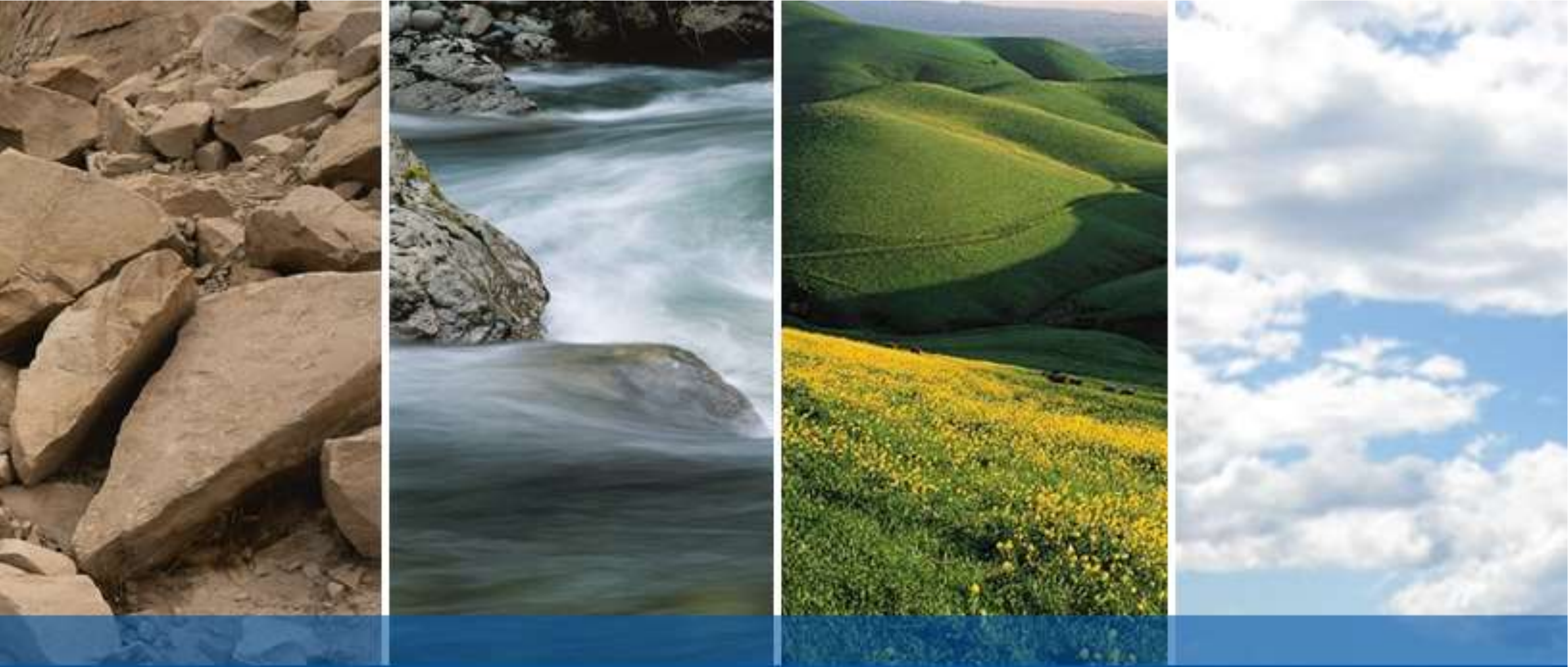

DIXON 257

DIXON, CALIFORNIA

GEOTECHNICAL EXPLORATION

SUBMITTED TO
Mr. Brad Slinkard
Land Acquisition & Entitlement Manager
MLC Holdings, Inc.
2603 Camino Ramon, Suite 140
San Ramon, CA 94583

PREPARED BY
ENGEO Incorporated

February 4, 2022

PROJECT NO.
19589.000.001

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GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES
COASTAL/MARINE GEOTECHNICS

Project No.
19589.000.001

February 4, 2022

Mr. Brad Slinkard
Land Acquisition & Entitlement Manager
MLC Holdings, Inc.
2603 Camino Ramon, Suite 140
San Ramon, CA 94583

Subject: Dixon 257
Dixon, California

GEOTECHNICAL EXPLORATION

Dear Mr. Slinkard:

ENGEO prepared this geotechnical report for MLC Holdings, Inc. as outlined in our agreement dated December 8, 2021. We characterized the subsurface conditions at the site to provide the enclosed geotechnical recommendations for design.

From a geotechnical engineering viewpoint, in our opinion, the site is suitable for the proposed development, provided the geotechnical recommendations in this report are properly incorporated into the design plans and specifications. The primary geotechnical concerns that could affect development on the site are expansive soil and existing fill.

Please let us know when working drawings are nearing completion, and we will be glad to discuss these additional services with you.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

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No. 3197
GEOTECHNICAL
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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

We prepared this geotechnical report for design of Dixon 257 project in Dixon, California. As outlined in our agreement dated December 8, 2021, you authorized us to conduct the following scope of services.

- Service plan development
- Subsurface field exploration
- Soil laboratory testing
- Data analysis and conclusions
- Report preparation

For our use, we received the following.

- Morton & Pitalo, Inc.; 2021, Dixon 257 Land Use Concept, Alternative 4-A; March 1, 2021.
- Morton & Pitalo, Inc.; 2021, Dixon Area Map; June 21, 2021.
- Morton & Pitalo, Inc.; 2022, Dixon 257, 905 Lots [Lotting Exhibit]; January 10, 2022

This report was prepared for the exclusive use of our client and their consultants for design of this project. If any changes are made in the character, design or layout of the development, we must be contacted to review the conclusions and recommendations contained in this report to evaluate whether modifications are recommended. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

1.2 PROJECT LOCATION

Figure 1 displays a Site Vicinity Map. The approximately 200-acre site consists of several parcels located on the west side of Pedrick Road between Interstate 80 and Vaughn Road in Dixon, California. Figure 2 shows site boundaries, proposed building and pavement areas, our exploratory locations, and pertinent site features. Adjacent properties include agricultural land to the west, north, northeast, and southwest, and industrial properties to the east and southeast.

1.3 PROJECT DESCRIPTION

The approximately 200-acre site is to be developed for over 900 single-family residential lots, three parks, paved streets, and associated underground utilities. When we developed our scope of services for this project, the project included approximately 50 additional acres immediately to the north. We understand that this area is no longer included as part of the project. The site boundary shown on Figure 2 has been adjusted accordingly.

Although architectural or structural plans were not available at the time of preparing this proposal, we assume that the single-family houses will be one- to two-story wood-frame buildings. We understand that the site plan by Morton & Pitalo (2022) is preliminary and that the exact configuration and number of lots and streets may change prior to development.

Grading plans were also not available at the time of preparing this proposal; however, based on the relatively flat nature of the site, we assume that cuts and fills for mass grading will be minimal, likely less than approximately 5 feet in thickness.

2.0 FINDINGS

2.1 FIELD EXPLORATION

Our field exploration included drilling 11 borings and advancing 3 Cone Penetration Test (CPT) soundings at various locations on the site. We performed our field exploration on January 3 and 4, 2022. The location and elevations of our explorations were approximated using Google Earth Pro and a GPS-enabled smartphone. We permitted and backfilled the explorations in accordance with the requirements of Solano County. A summary of the boring and CPT field exploration is presented below.

2.1.1 Borings

We observed the drilling of 11 borings at the locations shown on the Site Plan, Figure 2. An ENGEO representative observed the drilling and logged the subsurface conditions at each location. We retained a track-mounted Deidrich D-50 drill rig and crew to advance the borings using a 4-inch-diameter solid-flight auger. The borings were advanced to depths ranging from 11½ to 21½ feet below existing grade.

We obtained bulk soil samples from drill cuttings and retrieved disturbed samples at various intervals in the borings using both standard penetration test (SPT) (2-inch outside diameter) and modified California (3-inch outside diameter) split-spoon samplers. The blow counts were obtained by dropping a 140-pound hammer through a 30-inch free fall. The sampler was driven 18 inches and the number of blows was recorded for each 6 inches of penetration. Unless otherwise indicated, the blows per foot recorded on the boring log represent the accumulated number of blows to drive the last 1 foot of penetration; the blow counts have not been converted using any correction factors. When sampler driving was difficult, penetration was recorded as the number of blows divided by inches penetrated.

The logs are included in Appendix A and depict the subsurface conditions at the exploration locations and during the time of exploration; however, subsurface conditions may vary with time.

2.1.2 Cone Penetration Tests

We retained a track-mounted CPT rig to push the cone penetrometer at three locations to a maximum depth of about 50 feet. The CPT has a 20-ton compression-type cone with a 15-square-centimeter (cm^2) base area, an apex angle of 60 degrees, and a friction sleeve with a surface area of 225 cm^2. The cone, connected with a series of rods, was pushed into the ground at a near constant rate. Cone readings were taken at approximately 5-cm intervals with a penetration rate of 2 cm per second in accordance with ASTM D5778. Measurements include the tip resistance to penetration of the cone (Qc), the resistance of the surface sleeve (Fs), and pore pressure (U) (Robertson and Campanella, 1988). CPT logs are presented in Appendix C.

2.2 SITE BACKGROUND

2.2.1 Historical Map and Photograph Review

We reviewed the historical USGS topographic maps and aerial photographs for the years summarized in Table 2.2.1-1 below to identify former site features relevant to this report.

TABLE 2.2.1-1: Historical Maps and Photographs Summary

HISTORIC MAP/PHOTOGRAPH	YEARS
Topographic Maps (USGS)	1908, 1916, 1952, 1953, 1968, 1975, 1981, 2012
Aerial Photographs	1937, 1952, 1968, 1974, 1984, 1993, 2006, 2009, 2012, 2016

The notable site features are described below.

<u>1937 Photo</u>

- The site appeared to be primary used for agricultural purposes
- Structures were visible on the northwest portion of the site
- A northwest-southeast oriented drainage feature was visible on the southern portion of the site. On the north side of the drainage, there was a topographic depression. The depression appeared to contain some water. The drainage and depression were also shown on the 1916 USGS topographic map for the Dixon Quadrangle.
- A drainage was visible across the central portion of the eastern site boundary. The drainage was generally east-west oriented and terminated near the center of the site.

<u>1952 Photo</u>

- The geomorphic expression of the drainages identified in the 1937 photo were faint and appeared to have been graded over.
- The topographic depression appeared to be filled, although it was shown on the 1952 USGS topographic map for the Dixon Quadrangle.

<u>1968 Photo</u>

- The drainages and depression were completely filled and were no longer visible.
- Several of the structures formerly located on the northwest portion of the site were no longer visible.

<u>1974 Photo</u>

- Several structures and numerous vehicles and trailers were visible on a parcel on the northwest portion of the site. An excavation was visible on the western side of this parcel (this excavation was identified as the former Mistler Farm landfill by others).

<u>2006 Photo</u>

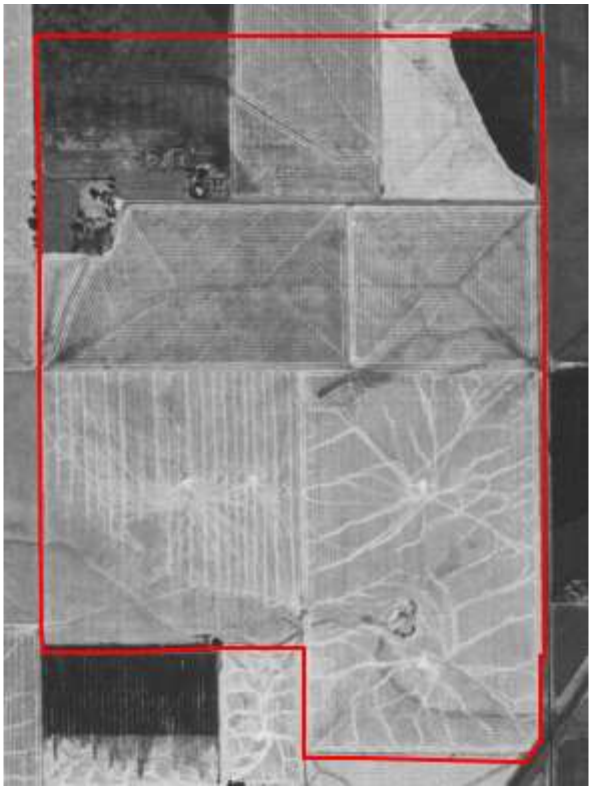
- The Mistler Farm landfill excavation appeared to be filled and only one structure was visible on the parcel.

<u>2012 Photo</u>

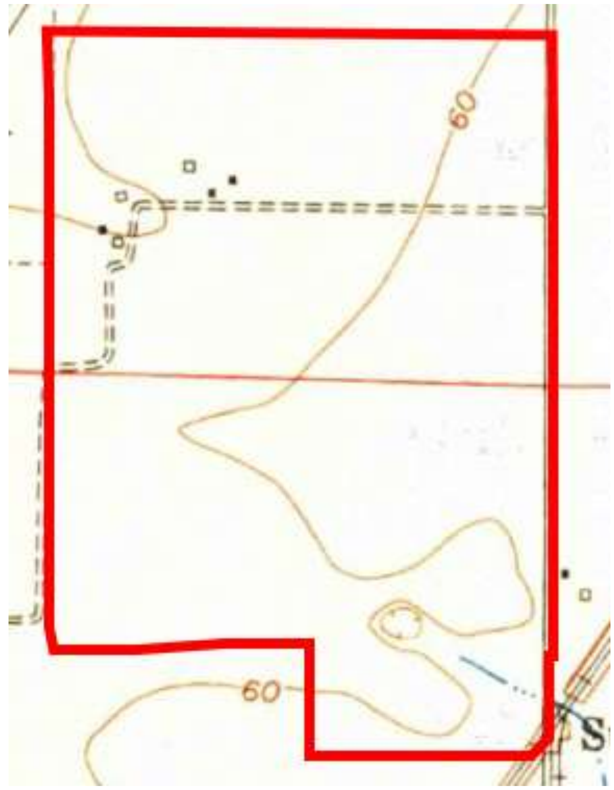
- No structures were visible on the site.

Exhibit 2.2.1-1 below shows excerpts from the 1937 aerial photograph and 1952 USGS topographic map showing the former drainages and topographic depression. The locations of these former features are also shown on our Site Plan, Figure 2.

EXHIBIT 2.2.1-1: Former Drainages and Topographic Depression on Historical Map and Photograph



1937 Aerial Photograph



1952 USGS Topographic Map

2.2.2 Former Landfill

As part of our Phase I Environmental Site Assessment being performed concurrently with this geotechnical exploration, we identified a former landfill at the site. Based on the *Abandon Mistler Farm Landfill Investigation* by Brusca Associates, Inc., the former landfill was located on the west side of the former farm facility on the Mistler Farm property (APN 111-040-010). The investigation estimates that the landfill was about 160 feet long, about 40 feet wide, and about 14 feet deep. The landfill contained waste and debris mixed with soil (Brusca, 2020). The approximate location of the landfill is shown on the Site Plan, Figure 2.

Based on conversations with you and Ramcon Engineering and Environmental Contracting, we understand that remediation of the landfill is currently underway.

2.2.3 Former Diesel Remediation Excavation

A former 10,000-gallon diesel above-ground storage tank was located on the south-central portion of the Mistler Farm property. Due to the presence of diesel-impacted soil near the tank, soil remediation was performed. According to the *Site Remedial Action Report* by Conestoga-Rover & Associates (2007), in 2006 approximately 926 cubic yards of diesel-impacted soil was excavated and removed from the site. The excavation was in the location of the former tank and concrete pad. In plan view, the excavation was shown as an irregular shape measuring approximately 1,500 square feet. The excavation is shown to have extended approximately 20 feet deep below grade to approximately Elevation 43 feet. The lower portion of the excavation was reportedly backfilled with imported pea gravel and was then capped with onsite soil. The fill was purportedly compacted in 3-foot-thick lifts (CRA, 2007). No compaction testing data was available for the backfilling operation. Groundwater monitoring wells were installed in the vicinity of the former tank.

The approximate location of the former diesel remediation excavation is shown on the Site Plan, Figure 2.

2.3 GEOLOGY

The site is located in the Great Valley geomorphic province. The Great Valley is an elongate, northwest-trending structural trough bound by the Coast Range on the west and the Sierra Nevada on the east. The northern portion of the Great Valley is commonly referred to as the Sacramento Valley. The Sacramento Valley has been, and is presently being filled with alluvium transported by powerful river systems originating in the surrounding mountains. These sediments of various ages underlie the site and are estimated to be several thousand feet thick at the site (Helley and Harwood, 1987). The origin and character of these deposits is related to the paleo-climactic conditions and the nature of the ancient depositional environment.

Surface deposits at the site are mapped as Holocene Alluvium (Qa) and Holocene Basin Deposits (Qb) (Helley and Harwood, 1985) as shown in Figure 3. Holocene alluvium is described as young unweathered gravel, sand, and silt deposited by present-day steam and river systems. The Basin Deposits are derived from the same sources as modern alluvium but are predominantly dark-gray to black fine-grained silt and clay. Typical of the alluvial sequence in Sacramento Valley, underlying the Holocene deposits are older Pleistocene deposits. Pleistocene Modesto Formation (Qml) (11,700 to 42,000 years old) is mapped in small areas surrounding the site and is likely below the Holocene deposits. These Pleistocene alluvial formations consist of gravel, sand, silt, and clay that generally show evidence of aging such as increased density, weathering, and cementation (Helley and Harwood, 1985).

2.4 SEISMICITY

The Northern California region contains numerous active earthquake faults. An active fault is defined by the California Geologic Survey as one that has had surface displacement within Holocene time (about the last 11,700 years) (CGS, 2018). The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults is believed to exist within the site.

Although fault rupture is not anticipated, an earthquake in the region could generate ground shaking at the site. Numerous small earthquakes occur every year in the Northern California region, and larger earthquakes have been recorded and can be expected to occur in the future. The Uniform California Earthquake Rupture Forecast (UCERF3) estimates the 30-year probability for a magnitude 6.7 or greater earthquake in Northern California Region at approximately 95 percent (Field et al., 2015).

The table below summarizes the distance to the fault rupture surface (R_{rup}) and the associated moment magnitude for nearby seismic sources used for the National Seismic Hazard Maps, which are incorporated into the California Building Code (CBC). We obtained the data using the

USGS Unified Hazard Tool (Dynamic Conterminous U.S. 2014 (update) (v4.2.0)) and deaggregated the hazard at the peak ground acceleration (PGA) for 2,475-year return period, and Site Class D. These results represent fault sources contributing at least one percent to the seismic hazard at the site; gridded or areal sources are not presented.

TABLE 2.4-1: Nearby Seismic Sources (Latitude: 38.4768 Longitude: -121.8082)

SOURCE	R_{RUP} (KM)	R_{RUP} (MILES)	MOMENT MAGNITUDE M_W
Great Valley 06 (Midland) alt1 [0]	7	4	6.75
Great Valley 04a Trout Creek [2]	21	13	7.07
Hunting Creek – Berryessa [0]	37	23	7.20
Great Valley 04b Gordon Valley [2]	23	14	6.46
Great Valley 03a Dunnigan Hills [0]	18	11	6.18

Source: USGS Unified Hazard Tool (USGS, n.d.)

2.5 SURFACE CONDITIONS

While no topographic information was provided, the site is relatively flat with surface grades ranging from approximately Elevation 55 to 65 feet (WGS84), according to Google Earth. The site slopes gently downward towards the southeast.

We observed the following site features during our site visits to mark for Underground Service Alert (USA) and to perform our field explorations.

- The ground surface was wet from recent rain events.
- The majority of the site was split up in to multiple agricultural fields with intervening farm roads, primarily oriented east-west and north-south.
- The former Mistler Farm property was partially fenced off and there were trucks and construction equipment on the property. The landfill excavation was open and there was a large stockpile of soil/debris near the excavation.
- Most of the farm roads between and on the perimeter of the agricultural fields were slightly higher in elevation than the fields.
- Irrigation/drainage ditches were located along the perimeter of several of the fields.
- A paved road was the primary access to the site from Pedrick Road. The road extended west toward the former Mistler Farm property.
- An irrigation well and pump were located on the southwestern portion of the site.

Below are several photographs of the surface conditions taken at the time of our field exploration.

PHOTO 2.5-1: Agricultural Field (typical)

PHOTO 2.5-2: Irrigation Well and Pump

PHOTO 2.5-3: Mistler Farm Landfill Excavation

PHOTO 2.5-4: Mistler Farm Stockpile

Please refer to the Site Plan, Figure 2, for more information on site features.

2.6 SUBSURFACE CONDITIONS

All of our borings encountered clay at the ground surface, extending to between 3 and over 20 feet deep. The clay was generally very stiff to hard and ranged from medium to high plasticity, except at Boring 1-B5, where approximately 3 feet of low plasticity clay fill was encountered. Based on laboratory testing summarized in Table 2.6-1, the near-surface clay has low to very high expansion potential. Borings 1-B2, 1-B6, 1-B7, 1-B8, 1-B9, 1-B10, 1-B11 encountered clay to their terminal depths. The other borings encountered coarse-grained soil below the upper clay layer and intermediate clay layers. The coarse-grained soil that we encountered was generally medium dense to dense sand and gravel with varying amounts of fines (material finer than the #200 sieve).

The CPTs encountered similar subsurface conditions as the borings. CPTs 1-CPT1 and 1-CPT2 encountered approximately 15 to 20 feet of clay, underlain by a 15 to 20 foot thick layer of sand and gravel, underlain by more clay to a depth of about 50 feet. CPT 1-CPT3 encountered the sand/gravel layer at a depth of about 25 feet and was terminated due to refusal on dense sand/gravel at a depth of about 32 feet. The clay above the sand/gravel layer in 1-CPT3 was relatively soft between about 15 to 20 feet. All of the other clay that was encountered was generally stiff.

TABLE 2.6-1: Summary of Expansion Potential Based on PI and EI Results

BORING ID	SAMPLE DEPTH (FEET)	PI	EI	EXPANSION POTENTIAL
1-B1	1.5	35	-	High
1-B1	2	-	104	High
1-B2	1.5	31	-	High
1-B3	2	47	-	Very High
1-B4	1.5	-	77	Medium
1-B5	2	13	-	Low
1-B6	2	26	-	High
1-B7	1.5	23	71	Medium
1-B8	1.5	42	-	Very High
1-B8	2	-	108	High
1-B10	2	26	-	High
1-B11	1.5	-	62	Medium

Note: PI = Plasticity Index; EI = Expansion Index

Consult the Site Plan and exploration logs for specific subsurface conditions at each location. We include our exploration logs in Appendix A. The logs contain the soil type, color, consistency, and visual classification in general accordance with the Unified Soil Classification System. The logs graphically depict the subsurface conditions encountered at the time of the exploration.

2.7 GROUNDWATER CONDITIONS

We did not observe static or perched groundwater in our borings and we were unable to measure groundwater in the CPTs due to hole collapse.

A cluster of four monitoring wells was identified on the former Mistler Farm on the State Water Resources Control Board GeoTracker website. According to the monitoring well logs, groundwater was measured at a depth of 19½ to 20 feet in March 2007.

We also reviewed the Department of Water Resources (DWR) On-line Water Data Library for nearby well data. Groundwater data from a well located on the eastern side of the site indicated the depth to groundwater ranged from approximately 35 to 82 feet between 2001 and 2018. Another well, just to the east of the site showed similar groundwater conditions, with depth to groundwater ranging from approximately 21 to 106 feet between 1984 and 2018.

Fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, and other factors not evident at the time measurements were made.

2.8 LABORATORY TESTING

We performed laboratory tests on selected soil samples to evaluate their engineering properties. For this project, we performed moisture content, sieve, dry density, unconfined compression, plasticity index, expansion index, hydrometer, resistance value, and soil corrosion potential testing. Moisture content, plasticity index, fines content, and dry density results are recorded on the boring logs in Appendix A. All individual laboratory test reports are included in Appendix B.

2.9 LIQUEFACTION ANALYSES

Liquefaction is a secondary seismic hazard that can result in reduced foundation support and ground settlement from an earthquake. We encountered medium dense saturated sand in our borings and CPTs; these deposits could be susceptible to liquefaction.

We evaluated liquefaction potential using the data from our CPTs; the CPT data is continuous and generally more reliable in estimating liquefaction-induced settlement than drilled borings. Our analyses incorporated the 2019 CBC Site Class D peak ground acceleration (PGA) of 0.48g, an earthquake moment magnitude of 6.5, and groundwater depth of 15 feet. The earthquake moment magnitude was selected as the mean over all seismic sources developed using the USGS Unified Hazard Tool, deaggregated at the PGA for Site Class D for a 2,475-year return period event (USGS, n.d.).

For our liquefaction analysis, we utilized the commercially available computer program CLiq (v.3.3.2.9) and the methodologies by Youd et al. (2001) and Robertson (2009). Our analyses indicated a potentially liquefiable layer between approximately 21 to 22 feet at 1-CPT1, potentially liquefiable layers between approximately 19 to 24 feet and 28 to 30 feet at 1-CPT2, and a potentially liquefiable layer between approximately 20½ and 21 feet at 1-CPT3. The theoretical liquefaction-induced ground settlement calculated by the Youd et al. (2001) and Robertson (2009) methods is up to about a ¼-inch at 1-CPT1 and 1-CPT3, and about 2¼ inches at 1-CPT2.

Based on the findings published by Ishihara in 1985 and Youd and Garris in 1995, a sufficiently thick layer of non-liquefiable soil that overlies liquefiable layers can provide a capping effect, which has been observed to result in less ground surface deformation than indicated by theoretical liquefaction analyses. At our exploration locations where potentially liquefiable sand layers up to approximately 5 feet thick were encountered, there was at least 19 feet of overlying non-liquefiable soil. Based on the layer thicknesses, the Ishihara charts predict a nonoccurrence of surface effects (ground settlement) from liquefaction. In our opinion and based on our engineering judgment, the liquefiable layers are too deep to cause bearing capacity failure for shallow foundations and the capping effects will likely reduce the theoretical settlements to less than ½ inch.

3.0 CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the site is suitable for the proposed development, provided the geotechnical recommendations in this report are properly incorporated into the design plans and specifications. The primary geotechnical concerns that could affect development on the site are expansive soil and existing fill. We summarize our conclusions below.

3.1 EXPANSIVE SOIL

We observed potentially expansive clay near the surface of the site in all of our borings. Our laboratory testing indicates that this soil exhibits low to very high shrink/swell potential with variations in moisture content.

Expansive soil changes in volume with changes in moisture and can shrink or swell and cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. To reduce the potential for damage to the planned structures, we recommend that buildings be supported on properly designed post-tensioned (PT) mat foundations bearing on competent native soil or compacted fill. In addition, to reduce expansion potential of compacted fills, we recommend that clays on site be compacted at a slightly lower relative compaction at a moisture content well over optimum. PT mat foundation recommendations are presented in Section 6 of this report.

Expansive soil generally provides poor subgrade support for roadways, as indicated by the low R-value laboratory test results included in Appendix B. A low R-value results in thicker pavement structural sections than a higher R-value. If desired to reduce the pavement section thickness, the roadway subgrade can be lime-treated to increase the R-value for design. We provide lime treatment recommendations in Section 5.7 and provide pavement design options in Section 9.1.

3.2 EXISTING FILL

Based on our boring data and research of the site history, summarized in Section 2.2, we identified areas of the site that are known or are likely underlain by non-engineered fill. Non-engineered fills can undergo excessive settlement, especially under new fill or building loads. Without proper documentation of existing fill placed on the site, we recommend removal and recompaction of the existing fill, as recommended in Section 5.1.

At the former Mistler Farm facility, there was a former diesel remediation excavation that was backfilled. There were no available records documenting the compaction of the backfill. The documents we reviewed indicated that the excavation was approximately 20 feet deep. We show the approximate location of the diesel remediation excavation on the Site Plan, Figure 2.

Boring 1-B5, located on a farm road on the southern side of the Mistler Farm facility, encountered approximately 3 feet of fill. This farm road and the other primary east-west farm roads that cross the site are higher in elevation than the surrounding fields and are likely composed of fill. We anticipate the fill to be up to 3 feet thick or more for the two primary east-west roads that cross the site.

We identified two former drainages and a former depression, shown on the Site Plan, Figure 2. The drainages and depression were likely filled to level the fields for agricultural use. We estimate that the drainages were likely less than 5 feet deep and the depression could be up to 20 feet deep, based on the historical map and photograph review summarized in Section 2.2.1. Additional subsurface exploration, such as test pits, can be performed in these areas if desired to obtain more specific fill depths.

The former Mistler Farm landfill was in the process of being excavated at the time of our field exploration. This landfill previously contained refuse and will need to be backfilled. The former landfill was estimated to be approximately 14 feet deep. We show the approximate location of the landfill excavation on the Site Plan, Figure 2.

3.3 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. Common secondary seismic hazards include ground shaking, liquefaction, and ground lurching. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift, lateral spreading, landslides, tsunamis, flooding or seiches is considered low to negligible at the site.

3.3.1 Ground Rupture

Since there are no known active faults crossing the property and the site is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the subject property.

3.3.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, structures should be designed using sound engineering judgment and the 2019 California Building Code (CBC) requirements, as a minimum. Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead-and-live loads. The code-prescribed lateral forces are generally considered to be substantially smaller than the comparable forces that would be associated with a major earthquake. Therefore, structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1999).

3.3.3 Liquefaction

As discussed in Section 2.9, we performed engineering analyses to evaluate the potential for liquefaction at the site. Based on our analyses and engineering judgment, in our opinion the liquefiable layers are too deep to cause bearing capacity failure for shallow foundations and the capping effects of the upper non-liquefiable layers will likely reduce the theoretical settlements to less ½ inch. We provide foundation recommendations in Section 6.0 that are intended to mitigate liquefaction-induced settlements.

3.3.4 Ground Lurching

Ground lurching is a result of the rolling motion imparted to the ground surface during energy released by an earthquake. Such rolling motion can cause ground cracks to form in weaker soil. The potential for the formation of these cracks is considered greater at contacts between deep alluvium and bedrock. Such an occurrence is possible at the site as in other locations in the region, but based on the site location, it is our opinion that the offset is expected to be minor. We provide recommendations for foundation and pavement design in this report that are intended to reduce the potential for adverse impacts from lurch cracking.

3.4 2019 CBC SEISMIC DESIGN PARAMETERS

The 2019 CBC utilizes design criteria set forth in the 2016 ASCE/SEI 7 Standard. Based on the subsurface conditions encountered, we characterized the site as Site Class D in accordance with the 2019 CBC. We provide the 2019 CBC seismic design parameters in Table 3.4-1 below, which include design spectral response acceleration parameters based on the mapped Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral response acceleration parameters.

TABLE 3.4-1: 2019 CBC Seismic Design Parameters, Latitude: 34.4768 **Longitude:** -121.8082

PARAMETER	VALUE
Site Class	D
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	0.948
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.357
Site Coefficient, F_A	1.121
Site Coefficient, F_V	Null[1]
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	1.063
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	Null[1]
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	0.708
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	Null[1]
Mapped MCE Geometric Mean (MCE_G) Peak Ground Acceleration, PGA (g)	0.397
Site Coefficient, F_{PGA}	1.203
MCE_G Peak Ground Acceleration adjusted for Site Class effects, PGA_M (g)	0.478

[1]A site-specific seismic hazard analysis is required to obtain these values unless the exception discussed in ASCE 7-16 Section 11.4.8 is met. Under this exception, refer to ASCE 7-16 Table 11.4-2 to obtain the value for F_v for site Class D.

3.5 SOIL CORROSION POTENTIAL

As part of this study, we obtained representative soil samples and submitted them to an analytical lab for determination of pH, minimum resistivity, sulfate content, and chloride content. The results are included in Appendix B and summarized in the table below.

TABLE 3.5-1: Corrosivity Test Results

SAMPLE LOCATION	DEPTH (FEET)	pH[1]	MINIMUM RESISTIVITY[1] (OHMS-CM)	CHLORIDE[2] (PPM)	SULFATE[3] (PPM)
1-B2	2	6.17	750	19.4	58.4
1-B7	2	6.41	1,370	3.2	17.9
1-B9	3.5	6.87	1,230	2.9	15.1
1-B11	4	6.82	880	3.8	26.5

[1] CA DOT Test 643; [2] CA DOT Test 422; [3] CA DOT Test 417

The 2019 CBC references the 2014 American Concrete Institute Manual, ACI 318-14, Section 19.3.1 for concrete durability requirements. ACI Table 19.3.1.1 provides the following exposure categories and classes, and ACI Table 19.3.2.1 provides requirements for concrete in contact with soil based upon the exposure class.

TABLE 3.5-2: ACI Table 19.3.1.1: Exposure Categories and Classes

CATEGORY	SEVERITY	CLASS	CONDITION
F Freezing and thawing	Not Applicable	F0	Concrete not exposed to freezing-and-thawing cycles
	Moderate	F1	Concrete exposed to freezing-and-thawing cycles and occasional exposure to moisture
	Severe	F2	Concrete exposed to freezing-and-thawing cycles and in continuous contact with moisture
	Very Severe	F3	Concrete exposed to freezing-and-thawing cycles and in continuous contact with moisture and exposed to deicing chemicals

CATEGORY	SEVERITY	CLASS	WATER- SOLUBLE SULFATE IN SOIL % BY WEIGHT*	DISSOLVED SULFATE IN WATER MG/KG (PPM)**
S Sulfate	Not applicable	S0	$SO_4 < 0.10$	$SO_4 < 150$
	Moderate	S1	$0.10 \leq SO_4 < 0.20$	$150 \leq SO_4 \leq 1,500$ seawater
	Severe	S2	$0.20 \leq SO_4 \leq 2.00$	$1,500 \leq SO_4 \leq 10,000$
	Very severe	S3	$SO_4 > 2.00$	$SO_4 > 10,000$
CATEGORY	**SEVERITY**	**CLASS**	**CONDITION**	
P Requiring low permeability	Not applicable	P0	In contact with water where low permeability is not required.	
	Required	P1	In contact with water where low permeability is required.	
C Corrosion protection of reinforcement	Not applicable	C0	Concrete dry or protected from moisture	
	Moderate	C1	Concrete exposed to moisture but not to external sources of chlorides	
	Severe	C2	Concrete exposed to moisture and an external source of chlorides from deicing chemicals, salt, brackish water, seawater, or spray from these sources	

In accordance with the criteria presented in the above table, the soil is categorized as F0 freeze-thaw class, S0 sulfate exposure class, P0 exposure class, and C1 corrosion class. Cement type, water-cement ratio, and concrete strength are not specified for these ranges.

Considering a 'Not Applicable' sulfate exposure, there is no requirement for cement type or water-cement ratio, however, a minimum concrete compressive strength of 2,500 psi is specified by the building code. For this sulfate range, we recommend Type II cement and a concrete mix design for foundations and building slabs-on-grade that incorporates a maximum water-cement ratio of 0.50. It should be noted, however, that the structural engineering design requirements for concrete may result in more stringent concrete specifications.

The resistivity measurements indicate the soil is considered severely to very severely corrosive, according to the National Association of Corrosion Engineers' interpretation of resistivity (Roberge, 2006).

If desired to investigate this further, we recommend a corrosion consultant be retained to evaluate if specific corrosion recommendations are advised for the project.

4.0 CONSTRUCTION MONITORING

Our experience and that of our profession clearly indicate that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to:

1. Review the final grading and foundation plans and specifications prior to construction to evaluate whether our recommendations have been implemented, and to provide additional or modified recommendations, as needed. This also allows us to check if any changes have occurred in the nature, design or location of the proposed improvements and provides the opportunity to prepare a written response with updated recommendations.

2. Perform construction monitoring to check the validity of the assumptions we made to prepare this report. Earthwork operations should be performed under the observation of our representative to check that the site is properly prepared, the selected fill materials are satisfactory, and that placement and compaction of the fills has been performed in accordance with our recommendations and the project specifications. Sufficient notification to us prior to earthwork is important.

If we are not retained to perform the services described above, then we are not responsible for any party's interpretation of our report (and subsequent addenda, letters, and verbal discussions).

5.0 EARTHWORK RECOMMENDATIONS

The relative compaction and optimum moisture content of soil and aggregate base referred to in this report are based on the most recent ASTM D1557 test method. Compacted soil is not acceptable if it is unstable. It should exhibit only minimal flexing or pumping, as observed by a representative of our firm.

As used in this report, the term "moisture condition" refers to adjusting the moisture content of the soil by either drying if too wet or adding water if too dry. We define "structural areas" in this report as any area sensitive to settlement of compacted soil. These areas include, but are not limited to building pads, sidewalks, pavement areas, and retaining walls.

We define "expansive" soil as soil with a PI greater than 12 and "low expansive" soil as soil having a PI of 12 or less.

As used in this report, relative compaction refers to the in-place dry unit weight of soil expressed as a percentage of the maximum dry unit weight of the same soil, as determined by the ASTM.

5.1 EXISTING FILL REMOVAL

Figure 2 displays the site feature that are known or are likely to contain non-engineered fill. The anticipated depths of the fills are estimated in Section 3.2 of this report. The lateral extent and depth of fill are expected to vary. Remove existing fill to competent native soil, as evaluated by ENGEO, or as otherwise recommended below.

At the location of the former diesel remediation excavation, we recommend that the fill be removed to a depth of at least 10 feet and replaced with properly compacted engineered fill.

We recommend that the backfilling operation for the Mistler Farm landfill be observed and tested under the supervision of a Geotechnical Engineer. We should be allowed to review compaction testing records to confirm that the backfill is suitable for the project. We should also be allowed to review the remediation documentation to evaluate that the refuse was properly removed from the old landfill.

We provide recommendations for acceptable fill in Section 5.5 and for fill compaction in Section 5.6.

5.2 GENERAL SITE CLEARING

Areas to be developed should be cleared of surface and subsurface deleterious materials, including existing building foundations, slabs, buried utility and irrigation lines, pavements, debris, and designated trees, shrubs, and associated roots. Clean and backfill excavations extending below the planned finished site grades with suitable material compacted to the recommendations presented in Section 5.6. ENGEO should be retained to observe and test backfilling.

Following clearing, the site should be stripped to remove surface organic materials. Strip organics from the ground surface to a depth of at least 2 to 3 inches below the surface. Remove strippings from the site or, if considered suitable by the landscape architect and owner, use them in landscape fill.

It may also be feasible to mulch organics in place, depending on the amount and type of vegetation present at the time of grading as well as the proposed mulching method. If desired, ENGEO can evaluate site vegetation at the time of grading to assess the feasibility of mulching organics in place. On a preliminary basis, we recommend that the soil that has been blended with mulched organics contain no more than 3 percent organic content by mass.

5.3 DIFFERENTIAL FILL THICKNESS

Differential building movements may result from conditions where building pads have significant differentials in fill thickness. We recommend that the differential fill thickness across any lot be no greater than 10 feet. Local subexcavation of soil material and replacement with compacted fill may be needed to achieve this recommendation. Depending on the final lot layout and fill thickness, this condition may occur at the former Mistler Farm landfill and the depression on the southern portion of the site.

5.4 OVER-OPTIMUM SOIL MOISTURE CONDITIONS

The contractor should anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, or during or following periods of rain. In addition, wet soil conditions may be found in the drainage ditches adjacent to the agricultural fields. Wet soil can make proper compaction difficult or impossible. Wet soil conditions can be mitigated by:

1. Frequent spreading and mixing during warm dry weather,
2. Mixing with drier materials,
3. Mixing with a lime, lime-flyash, or cement product, or
4. Stabilizing with aggregate or geotextile stabilization fabric, or both.

Options 3 and 4 should be evaluated by ENGEO prior to implementation.

5.5 ACCEPTABLE FILL

On-site soil material is suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 8 inches in maximum dimension.

Imported fill materials should meet the above requirements and have a plasticity index less than 12 and at least 20 percent passing the No. 200 sieve. Allow ENGEO to sample and test proposed imported fill materials at least 5 days prior to delivery to the site.

5.6 FILL COMPACTION

5.6.1 Grading in Structural Areas

Areas to receive fill should be scarified to a depth of 8 inches, moisture conditioned, and recompacted to provide adequate bonding with the initial lift of fill. Fills should be placed with a loose lift thickness no greater than 8 inches. The following compaction recommendations should be used for the placement and compaction of fills:

TABLE 5.6.1-1: Compaction and Moisture Content Requirements

DESCRIPTION	SOIL	RECOMMENDED RELATIVE COMPACTION (%)	MINIMUM MOISTURE CONTENT (PERCENTAGE POINTS ABOVE OPTIMUM)
Grading in Structural Areas	Expansive	87 to 92	4
	Low Expansive	90 or greater	1
Upper 6 inches of Pavement Subgrade	Expansive	90 or greater	4
	Low Expansive	95 or greater	1
Pavement Aggregate Base Section	Caltrans Class 2 AB	95 or greater	0

Relative compaction refers to in-place dry density of the fill material expressed as a percentage of the maximum dry density as determined by ASTM D1557. Optimum moisture is the moisture content corresponding to the maximum dry density. We recommend that the expansive soil be compacted at higher than optimum moisture contents as shown above to reduce potential swell.

5.6.2 Underground Utility Backfill

The contractor is responsible for conducting trenching and shoring in accordance with CALOSHA requirements. Project consultants involved in utility design should specify pipe bedding materials.

Place and compact trench backfill in structural areas as follows.

1. Trench backfill should have a maximum particle size of 6 inches;
2. Moisture condition fill outside the trench to the moisture content specified in Table 5.6.1-1;
3. Place fill in loose lifts not exceeding 12 inches; **and**
4. Compact fill to the relative compaction specified in Table 5.6.1-1.

Where utility trenches cross underneath buildings, we recommend that a plug be placed within the trench backfill to help prevent the normally granular bedding materials from acting as a conduit for water to enter beneath the building. The plug should be constructed using a sand cement slurry (minimum 28-day compressive strength of 500 psi) or relatively impermeable native soil for pipe bedding and backfill. We recommend that the plug extend for a distance of at least 3 feet in each direction from the point where the utility enters the building perimeter.

Jetting of backfill is not an acceptable means of compaction. We may allow thicker loose lift thicknesses based on acceptable density test results, where increased effort is applied to rocky fill, or for the first lift of fill over pipe bedding.

5.6.3 Landscape Fill

Process, place and compact fill in accordance with Sections 5.6.1, except compact to at least 85 percent relative compaction (ASTM D1557).

5.7 LIME TREATMENT

Where lime treatment of the soil is used to enhance roadway subgrade support, we recommend uniformly mixing the subgrade soil with at least 4 percent high calcium lime by dry weight. The soil should be moisture conditioned to at least 3 percentage points above the optimum moisture content before mixing. The mixing should be performed in accordance with the current version of Caltrans Standard Specifications with the following exceptions:

1. Following mixing, the treated soil should be allowed to fully hydrate prior to compaction.

2. Following hydration, the treated soil should be compacted to not less than 95 percent relative compaction at a moisture content at least 2 percentage points above the optimum to a non-yielding surface.

5.8 SLOPE GRADIENTS

Construct final slope gradients to 2:1 (horizontal:vertical) or flatter. The contractor is responsible to construct temporary construction slopes in accordance with CALOSHA requirements.

5.9 SITE DRAINAGE

The project civil engineer is responsible for designing surface drainage improvements. With regard to geotechnical engineering issues, we recommend that finish grades be sloped away from buildings and pavements to the maximum extent practical to reduce the potentially damaging effects of expansive soil. The latest California Building Code Section 1804.4 specifies that pervious surfaces have a minimum slope of 5 percent away from foundations. Where lot lines or surface improvements restrict meeting this slope requirement, we recommend that specific drainage requirements be developed. As a minimum, we recommend the following:

1. Discharge roof downspouts into closed conduits and direct away from foundations to appropriate drainage devices.

2. Consider the use of rear lot surface drainage collection systems to reduce overland surface drainage from back to front of lot.

3. Do not allow water to pond near foundations, pavements, or exterior flatwork.

5.10 STORMWATER INFILTRATION

Due to the predominance of clay at the surface of the site, the site soil is expected to have a low permeability value for stormwater infiltration in grassy swales or permeable pavers, unless subdrains are installed. Therefore, Best Management Practices should assume that limited stormwater infiltration will occur at the site.

5.11 STORMWATER BIORETENTION AREAS

If bioretention areas are implemented, we recommend that, when practical, they be planned a minimum of 5 feet away from structural site improvements, such as buildings, streets, retaining walls, and sidewalks/driveways. When this is not practical, bioretention areas located within 5 feet of structural site improvements can either:

1. Be constructed with structural side walls capable of withstanding the loads from the adjacent improvements, or

2. Incorporate filter material compacted to between 85 and 90 percent relative compaction and a waterproofing system designed to reduce the potential for moisture transmission into the subgrade soil beneath the adjacent improvement.

The retaining wall structures adjacent to the bioretention basins should be a cast-in-place or CMU wall system that would not allow water to freely pass through the wall.

We recommend that each of the bioretention basins and swales incorporate a waterproofing system lining the excavation and a subdrain, or other storm drain system, to collect and convey water to an approved outlet. The waterproofing system should cover the bioretention area excavation in such a manner as to reduce the potential for moisture transmission beneath the adjacent improvements.

Site improvements located adjacent to bioretention areas that are underlain by base rock, sand, or other imported granular materials, should be designed with a deepened edge that extends to the bottom of the imported material underlying the improvement.

Bioretention system internal slopes should follow the slope guidelines described in Section 5.8 of this report.

Given the nature of bioretention systems and possible proximity to improvements, we recommend we be retained to review design plans and provide testing and observation services during the installation of linings, compaction of the filter material, and connection of designed drains.

It should be noted that the contractor is responsible for conducting all excavation and shoring in a manner that does not cause damage to adjacent improvements during construction and future maintenance of the bioretention areas. As with any excavation adjacent to improvements, the contractor should reduce the exposure time such that the improvements are not detrimentally impacted.

5.12 LANDSCAPING CONSIDERATION

As the near-surface soil is predominantly highly expansive, we recommend greatly restricting the amount of surface water infiltration near structures, pavements, flatwork, and slab-on-grade. This may be accomplished by:

- Selecting landscaping that requires little or no watering, especially within 3 feet of structures, slabs-on-grade, or pavements.

- Using low precipitation sprinkler heads.

- Regulating the amount of water distributed to lawn or planter areas by installing timers on the sprinkler system.

- Providing surface grades to drain rainfall or landscape watering to appropriate collection systems and away from structures, slabs-on-grade, or pavements.

- Preventing water from draining toward or ponding near building foundations, slabs-on-grade, or pavements.

- Avoiding open planting areas within 3 feet of the building perimeter.

We recommend that these items be incorporated into the landscaping plans.

6.0 FOUNDATION RECOMMENDATIONS

6.1 POST-TENSIONED MAT FOUNDATIONS

We recommend that the proposed single-family residential structures be supported on post-tensioned (PT) mat foundations bearing on prepared native soil or engineered fill.

The Structural Engineer should determine the PT mat thickness using the geotechnical recommendations Table 6.1-1. We recommend that PT mats have a thickened edge at least 2 inches greater than the mat thickness and that the thickened edge be at least 12 inches wide. ENGEO should be retained to review the PT mat foundation design.

TABLE 6.1-1: Post-Tensioned Mat Design Recommendations

CONDITION	CENTER LIFT	EDGE LIFT
Edge Moisture Variation Distance, e_m (feet)	**6.2**	**3.5**
Differential Soil Movement, y_m (inches)	**0.9**	**1.5**

Recommendations are based on the procedure "Design of Post-Tensioned Slabs-on-Ground" Third Edition, including appropriate addenda (Post-Tensioning Institute, 2007).

PT mats may be designed for an average allowable bearing pressure of up to 1,000 pounds per square foot (psf) for dead-plus-live loads with maximum localized bearing pressures of 1,500 psf at column or wall loads. Allowable bearing pressures can be increased by one-third for wind or seismic loads.

Underlay PT mats with a moisture reduction system as recommended below. In addition, moisture conditioning of the building foundation subgrade should be to a moisture content at least 4 percentage points above optimum immediately prior to foundation construction. The subgrade should not be allowed to dry prior to concrete placement. We also recommend that ENGEO be retained to observe the pre-pour moisture conditions to check that our report recommendations have been followed.

6.2 INTERIOR SLAB MOISTURE VAPOR REDUCTION

When buildings are constructed with concrete PT mats, water vapor from beneath the mat will migrate through the concrete and into the building. This water vapor can be reduced but not stopped. Vapor transmission can negatively affect floor coverings and lead to increased moisture within a building. When water vapor migrating through the slab would be undesirable, we recommend the following to reduce, but not stop, water vapor transmission upward through the slab-on-grade.

1. Install a vapor retarder membrane directly beneath the slab. Seal the vapor retarder at all seams and pipe penetrations. Vapor retarders shall conform to Class A vapor retarder in accordance with ASTM E1745, latest edition, "Standard Specification for Plastic Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs."

2. Concrete shall have a concrete water-cement ratio of no more than 0.50.

3. Provide inspection and testing during concrete placement to check that the proper concrete and water cement ratio are used.

4. Moist cure slabs for a minimum of 3 days or use other equivalent curing specific by the structural engineer.

The structural engineer should be consulted as to the use of a layer of clean sand or pea gravel (less than 5 percent passing the U.S. Standard No. 200 Sieve) placed on top of the vapor retarder membrane to assist in concrete curing.

7.0 Exterior Flatwork

Exterior flatwork includes items such as concrete sidewalks, steps, and outdoor courtyards exposed to foot traffic only. Provide a minimum section of 4 inches of concrete over 4 inches of aggregate base. Compact the aggregate base to at least 90 percent relative compaction (ASTM D1557). Thicken flatwork edges to at least 8 inches to help control moisture variations in the subgrade and place wire mesh or rebar within the middle third of the slab to help control the width and offset of cracks. Construct control and construction joints in accordance with current Portland Cement Association Guidelines.

8.0 RETAINING WALLS

8.1 LATERAL SOIL PRESSURES

Design proposed retaining walls to resist lateral earth pressures from adjoining natural materials and/or backfill and from any surcharge loads. Provided that adequate drainage is included as recommended below, design walls restrained from movement at the top to resist an equivalent fluid pressure of 60 pounds per cubic foot (pcf). In addition, design restrained walls to resist an additional uniform pressure equivalent to one-half of any surcharge loads applied at the surface.

Design unrestrained retaining walls with adequate drainage to resist an equivalent fluid pressure of 45 pcf plus one-third of any surcharge loads.

The above lateral earth pressures assume level backfill conditions and sufficient drainage behind the walls to prevent any build-up of hydrostatic pressures from surface water infiltration and/or a rise in the groundwater level. If adequate drainage is not provided, we recommend that an additional equivalent fluid pressure of 40 pcf be added to the values recommended above for both restrained and unrestrained walls. Damp-proofing of the walls should be included in areas where wall moisture would be problematic.

Construct a drainage system, as recommended below, to reduce hydrostatic forces behind the retaining wall.

8.2 RETAINING WALL DRAINAGE

Construct either graded rock drains or geosynthetic drainage composites behind the retaining walls to reduce hydrostatic lateral forces. For rock drain construction, we recommend two types of rock drain alternatives.

1. A minimum 12-inch-thick layer of Class 2 Permeable Filter Material (Caltrans Specification 68-2.02F) placed directly behind the wall, or

2. A minimum 12-inch-thick layer of washed, crushed rock with 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 sieve. Envelop rock in a minimum 6-ounce, nonwoven geotextile filter fabric.

For both types of rock drains:

1. Place the rock drain directly behind the walls of the structure.

2. Extend rock drains from the wall base to within 12 inches of the top of the wall.

3. Place a minimum of 4-inch-diameter perforated pipe (glued joints and end caps) at the base of the wall, inside the rock drain and fabric, with perforations placed down.

4. Place pipe at a gradient at least 1 percent to direct water away from the wall by gravity to a drainage facility.

ENGEO should review and approve geosynthetic composite drainage systems prior to use.

8.3 BACKFILL

Backfill behind retaining walls should be placed and compacted in accordance with Section 5.6.1. Use light compaction equipment within 5 feet of the wall face. If heavy compaction equipment is used, the walls should be temporarily braced to avoid excessive wall movement.

8.4 FOUNDATIONS

Retaining walls may be supported on continuous footings with a minimum depth of 2 feet below lowest adjacent grade and a minimum width of 1½ feet. Footings with these minimum dimensions can be designed for a maximum allowable bearing pressure of 3,500 pounds per square foot (psf) for dead-plus-live loads. This bearing capacity can be increased by one-third for the short-term effects of wind or seismic loading. The maximum allowable bearing pressure is a net value; the weight of the footing may be neglected for design purposes. Footings located adjacent to utility trenches should have their bearing surfaces below an imaginary 1:1 (horizontal:vertical) plane projected upward from the bottom edge of the trench to the footing.

Lateral loads may be resisted by friction along the base and by passive pressure along the sides of foundations. The passive pressure is based on an equivalent fluid pressure in pounds per cubic foot (pcf). We recommend the following allowable values for design.

- Passive Lateral Pressure: 300 pcf
- Coefficient of Friction: 0.25

The above allowable values include a factor of safety of 1.5. Increase the above values by one-third for the short-term effects of wind or seismic loading.

Passive lateral pressure should not be used for footings on or above slopes.

9.0 PAVEMENT DESIGN

9.1 FLEXIBLE PAVEMENTS

We obtained three representative bulk samples of the near surface soil and performed R-value tests to provide data for pavement design. The results of the tests are included in Appendix B and indicate R-values of less than 5, 6, and 3. Based on these test results, it is our opinion that an R-value of 5 is applicable for design. Using estimated traffic indexes for various pavement loading requirements, we developed the following recommended pavement sections using Topic 633 of the Caltrans Highway Design Manual (including the asphalt factor of safety), presented in the table below. The table includes recommended pavement sections for pavement on native soil subgrade and pavement on lime-treated subgrade.

TABLE 9.1-1: Recommended Asphalt Concrete Pavement Sections

TRAFFIC INDEX	NATIVE SOIL SUBGRADE		LIME-TREATED SUBGRADE*	
	ASPHALT CONCRETE (INCHES)	CLASS 2 AGGREGATE BASE (INCHES)	ASPHALT CONCRETE (INCHES)	CLASS 2 AGGREGATE BASE (INCHES)
5	3	10	3	4
6	3½	13	3½	4
7	4	15½	4	4½
8	5	17½	5	5

* Assumed R-value of 50 for lime-treated subgrade

The civil engineer should determine the appropriate traffic indexes based on the estimated traffic loads and frequencies. According to the City of Dixon's Engineering Design Standards, Section DS3-02, "the structural section for local streets shall be a minimum of 3½ inches of asphalt concrete and 10 inches of aggregate base over engineering fabric."

9.2 RIGID PAVEMENTS

Use concrete pavement sections to resist heavy loads and turning forces in areas such as fire lanes or trash enclosures. Final design of rigid pavement sections and accompanying reinforcement should be performed based on estimated traffic loads and frequencies. We recommend the following minimum design sections for rigid pavements.

- Use a minimum section of 6 inches of Portland Cement concrete over 6 inches of Caltrans Class 2 Aggregate Base.

- Concrete pavement should have a minimum 28-day compressive strength of 3,500 psi.

- Provide minimum control joint spacing in accordance with Portland Cement Association guidelines.

9.3 SUBGRADE AND AGGREGATE BASE COMPACTION

Compact finished subgrade and aggregate base in accordance with Section 5.6.1. Aggregate Base should meet the requirements for ¾-inch maximum Class 2 AB in accordance with Section 26-1.02B of the latest Caltrans Standard Specifications.

9.4 CUT-OFF CURBS

Saturated pavement subgrade or aggregate base can cause premature failure or increased maintenance of asphalt concrete pavements. This condition often occurs where landscape areas directly abut and drain toward pavements. If desired to install pavement cutoff barriers, they should be considered where pavement areas lie downslope of any landscape areas that are to be sprinklered or irrigated, and should extend to a depth of at least 4 inches below the base rock layer. Cutoff barriers may consist of deepened concrete curbs or deep-root moisture barriers.

If reduced pavement life and greater than normal pavement maintenance are acceptable to the owner, then the cutoff barrier may be eliminated.

9.5 RESIDENTIAL DRIVEWAYS/GARAGE SLABS

We were not retained to provide design recommendations for residential driveways or garage slabs. They should be designed to resist the anticipated traffic and structural loads, and the effects of expansive soil movement.

10.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1.3 for the Dixon 257 project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strived to perform our professional services in accordance with generally accepted principles and practices currently employed in the area; there is no warranty, express or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data are representative of the actual subsurface conditions across the site. Considering possible underground variability of soil and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, ENGEO must be notified immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include excavation sloping or shoring, soil volume change factors, flood potential, or a geohazard exploration. In addition, our geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, the proper regulatory officials must be notified immediately.

This document must not be subject to unauthorized reuse, that is, reusing without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

Actual field or other conditions will necessitate clarifications, adjustments, modifications or other changes to ENGEO's documents. Therefore, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications or other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, rock, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

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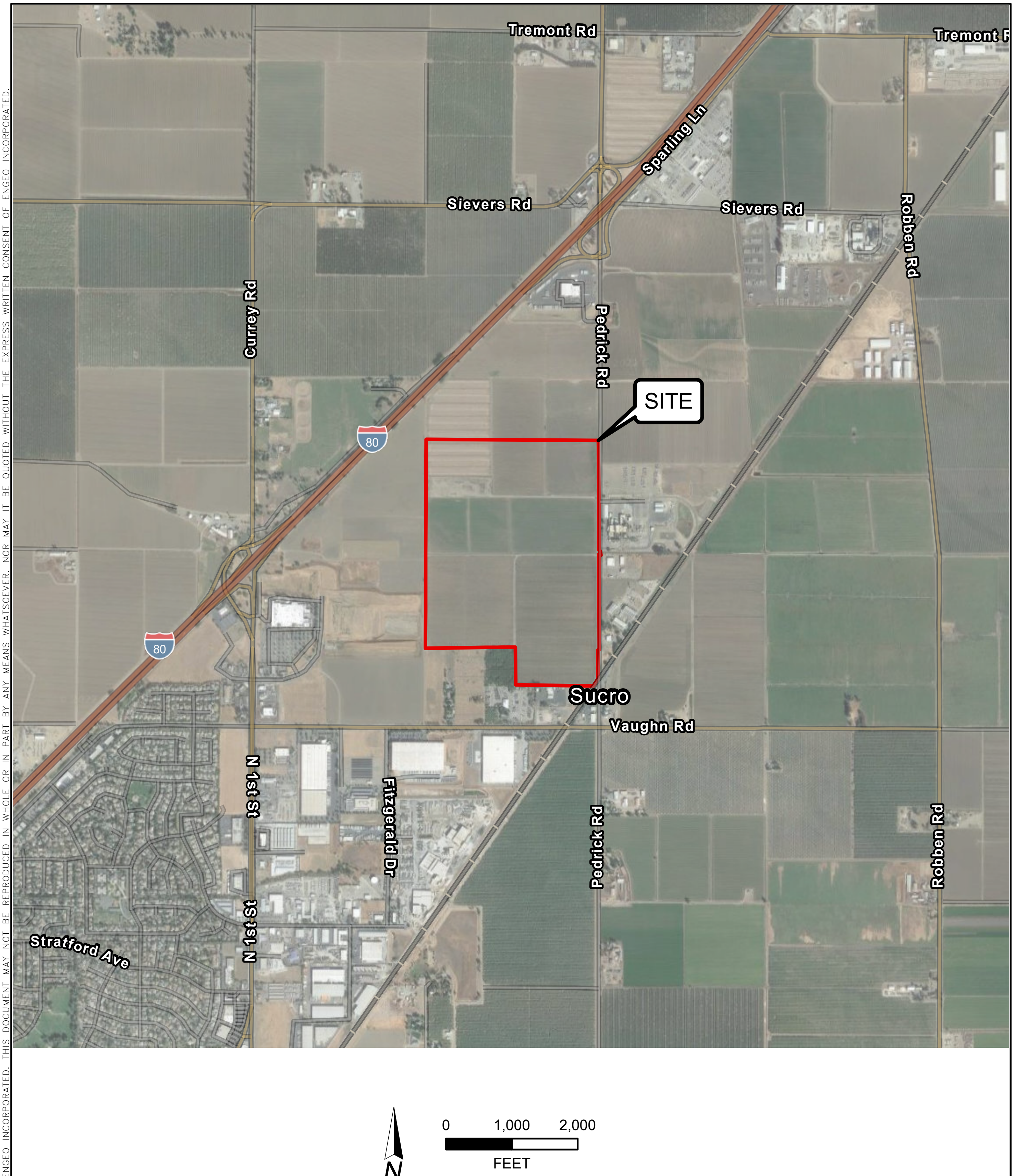
FIGURES

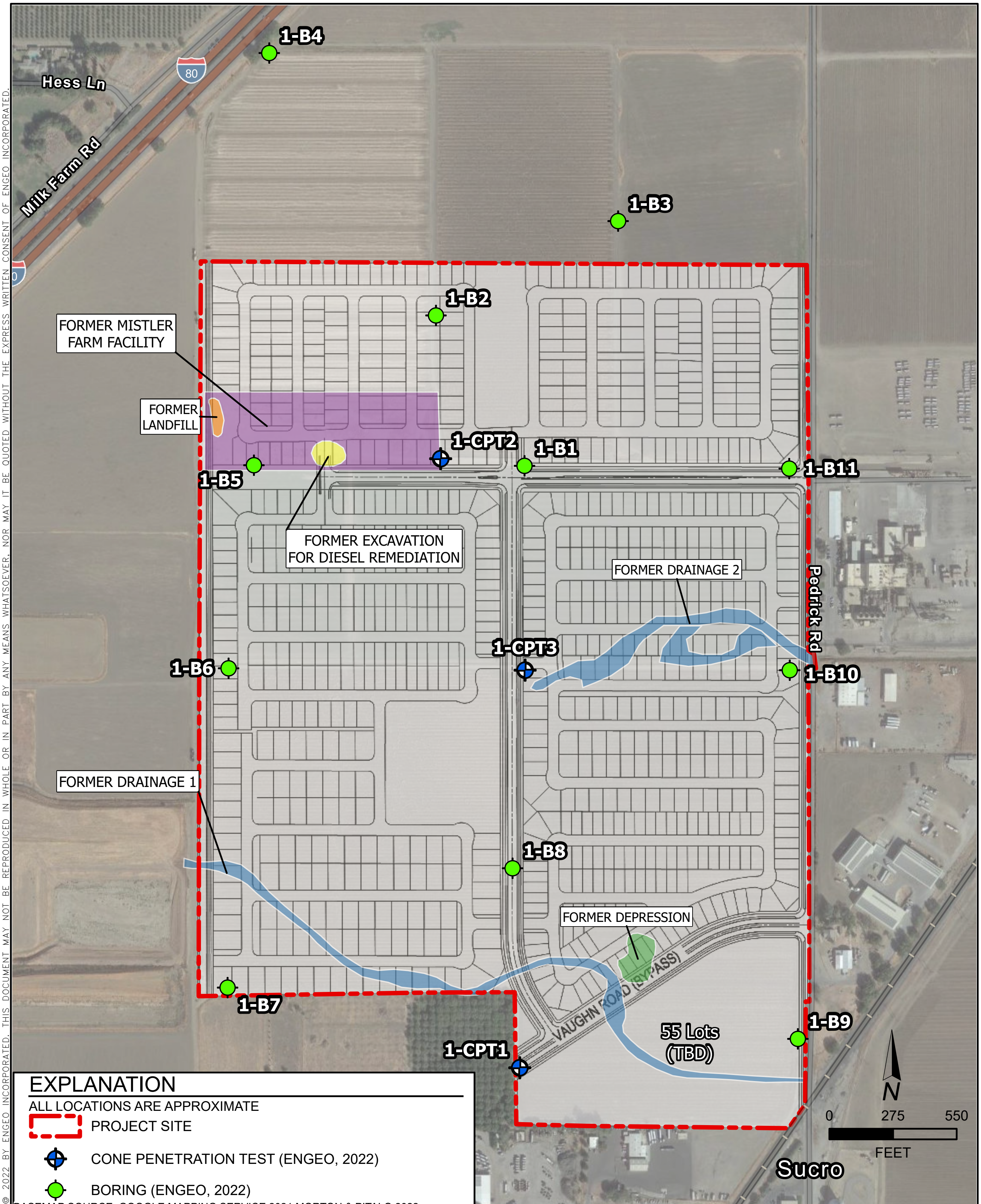


BASEMAP SOURCE: GOOGLE MAPPING SERVICE 2021

ENGEO Expect Excellence	VICINITY MAP DIXON 257 DIXON, CALIFORNIA	PROJECT NO. : 19589.000.001 SCALE: AS SHOWN DRAWN BY: QRL CHECKED BY: MMG	FIGURE NO. 1

PATH: G:\DRAFTING\PROJECTS_18000 TO 19999\19589\19589000001\GEOTECH\GEX\DIXON 257.APRX
LAYOUT: VICINITY USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR



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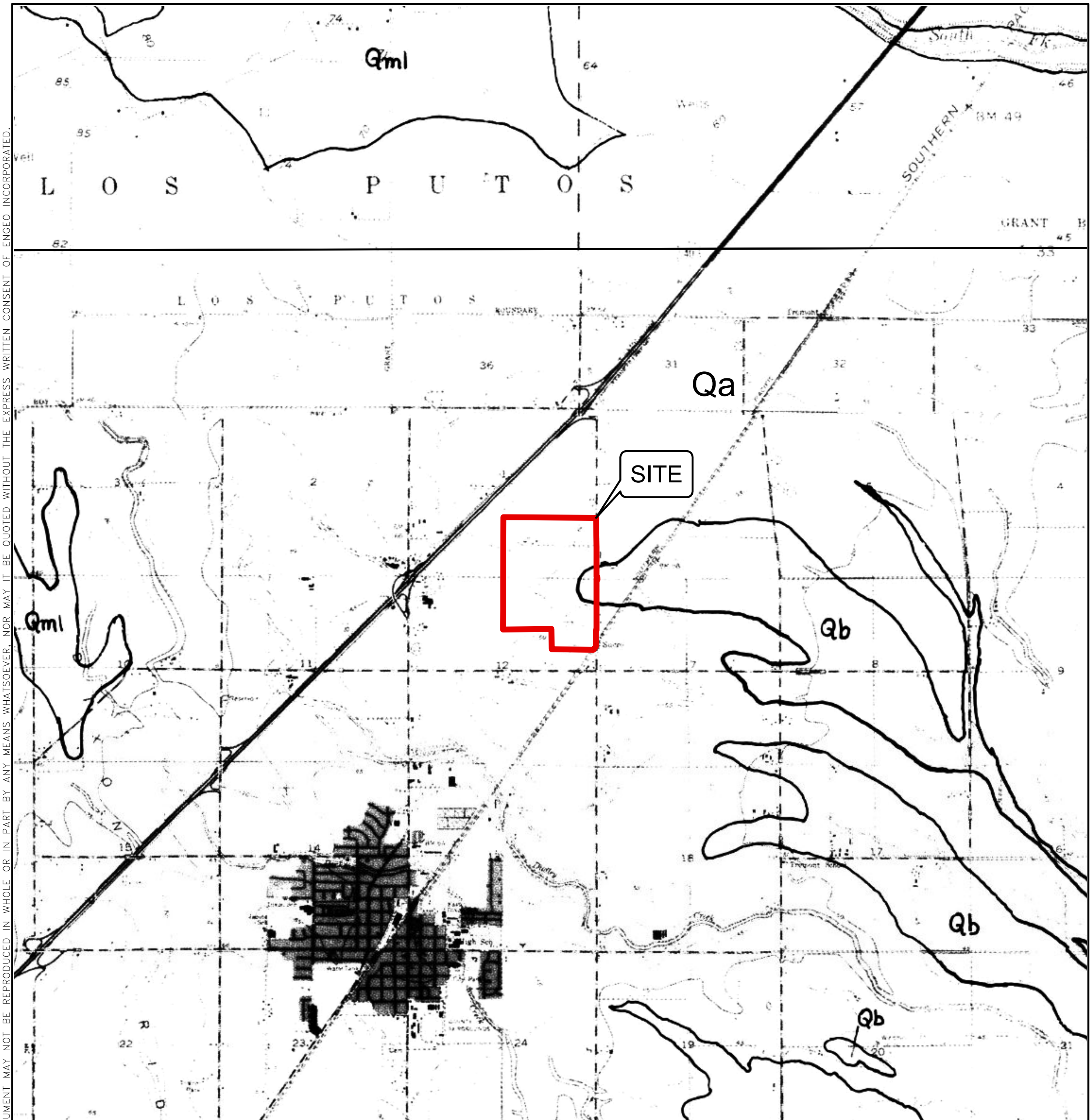
SITE PLAN
DIXON 257
DIXON, CALIFORNIA

PROJECT NO. : 19589.000.001	FIGURE NO. 2
SCALE: AS SHOWN	
DRAWN BY: QRL	CHECKED BY: MMG

PATH: G:\DRAFTING\PROJECTS_18000 TO 19999\19589\19589000001\GEOTECH\GEX\DIXON 257.APRX
LAYOUT: SITE PLAN USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

Qa	ALLUVIUM (HOLOCENE)
Qb	BASIN DEPOSITS, UNDIVIDED (HOLOCENE)
Qml	LOWER MEMBER-MODESTO FORMATION

N

0 2,000 4,000

FEET

BASEMAP SOURCE: HELLY AND HARWOOD, 1985

ENGEO
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REGIONAL GEOLOGIC MAP

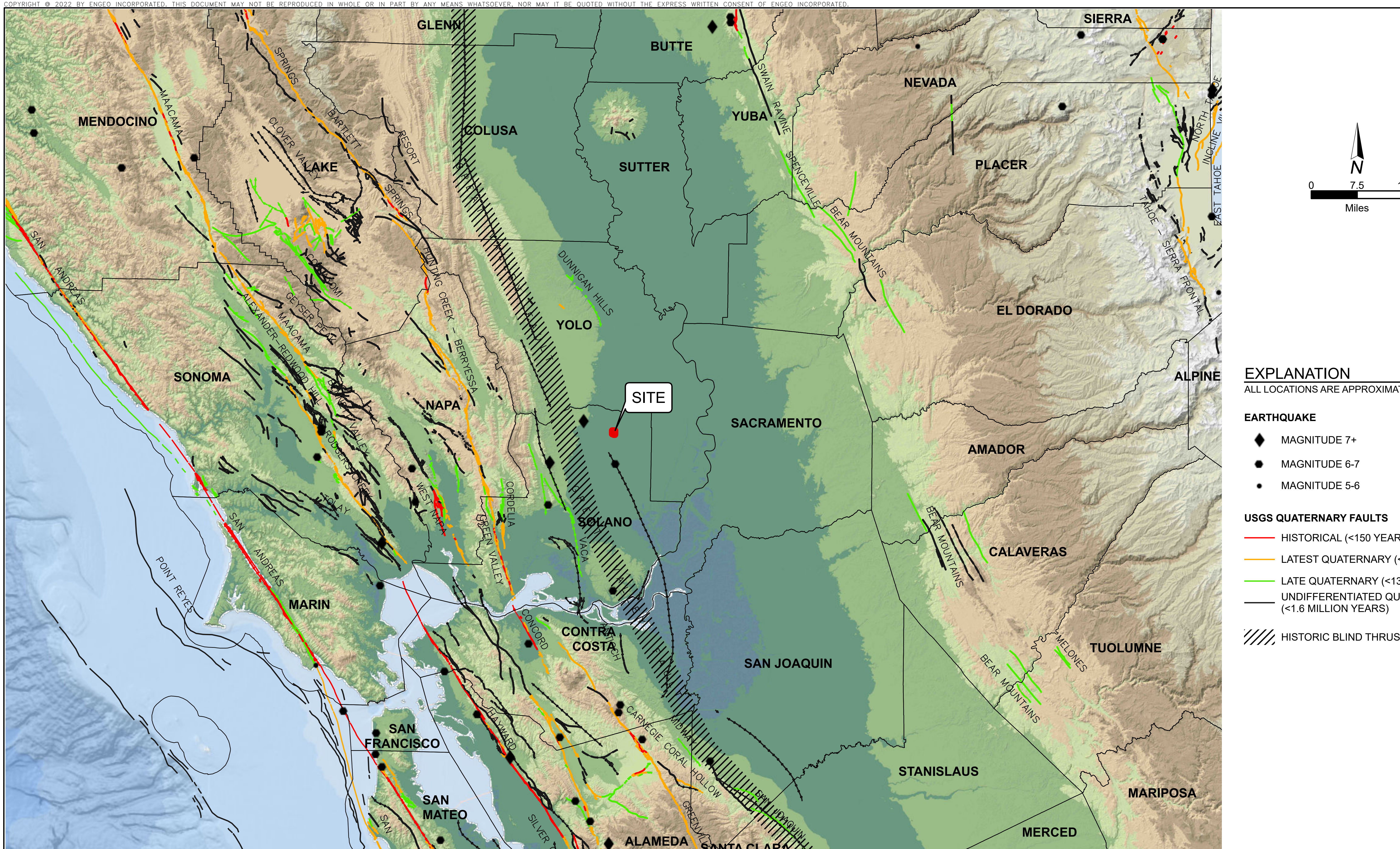
DIXON 257

DIXON, CALIFORNIA

PROJECT NO. : 19589.000.001	FIGURE NO. 3
SCALE: AS SHOWN	
DRAWN BY: QRL	CHECKED BY: MMG

PATH: G:\DRAFTING\PROJECTS_18000 TO 19999\19589\19589000001\GEOTECH\GEX\DIXON 257.APRX
LAYOUT: GEOLOGIC USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

EARTHQUAKE

- MAGNITUDE 7+
- MAGNITUDE 6-7
- MAGNITUDE 5-6

USGS QUATERNARY FAULTS

- HISTORICAL (<150 YEARS)
- LATEST QUATERNARY (<15,000 YEARS)
- LATE QUATERNARY (<130,000 YEARS)
- UNDIFFERENTIATED QUATERNARY (<1.6 MILLION YEARS)
- HISTORIC BLIND THRUST FAULT ZONE

BASE MAP SOURCE
ESRI, GEBCO, DELORME, NATURALVUE
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, 2018
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800-PRESENT)

ENGEO Expect Excellence	REGIONAL FAULTING AND SEISMICITY DIXON 257 DIXON, CALIFORNIA	PROJECT NO.: 19589.000.001 SCALE: AS SHOWN DRAWN BY: JV CHECKED BY: MMG	FIGURE NO. 4

PATH: G:\DRAFTING\PROJECTS_18000 TO 19999\19589\19589000001\GEOTECH\GEX\DIXON 257.APRX
LAYOUT: FAULT&SEISMICITY USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR

APPENDIX A

BORING LOG KEY
BORING LOGS

KEY TO BORING LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW - Well graded gravels or gravel-sand mixtures GP - Poorly graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES	GM - Silty gravels, gravel-sand and silt mixtures GC - Clayey gravels, gravel-sand and clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW - Well graded sands, or gravelly sand mixtures SP - Poorly graded sands or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES	SM - Silty sand, sand-silt mixtures SC - Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS		ML - Inorganic silt with low to medium plasticity CL - Inorganic clay with low to medium plasticity OL - Low plasticity organic silts and clays
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %		MH - Elastic silt with high plasticity CH - Fat clay with high plasticity OH - Highly plastic organic silts and clays
	HIGHLY ORGANIC SOILS		PT - Peat and other highly organic soils

For fine-grained soils with 15 to 29% retained on the #200 sieve, the words "with sand" or "with gravel" (whichever is predominant) are added to the group name.

For fine-grained soil with >30% retained on the #200 sieve, the words "sandy" or "gravelly" (whichever is predominant) are added to the group name.

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE: 200, 40, 10, 4
CLEAR SQUARE SIEVE OPENINGS: 3/4 ", 3", 12"

SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*
VERY SOFT	0-1/4
SOFT	1/4-1/2
MEDIUM STIFF	1/2-1
STIFF	1-2
VERY STIFF	2-4
HARD	OVER 4

SAMPLER SYMBOLS

- Modified California (3" O.D.) sampler
- California (2.5" O.D.) sampler
- S.P.T. - Split spoon sampler
- Shelby Tube
- Dames and Moore Piston
- Continuous Core
- Bag Samples
- Grab Samples
- NR No Recovery

MOISTURE CONDITION

DRY	Dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater

LINE TYPES

- Solid - Layer Break
- Dashed - Gradational or approximate layer break

GROUNDWATER SYMBOLS

- ▽ Groundwater level during drilling
- ▼ Stabilized groundwater level

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

ENGEO
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LOG OF BORING 1-B1

LATITUDE: 38.476794 LONGITUDE: -121.808214

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/3/2022
HOLE DEPTH: Approx. 21½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 63 ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			FAT CLAY (CH), dark brown, hard, moist, high plasticity, iron and manganese oxidation, trace fine- to medium-grained sand										
			[Expansion Index = 104]			26	58	23	35	99	24.5		4.5+*
	60		Graded to no iron oxidation			31					19.75	108.3	3.2
5			Grades to brown, carbonates, trace fine rounded gravel			37					19.4		4.5+*
	55												
10			LEAN CLAY (CL), yellowish brown, very stiff, moist, medium plasticity			15							2.5*
	50		POORLY GRADED SAND WITH CLAY (SP-SC), yellowish brown, medium dense, moist, fine- to medium-grained sand, some coarse-grained sand, approximately 10% fines										
15			POORLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC), yellowish brown, medium dense, moist, fine- to coarse-grained sand, approximately 20% fine to coarse round gravels, approximately 5% fines			18					7.4		
	45												
20						22							
			Boring terminated at 21½ feet below ground surface (bgs). No groundwater encountered.										

ENGEO

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LOG OF BORING 1-B2

LATITUDE: 38.478581 LONGITUDE: -121.809544

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/3/2021
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			LEAN CLAY (CL), dark brown, hard, moist, medium to high plasticity, trace fine- to coarse-grained sand										
						23	49	18	31	95	21.3		4.0*
			Grades to dark yellowish brown										
	35					10							2.25*
			Grades to very stiff, iron and manganese oxidation										
5						10					29.5		1.75*
			Grades to stiff										
	30		FAT CLAY (CH), dark yellowish brown, very stiff, moist, high plasticity, trace fine-grained sand, trace fine round gravel, carbonates										
10						26					18.7		4.0*
	25		LEAN CLAY (CL), dark yellowish brown, stiff, moist, medium plasticity, iron and manganese oxidation, pockets of SANDY LEAN CLAY (CL) with approximately 30% fine-grained sand										
15			Very stiff			15							2.75*
			Boring terminated at 16½ feet bgs. No groundwater encountered.										

ENGEO
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LOG OF BORING 1-B3

LATITUDE: 38.479697 LONGITUDE: -121.806792

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/3/2022
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			FAT CLAY (CH), dark brown, very stiff, moist, high plasticity, iron and manganese oxidation, trace fine rounded gravel			19	70	23	47	94	24.4		3.5*
	35		Grades to hard			20							4.5+*
			Grades to yellow brown										
5			LEAN CLAY (CL), yellowish brown, very stiff, moist, medium plasticity, trace fine-grained sand			10					17.4		3.5*
10	30		POORLY GRADED SAND WITH GRAVEL (SP), dark green, medium dense, moist, fine- to coarse-grained sand, approximately 20% fine round gravel, trace fines			17				3	6.2		
15	25		LEAN CLAY (CL), yellowish brown mottled with olive, very stiff, moist, medium plasticity, iron and manganese oxidation			16							2.5*
			Boring terminated at 16½ feet bgs. No groundwater encountered.										

ENGEO
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LOG OF BORING 1-B4

LATITUDE: 38.4817 LONGITUDE: -121.812053

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/3/2021
HOLE DEPTH: Approx. 21½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	DESCRIPTION	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
		LEAN CLAY (CL), dark yellowish brown, very stiff, moist, medium plasticity, iron and manganese oxidation, approximately 10% fine-grained sand, rootlets [Expansion Index = 77]	11				91	24		2.0*
	35		12					25	90.1	3.5*
5		SANDY FAT CLAY (CH), dark yellowish brown, stiff, moist, high plasticity, approximately 30% fine-grained sand	9							1.0*
	30	FAT CLAY (CH), dark yellowish brown, hard, moist, high plasticity, manganese oxidation, blocky structure								
10			29					22.3		4.5*
	25	LEAN CLAY (CL), dark yellowish brown, stiff, moist, medium plasticity, roots								
15			9							1.5*
	20	SANDY SILT (ML), yellowish brown, medium dense, moist, approximately 35% fine-grained sand								
20			13				65	28.8		

Boring terminated at 21½ feet bgs. No groundwater encountered.

LOG OF BORING 1-B5

ENGEO
Expect Excellence

LATITUDE: 38.476808 LONGITUDE: -121.812297

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/3/2022
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			LEAN CLAY (CL), dark brown, hard, moist, low plasticity, trace fine subangular gravel, hard inclusions [FILL]			10	35	22	13	79	19.3		4.5*
	35		SILT (ML), yellowish brown, medium dense, moist, trace fine-grained sand, manganese oxidation [NATIVE]			13				93	22.4		
5			LEAN CLAY (CL), dark yellowish brown, very stiff, moist, medium plasticity, abundant iron oxidation, trace fine-grained sand			12							2.25*
10	30		FAT CLAY (CH), dark brown, hard, moist, high plasticity, trace fine-grained sand, carbonates, blocky structure			32				94	20.1		4.5*
15	25		SILTY SAND (SM), dark yellowish brown, medium dense, moist, fine-grained sand, approximately 40% fines			18							
			Boring terminated at 16½ feet bgs. No groundwater encountered.										

ENGEO
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LOG OF BORING 1-B6

LATITUDE: 38.4744 LONGITUDE: -121.812686

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/4/2021
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Haugher / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			LEAN CLAY (CL), dark brown, hard, slightly moist, medium plasticity, blocky structure, weakly cemented, approximately 10% fine- to coarse-grained sand										
						25	45	19	26	90			4.5+*
	35					25					20.85	103.9	3.5
5			Grades to brown, manganese oxidation, not blocky, not cemented										
			Grades to medium-high plasticty			22					19.2		4.5*
	30												
10			Grades to high plasticity										
						25					18.3		4.5*
	25		LEAN CLAY (CL), dark yellowish brown, very stiff, moist, medium plasticity, iron and manganese oxidation, trace fine-grained sand										
15						12							2.5*
			Boring terminated at 16½ feet bgs. No groundwater encountered.										

LOG OF BORING 1-B7

ENGEO
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LATITUDE: 38.470611 LONGITUDE: -121.812711

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/4/2021
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			LEAN CLAY WITH SAND (CL), dark brown, very stiff, moist, medium plasticity, approximately 20% fine-grained sand, rootlets										
			[Expansion Index = 71]			15	42	19	23				2.5*
	35		Grades to brown, stiff			10							2.0*
5			LEAN CLAY (CL), brown, very stiff, moist, medium plasticity, manganese oxidation, trace fine-grained sand			12					21.1		3.0*
	30		FAT CLAY (CH), brown, very stiff, moist, high plasticity, approximately 10% fine-grained sand										
10						17							3.5*
	25												
15			Grades to stiff, managanese oxidation, trace fine-grained sand			12							1.75*
			Boring terminated at 16½ feet bgs. No groundwater encountered.										

LOG OF BORING 1-B8

ENGEO — Expect Excellence

LATITUDE: 38.472022 LONGITUDE: -121.808406

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/4/2021
HOLE DEPTH: Approx. 21½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			FAT CLAY (CH), dark gray to black, very stiff, moist, high plasticity, 7% fine- to coarse-grained sand										
			[Expansion Index = 108]			16	64	22	42	93			3.5*
	35		Grades to brown, trace manganese oxidation			15					25.3	90.1	2.25*
5			SANDY LEAN CLAY (CL), dark yellowish brown, stiff, moist, medium plasticity, approximately 30% fine-grained sand			15							1.75*
	30		FAT CLAY (CH), dark yellowish brown, hard, moist, high plasticity, manganese oxidation, hard inclusions										
10						30					20.4		4.5*
	25												
15			Grades to dark yellowish brown mottled with olive, very stiff, managanese oxidation			21							2.25*
	20		LEAN CLAY (CL), dark yellowish brown, stiff, moist, medium plasticity, approximately 10% fine-grained sand										
20						10					34.9		1.25*
			Boring terminated at 21½ feet bgs. No groundwater encountered.										

ENGEO
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LOG OF BORING 1-B9

LATITUDE: 38.469989 LONGITUDE: -121.804106

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/4/2021
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			LEAN CLAY (CL), dark yellowish brown, very stiff, moist, medium plasticity, manganese oxidation, trace fine-grained sand			15				88	24.3		3*
	35		FAT CLAY (CH), dark yellowish brown, very stiff, moist, high plasticity, manganese oxidation, rootlets			20					21.22	105.8	2.7
5						29							4*
	30		LEAN CLAY (CL), dark yellowish brown, very stiff, moist, medium plasticity, white veins										
10						19					24.1		2.25*
	25												
15			Grades to dark yellowish brown mottled with olive, stiff, iron and manganese oxidation			11							1.5*
			Boring terminated at 16½ feet bgs. No groundwater encountered.										

ENGEO
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LOG OF BORING 1-B10

LATITUDE: 38.474364 LONGITUDE: -121.804217

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/4/2021
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			LEAN CLAY (CL), dark brown, very stiff, moist, high plasticity, iron and manganese oxidation, trace fine- to medium-grained sand			18	46	20	26	97			3.5*
	35		Grades to hard with hard inclusions			20					20	105.9	4.0*
5						28							4.5*
	30												
10			Grades to dark yellowish brown, homogenous			23					22.8		4.25*
	25		LEAN CLAY (CL), dark yellowish brown, stiff, moist, medium plasticity, iron and manganese oxidation, cemented inclusions, trace fine rounded gravel										
15						7							1.5*
			Boring terminated at 16½ feet bgs. No groundwater encountered.										

ENGEO
Expect Excellence

LOG OF BORING 1-B11

LATITUDE: 38.476756 LONGITUDE: -121.804219

Geotechnical Exploration
Dixon 257
Dixon, CA
19589.000.001

DATE DRILLED: 1/4/2021
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (WGS84): Approx. 38½ ft.

LOGGED / REVIEWED BY: A. Hauger / MMG
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Unconfined Strength (tsf) *field approx
			LEAN CLAY (CL), dark brown, hard, moist, high plasticity, blocky structure										
			[Expansion Index = 62]			31							
	35					32							4.5+*
5						45							4.5+*
	30		LEAN CLAY WITH SAND (CL), dark yellowish brown, hard, moist, medium plasticity, approximately 20% fine-grained sand, manganese oxidation										
10						19					19.3		4.5+*
			Boring terminated at 11½ feet bgs. No groundwater encountered.										
													4.25*

APPENDIX B

LABORATORY TEST DATA

Expansion Index Test Reports (5 pages)
Liquid and Plastic Limits Test Reports (2 pages)
R-Value Test Reports (3 pages)
Particle Size Distribution Reports (13 pages)
Moisture Content Report (1 page)
Moisture-Density Determination Report (1 page)
Unconfined Compression Test Report (1 page)
Analytical Results of Soil Corrosion (4 pages)

EXPANSION INDEX TEST REPORT
ASTM D4829

SAMPLE ID	SOIL DESCRIPTION	SAMPLE LOCATION	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	FINAL MOISTURE CONTENT (%)	EXPANSION INDEX
1-B1@2	See exploration logs	1-B1 at 2 feet	100.0	12.3	33.2	104

TABLE 1: CLASSIFICATION OF EXPANSIVE SOIL

ASTM D4829

EXPANSION INDEX	POTENTIAL EXPANSION
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

ENGEO
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CLIENT: MCL Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/17/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

EXPANSION INDEX TEST REPORT
ASTM D4829

SAMPLE ID	SOIL DESCRIPTION	SAMPLE LOCATION	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	FINAL MOISTURE CONTENT (%)	EXPANSION INDEX
1-B4@1.5	See exploration logs	1-B4 at 1.5 feet	113.5	8.4	27.3	77

TABLE 1: CLASSIFICATION OF EXPANSIVE SOIL
ASTM D4829

EXPANSION INDEX	POTENTIAL EXPANSION
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

ENGEO
Expect Excellence

CLIENT: MCL Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/17/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

EXPANSION INDEX TEST REPORT
ASTM D4829

SAMPLE ID	SOIL DESCRIPTION	SAMPLE LOCATION	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	FINAL MOISTURE CONTENT (%)	EXPANSION INDEX
1-B7@1.5	See exploration logs	1-B7 at 1.5 feet	102.7	11.4	28.0	71

TABLE 1: CLASSIFICATION OF EXPANSIVE SOIL
ASTM D4829

EXPANSION INDEX	POTENTIAL EXPANSION
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

ENGEO
Expect Excellence

CLIENT: MCL Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/17/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

EXPANSION INDEX TEST REPORT
ASTM D4829

SAMPLE ID	SOIL DESCRIPTION	SAMPLE LOCATION	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	FINAL MOISTURE CONTENT (%)	EXPANSION INDEX
1-B8@2	See exploration logs	1-B8 at 2 feet	89.0	15.7	39.2	108

TABLE 1: CLASSIFICATION OF EXPANSIVE SOIL
ASTM D4829

EXPANSION INDEX	POTENTIAL EXPANSION
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

ENGEO
Expect Excellence

CLIENT: MCL Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/17/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

EXPANSION INDEX TEST REPORT
ASTM D4829

SAMPLE ID	SOIL DESCRIPTION	SAMPLE LOCATION	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	FINAL MOISTURE CONTENT (%)	EXPANSION INDEX
1-B11@1.5	See exploration logs	1-B11 at 1.5 feet	109.8	10.2	26.5	62

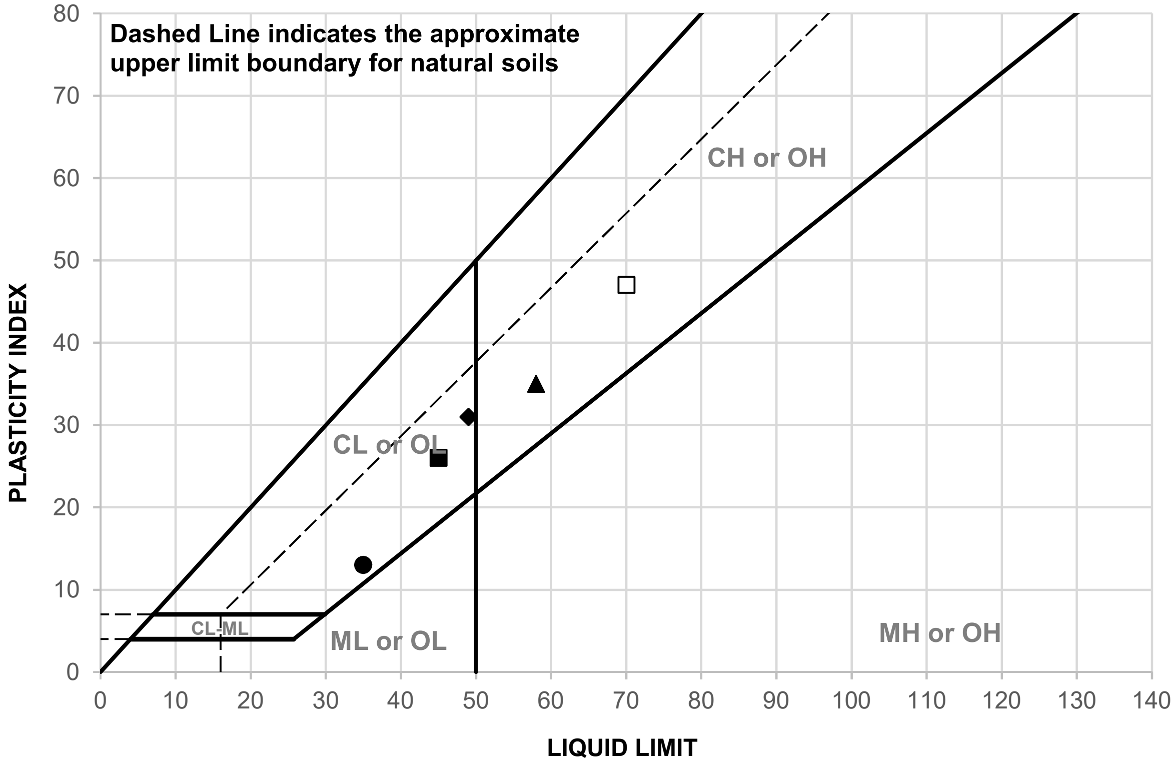
TABLE 1: CLASSIFICATION OF EXPANSIVE SOIL
ASTM D4829

EXPANSION INDEX	POTENTIAL EXPANSION
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

ENGEO
Expect Excellence

CLIENT: MCL Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/17/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

LIQUID AND PLASTIC LIMITS TEST REPORT
ASTM D4318



	SAMPLE ID	DEPTH (ft)	MATERIAL DESCRIPTION	LL	PL	PI
▲	1-B1@1.5	5	See exploration logs	58	23	35
◆	1-B2@1.5	1.5	See exploration logs	49	18	31
□	1-B3@2	2	See exploration logs	70	23	47
●	1-B5@2	2	See exploration logs	35	22	13
■	1-B6@2	2	See exploration logs	45	19	26

	SAMPLE ID	TEST METHOD	REMARKS
▲	1-B1@1.5	PI: ASTM D4318, Wet Method	
◆	1-B2@1.5	PI: ASTM D4318, Wet Method	
□	1-B3@2	PI: ASTM D4318, Wet Method	
●	1-B5@2	PI: ASTM D4318, Wet Method	
■	1-B6@2	PI: ASTM D4318, Wet Method	

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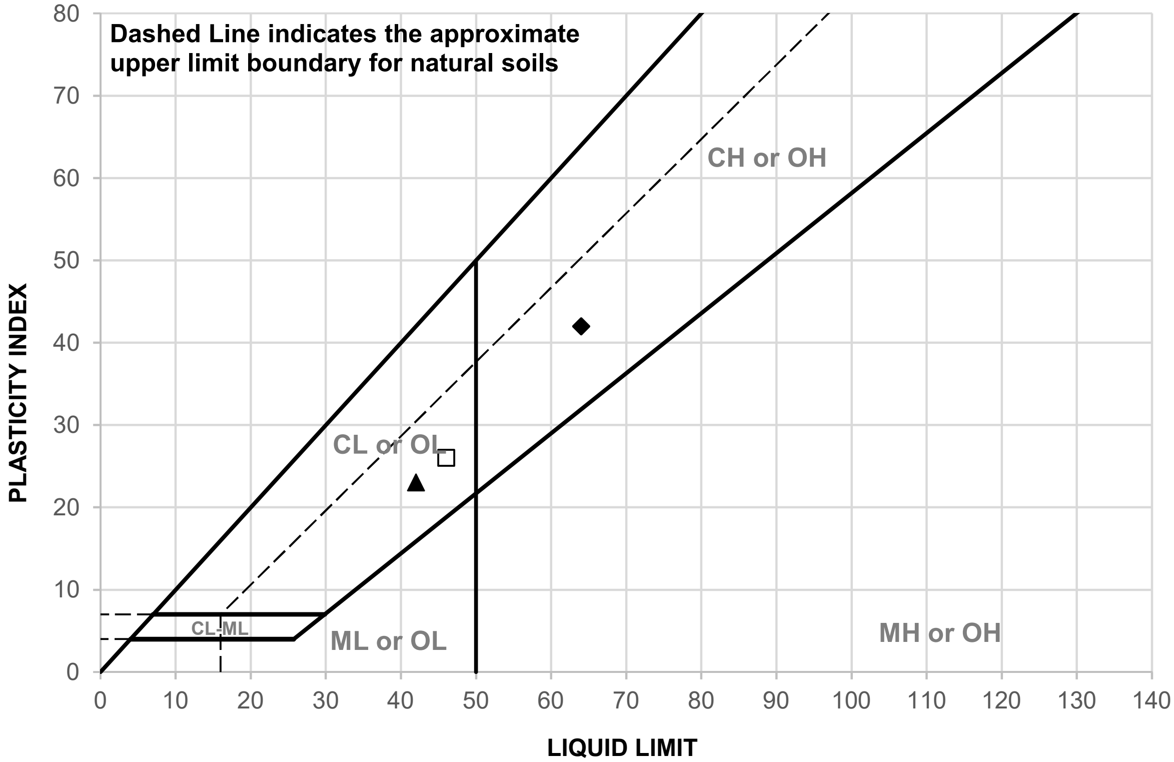
CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

LIQUID AND PLASTIC LIMITS TEST REPORT
ASTM D4318



	SAMPLE ID	DEPTH (ft)	MATERIAL DESCRIPTION	LL	PL	PI
▲	1-B7@1.5	1.5	See exploration logs	42	19	23
◆	1-B8@1.5	1.5	See exploration logs	64	22	42
□	1-B10@2	2	See exploration logs	46	20	26

	SAMPLE ID	TEST METHOD	REMARKS
▲	1-B7@1.5	PI: ASTM D4318, Wet Method	
◆	1-B8@1.5	PI: ASTM D4318, Wet Method	
□	1-B10@2	PI: ASTM D4318, Wet Method	

ENGEO
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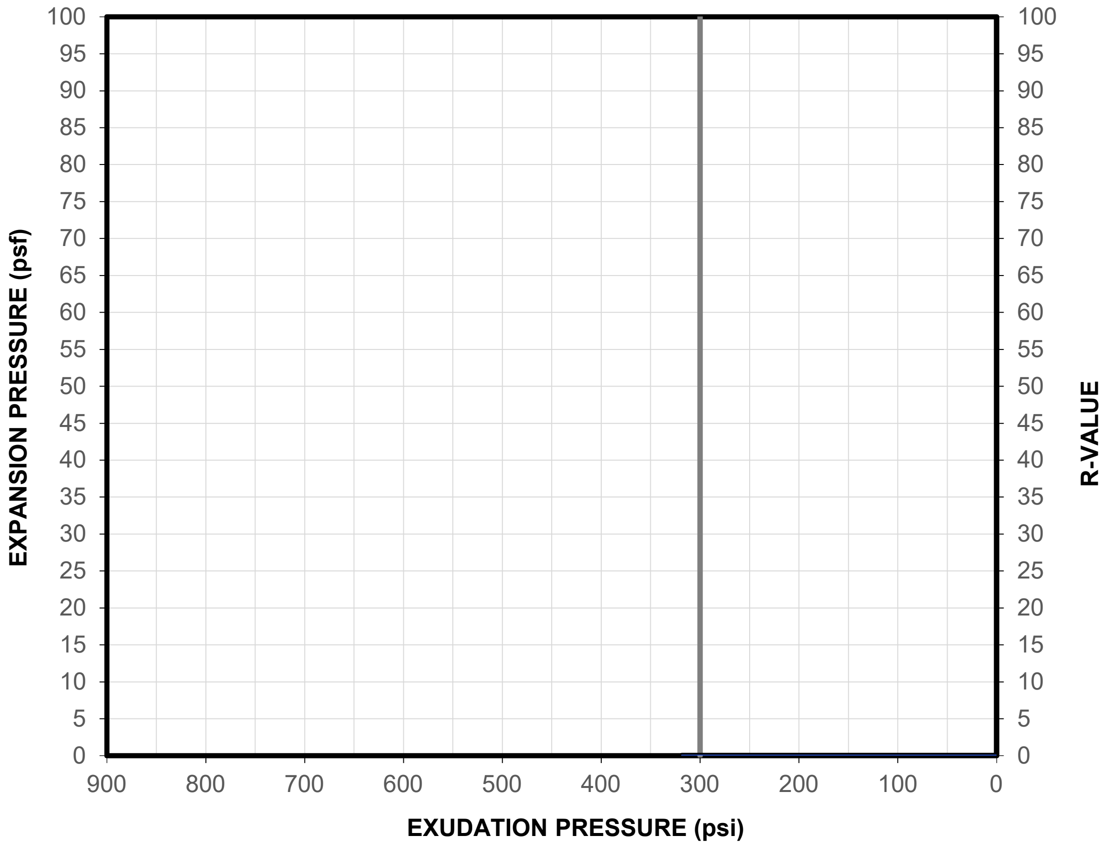
CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

R-VALUE TEST REPORT
CTM 301



SAMPLE ID	MATERIAL DESCRIPTION	SAMPLE LOCATION
1-B1@0	See exploration logs	1-B1 at 0 feet

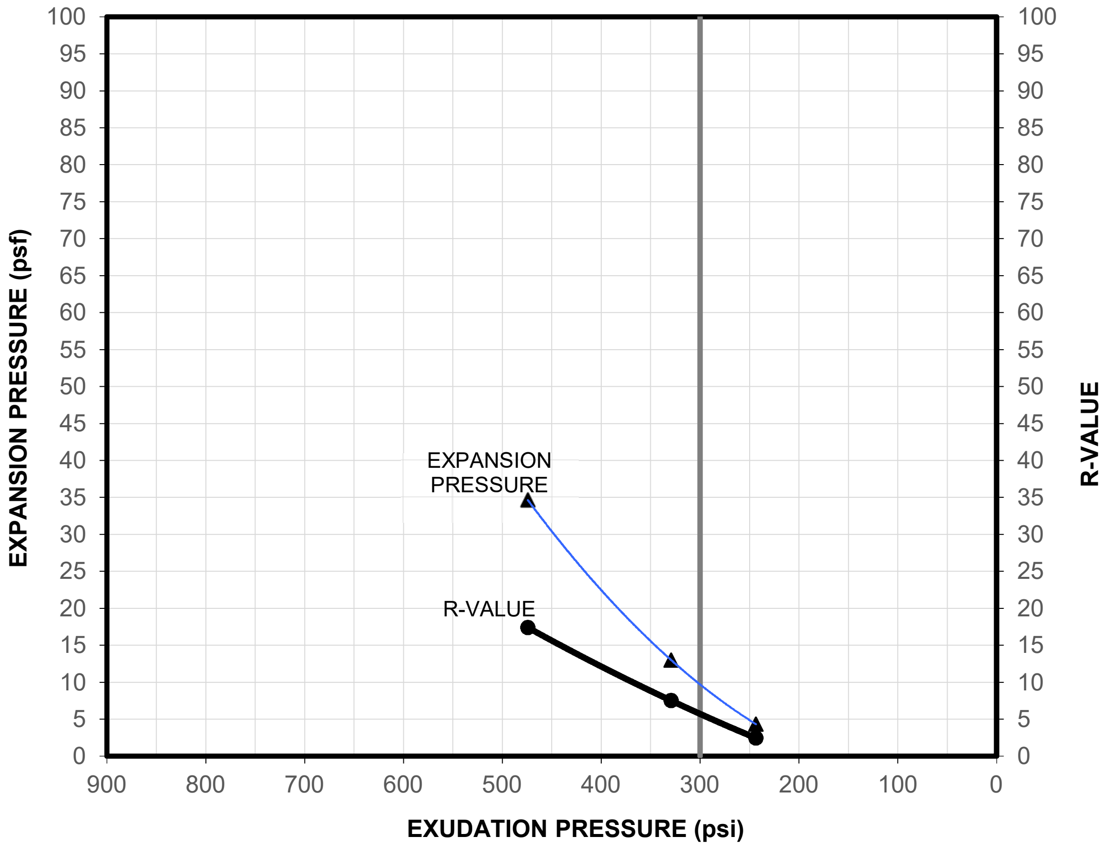
SPECIMENS	1 *	2	3
EXUDATION PRESSURE (psi)	318	0	0
EXPANSION PRESSURE (psf)	n/a	0	0
R-VALUE	< 5	n/a	n/a
MOISTURE CONTENT (%)	28.7	n/a	n/a
DRY DENSITY (pcf)	n/a	n/a	n/a
EXPANSION PRESSURE (psf) AT EXUDATION PRESSURE OF 300 psi		n/a	
R-VALUE AT EXUDATION PRESSURE OF 300 psi		TEST RESULT **Less than 5**	

* Soil extruded under the mold with less than 5 lights.

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589000001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/17/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

R-VALUE TEST REPORT

CTM 301



SAMPLE ID	MATERIAL DESCRIPTION	SAMPLE LOCATION		
1-B3@0	See exploration logs	1-B3 at 0 feet		
SPECIMENS		**1**	**2**	**3**
EXUDATION PRESSURE (psi)		474	329	243
EXPANSION PRESSURE (psf)		35	13	4
R-VALUE		17	8	2
MOISTURE CONTENT (%)		25.2	26.9	29.1
DRY DENSITY (pcf)		96.5	95.9	90.4
EXPANSION PRESSURE (psf) AT EXUDATION PRESSURE OF 300 psi			10	
R-VALUE AT EXUDATION PRESSURE OF 300 psi			**TEST RESULT**	
			6	

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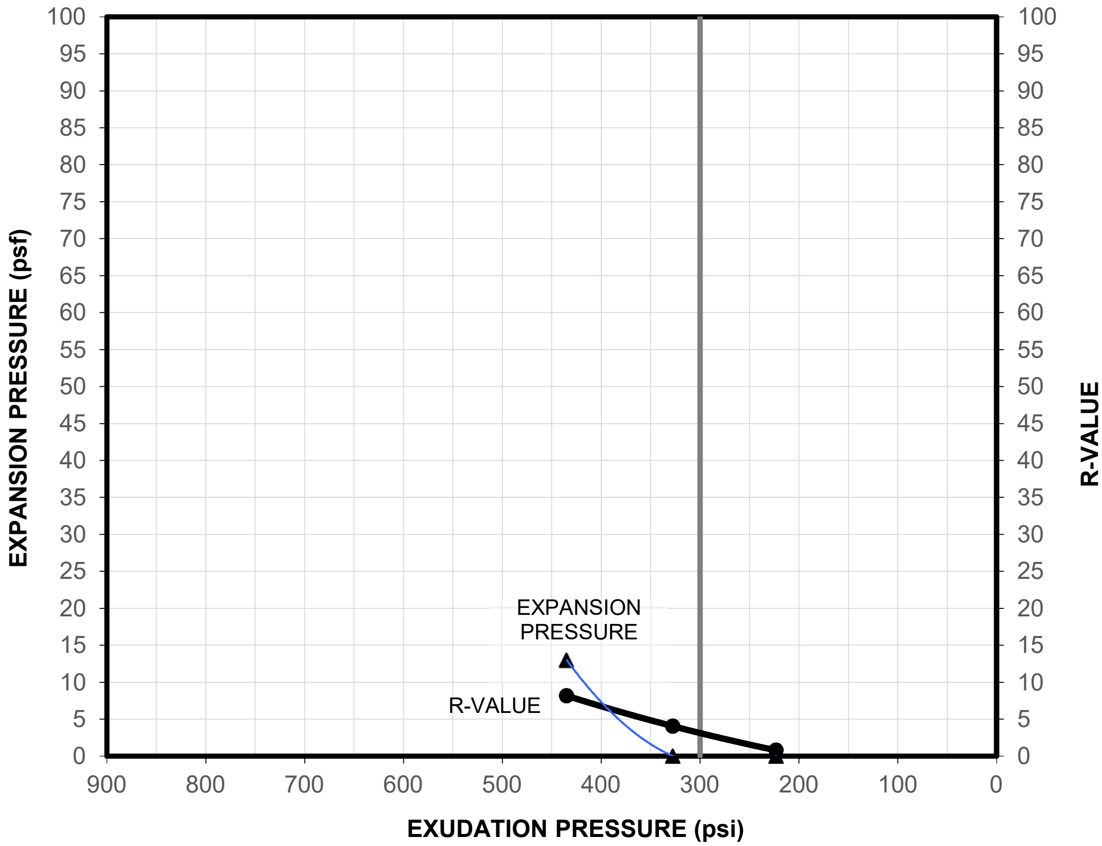
CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589000001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/17/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

R-VALUE TEST REPORT

CTM 301



SAMPLE ID	MATERIAL DESCRIPTION	SAMPLE LOCATION		
1-B3@0	See exploration logs	1-B3 at 0 feet		
SPECIMENS		**1**	**2**	**3**
EXUDATION PRESSURE (psi)		435	328	223
EXPANSION PRESSURE (psf)		13	0	0
R-VALUE		8	4	1
MOISTURE CONTENT (%)		42.7	44.7	46.7
DRY DENSITY (pcf)		83.8	81.6	79.6
EXPANSION PRESSURE (psf) AT EXUDATION PRESSURE OF 300 psi			0	
R-VALUE AT EXUDATION PRESSURE OF 300 psi		**TEST RESULT**		
		3		

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CLIENT: MLC Holdings, Inc.

PROJECT NAME: Dixon 257

PROJECT NO: 19589000001 PH001

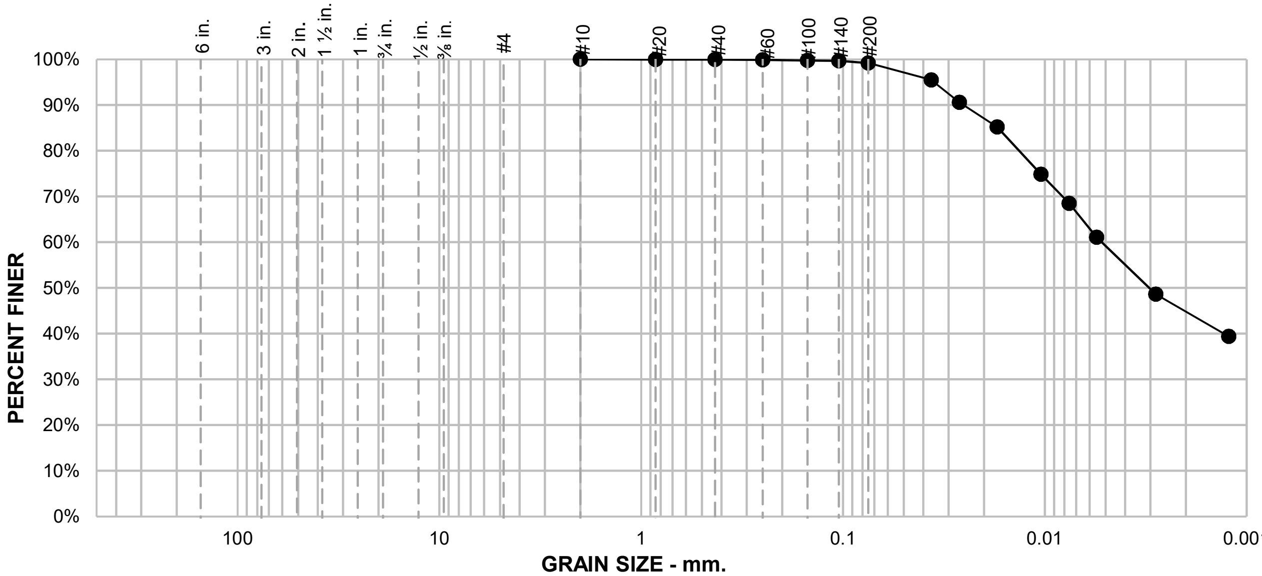
PROJECT LOCATION: Dixon, CA

REPORT DATE: 1/17/2022

TESTED BY: R. Montalvo

REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT
ASTM D422



SAMPLE ID: 1-B1@1.5

DEPTH (ft): 1.5

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
				0.1	0.7	54.4	44.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	99.9		
#60	99.9		
#100	99.8		
#140	99.6		
#200	99.2		
0.0365 mm.	95.5		
0.0265 mm.	90.6		
0.0172 mm.	85.2		
0.0104 mm.	74.8		
0.0076 mm.	68.5		
0.0055 mm.	61.1		
0.0028 mm.	48.6		
0.0012 mm.	39.4		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = 23 LL = 58 PI = 35

COEFFICIENTS

D_{90} = 0.0253 mm D_{85} = 0.0171 mm D_{60} = 0.0052 mm
D_{50} = 0.0030 mm D_{30} = D_{15} =
D_{10} = C_u = C_c =

CLASSIFICATION

USCS = CH

REMARKS

Silt/clay division of 0.002mm used
PI: ASTM D4318, Wet Method
USCS: ASTM D2487

* (no specification provided)

ENGEO
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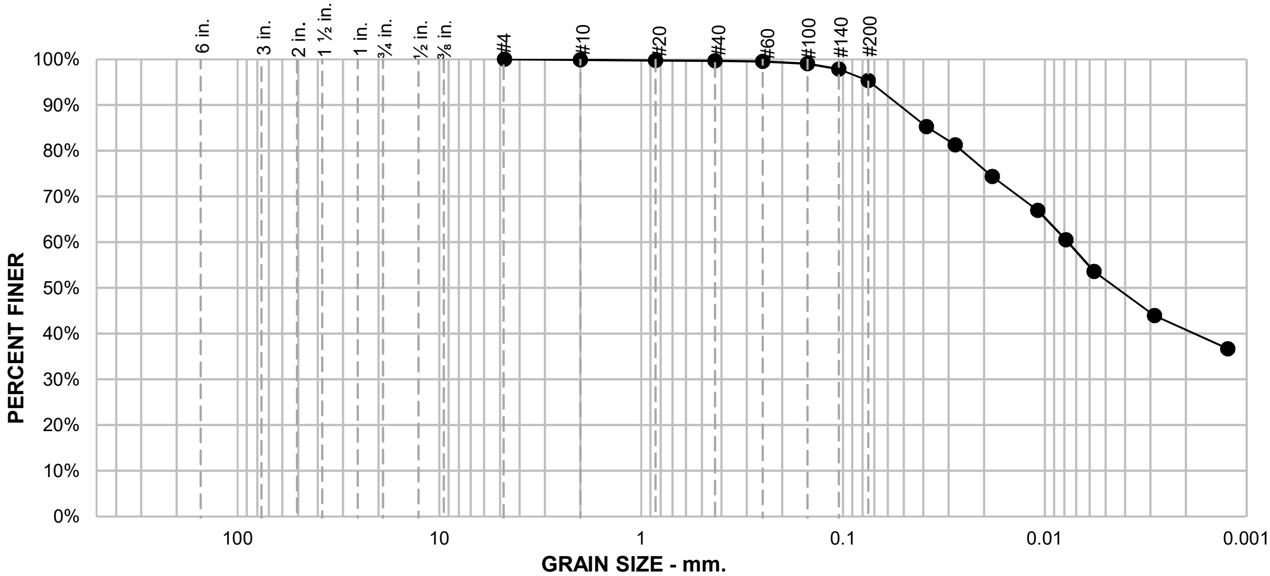
CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D422



SAMPLE ID: 1-B2@1.5

DEPTH (ft): 1.5

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
			0.2	0.1	4.3	54.6	40.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.8		
#40	99.7		
#60	99.5		
#100	99.0		
#140	97.8		
#200	95.4		
0.0386 mm.	85.2		
0.0278 mm.	81.3		
0.0182 mm.	74.3		
0.0108 mm.	66.9		
0.0079 mm.	60.5		
0.0057 mm.	53.6		
0.0029 mm.	44.0		
0.0012 mm.	36.7		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = 18	LL = 49	PI = 31

COEFFICIENTS

D_{90} = 0.0528 mm	D_{85} = 0.0380 mm	D_{60} = 0.0077 mm
D_{50} = 0.0044 mm	D_{30} =	D_{15} =
D_{10} =	C_u =	C_c =

CLASSIFICATION

USCS = CL

REMARKS

Silt/clay division of 0.002mm used
PI: ASTM D4318, Wet Method
USCS: ASTM D2487

* (no specification provided)

ENGEO
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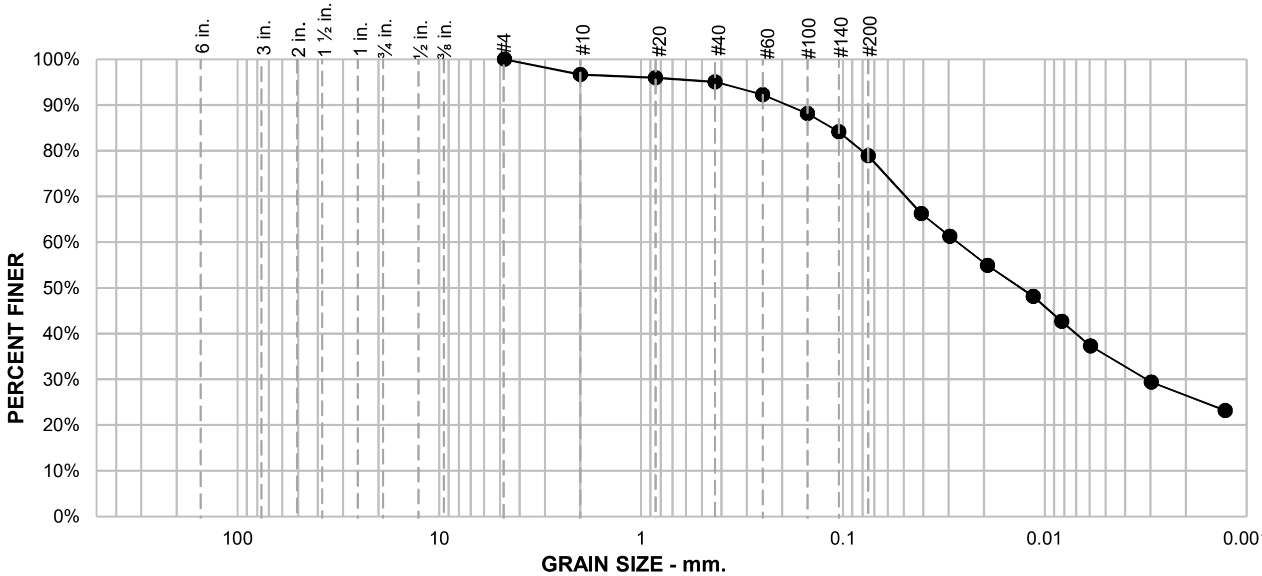
CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT
ASTM D422



SAMPLE ID: 1-B5@2

DEPTH (ft): 2

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
			3.3	1.6	16.2	52.4	26.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	96.7		
#20	95.9		
#40	95.1		
#60	92.3		
#100	88.1		
#140	84.1		
#200	78.9		
0.0408 mm.	66.2		
0.0296 mm.	61.3		
0.0192 mm.	54.9		
0.0114 mm.	48.1		
0.0082 mm.	42.7		
0.0059 mm.	37.3		
0.0030 mm.	29.4		
0.0013 mm.	23.2		

* (no specification provided)

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = 22 LL = 35 PI = 13

COEFFICIENTS

D_{90} = 0.1890 mm D_{85} = 0.1138 mm D_{60} = 0.0271 mm
D_{50} = 0.0132 mm D_{30} = 0.0031 mm D_{15} =
D_{10} = C_u = C_c =

CLASSIFICATION

USCS = CL

REMARKS

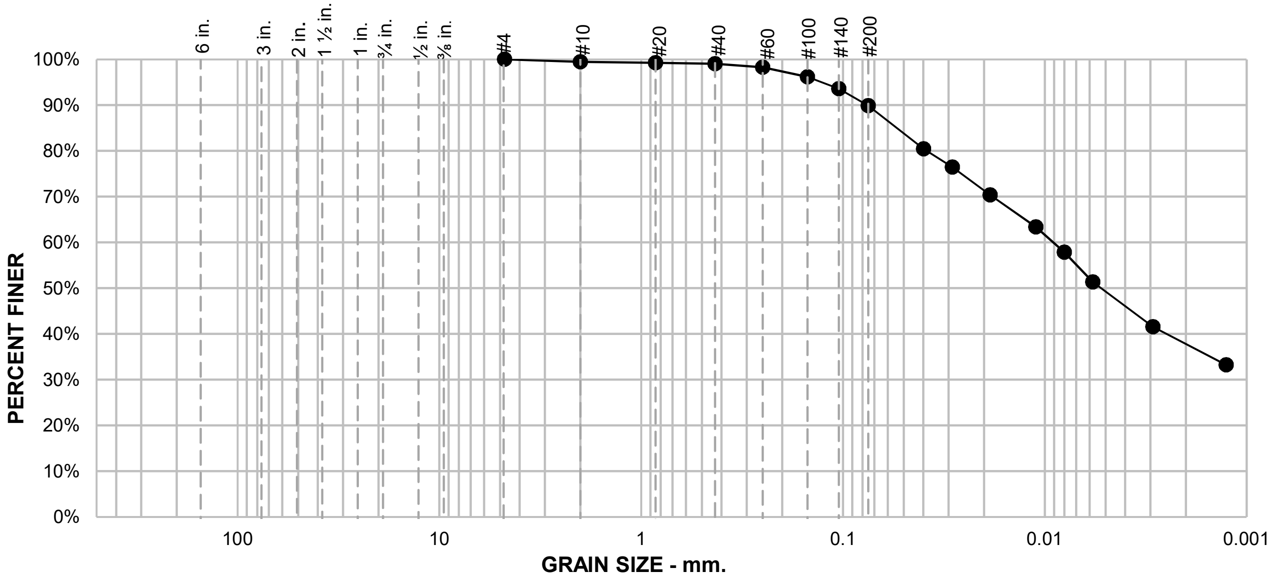
Silt/clay division of 0.002mm used
PI: ASTM D4318, Wet Method
USCS: ASTM D2487

Expect Excellence

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D422



SAMPLE ID: 1-B6@2

DEPTH (ft): 2

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
			0.6	0.4	9.1	52.1	37.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	99.3		
#40	99.0		
#60	98.3		
#100	96.2		
#140	93.6		
#200	89.9		
0.0399 mm.	80.4		
0.0287 mm.	76.4		
0.0187 mm.	70.4		
0.0111 mm.	63.4		
0.0080 mm.	57.9		
0.0058 mm.	51.4		
0.0029 mm.	41.6		
0.0013 mm.	33.2		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = 19 LL = 45 PI = 26

COEFFICIENTS

D_{90} = 0.0757 mm D_{85} = 0.0542 mm D_{60} = 0.0091 mm

D_{50} = 0.0053 mm D_{30} = D_{15} =

D_{10} = C_u = C_c =

CLASSIFICATION

USCS = CL

REMARKS

Silt/clay division of 0.002mm used
PI: ASTM D4318, Wet Method
USCS: ASTM D2487

* (no specification provided)

CLIENT: MLC Holdings, Inc.

PROJECT NAME: Dixon 257

PROJECT NO: 19589.000.001 PH001

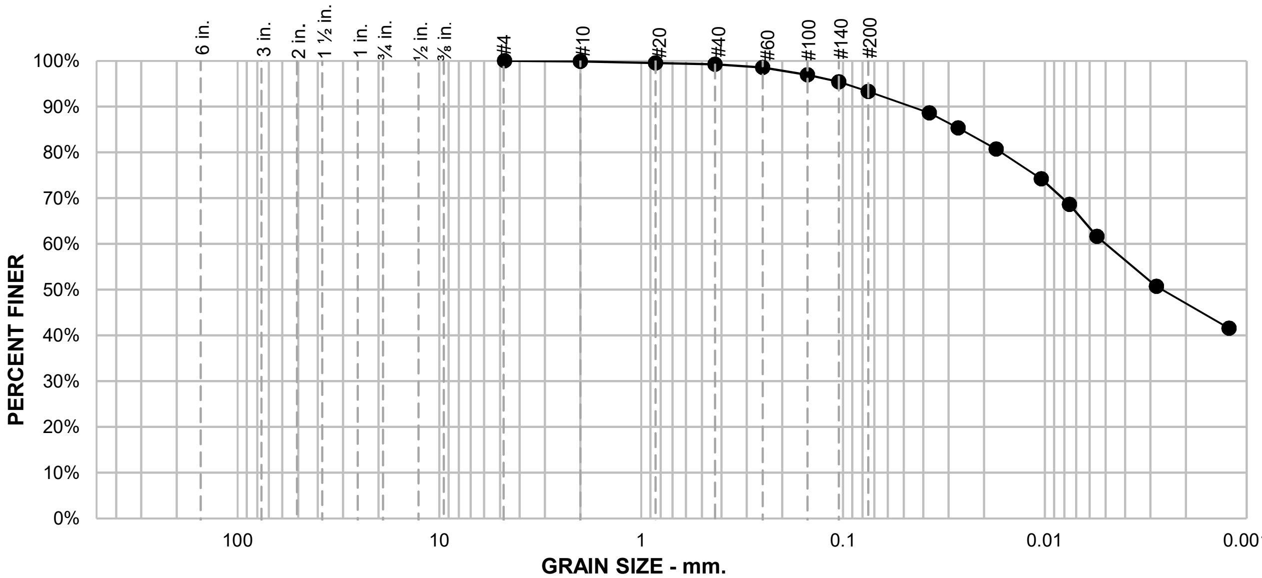
PROJECT LOCATION: Dixon, CA

REPORT DATE: 1/20/2022

TESTED BY: R. Montalvo

REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT
ASTM D422



SAMPLE ID: 1-B8@1.5

DEPTH (ft): 1.5

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
			0.2	0.5	6.0	46.3	47.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.5		
#40	99.3		
#60	98.5		
#100	96.9		
#140	95.4		
#200	93.3		
0.0373 mm.	88.6		
0.0269 mm.	85.4		
0.0174 mm.	80.7		
0.0104 mm.	74.2		
0.0076 mm.	68.6		
0.0055 mm.	61.6		
0.0028 mm.	50.7		
0.0012 mm.	41.6		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = 22 LL = 64 PI = 42

COEFFICIENTS

D_{90} = 0.0460 mm D_{85} = 0.0259 mm D_{60} = 0.0050 mm
D_{50} = 0.0026 mm D_{30} = D_{15} =
D_{10} = C_u = C_c =

CLASSIFICATION

USCS = CH

REMARKS

Silt/clay division of 0.002mm used
PI: ASTM D4318, Wet Method
USCS: ASTM D2487

* (no specification provided)

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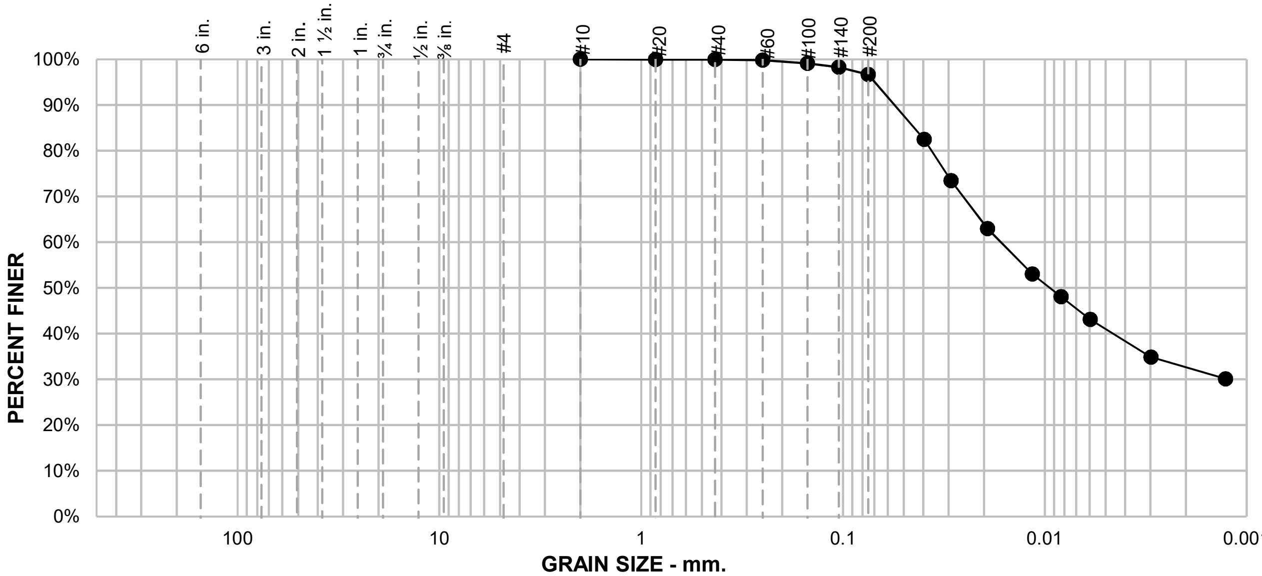
CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT
ASTM D422



SAMPLE ID: 1-B10@2

DEPTH (ft): 2

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
				0.1	3.2	64.1	32.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	99.9		
#60	99.8		
#100	99.1		
#140	98.3		
#200	96.7		
0.0395 mm.	82.4		
0.0291 mm.	73.5		
0.0192 mm.	63.0		
0.0115 mm.	53.0		
0.0083 mm.	48.1		
0.0060 mm.	43.1		
0.0030 mm.	34.9		
0.0013 mm.	30.1		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = 20 LL = 46 PI = 26

COEFFICIENTS

D_{90} = 0.0556 mm D_{85} = 0.0444 mm D_{60} = 0.0165 mm

D_{50} = 0.0094 mm D_{30} = D_{15} =

D_{10} = C_u = C_c =

CLASSIFICATION

USCS = CL

REMARKS

Silt/clay division of 0.002mm used
PI: ASTM D4318, Wet Method
USCS: ASTM D2487

* (no specification provided)

CLIENT: MLC Holdings, Inc.

PROJECT NAME: Dixon 257

PROJECT NO: 19589.000.001 PH001

PROJECT LOCATION: Dixon, CA

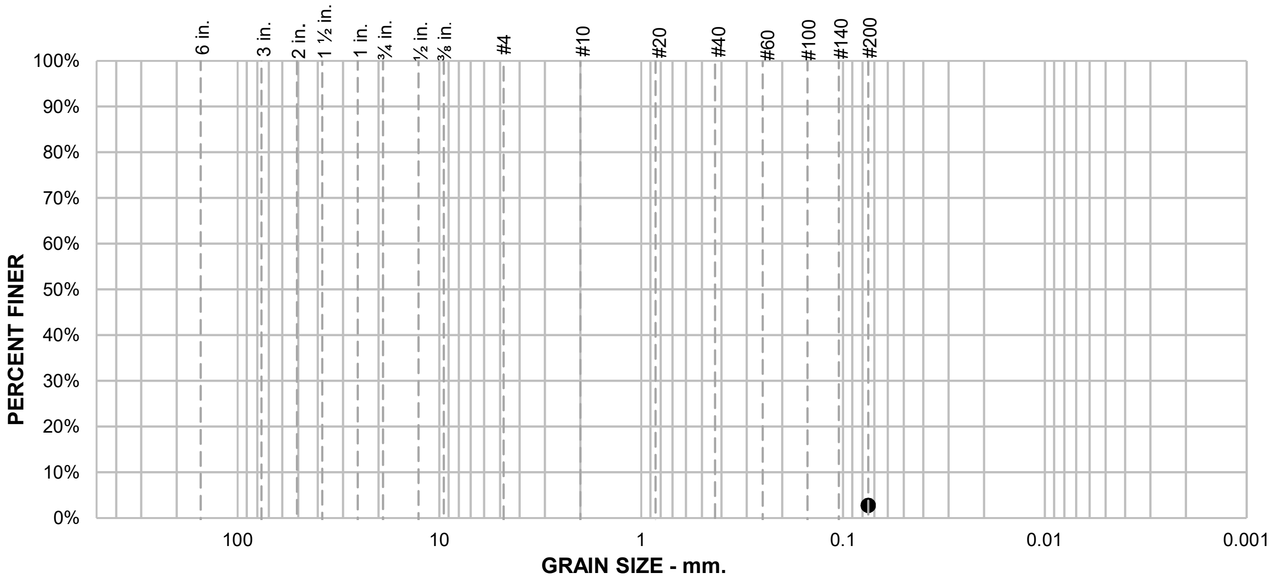
REPORT DATE: 1/20/2022

TESTED BY: R. Montalvo

REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D1140, Method B



SAMPLE ID: 1-B3@11

DEPTH (ft): 11

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
						2.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	2.8		

* (no specification provided)

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = LL = PI =

COEFFICIENTS

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

CLASSIFICATION

USCS =

REMARKS

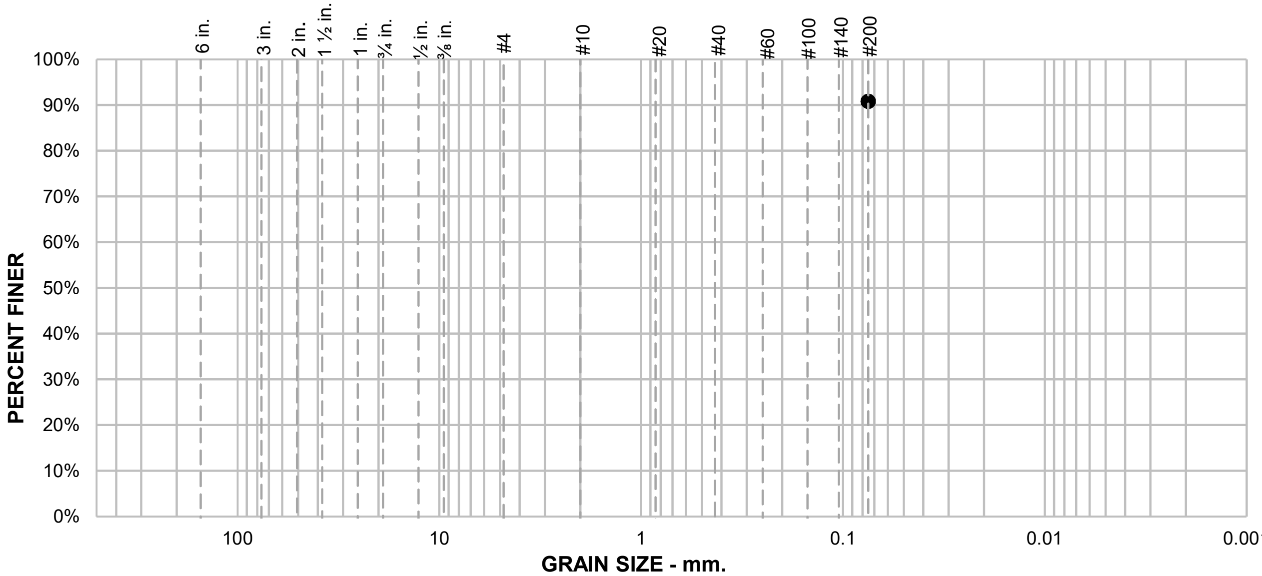
Soak time = 180 min
Dry sample weight = 584.3 g

ENGEO Expect Excellence

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon , CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D1140, Method B



SAMPLE ID: 1-B4@1.5

DEPTH (ft): 1.5

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
						90.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	90.8		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = LL = PI =

COEFFICIENTS

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

CLASSIFICATION

USCS =

REMARKS

Soak time = 180 min
Dry sample weight = 108.4 g

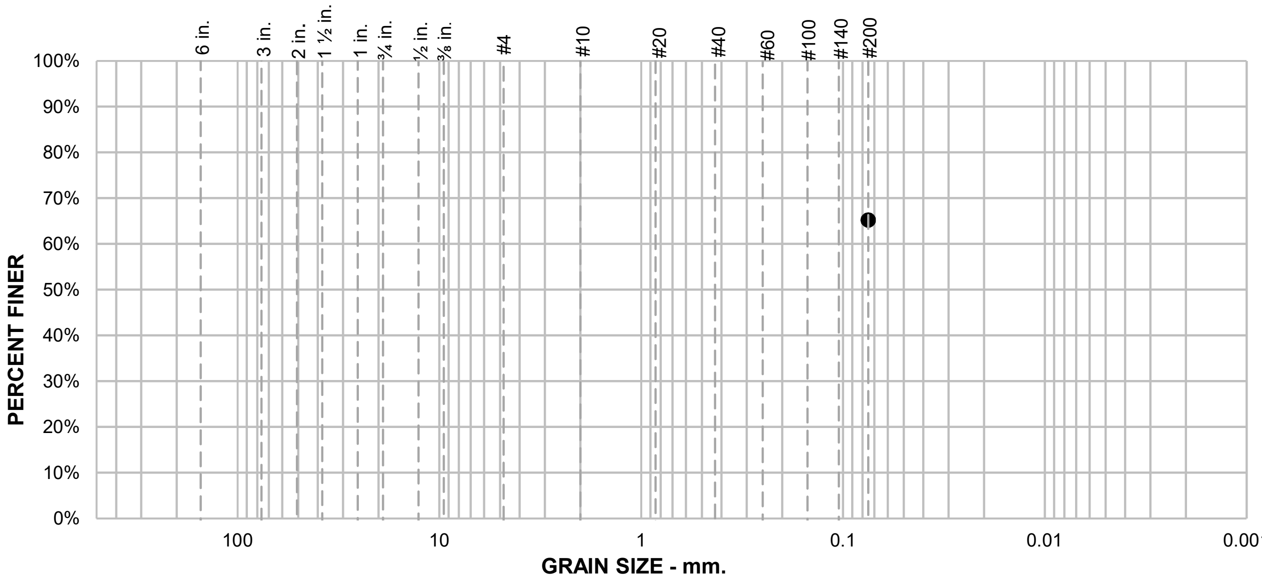
* (no specification provided)

ENGEO
Expect Excellence

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon , CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D1140, Method B



SAMPLE ID: 1-B4@20.5

DEPTH (ft): 20.5

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
						65.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	65.2		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = LL = PI =

COEFFICIENTS

D_{90} = D_{85} = D_{60} =

D_{50} = D_{30} = D_{15} =

D_{10} = C_u = C_c =

CLASSIFICATION

USCS =

REMARKS

Soak time = 180 min
Dry sample weight = 299.8 g

* (no specification provided)

CLIENT: MLC Holdings, Inc.

PROJECT NAME: Dixon 257

PROJECT NO: 19589.000.001 PH001

PROJECT LOCATION: Dixon , CA

REPORT DATE: 1/20/2022

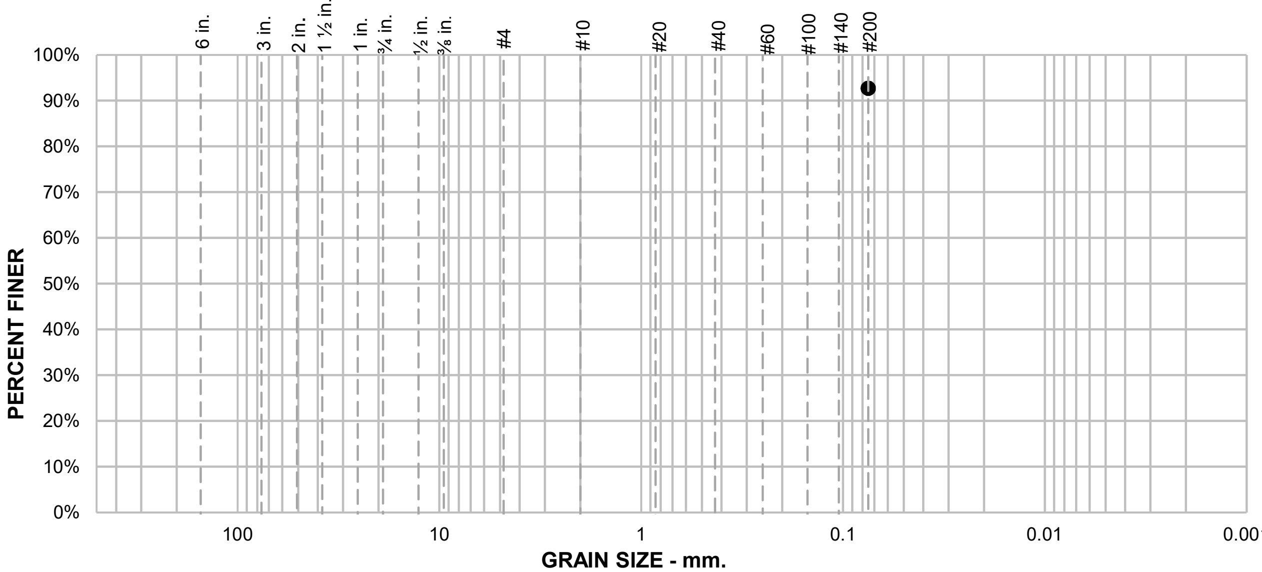
TESTED BY: R. Montalvo

REVIEWED BY: M. Gilbert

ENGEO
Expect Excellence

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D1140, Method B



SAMPLE ID: 1-B5@4

DEPTH (ft): 4

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
						92.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	92.7		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = LL = PI =

COEFFICIENTS

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

CLASSIFICATION

USCS =

REMARKS

Soak time = 180 min
Dry sample weight = 337.5 g

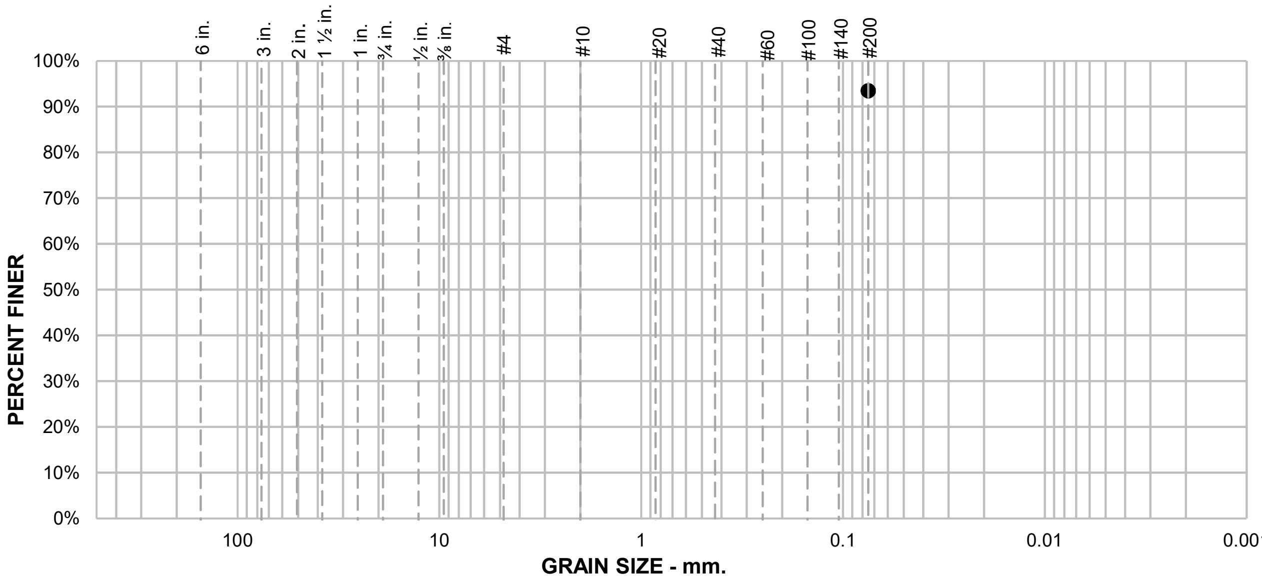
* (no specification provided)

ENGEO
Expect Excellence

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon , CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D1140, Method B



SAMPLE ID: 1-B5@11

DEPTH (ft): 11

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
						93.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	93.5		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL =	LL =	PI =

COEFFICIENTS

D_{90} =	D_{85} =	D_{60} =
D_{50} =	D_{30} =	D_{15} =
D_{10} =	C_u =	C_c =

CLASSIFICATION

USCS =

REMARKS

Soak time = 180 min
Dry sample weight = 213 g

* (no specification provided)

ENGEO
Expect Excellence

CLIENT: MLC Holdings, Inc.

PROJECT NAME: Dixon 257

PROJECT NO: 19589.000.001 PH001

PROJECT LOCATION: Dixon , CA

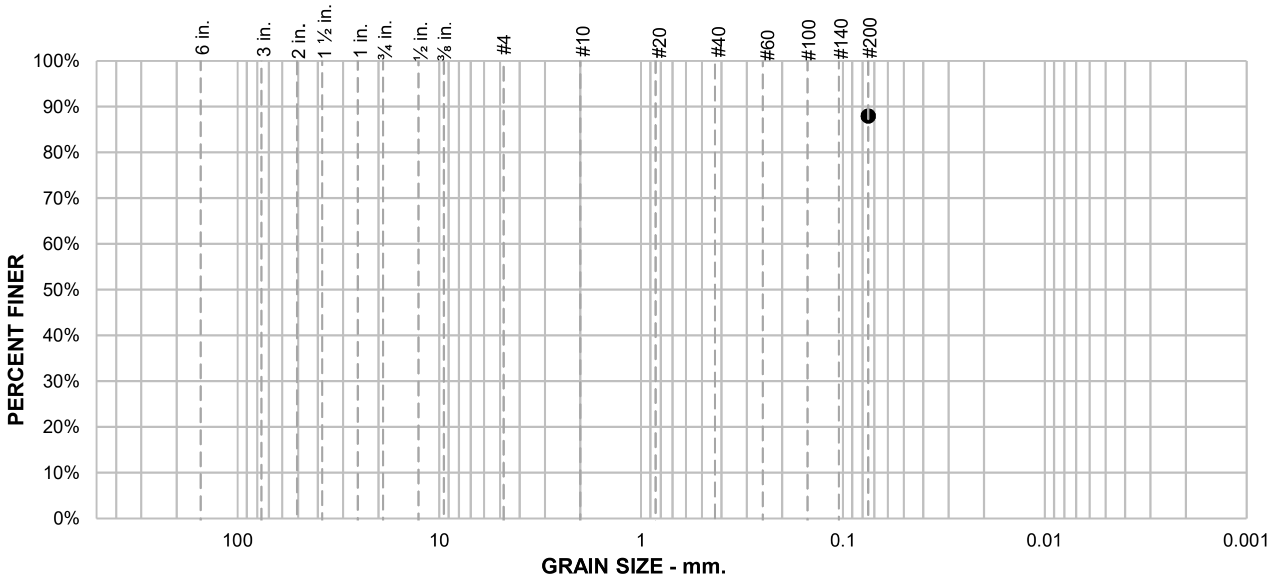
REPORT DATE: 1/20/2022

TESTED BY: R. Montalvo

REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D1140, Method B



SAMPLE ID: 1-B9@1.5

DEPTH (ft): 1.5

LOCATION: 1-B9 at 1.5 feet

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
						87.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	87.9		

* (no specification provided)

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = LL = PI =

COEFFICIENTS

D_{90} = D_{85} = D_{60} =

D_{50} = D_{30} = D_{15} =

D_{10} = C_u = C_c =

CLASSIFICATION

USCS =

REMARKS

Soak time = 180 min
Dry sample weight = 182.7 g

ENGEO
Expect Excellence

CLIENT: MLC Holdings, Inc.

PROJECT NAME: Dixon 257

PROJECT NO: 19589.000.001 PH001

PROJECT LOCATION: Dixon , CA

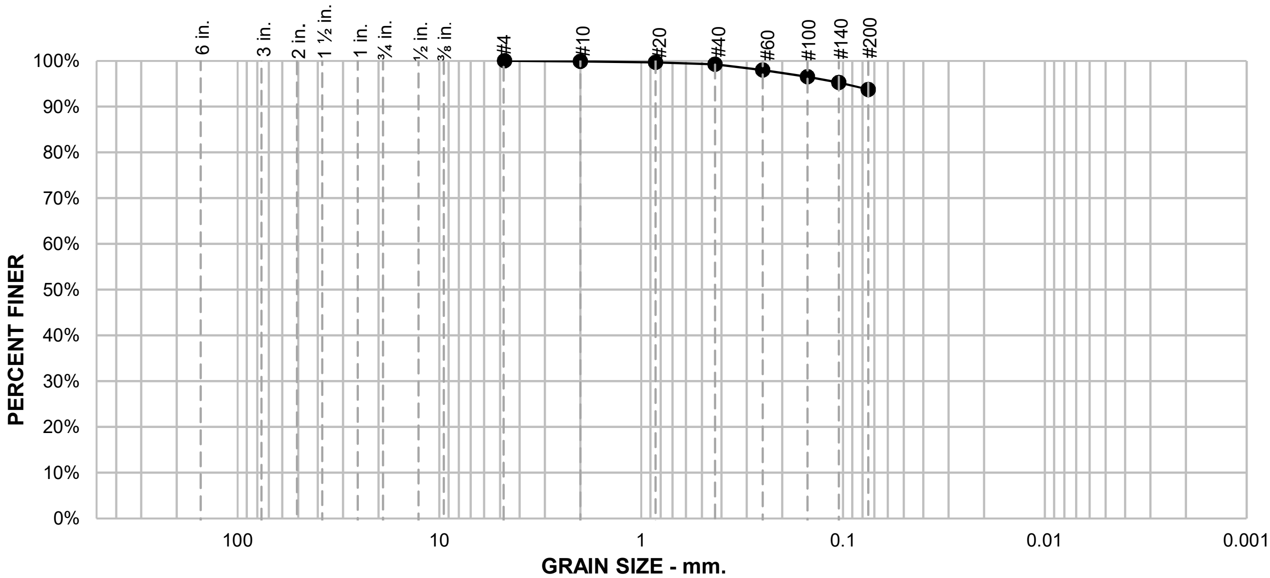
REPORT DATE: 1/20/2022

TESTED BY: R. Montalvo

REVIEWED BY: M. Gilbert

PARTICLE SIZE DISTRIBUTION REPORT

ASTM D6913, Method B



SAMPLE ID: 1-B3@2

DEPTH (ft): 2

% +75mm	% GRAVEL		% SAND			% FINES	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	CLAY
			0.1	0.7	5.5	93.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.7		
#40	99.2		
#60	98.0		
#100	96.5		
#140	95.2		
#200	93.7		

SOIL DESCRIPTION

See exploration logs

ATTERBERG LIMITS

PL = 23 LL = 70 PI = 47

COEFFICIENTS

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

CLASSIFICATION

USCS = CH

REMARKS

PI: ASTM D4318, Wet Method

* (no specification provided)

ENGEO
Expect Excellence

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon , CA
REPORT DATE: 1/20/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

MOISTURE CONTENT REPORT
ASTM D2216

SAMPLE ID	1-B1@1.5	1-B1@6	1-B1@15	1-B2@1.5	1-B2@5.5	1-B2@10.5	1-B3@2	1-B3@6
DEPTH (ft.)	1.5	6	15	1.5	5.5	10.5	2	6
METHOD A OR B	B	B	B	B	B	B	B	B
MOISTURE CONTENT (%)	24.5	19.4	7.4	21.3	29.5	18.7	24.4	17.4

SAMPLE ID	1-B3@11	1-B4@1.5	1-B4@10.5	1-B4@20.5	1-B5@2	1-B5@4	1-B5@11	1-B6@6
DEPTH (ft.)	11	1.5	10.5	20.5	2	4	11	6
METHOD A OR B	B	B	B	B	B	B	B	B
MOISTURE CONTENT (%)	6.2	24.0	22.3	28.8	19.3	22.4	20.1	19.2

SAMPLE ID	1-B6@10.5	1-B7@4	1-B7@6	1-B7@10.5	1-B8@10.5	1-B8@20.5	1-B9@1.5	1-B9@11
DEPTH (ft.)	10.5	4	6	10.5	10.5	20.5	1.5	11
METHOD A OR B	B	B	B	B	B	B	B	B
MOISTURE CONTENT (%)	18.3	20.4	21.1	22.4	20.4	34.9	24.3	24.1

SAMPLE ID	1-B10@10.5	1-B11@10.5						
DEPTH (ft.)	10.5	10.5						
METHOD A OR B	B	B						
MOISTURE CONTENT (%)	22.8	19.3						

ENGEO
Expect Excellence

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/14/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

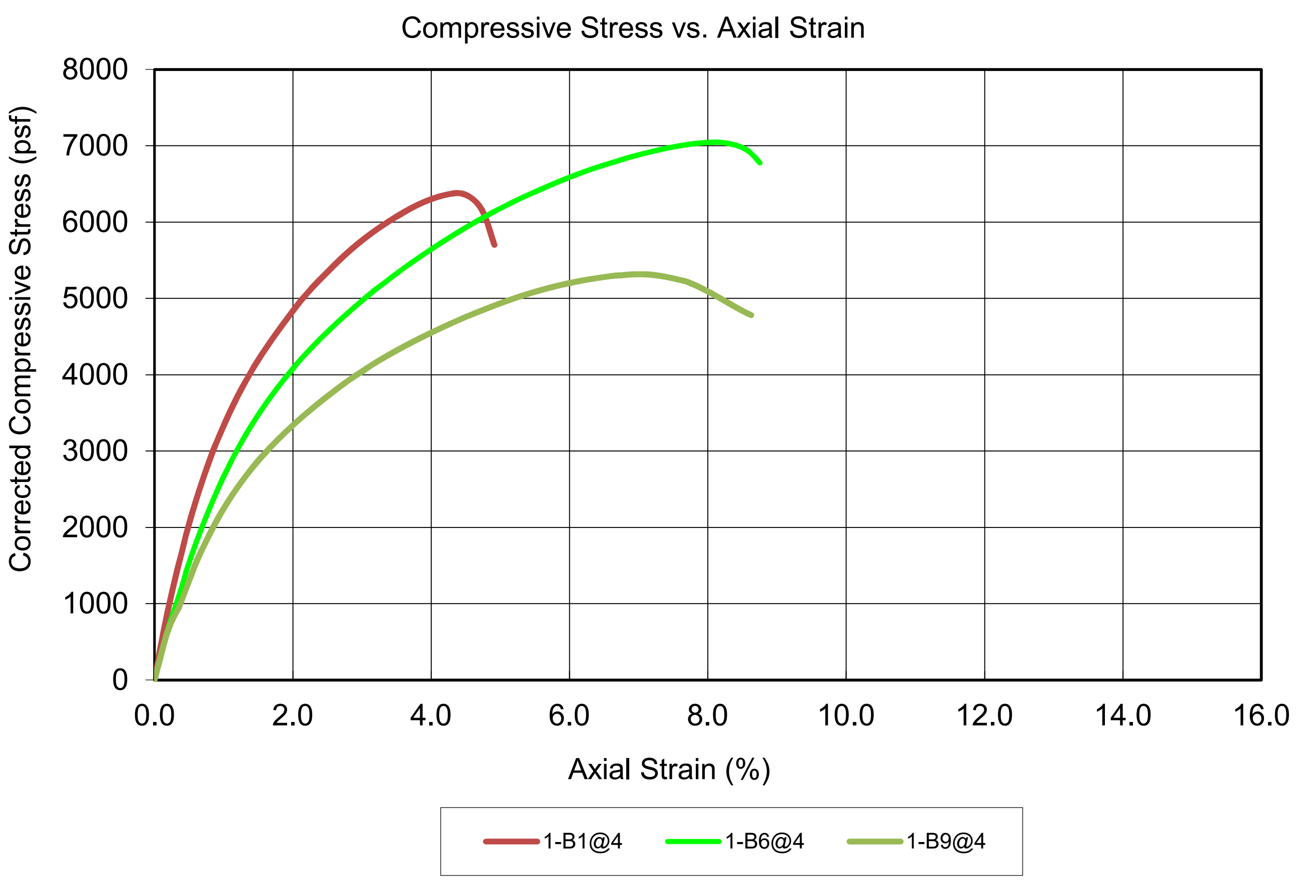
MOISTURE-DENSITY DETERMINATION REPORT
ASTM D7263

SAMPLE ID	1-B4@3.5	1-B8@4	1-B10@4					
DEPTH (ft.)	3.5	4	4					
METHOD A OR B	A	A	A					
MOISTURE CONTENT (%)	25.0	25.3	20.0					
DRY DENSITY (pcf)	90.1	95.2	105.9					

ENGEO
Expect Excellence

CLIENT: MLC Holdings, Inc.
PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.0001 PH001
PROJECT LOCATION: Dixon, CA
REPORT DATE: 1/14/2022
TESTED BY: R. Montalvo
REVIEWED BY: M. Gilbert

UNCONFINED COMPRESSION TEST REPORT
(ASTM D2166)



BEFORE TEST	SPECIMEN 1-B1@4	SPECIMEN 1-B6@4	SPECIMEN 1-B9@4
Test Moisture Content (%)	19.75	20.85	21.22
Dry Density (pcf)	108.3	103.9	105.8
Saturation (%)	94.6	89.4	95.5
Void Ratio	0.57	0.63	0.60
Diameter (in)	2.382	2.384	2.399
Height (in)	5.903	5.713	5.333
Height-To-Diameter Ratio	2.48	2.40	2.22
TEST DATA			
Unconfined Compressive Strength (psf)	6379	7047	5316
Undrained Shear Strength (psf)	3189.7	3523.5	2657.8
Strain Rate (in/min)	0.050	0.050	0.050
Specific Gravity (ASSUMED)	2.720	2.720	2.720
Strain at Failure(%)	4.40	8.05	7.13
Test Remarks			

SPECIMEN	DESCRIPTION
1-B1@4	See exploration logs
1-B6@4	See exploration logs
1-B9@4	See esploration logs

ENGEO
Expect Excellence

PROJECT NAME: Dixon 257
PROJECT NO: 19589.000.001 PH001
CLIENT: MLC Holdings, Inc.
LOCATION: Dixon, CA

Report Date: 1/14/21
Tested By: R. Montalvo
Reviewed By: M. Gilbert

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/19/2022
Date Submitted 01/12/2022

To: Abram Magel
Engeo, Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 19589.000.001 PH001 Site ID : 1-B2 @ 2.
Thank you for your business.

* For future reference to this analysis please use SUN # 86431-180019.

EVALUATION FOR SOIL CORROSION

Soil pH	6.17	
Minimum Resistivity	0.75 ohm-cm (x1000)	
Chloride	19.4 ppm	00.00194 %
Sulfate	58.4 ppm	00.00584 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/19/2022
Date Submitted 01/12/2022

To: Abram Magel
Engeo, Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 19589.000.001 PH001 Site ID : 1-B7 @ 2.
Thank you for your business.

* For future reference to this analysis please use SUN # 86431-180020.

EVALUATION FOR SOIL CORROSION

Soil pH	6.41		
Minimum Resistivity	1.37	ohm-cm (x1000)	
Chloride	3.2 ppm	00.00032	%
Sulfate	17.9 ppm	00.00179	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/19/2022
Date Submitted 01/12/2022

To: Abram Magel
Engeo, Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 19589.000.001 PH001 Site ID : 1-B9 @ 3.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 86431-180021.

EVALUATION FOR SOIL CORROSION

Soil pH	6.87	
Minimum Resistivity	1.23 ohm-cm (x1000)	
Chloride	2.9 ppm	00.00029 %
Sulfate	15.1 ppm	00.00151 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 01/19/2022
Date Submitted 01/12/2022

To: Abram Magel
Engeo, Inc.
2213 Plaza Dr.
Rocklin, CA 95765

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 19589.000.001 PH001 Site ID : 1-B11 @ 4.
Thank you for your business.

* For future reference to this analysis please use SUN # 86431-180022.

EVALUATION FOR SOIL CORROSION

Soil pH	6.82	
Minimum Resistivity	0.88 ohm-cm (x1000)	
Chloride	3.8 ppm	00.00038 %
Sulfate	26.5 ppm	00.00265 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422m

APPENDIX C

CPT LOGS AND LIQUEFACTION ANALYSIS

ENGEO Incorporated
2213 Plaza Drive
Rocklin, CA 95765
www.engeo.com

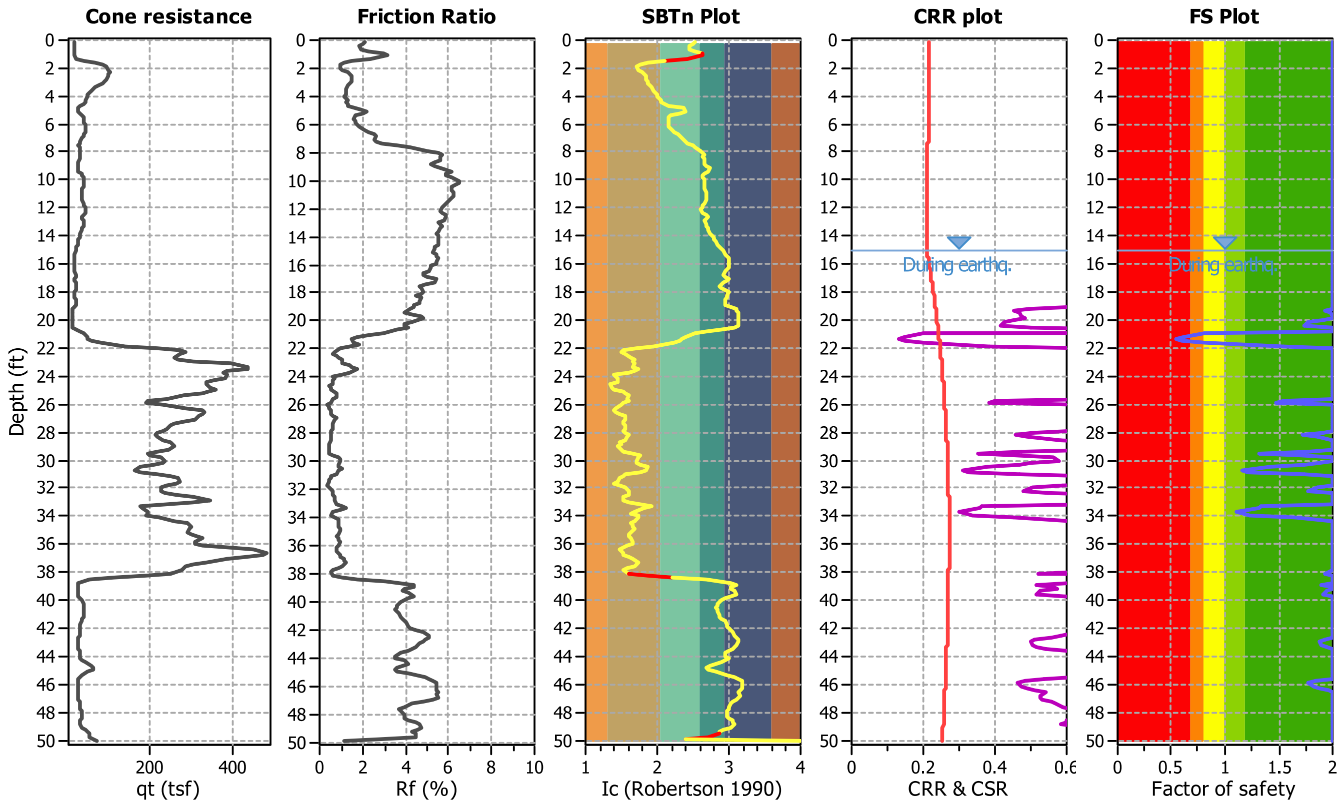
LIQUEFACTION ANALYSIS REPORT

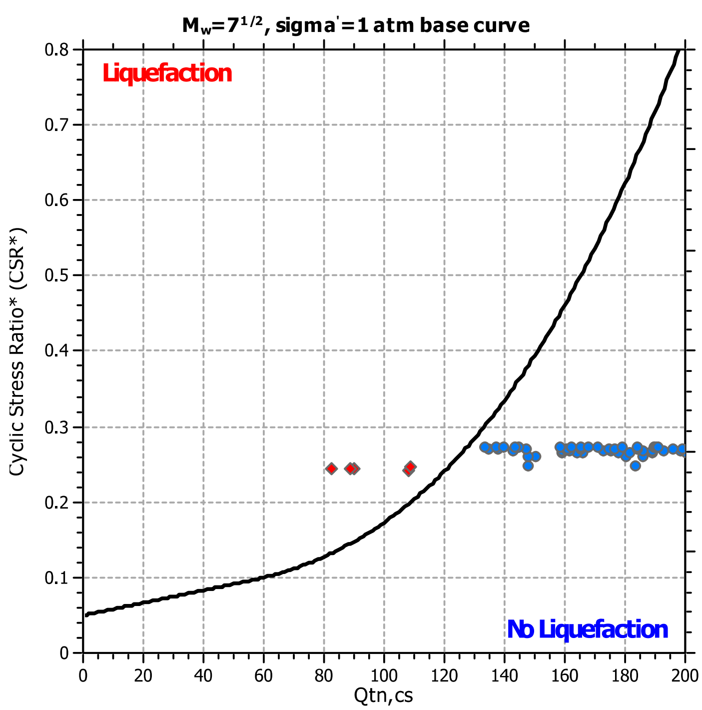
Project title : Dixon 257 **Location : Dixon, CA**

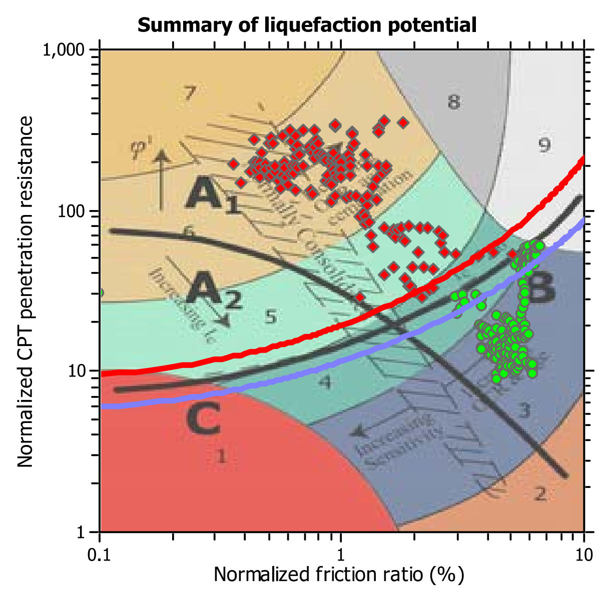
CPT file : 1-CPT1

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	25.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	No		

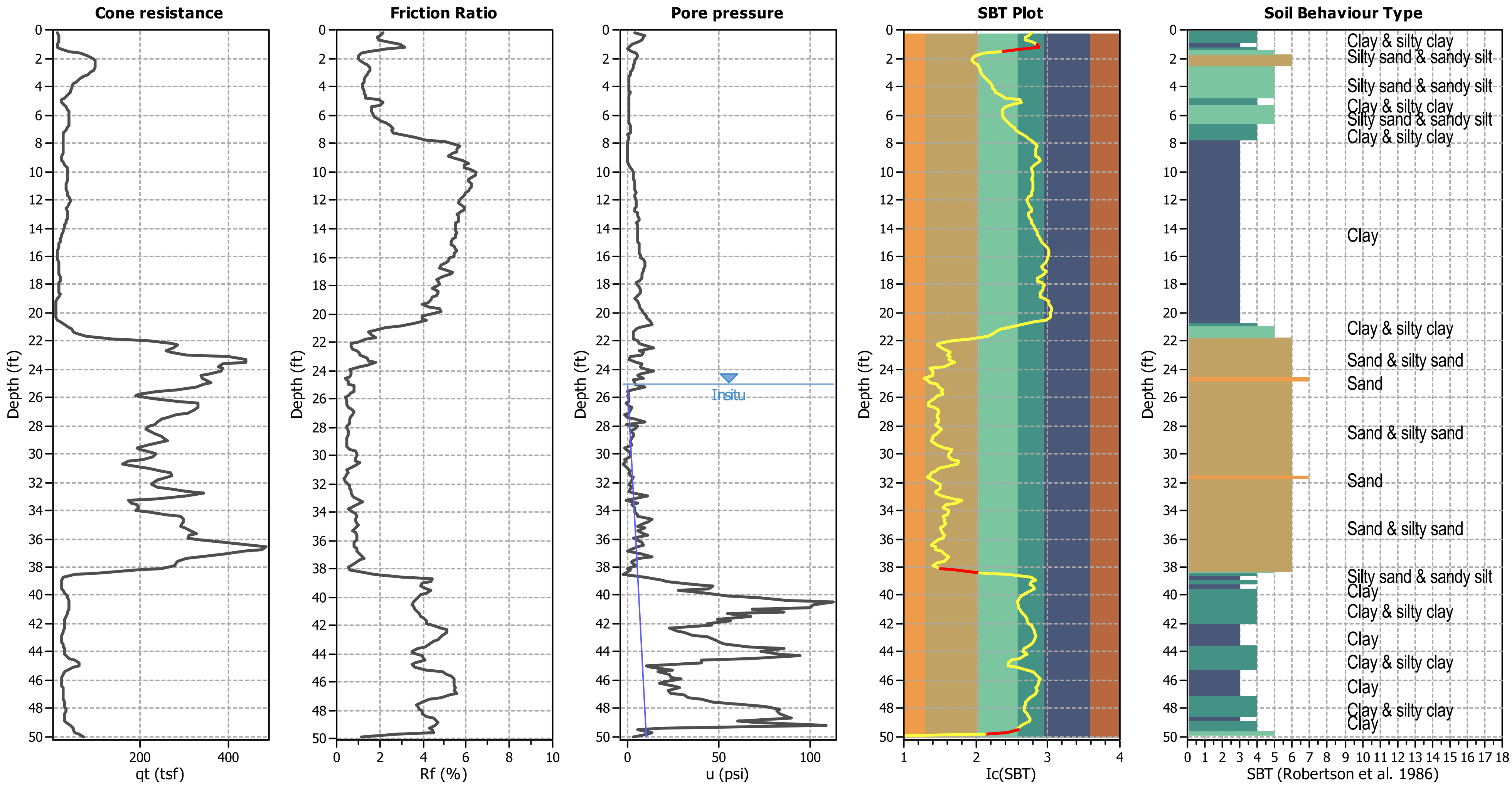






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



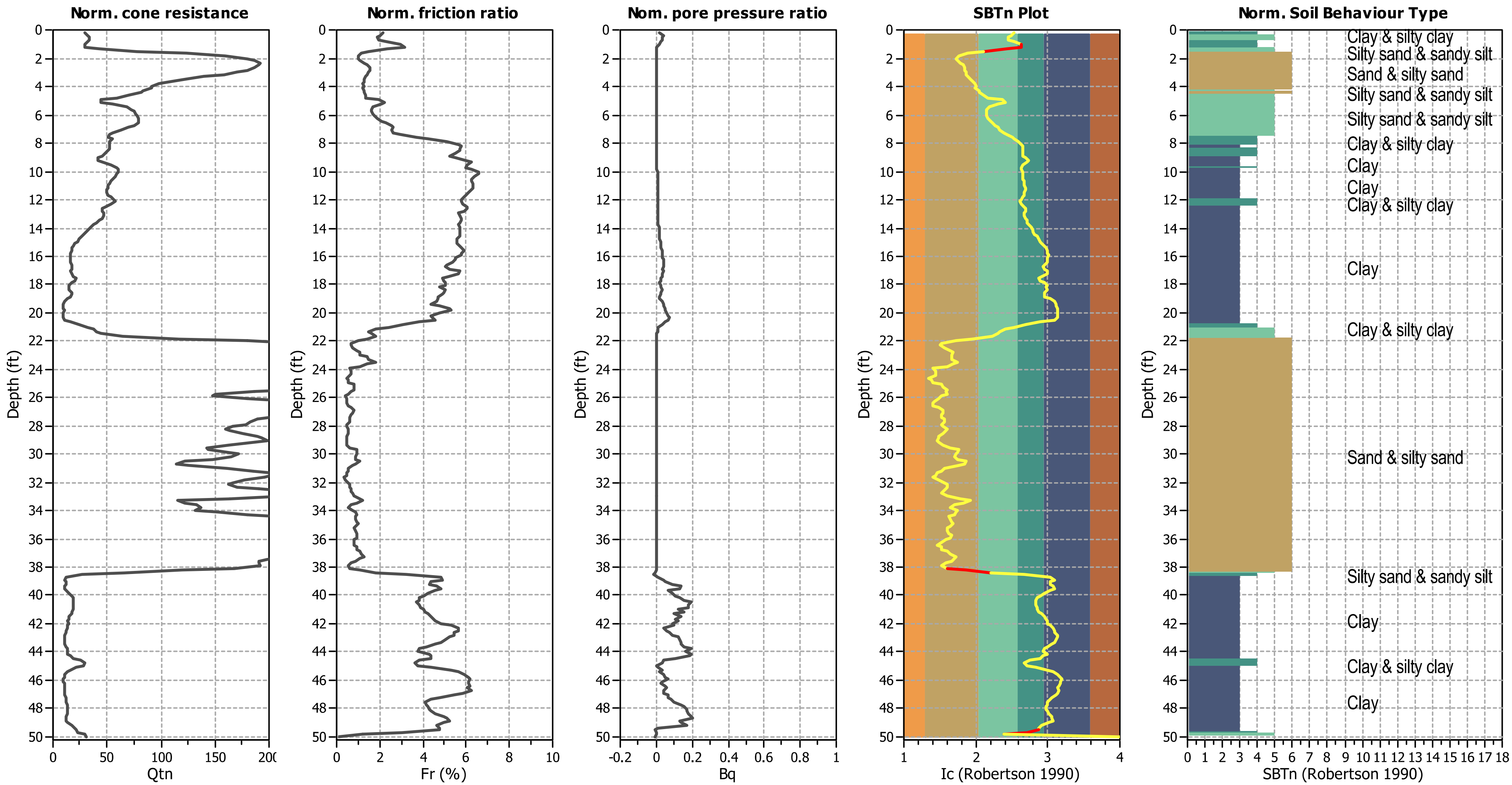
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	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:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



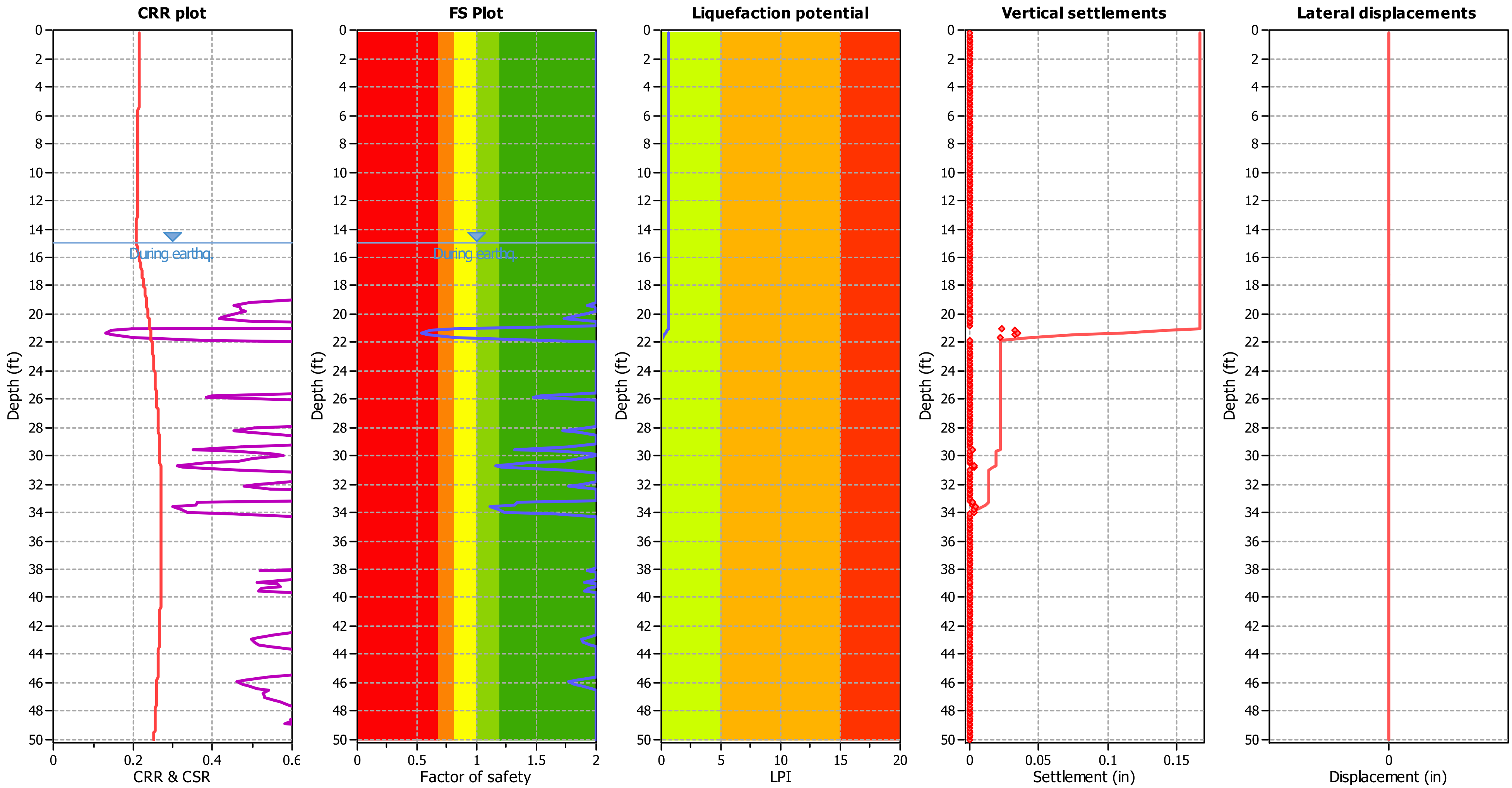
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	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:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	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:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	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

ENGEO Incorporated
2213 Plaza Drive
Rocklin, CA 95765
www.engeo.com

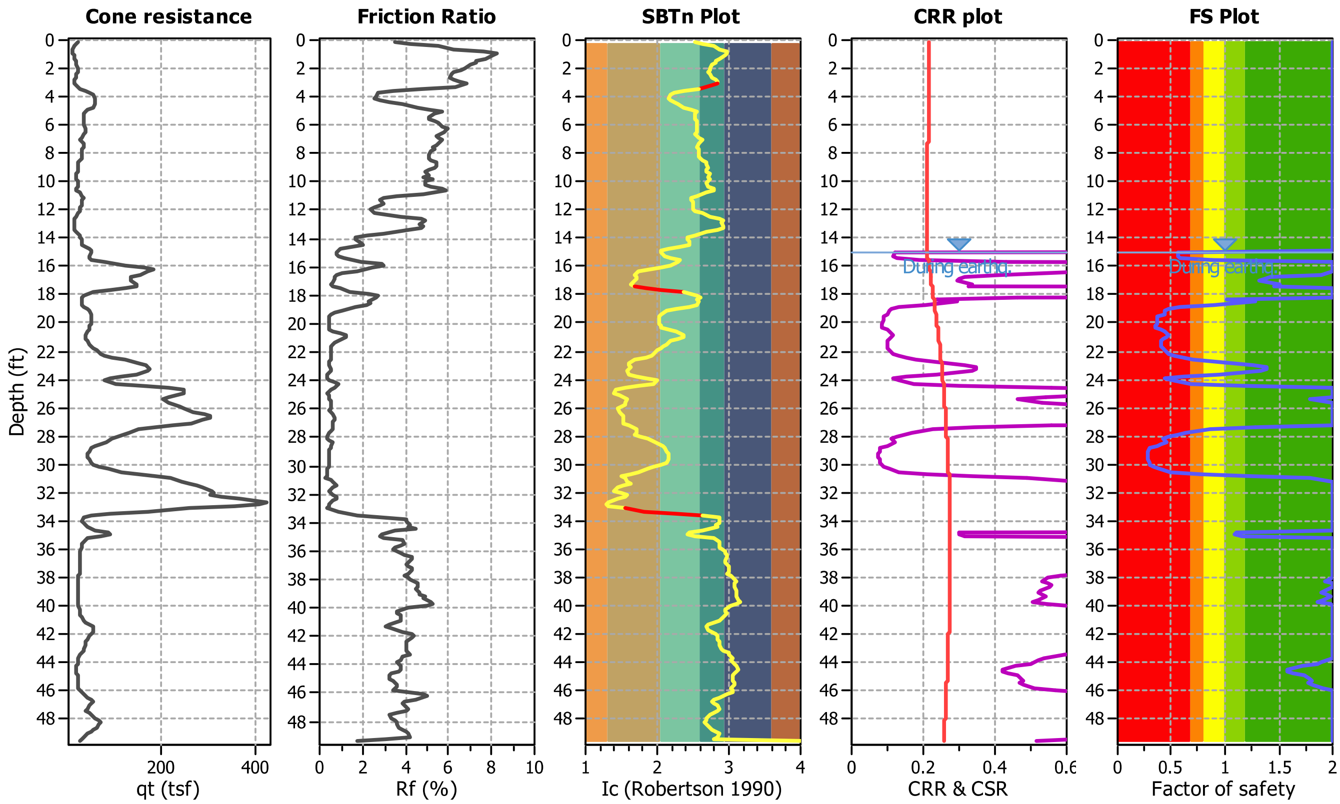
LIQUEFACTION ANALYSIS REPORT

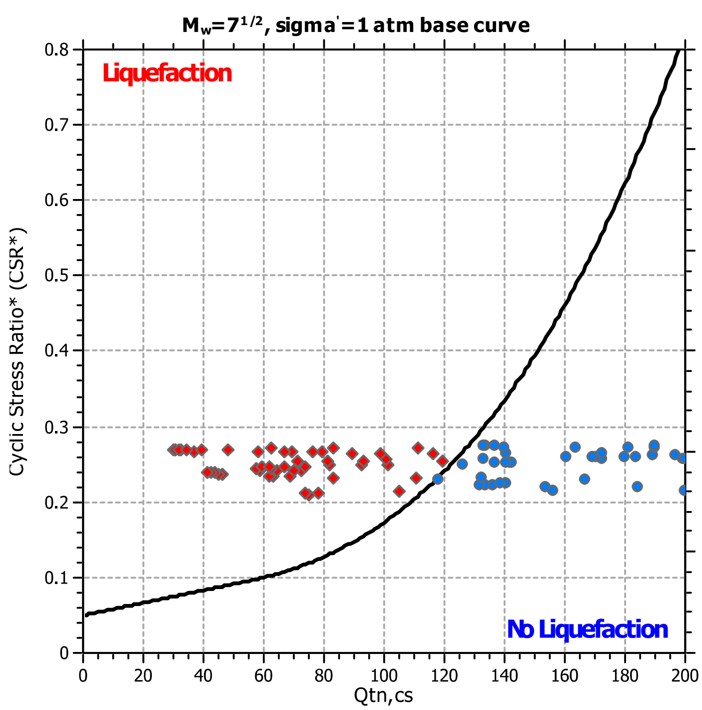
Project title : Dixon 257 **Location : Dixon, CA**

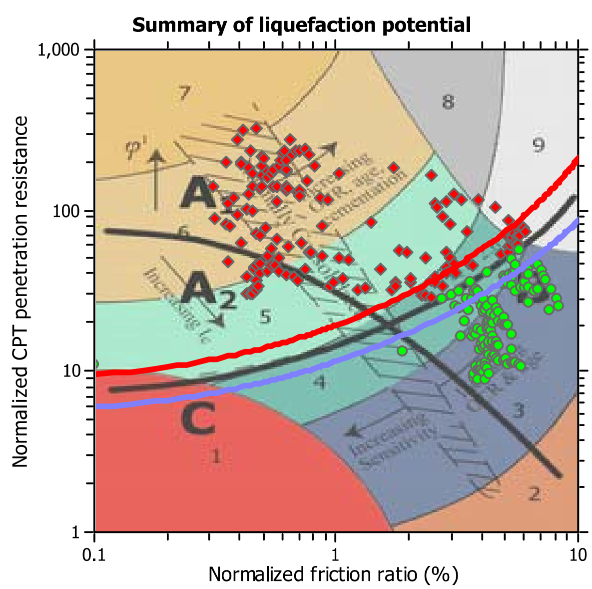
CPT file : 1-CPT2

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	25.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	No		

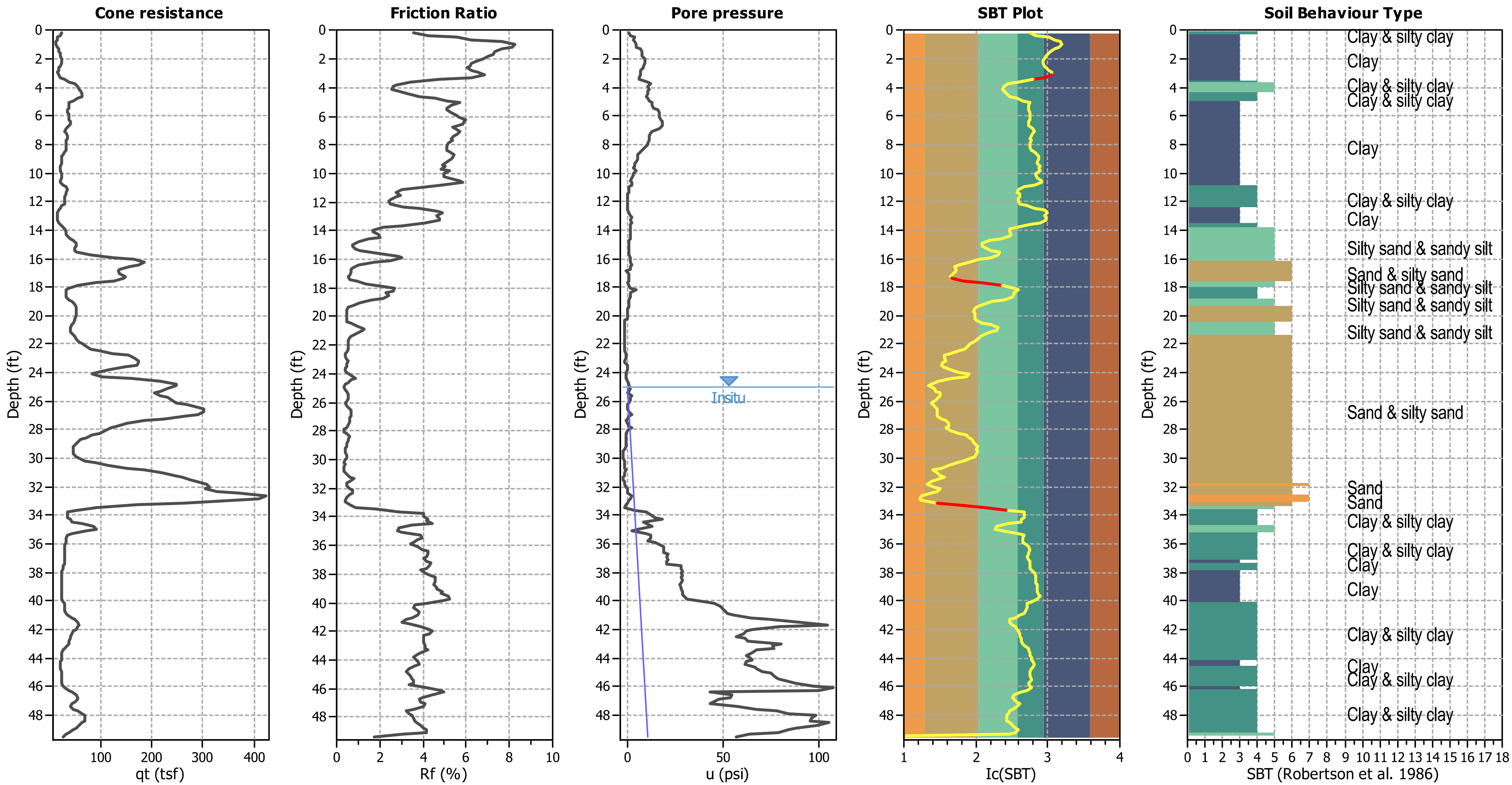






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



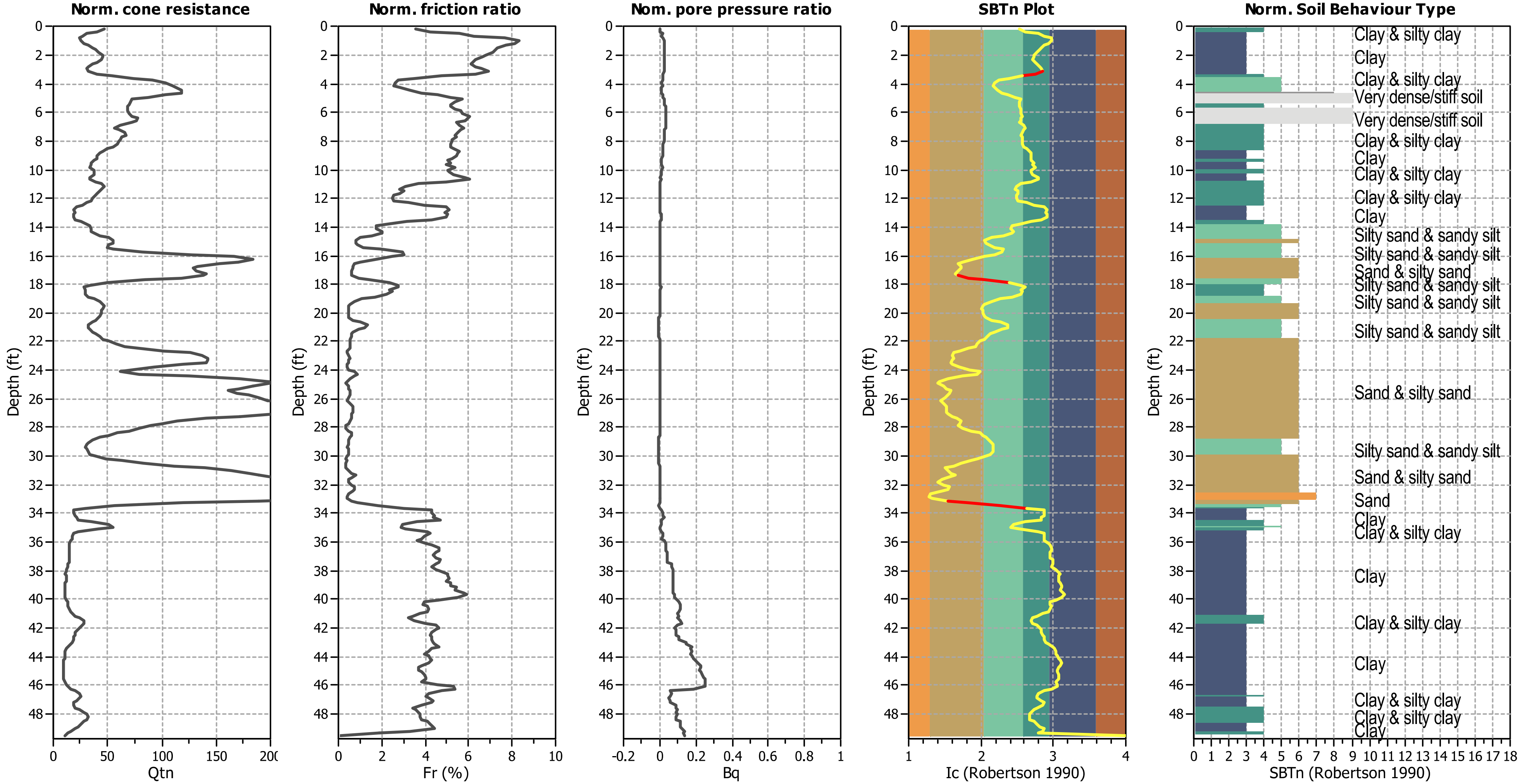
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	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:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



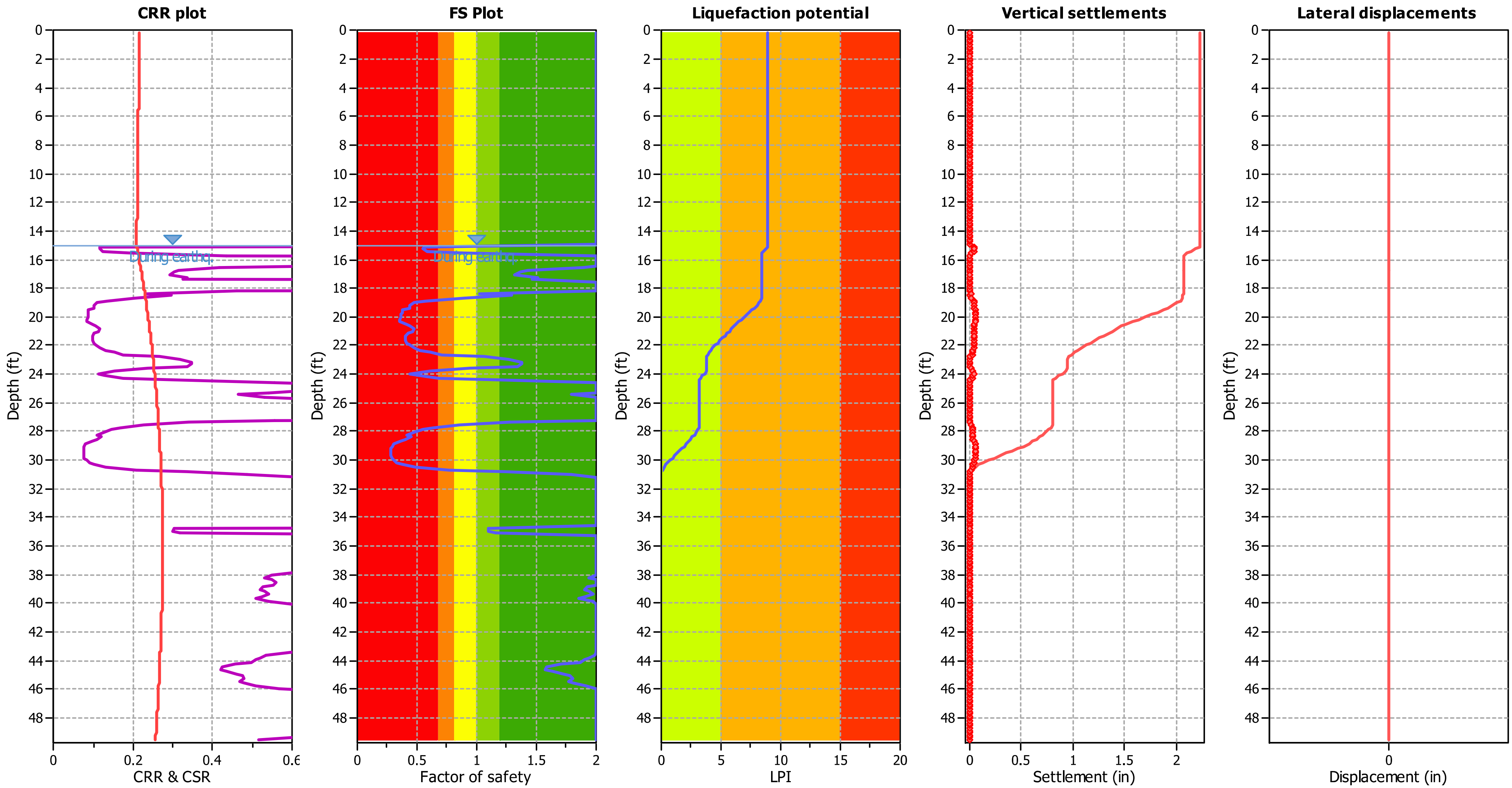
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	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:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)
Fines correction method:	Robertson (2009)
Points to test:	Based on Ic value
Earthquake magnitude M_w:	6.50
Peak ground acceleration:	0.48
Depth to water table (insitu):	25.00 ft

Depth to water table (erthq.):	15.00 ft
Average results interval:	3
Ic cut-off value:	2.60
Unit weight calculation:	Based on SBT
Use fill:	No
Fill height:	N/A

Fill weight:	N/A
Transition detect. applied:	Yes
K_σ applied:	No
Clay like behavior applied:	All soils
Limit depth applied:	No
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

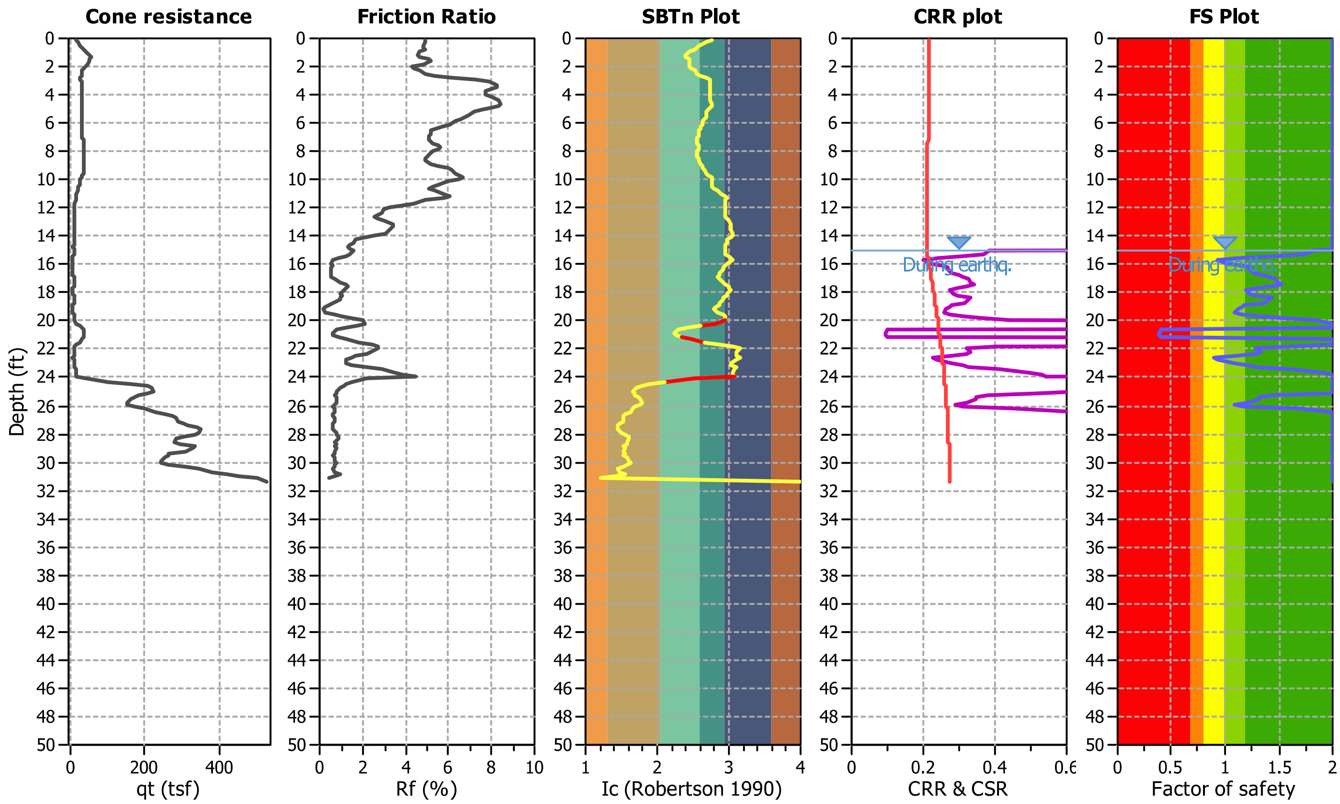
LIQUEFACTION ANALYSIS REPORT

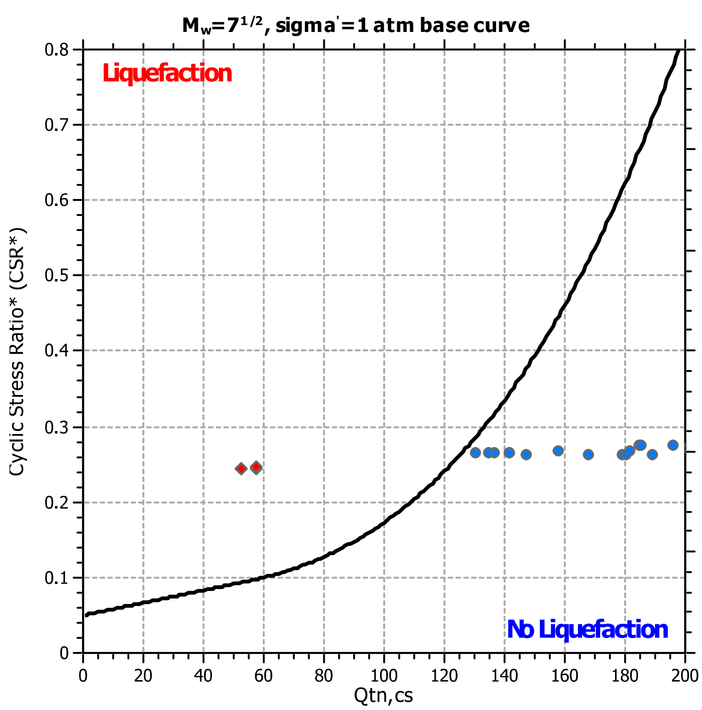
Project title : Dixon 257 **Location : Dixon, CA**

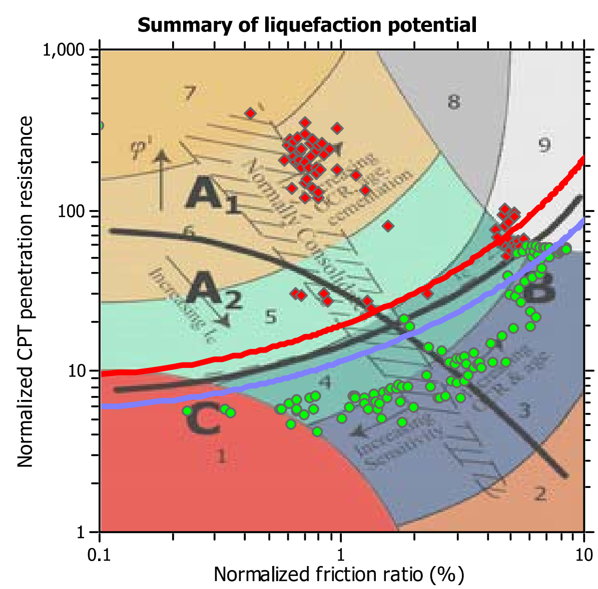
CPT file : 1-CPT3

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	25.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	15.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	No		

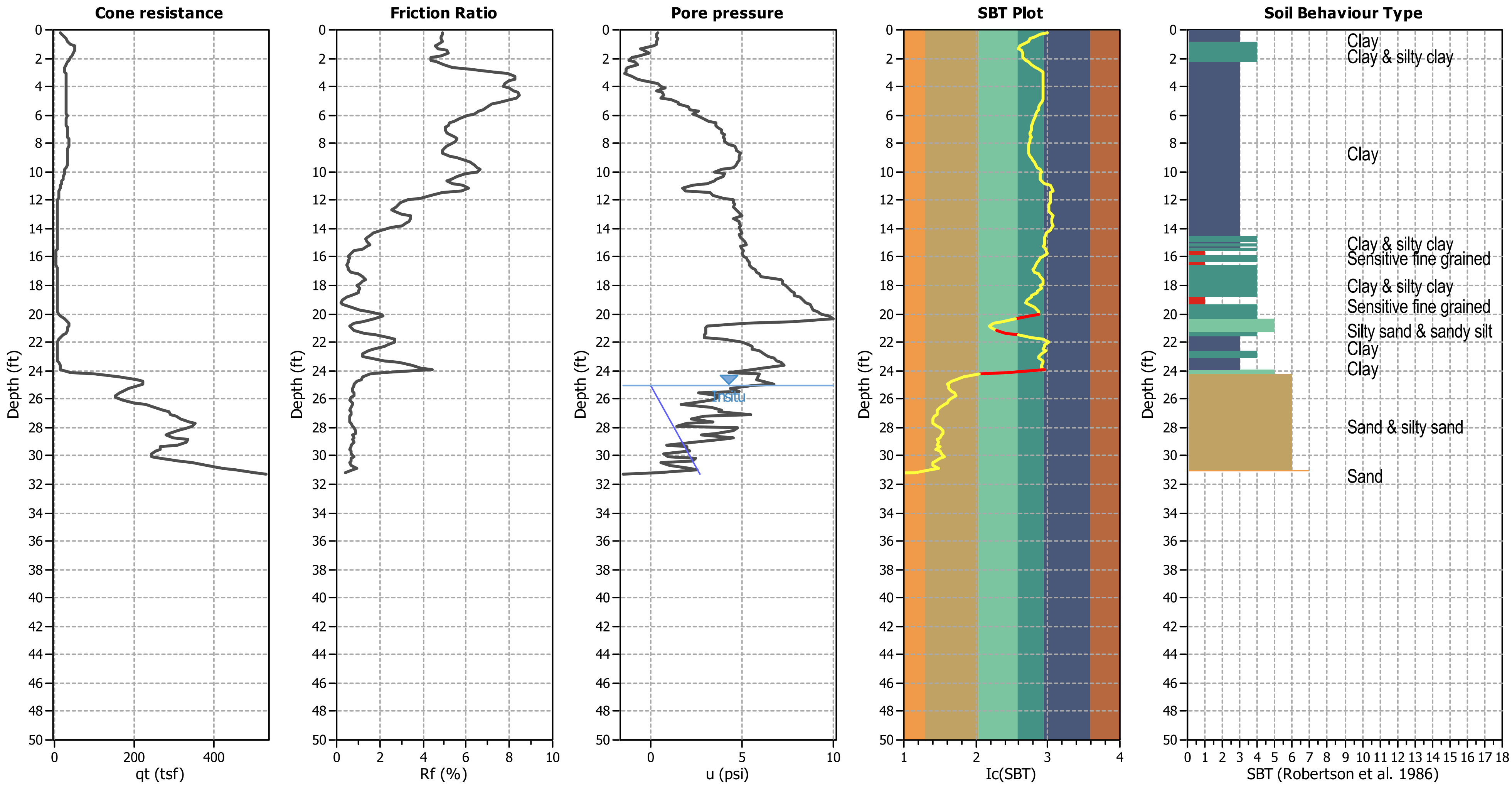






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



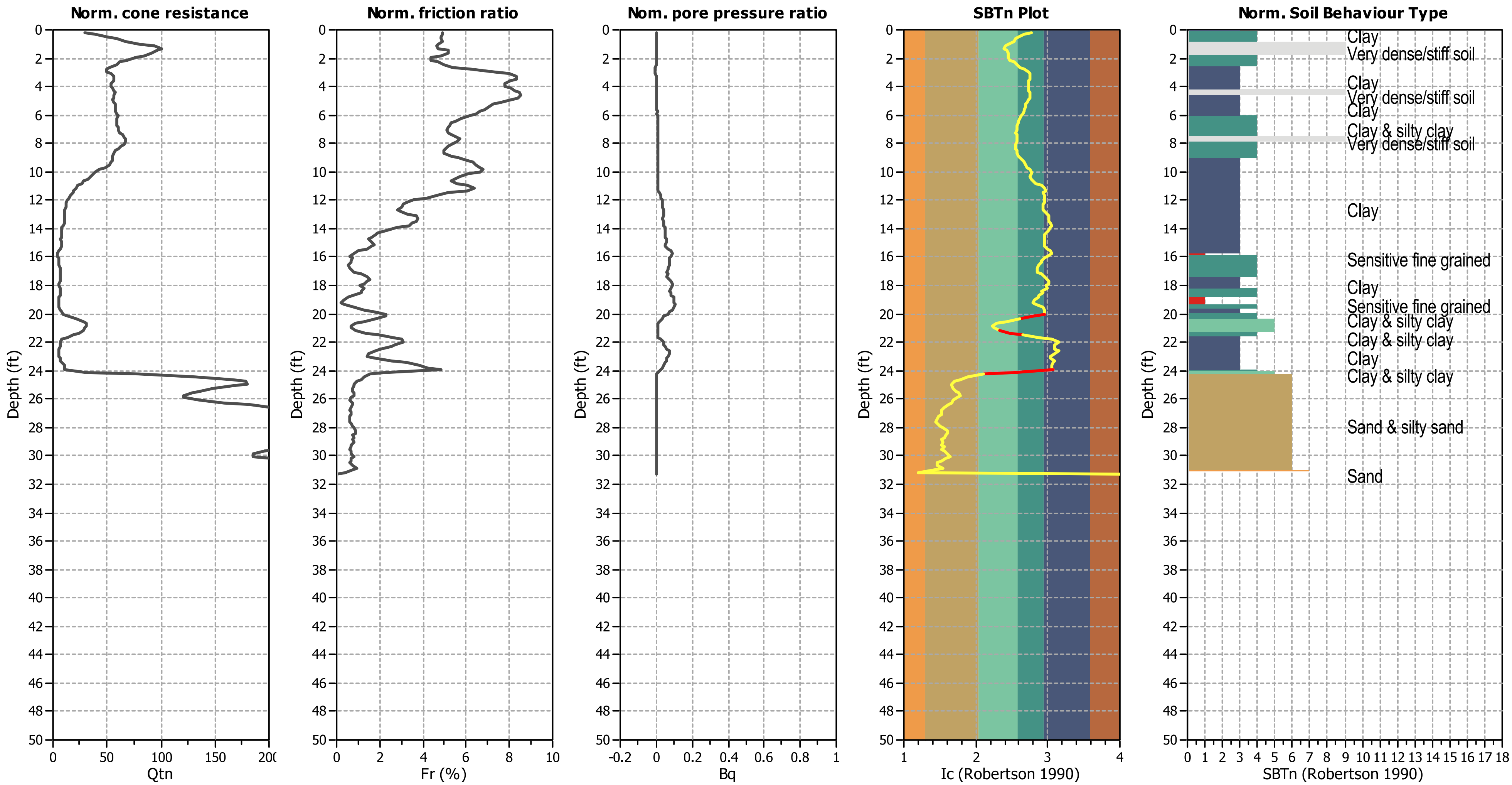
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	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:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
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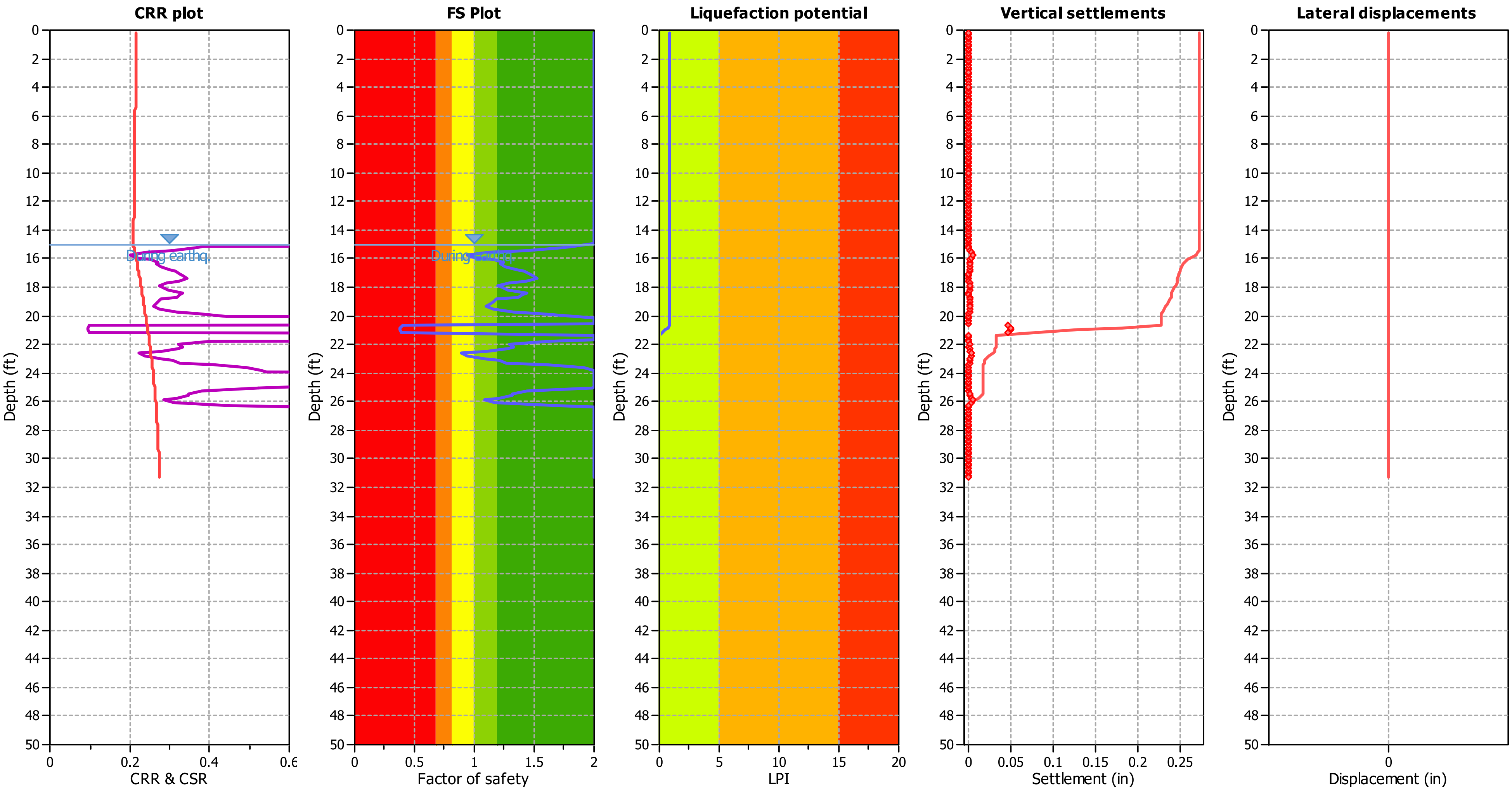
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	15.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
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Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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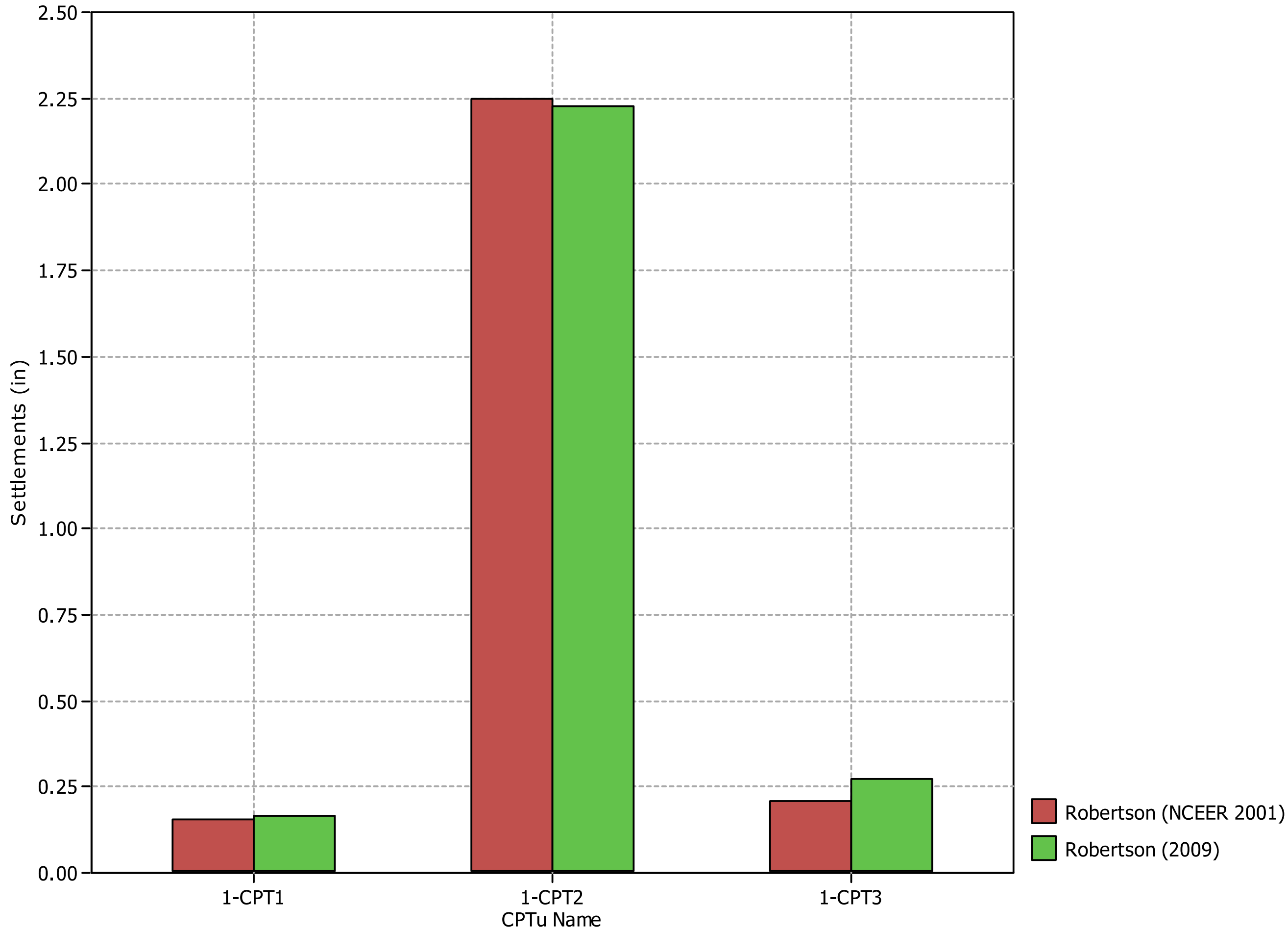
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

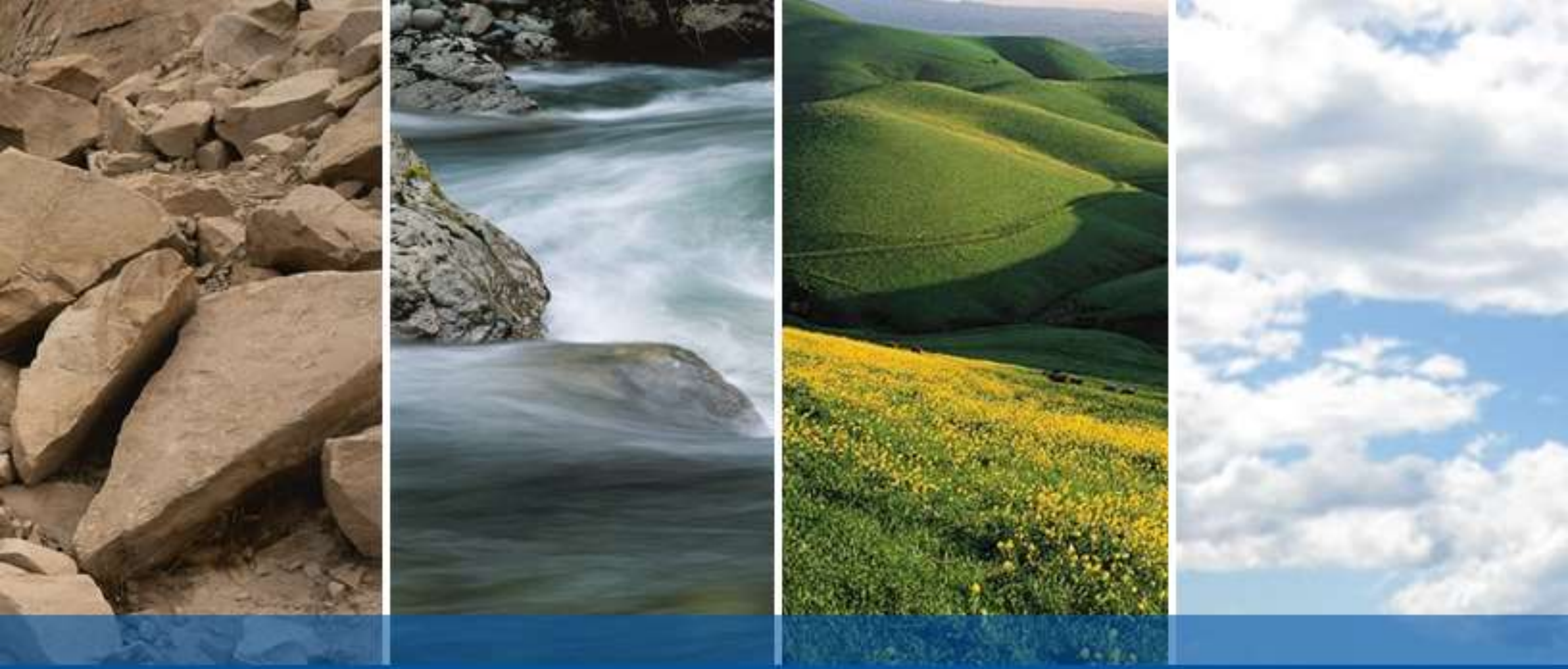
ENGEO Incorporated
2213 Plaza Drive
Rocklin, CA 95765
www.engeo.com

Overall Parametric Assessment Method



:: CPT main liquefaction parameters details ::

CPT Name	Earthquake Mag.	Earthquake Accel.	GWT in situ (ft)	GWT earthq. (ft)
1-CPT1	6.50	0.48	25.00	15.00
1-CPT2	6.50	0.48	25.00	15.00
1-CPT3	6.50	0.48	25.00	15.00



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