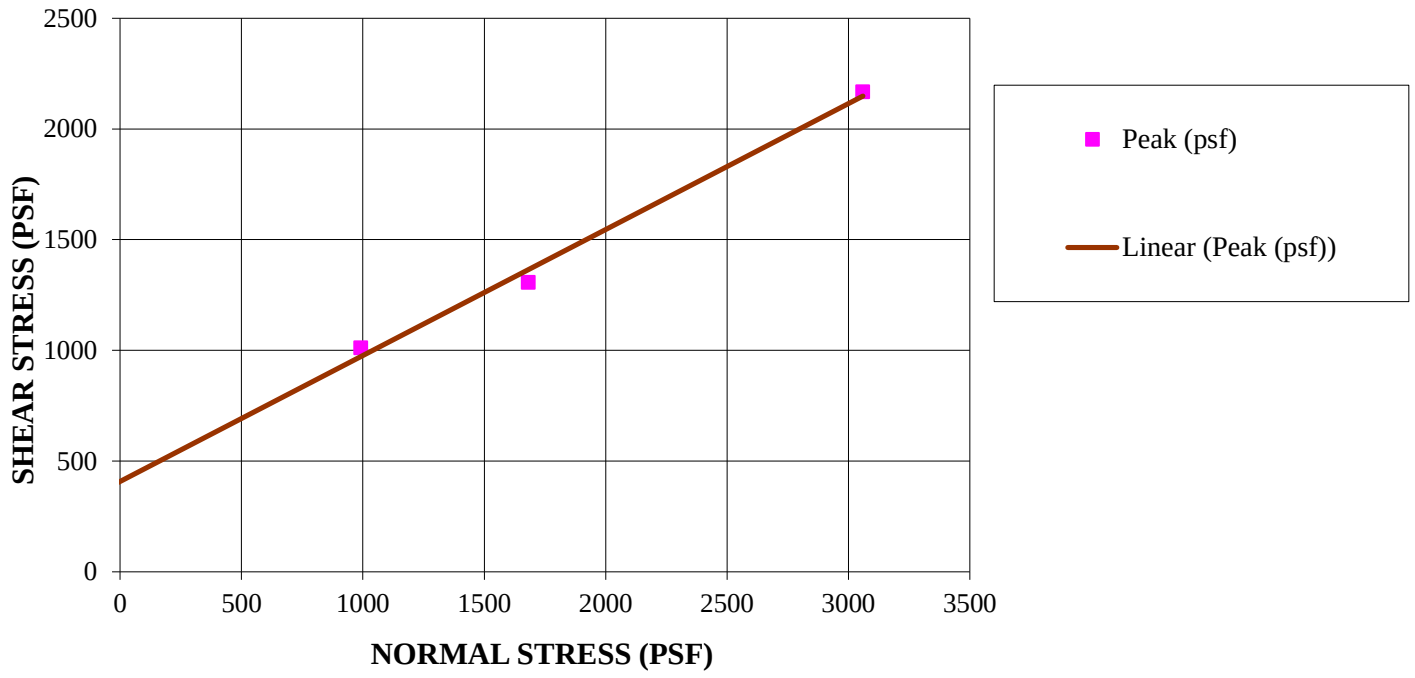
DIRECT SHEAR TEST ASTM D 3080

Job Data	
Job No.:	CIS-72092.4
Client:	Centerpoint Integrated Solutions
Date:	10/15/15
Sample Data	
Sample:	B-10 @ 1-5 ft.
Remolded:	90%
Remarks:	Sample innundated prior to testing
Soil Description:	Brown Clayey Sand

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

SHEAR TEST DIAGRAM



	Test Results			
	Phi		**Cohesion**	
Ultimate (psf)	30	degrees	409	psf

Average Initial Moisture	9.5%
Average Dry Density	111.4 pcf
Average Final Moisture	16.4%

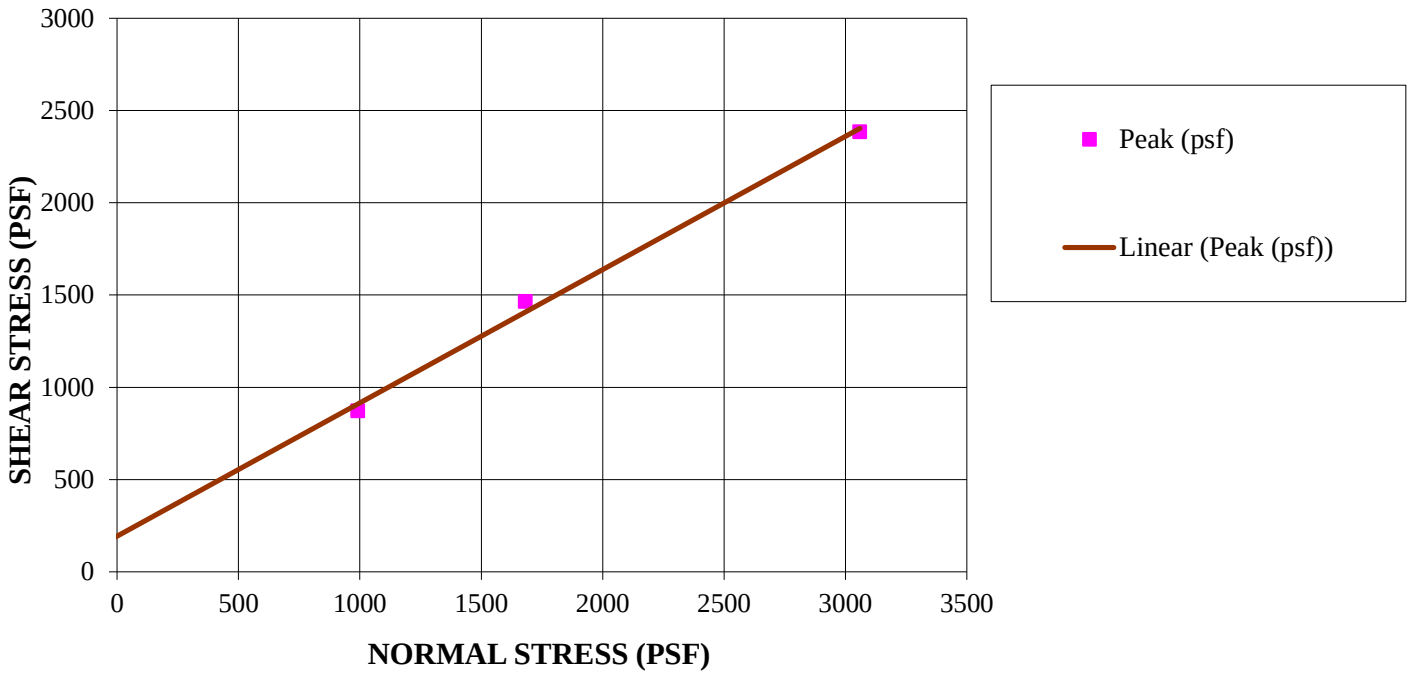
DIRECT SHEAR TEST ASTM D 3080

Job Data	
Job No.:	CIS-72092.4
Client:	Centerpoint Integrated Solutions
Date:	10/16/15
Sample Data	
Sample:	B-12 @ 1-6 ft.
Remolded:	90%
Remarks:	Sample innundated prior to testing
Soil Description:	Light Yellow Brown Silty Sand

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

SHEAR TEST DIAGRAM



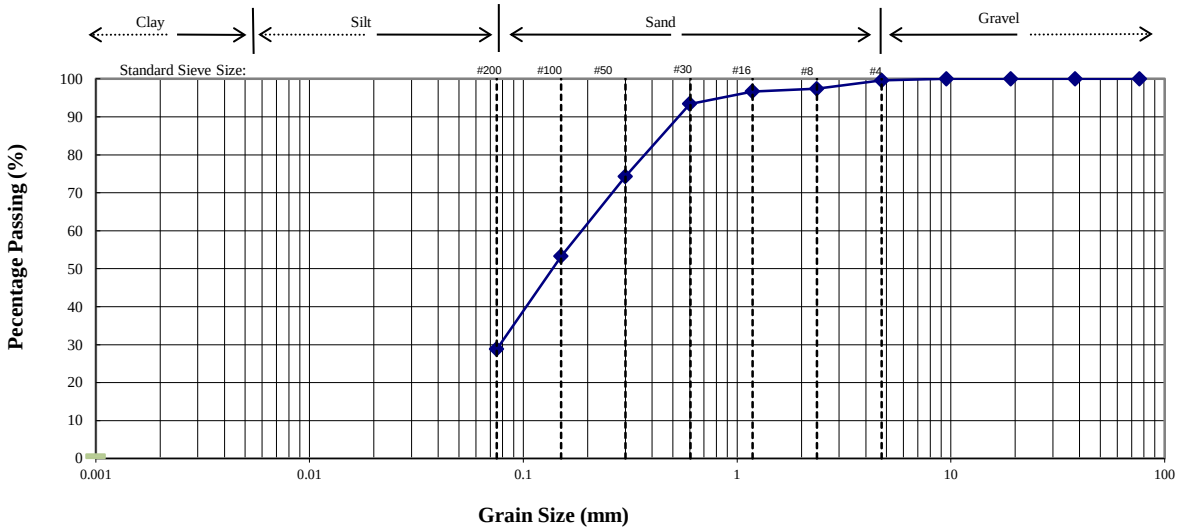
	Test Results			
	Phi		**Cohesion**	
Ultimate (psf)	36	degrees	194	psf

Average Initial Moisture	9.5%
Average Dry Density	111.4 pcf
Average Final Moisture	16.4%

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B-7 @ 5 ft.		D_{10} (mm)	N/A
Total Weight (g)	112.9		D_{30} (mm)	0.08
Dry Weight (g)	100.3		D_{60} (mm)	0.20
Wet Sieve Weight (g)	71.4		C_u	N/A
Initial Moisture (%)	12.6		C_c	N/A

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B-7 at 5 feet is classified as Clayey Sand (SC)



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2	0.0	0.0	100.0
1.5"	38.1	0.0	0.0	100.0
3/4"	19.05	0.0	0.0	100.0
3/8"	9.53	0.0	0.0	100.0
#4	4.75	0.4	0.4	99.6
#8	2.36	2.6	2.6	97.4
#16	1.18	3.3	3.3	96.7
#30	0.6	6.6	6.6	93.4
#50	0.3	25.8	25.7	74.3
#100	0.15	46.9	46.8	53.2
#200	0.075	71.4	71.2	28.8

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax National City

Job Number: CIS-72092.4

Date: 10/15/15

Boring Number: B-7

Depth: 5 ft.

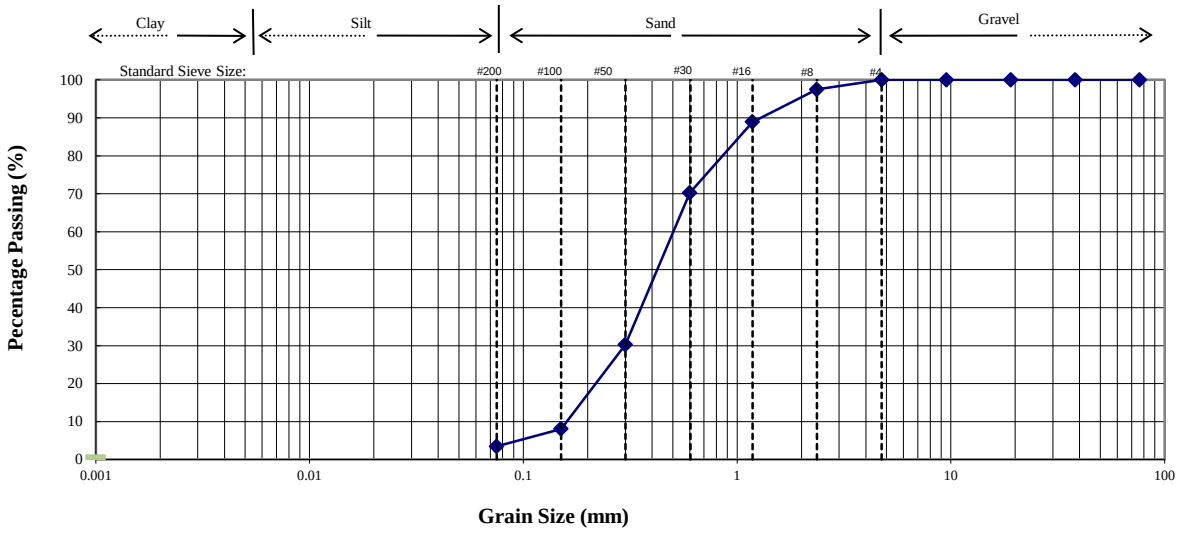
Soil Description: Light Brown Clayey Sand SC

Tested by: B D

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B-7 @ 10 ft.		D_{10} (mm)	0.163
Total Weight (g)	114.8		D_{30} (mm)	0.30
Dry Weight (g)	92.1		D_{60} (mm)	0.52
Wet Sieve Weight (g)	88.9		C_u	3.20
Initial Moisture (%)	24.6		C_c	1.04

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B-7 at 10 feet is classified as Poorly Graded Sand (SP)



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2	0.0	0.0	100.0
1.5"	38.1	0.0	0.0	100.0
3/4"	19.05	0.0	0.0	100.0
3/8"	9.53	0.0	0.0	100.0
#4	4.75	0.0	0.0	100.0
#8	2.36	2.3	2.5	97.5
#16	1.18	10.2	11.1	88.9
#30	0.6	27.4	29.8	70.2
#50	0.3	64.2	69.7	30.3
#100	0.15	84.7	92.0	8.0
#200	0.075	88.9	96.5	3.5

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax National City

Job Number: CIS-72092.4

Date: 10/15/15

Boring Number: B-7

Depth: 10 ft.

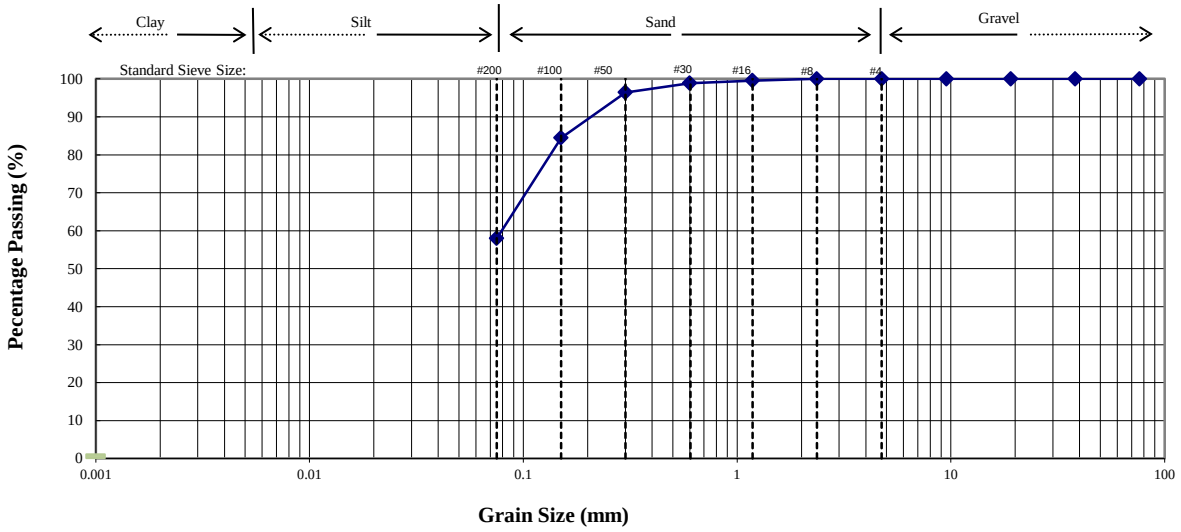
Soil Description: Brown Poorly Graded Sand SP

Tested by: B D

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B-7 @ 25 ft.		D_{10} (mm)	N/A
Total Weight (g)	114.8		D_{30} (mm)	N/A
Dry Weight (g)	89.5		D_{60} (mm)	0.08
Wet Sieve Weight (g)	37.6		C_u	N/A
Initial Moisture (%)	28.3		C_c	N/A

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B-7 at 25 feet is classified as Sandy Clay (CL)



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2	0.0	0.0	100.0
1.5"	38.1	0.0	0.0	100.0
3/4"	19.05	0.0	0.0	100.0
3/8"	9.53	0.0	0.0	100.0
#4	4.75	0.0	0.0	100.0
#8	2.36	0.0	0.0	100.0
#16	1.18	0.4	0.4	99.6
#30	0.6	1.0	1.1	98.9
#50	0.3	3.2	3.6	96.4
#100	0.15	13.9	15.5	84.5
#200	0.075	37.6	42.0	58.0

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Centerpoint Integrated Solutions

Project Name: Sweetwater Rd.

Job Number: CIS-72092.4

Date: 10/15/15

Boring Number: B-7

Depth: 25 ft.

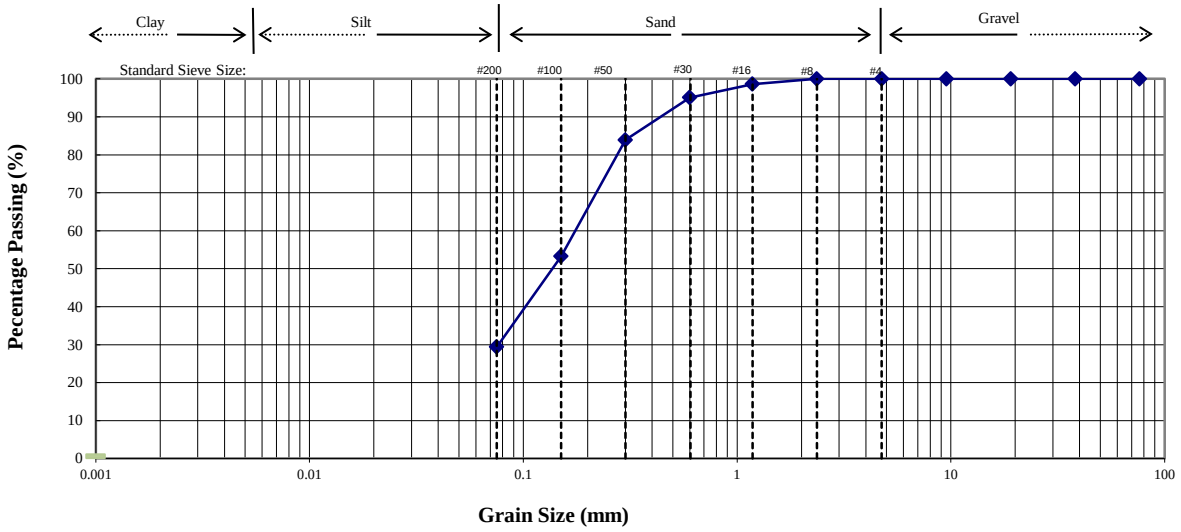
Soil Description: Dark Gray Sandy Clay CL

Tested by: B D

PARTICLE-SIZE ANALYSIS OF SOILS
ASTM METHOD D 422 (SIEVE ANALYSIS)

Sample :	B-7 @ 40 ft.		D_{10} (mm)	N/A
Total Weight (g)	116.5		D_{30} (mm)	0.08
Dry Weight (g)	93.9		D_{60} (mm)	0.18
Wet Sieve Weight (g)	66.3		C_u	N/A
Initial Moisture (%)	24.1		C_c	N/A

According to ASTM D 2487 Unified Soil Classification System (USCS) and ASTM D 422 (Standard Test Method for Particle-Size Analysis) test method results, soil sample B-7 at 40 feet is classified as Silty Sand (SM)



Sieve Size (in)	Sieve Size (mm)	Cumulative Weight of dry soil (gm)	Percent Retained (%)	Percent Passing (%)
3"	76.2	0.0	0.0	100.0
1.5"	38.1	0.0	0.0	100.0
3/4"	19.05	0.0	0.0	100.0
3/8"	9.53	0.0	0.0	100.0
#4	4.75	0.0	0.0	100.0
#8	2.36	0.0	0.0	100.0
#16	1.18	1.3	1.4	98.6
#30	0.6	4.6	4.9	95.1
#50	0.3	15.1	16.1	83.9
#100	0.15	43.9	46.8	53.2
#200	0.075	66.3	70.6	29.4

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax

Job Number: CIS-72092.4

Date: 10/15/15

Boring Number: B-7

Depth: 40 ft.

Soil Description: Gray Silty Sand SM

Tested by: B D

EXPANSION INDEX TEST

ASTM METHOD D 4829

Sample B-7 @ 2-5 ft.

Moisture Content of Initial Sample		% Saturation of Re-molded Sample		Moisture Content of Final Sample	
Tare No. -	91	Wt. of Soil and Ring (g) -	579	Wt. of Soil and Ring (g) -	623.9
Wet Weight and Tare (g) -	142.4	Ring Weight (g) -	189.0	Ring Weight (g) -	189.0
Dry Weight and Tare (g) -	133.0	Wet Weight of Soil (g) -	390.0	Wet Weight of Soil (g) -	434.9
Tare Weight (g) -	49.9	Dry Weight of Soil (g) -	350.4	Dry Weight of Soil (g) -	350.4
Water Loss (g) -	9.4	Volume of Ring (ft^3) -	0.0073	Weight of Water (g) -	84.5
Dry Weight (g) -	83.1	Dry Density (pcf) -	105.8	*Final Moisture (%)*	*24.1*
Initial Moisture (%) -	*11.3*	*Initital Saturation (%) -*	*51.6*	*Final Saturation (%) -*	*110.0*

Expansion Test - UBC (144 PSF)				
	Date	Time	Reading	
Add Weight	10/16/2015	7:15	0.000	
10 Minutes		7:25	0.000	Initial Reading
Add Water		9:00	0.055	
		10:30	0.064	
	10/19/2015	5:11	0.067	Final Reading

EImeasured	=	67
EI_{50}	**=**	**68**

Expansion Index, EI_{50}	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax National City

Job Number: CIS-72092.4

Date: 10/16/15

Sample Number: B-7

Location: 2-5 ft.

Description: Light Brown Clayey-Sand

Tested by: BD

EXPANSION INDEX TEST

ASTM METHOD D 4829

Sample B-10 @ 1-5 ft.

Moisture Content of Initial Sample		% Saturation of Re-molded Sample		Moisture Content of Final Sample	
Tare No. -	52	Wt. of Soil and Ring (g) -	605	Wt. of Soil and Ring (g) -	639.7
Wet Weight and Tare (g) -	121.5	Ring Weight (g) -	198.9	Ring Weight (g) -	198.9
Dry Weight and Tare (g) -	115.6	Wet Weight of Soil (g) -	406.1	Wet Weight of Soil (g) -	440.8
Tare Weight (g) -	49.9	Dry Weight of Soil (g) -	372.6	Dry Weight of Soil (g) -	372.6
Water Loss (g) -	5.9	Volume of Ring (ft^3) -	0.0073	Weight of Water (g) -	68.2
Dry Weight (g) -	65.7	Dry Density (pcf) -	112.5	*Final Moisture (%)*	*18.3*
Initial Moisture (%) -	*9.0*	*Initital Saturation (%) -*	*48.8*	*Final Saturation (%) -*	*99.4*

Expansion Test - UBC (144 PSF)				
	Date	Time	Reading	
Add Weight	10/16/2015	6:20	0.000	
10 Minutes		6:30	0.000	Initial Reading
Add Water		7:40	0.026	
		10:30	0.027	
	10/19/2015	6:15	0.028	Final Reading

EImeasured	=	28
EI_{50}	**=**	**27**

Expansion Index, EI_{50}	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax National City

Job Number: CIS-72092.4

Date: 10/16/15

Sample Number: B-10

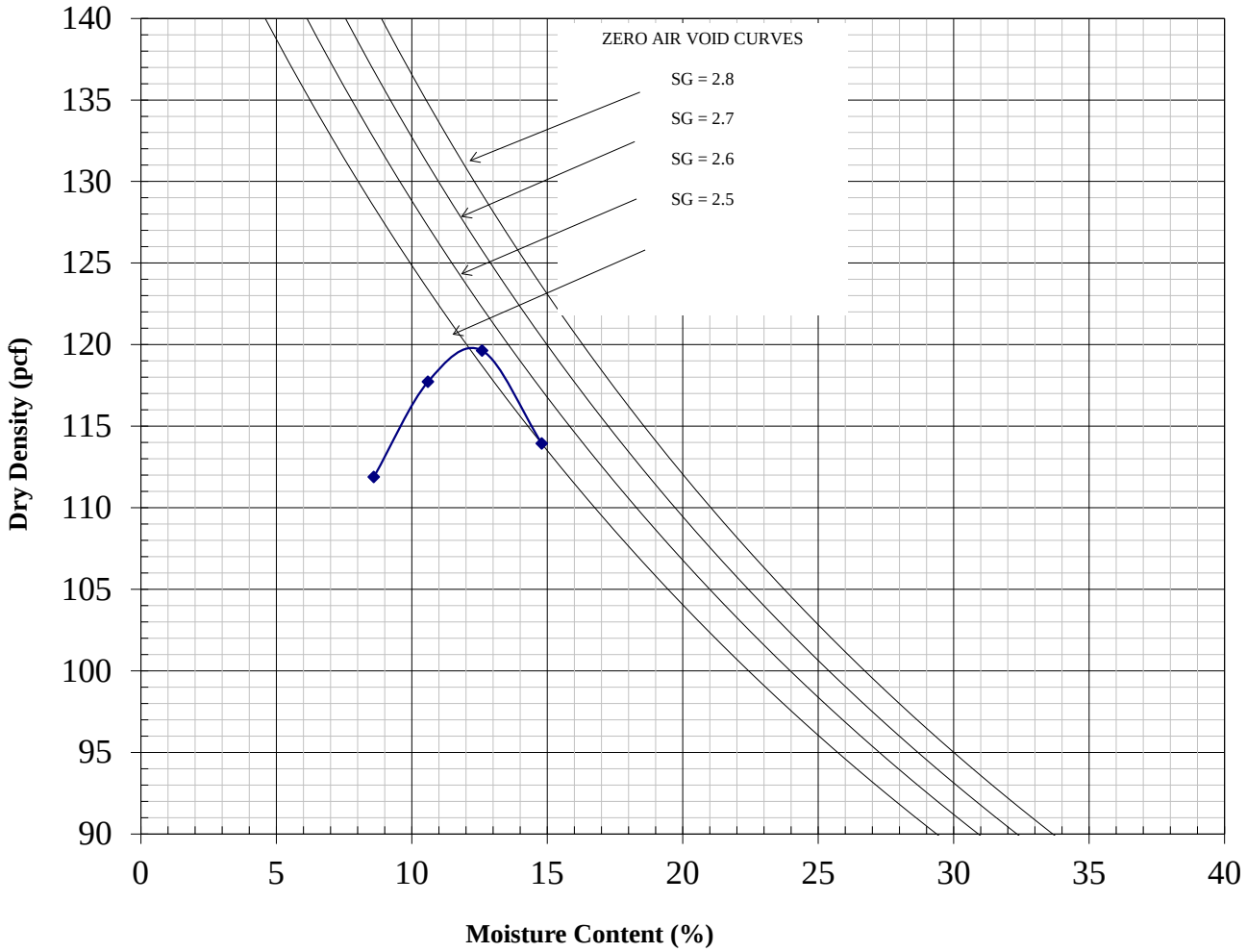
Location: 1-5 ft.

Description: Dark Brown Clayey Sand

Tested by: BD

LABORATORY COMPACTION ASTM D 1557

Sample	1	2	3	4
Mold and wet soil (lbs.)	8.340	8.630	8.780	8.650
Mold (lbs.)	4.290	4.290	4.290	4.290
Wet Soil (lbs.)	4.050	4.340	4.490	4.360
Wet Density (pcf)	121.50	130.20	134.70	130.80
Moisture (%)	**8.6**	**10.6**	**12.6**	**14.8**
Dry Density (pcf)	**111.9**	**117.7**	**119.6**	**113.9**



Maximum density 120.5 pcf @ 12.0% moisture

EEI Geotechnical & Environmental Solutions

2195 Faraday, Suite K, Carlsbad, CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax National City

Procedure: Method A

Job Number: CIS-72092.4

Date: 10/14/15

Boring Number: B-7

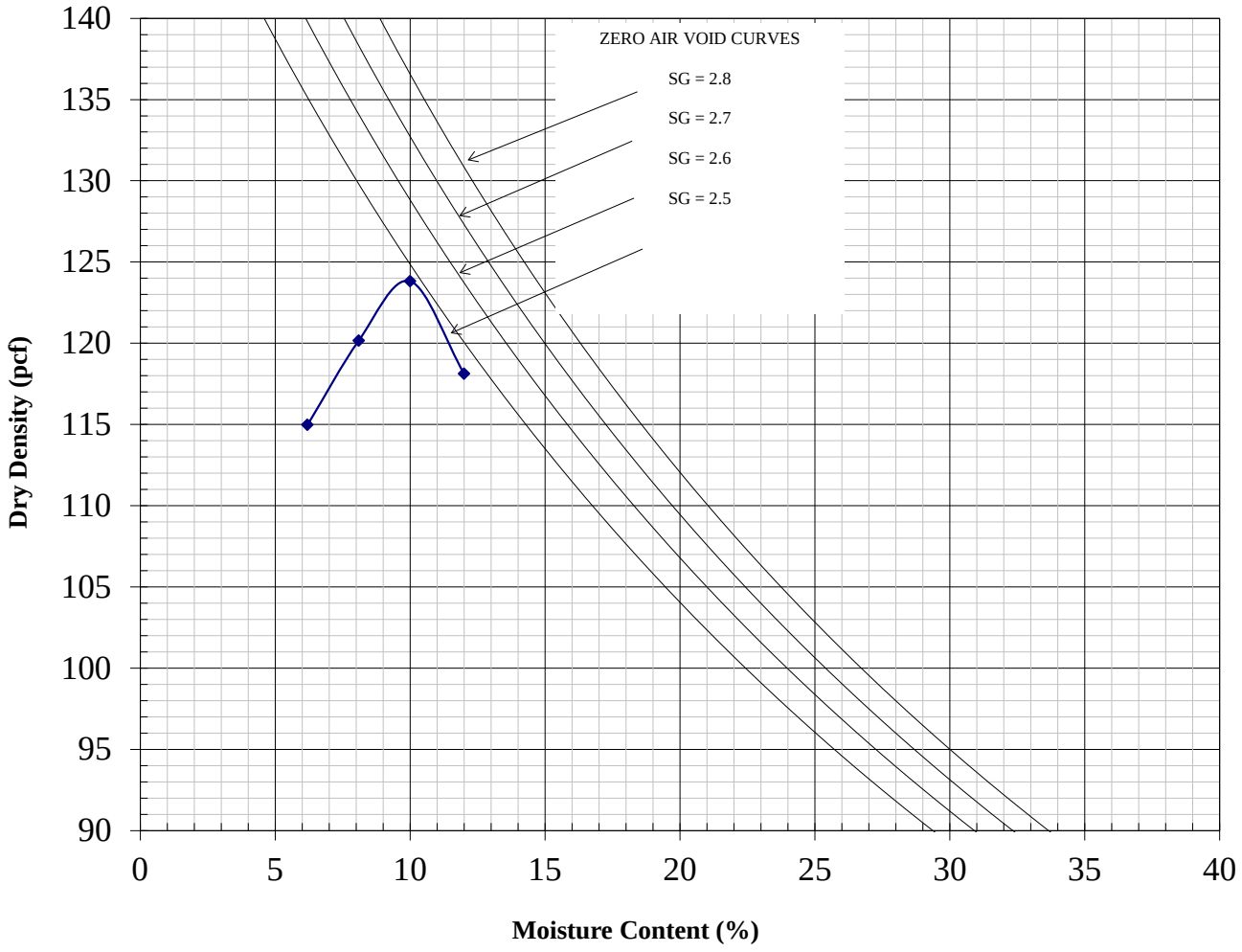
Location: 2-5 ft.

Soil Description: Light Brown Clayey Sand

Tested by: B D

LABORATORY COMPACTION ASTM D 1557

Sample	1	2	3	4
Mold and wet soil (lbs.)	8.360	8.620	8.830	8.700
Mold (lbs.)	4.290	4.290	4.290	4.290
Wet Soil (lbs.)	4.070	4.330	4.540	4.410
Wet Density (pcf)	122.10	129.90	136.20	132.30
Moisture (%)	**6.2**	**8.1**	**10.0**	**12.0**
Dry Density (pcf)	**115.0**	**120.2**	**123.8**	**118.1**



Maximum density 124.0 pcf @ 9.5% moisture

EEI Geotechnical & Environmental Solutions

2195 Faraday, Suite K, Carlsbad, CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax National City

Procedure: Method A

Job Number: CIS-72092.4

Date: 10/14/15

Boring Number: B-10

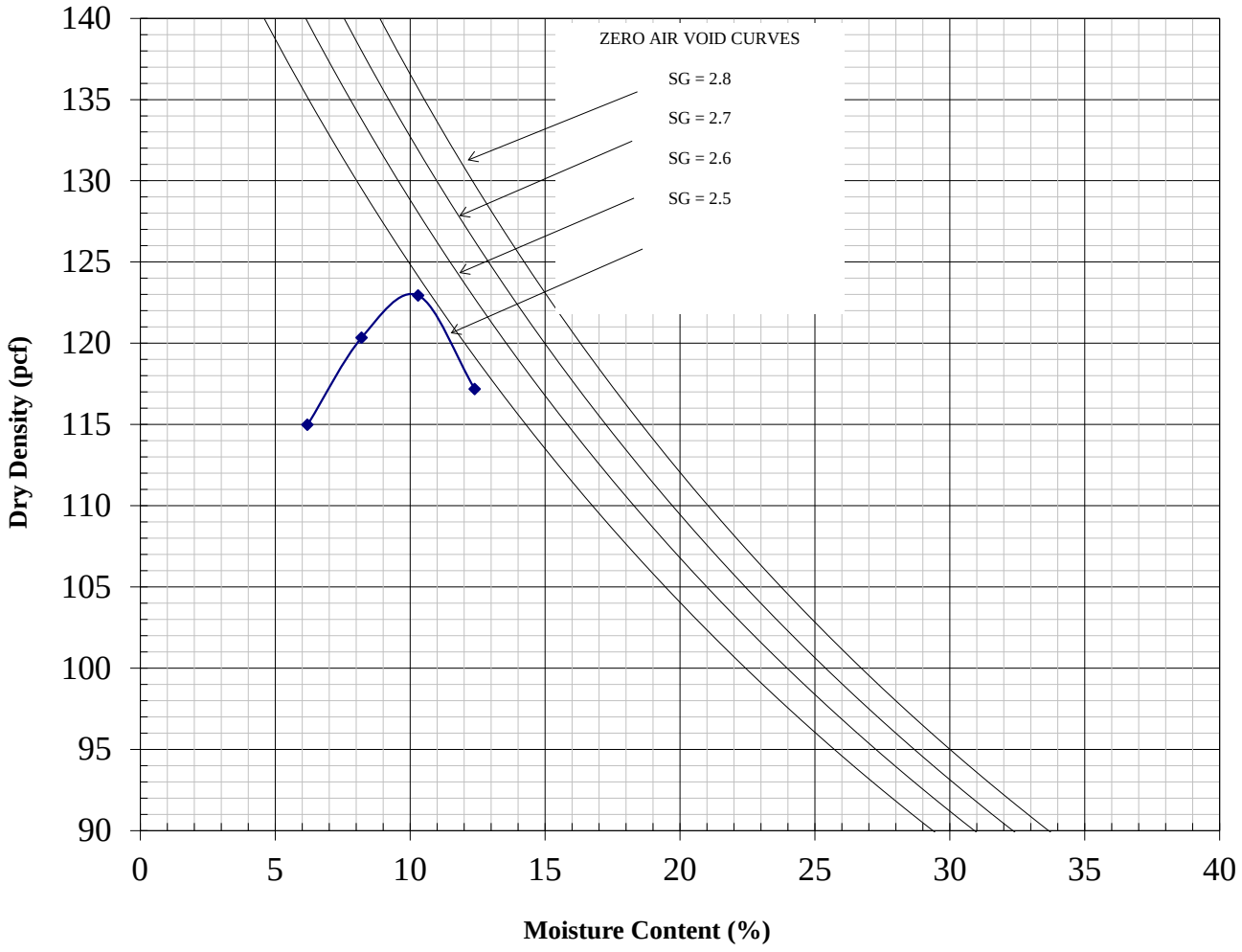
Location: 1-5 ft.

Soil Description: Dark Brown Clayey Sand

Tested by: B D

LABORATORY COMPACTION ASTM D 1557

Sample	1	2	3	4
Mold and wet soil (lbs.)	8.360	8.630	8.810	8.680
Mold (lbs.)	4.290	4.290	4.290	4.290
Wet Soil (lbs.)	4.070	4.340	4.520	4.390
Wet Density (pcf)	122.10	130.20	135.60	131.70
Moisture (%)	**6.2**	**8.2**	**10.3**	**12.4**
Dry Density (pcf)	**115.0**	**120.3**	**122.9**	**117.2**



Maximum density 124.0 pcf @ 9.5% moisture

EEI Geotechnical & Environmental Solutions

2195 Faraday, Suite K, Carlsbad, CA 92008

Client: Centerpoint Integrated Solutions

Project Name: CarMax National City

Procedure: Method A

Job Number: CIS-72092.4

Date: 10/14/15

Boring Number: B-12

Location: 1-6 ft.

Soil Description: Light Yellow Brown Silty Sand

Tested by: B D

L A B O R A T O R Y R E P O R T

Telephone (619) 425-1993 Fax 425-7917 Established 1928

C L A R K S O N L A B O R A T O R Y A N D S U P P L Y I N C.
350 Trousdale Dr. Chula Vista, Ca. 91910 www.clarksonlab.com
A N A L Y T I C A L A N D C O N S U L T I N G C H E M I S T S

Date: October 20, 2015
Purchase Order Number: CIS-72092-4
Sales Order Number: 28885
Account Number: EEI

To:
--
EEI Environmental Equalizers Inc
2195 Faraday Avenue Suite K
Carlsbad, CA 92008
Attention: Jeff Blake

Laboratory Number: SO5823 Customers Phone: 760-431-3747

Sample Designation:
--
One soil sample received on 10/15/15 at 1:45pm,
taken from Sweetwater Rd. Project#CIS-72092-4
marked as B-7 @ 2'-5' SM.

Analysis By California Test 643, 1999, Department of Transportation
Division of Construction, Method for Estimating the Service Life of
Steel Culverts.

pH 7.6

Water Added (ml)	Resistivity (ohm-cm)
10	1700
5	920
5	580
5	390
5	340
5	320
5	300
5	320
5	350

19 years to perforation for a 16 gauge metal culvert.
24 years to perforation for a 14 gauge metal culvert.
34 years to perforation for a 12 gauge metal culvert.
43 years to perforation for a 10 gauge metal culvert.
52 years to perforation for a 8 gauge metal culvert.

Water Soluble Sulfate Calif. Test 417 0.105% (1050ppm)

Water Soluble Chloride Calif. Test 422 0.107% (1070ppm)

Laura Torres
LT/ilv

APPENDIX C
LIQEUEFACTION ANALYSIS

EEI
Geotechnical & Environmental Solutions
2195 Faraday Avenue, Suite K, Carlsbad CA
www.EEItiger.com

LIQUEFACTION ANALYSIS REPORT

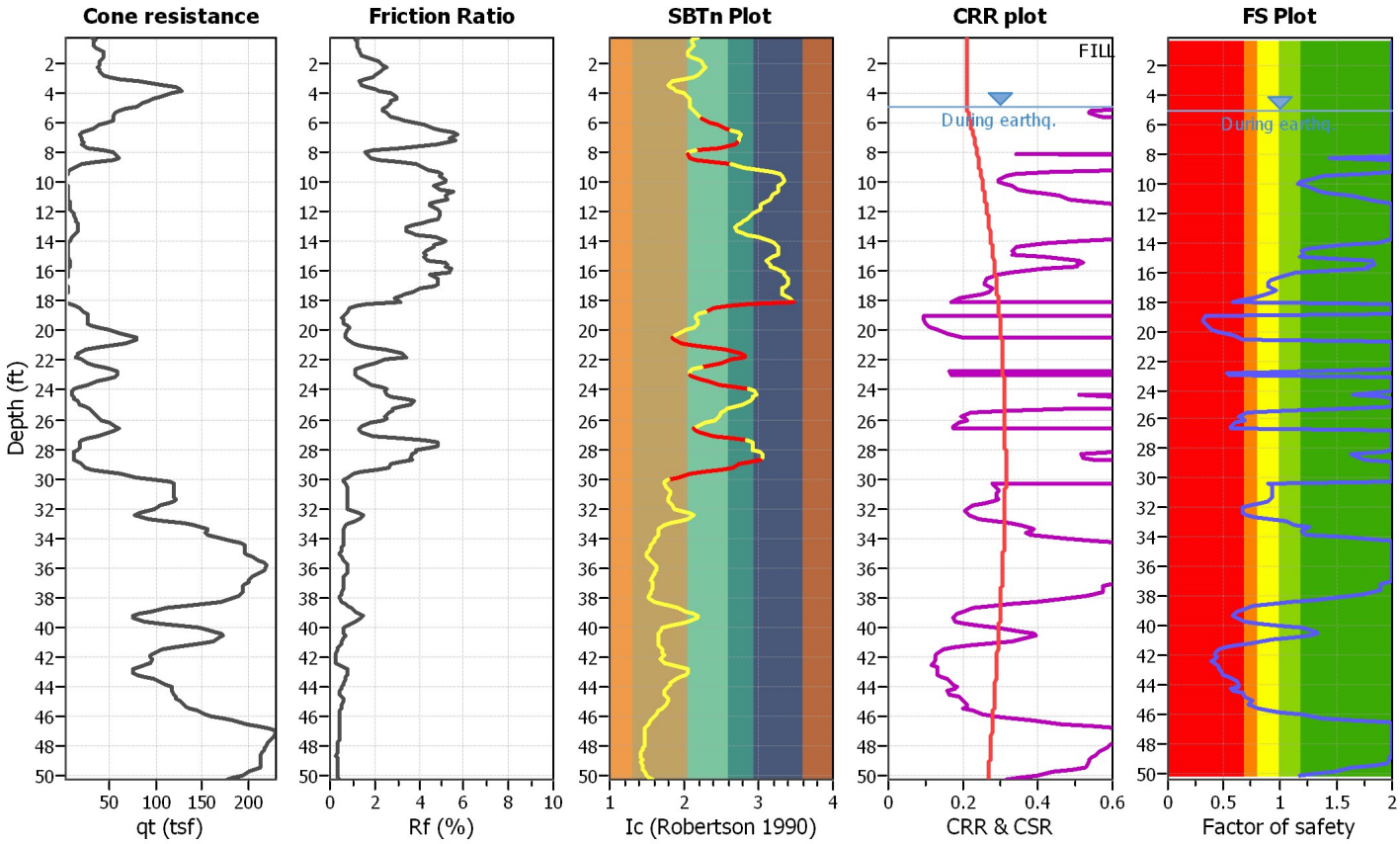
Project title : CIS-72092.4

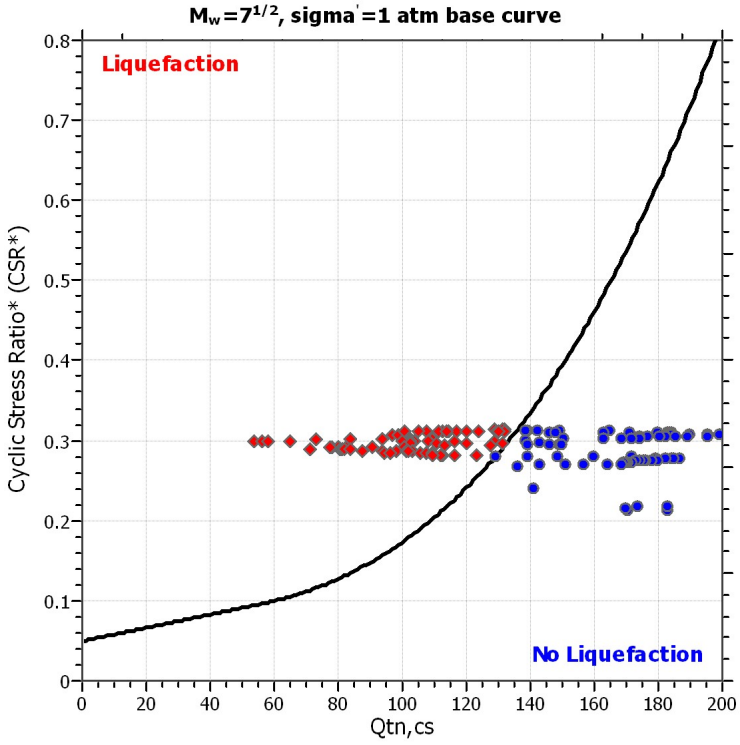
Location : Proposed CarMax National City

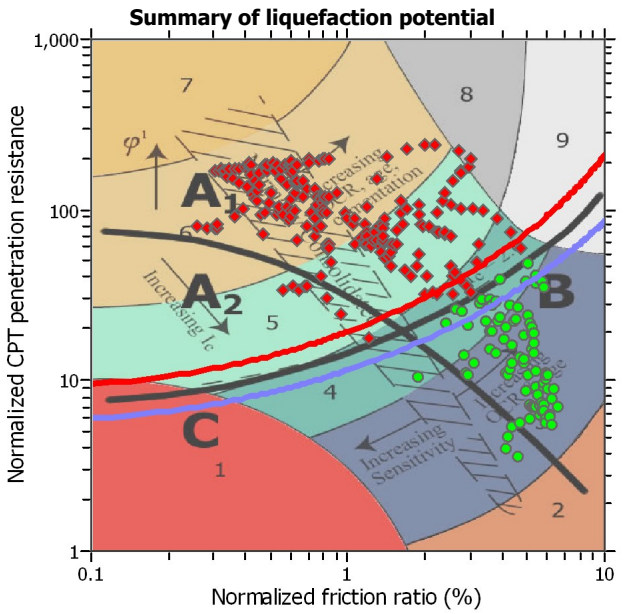
CPT file : CPT-01

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	Yes	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	5.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	120.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	6.76	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.43	Unit weight calculation:	Based on SBT	K_σ applied:	No		

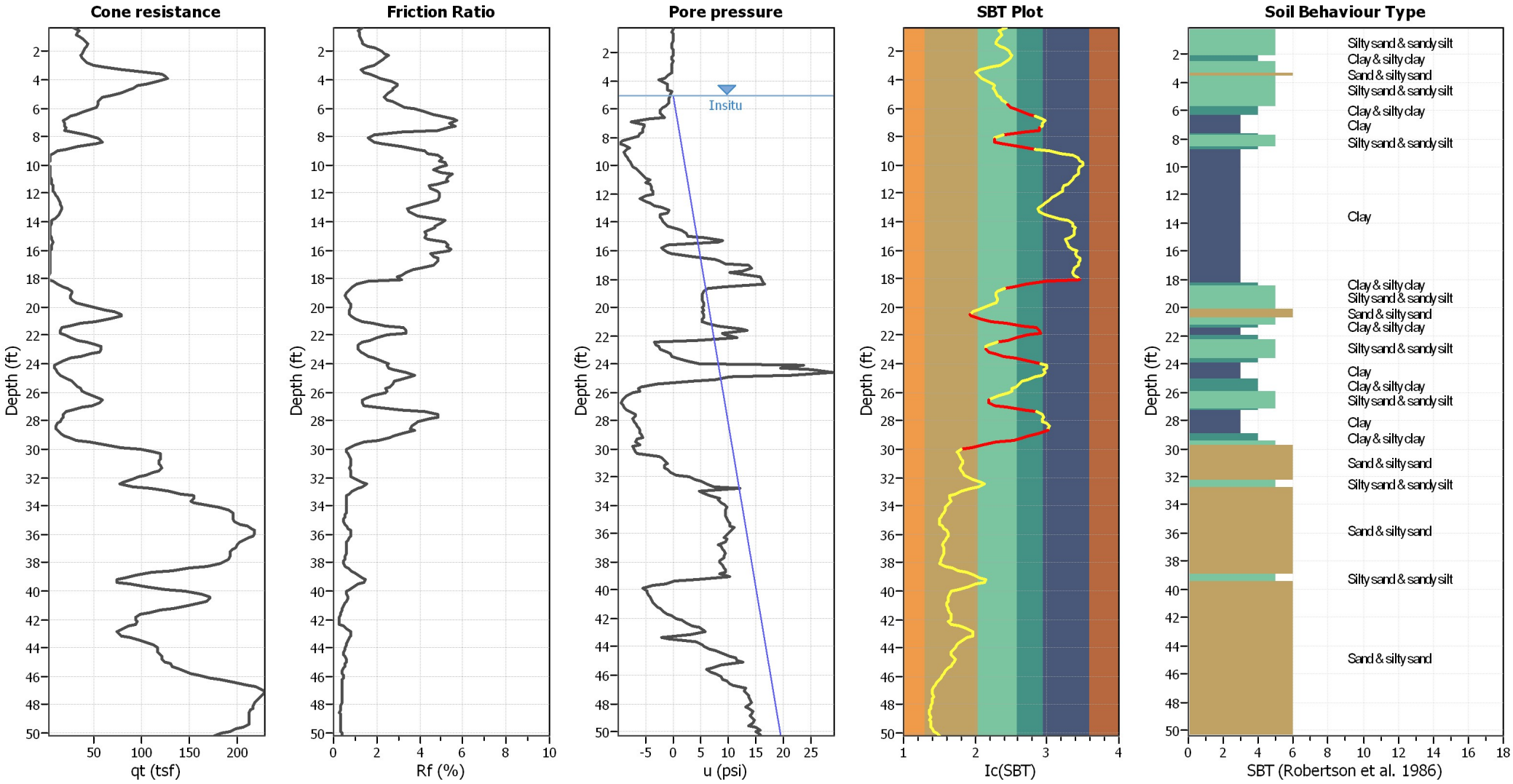






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



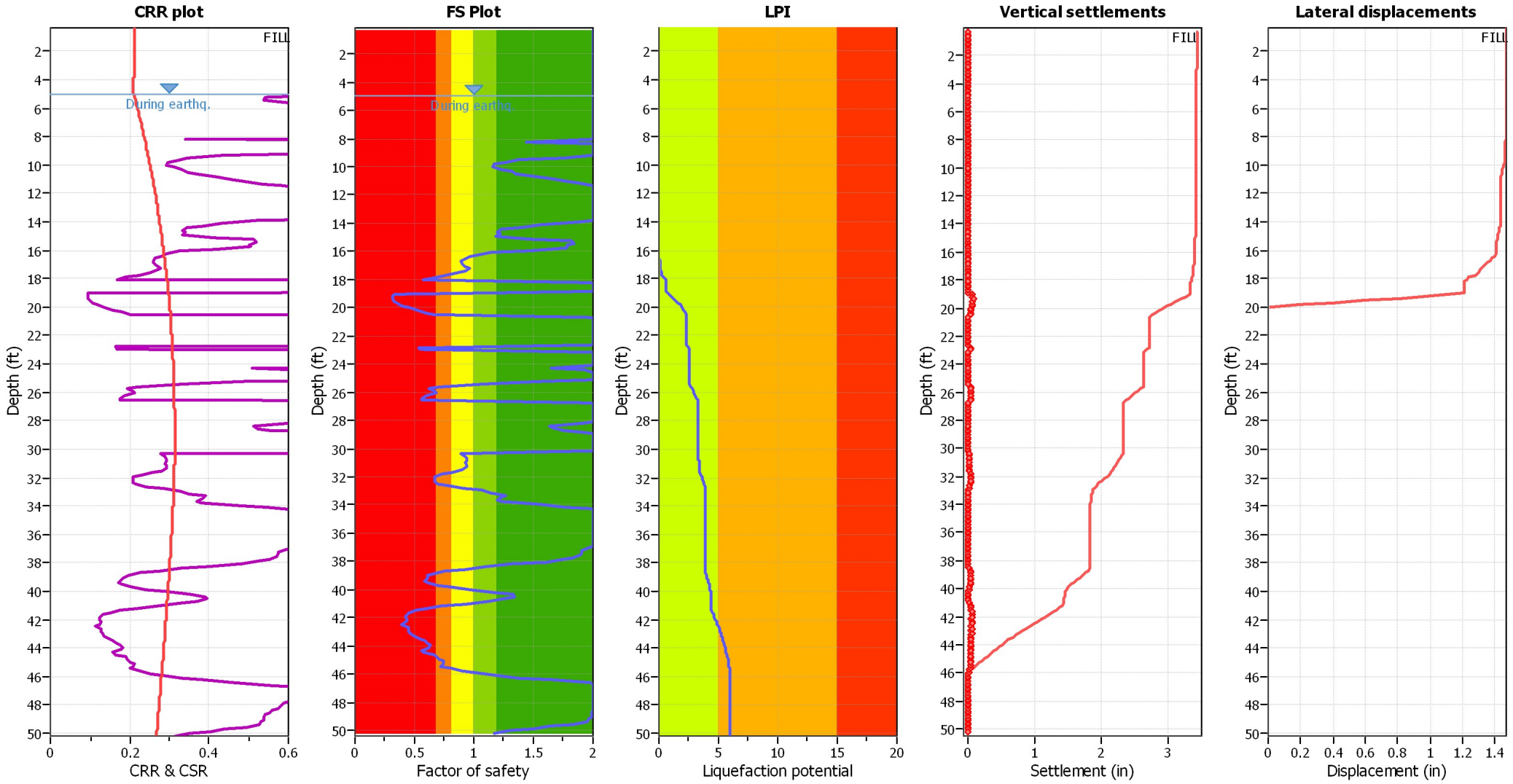
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
5.33	2.19	1.64	56.03	91.75	21	477.7	396	0.21	0.034	0.03	9.05	0.03	0.001
5.49	2.09	1.44	65.46	94.41	20	486.6	413	0.21	0.033	0.03	9.05	0.03	0.001
5.66	2.11	1.48	63.36	93.69	20	484.7	409	0.21	0.035	0.03	9.05	0.03	0.001
5.82	2.13	1.51	61.76	93.18	20	483.2	407	0.21	0.037	0.04	9.05	0.03	0.001
5.98	2.11	1.46	66.92	97.99	21	495.8	431	0.21	0.033	0.03	9.05	0.02	0.001
6.15	2.08	1.42	73.90	104.86	23	512.9	466	0.21	0.029	0.03	9.05	0.02	0.001
6.31	2.06	1.39	80.15	111.36	24	528.2	499	0.21	0.027	0.02	9.05	0.02	0.001
6.48	2.06	1.39	83.05	115.10	25	537.0	519	0.21	0.026	0.02	9.05	0.02	0.001
6.64	2.12	1.49	81.25	120.86	26	551.1	551	0.21	0.024	0.02	9.05	0.01	0.001
6.80	2.18	1.62	79.00	128.26	29	565.9	587	0.21	0.022	0.01	9.05	0.01	0.000
6.97	2.24	1.77	74.56	131.76	30	569.8	597	0.21	0.022	0.01	9.05	0.01	0.000
7.13	2.27	1.85	71.86	133.01	31	569.9	597	0.21	0.023	0.01	9.05	0.01	0.000
7.30	2.30	1.93	70.25	135.89	32	573.2	606	0.21	0.023	0.01	9.05	0.01	0.000
7.46	2.27	1.85	72.88	134.48	31	573.2	605	0.21	0.024	0.01	9.05	0.01	0.000
7.62	2.25	1.79	73.35	131.66	30	568.7	594	0.21	0.025	0.02	9.05	0.01	0.000
7.79	2.19	1.64	80.59	132.57	30	574.9	608	0.21	0.025	0.02	9.05	0.01	0.000
7.95	2.12	1.49	93.46	139.49	30	592.3	650	0.21	0.023	0.01	9.05	0.01	0.000
8.12	2.01	1.31	113.10	148.46	31	607.7	688	0.21	0.021	0.01	9.05	0.01	0.000
8.28	1.85	1.14	152.77	174.89	34	638.8	769	0.21	0.018	0.01	9.05	0.01	0.000
8.45	1.80	1.10	203.14	224.36	43	712.7	984	0.21	0.013	0.01	9.05	0.00	0.000
8.61	1.83	1.13	228.89	257.91	50	771.2	1176	0.21	0.011	0.00	9.05	0.00	0.000
8.77	1.87	1.16	238.73	277.70	55	810.2	1314	0.21	0.010	0.00	9.05	0.00	0.000
8.94	1.90	1.19	240.29	285.65	57	827.6	1378	0.21	0.009	0.00	9.05	0.00	0.000
9.10	2.00	1.29	222.39	287.69	60	845.5	1447	0.21	0.009	0.00	9.05	0.00	0.000
9.27	2.06	1.39	198.52	275.72	59	833.0	1401	0.21	0.010	0.00	9.05	0.00	0.000
9.43	2.08	1.42	180.74	257.35	55	805.4	1300	0.21	0.011	0.00	9.05	0.00	0.000
9.59	2.07	1.40	171.62	239.75	51	776.8	1199	0.21	0.012	0.00	9.05	0.00	0.000
9.76	2.08	1.42	163.21	232.43	50	765.3	1160	0.21	0.013	0.00	9.05	0.00	0.000
9.92	2.08	1.42	148.26	210.87	45	728.7	1039	0.21	0.015	0.01	9.05	0.00	0.000

Total estimated settlement: 0.01

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
10.09	183.35	2.00	0.00	1.00	0.00	10.25	170.56	2.00	0.00	1.00	0.00
10.41	170.07	2.00	0.00	1.00	0.00	10.58	173.90	2.00	0.00	1.00	0.00
10.74	182.90	2.00	0.00	1.00	0.00	10.91	188.42	2.00	0.00	1.00	0.00
11.07	191.19	2.00	0.00	1.00	0.00	11.23	186.45	2.00	0.00	1.00	0.00
11.40	219.11	2.00	0.00	1.00	0.00	11.56	309.56	2.00	0.00	1.00	0.00
11.73	162.41	2.00	0.00	1.00	0.00	11.89	157.76	2.00	0.00	1.00	0.00
12.05	155.34	2.00	0.00	1.00	0.00	12.22	162.78	2.00	0.00	1.00	0.00
12.38	407.43	2.00	0.00	1.00	0.00	12.55	363.98	2.00	0.00	1.00	0.00
12.71	131.17	2.00	0.00	1.00	0.00	12.87	128.72	2.00	0.00	1.00	0.00
13.04	134.13	2.00	0.00	1.00	0.00	13.20	141.21	1.43	0.00	1.00	0.00
13.37	151.24	2.00	0.00	1.00	0.00	13.53	152.79	2.00	0.00	1.00	0.00
13.69	147.04	2.00	0.00	1.00	0.00	13.86	234.72	2.00	0.00	1.00	0.00
14.02	111.45	2.00	0.00	1.00	0.00	14.19	92.93	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
14.35	81.75	1.76	0.01	1.00	0.00	14.51	74.83	1.38	0.05	1.00	0.00
14.68	71.46	1.26	0.08	1.00	0.00	14.84	70.80	1.18	0.11	1.00	0.00
15.01	70.73	1.16	0.11	1.00	0.00	15.17	71.32	1.23	0.09	1.00	0.00
15.34	71.96	1.31	0.06	1.00	0.00	15.50	74.93	1.36	0.05	1.00	0.00
15.66	80.56	1.45	0.04	1.00	0.00	15.83	83.99	1.63	0.02	1.00	0.00
15.99	87.05	1.78	0.01	1.00	0.00	16.16	89.73	1.87	0.00	1.00	0.00
16.32	90.18	2.00	0.00	1.00	0.00	16.48	90.42	2.00	0.00	1.00	0.00
16.65	92.93	2.00	0.00	1.00	0.00	16.81	100.02	2.00	0.00	1.00	0.00
16.98	106.58	2.00	0.00	1.00	0.00	17.14	112.58	2.00	0.00	1.00	0.00
17.30	118.12	2.00	0.00	1.00	0.00	17.47	123.24	2.00	0.00	1.00	0.00
17.63	122.17	2.00	0.00	1.00	0.00	17.80	119.79	2.00	0.00	1.00	0.00
17.96	291.96	2.00	0.00	1.00	0.00	18.12	257.61	2.00	0.00	1.00	0.00
18.29	109.36	2.00	0.00	1.00	0.00	18.45	107.48	2.00	0.00	1.00	0.00
18.62	104.67	2.00	0.00	1.00	0.00	18.78	102.25	2.00	0.00	1.00	0.00
18.94	92.42	1.89	0.00	1.00	0.00	19.11	84.03	1.56	0.02	1.00	0.00
19.27	78.05	1.39	0.04	1.00	0.00	19.44	74.39	1.24	0.07	1.00	0.00
19.60	71.34	1.20	0.08	1.00	0.00	19.76	71.32	1.21	0.07	1.00	0.00
19.93	70.97	1.18	0.08	1.00	0.00	20.09	77.61	1.48	0.03	1.00	0.00
20.26	85.84	1.82	0.01	1.00	0.00	20.42	92.56	1.84	0.00	1.00	0.00
20.58	92.13	1.78	0.01	1.00	0.00	20.75	91.90	1.78	0.01	1.00	0.00
20.91	86.03	1.47	0.03	1.00	0.00	21.08	76.87	1.14	0.09	1.00	0.00
21.24	68.57	1.02	0.14	1.00	0.00	21.40	67.92	0.97	0.17	1.00	0.00
21.57	67.13	0.91	0.22	1.00	0.00	21.73	66.85	0.90	0.23	1.00	0.00
21.90	66.80	0.90	0.22	1.00	0.00	22.06	67.03	0.93	0.20	1.00	0.00
22.23	64.76	0.96	0.17	1.00	0.00	22.39	61.70	0.92	0.20	1.00	0.00
22.55	58.29	0.87	0.25	1.00	0.00	22.72	54.12	0.76	0.50	1.00	0.01
22.88	49.50	0.64	0.50	1.00	0.01	23.05	48.32	0.57	0.50	1.00	0.01
23.21	56.24	2.00	0.00	1.00	0.00	23.37	81.73	2.00	0.00	1.00	0.00
23.54	56.60	2.00	0.00	1.00	0.00	23.70	58.39	2.00	0.00	1.00	0.00
23.87	58.70	2.00	0.00	1.00	0.00	24.03	56.52	0.32	3.73	1.00	0.07
24.19	54.02	0.32	3.87	1.00	0.07	24.36	56.08	0.32	3.75	1.00	0.08
24.52	58.43	0.33	3.63	1.00	0.07	24.69	65.06	0.35	3.32	1.00	0.07
24.85	73.42	0.39	3.01	1.00	0.06	25.01	83.46	0.45	2.71	1.00	0.05
25.18	93.93	0.52	2.46	1.00	0.05	25.34	102.60	0.60	2.29	1.00	0.04
25.51	109.14	0.66	2.18	1.00	0.04	25.67	111.10	2.00	0.00	1.00	0.00
25.83	105.69	2.00	0.00	1.00	0.00	26.00	98.98	2.00	0.00	1.00	0.00
26.16	96.98	2.00	0.00	1.00	0.00	26.33	128.17	2.00	0.00	1.00	0.00
26.49	97.94	2.00	0.00	1.00	0.00	26.65	95.52	2.00	0.00	1.00	0.00
26.82	95.50	2.00	0.00	1.00	0.00	26.98	176.64	2.00	0.00	1.00	0.00
27.15	90.45	2.00	0.00	1.00	0.00	27.31	89.27	2.00	0.00	1.00	0.00
27.47	89.74	2.00	0.00	1.00	0.00	27.64	92.90	2.00	0.00	1.00	0.00
27.80	96.60	0.53	2.40	1.00	0.05	27.97	98.66	0.55	2.36	1.00	0.05
28.13	98.50	2.00	0.00	1.00	0.00	28.30	95.49	2.00	0.00	1.00	0.00
28.46	90.25	2.00	0.00	1.00	0.00	28.62	85.60	2.00	0.00	1.00	0.00
28.79	187.66	2.00	0.00	1.00	0.00	28.95	74.67	2.00	0.00	1.00	0.00
29.12	68.50	2.00	0.00	1.00	0.00	29.28	68.39	1.64	0.01	1.00	0.00
29.44	74.75	1.93	0.00	1.00	0.00	29.61	86.16	2.00	0.00	1.00	0.00
29.77	97.18	2.00	0.00	1.00	0.00	29.94	104.12	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
30.10	236.92	2.00	0.00	1.00	0.00	30.26	164.86	1.59	0.00	1.00	0.00
30.43	139.66	1.07	0.44	1.00	0.01	30.59	114.50	0.70	2.03	1.00	0.04
30.76	107.26	0.62	2.21	1.00	0.05	30.92	111.19	0.67	2.12	1.00	0.04
31.08	112.25	0.68	2.09	1.00	0.04	31.25	104.84	0.60	2.25	1.00	0.05
31.41	100.93	0.56	2.32	1.00	0.04	31.58	100.40	0.56	2.33	1.00	0.05
31.74	96.46	2.00	0.00	1.00	0.00	31.90	91.80	2.00	0.00	1.00	0.00
32.07	96.19	2.00	0.00	1.00	0.00	32.23	224.17	2.00	0.00	1.00	0.00
32.40	114.07	2.00	0.00	1.00	0.00	32.56	116.32	2.00	0.00	1.00	0.00
32.72	113.76	2.00	0.00	1.00	0.00	32.89	107.04	2.00	0.00	1.00	0.00
33.05	95.95	2.00	0.00	1.00	0.00	33.22	86.92	1.91	0.00	1.00	0.00
33.38	80.07	1.64	0.01	1.00	0.00	33.54	79.95	1.66	0.01	1.00	0.00
33.71	83.17	1.76	0.01	1.00	0.00	33.87	85.81	2.00	0.00	1.00	0.00
34.04	89.32	2.00	0.00	1.00	0.00	34.20	196.58	2.00	0.00	1.00	0.00
34.36	97.37	2.00	0.00	1.00	0.00	34.53	86.93	2.00	0.00	1.00	0.00
34.69	90.11	2.00	0.00	1.00	0.00	34.86	96.66	2.00	0.00	1.00	0.00
35.02	109.32	2.00	0.00	1.00	0.00	35.19	121.84	2.00	0.00	1.00	0.00
35.35	128.74	0.89	1.08	1.00	0.02	35.51	131.23	0.93	1.05	1.00	0.02
35.68	131.91	0.94	1.04	1.00	0.02	35.84	131.66	0.93	1.04	1.00	0.02
36.01	131.34	0.93	1.05	1.00	0.02	36.17	131.56	0.93	1.04	1.00	0.02
36.33	131.70	0.94	1.04	1.00	0.02	36.50	129.10	0.90	1.07	1.00	0.02
36.66	123.55	0.82	1.49	1.00	0.03	36.83	116.78	0.73	1.97	1.00	0.04
36.99	111.53	0.67	2.11	1.00	0.04	37.15	111.04	0.66	2.12	1.00	0.04
37.32	111.24	0.67	2.11	1.00	0.04	37.48	113.72	0.70	2.05	1.00	0.04
37.65	120.22	0.78	1.55	1.00	0.03	37.81	129.93	0.91	1.06	1.00	0.02
37.97	138.82	1.06	0.45	1.00	0.01	38.14	142.79	1.13	0.44	1.00	0.01
38.30	149.67	1.26	0.22	1.00	0.00	38.47	148.20	1.23	0.31	1.00	0.01
38.63	146.19	1.20	0.31	1.00	0.01	38.79	147.97	1.23	0.31	1.00	0.01
38.96	163.03	1.56	0.00	1.00	0.00	39.12	171.21	1.77	0.00	1.00	0.00
39.29	180.18	2.00	0.00	1.00	0.00	39.45	184.35	2.00	0.00	1.00	0.00
39.61	183.98	2.00	0.00	1.00	0.00	39.78	183.25	2.00	0.00	1.00	0.00
39.94	182.86	2.00	0.00	1.00	0.00	40.11	184.60	2.00	0.00	1.00	0.00
40.27	189.79	2.00	0.00	1.00	0.00	40.43	195.62	2.00	0.00	1.00	0.00
40.60	199.83	2.00	0.00	1.00	0.00	40.76	201.88	2.00	0.00	1.00	0.00
40.93	201.38	2.00	0.00	1.00	0.00	41.09	199.15	2.00	0.00	1.00	0.00
41.26	195.50	2.00	0.00	1.00	0.00	41.42	189.60	2.00	0.00	1.00	0.00
41.58	185.40	2.00	0.00	1.00	0.00	41.75	182.67	2.00	0.00	1.00	0.00
41.91	180.58	2.00	0.00	1.00	0.00	42.08	177.17	1.97	0.00	1.00	0.00
42.24	174.61	1.90	0.00	1.00	0.00	42.40	174.50	1.90	0.00	1.00	0.00
42.57	174.16	1.89	0.00	1.00	0.00	42.73	171.95	1.83	0.00	1.00	0.00
42.90	168.72	1.75	0.00	1.00	0.00	43.06	163.21	1.61	0.00	1.00	0.00
43.22	150.39	1.32	0.22	1.00	0.00	43.39	138.81	1.10	0.45	1.00	0.01
43.55	128.49	0.92	1.08	1.00	0.02	43.72	115.98	0.75	1.64	1.00	0.03
43.88	108.10	0.66	2.19	1.00	0.04	44.04	103.76	0.62	2.27	1.00	0.04
44.21	102.54	0.60	2.29	1.00	0.05	44.37	100.19	0.58	2.33	1.00	0.04
44.54	102.71	0.61	2.29	1.00	0.05	44.70	110.42	0.69	2.14	1.00	0.04
44.86	119.96	0.81	1.56	1.00	0.03	45.03	130.98	0.98	0.69	1.00	0.01
45.19	142.86	1.19	0.32	1.00	0.01	45.36	149.52	1.32	0.22	1.00	0.00
45.52	150.24	1.34	0.22	1.00	0.00	45.68	146.31	1.26	0.22	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
45.85	139.25	1.13	0.44	1.00	0.01	46.01	127.64	0.93	1.09	1.00	0.02
46.18	113.16	0.73	2.06	1.00	0.04	46.34	100.70	0.60	2.32	1.00	0.04
46.50	90.46	0.51	2.54	1.00	0.05	46.67	82.56	0.45	2.73	1.00	0.06
46.83	78.03	0.43	2.86	1.00	0.05	47.00	78.41	0.43	2.85	1.00	0.06
47.16	79.71	0.44	2.81	1.00	0.05	47.32	77.37	0.42	2.88	1.00	0.06
47.49	71.28	0.39	3.08	1.00	0.06	47.65	80.81	0.45	2.78	1.00	0.05
47.82	81.02	0.45	2.78	1.00	0.06	47.98	81.76	0.45	2.76	1.00	0.05
48.15	83.51	0.47	2.71	1.00	0.06	48.31	87.77	0.50	2.60	1.00	0.05
48.47	93.62	0.54	2.47	1.00	0.05	48.64	97.92	0.58	2.38	1.00	0.05
48.80	101.00	0.61	2.32	1.00	0.04	48.97	103.05	0.64	2.28	1.00	0.05
49.13	102.18	0.63	2.30	1.00	0.04	49.29	94.60	0.56	2.45	1.00	0.05
49.46	96.51	0.57	2.41	1.00	0.05	49.62	105.63	0.67	2.23	1.00	0.04
49.79	107.24	0.69	2.21	1.00	0.05	49.95	109.39	0.71	2.17	1.00	0.04
50.11	112.21	0.75	2.09	1.00	0.04	50.28	111.80	0.74	2.10	1.00	0.04
50.44	109.31	0.72	2.17	1.00	0.04	50.61	116.56	0.81	1.62	1.00	0.03
50.77	123.03	0.90	1.15	1.00	0.02	50.93	129.50	1.01	0.69	1.00	0.01
51.10	139.40	1.19	0.32	1.00	0.01	51.26	148.50	1.38	0.00	1.00	0.00
51.43	160.05	1.65	0.00	1.00	0.00	51.59	171.79	1.98	0.00	1.00	0.00
51.75	179.49	2.00	0.00	1.00	0.00	51.92	184.62	2.00	0.00	1.00	0.00
52.08	186.80	2.00	0.00	1.00	0.00	52.25	184.82	2.00	0.00	1.00	0.00
52.41	182.21	2.00	0.00	1.00	0.00	52.57	180.27	2.00	0.00	1.00	0.00
52.74	177.92	2.00	0.00	1.00	0.00	52.90	176.26	2.00	0.00	1.00	0.00
53.07	175.49	2.00	0.00	1.00	0.00	53.23	174.42	2.00	0.00	1.00	0.00
53.39	172.89	2.00	0.00	1.00	0.00	53.56	171.76	2.00	0.00	1.00	0.00
53.72	170.58	1.99	0.00	1.00	0.00	53.89	170.17	1.98	0.00	1.00	0.00
54.05	170.17	1.99	0.00	1.00	0.00	54.22	169.30	1.96	0.00	1.00	0.00
54.38	168.63	1.95	0.00	1.00	0.00	54.54	164.32	1.83	0.00	1.00	0.00
54.71	156.96	1.63	0.00	1.00	0.00	54.87	151.34	1.50	0.00	1.00	0.00
55.04	142.90	1.31	0.22	1.00	0.00	55.20	136.11	1.18	0.33	1.00	0.01

Total estimated settlement: 3.43

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
10.09	66.25	124.65	2.38	183.35	2.00	74.27	0.00	0.00
10.25	59.85	112.53	2.34	170.56	2.00	70.90	0.00	0.00
10.41	56.63	106.42	2.51	170.07	2.00	69.05	0.00	0.00
10.58	54.86	103.07	2.73	173.90	2.00	68.00	0.00	0.00
10.74	54.82	102.96	3.03	182.90	2.00	67.96	0.00	0.00
10.91	53.04	99.57	3.32	188.42	2.00	66.86	0.00	0.00
11.07	48.01	90.06	3.75	191.19	2.00	63.54	0.00	0.00
11.23	39.71	74.35	4.23	186.45	2.00	57.22	0.00	0.00
11.40	31.84	59.46	4.65	219.11	2.00	49.84	0.00	0.00
11.56	25.71	47.84	4.98	309.56	2.00	42.67	0.00	0.00
11.73	20.90	38.74	5.55	162.41	2.00	35.70	0.03	0.00
11.89	18.85	34.85	5.73	157.76	2.00	32.20	0.03	0.00
12.05	19.76	36.55	5.36	155.34	2.00	33.77	0.03	0.00
12.22	20.52	37.96	5.65	162.78	2.00	35.03	0.03	0.00
12.38	21.92	40.59	5.29	407.43	2.00	37.24	0.00	0.00
12.55	20.64	38.15	4.85	363.98	2.00	35.19	0.00	0.00
12.71	26.75	49.69	3.14	131.17	2.00	43.92	0.00	0.00
12.87	43.42	81.18	1.89	128.72	2.00	60.12	0.00	0.00
13.04	53.59	96.59	1.60	134.13	2.00	65.86	0.00	0.00
13.20	57.02	101.97	1.68	141.21	1.43	67.64	1.13	0.00
13.37	59.86	106.93	1.87	151.24	2.00	69.21	0.00	0.00
13.53	53.39	97.37	2.21	152.79	2.00	66.12	0.00	0.00
13.69	33.95	63.19	3.18	147.04	2.00	51.85	0.00	0.00
13.86	20.78	38.26	3.85	234.72	2.00	35.29	0.00	0.00
14.02	12.26	22.15	4.24	111.45	2.00	17.24	0.05	0.00
14.19	7.74	13.58	4.39	92.93	2.00	1.11	0.08	0.00
14.35	5.38	9.11	4.83	81.75	1.76	0.00	0.17	0.00
14.51	4.36	7.17	5.04	74.83	1.38	0.00	0.55	0.00
14.68	4.07	6.60	4.92	71.46	1.26	0.00	0.84	0.00
14.84	3.85	6.18	5.19	70.80	1.18	0.00	1.18	0.00
15.01	3.84	6.13	5.21	70.73	1.16	0.00	1.25	0.01
15.17	4.04	6.50	4.95	71.32	1.23	0.00	0.96	0.00
15.34	4.31	6.99	4.64	71.96	1.31	0.00	0.69	0.00
15.50	4.45	7.25	4.94	74.93	1.36	0.00	0.59	0.00
15.66	4.74	7.78	5.48	80.56	1.45	0.00	0.43	0.00
15.83	5.29	8.79	5.30	83.99	1.63	0.00	0.24	0.00
15.99	5.75	9.65	5.22	87.05	1.78	0.00	0.15	0.00
16.16	6.04	10.17	5.30	89.73	1.87	0.00	0.12	0.00
16.32	6.58	11.19	4.86	90.18	2.00	0.00	0.09	0.00
16.48	7.20	12.34	4.44	90.42	2.00	0.00	0.08	0.00
16.65	7.60	13.09	4.47	92.93	2.00	0.00	0.08	0.00
16.81	8.24	14.28	4.85	100.02	2.00	2.76	0.07	0.00
16.98	9.38	16.41	4.91	106.58	2.00	7.34	0.07	0.00
17.14	10.61	18.73	4.90	112.58	2.00	11.71	0.06	0.00
17.30	11.91	21.16	4.87	118.12	2.00	15.74	0.06	0.00
17.47	13.27	23.72	4.82	123.24	2.00	19.50	0.05	0.00
17.63	14.64	26.29	4.37	122.17	2.00	22.90	0.05	0.00
17.80	15.06	27.04	4.12	119.79	2.00	23.84	0.05	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
17.96	16.45	28.96	3.65	291.96	2.00	26.10	0.00	0.00
18.12	16.89	29.38	3.43	257.61	2.00	26.57	0.00	0.00
18.29	15.62	27.06	3.46	109.36	2.00	23.86	0.05	0.00
18.45	13.42	23.33	3.73	107.48	2.00	18.97	0.05	0.00
18.62	11.79	20.49	3.90	104.67	2.00	14.68	0.06	0.00
18.78	8.87	15.26	4.73	102.25	2.00	4.95	0.07	0.00
18.94	6.56	10.87	5.19	92.42	1.89	0.00	0.11	0.00
19.11	5.60	9.01	5.00	84.03	1.56	0.00	0.29	0.00
19.27	5.14	8.06	4.67	78.05	1.39	0.00	0.50	0.00
19.44	4.71	7.20	4.67	74.39	1.24	0.00	0.88	0.00
19.60	4.62	6.98	4.33	71.34	1.20	0.00	1.04	0.00
19.76	4.72	7.11	4.24	71.32	1.21	0.00	0.97	0.00
19.93	4.66	6.95	4.29	70.97	1.18	0.00	1.10	0.00
20.09	5.66	8.70	4.24	77.61	1.48	0.00	0.37	0.00
20.26	6.83	10.74	4.39	85.84	1.82	0.00	0.13	0.00
20.42	6.98	10.91	5.16	92.56	1.84	0.00	0.12	0.00
20.58	6.82	10.54	5.28	92.13	1.78	0.00	0.15	0.00
20.75	6.91	10.61	5.21	91.90	1.78	0.00	0.15	0.00
20.91	5.90	8.77	5.42	86.03	1.47	0.00	0.38	0.00
21.08	4.83	6.83	5.38	76.87	1.14	0.00	1.29	0.01
21.24	4.46	6.14	4.48	68.57	1.02	0.00	2.20	0.01
21.40	4.31	5.83	4.64	67.92	0.97	0.00	2.85	0.01
21.57	4.14	5.49	4.83	67.13	0.91	0.00	3.84	0.02
21.73	4.12	5.41	4.85	66.85	0.90	0.00	4.16	0.02
21.90	4.17	5.45	4.79	66.80	0.90	0.00	4.06	0.02
22.06	4.31	5.64	4.64	67.03	0.93	0.00	3.50	0.01
22.23	4.45	5.84	4.04	64.76	0.96	0.00	2.99	0.01
22.39	4.37	5.65	3.66	61.70	0.92	0.00	3.54	0.01
22.55	4.19	5.32	3.34	58.29	0.87	0.00	4.78	0.02
22.72	3.82	4.66	3.14	54.12	0.76	0.00	9.12	0.04
22.88	3.41	3.95	2.93	49.50	0.64	0.00	4.00	0.02
23.05	3.17	3.52	3.16	48.32	0.57	0.00	4.00	0.02
23.21	7.39	10.25	1.62	56.24	2.00	0.00	0.09	0.00
23.37	12.71	17.56	1.10	81.73	2.00	9.59	0.00	0.00
23.54	17.98	24.46	0.89	56.60	2.00	20.52	0.00	0.00
23.70	22.94	30.76	0.78	58.39	2.00	28.09	0.00	0.00
23.87	26.91	35.52	0.67	58.70	2.00	32.84	0.00	0.00
24.03	27.06	35.41	0.59	56.52	0.32	32.73	51.20	0.20
24.19	26.22	34.09	0.53	54.02	0.32	31.48	51.20	0.20
24.36	26.00	33.85	0.62	56.08	0.32	31.25	51.20	0.21
24.52	27.42	35.59	0.66	58.43	0.33	32.90	51.20	0.20
24.69	31.58	40.87	0.76	65.06	0.35	37.46	51.20	0.21
24.85	38.24	49.15	0.84	73.42	0.39	43.55	51.20	0.20
25.01	49.62	62.77	0.81	83.46	0.45	51.63	34.10	0.00
25.18	62.38	77.53	0.74	93.93	0.52	58.60	22.70	0.00
25.34	71.62	88.09	0.73	102.60	0.60	62.81	22.70	0.00
25.51	79.02	96.28	0.71	109.14	0.66	65.75	10.43	0.00
25.67	78.80	96.10	0.79	111.10	2.00	65.69	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
25.83	66.64	82.45	1.02	105.69	2.00	60.63	0.00	0.00
26.00	51.05	64.23	1.33	98.98	2.00	52.39	0.00	0.00
26.16	36.97	47.33	1.79	96.98	2.00	42.31	0.00	0.00
26.33	24.53	31.87	2.45	128.17	2.00	29.26	0.00	0.00
26.49	16.86	21.99	3.20	97.94	2.00	17.01	0.06	0.00
26.65	15.01	19.45	3.33	95.52	2.00	12.96	0.06	0.00
26.82	14.78	19.04	3.38	95.50	2.00	12.25	0.06	0.00
26.98	20.04	25.51	2.50	176.64	2.00	21.91	0.00	0.00
27.15	26.39	33.18	2.05	90.45	2.00	30.59	0.00	0.00
27.31	33.18	41.12	1.69	89.27	2.00	37.67	0.00	0.00
27.47	42.58	51.90	1.36	89.74	2.00	45.35	0.00	0.00
27.64	52.84	63.37	1.14	92.90	2.00	51.94	0.00	0.00
27.80	57.74	68.76	1.11	96.60	0.53	54.64	34.10	0.00
27.97	58.47	69.43	1.16	98.66	0.55	54.96	34.10	0.00
28.13	55.64	66.07	1.26	98.50	2.00	53.32	0.00	0.00
28.30	47.77	56.91	1.42	95.49	2.00	48.39	0.00	0.00
28.46	37.20	44.48	1.61	90.25	2.00	40.26	0.00	0.00
28.62	26.56	31.82	1.88	85.60	2.00	29.20	0.00	0.00
28.79	17.83	21.23	2.24	187.66	2.00	15.85	0.00	0.00
28.95	11.87	13.82	2.53	74.67	2.00	1.68	0.08	0.00
29.12	9.62	10.88	2.50	68.50	2.00	0.00	0.09	0.00
29.28	9.51	10.68	2.52	68.39	1.64	0.00	0.21	0.00
29.44	11.00	12.56	2.73	74.75	1.93	0.00	0.09	0.00
29.61	12.48	14.41	3.36	86.16	2.00	3.05	0.07	0.00
29.77	15.01	17.50	3.73	97.18	2.00	9.47	0.07	0.00
29.94	19.01	22.25	3.58	104.12	2.00	17.40	0.05	0.00
30.10	23.74	27.70	3.12	236.92	2.00	24.63	0.00	0.00
30.26	28.12	32.66	2.85	164.86	1.59	30.06	0.00	0.00
30.43	31.05	35.89	2.77	139.66	1.07	33.18	0.00	0.00
30.59	33.61	38.62	2.62	114.50	0.70	35.60	51.20	0.00
30.76	36.04	41.14	2.44	107.26	0.62	37.69	51.20	0.00
30.92	38.32	43.59	2.51	111.19	0.67	39.59	51.20	0.00
31.08	41.49	46.94	2.41	112.25	0.68	42.04	51.20	0.00
31.25	48.90	54.66	1.84	104.84	0.60	47.06	34.10	0.00
31.41	56.76	62.73	1.44	100.93	0.56	51.61	34.10	0.00
31.58	59.73	65.59	1.34	100.40	0.56	53.08	34.10	0.00
31.74	56.51	61.81	1.31	96.46	2.00	51.12	0.00	0.00
31.90	49.03	53.51	1.39	91.80	2.00	46.36	0.00	0.00
32.07	37.73	41.29	1.96	96.19	2.00	37.80	0.00	0.00
32.23	26.80	29.32	3.13	224.17	2.00	26.51	0.00	0.00
32.40	20.75	22.51	4.24	114.07	2.00	17.79	0.05	0.00
32.56	18.61	20.03	4.84	116.32	2.00	13.93	0.06	0.00
32.72	17.76	18.92	4.84	113.76	2.00	12.05	0.06	0.00
32.89	17.18	18.14	4.42	107.04	2.00	10.66	0.06	0.00
33.05	15.38	15.96	3.90	95.95	2.00	6.44	0.07	0.00
33.22	12.50	12.56	3.84	86.92	1.91	0.00	0.10	0.00
33.38	10.99	10.76	3.64	80.07	1.64	0.00	0.21	0.00
33.54	11.19	10.94	3.57	79.95	1.66	0.00	0.20	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
33.71	11.81	11.58	3.72	83.17	1.76	0.00	0.15	0.00
33.87	15.02	15.13	3.20	85.81	2.00	4.67	0.07	0.00
34.04	20.51	21.00	2.73	89.32	2.00	15.50	0.06	0.00
34.20	24.47	25.16	2.62	196.58	2.00	21.46	0.00	0.00
34.36	31.29	32.23	2.11	97.37	2.00	29.63	0.00	0.00
34.53	45.55	46.83	1.41	86.93	2.00	41.96	0.00	0.00
34.69	61.70	63.13	1.04	90.11	2.00	51.82	0.00	0.00
34.86	78.60	79.86	0.76	96.66	2.00	59.58	0.00	0.00
35.02	98.80	99.76	0.61	109.32	2.00	66.92	0.00	0.00
35.19	114.75	115.43	0.59	121.84	2.00	71.74	0.00	0.00
35.35	120.45	120.98	0.66	128.74	0.89	73.29	4.50	0.00
35.51	120.50	120.88	0.75	131.23	0.93	73.26	3.99	0.00
35.68	119.60	119.72	0.80	131.91	0.94	72.94	3.86	0.00
35.84	118.87	118.68	0.82	131.66	0.93	72.65	3.90	0.00
36.01	118.88	118.31	0.82	131.34	0.93	72.55	3.96	0.00
36.17	120.48	119.51	0.80	131.56	0.93	72.88	3.91	0.00
36.33	121.94	120.57	0.77	131.70	0.94	73.17	3.88	0.00
36.50	119.19	117.49	0.77	129.10	0.90	72.32	4.39	0.00
36.66	112.60	110.67	0.78	123.55	0.82	70.35	5.72	0.00
36.83	104.94	102.79	0.78	116.78	0.73	67.91	7.92	0.00
36.99	97.82	95.53	0.82	111.53	0.67	65.49	10.18	0.00
37.15	90.11	87.85	1.04	111.04	0.66	62.73	21.74	0.00
37.32	80.69	78.45	1.34	111.24	0.67	58.99	21.37	0.00
37.48	77.90	75.51	1.51	113.72	0.70	57.73	17.76	0.00
37.65	91.26	88.26	1.36	120.22	0.78	62.88	10.97	0.00
37.81	109.36	105.52	1.17	129.93	0.91	68.77	4.16	0.00
37.97	129.50	124.56	0.90	138.82	1.06	74.25	2.72	0.00
38.14	140.81	134.97	0.74	142.79	1.13	76.90	2.50	0.00
38.30	155.76	148.89	0.63	149.67	1.26	80.14	1.98	0.00
38.47	154.71	147.47	0.62	148.20	1.23	79.82	2.08	0.00
38.63	152.62	145.10	0.62	146.19	1.20	79.29	2.22	0.00
38.79	155.31	147.31	0.62	147.97	1.23	79.79	2.09	0.00
38.96	172.21	163.03	0.59	163.03	1.56	83.13	1.28	0.00
39.12	181.21	171.21	0.61	171.21	1.77	84.75	0.98	0.00
39.29	191.12	180.18	0.61	180.18	2.00	86.43	0.00	0.00
39.45	195.98	184.35	0.59	184.35	2.00	87.19	0.00	0.00
39.61	196.06	183.98	0.56	183.98	2.00	87.12	0.00	0.00
39.78	195.76	183.25	0.52	183.25	2.00	86.99	0.00	0.00
39.94	195.78	182.86	0.48	182.86	2.00	86.92	0.00	0.00
40.11	198.08	184.60	0.47	184.60	2.00	87.23	0.00	0.00
40.27	204.05	189.79	0.51	189.79	2.00	88.15	0.00	0.00
40.43	210.77	195.62	0.60	195.62	2.00	89.15	0.00	0.00
40.60	215.87	199.83	0.69	199.83	2.00	89.85	0.00	0.00
40.76	218.67	201.88	0.79	201.88	2.00	90.19	0.00	0.00
40.93	218.77	201.38	0.83	201.38	2.00	90.10	0.00	0.00
41.09	216.90	199.15	0.81	199.15	2.00	89.74	0.00	0.00
41.26	213.48	195.50	0.76	195.50	2.00	89.13	0.00	0.00
41.42	207.55	189.60	0.70	189.60	2.00	88.12	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
41.58	203.39	185.40	0.63	185.40	2.00	87.38	0.00	0.00
41.75	200.85	182.67	0.59	182.67	2.00	86.89	0.00	0.00
41.91	199.05	180.58	0.59	180.58	2.00	86.51	0.00	0.00
42.08	195.85	177.17	0.60	177.17	1.97	85.88	0.96	0.00
42.24	193.51	174.61	0.60	174.61	1.90	85.40	1.03	0.00
42.40	193.77	174.50	0.58	174.50	1.90	85.38	1.03	0.00
42.57	193.77	174.16	0.55	174.16	1.89	85.31	1.04	0.00
42.73	191.67	171.95	0.51	171.95	1.83	84.89	0.91	0.00
42.90	188.47	168.72	0.48	168.72	1.75	84.27	1.01	0.00
43.06	182.73	163.21	0.45	163.21	1.61	83.17	1.20	0.00
43.22	169.37	150.39	0.54	150.39	1.32	80.47	1.81	0.00
43.39	150.59	132.67	0.68	138.81	1.10	76.33	2.67	0.00
43.55	132.47	115.77	0.80	128.49	0.92	71.83	4.01	0.00
43.72	111.53	96.47	0.95	115.98	0.75	65.81	7.30	0.00
43.88	95.08	81.35	1.14	108.10	0.66	60.19	22.41	0.00
44.04	82.03	69.41	1.34	103.76	0.62	54.95	34.10	0.00
44.21	74.74	62.68	1.50	102.54	0.60	51.58	34.10	0.00
44.37	74.71	62.50	1.42	100.19	0.58	51.49	34.10	0.00
44.54	88.12	74.25	1.16	102.71	0.61	57.17	22.70	0.00
44.70	105.44	89.48	0.97	110.42	0.69	63.33	18.35	0.00
44.86	125.74	107.55	0.75	119.96	0.81	69.40	5.86	0.00
45.03	146.09	125.66	0.62	130.98	0.98	74.54	3.44	0.00
45.19	162.73	140.14	0.63	142.86	1.19	78.14	2.25	0.00
45.36	171.20	147.23	0.65	149.52	1.32	79.77	1.80	0.00
45.52	172.16	147.71	0.66	150.24	1.34	79.88	1.75	0.00
45.68	168.80	144.53	0.63	146.31	1.26	79.16	1.99	0.00
45.85	162.47	138.81	0.57	139.25	1.13	77.82	2.51	0.00
46.01	149.81	127.61	0.49	127.64	0.93	75.05	3.73	0.00
46.18	133.52	113.16	0.43	113.16	0.73	71.08	7.86	0.00
46.34	119.45	100.70	0.39	100.70	0.60	67.23	14.16	0.00
46.50	107.92	90.46	0.35	90.46	0.51	63.69	22.70	0.00
46.67	98.95	82.56	0.30	82.56	0.45	60.68	22.70	0.00
46.83	93.94	78.03	0.30	78.03	0.43	58.81	22.70	0.00
47.00	94.47	78.41	0.28	78.41	0.43	58.97	22.70	0.00
47.16	96.02	79.71	0.25	79.71	0.44	59.52	22.70	0.00
47.32	93.72	77.37	0.30	77.37	0.42	58.53	22.70	0.00
47.49	87.43	71.28	0.46	71.28	0.39	55.83	22.70	0.00
47.65	81.32	65.53	0.61	80.81	0.45	53.05	34.10	0.00
47.82	75.11	59.77	0.80	81.02	0.45	50.01	34.10	0.00
47.98	75.53	59.94	0.82	81.76	0.45	50.11	34.10	0.00
48.15	78.49	62.29	0.82	83.51	0.47	51.37	34.10	0.00
48.31	88.03	70.34	0.73	87.77	0.50	55.39	22.70	0.00
48.47	98.39	79.07	0.67	93.62	0.54	59.25	22.70	0.00
48.64	107.86	87.20	0.57	97.92	0.58	62.48	22.70	0.00
48.80	111.86	90.37	0.59	101.00	0.61	63.66	22.70	0.00
48.97	116.41	94.16	0.55	103.05	0.64	65.01	11.84	0.00
49.13	116.72	94.36	0.51	102.18	0.63	65.08	12.29	0.00
49.29	116.91	94.60	0.44	94.60	0.56	65.17	14.50	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
49.46	119.51	96.51	0.47	96.51	0.57	65.83	14.50	0.00
49.62	121.96	98.16	0.52	105.63	0.67	66.39	10.29	0.00
49.79	122.14	97.82	0.59	107.24	0.69	66.27	9.49	0.00
49.95	125.42	100.37	0.59	109.39	0.71	67.12	8.52	0.00
50.11	130.57	104.60	0.57	112.21	0.75	68.48	7.41	0.00
50.28	131.65	105.44	0.53	111.80	0.74	68.75	7.52	0.00
50.44	136.20	109.31	0.48	109.31	0.72	69.94	8.43	0.00
50.61	144.62	116.56	0.43	116.56	0.81	72.06	5.92	0.00
50.77	152.42	123.03	0.42	123.03	0.90	73.84	4.31	0.00
50.93	160.43	129.50	0.44	129.50	1.01	75.53	3.18	0.00
51.10	172.40	139.40	0.44	139.40	1.19	77.96	2.26	0.00
51.26	183.23	148.50	0.43	148.50	1.38	80.05	1.66	0.00
51.43	196.98	160.05	0.42	160.05	1.65	82.52	1.13	0.00
51.59	210.93	171.79	0.41	171.79	1.98	84.86	0.78	0.00
51.75	220.28	179.49	0.41	179.49	2.00	86.31	0.00	0.00
51.92	226.63	184.62	0.41	184.62	2.00	87.24	0.00	0.00
52.08	229.62	186.80	0.41	186.80	2.00	87.63	0.00	0.00
52.25	227.77	184.82	0.41	184.82	2.00	87.27	0.00	0.00
52.41	225.05	182.21	0.41	182.21	2.00	86.80	0.00	0.00
52.57	223.08	180.27	0.40	180.27	2.00	86.45	0.00	0.00
52.74	220.52	177.92	0.39	177.92	2.00	86.02	0.00	0.00
52.90	218.70	176.26	0.37	176.26	2.00	85.71	0.00	0.00
53.07	217.90	175.49	0.36	175.49	2.00	85.56	0.00	0.00
53.23	216.72	174.42	0.34	174.42	2.00	85.36	0.00	0.00
53.39	214.84	172.89	0.32	172.89	2.00	85.07	0.00	0.00
53.56	213.56	171.76	0.30	171.76	2.00	84.85	0.00	0.00
53.72	212.70	170.58	0.31	170.58	1.99	84.63	0.77	0.00
53.89	212.75	170.17	0.32	170.17	1.98	84.55	0.78	0.00
54.05	212.91	170.17	0.31	170.17	1.99	84.55	0.77	0.00
54.22	212.43	169.30	0.32	169.30	1.96	84.38	0.79	0.00
54.38	212.15	168.63	0.33	168.63	1.95	84.25	0.80	0.00
54.54	207.35	164.32	0.33	164.32	1.83	83.39	0.92	0.00
54.71	199.03	156.96	0.33	156.96	1.63	81.88	1.16	0.00
54.87	193.00	151.34	0.35	151.34	1.50	80.68	1.39	0.00
55.04	183.50	142.90	0.37	142.90	1.31	78.78	1.83	0.00
55.20	176.01	136.11	0.40	136.11	1.18	77.17	2.30	0.00

Total estimated displacement: 1.47

Abbreviations

q_t:	Total cone resistance
Q_{tn}:	Adjusted cone resistance to an effective overburden stress of 1 atm
R_f:	Friction ration
$Q_{tn,cs}$:	Adjusted and corrected cone resistance due to fines
FS:	Calculated factor of safety against liquefaction
D_r:	Calculated relative density
$Gamma_{max}$:	Calculated maximum cyclic shear strain
Lat. disp.:	Lateral displacement

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LIQUEFACTION ANALYSIS REPORT

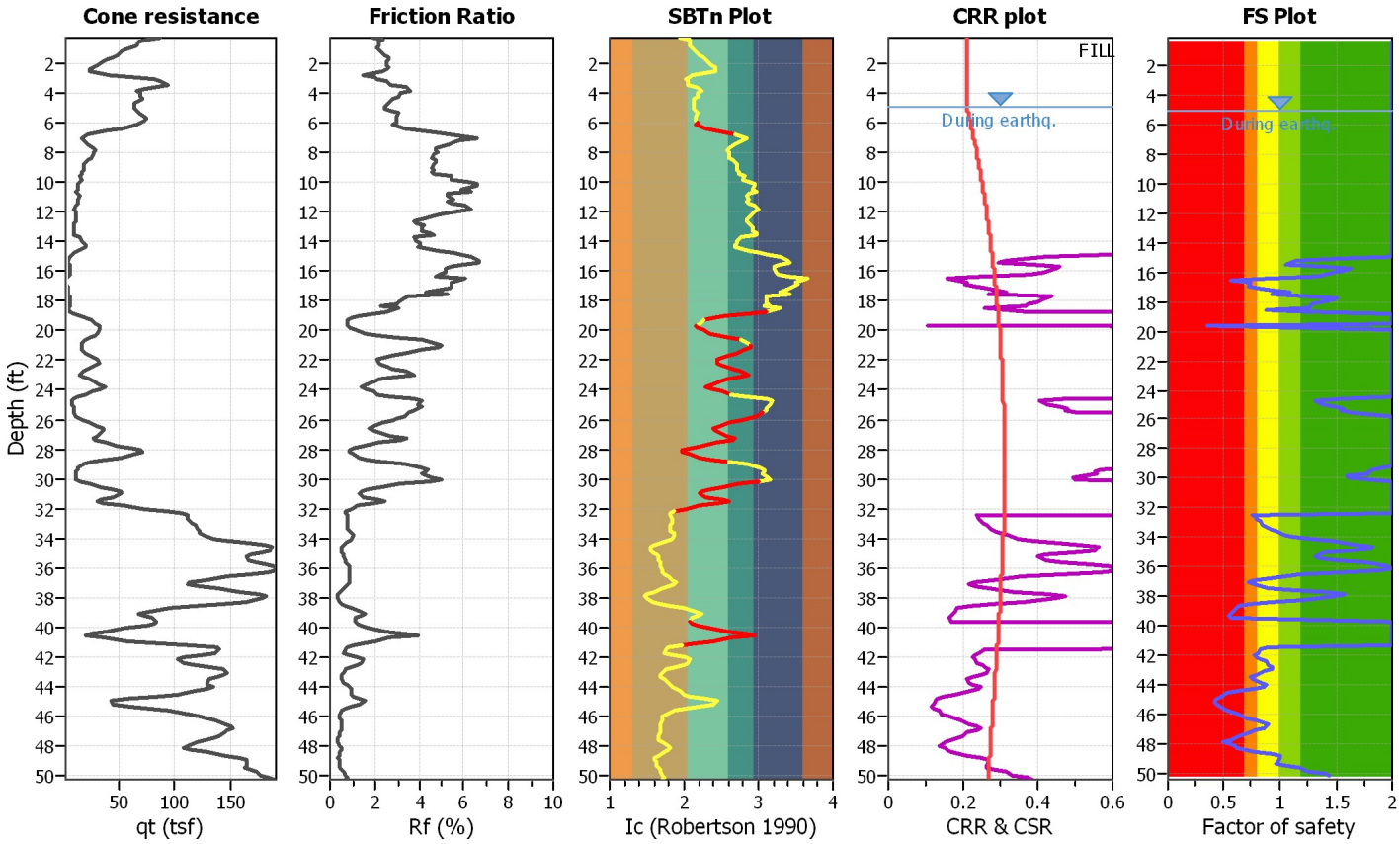
Project title : CIS-72092.4

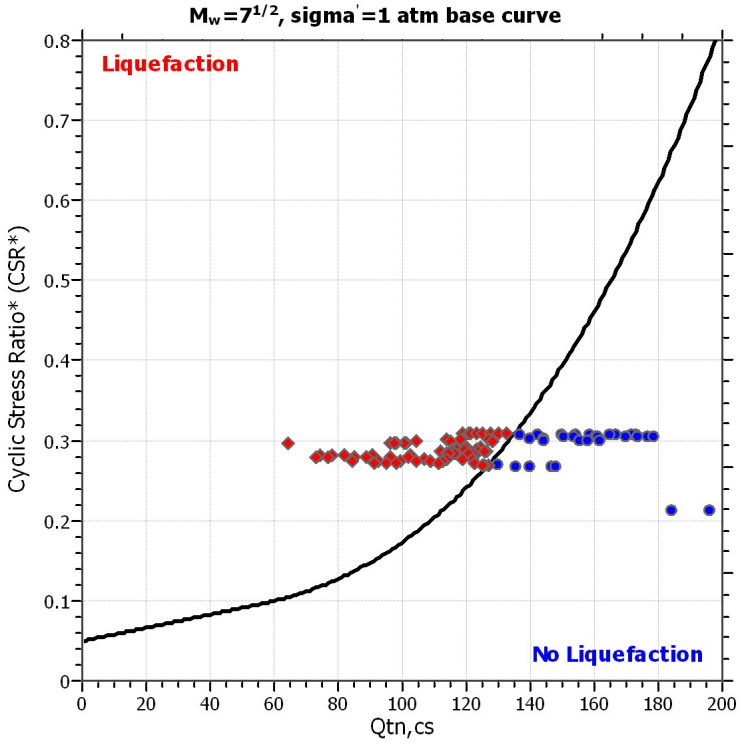
Location : Proposed CarMax National City

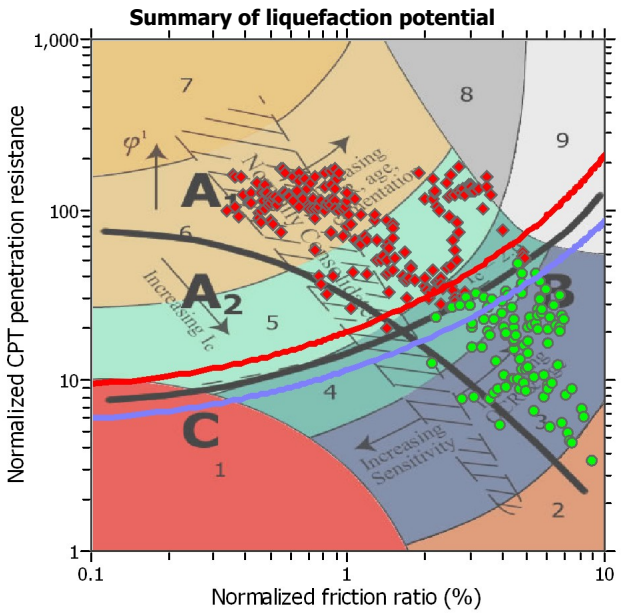
CPT file : CPT-02

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	Yes	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	5.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	120.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	6.76	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.43	Unit weight calculation:	Based on SBT	K_σ applied:	No		

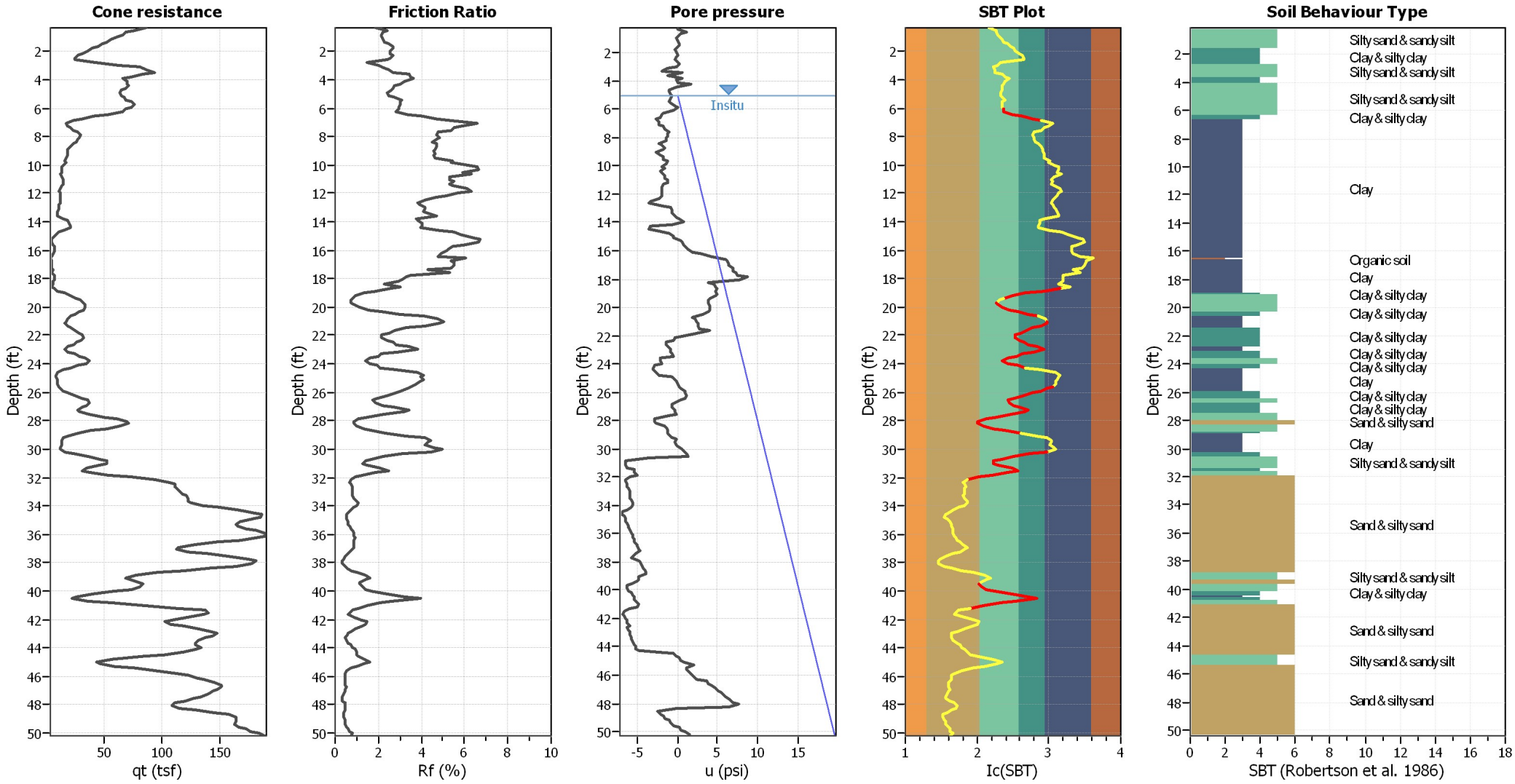






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



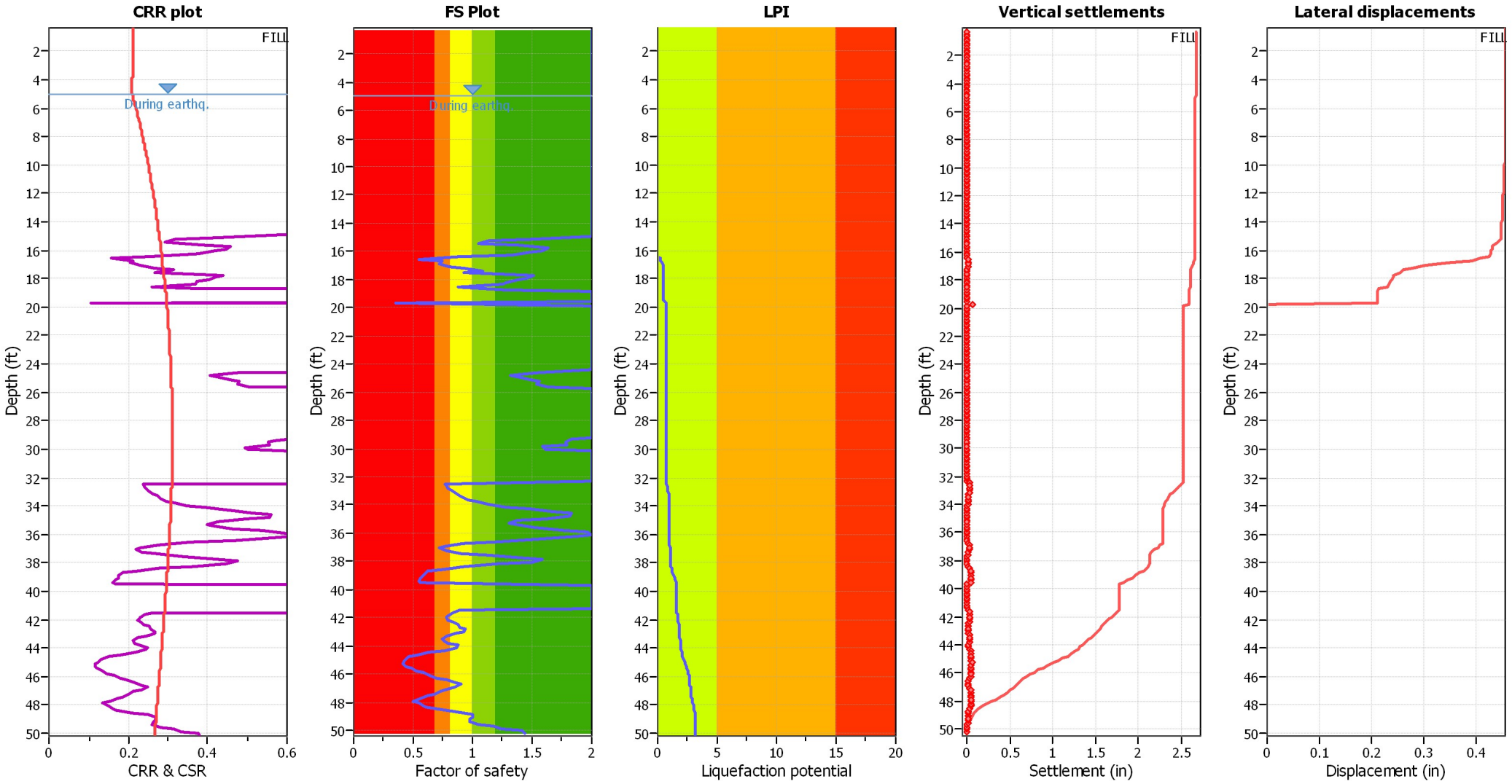
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
5.33	1.96	1.25	163.32	203.54	42	706.4	967	0.21	0.008	0.00	9.05	0.00	0.000
5.49	2.07	1.41	142.82	200.97	43	711.1	984	0.21	0.008	0.00	9.05	0.00	0.000
5.66	2.07	1.40	129.52	181.34	39	675.2	875	0.21	0.010	0.00	9.05	0.00	0.000
5.82	2.08	1.41	125.08	176.78	38	666.9	851	0.21	0.011	0.01	9.05	0.00	0.000
5.98	2.09	1.44	116.17	167.63	36	649.6	802	0.21	0.012	0.01	9.05	0.00	0.000
6.15	2.13	1.51	105.68	160.07	35	634.5	761	0.21	0.013	0.01	9.05	0.01	0.000
6.31	2.16	1.58	98.14	154.74	34	622.9	730	0.21	0.015	0.01	9.05	0.01	0.000
6.48	2.21	1.69	91.54	154.66	35	620.1	723	0.21	0.015	0.01	9.05	0.01	0.000
6.64	2.26	1.83	83.43	152.60	35	611.5	701	0.21	0.016	0.01	9.05	0.01	0.000
6.80	2.30	1.95	73.28	143.00	34	587.5	641	0.21	0.020	0.01	9.05	0.01	0.000
6.97	2.31	2.00	66.68	133.04	31	565.0	586	0.21	0.023	0.01	9.05	0.01	0.000
7.13	2.36	2.15	58.50	125.92	30	544.0	538	0.21	0.028	0.02	9.05	0.01	0.001
7.30	2.41	2.36	50.96	120.41	30	524.8	496	0.21	0.034	0.02	9.05	0.02	0.001
7.46	2.43	2.43	46.21	112.37	28	504.6	453	0.21	0.042	0.03	9.05	0.02	0.001
7.62	2.42	2.39	45.55	108.72	27	497.6	439	0.21	0.047	0.03	9.05	0.03	0.001
7.79	2.11	1.47	78.08	114.54	25	536.4	518	0.21	0.034	0.03	9.05	0.02	0.001
7.95	2.07	1.40	117.06	163.97	35	642.0	781	0.21	0.017	0.01	9.05	0.01	0.000
8.12	2.02	1.32	152.96	202.04	42	710.0	979	0.21	0.013	0.01	9.05	0.00	0.000
8.28	2.05	1.37	162.50	223.27	47	748.9	1104	0.21	0.011	0.00	9.05	0.00	0.000
8.45	2.06	1.38	176.92	244.28	52	783.7	1223	0.21	0.010	0.00	9.05	0.00	0.000
8.61	2.17	1.59	158.01	251.85	56	795.2	1265	0.21	0.010	0.00	9.05	0.00	0.000
8.77	2.21	1.69	138.45	233.51	53	762.8	1154	0.21	0.012	0.00	9.05	0.00	0.000
8.94	2.25	1.79	123.77	221.93	51	739.6	1077	0.21	0.013	0.00	9.05	0.00	0.000
9.10	2.19	1.65	131.77	217.11	49	736.7	1067	0.21	0.013	0.00	9.05	0.00	0.000
9.27	2.18	1.61	131.37	211.25	47	727.7	1038	0.21	0.014	0.01	9.05	0.00	0.000
9.43	2.14	1.54	132.89	204.00	45	716.5	1001	0.21	0.015	0.01	9.05	0.00	0.000
9.59	2.14	1.53	128.82	197.16	43	704.4	964	0.21	0.016	0.01	9.05	0.01	0.000
9.76	2.14	1.54	121.68	187.37	41	686.5	910	0.21	0.018	0.01	9.05	0.01	0.000
9.92	2.13	1.51	120.19	180.96	40	675.0	875	0.21	0.019	0.01	9.05	0.01	0.000

Total estimated settlement: 0.01

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
10.09	184.50	2.00	0.00	1.00	0.00	10.25	196.34	2.00	0.00	1.00	0.00
10.41	210.65	2.00	0.00	1.00	0.00	10.58	216.37	2.00	0.00	1.00	0.00
10.74	220.32	2.00	0.00	1.00	0.00	10.91	215.86	2.00	0.00	1.00	0.00
11.07	206.89	2.00	0.00	1.00	0.00	11.23	196.79	2.00	0.00	1.00	0.00
11.40	190.73	2.00	0.00	1.00	0.00	11.56	182.15	2.00	0.00	1.00	0.00
11.73	237.59	2.00	0.00	1.00	0.00	11.89	395.24	2.00	0.00	1.00	0.00
12.05	161.06	2.00	0.00	1.00	0.00	12.22	156.69	2.00	0.00	1.00	0.00
12.38	159.74	2.00	0.00	1.00	0.00	12.55	404.66	2.00	0.00	1.00	0.00
12.71	271.69	2.00	0.00	1.00	0.00	12.87	249.61	2.00	0.00	1.00	0.00
13.04	270.90	2.00	0.00	1.00	0.00	13.20	266.28	2.00	0.00	1.00	0.00
13.37	257.98	2.00	0.00	1.00	0.00	13.53	320.01	2.00	0.00	1.00	0.00
13.69	357.35	2.00	0.00	1.00	0.00	13.86	139.25	2.00	0.00	1.00	0.00
14.02	137.71	2.00	0.00	1.00	0.00	14.19	137.94	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
14.35	136.40	2.00	0.00	1.00	0.00	14.51	135.05	2.00	0.00	1.00	0.00
14.68	143.29	2.00	0.00	1.00	0.00	14.84	144.58	2.00	0.00	1.00	0.00
15.01	147.65	2.00	0.00	1.00	0.00	15.17	143.54	2.00	0.00	1.00	0.00
15.34	142.01	2.00	0.00	1.00	0.00	15.50	134.81	2.00	0.00	1.00	0.00
15.66	131.82	2.00	0.00	1.00	0.00	15.83	129.07	2.00	0.00	1.00	0.00
15.99	133.87	2.00	0.00	1.00	0.00	16.16	135.85	2.00	0.00	1.00	0.00
16.32	133.91	2.00	0.00	1.00	0.00	16.48	132.60	2.00	0.00	1.00	0.00
16.65	131.71	2.00	0.00	1.00	0.00	16.81	128.31	2.00	0.00	1.00	0.00
16.98	124.42	2.00	0.00	1.00	0.00	17.14	118.48	2.00	0.00	1.00	0.00
17.30	114.27	2.00	0.00	1.00	0.00	17.47	107.70	2.00	0.00	1.00	0.00
17.63	102.60	2.00	0.00	1.00	0.00	17.80	100.91	2.00	0.00	1.00	0.00
17.96	103.41	2.00	0.00	1.00	0.00	18.12	101.19	2.00	0.00	1.00	0.00
18.29	98.94	2.00	0.00	1.00	0.00	18.45	101.36	2.00	0.00	1.00	0.00
18.62	105.31	2.00	0.00	1.00	0.00	18.78	110.26	2.00	0.00	1.00	0.00
18.94	118.47	2.00	0.00	1.00	0.00	19.11	125.70	2.00	0.00	1.00	0.00
19.27	300.23	2.00	0.00	1.00	0.00	19.44	305.37	2.00	0.00	1.00	0.00
19.60	121.60	2.00	0.00	1.00	0.00	19.76	112.75	2.00	0.00	1.00	0.00
19.93	102.10	2.00	0.00	1.00	0.00	20.09	91.54	1.50	0.03	1.00	0.00
20.26	82.20	1.14	0.10	1.00	0.00	20.42	78.97	1.04	0.14	1.00	0.00
20.58	86.16	1.38	0.04	1.00	0.00	20.75	89.44	1.63	0.01	1.00	0.00
20.91	86.96	1.58	0.02	1.00	0.00	21.08	84.13	1.47	0.03	1.00	0.00
21.24	78.84	1.33	0.05	1.00	0.00	21.40	65.81	0.89	0.24	1.00	0.00
21.57	57.09	0.55	0.50	1.00	0.01	21.73	63.30	0.74	0.50	1.00	0.01
21.90	62.80	0.72	0.50	1.00	0.01	22.06	66.39	0.81	0.50	1.00	0.01
22.23	70.05	0.92	0.21	1.00	0.00	22.39	69.45	1.09	0.11	1.00	0.00
22.55	69.84	0.92	0.20	1.00	0.00	22.72	73.57	1.51	0.02	1.00	0.00
22.88	70.78	1.45	0.03	1.00	0.00	23.05	67.85	1.38	0.04	1.00	0.00
23.21	64.75	1.28	0.05	1.00	0.00	23.37	58.70	1.26	0.06	1.00	0.00
23.54	56.89	0.88	0.23	1.00	0.00	23.70	61.57	1.27	0.05	1.00	0.00
23.87	63.71	2.00	0.00	1.00	0.00	24.03	86.24	2.00	0.00	1.00	0.00
24.19	60.15	2.00	0.00	1.00	0.00	24.36	59.59	2.00	0.00	1.00	0.00
24.52	61.93	2.00	0.00	1.00	0.00	24.69	64.28	0.35	3.36	1.00	0.07
24.85	67.79	2.00	0.00	1.00	0.00	25.01	76.04	2.00	0.00	1.00	0.00
25.18	85.83	2.00	0.00	1.00	0.00	25.34	96.55	2.00	0.00	1.00	0.00
25.51	186.88	2.00	0.00	1.00	0.00	25.67	119.69	2.00	0.00	1.00	0.00
25.83	121.88	2.00	0.00	1.00	0.00	26.00	120.99	2.00	0.00	1.00	0.00
26.16	117.74	2.00	0.00	1.00	0.00	26.33	112.97	2.00	0.00	1.00	0.00
26.49	106.80	2.00	0.00	1.00	0.00	26.65	169.07	2.00	0.00	1.00	0.00
26.82	118.63	2.00	0.00	1.00	0.00	26.98	96.73	2.00	0.00	1.00	0.00
27.15	99.07	2.00	0.00	1.00	0.00	27.31	107.98	2.00	0.00	1.00	0.00
27.47	154.87	2.00	0.00	1.00	0.00	27.64	203.30	2.00	0.00	1.00	0.00
27.80	102.24	2.00	0.00	1.00	0.00	27.97	99.36	2.00	0.00	1.00	0.00
28.13	91.89	2.00	0.00	1.00	0.00	28.30	122.53	2.00	0.00	1.00	0.00
28.46	88.99	2.00	0.00	1.00	0.00	28.62	85.45	2.00	0.00	1.00	0.00
28.79	83.27	2.00	0.00	1.00	0.00	28.95	85.06	2.00	0.00	1.00	0.00
29.12	90.51	2.00	0.00	1.00	0.00	29.28	147.24	2.00	0.00	1.00	0.00
29.44	80.43	2.00	0.00	1.00	0.00	29.61	79.18	1.56	0.02	1.00	0.00
29.77	76.51	1.32	0.04	1.00	0.00	29.94	76.60	1.38	0.03	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
30.10	80.35	1.49	0.02	1.00	0.00	30.26	80.38	1.56	0.02	1.00	0.00
30.43	78.41	1.54	0.02	1.00	0.00	30.59	78.40	1.64	0.01	1.00	0.00
30.76	81.89	2.00	0.00	1.00	0.00	30.92	84.47	2.00	0.00	1.00	0.00
31.08	88.97	2.00	0.00	1.00	0.00	31.25	157.76	2.00	0.00	1.00	0.00
31.41	88.56	2.00	0.00	1.00	0.00	31.58	88.39	2.00	0.00	1.00	0.00
31.74	93.33	2.00	0.00	1.00	0.00	31.90	97.85	2.00	0.00	1.00	0.00
32.07	149.15	2.00	0.00	1.00	0.00	32.23	263.67	2.00	0.00	1.00	0.00
32.40	221.48	2.00	0.00	1.00	0.00	32.56	100.03	2.00	0.00	1.00	0.00
32.72	92.30	2.00	0.00	1.00	0.00	32.89	91.43	2.00	0.00	1.00	0.00
33.05	91.52	2.00	0.00	1.00	0.00	33.22	93.19	2.00	0.00	1.00	0.00
33.38	92.14	2.00	0.00	1.00	0.00	33.54	89.58	2.00	0.00	1.00	0.00
33.71	87.27	2.00	0.00	1.00	0.00	33.87	149.49	2.00	0.00	1.00	0.00
34.04	92.56	2.00	0.00	1.00	0.00	34.20	92.12	2.00	0.00	1.00	0.00
34.36	90.43	1.83	0.00	1.00	0.00	34.53	88.78	1.78	0.01	1.00	0.00
34.69	87.19	1.79	0.01	1.00	0.00	34.86	86.66	1.59	0.01	1.00	0.00
35.02	90.64	1.61	0.01	1.00	0.00	35.19	97.78	2.00	0.00	1.00	0.00
35.35	98.61	2.00	0.00	1.00	0.00	35.51	98.05	2.00	0.00	1.00	0.00
35.68	93.11	2.00	0.00	1.00	0.00	35.84	89.74	2.00	0.00	1.00	0.00
36.01	87.50	2.00	0.00	1.00	0.00	36.17	85.94	2.00	0.00	1.00	0.00
36.33	91.37	2.00	0.00	1.00	0.00	36.50	148.72	2.00	0.00	1.00	0.00
36.66	89.17	2.00	0.00	1.00	0.00	36.83	85.88	2.00	0.00	1.00	0.00
36.99	92.84	2.00	0.00	1.00	0.00	37.15	103.82	2.00	0.00	1.00	0.00
37.32	113.78	2.00	0.00	1.00	0.00	37.48	118.83	0.76	1.58	1.00	0.03
37.65	120.34	0.78	1.55	1.00	0.03	37.81	121.44	0.80	1.53	1.00	0.03
37.97	123.22	0.82	1.50	1.00	0.03	38.14	125.12	0.85	1.46	1.00	0.03
38.30	127.55	0.89	1.09	1.00	0.02	38.47	129.70	0.92	1.07	1.00	0.02
38.63	132.81	0.97	0.68	1.00	0.01	38.79	137.09	1.04	0.66	1.00	0.01
38.96	142.20	1.13	0.44	1.00	0.01	39.12	149.71	1.28	0.22	1.00	0.00
39.29	158.93	1.48	0.00	1.00	0.00	39.45	166.90	1.67	0.00	1.00	0.00
39.61	172.94	1.83	0.00	1.00	0.00	39.78	172.13	1.81	0.00	1.00	0.00
39.94	164.73	1.62	0.00	1.00	0.00	40.11	154.46	1.38	0.00	1.00	0.00
40.27	150.91	1.31	0.22	1.00	0.00	40.43	153.83	1.37	0.00	1.00	0.00
40.60	160.59	1.53	0.00	1.00	0.00	40.76	170.21	1.77	0.00	1.00	0.00
40.93	177.05	1.96	0.00	1.00	0.00	41.09	179.05	2.00	0.00	1.00	0.00
41.26	173.85	1.88	0.00	1.00	0.00	41.42	161.18	1.55	0.00	1.00	0.00
41.58	144.09	1.18	0.31	1.00	0.01	41.75	128.35	0.92	1.08	1.00	0.02
41.91	117.85	0.77	1.60	1.00	0.03	42.08	113.99	0.72	2.04	1.00	0.04
42.24	118.22	0.78	1.59	1.00	0.03	42.40	126.99	0.90	1.10	1.00	0.02
42.57	140.25	1.12	0.44	1.00	0.01	42.73	155.38	1.43	0.00	1.00	0.00
42.90	161.84	1.58	0.00	1.00	0.00	43.06	158.17	1.50	0.00	1.00	0.00
43.22	144.66	1.21	0.31	1.00	0.01	43.39	128.32	0.93	1.08	1.00	0.02
43.55	115.21	0.74	2.01	1.00	0.04	43.72	104.49	0.62	2.25	1.00	0.05
43.88	101.28	0.59	2.31	1.00	0.04	44.04	100.48	0.59	2.33	1.00	0.04
44.21	97.83	0.56	2.38	1.00	0.05	44.37	96.05	0.55	2.42	1.00	0.05
44.54	97.72	0.56	2.38	1.00	0.05	44.70	99.45	2.00	0.00	1.00	0.00
44.86	97.54	2.00	0.00	1.00	0.00	45.03	94.23	2.00	0.00	1.00	0.00
45.19	138.75	2.00	0.00	1.00	0.00	45.36	93.87	2.00	0.00	1.00	0.00
45.52	94.75	2.00	0.00	1.00	0.00	45.68	174.10	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
45.85	101.46	2.00	0.00	1.00	0.00	46.01	106.36	2.00	0.00	1.00	0.00
46.18	116.95	2.00	0.00	1.00	0.00	46.34	126.28	2.00	0.00	1.00	0.00
46.50	124.63	0.89	1.13	1.00	0.02	46.67	120.18	0.83	1.55	1.00	0.03
46.83	117.69	0.80	1.60	1.00	0.03	47.00	115.89	0.78	1.64	1.00	0.03
47.16	117.10	0.79	1.61	1.00	0.03	47.32	119.31	0.82	1.57	1.00	0.03
47.49	122.95	0.88	1.15	1.00	0.02	47.65	124.02	0.89	1.14	1.00	0.02
47.82	126.54	0.93	1.11	1.00	0.02	47.98	125.89	0.93	1.12	1.00	0.02
48.15	121.31	0.86	1.18	1.00	0.02	48.31	115.71	0.78	1.64	1.00	0.03
48.47	112.18	0.74	2.09	1.00	0.04	48.64	113.62	0.76	1.69	1.00	0.03
48.80	115.99	0.79	1.64	1.00	0.03	48.97	121.83	0.87	1.17	1.00	0.02
49.13	120.93	0.86	1.18	1.00	0.02	49.29	114.23	0.77	1.67	1.00	0.03
49.46	102.26	0.64	2.29	1.00	0.05	49.62	90.94	0.53	2.53	1.00	0.05
49.79	82.11	0.47	2.75	1.00	0.06	49.95	78.01	0.44	2.86	1.00	0.05
50.11	74.52	0.42	2.97	1.00	0.06	50.28	73.09	0.41	3.02	1.00	0.06
50.44	76.62	0.44	2.91	1.00	0.06	50.61	84.73	0.49	2.68	1.00	0.05
50.77	88.62	0.52	2.58	1.00	0.05	50.93	96.48	0.59	2.41	1.00	0.05
51.10	101.59	0.64	2.31	1.00	0.05	51.26	106.73	0.70	2.22	1.00	0.04
51.43	113.66	0.78	1.69	1.00	0.03	51.59	118.62	0.85	1.22	1.00	0.02
51.75	121.89	0.90	1.17	1.00	0.02	51.92	118.54	0.85	1.22	1.00	0.02
52.08	112.49	0.77	1.71	1.00	0.03	52.25	108.93	0.73	2.18	1.00	0.04
52.41	104.60	0.68	2.25	1.00	0.04	52.57	99.18	0.62	2.35	1.00	0.05
52.74	92.38	0.56	2.49	1.00	0.05	52.90	84.41	0.50	2.68	1.00	0.05
53.07	91.25	0.55	2.52	1.00	0.05	53.23	95.15	0.59	2.43	1.00	0.05
53.39	97.82	0.62	2.38	1.00	0.05	53.56	111.44	0.77	1.73	1.00	0.04
53.72	122.24	0.92	1.16	1.00	0.02	53.89	126.65	1.00	0.71	1.00	0.01
54.05	126.62	1.00	0.71	1.00	0.01	54.22	125.44	0.98	0.72	1.00	0.01
54.38	124.86	0.97	0.72	1.00	0.01	54.54	129.71	1.05	0.47	1.00	0.01
54.71	135.87	1.17	0.33	1.00	0.01	54.87	139.78	1.25	0.32	1.00	0.01
55.04	147.13	1.41	0.00	1.00	0.00	55.20	148.13	1.44	0.00	1.00	0.00

Total estimated settlement: 2.67

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
10.09	64.89	122.06	2.50	184.50	2.00	73.58	0.00	0.00
10.25	66.85	125.74	2.75	196.34	2.00	74.56	0.00	0.00
10.41	68.27	128.41	3.11	210.65	2.00	75.25	0.00	0.00
10.58	72.91	137.17	3.02	216.37	2.00	77.43	0.00	0.00
10.74	75.39	141.84	3.00	220.32	2.00	78.54	0.00	0.00
10.91	73.81	138.83	2.95	215.86	2.00	77.83	0.00	0.00
11.07	68.67	129.09	2.97	206.89	2.00	75.43	0.00	0.00
11.23	65.72	123.50	2.83	196.79	2.00	73.97	0.00	0.00
11.40	53.71	100.78	3.35	190.73	2.00	67.26	0.00	0.00
11.56	40.53	75.84	4.00	182.15	2.00	57.87	0.00	0.00
11.73	30.17	56.24	4.71	237.59	2.00	48.00	0.00	0.00
11.89	22.91	42.50	5.33	395.24	2.00	38.76	0.00	0.00
12.05	16.79	30.92	6.55	161.06	2.00	28.25	0.04	0.00
12.22	18.21	33.59	5.82	156.69	2.00	30.99	0.04	0.00
12.38	20.34	37.58	5.51	159.74	2.00	34.70	0.03	0.00
12.55	22.76	42.15	5.36	404.66	2.00	38.48	0.00	0.00
12.71	27.22	50.56	4.78	271.69	2.00	44.49	0.00	0.00
12.87	28.88	53.68	4.71	249.61	2.00	46.47	0.00	0.00
13.04	27.84	51.69	4.81	270.90	2.00	45.22	0.00	0.00
13.20	26.86	49.81	4.69	266.28	2.00	44.00	0.00	0.00
13.37	25.68	47.56	4.52	257.98	2.00	42.47	0.00	0.00
13.53	22.49	41.53	4.71	320.01	2.00	38.00	0.00	0.00
13.69	20.01	36.82	4.70	357.35	2.00	34.02	0.00	0.00
13.86	18.67	34.27	4.61	139.25	2.00	31.65	0.03	0.00
14.02	18.39	33.72	4.57	137.71	2.00	31.12	0.04	0.00
14.19	18.15	33.25	4.63	137.94	2.00	30.65	0.04	0.00
14.35	17.85	32.67	4.59	136.40	2.00	30.07	0.04	0.00
14.51	17.32	31.63	4.62	135.05	2.00	29.01	0.04	0.00
14.68	16.10	29.31	5.47	143.29	2.00	26.49	0.04	0.00
14.84	16.68	30.39	5.40	144.58	2.00	27.69	0.04	0.00
15.01	14.92	27.04	6.17	147.65	2.00	23.84	0.05	0.00
15.17	13.13	23.66	6.55	143.54	2.00	19.42	0.05	0.00
15.34	12.69	22.81	6.62	142.01	2.00	18.21	0.05	0.00
15.50	12.91	23.21	5.88	134.81	2.00	18.79	0.05	0.00
15.66	11.42	20.36	6.31	131.82	2.00	14.46	0.06	0.00
15.83	13.20	23.71	5.30	129.07	2.00	19.49	0.05	0.00
15.99	14.38	25.92	5.29	133.87	2.00	22.44	0.05	0.00
16.16	14.20	25.56	5.49	135.85	2.00	21.98	0.05	0.00
16.32	14.34	25.81	5.30	133.91	2.00	22.29	0.05	0.00
16.48	13.57	24.35	5.45	132.60	2.00	20.37	0.05	0.00
16.65	11.81	21.00	6.10	131.71	2.00	15.49	0.06	0.00
16.81	10.79	19.05	6.30	128.31	2.00	12.28	0.06	0.00
16.98	11.23	19.87	5.70	124.42	2.00	13.66	0.06	0.00
17.14	11.27	19.92	5.15	118.48	2.00	13.74	0.06	0.00
17.30	11.44	20.23	4.72	114.27	2.00	14.26	0.06	0.00
17.47	11.56	20.44	4.15	107.70	2.00	14.59	0.06	0.00
17.63	11.59	20.21	3.80	102.60	2.00	14.22	0.06	0.00
17.80	10.79	18.74	3.89	100.91	2.00	11.73	0.06	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
17.96	10.54	18.26	4.18	103.41	2.00	10.88	0.06	0.00
18.12	10.15	17.46	4.14	101.19	2.00	9.39	0.07	0.00
18.29	9.73	16.62	4.11	98.94	2.00	7.76	0.07	0.00
18.45	9.40	15.97	4.47	101.36	2.00	6.45	0.07	0.00
18.62	9.84	16.65	4.68	105.31	2.00	7.83	0.07	0.00
18.78	14.80	24.45	3.78	110.26	2.00	20.50	0.05	0.00
18.94	17.81	29.08	3.82	118.47	2.00	26.23	0.04	0.00
19.11	19.36	31.41	4.03	125.70	2.00	28.78	0.04	0.00
19.27	20.53	33.00	3.99	300.23	2.00	30.41	0.00	0.00
19.44	20.15	32.16	3.97	305.37	2.00	29.56	0.00	0.00
19.60	14.15	22.90	4.81	121.60	2.00	18.35	0.05	0.00
19.76	10.20	16.30	5.49	112.75	2.00	7.13	0.07	0.00
19.93	7.87	12.13	5.85	102.10	2.00	0.00	0.08	0.00
20.09	5.98	8.77	6.36	91.54	1.50	0.00	0.34	0.00
20.26	4.78	6.65	6.69	82.20	1.14	0.00	1.33	0.01
20.42	4.51	6.13	6.66	78.97	1.04	0.00	2.00	0.01
20.58	5.71	8.12	5.95	86.16	1.38	0.00	0.52	0.00
20.75	6.64	9.61	5.43	89.44	1.63	0.00	0.23	0.00
20.91	6.52	9.35	5.21	86.96	1.58	0.00	0.27	0.00
21.08	6.19	8.73	5.17	84.13	1.47	0.00	0.38	0.00
21.24	5.73	7.89	4.89	78.84	1.33	0.00	0.62	0.00
21.40	4.20	5.33	4.76	65.81	0.89	0.00	4.22	0.02
21.57	2.99	3.31	6.01	57.09	0.55	0.00	4.00	0.02
21.73	3.70	4.43	5.40	63.30	0.74	0.00	10.37	0.04
21.90	3.65	4.31	5.48	62.80	0.72	0.00	11.99	0.05
22.06	4.01	4.86	5.48	66.39	0.81	0.00	6.84	0.03
22.23	4.48	5.56	5.36	70.05	0.92	0.00	3.62	0.01
22.39	5.14	6.58	4.28	69.45	1.09	0.00	1.63	0.01
22.55	4.55	5.59	5.28	69.84	0.92	0.00	3.61	0.01
22.72	6.85	9.17	3.50	73.57	1.51	0.00	0.33	0.00
22.88	6.68	8.85	3.29	70.78	1.45	0.00	0.40	0.00
23.05	6.43	8.40	3.11	67.85	1.38	0.00	0.52	0.00
23.21	6.09	7.81	2.96	64.75	1.28	0.00	0.75	0.00
23.37	6.05	7.71	2.31	58.70	1.26	0.00	0.80	0.00
23.54	4.61	5.43	3.04	56.89	0.88	0.00	4.39	0.02
23.70	6.21	7.85	2.58	61.57	1.27	0.00	0.75	0.00
23.87	9.49	12.55	1.90	63.71	2.00	0.00	0.08	0.00
24.03	15.25	20.05	1.31	86.24	2.00	13.95	0.00	0.00
24.19	20.62	26.66	0.97	60.15	2.00	23.37	0.00	0.00
24.36	25.24	32.15	0.79	59.59	2.00	29.54	0.00	0.00
24.52	29.16	36.80	0.75	61.93	2.00	34.01	0.00	0.00
24.69	32.18	40.33	0.75	64.28	0.35	37.03	51.20	0.21
24.85	32.96	41.31	0.85	67.79	2.00	37.82	0.00	0.00
25.01	33.02	41.69	1.15	76.04	2.00	38.12	0.00	0.00
25.18	31.75	40.45	1.57	85.83	2.00	37.12	0.00	0.00
25.34	28.65	36.86	2.16	96.55	2.00	34.06	0.00	0.00
25.51	24.56	31.93	3.01	186.88	2.00	29.32	0.00	0.00
25.67	20.48	26.82	4.10	119.69	2.00	23.56	0.05	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
25.83	17.60	23.01	4.77	121.88	2.00	18.50	0.05	0.00
26.00	16.37	21.28	5.01	120.99	2.00	15.93	0.06	0.00
26.16	16.18	20.86	4.82	117.74	2.00	15.26	0.06	0.00
26.33	17.86	22.80	4.14	112.97	2.00	18.20	0.05	0.00
26.49	21.18	26.72	3.30	106.80	2.00	23.44	0.05	0.00
26.65	24.54	30.61	2.77	169.07	2.00	27.93	0.00	0.00
26.82	27.63	34.14	2.46	118.63	2.00	31.52	0.00	0.00
26.98	31.18	38.11	2.12	96.73	2.00	35.16	0.00	0.00
27.15	32.20	39.19	2.17	99.07	2.00	36.08	0.00	0.00
27.31	29.15	35.44	2.40	107.98	2.00	32.77	0.00	0.00
27.47	25.55	31.00	2.66	154.87	2.00	28.35	0.00	0.00
27.64	22.56	27.26	2.84	203.30	2.00	24.10	0.00	0.00
27.80	18.58	22.39	3.44	102.24	2.00	17.60	0.05	0.00
27.97	15.27	18.21	3.80	99.36	2.00	10.78	0.06	0.00
28.13	18.23	21.58	2.85	91.89	2.00	16.39	0.06	0.00
28.30	23.93	28.11	2.17	122.53	2.00	25.12	0.00	0.00
28.46	28.04	32.77	2.00	88.99	2.00	30.18	0.00	0.00
28.62	33.42	38.66	1.62	85.45	2.00	35.64	0.00	0.00
28.79	37.31	42.79	1.39	83.27	2.00	38.98	0.00	0.00
28.95	33.92	38.89	1.59	85.06	2.00	35.83	0.00	0.00
29.12	26.66	30.54	1.95	90.51	2.00	27.85	0.00	0.00
29.28	20.30	23.05	2.07	147.24	2.00	18.56	0.00	0.00
29.44	13.88	15.51	2.74	80.43	2.00	5.48	0.07	0.00
29.61	9.47	10.04	3.80	79.18	1.56	0.00	0.27	0.00
29.77	8.27	8.50	4.11	76.51	1.32	0.00	0.62	0.00
29.94	8.64	8.91	3.93	76.60	1.38	0.00	0.50	0.00
30.10	9.25	9.60	4.11	80.35	1.49	0.00	0.35	0.00
30.26	9.68	10.07	3.93	80.38	1.56	0.00	0.27	0.00
30.43	9.64	9.97	3.73	78.41	1.54	0.00	0.29	0.00
30.59	10.22	10.62	3.52	78.40	1.64	0.00	0.21	0.00
30.76	11.99	12.68	3.34	81.89	2.00	0.00	0.08	0.00
30.92	14.57	15.65	3.02	84.47	2.00	5.79	0.07	0.00
31.08	18.59	20.15	2.80	88.97	2.00	14.13	0.06	0.00
31.25	24.27	26.38	2.39	157.76	2.00	23.02	0.00	0.00
31.41	30.87	33.46	1.94	88.56	2.00	30.86	0.00	0.00
31.58	35.46	38.27	1.75	88.39	2.00	35.30	0.00	0.00
31.74	36.60	39.43	1.91	93.33	2.00	36.28	0.00	0.00
31.90	34.48	37.06	2.20	97.85	2.00	34.23	0.00	0.00
32.07	30.89	33.12	2.72	149.15	2.00	30.52	0.00	0.00
32.23	27.41	29.29	3.43	263.67	2.00	26.47	0.00	0.00
32.40	28.75	30.57	3.20	221.48	2.00	27.88	0.00	0.00
32.56	37.31	39.44	2.20	100.03	2.00	36.29	0.00	0.00
32.72	49.16	51.56	1.46	92.30	2.00	45.14	0.00	0.00
32.89	60.55	63.01	1.09	91.43	2.00	51.76	0.00	0.00
33.05	69.09	71.36	0.84	91.52	2.00	55.86	0.00	0.00
33.22	71.13	73.22	0.84	93.19	2.00	56.71	0.00	0.00
33.38	63.93	65.79	1.03	92.14	2.00	53.18	0.00	0.00
33.54	51.66	53.09	1.32	89.58	2.00	46.10	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
33.71	38.58	39.44	1.66	87.27	2.00	36.29	0.00	0.00
33.87	26.50	26.78	2.34	149.49	2.00	23.52	0.00	0.00
34.04	18.23	18.01	3.29	92.56	2.00	10.41	0.06	0.00
34.20	13.97	13.36	4.15	92.12	2.00	0.55	0.08	0.00
34.36	12.71	11.93	4.40	90.43	1.83	0.00	0.12	0.00
34.53	12.48	11.61	4.33	88.78	1.78	0.00	0.14	0.00
34.69	12.58	11.66	4.13	87.19	1.79	0.00	0.14	0.00
34.86	11.42	10.37	4.55	86.66	1.59	0.00	0.25	0.00
35.02	11.61	10.51	5.00	90.64	1.61	0.00	0.23	0.00
35.19	15.27	14.33	4.45	97.78	2.00	2.87	0.07	0.00
35.35	23.48	22.75	3.15	98.61	2.00	18.13	0.05	0.00
35.51	35.10	34.42	2.22	98.05	2.00	31.80	0.00	0.00
35.68	45.74	44.92	1.71	93.11	2.00	40.59	0.00	0.00
35.84	52.26	51.20	1.38	89.74	2.00	44.90	0.00	0.00
36.01	52.14	50.86	1.30	87.50	2.00	44.68	0.00	0.00
36.17	45.57	44.18	1.45	85.94	2.00	40.04	0.00	0.00
36.33	34.79	33.38	2.07	91.37	2.00	30.79	0.00	0.00
36.50	30.20	28.69	2.45	148.72	2.00	25.79	0.00	0.00
36.66	37.10	35.38	1.89	89.17	2.00	32.71	0.00	0.00
36.83	52.92	50.73	1.25	85.88	2.00	44.60	0.00	0.00
36.99	72.68	69.79	0.94	92.84	2.00	55.13	0.00	0.00
37.15	93.03	89.27	0.73	103.82	2.00	63.25	0.00	0.00
37.32	106.59	102.11	0.69	113.78	2.00	67.69	0.00	0.00
37.48	110.79	105.93	0.76	118.83	0.76	68.90	7.00	0.00
37.65	111.19	106.03	0.81	120.34	0.78	68.93	6.49	0.00
37.81	112.55	107.04	0.82	121.44	0.80	69.25	6.15	0.00
37.97	115.01	109.10	0.82	123.22	0.82	69.88	5.63	0.00
38.14	117.71	111.36	0.82	125.12	0.85	70.55	5.13	0.00
38.30	120.49	113.71	0.83	127.55	0.89	71.24	4.55	0.00
38.47	122.14	114.95	0.87	129.70	0.92	71.60	4.10	0.00
38.63	122.38	114.87	0.98	132.81	0.97	71.58	3.52	0.00
38.79	125.44	117.45	1.05	137.09	1.04	72.31	2.87	0.00
38.96	134.38	125.54	0.98	142.20	1.13	74.51	2.25	0.00
39.12	149.01	139.02	0.85	149.71	1.28	77.87	1.94	0.00
39.29	166.43	155.05	0.73	158.93	1.48	81.48	1.43	0.00
39.45	179.41	166.90	0.64	166.90	1.67	83.91	1.11	0.00
39.61	186.22	172.94	0.55	172.94	1.83	85.08	1.10	0.00
39.78	185.80	172.13	0.54	172.13	1.81	84.93	0.94	0.00
39.94	178.35	164.73	0.56	164.73	1.62	83.48	1.18	0.00
40.11	167.83	154.46	0.61	154.46	1.38	81.35	1.64	0.00
40.27	163.61	150.13	0.64	150.91	1.31	80.41	1.84	0.00
40.43	165.61	151.59	0.68	153.83	1.37	80.73	1.67	0.00
40.60	172.13	157.19	0.73	160.59	1.53	81.93	1.33	0.00
40.76	181.64	165.52	0.80	170.21	1.77	83.63	0.98	0.00
40.93	188.98	171.80	0.85	177.05	1.96	84.86	0.79	0.00
41.09	190.22	172.46	0.88	179.05	2.00	84.99	0.00	0.00
41.26	182.72	165.04	0.91	173.85	1.88	83.54	0.87	0.00
41.42	167.38	150.54	0.90	161.18	1.55	80.50	1.29	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
41.58	146.98	131.50	0.87	144.09	1.18	76.04	2.27	0.00
41.75	127.07	112.93	0.88	128.35	0.92	71.01	4.13	0.00
41.91	113.51	100.28	0.90	117.85	0.77	67.09	6.83	0.00
42.08	112.13	98.83	0.80	113.99	0.72	66.61	8.20	0.00
42.24	121.77	107.46	0.69	118.22	0.78	69.38	6.66	0.00
42.40	138.26	122.37	0.58	126.99	0.90	73.66	4.35	0.00
42.57	157.96	140.25	0.47	140.25	1.12	78.16	2.54	0.00
42.73	174.56	155.38	0.38	155.38	1.43	81.55	1.53	0.00
42.90	181.89	161.84	0.35	161.84	1.58	82.89	1.24	0.00
43.06	178.23	158.17	0.36	158.17	1.50	82.13	1.39	0.00
43.22	164.06	144.66	0.44	144.66	1.21	79.19	2.17	0.00
43.39	143.02	124.96	0.56	128.32	0.93	74.35	4.00	0.00
43.55	119.06	102.83	0.72	115.21	0.74	67.92	7.50	0.00
43.72	95.70	81.41	1.00	104.49	0.62	60.21	22.70	0.00
43.88	76.86	64.27	1.41	101.28	0.59	52.41	34.10	0.00
44.04	68.55	56.72	1.60	100.48	0.59	48.29	34.10	0.00
44.21	72.33	59.92	1.41	97.83	0.56	50.10	34.10	0.00
44.37	79.72	66.36	1.15	96.05	0.55	53.47	34.10	0.00
44.54	83.14	69.16	1.13	97.72	0.56	54.83	34.10	0.00
44.70	80.92	66.91	1.26	99.45	2.00	53.74	0.00	0.00
44.86	73.93	60.59	1.38	97.54	2.00	50.46	0.00	0.00
45.03	57.87	46.45	1.69	94.23	2.00	41.69	0.00	0.00
45.19	39.26	30.32	2.45	138.75	2.00	27.61	0.00	0.00
45.36	25.90	18.99	3.24	93.87	2.00	12.17	0.06	0.00
45.52	21.24	15.13	3.95	94.75	2.00	4.67	0.07	0.00
45.68	36.28	27.50	2.59	174.10	2.00	24.39	0.00	0.00
45.85	56.37	44.27	2.06	101.46	2.00	40.11	0.00	0.00
46.01	84.66	68.37	1.46	106.36	2.00	54.45	0.00	0.00
46.18	113.20	92.97	1.10	116.95	2.00	64.59	0.00	0.00
46.34	137.16	114.09	0.77	126.28	2.00	71.35	0.00	0.00
46.50	139.41	116.13	0.66	124.63	0.89	71.94	4.43	0.00
46.67	135.77	112.88	0.60	120.18	0.83	71.00	5.47	0.00
46.83	122.87	100.68	0.88	117.69	0.80	67.22	6.14	0.00
47.00	107.95	87.00	1.24	115.89	0.78	62.40	10.98	0.00
47.16	102.09	81.53	1.45	117.10	0.79	60.26	9.97	0.00
47.32	107.51	85.91	1.40	119.31	0.82	61.99	8.41	0.00
47.49	118.11	94.78	1.25	122.95	0.88	65.23	4.67	0.00
47.65	130.61	105.74	0.95	124.02	0.89	68.84	4.42	0.00
47.82	142.57	116.39	0.72	126.54	0.93	72.01	3.89	0.00
47.98	147.31	120.73	0.58	125.89	0.93	73.22	4.00	0.00
48.15	143.48	117.41	0.53	121.31	0.86	72.30	4.96	0.00
48.31	137.10	111.85	0.50	115.71	0.78	70.70	6.47	0.00
48.47	131.18	106.44	0.52	112.18	0.74	69.06	7.64	0.00
48.64	128.98	103.83	0.64	113.62	0.76	68.24	7.09	0.00
48.80	128.68	102.94	0.75	115.99	0.79	67.96	6.30	0.00
48.97	133.98	106.83	0.84	121.83	0.87	69.18	4.73	0.00
49.13	129.38	102.38	0.94	120.93	0.86	67.78	4.91	0.00
49.29	118.55	92.99	1.00	114.23	0.77	64.60	11.22	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
49.46	102.67	79.68	0.97	102.26	0.64	59.50	22.70	0.00
49.62	83.03	63.23	1.06	90.94	0.53	51.87	34.10	0.00
49.79	57.44	42.11	1.36	82.11	0.47	38.45	51.20	0.00
49.95	42.83	30.31	1.59	78.01	0.44	27.60	51.20	0.00
50.11	45.65	32.56	1.36	74.52	0.42	29.96	51.20	0.00
50.28	58.32	42.80	0.99	73.09	0.41	38.99	51.20	0.00
50.44	75.74	57.16	0.71	76.62	0.44	48.54	34.10	0.00
50.61	94.58	72.95	0.53	84.73	0.49	56.59	22.70	0.00
50.77	113.22	88.62	0.44	88.62	0.52	63.01	22.70	0.00
50.93	122.83	96.48	0.44	96.48	0.59	65.82	14.50	0.00
51.10	129.35	101.59	0.46	101.59	0.64	67.52	11.70	0.00
51.26	135.90	106.73	0.49	106.73	0.70	69.15	9.14	0.00
51.43	144.47	113.66	0.48	113.66	0.78	71.23	6.53	0.00
51.59	150.73	118.62	0.49	118.62	0.85	72.64	5.11	0.00
51.75	151.48	118.84	0.51	121.89	0.90	72.70	4.35	0.00
51.92	147.25	115.15	0.50	118.54	0.85	71.65	5.08	0.00
52.08	143.97	112.49	0.46	112.49	0.77	70.89	6.77	0.00
52.25	139.48	108.93	0.40	108.93	0.73	69.82	7.99	0.00
52.41	134.14	104.60	0.36	104.60	0.68	68.48	9.77	0.00
52.57	127.61	99.18	0.33	99.18	0.62	66.73	12.54	0.00
52.74	119.98	92.38	0.37	92.38	0.56	64.38	22.70	0.00
52.90	111.10	84.41	0.45	84.41	0.50	61.41	22.70	0.00
53.07	108.28	81.69	0.50	91.25	0.55	60.33	22.70	0.00
53.23	114.61	86.72	0.49	95.15	0.59	62.30	22.70	0.00
53.39	128.17	97.82	0.45	97.82	0.62	66.27	13.03	0.00
53.56	144.66	111.44	0.41	111.44	0.77	70.57	6.81	0.00
53.72	157.62	122.24	0.38	122.24	0.92	73.63	4.03	0.00
53.89	163.63	126.65	0.42	126.65	1.00	74.80	3.24	0.00
54.05	164.28	126.62	0.45	126.62	1.00	74.79	3.23	0.00
54.22	163.32	125.44	0.47	125.44	0.98	74.48	3.40	0.00
54.38	163.05	124.86	0.48	124.86	0.97	74.33	3.48	0.00
54.54	166.84	127.08	0.55	129.71	1.05	74.91	2.74	0.00
54.71	173.20	131.39	0.62	135.87	1.17	76.01	2.32	0.00
54.87	177.02	133.78	0.68	139.78	1.25	76.61	2.03	0.00
55.04	183.49	137.79	0.80	147.13	1.41	77.58	1.58	0.00
55.20	189.16	142.70	0.71	148.13	1.44	78.74	1.52	0.00

Total estimated displacement: 0.45

Abbreviations

q_t:	Total cone resistance
Q_{tn}:	Adjusted cone resistance to an effective overburden stress of 1 atm
R_f:	Friction ration
$Q_{tn,cs}$:	Adjusted and corrected cone resistance due to fines
FS:	Calculated factor of safety against liquefaction
D_r:	Calculated relative density
$Gamma_{max}$:	Calculated maximum cyclic shear strain
Lat. disp.:	Lateral displacement

EEI
Geotechnical & Environmental Solutions
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LIQUEFACTION ANALYSIS REPORT

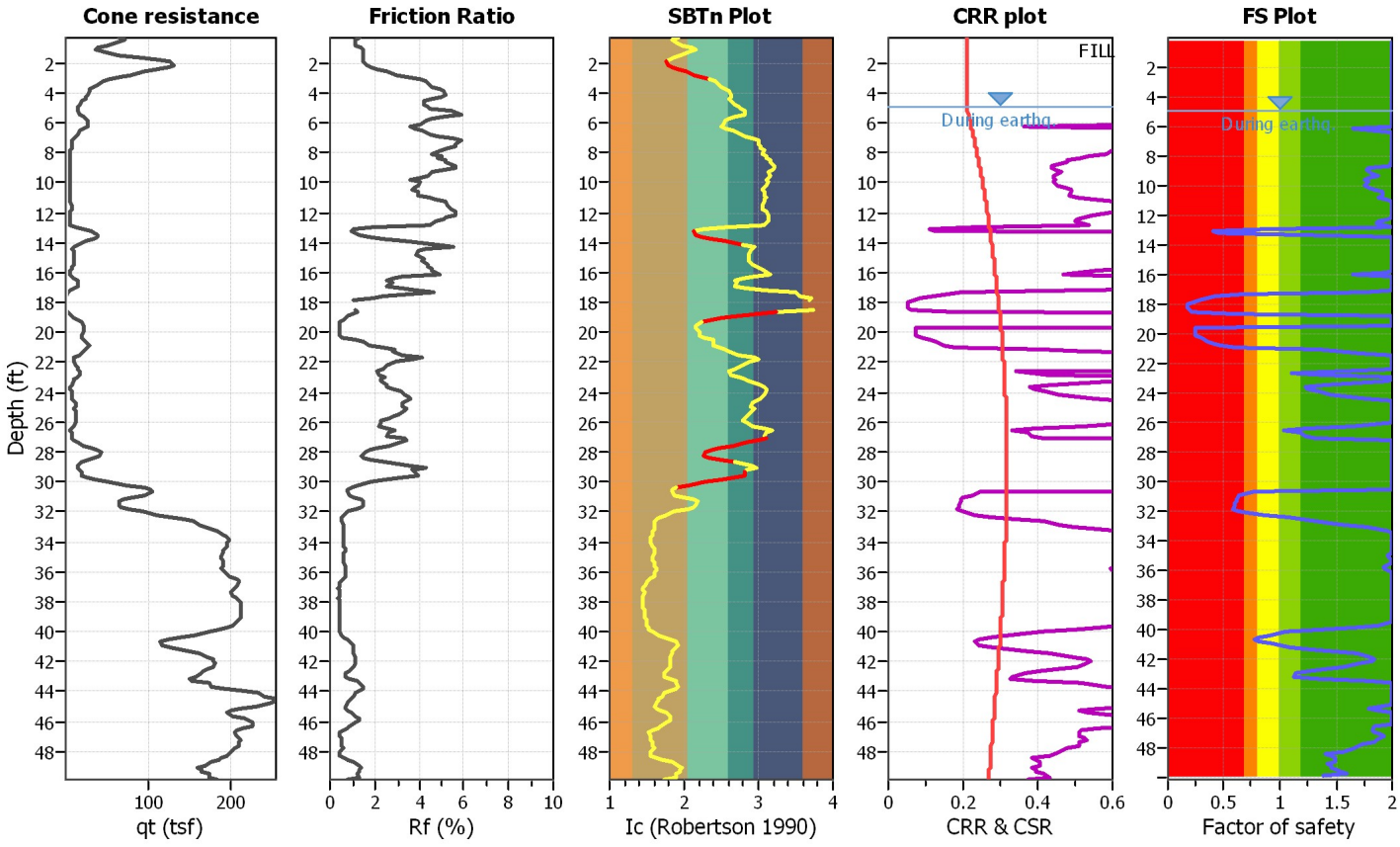
Project title : CIS-72092.4

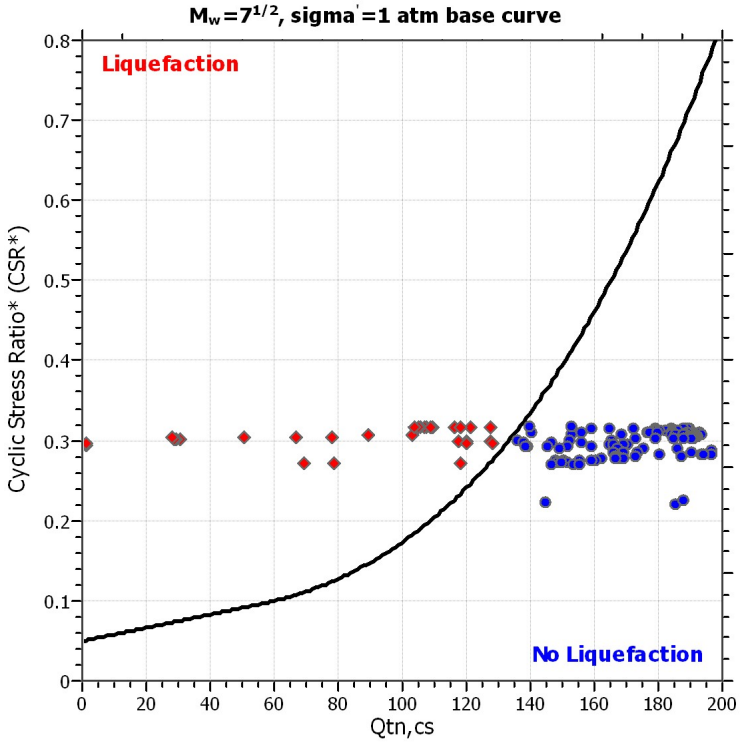
Location : Proposed CarMax National City

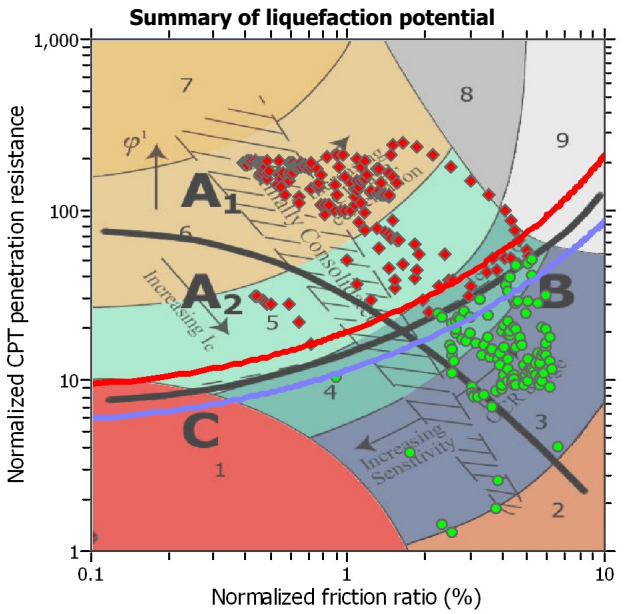
CPT file : CPT-03

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	Yes	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	5.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	120.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	6.76	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.43	Unit weight calculation:	Based on SBT	K_σ applied:	No		

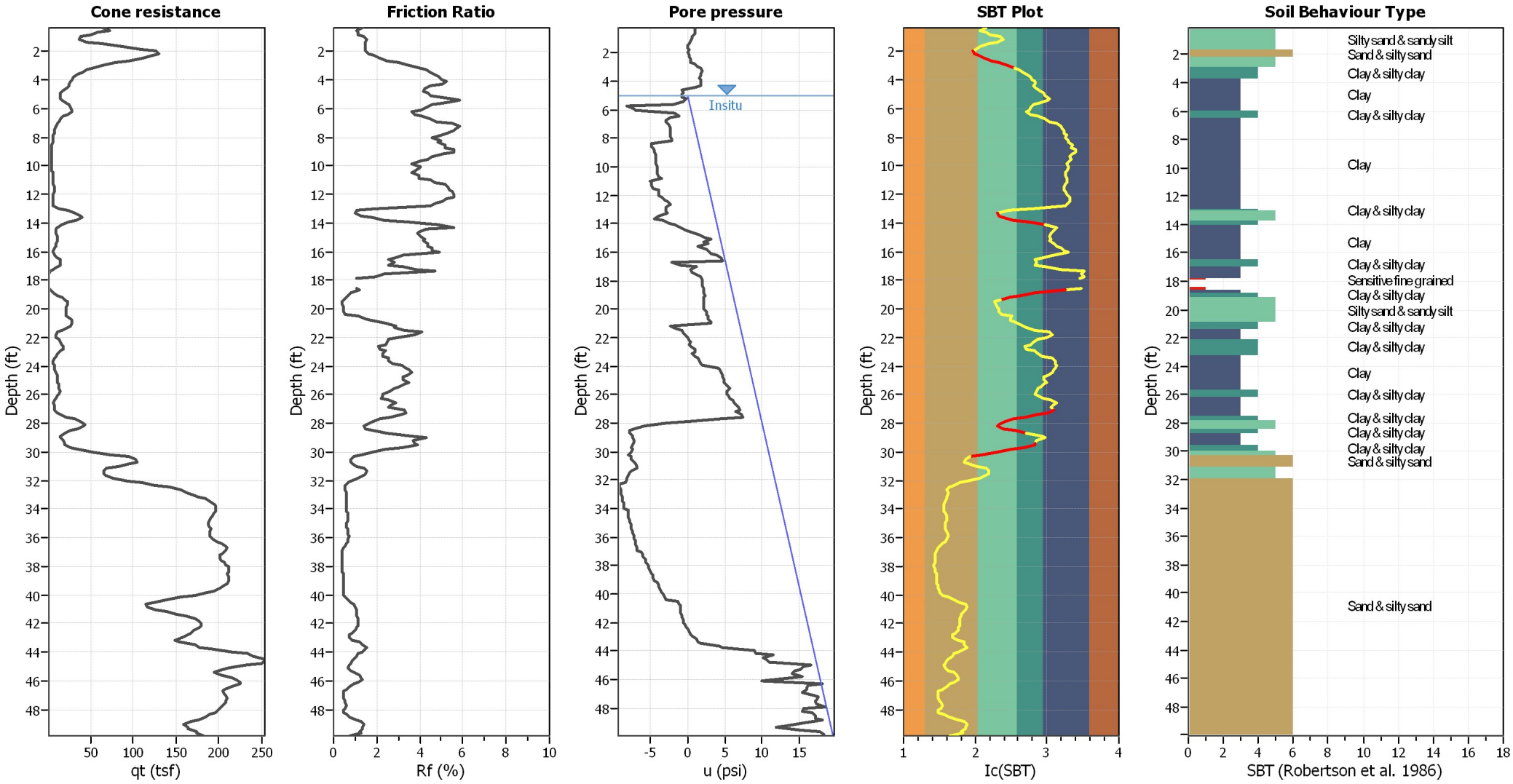






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



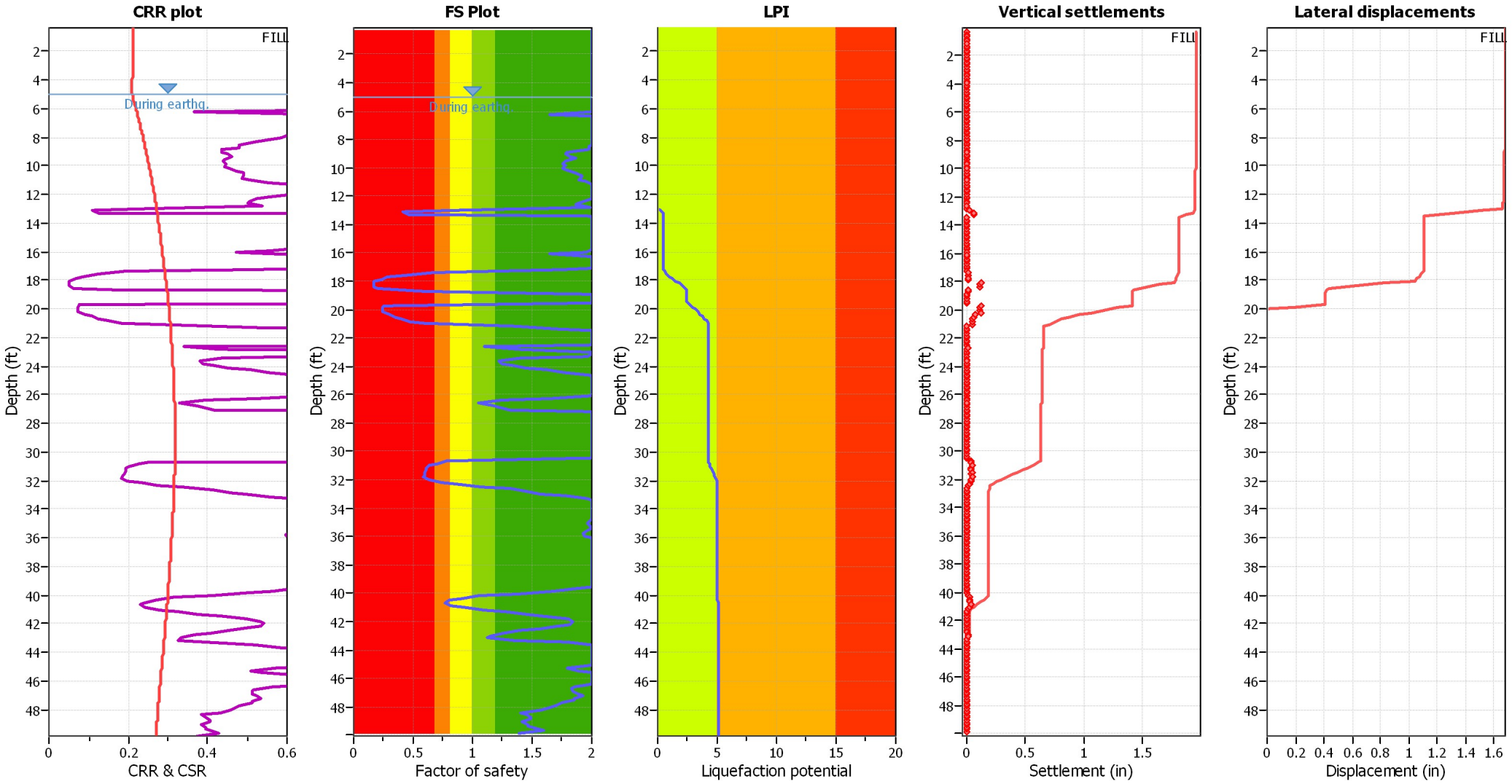
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
5.33	1.93	1.22	121.75	148.43	30	600.0	667	0.21	0.014	0.01	9.05	0.01	0.000
5.49	1.83	1.13	137.35	155.61	30	599.9	666	0.21	0.014	0.01	9.05	0.01	0.000
5.66	1.91	1.20	111.17	133.02	27	565.0	581	0.21	0.018	0.01	9.05	0.01	0.000
5.82	1.96	1.26	96.93	121.80	25	546.7	539	0.21	0.021	0.02	9.05	0.01	0.000
5.98	2.10	1.46	73.51	107.52	23	519.6	481	0.21	0.027	0.02	9.05	0.02	0.001
6.15	2.15	1.56	68.84	107.60	24	519.0	480	0.21	0.028	0.02	9.05	0.02	0.001
6.31	2.07	1.41	86.05	121.27	26	551.7	552	0.21	0.022	0.02	9.05	0.01	0.001
6.48	1.96	1.25	122.17	152.25	31	610.6	695	0.21	0.016	0.01	9.05	0.01	0.000
6.64	1.86	1.16	166.31	192.29	38	672.4	864	0.21	0.012	0.01	9.05	0.00	0.000
6.80	1.80	1.11	208.32	230.96	45	724.4	1021	0.21	0.010	0.00	9.05	0.00	0.000
6.97	1.77	1.09	238.96	259.84	50	761.5	1142	0.21	0.009	0.00	9.05	0.00	0.000
7.13	1.80	1.10	245.79	271.42	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
7.30	1.85	1.15	233.64	268.04	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
7.46	1.93	1.22	209.12	255.23	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
7.62	2.03	1.34	178.91	239.13	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
7.79	2.14	1.53	148.31	226.59	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
7.95	2.24	1.78	122.10	217.73	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
8.12	2.35	2.10	99.97	210.12	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
8.28	2.41	2.36	85.56	201.60	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
8.45	2.46	2.58	74.80	192.85	49	656.9	828	0.21	0.017	0.01	9.05	0.00	0.000
8.61	2.51	2.80	66.09	184.89	48	634.9	767	0.21	0.020	0.01	9.05	0.01	0.000
8.77	2.56	3.10	58.24	180.82	48	617.5	721	0.21	0.022	0.01	9.05	0.01	0.000
8.94	2.59	3.29	54.10	178.22	48	607.2	694	0.21	0.024	0.01	9.05	0.01	0.000
9.10	2.62	3.48	50.38	175.45	0	0.0	0	0.21	0.000	0.00	0.00	0.00	0.000
9.27	2.62	3.47	48.61	168.74	0	0.0	0	0.21	0.000	0.00	0.00	0.00	0.000
9.43	2.61	3.37	46.27	155.73	0	0.0	0	0.21	0.000	0.00	0.00	0.00	0.000
9.59	2.63	3.54	39.66	140.28	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
9.76	2.69	3.91	32.98	128.82	0	0.0	0	0.21	0.000	0.00	0.00	0.00	0.000
9.92	2.74	4.30	29.02	124.89	0	0.0	0	0.21	0.000	0.00	0.00	0.00	0.000

Total estimated settlement: 0.00

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
10.09	125.26	2.00	0.00	1.00	0.00	10.25	138.60	2.00	0.00	1.00	0.00
10.41	152.60	2.00	0.00	1.00	0.00	10.58	379.68	2.00	0.00	1.00	0.00
10.74	257.38	2.00	0.00	1.00	0.00	10.91	211.96	2.00	0.00	1.00	0.00
11.07	185.63	2.00	0.00	1.00	0.00	11.23	145.24	1.64	0.00	1.00	0.00
11.40	188.15	2.00	0.00	1.00	0.00	11.56	280.91	2.00	0.00	1.00	0.00
11.73	126.97	2.00	0.00	1.00	0.00	11.89	122.94	2.00	0.00	1.00	0.00
12.05	122.31	2.00	0.00	1.00	0.00	12.22	118.86	2.00	0.00	1.00	0.00
12.38	112.93	2.00	0.00	1.00	0.00	12.55	108.80	2.00	0.00	1.00	0.00
12.71	102.28	2.00	0.00	1.00	0.00	12.87	95.28	2.00	0.00	1.00	0.00
13.04	90.42	2.00	0.00	1.00	0.00	13.20	90.21	2.00	0.00	1.00	0.00
13.37	87.61	2.00	0.00	1.00	0.00	13.53	87.26	1.98	0.00	1.00	0.00
13.69	87.28	1.98	0.00	1.00	0.00	13.86	86.67	1.79	0.01	1.00	0.00
14.02	86.65	1.78	0.01	1.00	0.00	14.19	84.46	1.82	0.01	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
14.35	82.08	1.87	0.00	1.00	0.00	14.51	79.25	1.78	0.01	1.00	0.00
14.68	76.45	1.76	0.01	1.00	0.00	14.84	73.61	1.78	0.01	1.00	0.00
15.01	76.47	1.75	0.01	1.00	0.00	15.17	76.55	1.78	0.01	1.00	0.00
15.34	76.68	1.85	0.01	1.00	0.00	15.50	76.76	1.91	0.00	1.00	0.00
15.66	79.61	1.91	0.00	1.00	0.00	15.83	79.58	1.89	0.00	1.00	0.00
15.99	85.02	1.95	0.00	1.00	0.00	16.16	90.30	2.00	0.00	1.00	0.00
16.32	97.59	2.00	0.00	1.00	0.00	16.48	102.24	2.00	0.00	1.00	0.00
16.65	104.46	2.00	0.00	1.00	0.00	16.81	104.44	2.00	0.00	1.00	0.00
16.98	102.08	2.00	0.00	1.00	0.00	17.14	97.24	2.00	0.00	1.00	0.00
17.30	92.48	1.96	0.00	1.00	0.00	17.47	89.95	1.88	0.00	1.00	0.00
17.63	87.50	1.86	0.00	1.00	0.00	17.80	87.75	1.99	0.00	1.00	0.00
17.96	118.18	0.86	1.22	1.00	0.02	18.12	69.53	0.41	3.15	1.00	0.06
18.29	78.49	0.46	2.85	1.00	0.06	18.45	94.44	2.00	0.00	1.00	0.00
18.62	110.86	2.00	0.00	1.00	0.00	18.78	116.83	2.00	0.00	1.00	0.00
18.94	162.60	2.00	0.00	1.00	0.00	19.11	134.41	2.00	0.00	1.00	0.00
19.27	122.55	2.00	0.00	1.00	0.00	19.44	101.92	2.00	0.00	1.00	0.00
19.60	100.76	2.00	0.00	1.00	0.00	19.76	100.22	2.00	0.00	1.00	0.00
19.93	103.87	2.00	0.00	1.00	0.00	20.09	107.70	2.00	0.00	1.00	0.00
20.26	107.16	2.00	0.00	1.00	0.00	20.42	104.08	2.00	0.00	1.00	0.00
20.58	100.02	2.00	0.00	1.00	0.00	20.75	95.39	2.00	0.00	1.00	0.00
20.91	90.36	1.95	0.00	1.00	0.00	21.08	87.12	1.64	0.01	1.00	0.00
21.24	82.38	2.00	0.00	1.00	0.00	21.40	86.53	2.00	0.00	1.00	0.00
21.57	203.20	2.00	0.00	1.00	0.00	21.73	92.70	2.00	0.00	1.00	0.00
21.90	216.96	2.00	0.00	1.00	0.00	22.06	91.06	2.00	0.00	1.00	0.00
22.23	81.11	1.75	0.01	1.00	0.00	22.39	58.41	0.67	0.50	1.00	0.01
22.55	39.00	0.42	0.50	1.00	0.01	22.72	31.38	0.28	0.50	1.00	0.01
22.88	25.06	0.23	0.50	1.00	0.01	23.05	1.22	0.17	5.80	1.00	0.12
23.21	1.17	0.17	5.80	1.00	0.11	23.37	1.23	0.17	5.80	1.00	0.11
23.54	24.08	0.20	0.50	1.00	0.01	23.70	36.98	0.59	0.50	1.00	0.01
23.87	43.06	2.00	0.00	1.00	0.00	24.03	45.37	2.00	0.00	1.00	0.00
24.19	47.87	2.00	0.00	1.00	0.00	24.36	27.81	2.00	0.00	1.00	0.00
24.52	31.32	2.00	0.00	1.00	0.00	24.69	30.89	0.25	5.80	1.00	0.12
24.85	29.37	0.25	5.80	1.00	0.11	25.01	28.66	0.24	5.80	1.00	0.11
25.18	27.99	0.24	5.80	1.00	0.12	25.34	50.41	0.30	4.10	1.00	0.08
25.51	67.10	0.36	3.24	1.00	0.07	25.67	78.13	0.41	2.86	1.00	0.05
25.83	89.39	0.48	2.56	1.00	0.05	26.00	102.95	0.59	2.28	1.00	0.05
26.16	153.09	1.35	0.00	1.00	0.00	26.33	168.92	1.72	0.00	1.00	0.00
26.49	101.94	2.00	0.00	1.00	0.00	26.65	97.06	2.00	0.00	1.00	0.00
26.82	87.33	2.00	0.00	1.00	0.00	26.98	80.41	2.00	0.00	1.00	0.00
27.15	80.59	2.00	0.00	1.00	0.00	27.31	83.21	2.00	0.00	1.00	0.00
27.47	204.19	2.00	0.00	1.00	0.00	27.64	140.83	1.10	0.44	1.00	0.01
27.80	155.96	1.40	0.00	1.00	0.00	27.97	81.00	2.00	0.00	1.00	0.00
28.13	73.66	2.00	0.00	1.00	0.00	28.30	69.69	1.97	0.00	1.00	0.00
28.46	65.08	1.40	0.03	1.00	0.00	28.62	62.10	1.22	0.05	1.00	0.00
28.79	64.60	1.24	0.05	1.00	0.00	28.95	69.47	1.33	0.04	1.00	0.00
29.12	74.04	1.46	0.02	1.00	0.00	29.28	78.32	1.62	0.01	1.00	0.00
29.44	82.27	1.76	0.01	1.00	0.00	29.61	83.98	2.00	0.00	1.00	0.00
29.77	85.36	2.00	0.00	1.00	0.00	29.94	85.13	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
30.10	87.04	2.00	0.00	1.00	0.00	30.26	86.61	2.00	0.00	1.00	0.00
30.43	85.84	2.00	0.00	1.00	0.00	30.59	83.51	2.00	0.00	1.00	0.00
30.76	81.14	2.00	0.00	1.00	0.00	30.92	74.97	2.00	0.00	1.00	0.00
31.08	71.44	2.00	0.00	1.00	0.00	31.25	65.33	1.65	0.01	1.00	0.00
31.41	62.69	1.25	0.05	1.00	0.00	31.58	61.93	1.04	0.10	1.00	0.00
31.74	62.33	1.18	0.06	1.00	0.00	31.90	62.34	1.22	0.05	1.00	0.00
32.07	71.23	1.32	0.04	1.00	0.00	32.23	81.29	2.00	0.00	1.00	0.00
32.40	90.21	2.00	0.00	1.00	0.00	32.56	196.87	2.00	0.00	1.00	0.00
32.72	95.05	2.00	0.00	1.00	0.00	32.89	93.93	2.00	0.00	1.00	0.00
33.05	92.02	2.00	0.00	1.00	0.00	33.22	85.64	2.00	0.00	1.00	0.00
33.38	81.92	2.00	0.00	1.00	0.00	33.54	87.06	2.00	0.00	1.00	0.00
33.71	212.79	2.00	0.00	1.00	0.00	33.87	92.43	2.00	0.00	1.00	0.00
34.04	99.79	2.00	0.00	1.00	0.00	34.20	99.82	2.00	0.00	1.00	0.00
34.36	104.50	2.00	0.00	1.00	0.00	34.53	109.22	2.00	0.00	1.00	0.00
34.69	223.60	2.00	0.00	1.00	0.00	34.86	104.42	2.00	0.00	1.00	0.00
35.02	105.39	2.00	0.00	1.00	0.00	35.19	108.70	2.00	0.00	1.00	0.00
35.35	117.49	2.00	0.00	1.00	0.00	35.51	121.64	2.00	0.00	1.00	0.00
35.68	121.54	0.78	1.53	1.00	0.03	35.84	116.01	0.71	1.99	1.00	0.04
36.01	109.63	0.64	2.17	1.00	0.04	36.17	107.33	0.62	2.20	1.00	0.04
36.33	106.82	0.61	2.21	1.00	0.04	36.50	105.73	0.60	2.23	1.00	0.05
36.66	105.21	0.60	2.24	1.00	0.04	36.83	103.85	0.58	2.27	1.00	0.05
36.99	108.65	0.63	2.18	1.00	0.04	37.15	118.15	0.74	1.94	1.00	0.04
37.32	127.80	0.87	1.09	1.00	0.02	37.48	140.30	1.07	0.44	1.00	0.01
37.65	153.33	1.32	0.21	1.00	0.00	37.81	159.26	1.45	0.00	1.00	0.00
37.97	164.75	1.57	0.00	1.00	0.00	38.14	172.63	1.77	0.00	1.00	0.00
38.30	179.55	1.97	0.00	1.00	0.00	38.47	184.67	2.00	0.00	1.00	0.00
38.63	188.76	2.00	0.00	1.00	0.00	38.79	189.97	2.00	0.00	1.00	0.00
38.96	189.29	2.00	0.00	1.00	0.00	39.12	188.39	2.00	0.00	1.00	0.00
39.29	186.41	2.00	0.00	1.00	0.00	39.45	184.08	2.00	0.00	1.00	0.00
39.61	182.59	2.00	0.00	1.00	0.00	39.78	180.68	2.00	0.00	1.00	0.00
39.94	179.01	1.97	0.00	1.00	0.00	40.11	178.60	1.96	0.00	1.00	0.00
40.27	179.41	1.99	0.00	1.00	0.00	40.43	179.60	1.99	0.00	1.00	0.00
40.60	178.37	1.96	0.00	1.00	0.00	40.76	177.17	1.93	0.00	1.00	0.00
40.93	177.34	1.93	0.00	1.00	0.00	41.09	179.84	2.00	0.00	1.00	0.00
41.26	184.16	2.00	0.00	1.00	0.00	41.42	189.41	2.00	0.00	1.00	0.00
41.58	193.10	2.00	0.00	1.00	0.00	41.75	193.85	2.00	0.00	1.00	0.00
41.91	192.01	2.00	0.00	1.00	0.00	42.08	188.97	2.00	0.00	1.00	0.00
42.24	185.66	2.00	0.00	1.00	0.00	42.40	184.16	2.00	0.00	1.00	0.00
42.57	185.79	2.00	0.00	1.00	0.00	42.73	188.14	2.00	0.00	1.00	0.00
42.90	189.89	2.00	0.00	1.00	0.00	43.06	192.10	2.00	0.00	1.00	0.00
43.22	192.62	2.00	0.00	1.00	0.00	43.39	191.77	2.00	0.00	1.00	0.00
43.55	190.58	2.00	0.00	1.00	0.00	43.72	190.98	2.00	0.00	1.00	0.00
43.88	191.00	2.00	0.00	1.00	0.00	44.04	190.52	2.00	0.00	1.00	0.00
44.21	188.27	2.00	0.00	1.00	0.00	44.37	184.90	2.00	0.00	1.00	0.00
44.54	179.41	2.00	0.00	1.00	0.00	44.70	173.39	1.88	0.00	1.00	0.00
44.86	165.38	1.67	0.00	1.00	0.00	45.03	152.69	1.37	0.00	1.00	0.00
45.19	136.04	1.05	0.66	1.00	0.01	45.36	127.33	0.91	1.10	1.00	0.02
45.52	120.22	0.81	1.55	1.00	0.03	45.68	117.37	0.77	1.61	1.00	0.03

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
45.85	120.21	0.81	1.55	1.00	0.03	46.01	128.41	0.93	1.08	1.00	0.02
46.18	138.11	1.10	0.45	1.00	0.01	46.34	147.07	1.27	0.22	1.00	0.00
46.50	155.98	1.47	0.00	1.00	0.00	46.67	164.73	1.68	0.00	1.00	0.00
46.83	169.52	1.81	0.00	1.00	0.00	47.00	170.54	1.84	0.00	1.00	0.00
47.16	169.65	1.82	0.00	1.00	0.00	47.32	165.94	1.72	0.00	1.00	0.00
47.49	159.14	1.56	0.00	1.00	0.00	47.65	152.11	1.40	0.00	1.00	0.00
47.82	145.69	1.26	0.22	1.00	0.00	47.98	139.59	1.14	0.44	1.00	0.01
48.15	138.52	1.13	0.45	1.00	0.01	48.31	149.59	1.35	0.22	1.00	0.00
48.47	167.63	1.79	0.00	1.00	0.00	48.64	175.71	2.00	0.00	1.00	0.00
48.80	186.16	2.00	0.00	1.00	0.00	48.97	197.10	2.00	0.00	1.00	0.00
49.13	206.04	2.00	0.00	1.00	0.00	49.29	207.71	2.00	0.00	1.00	0.00
49.46	212.55	2.00	0.00	1.00	0.00	49.62	209.96	2.00	0.00	1.00	0.00
49.79	206.66	2.00	0.00	1.00	0.00	49.95	190.74	2.00	0.00	1.00	0.00
50.11	173.93	2.00	0.00	1.00	0.00	50.28	166.50	1.80	0.00	1.00	0.00
50.44	169.60	1.89	0.00	1.00	0.00	50.61	180.83	2.00	0.00	1.00	0.00
50.77	193.60	2.00	0.00	1.00	0.00	50.93	196.74	2.00	0.00	1.00	0.00
51.10	194.12	2.00	0.00	1.00	0.00	51.26	187.59	2.00	0.00	1.00	0.00
51.43	173.38	2.00	0.00	1.00	0.00	51.59	167.38	1.85	0.00	1.00	0.00
51.75	166.71	1.83	0.00	1.00	0.00	51.92	166.83	1.84	0.00	1.00	0.00
52.08	168.42	1.89	0.00	1.00	0.00	52.25	169.58	1.92	0.00	1.00	0.00
52.41	166.89	1.85	0.00	1.00	0.00	52.57	166.67	1.85	0.00	1.00	0.00
52.74	162.58	1.74	0.00	1.00	0.00	52.90	160.74	1.69	0.00	1.00	0.00
53.07	159.32	1.66	0.00	1.00	0.00	53.23	155.55	1.57	0.00	1.00	0.00
53.39	148.26	1.40	0.00	1.00	0.00	53.56	150.45	1.45	0.00	1.00	0.00
53.72	151.82	1.49	0.00	1.00	0.00	53.89	151.72	1.49	0.00	1.00	0.00
54.05	148.68	1.42	0.00	1.00	0.00	54.22	150.22	1.46	0.00	1.00	0.00
54.38	150.28	1.46	0.00	1.00	0.00	54.54	153.57	1.54	0.00	1.00	0.00
54.71	155.42	1.59	0.00	1.00	0.00	54.87	146.59	1.39	0.00	1.00	0.00

Total estimated settlement: 1.95

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
10.09	15.23	28.21	4.46	125.26	2.00	25.23	0.04	0.00
10.25	15.01	27.77	5.46	138.60	2.00	24.71	0.04	0.00
10.41	17.05	31.60	5.87	152.60	2.00	28.98	0.04	0.00
10.58	21.83	40.62	5.13	379.68	2.00	37.27	0.00	0.00
10.74	25.53	47.60	4.54	257.38	2.00	42.50	0.00	0.00
10.91	27.55	51.39	4.28	211.96	2.00	45.03	0.00	0.00
11.07	28.11	52.43	4.06	185.63	2.00	45.69	0.00	0.00
11.23	28.14	52.49	3.62	145.24	1.64	45.72	0.18	0.00
11.40	23.96	44.55	3.76	188.15	2.00	40.31	0.00	0.00
11.56	19.11	35.37	4.08	280.91	2.00	32.70	0.00	0.00
11.73	15.61	28.73	4.49	126.97	2.00	25.84	0.04	0.00
11.89	13.36	24.48	4.79	122.94	2.00	20.54	0.05	0.00
12.05	11.30	20.56	5.49	122.31	2.00	14.80	0.06	0.00
12.22	9.92	17.94	5.84	118.86	2.00	10.29	0.06	0.00
12.38	9.21	16.57	5.65	112.93	2.00	7.66	0.07	0.00
12.55	8.59	15.38	5.59	108.80	2.00	5.21	0.07	0.00
12.71	8.01	14.27	5.25	102.28	2.00	2.73	0.07	0.00
12.87	7.15	12.63	5.04	95.28	2.00	0.00	0.08	0.00
13.04	6.98	12.29	4.58	90.42	2.00	0.00	0.08	0.00
13.20	6.45	11.28	4.96	90.21	2.00	0.00	0.09	0.00
13.37	6.21	10.80	4.83	87.61	2.00	0.00	0.09	0.00
13.53	5.80	10.01	5.17	87.26	1.98	0.00	0.10	0.00
13.69	5.83	10.06	5.14	87.28	1.98	0.00	0.10	0.00
13.86	5.35	9.14	5.60	86.67	1.79	0.00	0.16	0.00
14.02	5.36	9.12	5.60	86.65	1.78	0.00	0.16	0.00
14.19	5.52	9.41	5.07	84.46	1.82	0.00	0.14	0.00
14.35	5.68	9.70	4.58	82.08	1.87	0.00	0.12	0.00
14.51	5.48	9.31	4.38	79.25	1.78	0.00	0.16	0.00
14.68	5.44	9.22	4.04	76.45	1.76	0.00	0.17	0.00
14.84	5.54	9.39	3.61	73.61	1.78	0.00	0.16	0.00
15.01	5.48	9.26	4.01	76.47	1.75	0.00	0.17	0.00
15.17	5.60	9.47	3.93	76.55	1.78	0.00	0.16	0.00
15.34	5.82	9.88	3.78	76.68	1.85	0.00	0.13	0.00
15.50	6.02	10.24	3.65	76.76	1.91	0.00	0.11	0.00
15.66	6.06	10.30	3.96	79.61	1.91	0.00	0.11	0.00
15.83	6.02	10.20	3.99	79.58	1.89	0.00	0.12	0.00
15.99	6.24	10.60	4.49	85.02	1.95	0.00	0.10	0.00
16.16	6.77	11.59	4.72	90.30	2.00	0.00	0.08	0.00
16.32	7.35	12.67	5.17	97.59	2.00	0.00	0.08	0.00
16.48	7.96	13.80	5.28	102.24	2.00	1.62	0.08	0.00
16.65	8.16	14.16	5.39	104.46	2.00	2.48	0.08	0.00
16.81	8.04	13.93	5.47	104.44	2.00	1.93	0.08	0.00
16.98	7.51	12.90	5.59	102.08	2.00	0.00	0.08	0.00
17.14	6.79	11.53	5.60	97.24	2.00	0.00	0.08	0.00
17.30	6.52	10.99	5.22	92.48	1.96	0.00	0.09	0.00
17.47	6.32	10.60	5.06	89.95	1.88	0.00	0.11	0.00
17.63	6.28	10.51	4.78	87.50	1.86	0.00	0.12	0.00
17.80	6.70	11.29	4.48	87.75	1.99	0.00	0.09	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
17.96	14.32	24.87	1.96	118.18	0.86	21.07	38.11	0.15
18.12	23.06	37.13	1.04	69.53	0.41	34.30	51.20	0.20
18.29	32.83	51.07	0.97	78.49	0.46	44.82	51.20	0.21
18.45	38.55	60.10	1.30	94.44	2.00	50.20	0.00	0.00
18.62	40.13	63.49	1.79	110.86	2.00	52.01	0.00	0.00
18.78	33.51	54.37	2.33	116.83	2.00	46.89	0.00	0.00
18.94	25.50	42.94	3.37	162.60	2.00	39.10	0.00	0.00
19.11	16.49	28.90	4.85	134.41	2.00	26.02	0.04	0.00
19.27	11.15	19.53	5.56	122.55	2.00	13.10	0.06	0.00
19.44	9.80	16.94	4.29	101.92	2.00	8.41	0.07	0.00
19.60	10.55	18.02	3.98	100.76	2.00	10.44	0.06	0.00
19.76	10.78	18.26	3.90	100.22	2.00	10.87	0.06	0.00
19.93	11.47	19.31	4.01	103.87	2.00	12.71	0.06	0.00
20.09	11.85	19.87	4.22	107.70	2.00	13.67	0.06	0.00
20.26	12.05	20.03	4.15	107.16	2.00	13.93	0.06	0.00
20.42	10.57	17.52	4.35	104.08	2.00	9.50	0.07	0.00
20.58	9.63	15.79	4.36	100.02	2.00	6.08	0.07	0.00
20.75	8.36	13.38	4.55	95.39	2.00	0.60	0.08	0.00
20.91	7.46	11.68	4.56	90.36	1.95	0.00	0.09	0.00
21.08	6.49	9.87	4.93	87.12	1.64	0.00	0.22	0.00
21.24	8.65	13.56	3.24	82.38	2.00	1.06	0.08	0.00
21.40	12.16	18.86	2.80	86.53	2.00	11.94	0.06	0.00
21.57	15.05	23.01	2.53	203.20	2.00	18.50	0.00	0.00
21.73	15.02	22.96	2.80	92.70	2.00	18.44	0.05	0.00
21.90	14.79	22.36	2.57	216.96	2.00	17.56	0.00	0.00
22.06	11.80	17.97	3.22	91.06	2.00	10.34	0.06	0.00
22.23	7.29	10.67	3.84	81.11	1.75	0.00	0.16	0.00
22.39	3.41	4.09	4.69	58.41	0.67	0.00	4.00	0.02
22.55	2.54	2.59	2.37	39.00	0.42	0.00	4.00	0.02
22.72	2.04	1.74	1.96	31.38	0.28	0.00	4.00	0.02
22.88	1.86	1.43	1.07	25.06	0.23	0.00	4.00	0.02
23.05	1.75	1.22	0.00	1.22	0.17	0.00	51.20	0.21
23.21	1.73	1.17	0.00	1.17	0.17	0.00	51.20	0.20
23.37	1.77	1.23	0.00	1.23	0.17	0.00	51.20	0.20
23.54	1.81	1.28	1.10	24.08	0.20	0.00	4.00	0.02
23.70	3.31	3.71	1.21	36.98	0.59	0.00	4.00	0.02
23.87	7.63	10.25	0.79	43.06	2.00	0.00	0.09	0.00
24.03	12.15	16.41	0.66	45.37	2.00	7.35	0.00	0.00
24.19	16.63	22.28	0.60	47.87	2.00	17.45	0.00	0.00
24.36	21.11	27.81	0.47	27.81	2.00	24.76	0.00	0.00
24.52	24.05	31.32	0.42	31.32	2.00	28.68	0.00	0.00
24.69	23.79	30.89	0.42	30.89	0.25	28.22	51.20	0.21
24.85	22.63	29.37	0.44	29.37	0.25	26.56	51.20	0.20
25.01	22.13	28.66	0.45	28.66	0.24	25.75	51.20	0.00
25.18	21.68	27.99	0.46	27.99	0.24	24.98	51.20	0.00
25.34	21.52	27.86	0.56	50.41	0.30	24.82	51.20	0.00
25.51	22.38	29.64	1.16	67.10	0.36	26.86	51.20	0.00
25.67	26.22	34.79	1.45	78.13	0.41	32.15	51.20	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
25.83	29.57	39.28	1.76	89.39	0.48	36.16	51.20	0.00
26.00	28.45	38.18	2.39	102.95	0.59	35.22	51.20	0.00
26.16	26.28	35.45	2.89	153.09	1.35	32.77	0.00	0.00
26.33	23.43	31.42	2.82	168.92	1.72	28.79	0.00	0.00
26.49	17.68	23.74	3.28	101.94	2.00	19.53	0.05	0.00
26.65	11.73	15.59	4.09	97.06	2.00	5.65	0.07	0.00
26.82	10.20	13.23	3.73	87.33	2.00	0.23	0.08	0.00
26.98	10.80	13.96	2.96	80.41	2.00	2.02	0.08	0.00
27.15	13.40	17.30	2.54	80.59	2.00	9.08	0.07	0.00
27.31	15.46	19.91	2.46	83.21	2.00	13.73	0.06	0.00
27.47	16.77	21.49	2.39	204.19	2.00	16.25	0.00	0.00
27.64	19.07	24.24	2.10	140.83	1.10	20.22	0.00	0.00
27.80	18.47	23.38	2.17	155.96	1.40	19.03	0.00	0.00
27.97	14.81	18.63	2.43	81.00	2.00	11.53	0.06	0.00
28.13	12.21	15.12	2.29	73.66	2.00	4.64	0.07	0.00
28.30	10.52	12.82	2.28	69.69	1.97	0.00	0.09	0.00
28.46	7.84	9.12	2.55	65.08	1.40	0.00	0.47	0.00
28.62	7.06	7.99	2.55	62.10	1.22	0.00	0.89	0.00
28.79	7.19	8.12	2.78	64.60	1.24	0.00	0.83	0.00
28.95	7.64	8.69	3.14	69.47	1.33	0.00	0.60	0.00
29.12	8.31	9.55	3.37	74.04	1.46	0.00	0.38	0.00
29.28	9.16	10.64	3.50	78.32	1.62	0.00	0.22	0.00
29.44	9.90	11.59	3.64	82.27	1.76	0.00	0.15	0.00
29.61	11.13	13.16	3.42	83.98	2.00	0.07	0.08	0.00
29.77	12.37	14.71	3.23	85.36	2.00	3.75	0.07	0.00
29.94	12.47	14.75	3.21	85.13	2.00	3.84	0.07	0.00
30.10	12.13	14.26	3.46	87.04	2.00	2.70	0.07	0.00
30.26	12.75	14.96	3.29	86.61	2.00	4.30	0.07	0.00
30.43	13.76	16.09	3.05	85.84	2.00	6.70	0.07	0.00
30.59	14.10	16.39	2.84	83.51	2.00	7.31	0.07	0.00
30.76	14.44	16.68	2.63	81.14	2.00	7.89	0.07	0.00
30.92	14.10	16.12	2.27	74.97	2.00	6.75	0.07	0.00
31.08	12.40	13.97	2.26	71.44	2.00	2.04	0.08	0.00
31.25	9.98	10.94	2.20	65.33	1.65	0.00	0.20	0.00
31.41	7.95	8.28	2.52	62.69	1.25	0.00	0.80	0.00
31.58	6.91	6.92	2.89	61.93	1.04	0.00	1.92	0.00
31.74	7.65	7.82	2.61	62.33	1.18	0.00	1.06	0.00
31.90	7.92	8.11	2.53	62.34	1.22	0.00	0.89	0.00
32.07	8.48	8.77	3.30	71.23	1.32	0.00	0.61	0.00
32.23	11.22	12.14	3.39	81.29	2.00	0.00	0.08	0.00
32.40	15.75	17.55	3.17	90.21	2.00	9.56	0.07	0.00
32.56	22.71	25.49	2.64	196.87	2.00	21.88	0.00	0.00
32.72	31.73	35.52	2.14	95.05	2.00	32.84	0.00	0.00
32.89	39.31	43.69	1.78	93.93	2.00	39.67	0.00	0.00
33.05	43.45	47.96	1.57	92.02	2.00	42.75	0.00	0.00
33.22	42.03	46.05	1.38	85.64	2.00	41.41	0.00	0.00
33.38	35.57	38.82	1.46	81.92	2.00	35.77	0.00	0.00
33.54	27.10	29.45	1.85	87.06	2.00	26.65	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
33.71	20.29	21.85	2.46	212.79	2.00	16.79	0.00	0.00
33.87	14.85	15.71	3.64	92.43	2.00	5.92	0.07	0.00
34.04	14.97	15.77	4.27	99.79	2.00	6.03	0.07	0.00
34.20	18.04	19.17	3.66	99.82	2.00	12.47	0.06	0.00
34.36	19.77	21.04	3.74	104.50	2.00	15.55	0.06	0.00
34.53	20.91	22.22	3.92	109.22	2.00	17.36	0.05	0.00
34.69	27.53	29.33	3.12	223.60	2.00	26.52	0.00	0.00
34.86	36.27	38.55	2.43	104.42	2.00	35.54	0.00	0.00
35.02	52.09	55.11	1.84	105.39	2.00	47.33	0.00	0.00
35.19	74.53	78.03	1.26	108.70	2.00	58.81	0.00	0.00
35.35	94.79	98.31	0.95	117.49	2.00	66.44	0.00	0.00
35.51	103.71	106.91	0.83	121.64	2.00	69.20	0.00	0.00
35.68	104.90	107.70	0.80	121.54	0.78	69.45	6.60	0.00
35.84	96.68	99.13	0.87	116.01	0.71	66.71	8.60	0.00
36.01	82.58	84.71	1.09	109.63	0.64	61.52	22.70	0.00
36.17	69.94	71.75	1.40	107.33	0.62	56.04	22.70	0.00
36.33	65.27	66.78	1.53	106.82	0.61	53.67	34.10	0.00
36.50	65.25	66.48	1.50	105.73	0.60	53.52	34.10	0.00
36.66	67.59	68.57	1.42	105.21	0.60	54.55	34.10	0.00
36.83	75.78	76.43	1.13	103.85	0.58	58.13	22.70	0.00
36.99	92.62	92.78	0.80	108.65	0.63	64.53	22.70	0.00
37.15	109.60	109.19	0.64	118.15	0.74	69.90	7.67	0.00
37.32	125.41	124.39	0.56	127.80	0.87	74.20	4.81	0.00
37.48	141.95	140.30	0.52	140.30	1.07	78.18	2.81	0.00
37.65	155.53	153.33	0.54	153.33	1.32	81.11	1.82	0.00
37.81	161.85	159.26	0.58	159.26	1.45	82.36	1.50	0.00
37.97	167.79	164.75	0.61	164.75	1.57	83.48	1.25	0.00
38.14	176.27	172.63	0.62	172.63	1.77	85.02	1.16	0.00
38.30	183.79	179.55	0.63	179.55	1.97	86.32	0.96	0.00
38.47	189.64	184.67	0.60	184.67	2.00	87.25	0.00	0.00
38.63	194.36	188.76	0.59	188.76	2.00	87.97	0.00	0.00
38.79	196.10	189.97	0.58	189.97	2.00	88.18	0.00	0.00
38.96	195.88	189.29	0.59	189.29	2.00	88.06	0.00	0.00
39.12	195.40	188.39	0.60	188.39	2.00	87.90	0.00	0.00
39.29	193.78	186.41	0.65	186.41	2.00	87.56	0.00	0.00
39.45	191.83	184.08	0.67	184.08	2.00	87.14	0.00	0.00
39.61	190.75	182.59	0.67	182.59	2.00	86.87	0.00	0.00
39.78	189.29	180.68	0.66	180.68	2.00	86.52	0.00	0.00
39.94	188.05	179.01	0.63	179.01	1.97	86.22	0.96	0.00
40.11	188.13	178.60	0.61	178.60	1.96	86.14	0.97	0.00
40.27	189.43	179.41	0.61	179.41	1.99	86.29	0.95	0.00
40.43	190.07	179.60	0.64	179.60	1.99	86.33	0.94	0.00
40.60	189.25	178.37	0.68	178.37	1.96	86.10	0.97	0.00
40.76	188.45	177.17	0.70	177.17	1.93	85.88	1.00	0.00
40.93	189.14	177.34	0.71	177.34	1.93	85.91	0.99	0.00
41.09	192.26	179.84	0.70	179.84	2.00	86.37	0.00	0.00
41.26	197.34	184.16	0.67	184.16	2.00	87.16	0.00	0.00
41.42	203.36	189.41	0.59	189.41	2.00	88.08	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
41.58	207.72	193.10	0.53	193.10	2.00	88.72	0.00	0.00
41.75	208.96	193.85	0.48	193.85	2.00	88.85	0.00	0.00
41.91	207.41	192.01	0.43	192.01	2.00	88.53	0.00	0.00
42.08	204.55	188.97	0.39	188.97	2.00	88.01	0.00	0.00
42.24	201.43	185.66	0.40	185.66	2.00	87.42	0.00	0.00
42.40	200.24	184.16	0.40	184.16	2.00	87.15	0.00	0.00
42.57	202.40	185.79	0.40	185.79	2.00	87.44	0.00	0.00
42.73	205.32	188.14	0.39	188.14	2.00	87.86	0.00	0.00
42.90	207.64	189.89	0.39	189.89	2.00	88.17	0.00	0.00
43.06	210.44	192.10	0.40	192.10	2.00	88.55	0.00	0.00
43.22	211.45	192.62	0.41	192.62	2.00	88.64	0.00	0.00
43.39	211.01	191.77	0.42	191.77	2.00	88.49	0.00	0.00
43.55	210.21	190.58	0.44	190.58	2.00	88.29	0.00	0.00
43.72	211.11	190.98	0.45	190.98	2.00	88.35	0.00	0.00
43.88	211.59	191.00	0.45	191.00	2.00	88.36	0.00	0.00
44.04	211.54	190.52	0.46	190.52	2.00	88.28	0.00	0.00
44.21	209.56	188.27	0.47	188.27	2.00	87.88	0.00	0.00
44.37	206.30	184.90	0.47	184.90	2.00	87.29	0.00	0.00
44.54	200.77	179.41	0.47	179.41	2.00	86.29	0.00	0.00
44.70	194.57	173.39	0.46	173.39	1.88	85.17	1.05	0.00
44.86	186.13	165.38	0.45	165.38	1.67	83.60	1.11	0.00
45.03	172.67	152.69	0.47	152.69	1.37	80.97	1.67	0.00
45.19	154.80	135.96	0.54	136.04	1.05	77.14	2.91	0.00
45.36	138.01	120.26	0.64	127.33	0.91	73.09	4.20	0.00
45.52	123.75	106.93	0.78	120.22	0.81	69.21	5.89	0.00
45.68	115.52	99.10	0.92	117.37	0.77	66.70	6.73	0.00
45.85	116.18	99.27	1.02	120.21	0.81	66.76	5.84	0.00
46.01	126.03	107.65	1.05	128.41	0.93	69.43	3.92	0.00
46.18	138.73	118.55	1.05	138.11	1.10	72.62	2.45	0.00
46.34	150.17	128.30	1.07	147.07	1.27	75.22	1.96	0.00
46.50	161.07	137.50	1.09	155.98	1.47	77.51	1.46	0.00
46.67	171.91	146.59	1.12	164.73	1.68	79.62	1.09	0.00
46.83	177.83	151.34	1.14	169.52	1.81	80.68	0.94	0.00
47.00	179.11	152.00	1.15	170.54	1.84	80.82	0.90	0.00
47.16	179.30	151.81	1.13	169.65	1.82	80.78	0.93	0.00
47.32	176.90	149.45	1.07	165.94	1.72	80.26	1.04	0.00
47.49	171.00	144.08	1.01	159.14	1.56	79.05	1.28	0.00
47.65	167.12	140.72	0.87	152.11	1.40	78.28	1.61	0.00
47.82	164.19	138.24	0.74	145.69	1.26	77.69	1.99	0.00
47.98	157.47	132.16	0.71	139.59	1.14	76.20	2.43	0.00
48.15	149.24	124.07	0.90	138.52	1.13	74.12	2.27	0.00
48.31	153.09	126.25	1.21	149.59	1.35	74.69	1.35	0.00
48.47	172.98	142.65	1.33	167.63	1.79	78.72	0.96	0.00
48.64	176.74	144.94	1.53	175.71	2.00	79.25	0.00	0.00
48.80	192.78	158.30	1.47	186.16	2.00	82.16	0.00	0.00
48.97	213.65	176.10	1.31	197.10	2.00	85.68	0.00	0.00
49.13	232.91	192.75	1.14	206.04	2.00	88.66	0.00	0.00
49.29	239.00	197.83	1.07	207.71	2.00	89.52	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
49.46	253.27	210.22	0.95	212.55	2.00	91.52	0.00	0.00
49.62	253.19	209.94	0.90	209.96	2.00	91.48	0.00	0.00
49.79	249.40	206.66	0.83	206.66	2.00	90.96	0.00	0.00
49.95	230.50	190.74	0.71	190.74	2.00	88.31	0.00	0.00
50.11	211.33	173.93	0.70	173.93	2.00	85.27	0.00	0.00
50.28	198.78	162.33	0.77	166.50	1.80	82.99	0.95	0.00
50.44	194.89	157.67	0.96	169.60	1.89	82.03	0.86	0.00
50.61	202.51	162.72	1.18	180.83	2.00	83.07	0.00	0.00
50.77	215.91	173.02	1.29	193.60	2.00	85.09	0.00	0.00
50.93	219.80	175.71	1.31	196.74	2.00	85.60	0.00	0.00
51.10	224.65	180.20	1.11	194.12	2.00	86.44	0.00	0.00
51.26	225.01	181.20	0.92	187.59	2.00	86.62	0.00	0.00
51.43	213.98	172.58	0.75	173.38	2.00	85.01	0.00	0.00
51.59	206.76	167.38	0.58	167.38	1.85	84.00	0.90	0.00
51.75	205.05	166.71	0.46	166.71	1.83	83.87	0.91	0.00
51.92	205.80	166.83	0.48	166.83	1.84	83.89	0.91	0.00
52.08	208.20	168.42	0.49	168.42	1.89	84.21	0.86	0.00
52.25	209.92	169.58	0.49	169.58	1.92	84.43	0.82	0.00
52.41	207.65	166.89	0.53	166.89	1.85	83.90	0.89	0.00
52.57	207.99	166.67	0.55	166.67	1.85	83.86	0.90	0.00
52.74	203.99	162.58	0.59	162.58	1.74	83.04	1.02	0.00
52.90	201.62	160.74	0.54	160.74	1.69	82.66	1.08	0.00
53.07	199.34	159.32	0.45	159.32	1.66	82.37	1.12	0.00
53.23	195.22	155.55	0.45	155.55	1.57	81.58	1.26	0.00
53.39	188.36	148.26	0.58	148.26	1.40	80.00	1.60	0.00
53.56	184.28	143.26	0.76	150.45	1.45	78.87	1.48	0.00
53.72	175.60	134.25	1.05	151.82	1.49	76.72	1.41	0.00
53.89	167.77	126.63	1.28	151.72	1.49	74.79	1.02	0.00
54.05	158.28	118.22	1.43	148.68	1.42	72.53	1.16	0.00
54.22	163.49	122.25	1.36	150.22	1.46	73.63	1.08	0.00
54.38	164.19	122.51	1.35	150.28	1.46	73.70	1.07	0.00
54.54	174.15	130.61	1.22	153.57	1.54	75.82	1.31	0.00
54.71	174.37	130.10	1.30	155.42	1.59	75.69	1.22	0.00
54.87	181.83	138.62	0.76	146.59	1.39	77.78	1.63	0.00

Total estimated displacement: 1.68

Abbreviations

q_t:	Total cone resistance
Q_{tn}:	Adjusted cone resistance to an effective overburden stress of 1 atm
R_f:	Friction ration
$Q_{tn,cs}$:	Adjusted and corrected cone resistance due to fines
FS:	Calculated factor of safety against liquefaction
D_r:	Calculated relative density
$Gamma_{max}$:	Calculated maximum cyclic shear strain
Lat. disp.:	Lateral displacement

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LIQUEFACTION ANALYSIS REPORT

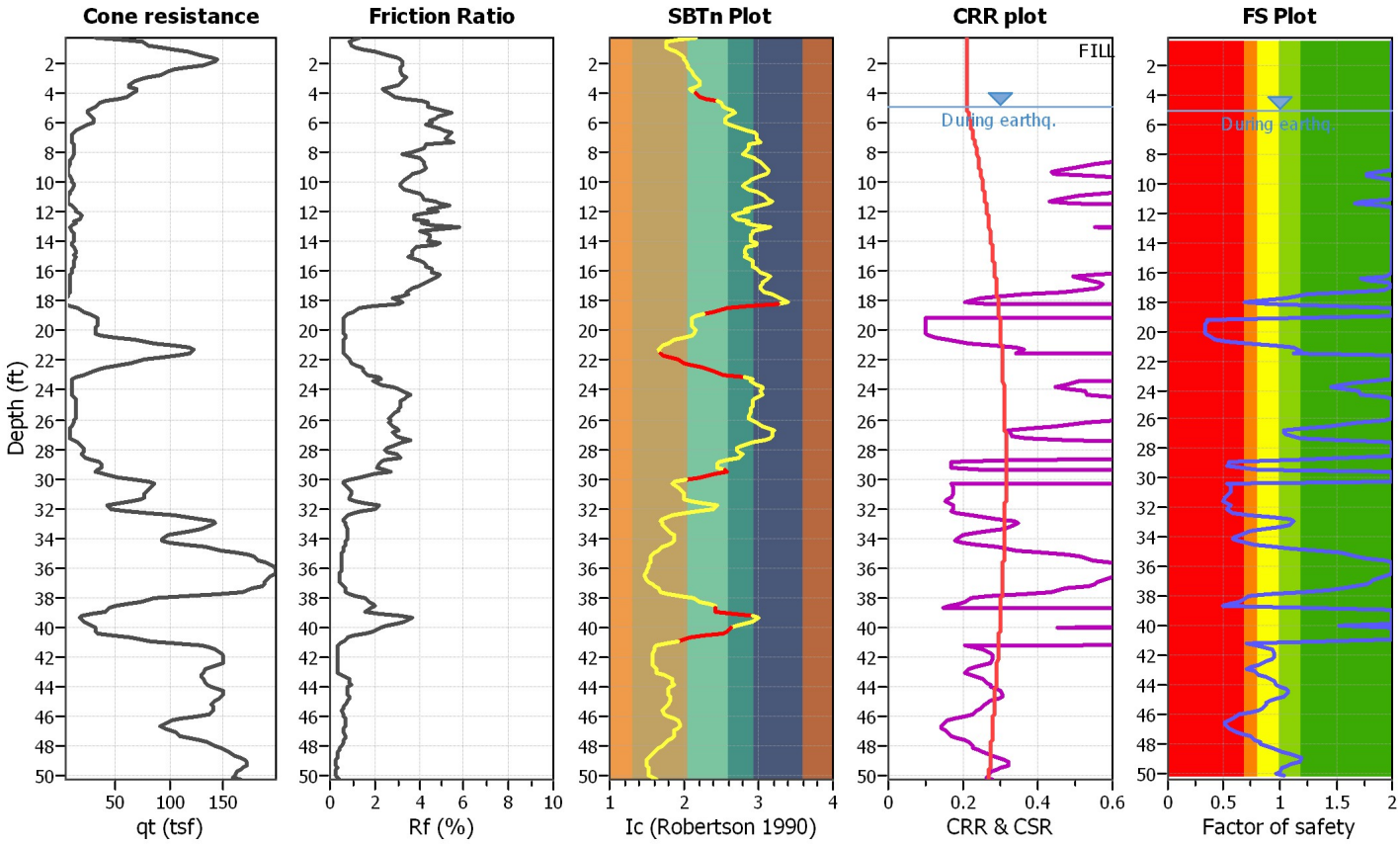
Project title : CIS-72092.4

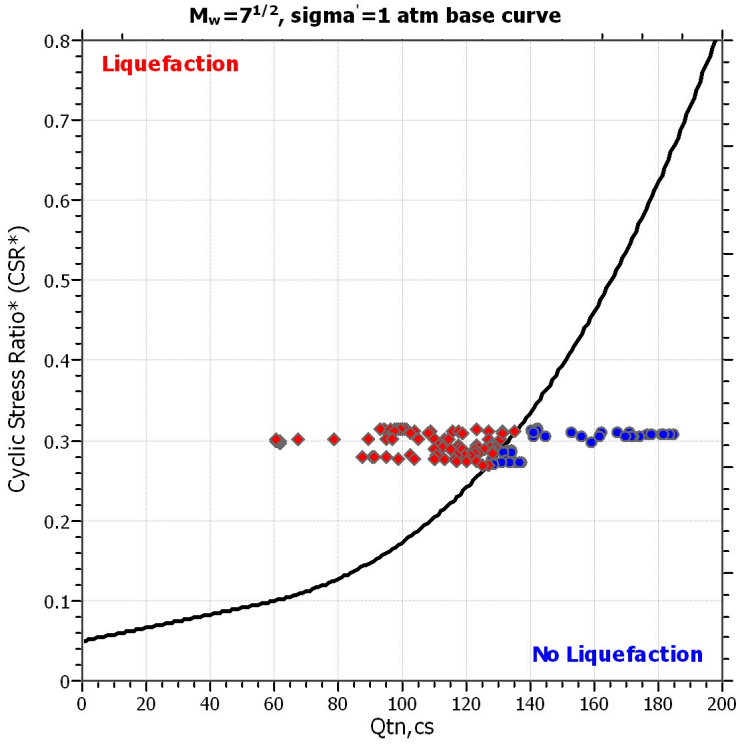
Location : Proposed CarMax National City

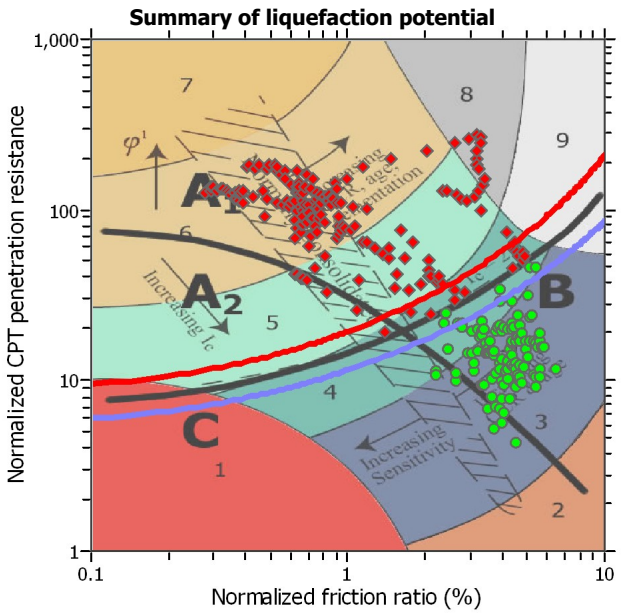
CPT file : CPT-04

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	5.00 ft	Use fill:	Yes	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	10.00 ft	Fill height:	5.00 ft	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	120.00 lb/ft^3	Limit depth:	N/A
Earthquake magnitude M_w:	6.76	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.43	Unit weight calculation:	Based on SBT	K_σ applied:	No		

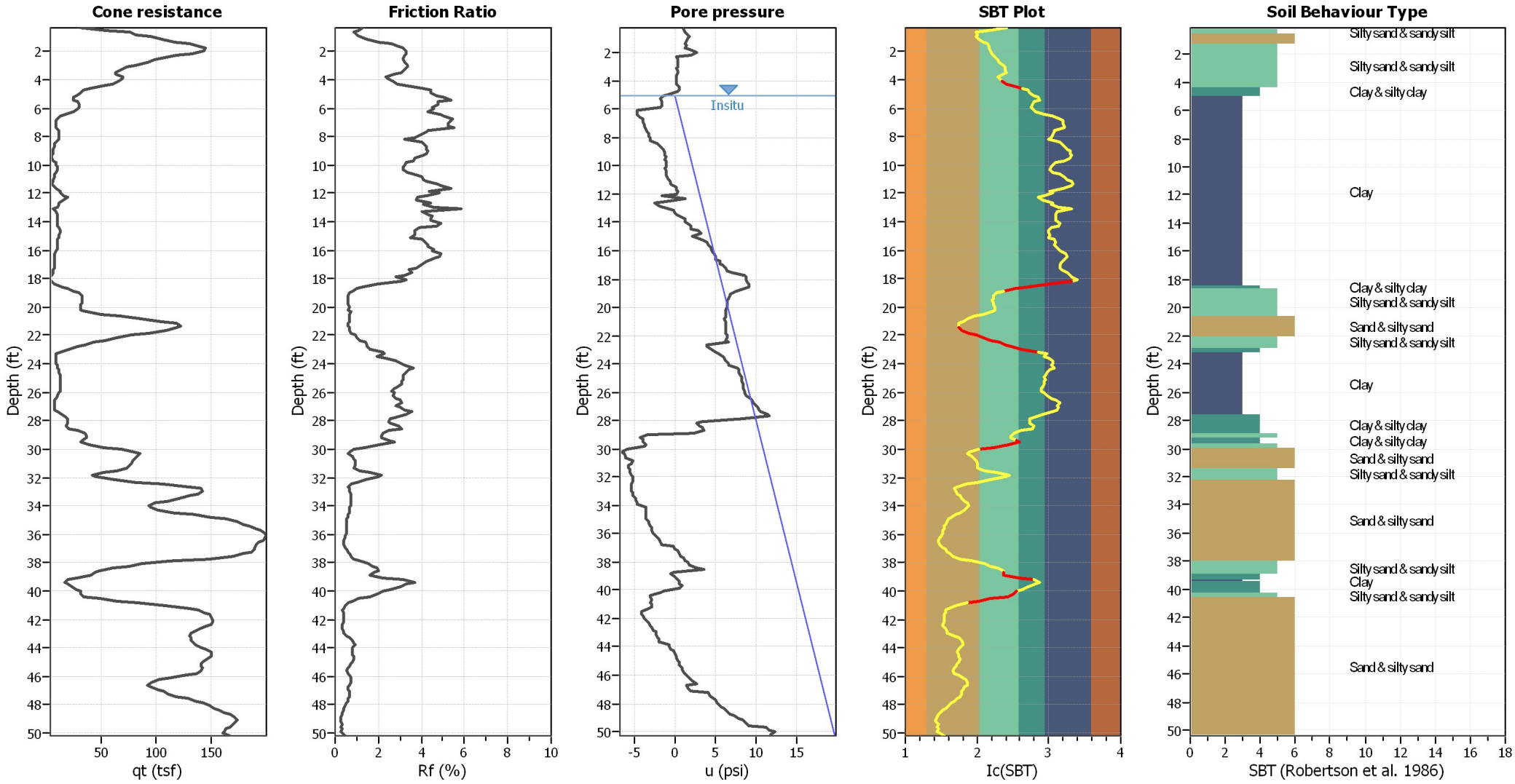






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



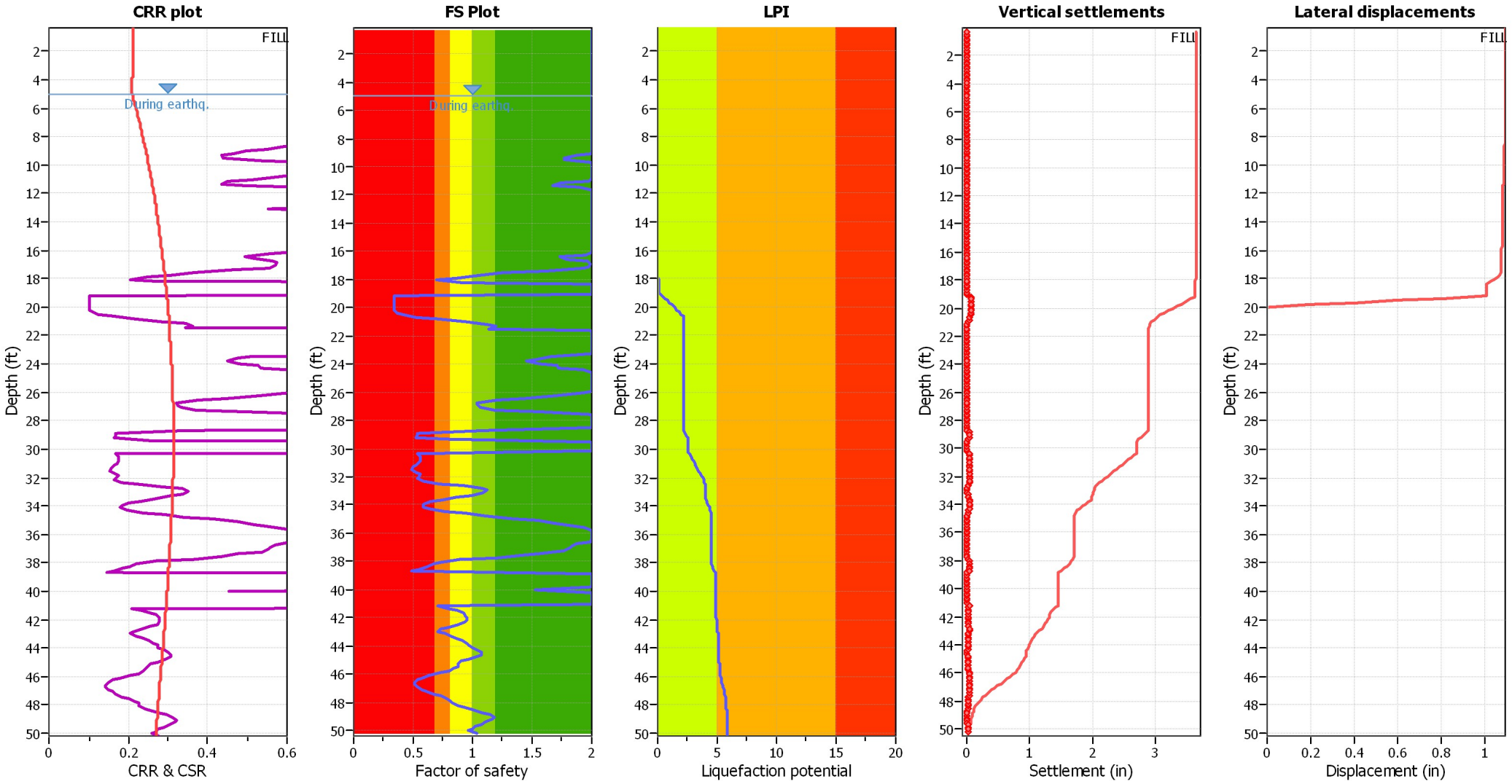
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	10.00 ft	Fill weight:	120.00 lb/ft^3
Fines correction method:	Robertson (2009)	Average results interval:	5	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.76	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.43	Use fill:	Yes	Limit depth applied:	No
Depth to water table (insitu):	5.00 ft	Fill height:	5.00 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

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Kc	Qc1n	Qc1n,cs	N1,60 (blows)	Vs (ft/s)	Gmax (tsf)	CSR	Shear, γ (%)	Svol,15 (%)	Nc	ev (%)	Settle. (in)
5.33	2.16	1.57	59.04	92.43	20	480.7	402	0.21	0.033	0.03	9.05	0.03	0.001
5.49	1.91	1.20	104.44	125.10	25	548.0	542	0.21	0.019	0.01	9.05	0.01	0.000
5.66	1.76	1.08	143.32	154.66	29	584.8	627	0.21	0.016	0.01	9.05	0.01	0.000
5.82	1.77	1.08	152.79	165.77	32	607.2	684	0.21	0.014	0.01	9.05	0.01	0.000
5.98	1.77	1.09	177.46	192.54	37	654.5	811	0.21	0.012	0.01	9.05	0.00	0.000
6.15	1.82	1.12	198.08	221.66	43	712.6	984	0.21	0.009	0.00	9.05	0.00	0.000
6.31	1.90	1.19	220.47	262.07	53	792.6	1251	0.21	0.007	0.00	9.05	0.00	0.000
6.48	1.96	1.25	244.91	307.35	63	869.7	1541	0.21	0.006	0.00	9.05	0.00	0.000
6.64	1.99	1.29	264.06	340.57	71	919.7	1745	0.21	0.005	0.00	9.05	0.00	0.000
6.80	2.00	1.31	273.61	357.45	75	943.9	1848	0.21	0.005	0.00	9.05	0.00	0.000
6.97	2.02	1.33	269.65	359.05	75	948.0	1866	0.21	0.005	0.00	9.05	0.00	0.000
7.13	2.04	1.36	249.40	338.84	72	922.4	1757	0.21	0.006	0.00	9.05	0.00	0.000
7.30	2.06	1.38	222.38	307.65	65	879.8	1583	0.21	0.007	0.00	9.05	0.00	0.000
7.46	2.08	1.42	198.80	282.38	61	843.7	1442	0.21	0.007	0.00	9.05	0.00	0.000
7.62	2.10	1.45	185.31	269.05	58	823.8	1368	0.21	0.008	0.00	9.05	0.00	0.000
7.79	2.12	1.50	173.50	259.51	57	808.9	1314	0.21	0.009	0.00	9.05	0.00	0.000
7.95	2.17	1.60	153.82	245.64	55	785.2	1230	0.21	0.010	0.00	9.05	0.00	0.000
8.12	2.20	1.65	138.87	229.82	52	757.8	1137	0.21	0.011	0.00	9.05	0.00	0.000
8.28	2.20	1.67	129.21	215.68	49	733.6	1057	0.21	0.012	0.00	9.05	0.00	0.000
8.45	2.21	1.69	119.05	201.00	45	707.5	974	0.21	0.014	0.01	9.05	0.00	0.000
8.61	2.17	1.60	117.98	188.48	42	687.4	913	0.21	0.016	0.01	9.05	0.01	0.000
8.77	2.09	1.44	131.19	188.46	41	688.9	916	0.21	0.016	0.01	9.05	0.01	0.000
8.94	2.10	1.46	130.41	190.05	41	691.9	925	0.21	0.016	0.01	9.05	0.01	0.000
9.10	2.15	1.55	122.83	190.66	42	692.3	927	0.21	0.016	0.01	9.05	0.01	0.000
9.27	2.20	1.66	114.01	189.79	0	0.0	0	0.21	0.000	0.00	0.00	0.00	0.000
9.43	2.28	1.89	98.30	186.08	0	0.0	0	0.21	0.000	0.00	0.00	0.00	0.000
9.59	2.44	2.46	74.09	182.56	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
9.76	2.50	2.78	63.74	177.38	0	0.0	0	0.21	0.000	0.00	9.05	0.00	0.000
9.92	2.53	2.95	57.54	169.54	44	602.8	682	0.21	0.029	0.01	9.05	0.01	0.000

Total estimated settlement: 0.00

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
10.09	260.32	2.00	0.00	1.00	0.00	10.25	337.10	2.00	0.00	1.00	0.00
10.41	384.20	2.00	0.00	1.00	0.00	10.58	259.60	2.00	0.00	1.00	0.00
10.74	240.07	2.00	0.00	1.00	0.00	10.91	216.53	2.00	0.00	1.00	0.00
11.07	230.77	2.00	0.00	1.00	0.00	11.23	240.91	2.00	0.00	1.00	0.00
11.40	138.76	2.00	0.00	1.00	0.00	11.56	125.15	2.00	0.00	1.00	0.00
11.73	116.72	2.00	0.00	1.00	0.00	11.89	110.81	2.00	0.00	1.00	0.00
12.05	108.72	2.00	0.00	1.00	0.00	12.22	106.65	2.00	0.00	1.00	0.00
12.38	108.79	2.00	0.00	1.00	0.00	12.55	107.80	2.00	0.00	1.00	0.00
12.71	105.72	2.00	0.00	1.00	0.00	12.87	103.26	2.00	0.00	1.00	0.00
13.04	100.79	2.00	0.00	1.00	0.00	13.20	93.68	2.00	0.00	1.00	0.00
13.37	92.77	2.00	0.00	1.00	0.00	13.53	90.41	2.00	0.00	1.00	0.00
13.69	87.90	2.00	0.00	1.00	0.00	13.86	85.23	2.00	0.00	1.00	0.00
14.02	82.35	2.00	0.00	1.00	0.00	14.19	79.42	1.88	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
14.35	76.43	1.77	0.01	1.00	0.00	14.51	73.56	1.77	0.01	1.00	0.00
14.68	79.76	2.00	0.00	1.00	0.00	14.84	84.88	2.00	0.00	1.00	0.00
15.01	87.19	2.00	0.00	1.00	0.00	15.17	89.28	2.00	0.00	1.00	0.00
15.34	91.44	2.00	0.00	1.00	0.00	15.50	89.72	2.00	0.00	1.00	0.00
15.66	85.22	2.00	0.00	1.00	0.00	15.83	85.27	2.00	0.00	1.00	0.00
15.99	82.43	1.98	0.00	1.00	0.00	16.16	79.31	1.74	0.01	1.00	0.00
16.32	81.75	1.67	0.01	1.00	0.00	16.48	87.42	1.89	0.00	1.00	0.00
16.65	108.79	2.00	0.00	1.00	0.00	16.81	117.17	2.00	0.00	1.00	0.00
16.98	121.55	2.00	0.00	1.00	0.00	17.14	124.87	2.00	0.00	1.00	0.00
17.30	263.19	2.00	0.00	1.00	0.00	17.47	117.04	2.00	0.00	1.00	0.00
17.63	111.94	2.00	0.00	1.00	0.00	17.80	109.52	2.00	0.00	1.00	0.00
17.96	104.31	2.00	0.00	1.00	0.00	18.12	99.45	2.00	0.00	1.00	0.00
18.29	97.42	2.00	0.00	1.00	0.00	18.45	104.02	2.00	0.00	1.00	0.00
18.62	108.24	2.00	0.00	1.00	0.00	18.78	108.07	2.00	0.00	1.00	0.00
18.94	107.70	2.00	0.00	1.00	0.00	19.11	108.45	2.00	0.00	1.00	0.00
19.27	105.96	2.00	0.00	1.00	0.00	19.44	103.38	2.00	0.00	1.00	0.00
19.60	102.23	2.00	0.00	1.00	0.00	19.76	101.98	2.00	0.00	1.00	0.00
19.93	100.19	2.00	0.00	1.00	0.00	20.09	97.47	2.00	0.00	1.00	0.00
20.26	99.01	2.00	0.00	1.00	0.00	20.42	100.95	2.00	0.00	1.00	0.00
20.58	102.71	2.00	0.00	1.00	0.00	20.75	102.53	2.00	0.00	1.00	0.00
20.91	100.56	2.00	0.00	1.00	0.00	21.08	96.05	2.00	0.00	1.00	0.00
21.24	93.35	1.95	0.00	1.00	0.00	21.40	88.30	1.73	0.01	1.00	0.00
21.57	88.23	1.79	0.01	1.00	0.00	21.73	88.27	1.96	0.00	1.00	0.00
21.90	88.05	1.99	0.00	1.00	0.00	22.06	85.52	1.97	0.00	1.00	0.00
22.23	82.93	1.92	0.00	1.00	0.00	22.39	75.06	1.61	0.01	1.00	0.00
22.55	68.71	1.25	0.06	1.00	0.00	22.72	62.06	1.04	0.12	1.00	0.00
22.88	54.66	0.85	0.27	1.00	0.01	23.05	52.87	0.69	0.50	1.00	0.01
23.21	58.03	0.92	0.20	1.00	0.00	23.37	62.37	2.00	0.00	1.00	0.00
23.54	91.96	2.00	0.00	1.00	0.00	23.70	61.18	2.00	0.00	1.00	0.00
23.87	60.36	2.00	0.00	1.00	0.00	24.03	61.10	2.00	0.00	1.00	0.00
24.19	61.77	0.34	3.47	1.00	0.07	24.36	61.79	0.34	3.47	1.00	0.07
24.52	61.77	0.34	3.47	1.00	0.07	24.69	61.54	0.34	3.48	1.00	0.07
24.85	61.10	0.34	3.50	1.00	0.07	25.01	60.76	0.34	3.52	1.00	0.07
25.18	60.76	0.34	3.52	1.00	0.07	25.34	67.36	0.36	3.23	1.00	0.06
25.51	78.64	0.42	2.85	1.00	0.06	25.67	95.05	0.53	2.44	1.00	0.05
25.83	113.39	0.71	2.06	1.00	0.04	26.00	130.49	0.95	1.06	1.00	0.02
26.16	141.36	1.13	0.44	1.00	0.01	26.33	145.05	1.20	0.31	1.00	0.01
26.49	141.51	1.13	0.44	1.00	0.01	26.65	133.21	2.00	0.00	1.00	0.00
26.82	122.36	2.00	0.00	1.00	0.00	26.98	110.00	2.00	0.00	1.00	0.00
27.15	99.73	2.00	0.00	1.00	0.00	27.31	94.11	2.00	0.00	1.00	0.00
27.47	90.60	2.00	0.00	1.00	0.00	27.64	85.19	2.00	0.00	1.00	0.00
27.80	78.31	2.00	0.00	1.00	0.00	27.97	90.27	2.00	0.00	1.00	0.00
28.13	72.26	2.00	0.00	1.00	0.00	28.30	66.48	2.00	0.00	1.00	0.00
28.46	61.11	1.66	0.01	1.00	0.00	28.62	63.81	1.54	0.02	1.00	0.00
28.79	68.51	1.46	0.02	1.00	0.00	28.95	72.91	1.56	0.02	1.00	0.00
29.12	77.02	1.71	0.01	1.00	0.00	29.28	80.81	1.72	0.01	1.00	0.00
29.44	82.56	1.93	0.00	1.00	0.00	29.61	84.09	2.00	0.00	1.00	0.00
29.77	83.79	2.00	0.00	1.00	0.00	29.94	83.52	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
30.10	83.46	2.00	0.00	1.00	0.00	30.26	83.15	2.00	0.00	1.00	0.00
30.43	82.97	2.00	0.00	1.00	0.00	30.59	80.79	2.00	0.00	1.00	0.00
30.76	78.67	2.00	0.00	1.00	0.00	30.92	76.61	2.00	0.00	1.00	0.00
31.08	74.98	1.93	0.00	1.00	0.00	31.25	70.90	1.70	0.01	1.00	0.00
31.41	68.60	1.43	0.03	1.00	0.00	31.58	65.89	1.21	0.06	1.00	0.00
31.74	62.93	1.03	0.11	1.00	0.00	31.90	60.69	1.04	0.11	1.00	0.00
32.07	62.89	1.06	0.10	1.00	0.00	32.23	67.46	1.18	0.06	1.00	0.00
32.40	77.72	1.55	0.02	1.00	0.00	32.56	86.05	2.00	0.00	1.00	0.00
32.72	87.33	2.00	0.00	1.00	0.00	32.89	86.07	2.00	0.00	1.00	0.00
33.05	85.78	2.00	0.00	1.00	0.00	33.22	85.95	2.00	0.00	1.00	0.00
33.38	91.14	2.00	0.00	1.00	0.00	33.54	97.31	2.00	0.00	1.00	0.00
33.71	142.27	1.11	0.44	1.00	0.01	33.87	98.36	0.54	2.37	1.00	0.05
34.04	98.63	0.54	2.36	1.00	0.05	34.20	97.45	0.53	2.39	1.00	0.05
34.36	123.19	0.81	1.50	1.00	0.03	34.53	152.64	2.00	0.00	1.00	0.00
34.69	96.19	2.00	0.00	1.00	0.00	34.86	90.78	2.00	0.00	1.00	0.00
35.02	90.76	2.00	0.00	1.00	0.00	35.19	94.76	2.00	0.00	1.00	0.00
35.35	97.77	0.53	2.38	1.00	0.05	35.51	100.88	0.56	2.32	1.00	0.04
35.68	101.14	0.56	2.32	1.00	0.05	35.84	100.92	0.56	2.32	1.00	0.04
36.01	99.97	0.55	2.34	1.00	0.05	36.17	97.50	0.53	2.39	1.00	0.05
36.33	94.21	0.50	2.45	1.00	0.05	36.50	92.84	0.49	2.48	1.00	0.05
36.66	96.19	0.52	2.41	1.00	0.05	36.83	100.71	0.56	2.32	1.00	0.05
36.99	99.65	0.55	2.34	1.00	0.04	37.15	97.54	0.53	2.38	1.00	0.05
37.32	103.51	0.59	2.27	1.00	0.05	37.48	115.56	0.72	2.00	1.00	0.04
37.65	131.28	0.93	1.05	1.00	0.02	37.81	140.34	1.08	0.44	1.00	0.01
37.97	142.65	1.12	0.44	1.00	0.01	38.14	140.49	1.08	0.44	1.00	0.01
38.30	135.06	0.99	0.67	1.00	0.01	38.47	126.66	0.86	1.11	1.00	0.02
38.63	117.53	0.74	1.95	1.00	0.04	38.79	108.88	0.64	2.18	1.00	0.04
38.96	103.59	0.59	2.27	1.00	0.05	39.12	102.61	0.58	2.29	1.00	0.04
39.29	108.17	0.64	2.19	1.00	0.04	39.45	118.93	0.76	1.58	1.00	0.03
39.61	131.45	0.94	1.05	1.00	0.02	39.78	141.11	1.10	0.44	1.00	0.01
39.94	153.32	1.34	0.21	1.00	0.00	40.11	162.43	1.55	0.00	1.00	0.00
40.27	167.57	1.68	0.00	1.00	0.00	40.43	171.12	1.77	0.00	1.00	0.00
40.60	177.17	1.94	0.00	1.00	0.00	40.76	181.07	2.00	0.00	1.00	0.00
40.93	183.97	2.00	0.00	1.00	0.00	41.09	184.74	2.00	0.00	1.00	0.00
41.26	183.66	2.00	0.00	1.00	0.00	41.42	181.76	2.00	0.00	1.00	0.00
41.58	178.13	1.98	0.00	1.00	0.00	41.75	174.23	1.87	0.00	1.00	0.00
41.91	172.49	1.83	0.00	1.00	0.00	42.08	171.93	1.81	0.00	1.00	0.00
42.24	169.94	1.76	0.00	1.00	0.00	42.40	161.84	1.56	0.00	1.00	0.00
42.57	156.24	1.43	0.00	1.00	0.00	42.73	145.22	1.20	0.31	1.00	0.01
42.90	127.05	0.89	1.10	1.00	0.02	43.06	114.48	0.73	2.03	1.00	0.04
43.22	109.89	0.67	2.16	1.00	0.04	43.39	105.18	0.62	2.24	1.00	0.05
43.55	97.11	0.55	2.39	1.00	0.05	43.72	89.68	0.49	2.55	1.00	0.05
43.88	81.51	2.00	0.00	1.00	0.00	44.04	177.46	2.00	0.00	1.00	0.00
44.21	83.64	2.00	0.00	1.00	0.00	44.37	86.19	2.00	0.00	1.00	0.00
44.54	86.92	2.00	0.00	1.00	0.00	44.70	88.32	2.00	0.00	1.00	0.00
44.86	86.95	2.00	0.00	1.00	0.00	45.03	159.11	1.53	0.00	1.00	0.00
45.19	124.82	2.00	0.00	1.00	0.00	45.36	83.32	2.00	0.00	1.00	0.00
45.52	71.40	2.00	0.00	1.00	0.00	45.68	75.01	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
45.85	83.37	2.00	0.00	1.00	0.00	46.01	91.02	2.00	0.00	1.00	0.00
46.18	111.02	0.70	2.12	1.00	0.04	46.34	117.80	0.79	1.60	1.00	0.03
46.50	123.36	0.87	1.15	1.00	0.02	46.67	127.29	0.93	1.10	1.00	0.02
46.83	128.43	0.94	1.08	1.00	0.02	47.00	128.78	0.95	0.70	1.00	0.01
47.16	128.83	0.95	0.70	1.00	0.01	47.32	127.71	0.94	1.09	1.00	0.02
47.49	123.46	0.87	1.15	1.00	0.02	47.65	117.90	0.80	1.60	1.00	0.03
47.82	112.78	0.73	2.07	1.00	0.04	47.98	109.92	0.70	2.16	1.00	0.04
48.15	114.92	0.76	1.66	1.00	0.03	48.31	118.73	0.81	1.58	1.00	0.03
48.47	122.78	0.87	1.16	1.00	0.02	48.64	125.34	0.91	1.12	1.00	0.02
48.80	127.85	0.95	0.70	1.00	0.01	48.97	128.19	0.96	0.70	1.00	0.01
49.13	130.83	1.01	0.69	1.00	0.01	49.29	133.23	1.05	0.68	1.00	0.01
49.46	134.68	1.07	0.45	1.00	0.01	49.62	134.65	1.08	0.45	1.00	0.01
49.79	132.03	1.03	0.68	1.00	0.01	49.95	128.06	0.97	0.70	1.00	0.01
50.11	123.87	0.90	1.14	1.00	0.02	50.28	122.29	0.88	1.16	1.00	0.02
50.44	121.51	0.87	1.18	1.00	0.02	50.61	119.47	0.85	1.57	1.00	0.03
50.77	116.75	0.81	1.62	1.00	0.03	50.93	110.78	0.73	2.13	1.00	0.04
51.10	102.32	0.64	2.29	1.00	0.05	51.26	95.29	0.57	2.43	1.00	0.05
51.43	90.87	0.54	2.53	1.00	0.05	51.59	87.21	0.51	2.61	1.00	0.05
51.75	87.56	0.51	2.61	1.00	0.05	51.92	91.34	0.54	2.52	1.00	0.05
52.08	95.15	0.58	2.43	1.00	0.05	52.25	98.66	0.61	2.36	1.00	0.05
52.41	104.03	0.67	2.26	1.00	0.04	52.57	109.73	0.73	2.17	1.00	0.04
52.74	113.34	0.78	1.69	1.00	0.03	52.90	116.37	0.82	1.63	1.00	0.03
53.07	116.62	0.83	1.62	1.00	0.03	53.23	119.76	0.87	1.20	1.00	0.02
53.39	123.08	0.92	1.15	1.00	0.02	53.56	128.35	1.01	0.70	1.00	0.01
53.72	132.22	1.08	0.46	1.00	0.01	53.89	135.47	1.14	0.45	1.00	0.01
54.05	137.74	1.19	0.32	1.00	0.01	54.22	136.91	1.17	0.33	1.00	0.01
54.38	133.67	1.11	0.46	1.00	0.01	54.54	131.29	1.07	0.46	1.00	0.01
54.71	128.17	1.02	0.70	1.00	0.01	54.87	126.69	1.00	0.71	1.00	0.01
55.04	124.81	0.97	0.72	1.00	0.01	55.20	128.83	1.04	0.70	1.00	0.01

Total estimated settlement: 3.65

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
10.09	27.17	50.74	4.71	260.32	2.00	44.61	0.00	0.00
10.25	24.10	44.93	5.06	337.10	2.00	40.59	0.00	0.00
10.41	24.08	44.87	5.40	384.20	2.00	40.55	0.00	0.00
10.58	28.38	52.98	4.79	259.60	2.00	46.03	0.00	0.00
10.74	30.01	56.04	4.73	240.07	2.00	47.89	0.00	0.00
10.91	30.14	56.27	4.51	216.53	2.00	48.02	0.00	0.00
11.07	28.63	53.40	4.54	230.77	2.00	46.29	0.00	0.00
11.23	24.60	45.77	4.31	240.91	2.00	41.21	0.00	0.00
11.40	17.06	31.49	4.92	138.76	2.00	28.86	0.04	0.00
11.56	13.04	23.88	5.06	125.15	2.00	19.73	0.05	0.00
11.73	10.34	18.76	5.42	116.72	2.00	11.77	0.06	0.00
11.89	9.36	16.90	5.34	110.81	2.00	8.31	0.07	0.00
12.05	9.21	16.58	5.21	108.72	2.00	7.69	0.07	0.00
12.22	8.75	15.70	5.26	106.65	2.00	5.88	0.07	0.00
12.38	8.73	15.65	5.50	108.79	2.00	5.78	0.07	0.00
12.55	11.15	20.21	4.30	107.80	2.00	14.22	0.06	0.00
12.71	10.91	19.74	4.22	105.72	2.00	13.45	0.06	0.00
12.87	11.17	20.22	3.94	103.26	2.00	14.23	0.06	0.00
13.04	11.36	20.55	3.70	100.79	2.00	14.77	0.06	0.00
13.20	11.06	19.97	3.25	93.68	2.00	13.83	0.06	0.00
13.37	8.45	15.01	4.03	92.77	2.00	4.40	0.07	0.00
13.53	7.83	13.83	4.09	90.41	2.00	1.70	0.08	0.00
13.69	7.10	12.42	4.23	87.90	2.00	0.00	0.08	0.00
13.86	6.64	11.54	4.22	85.23	2.00	0.00	0.08	0.00
14.02	6.04	10.40	4.30	82.35	2.00	0.00	0.09	0.00
14.19	5.68	9.70	4.22	79.42	1.88	0.00	0.12	0.00
14.35	5.40	9.16	4.07	76.43	1.77	0.00	0.16	0.00
14.51	5.44	9.22	3.67	73.56	1.77	0.00	0.16	0.00
14.68	6.62	11.44	3.62	79.76	2.00	0.00	0.08	0.00
14.84	8.50	14.97	3.29	84.88	2.00	4.32	0.07	0.00
15.01	9.26	16.39	3.24	87.19	2.00	7.32	0.07	0.00
15.17	10.15	18.04	3.15	89.28	2.00	10.48	0.06	0.00
15.34	10.76	19.20	3.16	91.44	2.00	12.52	0.06	0.00
15.50	9.51	16.80	3.37	89.72	2.00	8.12	0.07	0.00
15.66	7.67	13.31	3.65	85.22	2.00	0.43	0.08	0.00
15.83	7.01	12.04	4.00	85.27	2.00	0.00	0.08	0.00
15.99	6.31	10.71	4.12	82.43	1.98	0.00	0.09	0.00
16.16	5.65	9.45	4.25	79.31	1.74	0.00	0.17	0.00
16.32	5.48	9.10	4.75	81.75	1.67	0.00	0.21	0.00
16.48	6.14	10.34	4.89	87.42	1.89	0.00	0.12	0.00
16.65	8.98	15.69	5.34	108.79	2.00	5.87	0.07	0.00
16.81	13.22	23.68	4.39	117.17	2.00	19.46	0.05	0.00
16.98	12.82	22.92	4.84	121.55	2.00	18.37	0.05	0.00
17.14	16.08	29.05	4.23	124.87	2.00	26.20	0.04	0.00
17.30	18.93	34.15	3.80	263.19	2.00	31.54	0.00	0.00
17.47	15.86	28.61	3.78	117.04	2.00	25.70	0.04	0.00
17.63	11.76	20.85	4.42	111.94	2.00	15.25	0.06	0.00
17.80	12.12	21.50	4.13	109.52	2.00	16.27	0.06	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
17.96	9.60	16.73	4.58	104.31	2.00	7.98	0.07	0.00
18.12	6.89	11.58	5.81	99.45	2.00	0.00	0.08	0.00
18.29	9.38	16.27	4.05	97.42	2.00	7.07	0.07	0.00
18.45	10.27	17.93	4.29	104.02	2.00	10.27	0.06	0.00
18.62	10.75	18.83	4.47	108.24	2.00	11.89	0.06	0.00
18.78	10.81	18.88	4.44	108.07	2.00	11.97	0.06	0.00
18.94	10.88	18.85	4.41	107.70	2.00	11.92	0.06	0.00
19.11	9.80	16.91	4.90	108.45	2.00	8.34	0.07	0.00
19.27	9.75	16.67	4.72	105.96	2.00	7.87	0.07	0.00
19.44	11.79	19.80	3.90	103.38	2.00	13.55	0.06	0.00
19.60	12.51	20.77	3.68	102.23	2.00	15.12	0.06	0.00
19.76	12.52	20.63	3.68	101.98	2.00	14.91	0.06	0.00
19.93	11.86	19.44	3.71	100.19	2.00	12.93	0.06	0.00
20.09	11.96	19.41	3.51	97.47	2.00	12.88	0.06	0.00
20.26	10.39	16.88	4.04	99.01	2.00	8.28	0.07	0.00
20.42	10.49	16.97	4.19	100.95	2.00	8.45	0.07	0.00
20.58	10.74	17.27	4.28	102.71	2.00	9.03	0.07	0.00
20.75	10.64	17.00	4.32	102.53	2.00	8.51	0.07	0.00
20.91	9.70	15.30	4.53	100.56	2.00	5.04	0.07	0.00
21.08	8.85	13.70	4.52	96.05	2.00	1.39	0.08	0.00
21.24	7.73	11.68	4.92	93.35	1.95	0.00	0.09	0.00
21.40	7.01	10.37	4.85	88.30	1.73	0.00	0.17	0.00
21.57	7.29	10.76	4.66	88.23	1.79	0.00	0.14	0.00
21.73	7.98	11.83	4.26	88.27	1.96	0.00	0.09	0.00
21.90	8.16	12.05	4.17	88.05	1.99	0.00	0.08	0.00
22.06	8.14	11.94	3.93	85.52	1.97	0.00	0.09	0.00
22.23	8.05	11.69	3.73	82.93	1.92	0.00	0.10	0.00
22.39	6.96	9.81	3.45	75.06	1.61	0.00	0.24	0.00
22.55	5.67	7.63	3.53	68.71	1.25	0.00	0.82	0.00
22.72	4.93	6.39	3.24	62.06	1.04	0.00	1.97	0.01
22.88	4.24	5.22	2.83	54.66	0.85	0.00	5.25	0.02
23.05	3.67	4.26	3.27	52.87	0.69	0.00	4.00	0.02
23.21	4.55	5.64	3.08	58.03	0.92	0.00	3.71	0.01
23.37	8.23	11.34	1.94	62.37	2.00	0.00	0.09	0.00
23.54	13.88	18.99	1.30	91.96	2.00	12.16	0.00	0.00
23.70	19.46	26.17	1.03	61.18	2.00	22.76	0.00	0.00
23.87	25.09	33.07	0.80	60.36	2.00	30.48	0.00	0.00
24.03	30.08	38.99	0.66	61.10	2.00	35.92	0.00	0.00
24.19	32.44	41.66	0.62	61.77	0.34	38.10	51.20	0.20
24.36	32.79	41.92	0.61	61.79	0.34	38.30	51.20	0.21
24.52	33.03	42.05	0.61	61.77	0.34	38.40	51.20	0.20
24.69	32.75	41.55	0.61	61.54	0.34	38.01	51.20	0.21
24.85	31.83	40.31	0.63	61.10	0.34	37.01	51.20	0.20
25.01	31.11	39.32	0.64	60.76	0.34	36.19	51.20	0.00
25.18	31.47	39.59	0.64	60.76	0.34	36.41	51.20	0.00
25.34	36.29	45.47	0.72	67.36	0.36	40.99	51.20	0.00
25.51	49.11	60.57	0.69	78.64	0.42	50.45	34.10	0.00
25.67	67.25	81.44	0.65	95.05	0.53	60.22	22.70	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
25.83	86.59	103.33	0.65	113.39	0.71	68.08	8.50	0.00
26.00	105.05	123.86	0.65	130.49	0.95	74.06	3.75	0.00
26.16	118.71	138.54	0.62	141.36	1.13	77.76	2.49	0.00
26.33	122.71	142.63	0.64	145.05	1.20	78.72	2.21	0.00
26.49	118.85	137.91	0.64	141.51	1.13	77.61	2.49	0.00
26.65	108.95	126.62	0.66	133.21	2.00	74.79	0.00	0.00
26.82	93.71	109.79	0.77	122.36	2.00	70.08	0.00	0.00
26.98	76.83	90.92	0.91	110.00	2.00	63.86	0.00	0.00
27.15	63.87	76.00	1.00	99.73	2.00	57.94	0.00	0.00
27.31	53.52	64.09	1.16	94.11	2.00	52.32	0.00	0.00
27.47	42.74	51.57	1.40	90.60	2.00	45.15	0.00	0.00
27.64	34.87	42.11	1.49	85.19	2.00	38.45	0.00	0.00
27.80	28.71	34.55	1.46	78.31	2.00	31.92	0.00	0.00
27.97	20.71	24.85	1.64	90.27	2.00	21.05	0.00	0.00
28.13	12.63	14.96	2.22	72.26	2.00	4.30	0.07	0.00
28.30	9.56	11.01	2.30	66.48	2.00	0.00	0.09	0.00
28.46	9.38	10.69	1.92	61.11	1.66	0.00	0.20	0.00
28.62	8.85	9.95	2.26	63.81	1.54	0.00	0.29	0.00
28.79	8.49	9.42	2.83	68.51	1.46	0.00	0.38	0.00
28.95	9.04	10.09	3.10	72.91	1.56	0.00	0.27	0.00
29.12	9.84	11.07	3.25	77.02	1.71	0.00	0.17	0.00
29.28	9.97	11.17	3.61	80.81	1.72	0.00	0.17	0.00
29.44	11.05	12.51	3.44	82.56	1.93	0.00	0.10	0.00
29.61	12.13	13.83	3.30	84.09	2.00	1.70	0.08	0.00
29.77	12.56	14.28	3.19	83.79	2.00	2.76	0.07	0.00
29.94	12.76	14.44	3.14	83.52	2.00	3.13	0.07	0.00
30.10	12.58	14.15	3.18	83.46	2.00	2.46	0.08	0.00
30.26	12.90	14.46	3.10	83.15	2.00	3.16	0.07	0.00
30.43	12.94	14.42	3.09	82.97	2.00	3.09	0.07	0.00
30.59	13.14	14.56	2.89	80.79	2.00	3.41	0.07	0.00
30.76	13.12	14.44	2.74	78.67	2.00	3.13	0.07	0.00
30.92	12.94	14.14	2.63	76.61	2.00	2.44	0.08	0.00
31.08	11.72	12.64	2.73	74.98	1.93	0.00	0.09	0.00
31.25	10.53	11.10	2.66	70.90	1.70	0.00	0.18	0.00
31.41	9.17	9.39	2.84	68.60	1.43	0.00	0.41	0.00
31.58	7.99	7.90	3.00	65.89	1.21	0.00	0.95	0.00
31.74	7.10	6.78	3.10	62.93	1.03	0.00	2.02	0.00
31.90	7.16	6.82	2.79	60.69	1.04	0.00	1.97	0.00
32.07	7.32	6.97	3.00	62.89	1.06	0.00	1.77	0.00
32.23	8.03	7.78	3.24	67.46	1.18	0.00	1.04	0.00
32.40	10.10	10.19	3.57	77.72	1.55	0.00	0.28	0.00
32.56	14.09	14.86	3.26	86.05	2.00	4.07	0.07	0.00
32.72	17.89	19.04	2.79	87.33	2.00	12.26	0.06	0.00
32.89	19.77	21.01	2.53	86.07	2.00	15.51	0.06	0.00
33.05	20.04	21.22	2.49	85.78	2.00	15.83	0.06	0.00
33.22	19.52	20.54	2.56	85.95	2.00	14.76	0.06	0.00
33.38	18.81	19.71	2.98	91.14	2.00	13.40	0.06	0.00
33.54	21.18	22.27	3.12	97.31	2.00	17.43	0.05	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
33.71	28.39	29.93	2.47	142.27	1.11	27.19	0.00	0.00
33.87	34.84	36.73	2.24	98.36	0.54	33.94	51.20	0.00
34.04	37.20	39.06	2.15	98.63	0.54	35.97	51.20	0.00
34.20	36.48	38.12	2.14	97.45	0.53	35.17	51.20	0.00
34.36	32.34	33.63	2.47	123.19	0.81	31.03	51.20	0.00
34.53	31.56	32.70	2.72	152.64	2.00	30.10	0.00	0.00
34.69	39.18	40.44	1.99	96.19	2.00	37.11	0.00	0.00
34.86	53.03	54.42	1.32	90.78	2.00	46.92	0.00	0.00
35.02	67.61	68.87	0.89	90.76	2.00	54.69	0.00	0.00
35.19	80.32	81.24	0.65	94.76	2.00	60.14	0.00	0.00
35.35	85.31	85.98	0.61	97.77	0.53	62.01	22.70	0.00
35.51	83.19	83.88	0.79	100.88	0.56	61.20	22.70	0.00
35.68	80.48	80.99	0.89	101.14	0.56	60.04	22.70	0.00
35.84	79.16	79.45	0.93	100.92	0.56	59.41	22.70	0.00
36.01	77.76	77.79	0.95	99.97	0.55	58.71	22.70	0.00
36.17	76.14	75.89	0.92	97.50	0.53	57.89	22.70	0.00
36.33	72.94	72.44	0.90	94.21	0.50	56.36	22.70	0.00
36.50	64.28	63.67	1.12	92.84	0.49	52.10	34.10	0.00
36.66	52.36	51.69	1.60	96.19	0.52	45.22	34.10	0.00
36.83	41.28	40.46	2.18	100.71	0.56	37.14	51.20	0.00
36.99	45.20	44.21	1.99	99.65	0.55	40.06	51.20	0.00
37.15	61.06	59.73	1.41	97.54	0.53	49.99	34.10	0.00
37.32	81.24	79.31	1.03	103.51	0.59	59.35	22.70	0.00
37.48	104.74	101.94	0.76	115.56	0.72	67.63	8.41	0.00
37.65	129.10	125.25	0.64	131.28	0.93	74.43	3.94	0.00
37.81	140.88	136.38	0.64	140.34	1.08	77.24	2.74	0.00
37.97	142.46	137.60	0.67	142.65	1.12	77.54	2.53	0.00
38.14	138.57	133.48	0.71	140.49	1.08	76.53	2.72	0.00
38.30	130.35	125.21	0.75	135.06	0.99	74.42	3.26	0.00
38.47	120.67	115.50	0.75	126.66	0.86	71.76	4.87	0.00
38.63	109.89	104.79	0.75	117.53	0.74	68.55	7.55	0.00
38.79	98.97	94.01	0.77	108.88	0.64	64.96	22.70	0.00
38.96	93.46	88.42	0.75	103.59	0.59	62.94	22.70	0.00
39.12	94.08	88.76	0.70	102.61	0.58	63.06	22.70	0.00
39.29	101.59	95.67	0.69	108.17	0.64	65.54	11.73	0.00
39.45	115.67	108.85	0.67	118.93	0.76	69.80	6.98	0.00
39.61	133.75	125.76	0.63	131.45	0.94	74.56	3.81	0.00
39.78	148.99	139.88	0.59	141.11	1.10	78.08	2.62	0.00
39.94	163.53	153.32	0.56	153.32	1.34	81.11	1.74	0.00
40.11	173.57	162.43	0.54	162.43	1.55	83.01	1.29	0.00
40.27	179.41	167.57	0.52	167.57	1.68	84.04	1.10	0.00
40.43	183.60	171.12	0.52	171.12	1.77	84.73	0.98	0.00
40.60	190.46	177.17	0.53	177.17	1.94	85.88	0.99	0.00
40.76	195.04	181.07	0.52	181.07	2.00	86.60	0.00	0.00
40.93	198.58	183.97	0.51	183.97	2.00	87.12	0.00	0.00
41.09	199.83	184.74	0.49	184.74	2.00	87.26	0.00	0.00
41.26	199.07	183.66	0.44	183.66	2.00	87.07	0.00	0.00
41.42	197.39	181.76	0.41	181.76	2.00	86.72	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
41.58	193.90	178.13	0.40	178.13	1.98	86.06	0.95	0.00
41.75	190.18	174.23	0.43	174.23	1.87	85.33	1.05	0.00
41.91	188.79	172.49	0.48	172.49	1.83	84.99	0.92	0.00
42.08	188.78	171.93	0.56	171.93	1.81	84.89	0.93	0.00
42.24	187.18	169.94	0.63	169.94	1.76	84.50	0.99	0.00
42.40	178.67	161.59	0.68	161.84	1.56	82.84	1.28	0.00
42.57	169.01	152.23	0.72	156.24	1.43	80.87	1.52	0.00
42.73	147.58	131.97	0.89	145.22	1.20	76.16	2.19	0.00
42.90	116.18	102.74	1.15	127.05	0.89	67.89	4.42	0.00
43.06	85.96	74.86	1.56	114.48	0.73	57.44	14.71	0.00
43.22	74.15	63.94	1.73	109.89	0.67	52.24	34.10	0.00
43.39	59.81	50.82	1.97	105.18	0.62	44.66	51.20	0.00
43.55	48.96	41.01	2.00	97.11	0.55	37.58	51.20	0.00
43.72	44.54	36.97	1.84	89.68	0.49	34.16	51.20	0.00
43.88	40.71	33.52	1.62	81.51	2.00	30.92	0.00	0.00
44.04	27.44	21.69	2.19	177.46	2.00	16.55	0.00	0.00
44.21	19.12	14.35	3.14	83.64	2.00	2.93	0.07	0.00
44.37	17.39	12.82	3.68	86.19	2.00	0.00	0.08	0.00
44.54	19.89	14.88	3.32	86.92	2.00	4.12	0.07	0.00
44.70	23.40	17.81	2.99	88.32	2.00	10.06	0.06	0.00
44.86	27.44	21.24	2.55	86.95	2.00	15.86	0.06	0.00
45.03	31.17	24.38	2.25	159.11	1.53	20.42	0.00	0.00
45.19	31.57	24.69	1.96	124.82	2.00	20.83	0.00	0.00
45.36	33.32	26.16	1.62	83.32	2.00	22.75	0.00	0.00
45.52	48.02	38.95	1.04	71.40	2.00	35.87	0.00	0.00
45.68	63.80	52.74	0.78	75.01	2.00	45.88	0.00	0.00
45.85	82.06	68.80	0.61	83.37	2.00	54.66	0.00	0.00
46.01	107.10	91.02	0.47	91.02	2.00	63.90	0.00	0.00
46.18	129.55	111.02	0.39	111.02	0.70	70.45	8.88	0.00
46.34	137.31	117.80	0.36	117.80	0.79	72.41	6.38	0.00
46.50	143.87	123.36	0.38	123.36	0.87	73.93	4.86	0.00
46.67	148.59	127.29	0.38	127.29	0.93	74.96	4.00	0.00
46.83	150.12	128.43	0.37	128.43	0.94	75.26	3.63	0.00
47.00	150.89	128.78	0.38	128.78	0.95	75.35	3.57	0.00
47.16	151.23	128.83	0.38	128.83	0.95	75.36	3.55	0.00
47.32	150.11	127.71	0.36	127.71	0.94	75.07	3.68	0.00
47.49	145.52	123.46	0.34	123.46	0.87	73.96	4.71	0.00
47.65	139.58	117.90	0.36	117.90	0.80	72.44	6.13	0.00
47.82	134.12	112.78	0.37	112.78	0.73	70.97	7.81	0.00
47.98	131.16	109.92	0.38	109.92	0.70	70.12	8.92	0.00
48.15	130.63	108.51	0.55	114.92	0.76	69.70	6.98	0.00
48.31	131.01	108.14	0.69	118.73	0.81	69.58	5.78	0.00
48.47	131.59	107.93	0.84	122.78	0.87	69.52	4.74	0.00
48.64	133.80	109.41	0.88	125.34	0.91	69.97	4.17	0.00
48.80	135.96	110.86	0.93	127.85	0.95	70.40	3.67	0.00
48.97	140.21	114.48	0.83	128.19	0.96	71.46	3.59	0.00
49.13	145.11	118.49	0.80	130.83	1.01	72.60	3.15	0.00
49.29	149.62	122.13	0.78	133.23	1.05	73.60	2.80	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
49.46	150.12	122.07	0.83	134.68	1.07	73.58	2.60	0.00
49.62	149.30	120.97	0.86	134.65	1.08	73.28	2.59	0.00
49.79	145.86	117.72	0.86	132.03	1.03	72.38	2.92	0.00
49.95	142.50	114.77	0.81	128.06	0.97	71.55	3.51	0.00
50.11	140.09	112.77	0.73	123.87	0.90	70.97	4.27	0.00
50.28	141.01	113.59	0.65	122.29	0.88	71.20	4.59	0.00
50.44	142.05	114.43	0.61	121.51	0.87	71.45	4.74	0.00
50.61	140.99	113.45	0.57	119.47	0.85	71.16	5.20	0.00
50.77	136.60	109.39	0.59	116.75	0.81	69.96	5.90	0.00
50.93	125.98	99.93	0.65	110.78	0.73	66.98	7.83	0.00
51.10	112.24	88.00	0.71	102.32	0.64	62.78	22.70	0.00
51.26	102.09	79.34	0.72	95.29	0.57	59.36	22.70	0.00
51.43	95.77	73.91	0.73	90.87	0.54	57.02	22.70	0.00
51.59	91.87	70.61	0.70	87.21	0.51	55.51	22.70	0.00
51.75	94.81	73.04	0.63	87.56	0.51	56.63	22.70	0.00
51.92	101.17	78.18	0.61	91.34	0.54	58.87	22.70	0.00
52.08	105.86	81.76	0.64	95.15	0.58	60.35	22.70	0.00
52.25	110.13	84.98	0.67	98.66	0.61	61.63	22.70	0.00
52.41	118.52	91.74	0.66	104.03	0.67	64.15	21.47	0.00
52.57	128.09	99.57	0.62	109.73	0.73	66.86	7.83	0.00
52.74	135.37	105.61	0.58	113.34	0.78	68.80	6.55	0.00
52.90	142.47	111.61	0.52	116.37	0.82	70.63	5.64	0.00
53.07	148.40	116.62	0.47	116.62	0.83	72.07	5.54	0.00
53.23	151.98	119.76	0.42	119.76	0.87	72.95	4.74	0.00
53.39	155.73	123.08	0.37	123.08	0.92	73.85	4.02	0.00
53.56	161.83	128.35	0.33	128.35	1.01	75.24	3.15	0.00
53.72	166.42	132.22	0.31	132.22	1.08	76.22	2.74	0.00
53.89	170.29	135.47	0.29	135.47	1.14	77.02	2.45	0.00
54.05	173.17	137.74	0.29	137.74	1.19	77.57	2.26	0.00
54.22	172.50	136.91	0.29	136.91	1.17	77.37	2.31	0.00
54.38	169.35	133.67	0.32	133.67	1.11	76.58	2.57	0.00
54.54	166.38	131.29	0.29	131.29	1.07	75.99	2.78	0.00
54.71	163.19	128.17	0.31	128.17	1.02	75.19	3.09	0.00
54.87	161.24	126.69	0.27	126.69	1.00	74.81	3.23	0.00
55.04	160.13	124.81	0.34	124.81	0.97	74.32	3.51	0.00
55.20	166.65	128.83	0.46	128.83	1.04	75.36	2.99	0.00

Total estimated displacement: 1.09

Abbreviations

q_t:	Total cone resistance
Q_{tn}:	Adjusted cone resistance to an effective overburden stress of 1 atm
R_f:	Friction ration
$Q_{tn,cs}$:	Adjusted and corrected cone resistance due to fines
FS:	Calculated factor of safety against liquefaction
D_r:	Calculated relative density
$Gamma_{max}$:	Calculated maximum cyclic shear strain
Lat. disp.:	Lateral displacement

APPENDIX D
EARTHWORK AND GRADING GUIDELINES

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EARTHWORK AND GRADING GUIDELINES

GENERAL

These guidelines present general procedures and recommendations for earthwork and grading as required on the approved grading plans, including preparation of areas to be filled, placement of fill and installation of subdrains and excavations. The recommendations contained in the geotechnical report are applicable to each specific project, are part of the earthwork and grading guidelines and would supersede the provisions contained hereafter in the case of conflict. Observations and/or testing performed by the consultant during the course of grading may result in revised recommendations which could supersede these guidelines or the recommendations contained in the geotechnical report. Figures A through O are provided at the back of this appendix, exhibiting generalized cross sections relating to these guidelines.

The contractor is responsible for the satisfactory completion of all earthworks in accordance with provisions of the project plans and specifications. The project soil engineer and engineering geologist (geotechnical consultant) or their representatives should provide observation and testing services, and geotechnical consultation throughout the duration of the project.

EARTHWORK OBSERVATIONS AND TESTING

Geotechnical Consultant

Prior to the commencement of grading, a qualified geotechnical consultant (a soil engineer and engineering geologist) should be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report, the approved grading plans, and applicable grading codes and ordinances.

The geotechnical consultant should provide testing and observation so that determination may be made that the work is being completed as specified. It is the responsibility of the contractor to assist the consultant and keep them aware of work schedules and predicted changes, so that the consultant may schedule their personnel accordingly.

All removals, prepared ground to receive fill, key excavations, and subdrains should be observed and documented by the project engineering geologist and/or soil engineer prior to placing any fill. It is the contractor's responsibility to notify the engineering geologist and soil engineer when such areas are ready for observation.

Laboratory and Field Tests

Maximum dry density tests to determine the degree of compaction should be performed in accordance with American Standard Testing Materials test method ASTM designation D-1557-78. Random field compaction tests should be performed in accordance with test method ASTM designations D-1556-82, D-2937 or D-2922 & D-3017, at intervals of approximately two (2) feet of fill height per 10,000 sq. ft. or every one thousand cubic yards of fill placed. These criteria would vary depending on the soil conditions and the size of the project. The location and frequency of testing would be at the discretion of the geotechnical consultant

Contractor's Responsibility

All clearing, site preparation, and earthwork performed on the project should be conducted by the contractor, with observation by geotechnical consultants and staged approval by the appropriate governing agencies. It is the contractor's responsibility to prepare the ground surface to receive the fill to the satisfaction of the soil engineer, and to place, spread, moisture condition, mix and compact the fill in accordance with the recommendations of the soil engineer. The contractor should also remove all major deleterious material considered unsatisfactory by the soil engineer.

It is the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the earthwork in accordance with applicable grading guidelines, codes or agency ordinances, and approved grading plans. Sufficient watering apparatus and compaction equipment should be provided by the contractor with due consideration for the fill material, rate of placement, and climatic conditions. If, in the opinion of the geotechnical consultant, unsatisfactory conditions such as questionable weather, excessive oversized rock, deleterious material or insufficient support equipment are resulting in a quality of work that is not acceptable, the consultant will inform the contractor, and the contractor is expected to rectify the conditions, and if necessary, stop work until conditions are satisfactory.

The contractor will properly grade all surfaces to maintain good drainage and prevent ponding of water. The contractor will take action to control surface water and to prevent erosion control measures that have been installed.

SITE PREPARATION

All vegetation including brush, trees, thick grasses, organic debris, and other deleterious material should be removed and disposed of offsite, and must be concluded prior to placing fill. Existing fill, soil, alluvium, colluvium, or rock materials determined by the soil engineer or engineering geologist as unsuitable for structural in-place support should be removed prior to fill placement. Depending upon the soil conditions, these materials may be reused as compacted fills. Any materials incorporated as part of the compacted fills should be approved by the soil engineer.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, or other structures not located prior to grading are to be removed or treated in a manner recommended by the soil engineer. Soft, dry, spongy, highly fractured, or otherwise unsuitable ground extending to such a depth that surface processing cannot adequately improve the condition should be over excavated down to firm ground and approved by the soil engineer before compaction and filling operations continue. Over excavated and processed soils which have been properly mixed and moisture-conditioned should be recompacted to the minimum relative compaction as specified in these guidelines.

Existing ground which is determined to be satisfactory for support of the fills should be scarified to a minimum depth of six (6) inches, or as directed by the soil engineer. After the scarified ground is brought to optimum moisture (or greater) and mixed, the materials should be compacted as specified herein. If the scarified zone is greater than 6 inches in depth, it may be necessary to remove the excess and place the material in lifts restricted to six (6) inches in compacted thickness.

Existing grind which is not satisfactory to support compacted fill should be over excavated as required in the geotechnical report or by the onsite soils engineer and/or engineering geologists. Scarification, discing, or other acceptable form of mixing should continue until the soils are broken down and free of large fragments or clods, until the working surface is reasonably uniform and free from ruts, hollows, hummocks, or other uneven features which would inhibit compaction as described above.

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical) gradient, the ground should be benched. The lowest bench, which will act as a key, should be a minimum of 12 feet wide and should be at least two (2) feet deep into competent material, approved by the soil engineer and/or engineering geologist. In fill over cut slope conditions, the recommended minimum width of the lowest bench or key is at least 15 feet with the key excavated on competent material, as designated by the Geotechnical Consultant. As a general rule, unless superseded by the Soil Engineer, the minimum width of fill keys should be approximately equal to one-half (½) the height of the slope.

Standard benching is typically four feet (minimum) vertically, exposing competent material. Benching may be used to remove unsuitable materials, although it is understood that the vertical height of the bench may exceed four feet. Pre stripping may be considered for removal of unsuitable materials in excess of four feet in thickness.

All areas to receive fill, including processed areas, removal areas, and toe of fill benches should be observed and approved by the soil engineer and/or engineering geologist prior to placement of fill. Fills may then be properly placed and compacted until design grades are attained.

COMPACTED FILLS

Earth materials imported or excavated on the property may be utilized as fill provided that each soil type has been accepted by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. All unsuitable materials should be removed from the fill as directed by the soil engineer. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated unsuitable by the consultant and may require mixing with other earth materials to serve as a satisfactory fill material.

Fill materials generated from benching operations should be dispersed throughout the fill area. Benching operations should not result in the benched material being placed only within a single equipment width away from the fill/bedrock contact.

Oversized materials, defined as rock or other irreducible materials with a maximum size exceeding 12 inches in one dimension, should not be buried or placed in fills unless the location of materials and disposal methods are specifically approved by the soil engineer. Oversized material should be taken offsite or placed in accordance with recommendations of the soil engineer in areas designated as suitable for rock disposal. Oversized material should not be placed vertically within 10 feet of finish grade or horizontally within 20 feet of slope faces.

To facilitate trenching, rock should not be placed within the range of foundation excavations or future utilities unless specifically approved by the soil engineer and/or the representative developers.

If import fill material is required for grading, representative samples of the material should be analyzed in the laboratory by the soil engineer to determine its physical properties. If any material other than that previously analyzed is imported to the fill or encountered during grading, analysis of this material should be conducted by the soil engineer as soon as practical.

Fill material should be placed in areas prepared to receive fill in near-horizontal layers that should not exceed six (6) inches compacted in thickness. The soil engineer may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved. Each layer should be spread evenly and mixed to attain uniformity of material and moisture suitable for compaction.

Fill materials at moisture content less than optimum should be watered and mixed, and "wet" fill materials should be aerated by scarification, or should be mixed with drier material. Moisture conditioning and mixing of fill materials should continue until the fill materials have uniform moisture content at or above optimum moisture.

After each layer has been evenly spread, moisture-conditioned and mixed, it should be uniformly compacted to a minimum of 90 percent of maximum density as determined by ASTM test designation, D 1557-78, or as otherwise recommended by the soil engineer. Compaction equipment should be adequately sized and should be reliable to efficiently achieve the required degree of compaction.

Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction or improper moisture content, the particular layer or portion will be reworked until the required density and/or moisture content has been attained. No additional fill will be placed in an area until the last placed lift of fill has been tested and found to meet the density and moisture requirements, and is approved by the soil engineer.

Compaction of slopes should be accomplished by over-building the outside edge a minimum of three (3) feet horizontally, and subsequently trimming back to the finish design slope configuration. Testing will be performed as the fill is horizontally placed to evaluate compaction as the fill core is being developed. Special efforts may be necessary to attain the specified compaction in the fill slope zone. Final slope shaping should be performed by trimming and removing loose materials with appropriate equipment. A final determination of fill slope compaction should be based on observation and/or testing of the finished slope face.

If an alternative to over-building and cutting back the compacted fill slope is selected, then additional efforts should be made to achieve the required compaction in the outer 10 feet of each lift of fill by undertaking the following:

- Equipment consisting of a heavy short-shanked sheepsfoot should be used to roll (horizontal) parallel to the slopes continuously as fill is placed. The sheepsfoot roller should also be used to roll perpendicular to the slopes, and extend out over the slope to provide adequate compaction to the face slope.

- Loose fill should not be spilled out over the face of the slope as each lift is compacted. Any loose fill spilled over a previously completed slope face should be trimmed off or be subject to re-rolling.

- Field compaction tests will be made in the outer two (2) to five (5) feet of the slope at two (2) to three (3) foot vertical intervals, subsequent to compaction operations.

- After completion of the slope, the slope face should be shaped with a small dozer and then re-rolled with a sheepsfoot to achieve compaction to near the slope face. Subsequent to testing to verify compaction, the slopes should be grid-rolled to achieve adequate compaction to the slope face. Final testing should be used to confirm compaction after grid rolling.

- Where testing indicates less than adequate compaction, the contractor will be responsible to process, moisture condition, mix and recompact the slope materials as necessary to achieve compaction. Additional testing should be performed to verify compaction.

- Erosion control and drainage devices should be designed by the project civil engineer in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the soil engineer or engineering geologist.

EXCAVATIONS

Excavations and cut slopes should be observed and mapped during grading by the engineering geologist. If directed by the engineering geologist, further excavations or over-excavation and refilling of cut areas should be performed. When fills over cut slopes are to be graded, the cut portion of the slope should be observed by the engineering geologist prior to placement of the overlying fill portion of the slope. The engineering geologist should observe all cut slopes and should be notified by the contractor when cut slopes are started.

If, during the course of grading, unanticipated adverse or potentially adverse geologic conditions are encountered, the engineering geologist and soil engineer should investigate, evaluate and make recommendations to mitigate (or limit) these conditions. The need for cut slope buttressing or stabilizing should be based on as-grading evaluations by the engineering geologist, whether anticipated previously or not.

Unless otherwise specified in soil and geological reports, no cut slopes should be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies. Additionally, short-term stability of temporary cut slopes is the contractor’s responsibility.

Erosion control and drainage devices should be designed by the project civil engineer and should be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the soil engineer or engineering geologist.

SUBDRAIN INSTALLATION

Subdrains should be installed in accordance with the approved embedment material, alignment and details indicated by the geotechnical consultant. Subdrain locations or construction materials should not be changed or modified without approval of the geotechnical consultant. The soil engineer and/or engineering geologist may recommend and direct changes in subdrain line, grade and drain material in the field, pending exposed conditions. The location of constructed subdrains should be recorded by the project civil engineer.

COMPLETION

Consultation, observation and testing by the geotechnical consultant should be completed during grading operations in order to state an opinion that all cut and filled areas are graded in accordance with the approved project specifications.

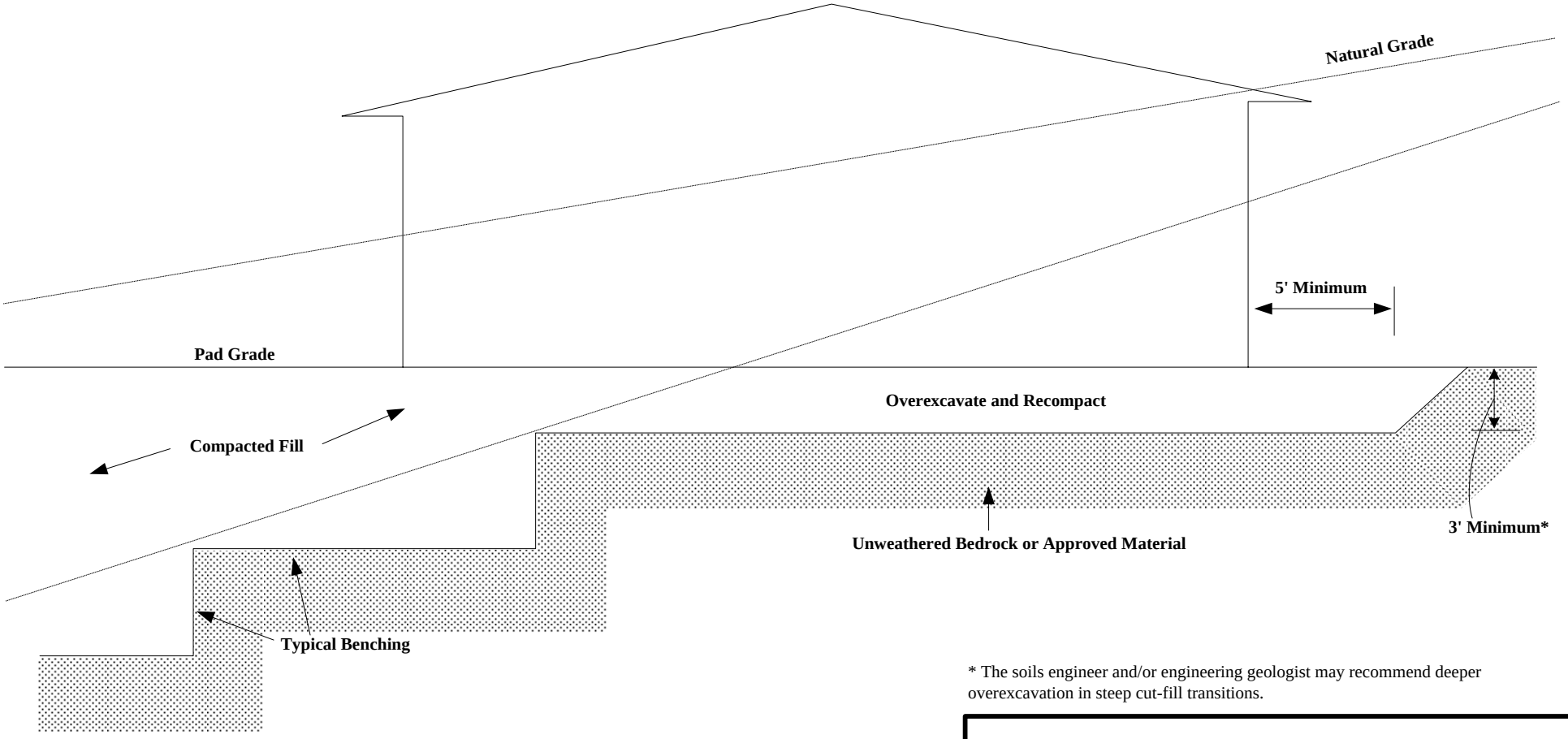
After completion of grading and after the soil engineer and engineering geologist have finished their observations, final reports should be submitted subject to review by the controlling governmental agencies. No additional grading should be undertaken without prior notification of the soil engineer and/or engineering geologist.

All finished cut and fill slopes should be protected from erosion, including but not limited to planting in accordance with the plan design specifications and/or as recommended by a landscape architect. Such protection and/or planning should be undertaken as soon as possible after completion of grading.

ATTACHMENTS

Figure A – Transition Lot Detail Cut Lot
Figure B – Transition Lot Detail Cut - Fill
Figure C – Rock Disposal Pits
Figure D – Detail for Fill Slope Toeing out on a Flat Alluviated Canyon
Figure E – Removal Adjacent to Existing Fill
Figure F – Daylight Cut Lot Detail
Figure G – Skin Fill of Natural Ground
Figure H – Typical Stabilization Buttress Fill Design
Figure I – Stabilization Fill for Unstable Material Exposed in Portion of Cut Slope
Figure J – Fill Over Cut Detail
Figure K – Fill Over Natural Detail
Figure L – Oversize Rock Disposal
Figure M – Canyon Subdrain Detail
Figure N – Canyon Subdrain Alternate Details
Figure O – Typical Stabilization Buttress Subdrain Detail
Figure P – Retaining Wall Backfill

TRANSITION LOT DETAIL
CUT LOT – MATERIAL TYPE TRANSITION



* The soils engineer and/or engineering geologist may recommend deeper overexcavation in steep cut-fill transitions.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TRANSITION LOT DETAIL
CUT LOT – MATERIAL TYPE TRANSITION

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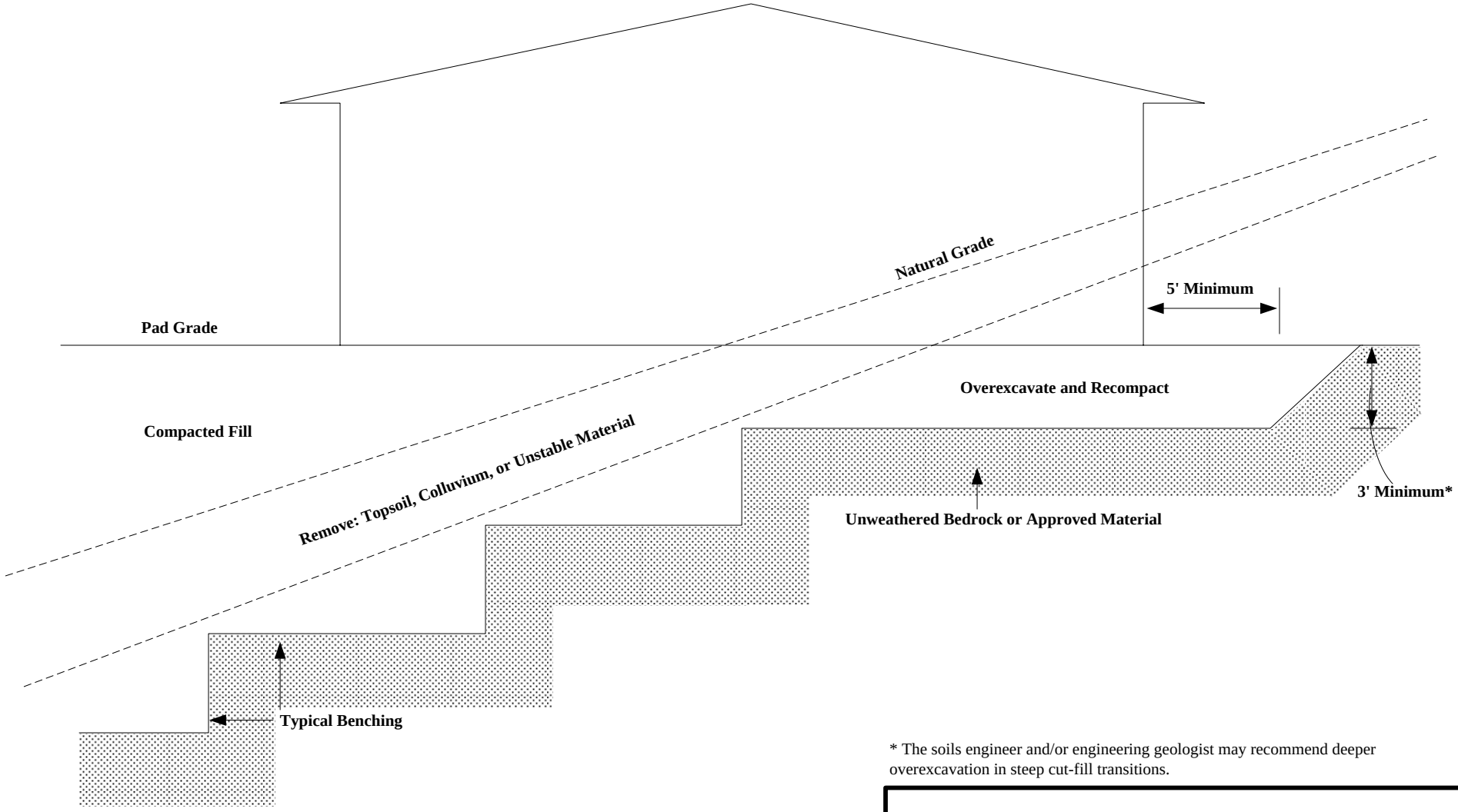
FIGURE A

TRANSITION LOT DETAIL
CUT – FILL – DAYLIGHT TRANSITION



* The soils engineer and/or engineering geologist may recommend deeper overexcavation in steep cut-fill transitions.

EARTHWORK AND GRADING GUIDELINES
TRANSITION LOT DETAIL
CUT – FILL – DAYLIGHT TRANSITION

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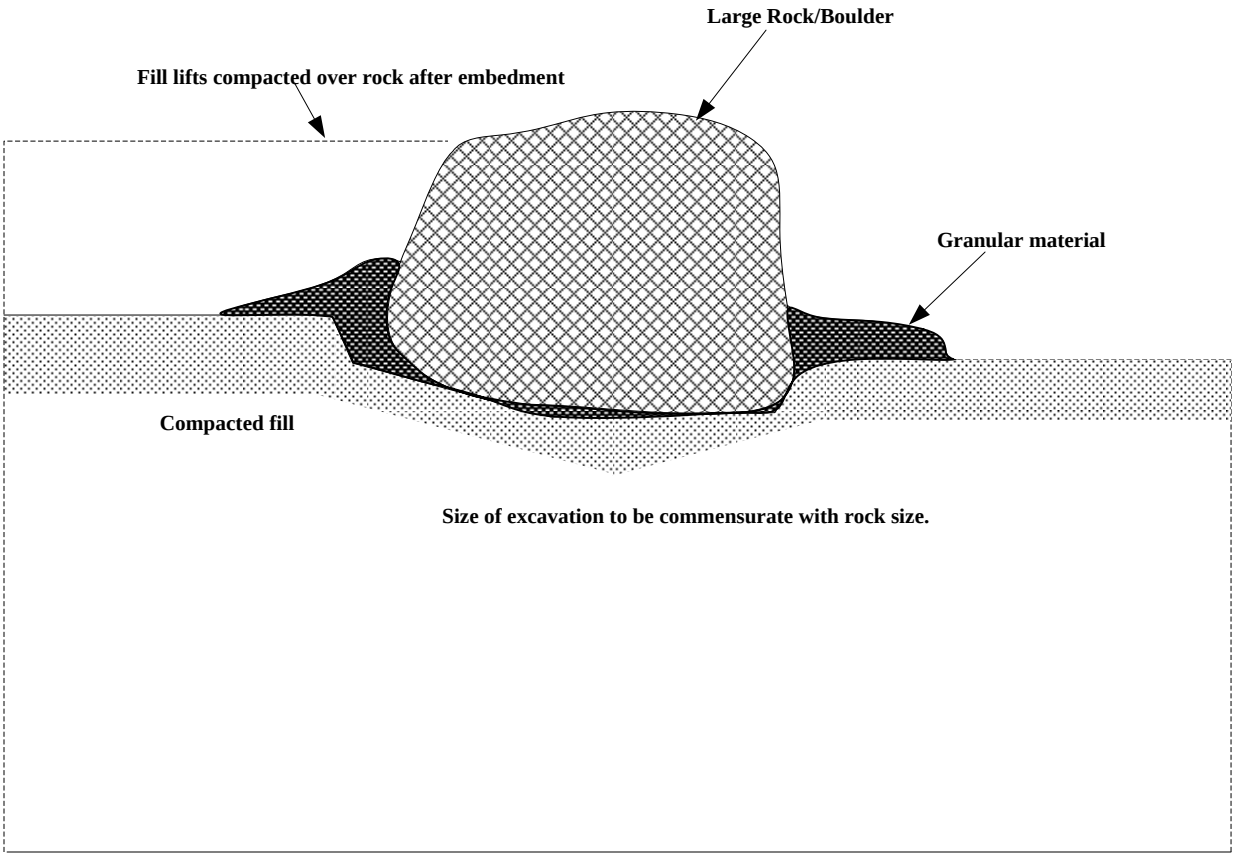
FIGURE B

Note: Figure not to scale

ROCK DISPOSAL PITS



Note: (1) Large rock is defined as having a diameter larger than 3 feet in maximum size.
(2) Pit shall be excavated into compacted fill to a depth equal to half of the rock size.
(3) Granular soil shall be pushed into the pit and then flooded around the rock using a sheepsfoot to help with compaction.
(4) A minimum of 3 feet of compacted fill should be laid over each pit.
(5) Pits shall have at least 15 feet of separation between one another, horizontally.
(6) Pits shall be placed at least 20 feet from any fill slope.
(7) Pits shall be used only in deep fill areas.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
ROCK DISPOSAL PITS

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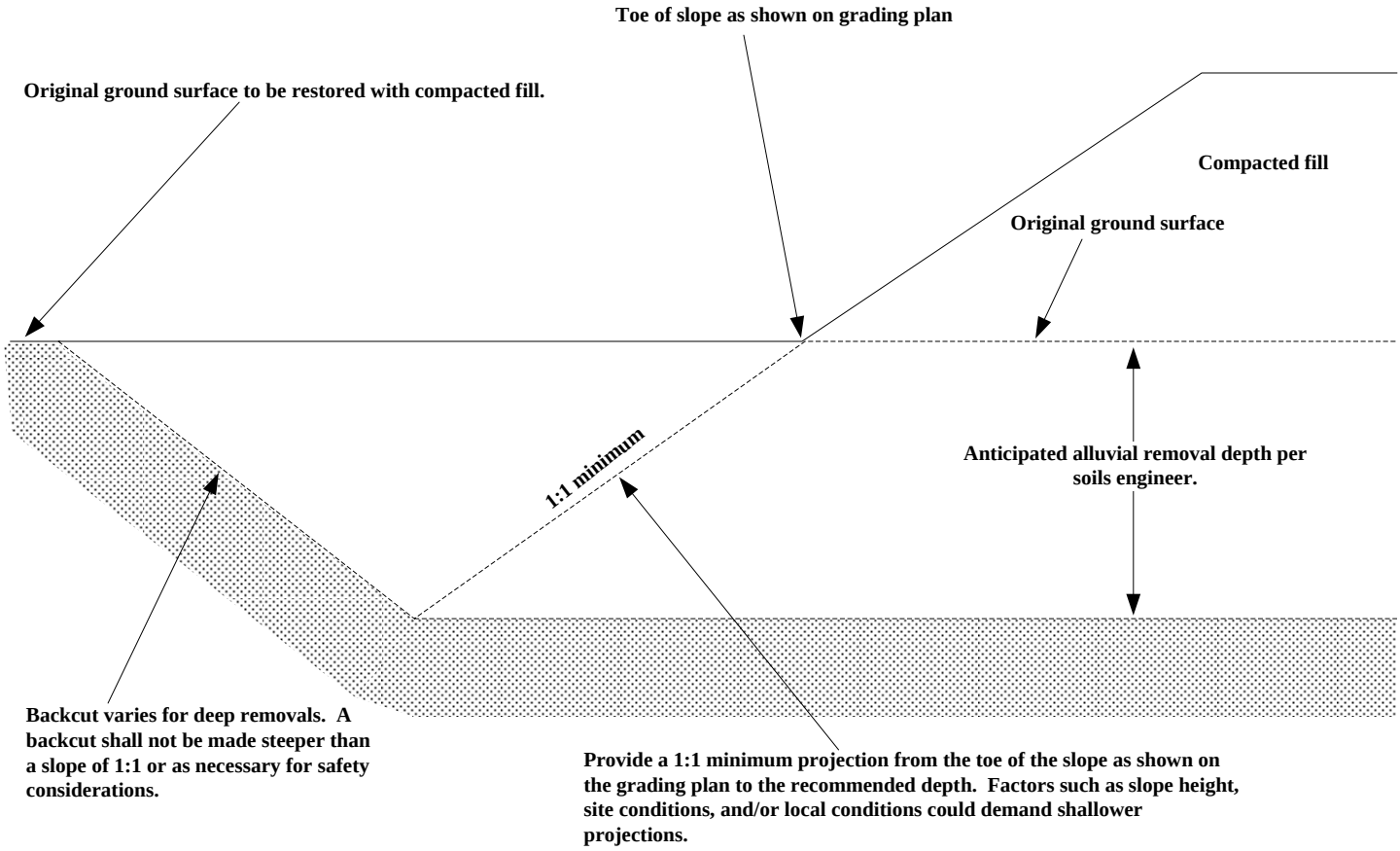
FIGURE C

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON



Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
DETAIL FOR FILL SLOPE TOEING OUT ON A FLAT ALLUVIATED CANYON

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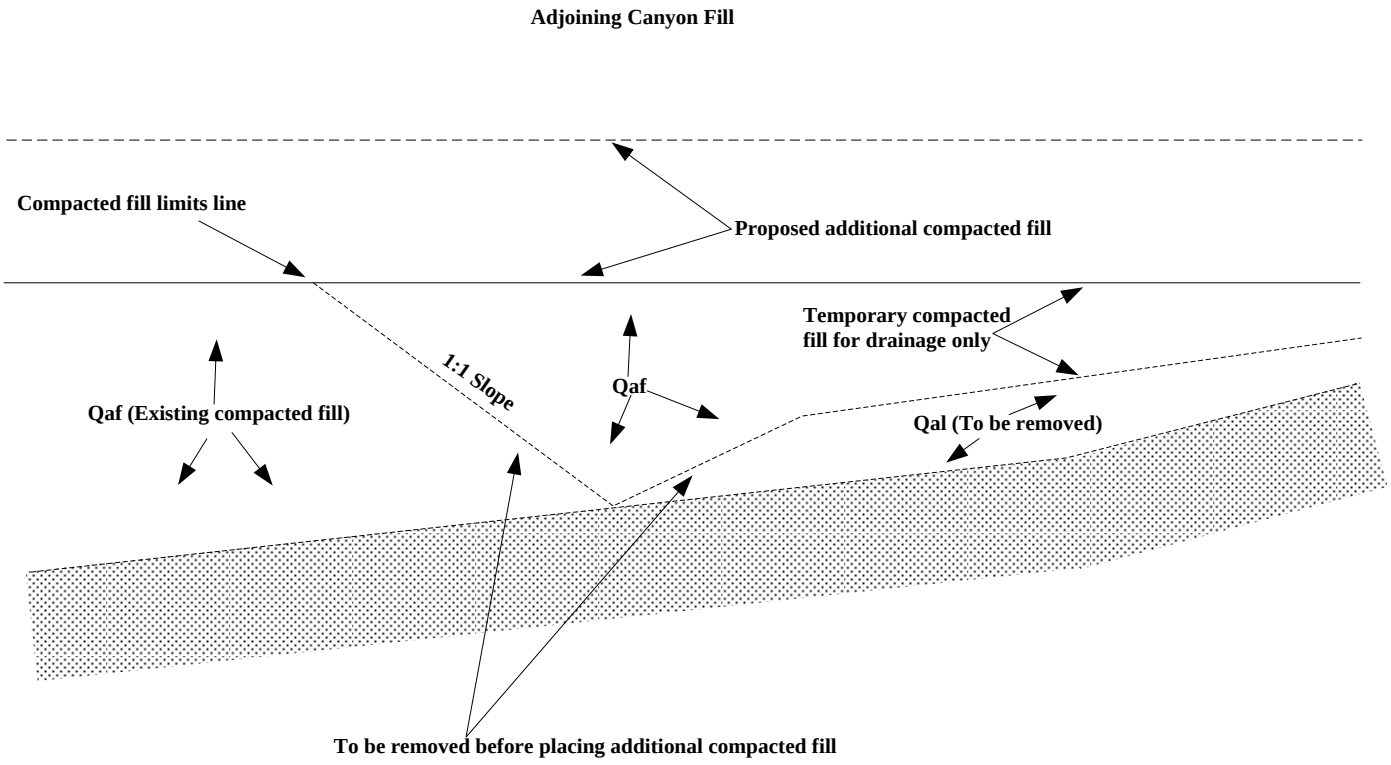
FIGURE D

REMOVAL ADJACENT TO EXISTING FILL



Legend

Qaf - Artificial Fill

Qal - Alluvium

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
REMOVAL ADJACENT TO EXISTING FILL

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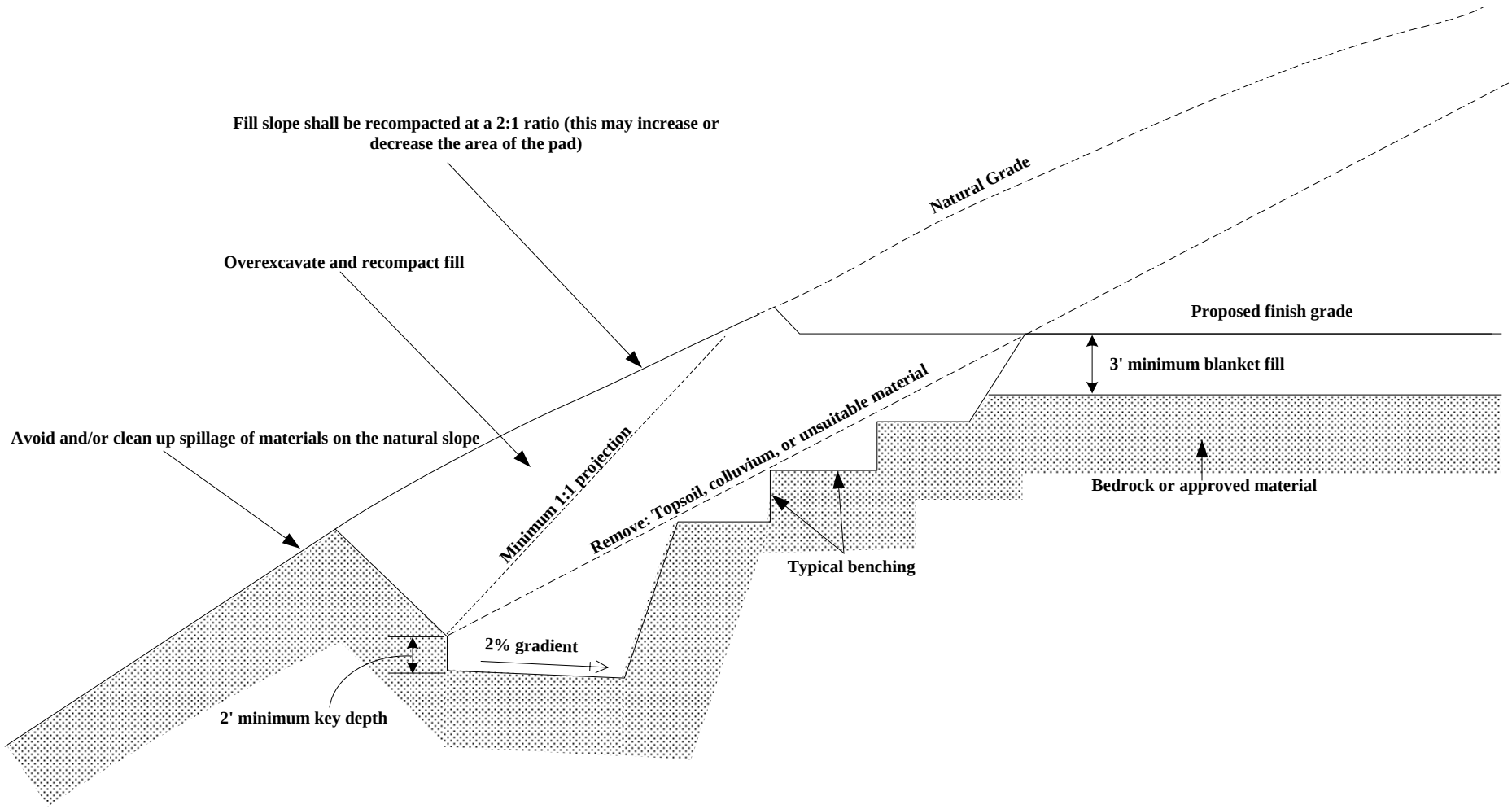
FIGURE E

DAYLIGHT CUT LOT DETAIL



Note: (1) Subdrain and key width requirements shall be determined based on exposed subsurface conditions and the thickness of overburden.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
DAYLIGHT CUT LOT DETAIL

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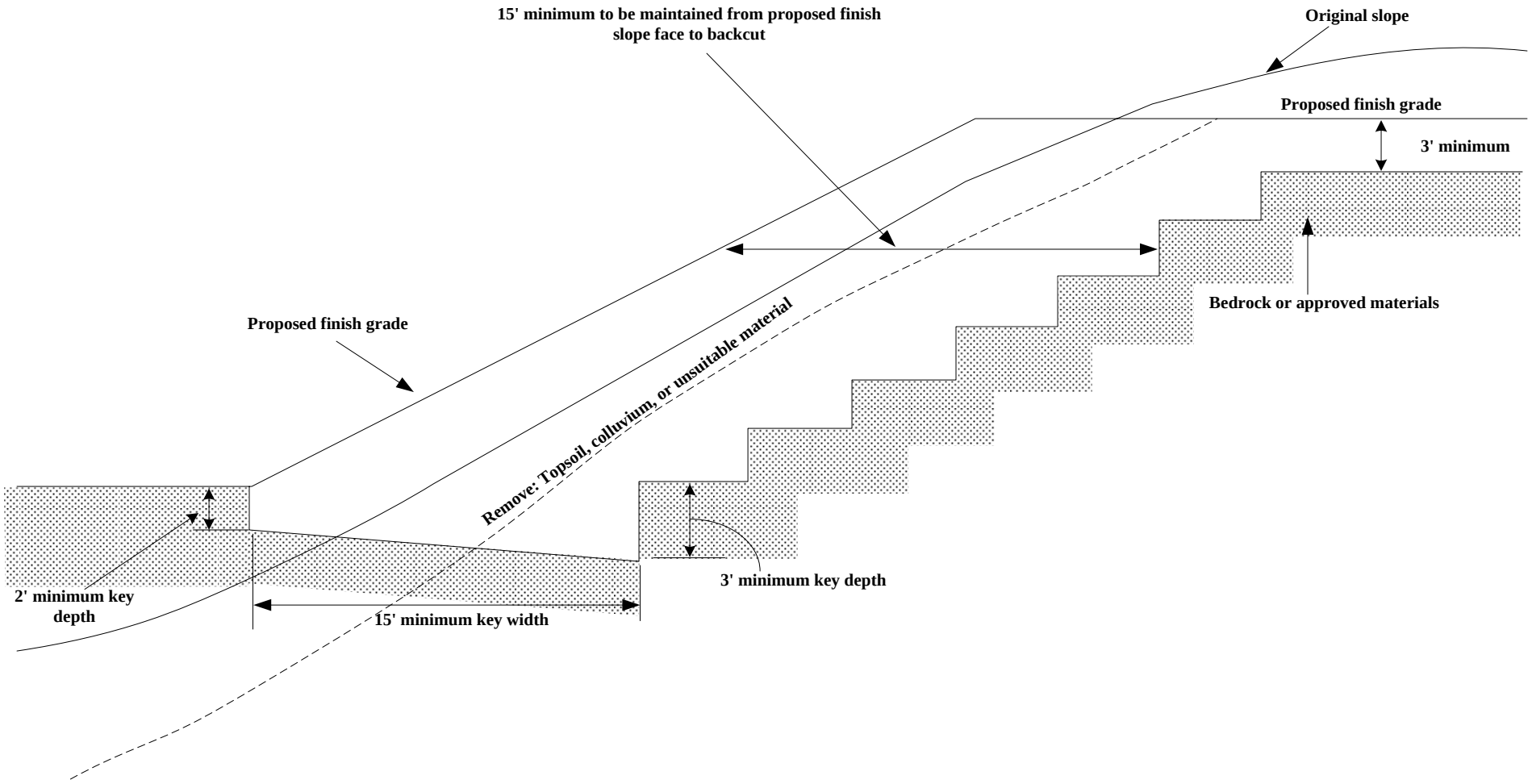
FIGURE F

SKIN FILL OF NATURAL GROUND



Note: (1) The need and disposition of drains will be determined by the soils engineer and/or engineering geologist based on site conditions.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
SKIN FILL OF NATURAL GROUND

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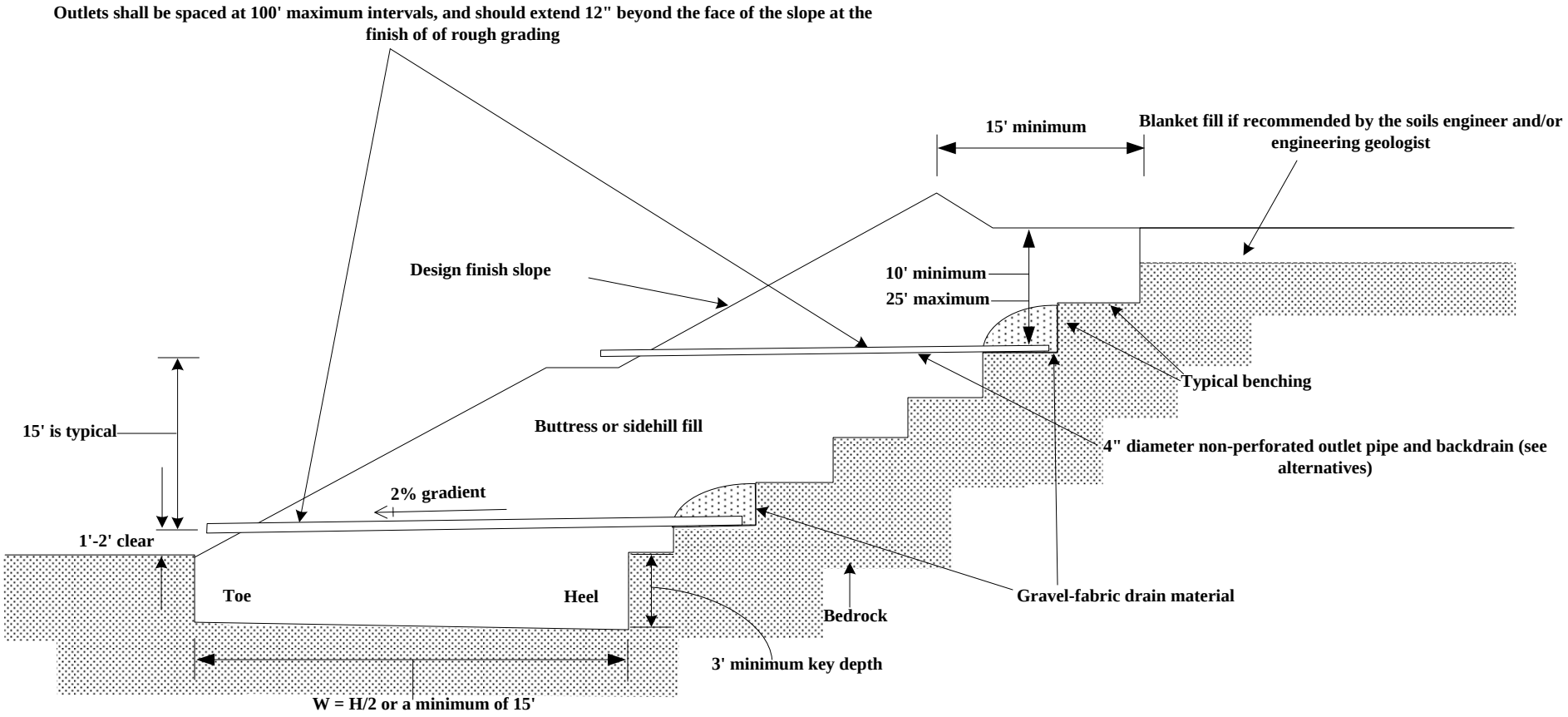
FIGURE G

TYPICAL STABILIZATION BUTTRESS FILL DESIGN



Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TYPICAL STABILIZATION BUTTRESS FILL DESIGN

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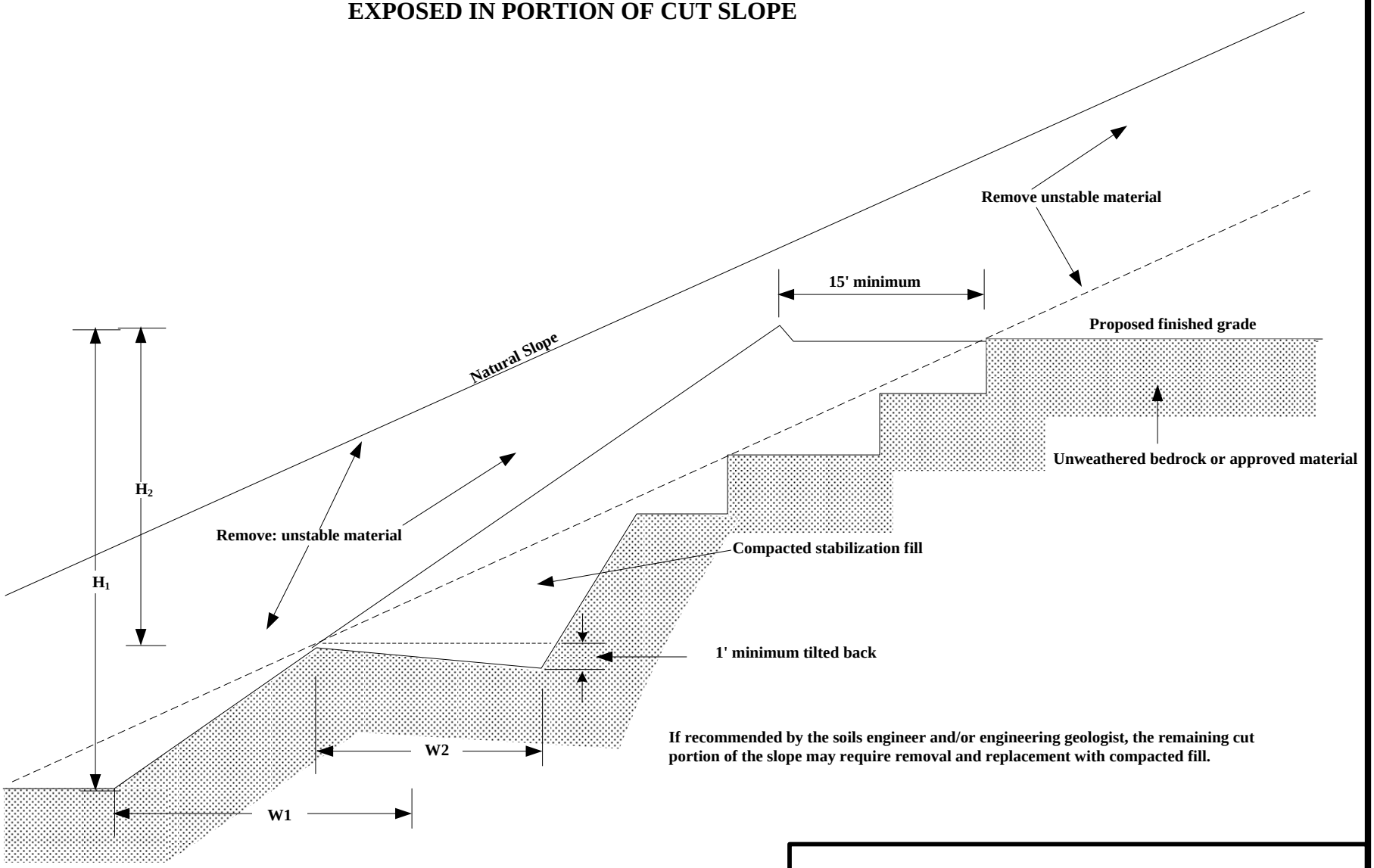
FIGURE H

STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE



Note: (1) Subdrains are required only if specified by the soils engineer and/or engineering geologist.

(2) "W" shall be the equipment width (15') for slope heights less than 25 feet. For slopes greater than 25 feet "W" shall be determined by the project soils engineer and/or the engineering geologist. "W" shall never be less than H/2.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES

STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE

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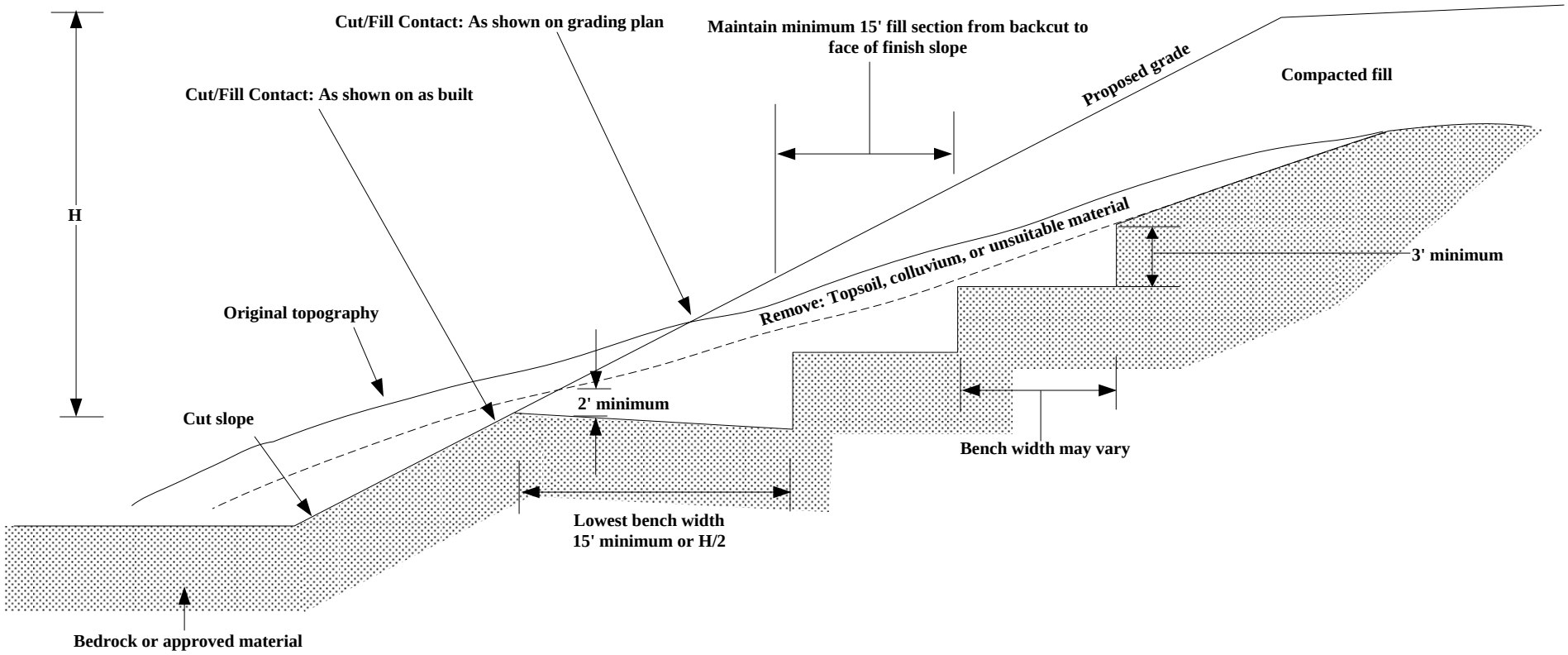
FIGURE I

FILL OVER CUT DETAIL



Note: The cut sectioin shall be excavated and evaluated by the soils engineer/engineering geologist prior to constructing the fill portion.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
FILL OVER CUT DETAIL

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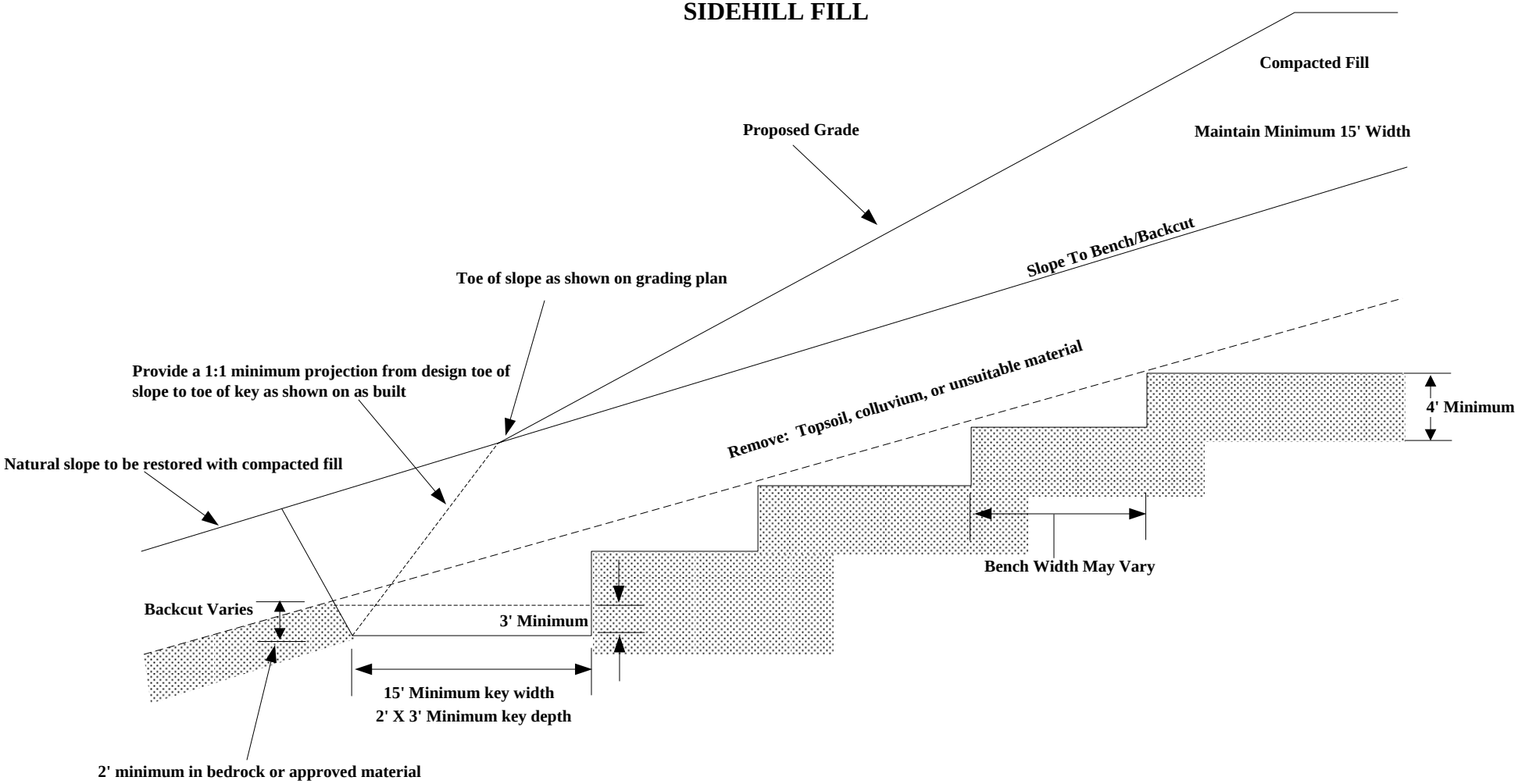
FIGURE J

FILL OVER NATURAL DETAIL
SIDEHILL FILL



Note: (1) Special recommendations shall be provided by the soils engineer/engineering geologist where the natural slope approaches or exceeds the design slope ratio.
(2) The need for and disposition of drains would be determined by the soils engineer/engineering geologist based upon exposed conditions.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
FILL OVER NATURAL DETAIL
SIDEHILL FILL

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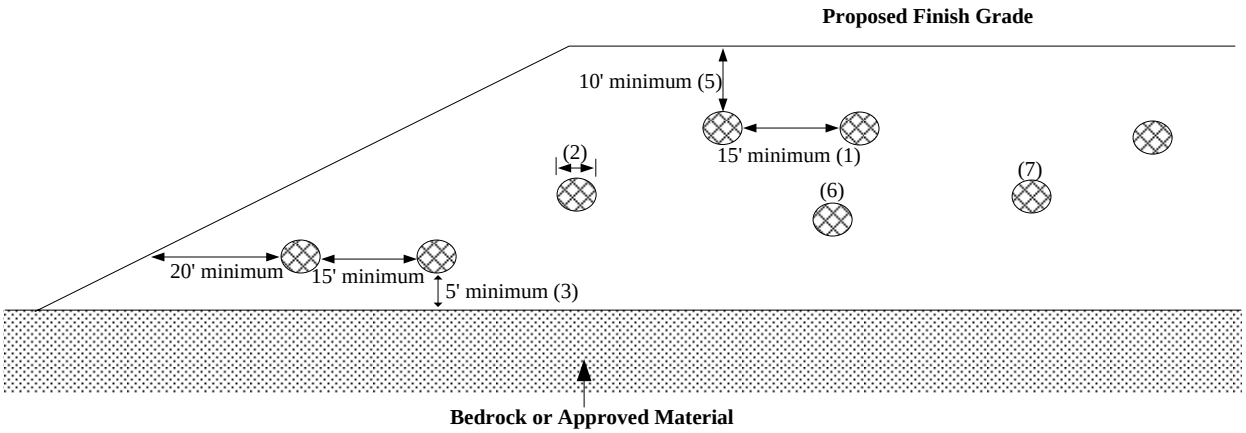
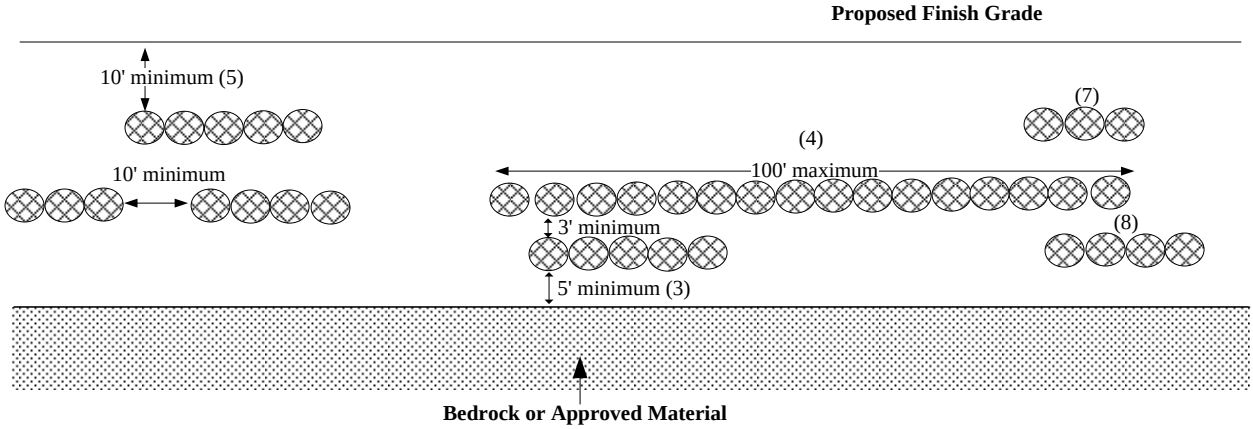
FIGURE K

OVERSIZE ROCK DISPOSAL

View Normal to Slope Face

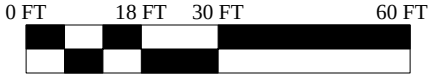


View Parallel to Slope Face



Note:
(1) One Equipment width or a minimum of 15 feet.
(2) Height and width may vary depending on rock size and type of equipment used. Length of windrow shall be no greater than 100 feet maximum.
(3) If approved by the soils engineer and/or engineering geologist.
(4) Orientation of windrows may vary but shall be as recommended by the soils engineer and/or engineering geologist. Unless recommended staggering of windrows is not necessary.
(5) Areas shall be cleared for utility trenches, foundations, and swimming pools.
(6) Voids in windrows shall be filled by flooding granular soil into place. Granular soil shall be any soil which has a unified soil classification system (Universal Building Code (UBC) 29-1). Designation of SM, SP, SW, GP, or GW.
(7) After fill between windrows is placed and compacted with the lift of fill covering windrow, windrow shall be proof rolled with a D-9 dozer or equivalent.
(8) Oversized rock is defined as larger than 12", and less than 4 feet in size.

Approximate Scale: 1" = 30'



Note: All distances are approximate

EARTHWORK AND GRADING GUIDELINES
OVERSIZE ROCK DISPOSAL

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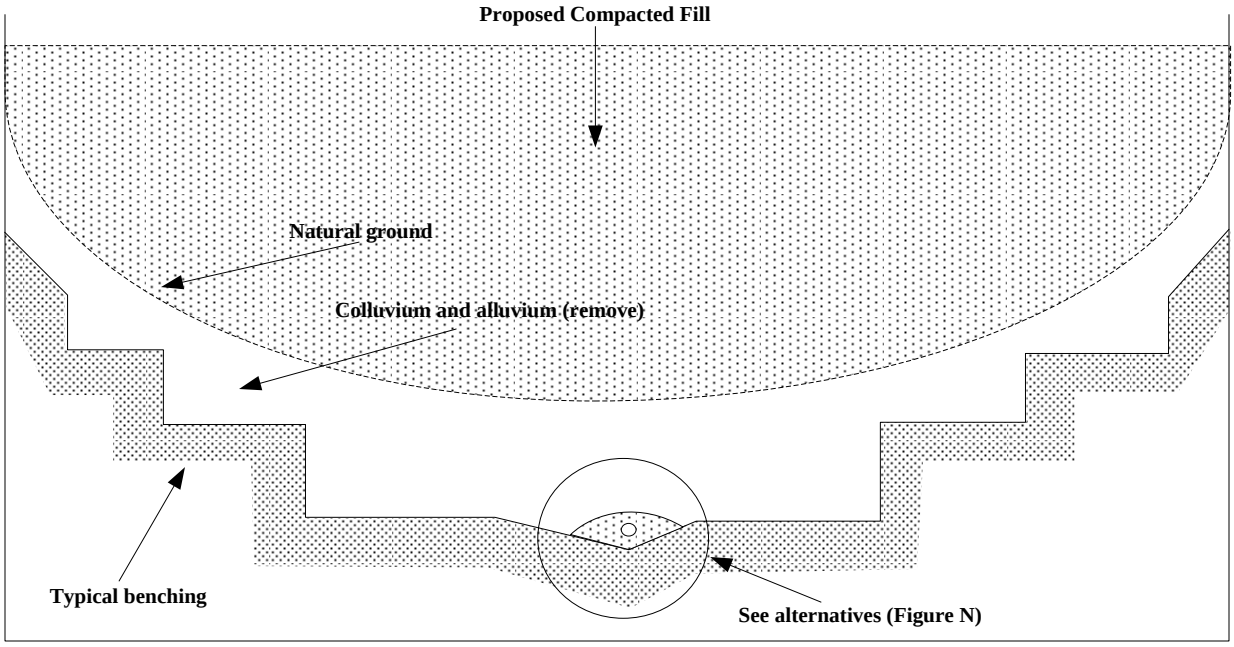
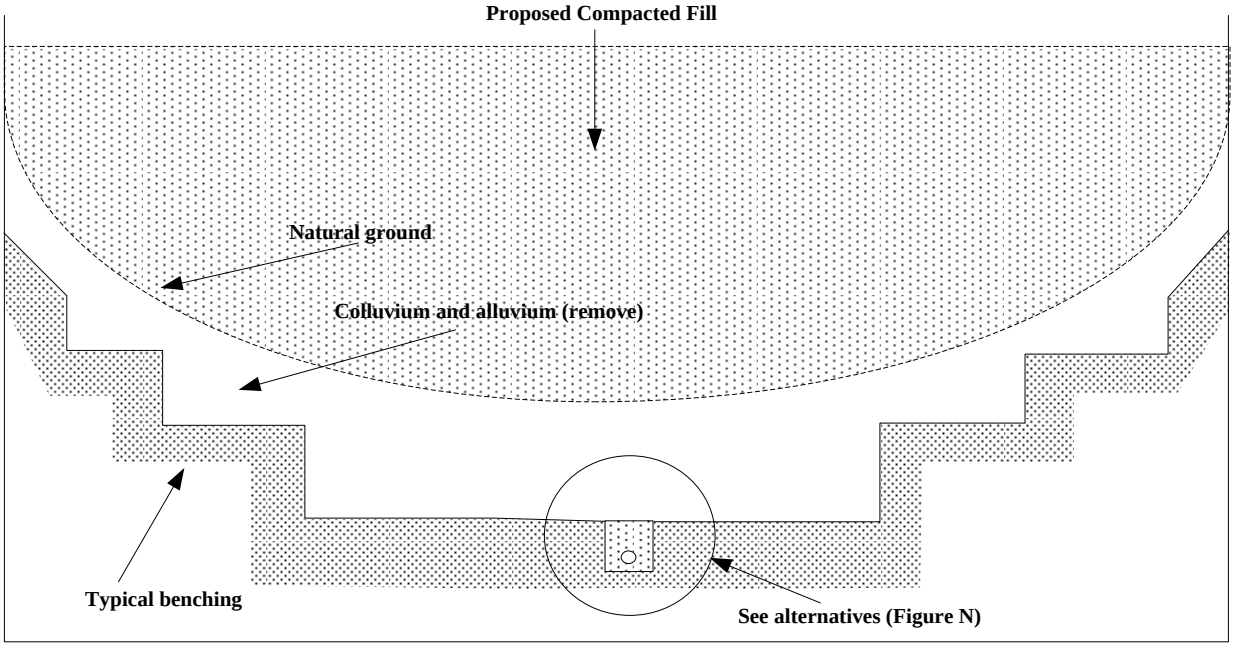
FIGURE L

CANYON SUBDRAIN DETAIL

Type A



Type B



Note: Alternatives, locations, and extent of subdrains should be determined by the soils engineer and/or engineering geologist during actual grading.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
CANYON SUBDRAIN DETAIL

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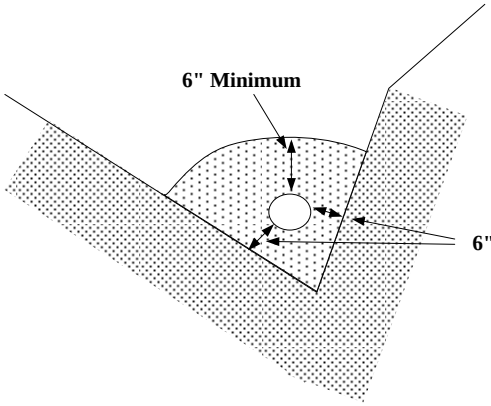
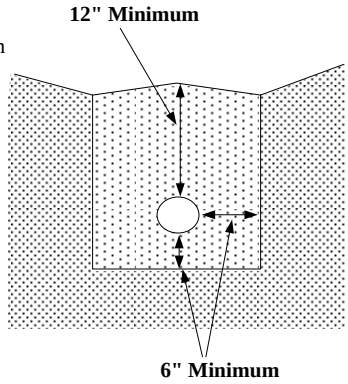
FIGURE M

CANYON SUBDRAIN ALTERNATE DETAILS

Alternate 1: Perforated Pipe and Filter Material



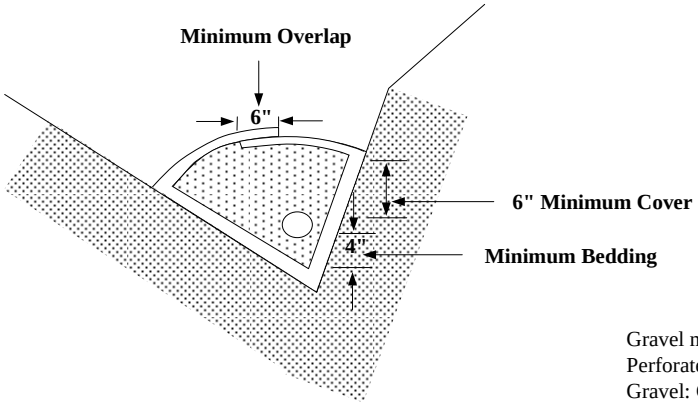
Filter material: Minimum volume of 9 feet^3/linear foot.
6" diameter ABS or PVC pipe or approved substitute with minimum 8 (¼" diameter) perforations per linear foot in bottom half of pipe.
ASTM D 2751, SDR 35 or ASTM D 1527, Schedule 40.
ASTM D 3034, SDR 35 or ASTM D 1785, Schedule 40.
For continuous run in excess of 500 feet use 8" diameter pipe.

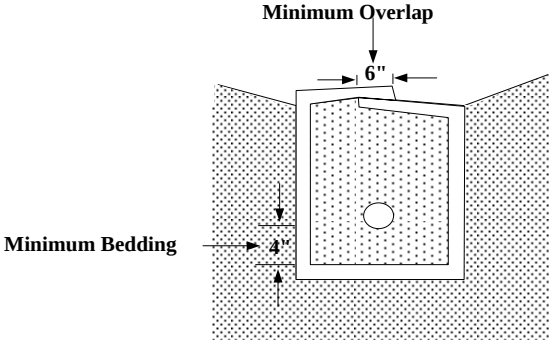


Filter Material

Sieve Size	Percent Passing
1"	100
¾"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

Alternate 2: Perforated Pipe, Gravel and Filter Fabric





Gravel material 9 feet^3/linear foot.
Perforated pipe: see alternate 1.
Gravel: Clean ¾" rock or approved substitute.
Filter Fabric: Mirafi 140 or approved substitute.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
CANYON SUBDRAIN ALTERNATE DETAILS

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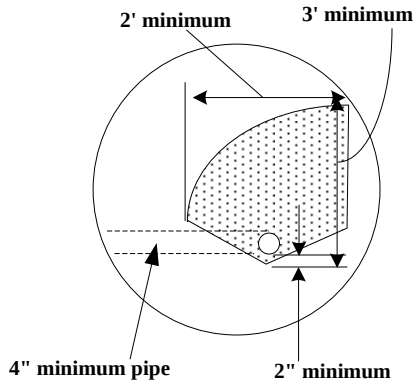
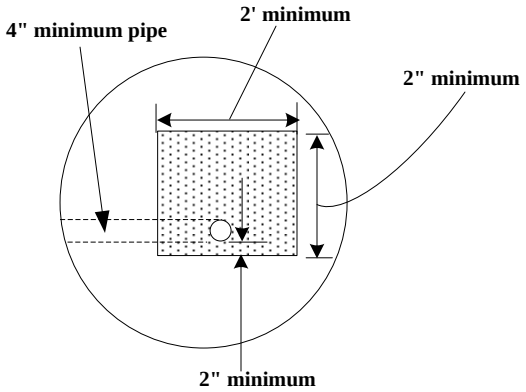
FIGURE N

TYPICAL STABILIZATION BUTTRESS SUBDRAIN DETAIL





Filter Material: Minimum of 5 ft^3/linear foot of pipe or 4 ft^3/linear foot of pipe when placed in square cut trench.

Alternative In Lieu Of Filter Material: Gravel may be encased in approved filter fabric. Filter fabric shall be mirafi 140 or equivalent. Filter fabric shall be lapped a minimum of 12" on all joints.

Minimum 4" Diameter Pipe: ABS-ASTM D-2751, SDR 35 or ASTM D-1527 schedule 40 PVC-ASTM D-3034, SDR 35 or ASTM D-1785 schedule 40 with a crushing strength of 1,000 pounds minimum, and a minimum of 8 uniformly spaced perforations per foot of pipe installed with perforations at bottom of pipe. Provide cap at upstream end of pipe. Slope at 2% to outlet pipe. Outlet pipe shall be connected to the subdrain pipe with tee or elbow.

Note: (1) Trench for outlet pipes shall be backfilled with onsite soil.
(2) Backdrains and lateral drains shall be located at the elevation of every bench drain. First drain shall be located at the elevation just above the lower lot grade. Additional drains may be required at the discretion of the soils engineer and/or engineering geologist.

Filter Material – Shall be of the following specification or an approved equivalent:

Filter Material

Sieve Size	Percent Passing
1"	100
¾"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

Gravel - Shall be of the following specification or an approved equivalent:

Filter Material

Sieve Size	Percent Passing
1½"	100
No. 4	50
No. 200	8

Sand equivalent: Minimum of 50

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
TYPICAL STABILIZATION BUTTRESS SUBDRAIN DETAIL

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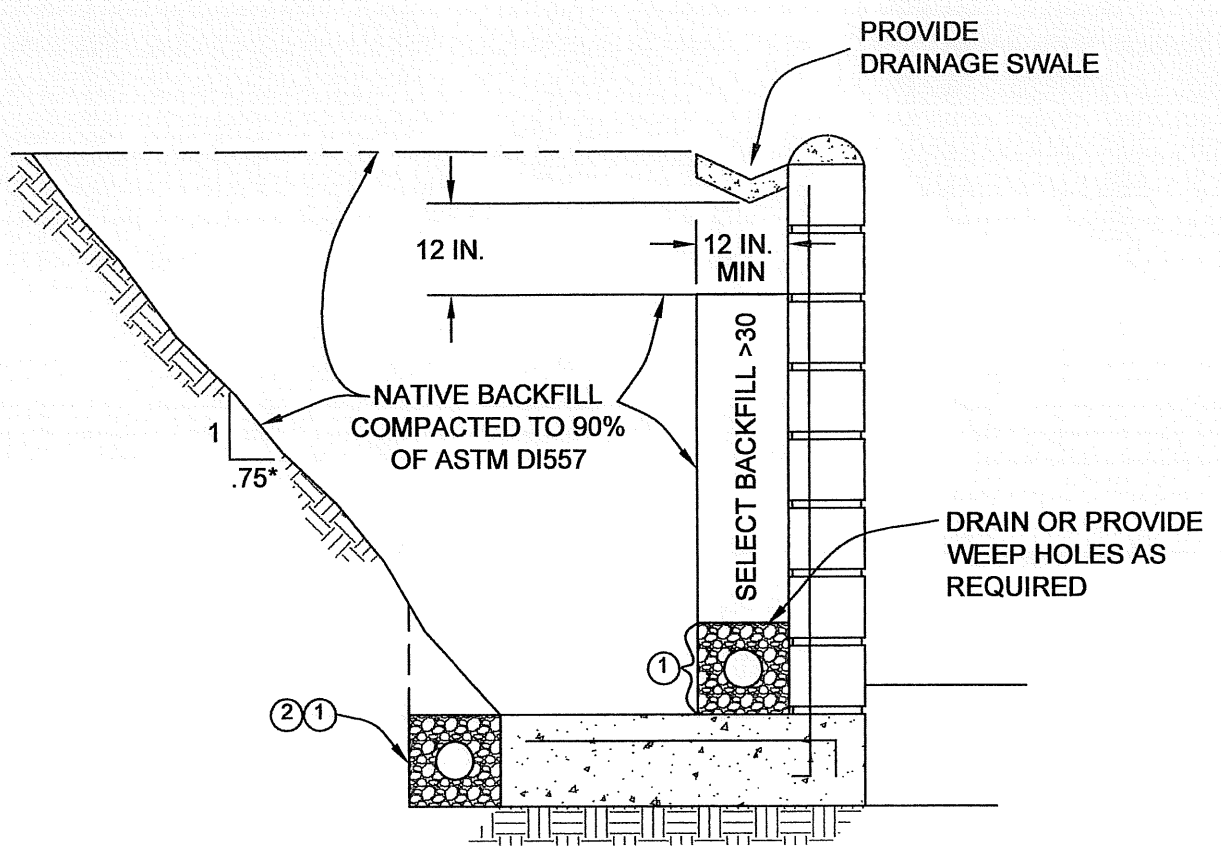
FIGURE O



* OR AS REQUIRED FOR SAFETY

NOTES

(1) 4-INCH PERFORATED PVC SCHEDULE 40 OR APPROVED ALTERNATE. PLACE PERFORATION DOWN AND SURROUND WITH A MINIMUM OF 1 CUBIC FOOT PER LINEAL FOOT (1 FT. /FT.) OF 3/4 INCH ROCK OR APPROVED ALTERNATE AND WRAPPED IN FILTER FABRIC.

(2) PLACE DRAIN AS SHOWN WHERE MOISTURE MIGRATION THROUGH THE WALL IS UNDESIRABLE.

NOTE: FIGURE NOT TO SCALE

EARTHWORK & GRADING GUIDELINES

TYPICAL RETAINING WALL BACKFILL

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FIGURE P