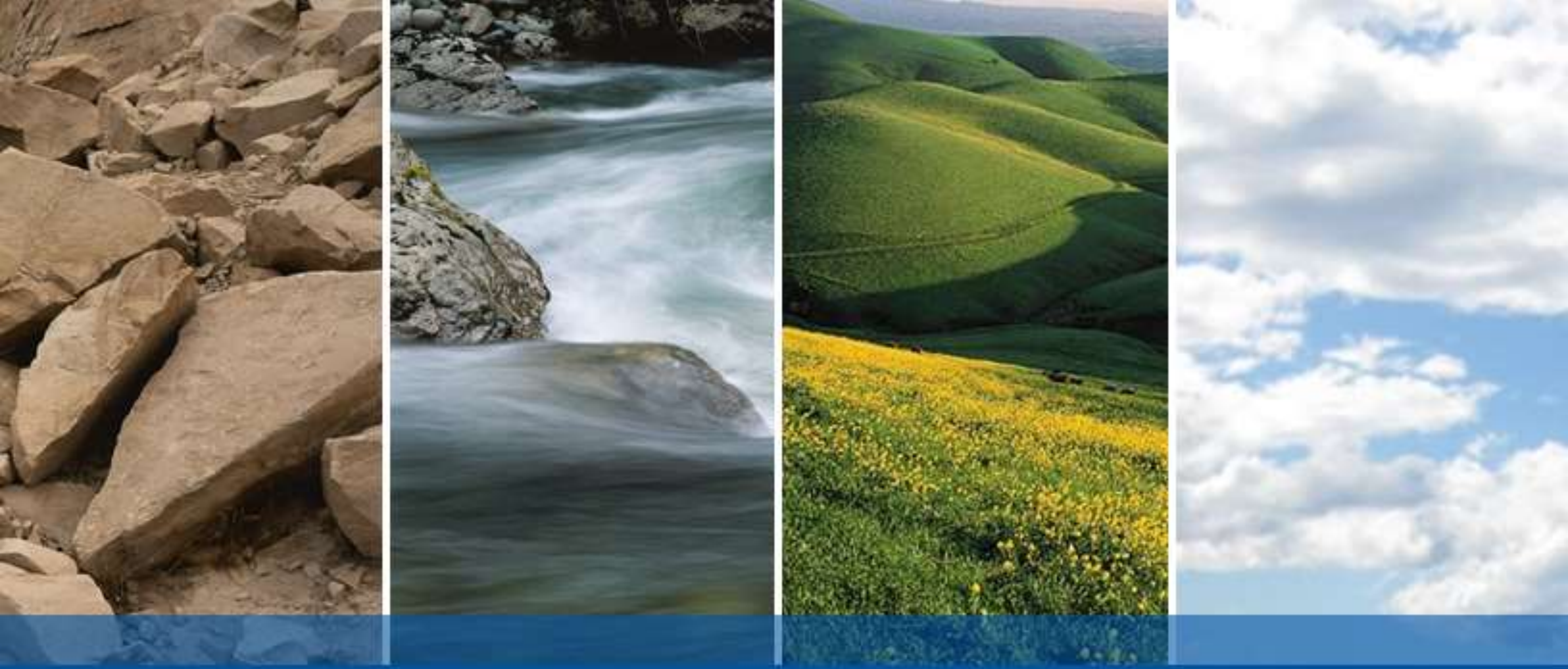

FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

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FEMA 65.10 (b) LEVEE EVALUATION

SUBMITTED TO:
Mr. Charles Anderson
Schaaf & Wheeler Consulting Civil Engineers
1171 Homestead Road, Suite 255
Santa Clara, CA 95050

PREPARED BY:
ENGEO Incorporated

November 17, 2017

PROJECT NO:
8602.001.000

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ENGEO
Expect Excellence

Project No.
8602.001.000

November 17, 2017

Mr. Charles Anderson
Schaaf & Wheeler Consulting Civil Engineers
1171 Homestead Road, Suite 255
Santa Clara, CA 95050

Subject: Foster City Levee Improvement Project
Foster City, California

FEMA 65.10 (b) LEVEE EVALUATION

Dear Mr. Anderson:

With your authorization, we completed the FEMA 65.10 (b) Levee Evaluation for the Foster City Levee Improvement Project in Foster City, California. The accompanying geotechnical report presents subsurface information collected, results of our analyses, and design-level recommendations for the proposed levee improvements.

It is our opinion that the proposed levee improvements are feasible from a geotechnical standpoint. Considering the proposed improvements and recommendations contained in this report, we found the levee segments evaluated will meet the criteria for settlement, seepage, and slope stability certification provided the recommended improvements are constructed.

We are pleased to be of service to you on this project. If you have any questions regarding the contents of this report, please do not hesitate to contact us.

Sincerely,

ENGEO Incorporated

Andrew H. Firmin, GE

Josef J. Tootle, GE

James Yang, PE

Jeanine T. Ruffoni, PE

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1.0 INTRODUCTION AND BACKGROUND

1.1 PURPOSE AND SCOPE

The purpose of this report is to present the results of our FEMA 65.10 (b) Levee Evaluation for the Foster City Levee Improvement Project in Foster City, California and to provide design recommendations for the levee improvement systems. The scope of our services included a review of available literature and geologic maps, performing supplemental geotechnical exploration and laboratory testing, analyzing seepage and slope stability, and preparing this report summarizing our conclusions and recommendations for the project.

We prepared this report exclusively for the Schaaf & Wheeler Consulting Civil Engineers and their design team consultants. In the event that any changes are made in the character, design, or layout of the project, the conclusions and recommendations contained in this report must be reviewed by ENGEO to determine whether modifications to the report are necessary.

1.2 ELEVATION DATUM AND PROJECT PLANS

The elevation datum applied to the project is NAVD88 datum. The figures and data presented in this report reference elevations based on this datum.

The project plans referenced throughout the report were prepared by Schaaf & Wheeler Consulting Civil Engineers (SW), and are referenced below.

- Schaaf & Wheeler Consulting Civil Engineers, Map and Construction Plan, Foster City Levee Improvement Project (CIP 301-657), 60% Design Submittal, City of Foster City, August 10, 2017.

1.3 SITE LOCATION AND DESCRIPTION

Figure 1 displays a Vicinity Map. Figure 2 is a Site Plan that shows the approximate levee alignment, exploration locations, geologic cross section model locations, and other pertinent information.

The project alignment is approximately 6½ miles in length, and generally traverses the northern and eastern borders of Foster City. The northern portion of the project runs parallel to East 3rd Avenue and crosses under Highway 92. The project then continues parallel to Beach Park Boulevard adjacent to the San Francisco Bay. The southern portion of the project traverses along the northern side of Belmont Slough until Port Royal Park. Finally, the project continues parallel to Rock Harbor Lane until the intersection of Seal Slough near the eastern side of Highway 101.

Based on a site reconnaissance and existing topographic plans, the crown of the existing levee is roughly 8 to 20 feet wide with side slope inclinations ranging from approximately 2:1 to 5:1 (horizontal:vertical). A paved pedestrian walkway is located on the levee crown. The top of the levee is at elevations ranging from approximately 10 to 15 feet.

The water side of the levee system is fully tidal open water, slough channels, wetlands, and mud flats. The land side of the levee system consist of streets, residential and commercial areas, landscaped open space and recreational areas, unimproved lots, muted tidal wetlands and seasonal wetlands.

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1.4 PROJECT DESCRIPTION AND PROPOSED IMPROVEMENTS

We understand the project will be designed considering projected sea level rise (SLR) for the year 2050. In general, this will require the project to raise the top of the existing levee (or floodwall) by 1 to 5½ feet. Three levee improvement types are currently considered to achieve the design requirements: 1) earthen levee, 2) conventional floodwall, and 3) hybrid sheet pile floodwall. Each improvement type is likely to be utilized along various portions of the project alignment. Below is a general description of each of the improvement types

- Earthen levee: Where an earthen levee is proposed, the levee improvements will be accomplished by placement of engineered fill on the land and/or water side of the existing embankment. According to project plans, the levee slopes will be reconstructed with a maximum planned slope gradient of approximately 2:1. At some locations, right-of-way limitations will require the construction of a retaining wall at the toe of the landside slope. We anticipate cantilevered structural retaining walls or mechanically stabilized earth (MSE) retaining walls will be utilized.

- Conventional floodwall: Conventional floodwalls comprise construction of retaining walls near the top of the waterside embankment, and backfilling the retaining walls with engineered fill. We anticipate cantilevered structural retaining walls or mechanically stabilized earth (MSE) retaining walls will be utilized as the floodwalls. This improvement type may be advantageous where right-of-way limitations exist.

- Hybrid sheet pile floodwall: The hybrid sheet pile floodwall consists of sheet piles driven adjacent to the water side of the existing levee, with the sheet piles also serving as a floodwall. Engineered fill will be placed behind the sheet piles to raise existing grades to the desired elevation; at this time, we anticipate the elevation will be 3 feet below the top of sheet pile (required top of floodwall). This improvement type would not require excavation of the existing levee, and therefore would not temporarily decrease the level of flood protection

Once the existing levee (or floodwall) is raised, a new pathway will be constructed to replace the existing pedestrian path. The pathway will be 18 feet in width, comprising a 12-foot-wide paved trail with a 3-foot-wide decomposed granite (DG) shoulder on each side.

The referenced plan set establishes a stationing system that runs from Station 0+00 on the northern end of the alignment at the adjacent San Mateo city limit, to Station 343+26 where the trail intersects Seal Slough near the eastern side of Highway 101. Below are several key notes about the proposed project.

- Station 16+00 through Station 45+00 is located adjacent to Mariners Point Golf Center. Flood protection is already provided from the adjacent high ground along this segment, and no levee improvements are proposed. We did not perform field exploration, analysis, or provide recommendations along this portion of the levee alignment.

- From Station 45+00 through Station 97+00, levee improvements will be constructed adjacent to existing muted or seasonal wetlands on the land side of the levee. In addition, from Station 63+00 to Station 73+00, levee improvements are proposed in close proximity to existing East 3rd Avenue and several existing underground utilities. We also anticipate existing improvements and underground utilities are in close proximity to proposed levee improvements at numerous other locations along the project alignment.

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- From Station 153+00 through Station 186+00, private property is located on the water side of the levee alignment. At some locations, we anticipate this will create right-of-way limitations that may require unique levee improvement types.

- From Station 234+00 through Station 255+00, we understand a new earthen levee will be constructed through an existing sedimentation basin/seasonal wetland. The new levee embankment will be approximately 1,500 feet in length (Station 0+00 through Station 15+37, Control Line 3), and will require up to 10 feet of engineered fill with 2:1 side slopes.

- From Station 255+00 through Station 343+26 (end of project), a new floodwall will be constructed to achieve the required elevation increase, but no engineered fill is proposed to raise existing levee grades. The exception is from Station 302+00 through Station 308+00 near the intersection of Baffin Street, where an earthen levee with up to approximately 4 feet of engineered fill is proposed.

1.5 SITE HISTORY

The project alignment is located entirely within an area of reclaimed land from the bay. This was accomplished by the placement of fill on top of the native bay clay, known locally as Young Bay Mud (YBM).

Foster City (formerly Brewer Island) was originally reclaimed in the early 1900s by placing fill in the tidal mud flats. It appears the perimeter was originally protected by dikes that were formed by dredging the nearby soil and placing it on the shallow mudflats near the shore, creating a perimeter channel on the land side of the dike. We anticipate the fill used to create the original dikes is primarily dredged YBM. When Foster City was established in the 1960s, it appears additional fill was placed to further raise the existing perimeter levees, and the perimeter channels (from original dike construction) were filled. It appears much of the fill to raise the perimeter levees was likely imported material. Since that time, it appears several portions of the perimeter levee system were constructed or improved including at Mariners Point Golf Center, the outboard levee north of East Third Avenue, and the majority of the outboard levee along Belmont Slough and Rock Harbor Lane.

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1.6 PREVIOUS STUDY

J.H. Kleinfelder & Associates (identified as Kleinfelder hereafter) prepared a geotechnical report in 1987 for the overall Foster City levee system. Their scope of services included field exploration, laboratory testing, engineering analysis, and preparation of a geotechnical report (Kleinfelder, 1987).

We prepared a geotechnical report in 2009 for previously planned improvements to the existing paved trailed. Our scope of services included field exploration, laboratory testing, engineering analysis, and preparation of a geotechnical report (ENGEO, 2009).

We reviewed the referenced geotechnical reports and incorporated their previous exploration locations and laboratory testing data as part of this study.

1.7 FEMA ACCREDITATION

We have performed this geotechnical exploration to support the City of Foster City effort to obtain FEMA accreditation for their levee alignment, as described in this report. The accreditation is based on the certification of the levee; the certification provides evidence that the proposed levee system meets 44 CFR, Section 65.10 and is signed and sealed by a Professional Engineer in accordance with 44 CFR, Section 65.2. As stated on FEMA's website, "*levee certification does not warrant or guarantee performance* (sic), and it is the responsibility of the levee owner to ensure the levee is being maintained and operated properly."

As stated on FEMA's website, "FEMA's accreditation is not a health and safety standard – it only affects insurance and building requirements." On FEMA's website, they describe the protection that levees provided against flooding:

> *Levees reduce the risk of flooding, but do not eliminate all flood risk. As levees age, their ability to reduce this risk can change and regular maintenance is required to retain this critical ability. In serious flood events, levees can fail or be overtopped and, when this happens, the flooding that follows can be catastrophic.*

It should be understood that with any levee system there is an inherent risk of flood.

1.8 DESIGN GUIDANCE

Levee design and/or construction guideline criteria have been developed, for varying purposes, by several State and Federal agencies, including the USACE and FEMA. The design criteria utilized are primarily based on the following documents:

- Code of Federal Regulations 44, Section 65.10
- Title 23 – California Code of Regulations
- USACE Engineering Manual 1110-2-1913
- USACE Engineering Technical Letter 1110-2-569
- USACE Guidelines for Seismic Stability Evaluation of USACE Levees

2.0 GEOLOGY AND SEISMICITY

2.1 REGIONAL AND SITE GEOLOGY

As shown on the Geologic Map prepared by Brabb and Graymer (1998), artificial fill (af) and artificial levee fill (alf) is mapped along the alignment (Figure 4). Pampeyan (1994) similarly maps the alignment as underlain by artificial fill.

Below the fill, Young Bay Mud (YBM) deposits are typically encountered. YBM is a marine deposit comprising high plasticity clay with organics. The California Division of Mines and Geology (CDMG), currently known as the California Geological Survey (CGS), mapped the approximate thickness of YBM in the Bay Area (CDMG, 1966). Figure 5 shows the mapped YBM thickness varies from approximately 20 to 80 feet along the project alignment.

The YBM deposits typically overlie alluvial deposits. The depth to bedrock is anticipated to be over 100 feet below ground surface.

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2.2 SEISMICITY

The Bay Area contains numerous active earthquake faults. An active fault is defined by the CGS as one that has had surface displacement within Holocene time (about the last 11,000 years) (Hart and Bryant, 1997). The project alignment 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 project alignment. The major active faults in the area include the San Andreas and San Gregorio to the west of the bay, and the Hayward and Calaveras to the east of the bay.

Numerous small earthquakes occur every year in the San Francisco Bay Region, and larger earthquakes have been recorded and can be expected to occur in the future. Figure 6 shows the approximate locations of these faults and significant historic earthquakes recorded within the San Francisco Bay Region.

3.0 GEOTECHNICAL DATA AND SUBSURFACE CONDITIONS

Geotechnical subsurface data has been collected along the project alignment by ENGEO as part of this study and a previous study in 2009; and previously by Kleinfelder as part of their 1987 study. Below is a description of field exploration activities, laboratory testing, and overall subsurface conditions.

The approximate exploration locations are shown on Figures 2 and 3A through 3U. The exploration locations are approximate and were estimated by pacing from existing site features. These measurements should be considered accurate only to the degree implied by the method used.

Refer to Appendices A and B for specific exploratory log and laboratory testing data.

3.1 LEVEE RECONNAISSANCE

We performed a reconnaissance of the existing levee alignment on October 2, 2015. Refer to Appendix F for the levee reconnaissance.

3.2 ENGEO FIELD EXPLORATION

3.2.1 Exploratory Borings

We drilled 13 exploratory borings (2-B1 through 2-B7, and 3-B1 through 3-B6) to depths of up to approximately 111½ feet below ground surface (bgs). We previously drilled 16 exploratory borings (1-B1 through 1-B14, 1-B16, and 1-B17) to depths of up to approximately 12½ feet below ground surface (bgs) in 2009.

An ENGEO representative observed the drilling activities and logged the subsurface conditions of the exploratory borings. The borings were logged in the field and soil samples were collected using either a 2½-inch inside diameter (I.D.) California-type split-spoon sampler fitted with 6-inch-long brass liners, a 2-inch outside diameter (O.D.) Standard Penetration Test (SPT) split-spoon sampler, or a 3-inch O.D. Shelby Tube sampler.

The penetration of the California-type and SPT samplers was recorded as the number of blows needed to drive the sampler 18 inches in 6-inch increments. The boring logs show the number of blows required for the last one foot of penetration, and the blow counts have not been converted

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using any correction factors. The samplers were driven with a 140-pound hammer falling a distance of 30 inches employing an automatic trip system. The 3-inch O.D. Shelby Tube sampler was pushed hydraulically with the drill rig. We used the field logs to develop the report logs in Appendix A1.

The report boring logs graphically depict the subsurface conditions encountered at the time of the exploration, and describe the soil type, color, consistency, and visual classification in general accordance with the Unified Soil Classification System (USCS). Subsurface conditions at other locations may differ from conditions occurring at these boring locations, and the passage of time may result in altered subsurface conditions. In addition, stratification lines represent the approximate boundaries between soil types and the transitions may be gradual.

3.2.2 Cone Penetration Test Soundings

We advanced 11 CPT probes (2-CPT1 through 2-CPT7, and 3-CPT1 through 3-CPT4) to depths of up to approximately 103 feet. An ENGEO representative supervised the CPT soundings and observed the subsurface conditions of exploratory CPTs. The CPTs were performed in general accordance with ASTM D-5778. Measurements collected during testing include the tip resistance to penetration of the cone (Qc), the resistance of the surface sleeve (Fs), and pore pressure (U). Raw data of the CPT logs are presented in Appendix A1.

3.2.3 Vane Shear Test

We retained a subcontractor to perform one vane shear test (VST) to a depth of 50 feet. The VST was performed in general accordance with ASTM D-2573. Measurements collected during testing include peak and remolded undrained shear strengths. The VST report is presented in Appendix A1.

3.2.4 Hand Auger Excavations

Due to soft ground concerns within the existing sedimentation basin/seasonal wetland area (from Station 0+00 through Station 15+37, Control Line 3), we were limited to hand equipment for field exploration activities. We advanced three hand auger excavations along this portion of the alignment. An ENGEO engineer performed the hand auger excavations and logged the subsurface conditions at each location. The hand auger excavation logs are presented in Appendix A1.

3.2.5 Test Pits

We observed excavation of six test pits to depths of up to 4½ feet. An ENGEO engineer observed the test pit excavations and logged the subsurface conditions at each location. The test pits were performed using a backhoe with a 2-foot-wide bucket.

The test pit logs present descriptions and graphically depict the subsurface conditions encountered. We used the field logs to develop the report logs in Appendix A1. The logs depict subsurface conditions at the exploration locations for the date of exploration; however, subsurface conditions may vary with time.

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3.3 KLEINFELDER FIELD EXPLORATION

Kleinfelder drilled six exploratory borings (B-1 through B-6) in 1987 to depths of up to approximately 102½ feet. The previous boring logs are included in Appendix A2.

3.4 LABORATORY TESTING

Laboratory testing on the samples recovered during ENGEO field exploration activities was performed to determine various soil characteristics. Laboratory result reports are included in Appendix B1. In addition, some of the laboratory test results are shown on the boring logs in Appendix A1. Laboratory testing included the following tests:

TABLE 3.4-1: Current Laboratory Testing

TEST	DESIGNATION
Determination of Moisture Content by Mass	ASTM D2216
Determination of Density	ASTM D7263
Amount of Material in Soils Finer than No. 200 Sieve	ASTM D1140
Particle-Size Analysis of Soil	ASTM D6913
Liquid Limit, Plastic Limit and Plasticity Index	ASTM D4318
Unconsolidated Undrained Triaxial Compression	ASTM D2850
Unconfined Compression	ASTM D2166
Laboratory Miniature Vane Shear	ASTM D4648
Consolidation Using Constant Rate of Strain	ASTM D4186
Incremental Consolidation	ASTM D2435, Method B
Hydraulic Conductivity	ASTM D5084

Kleinfelder also performed laboratory testing on samples collected during their previous field exploration activities. Laboratory testing reports are included in Appendix B2. In addition, some of the laboratory test results are shown on the boring logs in Appendix A2.

We also performed corrosion testing on several soil samples collected during the current study. The samples were delivered to CERCO Analytical, Inc. and tested according to ASTM Test Methods for redox potential, pH, resistivity, sulfate, sulfide, and chloride ion concentrations. These tests provide an indication of the corrosion potential of the soil environment on buried concrete, steel, and metal structures and pipes. The laboratory test results are included in Appendix B3.

3.5 GROUNDWATER

Groundwater depth encountered during drilling was measured and recorded during select exploration locations. In general, we measured depth to groundwater as approximately 4½ to 10 feet below existing grade during select boring locations. This corresponds to an approximate elevation range of 5 to 8 feet.

3.6 SUBSURFACE CONDITIONS

The subsurface conditions generally consist of existing artificial fills over Young Bay Mud (YBM) over alluvial deposits. In general, subsurface conditions encountered during the current exploration are consistent with those encountered during previous explorations.

Below existing pavement sections, exploration locations encountered 3 to 9 feet of surficial existing artificial fill. Up to 19 feet of existing fill was encountered at exploration locations from Stations 0+00 through Station 16+00. The fill material type is variable across the alignment and with depth. The upper portion of existing fill is typically classified as sandy lean clay to clayey sand with variable amounts of gravel. The sandy clay ranges from stiff to hard in consistency, and the clayey sand ranges from loose to dense in density. The lower several feet of existing fill consisted of fat clay that is likely dredged YBM deposits.

The existing fill unit adjacent to the San Francisco Bay often contains man-made debris such as asphalt, brick, wood, or concrete fragments. At exploration locations 1-B1, 1-B5 through 1-B7, 2-CPT3, and 2-CPT7, we encountered cobbles, concrete, and asphalt chunks, and zones with abundant seashells and wood fragments within the existing fill. We further explored some of these areas with test pits (3-TP1 through 3-TP6), and confirmed the presence of these materials. In general, minor to moderate amounts of oversized materials and deleterious materials up to 6 inches in diameter were encountered at test pit locations. At 3-TP1 and 3-TP2, we encountered several cobbles and boulders 12 to 24 inches in diameter.

Below the fill, exploration locations encountered 18 to 86 feet of YBM deposits. The YBM underlying the fill is characterized as a marine deposit comprising soft to stiff, high plasticity clay with organics. The upper several feet of YBM deposits are likely dredged YBM and somewhat desiccated; as a result they are stiffer in consistency.

We encountered geologically older alluvial deposits below the YBM, extending to the bottom of our exploration locations. The alluvial deposits consisted of interbedded layers of lean clay and clayey sand with variable amounts of gravel. The clayey deposits were medium stiff to very stiff in consistency, and the sandy deposits were medium dense to dense in consistency.

4.0 SEISMIC AND GEOLOGIC HAZARDS

We evaluated seismic and geologic hazards at the project alignment. Our discussion and conclusions related to various hazards are presented below.

4.1 SEISMIC HAZARDS

Because of the presence of nearby active faults, the San Francisco Bay Area Region is considered seismically active. Numerous small earthquakes occur every year in the region, and large (>M7) earthquakes have been recorded and can be expected to occur in the future. 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. The common secondary seismic hazards that may impact the levee alignment include ground shaking, liquefaction, lateral spreading, and tsunamis. The following sections present a discussion of these hazards as they apply to the site.

4.1.1 Ground Rupture

The subject levee system is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults is believed to exist along the alignment. Therefore, risk of fault rupture through the levee is not anticipated.

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4.1.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay region, could cause ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, levee improvements should be designed using sound engineering judgment and relevant references included in this report.

4.1.3 Liquefaction

Seismically induced soil liquefaction is a process by which soil undergoes a significant loss of strength due to cyclic loading and corresponding increase in pore water pressure. The effects of liquefaction can be a decrease in soil shear strength, reduction in soil volume, ground settlement, and lateral spread slope deformations. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded fine sands below the groundwater table. Empirical evidence and laboratory testing indicates that loose to medium dense gravels, silty sands, low-plasticity silts, and some low-plasticity clays are also potentially liquefiable.

On a regional basis, the California Geologic Survey (CGS) has not prepared a Seismic Hazard Zone map for the San Mateo quadrangle. However, the site is within an area mapped with a Very High to High liquefaction susceptibility according to mapping prepared by the Association of Bay Area Governments (ABAG). The ABAG maps are generally used for baseline studies since they are based on correlation between liquefaction potential and geologic units applied across a region mapped with a scale of 1:24,000 to 1:100,000. These maps are acknowledged to be limited and more detailed liquefaction potential evaluation with geotechnical borings and site-specific study by a licensed professional is necessary (Knudsen et al., 2000).

We analyzed the potential for liquefaction using the CPT data. We performed the analysis on CPTs that were advanced to a depth of at least 30 feet; and limited our analysis to a maximum depth of 50 feet. We performed the analysis with the software program CLiq applying the methodologies published by Boulanger and Idriss (2014). We used a design groundwater depth of 5 feet, a Peak Ground Acceleration (PGA) of 0.65g, and a moment magnitude of 7.9 based on the theoretical rupture of the San Andreas fault. We assigned the commonly accepted Soil Behavior Type Index, I_c, of 2.6 as the cut-off for evaluation of liquefaction.

We subsequently performed an analysis of potential settlement using the method by Zhang (2002). Our liquefaction analysis is included in Appendix C. The following table indicates the estimated values of liquefaction-induced settlement

TABLE 4.1.3-1: Estimated Liquefaction-Induced Settlements

EXPLORATION DESIGNATION	SETTLEMENT (INCHES)
2-CPT1	<¼
2-CPT3	¾
2-CPT5	1
2-CPT6	<¼
2-CPT7	<¼
2-CPT8	¾
3-CPT1	3¼
3-CPT2	<¼
3-CPT3	<¼
3-CPT4	<¼

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Based on our study and the results of our analysis, the majority of the existing fill and alluvium deposits are fine-grained clayey soils that are not likely to be susceptible to liquefaction. In general, and with exception to Station 0+00 through 16+00, we estimate up to approximately 1 inch of liquefaction-induced settlement may occur along the levee alignment as a result of a strong seismic event. The potentially liquefiable silty or sandy deposits along the levee alignment were generally identified in portions of the existing fill and alluvium layers. They generally appear to be variable and discontinuous, and therefore the actual amount of earthquake-induced settlement along the subject levee site is likely to be variable.

From Station 0+00 through 16+00, we encountered up to 19 feet of existing fill materials over YBM. Based on review of regional geologic maps and historic aerial photographs, we anticipate the fill may have been placed as hydraulic fill after dredging activities, and that similar conditions may be present around the perimeter of Mariners Island Golf Center (Station 16+00 through 45+00). The fill consists of intermixed layers of sand, silt, and lean to fat clay. At 3-CPT1, the fill appears to predominantly consist of silt and sand materials. At this location, we estimate up to 3¼ inches of liquefaction-induced settlement may occur at this location as a result of a strong seismic event.

The liquefaction analysis is attached in Appendix C.

4.1.4 Lateral Spreading

Lateral spreading is a failure within weak soils, typically due to liquefaction, which causes a soil mass to move toward a free face, such as an open channel, or down a gentle slope. There are potentially susceptible liquefiable layers along the levee alignment, however these soils appear discontinuous and are generally below any free face condition, such as the bay. Finally, levee conditions will be improved as part of the proposed construction. Therefore, lateral spreading is considered a low risk in our opinion.

Although lateral spreading is considered a low risk, there is potential for seismic slope deformation during a strong seismic event. The seismic stability of the levees is further analyzed and discussed in subsequent sections.

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4.1.5 Tsunamis

Tsunamis are long sea waves, generated by displacements associated with earthquakes. These waves can reach great heights when they encounter shallow water. Considering the levee is being raised, we anticipate the potential risk of tsunami inundation will decrease after construction. According to historical data, the greatest tsunami recorded at the Golden Gate was only 3 feet high. Since the site is located more than 15 miles from the Golden Gate, the tsunami waves will likely attenuate to much less than 3 feet high at the subject site location. As such, the potential for a tsunami to significantly affect the site is considered low.

4.2 GEOLOGIC HAZARDS AND GEOTECHNICAL CONCERNS

Potential geologic hazards and other geotechnical concerns relevant to the levee alignment include flooding, shallow groundwater, existing fill, expansive soils, consolidation settlement, corrosive soils, seepage, and slope stability. These concerns are discussed below.

4.2.1 Flooding

The San Francisco Bay is a potential source of floodwater to the levee alignment. It should be understood that with any levee system, there is an inherent risk of flood, as previously discussed in this report.

4.2.2 Shallow Groundwater

In general, we measured the depth to groundwater as approximately 4½ to 10 feet below existing grade at select boring locations. This corresponds to an approximate elevation range of 5 to 8 feet. Thus, shallow groundwater is present at the site and should be anticipated to impact construction activities.

Fluctuations in groundwater levels should be expected in response to tidal fluctuations and during seasonal changes or over a period of years because of precipitation changes, perched zones, changes in drainage patterns, and irrigation.

4.2.3 Existing Fill

The site is underlain by up to approximately 9 feet of non-engineered existing fill. In general, non-engineered fill could undergo vertical settlement under loading from new fill that is not easily predicted.

We do not consider it feasible to remove non-engineered fill as part of project improvement construction due to the depth of the existing fill, limited site right-of-way, and shallow groundwater conditions. Further, considering the density/consistency of the near-surface existing fill and proposed civil fill thickness, we anticipate vertical settlement of the existing fill as a result of new fill placement will be limited and the majority will occur during or shortly after grading activities.

As previously discussed, the existing fill unit adjacent to the San Francisco Bay often contains man-made debris or oversized materials such as asphalt, brick, wood, or concrete fragments. At exploration locations 1-B1, 1-B5 through 1-B7, 2-CPT3, and 2-CPT7, we encountered cobbles, concrete, and asphalt chunks, and zones with abundant seashells and wood fragments within the existing fill. We further explored some of these areas with test pits (3-TP1 through 3-TP6), and confirmed the presence of these materials. Based on the results of our field exploration, the contractor should anticipate minor to moderate amounts of oversized materials and deleterious materials up to 6 inches in diameter (and selectively up to 12 to 24 inches in diameter) from Stations 0+00 through 16+00, 134+00 through 142+00, and 152+00 through 171+00. At Test Pits 3-TP1 and 3-TP2, we encountered several cobbles and boulders 12 to 24 inches in diameter.

While we did not encounter significant man-made debris or oversized materials at other exploration locations, there may be additional zones along the project alignment with debris and oversized materials in the existing fill.

4.2.4 Expansive Soils

Expansive soils change in volume with changes in moisture. They can shrink or swell and cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations.

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Expansive soils are present along the alignment in existing fill and YBM deposits, and are expected to be encountered during construction. Successful performance of structures on expansive soils requires special attention during construction. It is imperative that exposed soils be kept moist prior to placement of surface improvements. It can be difficult to re-moisturize clayey soils without excavation, moisture conditioning, and recompaction.

4.2.5 Consolidation Settlement

The placement of additional fill and/or structural loads over YBM typically results in surface settlement. The amount of settlement that occurs is determined in large part by the amount of load imposed by the fill and/or structures, the area over which the fill is placed, the thickness of the YBM and the stress history of the YBM. Similarly, the amount of time for settlement to occur is determined by the above factors.

We performed consolidation testing on 12 soil samples of YBM at the site. We focused the laboratory testing on the upper 40 feet of subsurface soils because we anticipate the stress increase due to the proposed levee improvements will generally diminish below this depth. Consolidation testing indicated the upper several feet of YBM deposits are heavily overconsolidated along select northern and eastern portions of the alignment, approximately from Station 44+00 through 200+00, with estimated overconsolidation ratios (OCRs) of 3 to 5. YBM deposits below this depth are somewhat overconsolidated with OCRs ranging from 1.1 to 1.5. We summarize the relevant properties of the YBM from our review and analysis of consolidation testing in Appendix D.

To assess potential consolidation settlement, we used the computer program Settle3D. The software allows the user to create three-dimensional models to assess vertical consolidation and settlement under foundations, embankments, and surface loads. We reviewed the referenced plan set and selected reaches (stationing ranges) based on similar levee geometry, subsurface stratigraphy, soil properties, landside improvements, and/or project recommendations. We developed a cross section model in Settle3D for each selected reach, and estimated total consolidation settlement as a result of proposed fill, in one-half-foot increments of proposed fill. We assumed a total unit weight of 125 pounds per cubic foot (pcf) for engineered fill.

In general, we estimate approximately ½ to 2½ inches of consolidation settlement per foot of proposed fill, depending on location. Where the new earthen levee will be constructed through the existing sedimentation basin (Station 0+00 through Station 15+37, Control Line 3), we estimate approximately 3 to 4 inches of consolidation settlement per foot of proposed fill. Refer to figures in Appendix D for additional information.

In general, subsurface conditions are relatively uniform along the project alignment, and where changes in subsurface conditions occur (such as increased or decreased thickness of YBM), they occur gradually. Therefore, we anticipate consolidation settlement transitions will be relatively uniform along the levee alignment, provided the proposed loading conditions are also relatively uniform.

We also assessed time rate of consolidation settlement. For portions of the project alignment where 2 feet of fill or less is proposed (with exception to Station 0+00 through Station 15+37, Control Line 3), we estimate 70 to 90 percent of the total settlement will occur within 2 years of fill placement (i.e., the estimated project duration). Where more than 2 feet of fill is proposed, we estimate 50 to 85 percent of the total consolidation settlement will occur within 2 years. In general,

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where more than 2 feet of fill is proposed, we estimate 90 percent of total consolidation settlement will occur within 5 to 10 years.

4.2.6 Corrosivity Considerations

As part of this study, we collected seven representative soil samples and submitted to a qualified analytical lab for determination of redox potential, pH, resistivity, sulfide, chloride, and sulfate. The results are included in Appendix B3.

Due to the high clay content of some of the site soils and marine environment of the project, the majority of site soils are corrosive. We recommend a corrosion consultant be retained to evaluate if specific corrosion recommendations are advised for the project.

4.2.7 Seepage and Slope Stability

Seepage is a geotechnical concern that applies when the duration of flooding or water retention is long enough for seepage to advance through or under the levee embankment and emerge from the landside slope of the levee. Slope stability refers to the capacity of the levee and foundation soils to withstand shear stresses resulting from gravity, seepage, and earthquake forces acting on the levee. Detailed steady state seepage and slope stability analyses were performed at several cross section locations identified along the project alignment, and are discussed in detail in the subsequent Seepage and Slope Stability Evaluation sections.

5.0 SEEPAGE AND SLOPE STABILITY EVALUATION

We evaluated the seepage, stability, and seismic vulnerability potential for the subject Foster City levee improvement project.

5.1 WATER SURFACE ELEVATIONS

The mean sea level (MSL) is at Elevation 3.3 feet along the project alignment. The 100-year still-water surge elevation along the project alignment varies from Elevation 11.5 to 11.8 feet. The maximum wave run-up varies from Elevation 14.3 to 18 feet along the San Francisco Bay portions of the project alignment; wave run-up was not considered for portions of the project alignment adjacent to Belmont Slough.

For end-of-construction and seismic stability evaluations, we assumed a groundwater level equal to MSL. For steady-state seepage and stability evaluations, we assumed a groundwater level equal to the 100-year still-water surge elevation.

For coastal flood protection, the freeboard must be established at 1 foot above the height of the one percent wave, or the maximum wave run-up (whichever is greater) associated with the 100-year still-water surge elevation. The required flood protection elevation varies along the project alignment, and is shown on the referenced plan set prepared by Schaaf & Wheeler Consulting Civil Engineers (S&W).

5.2 REACH SELECTION

The specific cross sections analyzed in this evaluation are representative locations along the Foster City levee alignment. The cross section locations were selected based on similar levee

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geometry, subsurface stratigraphy, soil properties, landside improvements, and/or project recommendations. Figures 3A through 3U show the approximate locations of the analyzed cross sections. We also established a reach that was representative of each of the above cross sections. This information is tabulated below:

TABLE 5.2-1: Foster City Levee Cross Section Location and Reach Designation

CROSS SECTION DESIGNATION	APPROXIMATE STATION	REACH DESIGNATION	APPROXIMATE STATION LIMITS OF REACH
STA 15	15+00	Reach A	0+00 to 16+00
STA 54	54+00	Reach B	44+00 to 63+00
STA 66	66+00	Reach C	63+00 to 70+00
STA 80	80+00	Reach D	70+00 to 97+00
STA 120	120+00	Reach E	105+00 to 132+00
STA 149	149+00	Reach F	132+00 to 180+00
STA 183	183+00	Reach G	180+00 to 208+00
STA 215	215+00	Reach H	208+00 to 234+00
STA 9 CL3	9+00, CL3	Reach I	0+00 to 15+00, CL3
STA 288	288+00	Reach J	255+00 to 302+00
STA 305	305+00	Reach K	302+00 to 308+00
STA 315	315+00	Reach L	308+00 to 331+00
STA 335	335+00	Reach M	331+00 to 343+00

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5.3 CROSS SECTIONAL ANALYSIS

We created cross section models for evaluation at the above station locations, as described in the following sections.

5.3.1 Surface Geometry

We relied on site visit observations and the referenced plan set by S&W to develop the geometry of the cross sections; the plans included existing and proposed topographic contours.

5.3.2 Analytical Software

We conducted the analyses using the computer program Slide 7.0. Slide 7.0 is a computer program that performs both 2-dimensional steady-state seepage and slope stability calculations. We performed the steady-state seepage calculations using a finite-element method. We performed the stability calculations using a limit-equilibrium method with circular failure surfaces and Spencer's Method of slices.

5.3.3 Idealized Subsurface Stratigraphy

An idealized subsurface stratigraphy is a modeling or depiction of the various soil layers and their respective thicknesses and depths. Exploration logs, lab data, and geologic conditions were interpreted to develop a subsurface cross section representative of the location being analyzed. These analytical locations, identified by stationing, were chosen as representations of the respective reach based on their geometry, soil stratigraphy, and historical seepage and stability performance. Seepage and stability analyses for this evaluation incorporate idealizations of the subsurface stratigraphy as well as geometric surface information.

5.4 METHOD OF SEEPAGE EVALUATION

5.4.1 Steady State Seepage Analyses

The effect that steady state seepage has on the stability of the levee is evaluated in a steady seepage scenario. The steady state condition occurs when a water level remains long enough for the embankment soils to become fully saturated, resulting in a condition of steady seepage. Slide was used to perform steady state evaluations for the sections modeled in this evaluation. The pore water pressures determined in the seepage analyses are succinctly incorporated into the steady state slope stability calculations.

5.4.2 Under Seepage

Under seepage occurs when hydraulic head forces water to seep through the foundation soils. A hydraulic gradient is the drop in head over a given distance; an exit gradient is the vertical hydraulic gradient of the modeled condition at or near the landside toe of the feature being analyzed. We report the local y-gradient (as representing the exit gradient) by selecting a Gauss region along the ground surface of the SLIDE model. Under seepage instability is determined by comparing the reported exit gradient to the critical gradient.

5.4.3 Through Seepage

Through seepage is a condition that occurs when the upstream water stage in a cross section rises above the landside embankment toe elevation, and the phreatic water surface through the levee embankment daylights onto the landside slope. This can cause localized instability, unraveling of the landside levee slope soils, and, potentially, progressive mobilization of embankment soils causing levee failure. Considerations for a through seepage evaluation are:

- Height of through seepage above the landside levee toe of the embankment.
- The types of soil in the embankment and what type of soil the through seepage is exiting onto the surface from.
- Slope of the embankment onto which the through seepage is exiting.
- Quantity of through seepage flow.

Given the relatively fine-grained nature of the embankment soils, the relatively small calculated magnitude of breakout and the general gradients of the landside slopes, the steady state through seepage calculations do not represent a significant detrimental seepage condition. Therefore, the resulting impact to embankment stability can be considered negligible with regard to its impact on levee design and certification.

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5.4.4 Hydraulic Conductivity

To determine appropriate soil hydraulic conductivities (K) of the levee embankment and foundation soils for seepage analyses, we used the URS Guidance Document for Geotechnical Analysis (URS 2013) and previous hydraulic conductivity evaluations in the region.

In sedimentary units, it is common to have anisotropic porous media. This occurs when the geometry of the voids between the soil particles is not uniform in all directions; therefore, the permeability in one direction may be greater. For this evaluation, the ratio of horizontal conductivity to vertical conductivity (K_v/K_h) is generally 0.25, with the exception of cleaner sand with relatively higher hydraulic conductivities. For SP-SM soils, the modeled K_v/K_h is 0.5, and for SP or SW soils, the modeled K_v/K_h is 1.0.

The hydraulic conductivities of the materials in this evaluation were determined for saturated materials; hydraulic conductivities are generally much higher for saturated soils and, therefore, represent a more conservative condition. The specific hydraulic conductivities used in the analyses are presented on the stability and seepage analysis printouts in Appendix E

5.4.5 Seepage Criteria

5.4.5.1 Levee Under Seepage

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Based on USACE Engineering Manual 1110-2-1913, as modified by ETL 1110-2-569, the current guidance for upward exit gradient is as follows:

TABLE 5.4.5.1-1: USACE Exit Gradient Thresholds

LOCATION	EXIT GRADIENT THRESHOLD
Landside Toe of Levee	0.5
Drainage Ditch Offset 150 Feet from Landside Toe	0.8
Drainage Ditch Located within 150 Feet of Landside Toe	Interpolate* 0.5<X<0.8

* Where X=Distance from Landside Toe

5.5 METHOD OF SLOPE STABILITY EVALUATION

As previously described, we performed our slope stability analyses using the Slide 7.0 software program. Our slope stability models utilize the same modeling interface and framework as our seepage analyses, which allowed us to utilize the same model established in our seepage analysis. We used Spencer's method of analysis; this analytical method is an iterative solution that satisfies both force and moment equilibrium and assumes all slice side forces have the same inclination. The Factor of Safety (FS) is defined as the sum of available shear strength resistance divided by mobilized shear strength. A FS value less than 1.0 indicates slope instability and the greater the FS the greater the anticipated stability of the slope. Our analyses for this evaluation are derived from information from field exploration and laboratory testing, and the US Army Corps of Engineers Engineering Manual (EM) No. 1110-2-1913, *Design and Construction of Levees* (2000).

We based our analysis framework on FEMA and USACE EM guidelines as discussed in subsequent report sections.

5.5.1 Levee Slope Stability Analysis

The following is a list of the types of stability analyses performed.

- Case I – End of Construction: Condition that models the stability of the embankment after the proposed levee improvements are completed. We checked slope stability toward the water side of the levee. By inspection, slope stability toward the land side results in a higher factor of safety.

- Case II – Rapid Drawdown: Occurs after prolonged flood stage saturates at least the major part of the upstream embankment slope and then falls faster than the soil can drain. Due to the water elevation being within the bay and a function of fluctuating tidal influence, we deemed this analysis not applicable and therefore did not include in our analysis.

- Case III/IV – Steady Seepage From Full-Flood Stage: Occurs when the water remains at or near full-flood stage long enough so the embankment becomes fully saturated and steady seepage is reached. The pore water pressures we used during steady state seepage were based on the 100-year still-water surge elevation. Steady state seepage pore pressures were calculated in seepage analyses and then succinctly utilized in slope stability analyses.

- Case VI – Earthquake (Seismic Vulnerability): The effects of ground shaking are considered in this analysis method, including horizontal ground acceleration and residual soil strengths where applicable. Seismic analysis methods are further discussed in Section 5.5.3. We checked slope stability toward the water side of the levee. By inspection, slope stability toward the land side results in a higher factor of safety.

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5.5.1 Soil Strength Parameters

We selected soil strength parameters based on field exploration and laboratory testing data. The specific soil strength parameters we used in the analyses are presented below and on the analytical figures.

In general, we developed the following strength parameters for the slope stability analyses based on review of exploration locations performed near the location of each cross-section and associated laboratory testing results.

TABLE 5.5.1-1: Slope Stability Model Parameters

MATERIAL TYPE	UNIT WEIGHT	COHESIVE STRENGTH	COHESION CHANGE	FRICTION ANGLE
Proposed Fill (drained)	125 pcf	100 psf	-	32 degrees
Existing Clayey Levee Fill (drained)	115 pcf	100 psf	-	30 degrees
Existing Sandy Levee Fill (drained)	125 pcf	-	-	35 degrees
YBM – Levee Prism and Landside	See Table 5.5.1-2 below			

MATERIAL TYPE	UNIT WEIGHT	COHESIVE STRENGTH	COHESION CHANGE	FRICTION ANGLE
YBM – Waterside (Bay or Slough conditions)	95 pcf	100 psf	10 psf/ft	-
YBM – Waterside (Marsh conditions)	95 pcf	200 psf	10 psf/ft	-
YBM – Sedimentation Basin (STA 9 CL3)	95 pcf	250 psf	10 psf/ft	-
Alluvium - Clayey (undrained)	125 pcf	1,500 psf	-	-

TABLE 5.5.1-2: Slope Stability Model Parameters – YBM within Levee Prism and Landside

CROSS SECTION DESIGNATION	REACH DESIGNATION	UNIT WEIGHT	COHESIVE STRENGTH	COHESION CHANGE
STA 15	Reach A	95 pcf	400 psf	10 psf/ft
STA 54	Reach B	95 pcf	400 psf	10 psf/ft
STA 66	Reach C	95 pcf	400 psf	10 psf/ft
STA 80	Reach D	95 pcf	400 psf	10 psf/ft
STA 120	Reach E	95 pcf	400 psf	10 psf/ft
STA 149	Reach F	95 pcf	400 psf	10 psf/ft
STA 183	Reach G	95 pcf	350 psf	10 psf/ft
STA 215	Reach H	95 pcf	300 psf	7 psf/ft
STA 9 CL3	Reach I	95 pcf	250 psf	10 psf/ft
STA 288	Reach J	95 pcf	350 psf	5 psf/ft
STA 305	Reach K	95 pcf	350 psf	5 psf/ft
STA 315	Reach L	95 pcf	350 psf	5 psf/ft
STA 335	Reach M	95 pcf	350 psf	5 psf/ft

In developing the drained strength of proposed and existing fine-grained fill, we referred to Table 5.17 – Typical Peak Drained Strengths for Compacted Cohesive Soils from Duncan and Wright (2014). We also reviewed consolidated, undrained, triaxial compression tests performed on clayey existing fill materials for nearby levee projects.

We determined strength parameters for YBM within the levee prism and landside of the levee prism by reviewing field exploration and laboratory testing data along the project alignment. In particular, we reviewed undrained shear strength data from laboratory testing (unconsolidated-undrained triaxial strength tests and laboratory vane shear tests), field vane shear testing, correlations from CPT, and to a lesser degree field strength testing from miniature vane shear tests performed in the field on soil samples of YBM collected from boring locations.

At approximate Station 120+00, we performed a CPT probe (3-CPT3), exploratory boring (2-B2) and field vane shear test (2-VST1) adjacent to each other to correlate strength data from various exploration types. Review of the undrained shear strength testing at this location indicates that unconsolidated-undrained triaxial strength tests tend to provide the lowest (conservative) values of undrained shear strength, followed by laboratory vane shear testing and field vane shear testing that provided higher undrained shear strength values. This trend is in general accordance with Duncan and Wright (2014), which states that disturbance in unconsolidated-undrained triaxial testing can lead to low (conservative) values, whereas laboratory vane shear testing is very well-suited to measure undrained shear strength, and field vane shear testing is the best field test (in the author's opinion) to determine undrained shear strength of saturated clay soils. We noted that correlations from the raw CPT data did not match up to the laboratory and field undrained shear strength test results. Undrained shear strength is estimated from the CPT using the undrained shear strength cone factor (Nkt). A default value of 14 is typically used, but for sensitive clays Nkt can be as low as 6. Therefore, we back-calculated appropriate Nkt values to have the resulting undrained shear strength profile from the CPT probe correlate with laboratory and field undrained shear strength test results. We plotted the undrained shear strength data versus elevation, reviewed the plots, and developed the above strength profiles for YBM within the levee prism and landside of the levee prism.

We selected conservative strength profiles for offshore YBM based on review of Boring B-4 that was performed by Kleinfelder in marsh conditions, and previous experience on similar projects.

5.5.2 Slope Stability Criteria

The slope stability safety factors adopted for this stability analysis are based on Federal Emergency Management Agency (FEMA) guidelines, United States Army Corps (USACE) guidelines and Engineering Manuals. The slope stability factors of safety are tabulated here:

TABLE 5.5.2-1: Minimum Slope Stability Factors of Safety

END OF CONSTRUCTION (CASE I)	SUDDEN DRAWDOWN (CASE II)	STEADY SEEPAGE (CASE III/IV)	EARTHQUAKE (CASE VI)
1.3	Not Applicable	1.4	1.0

5.5.3 Seismic Analysis

We generally based our earthquake stability analyses on the USACE "Guidelines for Seismic Stability Evaluation of USACE Levees", dated December 2, 2011. The guidelines describe how to identify and screen for potentially liquefiable soil, how to perform seismic slope stability and how to estimate any associated horizontal and vertical displacement.

5.5.3.1 Seismicity

There is limited criteria published regarding the level of ground shaking to utilize for seismic evaluation and design of the levee system. Draft criteria by the United States Army Corps of Engineers (USACE, 2011) and United States Society on Dams (USSD, 2014) suggest that the return period of the seismic design event should be consistent with the return period of the intended flood protection. We understand the levee improvements will be designed to the 100-year still-water surge elevation (future sea level rise is also being considered in the design). Therefore, for seismic analyses we evaluated the level of ground shaking/seismicity to a 100-year return period for design. Using the 2008 U.S. Geological Survey (USGS) National Seismic Hazard Maps Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/, Version 3.3.1 that corresponds with ASCE 7-10) we calculated a peak ground acceleration (PGA) of 0.27g for the project alignment considering a 100-year return period.

5.5.3.2 Pseudostatic Seismic Analysis

In evaluating the stability of slopes under seismic conditions, we used a "pseudostatic" method of analysis. The pseudostatic method models the effects of transient or pulsating earthquake loading

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on a potential slide mass by using an equivalent sustained horizontal force that is the product of a seismic coefficient and the weight of the potential slide mass. To determine the pseudostatic seismic coefficient (kh), we followed the method outlined in California Geological Survey (CGS) Special Publication 117A (SP117A, 2008). We calculated a seismic coefficient (kh) of 0.14g using a PGA of 0.27g. The selected seismic coefficient is based on a displacement threshold of about 6 inches (or 15 centimeters). Based on our experience, and SP117A (2008), the 6-inch criteria represents an amount of displacement that would be considered acceptable for the proposed levee improvements.

5.5.3.3 Slope Deformation Analysis

For cross sections that indicated a factor of safety less than 1.0 with respect to seismic slope stability, we performed a Newmark-type displacement analysis based on the methodology proposed by Bray and Travasarou (2007) to estimate lateral deformations. As a qualitative estimate of loss of freeboard, the vertical deformation of the levee crown is estimated for pseudostatic conditions as approximately 70 percent of the total lateral deformation. The USACE criteria require that earthquake-induced deformation not exceed 1 foot of vertical deformation (or about 3 feet of lateral deformation).

5.5.3.4 Post Earthquake Slope Stability

Where potentially liquefiable soils were identified, we assigned the residual, or post-earthquake, strength of the liquefied soil and ran static stability analyses to model the post-earthquake slope stability. We determined residual undrained shear strengths proportional to the effective overburden stress, according to the methodology proposed in Olsen and Stark (2002). The specific soil strengths used in our analyses are shown on the analysis figures in Appendix E.

5.6 SEEPAGE AND SLOPE STABILITY RESULTS

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Seepage and slope stability calculations supporting this seepage and stability evaluation are presented in the analytical figures in Appendix E. A series of analytical figures for each cross section (associated with a specific stationing) includes material parameters utilized, calculated seepage results, and calculated slope stability results.

5.6.1 Seepage Analysis

Seepage analyses present the calculated vertical hydraulic gradient contours under a steady seepage condition at the 100-year still-water surge elevation. This graphic is where potential through seepage breakouts are identified (relative to the landside levee toe), and the maximum exit gradients are called out.

5.6.2 Static and Seismic Slope Stability Analysis

The results of the slope stability analyses are presented on graphics showing the idealized subsurface stratigraphy and calculated slip surface. A factor of safety against failure (“FS”) that is calculated by Slide and associated with the identified slip surface is also presented on this graphic. The water surface(s) utilized in the associated slope stability analysis is also shown and identified. For the horizontal acceleration utilized in the seismic analyses is noted at the top right of the graphic.

5.6.3 Results

The seepage and slope stability results for this reach are tabulated below. Analyses of the cross section are provided in Appendix E. The results indicate the analyzed cross sections meet the USACE seepage and stability criteria for a 100-year still-water design water surface elevation.

For seismic stability analyses, the resulting factors of safety were greater than 1.0 and therefore a seismic deformation analysis was not performed. At Station 15+00, a potentially liquefiable layer was identified within the existing fill. We modeled this layer using a residual shear strength of 200 psf and performed a post-earthquake slope stability analysis; an acceptable factor of safety was calculated.

TABLE 5.6.3-1: Seepage Analysis Summary

CROSS SECTION DESIGNATION	DESIGN WATER SURFACE ELEVATION	EXIT GRADIENT AT L.S. TOE
STA 15	11.7	0.01
STA 54	11.7	0.07
STA 66	11.8	0.05
STA 80	11.8	0.17
STA 120	11.8	0.16
STA 149	11.5	0.25
STA 183	11.5	0.27
STA 215	11.5	0.43
STA 9 CL3	11.5	0.25
STA 288	11.5	0.15
STA 305	11.5	0.20
STA 315	11.5	0.18
STA 335	11.5	0.10

TABLE 5.6.3-2: Slope Stability Analysis Summary

CROSS SECTION DESIGNATION	CASE ANALYZED	FACTOR OF SAFETY CIRCULAR	
		WATERSIDE	LANDSIDE
STA 15	Case I End of Construction	2.0	> 2.0-
	Case III/IV Steady Seepage	-	> 1.4
	Case VI Pseudo Static	1.0	> 1.0
	Case VI Post Earthquake	1.4	> 1.4
STA 54	Case I End of Construction	1.4	> 1.4

CROSS SECTION DESIGNATION	CASE ANALYZED	FACTOR OF SAFETY CIRCULAR	
		WATERSIDE	LANDSIDE
	Case III/IV Steady Seepage	-	2.2
	Case VI Pseudo Static	1.0	> 1.0
STA 66	Case I End of Construction	1.5	> 1.5
	Case III/IV Steady Seepage	-	3.8
	Case VI Pseudo Static	1.1	> 1.1
STA 80	Case I End of Construction	1.4	> 1.4
	Case III/IV Steady Seepage	-	1.6
	Case VI Pseudo Static	1.0	> 1.0
STA 120	Case I End of Construction	1.6	> 1.6
	Case III/IV Steady Seepage	-	2.4
	Case VI Pseudo Static	1.1	> 1.1
STA 149	Case I End of Construction	1.5	> 1.5
	Case III/IV Steady Seepage	-	2.3
	Case VI Pseudo Static	1.1	> 1.1
STA 183	Case I End of Construction	4.2	> 4.2
	Case III/IV Steady Seepage	-	2.1
	Case VI Pseudo Static	1.5	> 1.5
STA 215	Case I End of Construction	2.7	> 2.7
	Case III/IV Steady Seepage	-	2.7
	Case VI Pseudo Static	1.1	> 1.1

CROSS SECTION DESIGNATION	CASE ANALYZED	FACTOR OF SAFETY CIRCULAR	
		WATERSIDE	LANDSIDE
STA 9 CL 3	Case I End of Construction	1.7	> 1.7
	Case III/IV Steady Seepage	-	1.7
	Case VI Pseudo Static	1.1	> 1.1
STA 288	Case I End of Construction	2.9	> 2.9
	Case III/IV Steady Seepage	-	5.3
	Case VI Pseudo Static	1.2	> 1.2
STA 305	Case I End of Construction	1.9	> 1.9
	Case III/IV Steady Seepage	-	2.6
	Case VI Pseudo Static	1.0	> 1.0
STA 315	Case I End of Construction	2.4	> 2.4
	Case III/IV Steady Seepage	-	> 1.4
	Case VI Pseudo Static	1.2	> 1.2
STA 335	Case I End of Construction	2.6	> 2.6
	Case III/IV Steady Seepage	-	4.0
	Case VI Pseudo Static	1.3	> 1.3

5.7 SEISMIC STABILITY UNDER BUILDING DESIGN-LEVEL GROUND MOTIONS

Because the level of seismicity utilized in the above seismic stability analysis is lower than seismic standards for other types of improvements (such as new buildings), we also evaluated the potential performance of the levee under expected ground motions for seismic events that exceed a 100-year return period.

In accordance with the 2016 California Building Code (CBC) and ASCE 7-10, we calculated an average mapped Maximum Considered Earthquake (MCE) Mean Peak Ground Acceleration (PGA_M) along the alignment of approximately 0.55g using the USGS U.S. Seismic Design Map for ASCE 7-10 (https://earthquake.usgs.gov/designmaps/us/application.php). This corresponds to a design-level PGA of 0.37g, (two-thirds of the mapped PGA_M) consistent with the CBC and ASCE 7-10 design-level spectrum. In accordance with SP117A (2008) and based on a displacement threshold of about 6 inches (or 15 centimeters), we calculated a seismic coefficient (kh) of 0.19g using the above design PGA.

We performed additional seismic stability analyses on all cross sections using the increased seismic coefficient corresponding to design-level ground motions. For cross sections that indicated a factor of safety less than 1.0, we determined the yield acceleration coefficient (ky) that resulted in a factor of safety of 1.0, and performed a Newmark-type displacement analysis based on the methodology proposed by Bray and Travasarou (2007) to estimate lateral deformations. The table below presents our results.

TABLE 5.7-1: Seismic Slope Deformation Analysis Summary

CROSS SECTION DESIGNATION	YIELD ACCELERATION (Ky)	ESTIMATED LATERAL DISPLACEMENT (FEET)
STA 15	0.14g	¾
STA 54	0.14g	1
STA 66	0.16g	¾
STA 80	0.14g	1
STA 120	0.17g	¾
STA 149	0.16g	¾
STA 183	0.21g	< ½
STA 215	0.16g	< ½
STA 9 CL3	0.14g	¾
STA 288	0.18g	< ½
STA 305	0.14g	¾
STA 315	0.18g	< ½
STA 335	0.19g	< ½

Based on our analysis, we estimate that theoretical seismically induced lateral displacements to be on the order of up to 1 foot based on simplified methods. These results indicate that there would likely be some loss of freeboard, but not a loss of 100-year flood protection at design-level ground motions. They also indicate that some amount of levee raise may be necessary should an earthquake occur that has site shaking similar to the Building Code design event.

6.0 DESIGN RECOMMENDATIONS

We provide the following geotechnical recommendations for design of the levee improvements.

6.1 GRADING RECOMMENDATIONS

We provide the following general grading recommendations that should be incorporated into and/or considered for project design.

- As previously discussed and as shown on figures in Appendix D, we estimate up to 12 inches of consolidation settlement of YBM may occur due to placement of up to 5½ feet of engineered fill. The design levee (or floodwall) elevations should include an allowance for the estimated consolidation settlement, in addition to the required design elevations.

- Where the estimated consolidation settlement is considered excessive, geotechnical mitigation measure(s) may be incorporated to reduce the estimated consolidation settlement. These are discussed in more detail in the Geotechnical Mitigation Measures section.

- In areas where existing utilities, improvements, or other features that are sensitive to settlement will remain, we assume settlement from design fill and/or proposed improvements is not desirable. Therefore, we recommend limiting the proximity of new engineered fill near these features, and instead using lightweight fill (such as cellular concrete) to raise grades. Additional recommendations are presented in the Geotechnical Mitigation Measures section.

- We anticipate consolidation settlement transitions will be relatively uniform along the levee alignment, provided the proposed loading conditions are also relatively uniform. Therefore, we recommend a maximum trail slope gradient of 2 percent along the alignment. We also recommend the change in fill thickness be no more than 2 percent along the alignment. Where these conditions are not achieved, we should consult with you and provide additional recommendations.

- Unless soil reinforcement is incorporated in engineered fills, graded cut and fill slopes should be constructed at gradients no steeper than 2:1 (horizontal:vertical), and should be designed to a maximum height of 10 feet.

- In general, earthen improvements such as graded slopes are less sensitive to settlement than structural improvements such as retaining walls. Therefore, we recommend considering the use of reinforced soil slopes (RSS) to increase allowable graded slope gradients, and potentially reduce retaining wall heights or eliminate select retaining walls. RSS are discussed further in the Geotechnical Mitigation Measures section.

- Similarly, more flexible retaining wall types such as mechanically stabilized earth (MSE) walls are less sensitive to settlement than more rigid retaining wall types such as cantilevered structural retaining walls. We recommend this be considered when selecting retaining wall types.

- Considering the estimated time rates of consolidation settlement, we recommend a phased construction schedule be implemented for earthwork activities. Where possible, we recommend proposed improvements such as retaining walls, concrete flatwork, staircases, ramps, and asphalt paving be performed toward the end of the project to reduce post-construction consolidation settlement for these improvements. For retaining walls, temporary slopes in accordance with OSHA may be constructed during an interim grading phase.

- Exposed graded slopes should be landscaped or provided with appropriate slope protection to minimize erosion. In particular, on the waterside slopes incorporation of a 2-foot-thick rock riprap section underlain with geotextile stabilization fabric (Mirafi 500X or approved equivalent) should be considered based on still-water surge and wave run-up concerns.

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6.2 GEOTECHNICAL MITIGATION MEASURES

We discuss several geotechnical mitigation measures we consider feasible to reduce the impact of geologic and/or geotechnical concerns for the project.

6.2.1 Cellular Concrete

Cellular concrete is a low-density material consisting of a cement and water mixture injected with a stable foam. The material can cure in-place to a unit weight of approximately 30 pounds per cubic foot (pcf). This unit weight is approximately 95 pcf less than the assumed unit weight of proposed fill, and 85 pcf less than the average unit weight of existing fill.

To reduce consolidation settlement due to proposed fills, cellular concrete can be used as fill to raise site grades, in lieu of heavier soil fill. The figures in Appendix D may be used to estimate consolidation settlement due to placement of cellular concrete as engineered fill, by assuming the unit weight (or load) of cellular concrete is ¼ that was assumed for traditional engineered fill.

Where settlement will be detrimental to the existing or planned improvements, existing heavier onsite soil can be overexcavated and replaced with cellular concrete such that there is no increase in load, resulting in negligible future settlement. As an example, in an area where grade is to be raised by 2 feet, removing 3 feet of existing fill (assuming existing fill unit weight of 115 pcf) and replacing that fill with cellular concrete would allow raising grade 2 feet with conventional fill (assuming proposed fill unit weight of 125 pcf) and would result in essentially the same soil pressures. Cellular concrete is most efficiently used below existing grade such that the sides of excavations can be used to confine the material while it cures and hardens. However, it can also be cast above grade by using formwork, and reduce the amount of excavation of existing fill. As an example, where 4 feet of fill is planned, the weight of the new fill could be compensated by removing approximately the upper 1½ feet of existing fill and constructing to planned grade using cellular concrete. The table below presents recommendations for lightweight fill.

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TABLE 6.2.1-1: Cellular Concrete Mitigation

CELLULAR CONCRETE MITIGATION		
Design Fill Thickness	**Amount of Cellular Concrete Below Existing Grade (using traditional fill to raise grades)**	**Amount of Cellular Concrete Below Existing Grade (using cellular concrete to raise grades)**
1’	1½’	½’
2’	3’	1’
3’	4½’	1½’
4’	6’	1½’
5’	-	2’
6’	-	2½’

We recommend limiting the overexcavation to existing fill soil only, and not extending the excavation into YBM. Where design fill thickness exceeds 4 feet, cellular concrete will need to be used to raise grades.

We recommend that we consult further with you and the city to determine locations to incorporate the use of cellular concrete. Once determined, we recommend limiting the proximity of new engineered fill near these locations by extending the cellular concrete mitigation at least 10 feet outside the selected areas in all directions.

Cellular concrete also has a high shear strength compared to soil fill, and its use as fill in lieu of soil fill will improve potential slope stability concerns. It will also result in reduced or potentially negligible lateral earth pressures on structural floodwalls, sheet pile walls, or other planned retaining walls (as discussed in a subsequent section).

From Station 234+00 through Station 255+00, a new earthen levee up to 10 feet in height will be constructed through an existing sedimentation basin/seasonal wetland. We anticipate the estimated long-term consolidation settlement of YBM is excessive, and the use of cellular concrete may be feasible to reduce consolidation settlement. The earthen levee can be constructed with soil fill, then the levee crown can be excavated to original grade, and backfilled with cellular concrete. Surcharge fill is also feasible for this location, as discussed in a subsequent section. We recommend that we consult further with you and the city to determine final recommendations for this location.

6.2.1.1 Construction Considerations

Because cellular concrete is lighter than water, it will be buoyant when cast below the groundwater level. Where groundwater is encountered in areas to receive cellular concrete, the groundwater should be temporarily lowered to allow casting the cellular concrete and kept dewatered until the material has cured and engineered fill has been placed on top to prevent uplift.

Cellular concrete lift height should be limited to 4 feet in thickness to limit the risk of collapsing under its own weight. The cellular concrete should be allowed to cure at least 12 hours before placing the next lift. If any collapse occurs, the resulting cellular concrete will be heavier than planned, therefore, the entire lift of material will need to be removed and disposed of prior to placing the next lift.

Cellular concrete is not feasible for use as fill in geogrid-reinforced fills. Soil fill will be necessary where geogrid reinforcement (an additional geotechnical mitigation measure described below) is planned.

6.2.2 Geogrid Reinforcement

Geogrid reinforcement can be placed in soil fills to create a composite soil material with increased strength and stiffness compared to general soil fill. Geogrid reinforcement should be considered in the following applications.

- Geogrid can be placed in general soil fill placed to raise grades within the levee improvement prism. The geogrid-reinforced fill will create a composite soil material that will settle more uniformly compared to soil fill, and reduce potential for differential settlement and associated distress to surface improvements along the levee alignment. It will also result in reduced lateral earth pressures on structural floodwalls, sheet pile walls, or other planned retaining walls (as discussed in a subsequent section). When placed in general soil fill, geogrid should be placed with a maximum vertical spacing of 2 feet.

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- Geogrid reinforcement can be used in design and construction of MSE retaining walls. In general, MSE walls can typically tolerate larger vertical and lateral displacements, as compared to conventional structural walls.

- Geogrid can also be used in design and construction of reinforced soil slopes (RSS). Design slope gradients will be limited to 2:1 (horizontal:vertical) for general soil fill. The use of RSS will increase the stability of planned slopes, and allow for steeper slope gradients than general soil slopes. We recommend a maximum slope gradient of 1½:1 be considered for RSS. Due to potential differential settlement concerns, we recommend geogrid reinforcement for RSS be extended across the entire levee width. In addition, RSS provide additional lateral confinement at the face of graded slopes, reducing erosion concerns and potentially allowing for heavier equipment during construction. If used on the project, landscaping requirements may vary at these locations.

6.2.2.1 Construction Considerations

Geogrid has limited use where underground utilities/trenching are planned; however, we understand underground improvements are not planned below the levee. In addition, geogrid cannot be used in conjunction with cellular concrete as described above.

6.2.3 Surcharge Fill

From Station 234+00 through Station 255+00, a new earthen levee up to 10 feet in height will be constructed through an existing sedimentation basin/seasonal wetland. We anticipate the estimated long-term consolidation settlement of YBM is excessive, and a surcharge program may be feasible to mitigate this concern.

A surcharge program can be used to pre-consolidate YBM deposits by placing extra fill over improvement areas to adequately drive consolidation of the YBM and preload the soil to loads higher than the weight of the planned fills. The surcharge fill area, grades and extent would be determined during design depending on desired surcharge period, planned loads, and surcharge materials to allow the desired degree of consolidation to be achieved. Surcharge fill may be used in combination with wick drains (used to accelerate settlement rates).

For planning purposes assuming a 6-month surcharge program, we estimate a surcharge fill height of approximately 8 feet (in addition to civil fill). We assume wick drains will be installed to the bottom of the YBM (approximate depth of 40 feet) and spaced 5 feet on-center in a triangular pattern. Surcharging should be extended at least 5 feet beyond the areas to be surcharged.

6.3 RETAINING WALL RECOMMENDATIONS

The following sections present recommendations for various retaining wall types planned for the project alignment, including sheet pile flood/retaining walls, conventional structural concrete floodwalls, and mechanically stabilized earth (MSE) retaining walls.

The following recommendations apply to all retaining wall types.

- Approved native/import soil or cellular concrete are anticipated for backfill of the retaining walls. Refer to additional recommendations in each of the subsequent sections.

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- The seismic performance of the retaining walls should be evaluated. Refer to additional recommendations in each of the subsequent sections.

- Appropriate surcharge loads from vehicles, and other potential surcharge loadings, as applicable, should be incorporated. Unless appropriate surcharge loading for construction equipment is incorporated in the wall designs, lightweight construction equipment should be used during backfill compaction of engineered fill and improvement construction behind the walls, to reduce potential for possible overstressing of the walls.

- Drainage facilities should be installed behind retaining walls to prevent the build-up of hydrostatic pressures on the walls. Wall drainage may be provided using 4-inch-diameter perforated (SDR 35 or approved equivalent) pipe encapsulated in either Class 2 permeable material, or free-draining gravel surrounded by synthetic filter fabric. The width of the gravel-type drain blanket should be at least 12 inches. The drain blanket should extend from the base of the wall to about 1 foot below the finished grade at top of wall. The upper 1 foot of wall backfill should consist of clayey soil or other approved relatively impervious material. If preapproved by the Geotechnical Engineer, prefabricated wall drain panels could be considered in lieu of the granular drain blanket above the pipe system. Drainage should be collected by solid pipes and directed to an outlet approved by the Civil Engineer.

6.3.1 Sheet Pile Flood Walls

Driven sheet pile flood/retaining walls are planned at various locations along the project alignment. We anticipate sheet piles will be designed following methods contained in USACE Engineer Manual 1110-2-2504.

Sheet pile loading diagrams are included as Figures 7A through 7H. The figures provide loading diagrams for use in sheet pile design at various stationing locations along the project alignment, as indicated on each figure. Figures 7F and 7G present alternative loading diagrams that incorporate geogrid reinforcement or cellular concrete within the proposed fill, to reduce loading on the sheet piles. Due to potential differential settlement concerns, if geogrid or cellular concrete are used to reduce lateral earth pressures, we recommend they be applied over the entire levee width. Figure 7H presents passive earth pressure recommendations for existing fill material, which varies along the project alignment.

Due to corrosive site soils, appropriate corrosion protection should be incorporated into sheet pile design. The contractor should anticipate oversized materials within the existing fill, as discussed in Section 4.2.3.

The figures for the above conditions present design recommendations for cantilevered sheet pile walls. As an alternative, an anchored sheet pile wall derives its support from a combination of soil resistance and a mechanical device that inhibits movement. An anchored sheet pile wall may be used where lateral earth pressures and/or slope stability concerns limit the feasibility of a conventional cantilevered sheet pile wall, and where the above mitigation measure(s) is/are not considered. Potentially feasible anchors include a deadman, a tie rod and offset sheet pile, and grouted tieback. At this time, anchored sheet pile walls are not planned, but we can provide additional recommendations if needed.

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6.3.2 Conventional Structural Walls

This section provides retaining wall recommendations for conventional structural cantilevered concrete floodwalls supported on continuous spread footing foundations.

Approved import soil, geogrid-reinforced soil, or cellular concrete are anticipated for backfill of the floodwalls. We recommend the walls be designed as drained, unrestrained retaining walls. The walls may be designed using active lateral equivalent fluid pressure of 45 pounds per cubic foot (pcf) for approved import soil, 15 pcf for geogrid-reinforced soil, or 5 pcf for cellular concrete backfill for level backfill conditions. A total unit weight of 125 pcf may be assumed for approved import soil, and a total unit weight of 30 pcf may be assumed for cellular concrete. Due to potential differential settlement concerns, if geogrid or cellular concrete are used to reduce lateral earth pressures, we recommend they be applied over the entire levee crown width.

We also recommend the seismic performance of the retaining walls be evaluated. The seismic soil pressure acting on the walls can be taken as a lateral equivalent fluid pressure of 9 pcf for level backfill conditions.

We recommend the walls be supported on a shallow, 'L-shaped' or 'T-shaped' continuous footing foundation. We recommend that retaining wall footings be designed using an ultimate bearing capacity of 4,500 pounds per square foot (psf). The footing should be embedded at least 24 inches below lowest adjacent grade. We recommend a minimum footing thickness of 12 inches. Actual footing design (sizing, reinforcement, etc.) should be determined by the structural engineer based on structural design considerations. Footings located adjacent to utility trenches should have their bearing surfaces below an imaginary 1:1 plane projected upward from the bottom edge of the trench to the footing.

Passive pressures acting on footings and keyways may be assumed as an ultimate value of 250 pcf, provided that the area in front of the retaining wall (or keyway) is level for a distance of at least 10 feet. Considering the presence of variable sloping conditions in front of the walls, we anticipate passive pressure resistance will need to be neglected at many locations. An ultimate friction factor for sliding resistance may be assumed as 0.45. Appropriate safety factors to the above ultimate design values, as well as against overturning and sliding should be incorporated into the design calculations.

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6.3.3 MSE Walls

We recommend MSE retaining walls be designed in accordance with AASHTO, FHWA, or NCMA design methodology, as appropriate. Approved native or import soil should be used to construct MSE retaining walls. The following soil criteria should incorporated in the MSE wall design.

TABLE 6.3.3-1: Soil Material Parameters

CONDITION	COHESION (c') (pcf)	FRICTION ANGLE (∅') (degrees)	UNIT WEIGHT (γ) (pcf)
Reinforced Fill	0	28	125
Retained Soil	0	28	125
Foundation Fill	0	26	115

We recommend that the seismic performance of the MSE walls be evaluated using a design peak ground acceleration (PGA) of 0.27g. Appropriate safety factors should be incorporated into MSE wall design.

Due to potential differential settlement concerns, we recommend geogrid reinforcement for MSE walls be extended across the entire levee width.

6.4 PAVEMENT DESIGN

We understand that a new paved pedestrian trail will be constructed on the levee. The Traffic Index should be determined by the Civil Engineer or City of Foster City. The sections provided below should be revised, if applicable, based on R-value tests performed on samples of actual subgrade materials recovered at the time of grading.

We estimate that site soil will have a resistance (R-value) value of 5. The following preliminary pavement sections have been determined based on an assumed R-value of 5 according to the method contained in Topic 633 of the Caltrans Highway Design Manual (including the asphalt factor of safety), presented in the table below.

TABLE 6.4-1: Recommended Asphalt Concrete Pavement Sections

TRAFFIC INDEX	SECTION	
	ASPHALT CONCRETE (INCHES)	CLASS 2 AGGREGATE BASE (INCHES)
4	2.5	8.0
5	3.0	10.0
6	3.5	13.0
7	4.0	16.0

Pavement construction recommendations are presented in Section 7.0.

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7.0 EARTHWORK RECOMMENDATIONS

We provide the following earthwork recommendations for construction of the levee improvements.

7.1 MONITORING AND TESTING

It is important that all site preparations for site grading and improvements be done under the observation of the Geotechnical Engineer's field representative. The Geotechnical Engineer's field representative should observe all graded area preparation, including demolition and stripping, following the recommendations contained herein and in the Supplemental Recommendations.

7.2 SOFT SOIL AND CONSTRUCTION EQUIPMENT CONSIDERATIONS

Significant earthwork construction will be required for the proposed improvements, and earthwork activities will extend close to and/or into soft YBM deposits. We provide the following considerations.

- Soil conditions on the existing levee embankment and landside of the levee will comprise variable thicknesses of existing fill overlying soft YBM.
- Soil conditions at marsh areas, seasonal/muted tidelands, and the sediment basin consist of YBM at or very near the existing ground surface. These conditions exist on the landside at Stations 45+00 – 63+00, 70+00 – 97+00, and 230+00 – 254+00.
- Earthwork activities on or in close proximity to YBM deposits are not able to support heavy earthwork construction equipment. The contractor should utilize methods or equipment suitably sized for soft soil conditions. Construction equipment should be limited to lightweight sizes to reduce potential for subgrade disturbance, slope instability, and damage to shallow existing utilities.
- The contractor should minimize the use of rubber-tired equipment to reduce potential for creation of unstable areas, rutting, and instability. Light equipment with mud tracks may be required.
- As with any Bay Mud project, the contractor should be aware of the potential for slope failures due to presence of YBM. Stockpiles, construction equipment, and other loads should be appropriately setback from slopes.
- Temporary haul routes for trucks and other equipment should be designed for their intended use, and should be maintained regularly. Construction equipment should maintain low velocities at all times.

We should consult further with you, the city, and the contractor on the above issues once additional project and construction details are determined.

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7.3 WET SOIL CONDITIONS

The contractor should anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, during or following periods of rain, during periods of high tide, and within YBM deposits. Where possible, we recommend the construction project schedule more challenging activities during generally dry periods of the year.

Wet soil can make proper compaction difficult or impossible. In general, wet soil conditions can be mitigated by:

- Frequent spreading and mixing during warm dry weather
- Mixing with drier materials
- Removal and replacement with drier materials
- Mixing with a lime, lime-flyash, or cement product
- Stabilizing with aggregate, geotextile stabilization fabric, or both

7.4 SITE PREPARATION, CLEARING, AND STRIPPING

Clear work areas of all surface and subsurface deleterious materials, including abandoned buried structures, utilities, irrigation lines, pavements, debris, trees, shrubs and associated roots. Tree root balls should be removed down to a depth of at least 3 feet below finished grade. Remove all associated foundations, as well as buried utilities, which could act as water traps or could deteriorate. All vegetation, debris, and deleterious materials should be removed from areas to be graded. Backfill excavations extending below the planned finish site grades with engineered fill.

Following clearing, strip the site to remove surface organic materials. Strip organics from the ground surface to a depth of at least 2 to 3 inches below the surface. Actual depth of stripping should be evaluated by ENGEO during construction. If approved, the organics may be used in future landscape areas or otherwise should be off-hauled.

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, we can evaluate site vegetation at the time of grading to assess the feasibility of mulching organics in place.

7.5 REMEDIAL GRADING

We recommend the proposed levee embankments be reconstructed by benching and keying into the existing levee embankments, as described below, and as shown graphically on Figure 8.

Construct a minimum 6-foot-wide keyway inward from the toe of the new fill slope. Extend the key at least 1 foot below original grade, as determined by ENGEO. Slope the keyway bottom at least 2 percent downward toward the heel of the keyway. Where these grading activities extend into or in close proximity to YBM deposits, unstable subgrade conditions may be encountered. For budgeting purposes, for excavations that extend into or to within 2 feet of YBM deposits, we recommend assuming a layer of biaxial geogrid and 12 inches of compacted Class 2 aggregate base will be placed over the geogrid, as directed by the geotechnical engineer, prior to fill placement.

Cut benches into original grade after the keyway has been nearly filled and compacted in accordance with fill placement recommendations. Construct benches into original slope grade as filling proceeds every 3 to 5 feet vertically, to maintain a minimum 2-foot cut into existing slope. Bench configurations will vary depending on the original and proposed slope grades and locations. Typical keyway and benching details are presented on Figure 8.

7.6 GRADING RECOMMENDATIONS

We provide the following general grading recommendation that should be incorporated into project construction. Please also refer to recommendations contained in Section 6.1

- We anticipate the water side and land side levee embankment slopes will be reconstructed individually such that levee crown elevation is never below current existing elevations.

- We anticipate the water side levee embankment will be reconstructed in segments such that excavations are not left open overnight or during periods of high tide.

7.7 ACCEPTABLE FILL

Import fill to be used as new levee fill, including lightweight fill, should meet the following criteria:

- The fill material should have a maximum total unit weight of 125 pounds per cubic foot when compacted to the specifications provided below.

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- The fill material shall consist of clean soils with an organic content of 3 percent or less.
- The fill material shall have a Plasticity Index of no less than 10 and no greater than 30, and a maximum liquid limit of 45.
- The fill material shall have 50 percent or more passing through a No. 4 sieve, and 30 percent or more of the material passing through a No. 200 sieve
- The fill material shall not contain rock or aggregate larger than 3 inches in greatest dimension, with no more than 15 percent larger than 1 inch.
- The fill material shall not be more corrosive than native material or existing levee fill based on laboratory corrosion testing.

A sample of the proposed import fill material should be evaluated by ENGEO 2 to 4 weeks prior to the import date.

Select native soil may also be used as new levee soil. We provide the following considerations.

- Existing levee fill material is suitable as fill material provided it is stripped of vegetation and debris and meets the above criteria.
- Excavated YBM is not considered suitable for reuse as engineered fill.
- If desired to reuse asphalt or Portland Cement concrete as engineered fill, we recommend that it be ground up and thoroughly mixed with onsite or import soil. We recommend recycled fill not be used within 2 feet of finished grade. Alternatively, if desired for reuse as recycled aggregate base, the material is typically processed through a crusher. The recycled product may then be used as general engineered fill, or as aggregate base below planned street or sidewalk sections. If used as part of street or sidewalk sections, the generated material should be tested for gradation, R-value, sand equivalent, and durability index and compared to recycled aggregate base specifications from Caltrans.

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7.8 FILL PLACEMENT AND COMPACTION

Once a suitable firm base is achieved, the exposed non-yielding surface should be scarified to a depth of 10 inches, moisture conditioned and recompacted to provide adequate bonding with the initial lift of fill.

All fills should be placed in thin lifts, with the lift thickness not to exceed 10 inches or the depth of penetration of the compaction equipment used, whichever is less. We recommend that vibratory compaction equipment be avoided on this project. Engineered fill placed should be adequately benched into the existing levee fill.

The following compaction control requirements should be applied to general fill materials:

Test Procedures:	ASTM D-1557
Required Moisture Content:	Not less than 2 percentage points above optimum moisture content
Required Relative Compaction:	Not less than 90 percent

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material. Additional compaction recommendations may be provided during construction depending on the materials used.

7.9 EXCAVATIONS AND TEMPORARY SHORING

Excavations should be properly excavated and shored, as applicable, to create a stable and safe condition. The Contractor should be familiar with applicable local, state, and federal regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. It is the responsibility of the Contractor to provide stable, safe trench and construction slope conditions and to follow OSHA safety requirements. Since excavation procedures may be dangerous, it is also the responsibility of the Contractor to provide a trained “competent person” as defined by OSHA to supervise all excavation operations, ensure that all personnel are working in safe conditions and have thorough knowledge of OSHA excavation safety requirements.

We anticipate excavations up to approximately 10 feet deep may be required for construction of the proposed levee embankment. We anticipate excavations will extend into existing fill and YBM deposits, and below design groundwater levels. Excavations should generally consider classification of Type C soil in Cal OSHA shoring, sloping, and benching design. The Geotechnical Engineer should be present during the excavation of site soils to provide geotechnical recommendations as necessary and identify variations in soil conditions as appropriate.

While not anticipated at this time, supplemental recommendations for shoring design can be provided upon request. The contractor should be responsible for the design and construction of all shoring systems.

7.10 DEWATERING CONSIDERATIONS

Groundwater may be encountered in excavations extending into or in close proximity to YBM deposits. Temporary dewatering during construction may be necessary. Assessment of dewatering and subsurface water migration and rates should be made during initial construction excavation procedures to determine the level of groundwater control and dewatering necessary.

We anticipate that groundwater may be removed using sumps, pumps, or other methods. The water level at excavation locations should be maintained below the bottom of the excavations. The selection of equipment and method should be determined by the contractor. The dewatering system implemented should be selected so as to have minimal impact on the groundwater level surrounding the proposed excavations. The dewatering system should be designed to prevent pumping soil fines with the discharge water. Uncontrolled dewatering could cause settlement of the general area and affect existing improvements in the vicinity of the site.

Groundwater management including temporary storage in Baker tanks (or similar) and testing may be required by the Regional Water Quality Control Board or other agency(s) prior to discharge of generated water. Requirements of potential receiving facilities should be determined in advance of construction. Impacted groundwater may require discharge to a specialty facility.

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7.11 PAVEMENT CONSTRUCTION

Pavement construction and all materials (hot mix asphalt and aggregate base) should comply with the requirements of the Standard Specifications of the State of California Division of Highways, City of Foster City requirements and the following minimum requirements.

- All pavement subgrades should be scarified to a depth of 10 to 12 inches below finished subgrade elevation, moisture conditioned and compacted as recommended in the field.
- Subgrade soils should be in a stable, non-pumping condition at the time aggregate baserock materials are placed and compacted. Proof-rolling with a heavy wheel-loaded piece of construction equipment should be implemented. Yielding materials should be appropriately mitigated, with suitable mitigation measures developed in coordination with the client, contractor and Geotechnical Engineer.
- Aggregate baserock materials should meet current Caltrans specifications for Class 2 aggregate baserock and should be compacted to at least 95 percent of maximum dry density at a moisture content of at least optimum.
- Hot mix asphalt paving materials should meet current Caltrans specifications and City requirements.
- Adequate provisions must be made such that the subgrade soils and aggregate baserock materials are not allowed to become saturated.

7.12 DRAINAGE

Perimeter grades should be positively sloped at all times to provide for rapid removal of surface water runoff away graded areas and to prevent ponding of water at any time during or after construction. Ponded water may cause undesirable soil swell and loss of strength.

7.13 VEGETATION

We recommend USACE ETL 110-2-583 be followed as a guideline for vegetation design for the levee. ETL 110-2-583 generally provides a guide for managing vegetation on levees, with the ultimate goal of a "vegetation free zone" within the levee prism and within 15 feet of the landside and waterside levee toe. Vegetation free refers to vegetation other than "approved grasses." The guide states that the primary purposes of this "vegetation free zone" is to provide access and to minimize any potential impact that root systems may have on the levee.

8.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report is issued with the understanding that it is the responsibility of the owner to transmit the information and recommendations of this report to developers, contractors, buyers, architects, engineers and designers for the project so that the necessary steps can be taken by the contractors and subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this report are solely professional opinions.

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The professional staff of ENGEO strives to perform its services in a proper and professional manner with reasonable care and competence but is not infallible. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our work.

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FIGURES

0 FEET 2000

0 METERS 1000

N

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE

ENGEO Expect Excellence	VICINITY MAP FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JJT	FIGURE NO. 1

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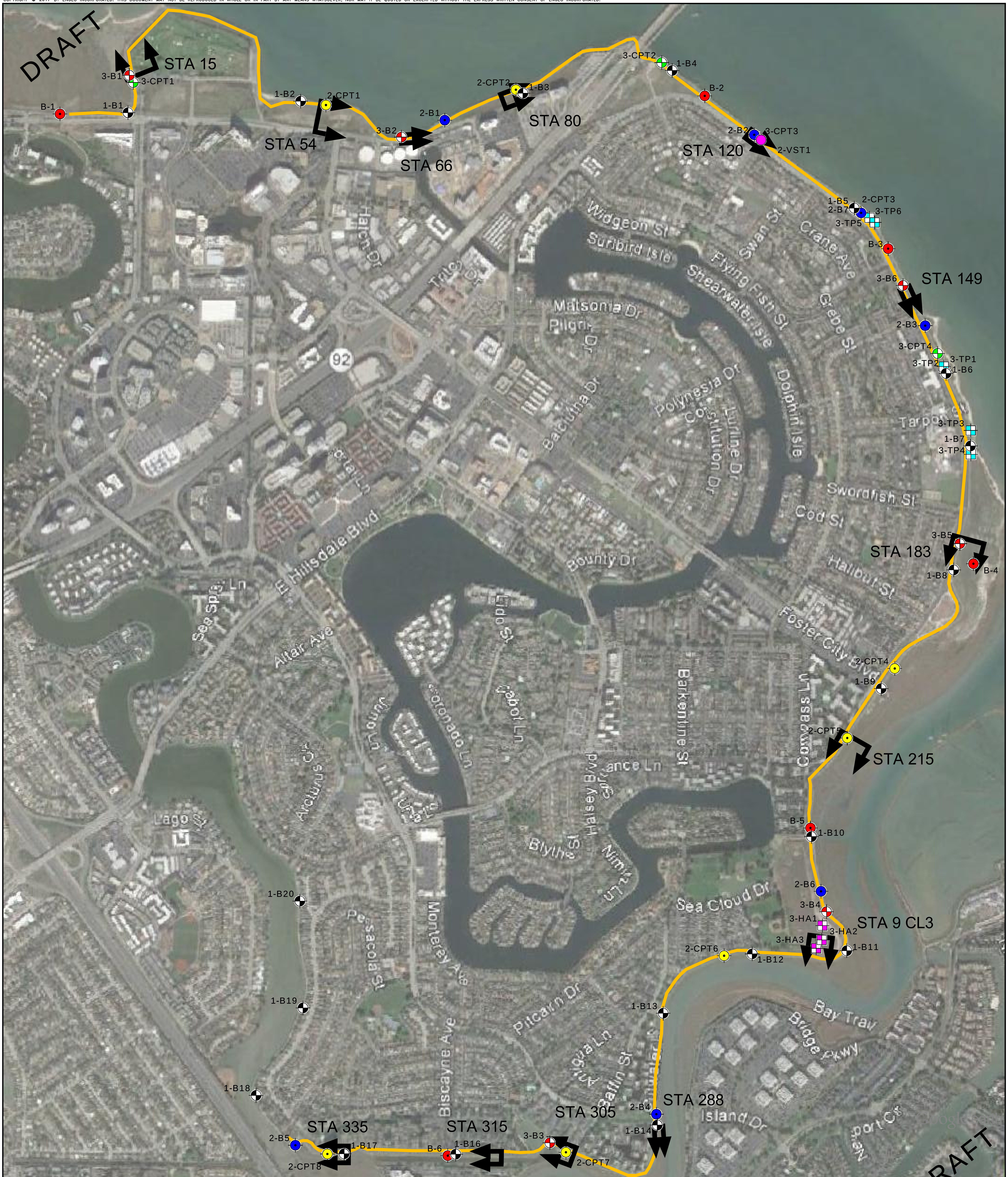

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

3-B6	BORING (ENGEO, 2017)
2-B7	BORING (ENGEO, 2016)
1-B17	BORING (ENGEO, 2009)
B-6	BORING (KLEINFELDER, 1987)
3-CPT4	CONE PENETRATION TEST (ENGEO, 2017)
2-CPT8	CONE PENETRATION TEST (ENGEO, 2016)
2-VST1	VANE SHEAR TEST (ENGEO, 2016)
3-TP3	TEST PIT (ENGEO, 2017)
3-HA3	HAND AUGER (ENGEO, 2017)
	LEVEE ALIGNMENT
STA 335	CROSS SECTION LOCATION

N

0 FEET 800
0 METERS 400

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE

ENGEO
Expect Excellence

SITE PLAN
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000	FIGURE NO. 2
SCALE: AS SHOWN	
DRAWN BY: GLJ	CHECKED BY: JJT

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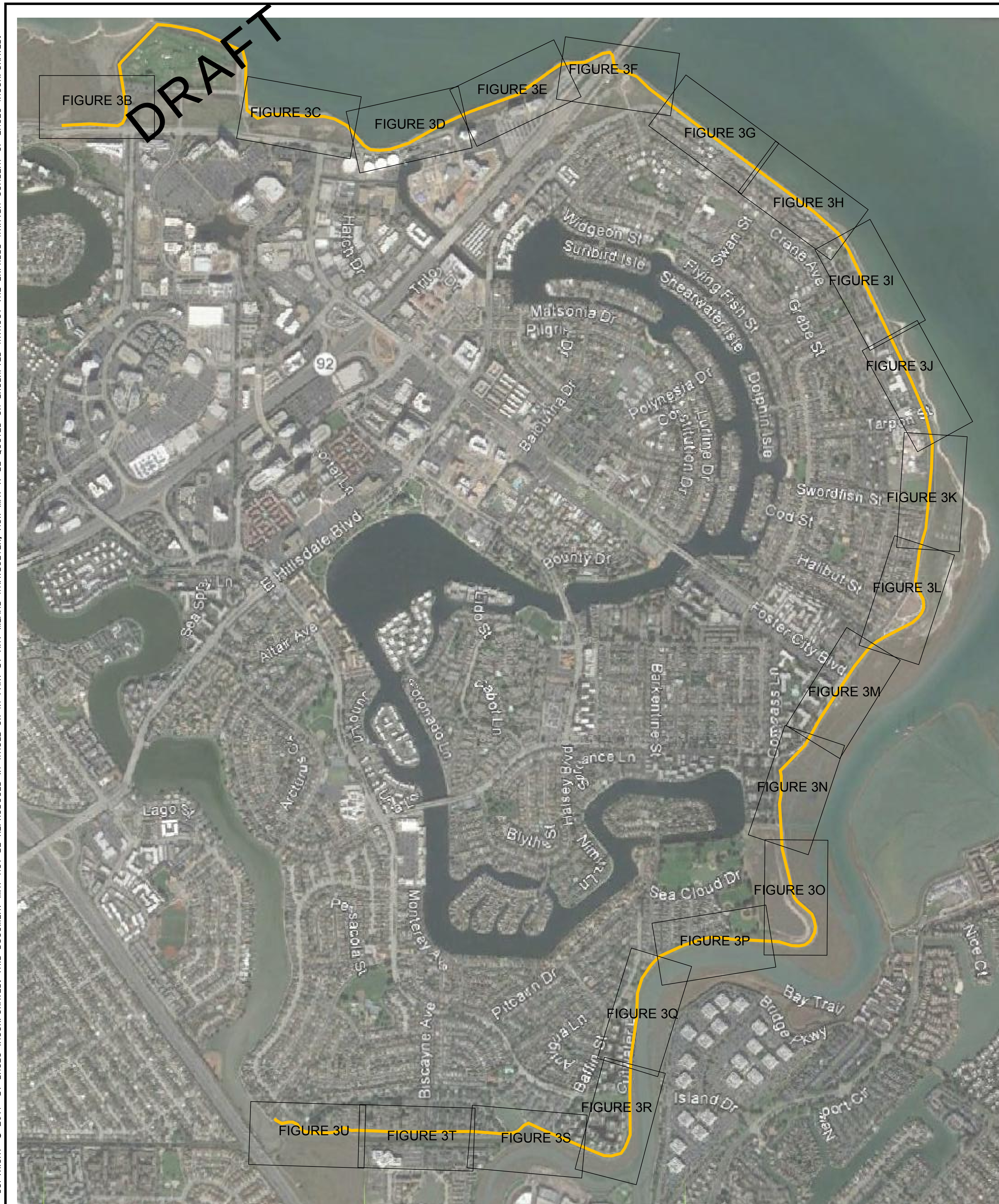

N

0 FEET 1600
0 METERS 800

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

3-B6	BORING (ENGEO, 2017)
2-B7	BORING (ENGEO, 2016)
1-B17	BORING (ENGEO, 2009)
B-6	BORING (KLEINFELDER, 1987)
3-CPT4	CONE PENETRATION TEST (ENGEO, 2017)
2-CPT8	CONE PENETRATION TEST (ENGEO, 2016)
2-VST1	VANE SHEAR TEST (ENGEO, 2016)
3-TP3	TEST PIT (ENGEO, 2017)
3-HA3	HAND AUGER (ENGEO, 2017)
	LEVEE ALIGNMENT
STA 335	CROSS SECTION LOCATION
4'	THICKNESS OF EXISTING FILL
24'	THICKNESS OF YOUNG BAY MUD
-	NOT MEASURED, EXPLORATION NOT ADVANCED TO BOTTOM OF YOUNG BAY MUD
34'	TOTAL DEPTH OF EXPLORATION

DRAFT

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE

ENGEO Expect Excellence	SITE PLAN - INDEX FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JJT	FIGURE NO. 3A

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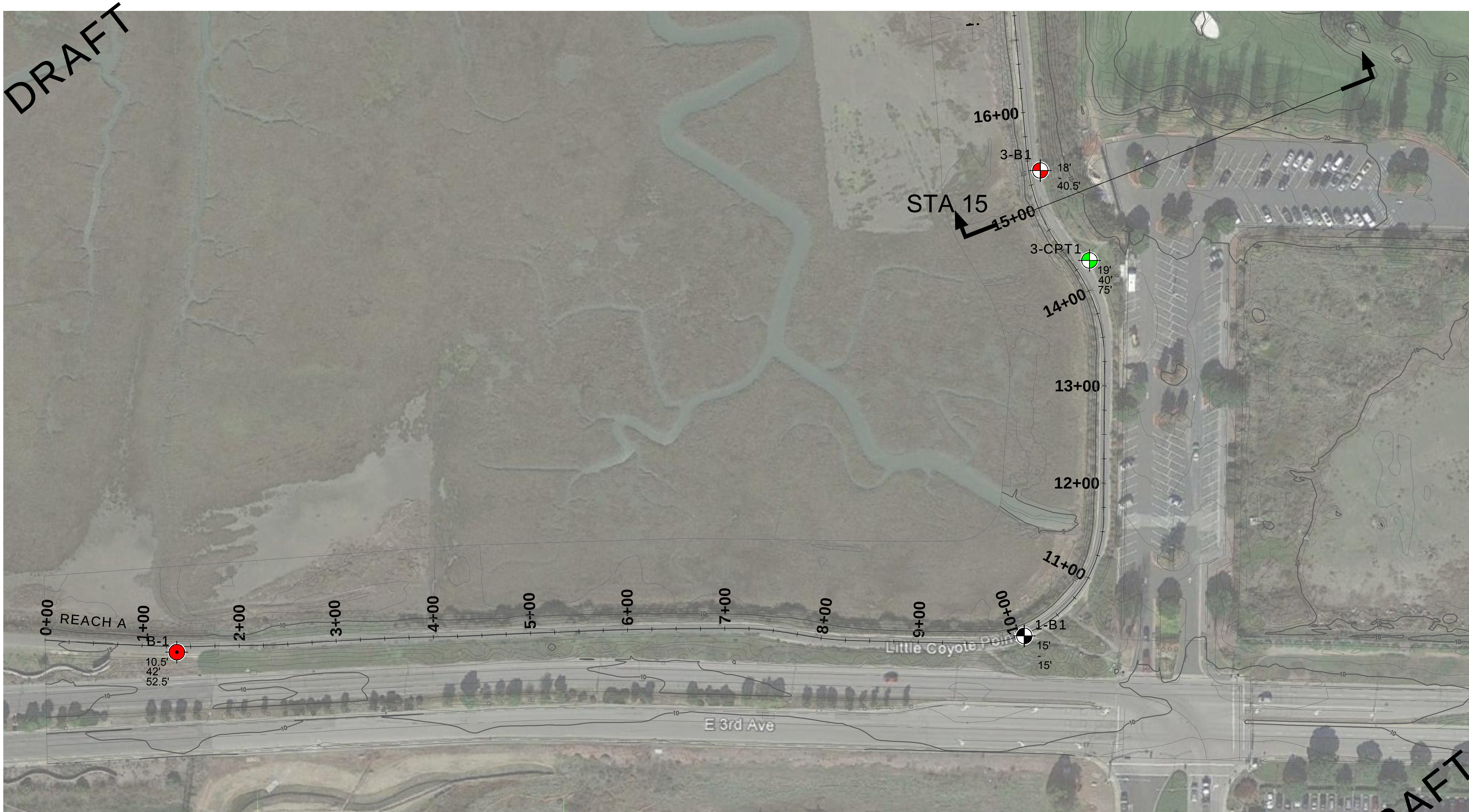

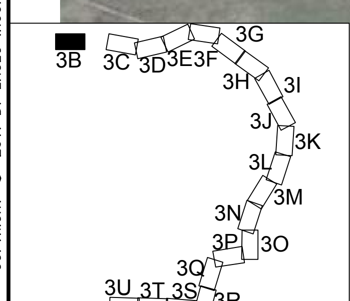

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
Expect Excellence

SITE PLAN STATIONS 0+00 TO 17+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000
SCALE: AS SHOWN
DRAWN BY: GLJ
CHECKED BY: JJT

FIGURE NO.
3B

ORIGINAL FIGURE PRINTED IN COLOR

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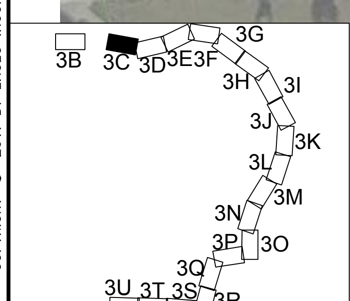

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 44+00 TO 61+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JJT	FIGURE NO. 3C

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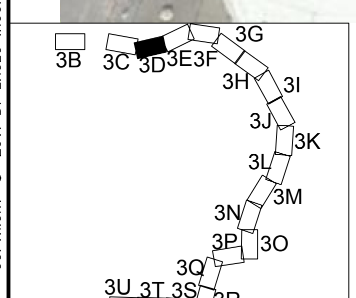

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
Expect Excellence

SITE PLAN STATIONS 61+00 TO 77+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO. 3D
SCALE: AS SHOWN		
DRAWN BY: GLJ	CHECKED BY: JJT	

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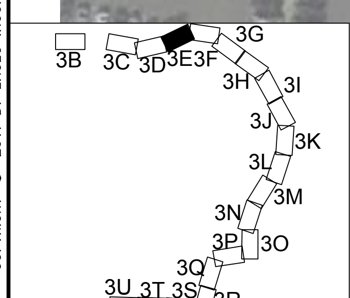

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
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SITE PLAN STATIONS 78+00 TO 92+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000
SCALE: AS SHOWN
DRAWN BY: GLJ
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FIGURE NO.
3E

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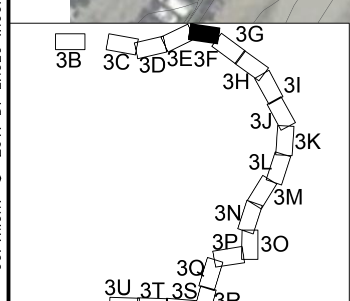

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence

SITE PLAN STATIONS 93+00 TO 111+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO.
SCALE: AS SHOWN		3F
DRAWN BY: GLJ	CHECKED BY: JT	

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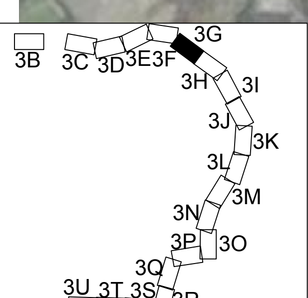

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 111+00 TO 126+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JT	FIGURE NO. 3G

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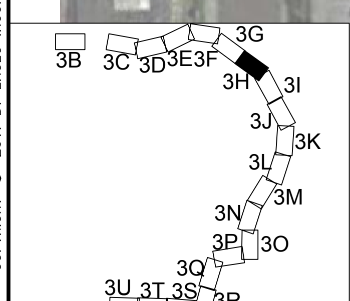

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0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 126+00 TO 140+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JT	FIGURE NO. 3H

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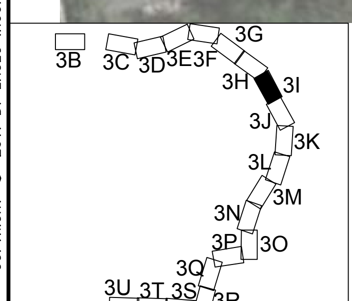

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 141+00 TO 155+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ / CHECKED BY: JJT	FIGURE NO. 3I

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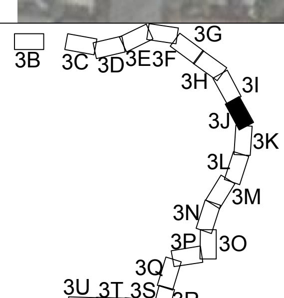

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
Expect Excellence

SITE PLAN STATIONS 155+00 TO 170+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000
SCALE: AS SHOWN
DRAWN BY: GLJ
CHECKED BY: JJT

FIGURE NO.
3J

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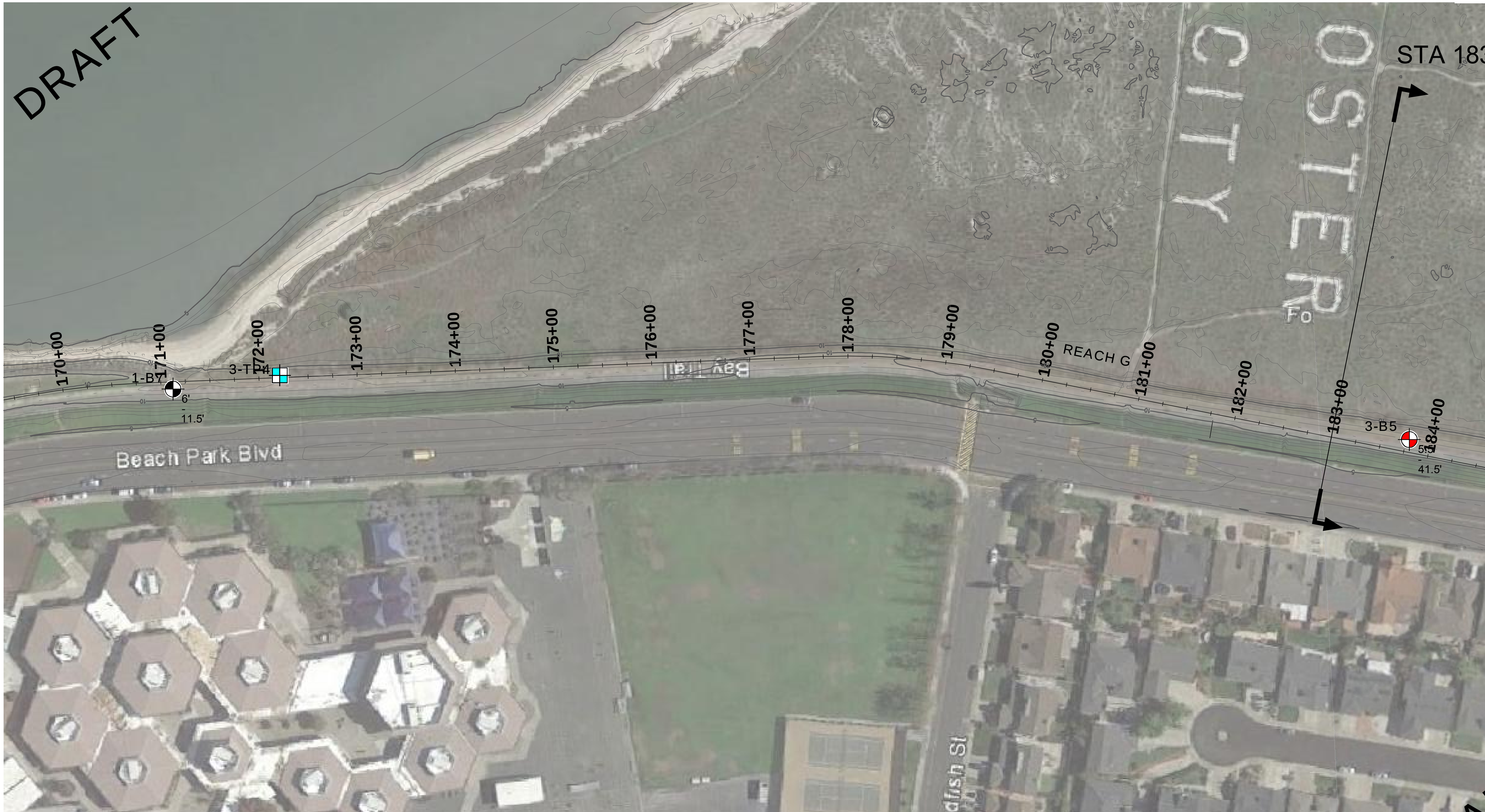

SEE FIGURE 3J

SEE FIGURE 3L

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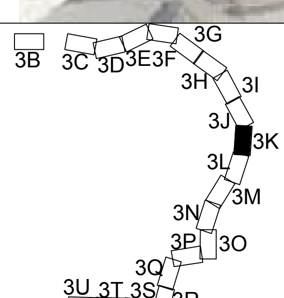
SEE FIGURE 3A FOR EXPLANATION



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0 FEET 100
0 METERS 50

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence

SITE PLAN STATIONS 170+00 TO 184+00

FOSTER CITY LEVEE IMPROVEMENT PROJECT

FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO.
SCALE: AS SHOWN		3K
DRAWN BY: GLJ	CHECKED BY: JJT	

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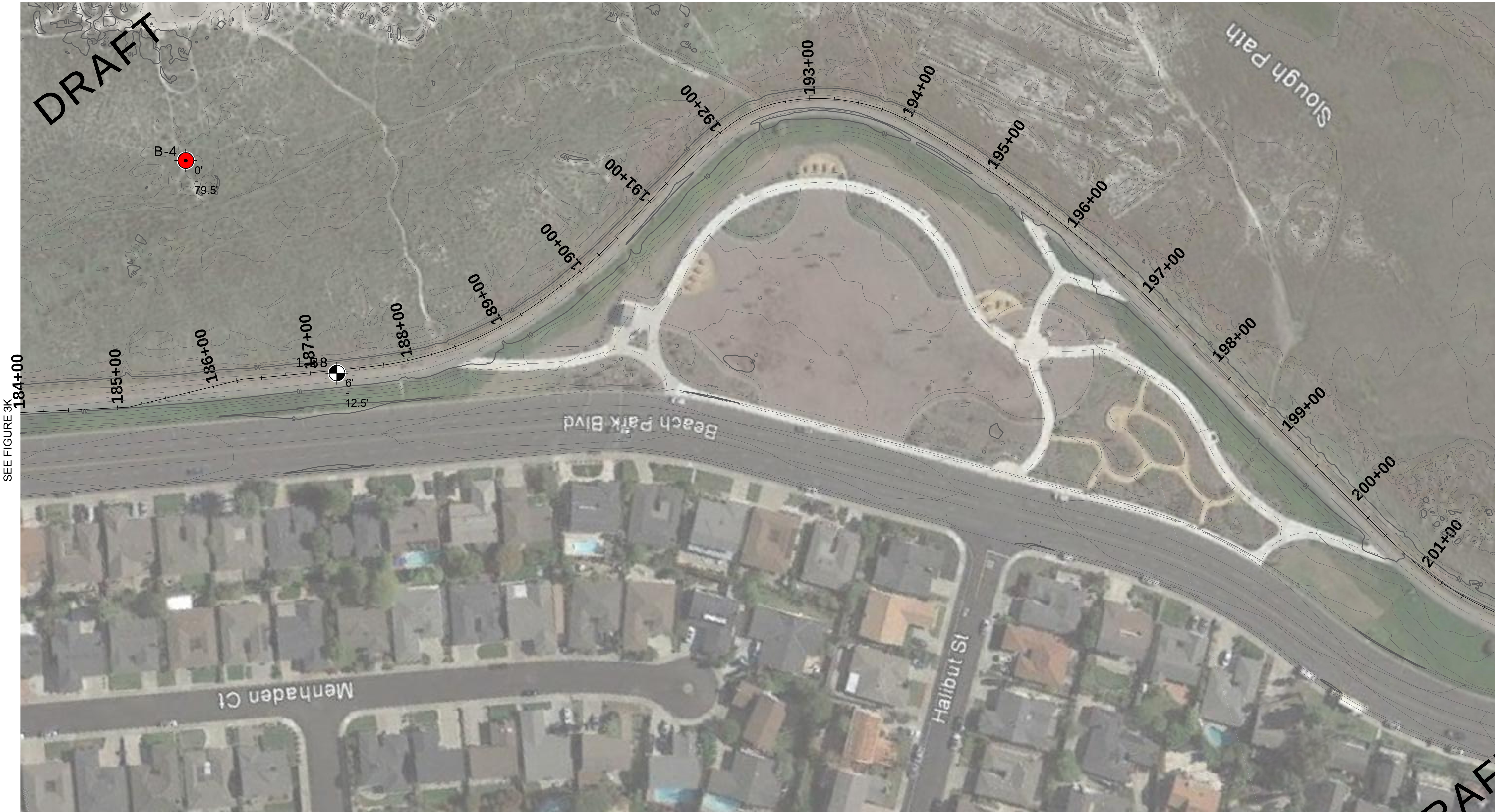
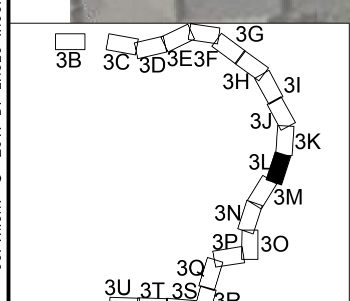


SEE FIGURE 3A FOR EXPLANATION



N

0 FEET 100
0 METERS 50

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence

SITE PLAN STATIONS 185+00 TO 202+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000	FIGURE NO. 3L
SCALE: AS SHOWN	
DRAWN BY: GLJ	CHECKED BY: JJT

ORIGINAL FIGURE PRINTED IN COLOR

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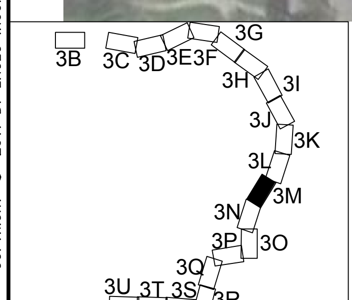

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0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
Expect Excellence

SITE PLAN STATIONS 202+00 TO 216+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000
SCALE: AS SHOWN
DRAWN BY: GLJ
CHECKED BY: JJT

FIGURE NO.
3M

ORIGINAL FIGURE PRINTED IN COLOR

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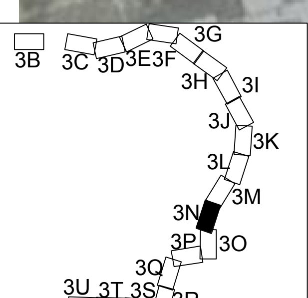

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 216+00 TO 232+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JJT	FIGURE NO. 3N

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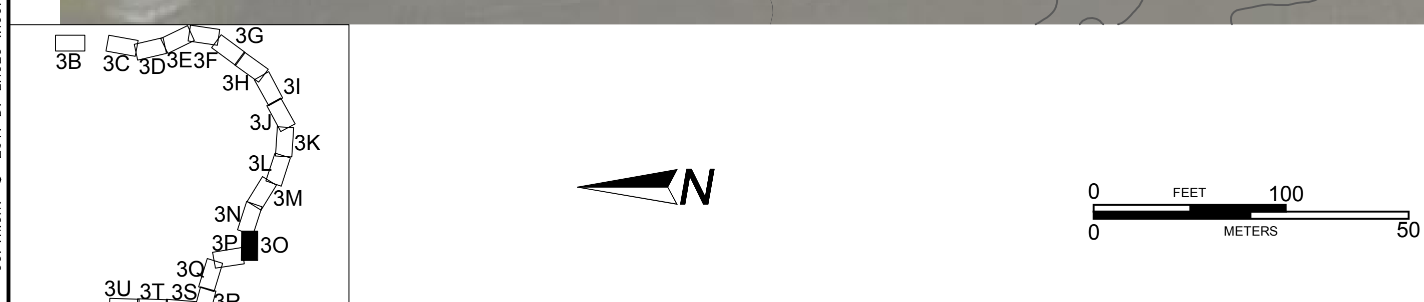

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 232+00 TO 253+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JJT	FIGURE NO. 3O

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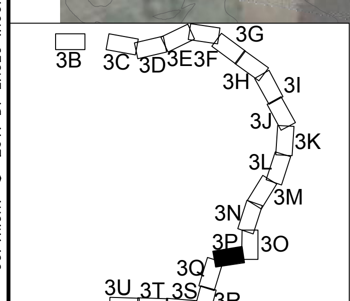

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0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
Expect Excellence

SITE PLAN STATIONS 253+00 TO 268+00	PROJECT NO.: 8602.001.000	FIGURE NO.
FOSTER CITY LEVEE IMPROVEMENT PROJECT	SCALE: AS SHOWN	3P
FOSTER CITY, CALIFORNIA	DRAWN BY: GLJ CHECKED BY: JJT	

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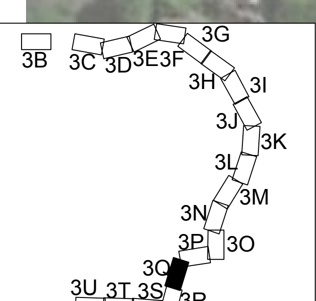
SEE FIGURE 3A FOR EXPLANATION



N

0 FEET 100
0 METERS 50

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
Expect Excellence

SITE PLAN STATIONS 267+00 TO 282+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO.
SCALE: AS SHOWN		3Q
DRAWN BY: GLJ	CHECKED BY: JJT	

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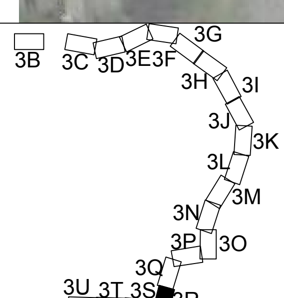

N

0 FEET 100

0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 283+00 TO 300+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ / CHECKED BY: JJT	FIGURE NO. 3R

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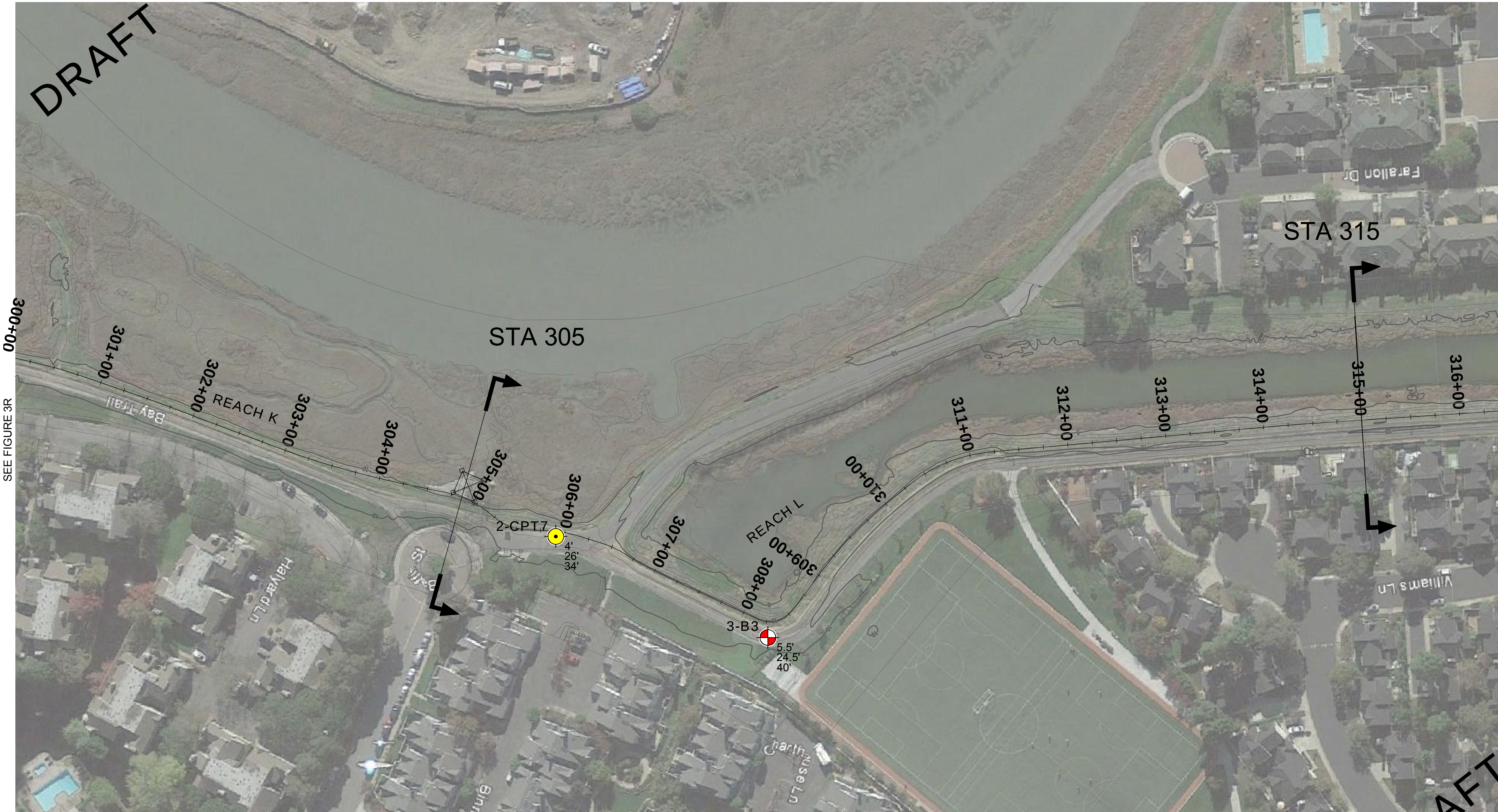

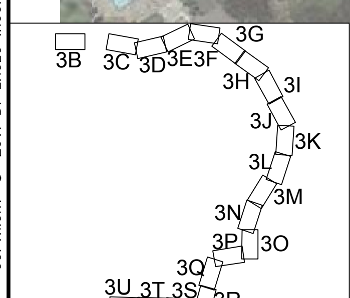

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO Expect Excellence	SITE PLAN STATIONS 301+00 TO 316+00 FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JJT	FIGURE NO. 3S

ORIGINAL FIGURE PRINTED IN COLOR

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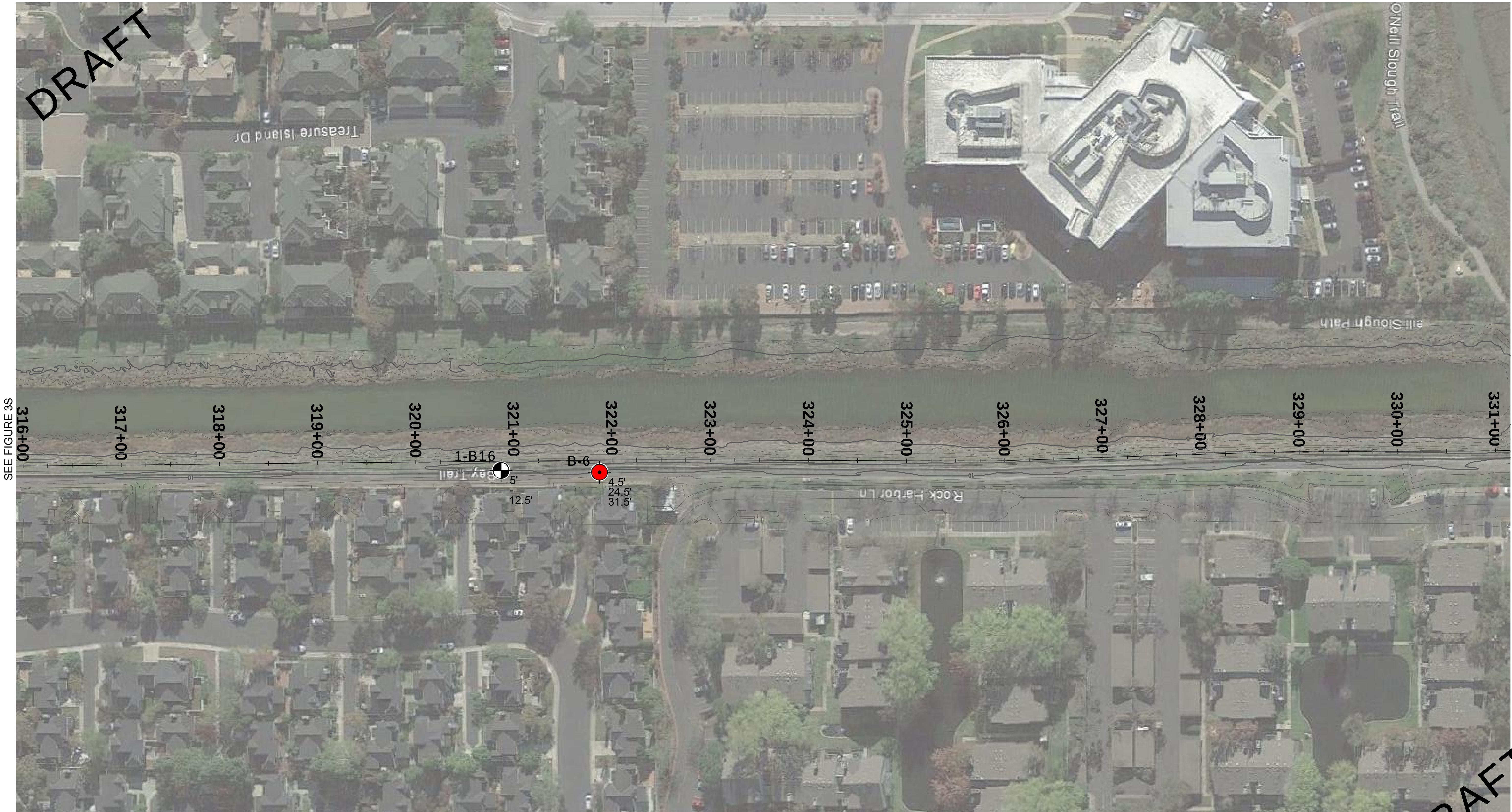

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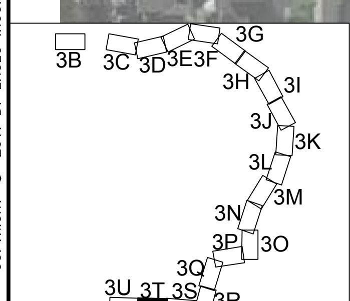

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

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SITE PLAN STATIONS 316+00 TO 331+00
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO.
SCALE: AS SHOWN		3T
DRAWN BY: GLJ	CHECKED BY: JJT	

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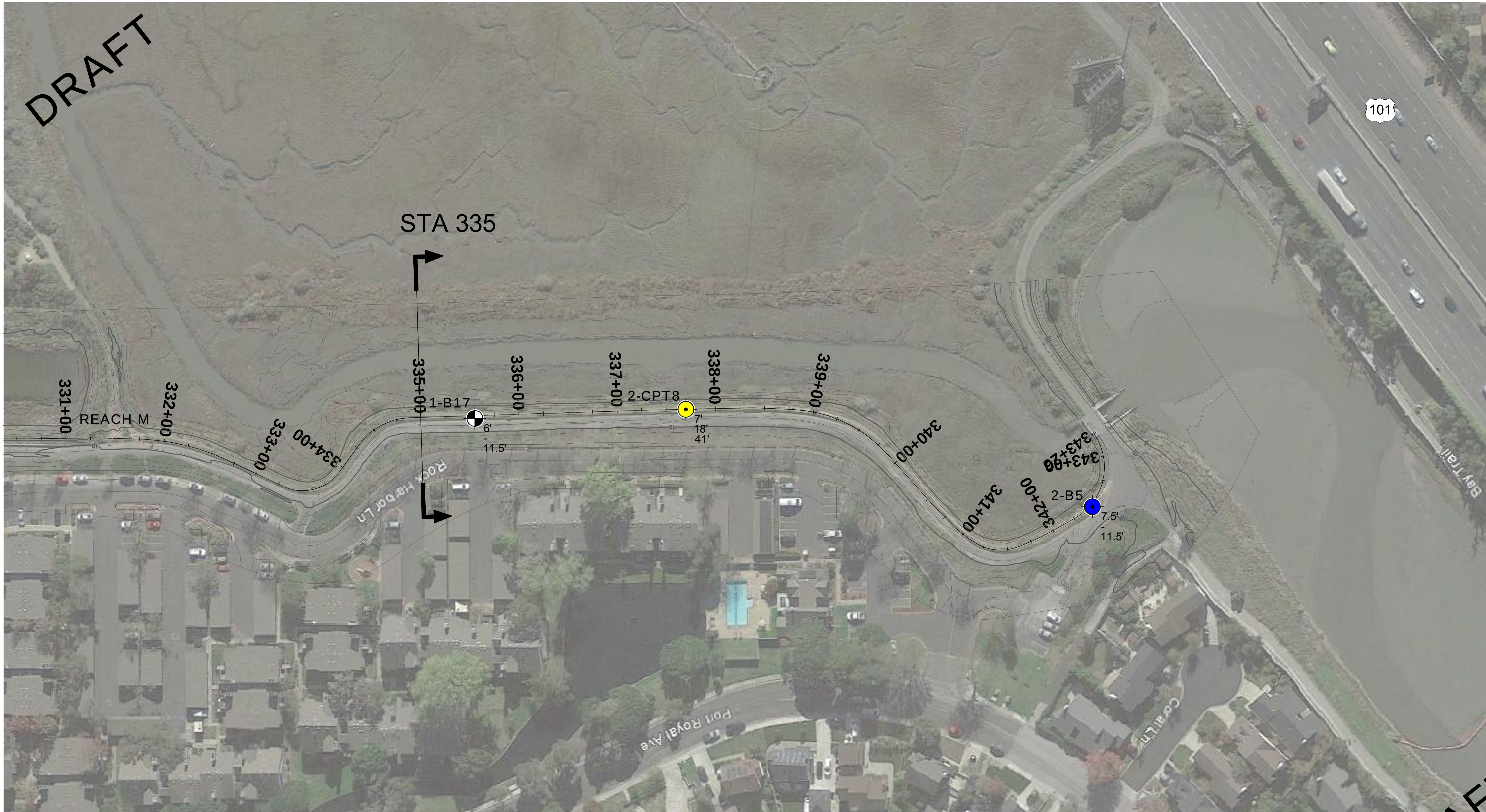

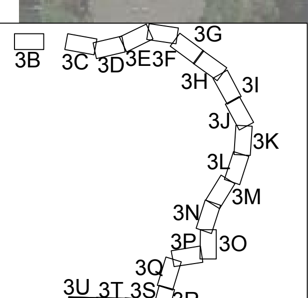

N

0 FEET 100
0 METERS 50

SEE FIGURE 3A FOR EXPLANATION

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, SCHAAF & WHEELER

ENGEO
Expect Excellence

SITE PLAN STATIONS 331+00 TO 343+26
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000	FIGURE NO. 3U
SCALE: AS SHOWN	
DRAWN BY: GLJ	CHECKED BY: JJT

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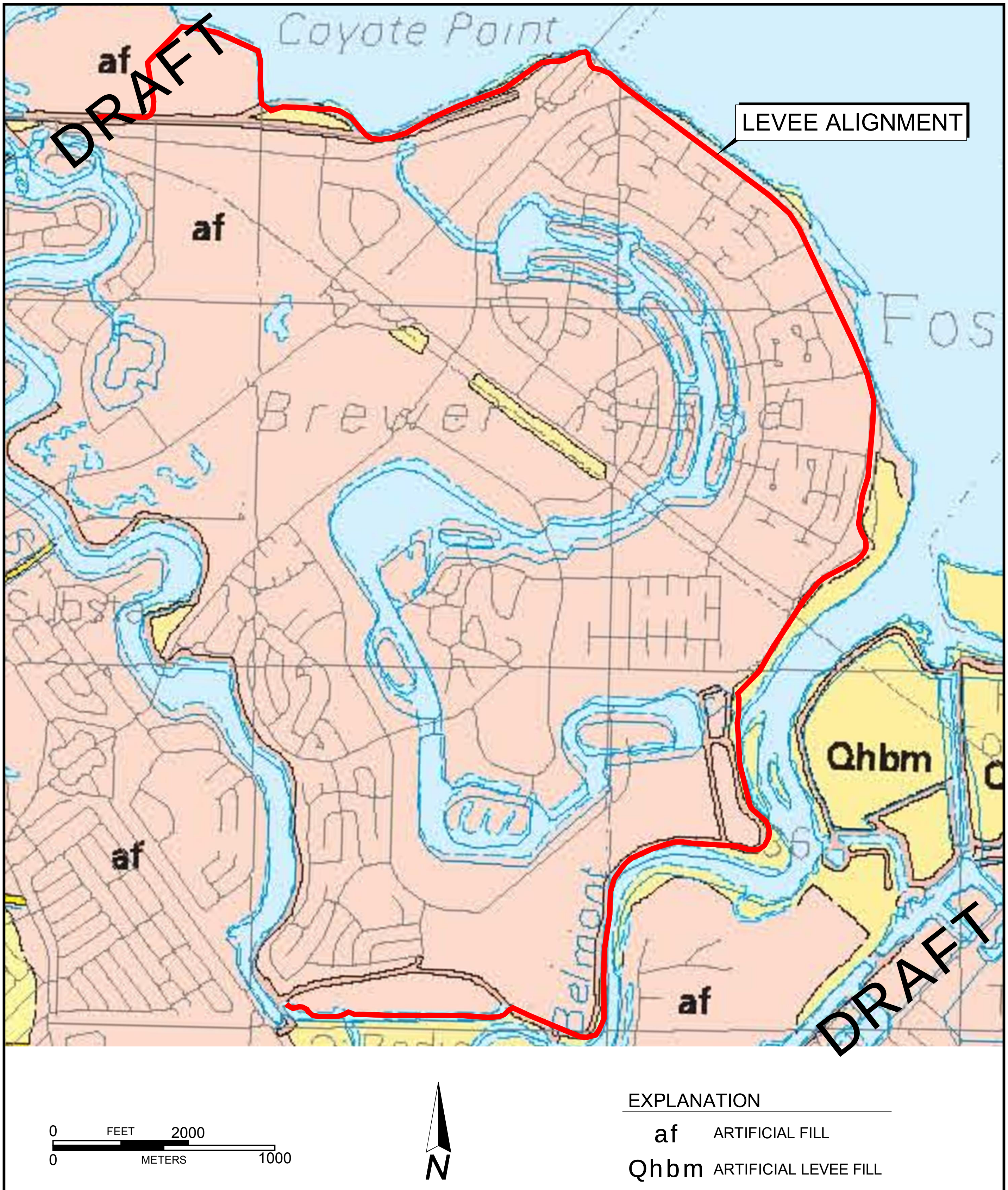

BASE MAP SOURCE: BRABB, 1998

ENGEO Expect Excellence	REGIONAL GEOLOGIC MAP FOSTER CITY LEVEE IMPORVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JT	FIGURE NO. 4

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EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

— 80 - - - MAPPED THICKNESS OF YOUNGER BAY MUD (QUERIED WHERE INFERRED)

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, DIVISION OF MINES AND GEOLOGY, 1966, COMPILED BY JAMES E. KAHLE AND HAROLD B. GOLDMAN

ENGEO Expect Excellence	BAY MUD THICKNESS MAP FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: GLJ CHECKED BY: JT	FIGURE NO. 5

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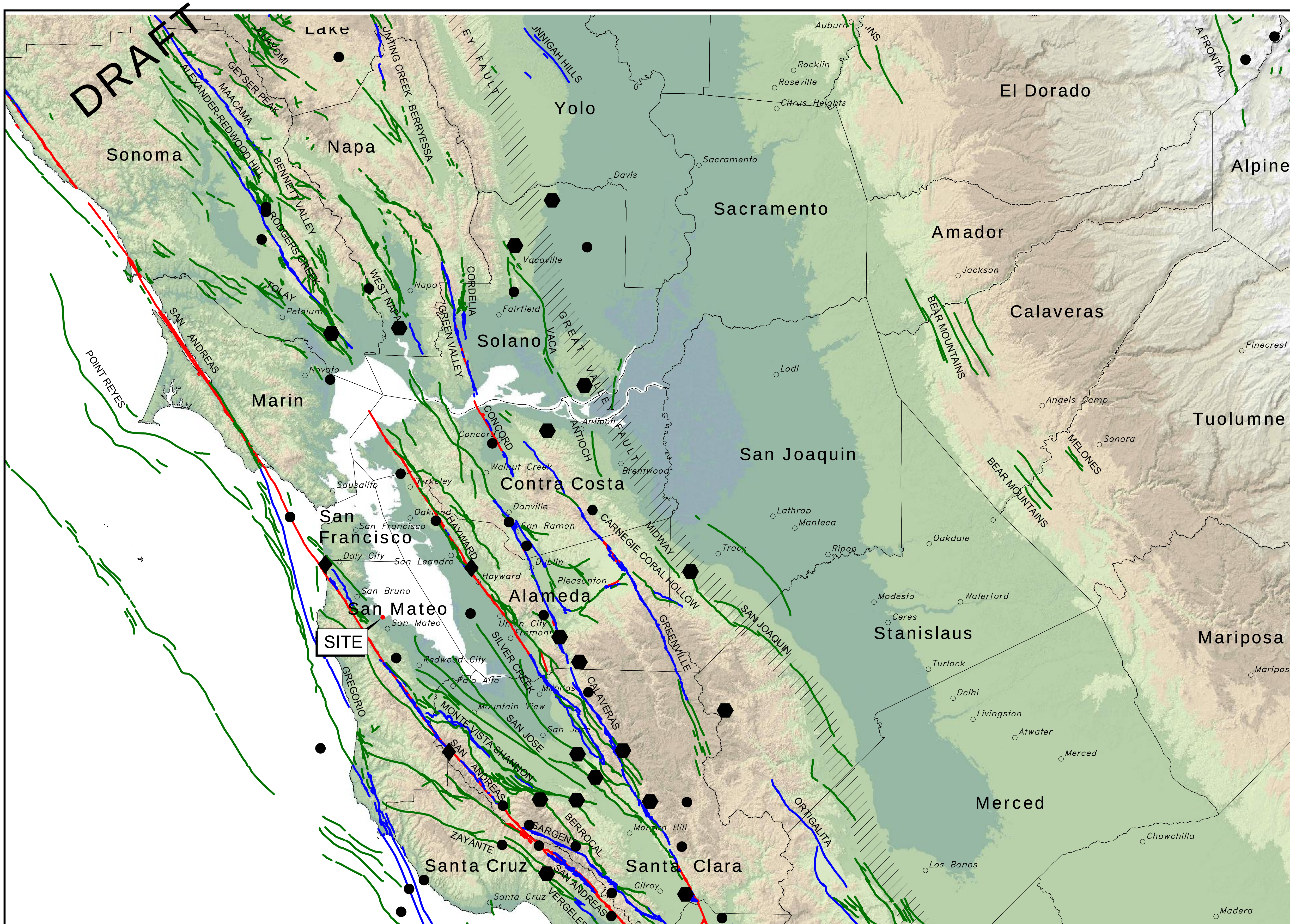
ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

- MAGNITUDE 7+
- MAGNITUDE 6-7
- MAGNITUDE 5-6
- HISTORIC FAULT
- HOLOCENE FAULT
- QUATERNARY FAULT
- HISTORIC BLIND THRUST FAULT ZONE

DRAFT

BASE MAP SOURCE:
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATASET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, NOVEMBER, 2010
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800–2000)

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REGIONAL FAULTING AND SEISMICITY
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO.
SCALE: AS SHOWN		6
DRAWN BY: GLJ	CHECKED BY: JT	

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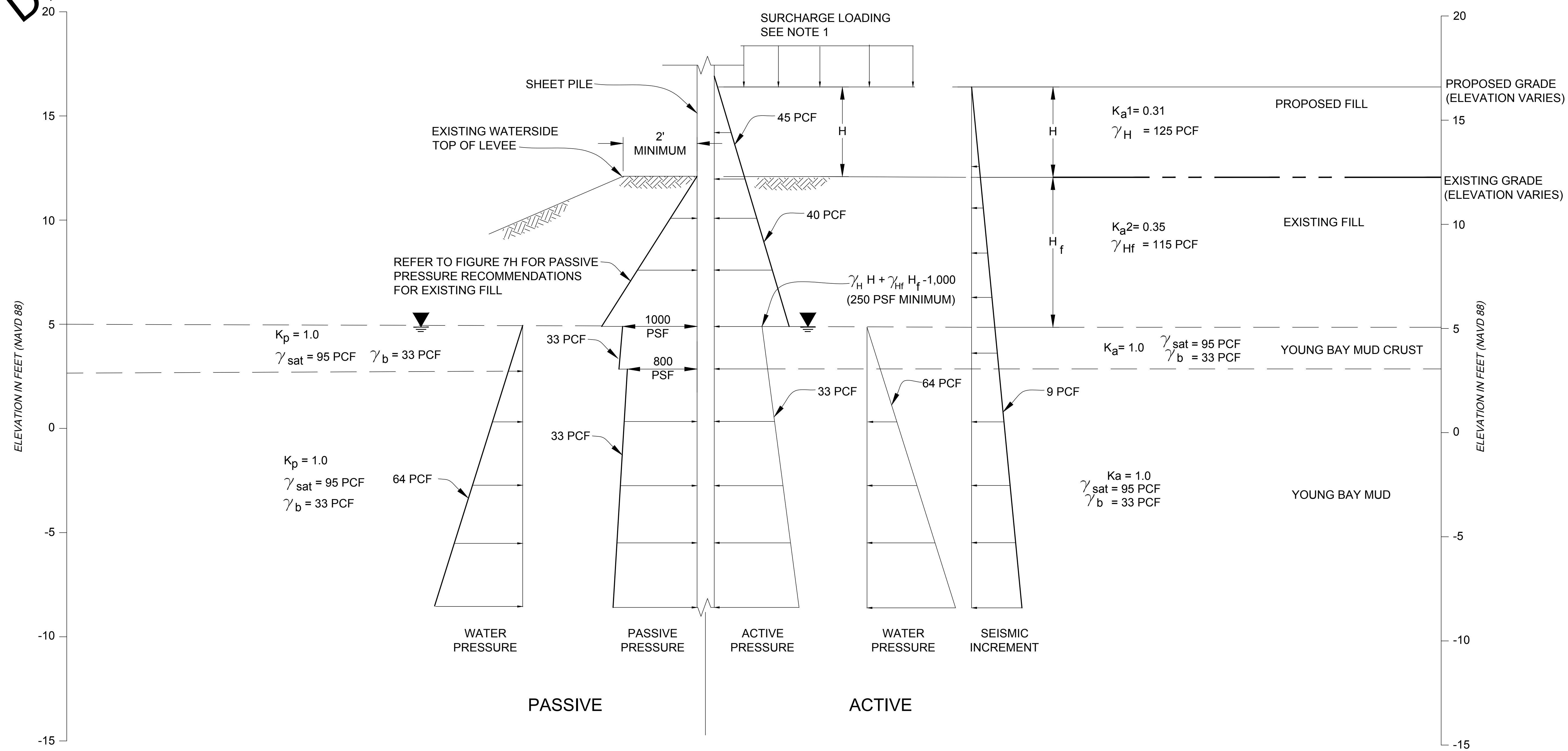

DRAFT

NOTES:

1. APPROPRIATE SURCHARGE LOADING SHOULD BE INCLUDED BY DESIGNER.
2. PASSIVE PRESSURES ARE ULTIMATE VALUES. SAFETY FACTORS SHOULD BE INCLUDED BY DESIGNER.
3. DRAINED CONDITIONS ASSUMED FOR RETAINED HEIGHT H.
4. GROUNDWATER ENCOUNTERED AT APPROXIMATE ELEVATION 5' DURING FIELD EXPLORATION.

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CANTILEVERED SHEET PILE LOADING DIAGRAM
STATION 50+00 TO STATION 170+00 - LEVEE FILL LOADING
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO. 7A
SCALE: AS SHOWN		
DRAWN BY: SRP	CHECKED BY: JJT	

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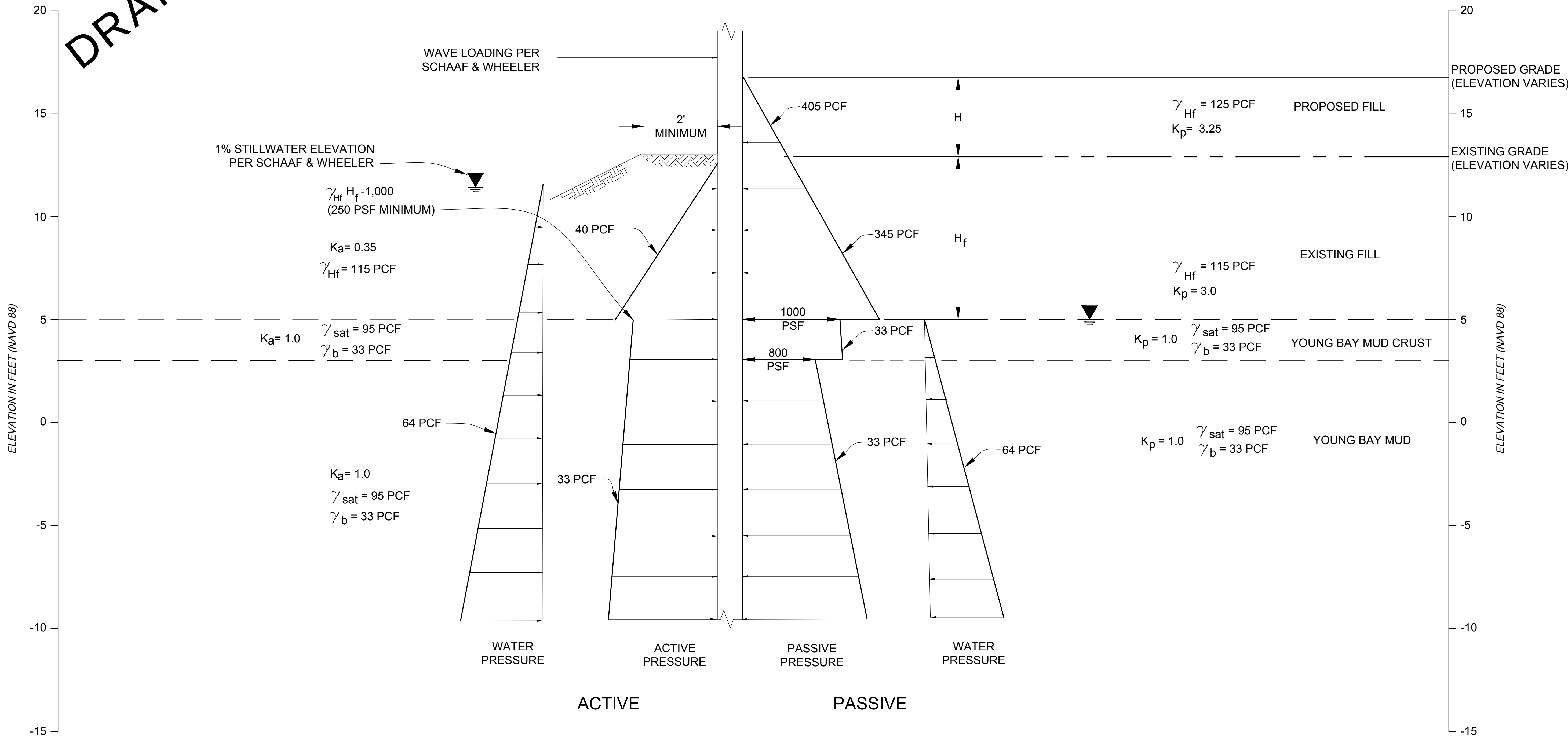

NOTES:

1. WAVE LOADING AND WATER SIDE GROUNDWATER ELEVATION PER SCHAFF & WHEELER.
2. PASSIVE PRESSURES ARE ULTIMATE VALUES. SAFETY FACTORS SHOULD BE INCLUDED BY DESIGNER.
3. GROUNDWATER ENCOUNTERED AT APPROXIMATE ELEVATION 5", DURING FIELD EXPLORATION.

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CANTILEVERED SHEET PILE LOADING DIAGRAM
STATION 50+00 TO STATION 170+00 - WAVE LOADING
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000	
SCALE: AS SHOWN	
DRAWN BY: SRP	CHECKED BY: JJT

FIGURE NO. 7B

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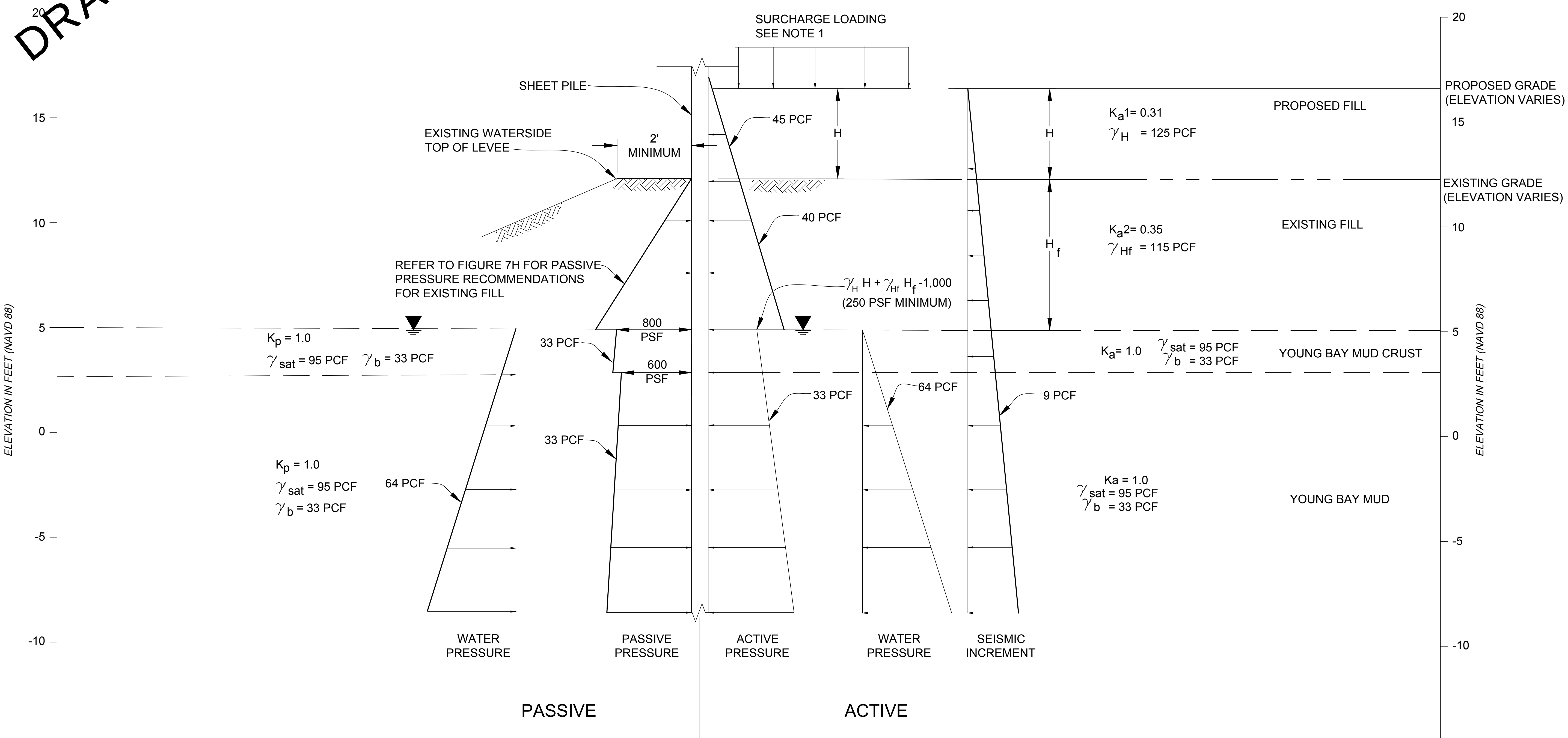

DRAFT

NOTES:

1. APPROPRIATE SURCHARGE LOADING SHOULD BE INCLUDED BY DESIGNER.
2. PASSIVE PRESSURES ARE ULTIMATE VALUES. SAFETY FACTORS SHOULD BE INCLUDED BY DESIGNER.
3. DRAINED CONDITIONS ASSUMED FOR RETAINED HEIGHT H.
4. GROUNDWATER ENCOUNTERED AT APPROXIMATE ELEVATION 5' DURING FIELD EXPLORATION.

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CANTILEVERED SHEET PILE LOADING DIAGRAM
STATION 170+00 TO STATION 235+00 - LEVEE FILL LOADING
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000	FIGURE NO. 7C
SCALE: AS SHOWN	
DRAWN BY: SRP	CHECKED BY: JJT

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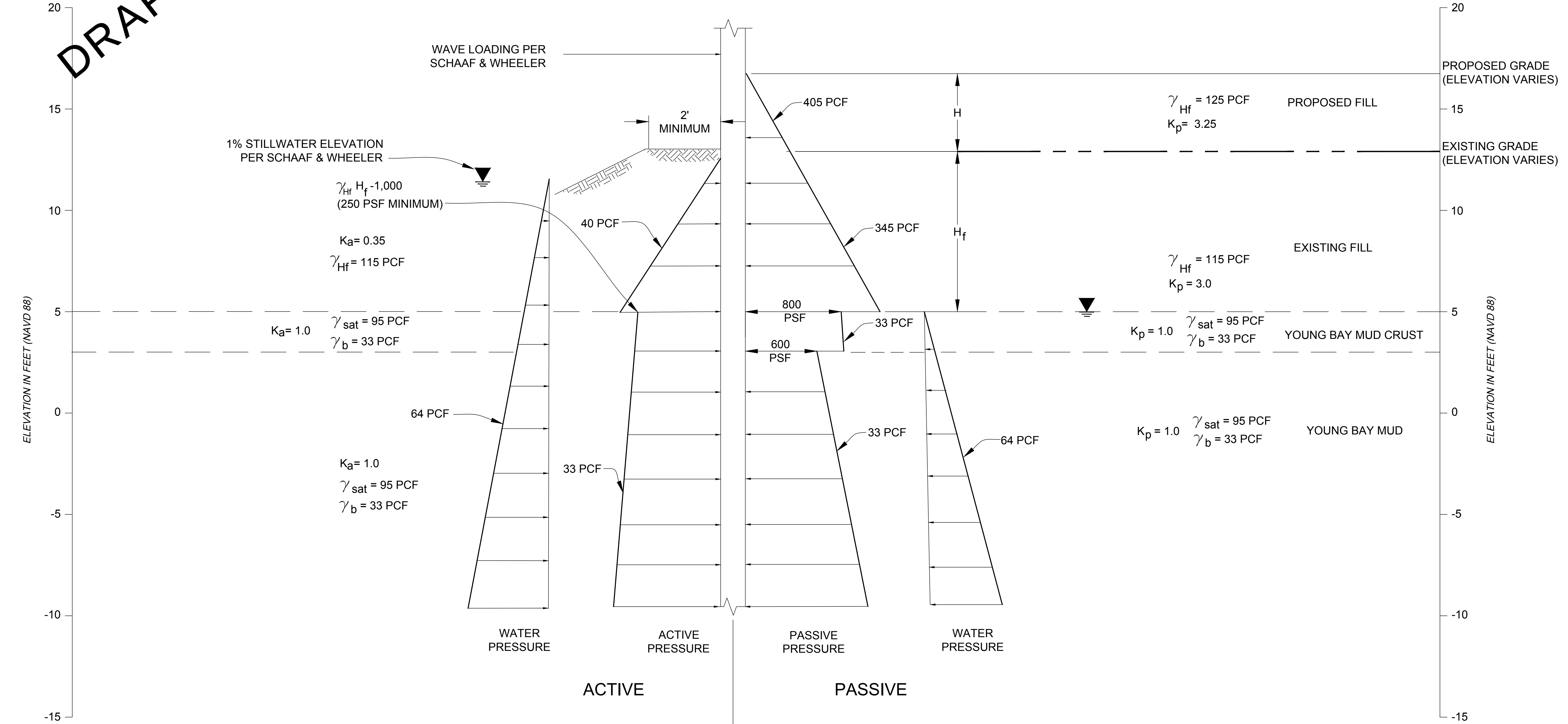

DRAFT

NOTES:
1. WAVE LOADING AND WATER SIDE GROUNDWATER ELEVATION PER SCHAFF & WHEELER.
2. PASSIVE PRESSURES ARE ULTIMATE VALUES. SAFETY FACTORS SHOULD BE INCLUDED BY DESIGNER.
3. GROUNDWATER ENCOUNTERED AT APPROXIMATE ELEVATION 5", DURING FIELD EXPLORATION.

ENGEO Expect Excellence	CANTILEVERED SHEET PILE LOADING DIAGRAM STATION 170+00 TO STATION 235+00 - WAVE LOADING FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: SRP CHECKED BY: JJT	FIGURE NO. 7D

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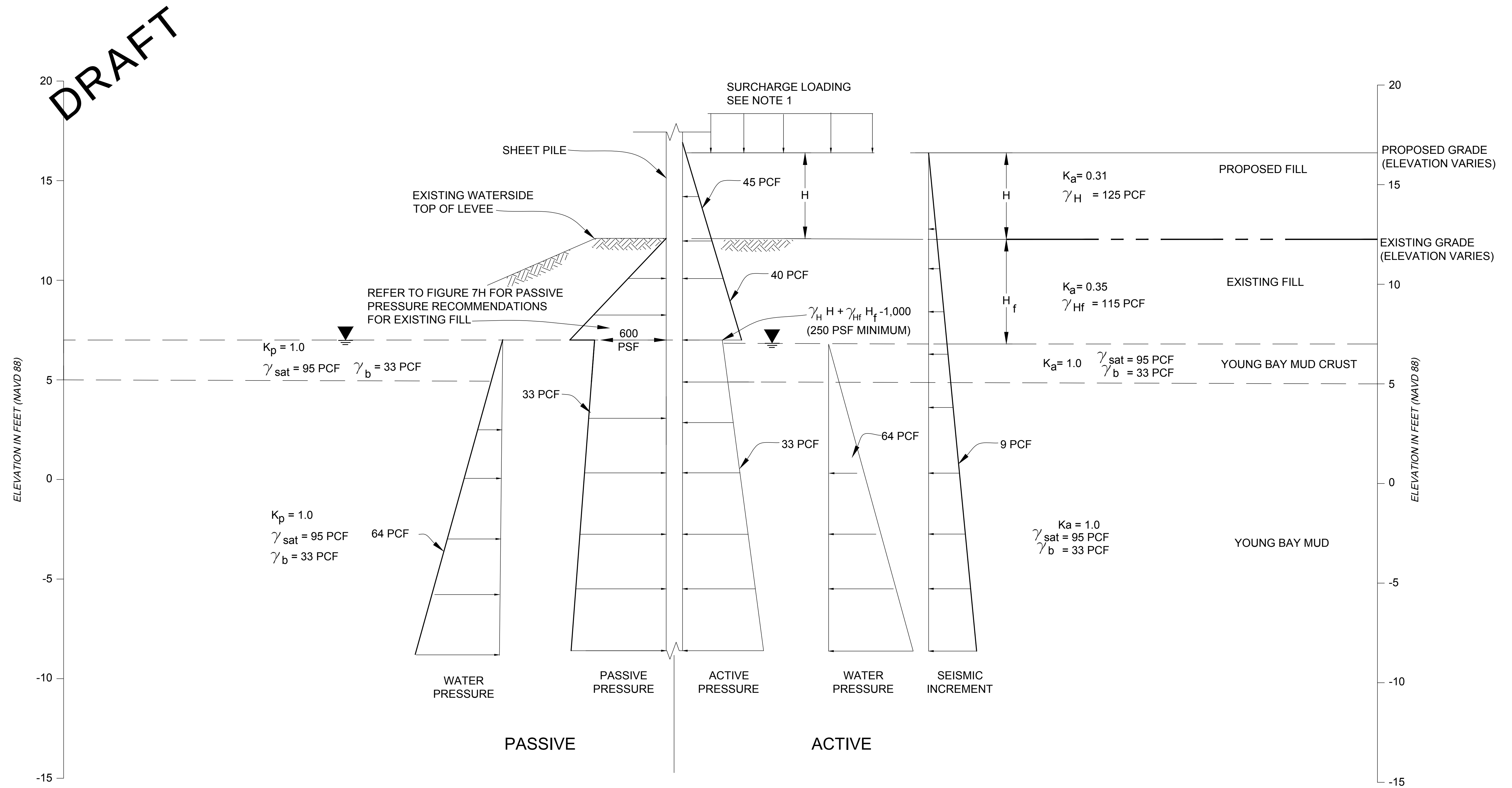

NOTES:
1. APPROPRIATE SURCHARGE LOADING SHOULD BE INCLUDED BY DESIGNER.
2. PASSIVE PRESSURES ARE ULTIMATE VALUES. SAFETY FACTORS SHOULD BE INCLUDED BY DESIGNER.
3. DRAINED CONDITIONS ASSUMED FOR RETAINED HEIGHT H.

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CANTILEVERED SHEET PILE LOADING DIAGRAM
STATION 255+00 TO STATION 344+00 - LEVEE LOADING
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO.
SCALE: AS SHOWN		7E
DRAWN BY: SRP	CHECKED BY: JJT	

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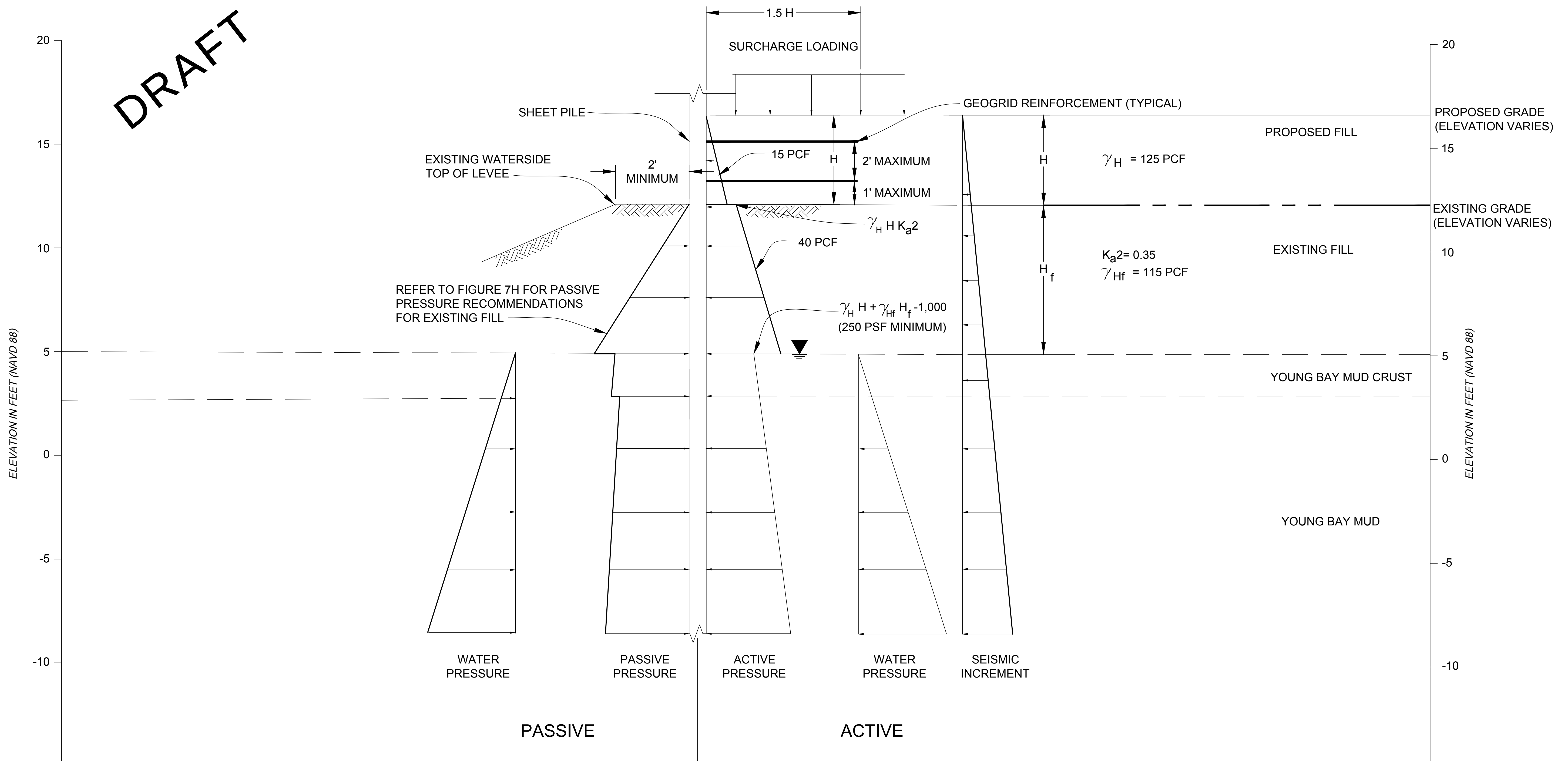

DRAFT

NOTES:

1. FOR INFORMATION NOT SHOWN, REFER TO APPROPRIATE LOADING DIAGRAM.
2. GEOGRID LENGTH OF 1.5H IS MINIMUM LENGTH TO ACHIEVE REDUCED ACTIVE PRESSURE LOADING FOR PROPOSED FILL. GEOGRID MAY BE EXTENDED ACROSS FULL TRAIL WIDTH TO REDUCE DIFFERENTIAL SETTLEMENT POTENTIAL.

ENGEO Expect Excellence	CANTILEVERED SHEET PILE LOADING DIAGRAM LEVEE FILL LOADING WITH GEOGRID REINFORCEMENT FOSTER CITY LEVEE IMPROVEMENT PROJECT FOSTER CITY, CALIFORNIA	PROJECT NO.: 8602.001.000 SCALE: AS SHOWN DRAWN BY: SRP CHECKED BY: JJT	FIGURE NO. 7F

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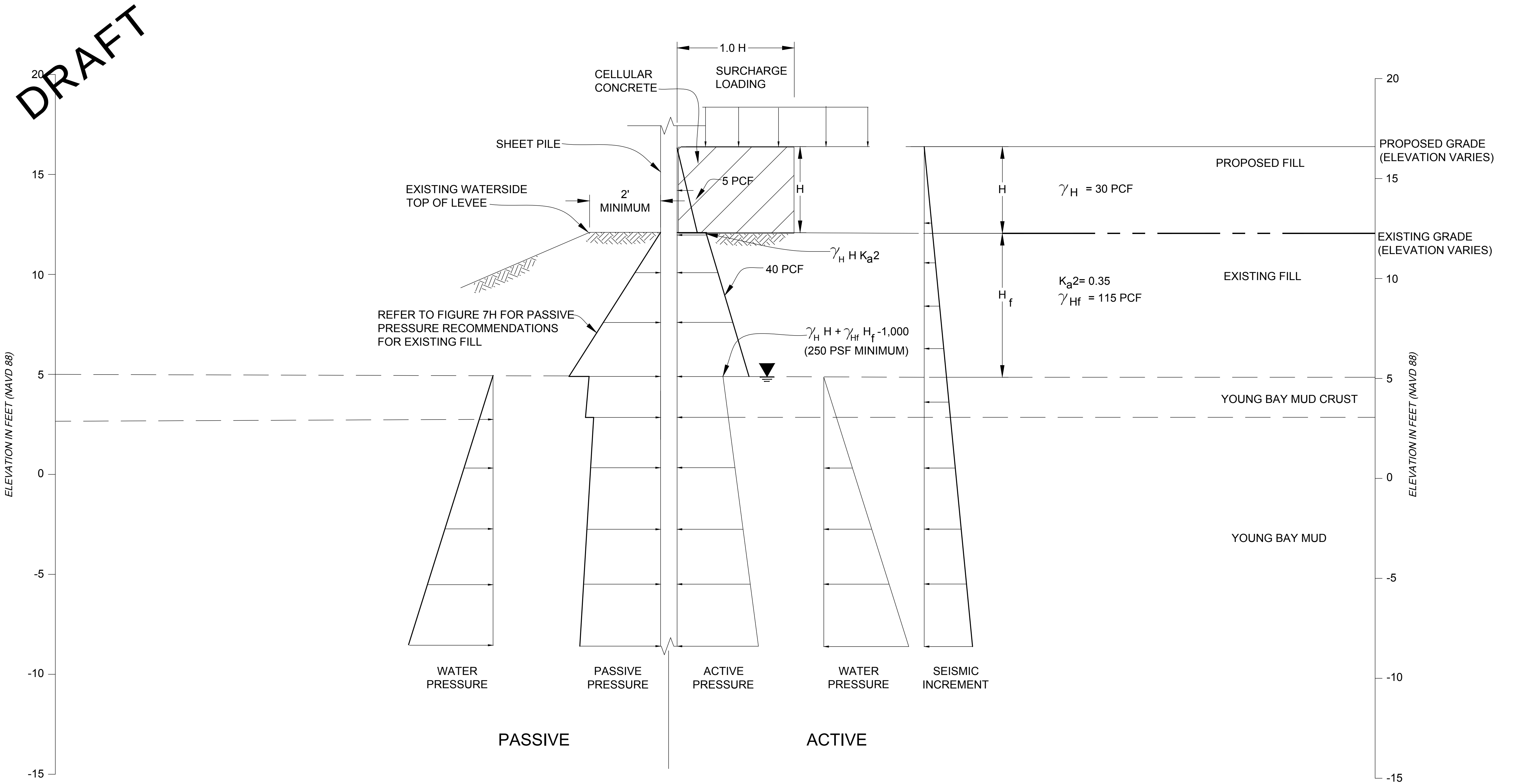

NOTES:

1. FOR INFORMATION NOT SHOWN, REFER TO APPROPRIATE LOADING DIAGRAM.
2. CELLULAR CONCRETE BACKFILL WIDTH OF 1.0H IS MINIMUM LENGTH TO ACHIEVE REDUCED ACTIVE PRESSURE LOADING FOR PROPOSED FILL. CELLULAR CONCRETE MAY BE EXTENDED ACROSS FULL TRAIL WIDTH TO REDUCE DIFFERENTIAL SETTLEMENT POTENTIAL.

ENGEO Expect Excellence

CANTILEVERED SHEET PILE LOADING DIAGRAM
LEVEE FILL LOADING WITH CELLULAR CONCRETE
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000		FIGURE NO.
SCALE: AS SHOWN		7G
DRAWN BY: SRP	CHECKED BY: JJT	

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EXISTING FILL - PASSIVE PRESSURE RECOMMENDATIONS

STATIONING	TOTAL UNIT WEIGHT (pcf)	PASSIVE COEFFICENT, Kp	ULTIMATE PASSIVE PRESSURE (pcf)
50+00 - 66+00	115	2.2	250
69+00 - 78+00			
82+00 - 95+00			
105+00 - 143+00			
159+00 - 171+00			
175+00 - 187+00			
66+00 - 69+00	115	1.7	200
78+00 - 82+00			
95+00 - 99+00			
143+00 - 159+00			
171+00 - 175+00			
187+00 - 234+00			
255+00 - 344+00	100	1.0	100

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EXISTING FILL - PASSIVE PRESSURE RECOMMENDATIONS
FOSTER CITY LEVEE IMPROVEMENT PROJECT
FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000
SCALE: NO SCALE
DRAWN BY: SRP
CHECKED BY: JJT
FIGURE NO. 7H

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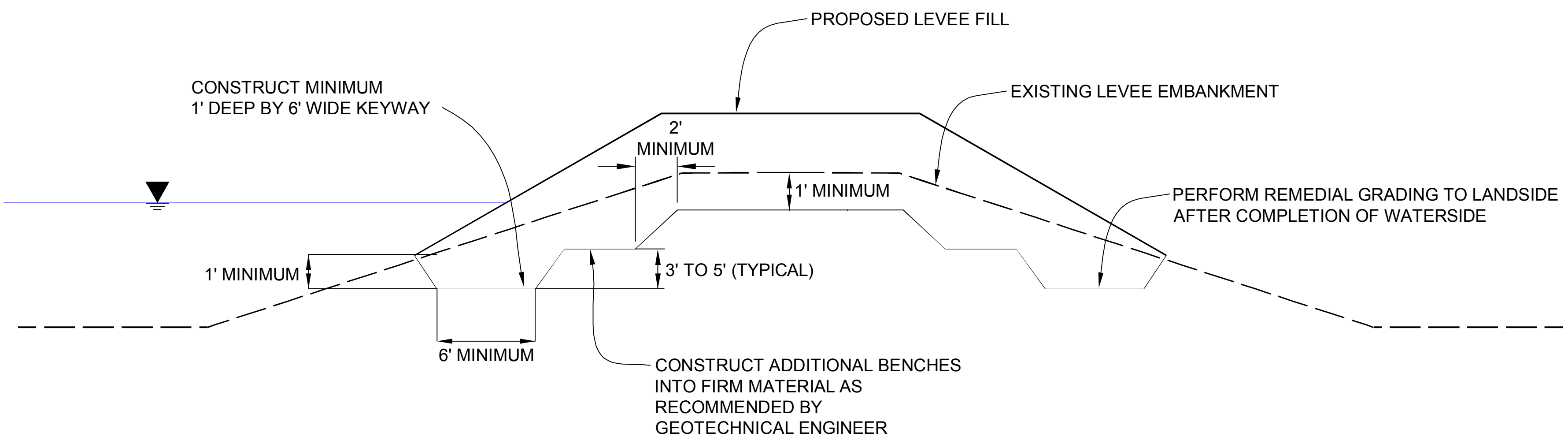

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TYPICAL REMEDIAL GRADING - EARTHEN LEVEE IMPROVEMENTS

FOSTER CITY LEVEE IMPROVEMENT PROJECT

FOSTER CITY, CALIFORNIA

PROJECT NO.: 8602.001.000

SCALE: NO SCALE

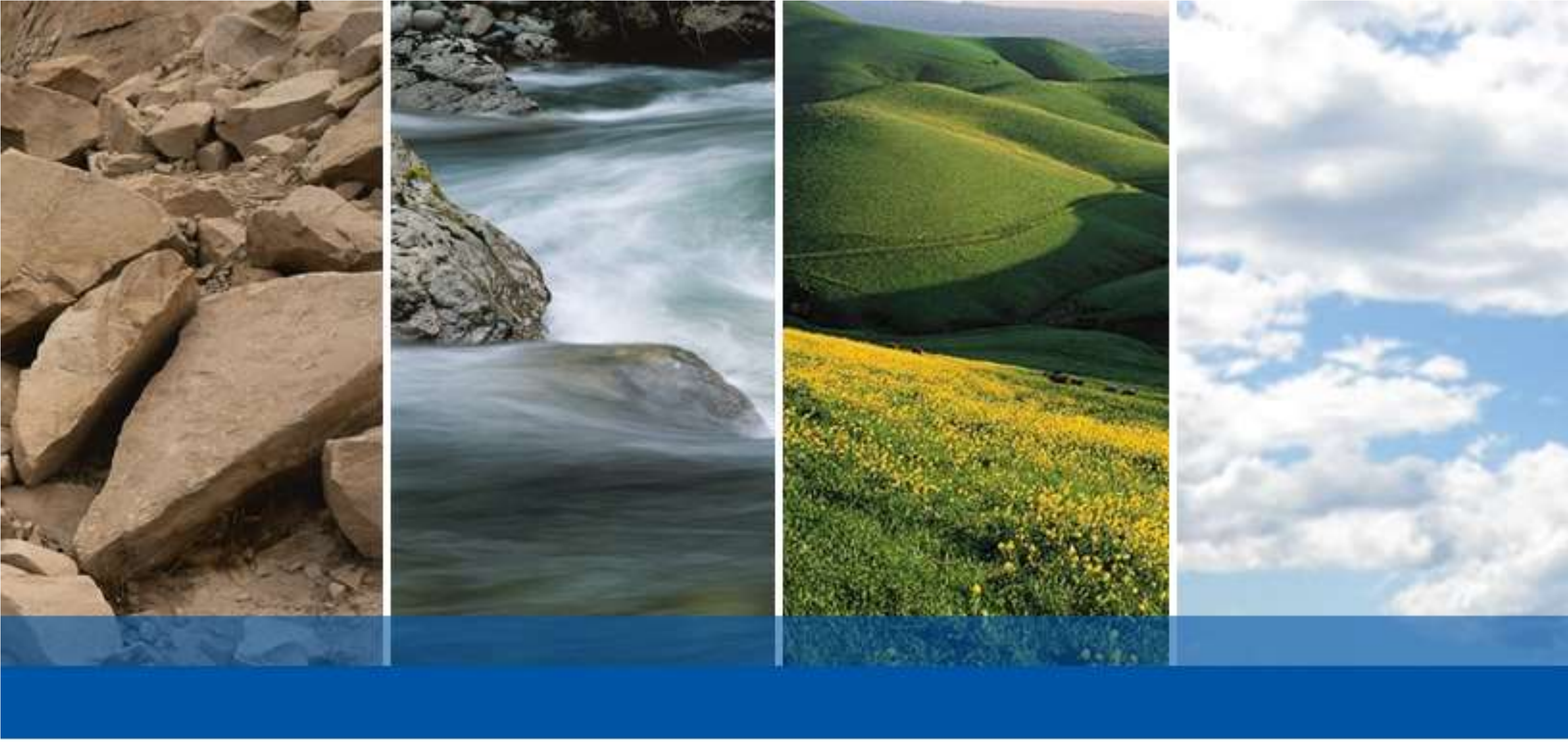
DRAWN BY: GLJ

CHECKED BY: JJT

FIGURE NO.

8

ORIGINAL FIGURE PRINTED IN COLOR



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APPENDIX A

SUBSURFACE DATA

Appendix A1 – ENGEO Explorations
Appendix A2 – Kleinfelder Explorations

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APPENDIX A

SUBSURFACE DATA

Appendix A1 – ENGEO Explorations

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
- 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

GROUND-WATER 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

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LOG OF BORING 3-B1

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/11/2017
HOLE DEPTH: Approx. 40½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			Gravel shoulder on waterside of pedestrian trail. Hollow stem auger used to start drilling.												
			CLAYEY SAND (SC), dark brown, very dense, moist, fine- to medium-grained sand, trace fine gravel (FILL)												
	10					50/6"				14					
5			CLAYEY SAND TO SANDY LEAN CLAY (SC-CL), reddish brown, medium dense to stiff, moist, fine- to medium-grained sand, trace shell fragments (FILL)			19				51	23.4	97.5		1.74	UC
	5		FAT CLAY (CH), dark grayish green, stiff, moist (FILL)												
10						7				90				1.25*	PP
	0		Switch to mud rotary drilling at approximately 11 feet below existing grade.												
15			FAT CLAY (CH), dark grayish green, stiff, moist to wet (FILL)			11									
	-5		FAT CLAY (CH), dark grayish green, medium stiff, wet (YOUNG BAY MUD)												
20						50 psi					78.2	55.3	649		LVS
	-10														

LOG OF BORING 3-B1

ENGEO
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Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/11/2017
HOLE DEPTH: Approx. 40½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
25															
	-15		FAT CLAY (CH), dark grayish green, medium stiff, wet			50 psi					50.7	72.8	983		LVS
30															
	-20														
35															
	-25														
			FAT CLAY (CH), dark grayish green, medium stiff, wet			50 - 100 psi					50.2	71	545		UU
40															
			Bottom of boring at approximately 40.5 feet below existing grade. Groundwater not measured during drilling due to drilling method.												

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LOG OF BORING 3-B2

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/11/2017
HOLE DEPTH: Approx. 42½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	DESCRIPTION	Blow Count/Foot	Liquid Limit	Plastic Limit	Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
0		Gravel shoulder on waterside of pedestrian trail. Hollow stem auger used to start drilling.										
		CLAYEY SAND (SC), yellowish brown, dense, moist, fine- to coarse-grained sand, trace fine gravel (FILL)	33				19	8.1	120.2		4.5+*	PP
	10	SANDY LEAN CLAY (CL), yellowish brown, very stiff, moist, trace fine gravel (FILL)										
5		FAT CLAY (CH), dark brown, medium stiff, moist, trace shell fragments (FILL)	7					45.3	69.8		0.59	UC
	5	FAT CLAY (CH), dark grayish green, medium stiff, wet, trace shell fragments (YOUNG BAY MUD)	3					77.8	56.1	512*		TV
10		Switch to mud rotary drilling at approximately 9 feet below existing grade.										
	0	FAT CLAY (CH), dark grayish green, soft, wet, trace organics	100 psi							307*		TV
15	-5											
20	-10	FAT CLAY (CH), dark grayish green, soft, wet, trace shell fragments and organics	50 psi					57.9	66.7	461*		TV

LOG - GEOTECHNICAL_SU+QU W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 10/18/17

LOG OF BORING 3-B2

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/11/2017
HOLE DEPTH: Approx. 42½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
25															
	-15														
			FAT CLAY (CH), dark grayish green, medium stiff, wet, trace shell fragments			50 psi					53.4	68.4	512*		TV
30															
	-20														
35															
	-25														
40			FAT CLAY (CH), dark grayish green, medium stiff, wet			100 psi					56.4	66.8	774		LVS
	-30														
			Bottom of boring at approximately 42.5 feet below existing grade. Groundwater not measured during drilling due to drilling method.												

LOG OF BORING 3-B3

ENGEO Expect Excellence

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/12/2017
HOLE DEPTH: Approx. 40 ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 10½ ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	10		Vegetated shoulder on landside of pedestrian trail. Hollow stem auger used to start drilling.												
			CLAYEY SAND (SC), olive brown, medium dense, moist, fine- to coarse-grained sand, trace shell fragments (FILL)			28				35	11	103.5		4.5+*	PP
			CLAYEY SAND (SC), olive brown and yellowish brown, loose, moist			5									
5	5		FAT CLAY (CH), dark grayish green, stiff, wet (YOUNG BAY MUD)								39.8	79.1		1.0*	PP
			FAT CLAY (CH), dark grayish green, medium stiff, wet, trace organics			50 psi							725		LVS
10	0		Switch to mud rotary drilling at approximately 10 feet below existing grade.												
15	-5		FAT CLAY (CH), dark grayish green, soft, wet, trace shell fragments			50 psi					85.3	50.8	329		LVS
20	-10														

LOG - GEOTECHNICAL_SU+QU W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 10/18/17

LOG OF BORING 3-B3

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/12/2017
HOLE DEPTH: Approx. 40 ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 10½ ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
25	-15		FAT CLAY (CH), dark grayish green, soft, wet			50 psi					79.6	52.3	430		LVS
30	-20		LEAN CLAY (CL), grayish green, very stiff, wet (ALLUVIUM)			18	48	15	33		21.1	108.9	2468		UU
35	-25														
			LEAN CLAY (CL), yellowish brown and light gray, very stiff, wet			14				98					
40			Bottom of boring at approximately 40 feet below existing grade. Groundwater not measured during drilling due to drilling method.												

LOG OF BORING 3-B4

ENGEO Expect Excellence

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/12/2017
HOLE DEPTH: Approx. 40½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 11 ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			Gravel shoulder on waterside of pedestrian trail. Hollow stem auger used to start drilling.												
	10		FAT CLAY (CH), grayish green and yellowish red, stiff, moist (FILL)												
						8				95	49.8	65.8		1.50*	PP
5			FAT CLAY (CH), grayish green, soft, wet, trace organics (YOUNG BAY MUD)												
	5		Switch to mud rotary drilling at approximately 6 feet below existing grade.			1					77.4	54.9	372		UU
10															
	0		FAT CLAY (CH), dark grayish green, soft, wet												
						< 50 psi					88.3	50.3	445		LVS
15	-5														
			FAT CLAY (CH), grayish green, soft, wet			50 psi					89.1	49.4	420		UU
20	-10														

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LOG OF BORING 3-B4

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/12/2017
HOLE DEPTH: Approx. 40½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 11 ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
25			FAT CLAY (CH), grayish green, soft, wet												
	-15					50 psi					91.5	49.1	307*		TV
30															
	-20														
			No recovery												
						50 psi									
35															
	-25														
			FAT CLAY (CH), grayish green, medium stiff, wet												
			LEAN CLAY (CL), grayish green and yellowish brown, stiff, wet (ALLUVIUM)			150 psi					27.7	97	1979		LVS
40															
			Bottom of boring at approximately 40.5 feet below existing grade. Groundwater measured at approximately 6 feet during drilling.												

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LOG OF BORING 3-B5

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/12/2017
HOLE DEPTH: Approx. 41½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 10½ ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	10	Gravel shoulder on waterside of pedestrian trail. Hollow stem auger used to start drilling.										
		SILTY SAND (SM), yellowish brown, loose to medium dense, moist (FILL)	10				14	11.5	97.9			
		CLAYEY SAND (SC), yellowish brown, loose to medium dense, moist, trace shell fragments (FILL)	10				43	55.4	63.6		1.5*	PP
5	5	FAT CLAY (CH), dark grayish green, medium stiff, wet (YOUNG BAY MUD)										
		FAT CLAY (CH), dark grayish green, medium stiff, wet, trace organics	50 psi					66.2	61.2	704		LVS
10	0	Switch to mud rotary drilling at approximately 10 feet below existing grade.										
15	-5	FAT CLAY (CH), dark grayish green, soft, wet, trace organics	< 50 psi					81.4	53.6	312		LVS
20	-10											

LOG OF BORING 3-B5

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/12/2017
HOLE DEPTH: Approx. 41½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 10½ ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
25	-15		FAT CLAY (CH), dark grayish green, soft, wet			< 50 psi					72.7	50.2			
30	-20		FAT CLAY (CH), dark grayish green, medium stiff, wet			50 psi					54.7	68.7	501		UU
35	-25														
40	-30		FAT CLAY (CH), dark grayish green, medium stiff, wet			1							512*		TV
			Bottom of boring at approximately 41.5 feet below existing grade. Groundwater not measured during drilling.												

LOG - GEOTECHNICAL_SU+QU W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 10/18/17

LOG OF BORING 3-B6

ENGEO
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Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/13/2017
HOLE DEPTH: Approx. 57½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 6½ ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			4 inches asphalt concrete (Beach Park Boulevard shoulder)												
	5		POORLY GRADED SAND (SP), yellowish brown, loose, moist, trace fine gravel (FILL)												
			CLAYEY SAND TO SANDY LEAN CLAY (SC-CL), yellowish brown, loose to very stiff, moist (FILL)			5				49	31			2.5*	PP
			FAT CLAY (CH), dark grayish green, very stiff, wet (YOUNG BAY MUD)								39.3	75.8		2.0*	PP
5	0		FAT CLAY (CH), dark grayish green, medium stiff, wet			100 psi					60.9	63.8	913		LVS
			Switch to mud rotary drilling at approximately 7.5 feet below existing grade.												
10	-5														
15	-10		FAT CLAY (CH), dark grayish green, soft, wet			< 50 psi					61.3	65.2	490		LVS
20															

LOG - GEOTECHNICAL_SU+QU W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 10/18/17

LOG OF BORING 3-B6

ENGEO
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Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/13/2017
HOLE DEPTH: Approx. 57½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 6½ ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	-15														
25			FAT CLAY (CH), dark grayish green, medium stiff, wet												
	-20					< 50 psi					59.3	65.8	531		LVS
30															
	-25														
35			FAT CLAY (CH), dark grayish green, medium stiff, wet												
	-30					50 psi					61	64	661		UU
40															

LOG - GEOTECHNICAL_SU+QU W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 10/18/17

LOG OF BORING 3-B6

ENGEO
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Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 9/13/2017
HOLE DEPTH: Approx. 57½ ft.
HOLE DIAMETER: 4.5 in.
SURF ELEV (NAVD 88): Approx. 6½ ft.

LOGGED / REVIEWED BY: Y. Zepeda / A. Firmin
DRILLING CONTRACTOR: Geo-Ex Subsurface
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	-35														
45	-40		FAT CLAY (CH), dark grayish green, medium stiff, wet			< 50 psi					53.1	69.4	512*		TV
50	-45														
55	-50		FAT CLAY (CH), dark grayish green, medium stiff, wet			50 psi					54.5	68	913		LVS
			Bottom of boring at approximately 57.5 feet below existing grade. Groundwater not measured during drilling.												

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

9/5/2017

ENGEO
Attn: Andy Firmin

Subject: CPT Site Investigation
Foster City Levees
Foster City, California
GREGG Project Number: 17-140MA

Dear Mr. Firmin:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☐
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	UVOST Laser Induced Fluorescence	(UVOST)	☐
5	Groundwater Sampling	(GWS)	☐
6	Soil Sampling	(SS)	☐
7	Vapor Sampling	(VS)	☐
8	Pressuremeter Testing	(PMT)	☐
9	Vane Shear Testing	(VST)	☐
10	Dilatometer Testing	(DMT)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (925) 313-5800.

Sincerely,
GREGG Drilling & Testing, Inc.

Mary Walden

Mary Walden
Operations Manager

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (feet)	Depth of Groundwater Samples (feet)	Depth of Soil Samples (feet)	Depth of Pore Pressure Dissipation Tests (feet)
3-CPT1	9/1/17	75	-	-	-
3-CPT2	9/1/17	69	-	-	-
3-CPT3	9/1/17	100	-	-	-
3-CPT4	9/1/17	103	-	-	-

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Copies of ASTM Standards are available through www.astm.org

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*.

The cone takes measurements of tip resistance (q_c), sleeve resistance (f_s), and penetration pore water pressure (u_2). Measurements are taken at either 2.5 or 5 cm intervals during penetration to provide a nearly continuous profile. CPT data reduction and basic interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored electronically for further analysis and reference. All CPT soundings are performed in accordance with revised ASTM standards (D 5778-12).

The 5mm thick porous plastic filter element is located directly behind the cone tip in the u_2 location. A new saturated filter element is used on each sounding to measure both penetration pore pressures as well as measurements during a dissipation test (*PPDT*). Prior to each test, the filter element is fully saturated with oil under vacuum pressure to improve accuracy.

When the sounding is completed, the test hole is backfilled according to client specifications. If grouting is used, the procedure generally consists of pushing a hollow tremie pipe with a "knock out" plug to the termination depth of the CPT hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

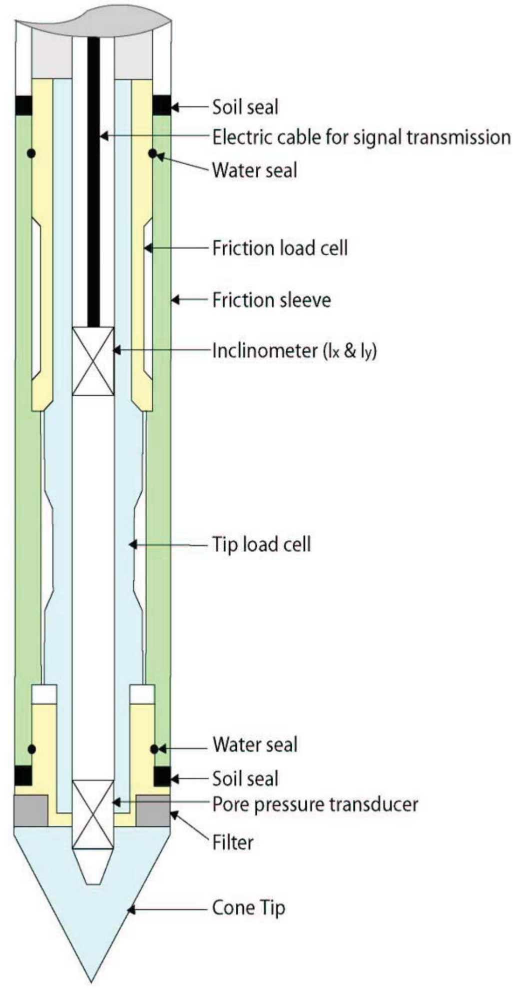


Figure CPT

Gregg 15cm^2 Standard Cone Specifications

Dimensions	
Cone base area	15 cm^2
Sleeve surface area	225 cm^2
Cone net area ratio	0.80
Specifications	
Cone load cell	
Full scale range	180 kN (20 tons)
Overload capacity	150%
Full scale tip stress	120 MPa (1,200 tsf)
Repeatability	120 kPa (1.2 tsf)
Sleeve load cell	
Full scale range	31 kN (3.5 tons)
Overload capacity	150%
Full scale sleeve stress	1,400 kPa (15 tsf)
Repeatability	1.4 kPa (0.015 tsf)
Pore pressure transducer	
Full scale range	7,000 kPa (1,000 psi)
Overload capacity	150%
Repeatability	7 kPa (1 psi)

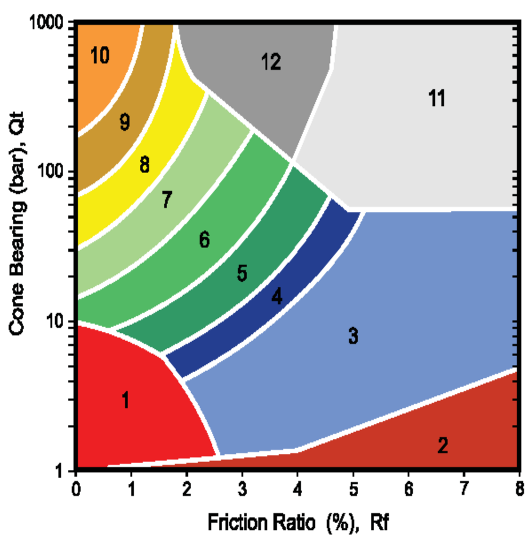
Note: The repeatability during field use will depend somewhat on ground conditions, abrasion, maintenance and zero load stability.

Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected are presented in graphical and electronic form in the report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings deeper than 30m, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson (Guide to Cone Penetration Testing, 2015). The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software. Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



ZONE	SBT
1	Sensitive, fine grained
2	Organic materials
3	Clay
4	Silty clay to clay
5	Clayey silt to silty clay
6	Sandy silt to clayey silt
7	Silty sand to sandy silt
8	Sand to silty sand
9	Sand
10	Gravely sand to sand
11	Very stiff fine grained*
12	Sand to clayey sand*

*over consolidated or cemented

Figure SBT (After Robertson et al., 1986) – Note: Colors may vary slightly compared to plots

Cone Penetration Test (CPT) Interpretation

Gregg uses a proprietary CPT interpretation and plotting software. The software takes the CPT data and performs basic interpretation in terms of soil behavior type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by Lunne, Robertson and Powell (1997). The interpretation is presented in tabular format using MS Excel. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

The following provides a summary of the methods used for the interpretation. Many of the empirical correlations to estimate geotechnical parameters have constants that have a range of values depending on soil type, geologic origin and other factors. The software uses 'default' values that have been selected to provide, in general, conservatively low estimates of the various geotechnical parameters.

Input:

1. Units for display (Imperial or metric) (atm. pressure, p_a = 0.96 tsf or 0.1 MPa)
2. Depth interval to average results (ft or m). Data are collected at either 0.02 or 0.05m and can be averaged every 1, 3 or 5 intervals.
3. Elevation of ground surface (ft or m)
4. Depth to water table, z_w (ft or m) – input required
5. Net area ratio for cone, a (default to 0.80)
6. Relative Density constant, C_{Dr} (default to 350)
7. Young's modulus number for sands, α (default to 5)
8. Small strain shear modulus number
    a. for sands, S_G (default to 180 for SBT_n 5, 6, 7)
    b. for clays, C_G (default to 50 for SBT_n 1, 2, 3 & 4)
9. Undrained shear strength cone factor for clays, N_{kt} (default to 15)
10. Over Consolidation ratio number, k_{ocr} (default to 0.3)
11. Unit weight of water, (default to γ_w = 62.4 lb/ft^3 or 9.81 kN/m^3)

Column

1. Depth, z, (m) – CPT data is collected in meters
2. Depth (ft)
3. Cone resistance, q_c (tsf or MPa)
4. Sleeve resistance, f_s (tsf or MPa)
5. Penetration pore pressure, u (psi or MPa), measured behind the cone (i.e. u_2)
6. Other – any additional data
7. Total cone resistance, q_t (tsf or MPa) $q_t = q_c + u\,(1-a)$

8	Friction Ratio, R_f (%)	$R_f = (f_s/q_t) \times 100\%$
9	Soil Behavior Type (non-normalized), SBT	see note
10	Unit weight, γ (pcf or kN/m^3)	based on SBT, see note
11	Total overburden stress, σ_v (tsf)	$\sigma_{vo} = \sigma\ z$
12	In-situ pore pressure, u_o (tsf)	$u_o = \gamma_w\ (z - z_w)$
13	Effective overburden stress, σ'_{vo} (tsf)	$\sigma'_{vo} = \sigma_{vo} - u_o$
14	Normalized cone resistance, Q_{t1}	$Q_{t1} = (q_t - \sigma_{vo}) / \sigma'_{vo}$
15	Normalized friction ratio, F_r (%)	$F_r = f_s / (q_t - \sigma_{vo}) \times 100\%$
16	Normalized Pore Pressure ratio, B_q	$B_q = u - u_o / (q_t - \sigma_{vo})$
17	Soil Behavior Type (normalized), SBT_n	see note
18	SBT_n Index, I_c	see note
19	Normalized Cone resistance, Q_{tn} (n varies with I_c)	see note
20	Estimated permeability, k_{SBT} (cm/sec or ft/sec)	see note
21	Equivalent SPT N_{60}, blows/ft	see note
22	Equivalent SPT $(N_1)_{60}$ blows/ft	see note
23	Estimated Relative Density, D_r, (%)	see note
24	Estimated Friction Angle, ϕ', (degrees)	see note
25	Estimated Young's modulus, E_s (tsf)	see note
26	Estimated small strain Shear modulus, Go (tsf)	see note
27	Estimated Undrained shear strength, s_u (tsf)	see note
28	Estimated Undrained strength ratio	s_u/σ_v'
29	Estimated Over Consolidation ratio, OCR	see note

Notes:

1 Soil Behavior Type (non-normalized), SBT (Lunne et al., 1997 and table below)

2 Unit weight, γ either constant at 119 pcf or based on Non-normalized SBT (Lunne et al., 1997 and table below)

3 Soil Behavior Type (Normalized), SBT_n Lunne et al. (1997)

4 SBT_n Index, I_c $I_c = ((3.47 - \log Q_{t1})^2 + (\log F_r + 1.22)^2)^{0.5}$

5 Normalized Cone resistance, Q_{tn} (n varies with Ic)

$Q_{tn} = ((q_t - \sigma_{vo})/pa)\ (pa/(\sigma'_{vo})^n$ and recalculate I_c, then iterate:

When $I_c < 1.64$, n = 0.5 (clean sand)
When $I_c > 3.30$, n = 1.0 (clays)
When $1.64 < I_c < 3.30$, $n = (I_c - 1.64)0.3 + 0.5$
Iterate until the change in n, $\Delta n < 0.01$

6 Estimated permeability, k_{SBT} based on Normalized SBT_n (Lunne et al., 1997 and table below)

7 Equivalent SPT N_{60}, blows/ft Lunne et al. (1997)

$$\frac{(q_t/p_a)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

8 Equivalent SPT $(N_1)_{60}$ blows/ft $(N_1)_{60} = N_{60}\,C_N,$
where $C_N = (pa/\sigma'_{vo})^{0.5}$

9 Relative Density, D_r, (%) $D_r^2 = Q_{tn} / C_{Dr}$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

10 Friction Angle, ϕ', (degrees) $\tan\phi' = \frac{1}{2.68}\left[\log\left(\frac{q_c}{\sigma'_{vo}}\right) + 0.29\right]$

Only SBT_n 5, 6, 7 & 8 *Show'N/A' in zones 1, 2, 3, 4 & 9*

11 Young's modulus, E_s $E_s = \alpha\, q_t$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

12 Small strain shear modulus, Go
a. $G_o = S_G\,(q_t\ \sigma'_{vo}\ pa)^{1/3}$ *For SBT_n 5, 6, 7*
b. $G_o = C_G\,q_t$ *For SBT_n 1, 2, 3& 4*
Show 'N/A' in zones 8 & 9

13 Undrained shear strength, s_u $s_u = (q_t - \sigma_{vo}) / N_{kt}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

14 Over Consolidation ratio, OCR $OCR = k_{ocr}\,Q_{t1}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

The following updated and simplified SBT descriptions have been used in the software:

SBT Zones

1 sensitive fine grained
2 organic soil
3 clay
4 clay & silty clay
5 clay & silty clay
6 sandy silt & clayey silt

SBT_n Zones

1 sensitive fine grained
2 organic soil
3 clay
4 clay & silty clay

7	silty sand & sandy silt	5	silty sand & sandy silt
8	sand & silty sand	6	sand & silty sand
9	sand		
10	sand	7	sand
11	very dense/stiff soil*	8	very dense/stiff soil*
12	very dense/stiff soil*	9	very dense/stiff soil*

*heavily overconsolidated and/or cemented

Track when soils fall with zones of same description and print that description (i.e. if soils fall only within SBT zones 4 & 5, print ‘clays & silty clays’)

Estimated Permeability (see Lunne et al., 1997)

SBT_n	Permeability (ft/sec)	(m/sec)
1	$3x\ 10^{-8}$	$1x\ 10^{-8}$
2	$3x\ 10^{-7}$	$1x\ 10^{-7}$
3	$1x\ 10^{-9}$	$3x\ 10^{-10}$
4	$3x\ 10^{-8}$	$1x\ 10^{-8}$
5	$3x\ 10^{-6}$	$1x\ 10^{-6}$
6	$3x\ 10^{-4}$	$1x\ 10^{-4}$
7	$3x\ 10^{-2}$	$1x\ 10^{-2}$
8	$3x\ 10^{-6}$	$1x\ 10^{-6}$
9	$1x\ 10^{-8}$	$3x\ 10^{-9}$

Estimated Unit Weight (see Lunne et al., 1997)

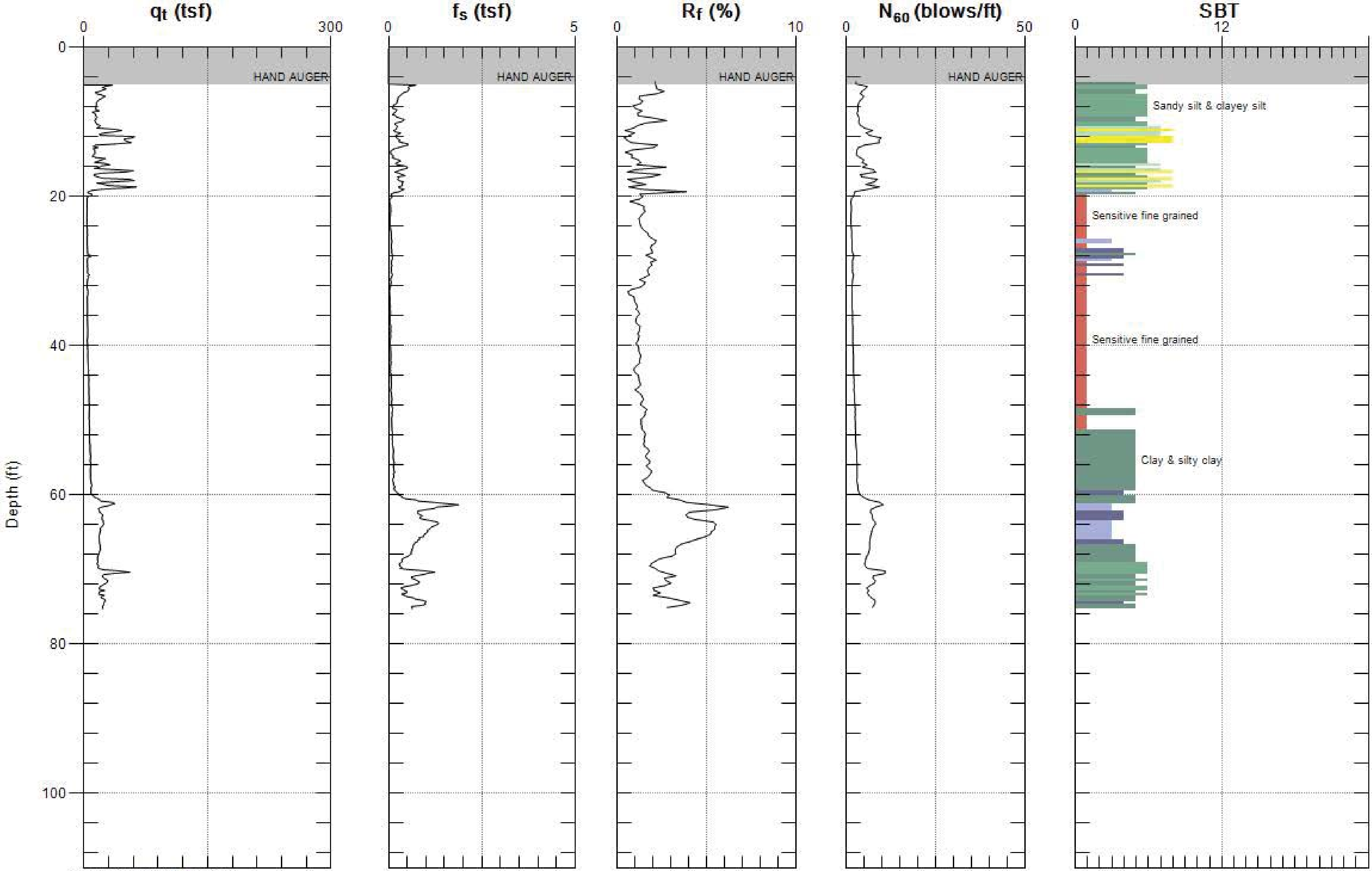
SBT	Approximate Unit Weight (lb/ft^3)	(kN/m^3)
1	111.4	17.5
2	79.6	12.5
3	111.4	17.5
4	114.6	18.0
5	114.6	18.0
6	114.6	18.0
7	117.8	18.5
8	120.9	19.0
9	124.1	19.5
10	127.3	20.0
11	130.5	20.5
12	120.9	19.0

GREGG

ENGEO

Site: FOSTER CITY LEVEES
Sounding: 3-CPT1

Engineer: S.NEUMAYR
Date: 9/1/2017 08:29



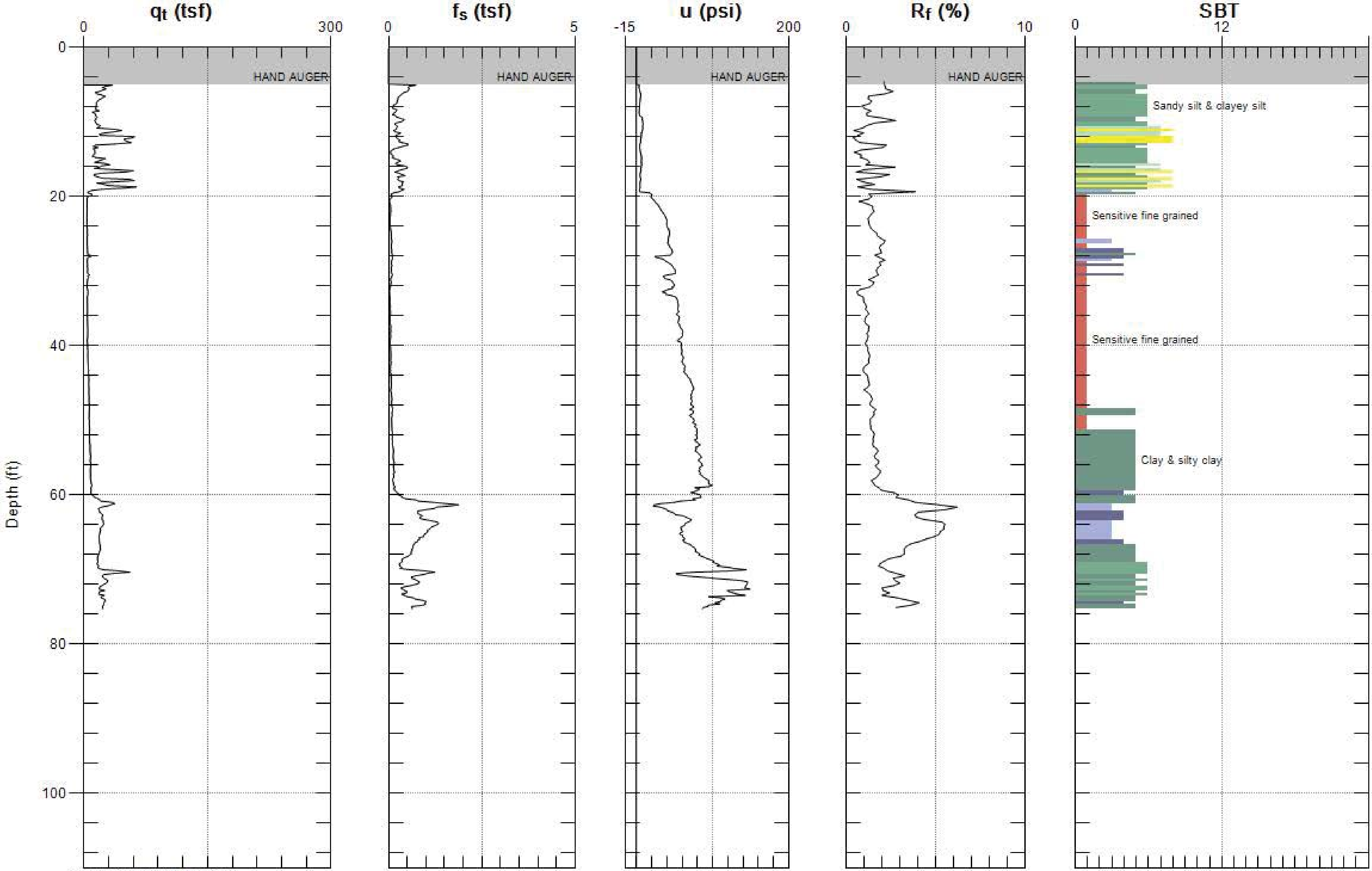
Max. Depth: 75.295 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: FOSTER CITY LEVEES **Engineer:** S.NEUMAYR

Sounding: 3-CPT1 **Date:** 9/1/2017 08:29

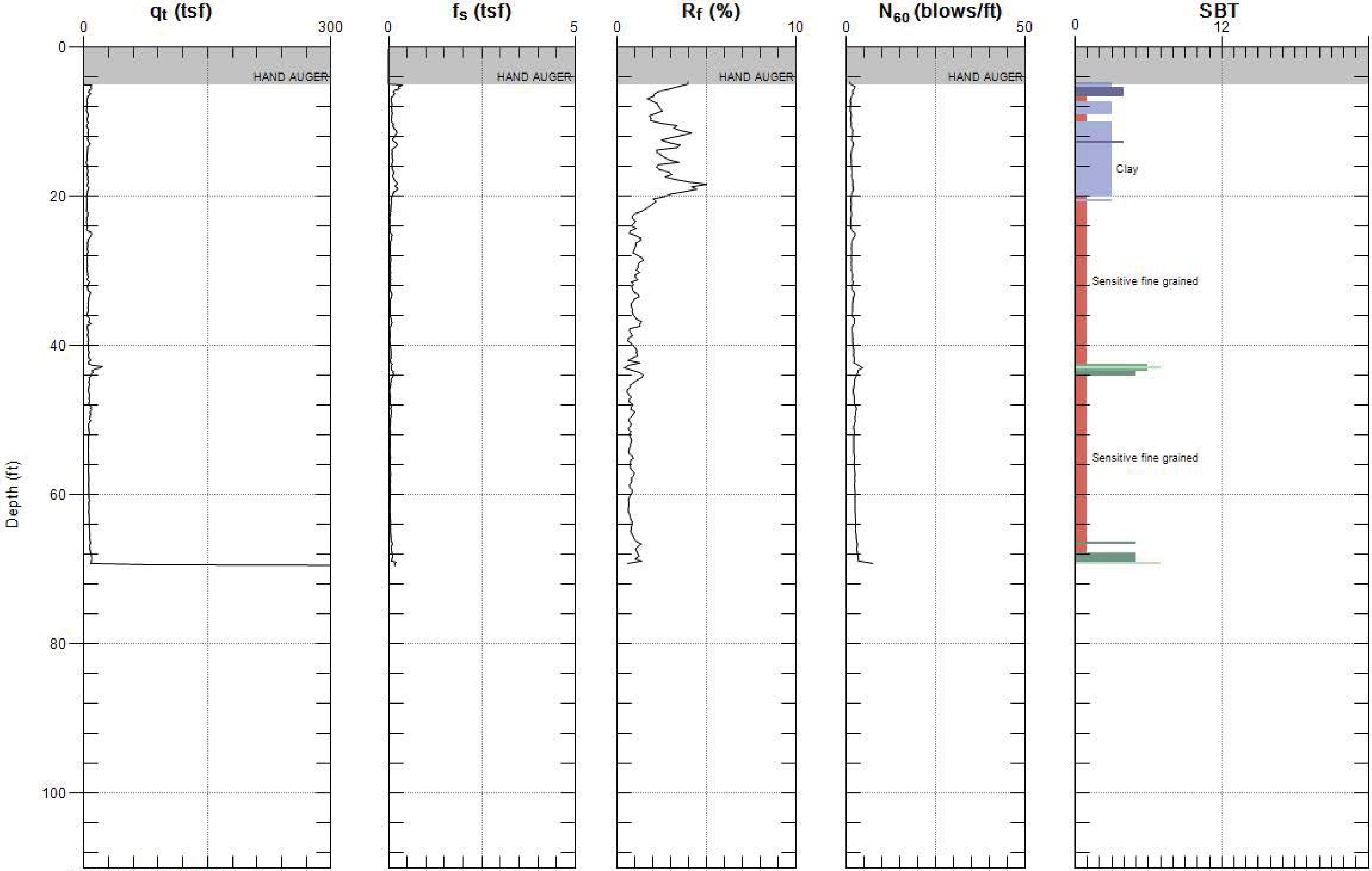


Max. Depth: 75.295 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Site: FOSTER CITY LEVEES **Engineer: S.NEUMAYR**

Sounding: 3-CPT2 **Date: 9/1/2017 11:13**



Max. Depth: 69.554 (ft)
Avg. Interval: 0.328 (ft)

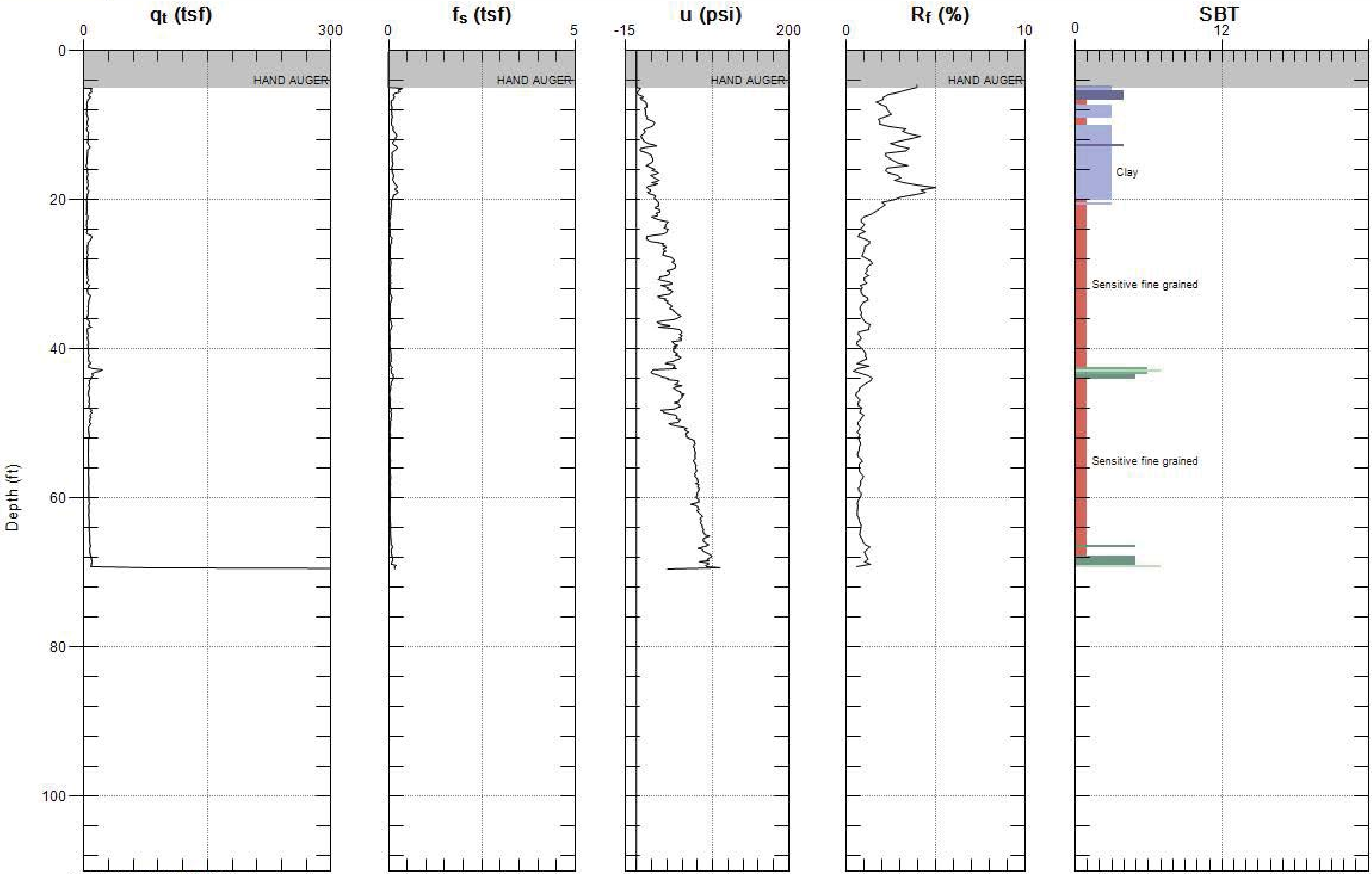
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

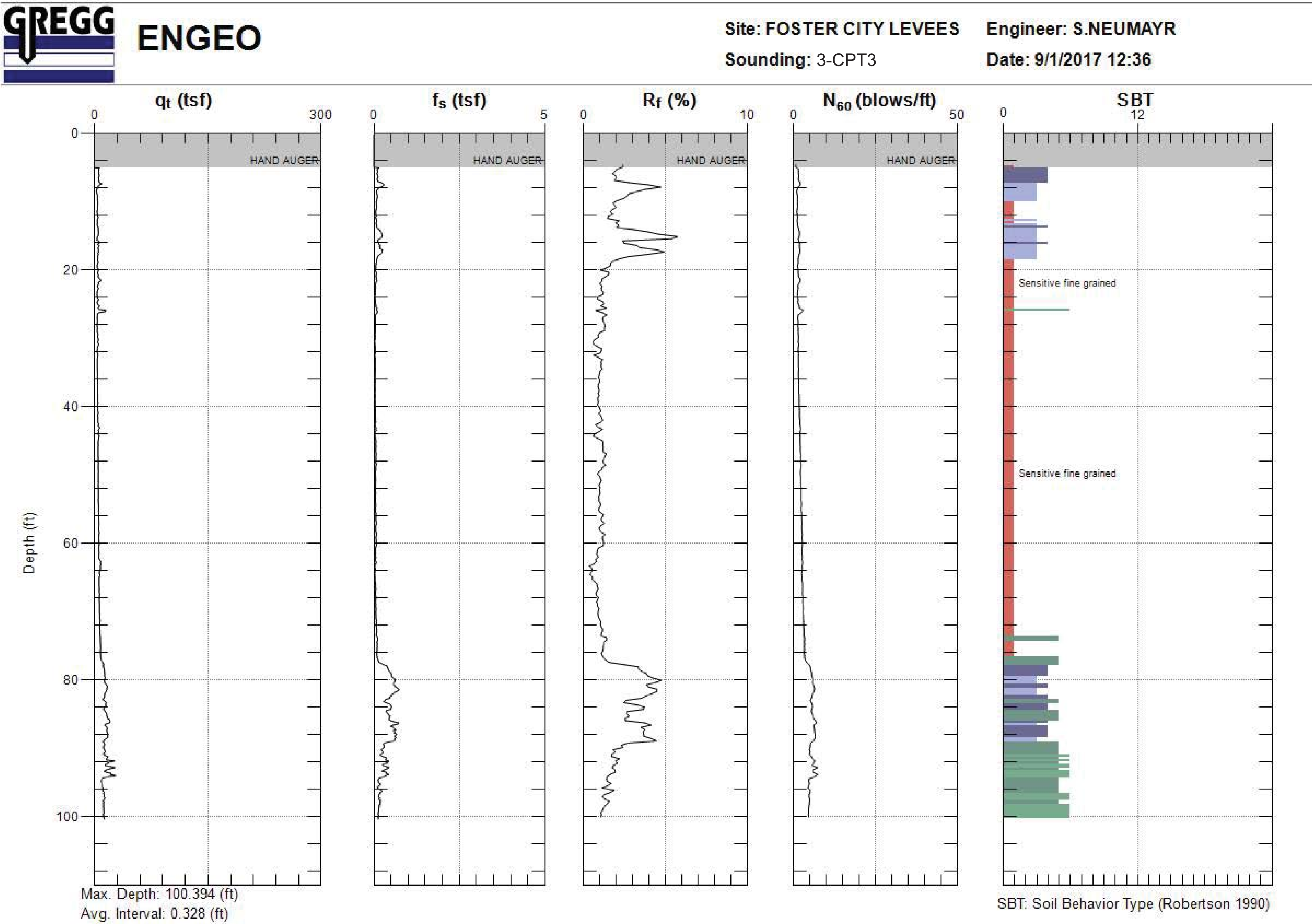
Site: FOSTER CITY LEVEES
Sounding: 3-CPT2

Engineer: S.NEUMAYR
Date: 9/1/2017 11:13



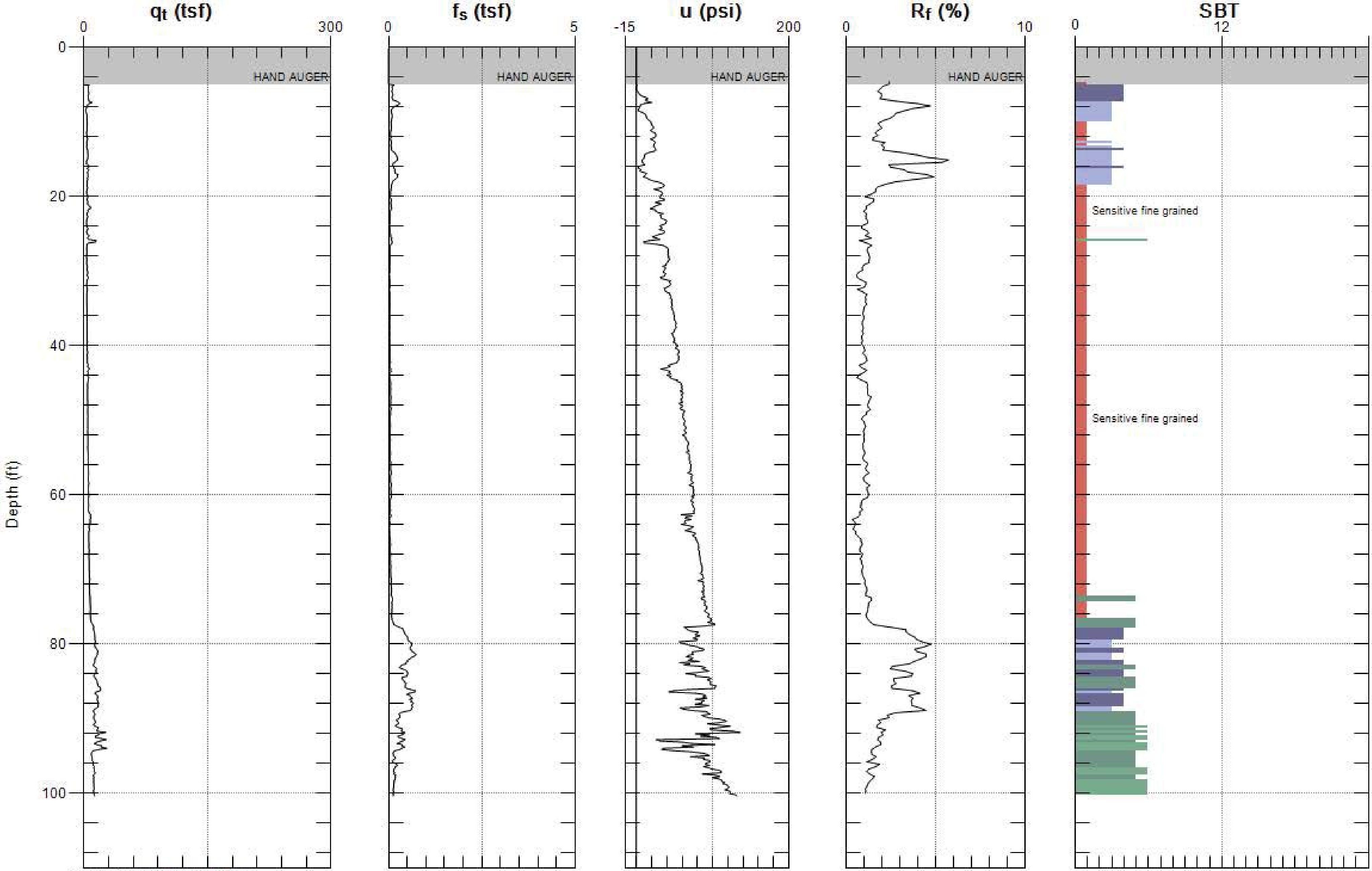
Max. Depth: 69.554 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)


GREGG
ENGEO
Site: FOSTER CITY LEVEES
Engineer: S.NEUMAYR
Sounding: 3-CPT3
Date: 9/1/2017 12:36
qt (tsf)
fs (tsf)
Rf (%)
N60 (blows/ft)
SBT
HAND AUGER
Sensitive fine grained
Depth (ft)
Max. Depth: 100.394 (ft)
Avg. Interval: 0.328 (ft)
SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: FOSTER CITY LEVEES
Sounding: 3-CPT3
Engineer: S.NEUMAYR
Date: 9/1/2017 12:36



Max. Depth: 100.394 (ft)
Avg. Interval: 0.328 (ft)

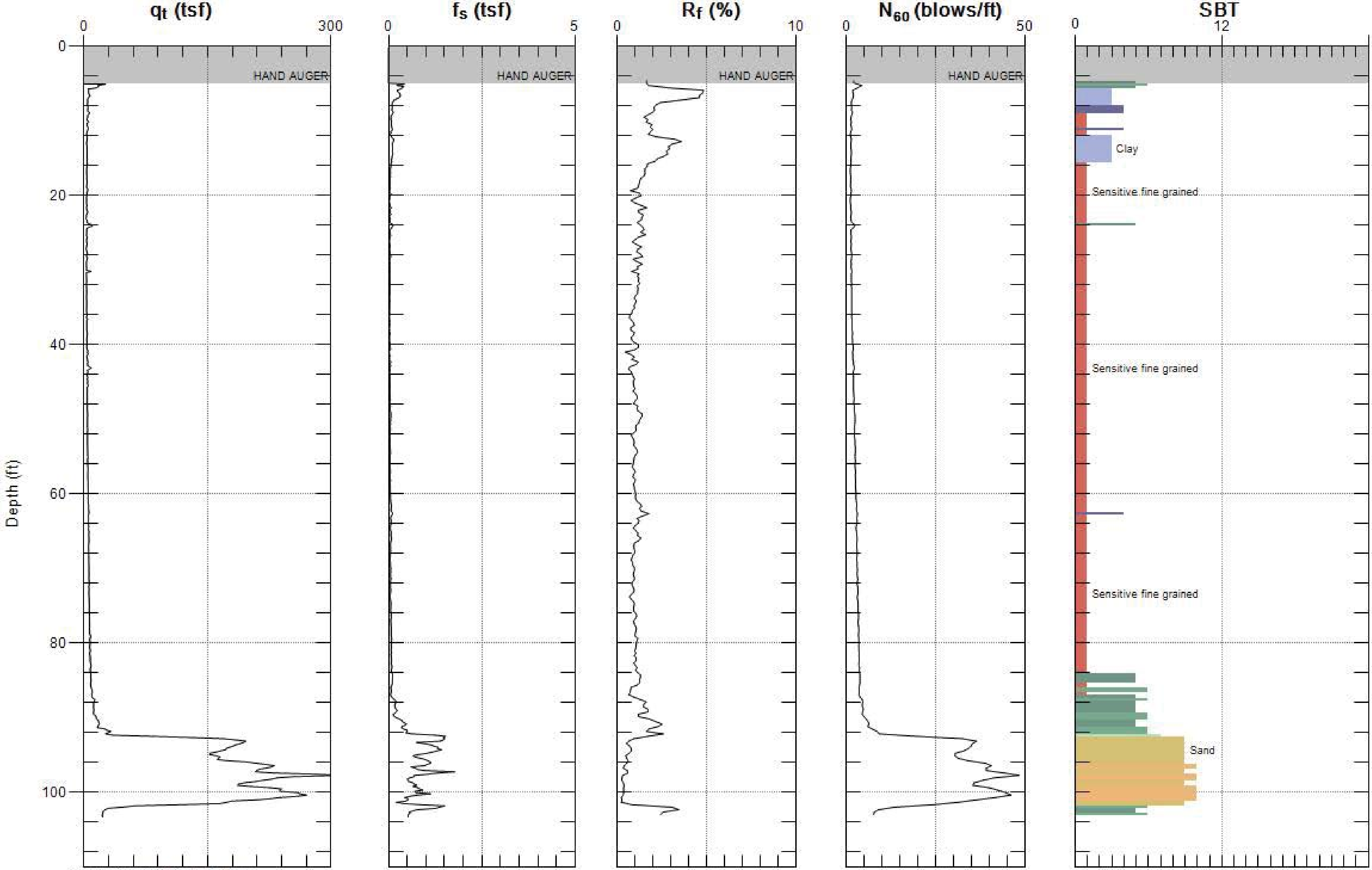
SBT: Soil Behavior Type (Robertson 1990)

GREGG

ENGEO

Site: FOSTER CITY LEVEES
Sounding: 3-CPT4

Engineer: S.NEUMAYR
Date: 9/1/2017 02:26



Max. Depth: 103.346 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

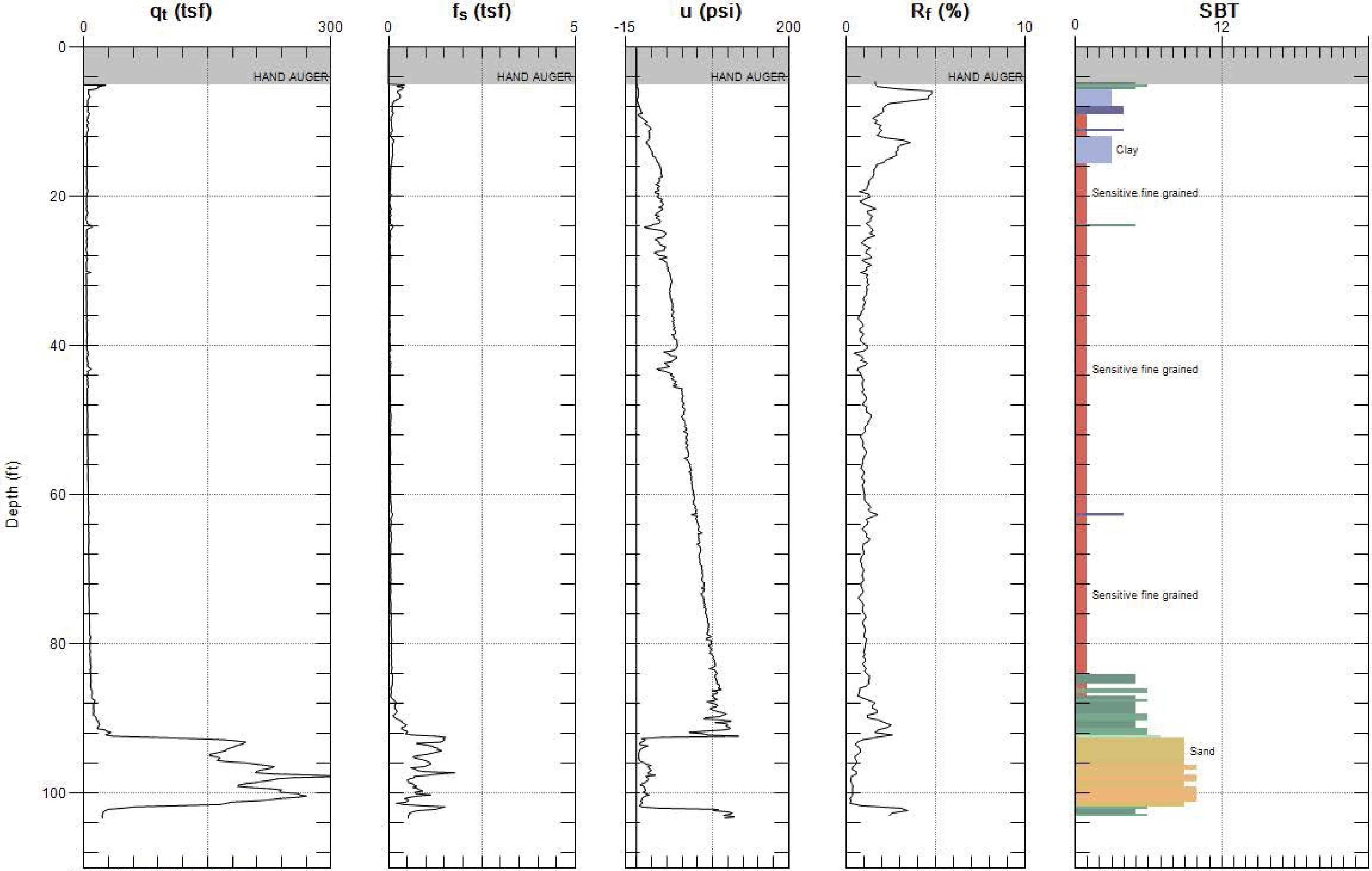
ENGEO

Site: FOSTER CITY LEVEES

Sounding: 3-CPT4

Engineer: S.NEUMAYR

Date: 9/1/2017 02:26



Max. Depth: 103.346 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO Expect Excellence		TEST PIT LOG
Foster City Levee Improvements Foster City, CA 8602.001.000		Logged By: Stephen Neumayr Logged Date: September 19, 2017
Test Pit Number	Depth (Feet)	Description
3-TP1	0 – 1.5	POORLY GRADED SAND (SP), olive, slightly moist, with gravel, some cobbles up to 6 inches, concrete fragments up to 18 inches, trace shell fragments.
	1.5 – 4.0	SANDY LEAN CLAY (CL), dark olive brown, moist, with gravel, cobbles up to 6 inches, trace shell and brick fragments.
	4.0 – 4.5	CLAYEY SAND (SC), dark brown, moist, trace gravel, several zones with abundant shell fragments.
		Bottom of test pit at 4.5 feet. No groundwater encountered.

TEST PIT LOG

Foster City Levee Improvements
Foster City, CA
8602.001.000

Logged By: Stephen Neumayr
Logged Date: September 19, 2017

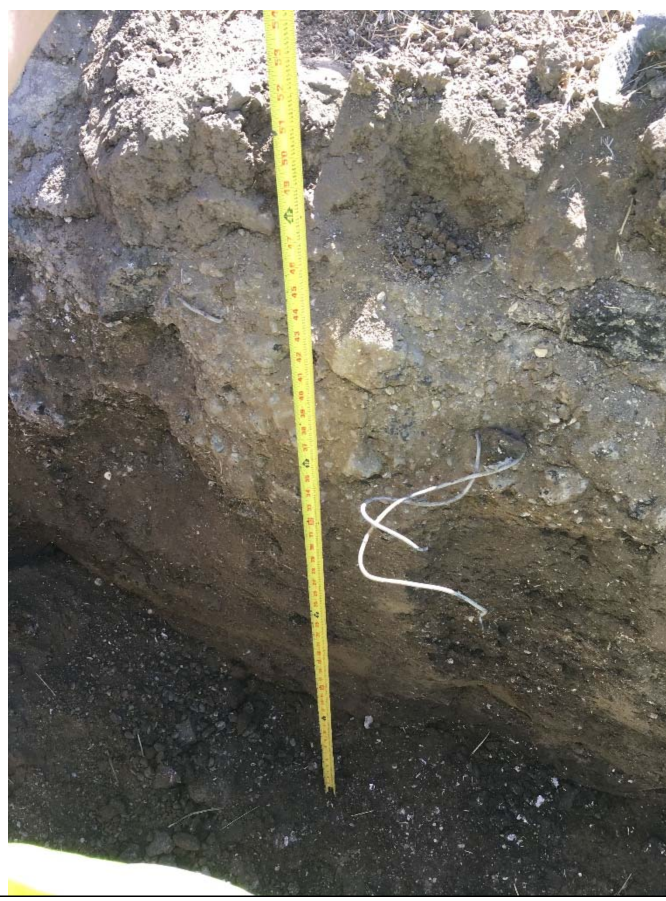
Test Pit Number	Depth (Feet)	Description
3-TP2	0 – 3.5	CLAYEY SAND (SC), olive brown, moist, some cobbles and concrete fragments up to 6 inches, trace wood fragments, 18-inch boulder at depth of 2 feet.
	3.5 – 4.5	SILTY SAND (SM), olive brown, moist, some gravel and concrete fragments up to 3 inches, several zones with abundant shell fragments.
		Bottom of test pit at 4.5 feet. No groundwater encountered.

TEST PIT LOG

Foster City Levee Improvements
Foster City, CA
8602.001.000

Logged By: Stephen Neumayr
Logged Date: September 19, 2017

Test Pit Number	Depth (Feet)	Description
3-TP3	0 – 1.0	CLAYEY SAND (SC), dark brown, slightly moist, with gravel.
	1.0 – 2.0	POORLY GRADED SAND (SM), light gray, slightly moist, some gravel, asphalt, and concrete fragments up to 4 inches, stray wire at depth of 2 feet.
	2.0 – 3.5	CLAYEY SAND (SC), dark gray, moist, trace shell fragments.
	3.5 – 4.5	SANDY LEAN CLAY (CL), dark gray, moist.
		Bottom of test pit at 4.5 feet. No groundwater encountered.



ENGEO Expect Excellence	TEST PIT LOG
Foster City Levee Improvements Foster City, CA 8602.001.000	Logged By: Stephen Neumayr Logged Date: September 19, 2017

Test Pit Number	Depth (Feet)	Description
3-TP4	0 – 1	CLAYEY SAND (SC), light gray, slightly moist, with gravel, some cobbles up to 4 inches.
	1 - 4	CLAYEY SAND (SC), dark reddish brown, moist, with gravel, cobbles up to 3 inches.
	4 – 4.5	SANDY LEAN CLAY (CL), dark gray, moist, trace gravel.
		Bottom of test pit at 4.5 feet. No groundwater encountered.

TEST PIT LOG

Foster City Levee Improvements
Foster City, CA
8602.001.000

Logged By: Stephen Neumayr
Logged Date: September 19, 2017

Test Pit Number	Depth (Feet)	Description
3-TP5	0 – 3	CLAYEY SAND (SC) dark brown, moist, with gravel, trace wood fragments, asphalt and concrete fragments up to 4 inches, some zones with abundant shell fragments.
	3 – 4	LEAN CLAY (CL), brown, moist, with sand, trace gravel.
		Bottom of test pit at 4 feet. No groundwater encountered.

TEST PIT LOG

Foster City Levee Improvements Foster City, CA 8602.001.000		Logged By: Stephen Neumayr Logged Date: September 19, 2017
Test Pit Number	Depth (Feet)	Description
3-TP6	0 – 1.5	POORLY GRADED SAND (SP), light gray, slightly moist, with gravel.
	1.5 – 2.5	GRAVEL AND COBBLES, with sand, cobbles up to 6 inches, zone with abundant shell fragments at 2 feet.
	2.5 – 4.0	SANDY LEAN CLAY (CL), dark brown, moist, trace gravel, some zones with abundant shell fragments.
		Bottom of test pit at 4 feet. No groundwater encountered.

<table>
<tr><td colspan="2"></td><td>HAND AUGER LOG</td></tr>
<tr><td colspan="2">Foster City Levee Improvements
Foster City, CA
8602.001.000</td><td>Logged By: Yanet Zepeda
Logged Date: September 11, 2017</td></tr>
<tr><td>Hand Auger Number</td><td>Depth (Feet)</td><td>Description</td></tr>
<tr><td>3-HA1</td><td>0 – 1.0

1.0 – 2.0</td><td>FAT CLAY (CH), brown to dark brown, medium stiff, moist.

FAT CLAY (CH), dark grayish brown, soft to medium stiff, moist to wet.

Bottom of hand auger at 2 feet. No groundwater encountered.</td></tr>
</table>

HAND AUGER LOG

Foster City Levee Improvements
Foster City, CA
8602.001.000

Logged By: Yanet Zepeda
Logged Date: September 11, 2017

Hand Auger Number	Depth (Feet)	Description
3-HA2	0 – 0.5	FAT CLAY (CH), brown to dark brown, medium stiff, moist.
	0.5 – 1.5	FAT CLAY (CH), dark grayish brown, soft to medium stiff, moist to wet.
		Bottom of hand auger at 1.5 feet. No groundwater encountered.

ENGEO
Expect Excellence

HAND AUGER LOG

Foster City Levee Improvements Foster City, CA 8602.001.000		Logged By: Yanet Zepeda Logged Date: September 11, 2017
Hand Auger Number	Depth (Feet)	Description
3-HA3	0 – 0.5	FAT CLAY (CH), reddish brown to dark brown, stiff, moist.
	0.5 – 1.5	FAT CLAY (CH), dark grayish brown, soft to medium stiff, moist to wet.
		Bottom of hand auger at 1.5 feet. No groundwater encountered.

LOG OF BORING 2-B1

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/22/2016
HOLE DEPTH: Approx. 66½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	DESCRIPTION	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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
		Gravel shoulder on waterside of pedestrian trail. Hollow stem auger drilling used to start boring.											
		CLAYEY SAND (SC), dark brown, medium dense, moist, with fine gravel (FILL)											
	10												
		POORLY GRADED SAND (SP), yellowish brown, medium dense, moist, with fine to coarse gravel (FILL)		25				0					
		FAT CLAY WITH SAND (CH), dark grayish brown, stiff, moist, some shell fragments (FILL)											
5													
				12								1.25*	PP
					65	25	40	81	45.6	74.9		0.45	UC
	5	LEAN CLAY WITH SAND (CL), dark reddish brown, stiff, moist (FILL)											
			∇										
				7								1.00*	PP
		FAT CLAY (CH), grayish green mottled with very dark brown, soft, wet (YOUNG BAY MUD) Switch to mud rotary drilling at approximately 9.5 feet below existing grade.							52.8	67.3			
10													
	0	FAT CLAY (CH), grayish green mottled with very dark brown, soft, wet, trace organics											
				100 psi									
									74.9	54.3	312		LVS
15											410*		TV
	-5												
20													

LOG OF BORING 2-B1

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/22/2016
HOLE DEPTH: Approx. 66½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			FAT CLAY (CH), grayish green, soft, wet, some shell fragments												
						75 psi					61.8	64.2	464		UU
	-10										85.7	52.1			
25															
	-15														
30			FAT CLAY (CH), grayish green mottled with very dark brown, soft, wet, some shell fragments												
						100 psi							293		LVS
	-20										53	70.4			
													369*		TV
35															
	-25														
40															

LOG OF BORING 2-B1

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/22/2016
HOLE DEPTH: Approx. 66½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	-30		FAT CLAY (CH), grayish green mottled with very dark brown, medium stiff, wet, trace shell framents			100 psi					52.7	70.4	798		LVS
45															
	-35														
50															
	-40														
			CLAYEY SAND (SC), yellowish brown mottled with reddish brown, dense, wet (ALLUVIUM)			32				46	29.9	93.3			
55															
	-45														
60															

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

LOG OF BORING 2-B1

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/22/2016
HOLE DEPTH: Approx. 66½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			CLAYEY SAND (SC), yellowish brown mottled with reddish brown, dense, wet (ALLUVIUM)												
	-50														
65			POORLY GRADED SAND TO CLAYEY SAND (SP-SC), dark yellowish brown, dense, wet			31					24.5				
			Bottom of boring at approximately 66.5 feet below existing grade. Groundwater encountered during drilling at approximately 8 feet below existing grade.												

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

ENGEO INCORPORATED

LOG OF BORING 2-B2

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/21/2016
HOLE DEPTH: Approx. 111½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
		Gravel shoulder on waterside of pedestrian trail. Hollow stem auger drilling used to start boring.										
	10	SANDY LEAN CLAY (CL), yellowish brown, stiff, moist, trace fine gravel (FILL)	13				38	19.8	100.4		1.50*	PP
		SANDY LEAN CLAY (CL), brown, stiff, moist, some shell fragments (FILL)										
		LEAN CLAY (CL), brown mottled with yellowish brown, stiff, moist, trace shell fragments (FILL)	7								1.50*	PP
5												
	5		2									
		FAT CLAY (CH), grayish green, soft, wet (YOUNG BAY MUD)						70.8	56.2			
		Switch to mud rotary drilling at approximately 9.5 feet below existing grade.										
10		FAT CLAY (CH), grayish green, soft, wet	50 psi	76	24	52		76.5	54.8	328		UU
	0											
15												
	-5	FAT CLAY (CH), grayish green, soft, wet, some shell fragments	50 psi					81.9	53.6	439		LVS
20												

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

LOG OF BORING 2-B2

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/21/2016
HOLE DEPTH: Approx. 111½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	-10														
25			FAT CLAY (CH), grayish green, medium stiff, wet, some shell fragments			75 psi					59.1	65.9	516		LVS
	-15														
30															
	-20														
35			FAT CLAY (CH), grayish green, medium stiff, wet, trace shell fragments			100 psi					59.6	65.2	566		UU
	-25											49	73.2			
40															

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

ENGEO INCORPORATED

LOG OF BORING 2-B2

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/21/2016
HOLE DEPTH: Approx. 111½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	-30														
45															
	-35														
			FAT CLAY (CH), grayish green, medium stiff, wet			0					49.8	69.1			
50															
	-40														
55															
	-45														
60															

ENGEO INCORPORATED

LOG OF BORING 2-B2

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/21/2016
HOLE DEPTH: Approx. 111½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			FAT CLAY (CH), grayish green, medium stiff, wet												
						75 psi							916		LVS
	-50										32.6	87.2			
65															
	-55														
70			FAT CLAY (CH), grayish green, medium stiff, wet			0					42.6	75.9			
	-60														
			At 74 feet, driller notes harder drilling; cuttings change to bluish gray.												
75															
	-65														
80															

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

LOG OF BORING 2-B2

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/21/2016
HOLE DEPTH: Approx. 111½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			LEAN CLAY (CL), bluish gray mottled with greenish gray, stiff, wet (ALLUVIUM)			30					27.2	96.9		1.25*	PP
	-70														
85															
	-75														
90			FAT CLAY (CH), dark yellowish brown, medium stiff, wet			7					36.2	85.3		0.50*	PP
	-80														
95			From 95 to 97 feet, driller notes harder drilling; drilling cuttings are sandy												
	-85														
100															

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

ENGEO INCORPORATED

LOG OF BORING 2-B2

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/21/2016
HOLE DEPTH: Approx. 111½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			FAT CLAY (CH), dark yellowish brown mottled with gray, stiff, wet			7					29			1.00*	PP
	-90														
105															
	-95		At 107 feet, cuttings change to sand												
110			POORLY GRADED SAND (SP), brown, medium dense, wet			32					26.2				
			Bottom of boring at approximately 111.5 feet below existing grade. Groundwater not measured due to mud rotary drilling method.												

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

ENGEO INCORPORATED

LOG OF BORING 2-B3

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/22/2016
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			Gravel shoulder on waterside of pedestrian trail.												
	10		POORLY GRADED SAND (SP), yellowish brown, very dense, moist, with fine to coarse gravel, trace shell fragments (FILL)			79				1	10.9	122.9			
5			POORLY GRADED GRAVEL (SP), brown mottled with yellowish red, medium dense, moist, trace fine gravel			22				2	19.4	71			
	5		GRAVELLY LEAN CLAY (CL), olive brown, medium stiff, moist to wet, trace shell fragments (FILL)		∇										
			FAT CLAY (CH), grayish green, soft, wet, trace shell fragments (YOUNG BAY MUD)			0									
10			FAT CLAY (CH), grayish green, soft, wet, trace shell fragments			0					51.3				
			Bottom of boring at approximately 11.5 feet below existing grade. Groundwater encountered at approximately 6.5 feet during drilling.												

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

ENGEO INCORPORATED

LOG OF BORING 2-B4

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/24/2016
HOLE DEPTH: Approx. 41½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: S. Barua / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
		4 inches asphaltic concrete										
	10	FAT CLAY (CH), dark brown, stiff to very stiff, moist, some fine-grained sand (FILL)									3.25*	PP
			15									
				80	32	48	87	47	72.9		1.38	UC
5		FAT CLAY (CH), dark gray mottled with dark brown, soft, wet, trace organics (YOUNG BAY MUD)	0									
	5	FAT CLAY (CH), dark gray, soft, wet, trace organics	0					83.7	49.4	359		LVS
10			0									
	0											
15		FAT CLAY (CH), dark gray, soft, wet	0					96.1	47.4			
										364		LVS
	-5											
20												

ENGEO INCORPORATED

LOG OF BORING 2-B4

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/24/2016
HOLE DEPTH: Approx. 41½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: S. Barua / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	-10		FAT CLAY (CH), dark gray, soft, wet			0					90.1	48.4	276		UU
25			FAT CLAY (CH), dark gray, soft, wet			0					77	52.7	390		LVS
30	-15		FAT CLAY (CH), dark gray, soft, wet			0					75.3	52.3			
35	-20		SANDY LEAN CLAY (CL), dark bluish gray mottled with dark gray, very stiff, wet, trace fine gravel (ALLUVIUM)			24				67	20.1	107.9		2.25*	PP
40	-25														

LOG OF BORING 2-B4

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/24/2016
HOLE DEPTH: Approx. 41½ ft.
HOLE DIAMETER: 7.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

LOGGED / REVIEWED BY: S. Barua / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: HSA/Mud Rotary
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	Plastic Limit	Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			SANDY LEAN CLAY (CL), dark yellowish brown, very stiff, wet			22					19.4			2.50*	PP
			Bottom of boring at approximately 41.5 feet below existing grade. Groundwater encountered at approximately 4.5 feet during drilling.												

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

ENGEO INCORPORATED

LOG OF BORING 2-B5

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/22/2016
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (NAVD 88): Approx. 11 ft.

LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			Dirt shoulder on waterside of paved pedestrian trail												
	10		CLAYEY SAND (SC), dark brown mottled with reddish brown, medium dense, moist, some gravel, trace shell fragments			18				31	12.8				
5			LEAN CLAY (CL), gray mottled with reddish brown, medium stiff, moist, trace shell fragments			16				95	44.9	54.3		0.50*	PP
	5		POORLY GRADED SAND (SP), dark olive brown, loose, moist		∇										
			FAT CLAY (CH), grayish green, soft, wet			6					70.8	70.4			
10	0		FAT CLAY (CH), grayish green, soft, wet			0					87	70.4	325*		TV
			Bottom of boring at approximately 11.5 feet below existing grade. Groundwater encountered at approximately 7 feet during drilling.												

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

LOG OF BORING 2-B6

ENGEO INCORPORATED

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/23/2016
HOLE DEPTH: Approx. 8½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (NAVD 88): Approx. 11 ft.

LOGGED / REVIEWED BY: S. Barua / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			2.5 inches asphaltic concrete												
	10		SANDY LEAN CLAY (CL), dark yellowish brown mottled with reddish brown, very stiff, moist, trace shell fragments (FILL)			14	40	16	24	54	21.5	96.9		2.5*	PP
5	5		FAT CLAY (CH), dark gray mottled with grayish brown, soft, wet (YOUNG BAY MUD)		▽	0					67.1	93.3			
			FAT CLAY (CH), dark gray mottled with grayish brown, soft, wet			0					87.5				

SHEAR AND UNCONF STRENGTH W/ ELEV 8602.001.000 FOSTER CITY GINT LOGS.GPJ ENGEO INC.GDT 8/31/16

ENGEO INCORPORATED

LOG OF BORING 2-B7

Geotechnical Exploration
Levee Improvements Project
Foster City, California
8602.001.000

DATE DRILLED: 3/21/2016
HOLE DEPTH: Approx. 13½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (NAVD 88): Approx. 12 ft.

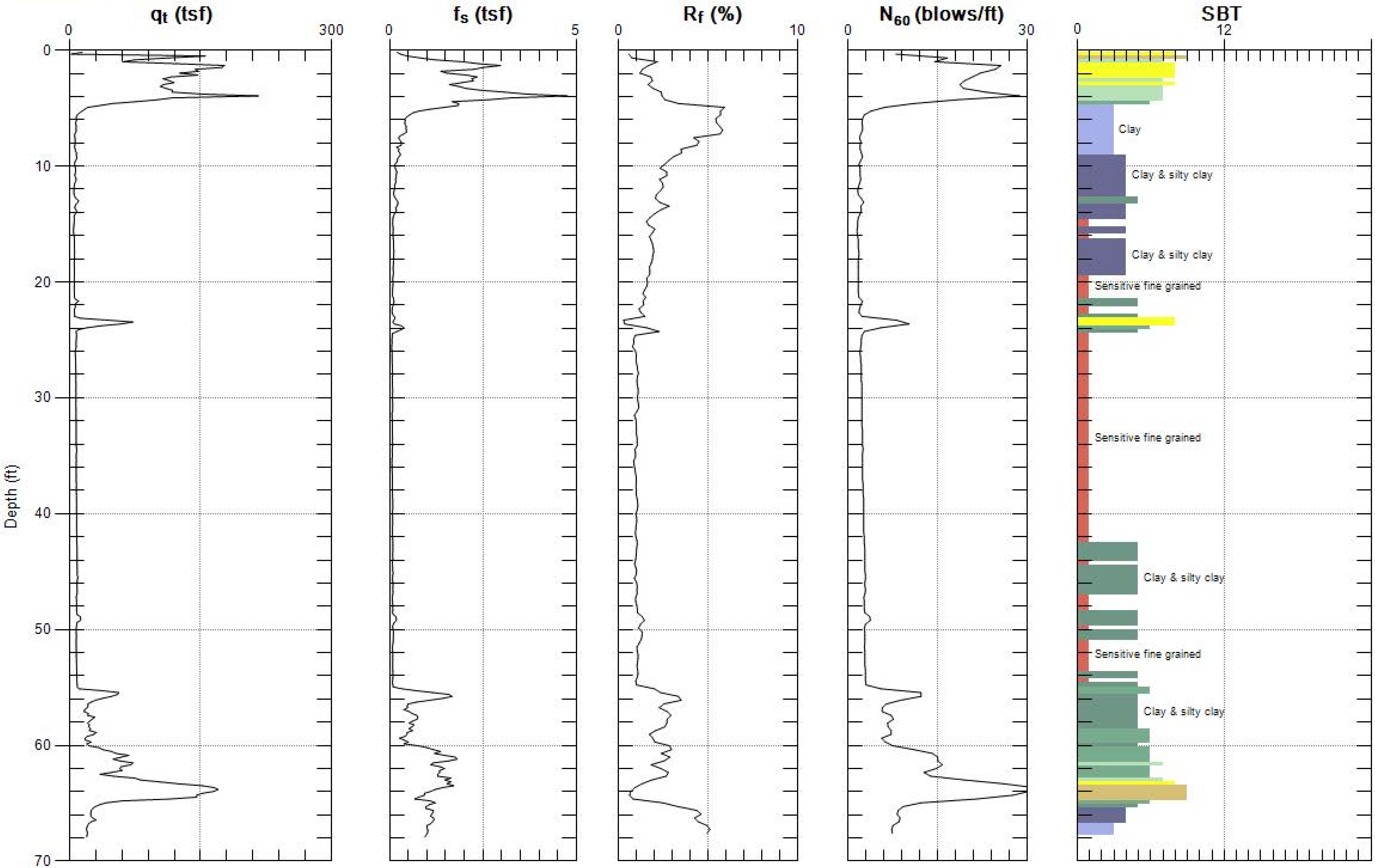
LOGGED / REVIEWED BY: M. Clark / A. Firmin
DRILLING CONTRACTOR: Pitcher Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: 140 lb. Auto Trip

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)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			Dirt shoulder on waterside of paved pedestrian trail												
	10		POORLY GRADED SAND (SP), dark yellowish brown, medium dense, moist, trace shell fragments (FILL)			17									
			LEAN CLAY (CL), dark brown, medium stiff, moist, with shell fragments (FILL)								16.9	100.4			
5															
	5		LEAN CLAY (CL), dark brown, medium stiff, moist, with shell fragments (FILL)			3									
			CLAYEY SAND (SC), dark gray, loose, wet, some shell fragments (FILL)		∇										
10			FAT CLAY (CH), dark gray, soft, wet (YOUNG BAY MUD)			6					57.4	65		0.25*	PP
	0		FAT CLAY (CH), dark gray, soft, wet			0									

GREGG ENGEO

Site: FOSTER CITY LEVEE
Sounding: 2-CPT1

Engineer: M.CLARK
Date: 3/15/2016 08:36



Max. Depth: 67.913 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

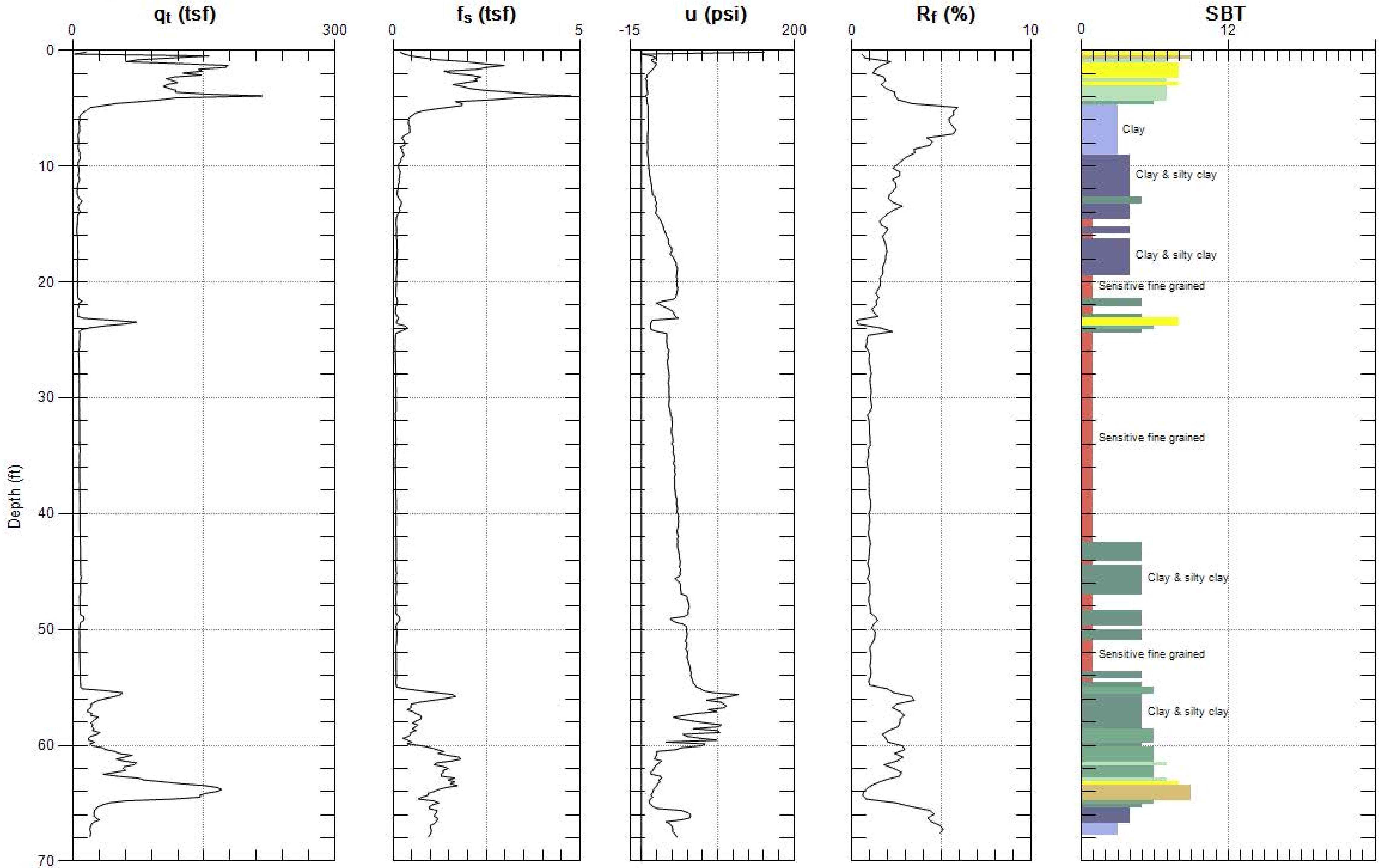
ENGEO

Site: FOSTER CITY LEVEE

Sounding: 2-CPT1

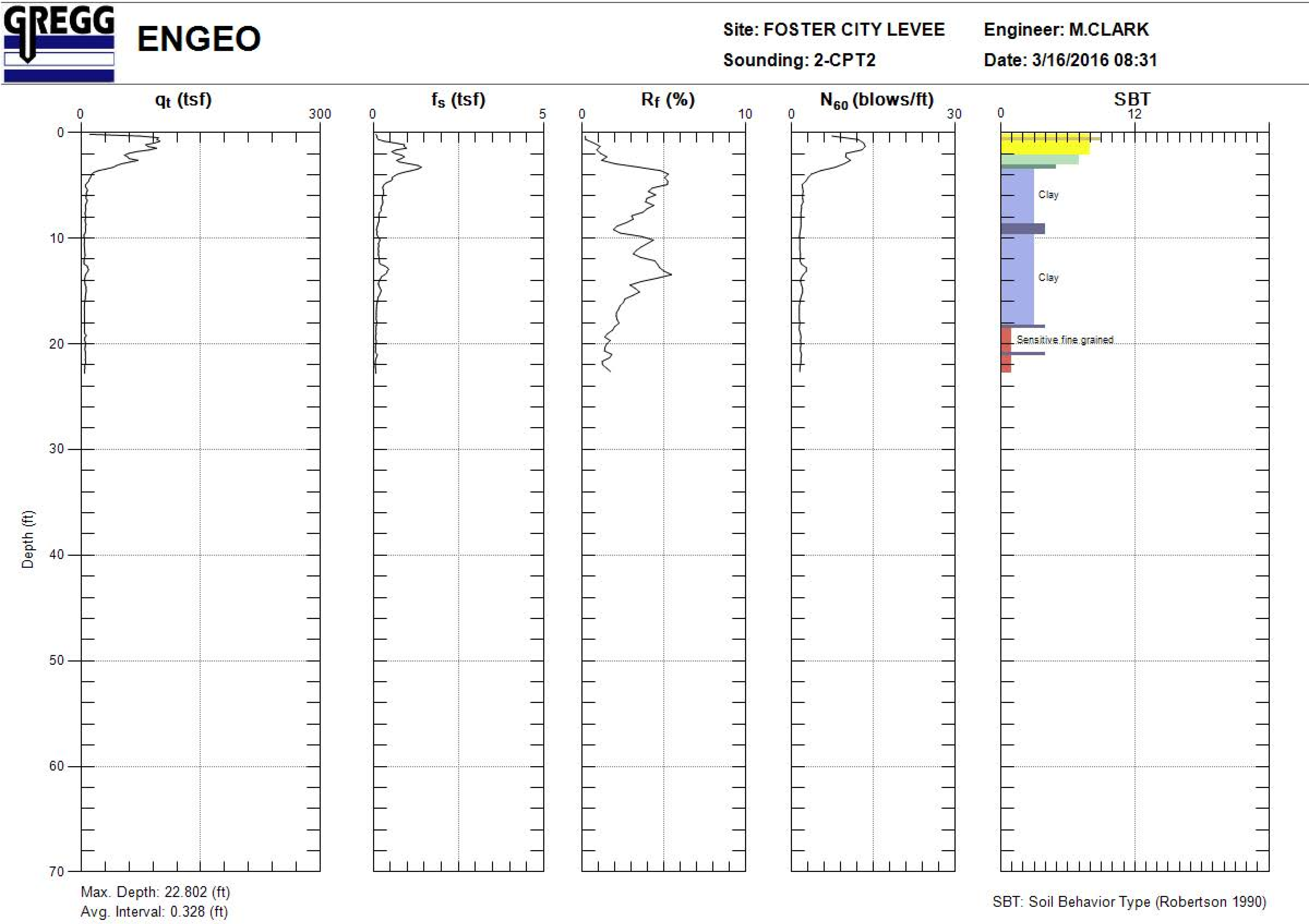
Engineer: M.CLARK

Date: 3/15/2016 08:36



Max. Depth: 67.913 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

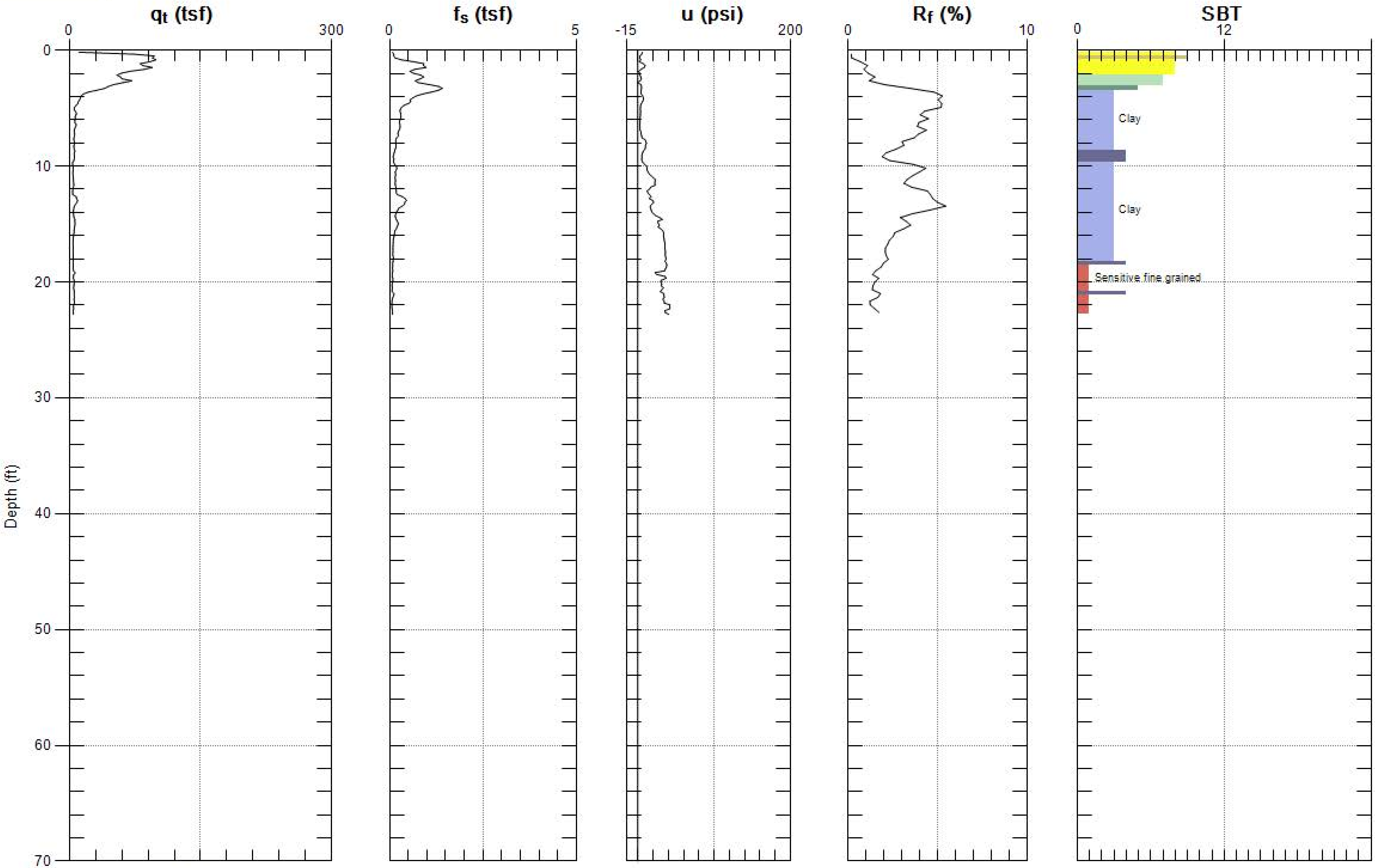


GREGG
ENGEO
Site: FOSTER CITY LEVEE
Sounding: 2-CPT2
Engineer: M.CLARK
Date: 3/16/2016 08:31
q_t (tsf)
f_s (tsf)
R_f (%)
N_{60} (blows/ft)
SBT
Depth (ft)
Clay
Clay
Sensitive fine grained
Max. Depth: 22.802 (ft)
Avg. Interval: 0.328 (ft)
SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: FOSTER CITY LEVEE
Sounding: 2-CPT2

Engineer: M.CLARK
Date: 3/16/2016 08:31



Max. Depth: 22.802 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

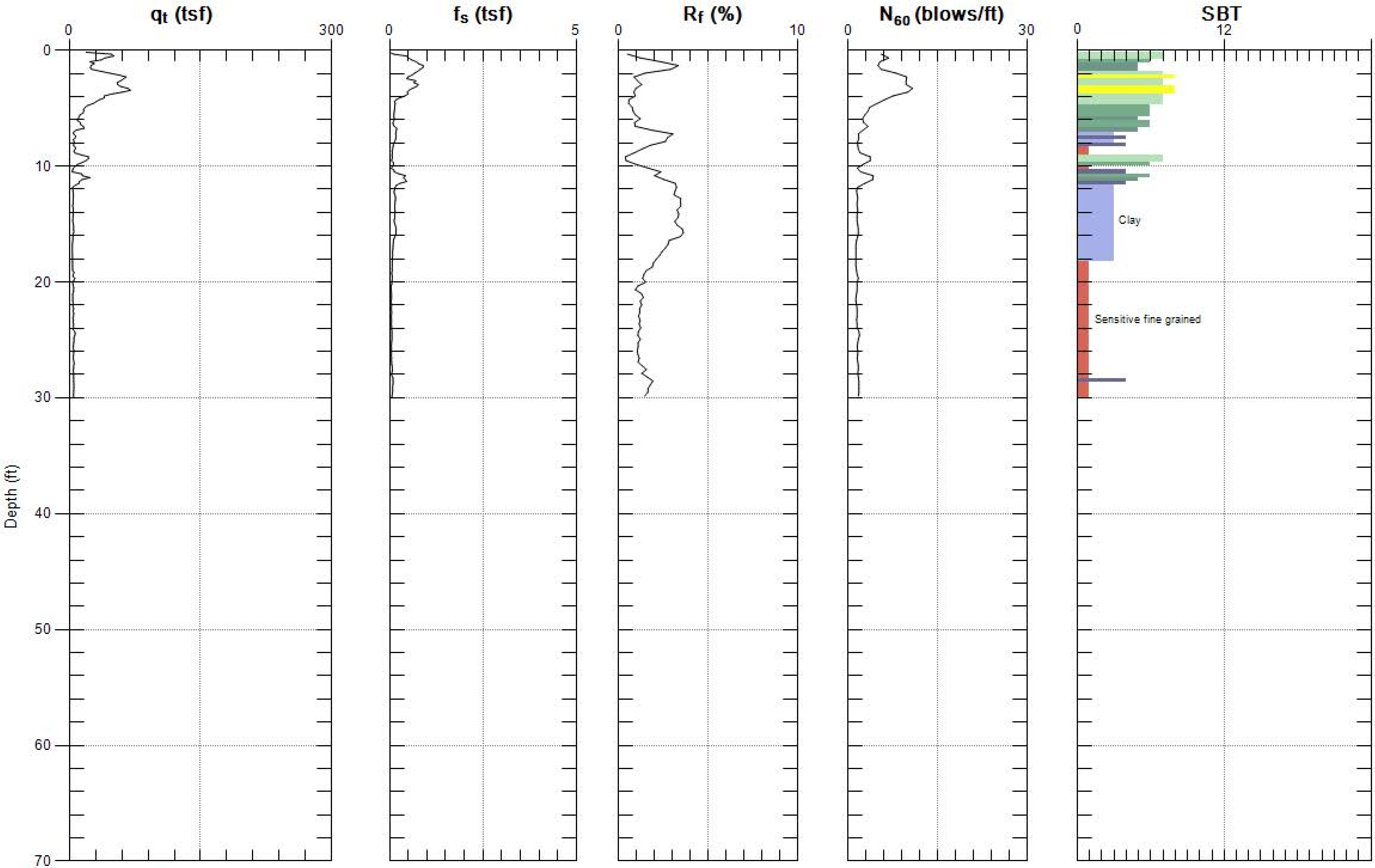
ENGEO

Site: FOSTER CITY LEVEE

Engineer: M.CLARK

Sounding: 2-CPT3

Date: 3/16/2016 10:32

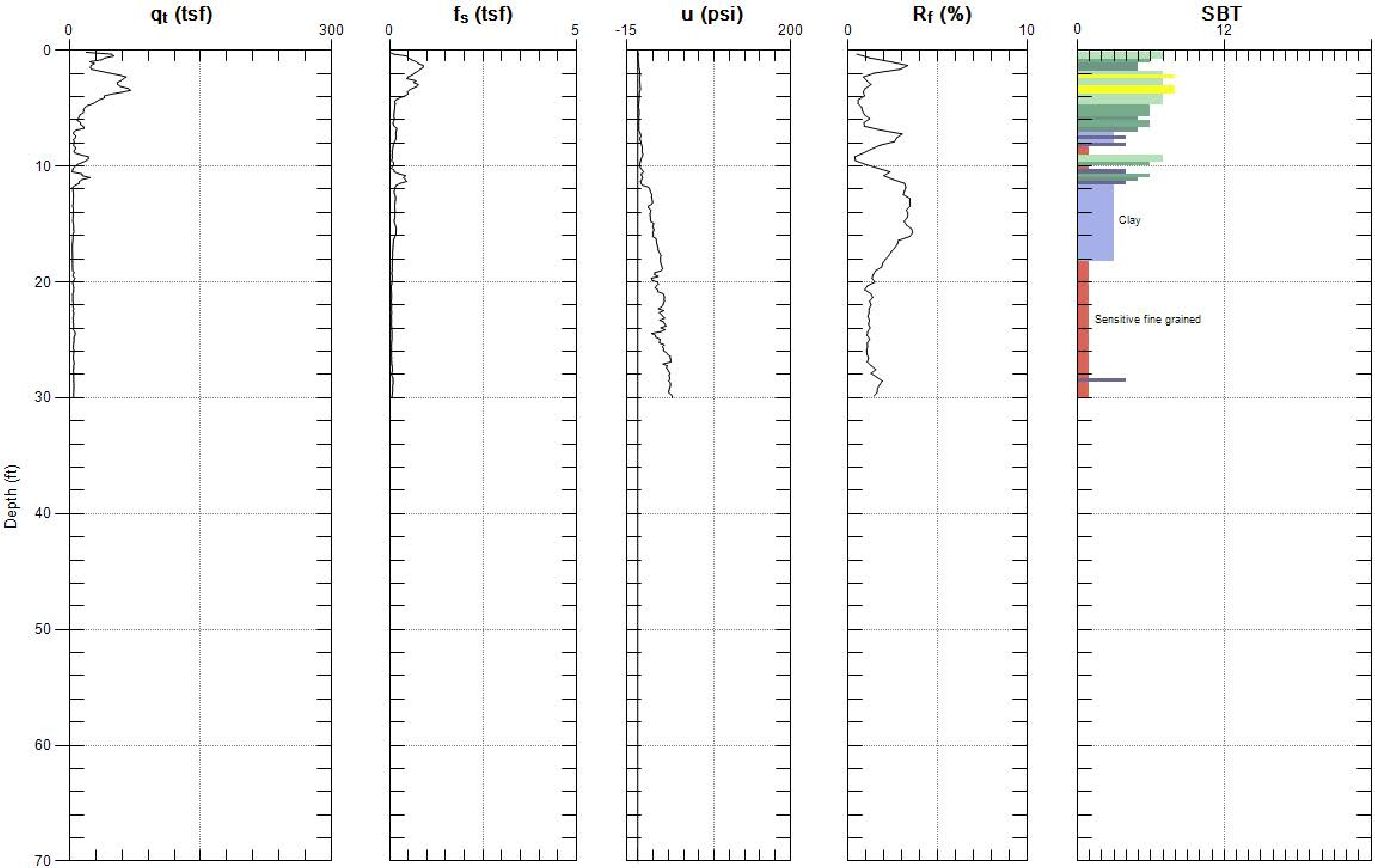


Max. Depth: 30.020 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

ENGEO

Site: FOSTER CITY LEVEE
Sounding: 2-CPT3
Engineer: M.CLARK
Date: 3/16/2016 10:32



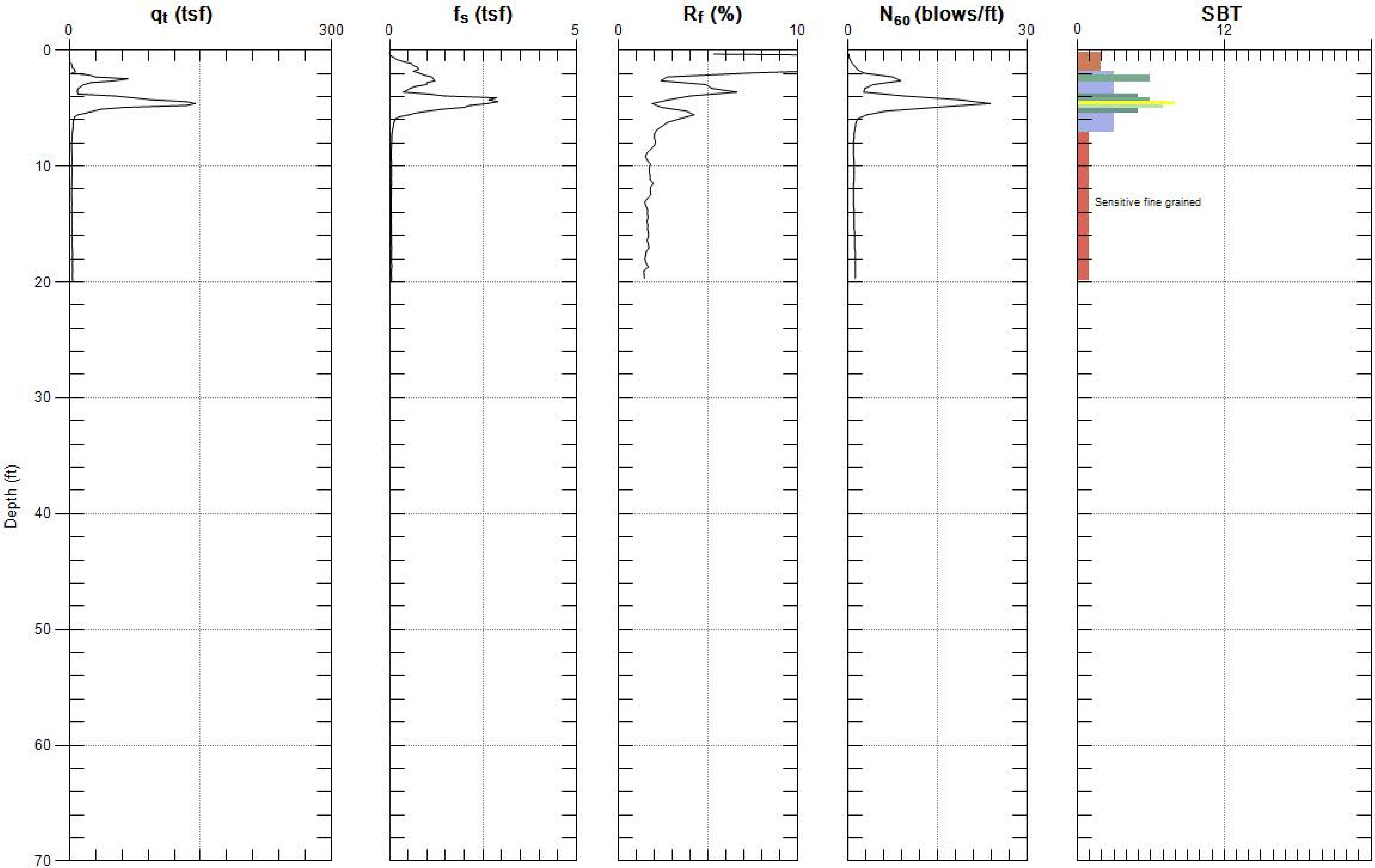
Max. Depth: 30.020 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **ENGEO**

Site: FOSTER CITY LEVEE **Engineer: M.CLARK**

Sounding: 2-CPT4 **Date: 3/15/2016 12:00**



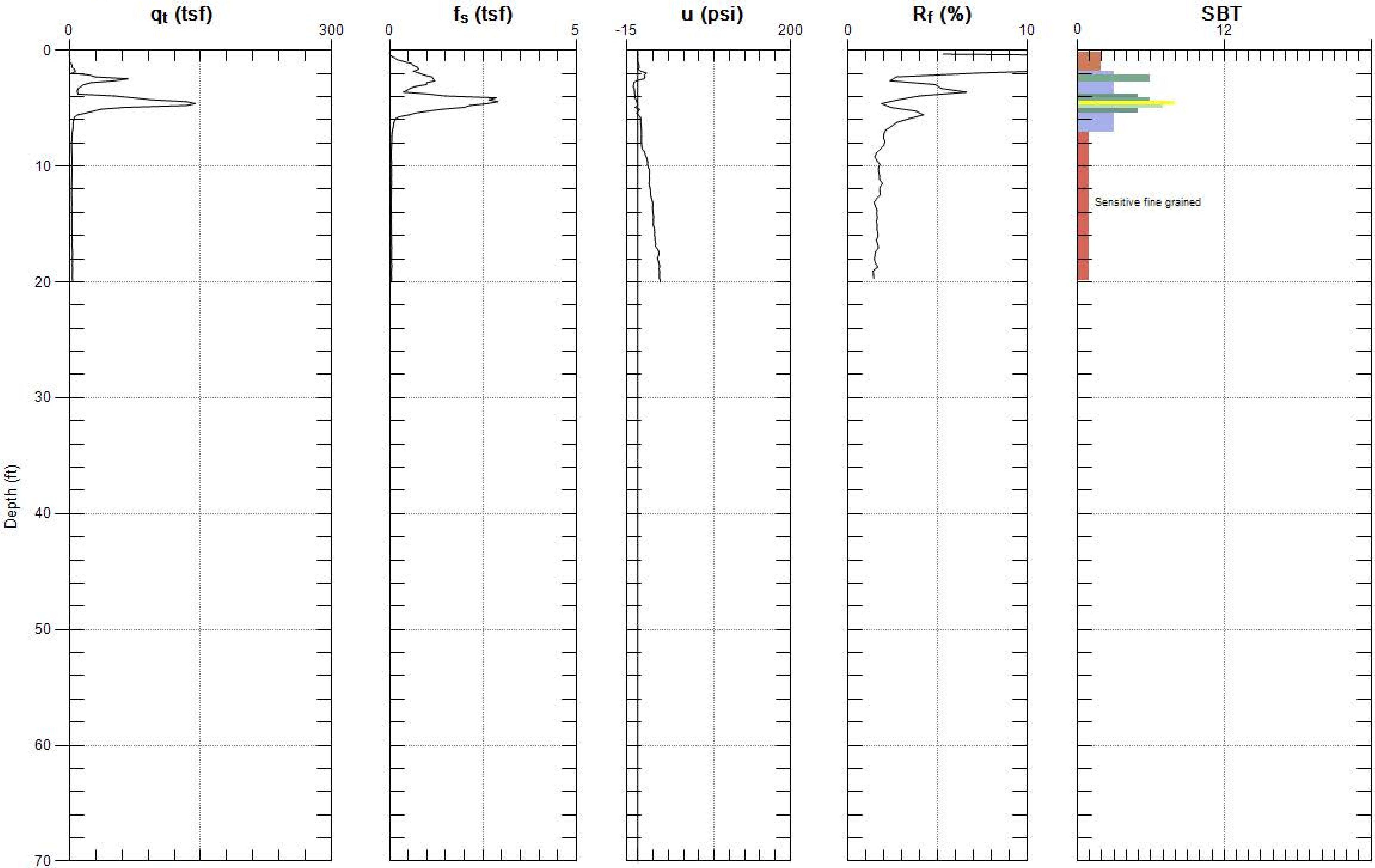
Max. Depth: 20.013 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: FOSTER CITY LEVEE
Sounding: 2-CPT4

Engineer: M.CLARK
Date: 3/15/2016 12:00



Max. Depth: 20.013 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

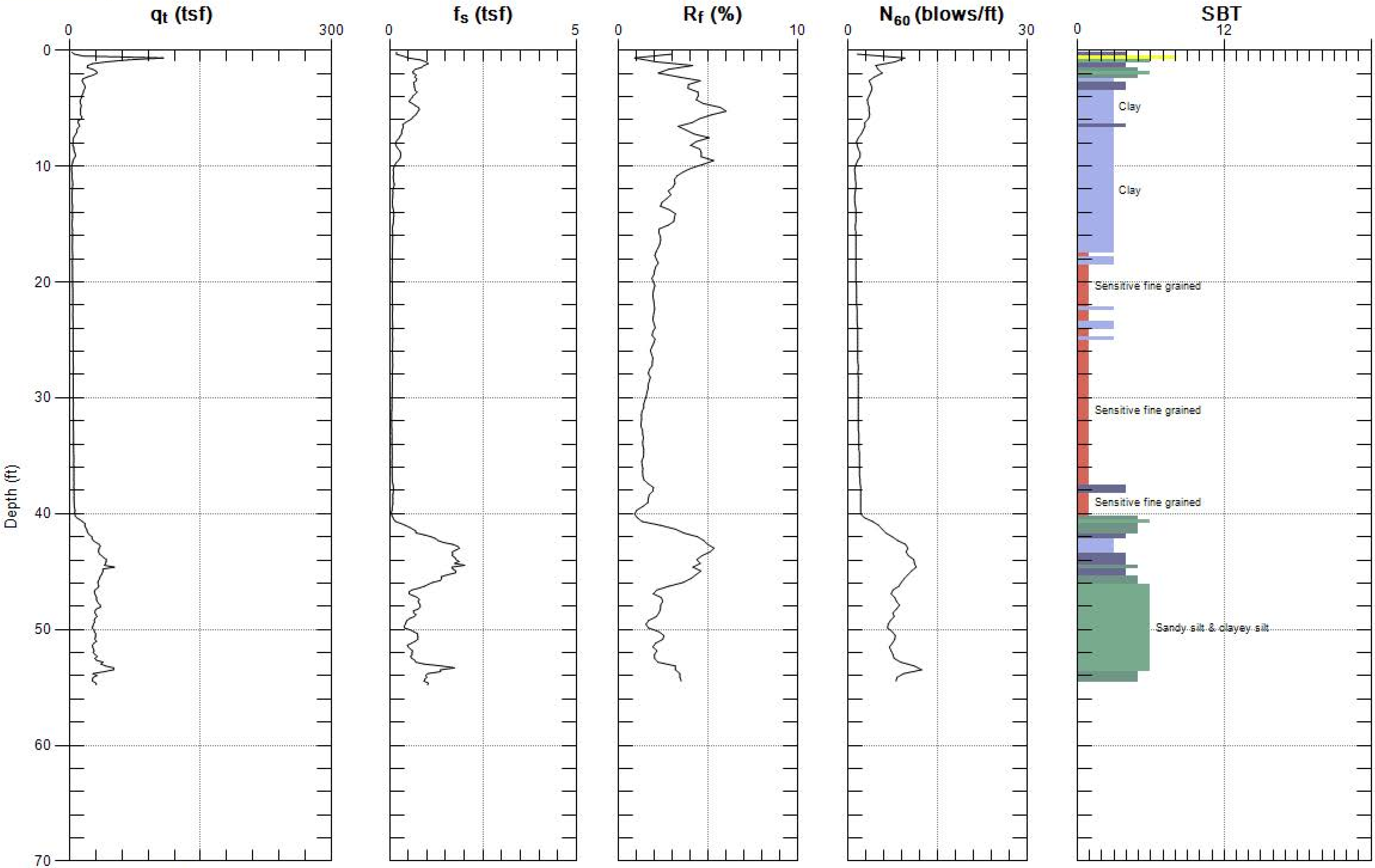
ENGEO

Site: FOSTER CITY LEVEE

Sounding: 2-CPT5

Engineer: M.CLARK

Date: 3/15/2016 10:53

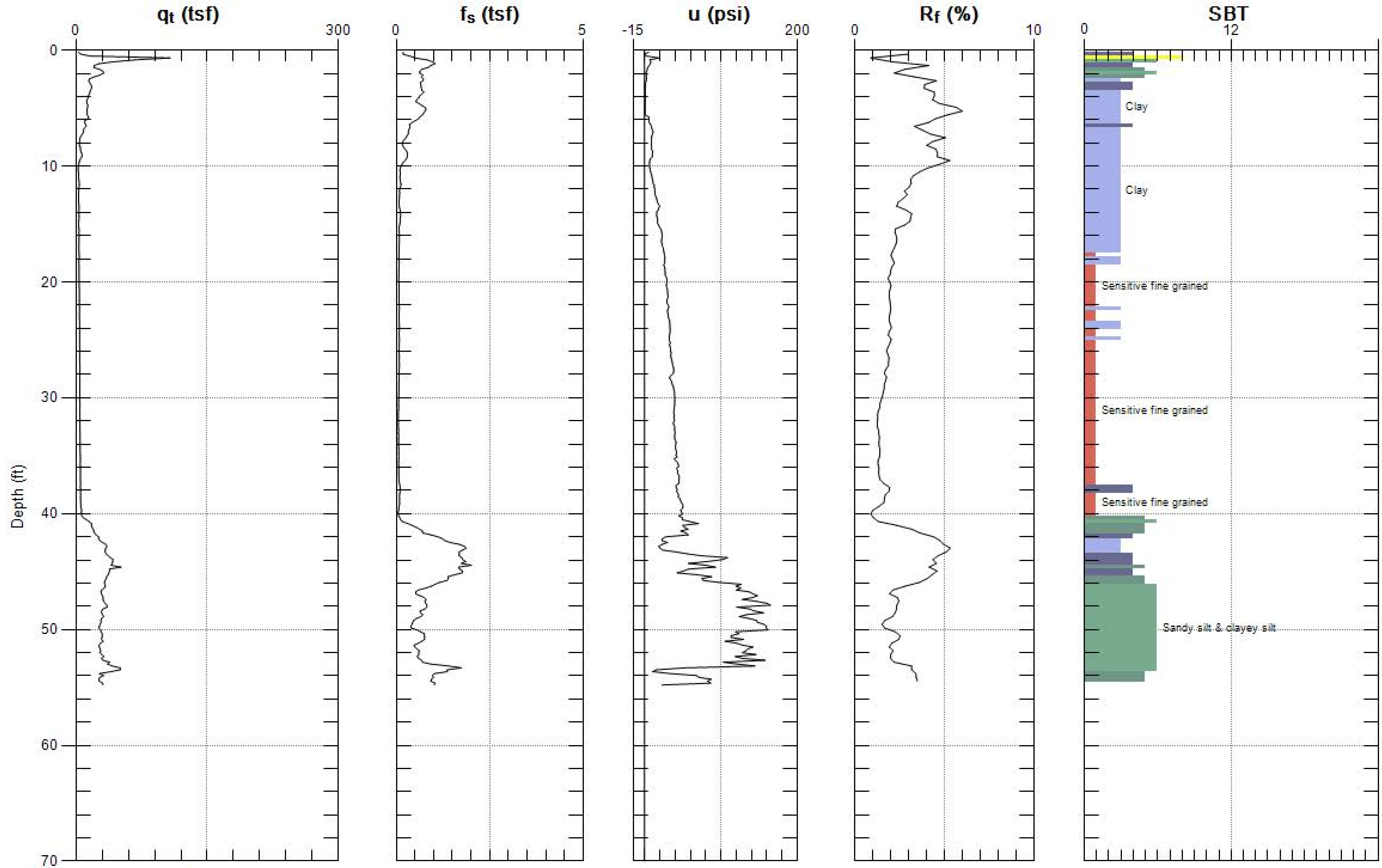


Max. Depth: 54.790 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: FOSTER CITY LEVEE
Sounding: 2-CPT5
Engineer: M.CLARK
Date: 3/15/2016 10:53



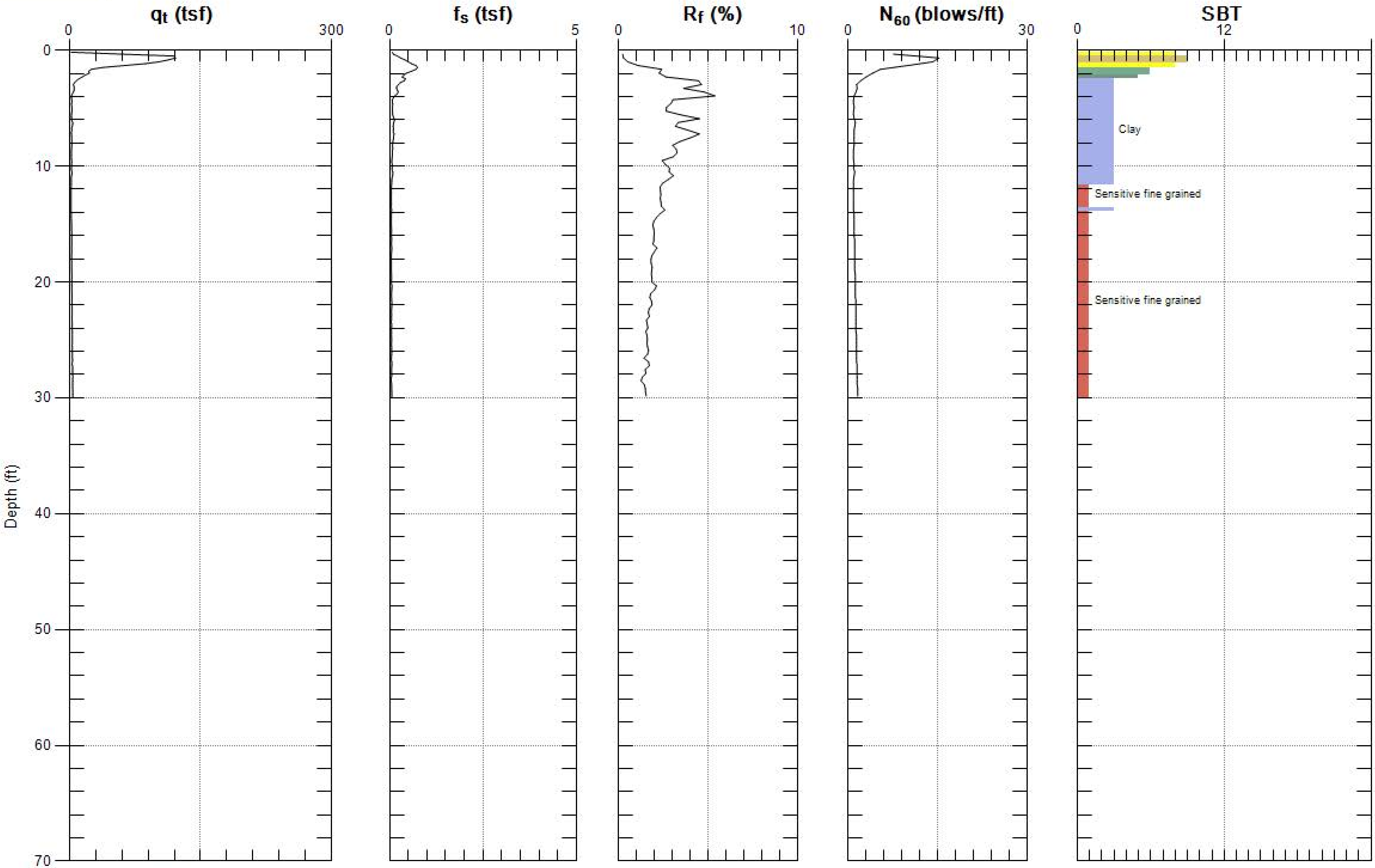
Max. Depth: 54.790 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG ENGEO

Site: FOSTER CITY LEVEE
Sounding: 2-CPT6

Engineer: M.CLARK
Date: 3/16/2016 11:50



Max. Depth: 30.020 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

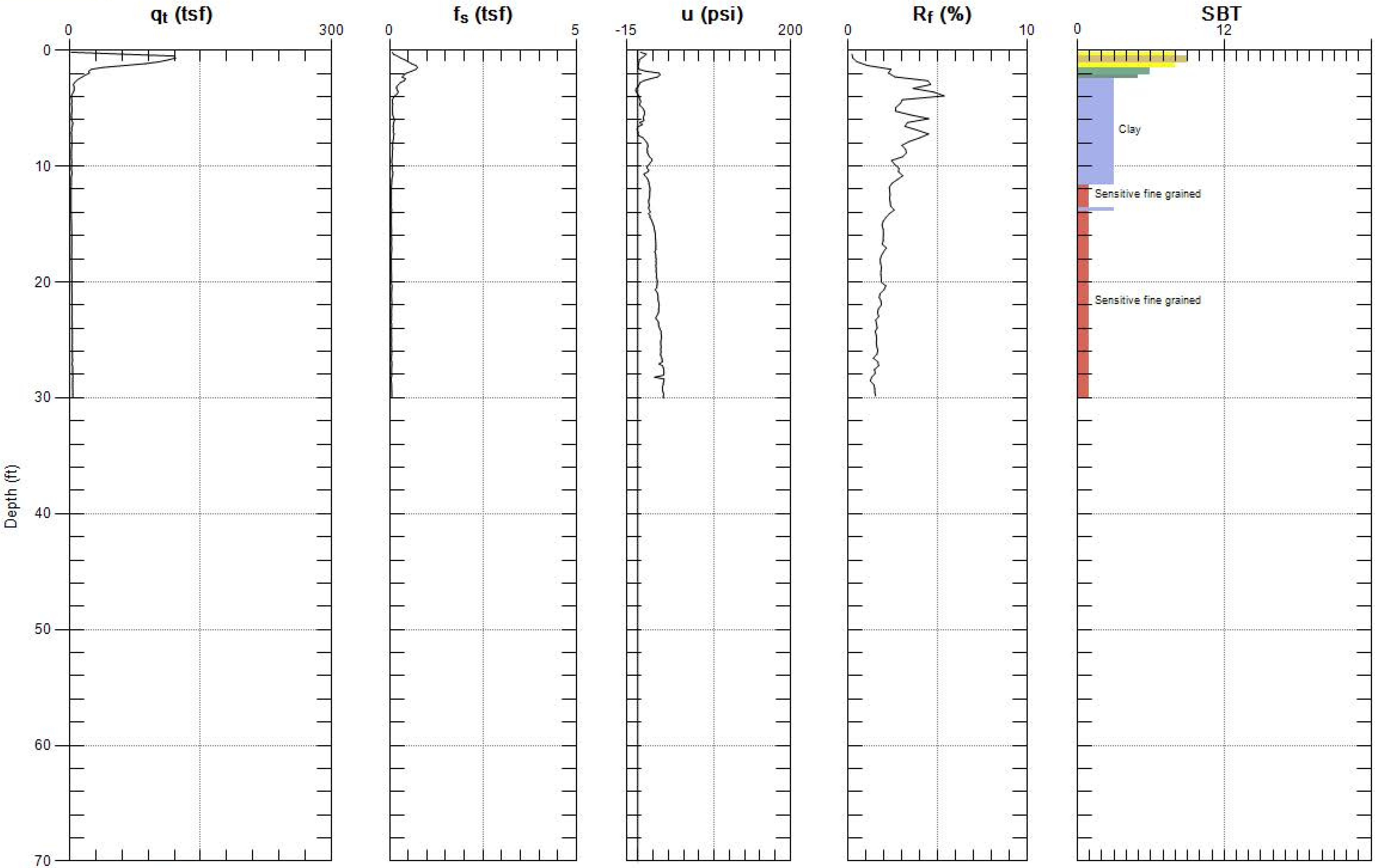
ENGEO

Site: FOSTER CITY LEVEE

Sounding: 2-CPT6

Engineer: M.CLARK

Date: 3/16/2016 11:50



Max. Depth: 30.020 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

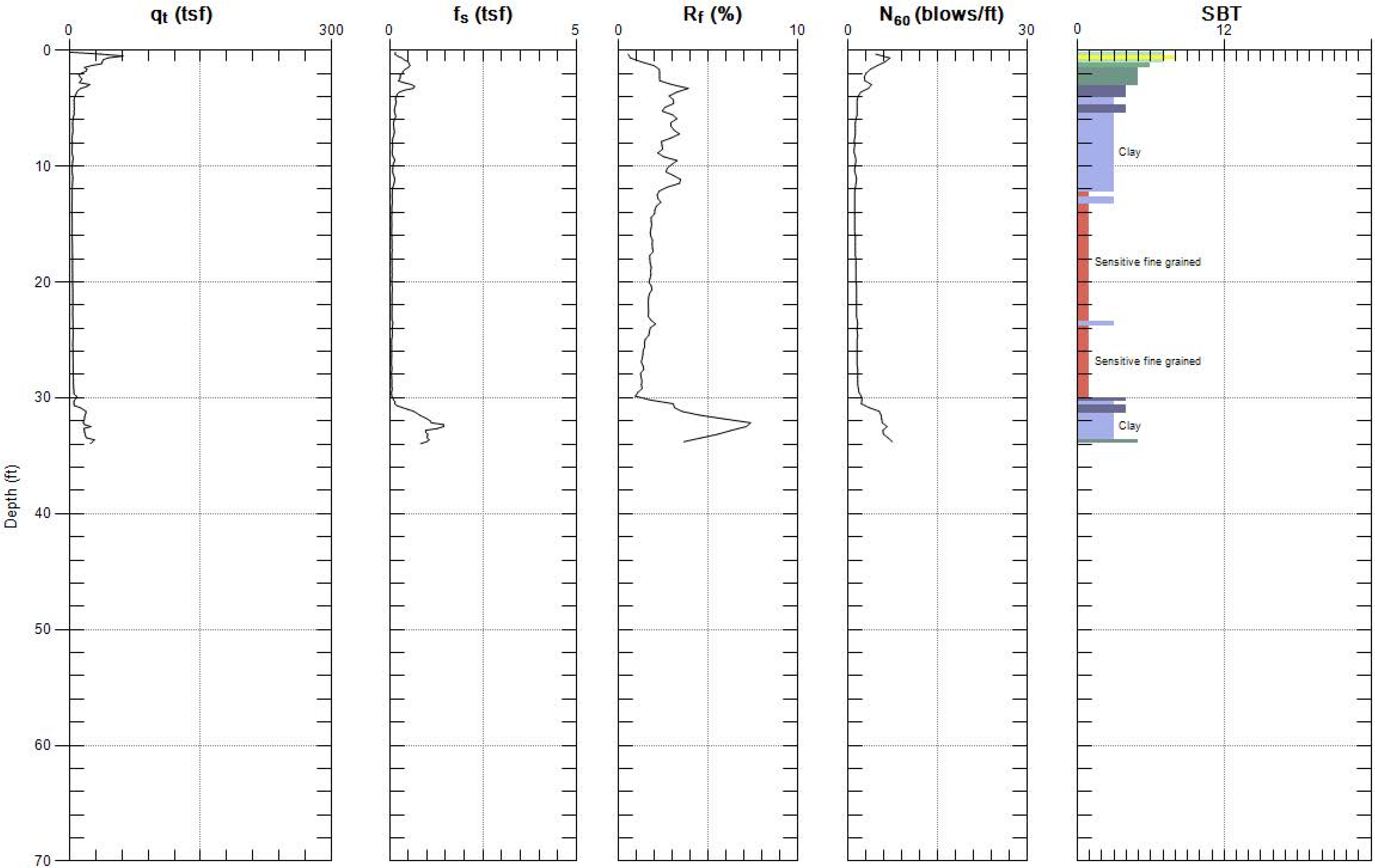
GREGG ENGEO

Site: FOSTER CITY LEVEE

Sounding: 2-CPT7

Engineer: M.CLARK

Date: 3/15/2016 04:26



Max. Depth: 33.957 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

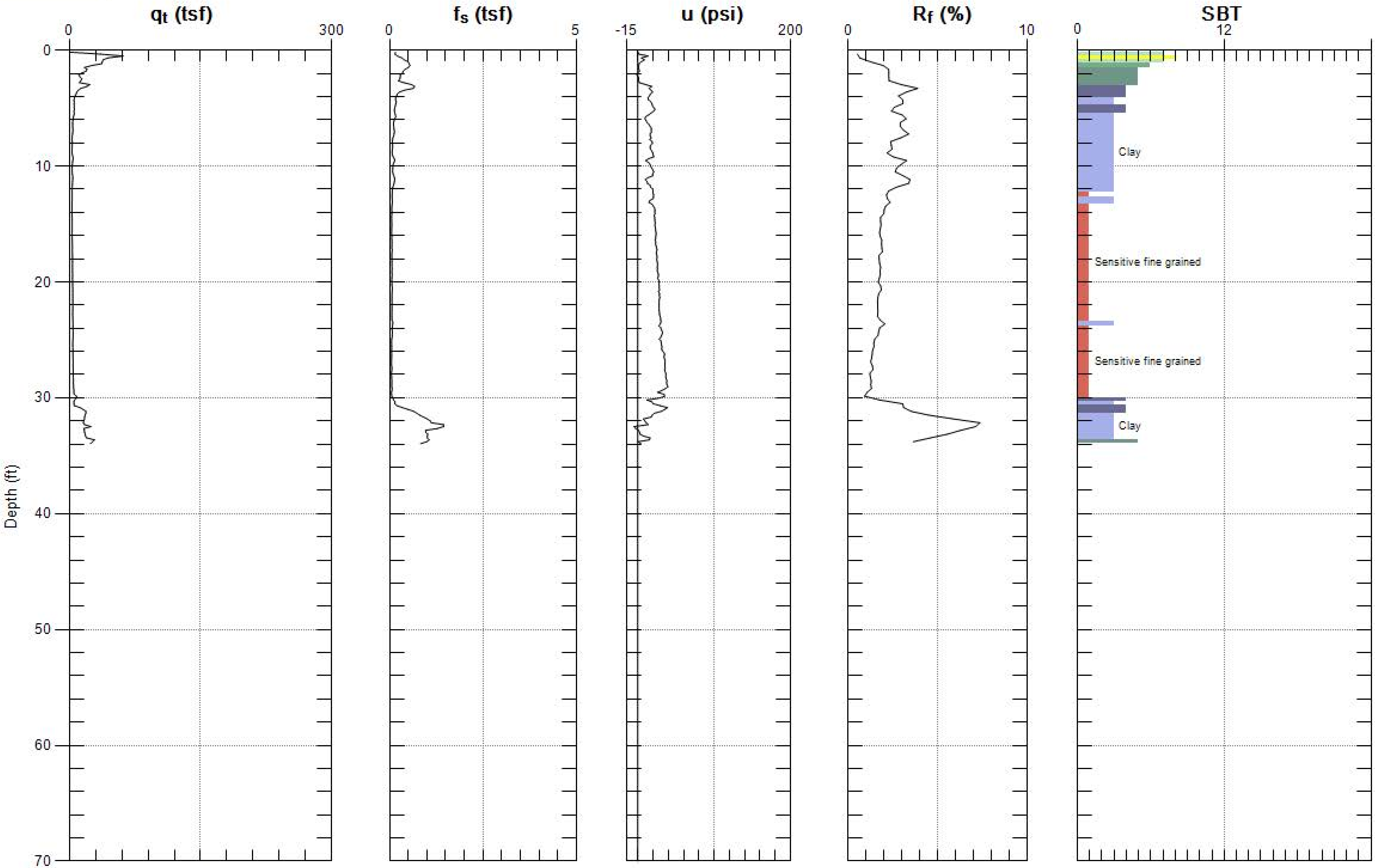
ENGEO

Site: FOSTER CITY LEVEE

Sounding: 2-CPT7

Engineer: M.CLARK

Date: 3/15/2016 04:26



Max. Depth: 33.957 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

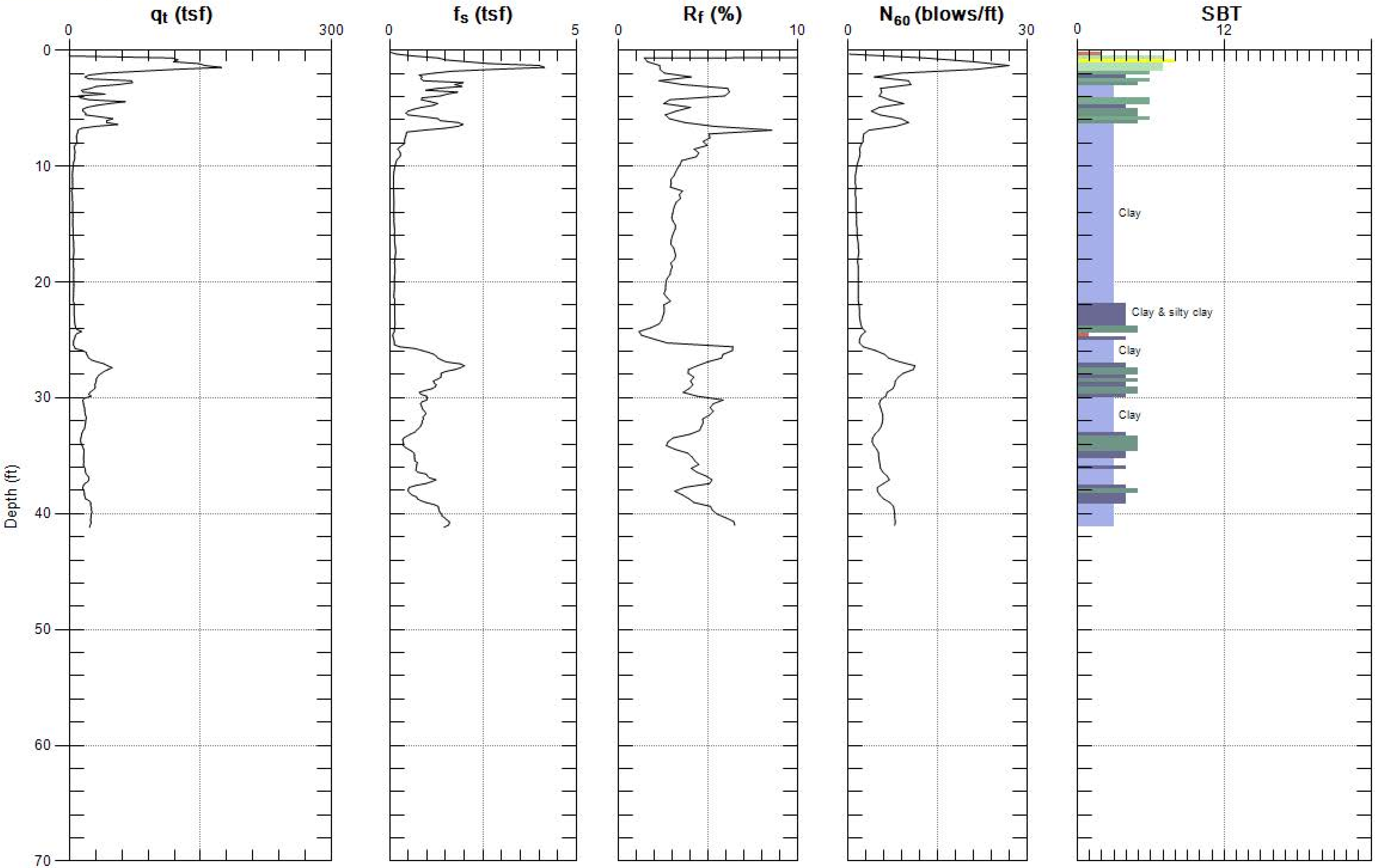
ENGEO

Site: FOSTER CITY LEVEE

Sounding: 2-CPT8

Engineer: M.CLARK

Date: 3/15/2016 02:24



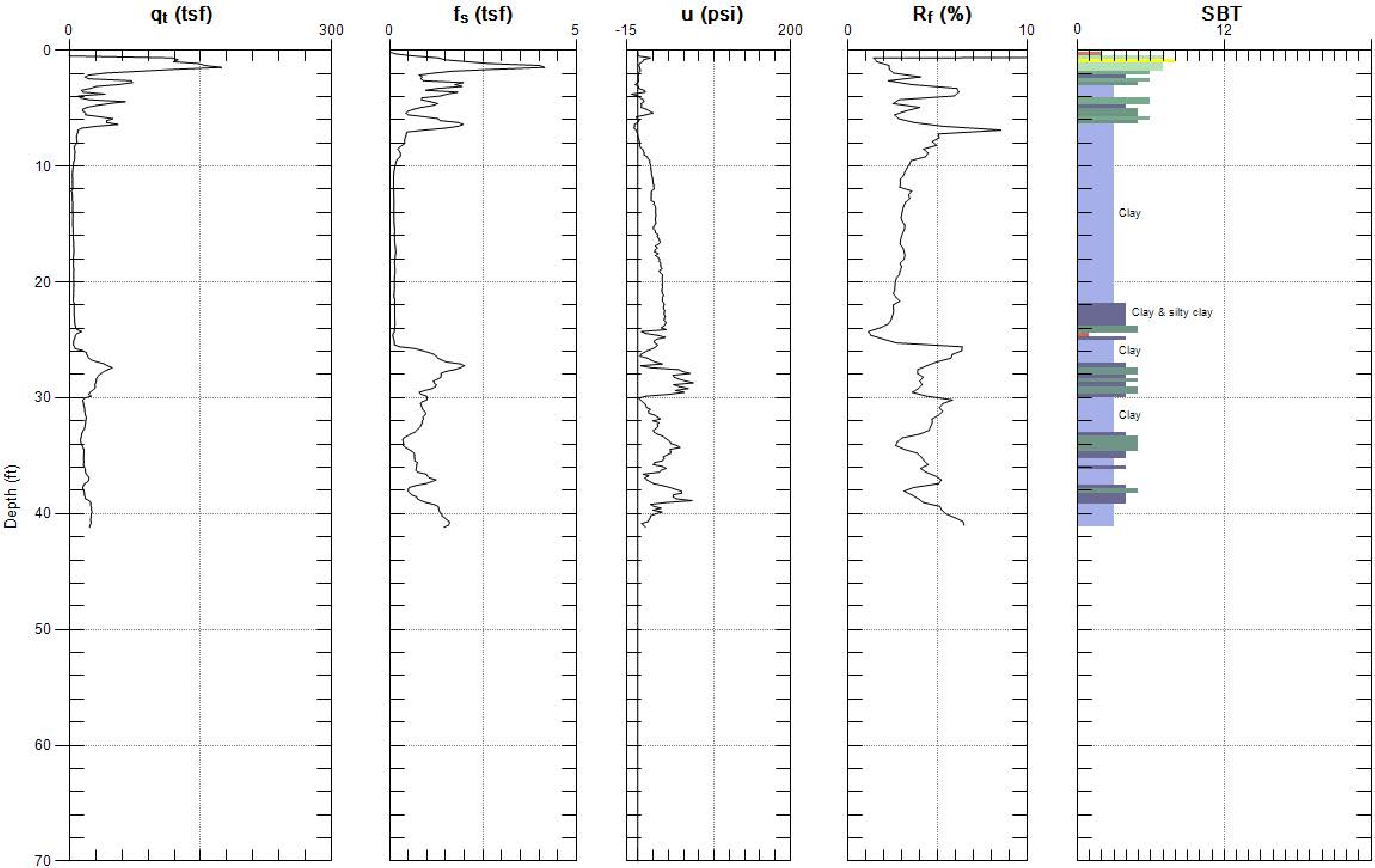
Max. Depth: 41.175 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **ENGEO**

Site: FOSTER CITY LEVEE **Engineer: M.CLARK**

Sounding: 2-CPT8 **Date: 3/15/2016 02:24**



Max. Depth: 41.175 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

April 27, 2016

Engeo
Attn: Seema Barua

Subject: CPT Site Investigation
Beach Park Blvd., Foster City Levee
Foster City, California

Dear Mr. Barua:

The following report presents the results of GREGG Drilling & Testing's Field Vane Shear Tests for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☐
2	Pore Pressure Dissipation Tests	(PPD)	☐
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	UVOST Laser Induced Fluorescence	(UVOST)	☐
5	Groundwater Sampling	(GWS)	☐
6	Soil Sampling	(SS)	☐
7	Vapor Sampling	(VS)	☐
8	Pressuremeter Testing	(PMT)	☐
9	Vane Shear Testing	(VST)	☒
10	Dilatometer Testing	(DMT)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (562) 427-6899.

Sincerely,
GREGG Drilling & Testing, Inc.

Peter Robertson
Technical Director, Gregg Drilling & Testing, Inc.

2726 Walnut Ave. • Signal Hill, California 90755 • (562) 427-6899 • FAX (562) 427-3314
www.greggdrilling.com

Field Vane Shear Test Summary

-Table 1-

FVST Sounding Identification	Date	Test Depths (feet)	Comments
2-VST1	3/23/16	11.5, 15, 20, 25, 30, 35, 40, 50	-

Bibliography

Greig, J.W., R.G. Campanella and P.K. Robertson, "Comparison of Field Vane Results With Other In-Situ Test Results", International Symposium on Laboratory and Field Vane Shear Strength Testing, ASTM, Tampa FL, Proceedings, 1987

Mayne, P.W., "NHI (2002) Manual on Subsurface Investigations: Geotechnical Site Characterization", available through www.ce.gatech.edu/~geosys/Faculty/Mayne/papers/index.html, Section 5.3, pp.107=112.

Richards, Adrian F. (Editor), "Vane Shear Testing in Soils", The International Symposium on Laboratory and Field Vane Shear Strength Testing, January 1987.

Chandler, R.J., "The In-Situ Measurement of the Undrained Shear Strength of Clays Using the Field Vane," Vane Shear Testing in Soils: Field and Laboratory Studies, ASTM STP 1014, A.F. Richards, Ed., American Society for Testing and Materials, Philadelphia, 1988, pp. 13-44.

Copies of ASTM Standards are available through www.astm.org

CLIENT	Engeo
SITE	Foster City
LOCATION	2-VST1
VANE TYPE	Geonor H-10
VANE DIAMETER, d (mm)	55
VANE LENGTH, l (mm)	110

GREGG

DEPTH (m)	DEPTH (ft)	SHEAR STRENGTH (kPa)	SHEAR STRENGTH (psf)	REMOLDED SHEAR STRENGTH (kPa)	REMOLDED SHEAR STRENGTH (psf)	SENSITIVITY
3.51	11.50	4.88	102.00	NA	NA	NA
4.57	15.00	23.22	485.00	5.70	119.00	4.08
6.10	20.00	57.92	1210.00	8.23	172.00	7.03
7.62	25.00	29.68	620.00	6.13	128.00	4.84
9.15	30.00	32.93	688.00	8.23	172.00	4.00
10.67	35.00	33.37	697.00	9.91	207.00	3.37
12.20	40.00	38.97	814.00	9.10	190.00	4.28
15.24	50.00	39.92	834.00	11.63	243.00	3.43

LOG OF BORING 1-B1

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 15½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			ASPHALT CONCRETE (AB) AC/AB - 5 inches of Ashpalt Concrete over 6 inches of Aggregate Base. Geotextile at bottom of AB.										
			AGGREGATE BASE (AB)										
	1		CLAYEY SAND (SC), dark brown, dense to hard, moist, low plasticity, some cobbles, chunks of broken concrete in sample, abundant organics. (FILL)			54					21.3		
5	2					20	25	13	12	19	7.7	117	
			SILTY CLAY (CH), olive green, soft, wet, high plasticity, some organics		∇								
10	3					5					66.4		
	4		CLAYEY SAND (SC), dark olive green, loose, wet			150 psi							
15						1				43			
			Bottom of boring at approximately 15-1/2 feet below ground surface. Groundwater encountered at approximately 7 feet at time of drilling.										

LOG - GEOTECHNICAL 8602000000-GINT.GPJ ENGEO INC.GDT 8/20/09

ENGEO INCORPORATED

LOG OF BORING 1-B2

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 13½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC/AB - 3 inches of Asphalt Concrete over 4 inches of Aggregate Base.										
	1		SANDY LEAN CLAY WITH GRAVEL (CL), reddish brown, stiff, moist, low plasticity, gravel to 1 inch diameter, concrete chunks to 1.5 inches diameter. (FILL)			20					17.6	105	0.70
5	2		SILTY CLAY (CH), olive green, soft, moist, high plasticity, some organics.										
			TxUU = 393 psf		▽	100 psi							
10	3												
	4		Some shells.			4							0.25*
			Bottom of boring at approximately 13-1/2 feet below ground surface. Groundwater encountered at approximately 8-1/2 feet at time of drilling.										

ENGEO INCORPORATED

LOG OF BORING 1-B3

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 3 inches of Asphalt Concrete.										
	1		CLAYEY SAND (SC), reddish brown, very dense, moist, some plasticity, chunks of heavily weathered claystone/sandstone, cobbles, abundant iron oxide staining. (FILL)			56							
5	2		CLAYEY GRAVEL (GC), orange brown, medium dense, moist, chunks of sandstone/claystone cobbles, abundant iron oxide staining. (FILL)			45							
10	3		SILTY CLAY (CH), olive green, soft, moist, high plasticity, abundant organics.		▽	100 psi							
			Bottom of boring at approximately 12-1/2 feet below ground surface. Groundwater encountered at approximately 10 feet at time of drilling.										

LOG OF BORING 1-B4

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 2 inches of Asphalt Concrete.										
			CLAYEY SAND WITH GRAVEL (SC), orange brown, loose, moist, low plasticity, iron oxide staining, gravel to 1 inch diameter, fragments of asphalt. (FILL)			14	25	14	11	28			
5	1		SILTY CLAY (CH), dark olive brown, soft, moist, high plasticity, abundant shells, abundant organics. (FILL)			4							0.30*
10	2, 3		SILTY CLAY (CH), olive green, soft, moist, high plasticity, some organics.		∇	100 psi							
			Bottom of boring at approximately 12-1/2 feet below ground surface. Groundwater encountered at approximately 10 feet at time of drilling.										

ENGEO INCORPORATED

LOG OF BORING 1-B5

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 3 inches of Asphalt Concrete.										
			SILTY SAND WITH GRAVEL (SM), reddish brown, medium dense, moist, high plasticity, some shells, gravel to ½ inch diameter. (FILL)			14							
5	1, 2		SILTY CLAY (CH), grayish brown mottled with orange, stiff, moist, high plasticity, iron oxide staining, abundant shells. (FILL)			12					26.5	86.3	1.40
10	3		SILTY CLAY (CH), dark olive green, soft, moist, some organics.		▽	0							0.25*
			Bottom of boring at approximately 11-1/2 feet below ground surface. Groundwater encountered at approximately 8 feet at time of drilling.										

ENGEO INCORPORATED

LOG OF BORING 1-B6

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 3½ inches of Asphalt Concrete.										
			SILTY SAND (SM), light brown, dense to very dense, moist, some angular gravel, iron oxide staining, heavily weathered claystone cobbles, some shells. (FILL)										
	1					91							
5			Switched to rock bit at 5 ft, large cobbles, some concrete chunks. Rough drilling to approximately 7½ feet.			36							
	2												
			SILTY CLAY (CH), dark olive green, soft, moist, high plasticity, some sand, some shells, thin layers of peat.										
10	3												
						100 psi							
			Bottom of boring at approximately 12-1/2 feet below ground surface.										

LOG - GEOTECHNICAL 8602000000-GINT.GPJ ENGEO INC.GDT 8/20/09

LOG OF BORING 1-B7

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
		AC - 4 inches of Asphalt Concrete.								
		SANDY CLAY TO CLAYEY SAND (CL-SC), dark brown, stiff, moist, low plasticity, gravel to 1 inch diameter, some shells, some cobbles. (FILL)								
	1		12	71	26	45	49			4.5*
5		Softer, less gravel, more shells, some organics.	6					51.7	68	0.5* 0.4
	2	SILTY CLAY (CH), dark olive green, soft, moist, high plasticity, some organics.								
10	3									
		Abundant organics, strong odor, peat layers.	0							0.35*
		Bottom of boring at approximately 11-1/2 feet below ground surface.								

LOG - GEOTECHNICAL 860200000-GINT.GPJ ENGEO INC.GDT 8/20/09

ENGEO INCORPORATED

LOG OF BORING 1-B8

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 5½ inches of Asphalt Concrete.										
			SILTY CLAY (CL), dark brown, stiff, moist, medium plasticity, iron oxide staining (FILL)										
	1					13					36.1	78	3.13
5						15							0.80*
	2		SILTY CLAY (CH), olive green, soft, moist, high plasticity, some organics.										
					▽								
10	3												
						100 psi							
			Bottom of boring at approximately 12-1/2 feet below ground surface. Groundwater encountered at approximately 8-1/2 feet at time of drilling.										

LOG - GEOTECHNICAL 8602000000-GINT.GPJ ENGEO INC.GDT 8/20/09

ENGEO INCORPORATED

LOG OF BORING 1-B9

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC/AB - 2½ inches of Asphalt Concrete over 2½ inches of Aggregate Base.										
			SILTY CLAY WITH GRAVEL (CL), light brown, stiff, moist, medium plasticity, some fine-grained sand, some organics, gravel to 1 inch diameter. (FILL)			17							
	1		SILTY CLAY (CH), olive green mottled with black, stiff, moist, high plasticity, some peat, iron oxide staining, some asphalt chunks. (FILL)										
5						20							0.40*
	2		SILTY CLAY (CH), olive green, soft, moist, high plasticity		▽								
10	3					2							0.20*
			Bottom of boring at approximately 11-1/2 feet below ground surface. Groundwater encountered at approximately 8 feet at time of drilling.										

LOG - GEOTECHNICAL 8602000000-GINT.GPJ ENGEO INC.GDT 8/20/09

LOG OF BORING 1-B10

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 4/30/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 4 inches of Asphalt Concrete.										
	1		SILTY CLAY (CL), light brown, stiff, moist, medium plasticity, iron oxide staining, pockets of fine grained sand. (FILL)			13					37.7	81	0.31
5	2		SILTY CLAY (CH), olive green, soft, moist, high plasticity, some organics			4							0.70*
10	3					100 psi							
			Bottom of boring at approximately 12-1/2 feet below ground surface.										

ENGEO INCORPORATED

LOG OF BORING 1-B11

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 5/5/2009
HOLE DEPTH: Approx. 10½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 5 inches of Asphalt Concrete.										
			SANDY CLAY TO CLAYEY SAND (CL-SC), dark brown, stiff, moist, low plasticity, some fine gravel, chunks of bluish green clay (higher plasticity), some shells. (FILL)										
	1					13					26.5	94	0.72
5			SILTY CLAY (CH), bluish green mottled with black, soft, moist, high plasticity, some organics, thin peat layers.										
	2					3							.45*
10	3					100 psi							.25*
			Bottom of boring at approximately 10-1/2 feet below ground surface.										

LOG OF BORING 1-B12

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED:	5/5/2009	LOGGED / REVIEWED BY:	D. Wahl / RWR
HOLE DEPTH:	Approx. 11½ ft.	DRILLING CONTRACTOR:	HEW Drilling
HOLE DIAMETER:	4.0 in.	DRILLING METHOD:	Solid Flight Auger
SURF ELEV (MSL):	Approx. 9 ft.	HAMMER TYPE:	Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 4 inches of Asphalt Concrete.										
			SILTY CLAY (CH), olive brown mottled with orangeish brown, medium stiff, moist, high plasticity, some fine-grained sand, some organics, iron oxide staining, sand in small lenses and pockets. (FILL)			5					71.3	56	0.52
	1		SILTY CLAY (CH), olive green mottled with black, very soft to soft, moist, high plasticity										
5	2		olive green			1							.5*
10	3					2							.1*
			Bottom of boring at approximately 11-1/2 feet below ground surface.										

LOG OF BORING 1-B13

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 5/5/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 5 inches of Asphalt Concrete.										
	1		SANDY CLAY (CL-CH), brown, medium stiff, moist, some shells, chunks of intact high plasticity clay, matrix material low plasticity to non-plastic. (FILL)			8					32	86	1.06
5	2		SILTY CLAY (CH), olive green, very soft to soft, moist, some organics, thin layers of peat.			8							0.6*
10	3					100 psi							0.13*
			Bottom of boring at approximately 12-1/2 feet below ground surface.										

LOG OF BORING 1-B14

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 5/5/2009
HOLE DEPTH: Approx. 10 ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 4 inches of Asphalt Concrete.										
	1		CLAYEY SAND TO SANDY CLAY (SC-CL), orangeish brown, stiff, moist, low plasticity, some gravel, iron oxide staining, chunks of asphalt, chunks of high plasticity clay, gravel to 1 inch diameter. (FILL)			14				49			
5	2	NR	SILTY CLAY (CH), olive green mottled with black, soft, moist, high plasticity			2							
10	3		olive green			100 psi							.13*
			Bottom of boring at approximately 10 feet below ground surface.										

LOG - GEOTECHNICAL 8602000000-GINT.GPJ ENGEO INC.GDT 8/20/09

LOG OF BORING 1-B16

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 5/5/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 3.5 inches of Asphalt Concrete.										
	1		SANDY LEAN CLAY WITH GRAVEL (CL-SC), brown, very stiff, moist, low plasticity, fine- to coarse-grained sand, iron oxide staining, gravel to 1 inch diameter. (FILL)			23							
5	2		SILTY CLAY (CH), olive green, soft, moist, high plasticity, some organics		∇	2							
10	3					100 psi							
			Bottom of boring at approximately 12-1/2 feet below ground surface. Groundwater encountered at approximately 8-1/2 feet at time of drilling.										

LOG OF BORING 1-B17

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 5/5/2009
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 4 inches of Asphalt Concrete.										
			CLAYEY SAND (SC), brown, very stiff, moist, low plasticity, mix of sand with intact chunks of high plasticity clay, some gravel to 3/4 inch diameter, some shells. (FILL)										
	1					23				41			
5						25							
	2		SILTY CLAY (CH), olive green mottled with black, soft, moist, high plasticity, some organics										
10	3		Olive green, some peat			Push							0.35*
			Bottom of boring at approximately 11-1/2 feet below ground surface.										

LOG OF BORING 1-B18

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 5/5/2009
HOLE DEPTH: Approx. 12½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC/AB - 1 inch of Asphalt Concrete over 2 inches of aggregate base.										
	1		SILTY CLAY (CH), reddish brown, stiff, moist, chunks of intact high plasticity clay. (FILL)			13				73	47.5		
5	2		SILTY CLAY (CH), light olive brown mottled with gray, soft to medium stiff, moist, high plasticity			6							0.40*
10	3					100 psi							0.25*
			Bottom of boring at approximately 12-1/2 feet below ground surface.										

LOG - GEOTECHNICAL 8602000000-GINT.GPJ ENGEO INC.GDT 8/20/09

LOG OF BORING 1-B19

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED: 5/5/2009
HOLE DEPTH: Approx. 11½ ft.
HOLE DIAMETER: 4.0 in.
SURF ELEV (MSL): Approx. 9 ft.

LOGGED / REVIEWED BY: D. Wahl / RWR
DRILLING CONTRACTOR: HEW Drilling
DRILLING METHOD: Solid Flight Auger
HAMMER TYPE: Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 4 inches of Asphalt Concrete.										
			SILTY SAND (SM), reddish brown, loose to medium dense, moist, some gravel, iron oxide staining (FILL)			6							
	1		SILTY CLAY (CH), olive green mottled with black, soft, moist, strong organic odor.										
5	2		Organic material appears dessicated within sample.			1							0.40*
10	3					push							0.20*
			Bottom of boring at approximately 11-1/2 feet below ground surface.										

LOG - GEOTECHNICAL 860200000-GINT.GPJ ENGEO INC.GDT 8/20/09

LOG OF BORING 1-B20

ENGEO INCORPORATED

Geotechnical Exploration
Foster City Levees - Pedway Eval
Foster City, California
8602.000.000

DATE DRILLED:	5/5/2009	LOGGED / REVIEWED BY:	D. Wahl / RWR
HOLE DEPTH:	Approx. 12½ ft.	DRILLING CONTRACTOR:	HEW Drilling
HOLE DIAMETER:	4.0 in.	DRILLING METHOD:	Solid Flight Auger
SURF ELEV (MSL):	Approx. 9 ft.	HAMMER TYPE:	Automatic Trip Hammer

Depth in Feet	Depth in Meters	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
			AC - 2.5 inches of Asphalt Concrete.										
			CLAYEY SAND (SC), reddish brown, loose, moist, some gravel (FILL)										
			SILTY CLAY (CH), olive green mottled with black, soft, moist, high plasticity, some organics			4							0.30*
	1												
5						push							0.25*
	2												
10	3												
			TxUU = 300 psf			100 psi							0.85
													0.11*
			Bottom of boring at approximately 12-1/2 feet below ground surface.										

LOG - GEOTECHNICAL 8602000000-GINT.GPJ ENGEO INC.GDT 8/20/09

DRAFT

APPENDIX A

SUBSURFACE DATA

Appendix A2 – Kleinfelder Explorations

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel sand mixture, little or no fines.
		GM	Silty gravels, gravel-sand-clay mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.

MAJOR DIVISIONS		LTR	DESCRIPTION
FINE GRAINED SOILS	SILTS AND CLAYS LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silt-clays of low plasticity
	SILTS AND CLAYS LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

Standard penetration split spoon sample

Modified California Sampler

Shelby tube sample

Water level observed in boring

* No recovery

NFWE No free water encountered

NOTE: Blow count represents the number of blows of a 140-pound hammer falling 30 inches per blow required to drive a sampler through the last 12 inches of an 18-inch penetration.

NOTE: The line separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

BORING LOG LEGEND

PLATE B-1

Date Completed: 9/15/87

Logged By: Eric Swenson

Total Depth: 52.5 feet

Sampler: Modified California Sampler 2.5" O.D. 2.0" I.D.; Shelby Tube Sampler 2.8" Diameter

Hammer Wt: 140 lbs

Surface Elevation:

Depth, ft	Sample	Blows/ft (Field)	Dry Density pcf	Moisture Content, %	Compressive Strength, tsf	Other Tests	Torvane, tsf *	DESCRIPTION
								SANDY CLAY (CL) - brown, some gravel, dry - some fine gravel, very moist below 2'
		30						
5								SILTY CLAY (CL) - gray, low plasticity, some fine gravel, very moist - brown, medium plasticity, wet at 5'
			72	52	0.82		0.45	
							0.37×	- estimated levee fill/bay mud foundation contact at 6.5'
								SILTY CLAY (CH) - blue-gray, high plasticity
10								CLAYEY GRAVEL (GC) - blue-gray, fine to coarse, subangular to angular, well graded
							0.40	
								CLAY TO SILTY CLAY (CH) - firm, blue-gray, medium to high plasticity, saturated - mottled black at 13' - organics at 15'
15							0.35	
							0.30	
20						LL = 105		
						PI = 60	0.36	
25								
30								
35								

* 1/2 unconfined compressive strength

× 1/2 unconfined compressive strength determined by pocket penetrometer

KLEINFELDER

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-1

PLATE B-2

PROJECT NO. 11-1765-01

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content, %	LABORATORY: Compressive Strength, tsf	LABORATORY: Other Tests	Torvane, tsf *	DESCRIPTION (Continued from Plate B-2)
							0.25	CLAY TO SILTY CLAY (CH) - firm, blue-gray, medium to high plasticity, saturated - soft to firm, some fine sand at 37.5'
40								
								- stiffer at 42.5'
45								
							0.50	- firm to stiff at 47.5'
50								
							0.65	- stiff, dark brown to black at 52.5'
55								
60								
65								
70								
75								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-1

PLATE B-3

Date Completed: 9/15/87
Logged By: Eric Swenson
Total Depth: 102.5 feet

Sampler: Modified California Sampler
2.5" O.D. 2.0" I.D.
Shelby Tube Sampler
2.8" Diameter
Hammer Wt: 140 lbs

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content, %	LABORATORY: Compressive Strength, tsf	LABORATORY: Other Tests	Torvane, tsf *	DESCRIPTION (Surface Elevation:)
		34	108	8		-#200=22%		SANDY SILT (ML) to CLAYEY SAND (SC) - brown to gray, some blue-gray clay and gravel, fill material
5		4					0.10	- estimated levee fill/bay mud foundation contact at 4' SILTY CLAY (CH) - very soft to soft, brown, medium to high plasticity, saturated
10								
			50	84			0.25	- soft to firm, some organics at 12.5'
								- blue-gray below 12.5'
15			58	71	0.47	LL = 80 PI = 48	0.30	- firm below 16.5'
								- sample lost, 19' to 20.5'
20		2						
			64	60				- organic odor, many shells at 23.5'
25								
30								
								- low to medium plasticity, some fine sand, coarse ground shells at 32.5'
35								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-2

PLATE B-4

Depth, ft	Sample (Field)	Blows/ft (Field)	Dry Density pcf (Laboratory)	Moisture Content, % (Laboratory)	Compressive Strength, tsf (Laboratory)	Other Tests (Laboratory)	Torvane, tsf *	DESCRIPTION
								(Continued from Plate B-4)
								SILTY CLAY (CH) - firm, blue-gray, medium to high plasticity, saturated
40								
			73	48			0.40	- some fine sand at 42.5'
45								
50								
							0:35	
55								
60								
			56	70			0.32	
65								
70								
							0.40	
75								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-2

PLATE B-5

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content, %	LABORATORY: Compressive Strength, tsf	LABORATORY: Other Tests	Torvane, tsf *	DESCRIPTION (Continued from Plate B-5)
								SILTY CLAY (CH) - firm, blue-gray, medium to high plasticity, saturated
80								
85	X		63	62			0.50	- firm to stiff at 84.5'
90								- stiffer at 93'
95								SILTY SAND (SM) - dark blue-black, very fine sand
100	X						0.25	
105								
110								
115								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-2

PLATE B-6

Date Completed: 9/16/87

Logged By: Eric Swenson

Total Depth: 89.5 feet

Sampler: Modified California Sampler
2.5" O.D. 2.0" I.D.
Shelby Tube Sampler
2.8" Diameter

Hammer Wt: 140 lbs

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content, %	LABORATORY: Compressive Strength, tsf	LABORATORY: Other Tests	Torvane, tsf *	DESCRIPTION (Surface Elevation:)
0–6		79	119	12		-#200=34%		SILTY SAND (SM) - brown, some lumps of clay, dry, friable, shells
5								
6–10								- estimated levee fill/bay mud foundation contact at 6' SILTY CLAY (CH) - soft, blue-gray, medium to high plasticity, saturated - shells and gravel up to 1" diameter at 6.5' - sample lost, 8' to 10.5'
10								
15								
16–19			49 52 51	87 82 84		LL = 96 PI = 58	0.10	- very soft to soft at 18.5'
20								
25								
26–27							0.16	
30								
35								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-3

PLATE B-7

Depth, ft	Sample	Blows/ft	Dry Density pcf	Moisture Content, %	Compressive Strength, tsf	Other Tests	Torvane, tsf *	DESCRIPTION (Continued from Plate B-7)
								SILTY CLAY (CH) - soft, blue-gray, medium to high plasticity, saturated
40						LL = 59		
			68	55		PI = 31	0.40	- siltier than other samples at 42.5'
								- firm below 42.5'
45								
50								
55								
60								
			68	54	0.51		0.35	
65								
70								
75								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-3

PLATE B-8

Depth, ft	Sample	Blows/ft	Dry Density pcf	Moisture Content, %	Compressive Strength, tsf	Other Tests	Torvane, tsf *	DESCRIPTION
								(Continued from Plate B-8)
							0.42	SILTY CLAY (CH) - firm, blue-gray, medium to high plasticity, saturated
80								
85								- stiffer at 87'
							0.45	- blue-gray to dark gray, low plasticity, sandy, very fine sand at 89.5'
90								
95								
100								
105								
110								
115								

* 1/2 unconfined compressive strength

KLEINFELDER

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-3

PLATE B-9

PROJECT NO. 11-1765-01

Date Completed: 9/16/87
Logged By: Eric Swenson
Total Depth: 79.5 feet

Sampler: Modified California Sampler
2.5" O.D. 2.0" I.D.
Shelby Tube Sampler
2.8" Diameter
Hammer Wt: 140 lbs

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content, %	LABORATORY Compressive Strength, tsf	LABORATORY Other Tests	Torvane, tsf *	DESCRIPTION (Surface Elevation:)
								SILTY CLAY (CH) - soft, blue-gray to brown, medium to high plasticity, moist - friable, shells in matrix with clay to 5'
5		3						
			40 34	114 141	0.17	LL = 137 PI = 88	0.15	- blue-gray, saturated below 8.5'
10			44	103			0.15	
15							0.20	
20			46	99	0.28		0.25	- soft to firm, mottled blue-gray and black
25								
30								- sample lost, 30' to 32.5'
35								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-4

PLATE B-10

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content, %	LABORATORY: Compressive Strength, tsf	LABORATORY: Other Tests	Torvane, tsf *	DESCRIPTION (Continued from Plate B-10)
								SILTY CLAY (CH) - soft to firm, blue-gray, medium to high plasticity, saturated
40								
			61	66	0.32		0.30	- firm below 42.5'
45								
50								
55								
60								
			63	63			0.30	- lower plasticity at 62.5'
65								
70								
75								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-4

PLATE B-11

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content, %	LABORATORY: Compressive Strength, tsf	LABORATORY: Other Tests	Torvane, tsf *	DESCRIPTION (Continued from Plate B-11)
								SILTY CLAY (CH) - firm, blue-gray, medium to high plasticity, saturated
							0.50	- firm to stiff, sandy, very fine sand at 79.5'
80								
85								
90								
95								
100								
105								
110								
115								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-4

PLATE B-12

Date Completed: 9/17/87	Sampler: Modified California Sampler 2.5" O.D. 2.0" I.D. Shelby Tube Sampler 2.8" Diameter
Logged By: Eric Swenson	
Total Depth: 47.0 feet	Hammer Wt: 140 lbs

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content, %	LABORATORY: Compressive Strength, tsf	LABORATORY: Other Tests	Torvane, tsf *	DESCRIPTION (Surface Elevation:)
								CLAYEY SILT (ML) to CLAYEY SAND (SC) - brown, some shells
		30	100	18	1.80			CLAY (CH) - soft, brown to blue-gray, some sand, organics
5		3						- disturbed sample, 5' to 6.5'
								- estimated levee fill/bay mud foundation contact at 7'
10							0.20	ORGANIC SILT (OH) - soft, black, friable, highly organic
								SILTY CLAY (CH) - soft, blue-gray, medium to high plasticity, saturated
							0.15	- organics at 14.5'
15								
			49 48	88 88	0.46		0.22	
20								
							0.20	- shells at 22.5'
25								
30								
							0.25	- soft to firm at 32.5'
35								

* 1/2 unconfined compressive strength

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-5

PLATE B-13

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content, %	LABORATORY Compressive Strength, tsf	LABORATORY Other Tests	Torvane, tsf	DESCRIPTION (Continued from Plate B-13)
								SILTY CLAY (CH) - soft to firm, blue-gray, medium to high plasticity, saturated
40								
45							1.25 1.12×	- stiff at 47'
50								
55								
60								
65								
70								
75								

* 1/2 unconfined compressive strength
× 1/2 unconfined compressive strength determined by pocket penetrometer

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-5

PLATE B-14

Date Completed: 9/17/87

Logged By: Eric Swenson

Total Depth: 31.5 feet

Sampler: Modified California Sampler
2.5" O.D. 2.0" I.D.
Shelby Tube Sampler
2.8" Diameter

Hammer Wt: 140 lbs

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content, %	LABORATORY Compressive Strength, tsf	LABORATORY Other Tests	Torvane, tsf *	DESCRIPTION (Surface Elevation:)
								CLAYEY SAND (SC) - red-brown, pockets of clay, moist
		24				-#200=18%	0.37×	
5								SILTY CLAY (CH) - soft to firm, blue-gray, medium to high plasticity, dry
		6	60	64	0.48		0.42 0.25×	- mottled blue-gray and black at 6.5' - saturated below 6.5' - estimated levee fill/bay mud foundation contact at 8'
10							0.25	
15							0.25	
20							0.28	
25								
								- stiffer at 29'
30							1.15 0.87×	- stiff, blue-gray to brown at 31.5'
35								

* 1/2 unconfined compressive strength
× 1/2 unconfined compressive strength determined by pocket penetrometer

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

LOG OF BORING NO. B-6

PLATE B-15

DRAFT

APPENDIX B

LABORATORY TESTING

Appendix B1 – ENGEO Laboratory Test Data
Appendix B2 – Kleinfelder Laboratory Test Data
Appendix B3 – Corrosion Laboratory Test Data

DRAFT

APPENDIX B

LABORATORY TESTING

Appendix B1 – ENGEO Laboratory Test Data

MOISTURE-DENSITY DETERMINATION
ASTM D7263

BORING ID:	3-B1	3-B2	3-B2	3-B2	3-B2	3-B2	3-B3	3-B3
DEPTH (ft.):	27-29.5	2-2.5	8.5-9	20-22.5	28-30.5	40-42.5	2-2.5	5-5.5
MOISTURE CONTENT (%):	50.7	8.1	77.8	57.9	53.4	56.4	11.0	39.8
DRY DENSITY (lbs/ft^3):	72.8	120.2	56.1	66.7	68.4	66.8	103.5	79.1

BORING ID:	3-B3	3-B3						
DEPTH (ft.):	15-17.5	24-26.5						
MOISTURE CONTENT (%):	85.3	79.6						
DRY DENSITY (lbs/ft^3):	50.8	52.3						

Testing remarks: For moisture content only, ASTM D2216

PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaaf & Wheeler
PHASE NUMBER: 004

DATE: 10/04/17

ENGEO
Expect Excellence

Tested by: M. Quasem   Reviewed by: G. Criste

Laboratory address: 3420 Fostoria Way, Suite E, San Ramon, CA 94583. Phone No. (925) 355-9047.

MOISTURE-DENSITY DETERMINATION
ASTM D7263

BORING ID:	3-B4	3-B4	3-B5	3-B5	3-B5	3-B6	3-B6	3-B6
DEPTH (ft.):	4-4.5	38-40.5	1-2.5	4-5.5	23-25.5	2.5-3	3-3.5	15-17.5
MOISTURE CONTENT (%):	49.8	27.7	11.5	55.4	72.7	31.0	39.3	61.3
DRY DENSITY (lbs/ft^3):	65.8	97.0	97.9	63.6	50.2		75.8	65.2

BORING ID:	3-B6	3-B6	3-B6					
DEPTH (ft.):	25-27.5	45-47.5	55-57.5					
MOISTURE CONTENT (%):	59.3	53.1	54.5					
DRY DENSITY (lbs/ft^3):	65.8	69.4	68.0					

Testing remarks: For moisture content only, ASTM D2216

PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaaf & Wheeler
PHASE NUMBER: 004

DATE: 09/27/17

ENGEO
Expect Excellence

Tested by: W. Miller   Reviewed by: G. Criste

Laboratory address: 3420 Fostoria Way, Suite E, San Ramon, CA 94583. Phone No. (925) 355-9047.

MOISTURE-DENSITY DETERMINATION
ASTM D7263

BORING ID:	2-B1	2-B1	2-B1	2-B1	2-B1	2-B1	2-B2	2-B2
DEPTH (ft.):	9-9.5	12-14.5	30-32.5	42-44.5	55.5-56	65-66.5	1.5-2	7-7.5
%MOISTURE CONTENT:	52.8	74.9	53.0	52.7	29.9	24.5	19.8	70.8
DENSITY (lbs/ft^3):	67.3	54.3	70.4	70.4	93.3		100.4	56.2

BORING ID:	2-B2	2-B2	2-B2	2-B2	2-B2	2-B2	2-B2	2-B2
DEPTH (ft.):	25-27.5	49-49.5	60-62.5	71-71.5	81-81.5	91-91.5	101-101.5	110-111.5
%MOISTURE CONTENT:	59.1	49.8	32.6	42.6	27.2	31.2	29.0	26.2
DENSITY (lbs/ft^3):	65.9	69.1	87.2	75.9	96.9	85.3		

BORING ID:	2-B3	2-B3	2-B3	2-B4	2-B4	2-B4	2-B4	2-B4
DEPTH (ft.):	2.5-3	5.5-6	10-11.5	8-8.5	26-26.5	30.5-31	36-36.5	41-41.5
%MOISTURE CONTENT:	10.9	19.4	51.3	83.7	77.0	75.3	20.1	19.4
DENSITY (lbs/ft^3):	122.9	71.0		49.4	52.7	52.3	107.9	

BORING ID:	2-B5	2-B5	2-B5	2-B5	2-B6	2-B6	2-B7	2-B7
DEPTH (ft.):	1-2.5	5-5.5	8-8.5	10.5-11	5-5.5	8-8.5	4-4.5	10-10.5
%MOISTURE CONTENT:	12.8	44.9	70.8	87.0	67.1	87.5	16.9	57.4
DENSITY (lbs/ft^3):	67.3	54.3	70.4	70.4	93.3		100.4	65.0

ASTM D7263 D2216

PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaff & Wheeler
PHASE NUMBER: 002

DATE: 04/13/16

ENGEO INCORPORATED

Tested by: I. McCauley   Reviewed by: K. Lecce

MOISTURE-DENSITY DETERMINATION
ASTM D7263

BORING ID:	2-B1	2-B1	2-B2	2-B2	2-B1			
DEPTH (ft.):	12-14.5	42-44.5	25-27.5	60-62.5	30-32.5			
%MOISTURE CONTENT:	74.9	52.7	59.1	32.6	53.0			
DENSITY (lbs/ft^3):	54.3	70.4	65.9	87.2	70.4			

Testing remarks:

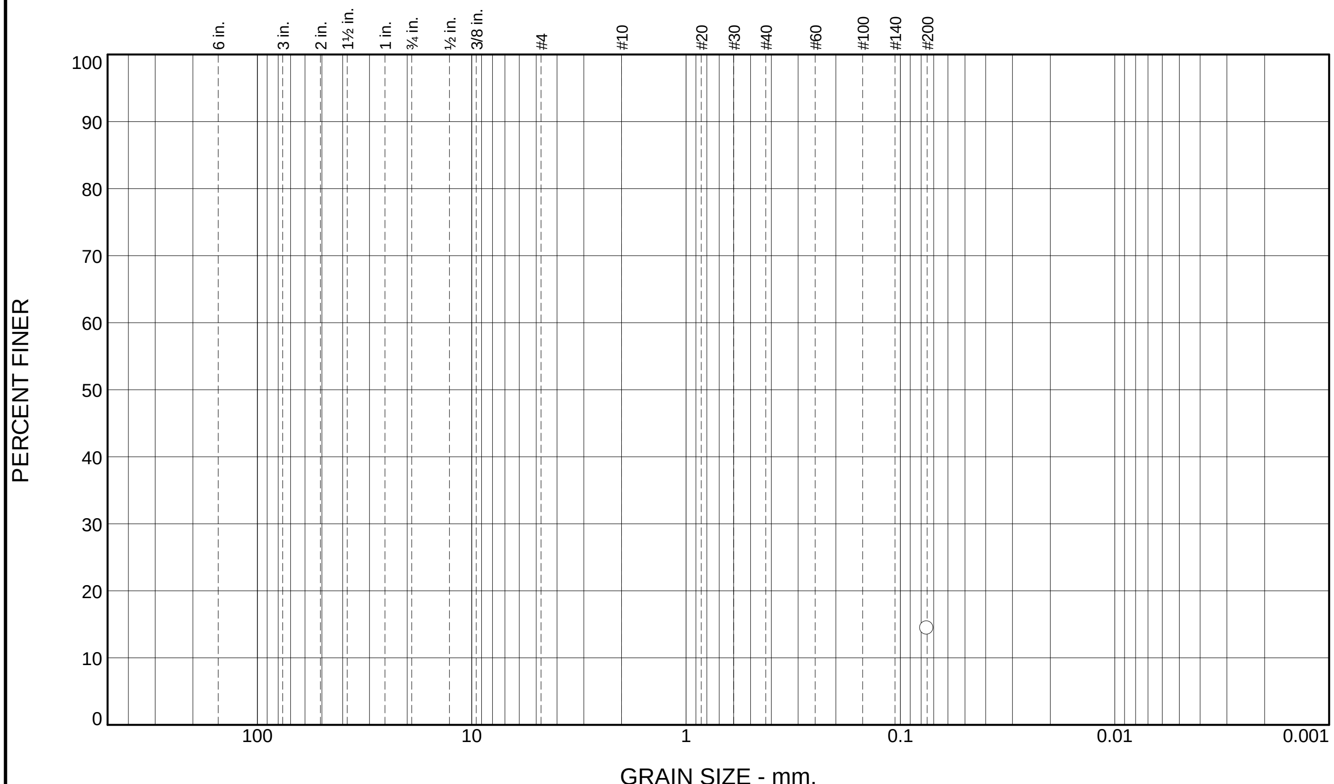
PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaaf & Wheeler
PHASE NUMBER: 002

DATE: 04/13/16

ENGEO
Expect Excellence

Tested by: G. Criste   Reviewed by: D. Seibold

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						14.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	14.4		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B1 @ 2.5 **Depth:** 2.5-3.0 feet

Date: 10/06/17

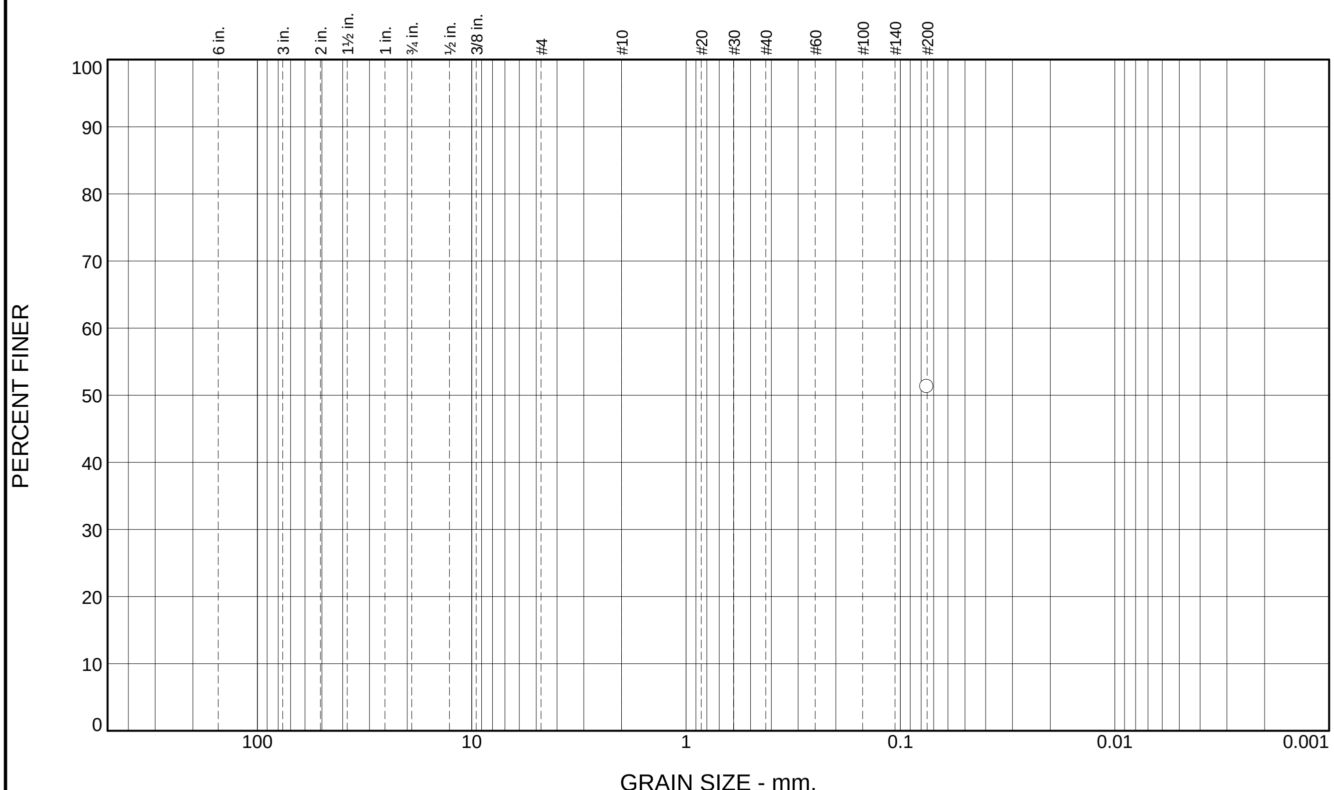
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: M. Quasem **Checked By:** D. Seibold

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						51.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	51.2		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B1 @ 6 **Depth:** 6.0-6.5 feet

Date: 10/06/17

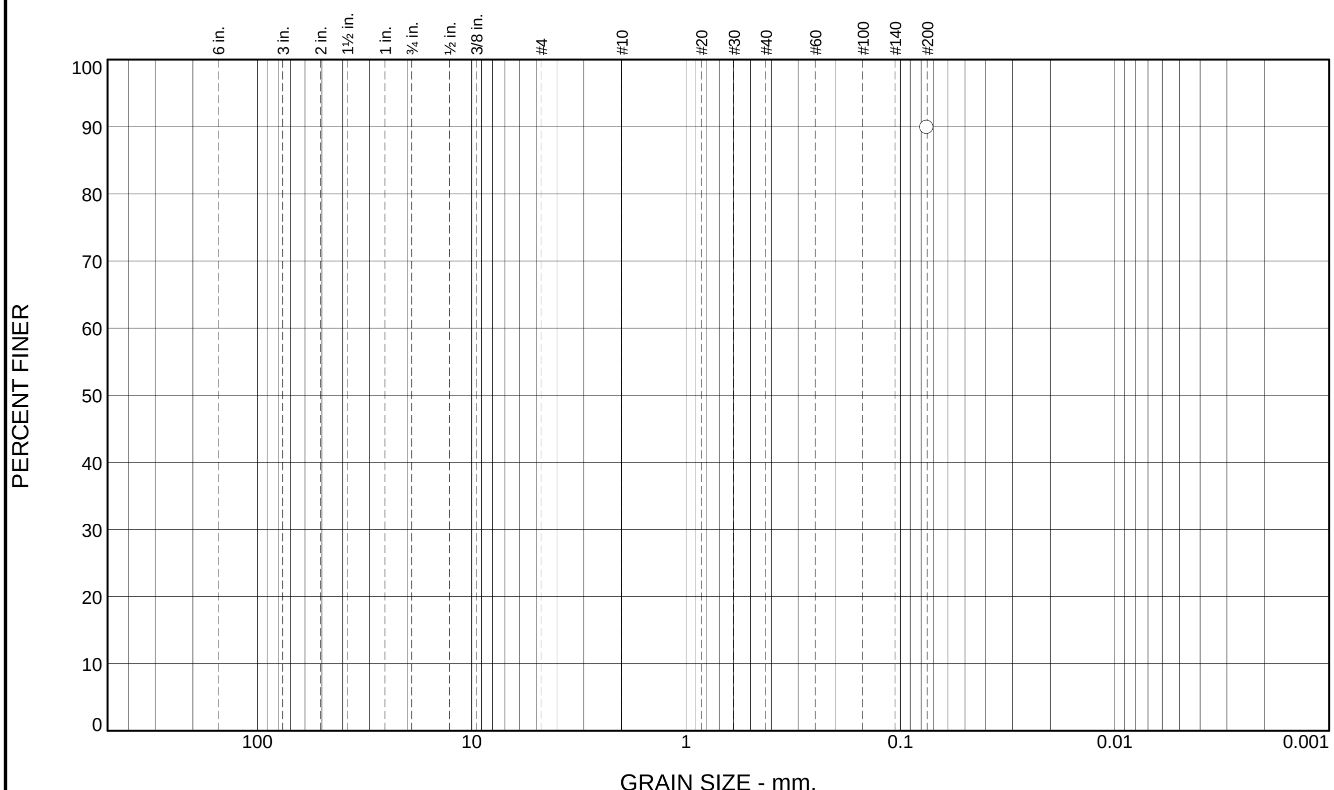
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: M. Quasem **Checked By:** D. Seibold

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						89.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	89.8		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B1 @ 9 **Depth:** 9.0-10.5 feet

Date: 10/06/17

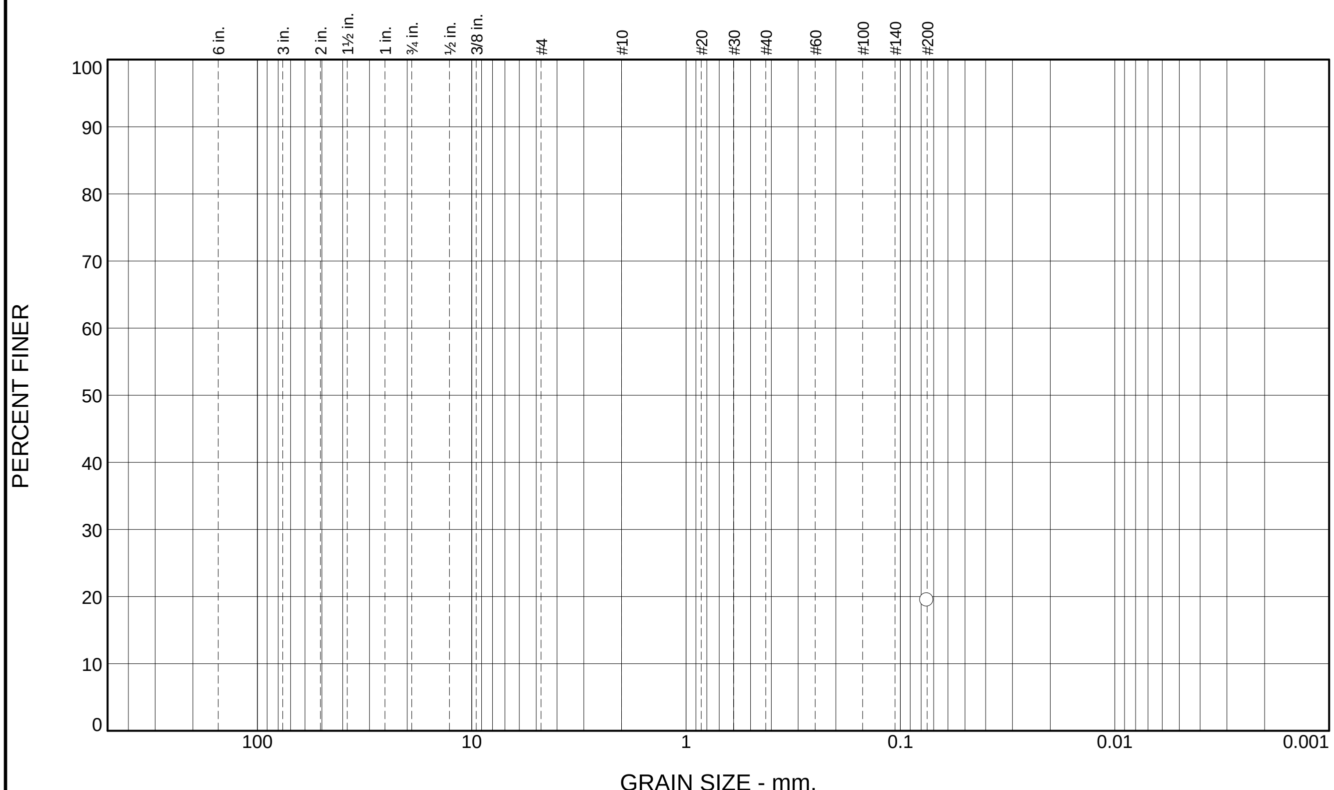
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: M. Quasem **Checked By:** D. Seibold

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						19.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	19.4		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B2 @ 2 **Depth:** 2.0-2.5 feet

Date: 10/06/17

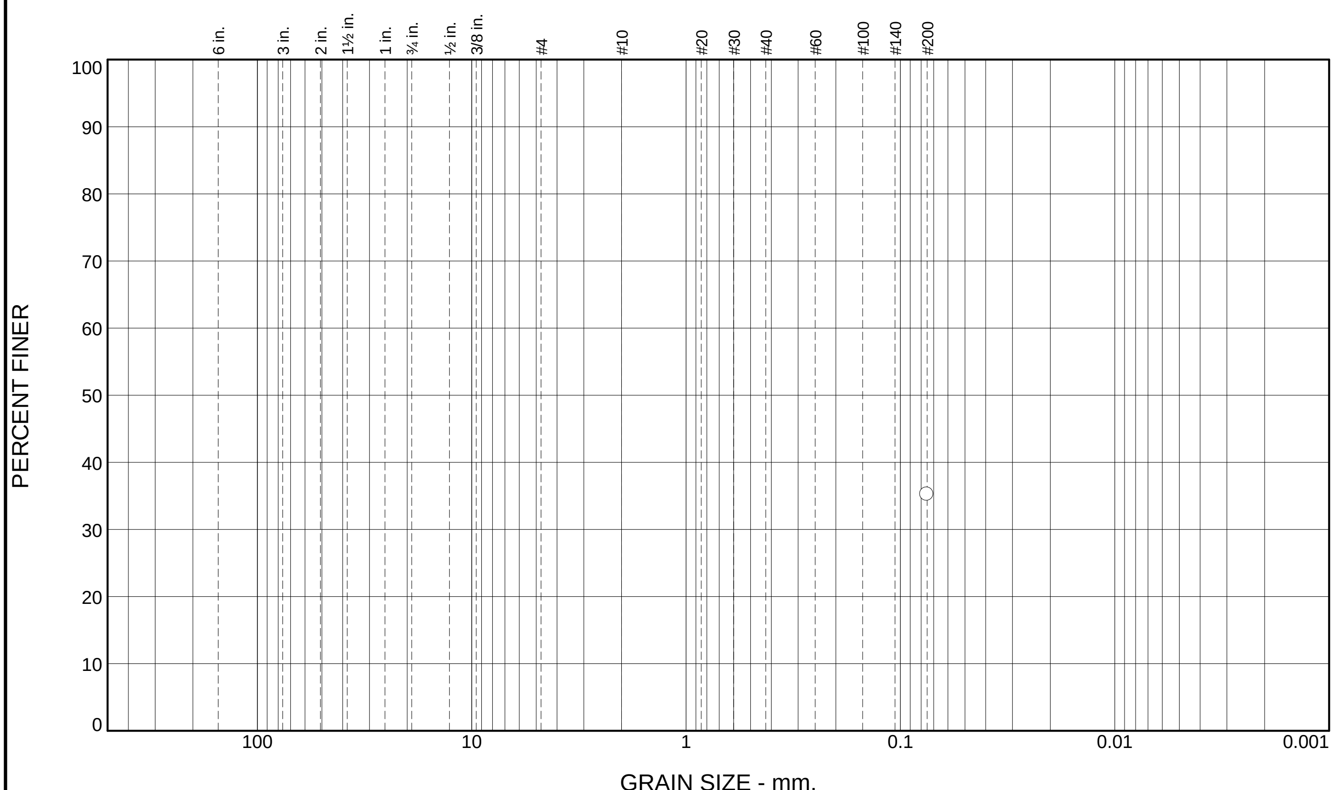
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: M. Quasem **Checked By:** D. Seibold

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						35.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	35.2		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B3 @ 2 **Depth:** 2.0-2.5 feet

Date: 10/06/17

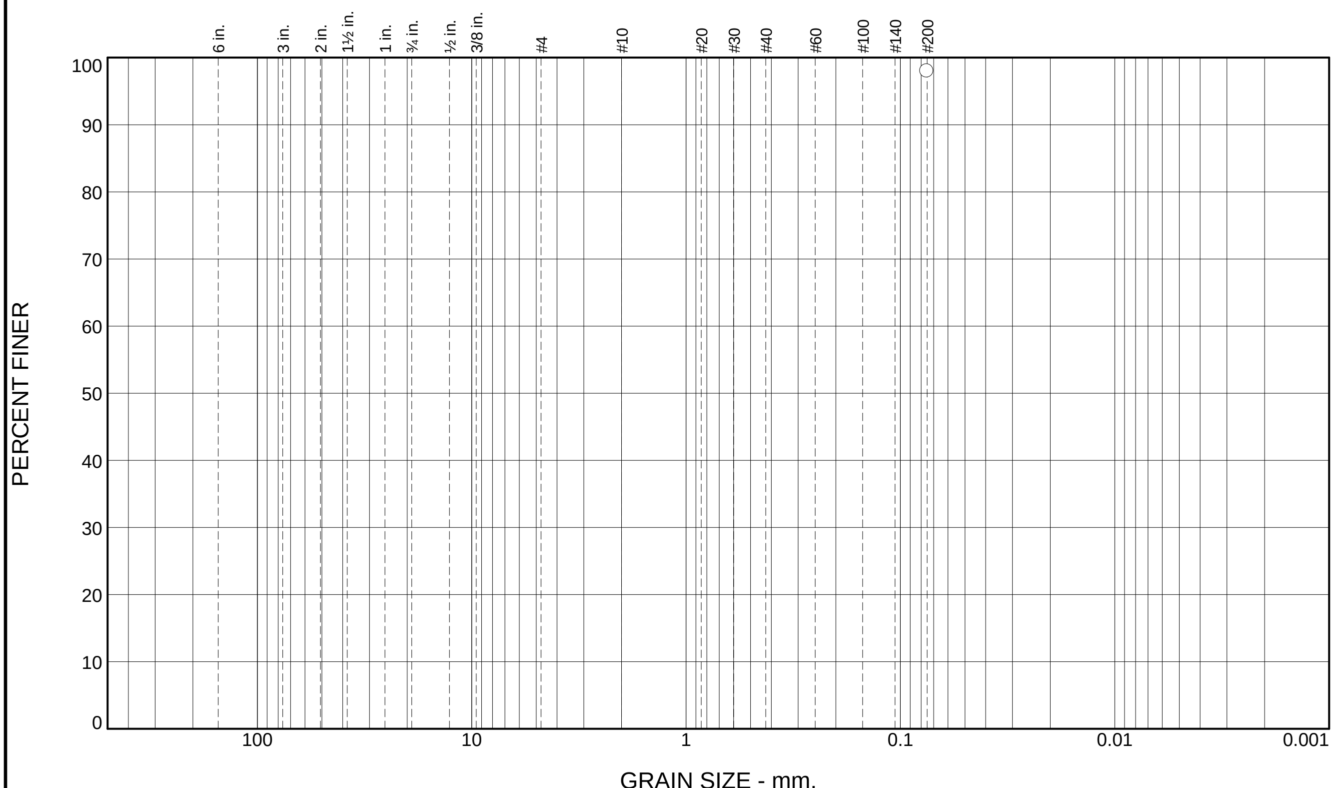
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: M. Quasem **Checked By:** D. Seibold

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						98.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	98.0		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B3 @ 39 **Depth:** 39.0-40.0 feet

Date: 10/06/17

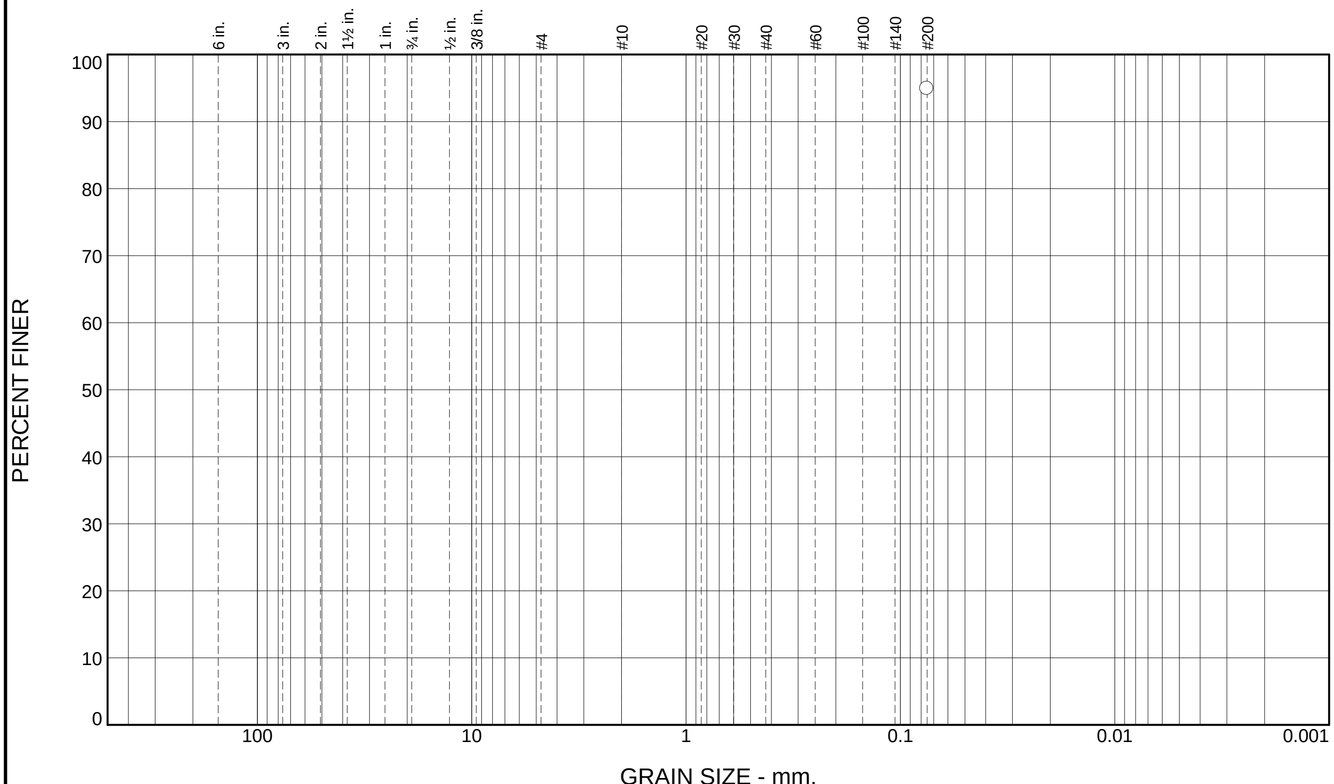
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: M. Quasem **Checked By:** D. Seibold

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						94.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	94.9		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B4 @ 4 **Depth:** 4.0-4.5 feet

Date: 09/28/17

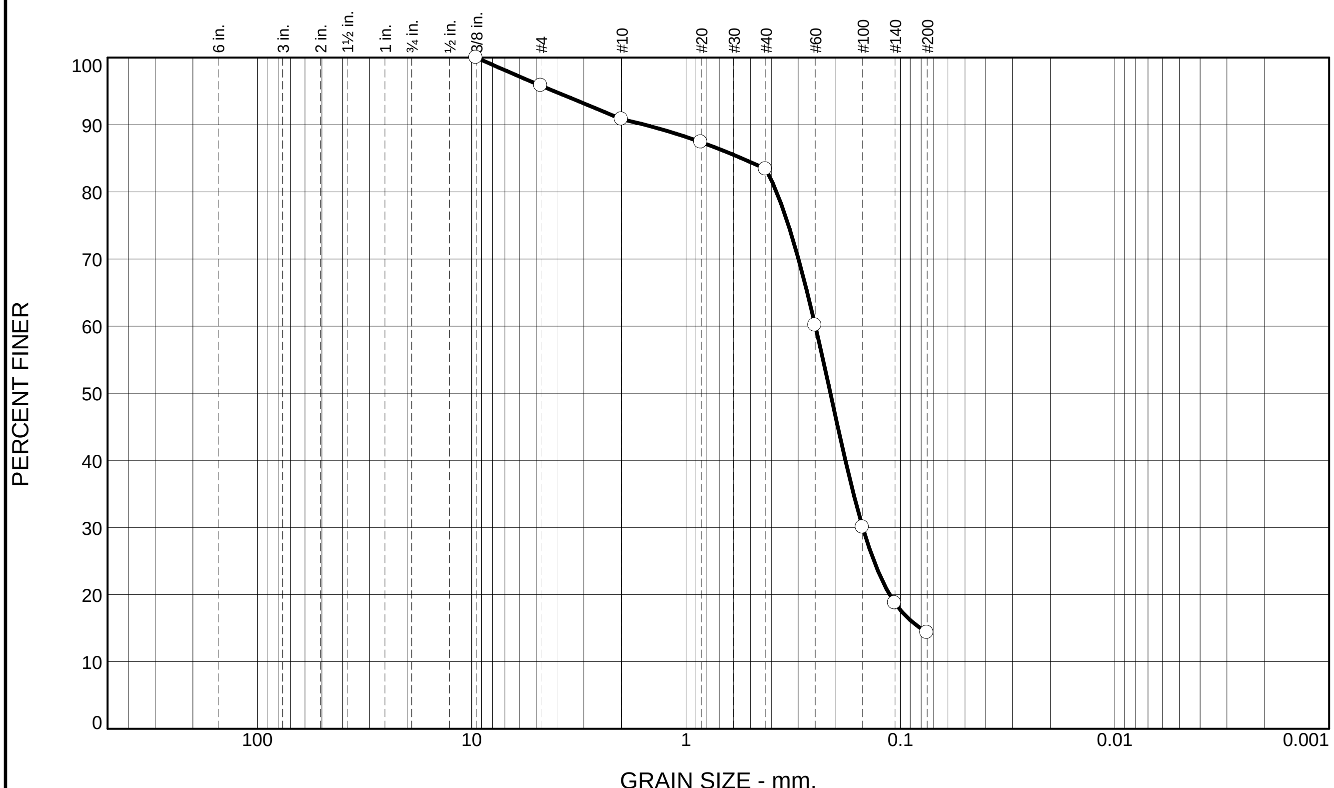
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: W. Miller **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	5.0	7.4	69.1	14.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100.0		
#4	95.8		
#10	90.8		
#20	87.4		
#40	83.4		
#60	60.1		
#100	30.0		
#140	18.7		
#200	14.3		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.5593 D_{85}= 0.5494 D_{60}= 0.2496
D_{50}= 0.2122 D_{30}= 0.1499 D_{15}= 0.0807
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913

Sample Number: 3-B5 @ 1 **Depth:** 1.0-2.5 feet

Date: 09/28/17

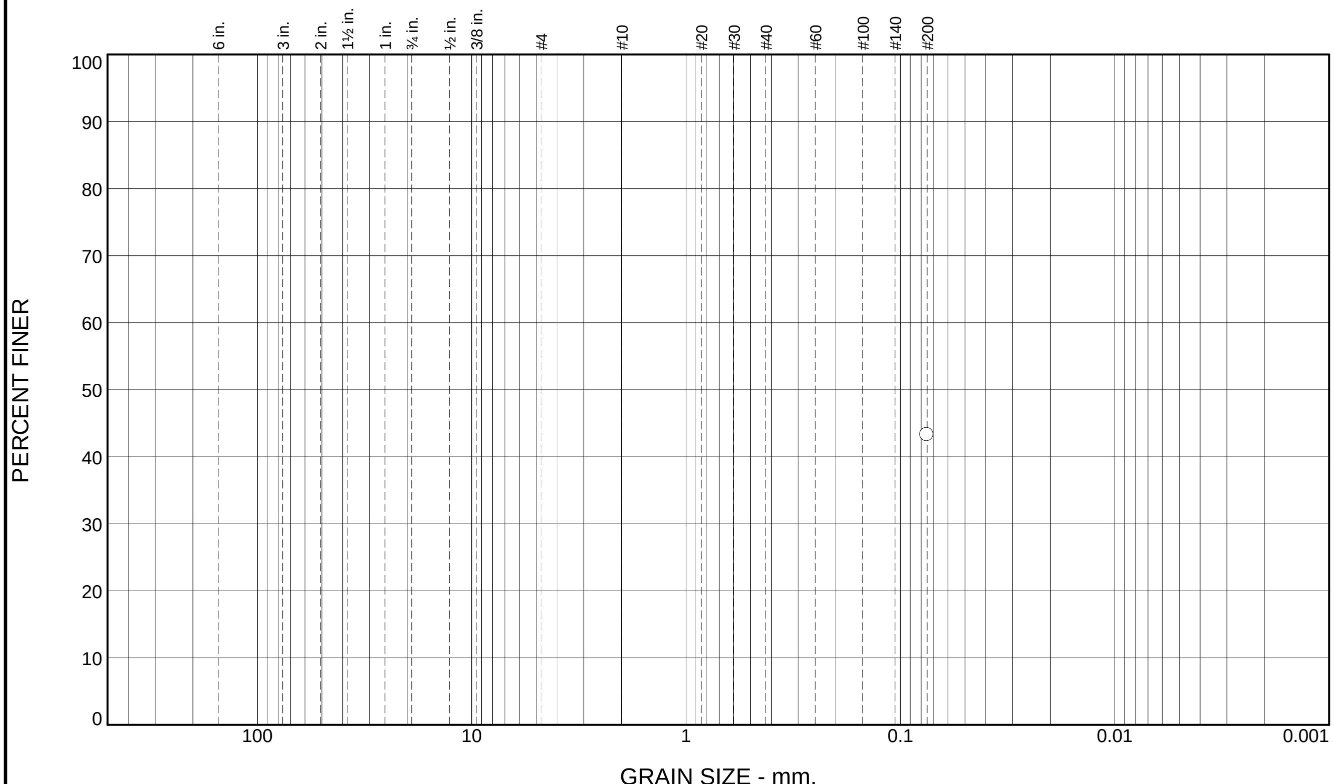
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: W. Miller **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						43.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	43.3		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B5 @ 4 **Depth:** 4.0-4.5 feet

Date: 09/28/17

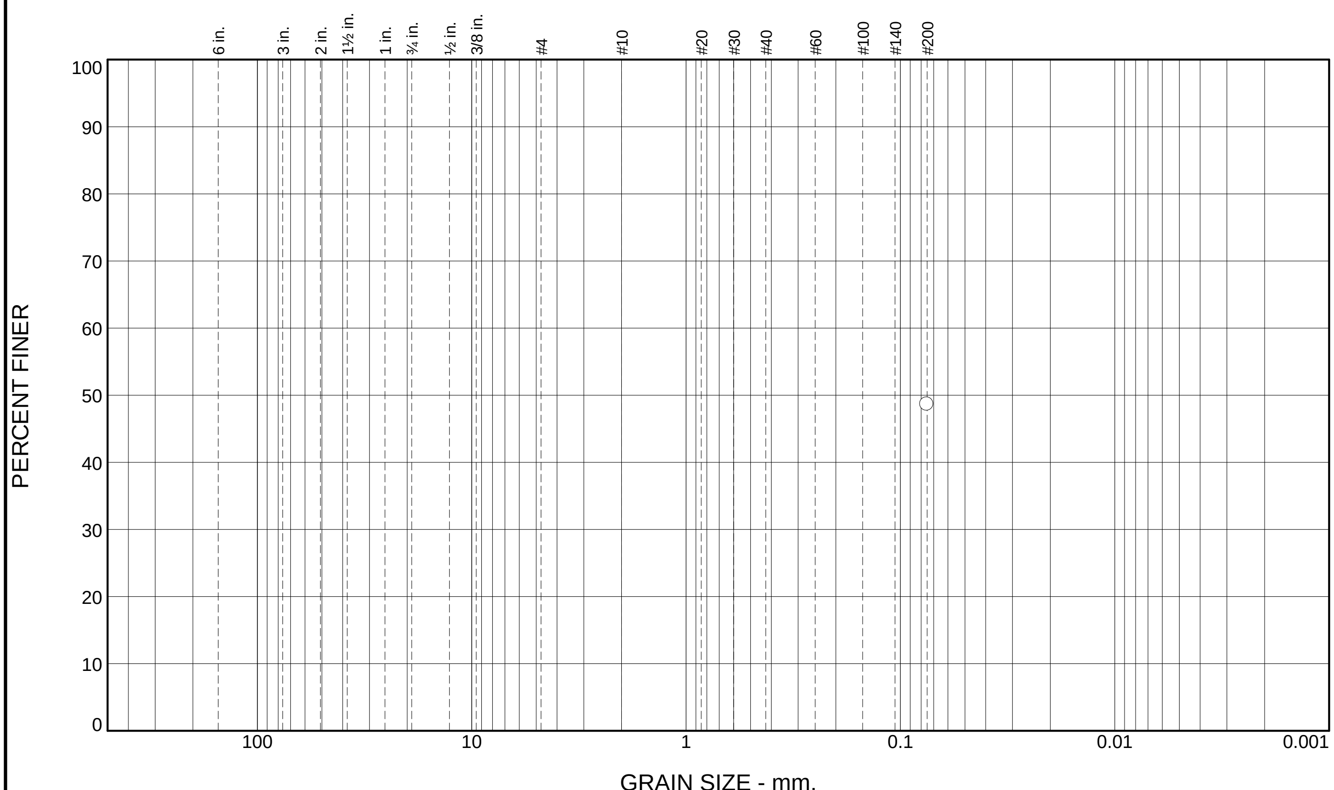
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: W. Miller **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						48.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	48.6		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 3-B6 @ 2.5 **Depth:** 2.5-3.0 feet

Date: 09/28/17

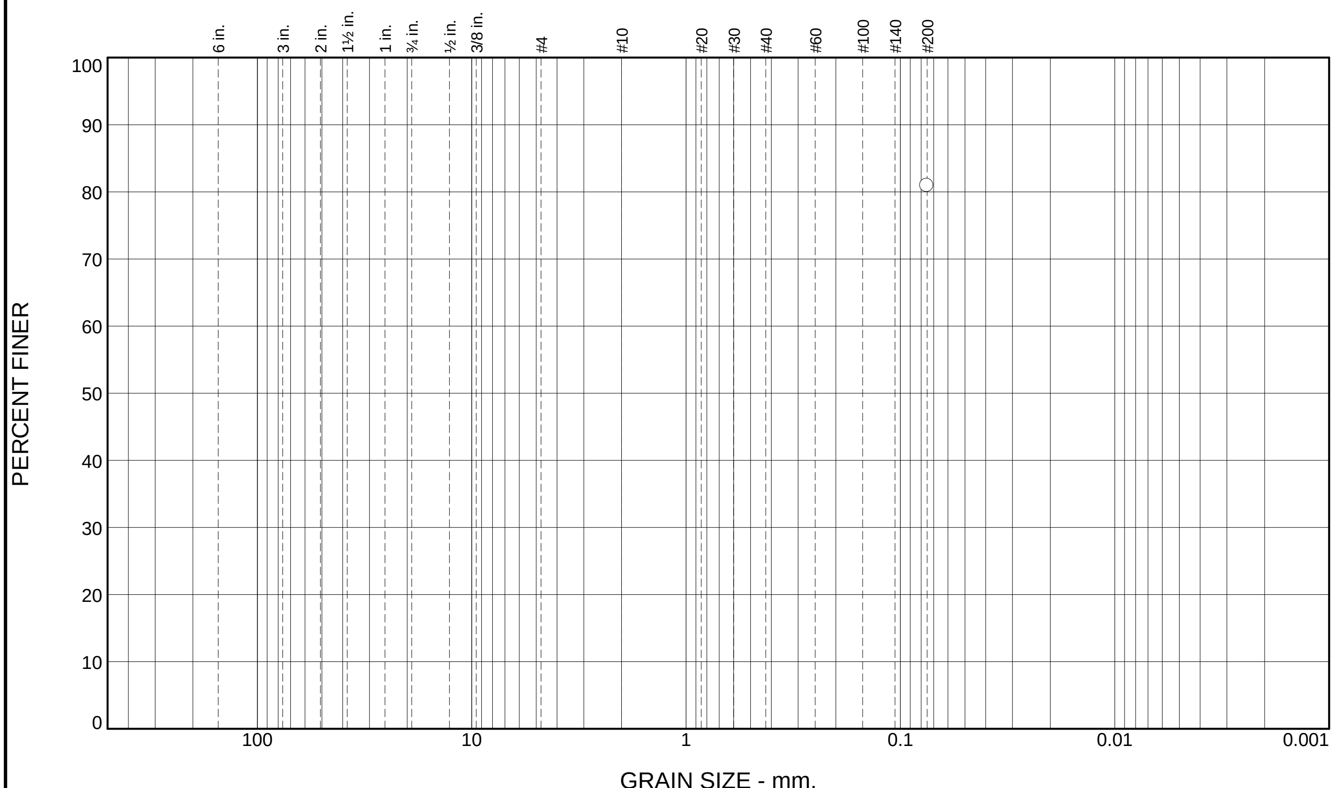
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000

Tested By: W. Miller **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						80.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	80.9		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 25 LL= 65 PI= 40

Coefficients

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

Classification

USCS= AASHTO=

Remarks

ASTM D1140
ASTM D4318, wet method

Sample Number: 2-B1 @ 5.5-6 **Depth:** 5.5-6 feet

Date: 4-12-16

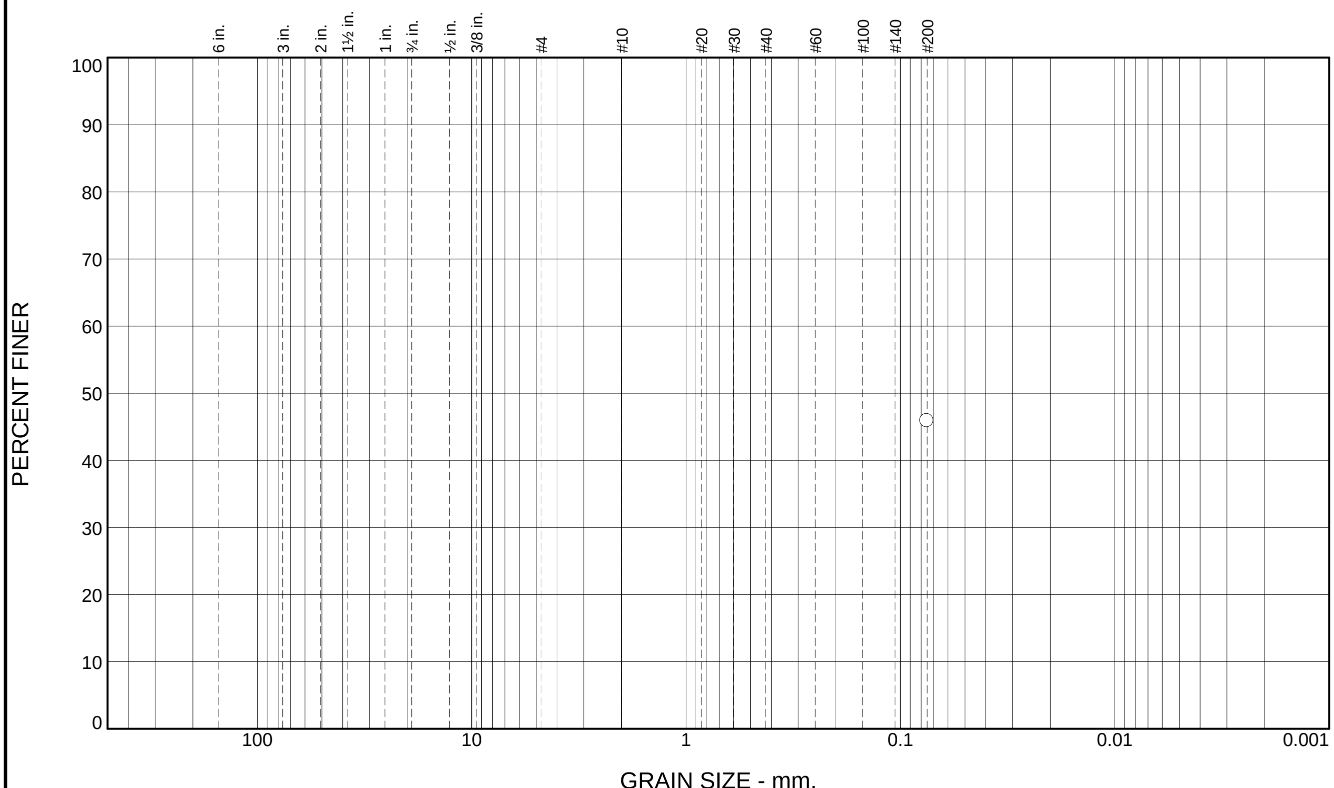
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						45.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	45.9		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 2-B1 @ 55.5-56 **Depth:** 55.5-56 feet

Date: 4-12-16

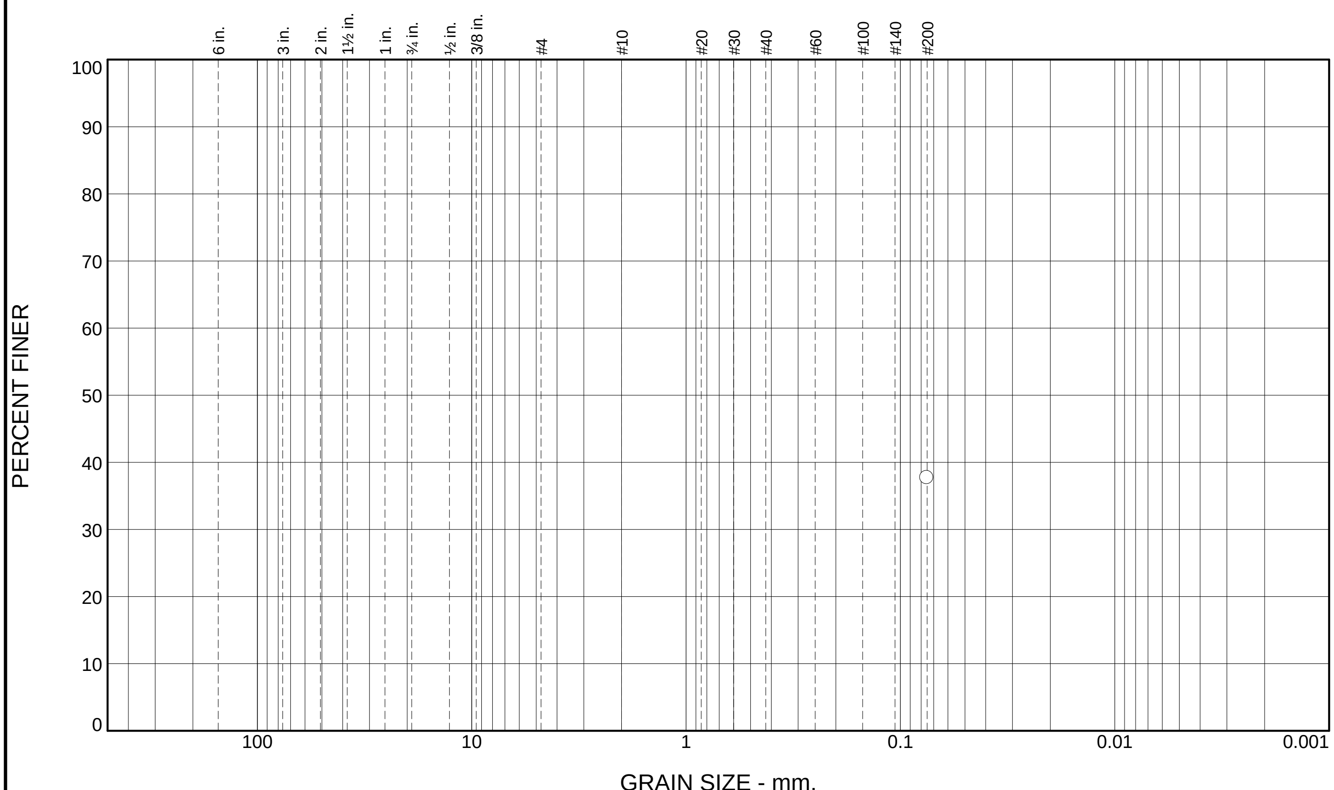
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						37.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	37.7		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 2-B2 @ 1.5-2 **Depth:** 1.5-2 feet

Date: 4-12-16

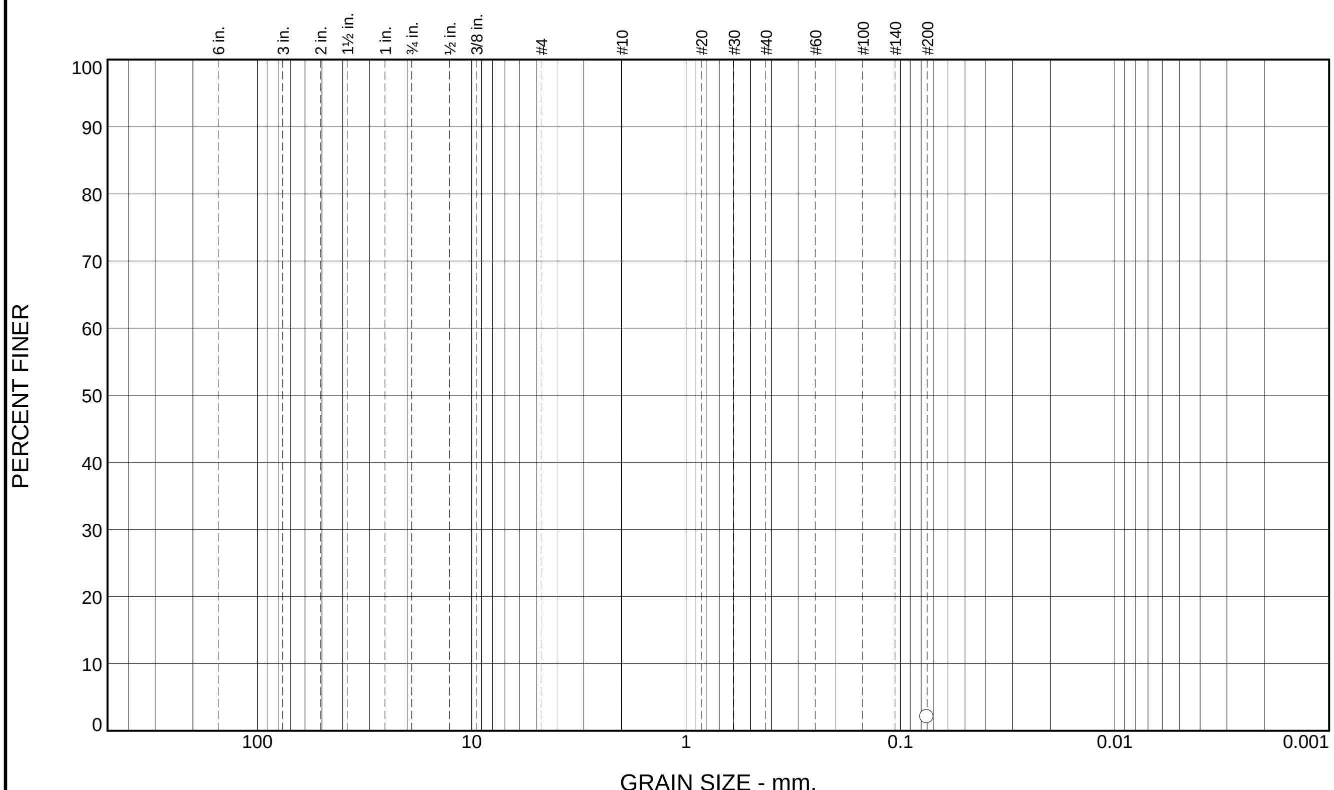
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						2.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	2.0		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 2-B3 @ 6-6.5 **Depth:** 6-6.5 feet

Date:

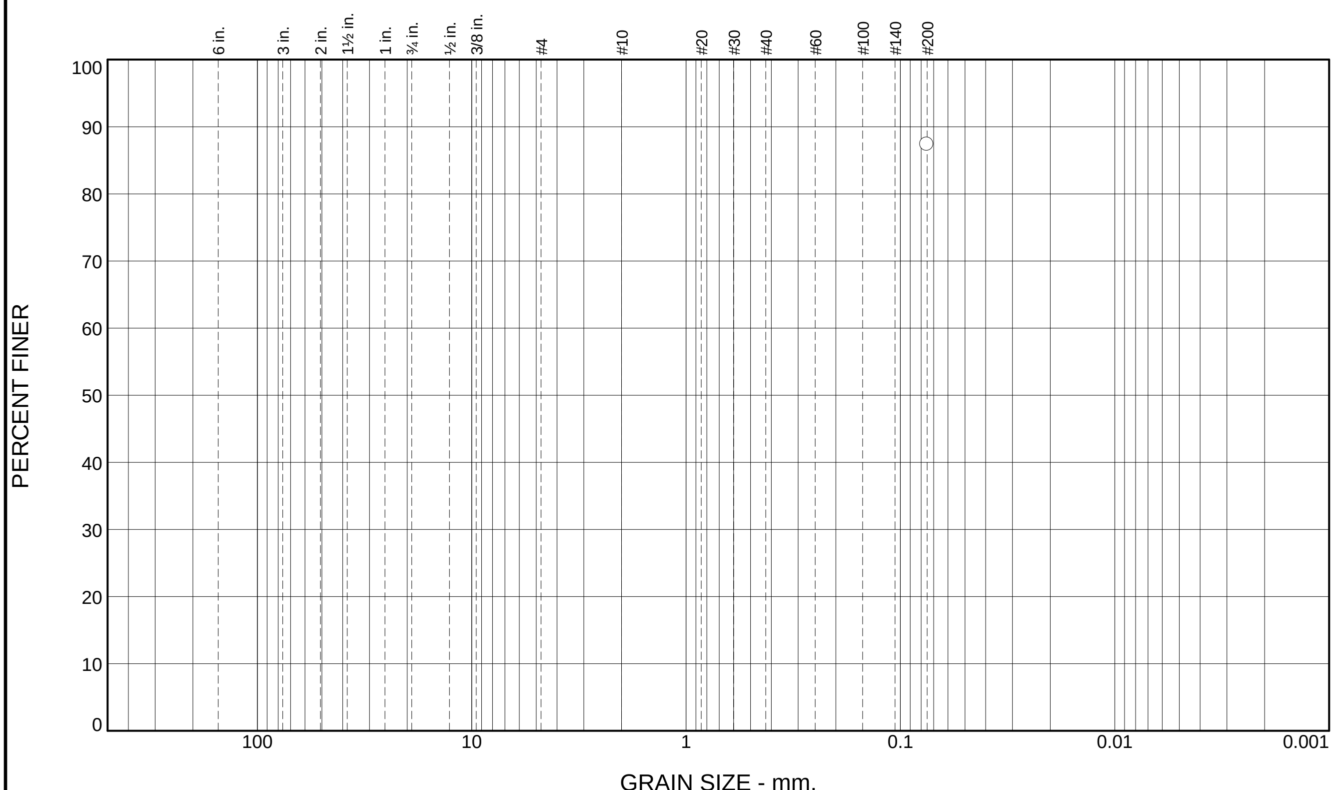
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						87.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	87.3		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 2-B4 @ 2.5-3 **Depth:** 2.5-3 feet

Date: 4-12-16

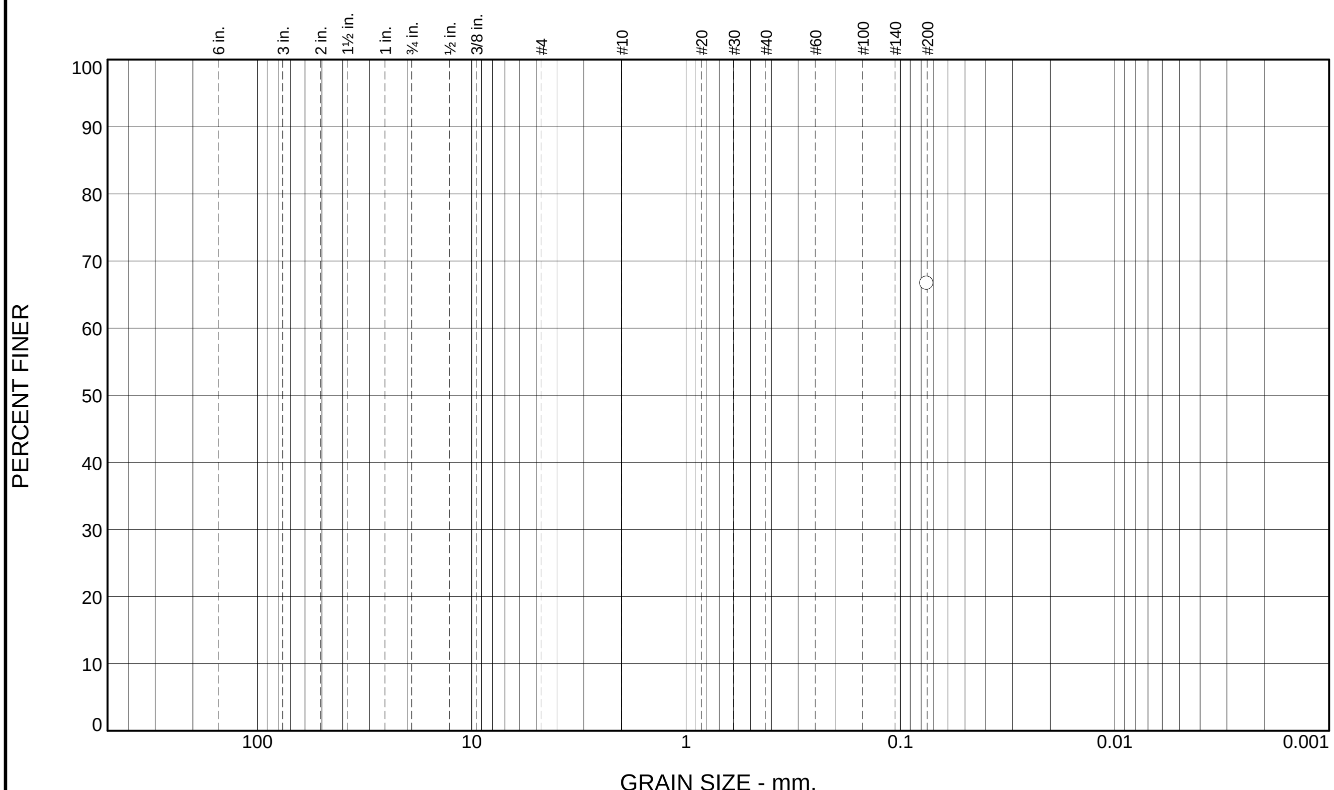
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						66.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	66.6		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 2-B4 @ 36-36.5 **Depth:** 36-36.5 feet

Date: 4-12-16

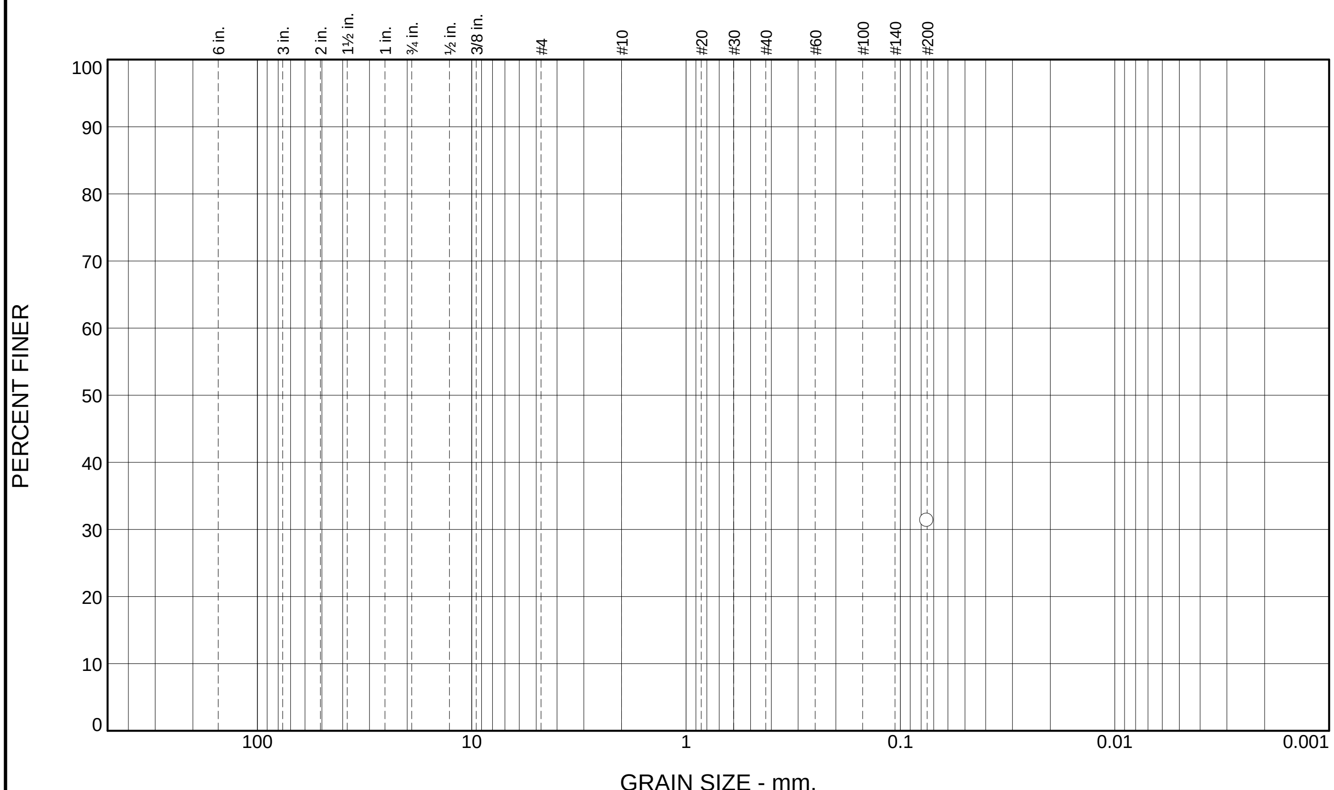
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						31.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	31.3		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 2-B5 @ 1-2.5 **Depth:** 1-2.5 feet

Date: 4-12-16

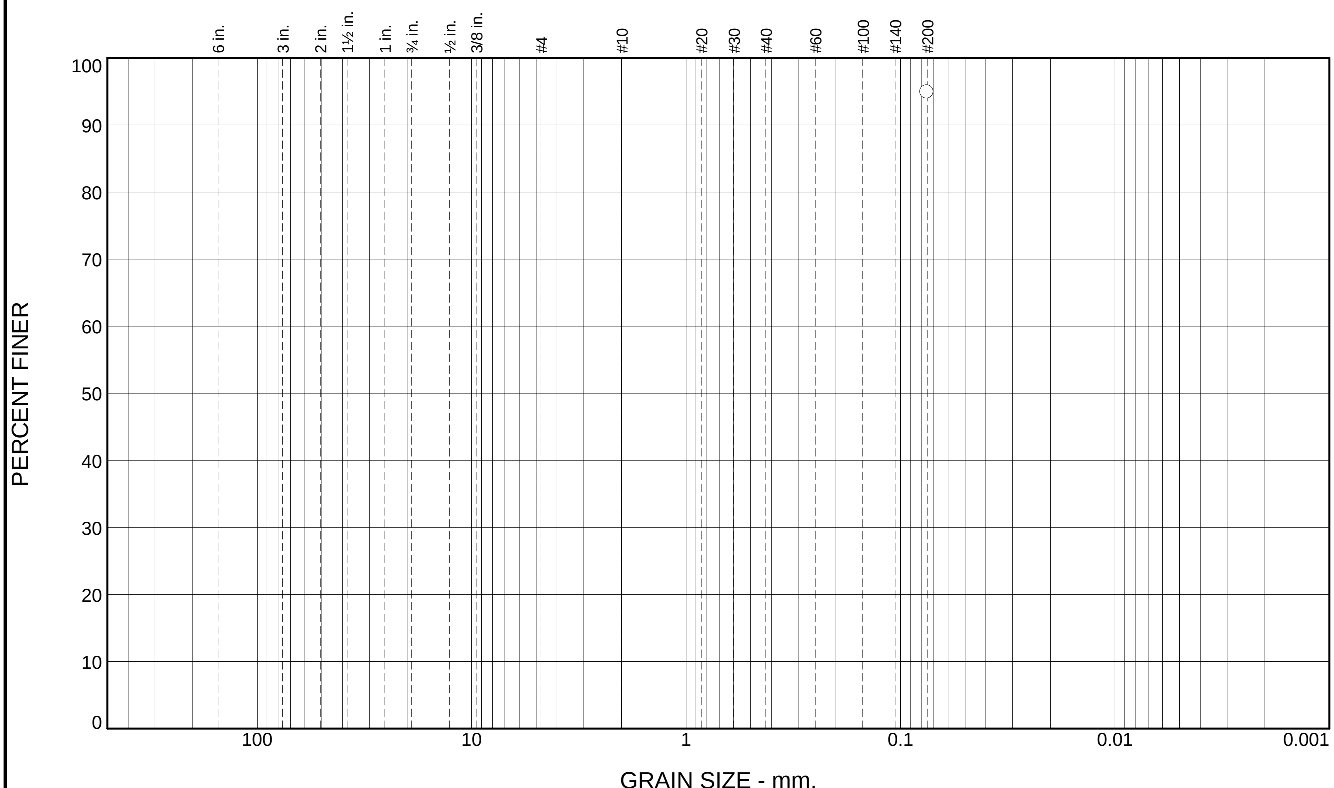
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						94.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	94.9		

* (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= AASHTO=

Remarks

ASTM D1140

Sample Number: 2-B5 @ 5-5.5 **Depth:** 5-5.5 feet

Date: 4-12-16

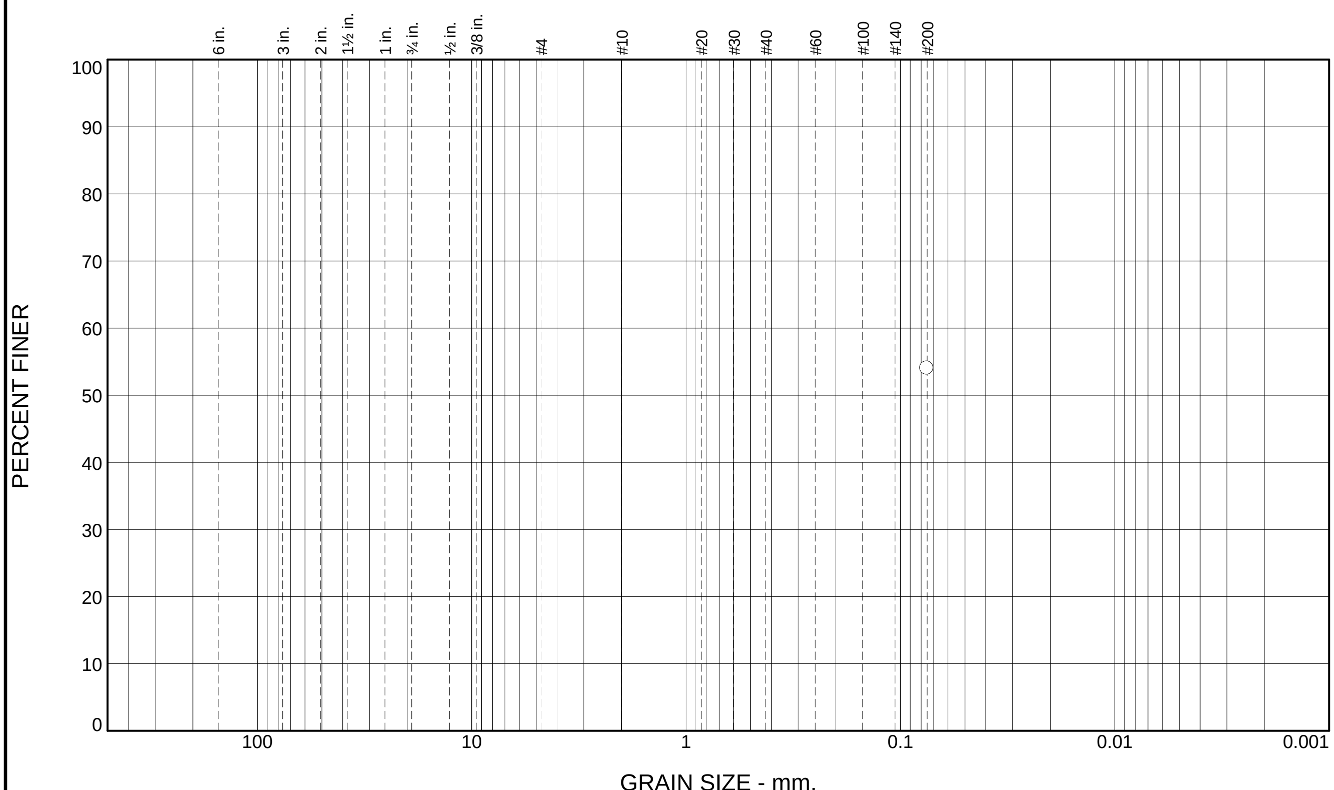
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						54.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	54.0		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 16 LL= 40 PI= 24

Coefficients

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

Classification

USCS= AASHTO=

Remarks

ASTM D1140
ASTM D4318, wet method

Sample Number: 2-B6 @ 1.5-2 **Depth:** 1.5-2 feet

Date: 4-12-16

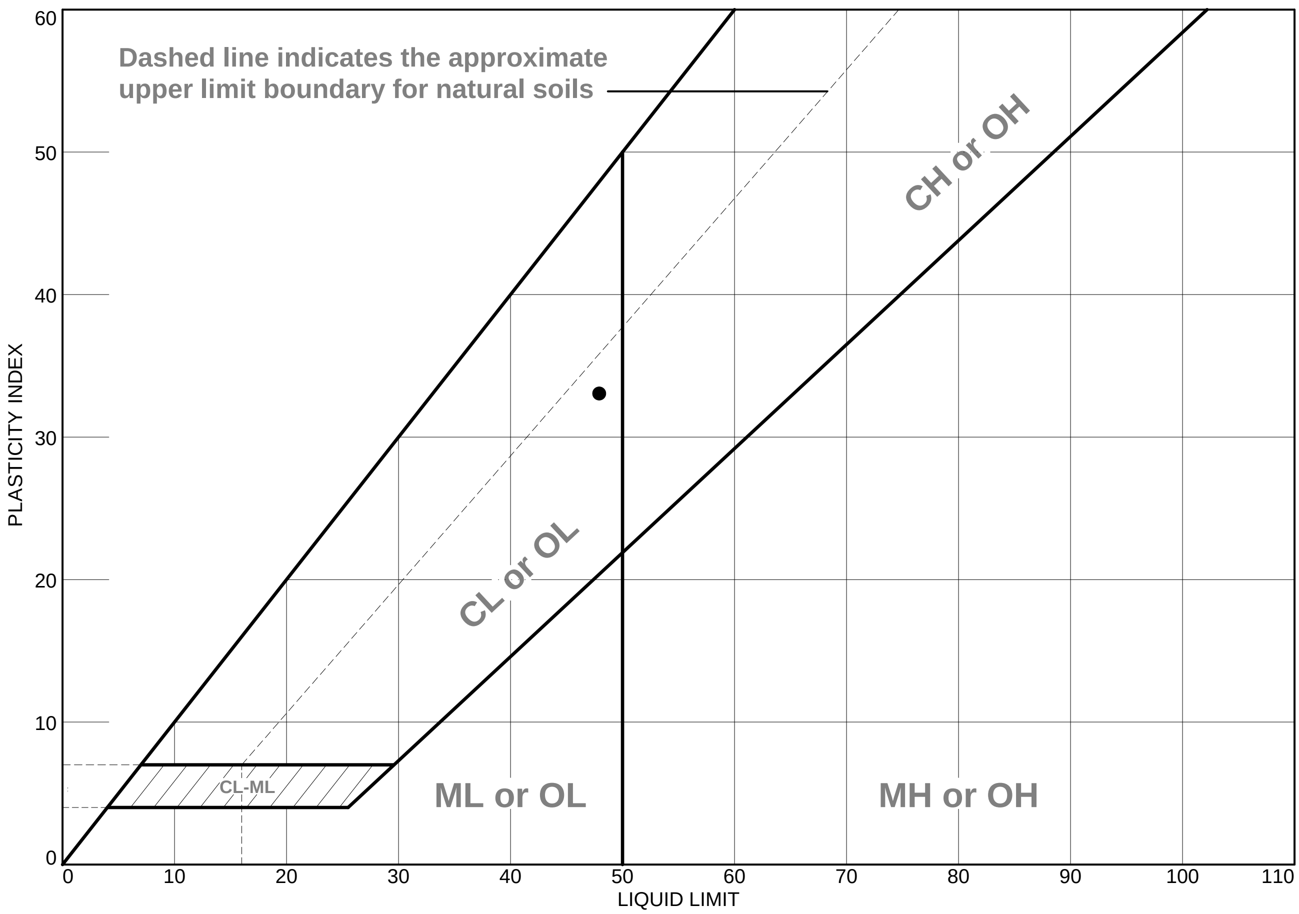
ENGEO INCORPORATED

Client: Schaaf & Wheeler
Project: Foster City Levees - Widening

Project No: 8602.001.000 **Figure**

Tested By: I. McCauley **Checked By:** K. Lecce

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	See exploration logs	48	15	33			

Project No. 8602.001.000 **Client:** Schaaf & Wheeler

Project: Foster City Levees - Widening

●**Depth:** 32.0-32.5 feet **Sample Number:** 3-B3 @ 32

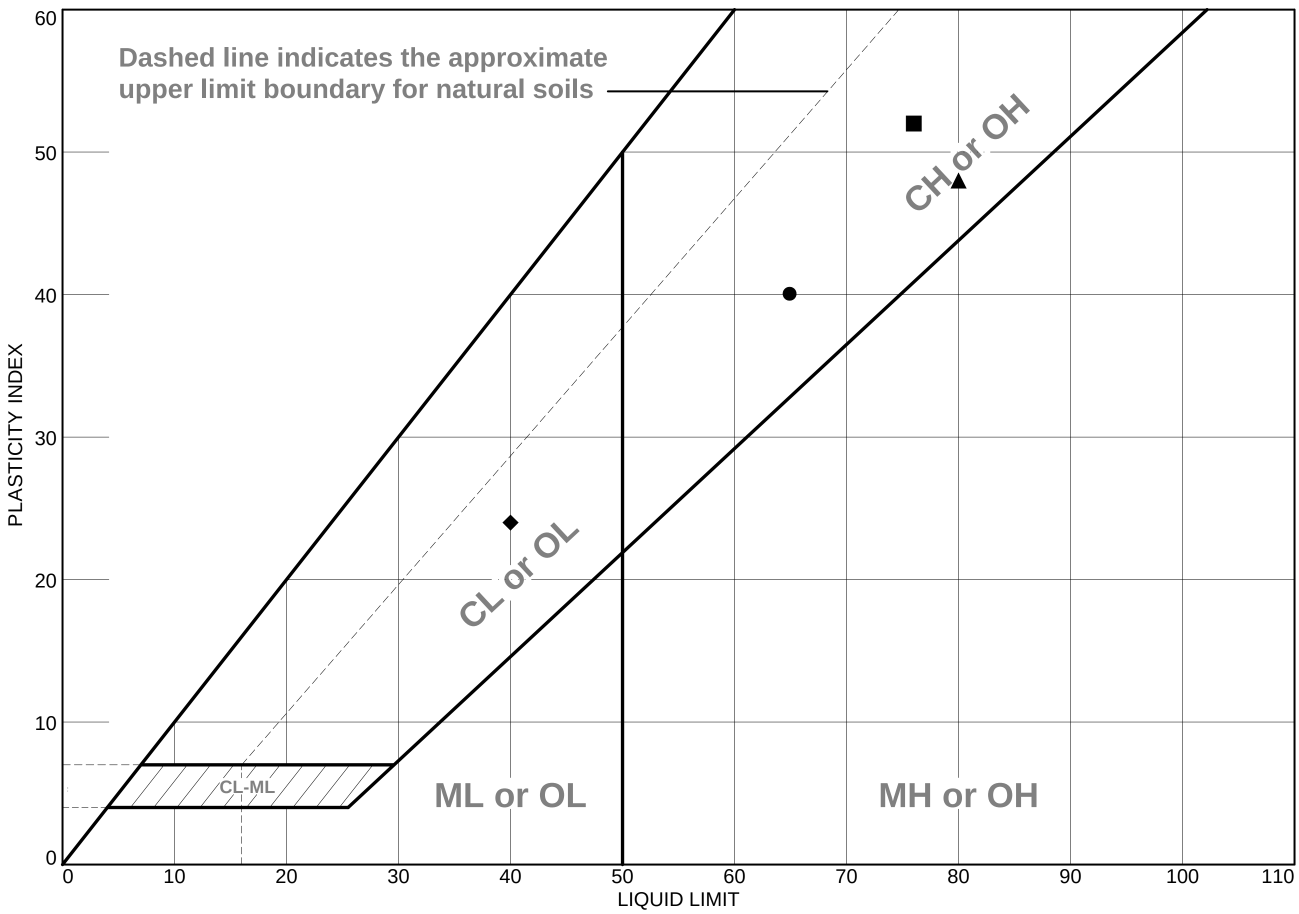
ENGEO INCORPORATED

Remarks:

●ASTM D4318, Wet method

Tested By: M. Quasem **Checked By:** G. Criste

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	See exploration logs	65	25	40		80.9	
■	See exploration logs	76	24	52			
▲	See exploration logs	80	32	48			
◆	See exploration logs	40	16	24		54.0	

Project No. 8602.001.000 **Client:** Schaaf & Wheeler

Project: Foster City Levees - Widening

●**Depth:** 5.5-6 feet **Sample Number:** 2-B1 @ 5.5-6
■**Depth:** 10.0-12.5 feet **Sample Number:** 2-B2 @ 10-12.5
▲**Depth:** 3-3.5 feet **Sample Number:** 2-B4 @ 3-3.5
◆**Depth:** 1.5-2 feet **Sample Number:** 2-B6 @ 1.5-2

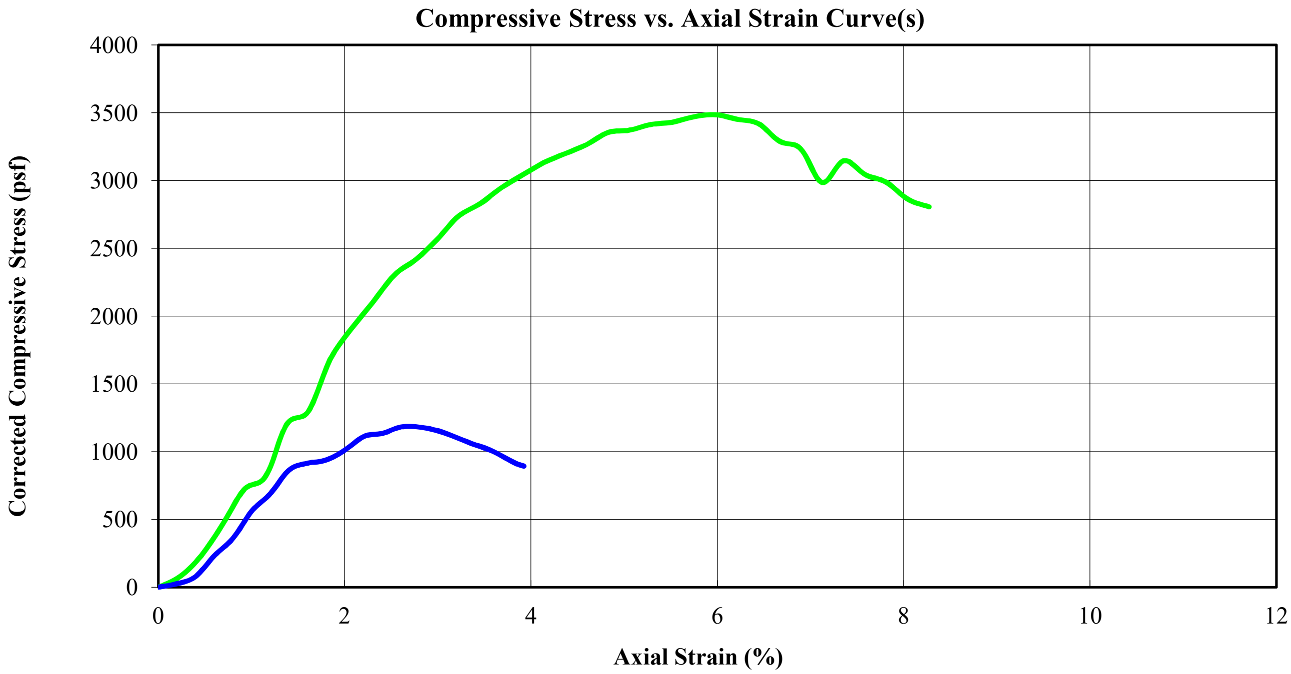
Remarks:
●ASTM D4318, wet method
ASTM D1140
■ASTM D4318, Wet method
▲ASTM D4318, wet method
◆ASTM D4318, wet method
ASTM D1140

ENGEO INCORPORATED

Figure

Tested By: I. McCauley **Checked By:** K. Lecce

UNCONFINED COMPRESSION TEST REPORT
(ASTM D2166)



BEFORE TEST	SPECIMEN 3-B1@6-6.5	SPECIMEN 3-B2@5-5.5
Moisture Content (%)	23.4	45.3
Dry Density (pcf)	97.5	69.8
Saturation (%)	89.1	87.6
Void Ratio	0.70	1.37
Diameter (in)	2.414	2.418
Height (in)	4.39	5.02
Height-To-Diameter Ratio	1.82	2.08
TEST DATA		
Unconfined Compressive Strength (psf)	3486	1183
Undrained Shear Strength (psf)	1743	591
Strain Rate (in./min.)	0.05	0.05
Specific Gravity (Assumed)	2.650	2.650
Strain at Failure (%)	5.98	2.61

Test Remarks

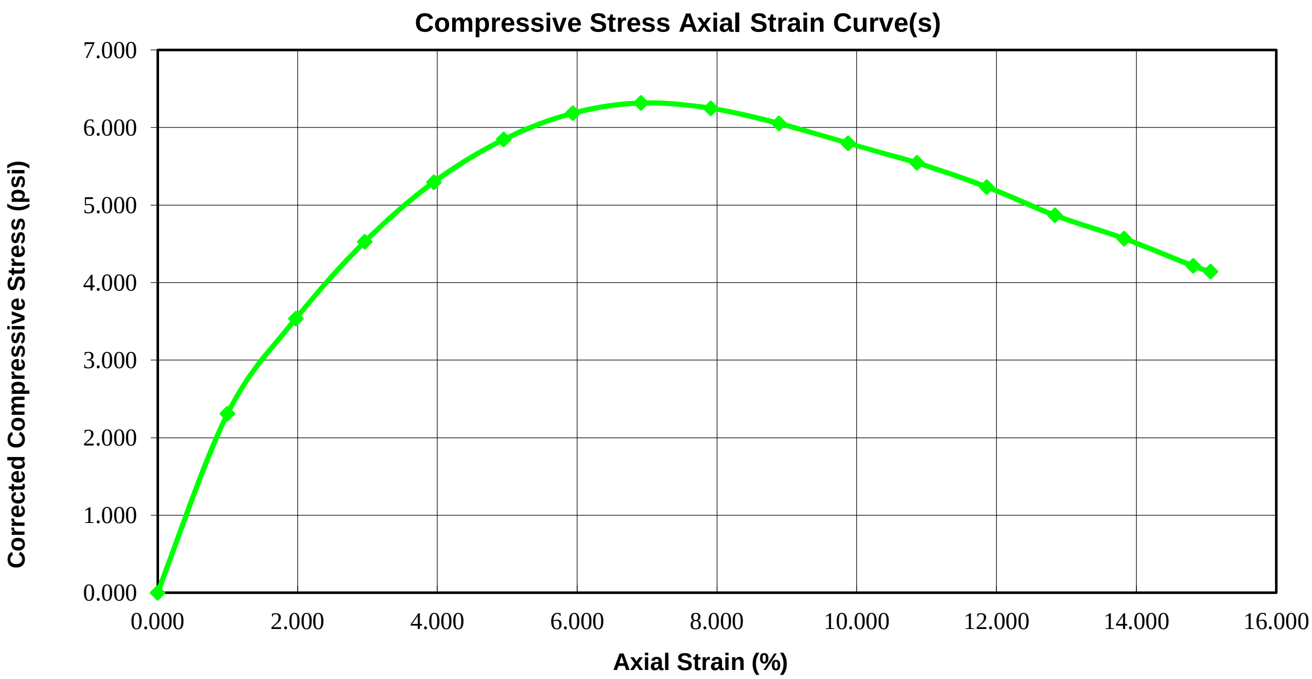
SPECIMEN	DESCRIPTION
3-B1@6-6.5	See exploration logs
3-B2@5-5.5	See exploration logs

PROJECT NAME: Foster City Levees - Widening
PROJECT NO: 8602.001.000
CLIENT: Schaaf & Wheeler
LOCATION: Foster City, CA
PHASE NO: 004

Test Date: 10/04/17
Tested By: M. Quasem
Reviewed By: G. Criste

ENGEO Expect Excellence

UNCONFINED COMPRESSION TEST REPORT
(ASTM D2166)



	SPECIMEN
BEFORE TEST	**2-B1 @ 6-6.5**
Moisture Content (%)	45.6
Dry Density (pcf)	74.9
Saturation (%)	99.88
Void Ratio	1.21
Diameter (in)	2.389
Height (in)	5.090
Height-To-Diameter Ratio	2.131
TEST DATA	
Unconfined Compressive Strength (psf)	909.638
Undrained Shear Strength (psf)	454.819
Strain Rate (in./min.)	0.05
Specific Gravity	2.650
Strain at Failure (%)	6.91
Liquid Limit	
Plastic Limit	
Test Remarks	

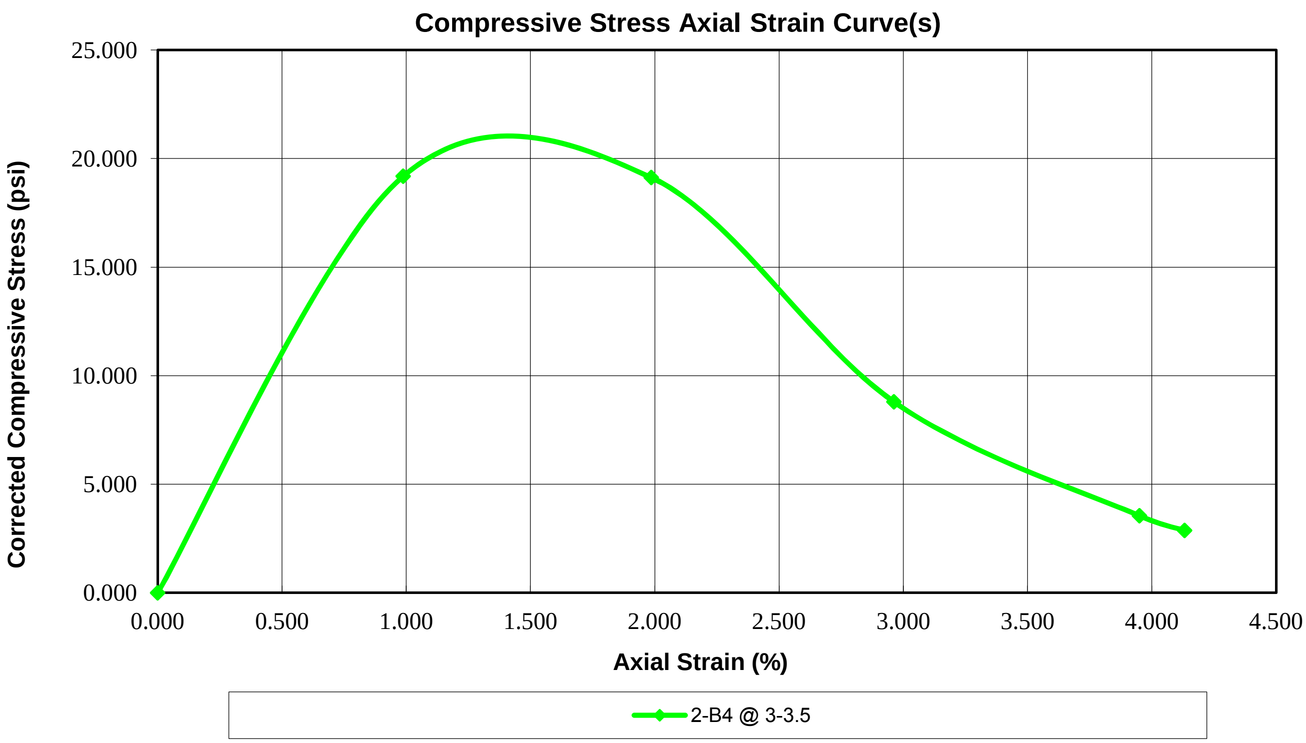
SPECIMEN	DESCRIPTION
2-B1 @ 6-6.5	See Exploration Log

PROJECT NAME: Foster City Levees - Widening
PROJECT NO: 8602.001.000
CLIENT: Schaaf & Wheeler
LOCATION: 2-B1
PHASE NO: 2.00

Test Date: 42467.00
Tested By: I. McCauley
Reviewed By: K. Lecce

ENGEO
Expect Excellence

UNCONFINED COMPRESSION TEST REPORT
(ASTM D2166)



	SPECIMEN
BEFORE TEST	**2-B4 @ 3-3.5**
Moisture Content (%)	47.0
Dry Density (pcf)	72.9
Saturation (%)	98.11
Void Ratio	1.27
Diameter (in)	2.406
Height (in)	5.090
Height-To-Diameter Ratio	2.116
TEST DATA	
Unconfined Compressive Strength (psf)	2762.355
Undrained Shear Strength (psf)	1381.178
Strain Rate (in./min.)	0.05
Specific Gravity	2.650
Strain at Failure (%)	0.99
Liquid Limit	
Plastic Limit	
Test Remarks	

SPECIMEN	DESCRIPTION
2-B4 @ 3-3.5	See Exploration Log

PROJECT NAME: Foster City Levees - Widening
PROJECT NO: 8602.001.000
CLIENT: Schaaf & Wheeler
LOCATION: 2-B4
PHASE NO: 01/02/00

Test Date: 04/07/16
Tested By: I. McCauley
Reviewed By: K. Lecce

ENGEO
Expect Excellence

EN GEO

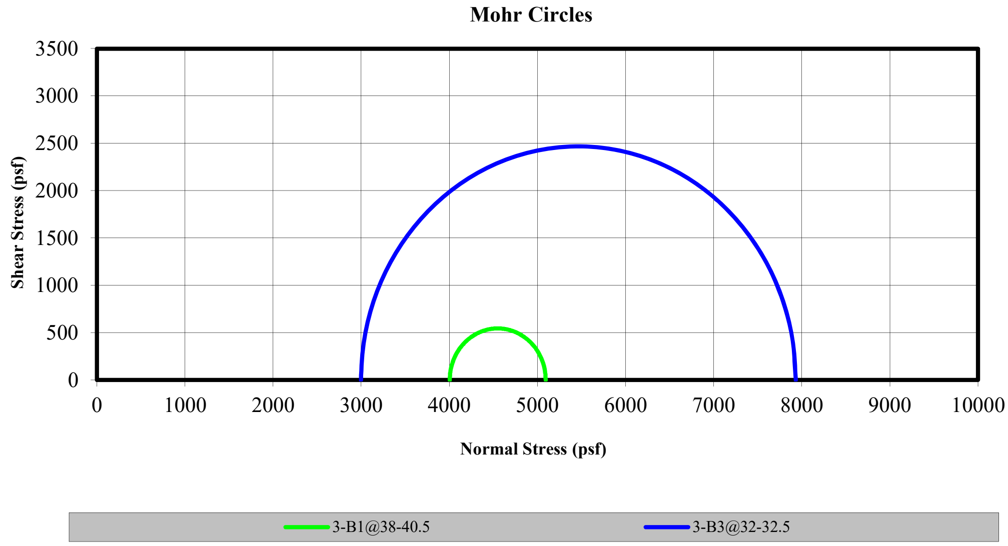
Unconsolidated Undrained Triaxial Test (ASTM D2850)

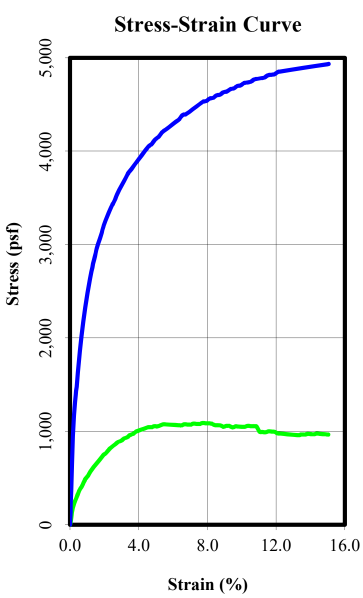
Date: 10/04/17

Checked By: D. Seibold

Date: 10/04/17

Tested By: G. Criste





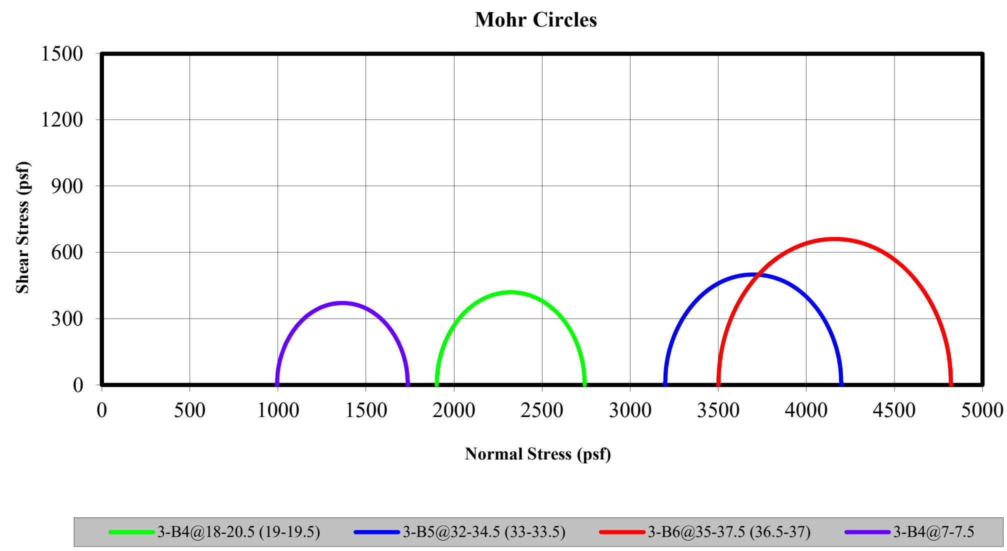
	Specimen			
Before Test	3-B1@38-40.5	3-B3@32-32.5		
Water Content (%)	50.20	21.11		
Dry Density (pcf)	70.98	108.88		
Saturation (%)	99.97	100.00		
Void Ratio	1.33	0.58		
Diameter (in)	2.861	2.425		
Height (in)	5.747	5.071		
Liquid Limit	-	-		
Plastic Limit	-	-		
Specific Gravity	2.650	2.760		
Height-to-Diameter Ratio	2.009	2.091		
After Test	3-B1@38-40.5	3-B3@32-32.5		
Water Content (%)	50.20	21.11		
Saturation (%)	99.97	100.00		
Strain Rate (in/min)	0.05	0.05		
Peak Deviator Stress (psf)	1089.8	4935.6		
Axial Strain @ Failure (%)	7.708	15.066		
	Cell Pressure			
Cell (psf)	4003.2	2995.2		
Back (psf)	n/a	n/a		
	Principle Stresses at Failure			
σ1 (psf)	5093.0	7930.8		
σ3 (psf)	4003.2	2995.2		

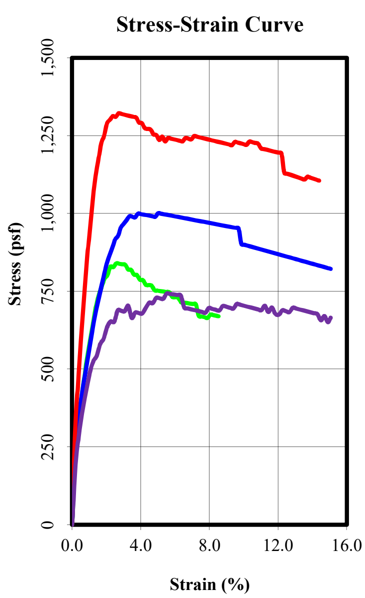
Mohr-Coulomb Parameters with a Non-zero Friction Angle (Ø≠0)			**Cohesion at Failure with a Zero Friction Angle (Ø=0)**			
Cohesion, c (psf)	0.0		544.9	2467.8		
Friction Angle Ø	0.00		n/a	n/a		

Project Information			
Project Name:	Foster City Levees - Widening		
Project Number:	8602.001.000	Job Number:	8602.001.000
Location:	Foster City, California	Boring Number:	Multiple
Client:	Schaaf & Wheeler	Sample Number:	Multiple
Description:	See exploration logs		

EN GEO

Unconsolidated Undrained Triaxial Test (ASTM D2850)





Before Test	3-B4@18-20.5	3-B5@32-34.5	3-B6@35-37.5	3-B4@7-7.5
	Specimen			
Water Content (%)	89.05	54.68	61.00	77.40
Dry Density (pcf)	49.42	68.71	64.02	54.90
Saturation (%)	99.90	99.87	99.75	99.89
Void Ratio	2.40	1.52	1.68	2.14
Diameter (in)	2.853	2.842	2.851	2.419
Height (in)	5.866	6.023	5.946	4.932
Liquid Limit	-	-	-	-
Plastic Limit	-	-	-	-
Specific Gravity (Assumed)	2.690	2.770	2.750	2.760
Height-to-Diameter Ratio	2.056	2.119	2.086	2.039
After Test	**3-B4@18-20.5**	**3-B5@32-34.5**	**3-B6@35-37.5**	**3-B4@7-7.5**
Water Content (%)	89.05	54.68	61.00	77.40
Saturation (%)	99.90	99.87	99.75	99.89
Strain Rate (in/min)	0.05	0.05	0.05	0.05
Peak Deviator Stress (psf)	840.1	1001.3	1322.1	743.2
Axial Strain @ Failure (%)	2.574	5.014	2.709	5.511
	Cell Pressure			
Cell (psf)	1900.8	3196.8	3499.2	993.6
Back (psf)	n/a	n/a	n/a	n/a
	Principle Stresses at Failure			
σ1 (psf)	2740.9	4198.1	4821.3	1736.8
σ3 (psf)	1900.8	3196.8	3499.2	993.6

Mohr-Coulomb Parameters with a Non-zero Friction Angle (Ø≠0)			Cohesion at Failure with a Zero Friction Angle (Ø=0)			
Cohesion, c (psf)	0.0		420.0	500.6	661.1	371.6
Friction Angle Ø	0.00		n/a	n/a	n/a	n/a

Project Information			
Project Name:	Foster City Levees - Widening		
Project Number:	8602.001.000	Job Number:	8602.001.000
Location:	Foster City, California	Boring Number:	Multiple
Client:	Schaaf & Wheeler	Sample Number:	Multiple
Description:	See exploration logs		

Date: 10/03/17

Checked By: D. Seibold

Date: 10/03/17

Tested By: G. Criste

EN GEO

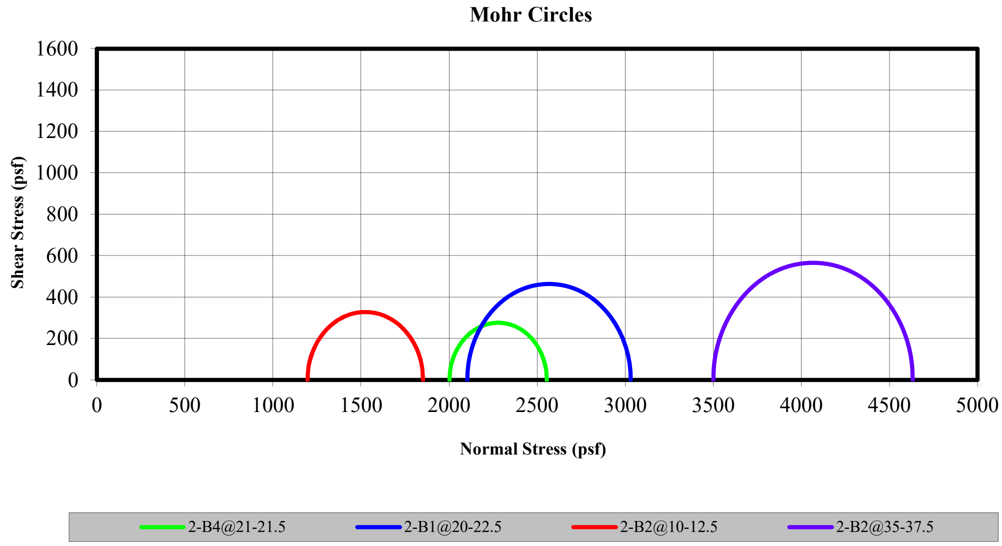
Unconsolidated Undrained Triaxial Test (ASTM D2850)

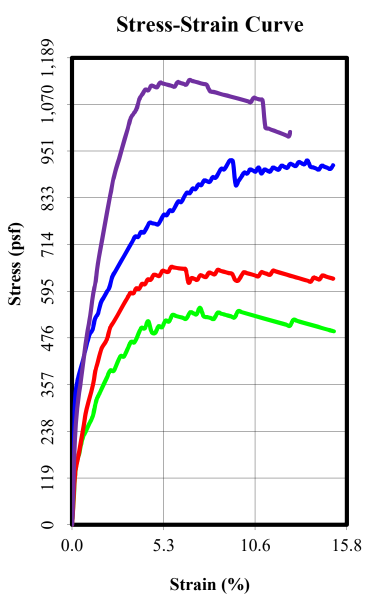
Date: 04/13/16

Checked By: D. Seibold

Date: 04/13/16

Tested By: G. Criste





	Specimen			
Before Test	2-B4@21-21.5	2-B1@20-22.5	2-B2@10-12.5	2-B2@35-37.5
Water Content (%)	90.08	61.78	76.54	59.62
Dry Density (pcf)	48.42	64.17	54.78	65.29
Saturation (%)	98.77	100.00	100.00	100.00
Void Ratio	2.42	1.72	2.03	1.65
Diameter (in)	2.393	2.828	2.845	2.837
Height (in)	5.050	6.086	5.999	5.962
Liquid Limit	-	-	-	-
Plastic Limit	-	-	-	-
Specific Gravity (Assumed)	2.650	2.800	2.660	2.770
Height-to-Diameter Ratio	2.110	2.152	2.109	2.102
After Test	2-B4@21-21.5	2-B1@20-22.5	2-B2@10-12.5	2-B2@35-37.5
Water Content (%)	90.08	61.78	76.54	59.62
Saturation (%)	98.77	100.00	100.00	100.00
Strain Rate (in/min)	0.05	0.05	0.05	0.05
Peak Deviator Stress (psf)	552.7	928.2	656.6	1132.7
Axial Strain @ Failure (%)	7.376	9.098	5.706	6.754
	Cell Pressure			
Cell (psf)	2001.6	2102.4	1195.2	3499.2
Back (psf)	n/a	n/a	n/a	n/a
	Principle Stresses at Failure			
σ1 (psf)	2554.3	3030.6	1851.8	4631.9
σ3 (psf)	2001.6	2102.4	1195.2	3499.2

Mohr-Coulomb Parameters with a Non-zero Friction Angle (Ø≠0)			Cohesion at Failure with a Zero Friction Angle (Ø=0)			
Cohesion, c (psf)	0.0		276.4	464.1	328.3	566.3
Friction Angle Ø	0.00		n/a	n/a	n/a	n/a

Project Information			
Project Name:	Foster City Levees - Widening		
Project Number:	8602.001.000	Job Number:	8602.001.000
Location:	Foster City, CA	Boring Number:	Multiple
Client:	Schaaf & Wheeler	Sample Number:	Multiple
Description:	See exploration logs		

LABORATORY MINIATURE VANE SHEAR

ASTM D4648

APPARATUS USED: Wykeham Farrance, Model 27-WF1730/4

Sample #	Sample ID	Remold? (Y/N)	Test depth (ft)	Spring number	Shear strength (psf)
1	3-B1@19-21.5	N	21-21.25	2	649
2	3-B1@27-29.5	N	29-29.25	2	983
3	3-B2@40-42.5	N	41.5-42	2	774
4	3-B3@7-9.5	N	8.25-8.5	3	725
5	3-B3@15-17.5	N	17-17.25	3	329
6	3-B3@24-26.5	N	26-26.25	3	430

Testing remarks:

PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaaf & Wheeler
PHASE NUMBER: 004

DATE: 10/03/17

ENGEO
Expect Excellence

Tested by: G. Criste

Reviewed by: D. Seibold

LABORATORY MINIATURE VANE SHEAR

ASTM D4648

APPARATUS USED: Wykeham Farrance, Model 27-WF1730/4

Sample #	Sample ID	Remold? (Y/N)	Test depth (ft)	Spring number	Shear strength (psf)
1	3-B4@11-13.5	N	12.5-12.75	3	445
2	3-B4@38-40.5	N	40-40.25	4	1979
3	3-B5@7-9.5	N	9-9.25	3	704
4	3-B5@15-17.5	N	16.5-16.75	2	312
5	3-B6@5-7.5	N	7-7.25	4	913
6	3-B6@15-17.5	N	17-17.25	3	490
7	3-B6@25-27.5	N	26-26.5	3	531
8	3-B6@55-57.5	N	56-56.5	4	913

Testing remarks:

PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaaf & Wheeler
PHASE NUMBER: 004

DATE: 09/27/17

ENGEO
Expect Excellence

Tested by: G. Criste
Reviewed by: D. Seibold

LABORATORY MINIATURE VANE SHEAR

ASTM D4648

APPARATUS USED: Wykeham Farrance, Model 27-WF1730/4

Sample #	Sample ID	Remold? (Y/N)	Test depth (ft)	Spring number	Shear strength (psf)
1	2-B1@12-14.5	N	13.5-14	2	312
2	2-B1@30-32.5	N	31.5-32	2	108
3	2-B1@42-44.5	N	44-44.5	2	96
4	2-B2@16-18.5	N	18-18.5	2	439
5	2-B2@25-27.5	N	26-26.5	2	42
6	2-B2@60-62.5	N	60.5-61	2	916
7	2-B4@8.5-9	N	8.75-9	1	359
8	2-B4@16-16.5	N	16.25-16.5	1	364
9	2-B4@25.5-26	N	25.75-26	2	390

Testing remarks: Section tested for Sample 2-B2@60-62.5 was silty, clayey sand.

PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaaf & Wheeler
PHASE NUMBER: 002

DATE: 04/11/16

ENGEO
Expect Excellence

Tested by: G. Criste

Reviewed by: D. Seibold

LABORATORY MINIATURE VANE SHEAR

ASTM D4648

APPARATUS USED: Wykeham Farrance, Model 27-WF1730/4

Sample #	Sample ID	Remold? (Y/N)	Test depth (ft)	Spring number	Shear strength (psf)
1	2-B1@30-32.5	N	31.25-31.5	2	293
2	2-B1@42-44.5	N	43.25-43.5	2	798
3	2-B2@25-27.5	N	25.75-26	2	516

Testing remarks: Re-test of low strength borings at different depths

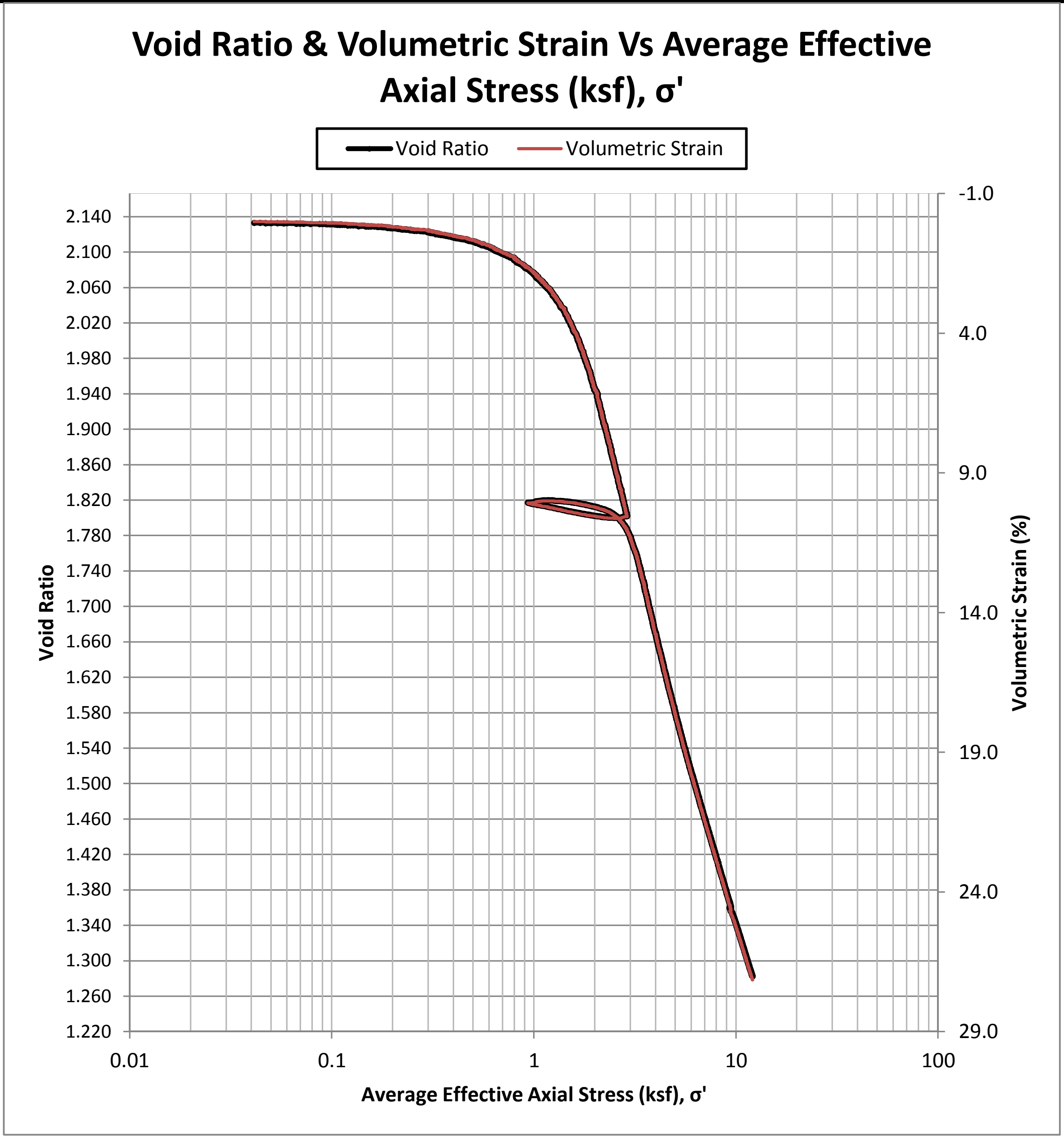
PROJECT NAME: Foster City Levees - Widening
PROJECT NUMBER: 8602.001.000
CLIENT: Schaaf & Wheeler
PHASE NUMBER: 002

DATE: 04/15/16

ENGEO
Expect Excellence

Tested by: G. Criste
Reviewed by: D. Seibold

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	Final
Moisture (%):	78.20%	52.52%
Dry Density (pcf):	55.30	75.90
Saturation (%):	101.93%	100.00%
Void Ratio:	2.1329	1.2825

Test Date: 10/18/2017

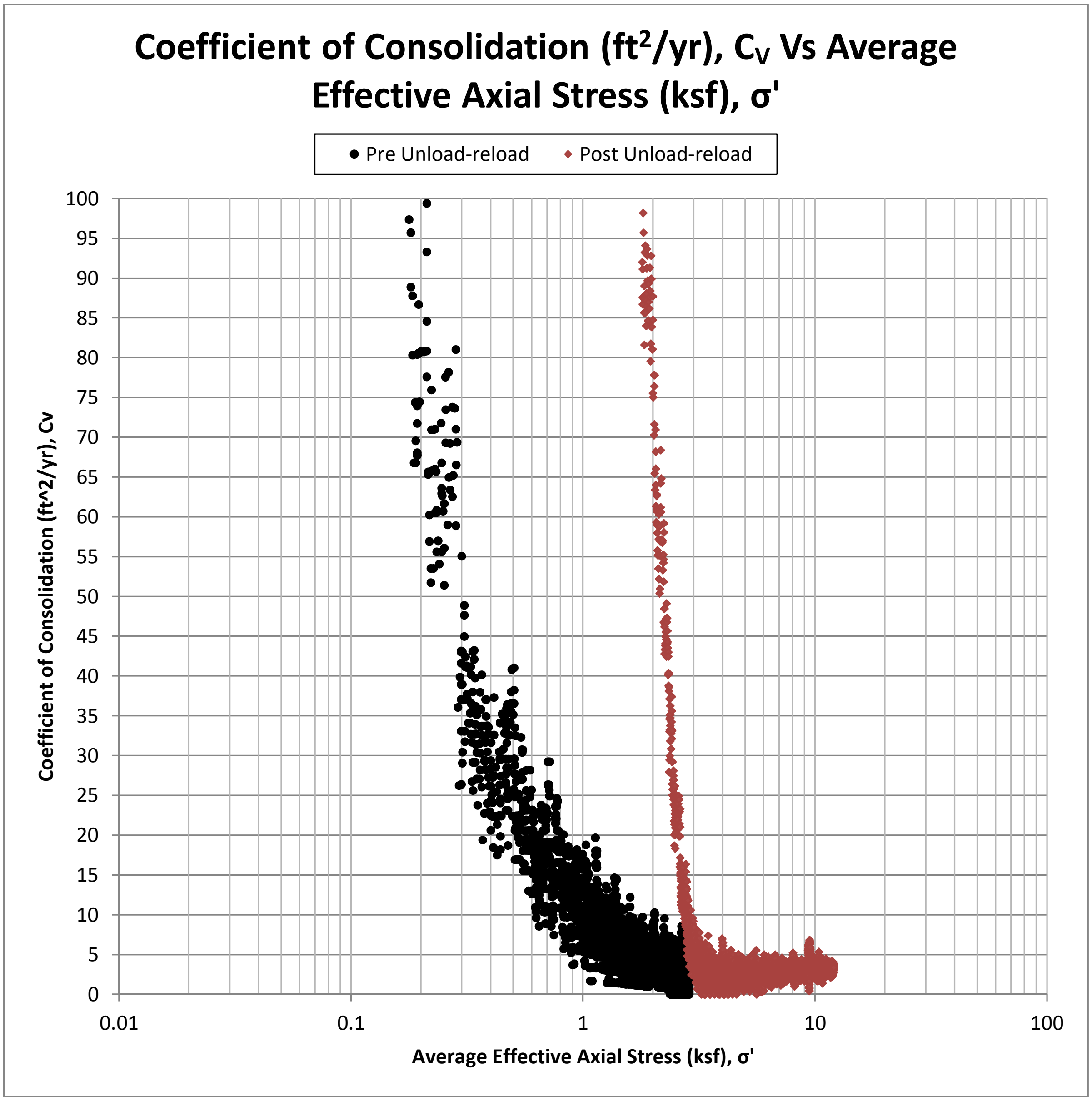
ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.780
Soil Description:	See exploration logs

Project Number:	8602.001.000	**Depth:**	21-21.5 ft
Sample Number:	3-B1 @ 19-21.5	**Boring #:**	3-B1
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	**Reviewed By:**	J. Ruffoni

ENGEO
Expect Excellence

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - 2974 Method A (OD mass)		
	Initial	**Final**
Moisture (%):	78.20%	52.52%
Dry Density (pcf):	55.30	75.90
Saturation (%):	101.93%	100.00%
Void Ratio:	2.1329	1.2825

Test Date: 10/18/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.780
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B1 @ 19-21.5
Project Name:	Foster City Levees - Widening
Client:	Schaaf & Wheeler
Location:	Foster City, California
Tested By:	D. Seibold

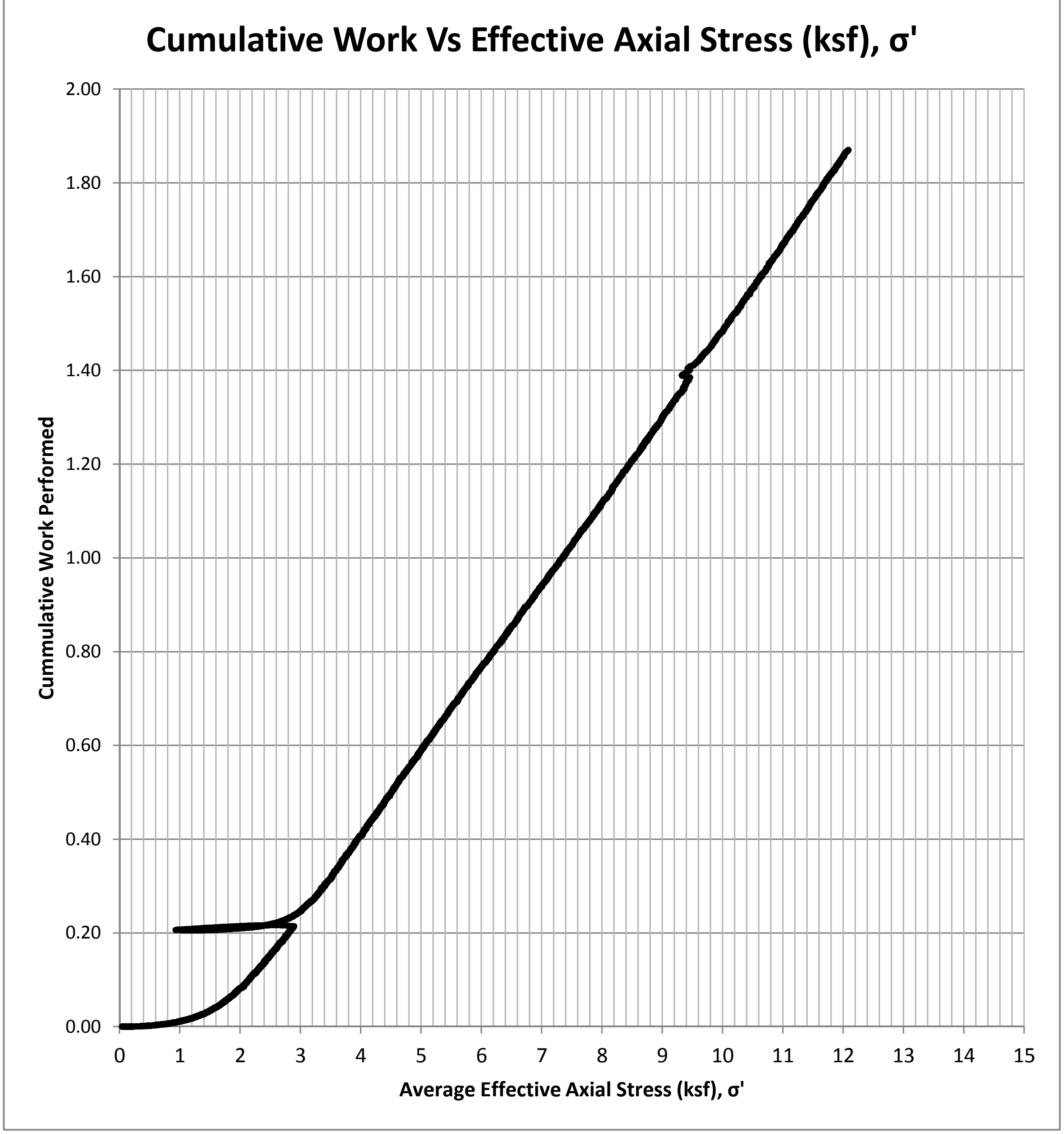
Depth: 21-21.5 ft
Boring #: 3-B1

ENGEO Expect Excellence

Reviewed By: J. Ruffoni

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	Final
Moisture (%):	78.20%	52.52%
Dry Density (pcf):	55.30	75.90
Saturation (%):	101.93%	100.00%
Void Ratio:	2.1329	1.2825

Test Date: 10/18/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.780
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B1 @ 19-21.5
Project Name:	Foster City Levees - Widening
Client:	Schaaf & Wheeler
Location:	Foster City, California
Tested By:	D. Seibold
Depth:	21-21.5 ft
Boring #:	3-B1
Reviewed By:	J. Ruffoni

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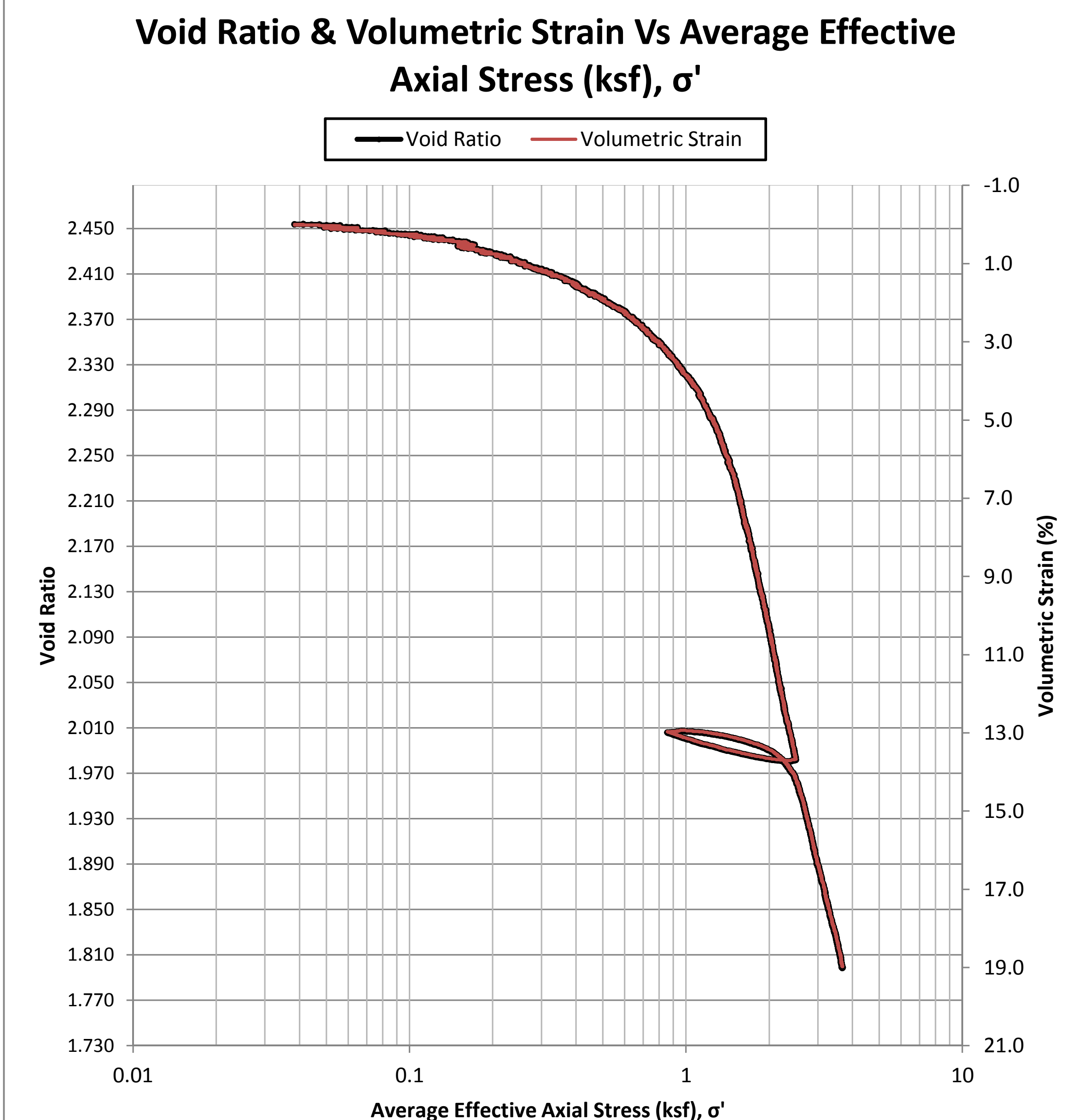
Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	**Final**
Moisture (%):	88.11%	71.93%
Dry Density (pcf):	50.70	62.57
Saturation (%):	100.89%	100.00%
Void Ratio:	2.4540	1.7986

Test Date: 10/20/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.810
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B3 @ 15-17.5
Project Name:	Foster City Levees - Widening
Client:	Schaaf & Wheeler
Location:	Foster City , California
Tested By:	D. Seibold
Depth:	16-16.5 ft
Boring #:	3-B3
Reviewed By:	J. Ruffoni

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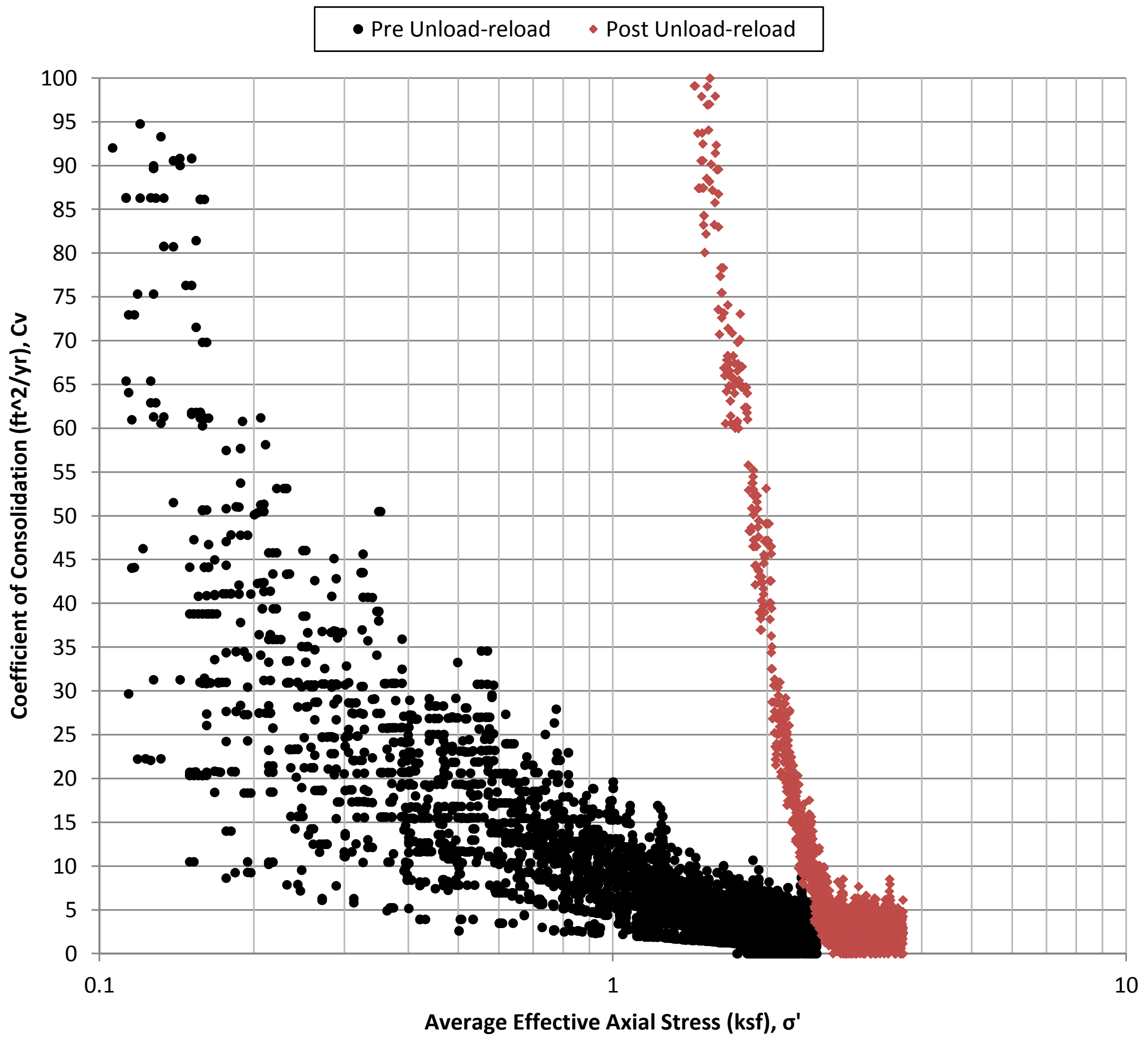
Remarks:

Constant Rate of Strain Consolidation
ASTM D4186

Coefficient of Consolidation (ft²/yr), C_V Vs Average Effective Axial Stress (ksf), σ'

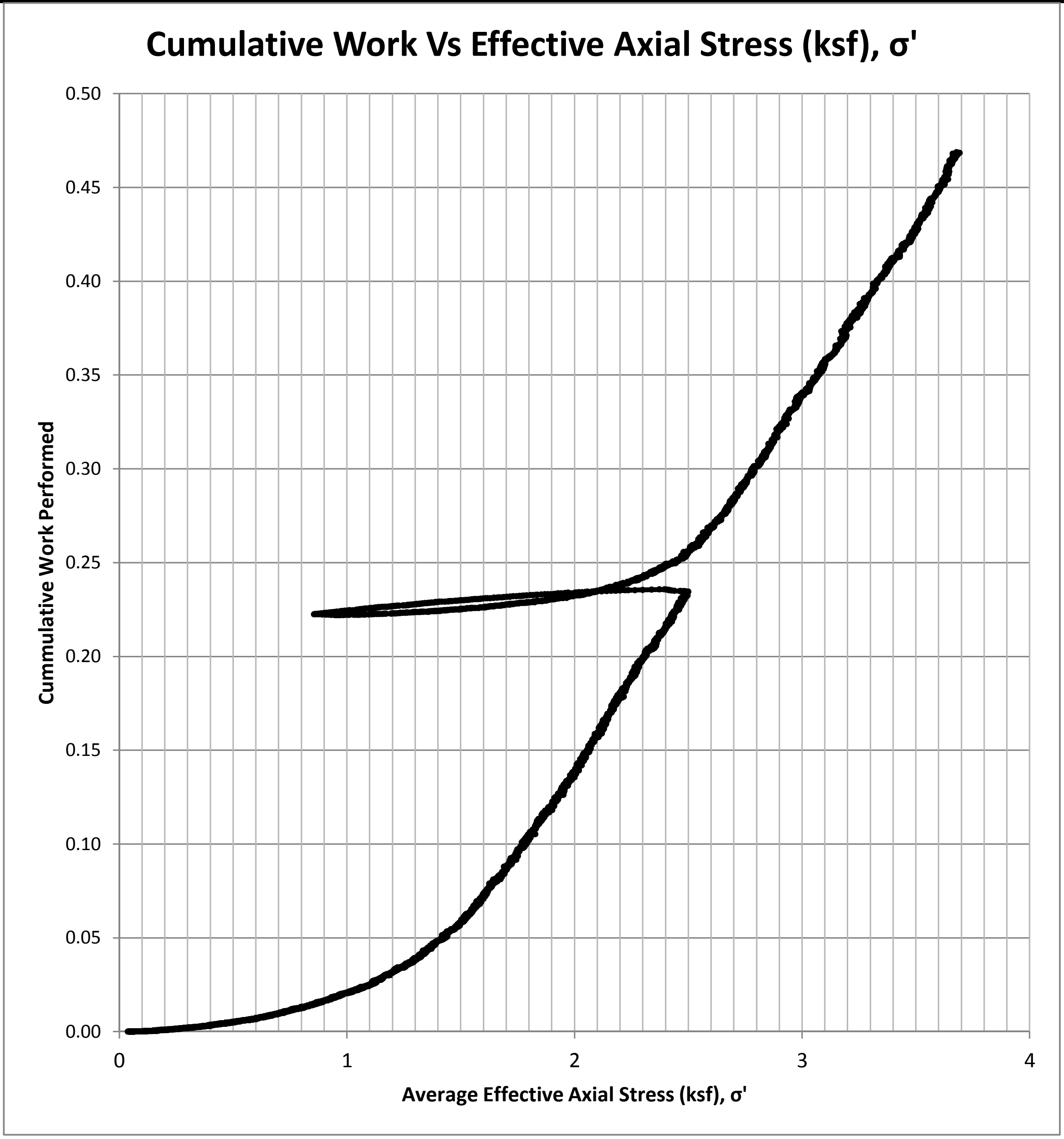


ASTM D2974 - 2974 Method A (OD mass)				Test Date: 10/20/2017
	Initial	Final	ASTM D4318 - Wet Method	
Moisture (%):	88.11%	71.93%	Liquid Limit:	
Dry Density (pcf):	50.70	62.57	Plastic Limit:	
Saturation (%):	100.89%	100.00%	ASTM D854 - Measured	
Void Ratio:	2.4540	1.7986	Specific Gravity:	2.810
			Soil Description:	See exploration logs

Project Number:	8602.001.000	Depth:	16-16.5 ft
Sample Number:	3-B3 @ 15-17.5	Boring #:	3-B3
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City , California		
Tested By:	D. Seibold	Reviewed By:	J. Ruffoni
Remarks:			

ENGEO
Expect Excellence

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)				Test Date: 10/20/2017
	Initial	Final	ASTM D4318 - Wet Method	
Moisture (%):	88.11%	71.93%	Liquid Limit:	
Dry Density (pcf):	50.70	62.57	Plastic Limit:	
Saturation (%):	100.89%	100.00%	ASTM D854 - Measured	
Void Ratio:	2.4540	1.7986	Specific Gravity:	2.810
			Soil Description:	See exploration logs

Project Number:	8602.001.000	Depth:	16-16.5 ft
Sample Number:	3-B3 @ 15-17.5	Boring #:	3-B3
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City , California		
Tested By:	D. Seibold	Reviewed By:	J. Ruffoni

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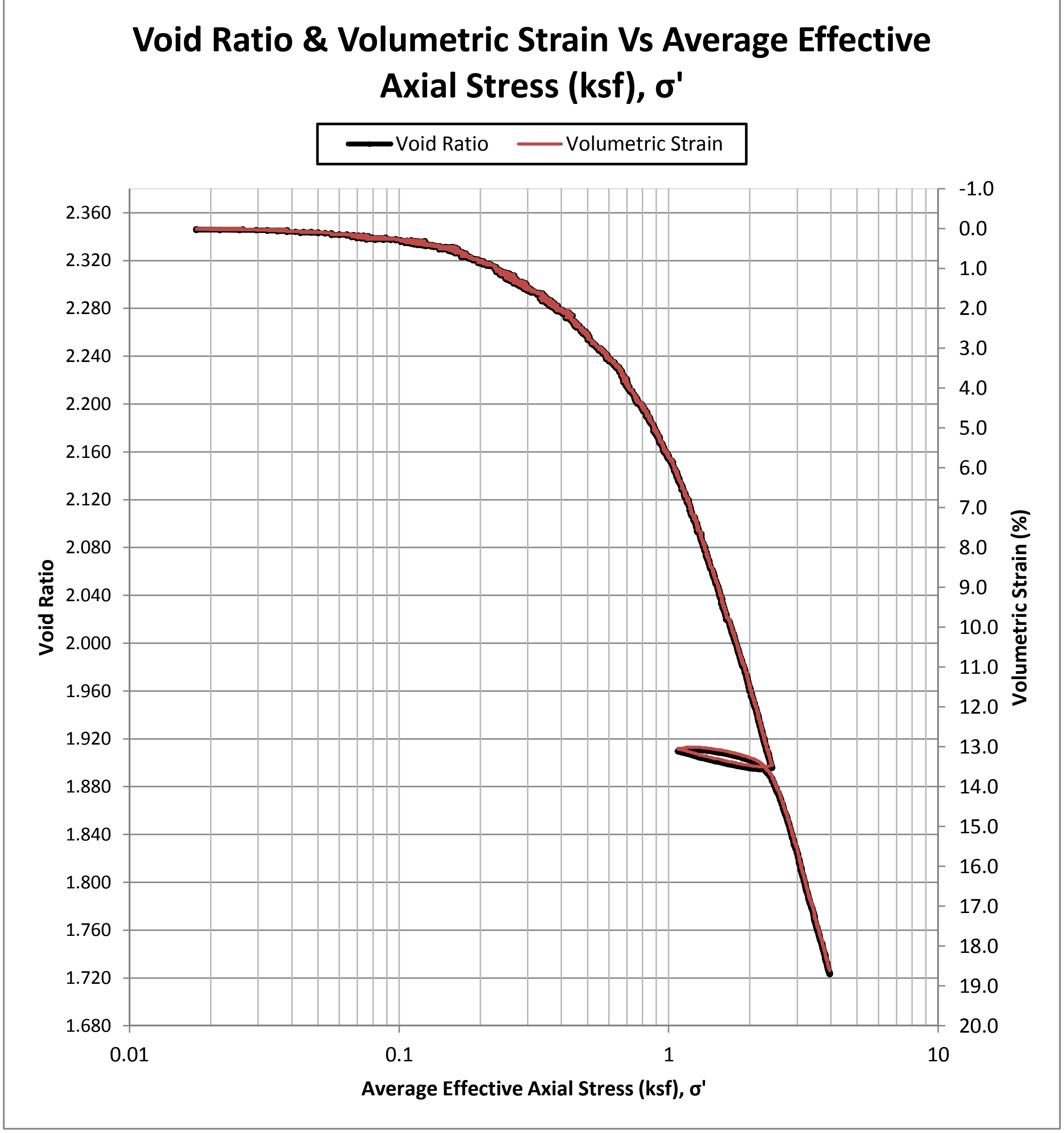
Expect Excellence

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)	Initial	Final
Moisture (%):	88.26%	67.28%
Dry Density (pcf):	50.32	61.83
Saturation (%):	101.65%	100.00%
Void Ratio:	2.3462	1.7232

Test Date: 9/25/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.702
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B4 @ 11-13.5
Project Name:	Foster City Levees - Widening
Client:	Schaaf & Wheeler
Location:	Foster City, California
Tested By:	D. Seibold
Depth:	12-12.5 ft
Boring #:	3-B4
Reviewed By:	J. Ruffoni

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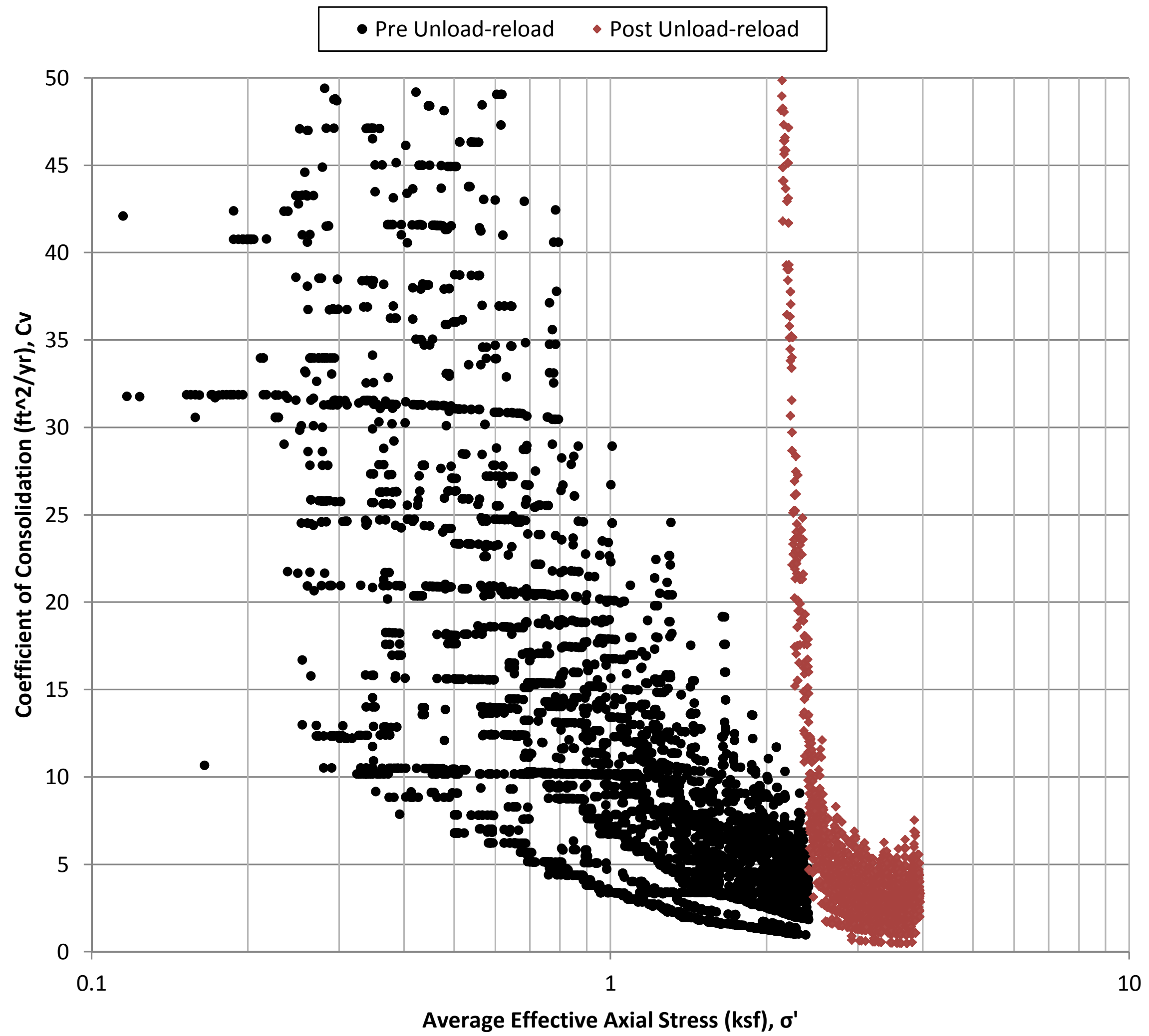
Remarks:

Constant Rate of Strain Consolidation
ASTM D4186

Coefficient of Consolidation (ft²/yr), C_V Vs Average Effective Axial Stress (ksf), σ'

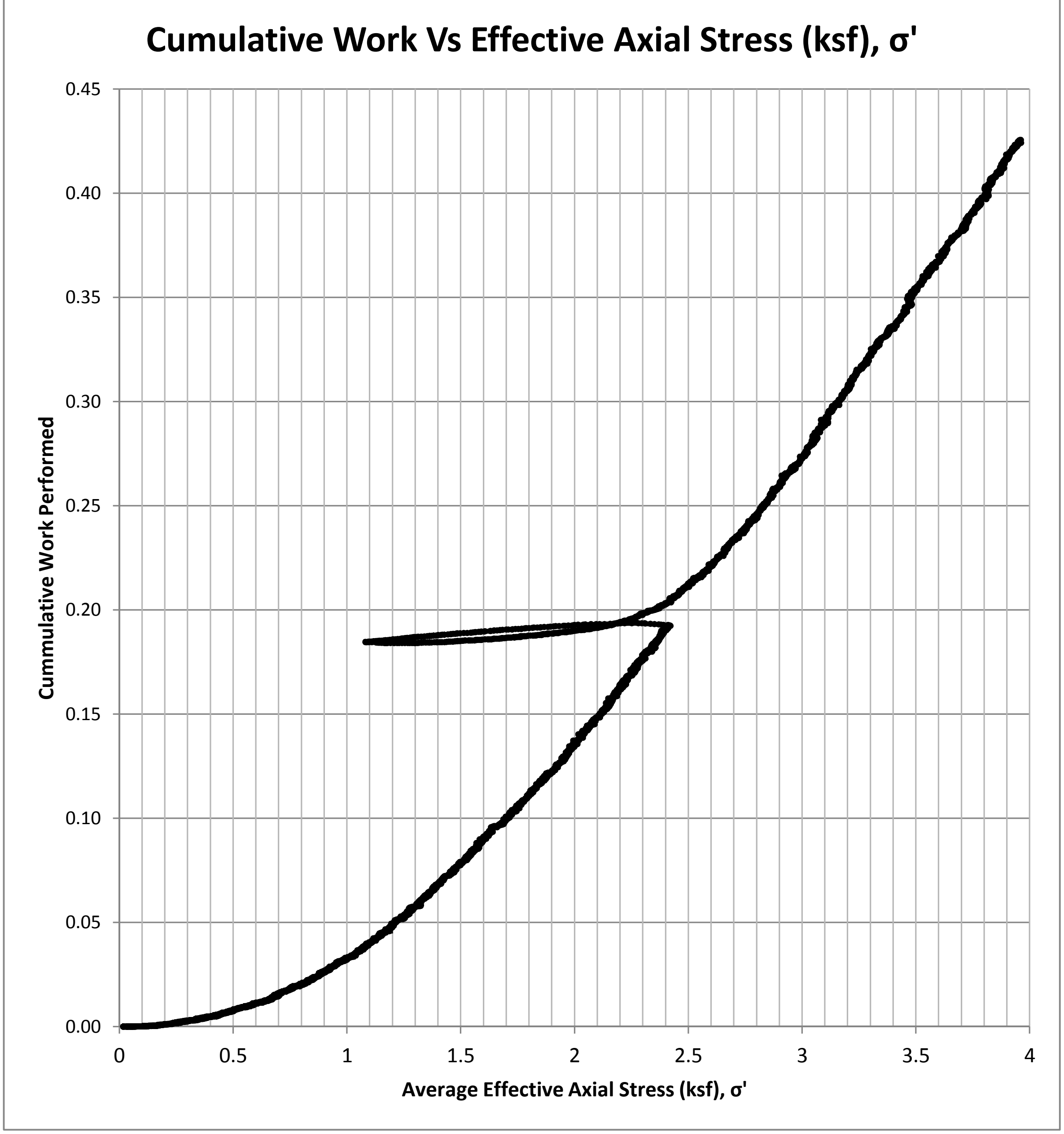


ASTM D2974 - 2974 Method A (OD mass)				Test Date: 9/25/2017
	Initial	Final	ASTM D4318 - Wet Method	
Moisture (%):	88.26%	67.28%	Liquid Limit:	
Dry Density (pcf):	50.32	61.83	Plastic Limit:	
Saturation (%):	101.65%	100.00%	ASTM D854 - Measured	
Void Ratio:	2.3462	1.7232	Specific Gravity:	2.702
			Soil Description:	See exploration logs

Project Number:	8602.001.000	**Depth:**	12-12.5 ft
Sample Number:	3-B4 @ 11-13.5	**Boring #:**	3-B4
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	**Reviewed By:**	J. Ruffoni
Remarks:			

ENGEO Expect Excellence

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)	Initial	Final
Moisture (%):	88.26%	67.28%
Dry Density (pcf):	50.32	61.83
Saturation (%):	101.65%	100.00%
Void Ratio:	2.3462	1.7232

Test Date: 9/25/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.702
Soil Description:	See exploration logs

Project Number: 8602.001.000
Sample Number: 3-B4 @ 11-13.5
Project Name: Foster City Levees - Widening
Client: Schaaf & Wheeler
Location: Foster City, California
Tested By: D. Seibold

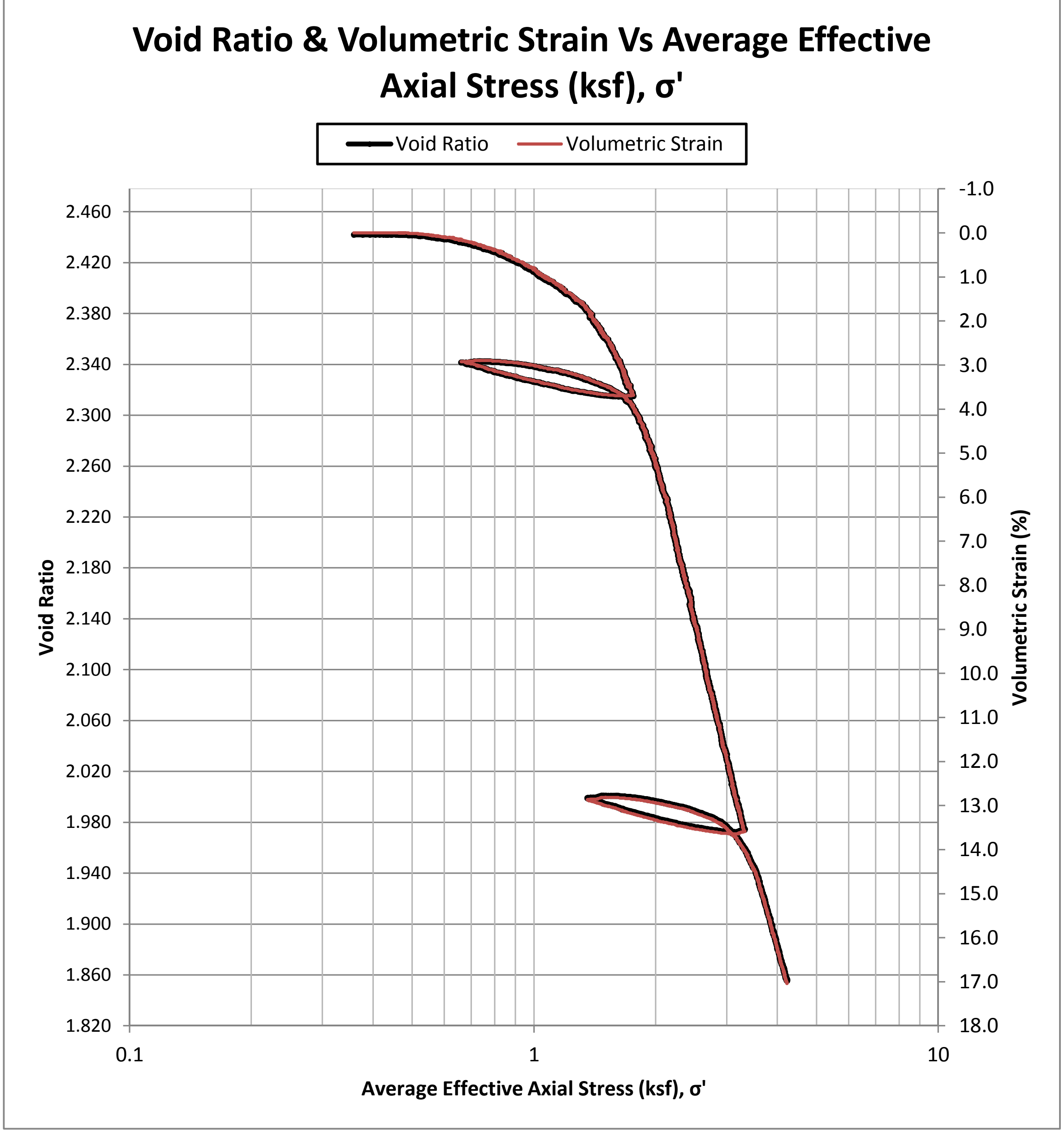
Depth: 12-12.5 ft
Boring #: 3-B4

ENGEO Expect Excellence

Reviewed By: J. Ruffoni

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)	Initial	Final
Moisture (%):	91.49%	71.43%
Dry Density (pcf):	49.10	59.18
Saturation (%):	101.60%	100.00%
Void Ratio:	2.4422	1.8557

Test Date: 10/2/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.712
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B4 @ 25-27.5
Project Name:	Foster City Levees - Widening
Client:	Schaaf & Wheeler
Location:	Foster City, California
Tested By:	D. Seibold
Depth:	26-26.5 ft
Boring #:	3-B4
Reviewed By:	J. Ruffoni

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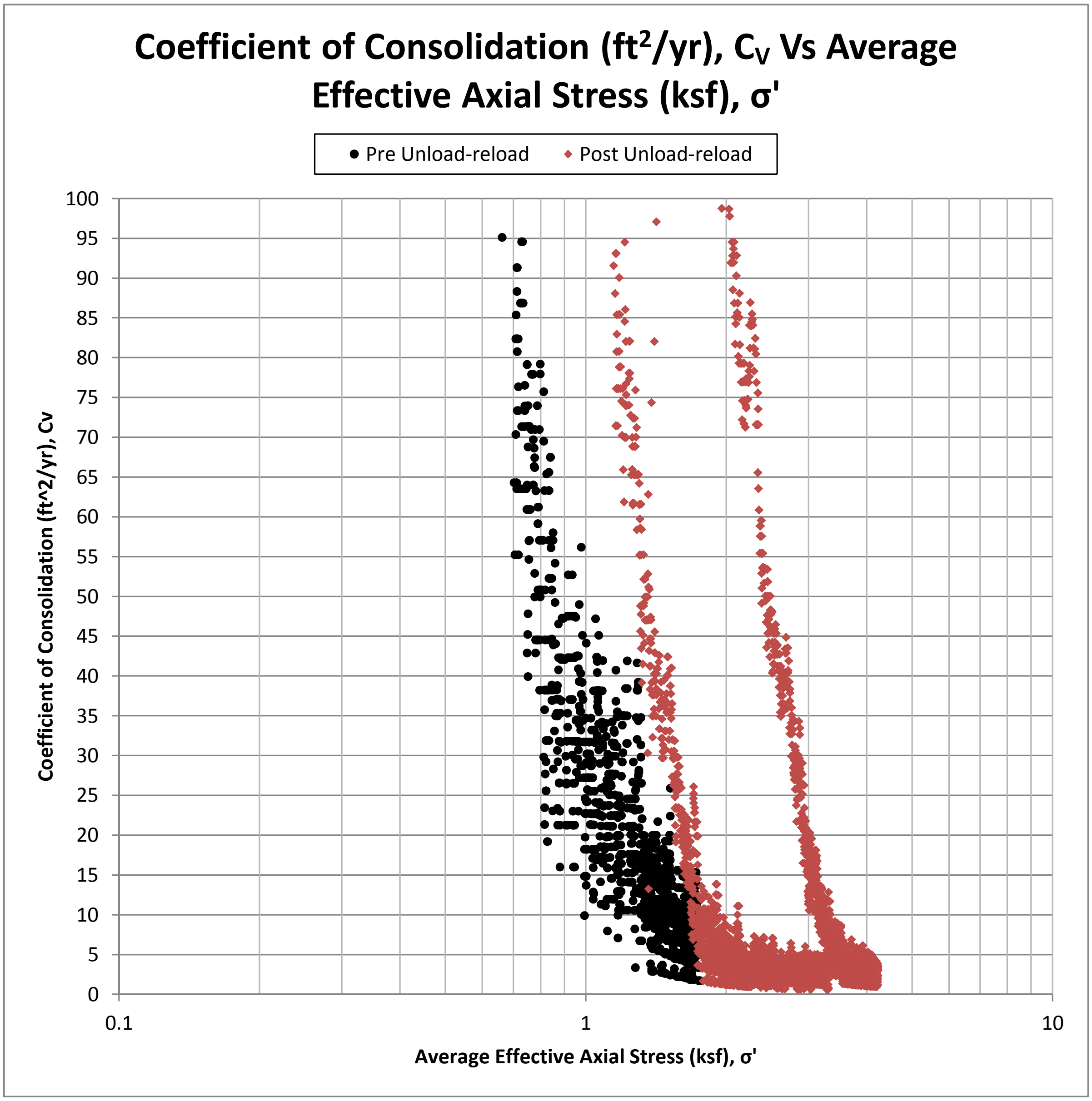
Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - 2974 Method A (OD mass)	Initial	Final
Moisture (%):	91.49%	71.43%
Dry Density (pcf):	49.10	59.18
Saturation (%):	101.60%	100.00%
Void Ratio:	2.4422	1.8557

Test Date: 10/2/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.712
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B4 @ 25-27.5
Project Name:	Foster City Levees - Widening
Client:	Schaaf & Wheeler
Location:	Foster City, California
Tested By:	D. Seibold
Depth:	26-26.5 ft
Boring #:	3-B4
Reviewed By:	J. Ruffoni

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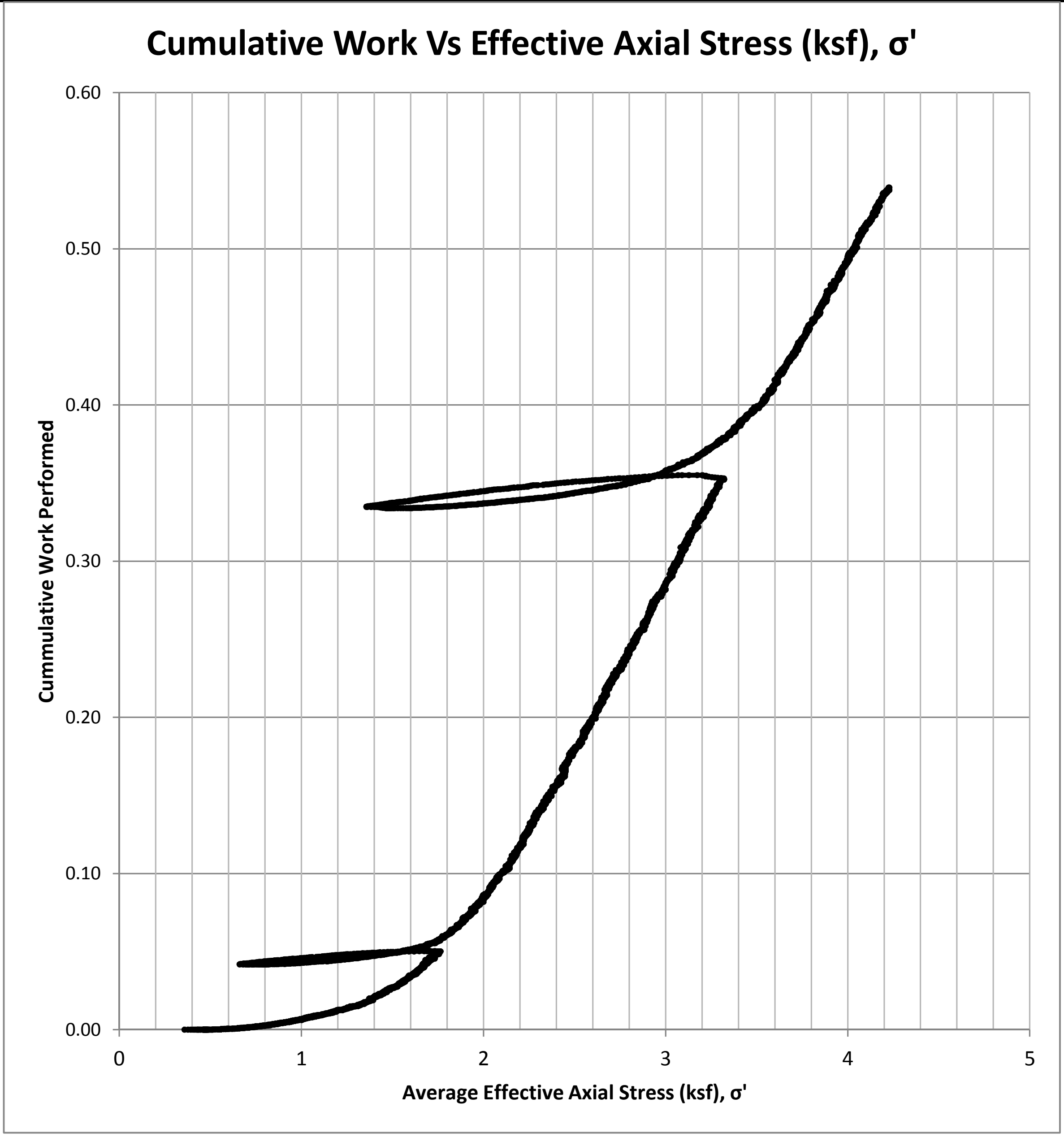
Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	Final
Moisture (%):	91.49%	71.43%
Dry Density (pcf):	49.10	59.18
Saturation (%):	101.60%	100.00%
Void Ratio:	2.4422	1.8557

Test Date: 10/2/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.712
Soil Description:	See exploration logs

Project Number:	8602.001.000	**Depth:**	26-26.5 ft
Sample Number:	3-B4 @ 25-27.5	**Boring #:**	3-B4
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	**Reviewed By:**	J. Ruffoni

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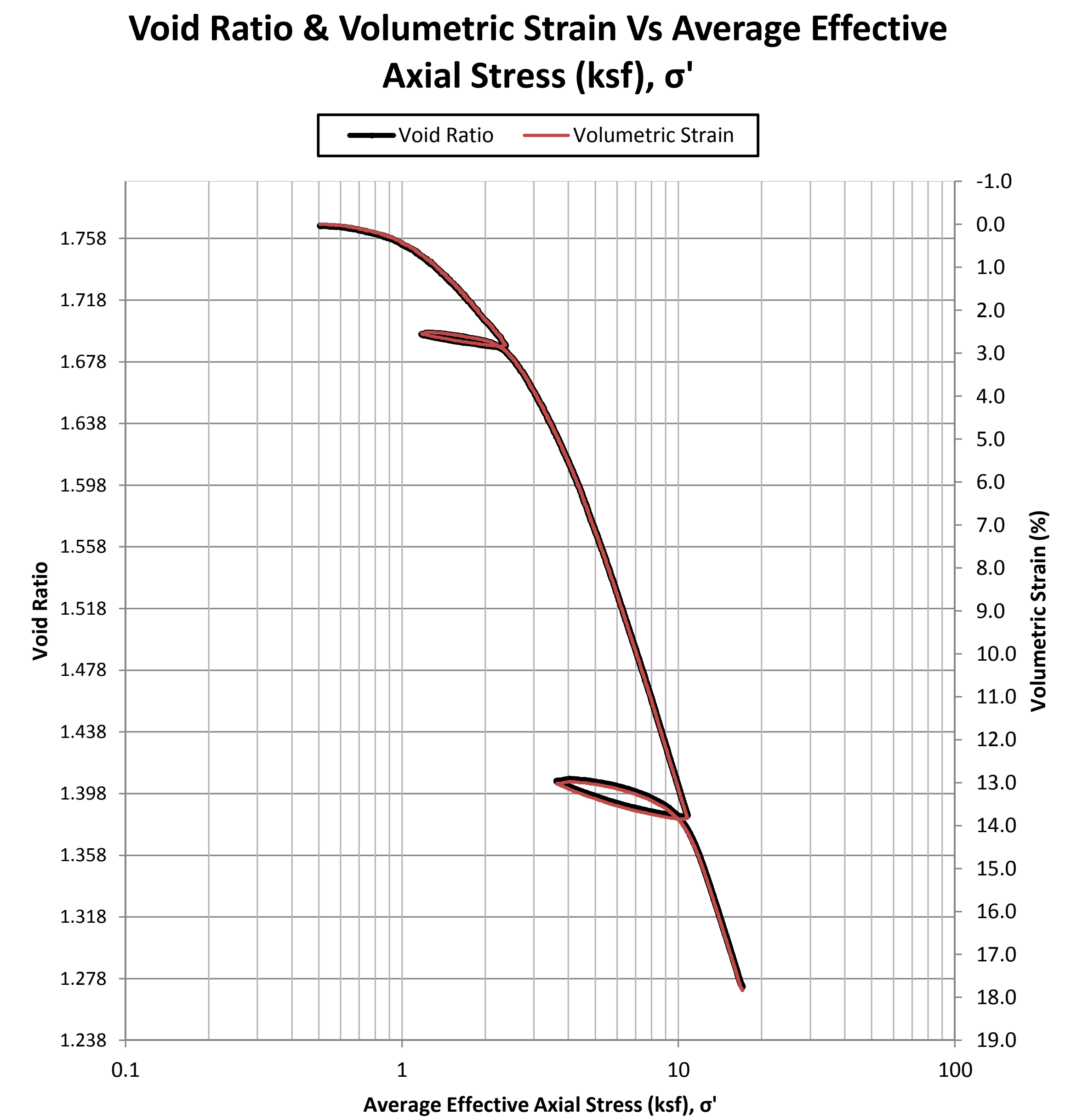
Remarks:

Constant Rate of Strain Consolidation

ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	Final
Moisture (%):	66.18%	53.07%
Dry Density (pcf):	61.21	74.60
Saturation (%):	101.79%	100.00%
Void Ratio:	1.7665	1.2696

Test Date: 10/4/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.717
Soil Description:	See exploration logs

Project Number:	8602.001.000	**Depth:**	8-8.5 ft
Sample Number:	3-B5 @ 7-9.5	**Boring #:**	3-B5
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	**Reviewed By:**	J. Ruffoni

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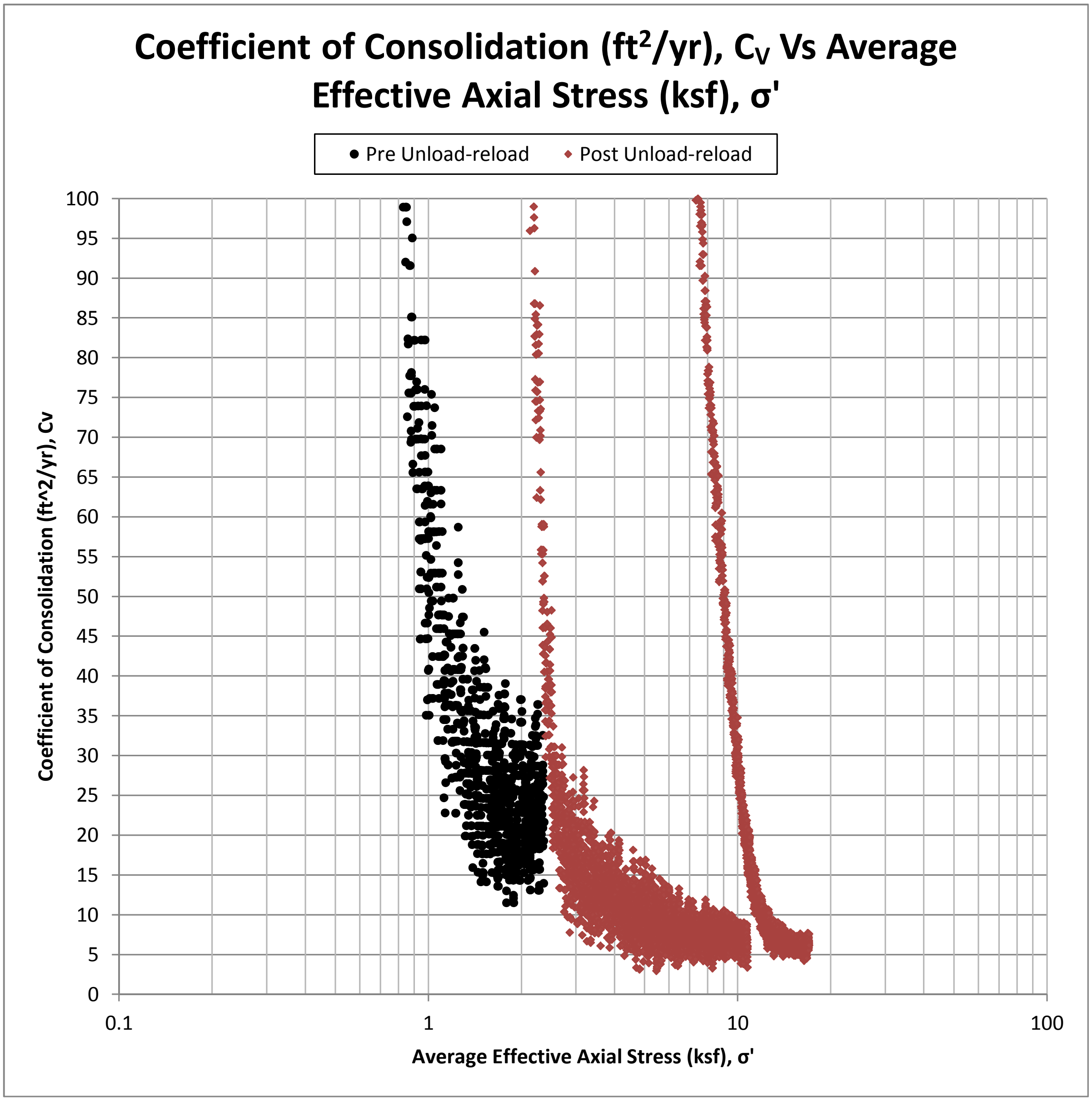
Remarks:

Lab Address: 3420 Fostoria Way, Suite E, San Ramon, CA 94583. Phone No. (925) 355-9047

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - 2974 Method A (OD mass)				
	Initial	Final		
Moisture (%):	66.18%	53.07%	Liquid Limit:	
Dry Density (pcf):	61.21	74.60	Plastic Limit:	
Saturation (%):	101.79%	100.00%	ASTM D854 - Measured	
Void Ratio:	1.7665	1.2696	Specific Gravity:	2.717
			Soil Description:	See exploration logs

Test Date: 10/4/2017

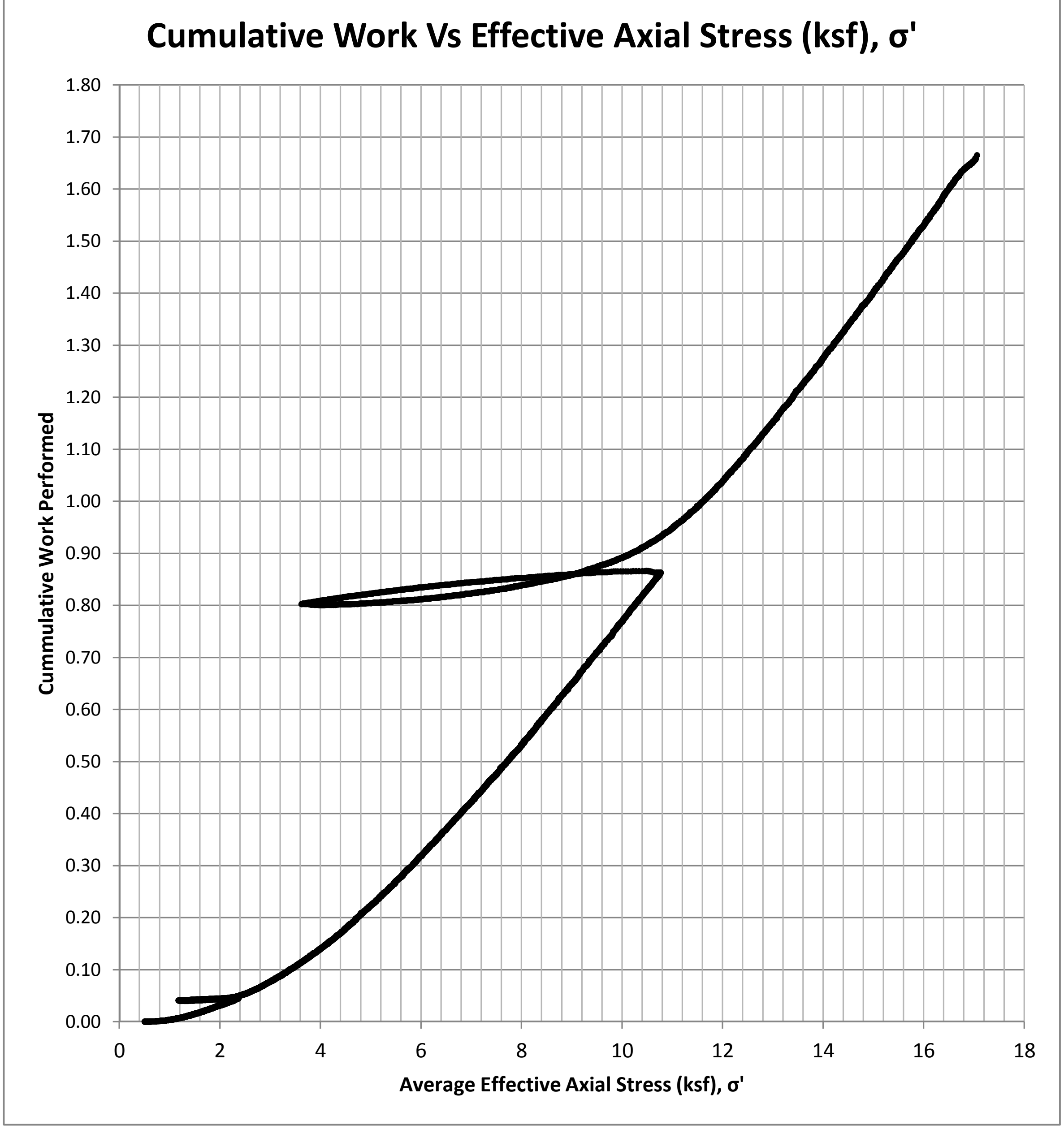
ASTM D4318 - Wet Method

Project Number:	8602.001.000	Depth:	8-8.5 ft
Sample Number:	3-B5 @ 7-9.5	Boring #:	3-B5
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	Reviewed By:	J. Ruffoni

ENGEO Expect Excellence

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



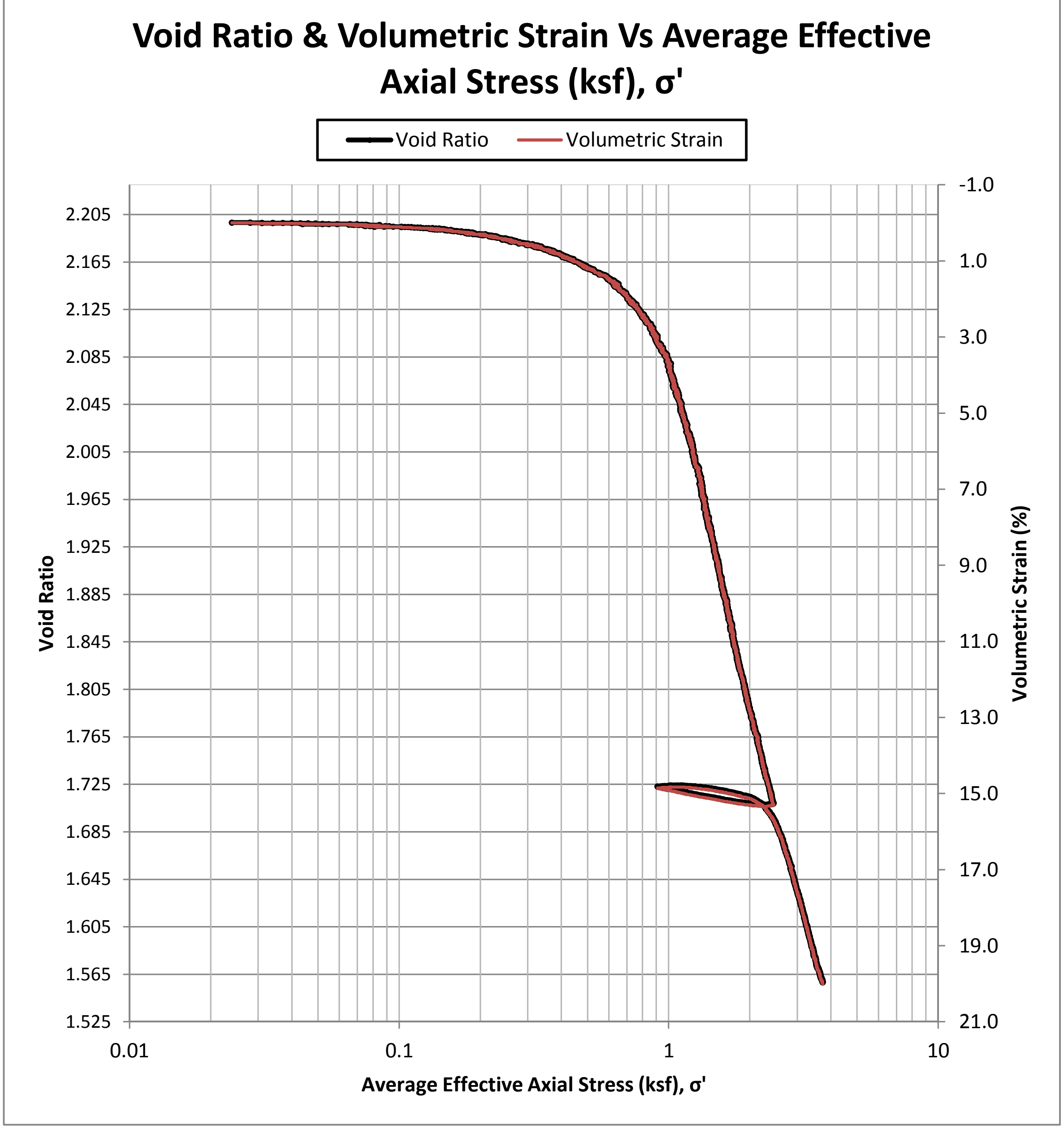
ASTM D2974 - Method A (OD mass)				**Test Date:** 10/4/2017
	Initial	**Final**	**ASTM D4318 - Wet Method**	
Moisture (%):	66.18%	53.07%	**Liquid Limit:**	
Dry Density (pcf):	61.21	74.60	**Plastic Limit:**	
Saturation (%):	101.79%	100.00%	**ASTM D854 - Measured**	
Void Ratio:	1.7665	1.2696	**Specific Gravity:**	2.717
			Soil Description:	See exploration logs

Project Number:	8602.001.000	**Depth:**	8-8.5 ft
Sample Number:	3-B5 @ 7-9.5	**Boring #:**	3-B5
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	**Reviewed By:**	J. Ruffoni

Remarks:

ENGEO Expect Excellence

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)	Initial	Final
Moisture (%):	81.39%	64.12%
Dry Density (pcf):	53.58	66.99
Saturation (%):	101.82%	100.00%
Void Ratio:	2.1984	1.5583

Test Date: 10/6/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.750
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B5 @ 15-17.5
Project Name:	Foster City Levees - Widening
Client:	Schaaf & Wheeler
Location:	Foster City, California
Tested By:	D. Seibold
Depth:	15.5-16
Boring #:	3-B5
Reviewed By:	J. Ruffoni

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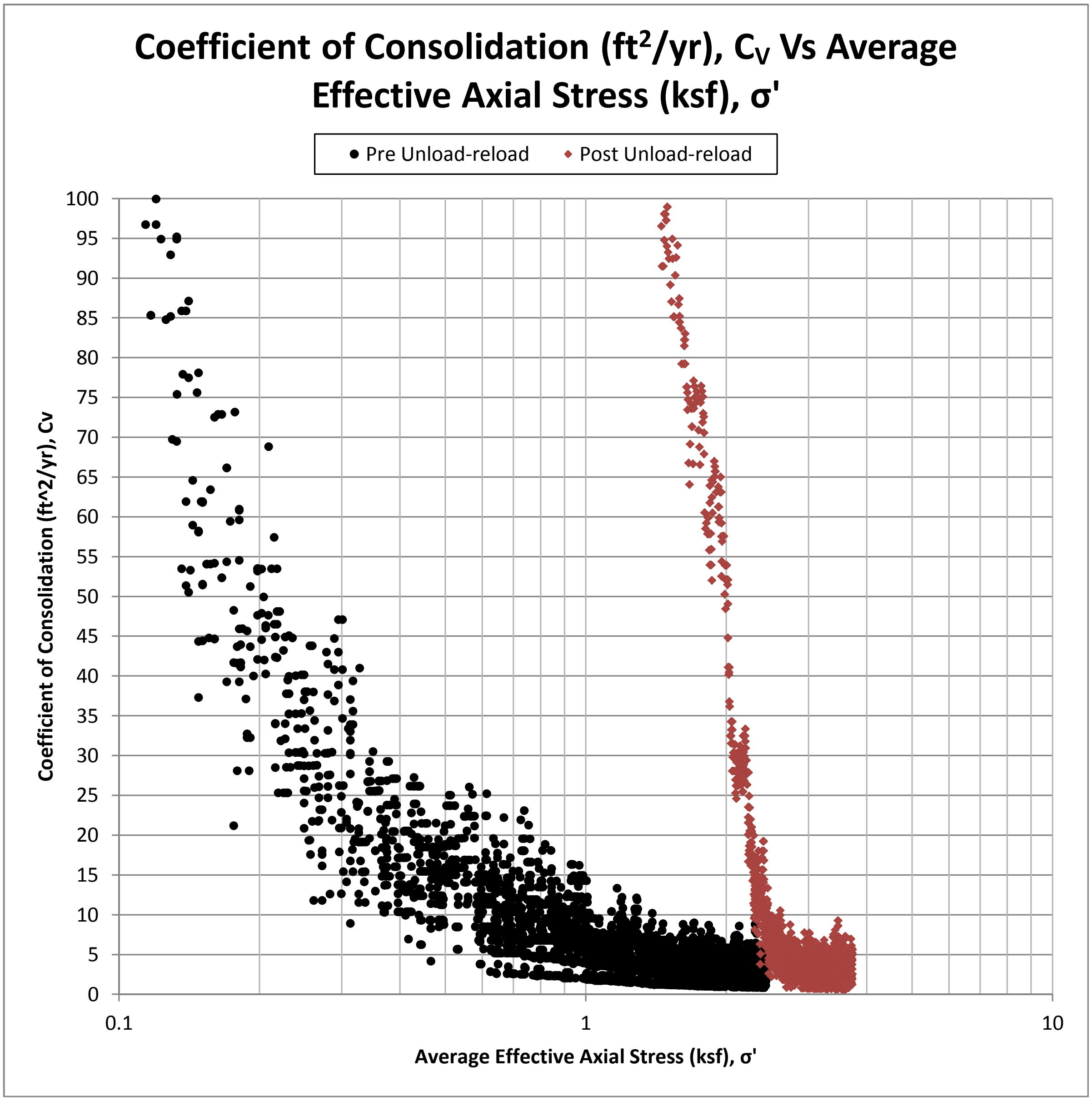
Remarks:

Constant Rate of Strain Consolidation
ASTM D4186

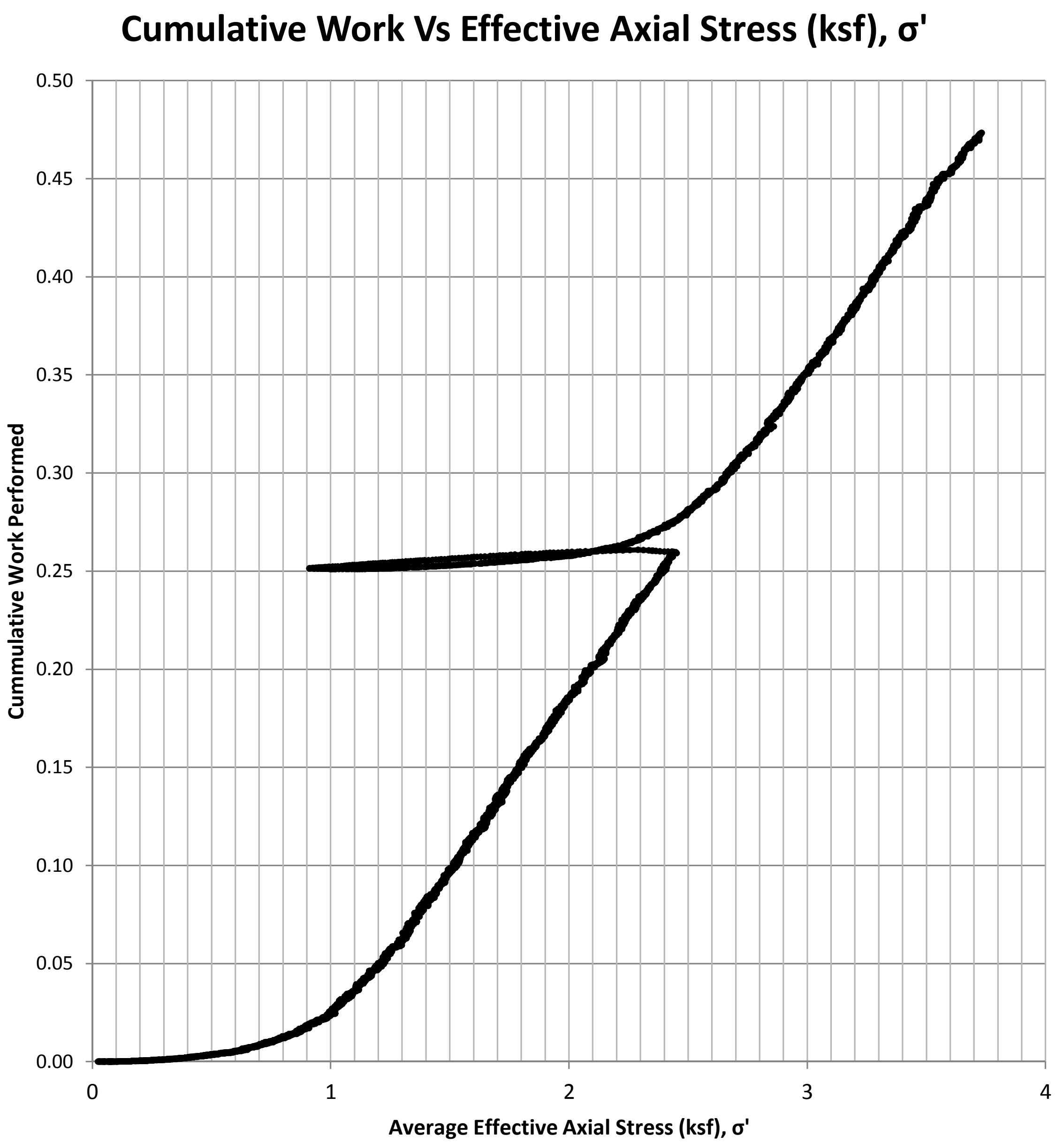


ASTM D2974 - 2974 Method A (OD mass)				Test Date: 10/6/2017
	Initial	Final	ASTM D4318 - Wet Method	
Moisture (%):	81.39%	64.12%	Liquid Limit:	
Dry Density (pcf):	53.58	66.99	Plastic Limit:	
Saturation (%):	101.82%	100.00%	ASTM D854 - Measured	
Void Ratio:	2.1984	1.5583	Specific Gravity:	2.750
			Soil Description:	See exploration logs

Project Number:	8602.001.000	Depth:	15.5-16
Sample Number:	3-B5 @ 15-17.5	Boring #:	3-B5
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	Reviewed By:	J. Ruffoni
Remarks:			

ENGEO Expect Excellence

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)				Test Date: 10/6/2017
	Initial	Final	ASTM D4318 - Wet Method	
Moisture (%):	81.39%	64.12%	Liquid Limit:	
Dry Density (pcf):	53.58	66.99	Plastic Limit:	
Saturation (%):	101.82%	100.00%	ASTM D854 - Measured	
Void Ratio:	2.1984	1.5583	Specific Gravity:	2.750
			Soil Description:	See exploration logs

Project Number: 8602.001.000
Sample Number: 3-B5 @ 15-17.5
Project Name: Foster City Levees - Widening
Client: Schaaf & Wheeler
Location: Foster City, California
Tested By: D. Seibold

Depth: 15.5-16
Boring #: 3-B5

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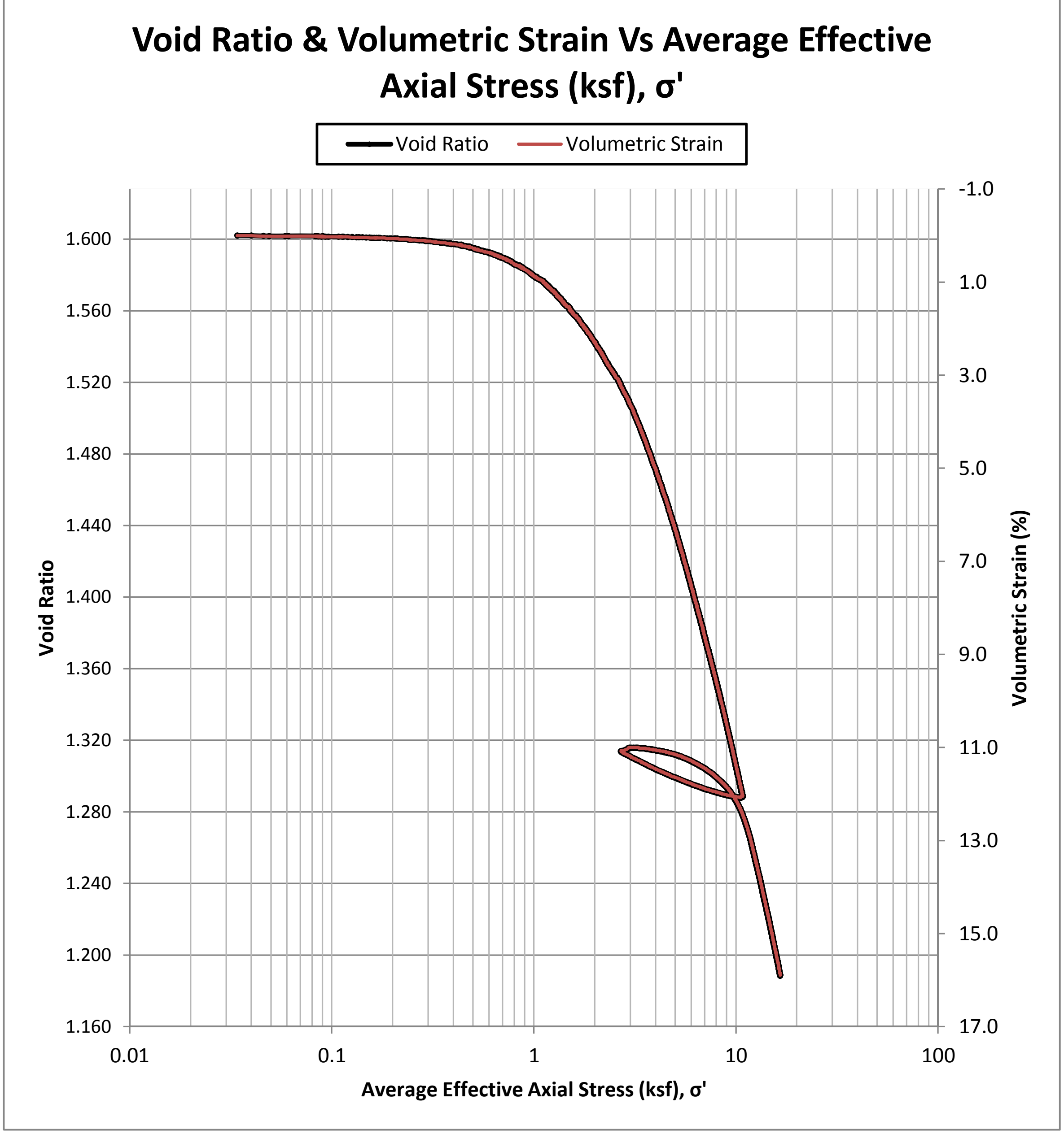
Expect Excellence

Reviewed By: J. Ruffoni

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	Final
Moisture (%):	60.90%	49.75%
Dry Density (pcf):	63.75	75.79
Saturation (%):	101.17%	100.00%
Void Ratio:	1.6025	1.1888

Test Date: 10/13/2017

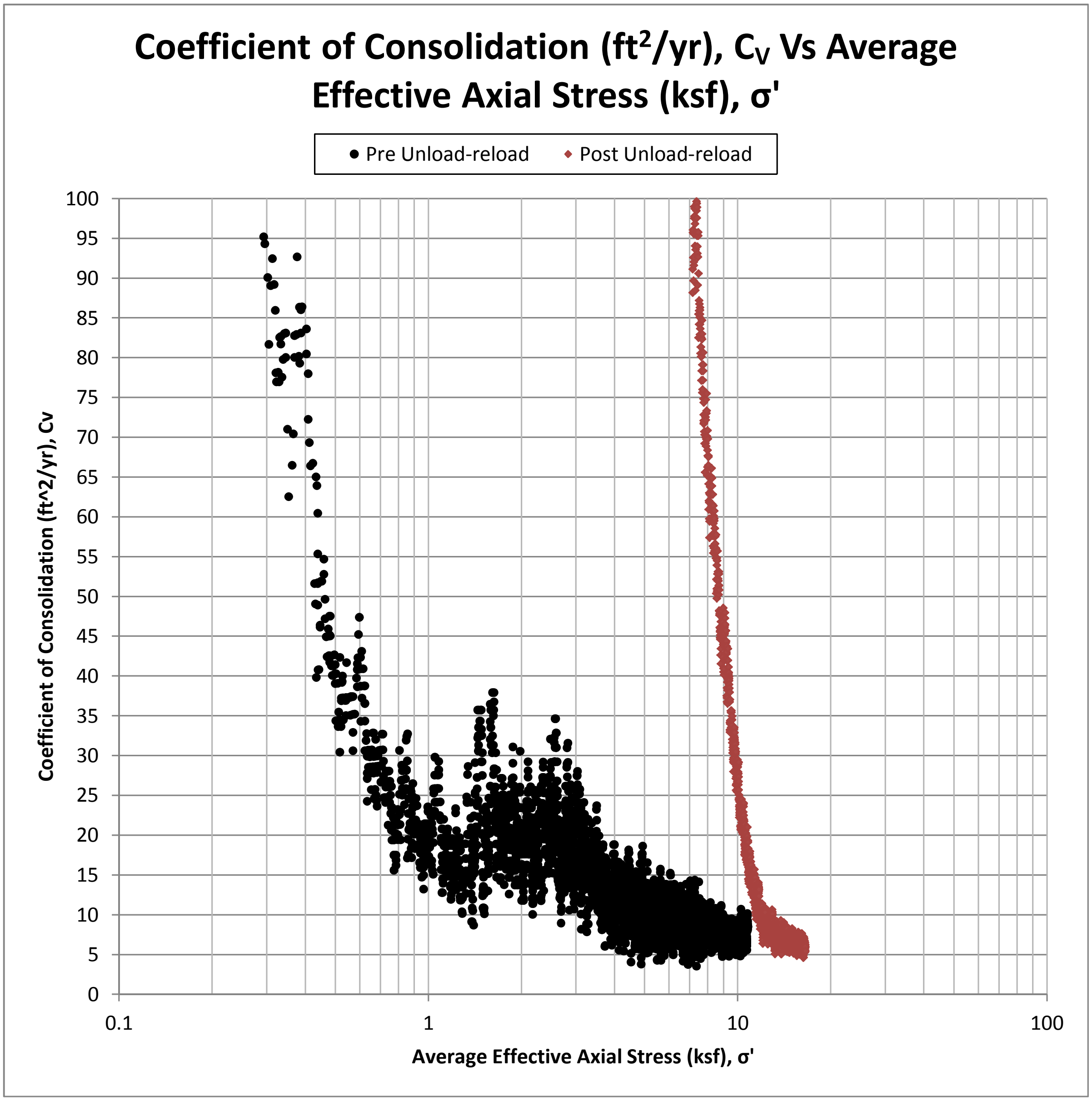
ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.662
Soil Description:	See exploration logs

Project Number:	8602.001.000	**Depth:**	6.5-7 ft
Sample Number:	3-B6 @ 5-7.5	**Boring #:**	3-B6
Project Name:	Foster City Levees- Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	**Reviewed By:**	J. Ruffoni

ENGEO Expect Excellence

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186

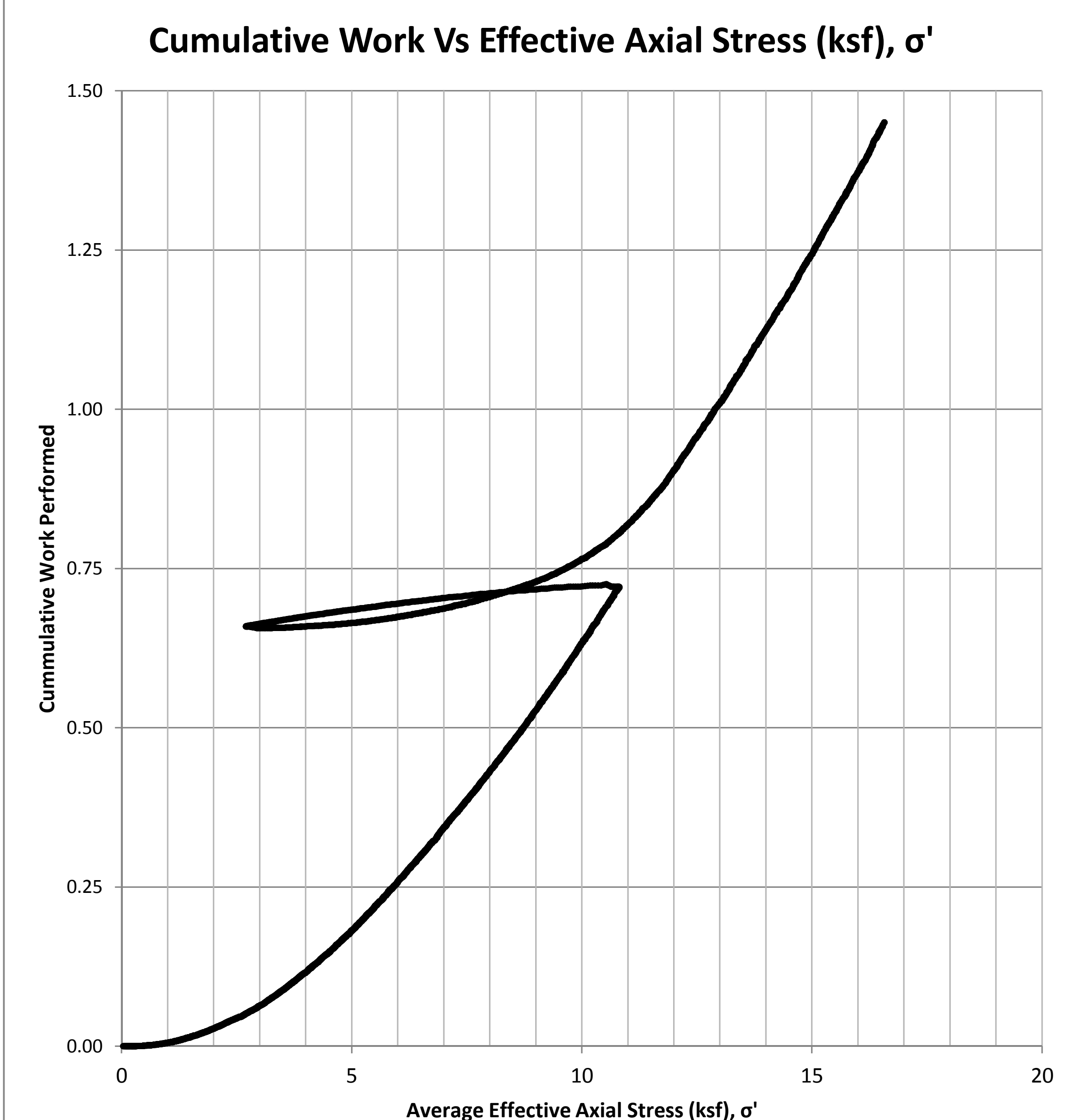


ASTM D2974 - 2974 Method A (OD mass)				Test Date: 10/13/2017
	Initial	Final	ASTM D4318 - Wet Method	
Moisture (%):	60.90%	49.75%	Liquid Limit:	
Dry Density (pcf):	63.75	75.79	Plastic Limit:	
Saturation (%):	101.17%	100.00%	ASTM D854 - Measured	
Void Ratio:	1.6025	1.1888	Specific Gravity:	2.662
			Soil Description:	See exploration logs

Project Number:	8602.001.000	Depth:	6.5-7 ft
Sample Number:	3-B6 @ 5-7.5	Boring #:	3-B6
Project Name:	Foster City Levees- Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	Reviewed By:	J. Ruffoni
Remarks:			

ENGEO Expect Excellence

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)	Initial	Final
Moisture (%):	60.90%	49.75%
Dry Density (pcf):	63.75	75.79
Saturation (%):	101.17%	100.00%
Void Ratio:	1.6025	1.1888

Test Date: 10/13/2017

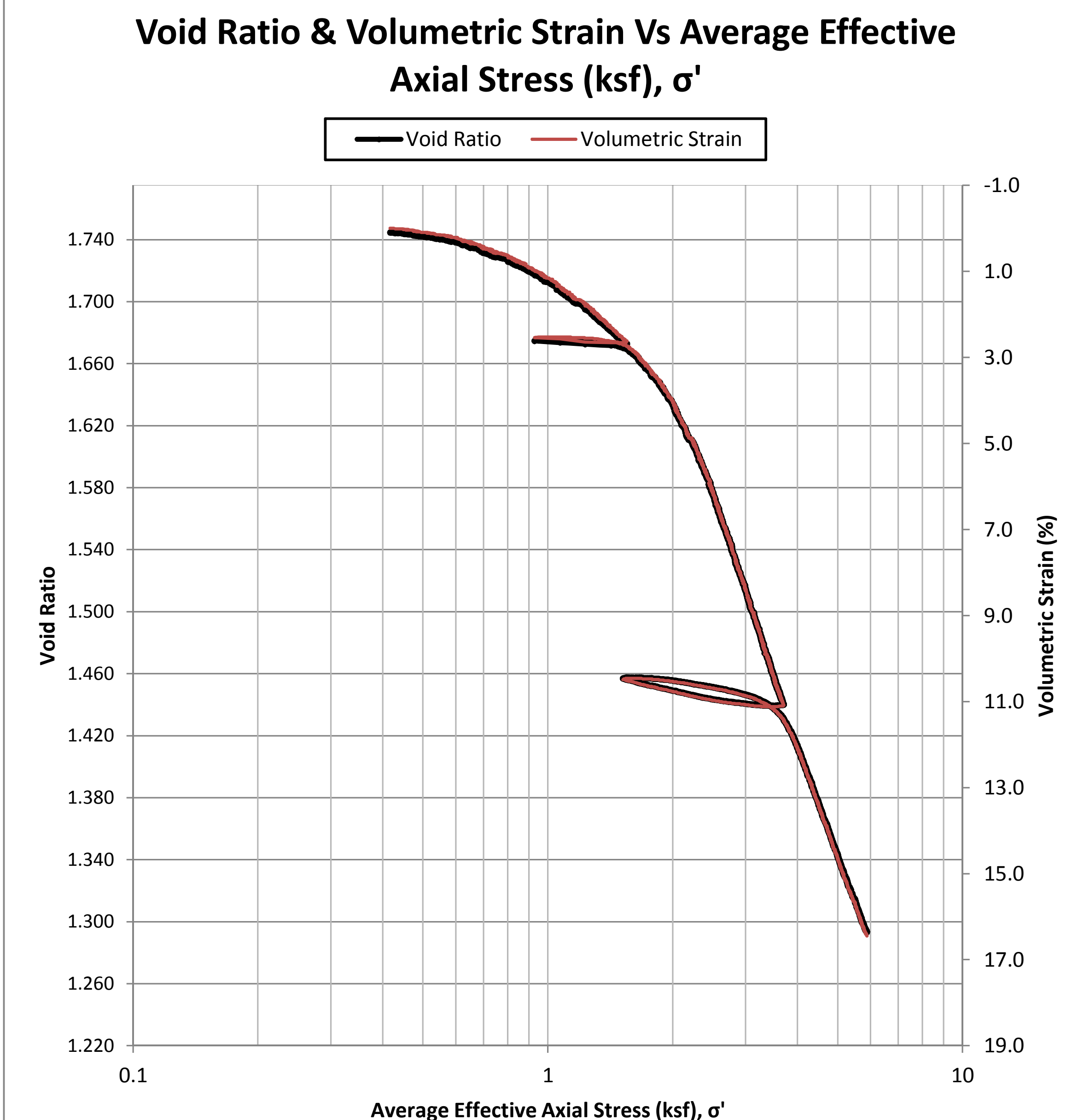
ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.662
Soil Description:	See exploration logs

Project Number:	8602.001.000
Sample Number:	3-B6 @ 5-7.5
Project Name:	Foster City Levees- Widening
Client:	Schaaf & Wheeler
Location:	Foster City, California
Tested By:	D. Seibold
Depth:	6.5-7 ft
Boring #:	3-B6
Reviewed By:	J. Ruffoni

ENGEO Expect Excellence

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	Final
Moisture (%):	65.44%	53.21%
Dry Density (pcf):	60.62	72.56
Saturation (%):	100.17%	100.00%
Void Ratio:	1.7443	1.2929

Test Date: 10/27/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.670
Soil Description:	See exploration logs

Project Number: 8602.001.000
Sample Number: 3-B6 @ 35-37.5
Project Name: Foster City Levees - Widening
Client: Schaaf & Wheeler
Location: Foster City, California
Tested By: D. Seibold

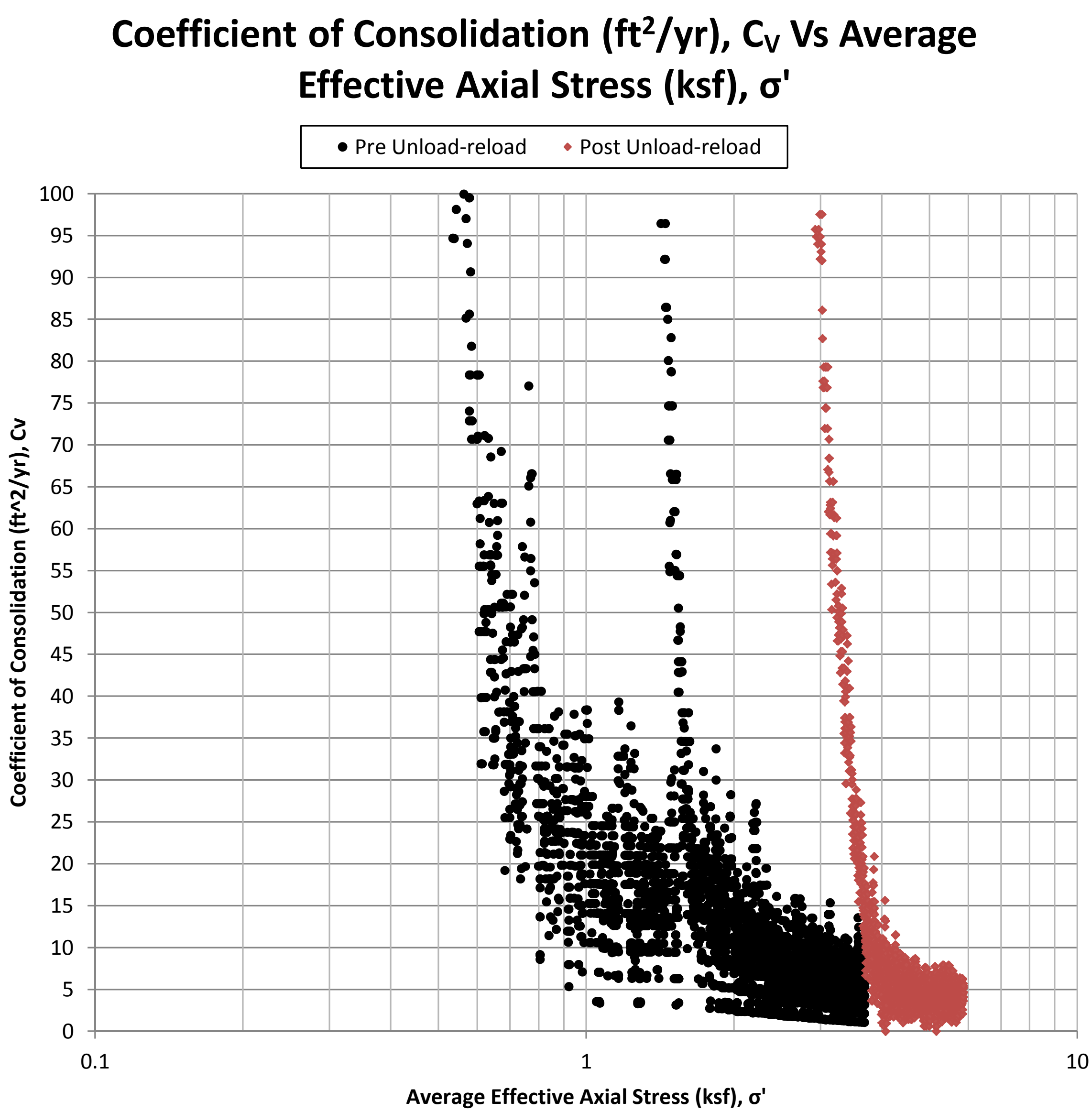
Depth: 36.5-36.75 ft
Boring #: 3-B6

ENGEO
Expect Excellence

Reviewed By: J. Ruffoni

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



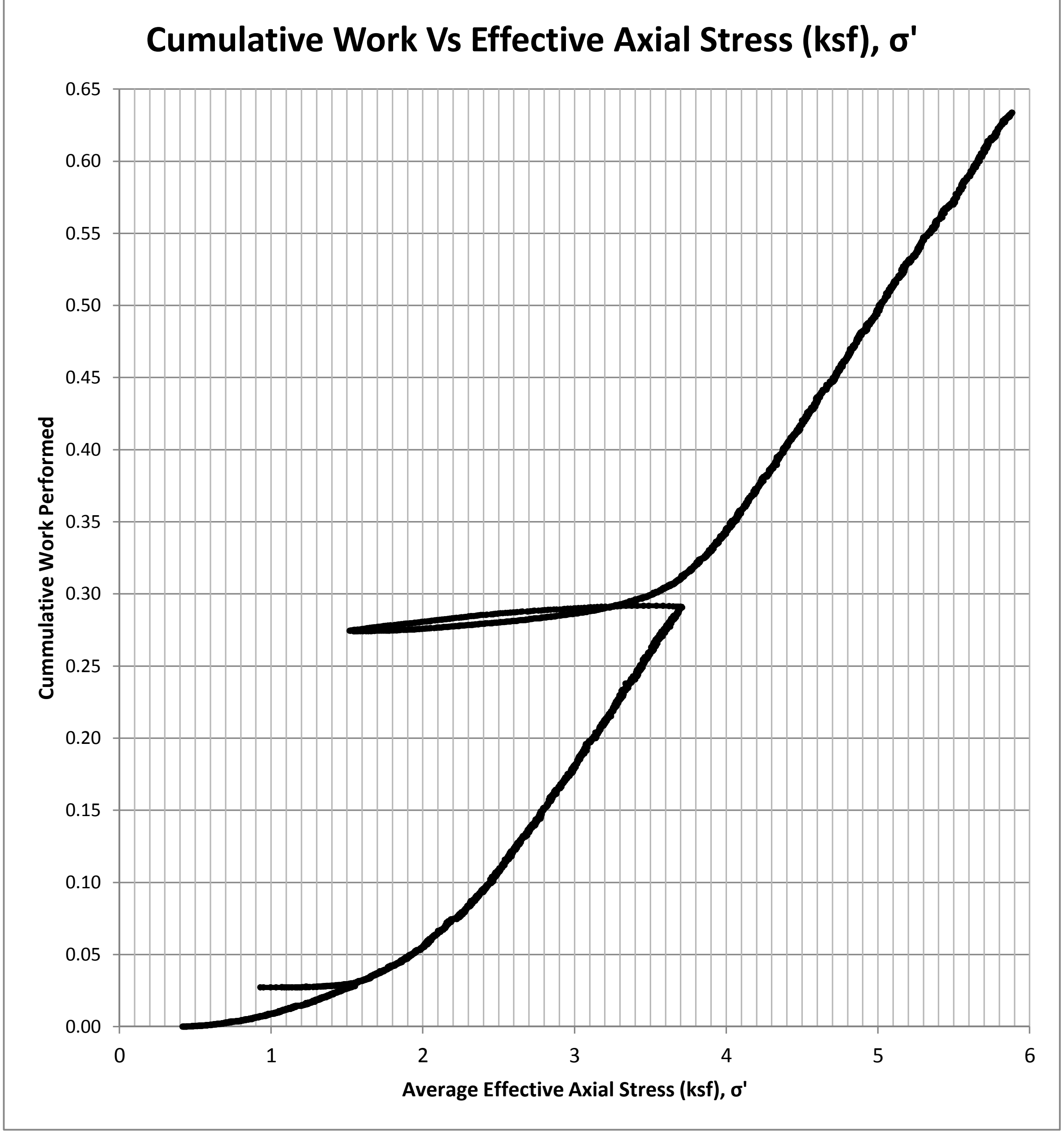
ASTM D2974 - 2974 Method A (OD mass)				
	Initial	Final		Test Date: 10/27/2017
			ASTM D4318 - Wet Method	
Moisture (%):	65.44%	53.21%	Liquid Limit:	
Dry Density (pcf):	60.62	72.56	Plastic Limit:	
Saturation (%):	100.17%	100.00%	ASTM D854 - Measured	
Void Ratio:	1.7443	1.2929	Specific Gravity:	2.670
			Soil Description:	See exploration logs

Project Number:	8602.001.000	Depth:	36.5-36.75 ft
Sample Number:	3-B6 @ 35-37.5	Boring #:	3-B6
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	Reviewed By:	J. Ruffoni

ENGEO Expect Excellence

Remarks:

Constant Rate of Strain Consolidation
ASTM D4186



ASTM D2974 - Method A (OD mass)		
	Initial	Final
Moisture (%):	65.44%	53.21%
Dry Density (pcf):	60.62	72.56
Saturation (%):	100.17%	100.00%
Void Ratio:	1.7443	1.2929

Test Date: 10/27/2017

ASTM D4318 - Wet Method	
Liquid Limit:	
Plastic Limit:	
ASTM D854 - Measured	
Specific Gravity:	2.670
Soil Description:	See exploration logs

Project Number:	8602.001.000	**Depth:**	36.5-36.75 ft
Sample Number:	3-B6 @ 35-37.5	**Boring #:**	3-B6
Project Name:	Foster City Levees - Widening		
Client:	Schaaf & Wheeler		
Location:	Foster City, California		
Tested By:	D. Seibold	**Reviewed By:**	J. Ruffoni

ENGEO
Expect Excellence

Remarks:

Hydraulic Conductivity
ASTM D 5084
Method C: Falling Head Rising Tailwater

Job No:	414-091	**Boring:**	2-B6	**Date:**	04/20/16
Client:	Engeo, Inc.	**Sample:**		**By:**	MD/PJ
Project:	2655.001.000 PH 002	**Depth, ft.:**	2-2.5	**Remolded:**	

Visual Classification: Olive Brown Clayey SAND (Silty) near Silty SAND (slightly plastic)

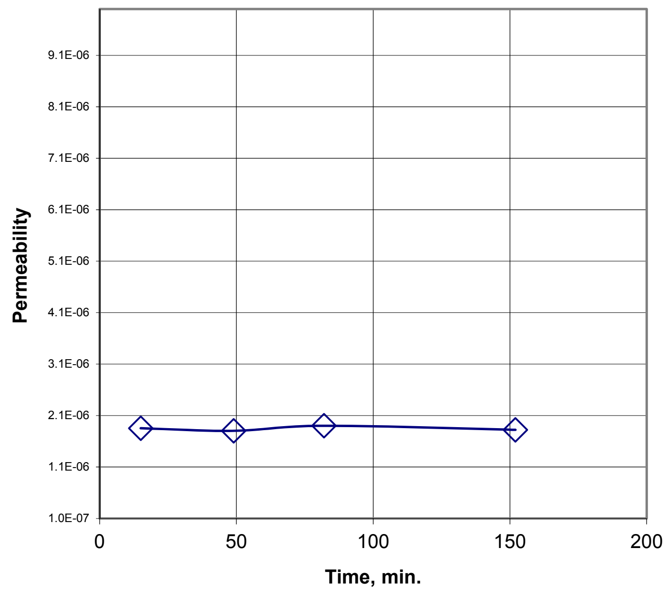
Max Sample Pressures, psi:

Cell:	Bottom	Top	Avg. Sigma3
64	59.5	58.5	5

B: = >0.95 ("B" is an indication of saturation)

Max Hydraulic Gradient: = 21

Date	Minutes	Head, (in)	K,cm/sec
4/13/2016	0.00	42.69	Start of Test
4/13/2016	15.00	41.54	1.9E-06
4/13/2016	49.00	39.14	1.8E-06
4/13/2016	82.00	36.64	1.9E-06
4/13/2016	152.00	32.54	1.8E-06



Average Hydraulic Conductivity: 2.E-06 cm/sec

Sample Data:	Initial (As-Received)		Final (At-Test)
Height, in	2.02		2.02
Diameter, in	2.41		2.40
Area, in2	4.56		4.51
Volume in3	9.23		9.08
Total Volume, cc	151.2		148.8
Volume Solids, cc	87.0		87.0
Volume Voids, cc	64.2		61.8
Void Ratio	0.7		0.7
Total Porosity, %	42.5		41.5
Air-Filled Porosity (θa),%	9.1		0.8
Water-Filled Porosity (θw),%	33.4		40.8
Saturation, %	78.7		98.2
Specific Gravity	2.70	Assumed	2.70
Wet Weight, gm	285.4		295.5
Dry Weight, gm	234.9		234.9
Tare, gm	0.00		0.00
Moisture, %	21.5		25.8
Wet Bulk Density, pcf	117.8		124.0
Dry Bulk Density, pcf	96.9		98.5
Wet Bulk Dens.ρb, (g/cm^3)	1.89		1.99
Dry Bulk Dens.ρb, (g/cm^3)	1.55		1.58

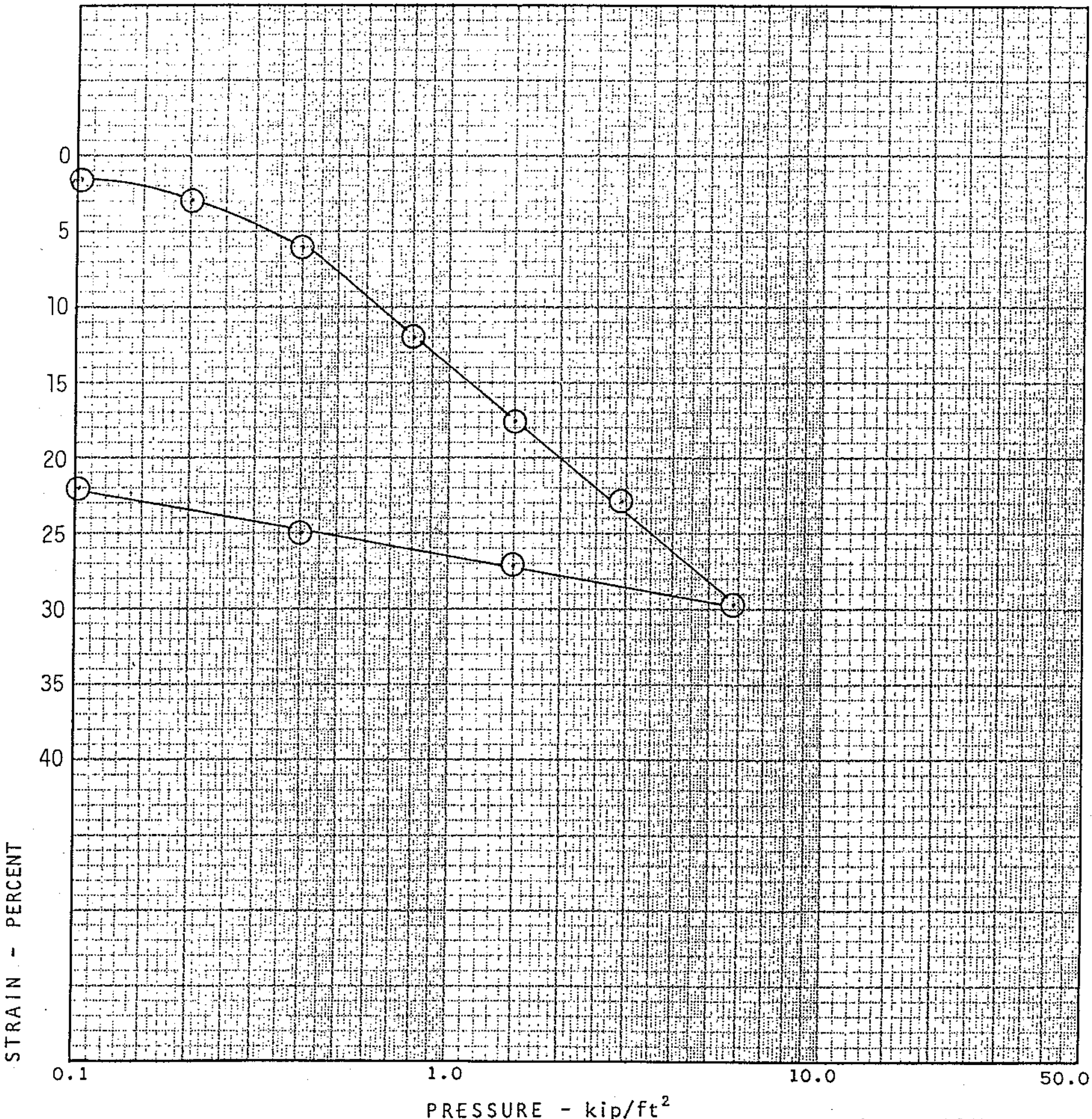
Remarks:

DRAFT

APPENDIX B

LABORATORY TESTING

Appendix B2 – Kleinfelder Laboratory Test Data



BORING NO.	B-3 Sample No. 3
DEPTH	16.5 feet
SAMPLE DESCRIPTION	CLAY (CH) - very soft, gray, with sand & shells
OVERBURDEN PRESSURE	1060 psf (est.)
PRECONSOLIDATION PRESSURE	360 psf
COMPRESSION INDEX, C_c	0.65
RECOMPRESSION INDEX, C_r	

	INITIAL	FINAL
DRY DENSITY - lb/ft^3	51.4	65.7
WATER CONTENT - %	84.1	57.9
VOID RATIO	2.234	1.527
DEGREE OF SATURATION, %	100	100
SAMPLE HEIGHT - inches	0.7500	0.5860

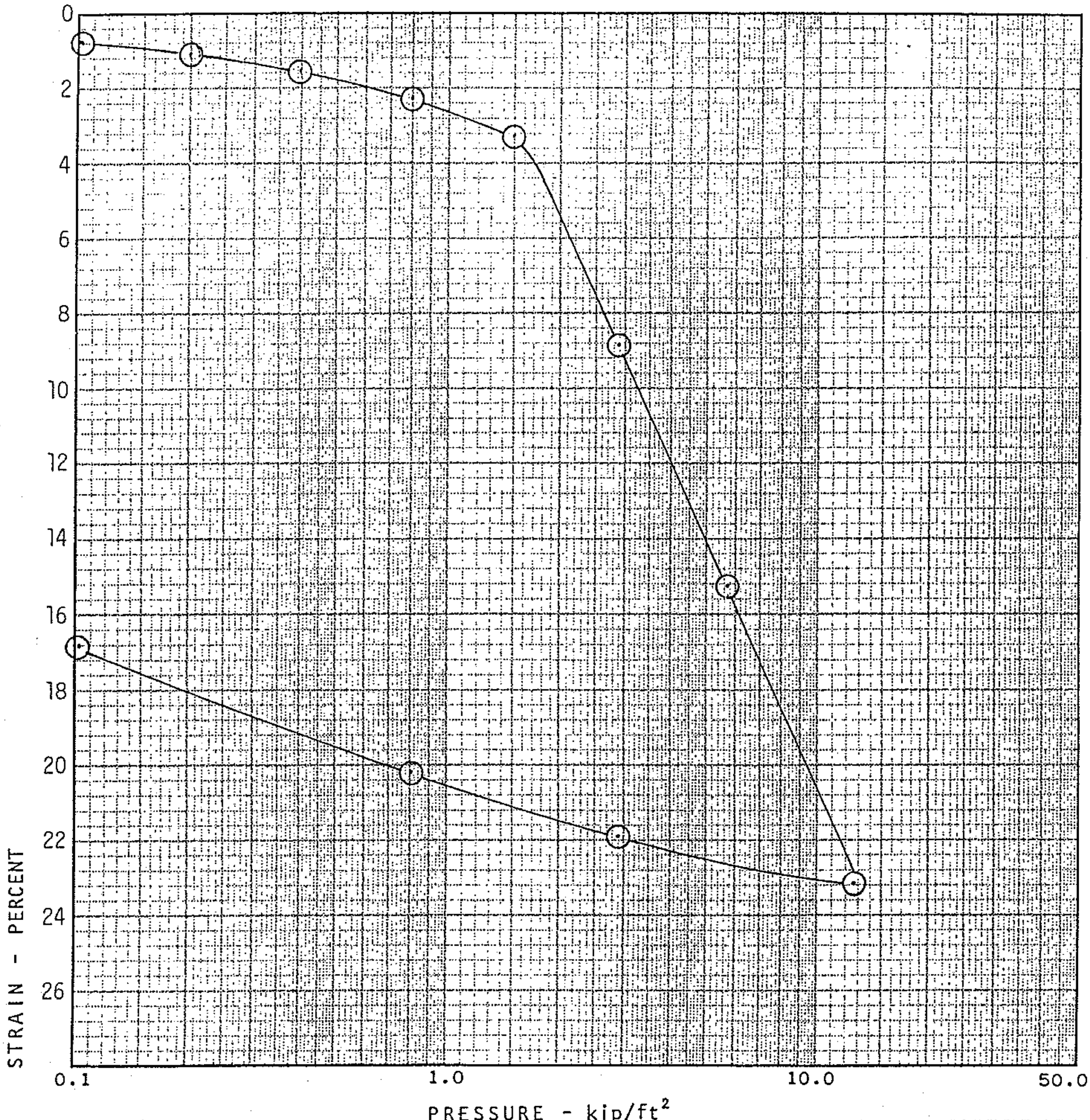
KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

CONSOLIDATION TEST

PLATE C-1



BORING NO. B-3 Sample No.5
DEPTH 42 feet
SAMPLE DESCRIPTION SILT (MH) - gray, fine sand
OVERBURDEN PRESSURE 2010 psf (est.)
PRECONSOLIDATION PRESSURE 1700 psf
COMPRESSION INDEX, C_c 0.54
RECOMPRESSION INDEX, C_r

	INITIAL	FINAL
DRY DENSITY - lb/ft^3	68.3	81.9
WATER CONTENT - %	54.9	40.3
VOID RATIO	1.432	1.029
DEGREE OF SATURATION, %	100	100
SAMPLE HEIGHT - inches	0.7500	0.6254

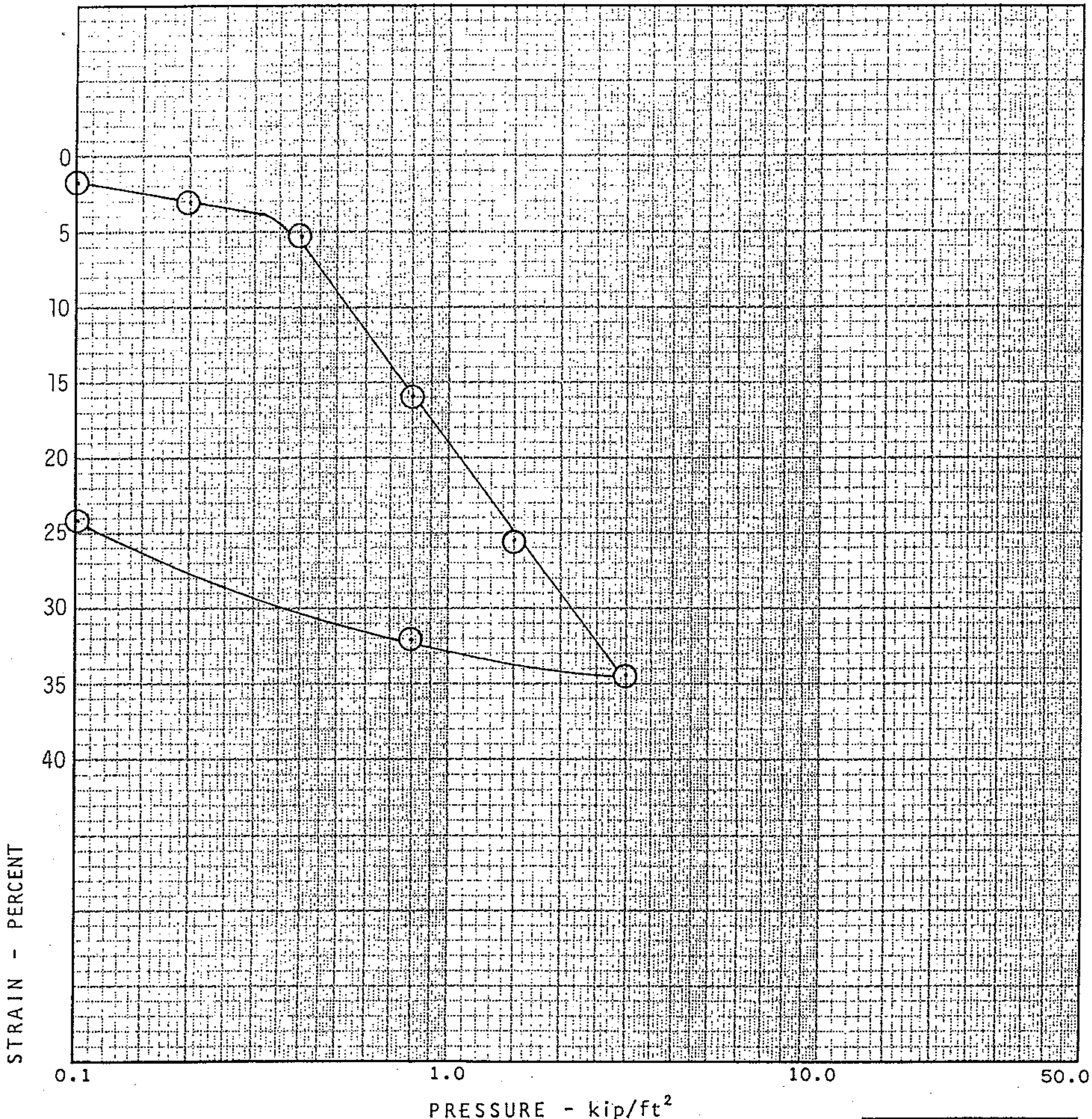
KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

CONSOLIDATION TEST

PLATE C-2



BORING NO. B-4 Sample No. 2
DEPTH 8 feet
SAMPLE DESCRIPTION CLAY (CH) - gray, with organics
OVERBURDEN PRESSURE 350 psf (est.)
PRECONSOLIDATION PRESSURE 360 psf
COMPRESSION INDEX, C_c 1.16
RECOMPRESSION INDEX, C_r

	INITIAL	FINAL
DRY DENSITY - lb/ft^3	33.6	44.5
WATER CONTENT - %	141.3	101.0
VOID RATIO	2.525	1.666
DEGREE OF SATURATION, %	100	100
SAMPLE HEIGHT - inches	0.7000	0.5294

KLEINFELDER

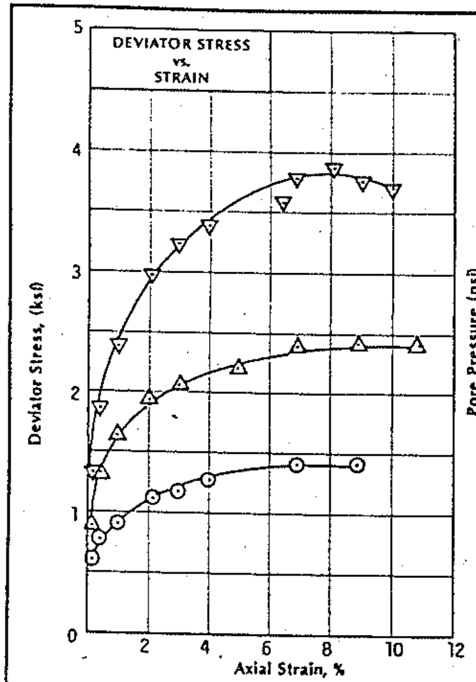
PROJECT NO. 11-1765-01

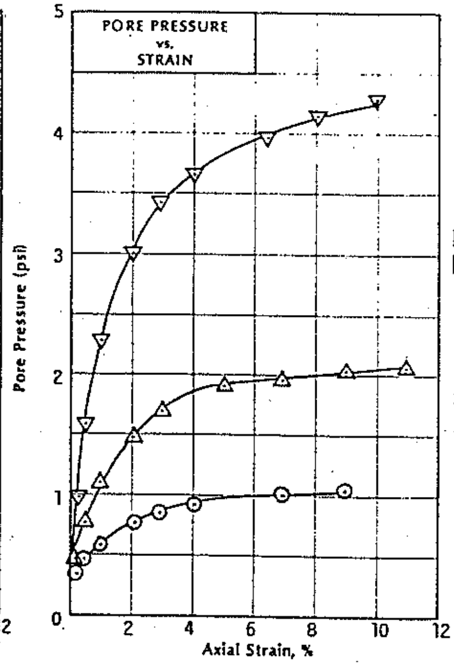
FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

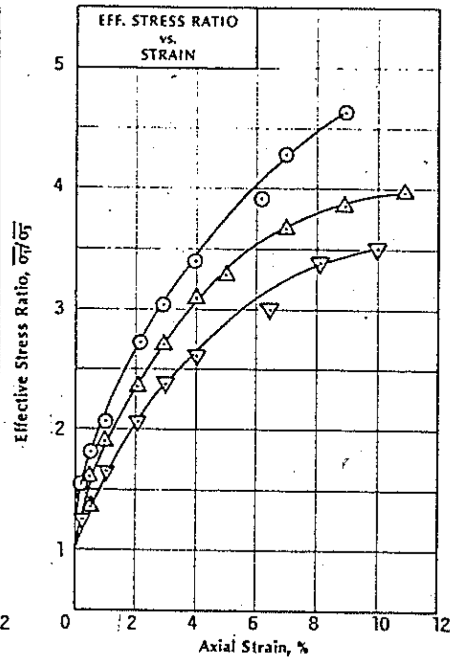
CONSOLIDATION TEST

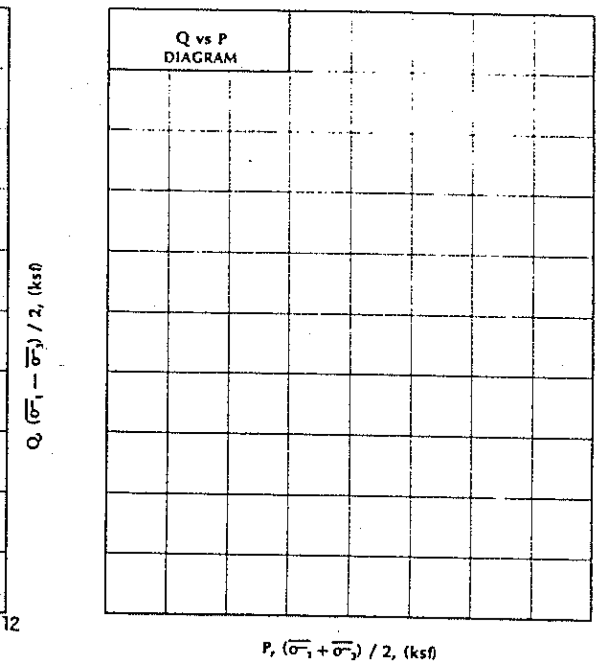
PLATE
C-3

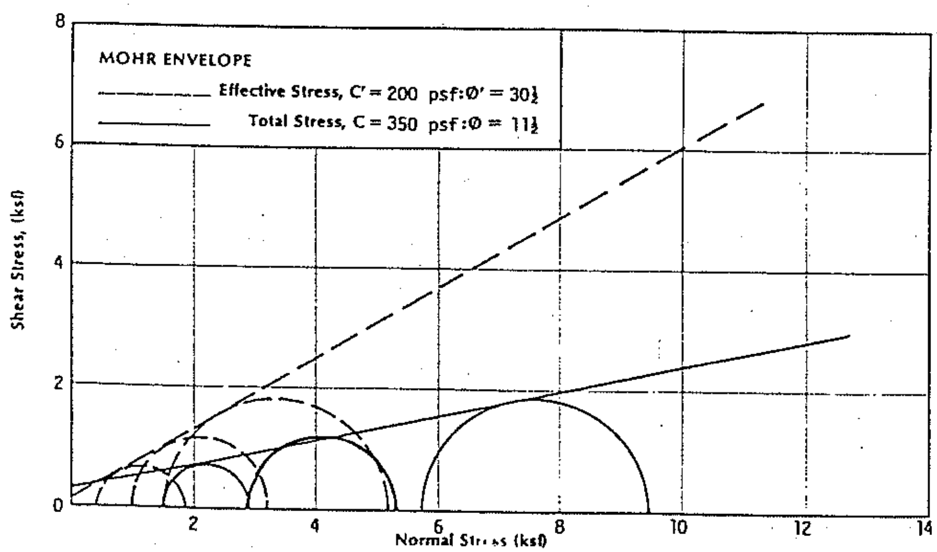
C5











Sample No.	Boring No.	Symbol	Classification	Diameter (in.)	Height (in.)	Strain Rate (in./min.)	Back Pressure (psi)	Eff. Consol. Pressure (psi)
A	3/3 @ 16'	⊙		2.50	5.10	0.00035	40	10
B	3/3 @ 16'	△		2.43	5.00	0.00032	40	20
C	5/5 @ 18'	▽		2.48	5.05	0.00032	30	40

Sample No.	INITIAL SAMPLE DATA				FINAL SAMPLE DATA			
	Dry Density (pcf)	Moisture (w/s)	Void Ratio	Saturation %	Dry Density (pcf)	Moisture %	Void Ratio	Time to Failure
A	48.7	87.3	2.394	97	59.6	66.9	1.774	1400 min.+
B	51.7	81.7	2.199	98	68.0	54.0	1.430	1400 min.+
C	48.5	87.9	2.410	97	67.4	54.8	1.452	1400 min.+

NOTES: All samples trimmed from 2.87" ϕ shelby tubes

KLEINFELDER

PROJECT NO. 11-1765-01

FOSTER CITY LEVEES
FOSTER CITY, CALIFORNIA

TRIAXIAL COMPRESSION TEST

PLATE C-4

DRAFT

APPENDIX B

LABORATORY TESTING

Appendix B3 – Corrosion Laboratory Test Data

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

13 October, 2017

Job No. 1710045
Cust. No. 10169

Mr. Andy Firmin
ENGEO Inc.
2010 Crow Canyon Place, Suite 250
San Ramon, CA 94583

Subject: Project No.: 8602.001.000
Project Name: Foster City Levees-Widening
Corrosivity Analysis – ASTM Test Methods

Dear Mr. Firmin:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on October 04, 2017. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, both sample are classified as "severely corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations were 2,800 and 3,600 mg/kg and are considered corrosive to embedded reinforcing steel; and, as such, the concrete mix design shall be adjusted accordingly by a qualified corrosion engineer.

The sulfate ion concentrations were 110 and 190 mg/kg and are determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

The pH of the soils were 7.87 and 8.15, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potentials were 380-mV and 460-mV. Sample No.002 is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions, and Sample No.001 is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

Cheryl McMillen for

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: ENGEO Incorporated
Client's Project No.: 8602.001.000
Client's Project Name: Foster City Levees-Widening
Date Sampled: 4-Oct-17
Date Received: 4-Oct-17
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 13-Oct-2017

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1710045-001	3-B5 @ 8.5'-9'	460	7.87	-	100	-	3,600[(1)]	110
1710045-002	3-B6 @ 5'-7.5'	380	8.15	-	94	-	2,800[(1)]	190

	Redox	pH	Conductivity	Resistivity	Sulfide	Chloride	Sulfate
Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
	11-Oct-2017	11-Oct-2017	-	13-Oct-2017	-	12-Oct-2017	11-Oct-2017

Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis

N.D. - None Detected

(1) Detection limit is elevated to 75 mg/kg due to dilution

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

1710045 10169

CHAIN OF CUSTODY RECORD

PROJECT NUMBER: 8602.001.000

PROJECT NAME: Foster City Levees - Widening

SAMPLED BY: (SIGNATURE/PRINT) Jeanine Ruffoni

PROJECT MANAGER: Andy Firmin

ROUTING: E-MAIL afirmin@engeo.com

Hard Copy

	SAMPLE NUMBER	DATE	TIME	MATRIX	NUMBER OF CONTAINERS	CONTAINER SIZE	PRESERVATIVE (Y/N)	TPH-GASOLINE (EPA 8015, 5030)	TPH-DIESEL (EPA 8015, 3550, 3510)	PURGEABLE AROMATICS BTEX (EPA 602, 8020)	PURGEABLE HALOCARBONS (EPA 601)	VOLATILE ORGANICS (EPA 624, 8240)	BASE / NEUTRALS, ACIDS (EPA 625, 5270)	TOTAL OIL & GREASE	O-C PESTICIDES / PCBs (EPA 605, 8080)	O-P PESTICIDES (EPA 614, 8140)	TITLE 16 METALS (17)	PRIORITY METALS (13)	MTBE	ASTM CORROSITY	ASTM CORROSITY w/ brief evaluation			REMARKS REQUIRED DETECTION LIMITS
001	3-B5@7-9.5 *	10/04/17		soil	1	Shelby	N														X			Container Labeled 3B5@8.5-9
002	3-B6@5-7.5	10/04/17		soil	1	Shelby	N														X			

* Use the Sample I.D. that is on the bag per Andy Firmin

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
	10/4/17 2:30pm			10/4/17 1515	

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME

REMARKS: Questions? Please call (408) 215-7012

ENGEO INCORPORATED

3420 FOSTORIA WAY, SUITE E
SAN RAMON, CALIFORNIA 94583
(925) 355-9047 FAX (888) 279-2698
WWW.ENGEO.COM

DISTRIBUTION: ORIGINAL ACCOMPANIES SHIPMENT; COPY TO PROJECT FIELD FILES

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: ENGEO Incorporated
Client's Project No.: 8602.001.000
Client's Project Name: Foster City Levees
Date Sampled: 03/21, 22 & 24/16
Date Received: 15-Apr-16
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 22-Apr-2016

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1604142-001	2-B1 @ 2.5'-3'	470	8.32	-	550	N.D.	420	210
1604142-002	2-B2 @ 4'-4.5'	460	7.58	-	140	N.D.	3000**	890
1604142-003	2-B2 @ 10'-11'	330	7.53	-	82	N.D.	4800**	360
1604142-004	2-B4 @ 5.5'-6'	310	8.14	-	150	N.D.	2700**	220
1604142-005	2-B5 @ 4.5'-5'	310	7.98	-	590	N.D.	280	640

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	18-Apr-2016	18-Apr-2016	-	21-Apr-2016	21-Apr-2016	18-Apr-2016	18-Apr-2016

Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis
N.D. - None Detected
**Reporting level elevated to 75 mg/kg due to dilution.

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

1604142 11521

CHAIN OF CUSTODY RECORD

PROJECT NUMBER: 8602.001.000	PROJECT NAME: Foster City Levees
SAMPLED BY: (SIGNATURE/PRINT) Andy Firmin	
PROJECT MANAGER: Andy Firmin	
ROUTING: E-MAIL afirmin@engeo.com	Hard Copy Andy Firmin

	SAMPLE NUMBER	DATE	TIME	MATRIX	NUMBER OF CONTAINERS	CONTAINER SIZE	PRESERVATIVE	Redox	pH	Sulfate	Resistivity	Chloride	Sulfide		REMARKS REQUIRED DETECTION LIMITS
001	2-B1 @ 2.5-3	22-Mar-16	AM	Soil	1	Liner	None	x	x	x	x	x	x	Tubes	ASTM Test Methods
002	2-B2 @ 4-4.5	21-Mar-16	AM	Soil	1	Liner	None	x	x	x	x	x	x		ASTM Test Methods
003	2-B2 @ 10-11	21-Mar-16	AM	Soil	1	Shelby	None	x	x	x	x	x	x		ASTM Test Methods
004	2-B4 @ 5.5-6	24-Mar-16	AM	Soil	1	Liner	None	x	x	x	x	x	x		ASTM Test Methods
005	2-B5 @ 4.5-5	22-Mar-16	AM	Soil	1	Liner	None	x	x	x	x	x	x		ASTM Test Methods

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
[signature]	4-15-16 8:45	[signature]	[signature]	4/15/16 12:05	[signature]
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
[signature]	4/15/16 1315	[signature]			
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR LABORATORY BY: (SIGNATURE)	DATE/TIME	REMARKS	STANDARD 10 DAY TURNAROUND

ENGEO INCORPORATED

6399 SAN IGNACIO AVENUE, SUITE 150
SAN JOSE, CALIFORNIA 95119
(408) 574-4900 FAX (888) 279-2698
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DRAFT

APPENDIX C

Liquefaction Assessment

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Geotechnical Software

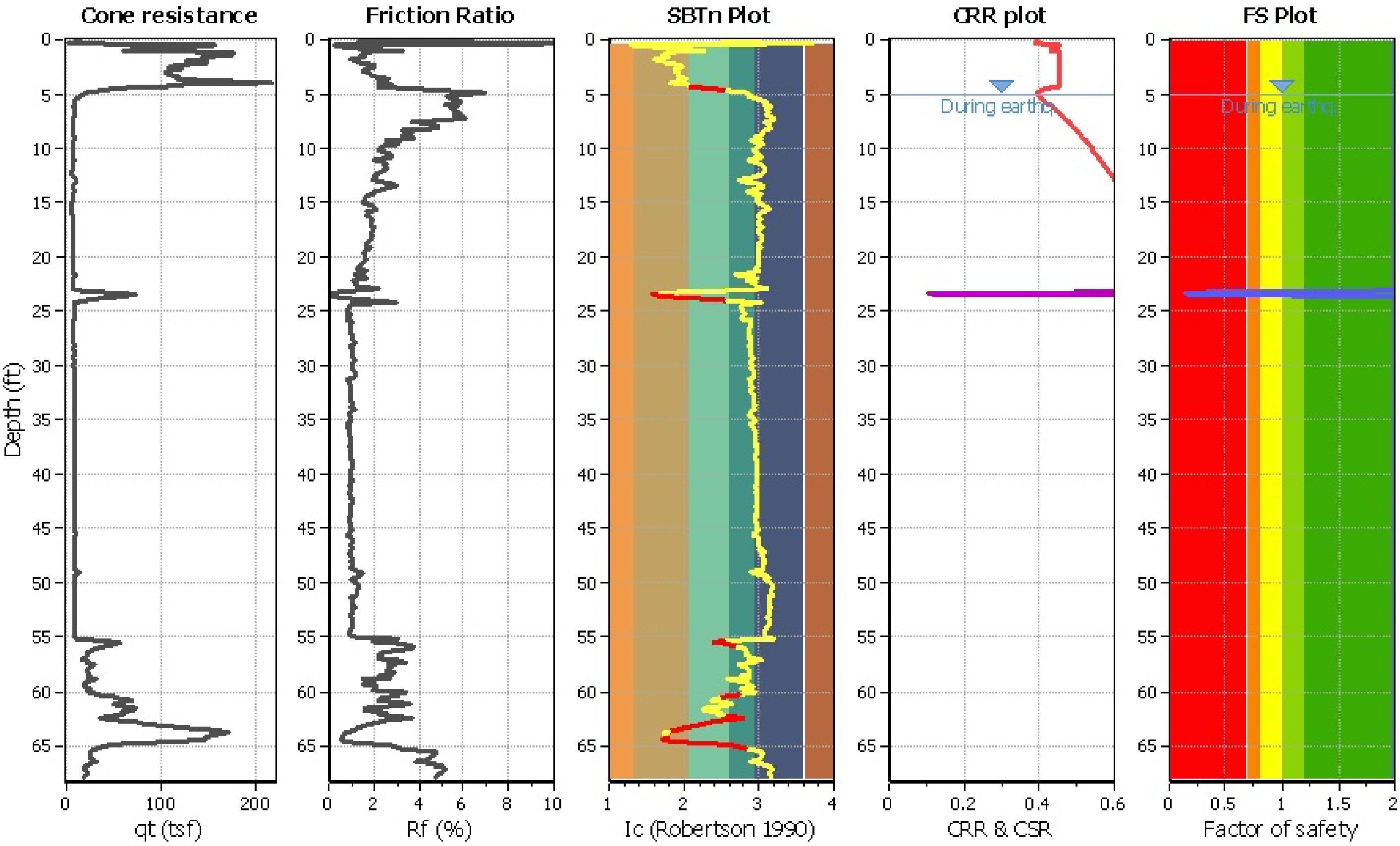
LIQUEFACTION ANALYSIS REPORT

Project title : Foster City Levee Improvement **Location : Foster City**

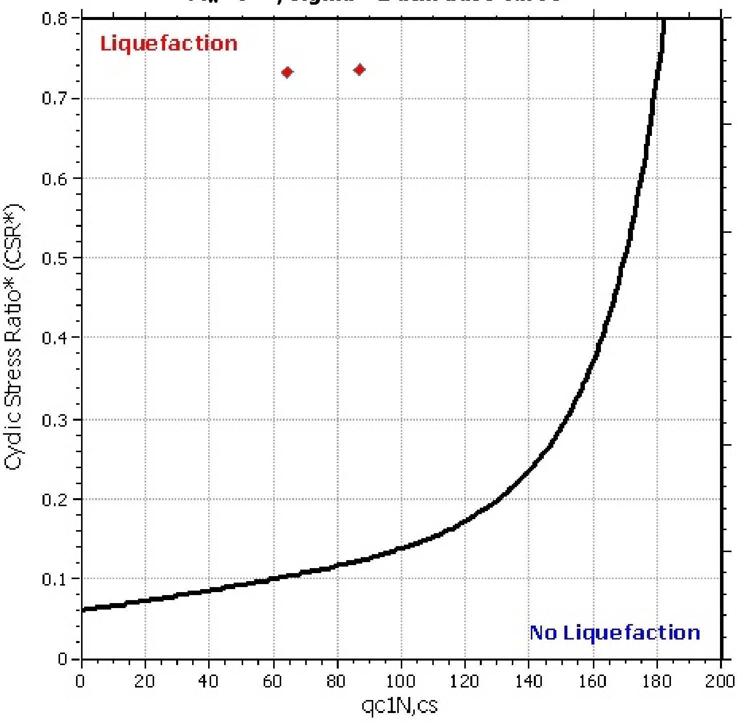
CPT file : 2-CPT1

Input parameters and analysis data

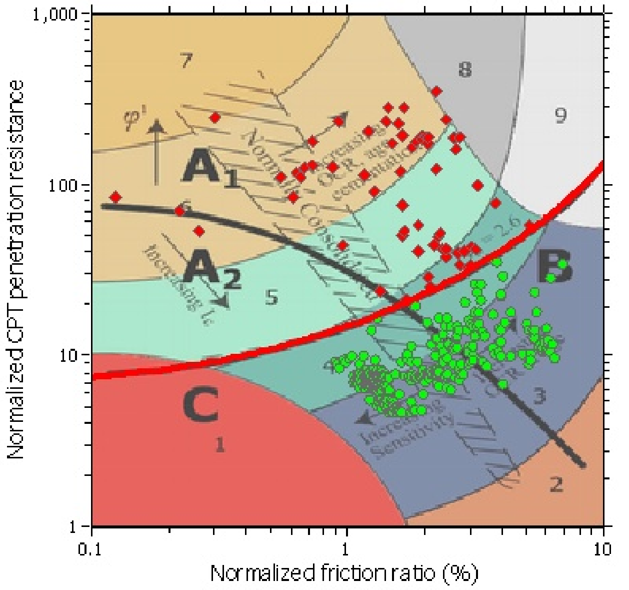
Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



M_w=7$^{1/2}$, sigma'=1 atm base curve

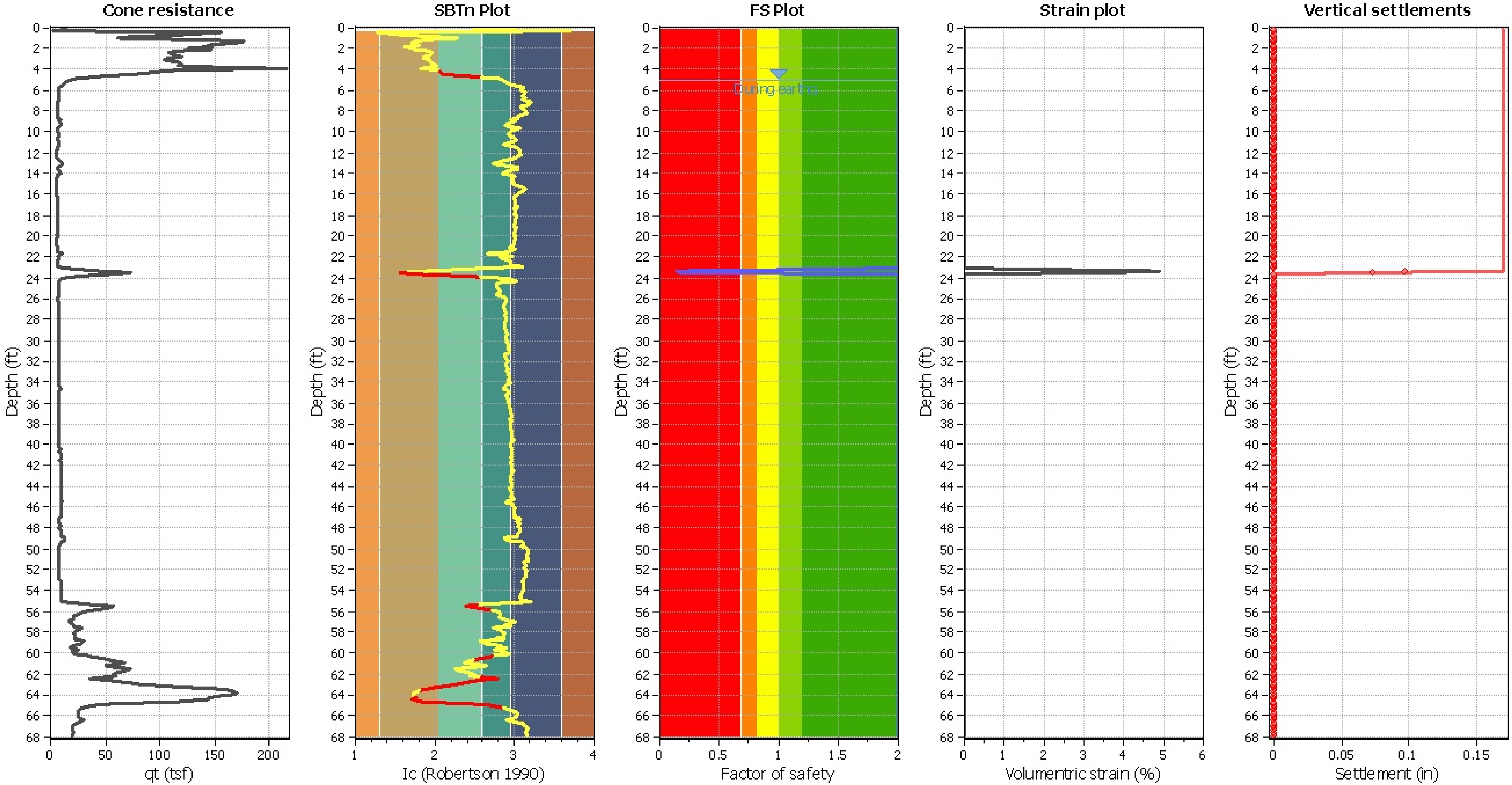


Summary of liquefaction potential



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

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

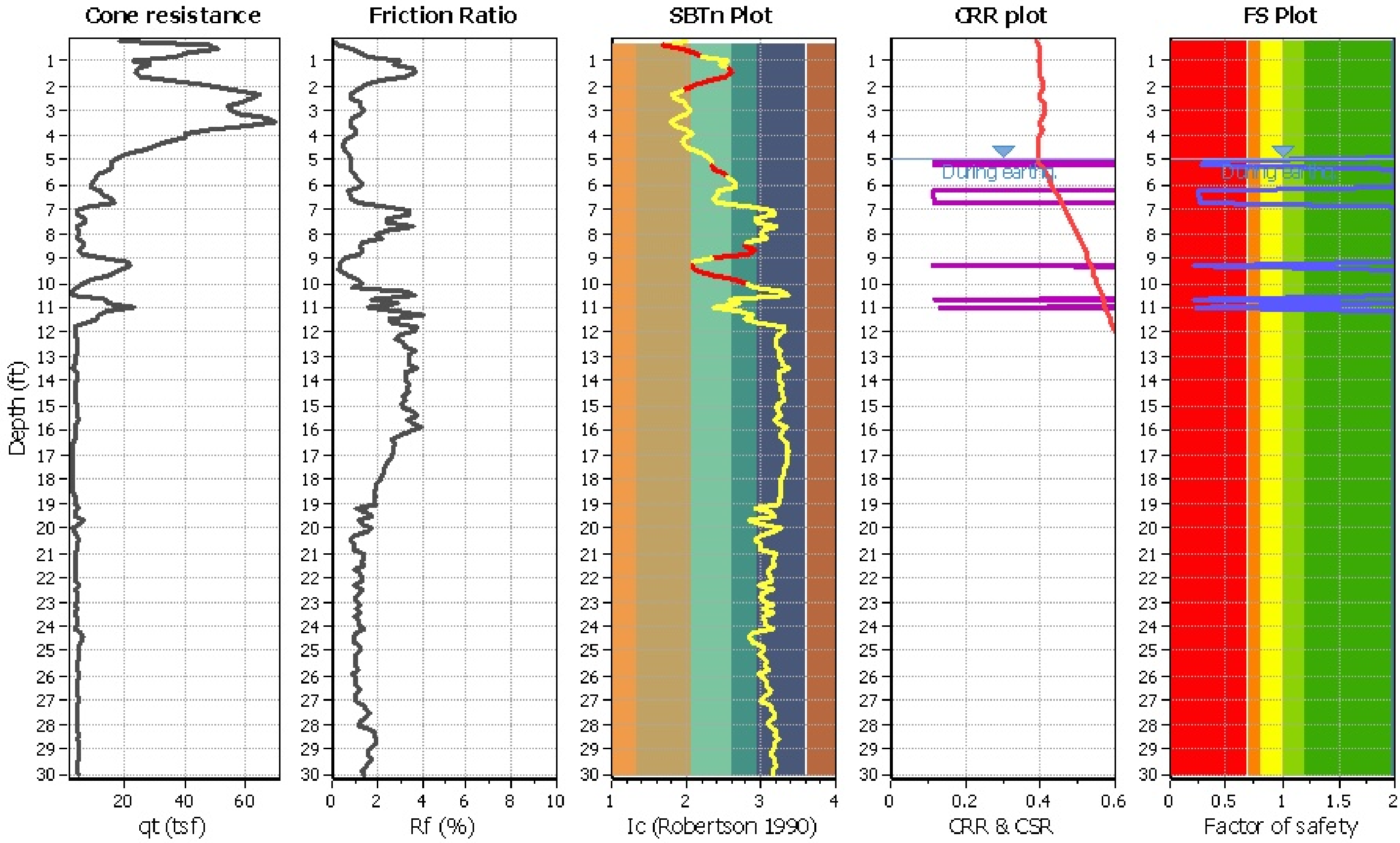
LIQUEFACTION ANALYSIS REPORT

Project title : Foster City Levee Improvement **Location : Foster City**

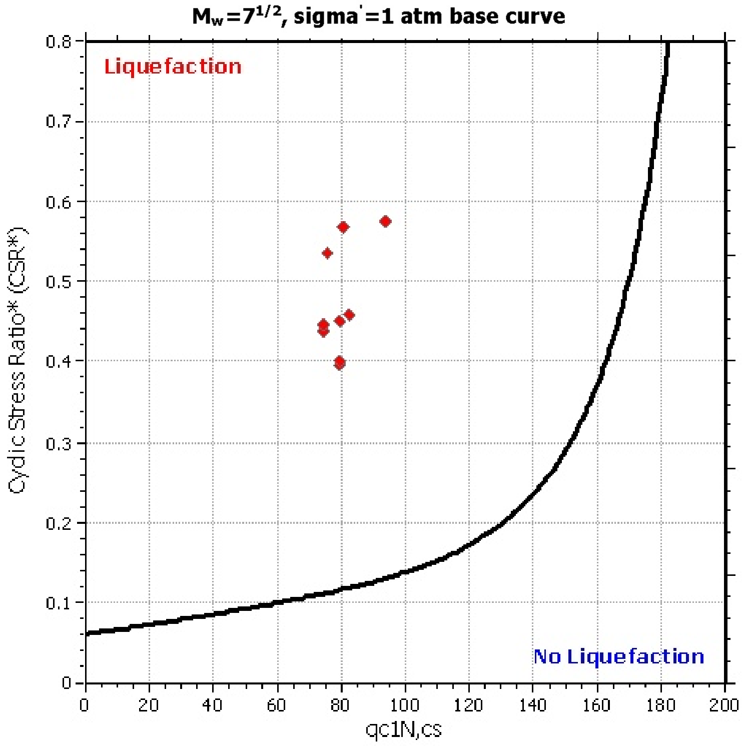
CPT file : 2-CPT3

Input parameters and analysis data

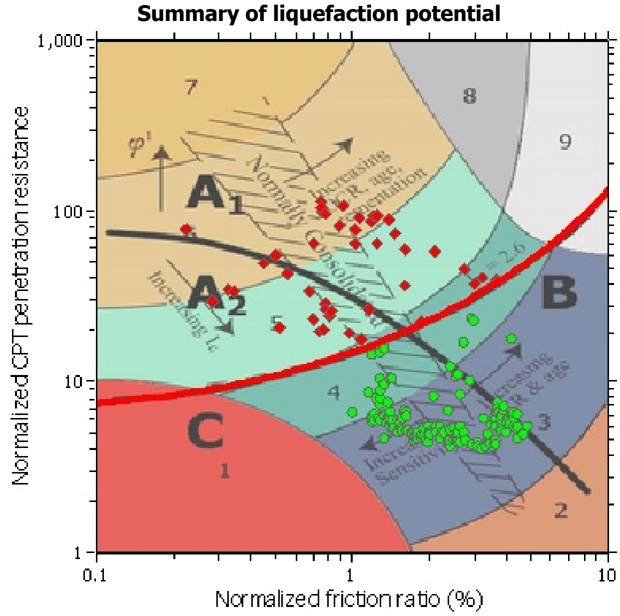
Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



M_w=7$^{1/2}$, sigma'=1 atm base curve

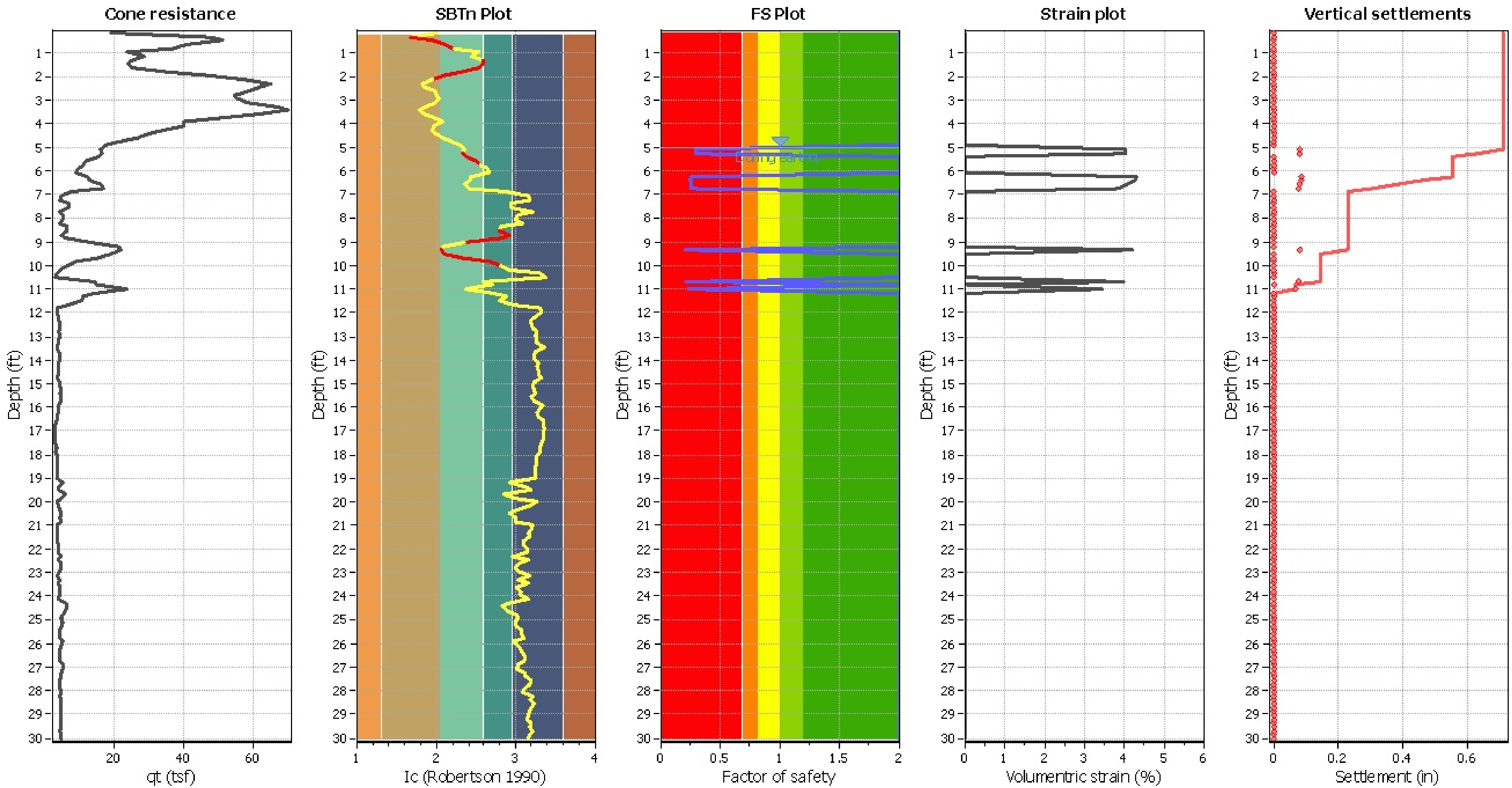


Summary of liquefaction potential



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

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

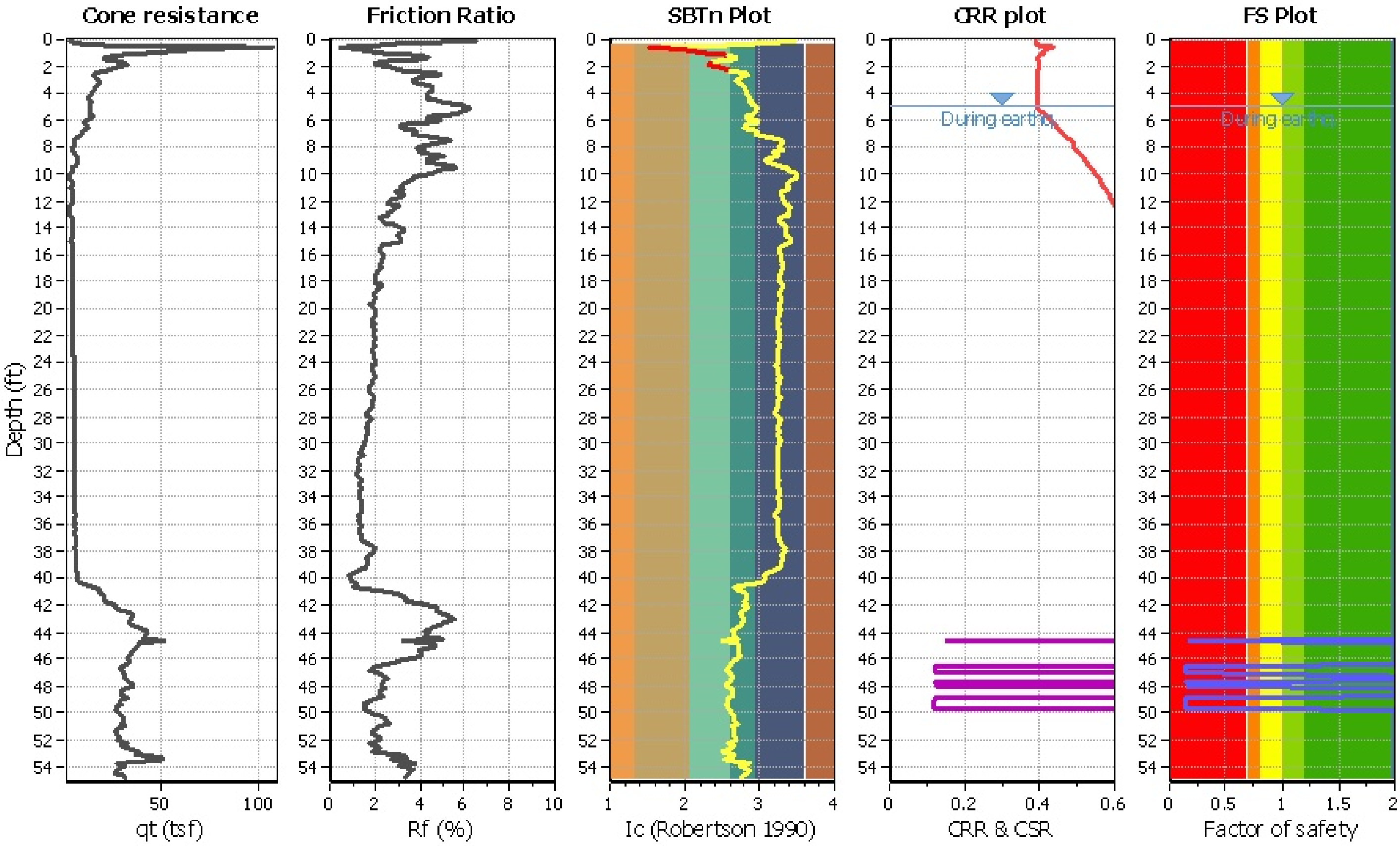
LIQUEFACTION ANALYSIS REPORT

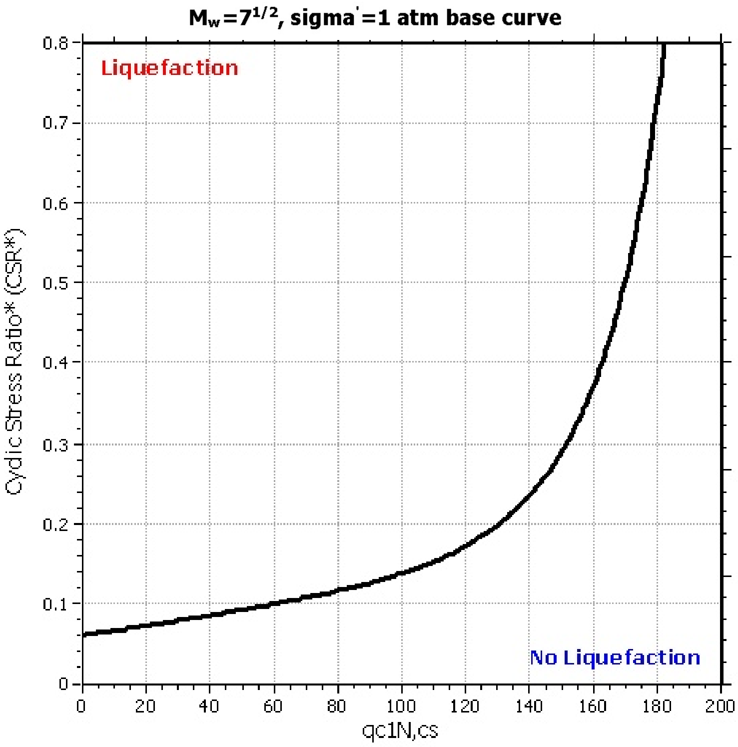
Project title : Foster City Levee Improvement **Location : Foster City**

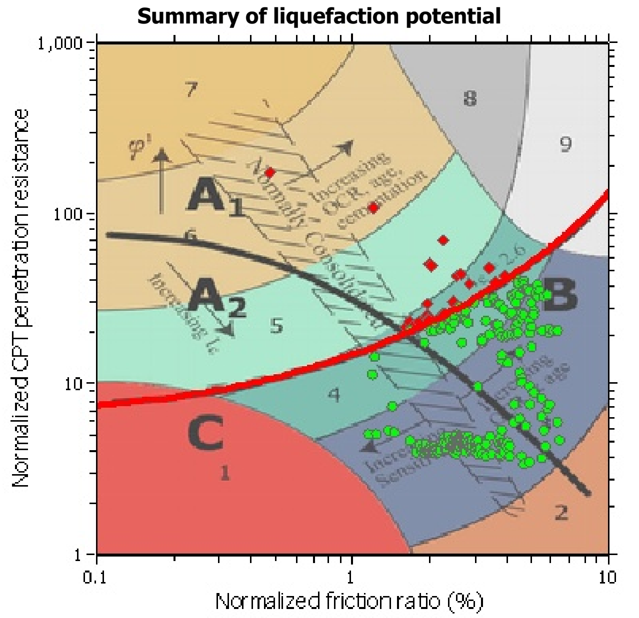
CPT file : 2-CPT5

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	50.00 ft
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method

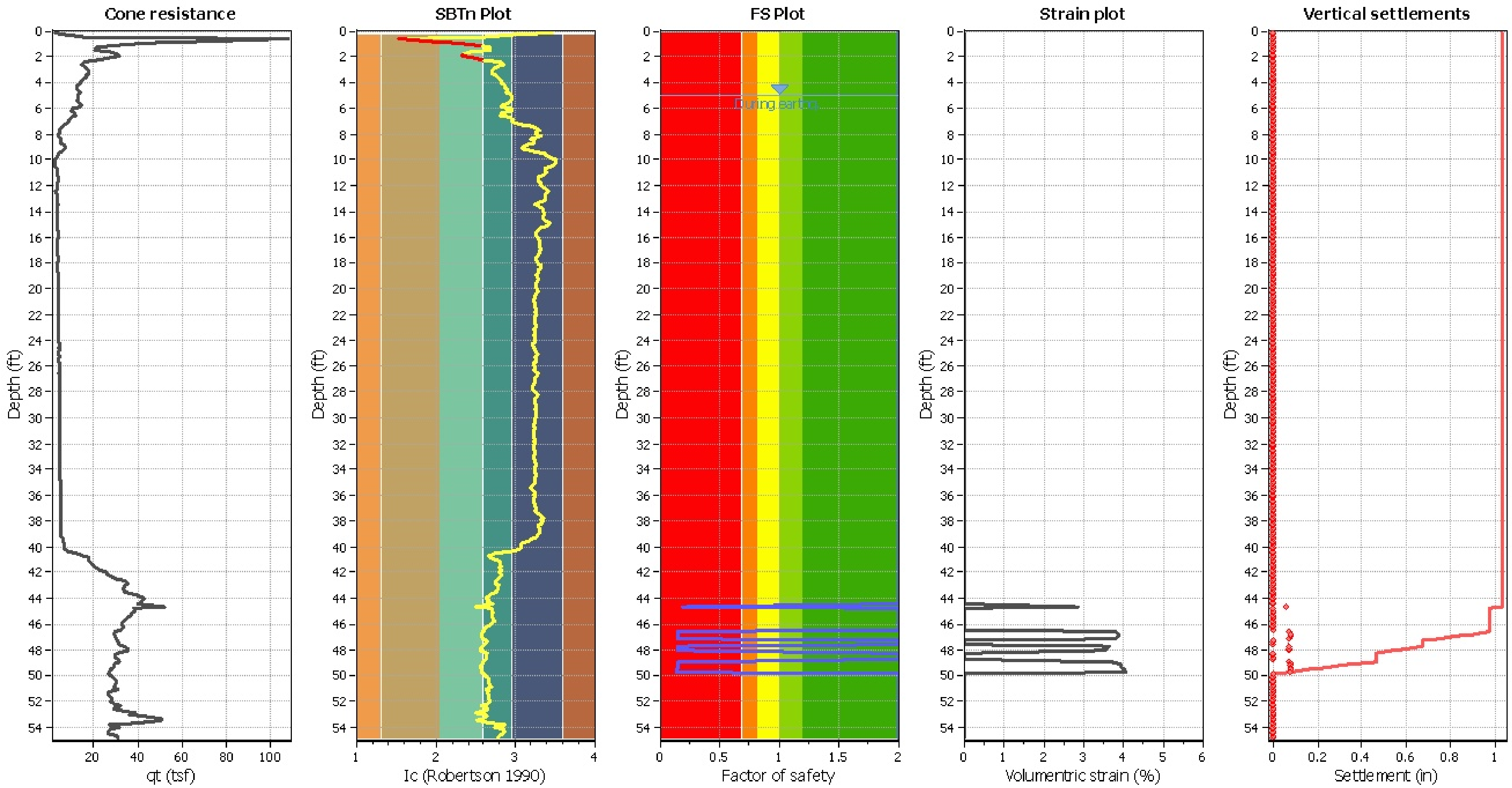






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Estimation of post-earthquake settlements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
FS: Calculated Factor of Safety against liquefaction
Volumentric strain: Post-liquefaction volumentric strain

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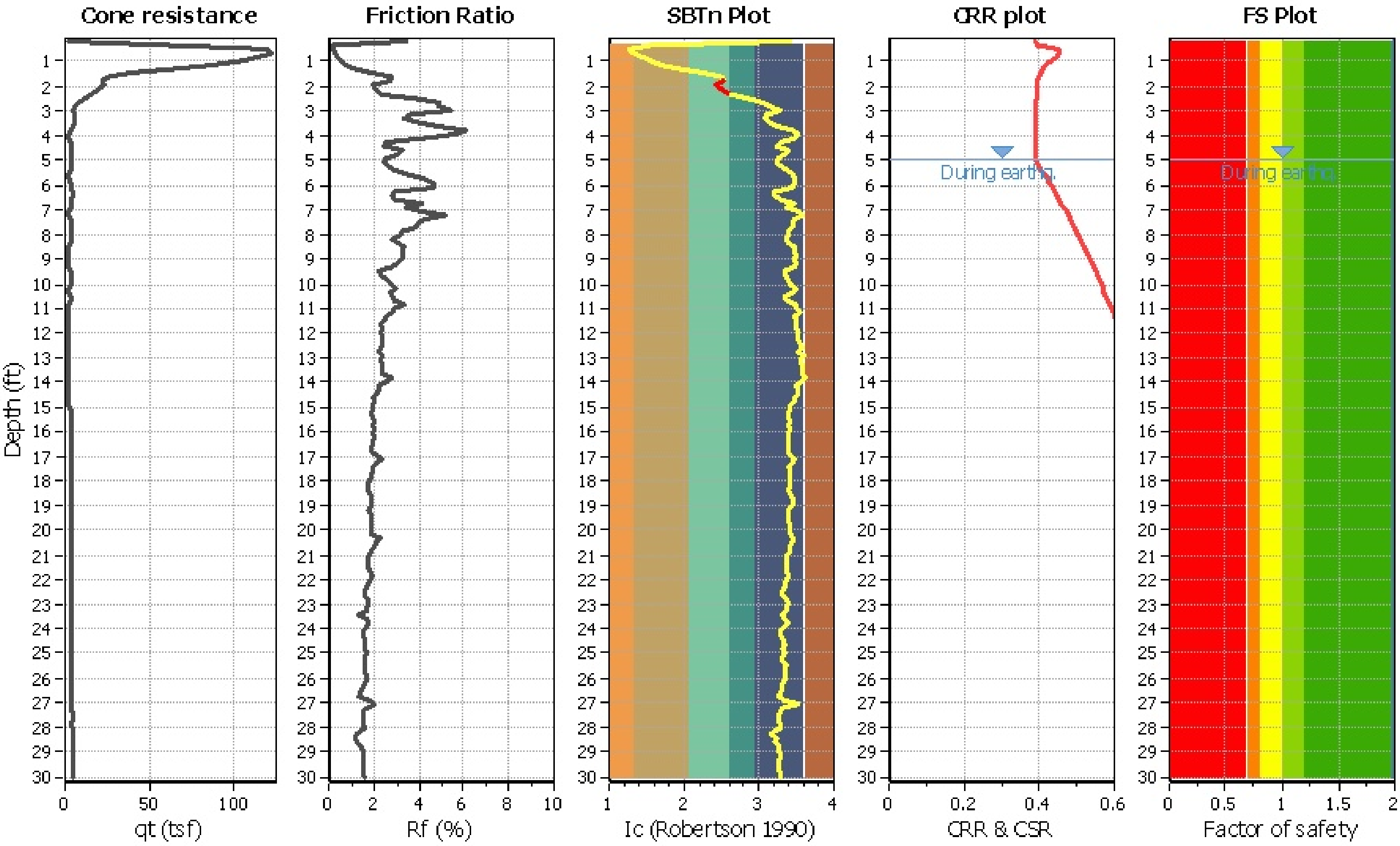
LIQUEFACTION ANALYSIS REPORT

Project title : Foster City Levee Improvement **Location : Foster City**

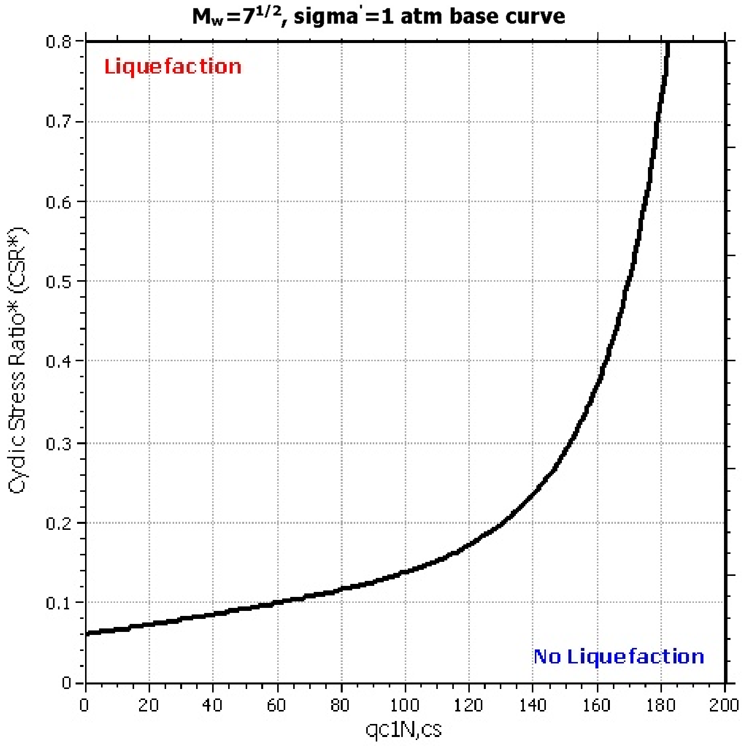
CPT file : 2-CPT6

Input parameters and analysis data

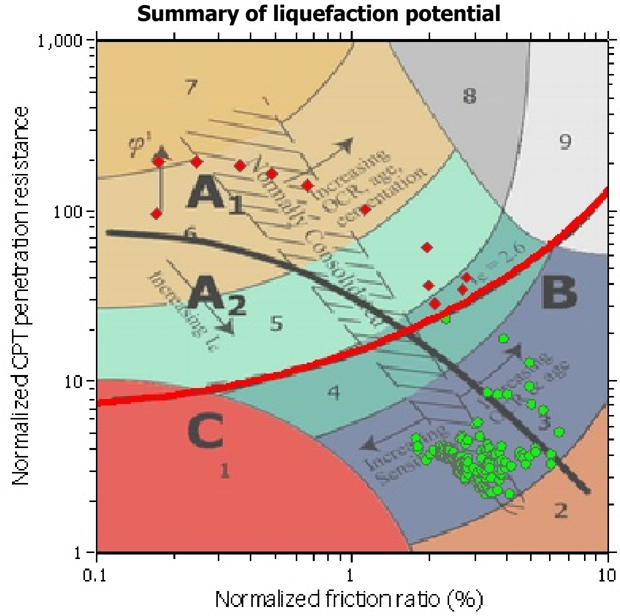
Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



M_w=7$^{1/2}$, sigma'=1 atm base curve

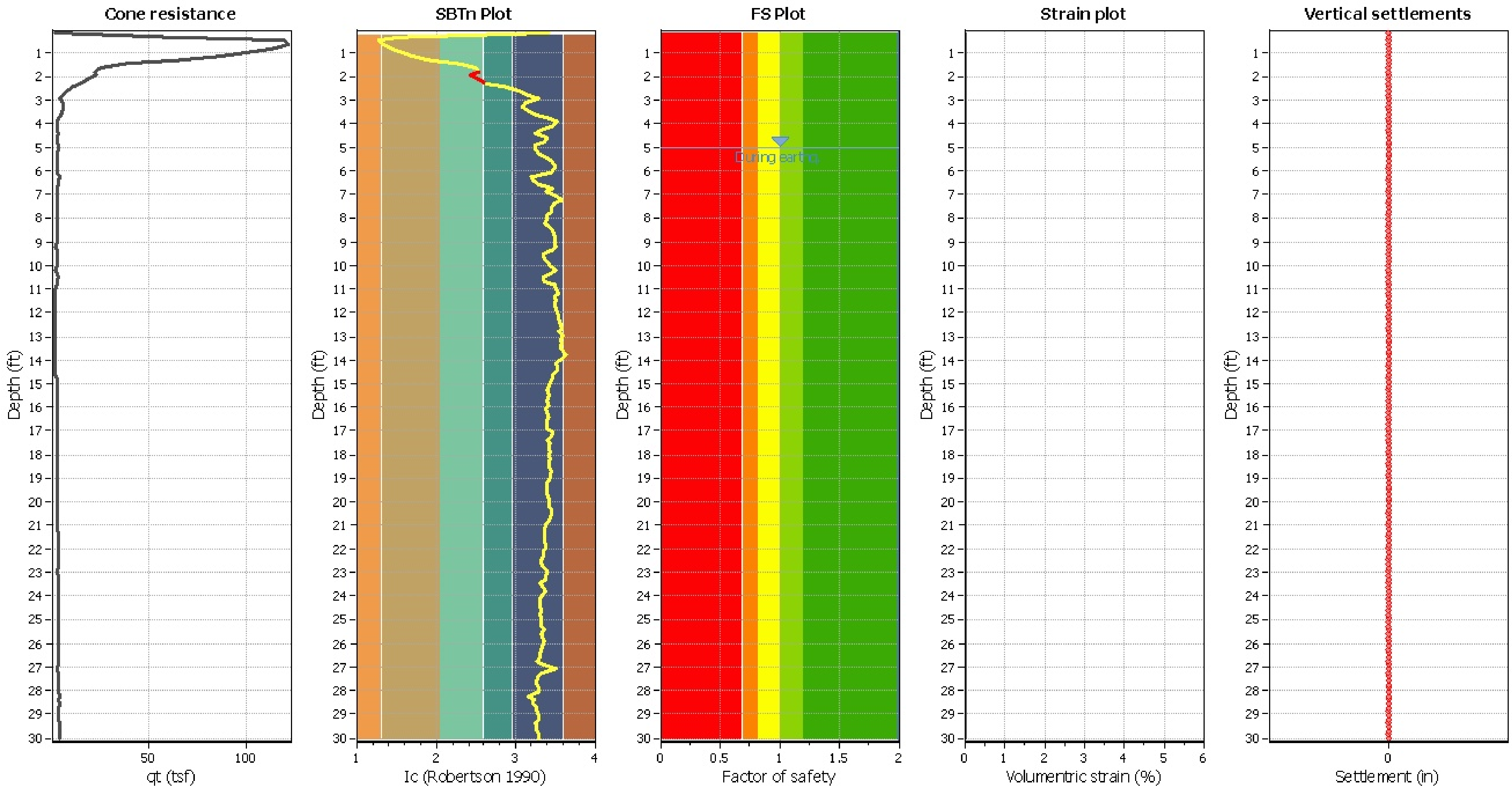


Summary of liquefaction potential



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

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

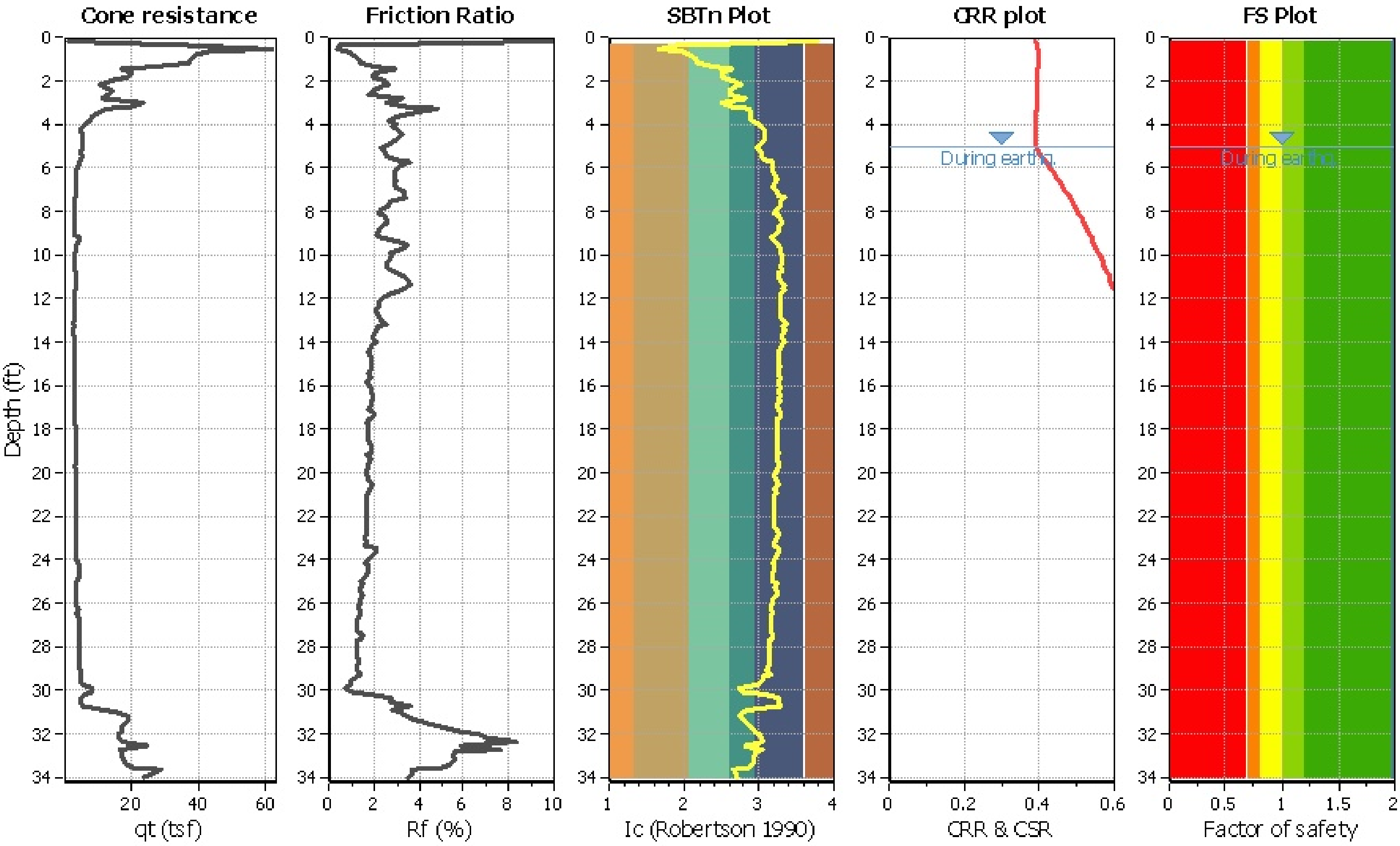
LIQUEFACTION ANALYSIS REPORT

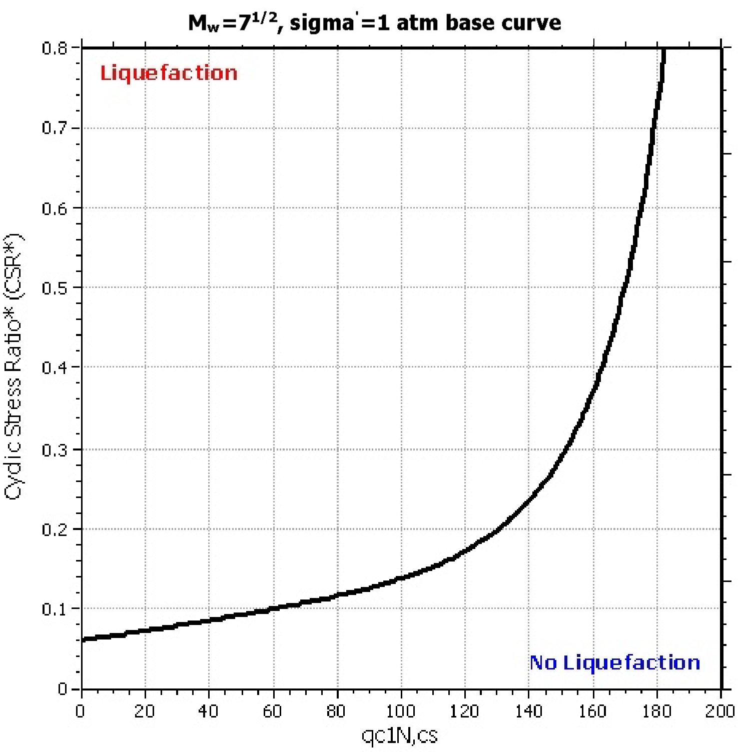
Project title : Foster City Levee Improvement **Location : Foster City**

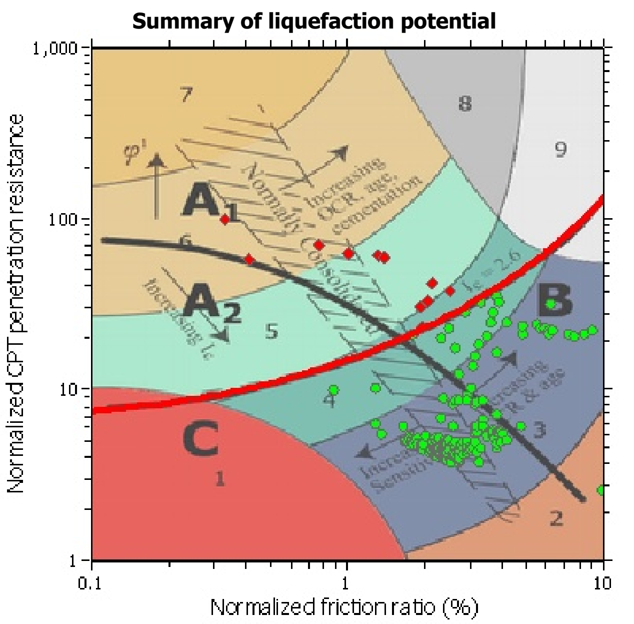
CPT file : 2-CPT7

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

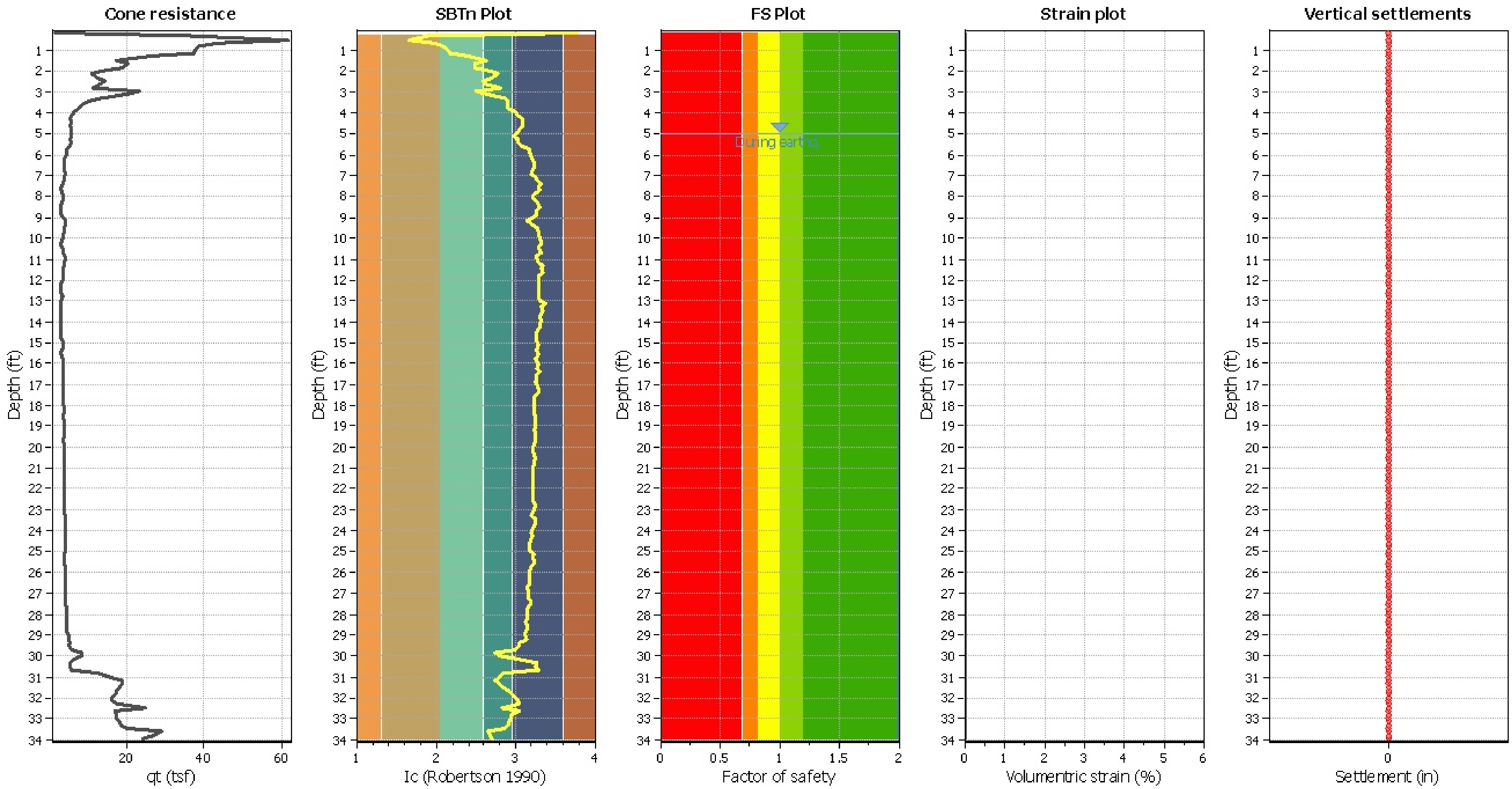






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Estimation of post-earthquake settlements



Abbreviations

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I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

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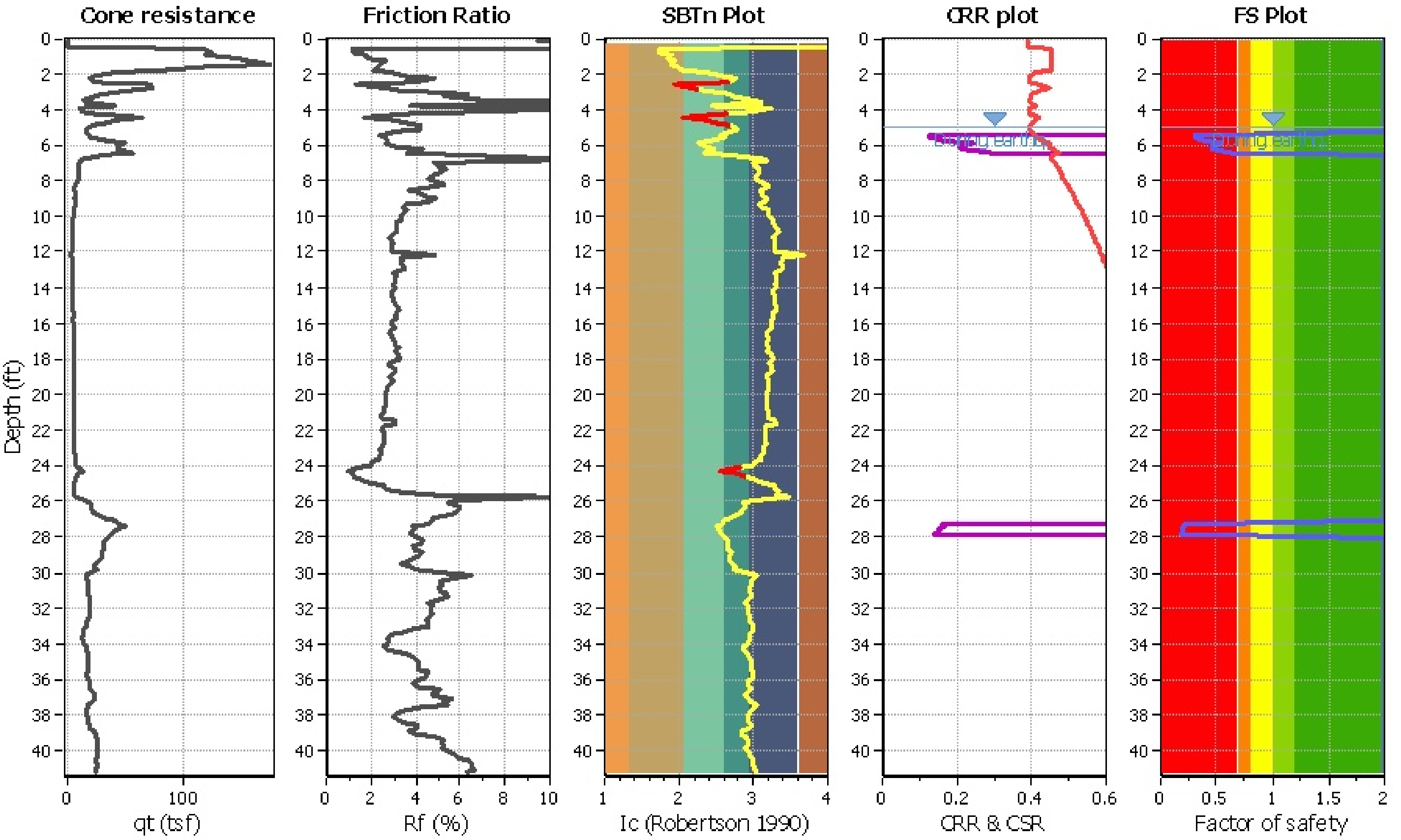
LIQUEFACTION ANALYSIS REPORT

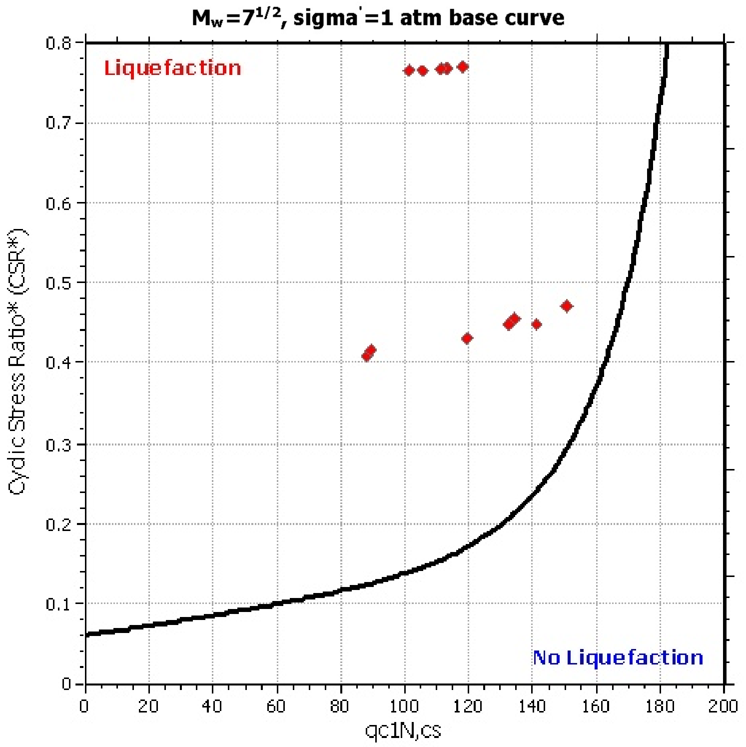
Project title : Foster City Levee Improvement **Location : Foster City**

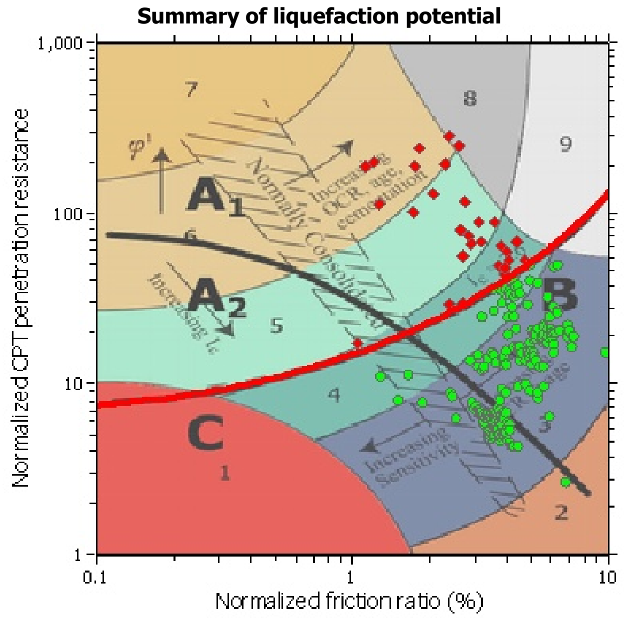
CPT file : 2-CPT8

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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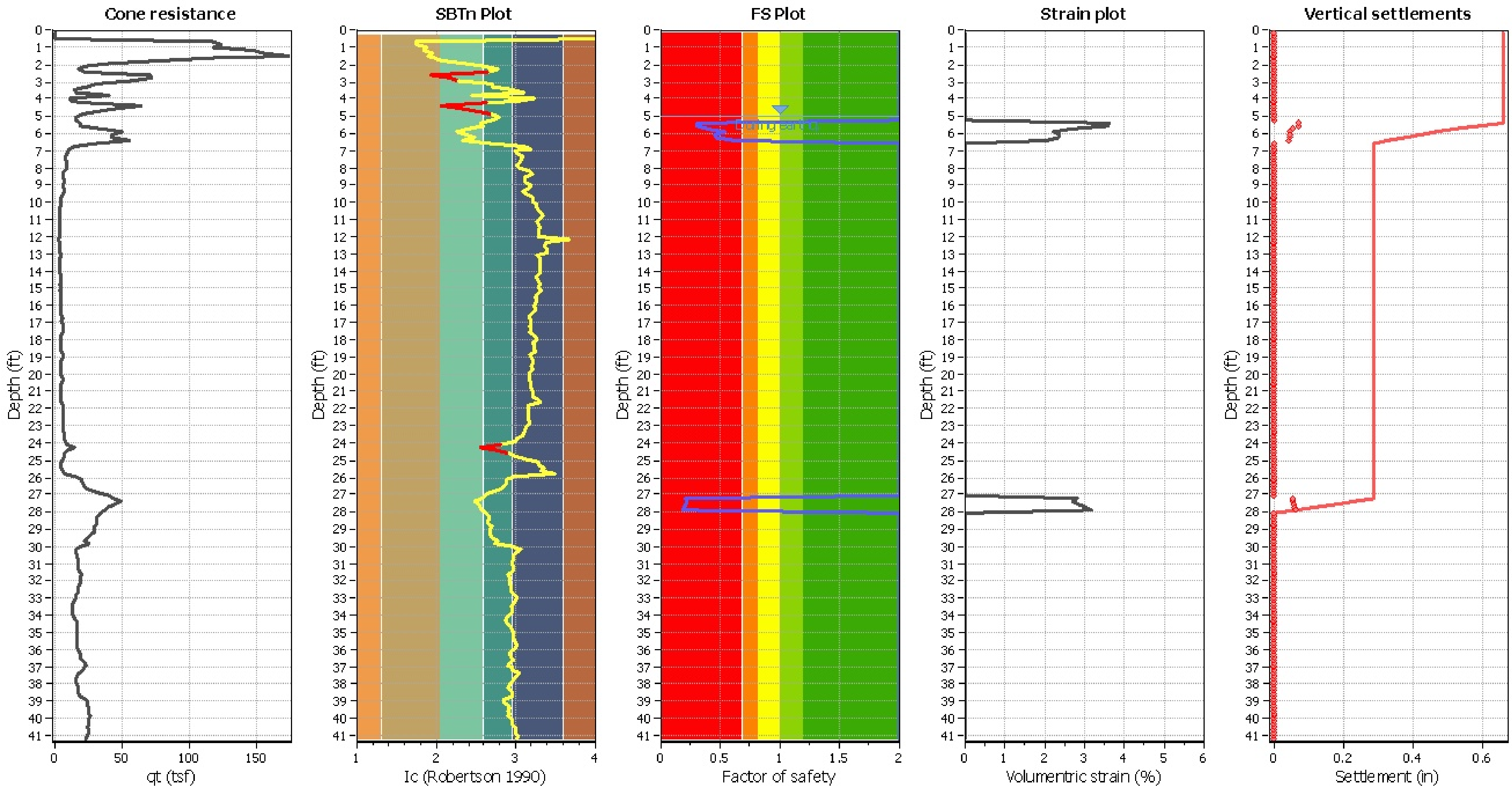
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Estimation of post-earthquake settlements



Abbreviations

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I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

GEOLOGISMIKI Geotechnical Software

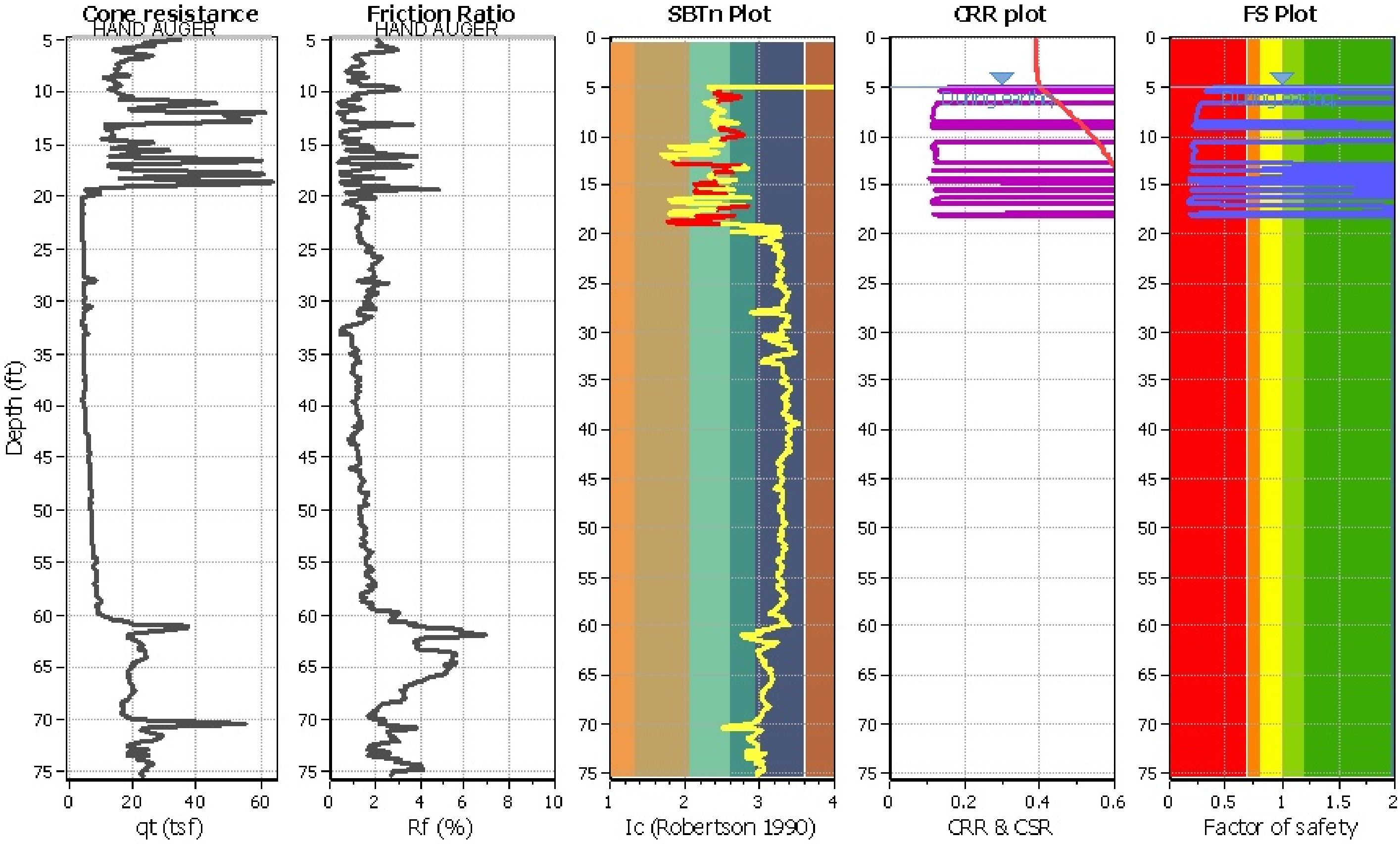
LIQUEFACTION ANALYSIS REPORT

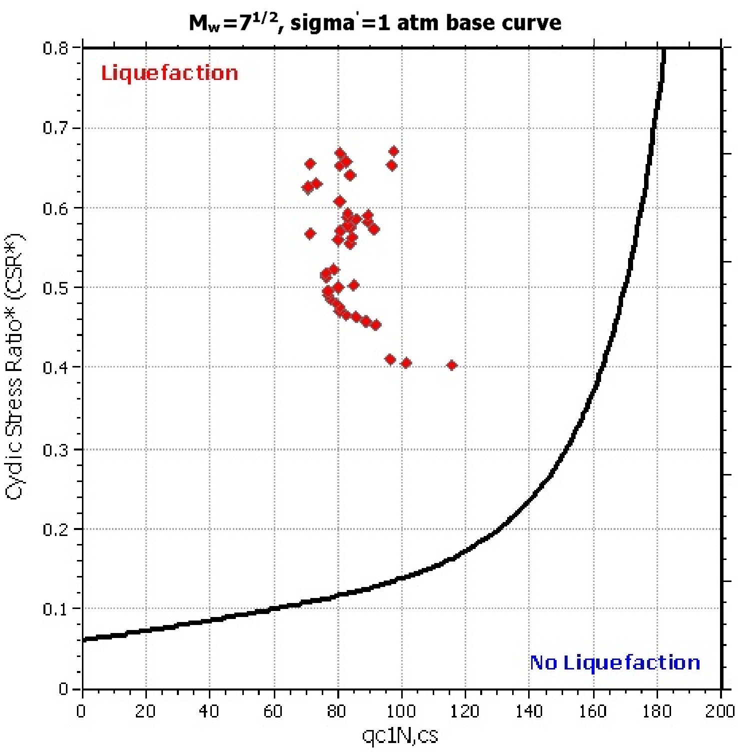
Project title : Foster City Levee Improvement **Location : Foster City**

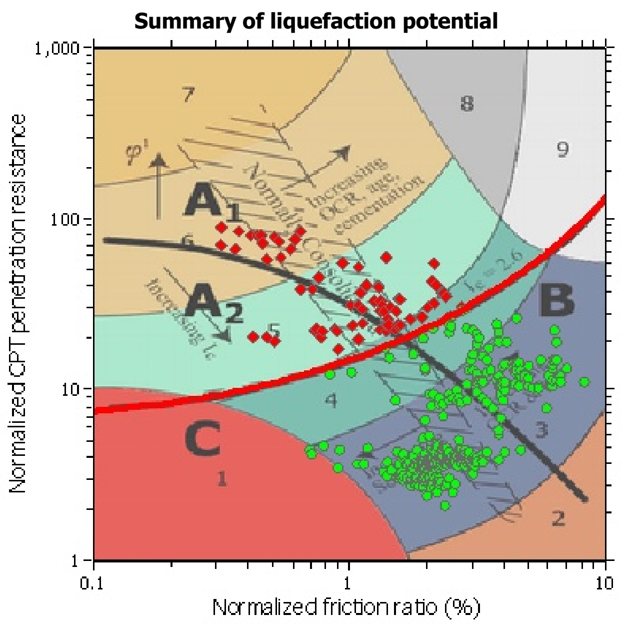
CPT file : 3-CPT1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







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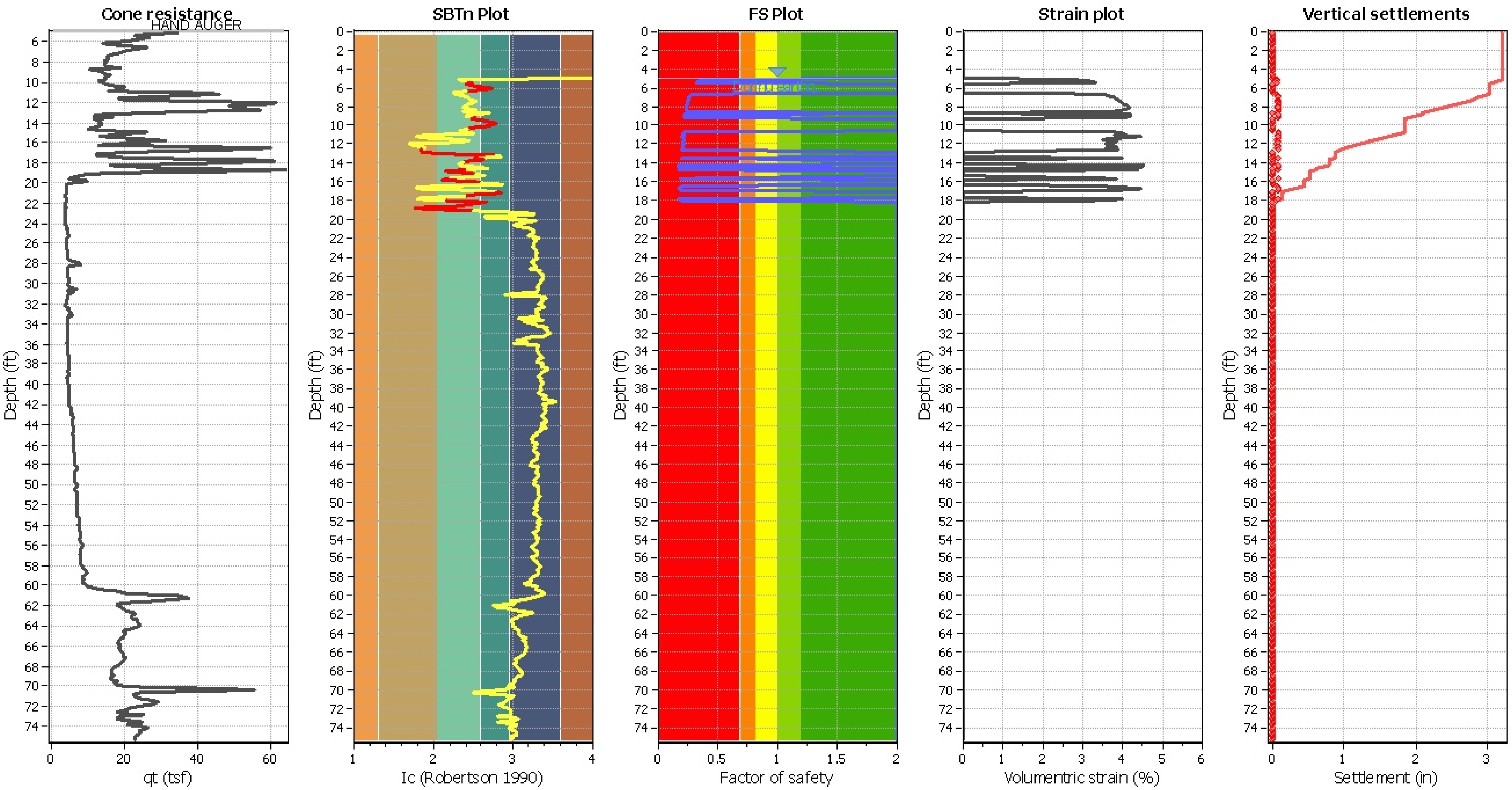
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

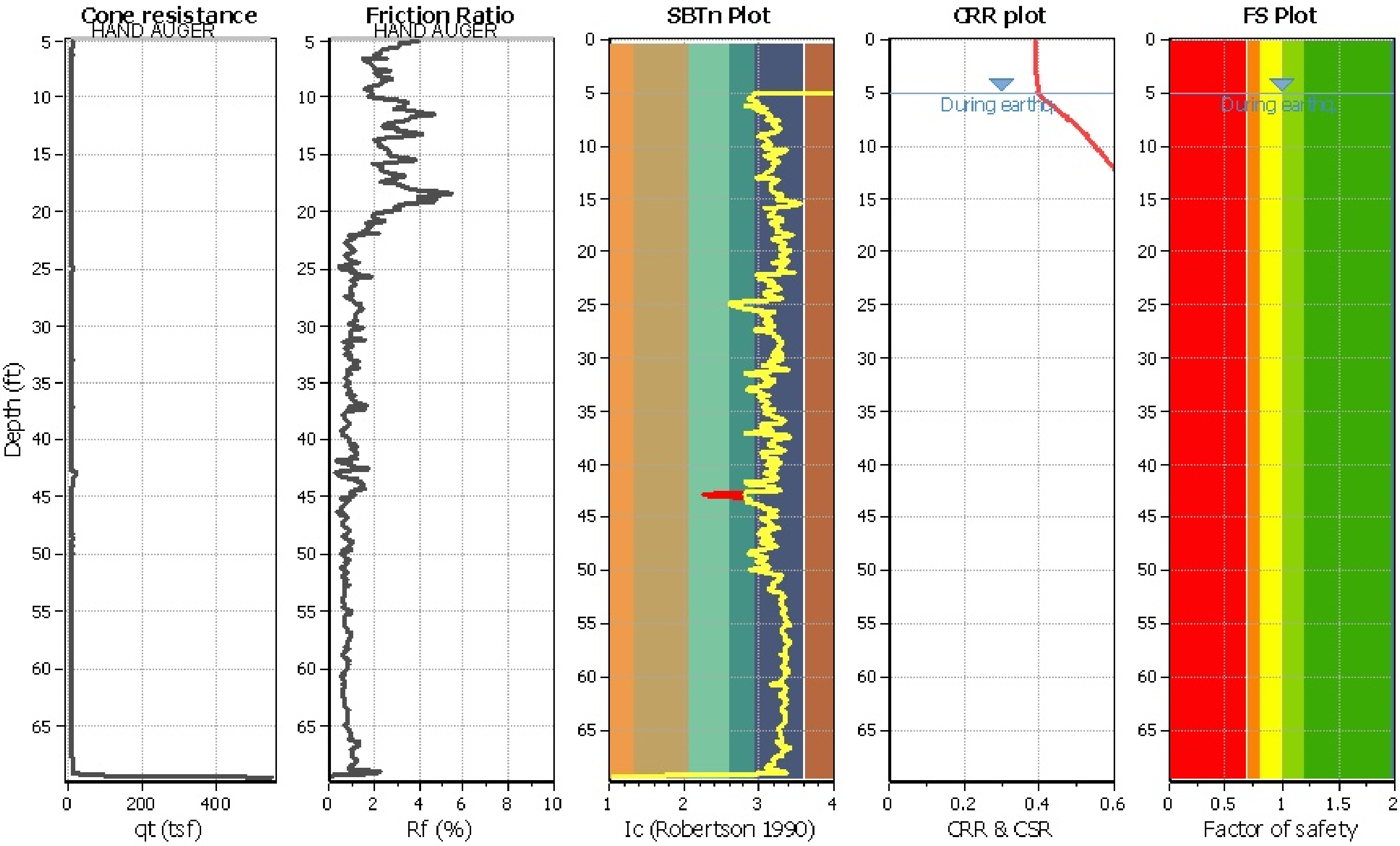
LIQUEFACTION ANALYSIS REPORT

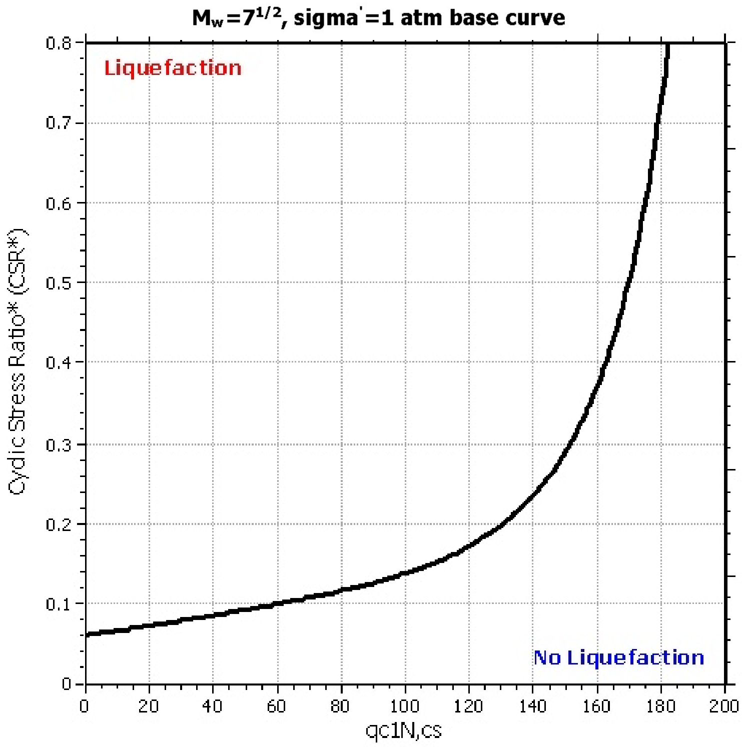
Project title : Foster City Levee Improvement **Location : Foster City**

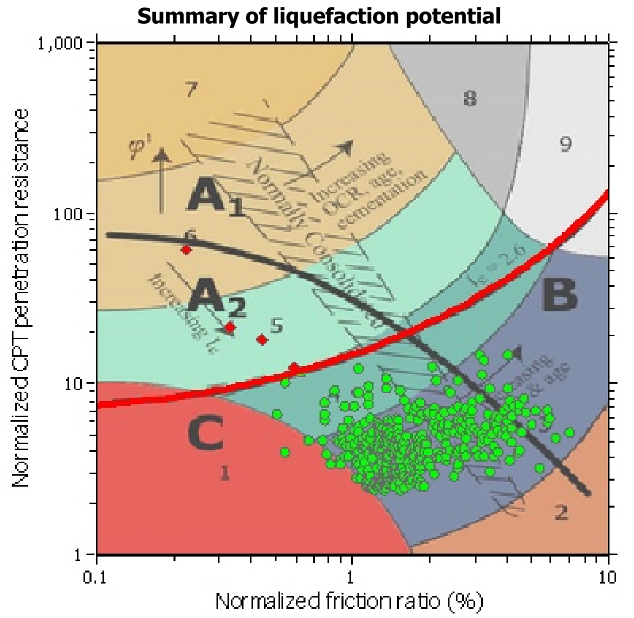
CPT file : 3-CPT2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

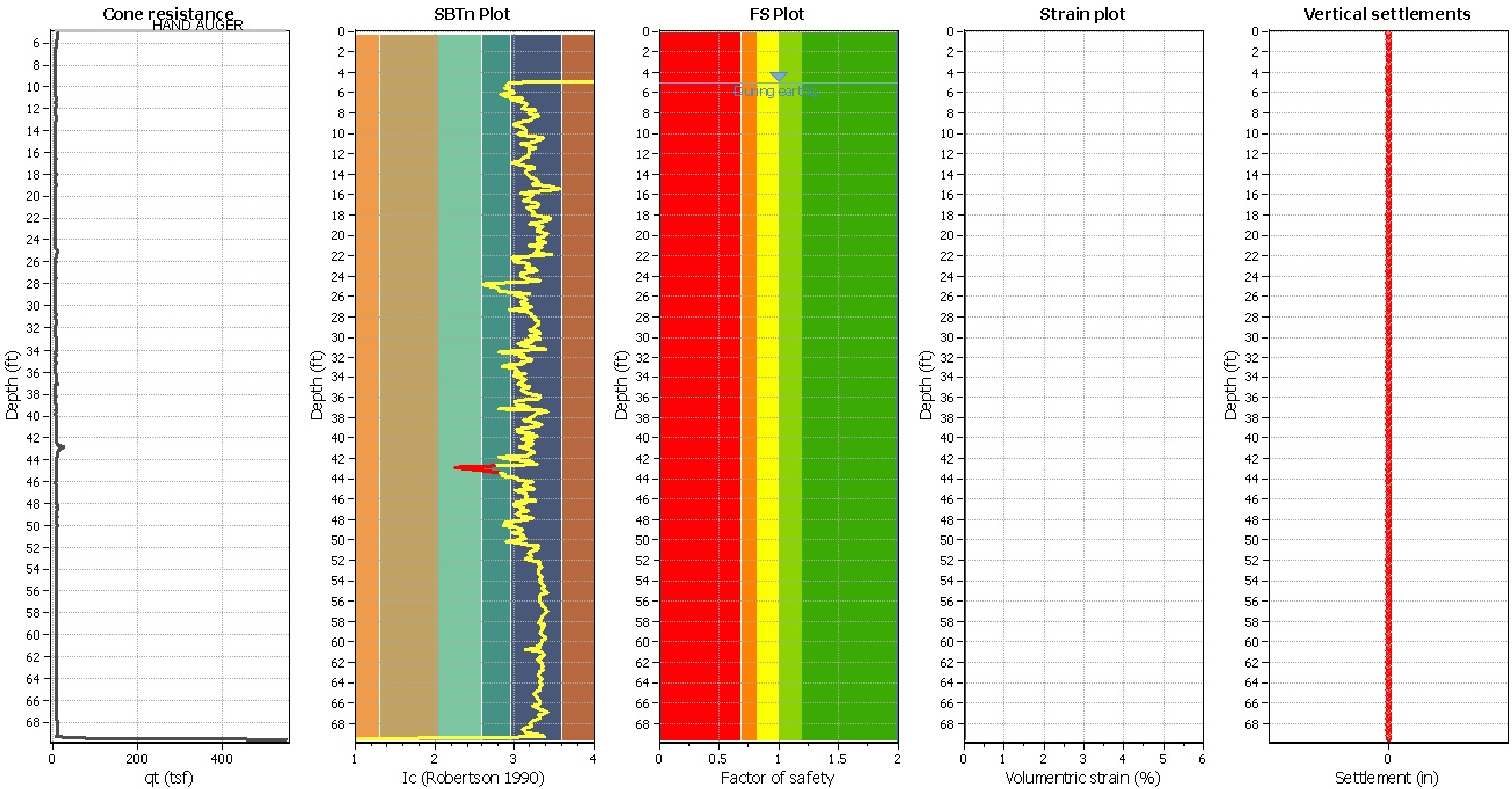






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Estimation of post-earthquake settlements



Abbreviations

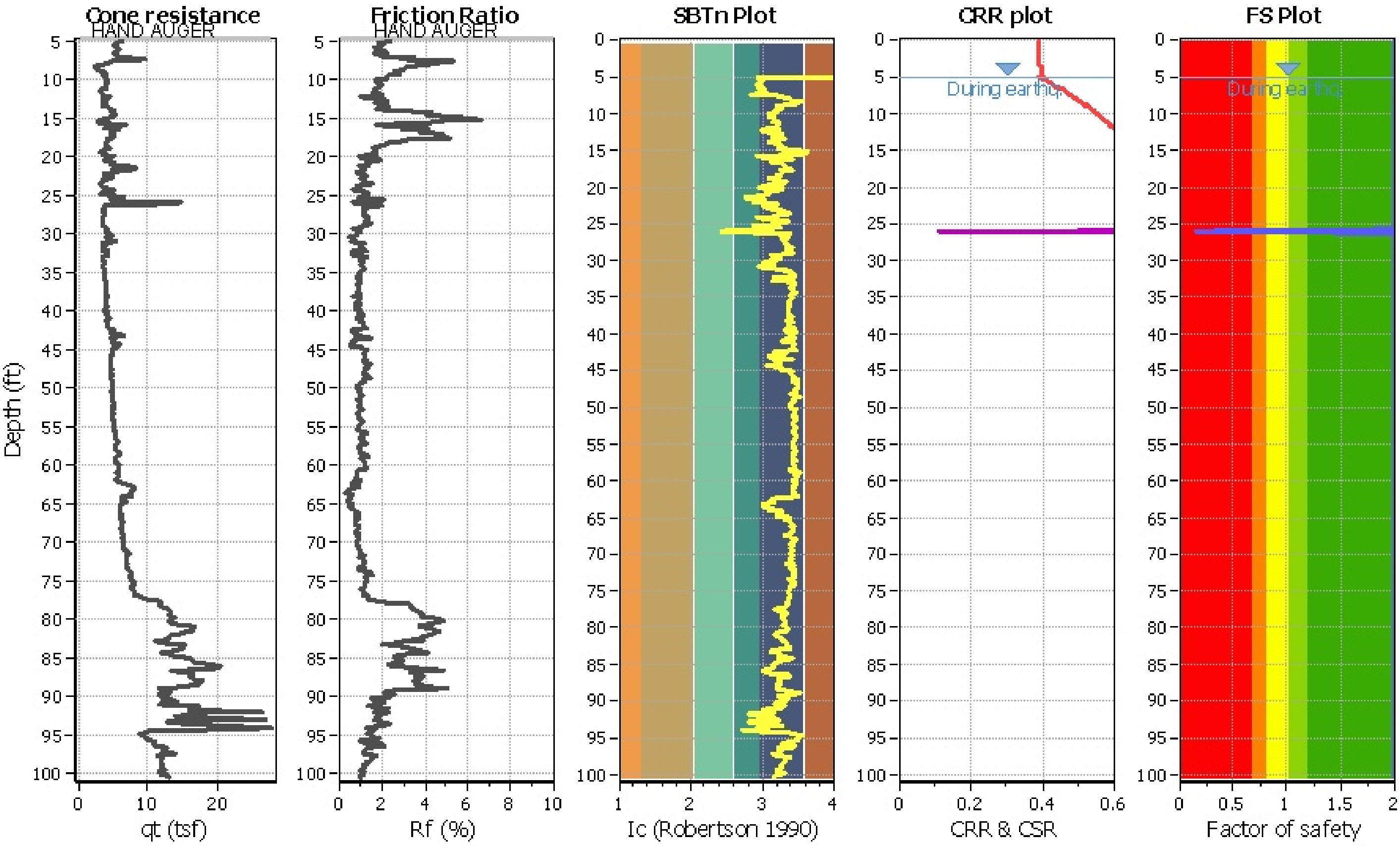
q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

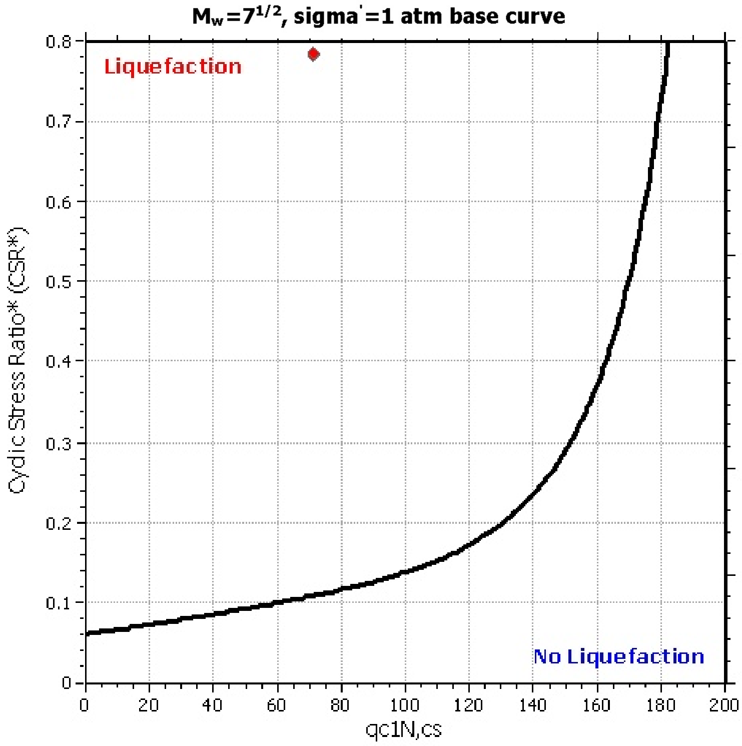
Project title : Foster City Levee Improvement **Location : Foster City**

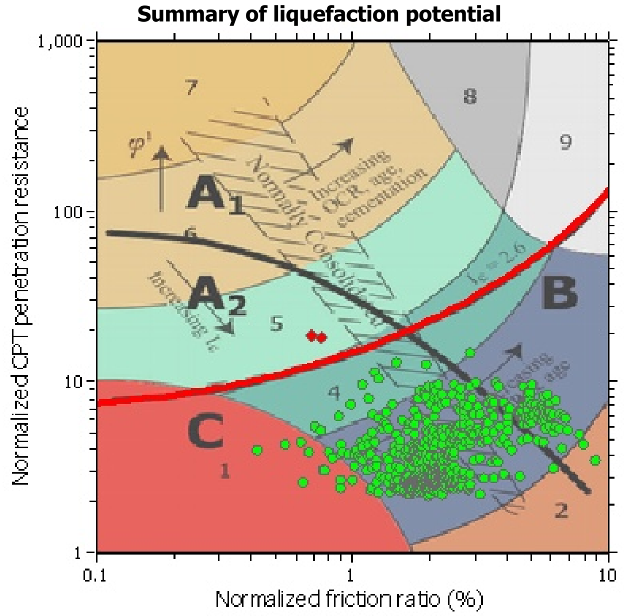
CPT file : 3-CPT3

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

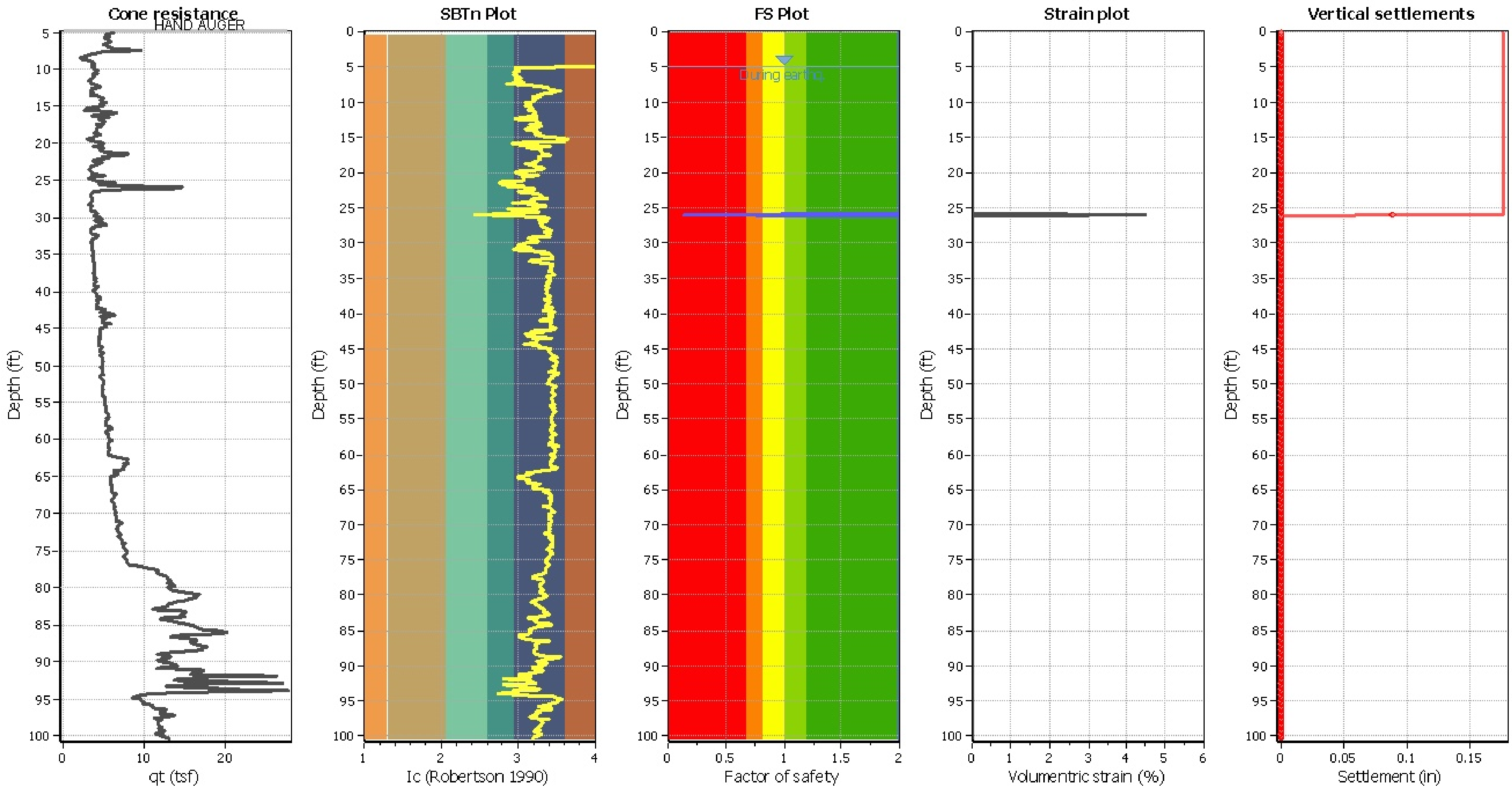






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

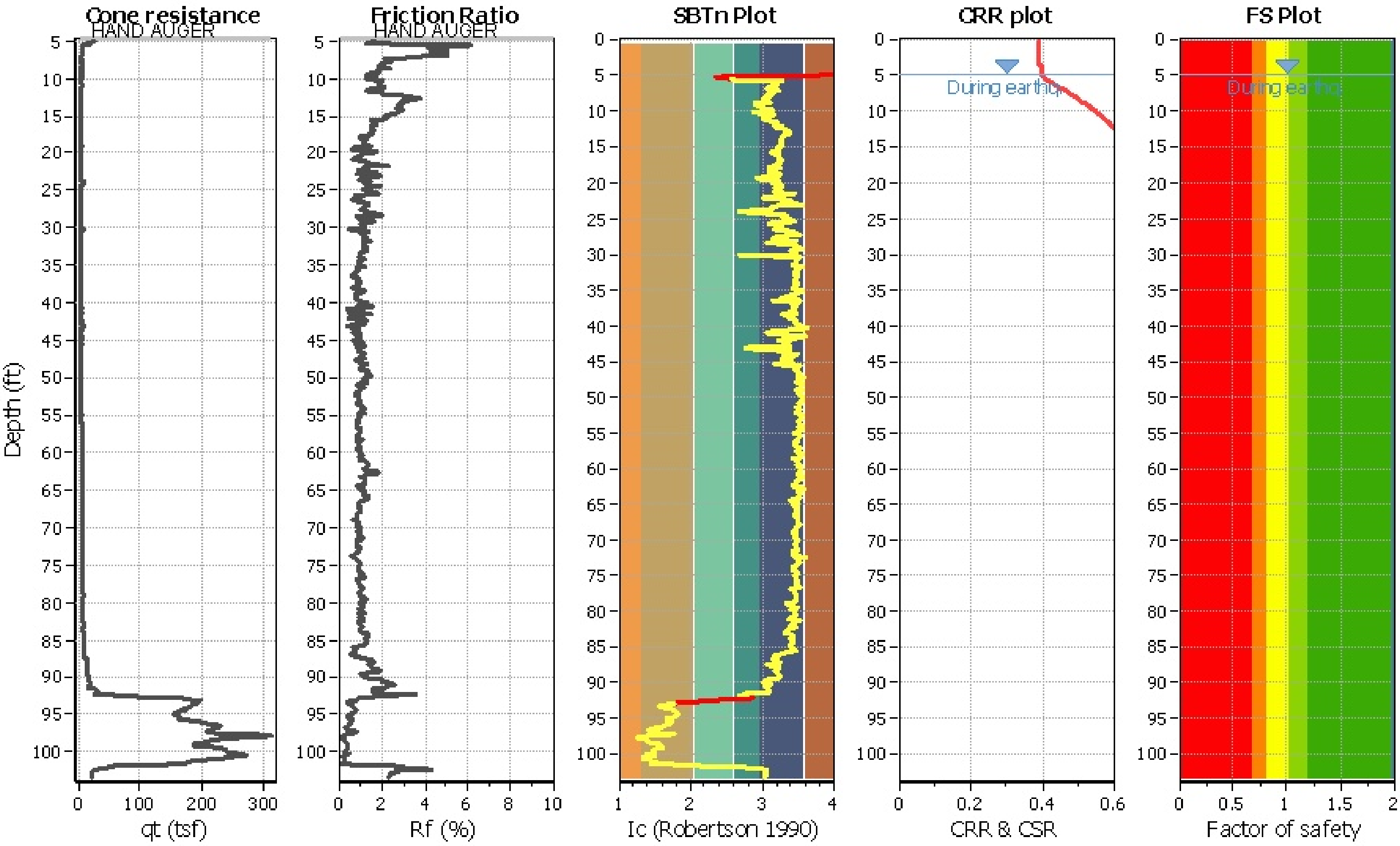
LIQUEFACTION ANALYSIS REPORT

Project title : Foster City Levee Improvement **Location : Foster City**

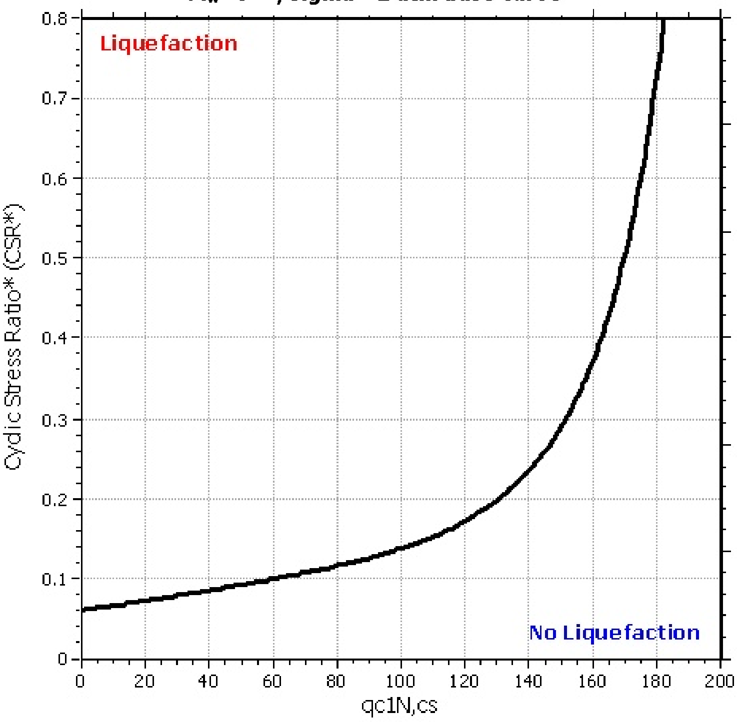
CPT file : 3-CPT4

Input parameters and analysis data

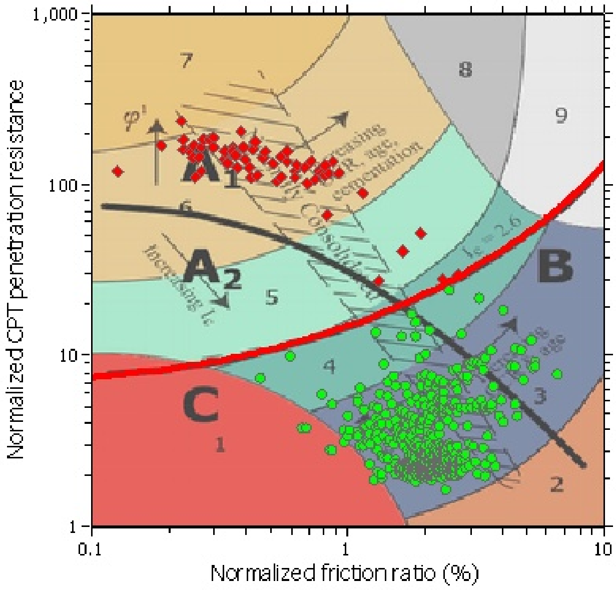
Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	7.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



$M_w=7^{1/2}$, sigma'=1 atm base curve

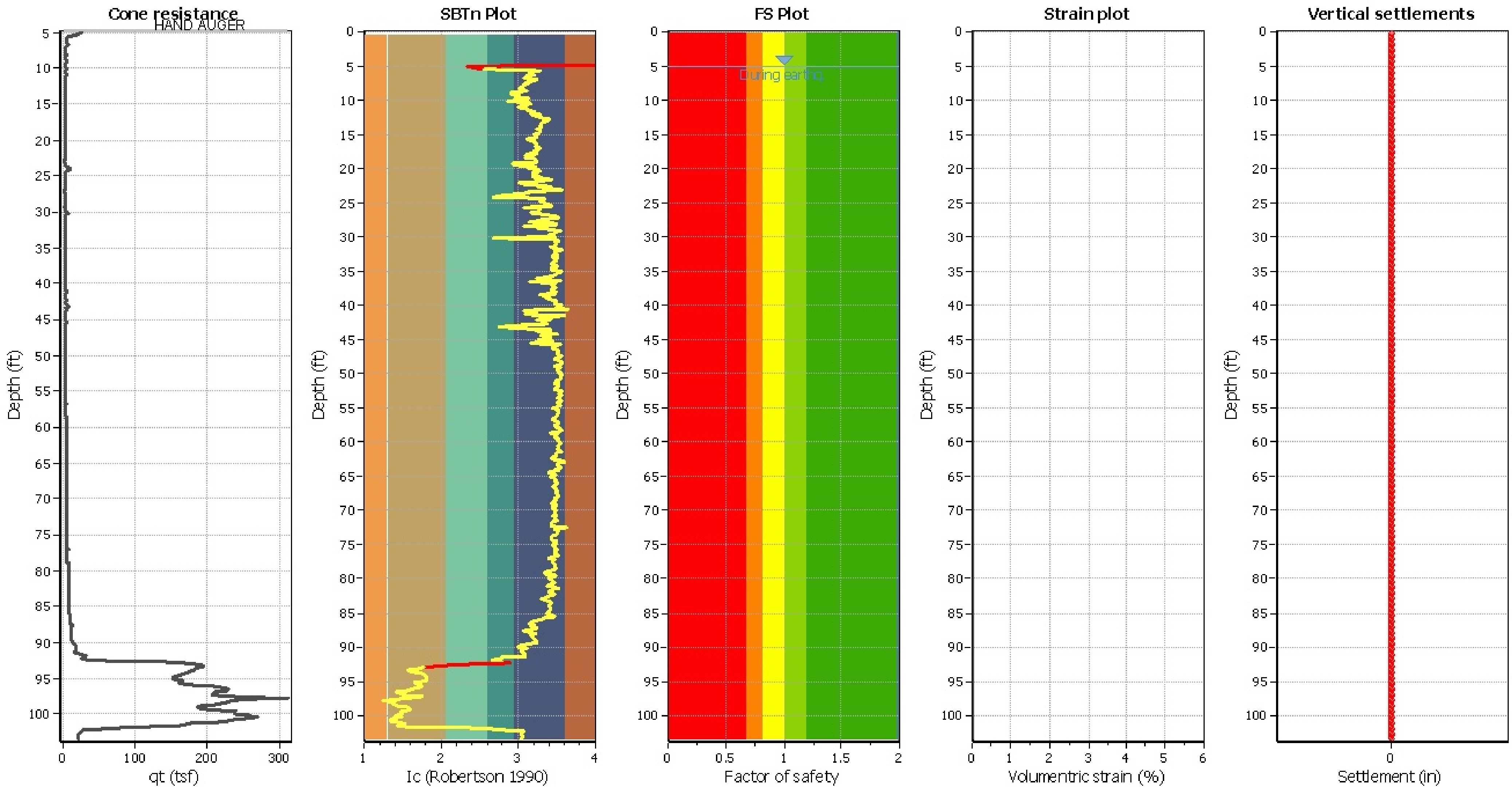


Summary of liquefaction potential



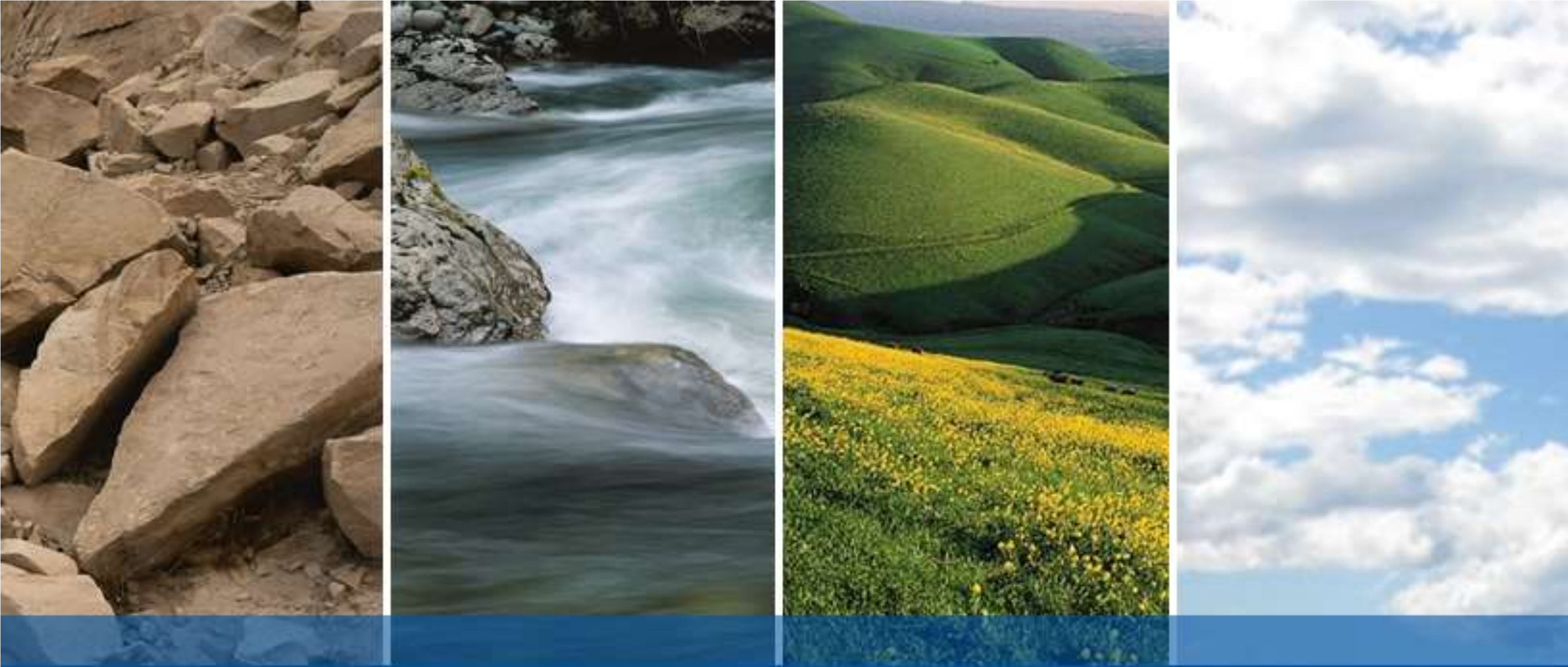
Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain



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APPENDIX D

Consolidation Settlement Figures

TABLE D-1: Geotechnical Properties of Young Bay Mud

APPROXIMATE STATION	BORING DESIGNATION	DEPTH (FEET)	ELEVATION (FEET)	COMPRESSION INDEX (Cce)	RECOMPRESSION INDEX (Cre)	OVERCONSOLIDATION RATIO (OCR)
14+70	3-B1	19	-7	0.30	0.013	1.5
72+20	2-B1	21	-9	0.39	0.015	1.5
120+00	2-B2	17	-5	0.30	0.021	1.5
120+00	2-B2	37	-25	0.22	0.011	1.2
148+70	3-B6	6½	0	0.20	0.019	5
148+70	3-B6	36½	-30	0.23	0.022	1.1
184+00	3-B5	8	2½	0.14	0.021	3.7
184+00	3-B5	16	-5½	0.28	0.016	1.3
240+00	3-B4	12	-1	0.24	0.057	1
240+00	3-B4	26	-15	0.33	0.025	1.3
287+00	2-B4	16	-4	0.30	0.042	1.1
308+00	3-B3	16	-5½	0.33	0.018	1.1

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FIGURE D-1: Consolidation Settlement Summary – Station 0+00 to 106+00

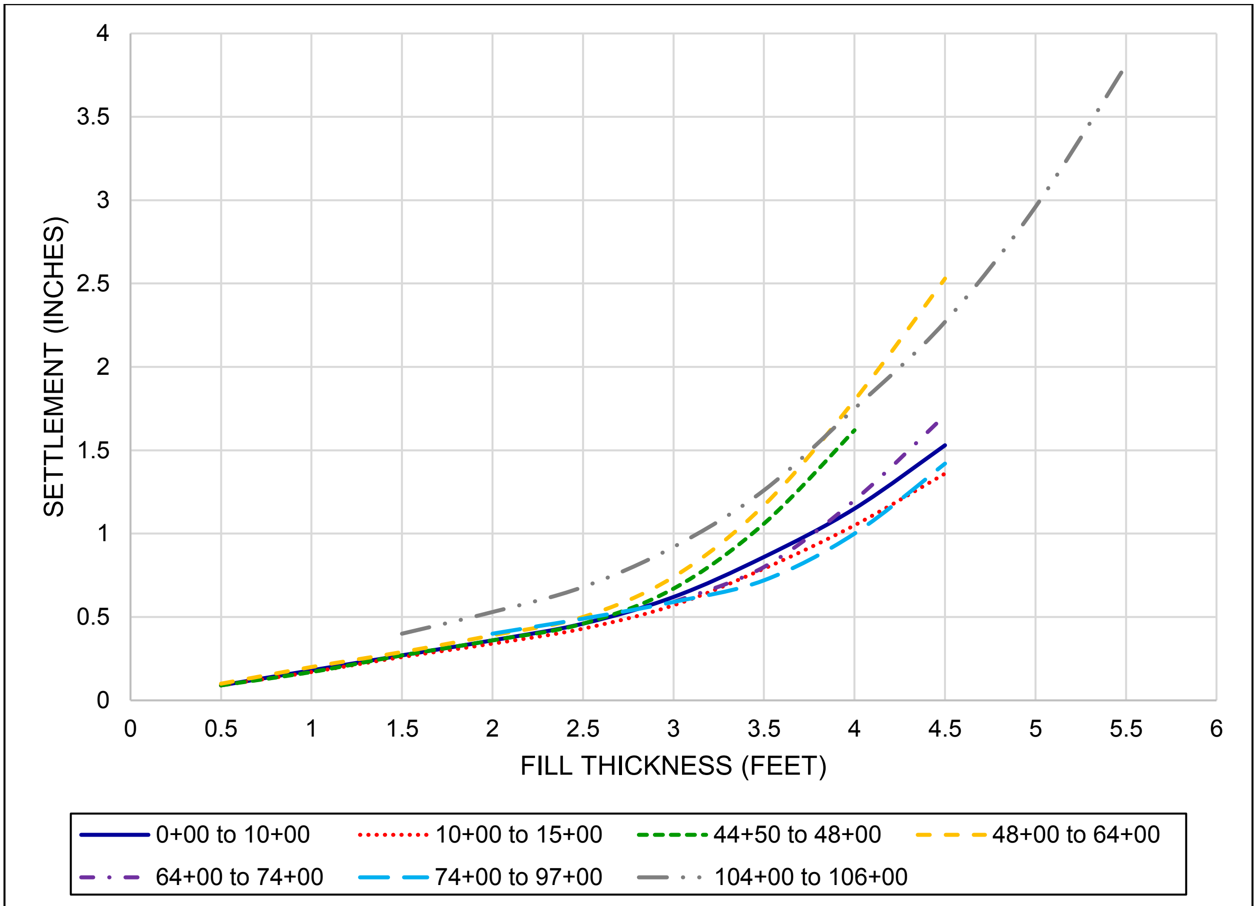

FIGURE D-2: Consolidation Settlement Summary – Station 106+00 to 200+00

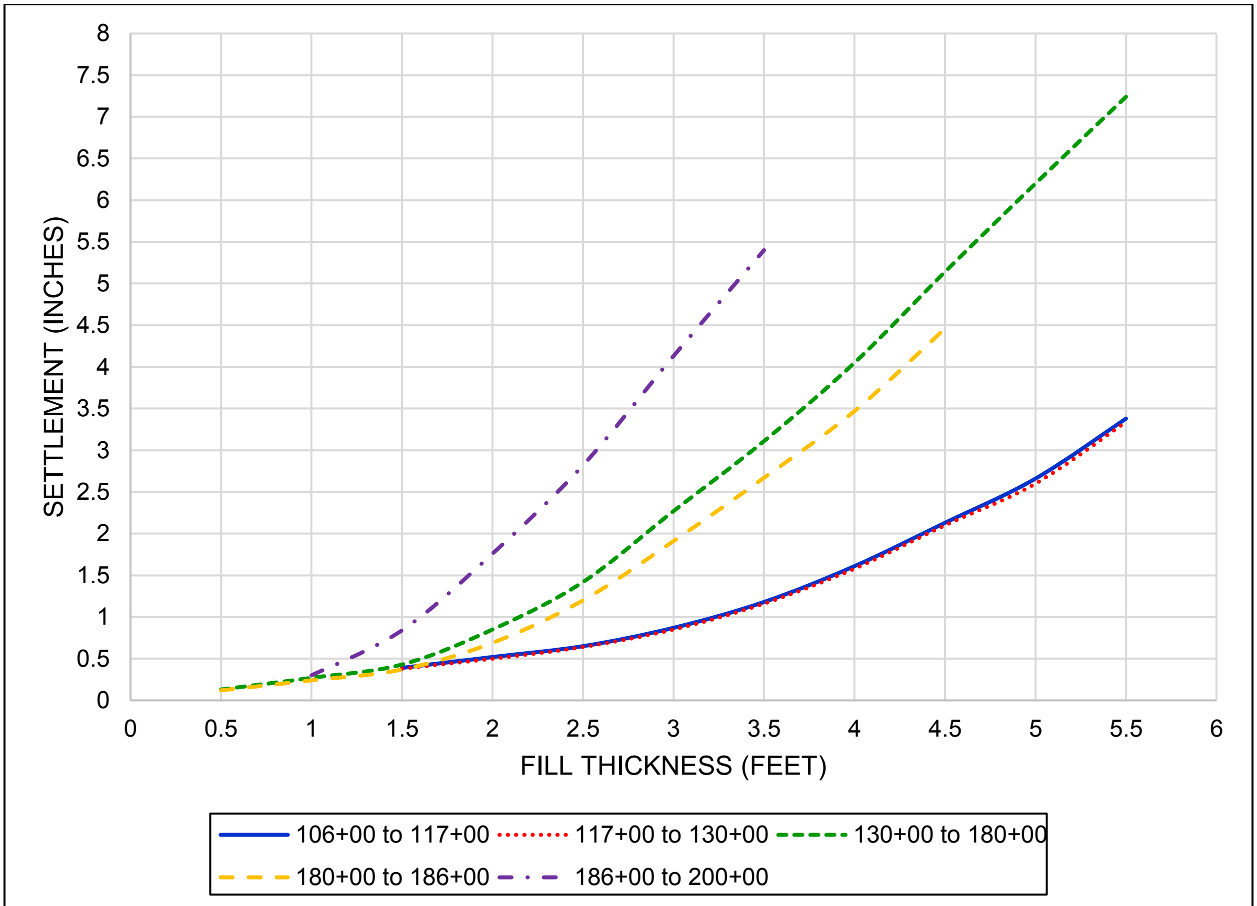

FIGURE D-3: Consolidation Settlement Summary – Station 200+00 to 220+00

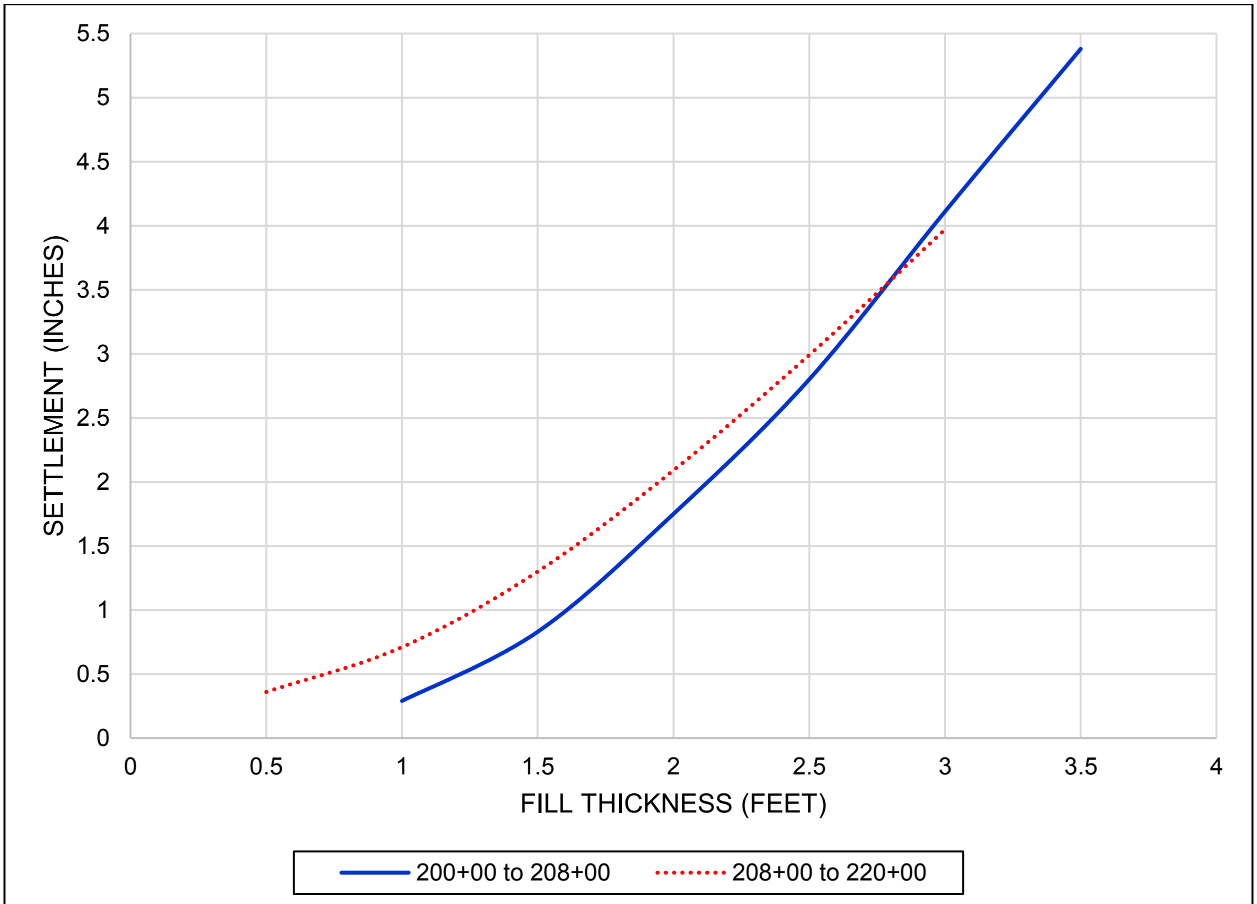

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FIGURE D-4: Consolidation Settlement Summary – Station 0+00 to 15+37 (Control Line 3) / Station 234+00 to 255+00 (Control Line 1)

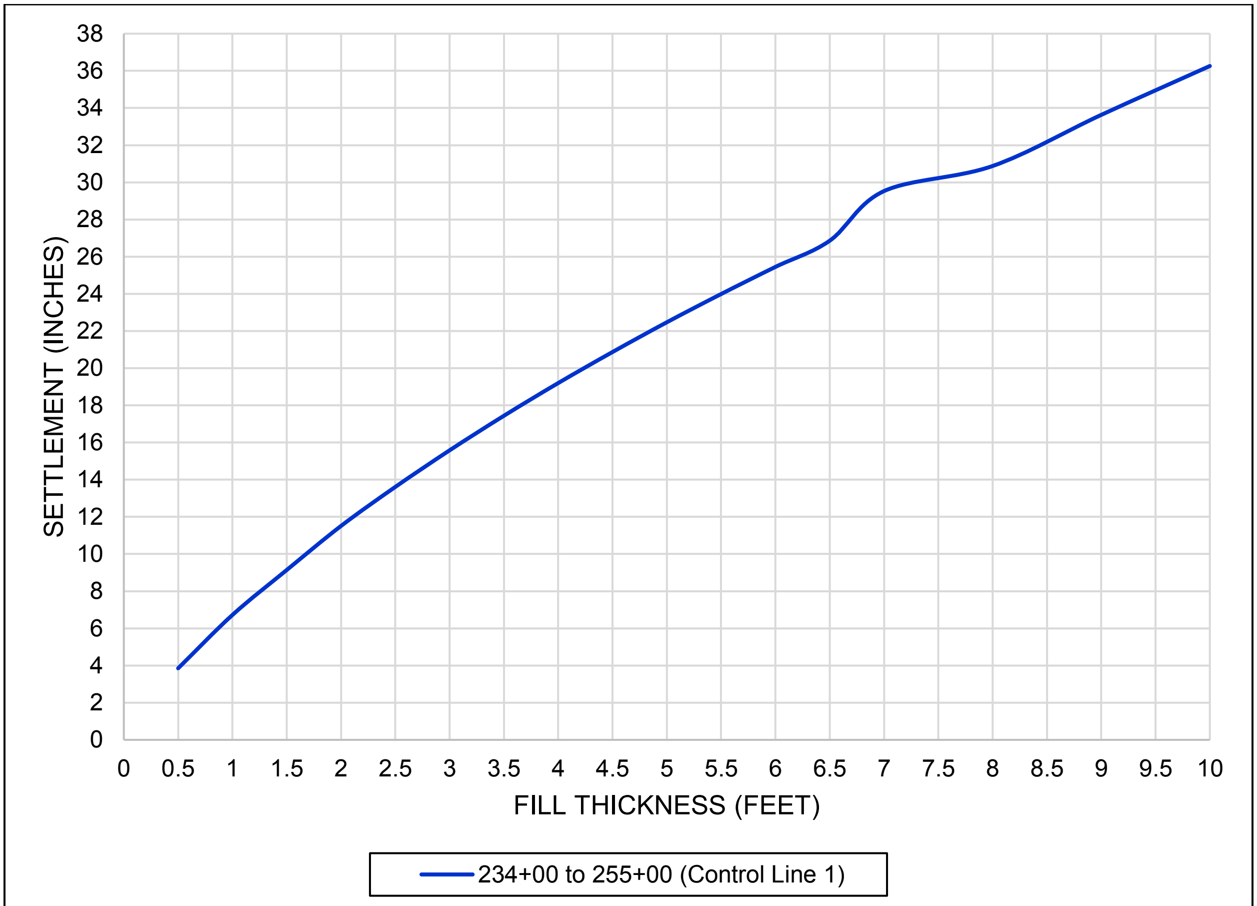
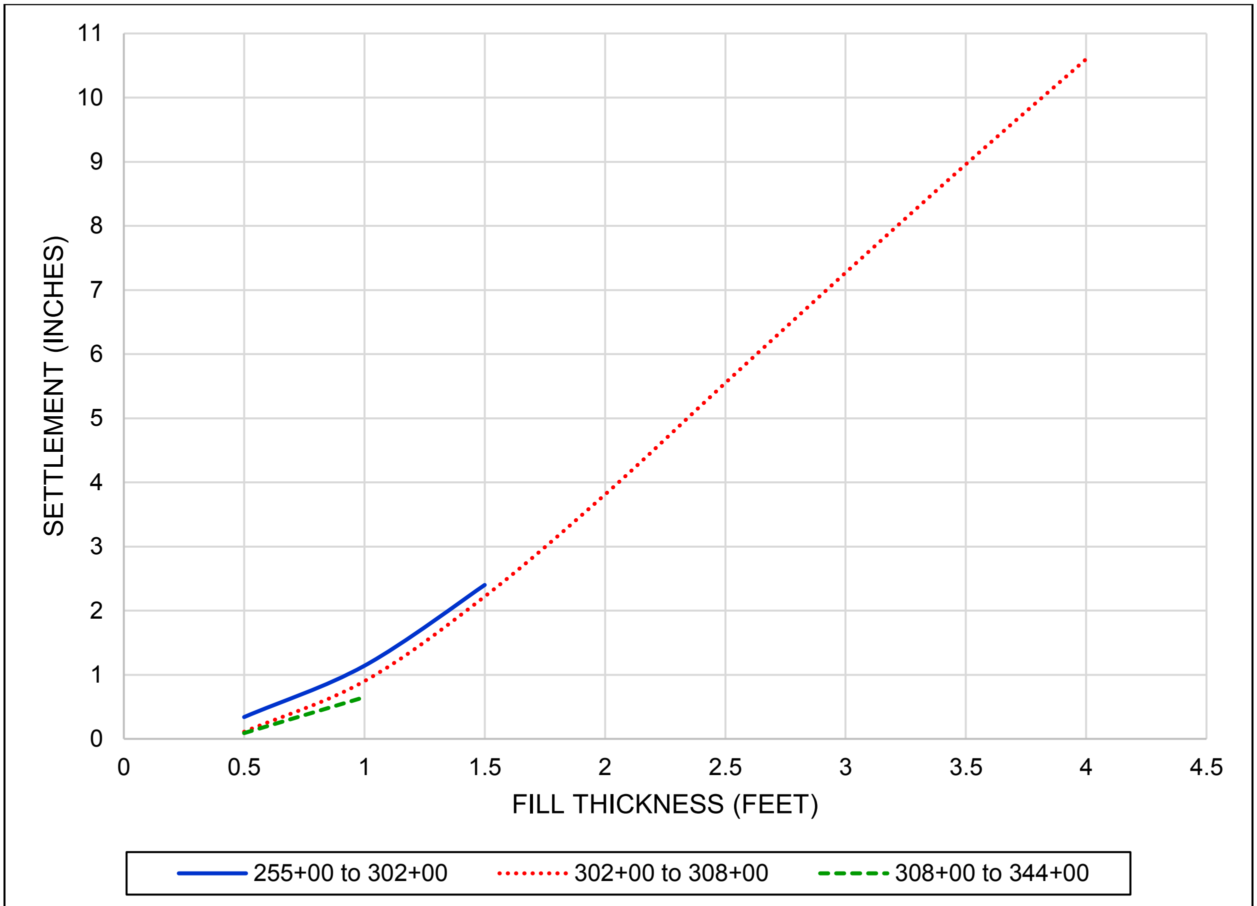


FIGURE D-5: Consolidation Settlement Summary – Station 255+00 to 3+44 (end)



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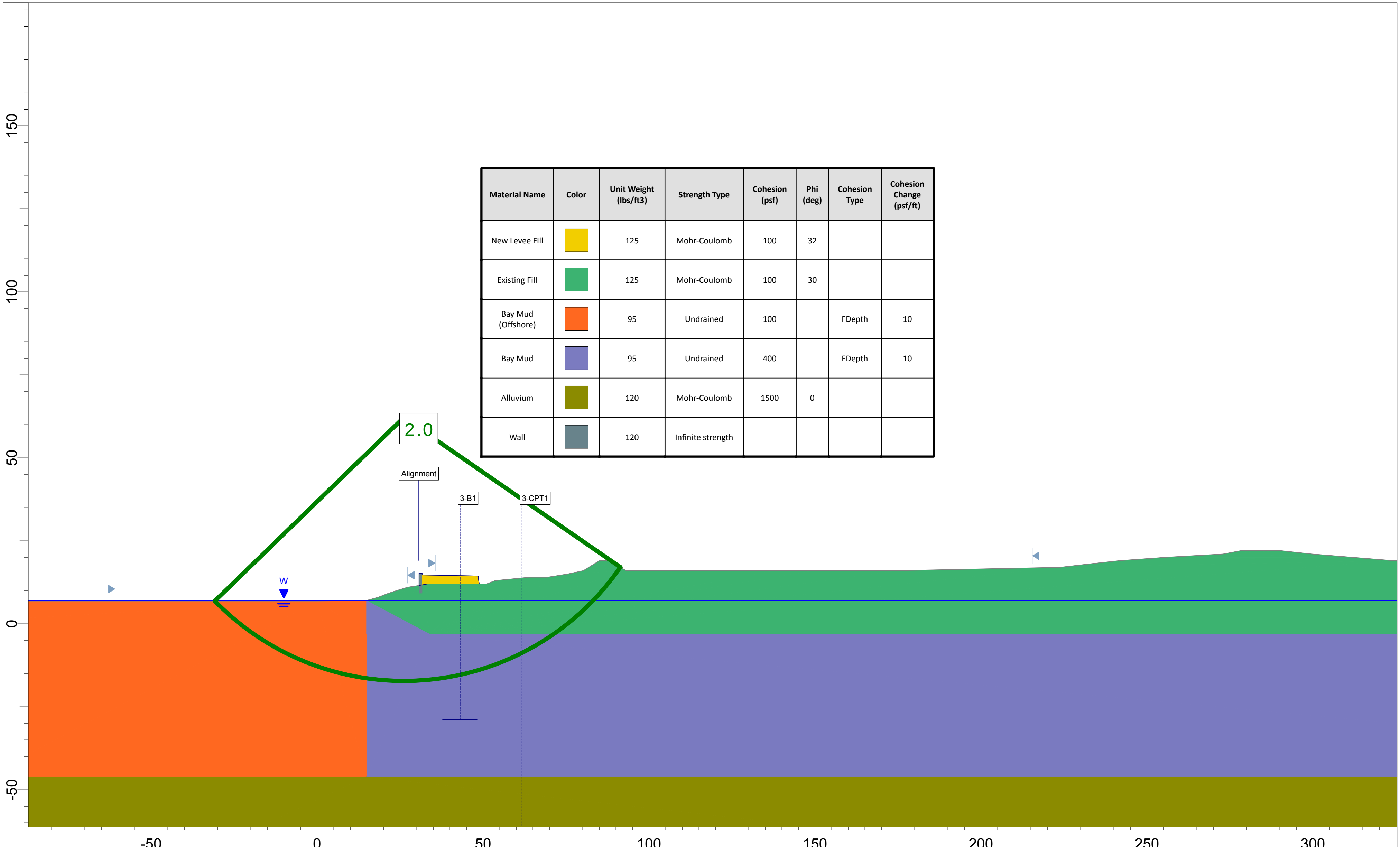
APPENDIX E

Slope Stability and Seepage Analysis



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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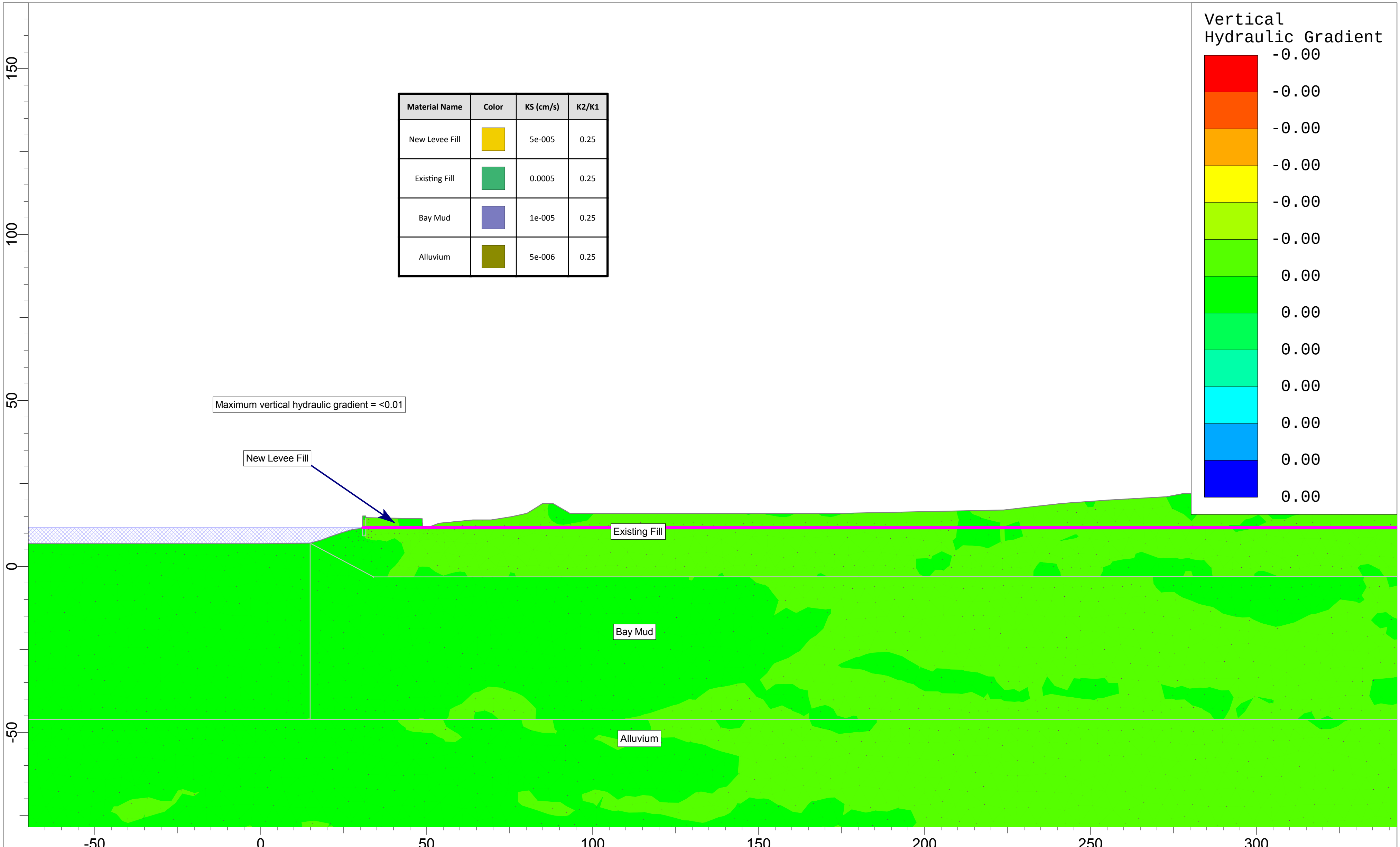
Project	Foster City Levee Improvements
Analysis Description	STA 15 - End of Construction
Drawn By JSY	*Scale* 1:480
Company	ENGEO Incorporated
Date	October 16, 2017
File Name	Sec15.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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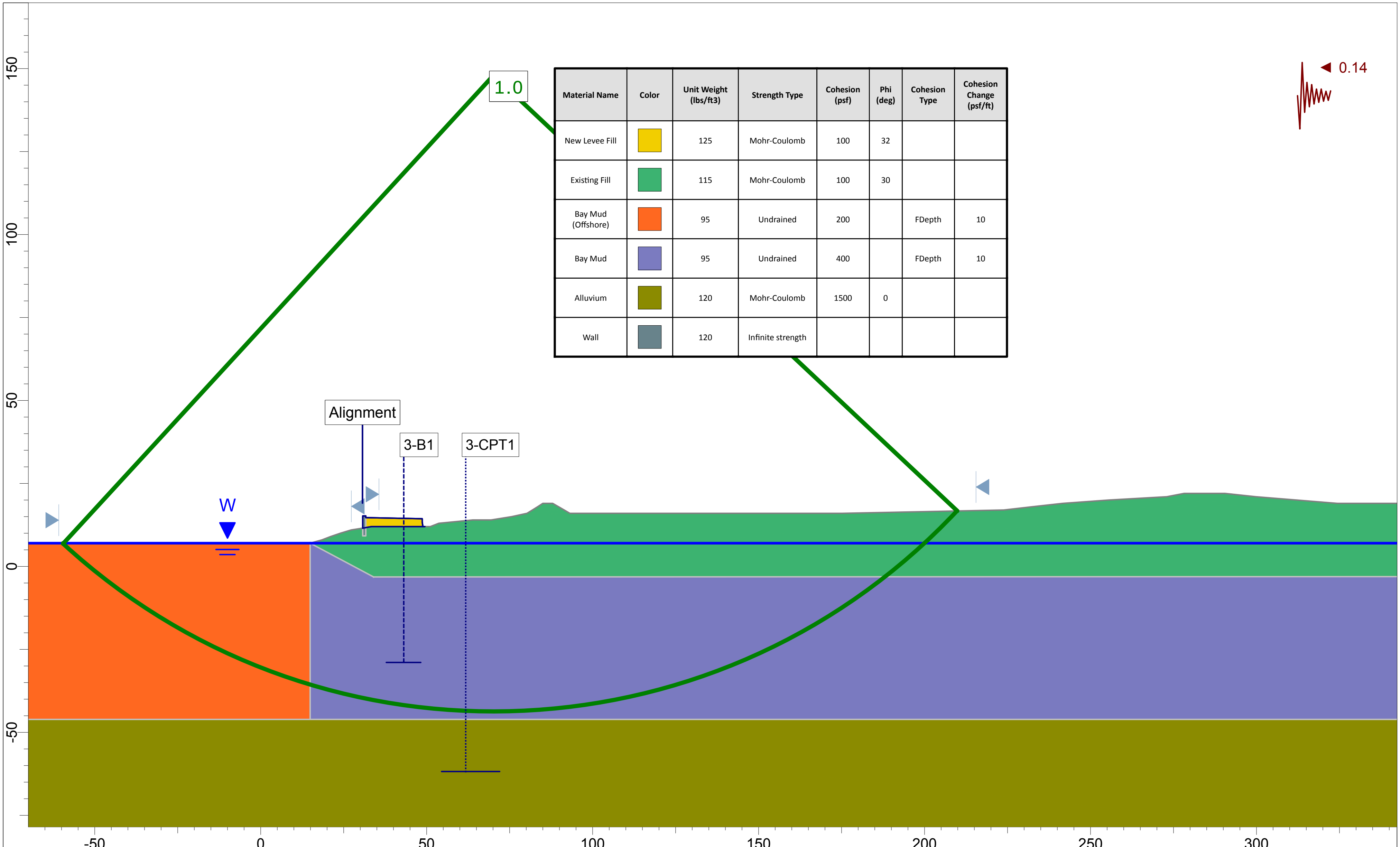
Project	Foster City Levee Improvements
Analysis Description	STA 15 - Seepage
Drawn By	JSY
Scale	1:480
Company	ENGEO Incorporated
Date	October 16, 2017
File Name	Sec15 - Seep.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	200		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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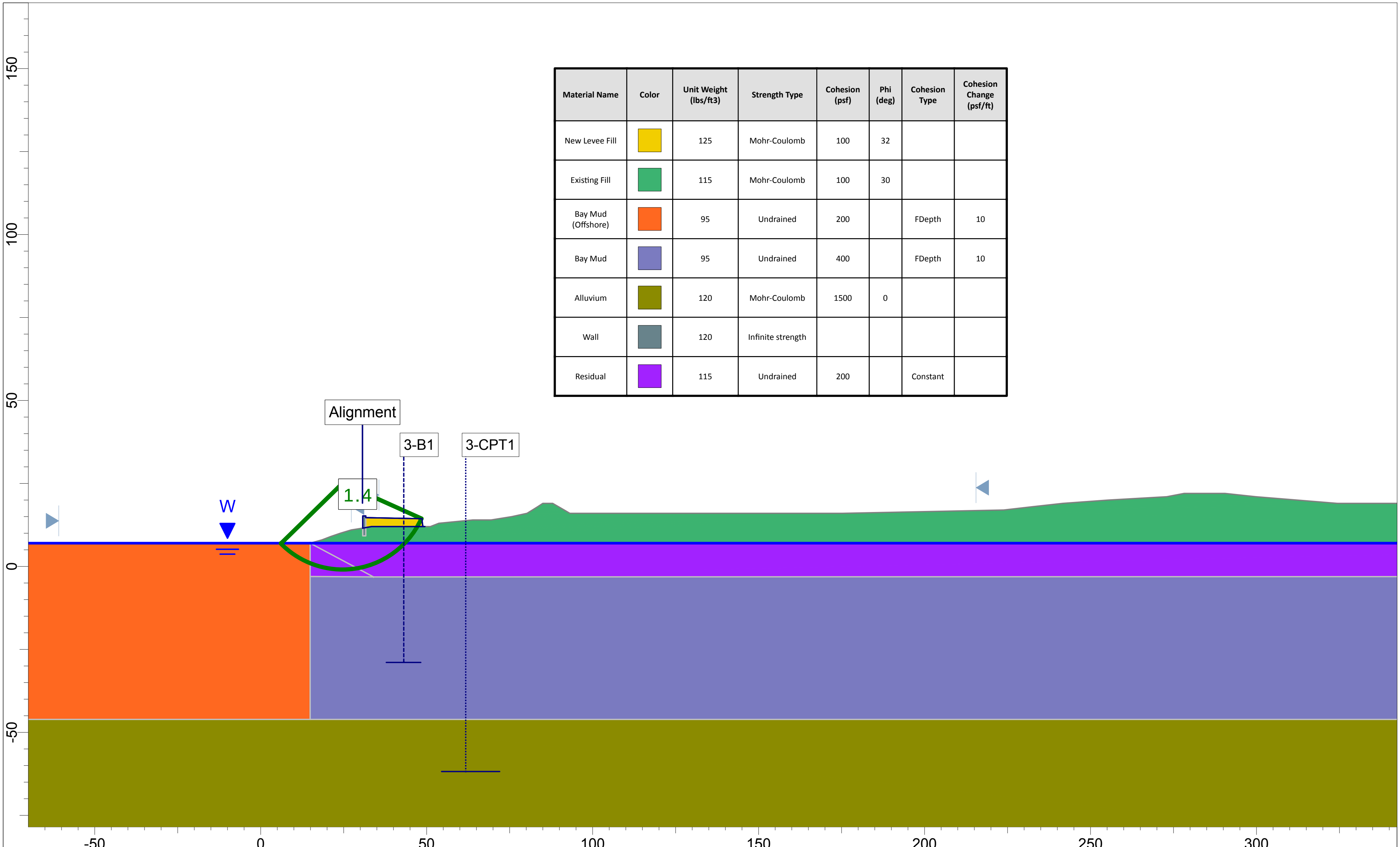
Project	Foster City Levee Improvements
Analysis Description	STA 15 - Earthquake
Drawn By	JSY
Scale	1:480
Company	ENGEO Incorporated
Date	October 16, 2017
File Name	Sec15 - kh.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	200		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				
Residual		115	Undrained	200		Constant	

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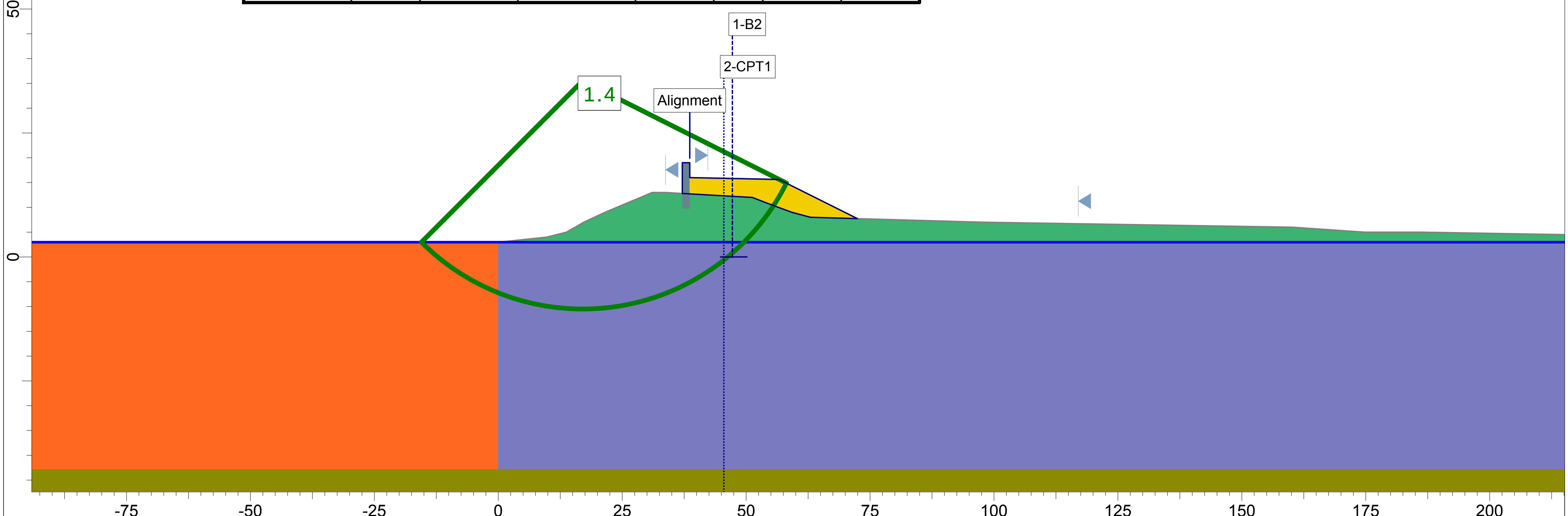
Project	Foster City Levee Improvements		
Analysis Description	STA 15 - Residual		
Drawn By JSY	*Scale* 1:480	*Company*	ENGEO Incorporated
Date October 16, 2017		*File Name*	Sec15 - residual.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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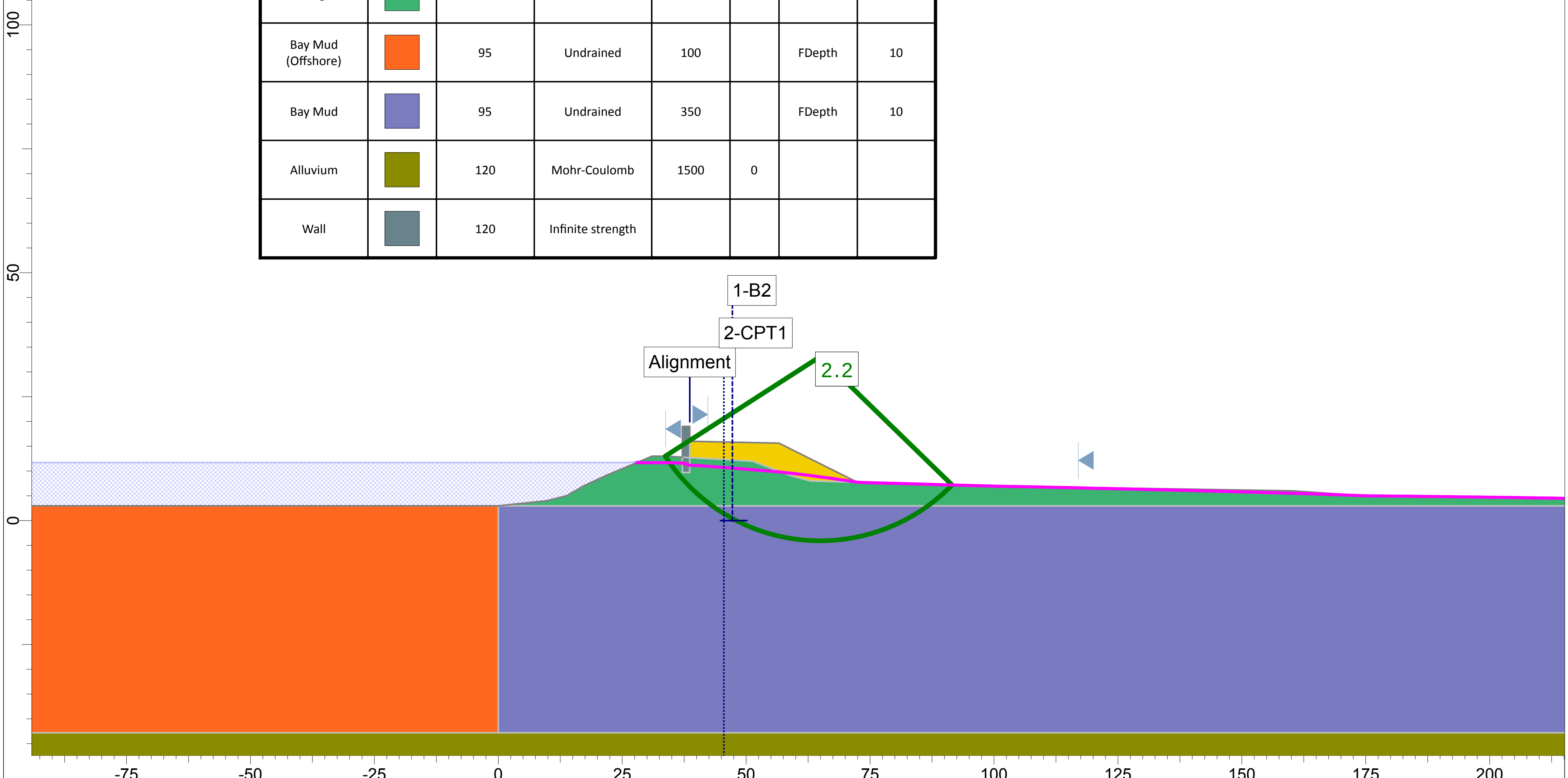
Project	Foster City Levee Improvements
Analysis Description	STA 54 - End of Construction
Drawn By	JSY
Scale	1:360
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec54.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



Project	Foster City Levee Improvements		
Analysis Description	STA 54 - Steady State Seepage		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec54 - Seep stab.slim

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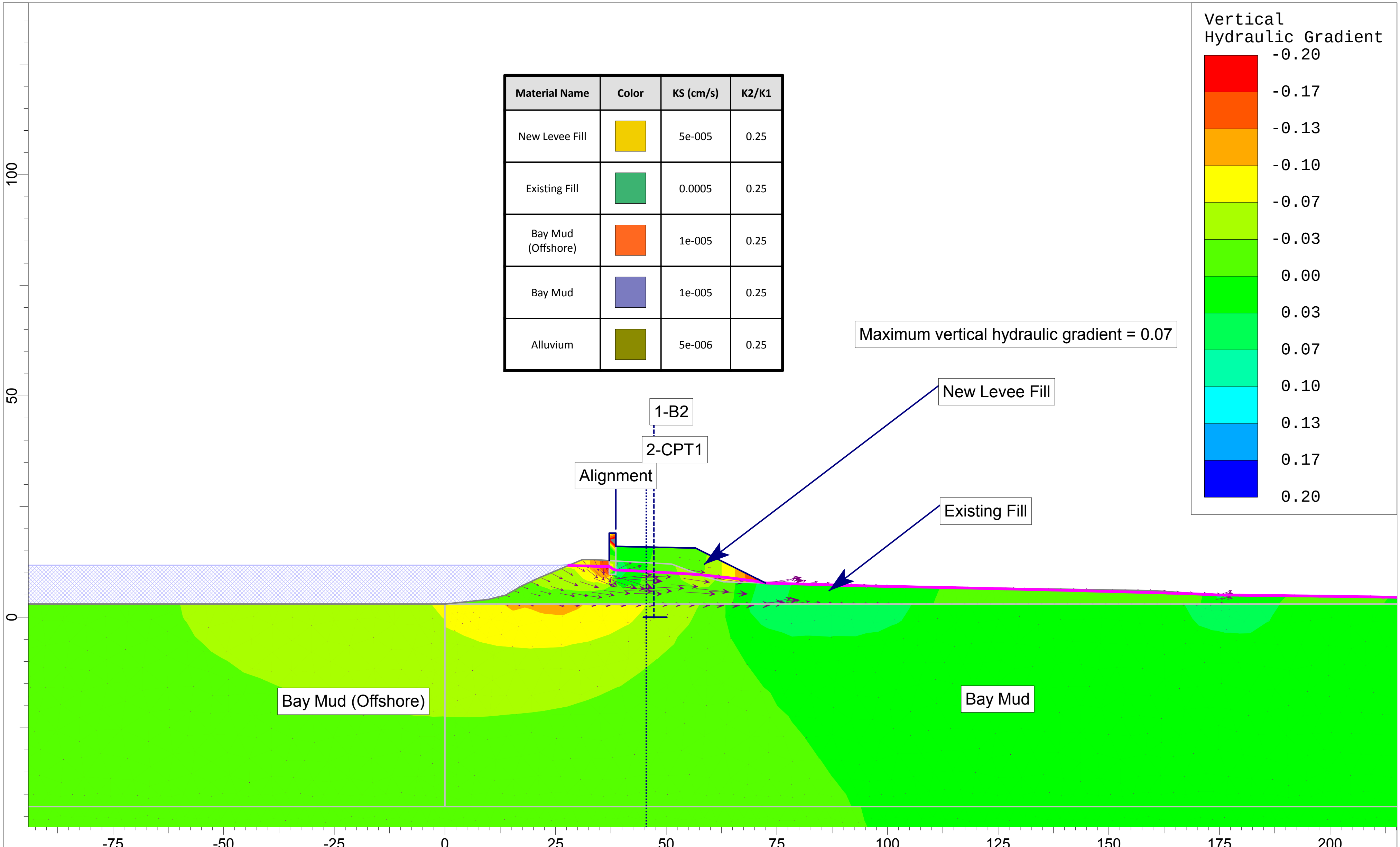

Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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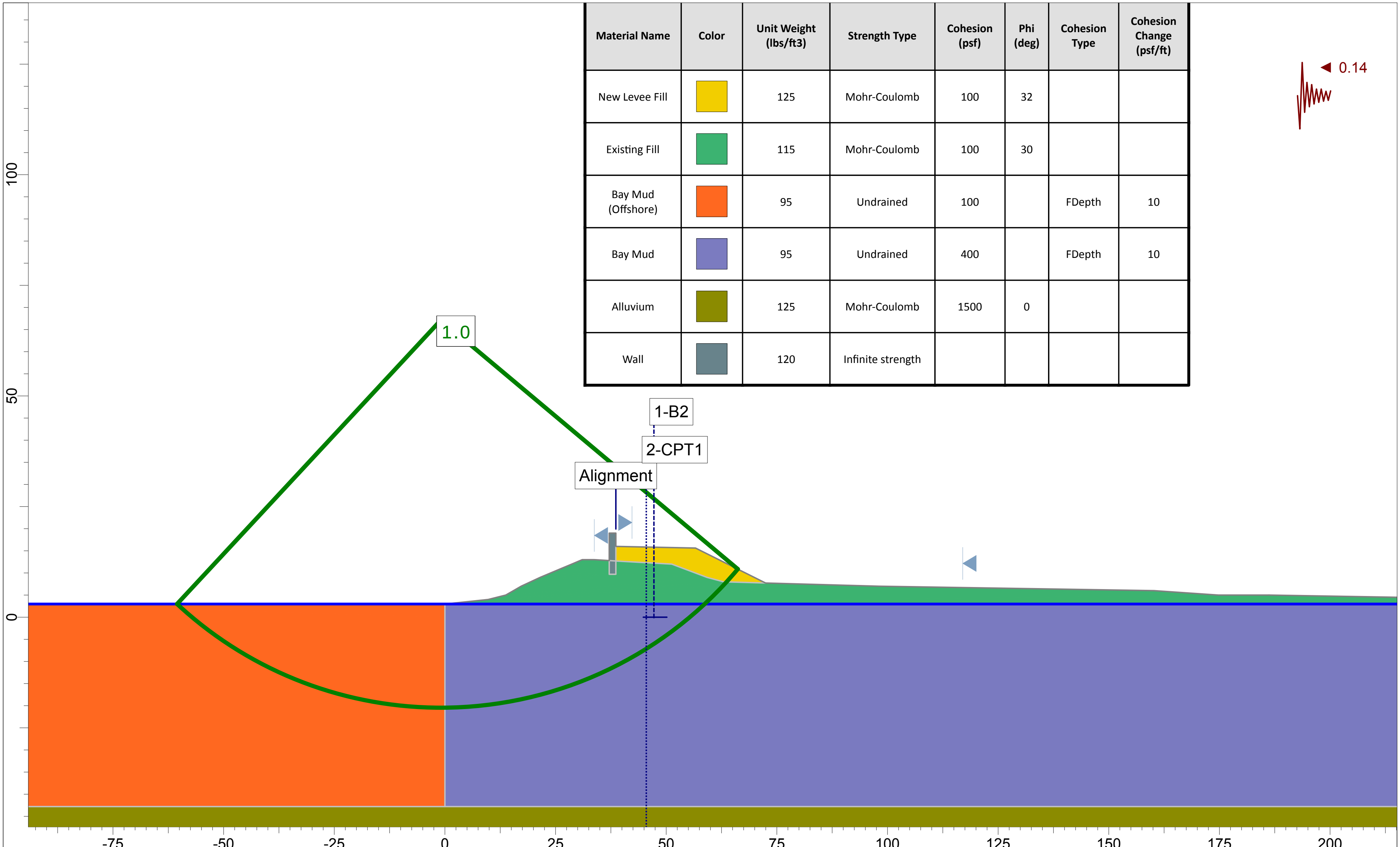
Project	Foster City Levee Improvements
Analysis Description	STA 54 - Steady State Seepage
Drawn By JSY	*Scale* 1:360
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec54 - Seep.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		125	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



Project	Foster City Levee Improvements		
Analysis Description	STA 54 - Earthquake		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec54 - kh.slim

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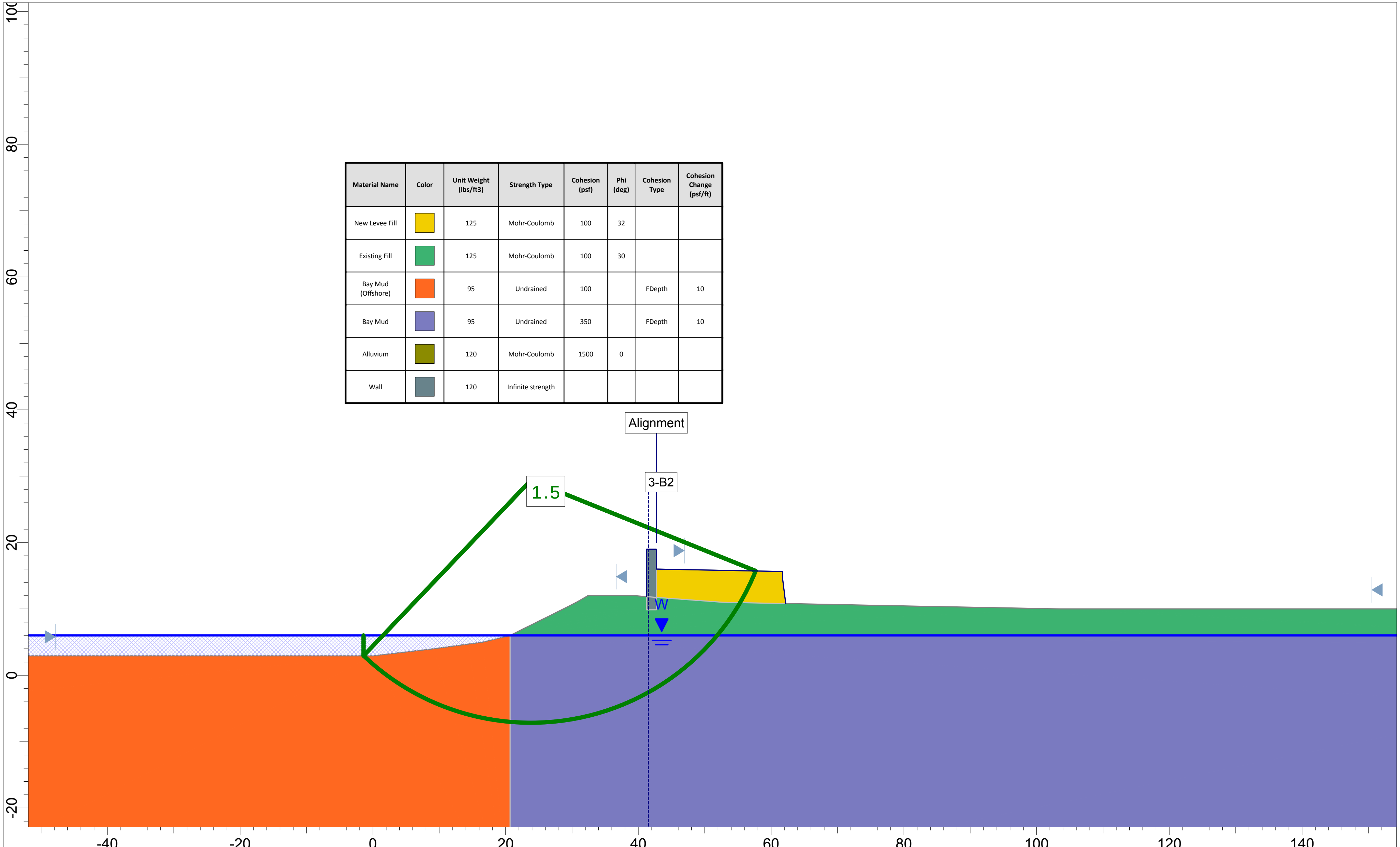

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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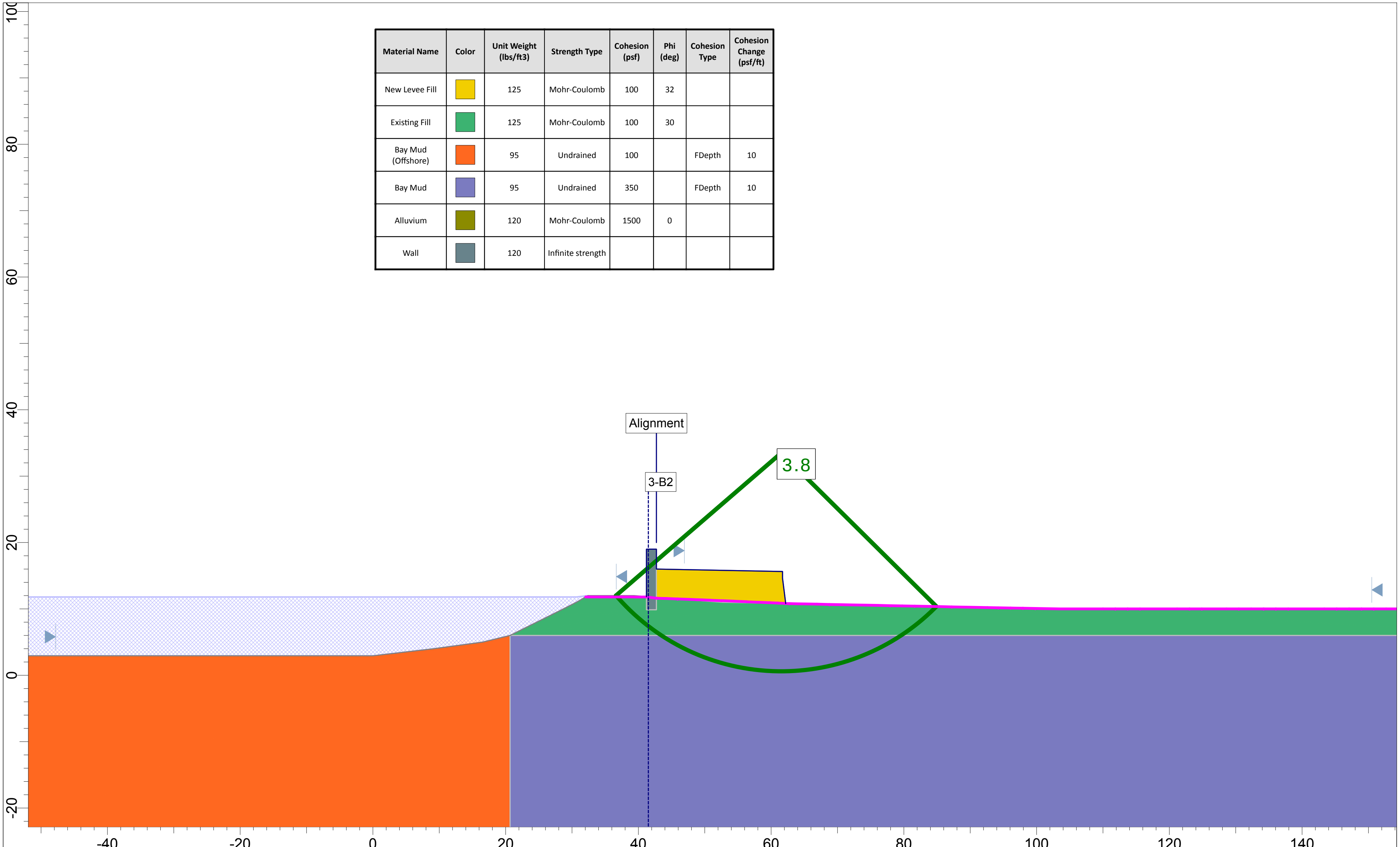
Project	Foster City Levee Improvements		
Analysis Description	STA 66 - End of Construction		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec66.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



Project	Foster City Levee Improvements
Analysis Description	STA 66 - Seepage
Drawn By JSY	*Scale* 1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	sec66 - seep stab.slim

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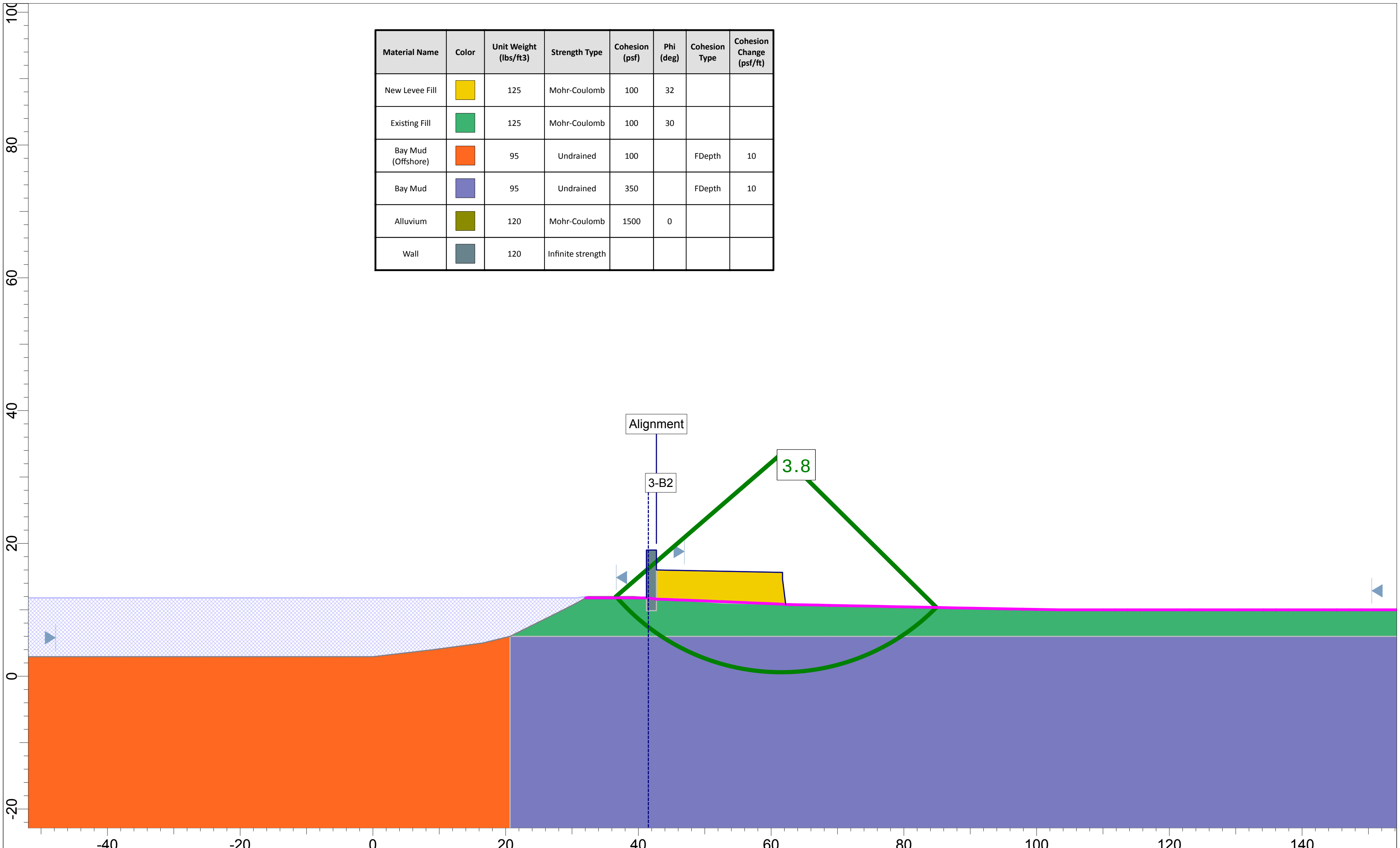
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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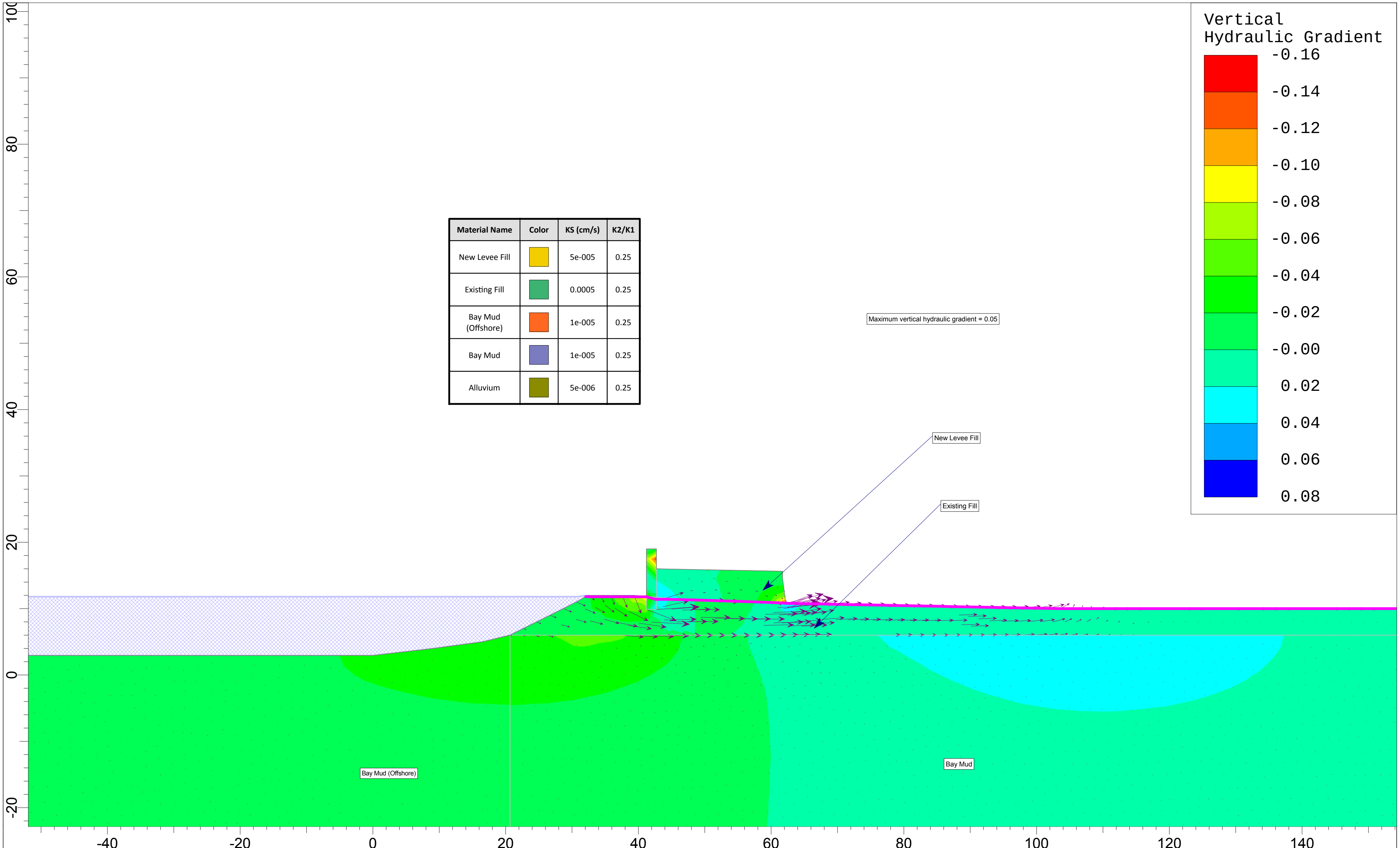
Project	Foster City Levee Improvements
Analysis Description	STA 66 - Seepage
Drawn By	JSY
Scale	1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	sec66 - seep stab.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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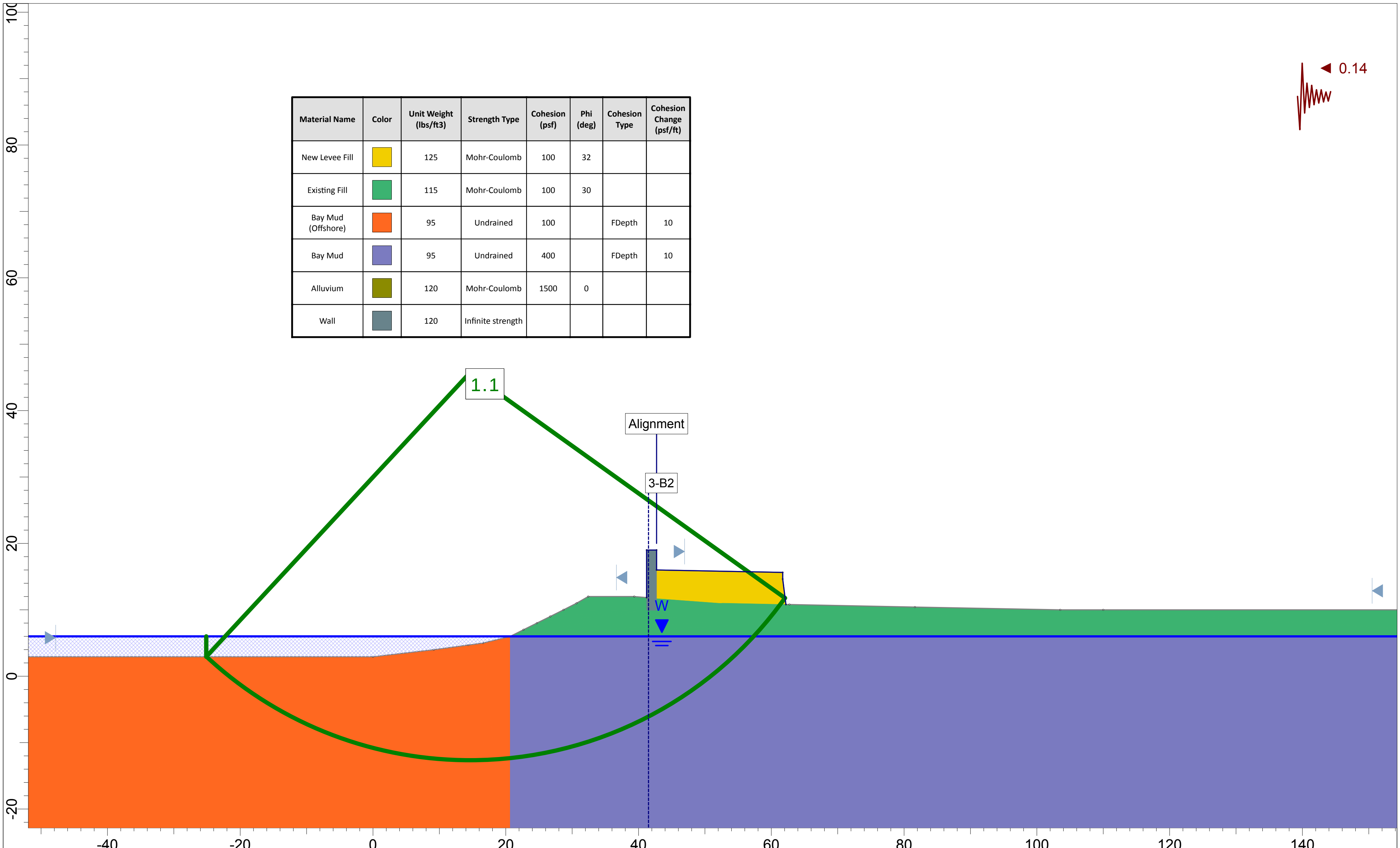
Project	Foster City Levee Improvements		
Analysis Description	STA 66 - Seepage		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec66 - seep.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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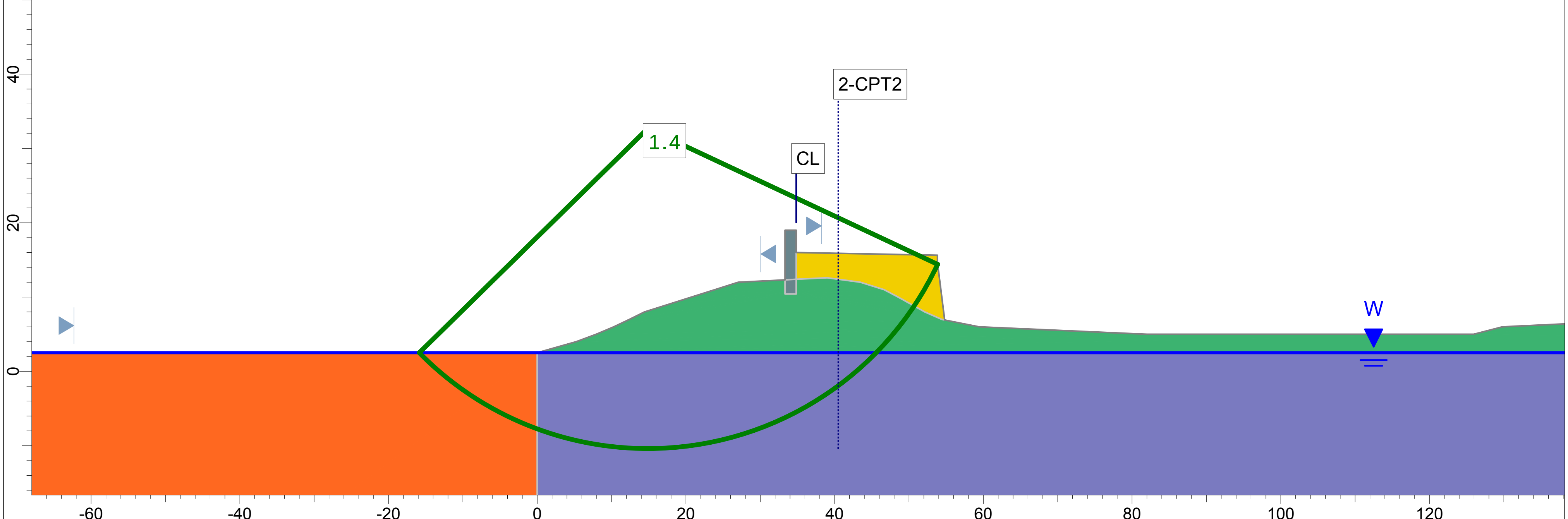
Project	Foster City Levee Improvements		
Analysis Description	STA 66 - Earthquake		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec66 - kh.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



Project	Foster City Levee Improvements		
Analysis Description	STA 80 - End of Construction		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec80.slim

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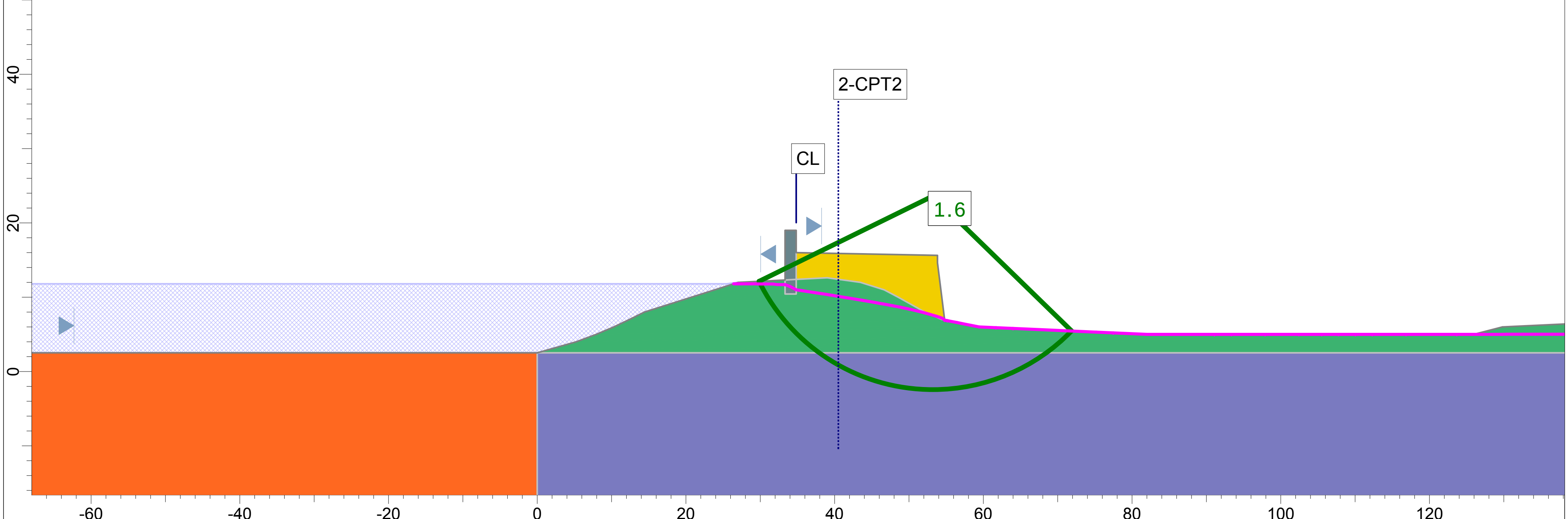
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



Project	Foster City Levee Improvements		
Analysis Description	STA 80 - Seepage		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec80 - seep stab.slim

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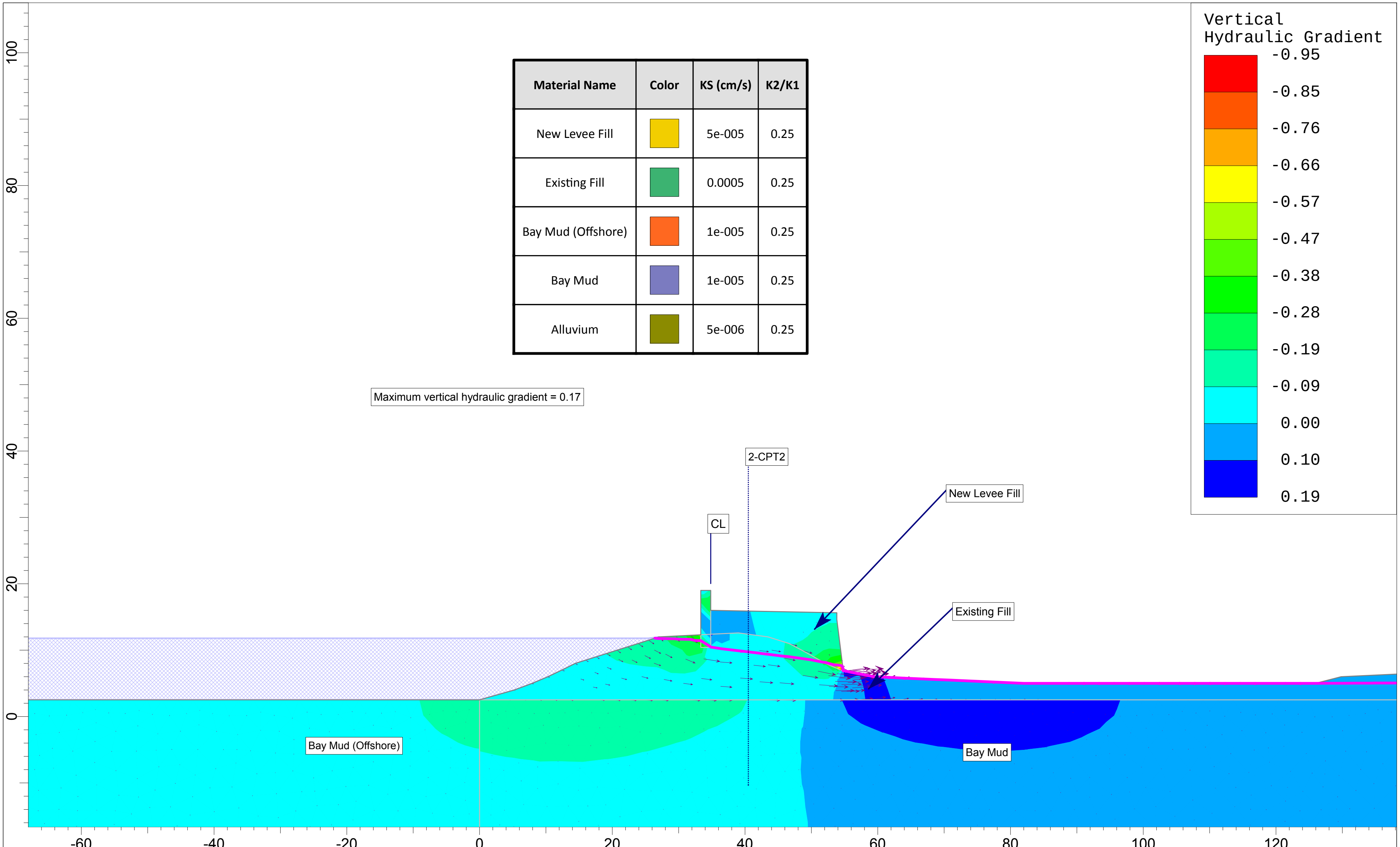

Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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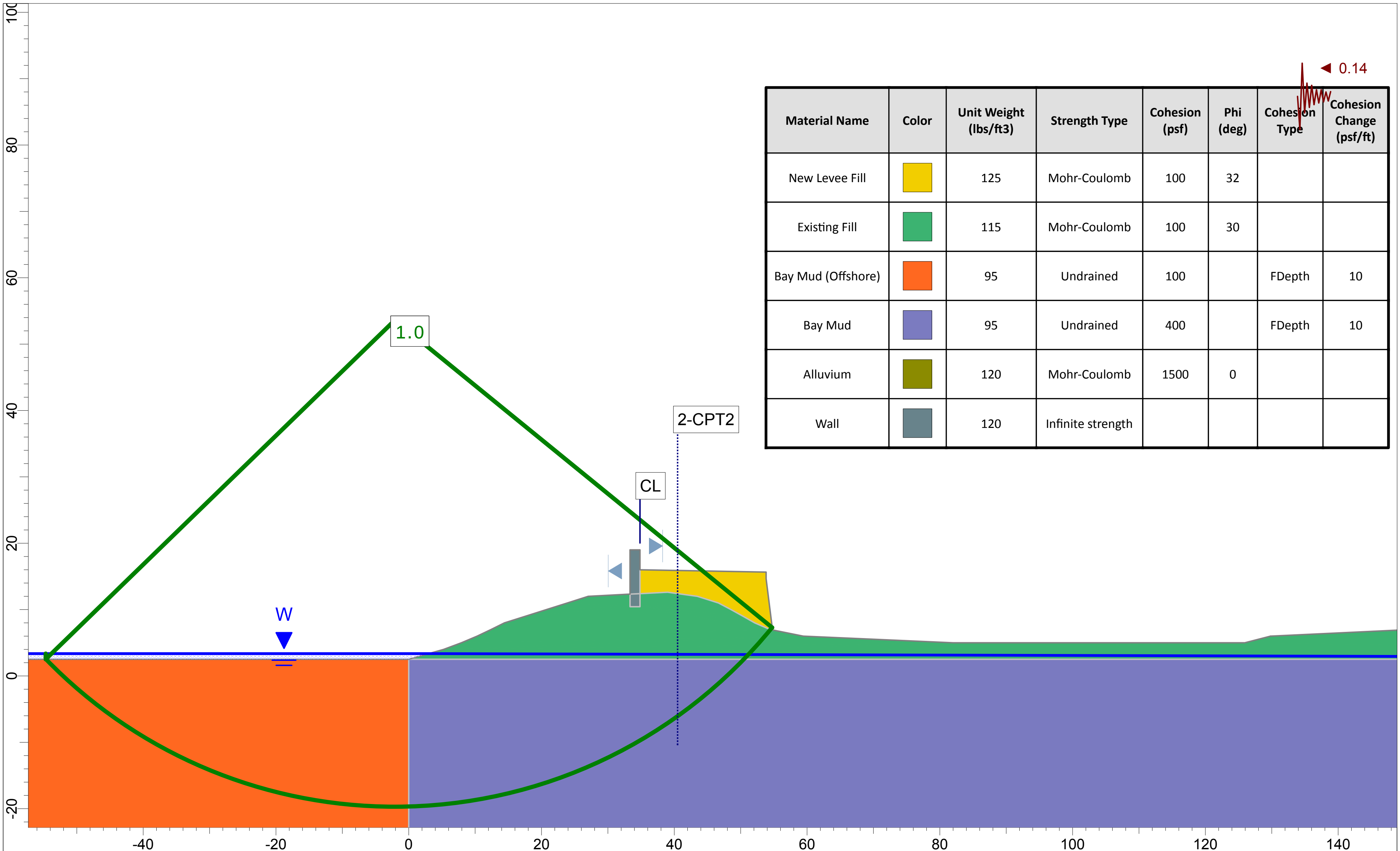
Project	Foster City Levee Improvements		
Analysis Description	STA 80 - Seepage		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec80 - seep.slim



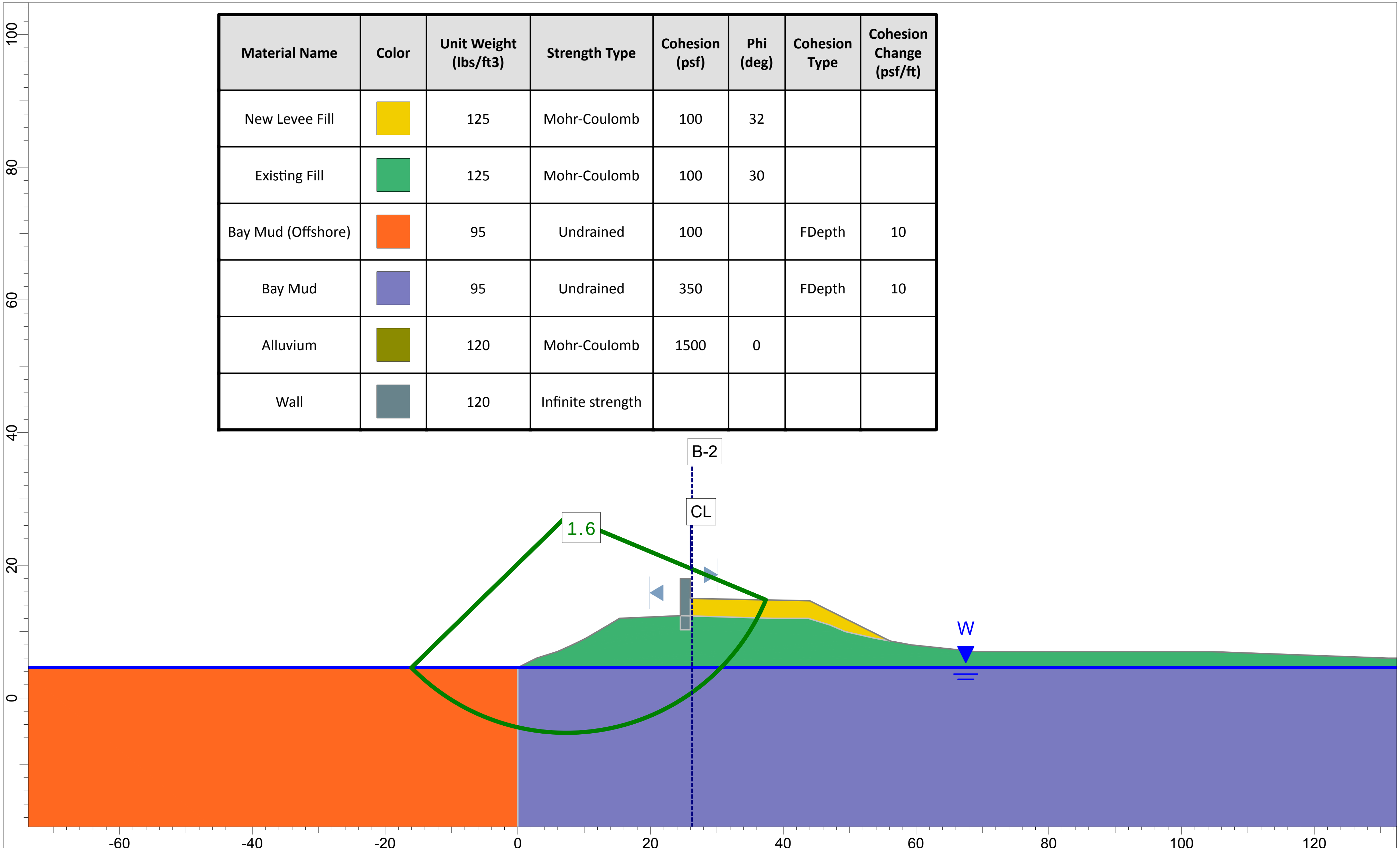
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

rocscience

SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements		
Analysis Description	STA 80 - Earthquake		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec80 - kh.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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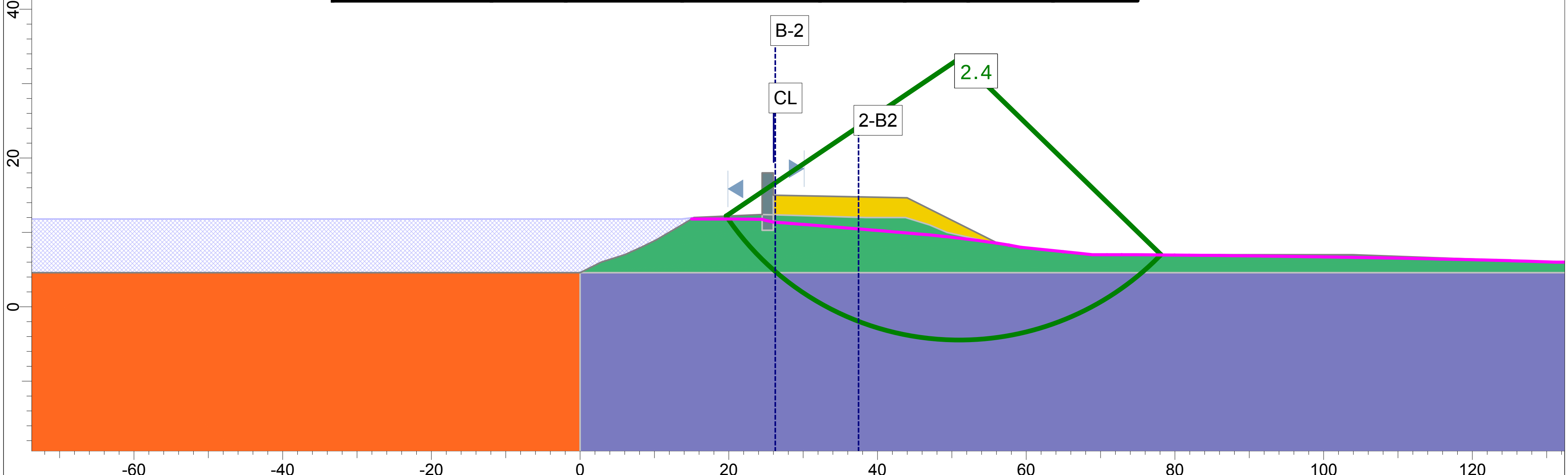
Project	Foster City Levee Improvements
Analysis Description	STA 120 - End of Construction
Drawn By	JSY
Scale	1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec120.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



Project	Foster City Levee Improvements
Analysis Description	STA 120 - Seepage
Drawn By	JSY
Scale	1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec120 - seep stab.slim

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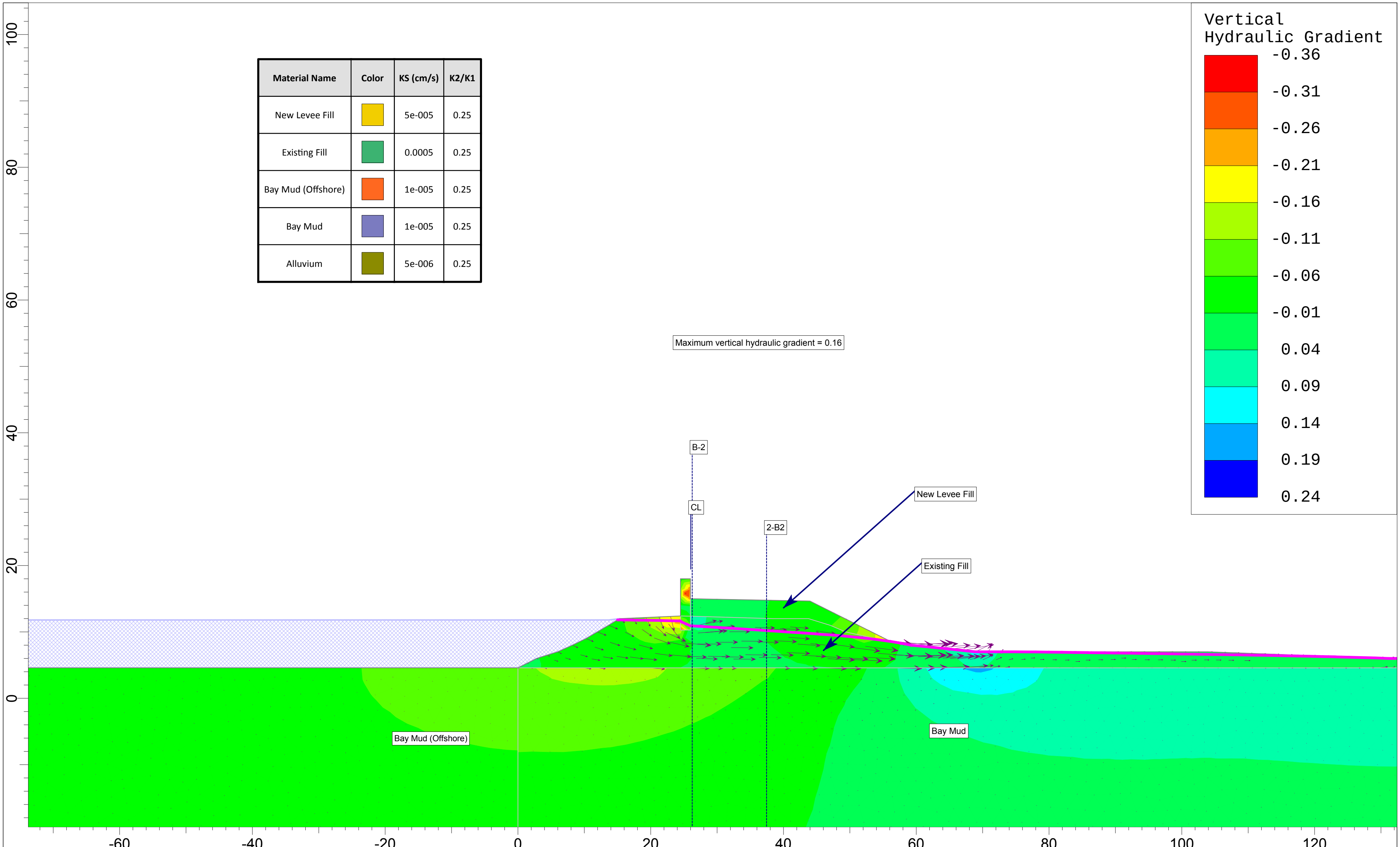

Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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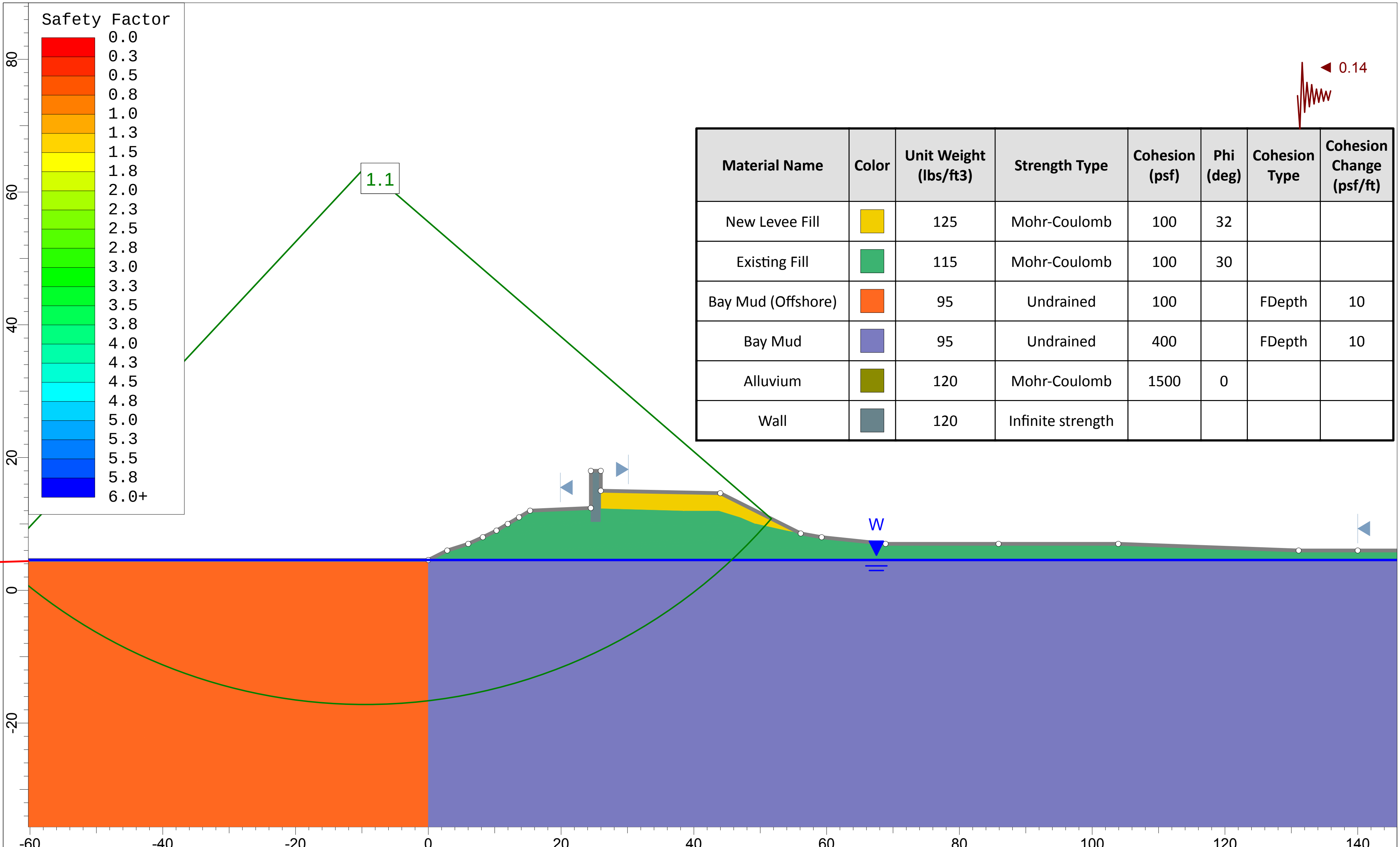
Project	Foster City Levee Improvements		
Analysis Description	STA 120 - Seepage		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec120 - seep.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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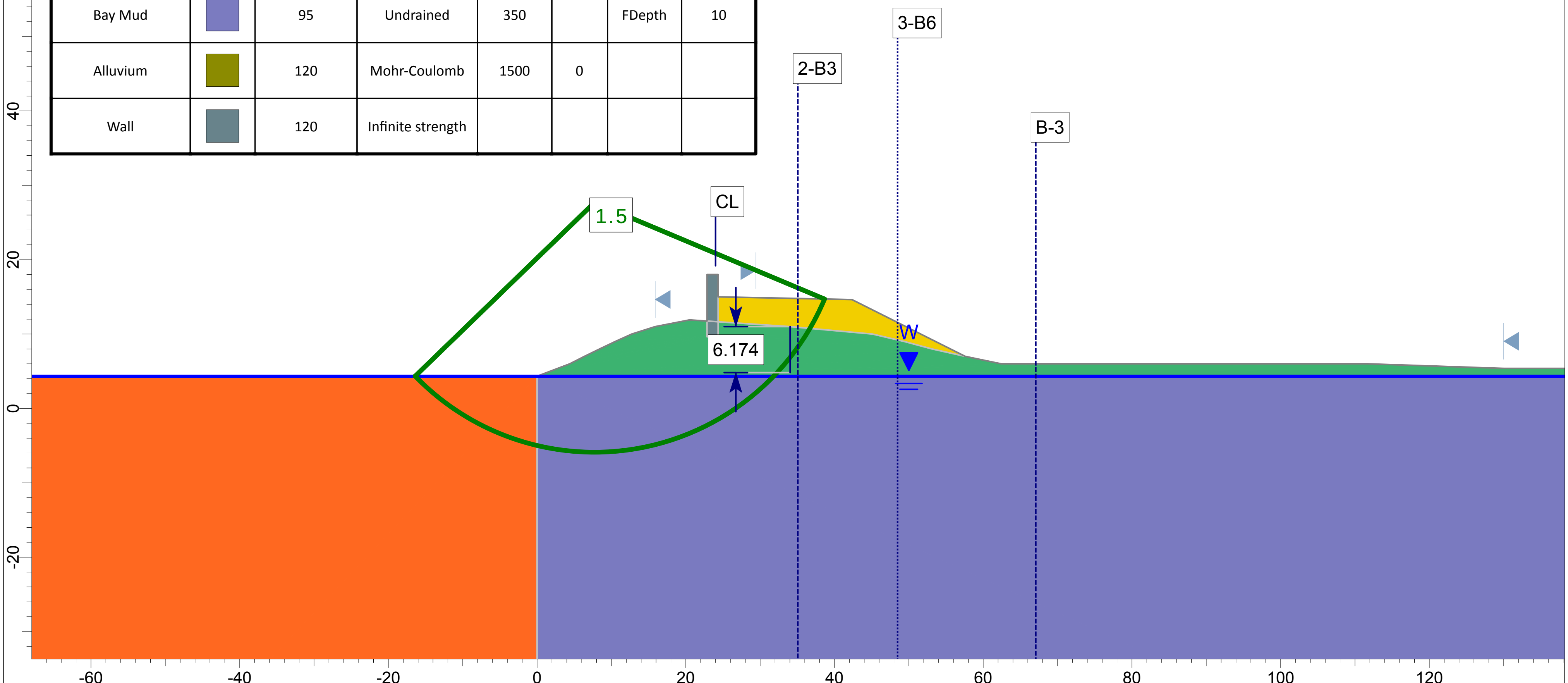
Project	Foster City Levee Improvements
Analysis Description	STA 120 - Earthquake
Drawn By	JSY
Scale	1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec120 - kh.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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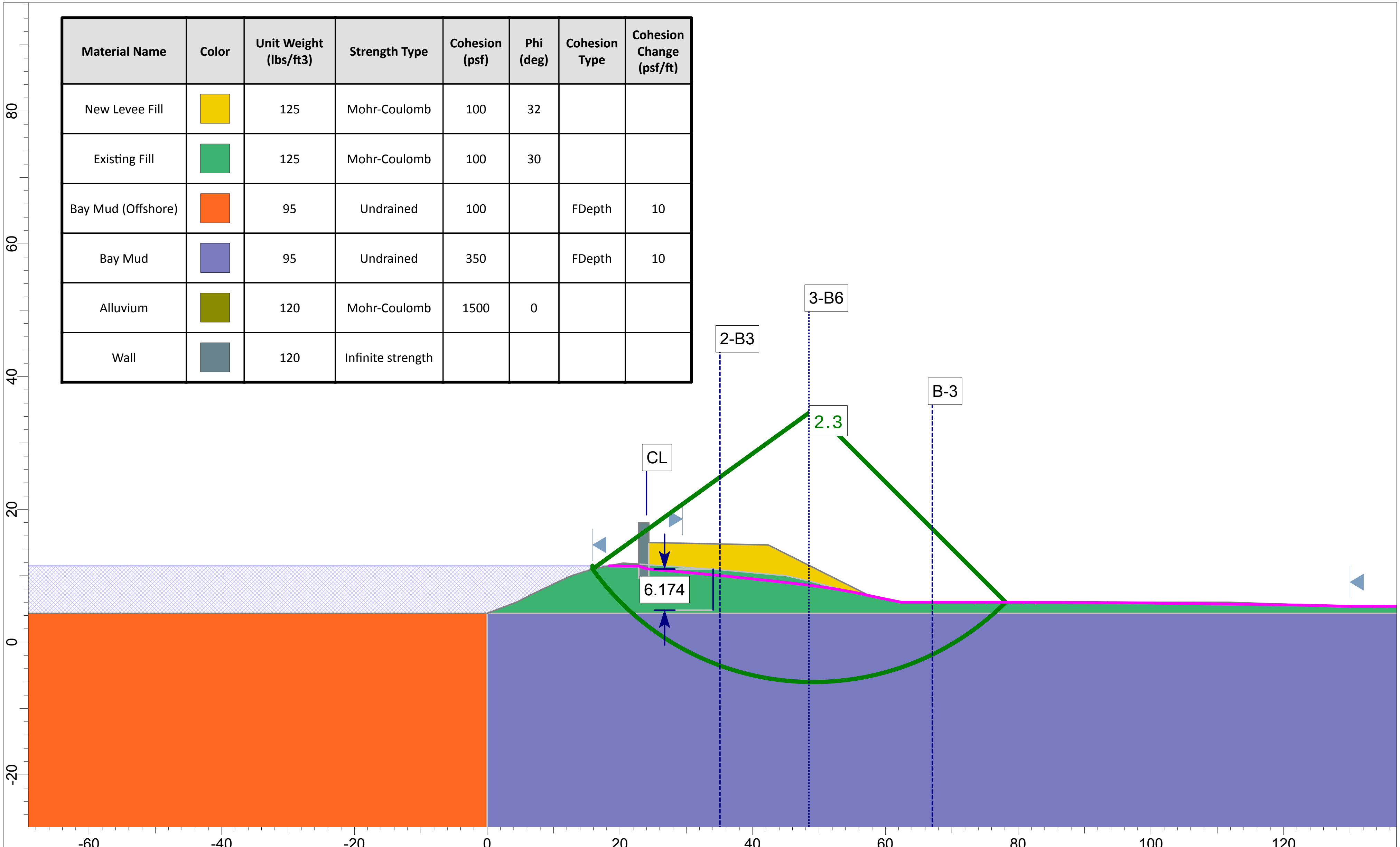
Project	Foster City Levee Improvements		
Analysis Description	STA 149 - End of Construction		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec149.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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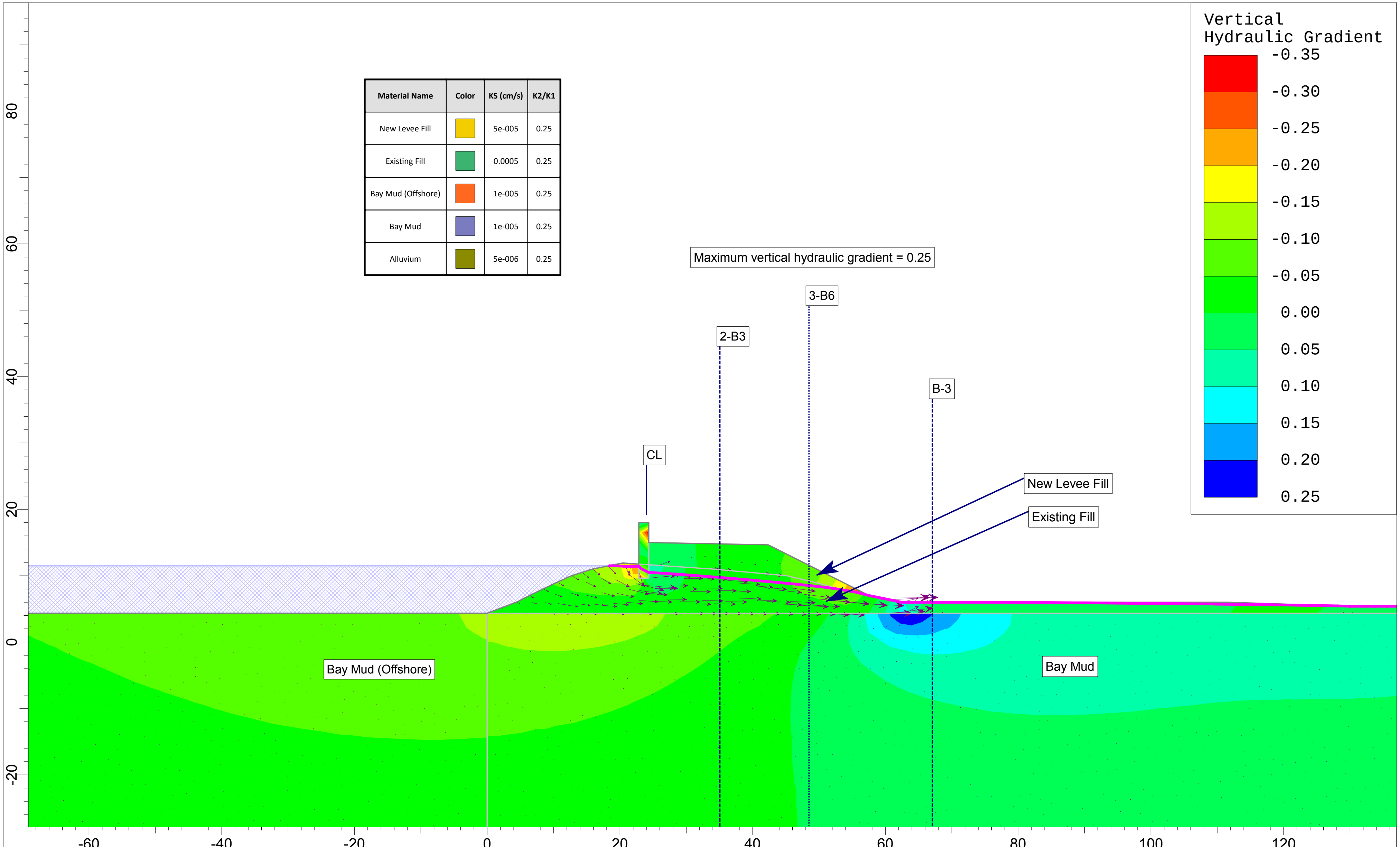
Project	Foster City Levee Improvements
Analysis Description	STA 149 - Seepage

Drawn By	JSY	*Scale*	1:240	*Company*	ENGEO Incorporated
Date	2017 October 16			*File Name*	Sec149 - seep stab.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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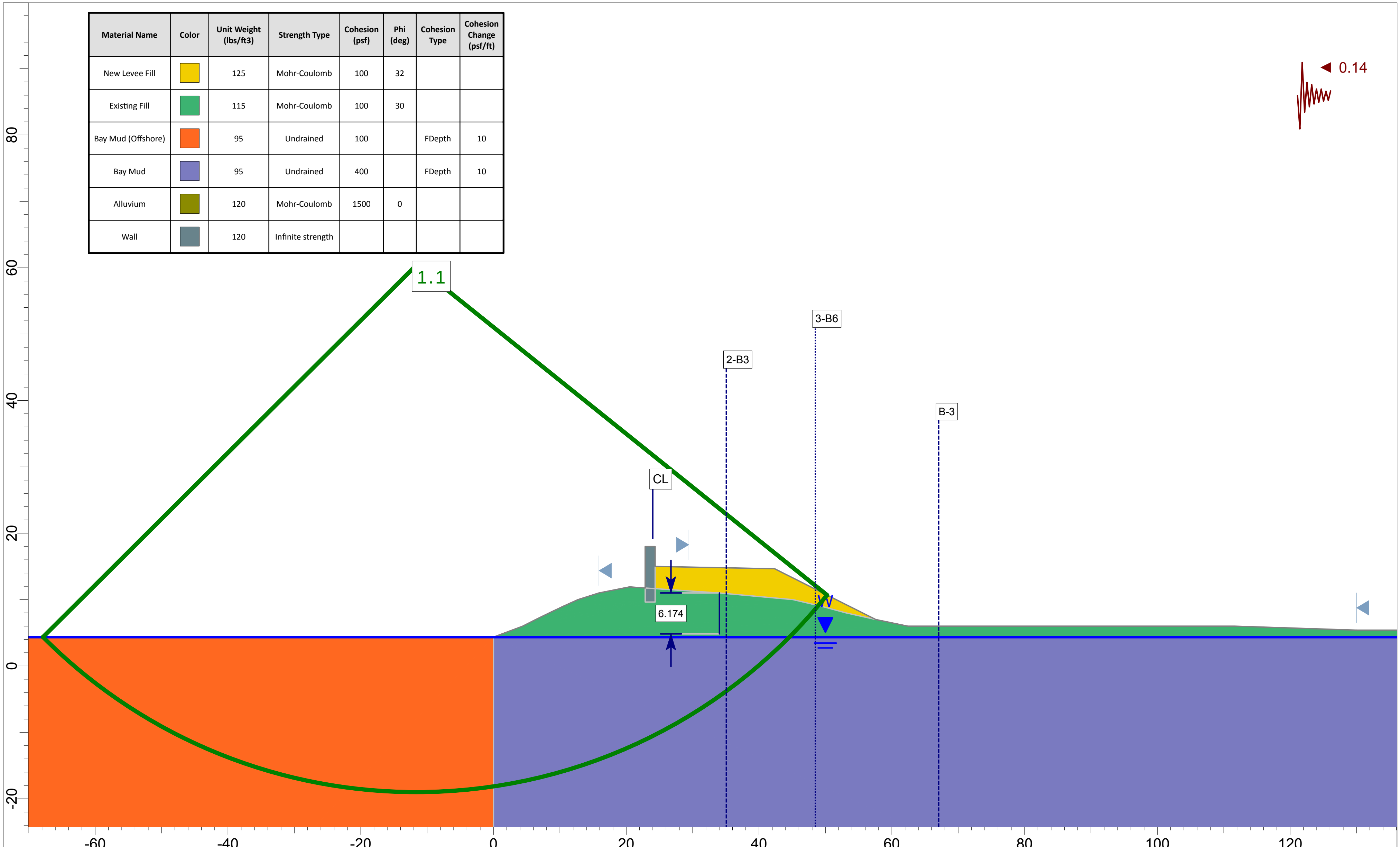
Project	Foster City Levee Improvements		
Analysis Description	STA 149 - Seepage		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	sec149 - seep.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	400		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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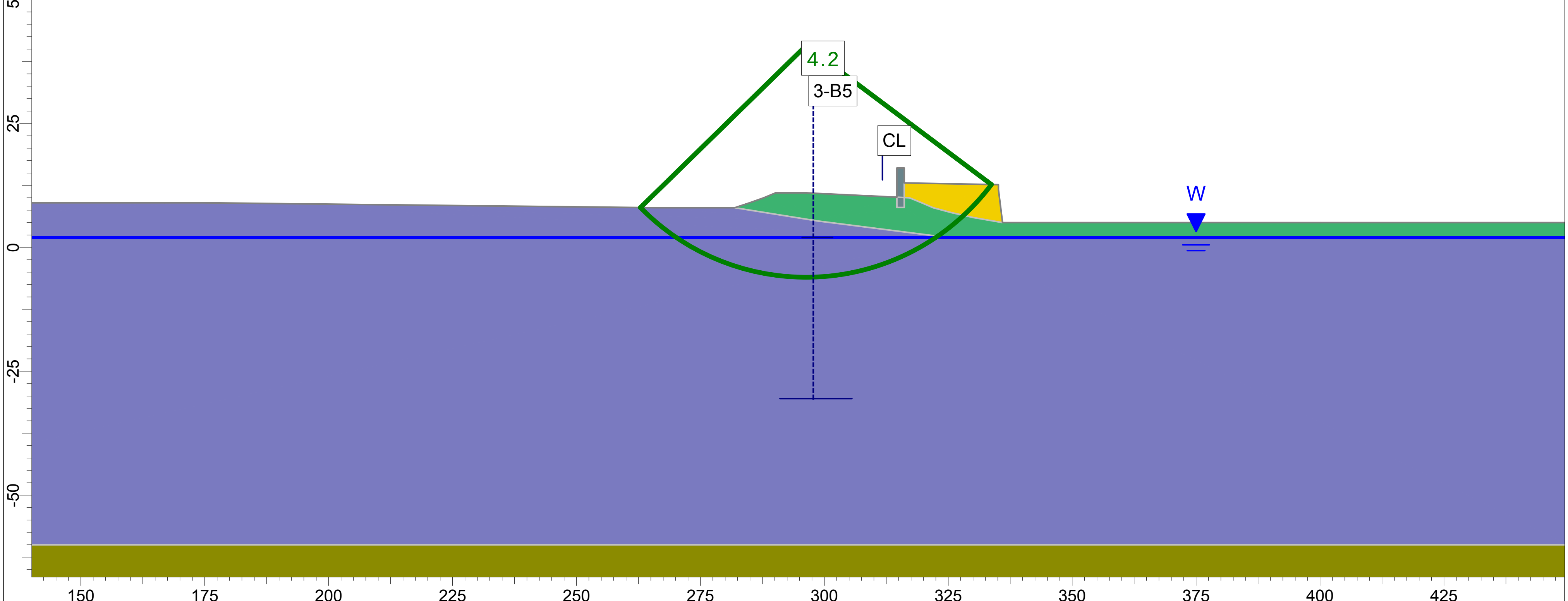
Project	Foster City Levee Improvements		
Analysis Description	STA 149 - Earthquake		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec149 - kh.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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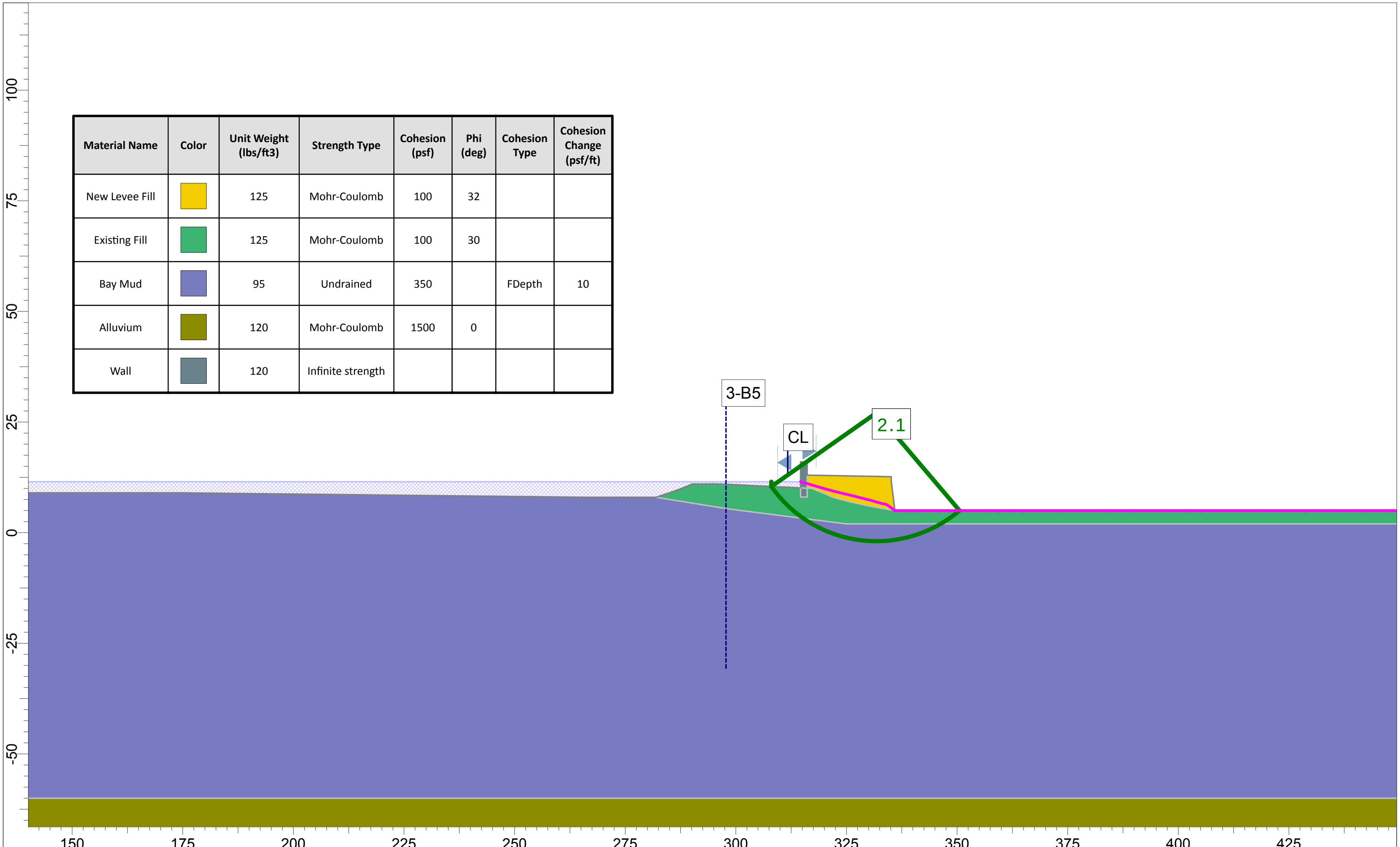
Project	Foster City Levee Improvements		
Analysis Description	STA 180 - End of Construction		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec183.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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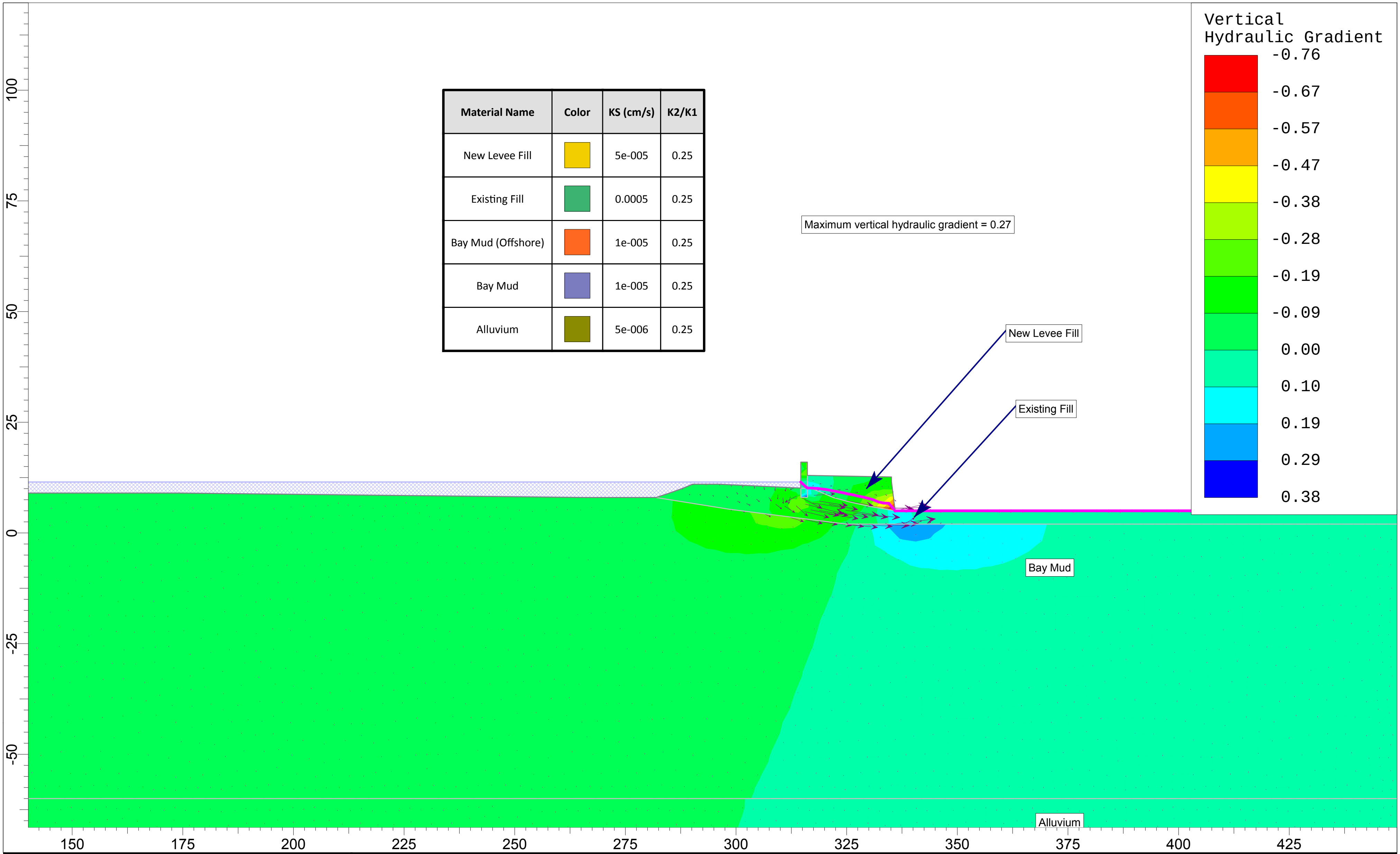
Project	Foster City Levee Improvements		
Analysis Description	STA 180 - Seepage		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec183 - seep stab.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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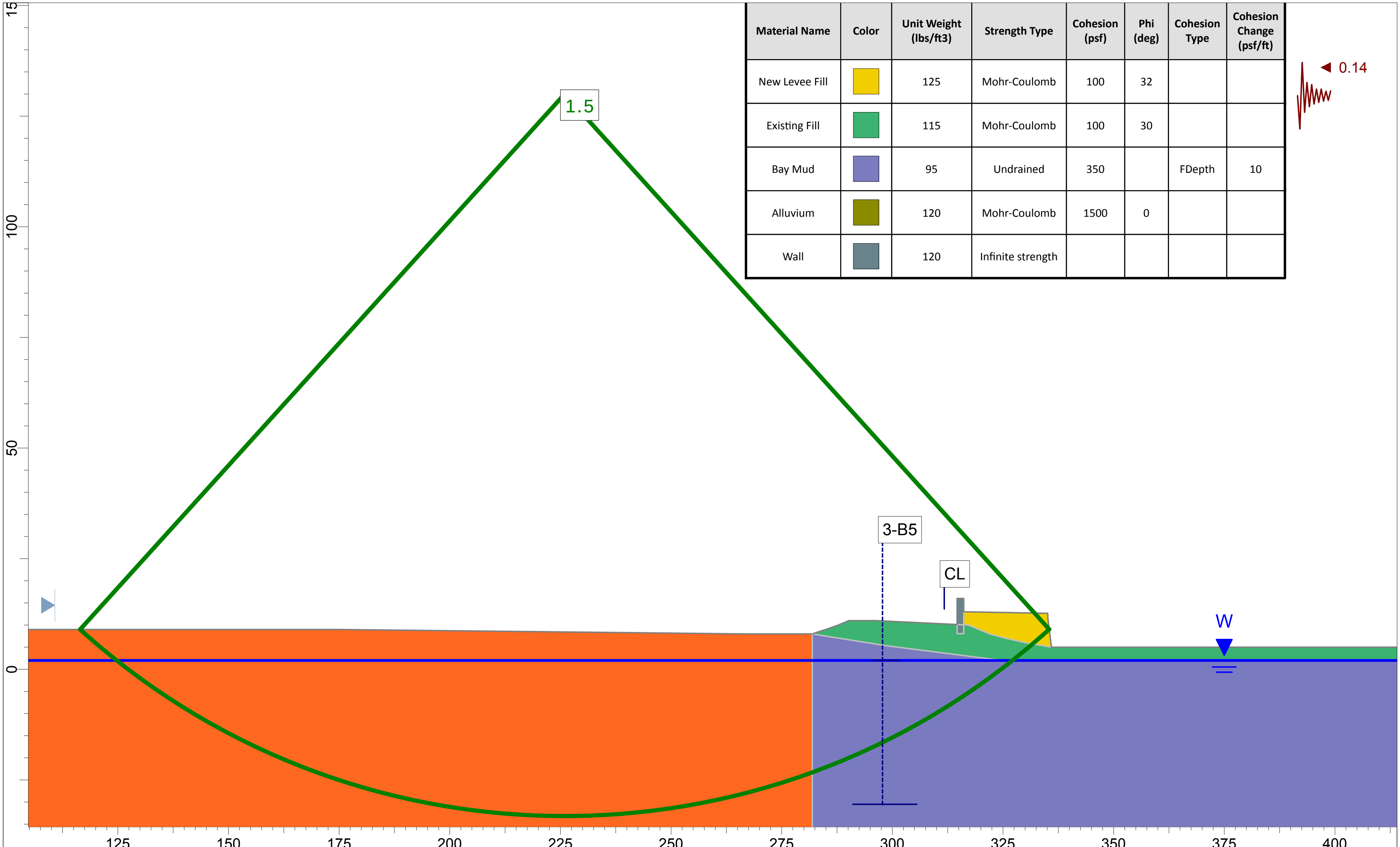
Project	Foster City Levee Improvements
Analysis Description	STA 180 - Seepage
Drawn By	JSY
Scale	1:360
Company	ENGEO Incorporated
Date	2017 October 16
File Name	sec183 - seep.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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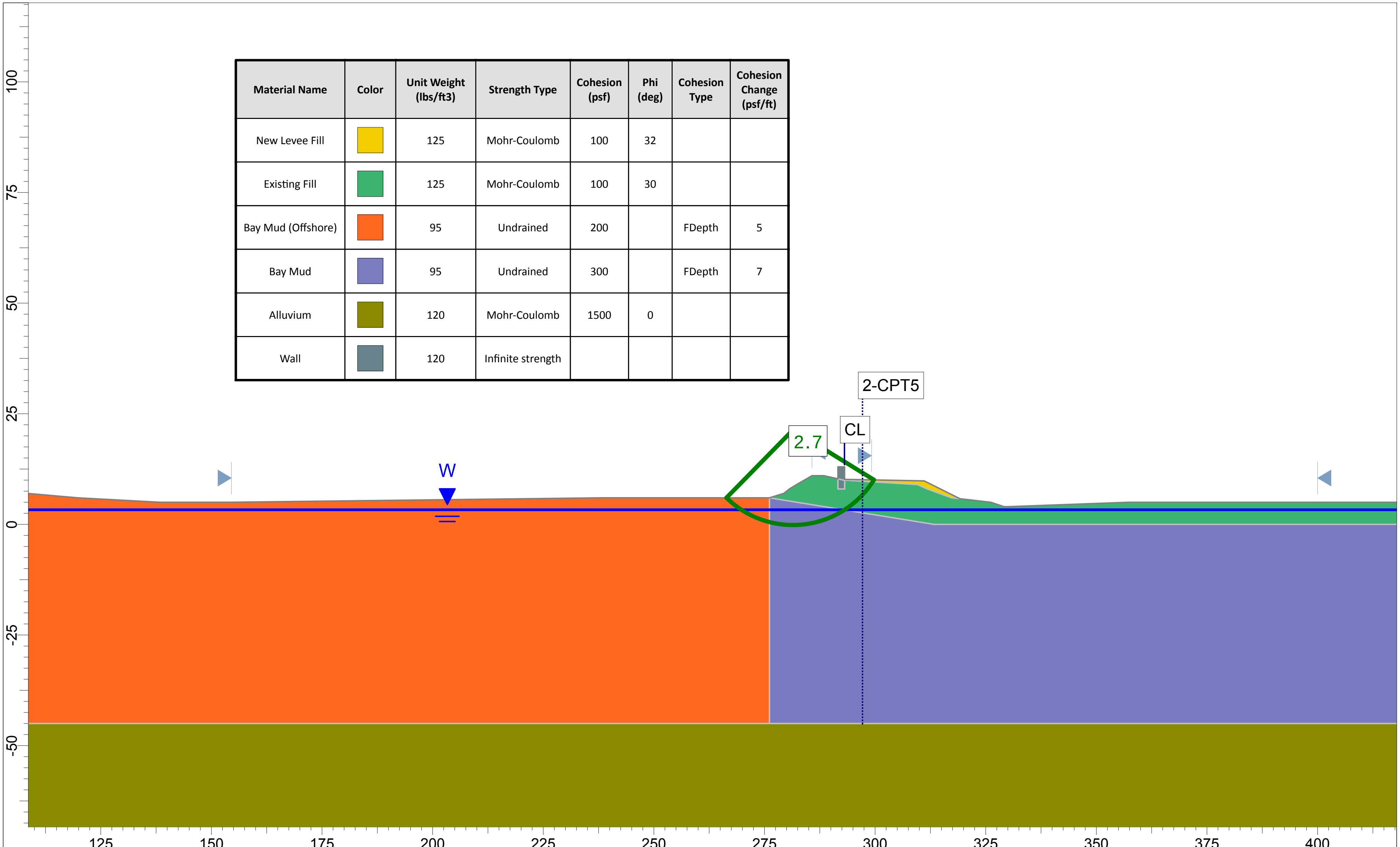
Project	Foster City Levee Improvements
Analysis Description	STA 180 - Earthquake
Drawn By	JSY
Scale	1:360
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec183 - kh.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	200		FDepth	5
Bay Mud		95	Undrained	300		FDepth	7
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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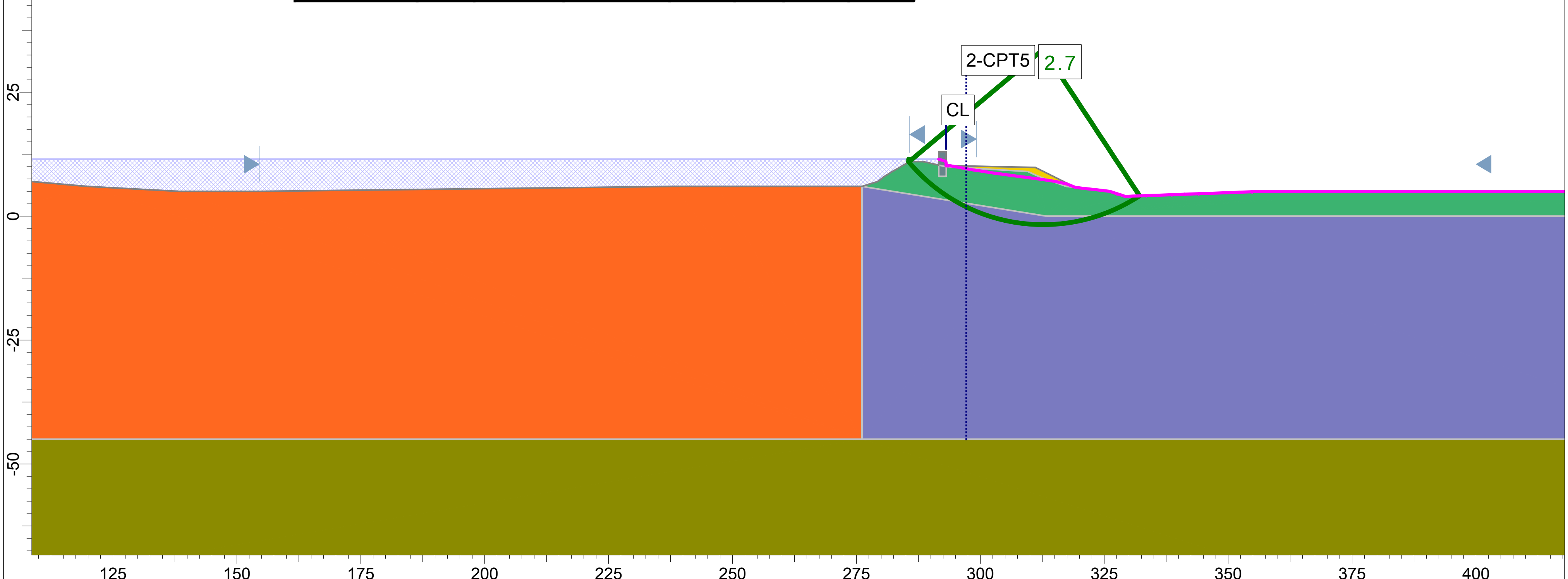
Project	Foster City Levee Improvements		
Analysis Description	STA 215 - End of Construction		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec215.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	200		FDepth	5
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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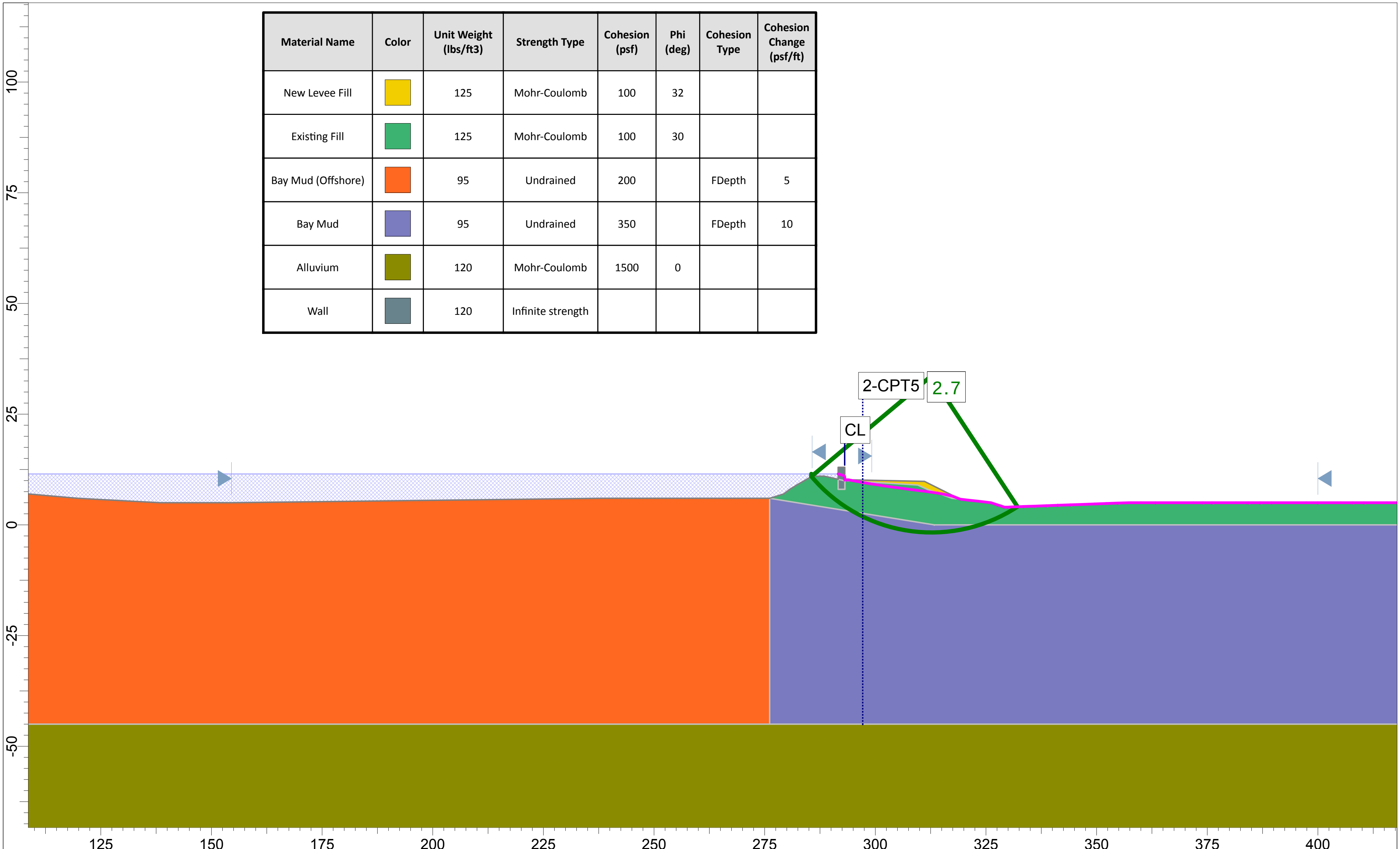
Project	Foster City Levee Improvements		
Analysis Description	STA 215 - Seepage		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec215 - seep stab.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	200		FDepth	5
Bay Mud		95	Undrained	350		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



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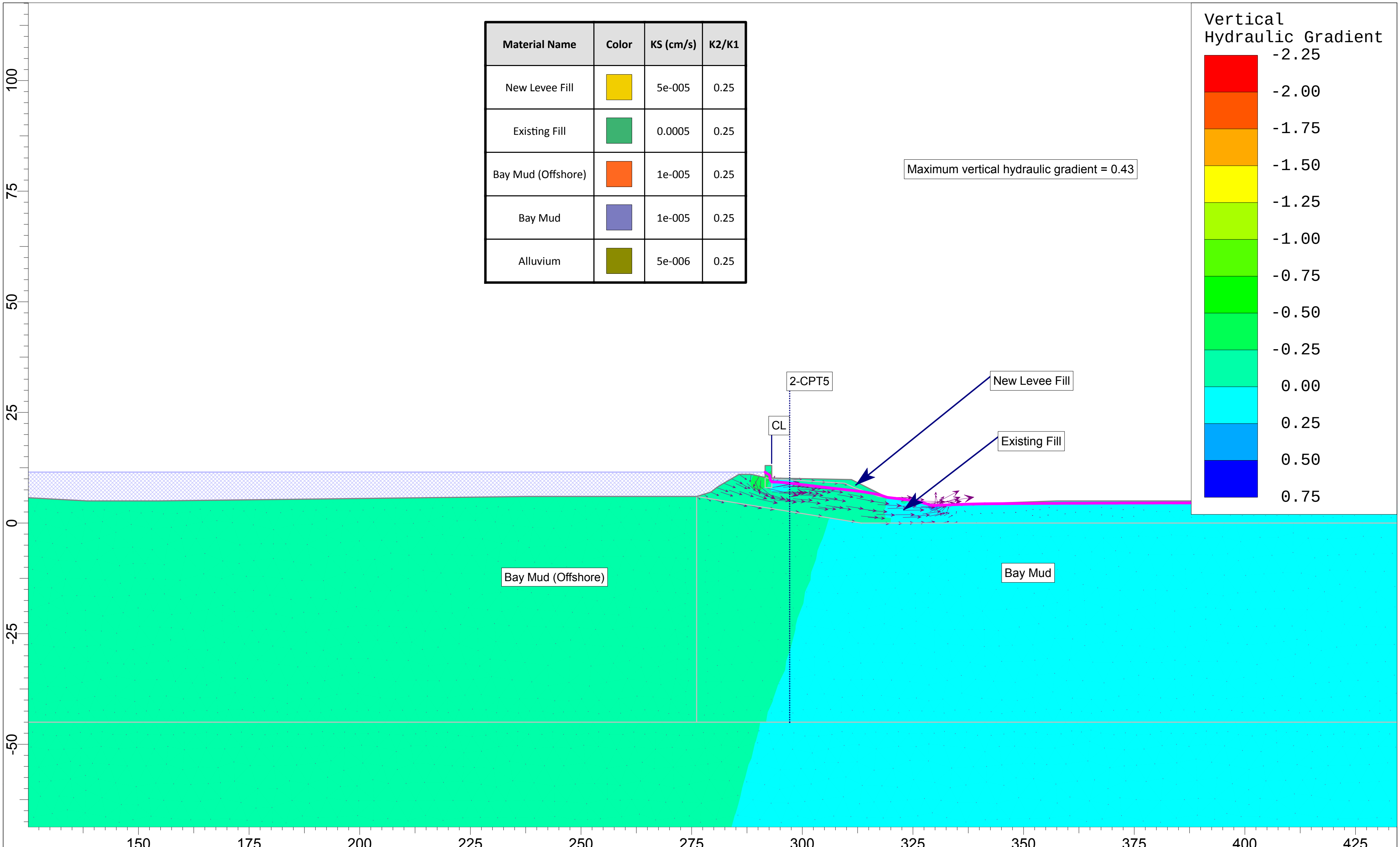
Project	Foster City Levee Improvements
Analysis Description	STA 215 - Seepage
Drawn By	JSY
Scale	1:360
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec215 - seep stab.slim

Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25



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Project	Foster City Levee Improvements		
Analysis Description	STA 215 - Seepage		
Drawn By: JSY	Scale: 1:360	Company	ENGEO Incorporated
Date	2017 October 16	File Name	sec215 - seep.slim

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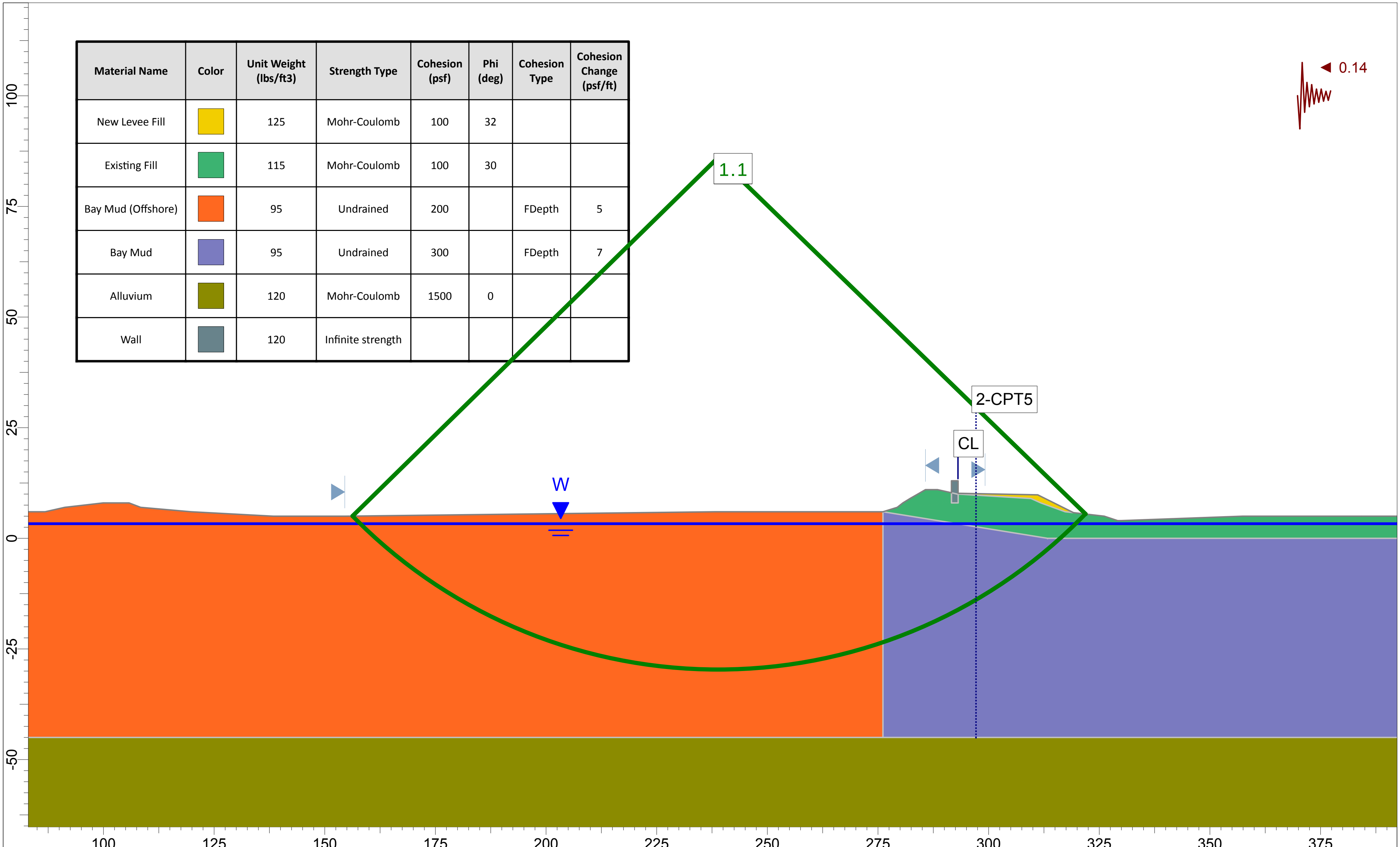

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	200		FDepth	5
Bay Mud		95	Undrained	300		FDepth	7
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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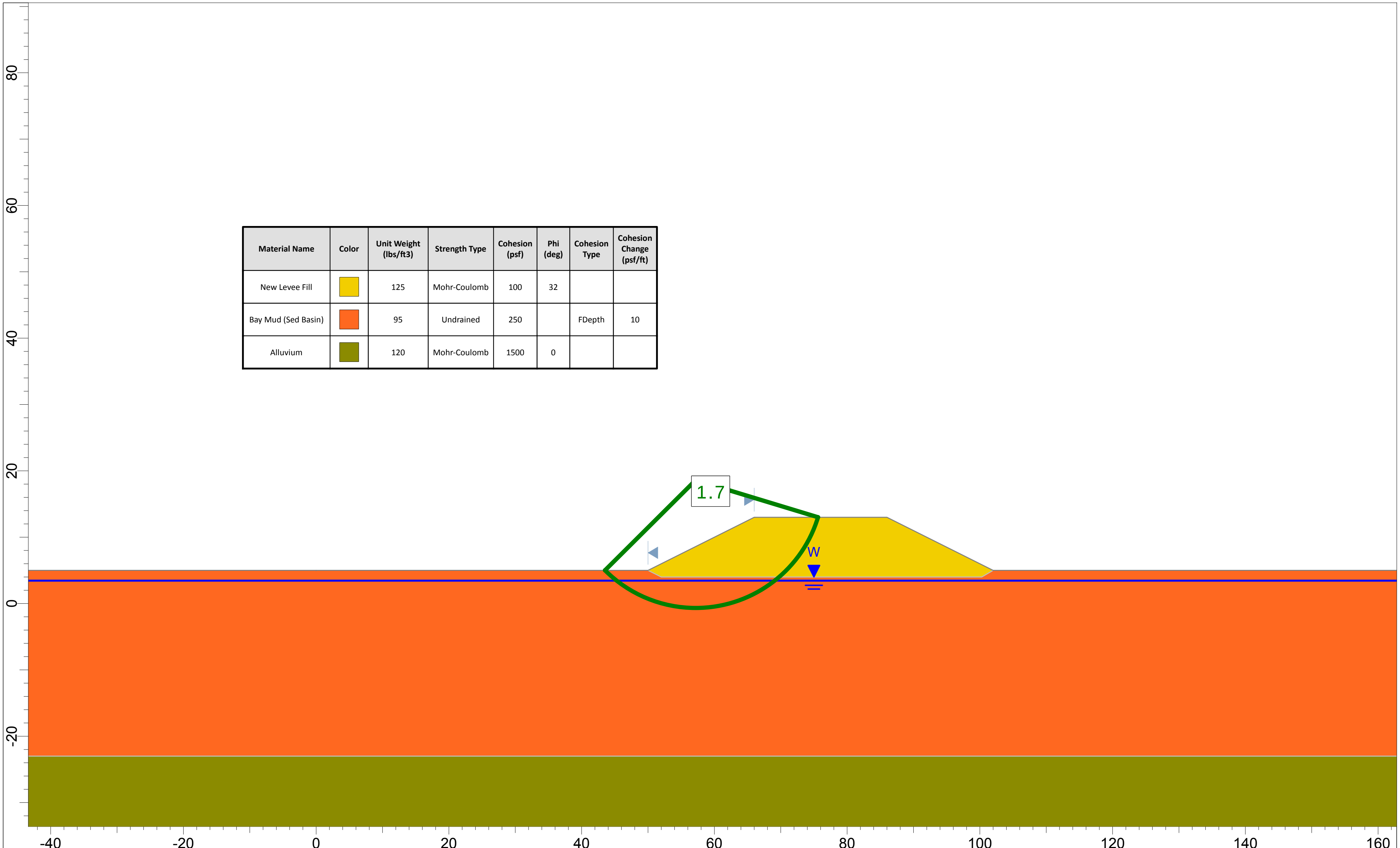
Project	Foster City Levee Improvements		
Analysis Description	STA 215 - Earthquake		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec215 - kh.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Bay Mud (Sed Basin)		95	Undrained	250		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		

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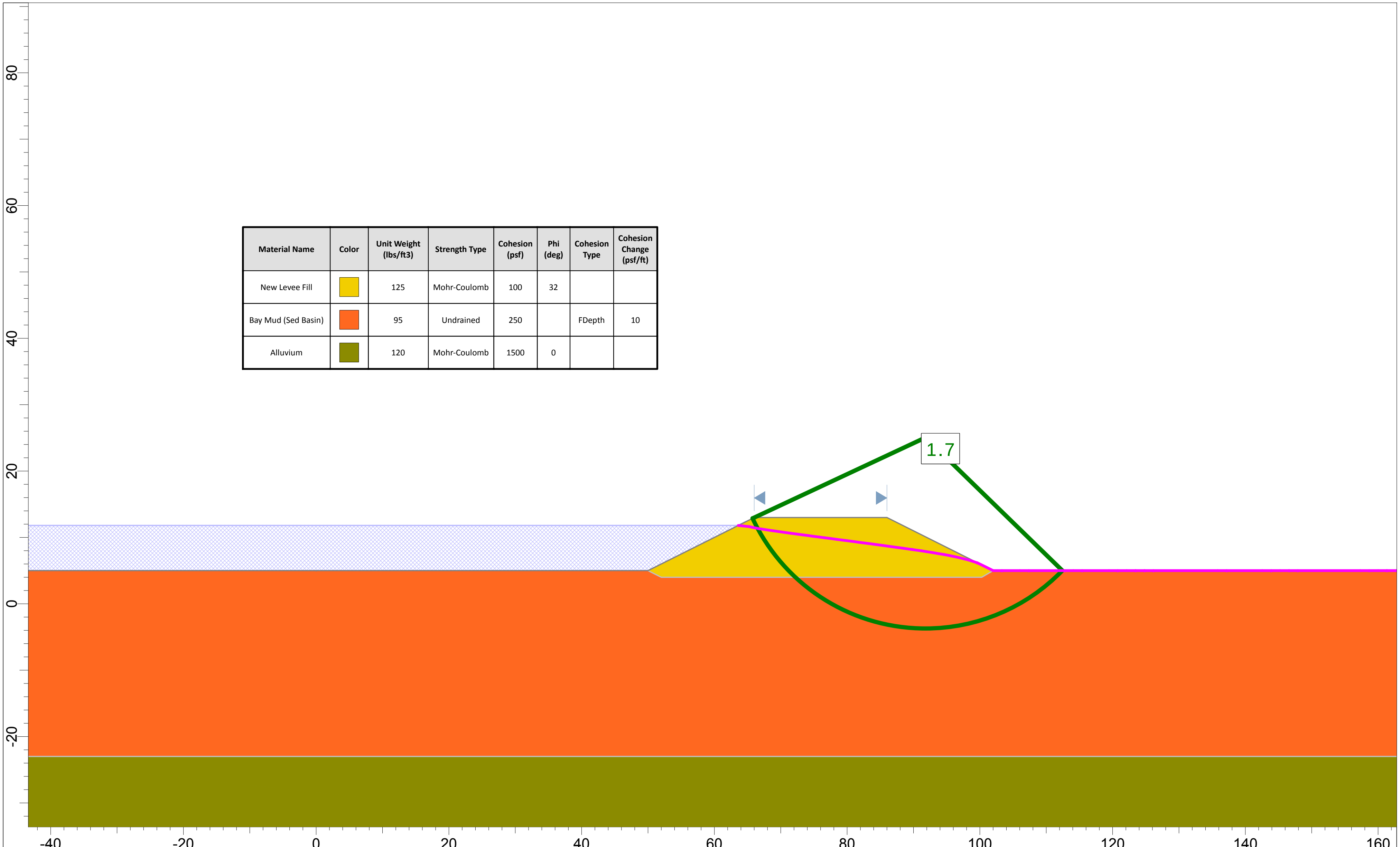
Project	Foster City Levee Improvements		
Analysis Description	STA 9 CL3 - End of Construction		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec9 CL3.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Bay Mud (Sed Basin)		95	Undrained	250		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		

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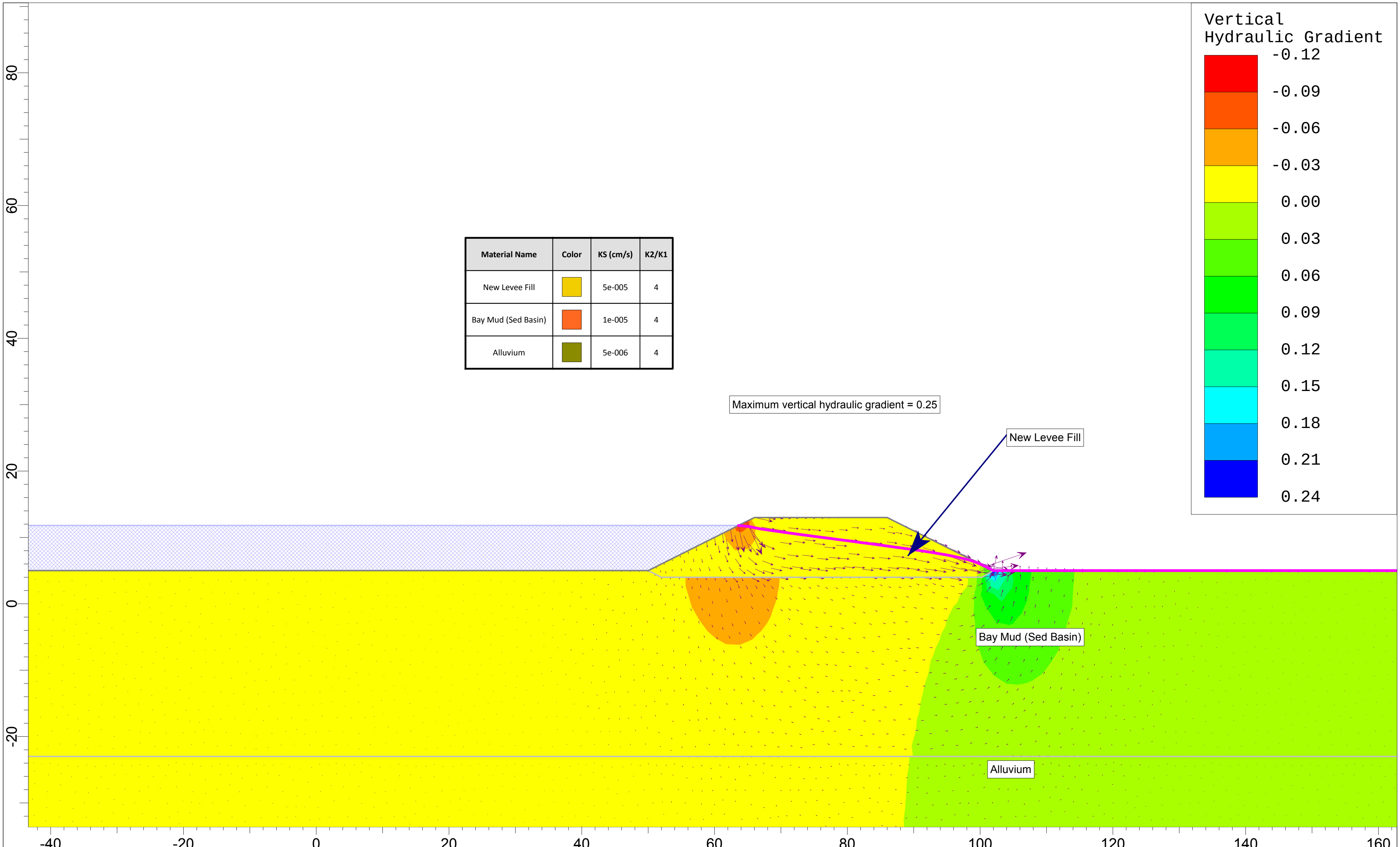
Project	Foster City Levee Improvements
Analysis Description	STA 9 CL3 - Seepage
Drawn By	JSY
Scale	1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec9 CL3 - seep stab.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	4
Bay Mud (Sed Basin)		1e-005	4
Alluvium		5e-006	4

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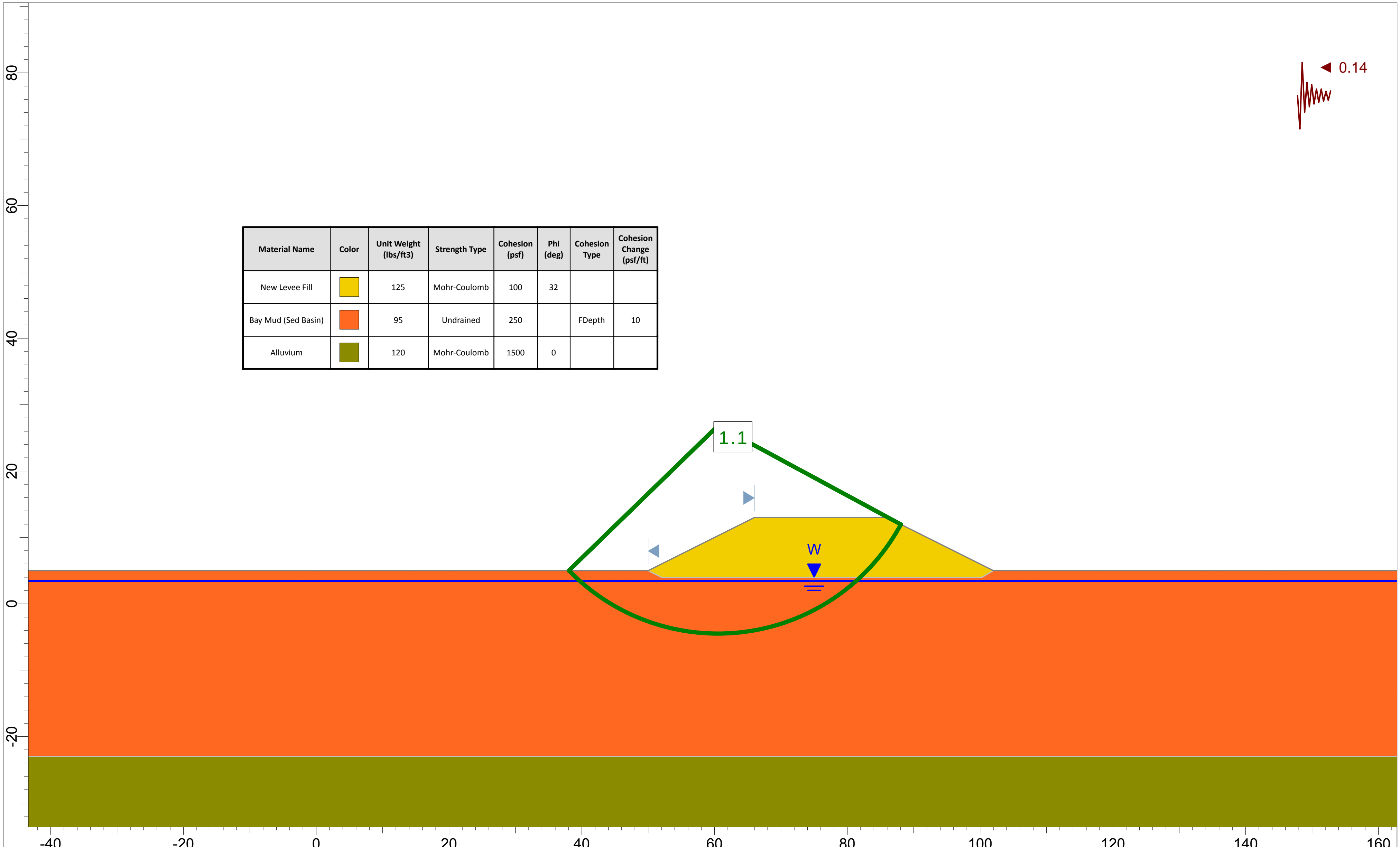
Project	Foster City Levee Improvements		
Analysis Description	STA 9 CL3 - Seepage		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec9 CL3 - seep.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Bay Mud (Sed Basin)		95	Undrained	250		FDepth	10
Alluvium		120	Mohr-Coulomb	1500	0		

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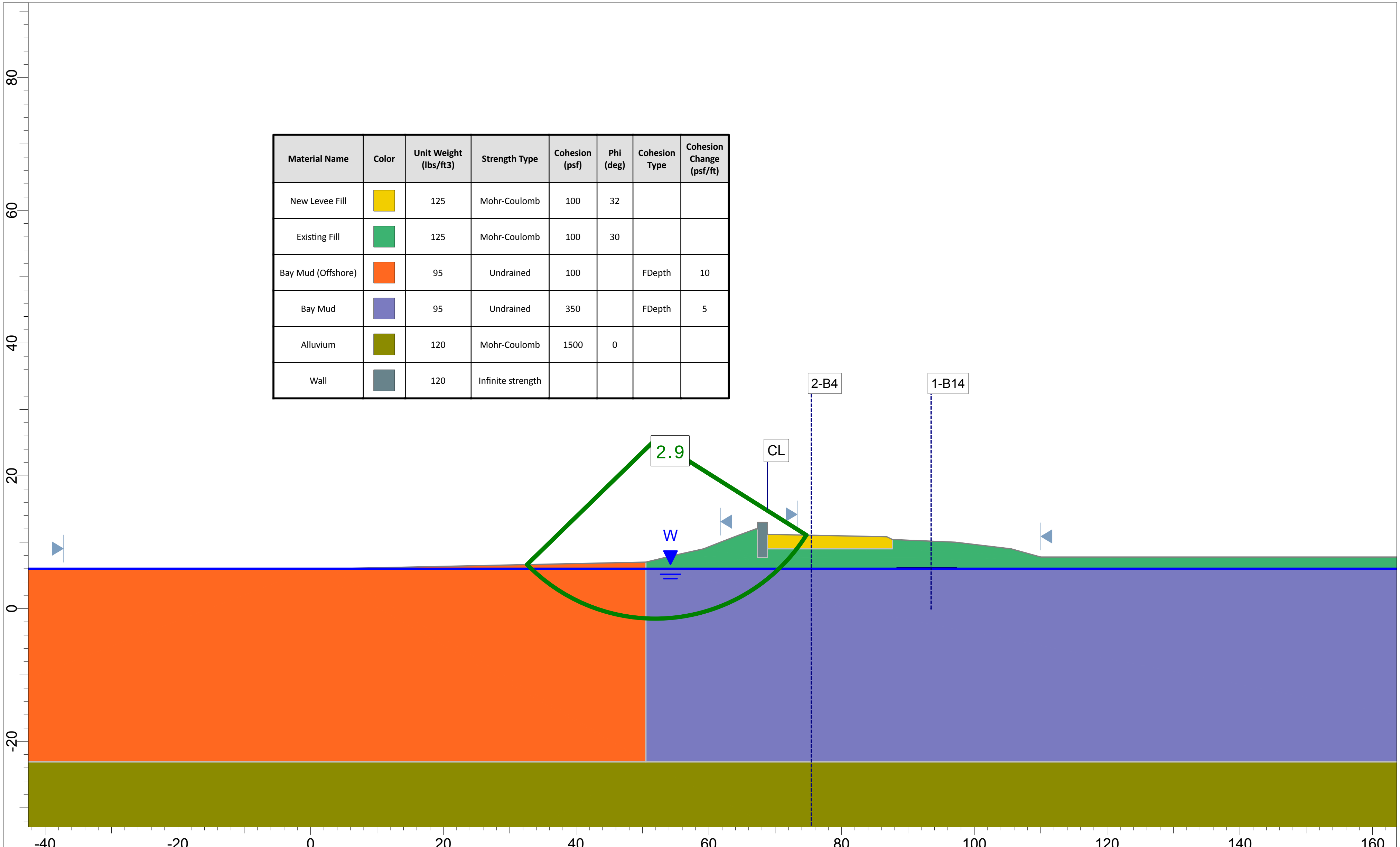
Project	Foster City Levee Improvements		
Analysis Description	STA 9 CL3 - Earthquake		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec9 CL3 - kh.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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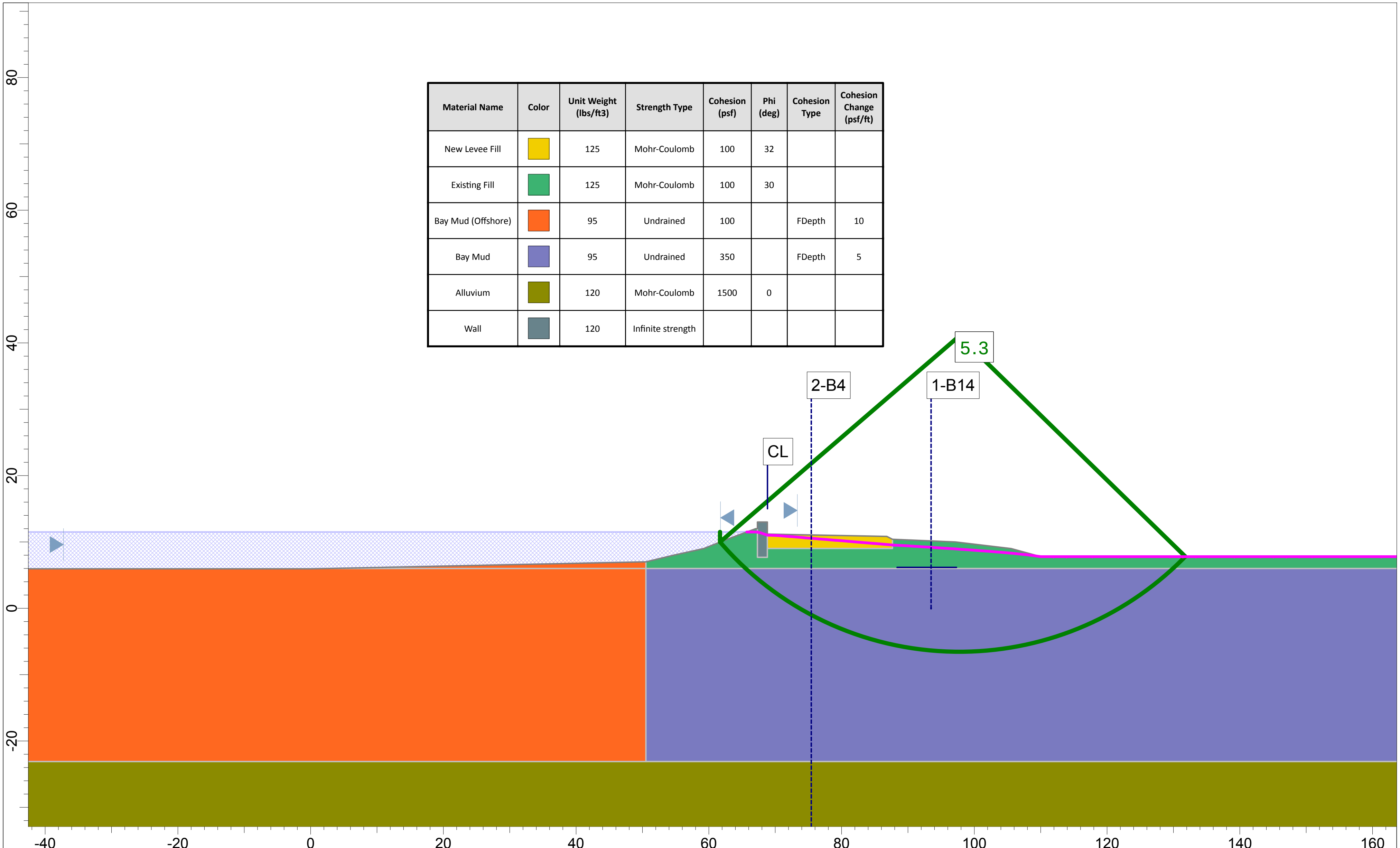
Project	Foster City Levee Improvements		
Analysis Description	STA 288 - End of Construction		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec288.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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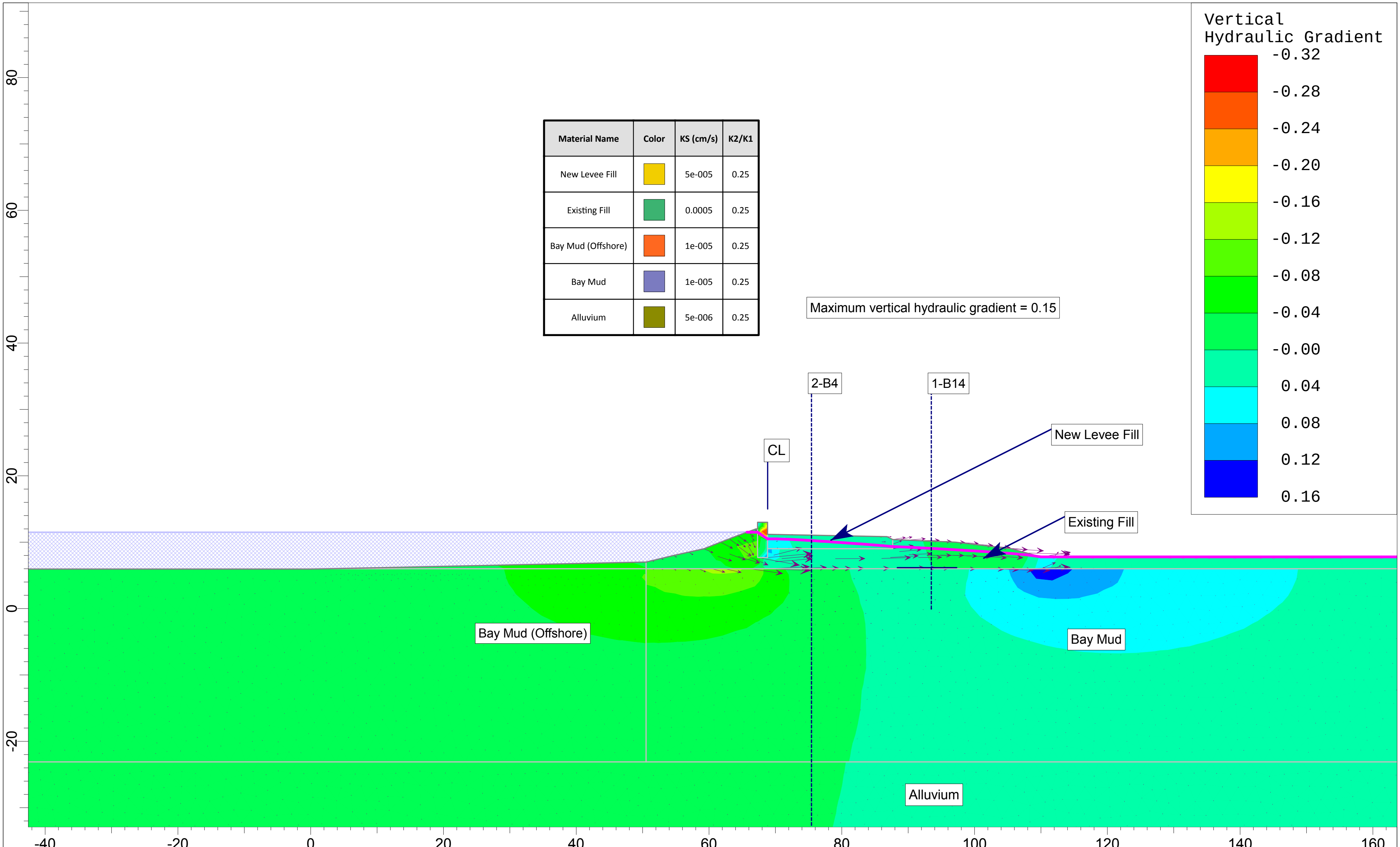
Project	Foster City Levee Improvements
Analysis Description	STA 288 - Seepage
Drawn By	JSY
Scale	1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec288 - seep stab.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

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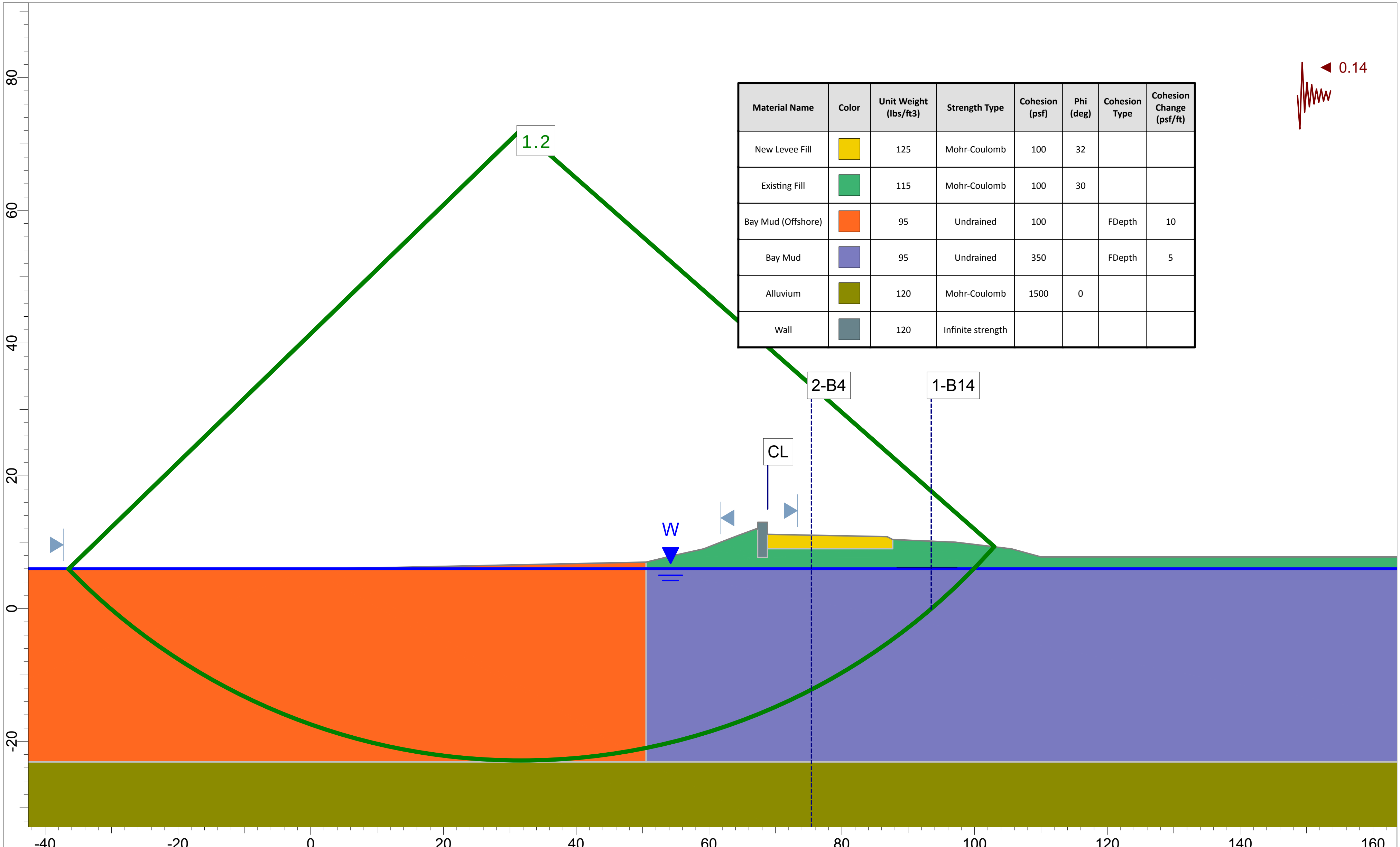
Project Foster City Levee Improvements			
Analysis Description STA 288 - Seepage			
Drawn By JSY	*Scale* 1:240	*Company* ENGEO Incorporated	
Date 2017 October 16		*File Name* sec288 - seep.slim	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

ENGEO
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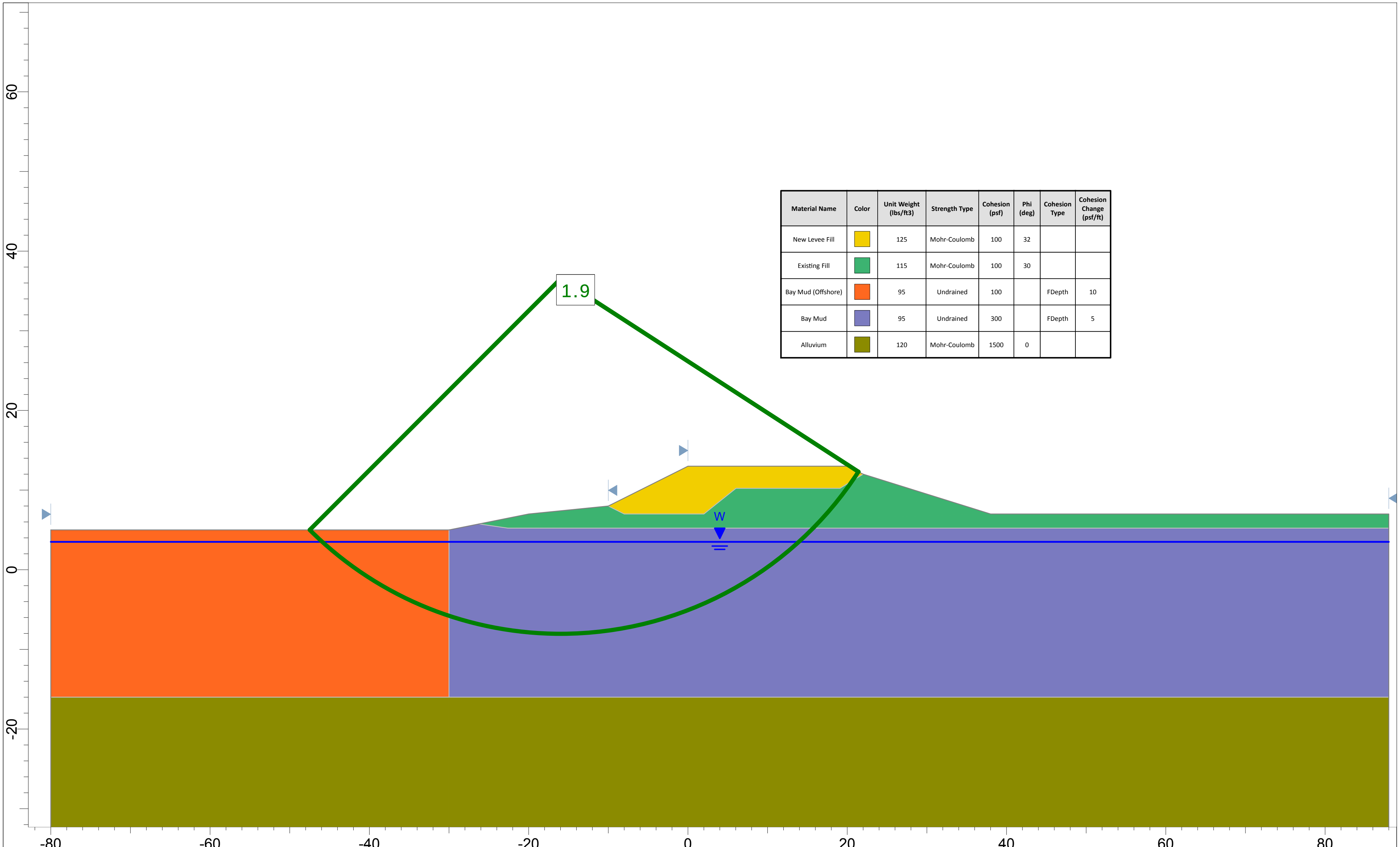
SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements		
Analysis Description	STA 288 - Earthquake		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec288 - kh.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	300		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		

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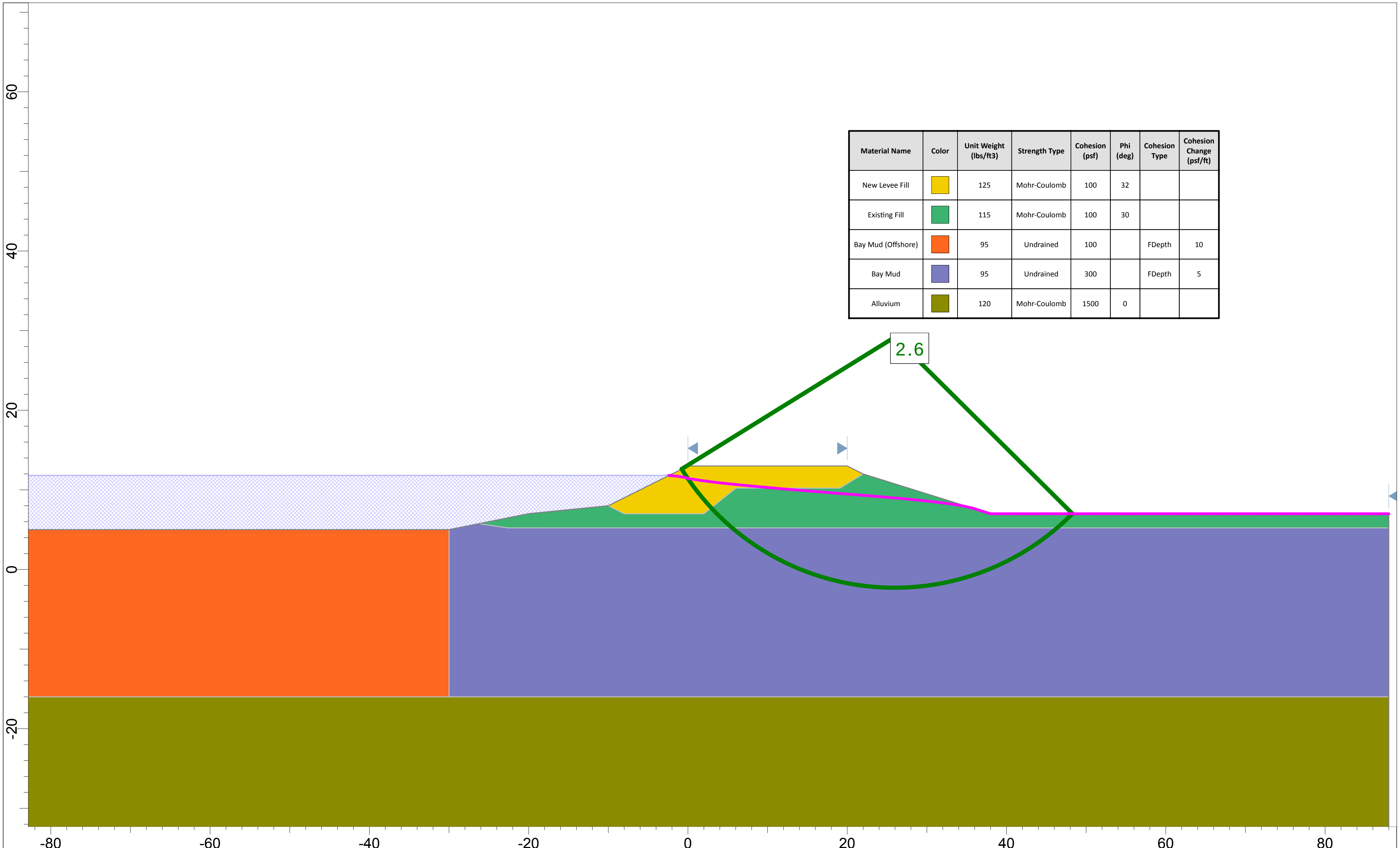
Project	Foster City Levee Improvements		
Analysis Description	STA 305 - End of Construction		
Drawn By JSY	*Scale* 1:200	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec305.slim

SLIDEINTERPRET 7.023

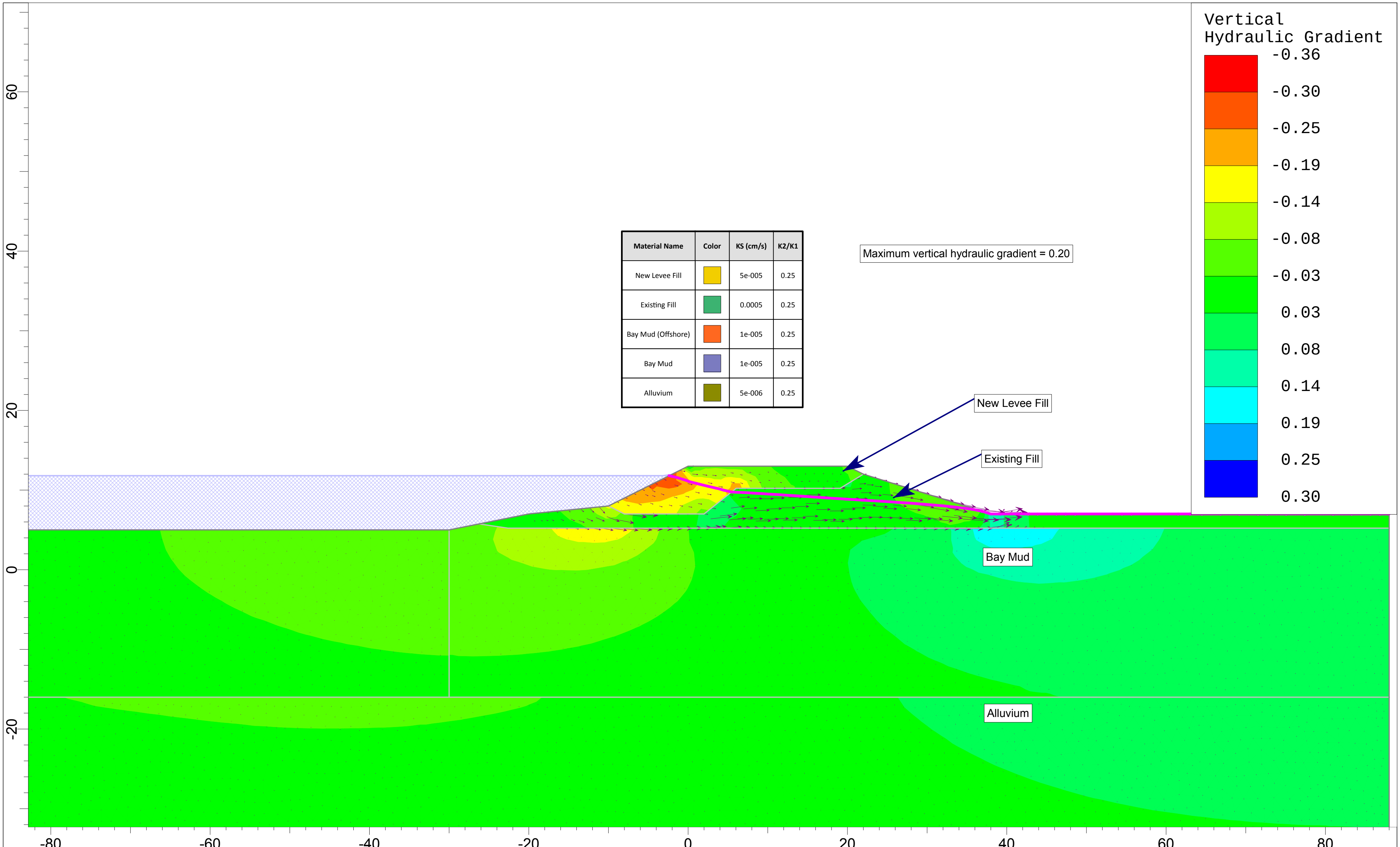


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	300		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		

ENGEO
Expect Excellence

SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements		
Analysis Description	STA 305 - Seepage		
Drawn By JSY	*Scale* 1:200	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec305 - seep stab.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

ENGEO
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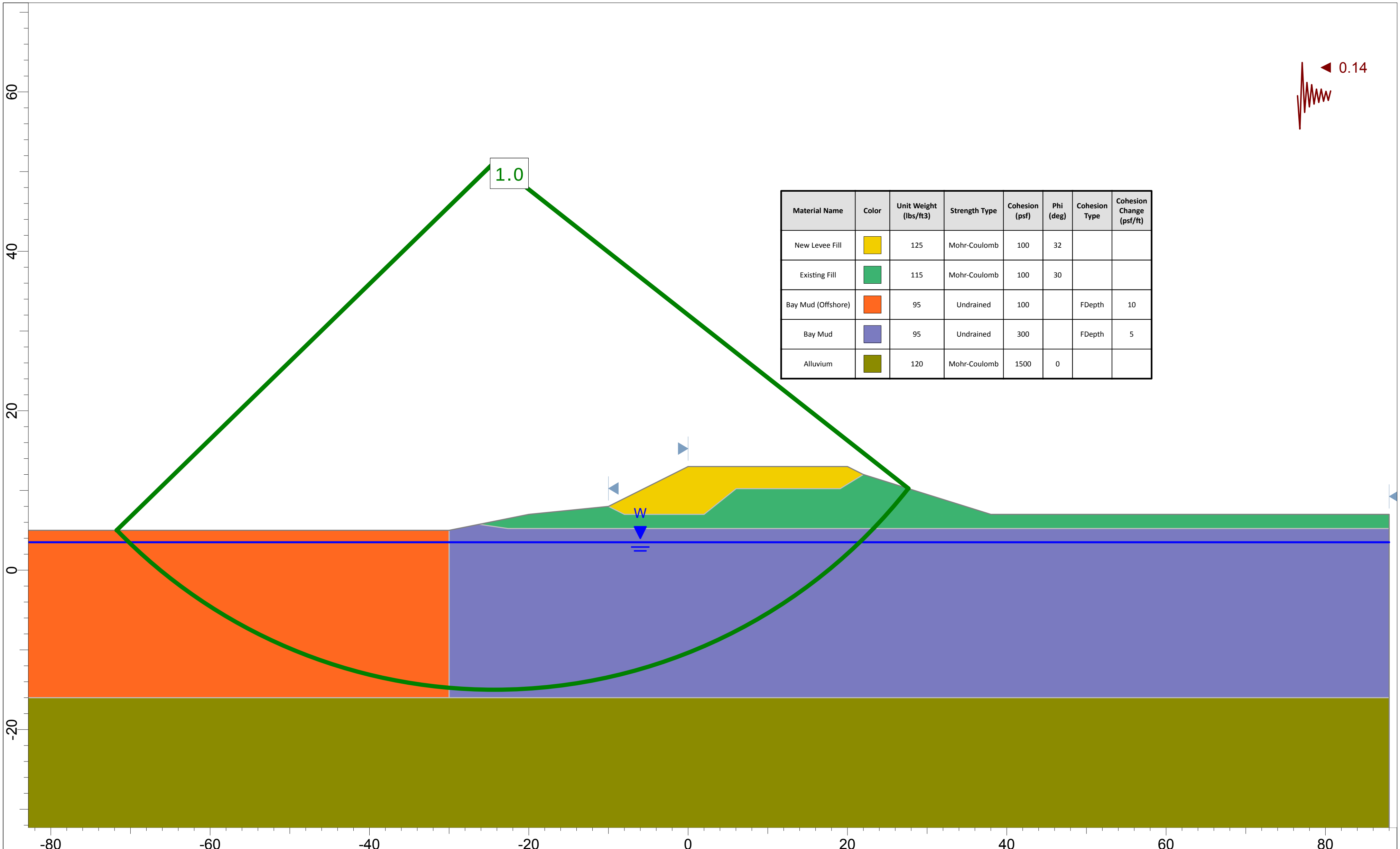
Project	Foster City Levee Improvements		
Analysis Description	STA 305 - Seepage		
Drawn By JSY	*Scale* 1:200	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	Sec305 - seep.slim

SLIDEINTERPRET 7.023



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	300		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		

ENGEO
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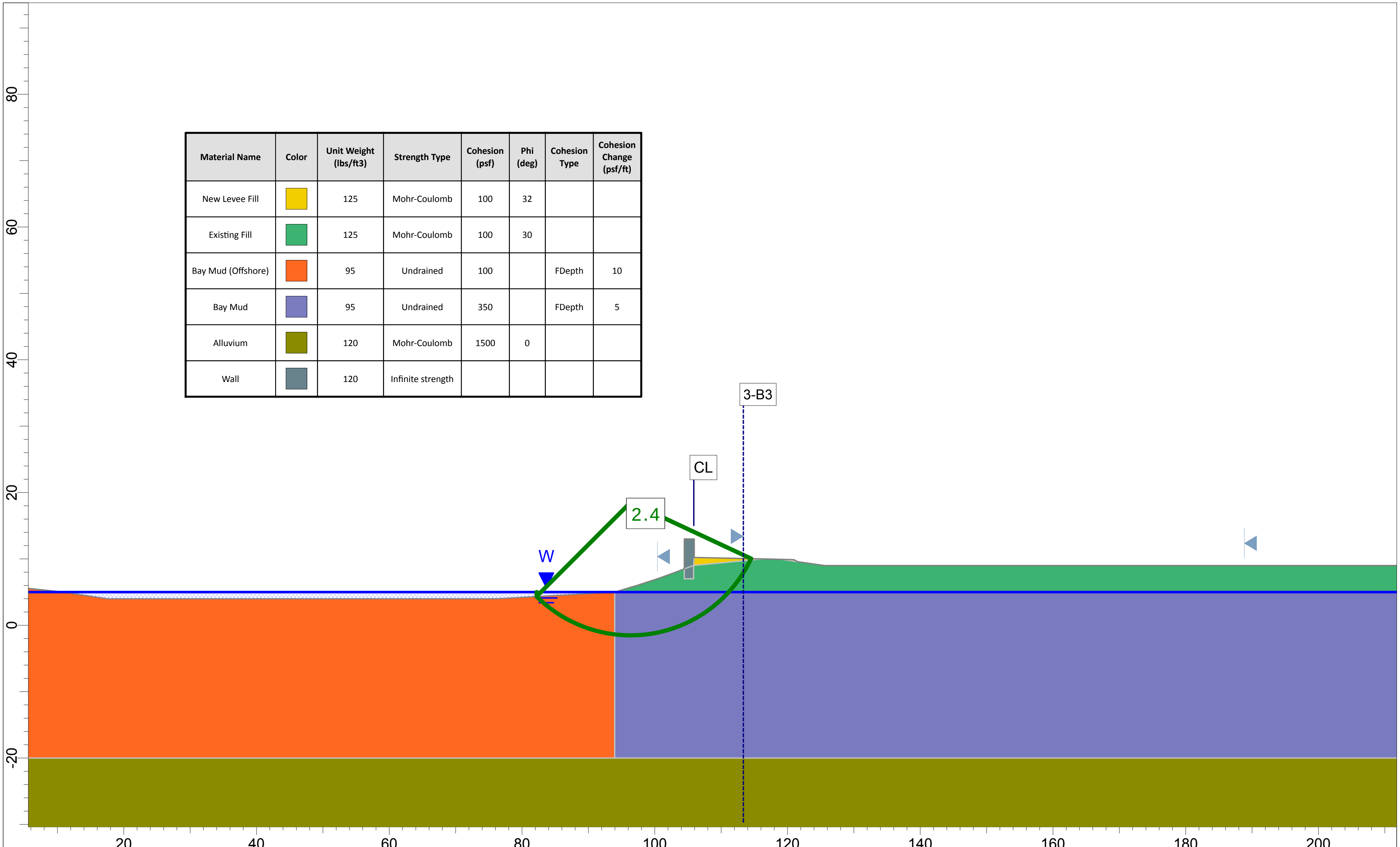
SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements
Analysis Description	STA 305 - Earthquake
Drawn By	JSY
Scale	1:200
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec305 - kh.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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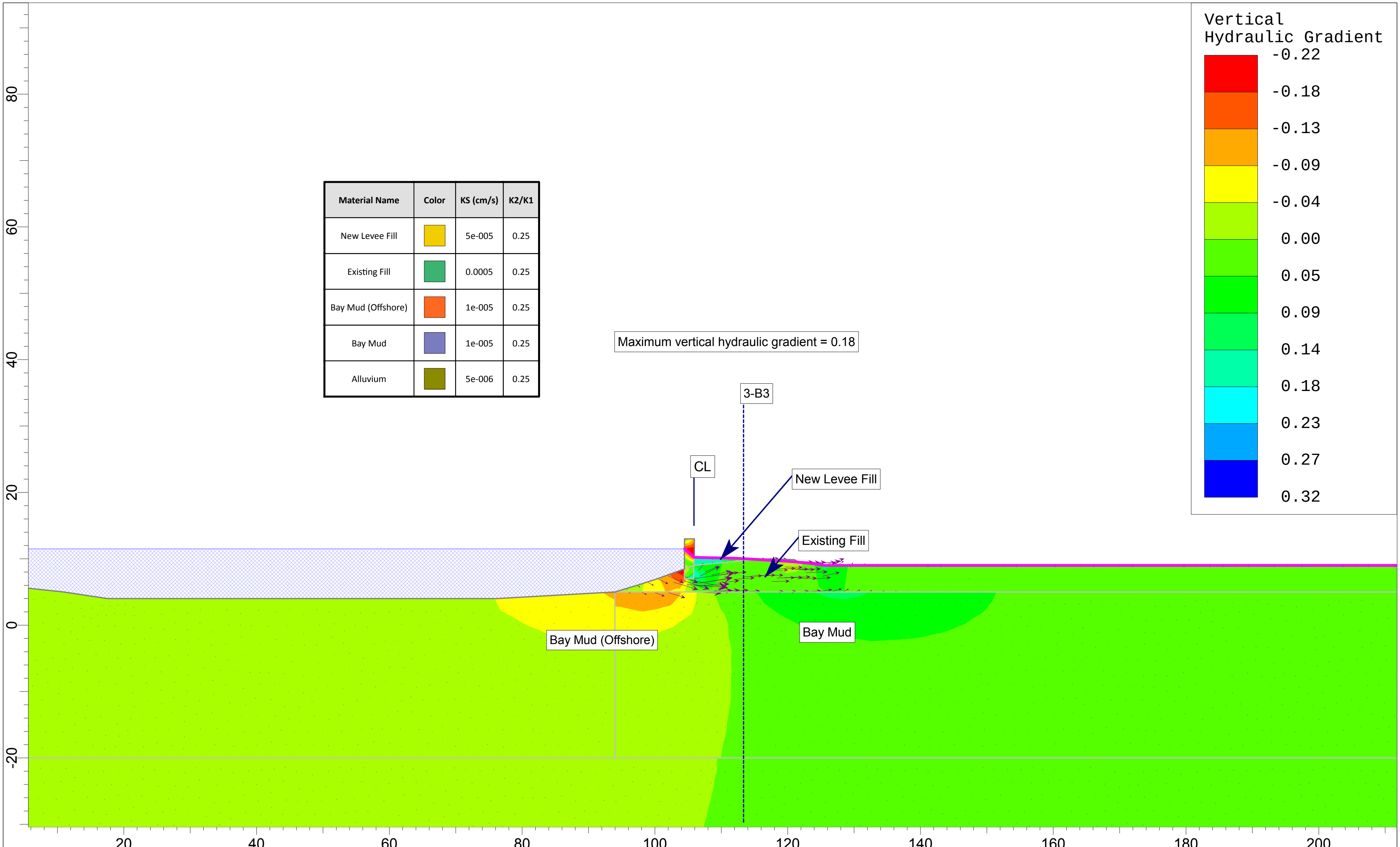
SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements
Analysis Description	STA 315 - Seepage
Drawn By	JSY
Scale	1:240
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec315.slim



Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

ENGEO
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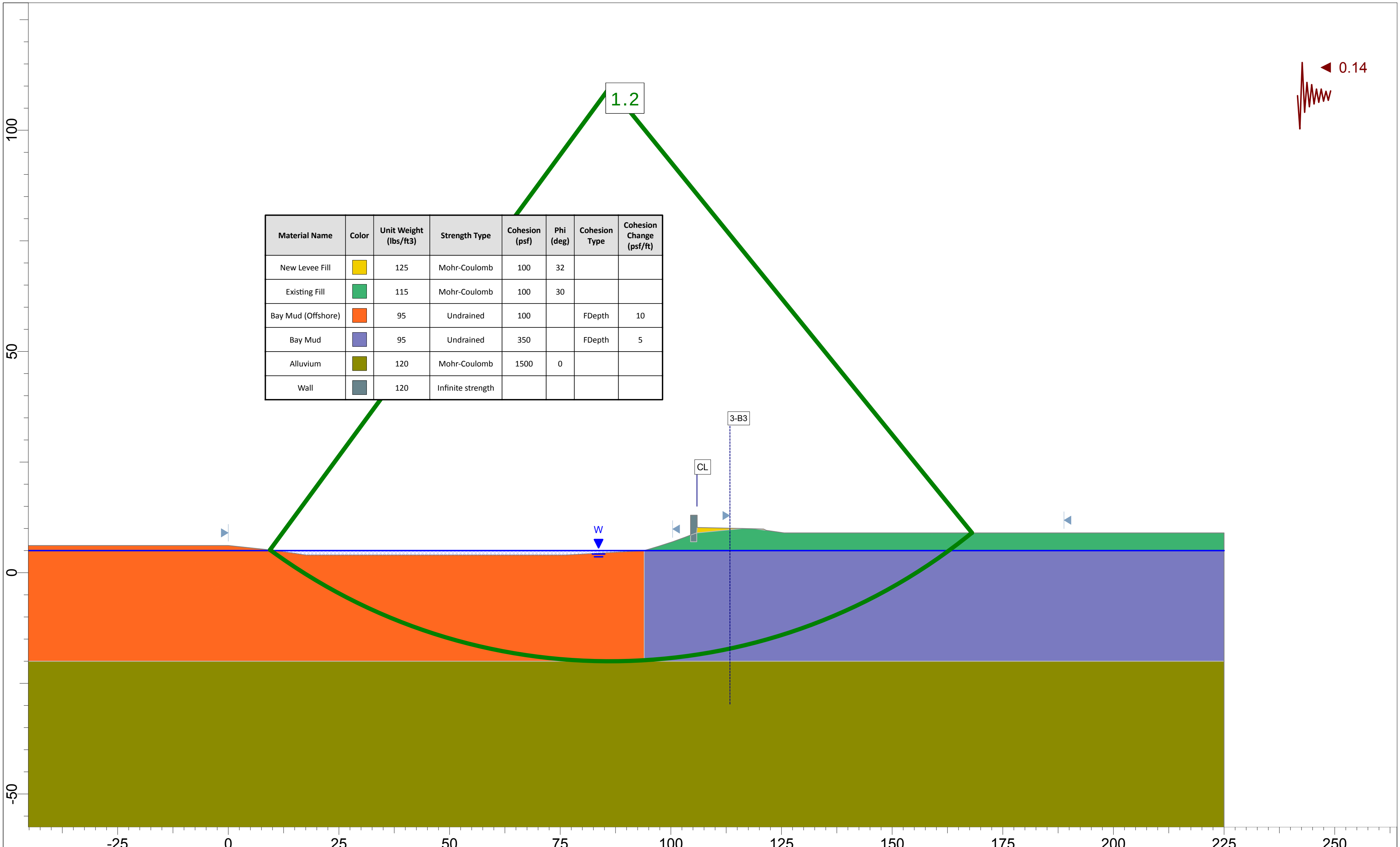
SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements		
Analysis Description	STA 315 - Seepage		
Drawn By JSY	*Scale* 1:240	*Company*	ENGEO Incorporated
Date 2017 October 16		*File Name*	sec315 - seep.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	350		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				

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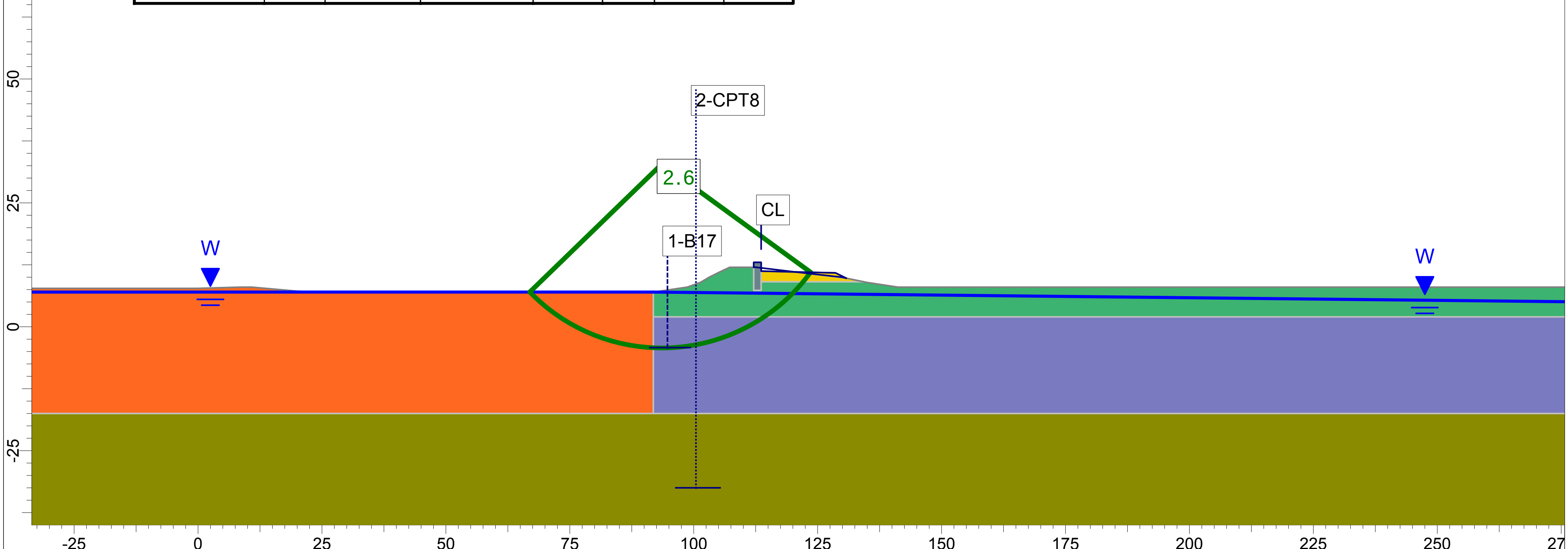
SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements		
Analysis Description	STA 315 - Earthquake		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	Sec315 -kh.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	300		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



ENGEO
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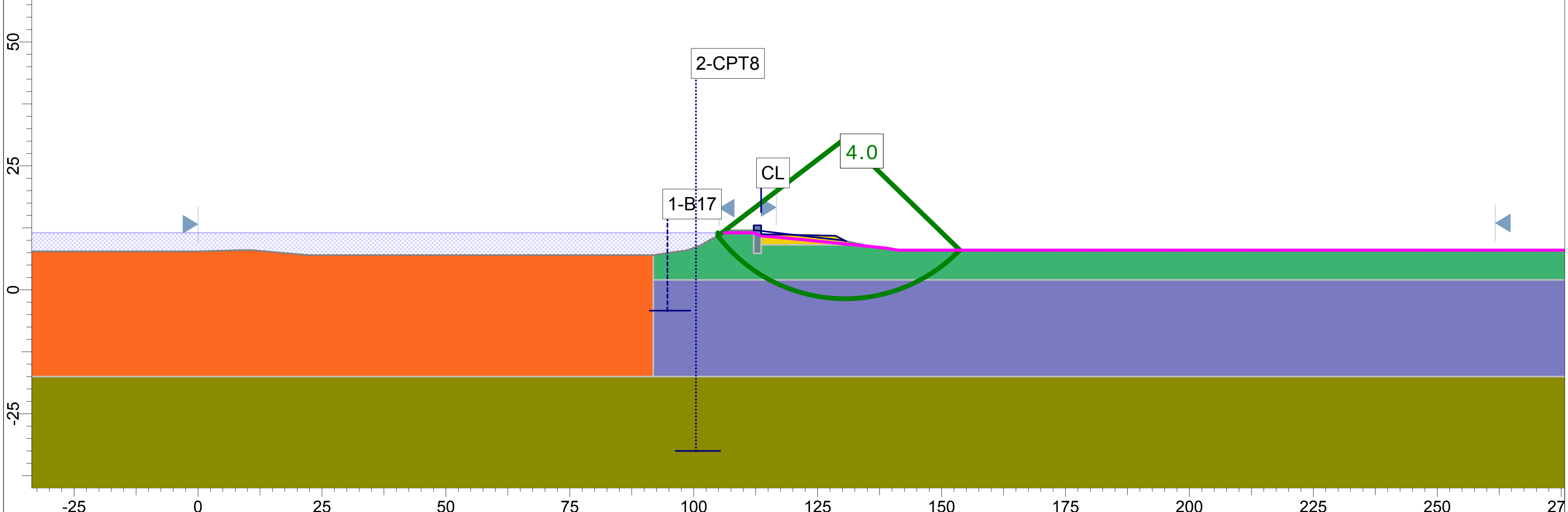
SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements
Analysis Description	STA 335 - End of Construction
Drawn By JSY	*Scale* 1:360
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec335.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		125	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	300		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



Project	Foster City Levee Improvements
Analysis Description	STA 335 - Seepage
Drawn By	JSY
Scale	1:360
Company	ENGEO Incorporated
Date	2017 October 16
File Name	Sec335 - seep stab.slim

ENGEO
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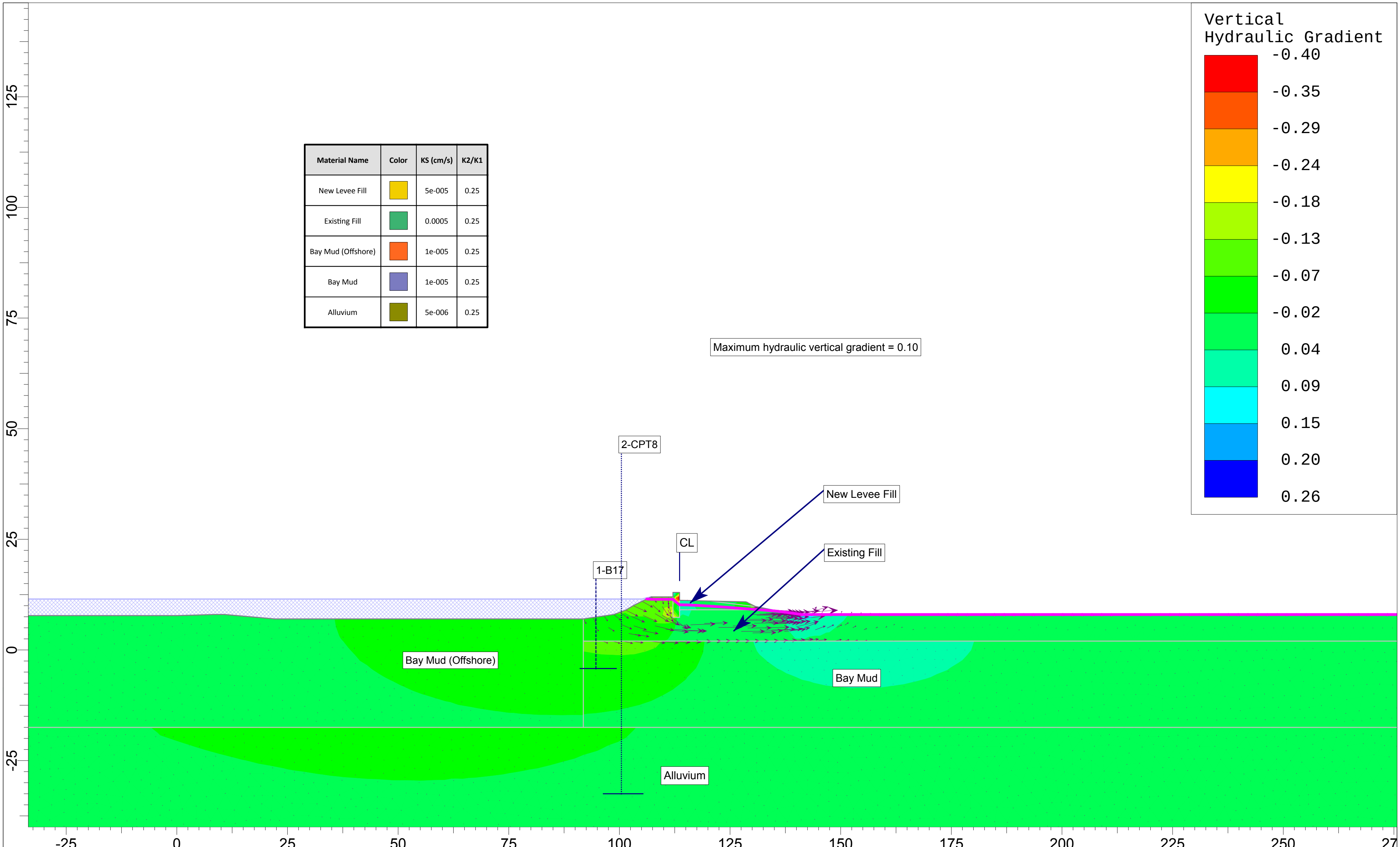
SLIDEINTERPRET 7.023



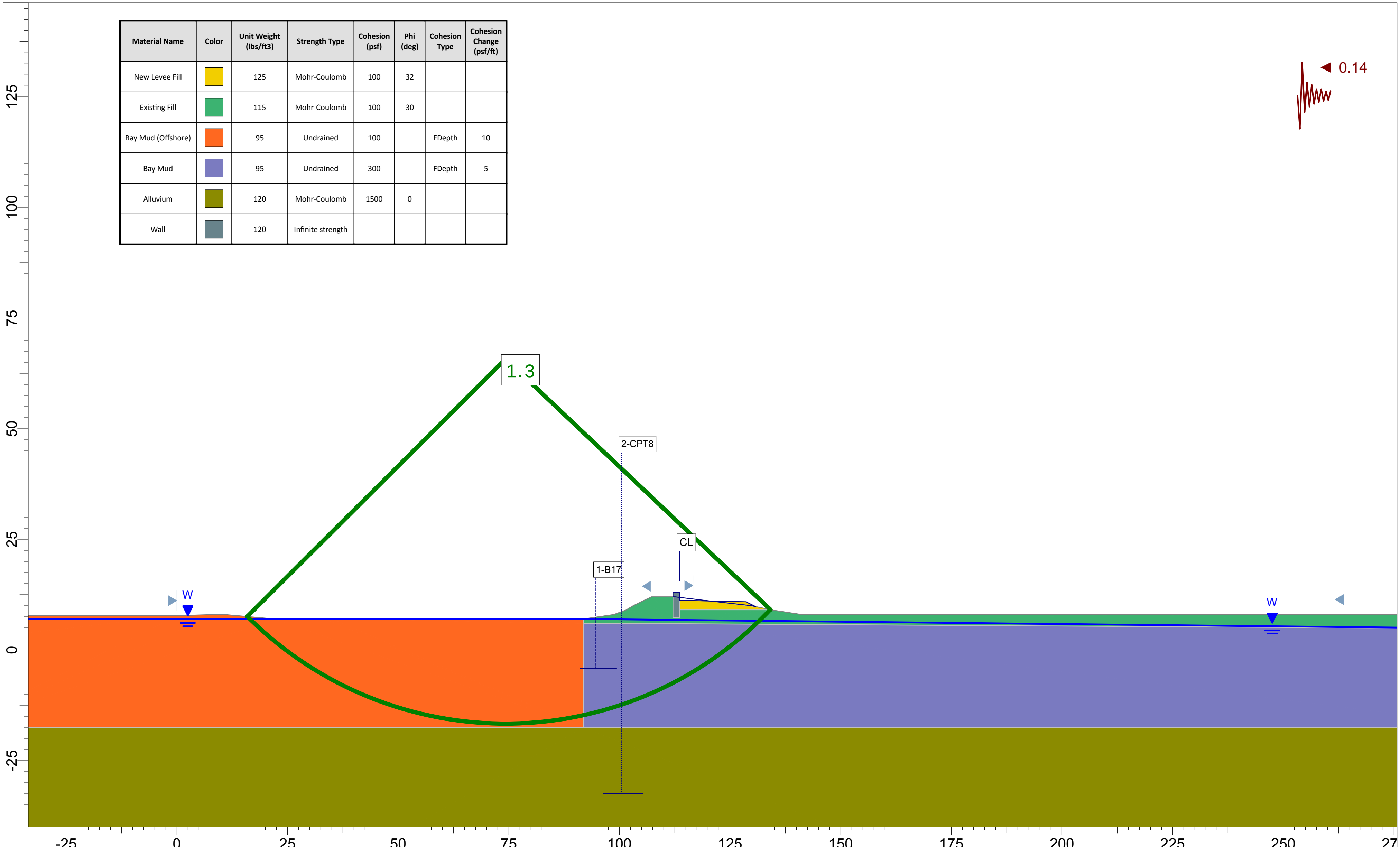
Material Name	Color	KS (cm/s)	K2/K1
New Levee Fill		5e-005	0.25
Existing Fill		0.0005	0.25
Bay Mud (Offshore)		1e-005	0.25
Bay Mud		1e-005	0.25
Alluvium		5e-006	0.25

ENGEO Expect Excellence

SLIDEINTERPRET 7.023

Project	Foster City Levee Improvements		
Analysis Description	STA 335 - Seepage		
Drawn By JSY	*Scale* 1:360	*Company*	ENGEO Incorporated
Date	2017 October 16	*File Name*	sec335 - seep.slim

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Cohesion Type	Cohesion Change (psf/ft)
New Levee Fill		125	Mohr-Coulomb	100	32		
Existing Fill		115	Mohr-Coulomb	100	30		
Bay Mud (Offshore)		95	Undrained	100		FDepth	10
Bay Mud		95	Undrained	300		FDepth	5
Alluvium		120	Mohr-Coulomb	1500	0		
Wall		120	Infinite strength				



ENGEO Expect Excellence	*Project*	Foster City Levee Improvements	
	Analysis Description	STA 335 - End of Construction	
	Drawn By JSY	*Scale* 1:360	*Company* ENGEO Incorporated
SLIDEINTERPRET 7.023	*Date* 2017 October 16		*File Name* Sec335 - kh.slim

DRAFT

APPENDIX F

Levee Reconnaissance

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	1:18 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 0+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	12 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Ties into San Mateo Levee, which appeared to be ~2 ft higher than the Foster City Levee

Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	1H:1V to 2H:1V
Slope Condition:	Vegetated
Signs of Borrowing?	Yes
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	1:13 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 12+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	15 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Fence along water side. Large marsh land on water side.

Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	2H:1V
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Parking Lot on the land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:		Weather:	

Levee Segment Observations at Station 16+00

Top of Levee

Type of Cover:	Asphalt
Approx. Width:	12 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Dirt and green vegetation
Approx. Slope:	2H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	Gentle slope, some vegetation
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	1:09 PM	Weather:	Clear, warm

Levee Segment Observations at Station 22+00

Top of Levee

Type of Cover:	Paved and decomposed granite
Approx. Width:	30 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Huge tidal plain in from of levee.

Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	3H:1V or flatter
Slope Condition:	Rip rap 1 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Golf Course (high land) on land side.

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	1:05 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 30+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	20 feet with bike path
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	2H:1V
Slope Condition:	Rip rap with beach/ habitat rehab area in front
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	High ground (golf course) on land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	1:01 PM	Weather:	Clear, warm

Levee Segment Observations at Station 34+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	20 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	1H:1V
Slope Condition:	Rip rap 3 to 4 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Marshland on land side before sloping up

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	2:11 PM	Weather:	Sunny and windy

Levee Segment Observations at Station 40+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	4 feet
Cracks?	No
Settlement?	No
Flood Wall?	
Comments:	Very flat levee with bike trail

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2.5H:1V
Slope Condition:	0
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Very flat levee and bike trail on the land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Flat at toe, then slope up at 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:58 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 44+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	20 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Slow zone near golf course noted. May not an able to drill here

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	1H:1V
Slope Condition:	Rip rap 2 to 3 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Very flat levee and bike trail on the land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Flat at toe, then slope up at 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase: 001	Task: --
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler
Logged By:	SB	Date:	10/2/2015	Time: 2:05 PM	Weather: Sunny, bit windy

Levee Segment Observations at Station 52+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	4 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Levee is at the same level as bike trail

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Levee is at the same level as bike trail

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Flat at toe, then slope up at 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:54 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 56+00

Top of Levee

Type of Cover:	Paved and decomposed granite
Approx. Width:	20 feet with bike path
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

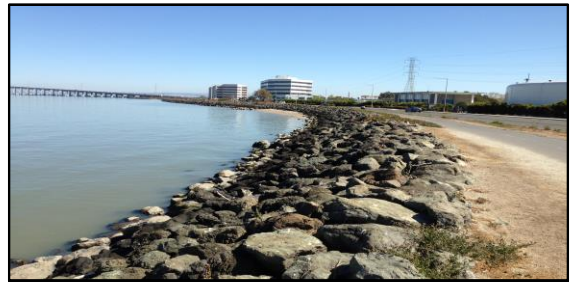
Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V
Slope Condition:	Rip rap 3 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Levee is at the same level as bike trail

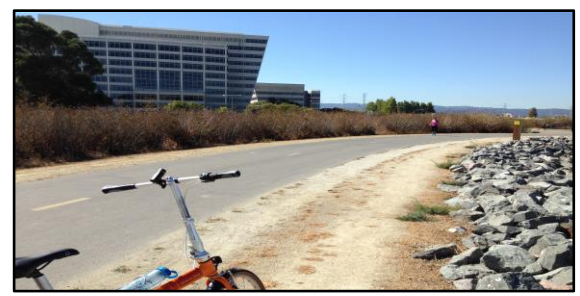
Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Flat at toe, then slope up at 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Beach in front of levee

Photographs





LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:49 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 66+00

Top of Levee

Type of Cover:	Paved and decomposed granite
Approx. Width:	10 to 20 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	1H:1V to near vertical
Slope Condition:	Rip rap 1 to 2 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Levee is at the same level as bike trail

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Flat at toe, then slope up at 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:45 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 76+00

Top of Levee

Type of Cover:	Some vegetation and some pavement
Approx. Width:	15 feet with bike path
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Flat at toe, then slope up at 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:42 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 84+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	15 feet with a 8 feet wide bike path
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Observed a culvert and associated discharge pipe as well as concrete abutment walls

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	3H:1V
Slope Condition:	Rip rap 2 to 3 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Flat at toe, then slope up at 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001
				Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler
Logged By:	SB	Date:	10/2/2015	Time:	11:48 AM
				Weather:	Sunny

Levee Segment Observations at Station 88+00

Top of Levee

Type of Cover:	Asphalt
Approx. Width:	8 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Small holes observed on asphalt cover

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	Flat
Slope Condition:	stable
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Green vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:38 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 92+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	15 feet with bike path
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	3H:1V
Slope Condition:	Rip rap 3 to 5 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Green vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Creek/ drainage slough located on the land sider

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase: 001	Task: --
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler
Logged By:	SB	Date:	10/2/2015	Time: 1:42 PM	Weather:

Levee Segment Observations at Station 98+00

Top of Levee

Type of Cover:	Riprap
Approx. Width:	15 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	3H:1V
Slope Condition:	
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Green vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Small holes observed on asphalt cover

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:30pm	Weather:	Clear, warm breezy

Levee Segment Observations at Station 112+00

Top of Levee

Type of Cover:	Paved
Approx. Width:	10 to 20 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V and steeper
Slope Condition:	Rip rap 3 to 5 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Green vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase: 001	Task: --
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler
Logged By:	SB	Date:	10/2/2015	Time: 1:25 PM	Weather: Sunny

Levee Segment Observations at Station 116+00

Top of Levee

Type of Cover:	asphalt and dirt
Approx. Width:	15 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Small holes observed on the surface of the bike trail

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	1.5H:1V
Slope Condition:	
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Small holes observed on the surface of the bike trail

Land Side Slope of Levee

Type of Cover:	Green vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Small holes observed on asphalt cover

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:25 PM	Weather:	Clear, warm breezy

Levee Segment Observations at Station 120+00

Top of Levee

Type of Cover:	Fine gravel cover
Approx. Width:	8 feet at turn and widen to 40 feet under bridge
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Located below San Mateo Bridge

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V to near vertical
Slope Condition:	Rip rap 1 to 5 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Small holes observed on the surface of the bike trail

Land Side Slope of Levee

Type of Cover:	Building is present
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Building appears to be 4 to 5 ft. lower than levee. Concrete wall at the levee

Photographs





LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	1:17 PM	Weather:	

Levee Segment Observations at Station 122+00

Top of Levee

Type of Cover:	Asphalt
Approx. Width:	5 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Vegetated, rip rap
Approx. Slope:	1H:1V to 2H:1V
Slope Condition:	
Signs of Borrowing?	
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Vegetation and bridget structure
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:19 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 124+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	10 feet widen to over 50 feet at hwy 92 abutment
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	PGE tower

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V and a bit steeper
Slope Condition:	Rip rap 4to 5 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	vegetation
Approx. Slope:	Flat
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs






LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:15 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 134+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	15 to 20 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	1H:1V and steeper
Slope Condition:	Rip rap 2 to 3 ft long
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	A structure supported on 6 steel piles observed in waterside. Rip rap appears to be larger in size than previous section

Land Side Slope of Levee

Type of Cover:	Green vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:10 PM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 146+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	15 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Open water, but bank appears to be gentle

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	1H:1V and steeper
Slope Condition:	Rip rap 1 to 3 ft long
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Green vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Small holes observed on asphalt cover

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	1:03 PM	Weather:	Sunny

Levee Segment Observations at Station 150+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	4 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Crest of levee is level with bike trail

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	Flat
Slope Condition:	
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	12:06 PM	Weather:	Clear, warm breezy

Levee Segment Observations at Station 156+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	5 to 8 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	1V:1H and steeper
Slope Condition:	Riprap 1 to 3 ft in length
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	12:56 PM	Weather:	Sunny

Levee Segment Observations at Station 164+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	10 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

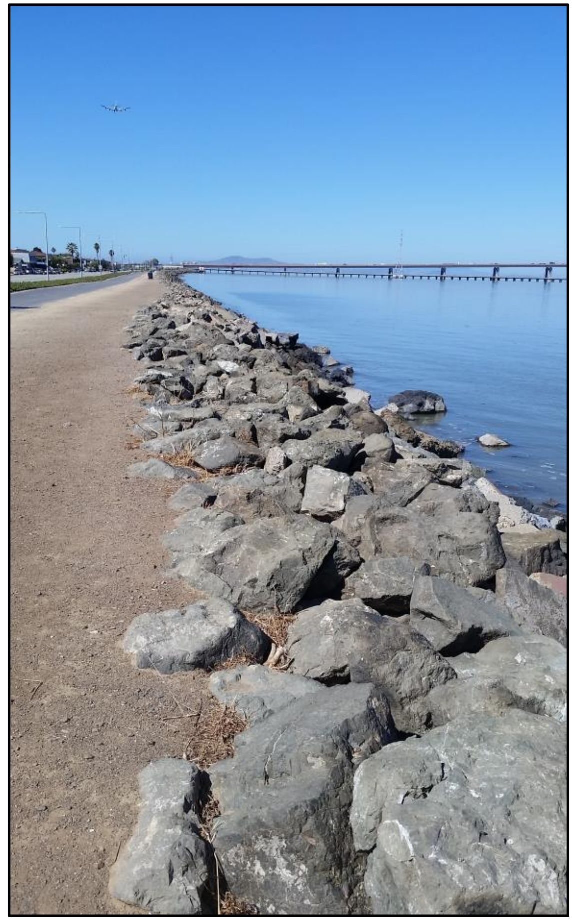
Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs



LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:51 AM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 170+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	30 feet plus
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V to 1H:1V
Slope Condition:	Rip rap about 1 to 3 feet long
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:36 AM	Weather:	Clear, warm, light wind

Levee Segment Observations at Station 186+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	5 to 8 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V
Slope Condition:	Bare with riprap protection
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs





LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:32 AM	Weather:	Warm, clear, light wind

Levee Segment Observations at Station 188+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	8 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	Wide beach on water side

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V and steeper
Slope Condition:	Light vegatation
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:28 AM	Weather:	Clear, warm breezy

Levee Segment Observations at Station 196+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	12 to 15 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

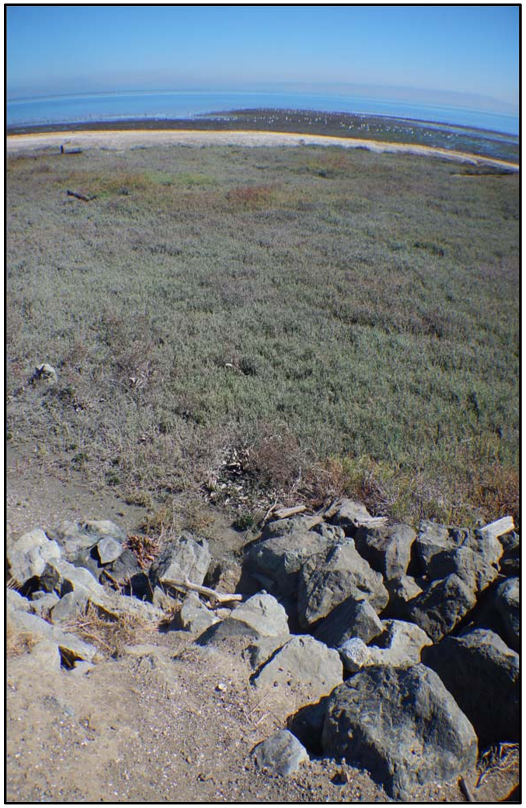
Type of Cover:	Riprap
Approx. Slope:	2H:1V
Slope Condition:	Some riprap. Riprap protection about to end here
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs



LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:19 AM	Weather:	Clear, warm breezy

Levee Segment Observations at Station 210+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	10 feet then widens to over 20 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Rip rap about 1 to 2 ft long in size. Beach observed in front to riprap

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs





LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:08 AM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 218+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	12 to15 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V
Slope Condition:	Some vegetation
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Rip rap about 1 to 2 ft long in size. Beach observed in front to riprap

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	12:26 PM	Weather:	Sunny

Levee Segment Observations at Station 220+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	3 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	Top of levee relatively flat

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Rip rap about 1 to 2 ft long in size. Beach observed in front to riprap

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:04 AM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 228+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	12 to 15 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Riprap
Approx. Slope:	2H:1V, marshland is very flat at toe of slope
Slope Condition:	Little vegetation
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Rip rap about 1 to 2 ft long in size. Beach observed in front to riprap

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	11:00 AM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 240+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	8 to 10 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	Two more erosion gullies toward the marshland observed

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	2H:1V
Slope Condition:	Little vegetation
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Slope slightly towards land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Crest of levee is level with bike trail

Photographs






LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:56 AM	Weather:	Clear, warm, light wind

Levee Segment Observations at Station 246+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	3 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	An erosion gully leading toward the marshland observed

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	3H:1V
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Slope slightly towards land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:51 AM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 258+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	3 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	2H:1V with vertical at bottom
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	1 PG&E tower; debris observed in the marshland, slough and near PGEX tower base

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relative Flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly toward bike bath

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:46 AM	Weather:	Clear, warm breezy

Levee Segment Observations at Station 266+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	2 to 5 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

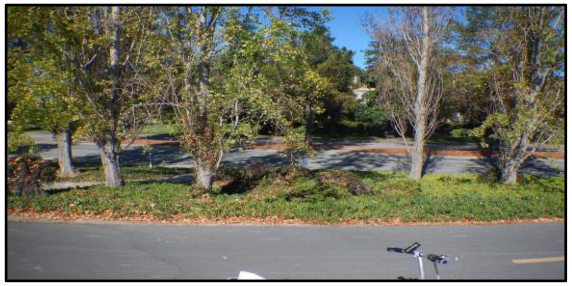
Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	1H:1V to near vertical. Tall levee slope, ~10-12 ft high
Slope Condition:	Little vegatation
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Narrow top of levee; Possible rig access point Some erosion at toe of slope

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	11:54 AM	Weather:	Sunny

Levee Segment Observations at Station 268+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	1 to 2 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	narrow top of levee and steep slopes on water and land side

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	1H:1V
Slope Condition:	Stable
Signs of Borrowing?	Yes
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	narrow top of levee and steep slopes on water and land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:43 AM	Weather:	Clear and warm. Breezy

Levee Segment Observations at Station 272+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	2 to 3 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	1H:1V to 2H:1V
Slope Condition:	Little vegetation. Bare soil
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	narrow top of levee and steep slopes on water and land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs



LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:37 AM	Weather:	Clear and warm. Starts to get windy.

Levee Segment Observations at Station 278+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	8 to 10 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	1H:1V and steeper
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	narrow top of levee and steep slopes on water and land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs






LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase: 001	Task: --
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler
Logged By:	SB	Date:	10/2/2015	Time: 11:47 AM	Weather: Sunny

Levee Segment Observations at Station 280+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	2 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	Steeper slope toward the land side

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	2H:1V
Slope Condition:	Stable; relatively flat
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Steeper slope toward the land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:23 AM	Weather:	Clear and warm

Levee Segment Observations at Station 286+00

Top of Levee

Type of Cover:	Dirt transition to paved
Approx. Width:	10 feet and widen to 30 feet
Cracks?	No
Settlement?	No
Flood Wall?	Yes
Comments:	Wall appears to have little distress. Square concrete piles observed near pumps

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	1H:1V to vertical at flood wall
Slope Condition:	Vegetated to concrete wall. Wall is about 8 to 10ft
Signs of Borrowing?	
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Steeper slope toward the land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs





LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:20 AM	Weather:	Clear and warm

Levee Segment Observations at Station 294+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	12 to 15 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	2H:1V
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Slope slightly towards land side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase: 001	Task: --
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler
Logged By:	JYK	Date:	10/2/2015	Time: 10:16 AM	Weather: Sunny and warm

Levee Segment Observations at Station 302+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	10 to 12 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	Large marshland on water side. Fence on land side

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	3H:1V
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Levee widens up

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:12 AM	Weather:	Sunny and warm

Levee Segment Observations at Station 306+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	5 to 8 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	Large open flat land on the water side

Water Side Slope of Levee

Type of Cover:	Vegetation
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Large open flat land on the water side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs





LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:08 AM	Weather:	Clear and warm

Levee Segment Observations at Station 312+00

Top of Levee

Type of Cover:	Dirt with paved path on the side
Approx. Width:	5 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Vegetation
Approx. Slope:	3H:1V
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Large open flat land on the water side

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	10:05 AM	Weather:	Clear and warm

Levee Segment Observations at Station **320+00**

Top of Levee

Type of Cover:	Dirt
Approx. Width:	1 to 2 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	1H:1V to 2H:1V
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Elevation lower than previous section. Levee is about level to the land side bike trail

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase: 001	Task: --
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler
Logged By:	JYK	Date:	10/2/2015	Time: 9:59 AM	Weather: Clear and warm

Levee Segment Observations at Station 328+00

Top of Levee

Type of Cover:	Dirt with paved bike path
Approx. Width:	3 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	Water side levee slope is very gentle

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	2H:1V and flatter
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Elevation lower than previous section. Levee is about level to the land side bike trail

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:		Weather:	

Levee Segment Observations at Station 334+00

Top of Levee

Type of Cover:	
Approx. Width:	1 to 2 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	Waterside slope is very flat although levee slope is steep

Water Side Slope of Levee

Type of Cover:	
Approx. Slope:	1.5H:1V
Slope Condition:	;teeper than previous section at top of levee; flattens out at the to
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Waterside slope is very flat although levee slope is steep

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:		Weather:	

Levee Segment Observations at Station 338+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	3 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	
Comments:	Possible drill rig access point. Very flat waterside slope although levee slope is steep.

Water Side Slope of Levee

Type of Cover:	
Approx. Slope:	2H:1V and steeper
Slope Condition:	
Signs of Borrowing?	
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Waterside slope is very flat although levee slope is steep

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Slope slightly towards land side

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:		Weather:	

Levee Segment Observations at Station 342+00

Top of Levee

Type of Cover:	
Approx. Width:	6 feet
Cracks?	No
Settlement?	Yes
Flood Wall?	No
Comments:	

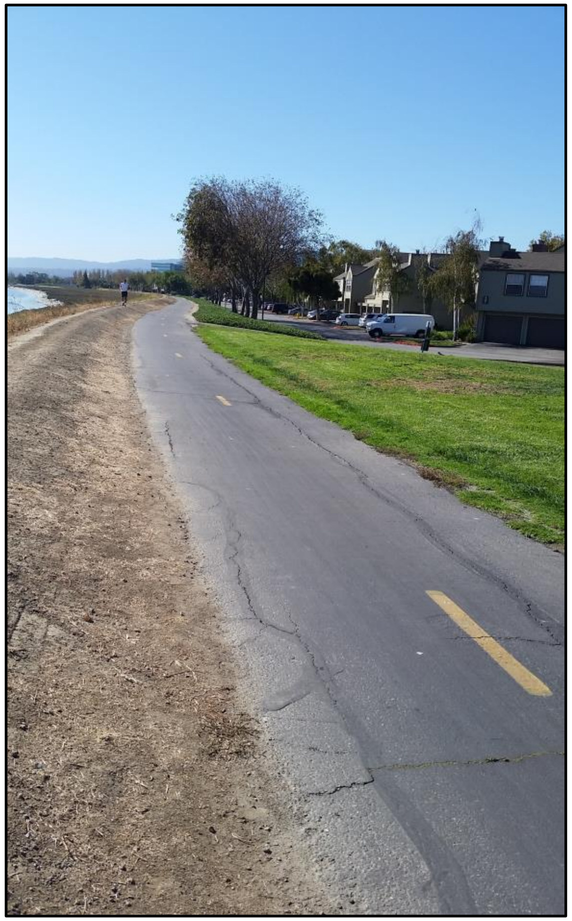
Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	Flattens out toward channel
Slope Condition:	
Signs of Borrowing?	Yes
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	Minor cracking due to settlement
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs



LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:		Date:	12:00:00 AM	Time:		Weather:	

Levee Segment Observations at Station 344+00

Top of Levee

Type of Cover:	Dirt
Approx. Width:	3 ft
Cracks?	Yes
Settlement?	Yes
Flood Wall?	
Comments:	Bike path on land side. No flood wall.

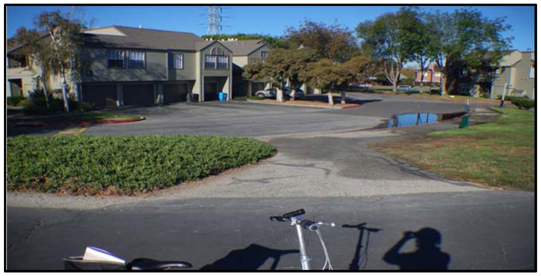
Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	2H:1V or flatter
Slope Condition:	Approximately 10 to 15 ft high and 3ft wide at top
Signs of Borrowing?	
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Bike Path on Land side
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs



LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:		Weather:	

Levee Segment Observations at Station 350+00

Top of Levee

Type of Cover:	Earthen berm, dry vegegetation
Approx. Width:	6 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	Minor cracking and slight settlement

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	
Slope Condition:	Sharper decline at top fo levee; gradually flattens out at toe
Signs of Borrowing?	Yes
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Minor cracking and slight settlement

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	Some sloping due to settlement
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Minor cracking and slight settlement

Photographs



LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--		
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler				
Logged By:	SB	Date:	10/2/2015	Time:	10:29 AM	Weather:	Sunny		

Levee Segment Observations at Station 370+00

Top of Levee

Type of Cover:	Earthen berm, dry vegegetation
Approx. Width:	6 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	
Slope Condition:	Steeper slope towards the water
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	10:19 AM	Weather:	Sunny

Levee Segment Observations at Station 378+00

Top of Levee

Type of Cover:	Earthen berm
Approx. Width:	6 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	minor cracking

Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	Gently sloping
Slope Condition:	signs of settlement
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	Dirt with Bike Path on the Side
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	10:09 AM	Weather:	Sunny

Levee Segment Observations at Station **386+00**

Top of Levee

Type of Cover:	Soil, some dry vegetation
Approx. Width:	6 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	minor cracking

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	
Slope Condition:	Steeper slope towards the water
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	minor cracking

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	minor cracking

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	SB	Date:	10/2/2015	Time:	9:53 AM	Weather:	Sunny

Levee Segment Observations at Station 392+00

Top of Levee

Type of Cover:	Dry grasses, vegetion, concrete floodwall
Approx. Width:	3 feet
Cracks?	Yes
Settlement?	Yes
Flood Wall?	Yes
Comments:	Wider section than previous section

Water Side Slope of Levee

Type of Cover:	Dry grasses and heavy vegetation
Approx. Slope:	
Slope Condition:	Steeper slope towards the water
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Wider section than previous section

Land Side Slope of Levee

Type of Cover:	Asphalt
Approx. Slope:	Relatively flat
Slope Condition:	0
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Wider section than previous section

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:		Date:	10/2/2015	Time:		Weather:	

Levee Segment Observations at Station 414+00

Top of Levee

Type of Cover:	
Approx. Width:	
Cracks?	No
Settlement?	No
Flood Wall?	Yes
Comments:	

Water Side Slope of Levee

Type of Cover:	Dry grasses
Approx. Slope:	
Slope Condition:	Gentle slope, minor settlement
Signs of Borrowing?	Yes
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:		Date:	10/2/2015	Time:		Weather:	

Levee Segment Observations at Station **418+00**

Top of Levee

Type of Cover:	
Approx. Width:	
Cracks?	Yes
Settlement?	Yes
Flood Wall?	No
Comments:	

Water Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	Some settlement, minor cracking, , dry veg
Signs of Borrowing?	Yes
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	Gentle slope, some vegetation
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs




LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:		Date:	10/2/2015	Time:	9:41 AM	Weather:	Sunny

Levee Segment Observations at Station 402+00

Top of Levee

Type of Cover:	Floodwall
Approx. Width:	1 feet
Cracks?	Yes
Settlement?	No
Flood Wall?	Yes
Comments:	Minor cracking in floodwall, dry vegetation

Water Side Slope of Levee

Type of Cover:	Dry grasses, heavier vegetation near water
Approx. Slope:	
Slope Condition:	Steeper slope towards floodwall
Signs of Borrowing?	Yes
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	Minor cracking in floodwall, dry vegetation

Land Side Slope of Levee

Type of Cover:	Dirt covered with leaves
Approx. Slope:	
Slope Condition:	Some cracks in bike trail
Signs of Borrowing?	No
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	Minor cracking in floodwall, dry vegetation

Photographs

LEVEE RECONNAISSANCE

Project Information

Project Name:	Foster City Levee Improvements	Project No.:	8602.001.000	Phase:	001	Task:	--
Project Location:	San Mateo City Limit (Sta. 0+00) to O'Neil Tide Gate (Sta. 427+00)			Client:	Schaaf & Wheeler		
Logged By:	JYK	Date:	10/2/2015	Time:	9:20 AM	Weather:	Clear, warm, breezy

Levee Segment Observations at Station 428+00

Top of Levee

Type of Cover:	Concrete
Approx. Width:	10 to 15 feet
Cracks?	No
Settlement?	No
Flood Wall?	No
Comments:	O'Neil Tide Gate Location

Water Side Slope of Levee

Type of Cover:	Vegetated
Approx. Slope:	Concrete Wall at Flood Gate; 2:1 on side
Slope Condition:	Vegetated
Signs of Borrowing?	No
Comments e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion	

Land Side Slope of Levee

Type of Cover:	
Approx. Slope:	
Slope Condition:	
Signs of Borrowing?	
Comments: e.g culverts, pipes, riprap, wells, ponding, water, fence, erosion, trash	

Photographs




DRAFT

APPENDIX G

Supplemental Recommendations

TABLE OF CONTENTS

GENERAL INFORMATION

PREFACE

These supplemental recommendations are intended as a guide for earthwork and are in addition to any previous earthwork recommendations made by the Geotechnical Engineer. If there is a conflict between these supplemental recommendations and any previous recommendations, it should be immediately brought to the attention of ENGEO. Testing standards identified in this document shall be the most current revision (unless stated otherwise).

DEFINITIONS

BACKFILL	Soil, rock or soil-rock material used to fill excavations and trenches.
DRAWINGS	Documents approved for construction which describe the work.
THE GEOTECHNICAL ENGINEER	The project geotechnical engineering consulting firm, its employees, or its designated representatives.
ENGINEERED FILL	Fill upon which the Geotechnical Engineer has made sufficient observations and tests to confirm that the fill has been placed and compacted in accordance with geotechnical engineering recommendations.
FILL	Soil, rock, or soil-rock materials placed to raise the grades of the site or to backfill excavations.
IMPORTED MATERIAL	Soil and/or rock material which is brought to the site from offsite areas.
ONSITE MATERIAL	Soil and/or rock material which is obtained from the site.
OPTIMUM MOISTURE	Water content, percentage by dry weight, corresponding to the maximum dry density as determined by ASTM D-1557.
RELATIVE COMPACTION	The ratio, expressed as a percentage, of the in-place dry density of the fill or backfill material as compacted in the field to the maximum dry density of the same material as determined by ASTM D-1557.
SELECT MATERIAL	Onsite and/or imported material which is approved by the Geotechnical Engineer as a specific-purpose fill.

PART I - EARTHWORK

1.0 GENERAL

1.1 WORK COVERED

Supplemental recommendations for performing earthwork and grading. Activities include:

- ✓ Site Preparation and Demolition
- ✓ Excavation
- ✓ Grading
- ✓ Backfill of Excavations and Trenches
- ✓ Engineered Fill Placement, Moisture Conditioning, and Compaction

1.2 CODES AND STANDARDS

The contractor should perform their work complying with applicable occupational safety and health standards, rules, regulations, and orders. The Occupational Safety and Health Standards (OSHA) Board is the only agency authorized in the State to adopt and enforce occupational safety and health standards (Labor Code § 142 et seq.). The owner, their representative and contractor are responsible for site safety; ENGEO representatives are not responsible for site safety.

Excavating, trenching, filling, backfilling, shoring and grading work should meet the minimum requirements of the applicable Building Code, and the standards and ordinances of state and local governing authorities.

1.3 TESTING AND OBSERVATION

Site preparation, cutting and shaping, excavating, filling, and backfilling should be carried out under the testing and observation of ENGEO. ENGEO shall be retained to perform appropriate field and laboratory tests to check compliance with the recommendations. Any fill or backfill that does not meet the supplemental recommendations shall be removed and/or reworked, until the supplemental recommendations are satisfied.

Tests for compaction shall be made in accordance with test procedures outlined in ASTM D-1557, as applicable, unless other testing methods are deemed appropriate by ENGEO. These and other tests shall be performed in accordance with accepted testing procedures, subject to the engineering discretion of ENGEO.

2.0 MATERIALS

2.1 STANDARD

Materials, tools, equipment, facilities, and services as required for performing the required excavating, trenching, filling and backfilling should be furnished by the Contractor.

2.2 ENGINEERED FILL AND BACKFILL

Material to be used for engineered fill and backfill should be free from organic matter and other deleterious substances, and of such quality that it will compact thoroughly without excessive voids when watered and rolled.

Unless specified elsewhere by ENGEO, engineered fill and backfill shall be free of significant organics, or any other unsatisfactory material. In addition, engineered fill and backfill shall comply with the grading requirements shown in the following table:

TABLE 2.2-1: Engineered Fill and Backfill Requirements

US STANDARD SIEVE	PERCENTAGE PASSING
3"	100
No. 4	35–100
No. 30	20–100

Earth materials to be used as engineered fill and backfill shall be cleared of debris, rubble and deleterious matter. Rocks and aggregate exceeding the maximum allowable size shall be removed from the site. Rocks of maximum dimension in excess of two-thirds of the lift thickness shall be removed from any fill material to the satisfaction of ENGEO.

ENGEO shall be immediately notified if potential hazardous materials or suspect soils exhibiting staining or odor are encountered. Work activities shall be discontinued within the area of potentially hazardous materials. ENGEO shall be notified at least 72 hours prior to the start of filling and backfilling operations. Materials to be used for filling and backfilling shall be submitted to ENGEO no less than 10 days prior to intended delivery to the site. Unless specified elsewhere by ENGEO, where conditions require the importation of low expansive fill material, the material shall be an inert, low to non-expansive soil, or soil-rock material, free of organic matter and meeting the following requirements:

TABLE 2.2-2: Imported Fill Material Requirements

	SIEVE SIZE	PERCENT PASSING
GRADATION (ASTM D-421)	2-inch	100
	#200	15 - 70
PLASTICITY (ASTM D-4318)	Plasticity Index < 12	
ORGANIC CONTENT (ASTM D-2974)	Less than 2 percent	

A sample of the proposed import material should be submitted to ENGEO no less than 10 days prior to intended delivery to the site.

2.3 SUBDRAINS

A subdrain system is an underground network of piping used to remove water from areas that collect or retain surface water or subsurface water. Subsurface water is collected by allowing water into the pipe through perforations. Subdrain systems may drain and discharge to an appropriate outlet such as storm drain, natural swales or drainage, etc.. Details for subdrain systems may vary depending on many items, including but not limited to site conditions, soil types, subdrain spacing, depth of the pipe and pervious medium, as well as pipe diameter.

2.4 PIPE

Subdrain pipe shall conform with these supplemental recommendations unless specified elsewhere by ENGEO. Perforated pipe for various depths shall be manufactured in accordance with the following requirements:

TABLE 2.4-1: Perforated Pipe Requirements

PIPE TYPE	STANDARD	TYPICAL SIZES (INCHES)	PIPE STIFFNESS (PSI)
PIPE STIFFNESS ABOVE 200 PSI (BELOW 50 FEET OF FINISHED GRADE)			
ABS SDR 15.3		4 to 6	450
PVC Schedule 80	ASTM D1785	3 to 10	530
PIPE STIFFNESS BETWEEN 100 PSI AND 150 PSI (BETWEEN 15 AND 50 FEET OF FINISHED GRADE)			
ABS SDR 23.5	ASTM D2751	4 to 6	150
PVC SDR 23.5	ASTM D3034	4 to 6	153
PVC Schedule 40	ASTM D1785	3 to 10	135
ABS Schedule 40/DWV	ASTM D1527 & D2661	3 to 10	
PIPE STIFFNESS BETWEEN 45 PSI AND 50 PSI* (BETWEEN 0 TO 15 FEET OF FINISHED GRADE)			
PVC A-2000	ASTM F949	4 to 10	50
PVC SDR 35	ASTM D3034	4 to 8	46
ABS SDR 35	ASTM D2751	4 to 8	45
Corrugated PE	AASHTO M294 Type S	4 to 10	45

***Pipe with a stiffness less than 45 psi should not be used.**

Other pipes not listed in the table above shall be submitted for review by the Geotechnical Engineer not less 72 hours before proposed use.

2.5 OUTLETS AND RISERS

Subdrain outlets and risers must be fabricated from the same material as the subdrain pipe. Outlet and riser pipe and fittings must not be perforated. Covers must be fitted and bolted into the riser pipe or elbow. Covers must seat uniformly and not be subject to rocking.

2.6 PERMEABLE MATERIAL

Permeable material shall generally conform to Caltrans Standard Specification unless specified otherwise by ENGEO. Class 2 permeable material shall comply with the gradation requirements shown in the following table.

TABLE 2.6-1: Class 2 Permeable Material Grading Requirements

SIEVE SIZES	PERCENTAGE PASSING
1"	100
3/4"	90 to 100
3/8"	40 to 100
No. 4	25 to 40
No. 8	18 to 33
No. 30	5 to 15
No. 50	0 to 7
No. 200	0 to 3

2.7 FILTER FABRIC

Filter fabric shall meet the following Minimum Average Roll Values unless specified elsewhere by ENGEO.

Grab Strength (ASTM D-4632) .... 180 lbs
Mass per Unit Area (ASTM D-4751) ....6 oz/yd^2
Apparent Opening Size (ASTM D-4751) ....70-100 U.S. Std. Sieve
Flow Rate (ASTM D-4491)... 80 gal/min/ft^2
Puncture Strength (ASTM D-4833) .... 80 lbs

Areas to receive filter fabric must comply with the compaction and elevation tolerance specified for the material involved. Handle and place filter fabric under the manufacturer's instructions. Align and place filter fabric without wrinkles.

Overlap adjacent roll ends of filter fabric in accordance with manufacturer’s recommendations. The preceding roll must overlap the following roll in the direction that the permeable material is being spread. Completely replace torn or punctured sections damaged during placement or repair by placing a piece of filter fabric that is large enough to cover the damaged area and comply with the overlap specified. Cover filter fabric with the thickness of overlying material shown within 72 hours of placing the fabric.

2.8 GEOCOMPOSITE DRAINAGE

Geocomposite drainage is a prefabricated material that includes filter fabric and plastic pipe. Filter fabric must be Class A. The drain shall be of composite construction consisting of a supporting structure or drainage core material surrounded by a geotextile. The geotextile shall encapsulate the drainage core and prevent random soil intrusion into the drainage structure. The drainage core material shall consist of a three-dimensional polymeric material with a structure that permits flow along the core laterally. The core structure shall also be constructed to permit flow regardless of the water inlet surface. The drainage core shall provide support to the geotextile.

A geotextile flap shall be provided along drainage core edges. This flap shall be of sufficient width for sealing the geotextile to the adjacent drainage structure edge to prevent soil intrusion into the structure during and after installation. The geotextile shall cover the full length of the core. The geocomposite core shall be furnished with an approved method of constructing and connecting with outlet pipes. If the fabric on the geocomposite drain is torn or punctured, replace the damaged section completely. The specific drainage composite material and supplier shall be preapproved by ENGEO.

The Contractor shall submit a manufacturer's certification that the geocomposite meets the design properties and respective index criteria measured in full accordance with applicable test methods. The manufacturer's certification shall include a submittal package of documented test results that confirm the design values. In case of dispute over validity of design values, the Contractor will supply design property test data from a laboratory approved by ENGEO, to support the certified values submitted.

Geocomposite material suppliers shall provide a qualified and experienced representative onsite to assist the Contractor and ENGEO at the start of construction with directions on the use of drainage composite. If there is more than one application on a project, this criterion will apply to construction of the initial application only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining applications. The soil surface against which the geocomposite is to be placed shall be free of debris and inordinate irregularities that will prevent intimate contact between the soil surface and the drain.

Edge seams shall be formed by utilizing the flap of the geotextile extending from the geocomposite's edge and lapping over the top of the fabric of the adjacent course. The fabric flap shall be securely fastened to the adjacent fabric by means of plastic tape or non-water-soluble construction adhesive, as recommended by the supplier. To prevent soil intrusion, exposed edges of the geocomposite drainage core edge must be covered.

Approved backfill shall be placed immediately over the geocomposite drain. Backfill operations should be performed to not damage the geotextile surface of the drain. Also during operations, avoid excessive settlement of the backfill material. The geocomposite drain, once installed, shall not be exposed for more than 7 days prior to backfilling.

PART II - GEOGRID SOIL REINFORCEMENT

Geogrid soil reinforcement (geogrid) shall be submitted to ENGEO and should be approved before use. The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under construction stresses and shall have high resistance to damage during construction to ultraviolet degradation and to chemical and biological degradation encountered in the soil being reinforced. The geogrids shall have an Allowable Tensile Strength (T_a) and Pullout Resistance, for the soil type(s) as specified on design plans.

The contractor shall submit a manufacturer's certification that the geogrids supplied meet plans and project specifications. The contractor shall check the geogrid upon delivery to ensure that the proper material has been received. During periods of shipment and storage, the geogrid shall be protected from temperatures greater than 140°F, mud, dirt, dust, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the geogrid will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be repaired by placing a patch over the damaged area. Any geogrid damaged during storage or installation shall be replaced by the Contractor at no additional cost to the owner.

Geogrid material suppliers shall provide a qualified and experienced representative onsite at the initiation of the project, for a minimum of three days, to assist the Contractor and ENGEO personnel at the start of construction. If there is more than one slope on a project, this criterion will apply to construction of the initial slope only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s). Geogrid reinforcement may be joined with mechanical connections or overlaps as recommended and approved by the manufacturer. Joints shall not be placed within 6 feet of the slope face, within 4 feet below top of slope, nor horizontally or vertically adjacent to another joint.

The geogrid reinforcement shall be installed in accordance with the manufacturer's recommendations. The geogrid reinforcement shall be placed within the layers of the compacted soil as shown on the plans or as directed. The geogrid reinforcement shall be placed in continuous longitudinal strips in the direction of main reinforcement. However, if the Contractor is unable to complete a required length with a single continuous length of geogrid, a joint may be made with the manufacturer's approval. Only one joint per length of geogrid shall be allowed. This joint shall be made for the full width of the strip by using a similar material with similar strength. Joints in geogrid reinforcement shall be pulled and held taut during fill placement.

Adjacent strips, in the case of 100 percent coverage in plan view, need not be overlapped. The minimum horizontal coverage is 50 percent, with horizontal spacing between reinforcement no greater than 40 inches. Horizontal coverage of less than 100 percent shall not be allowed unless specifically detailed in the construction drawings. Adjacent rolls of geogrid reinforcement shall be overlapped or mechanically connected where exposed in a wrap around face system, as applicable.

The Contractor may place only that amount of geogrid reinforcement required for immediately pending work to prevent undue damage. After a layer of geogrid reinforcement has been placed, the next succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, the next geogrid reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of geogrid reinforcement and soil. Geogrid reinforcement shall be placed to lay flat and pulled tight prior to backfilling. After a layer of geogrid reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geogrid reinforcement in position until the subsequent soil layer can be placed.

Under no circumstances shall a track-type vehicle be allowed on the geogrid reinforcement before at least 6 inches of soil have been placed. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geogrid reinforcement. If approved by the Manufacturer, rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided. During construction, the surface of the fill should be kept approximately horizontal. Geogrid reinforcement shall be placed directly on the compacted horizontal fill surface. Geogrid reinforcements are to be placed as shown on plans, and oriented correctly.

PART III - GEOTEXTILE SOIL REINFORCEMENT

The specific geotextile material and supplier shall be preapproved by ENGEO. The contractor shall submit a manufacturer's certification that the geotextiles supplied meet the respective index criteria set when geotextile was approved by ENGEO, measured in full accordance with specified test methods and standards.

The contractor shall check the geotextile upon delivery to ensure that the proper material has been received. During periods of shipment and storage, the geotextile shall be protected from temperatures greater than 140°F, mud, dirt, dust, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the geotextile will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be repaired by placing a patch over the damaged area. Any geotextile damaged during storage or installation shall be replaced by the Contractor at no additional cost to the owner.

Geotextile material suppliers shall provide a qualified and experienced representative onsite at the initiation of the project to assist the Contractor and ENGEO personnel at the start of construction. The geotextile reinforcement shall be installed in accordance with the manufacturer's recommendations. The geotextile reinforcement shall be placed within the layers of the compacted soil as shown on the plans or as directed, secured with staples, pins, or small piles of backfill, placed without wrinkles, and aligned with the primary strength direction perpendicular to slope contours. Cover geotextile reinforcement with backfill within the same work shift. Place at least 6 inches of backfill on the geotextile reinforcement before operating or driving equipment or vehicles over it, except those used under the conditions specified below for spreading backfill.

Adjacent strips, in the case of 100 percent coverage in plan view, need not be overlapped. The minimum horizontal coverage is 50 percent, with horizontal spacing between reinforcement no greater than 40 inches. Horizontal coverage of less than 100 percent shall not be allowed unless specifically detailed in the construction drawings. Adjacent rolls of geotextile reinforcement shall be overlapped or mechanically connected where exposed in a wraparound face system, as applicable.

The contractor may place only that amount of geotextile reinforcement required for immediately pending work to prevent undue damage. After a layer of geotextile reinforcement has been placed, the succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, the next geotextile reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of geotextile reinforcement and soil.

Geotextile reinforcement shall be placed to lay flat and be pulled tight prior to backfilling. After a layer of geotextile reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geotextile reinforcement in position until the subsequent soil layer can be placed. Under no circumstances shall a track-type vehicle be allowed on the geotextile reinforcement before at least six inches of soil has been placed. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geotextile reinforcement. If approved by the Manufacturer, rubber-tired equipment may pass over the geotextile reinforcement as slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided.

During construction, the surface of the fill should be kept approximately horizontal. Geotextile reinforcement shall be placed directly on the compacted horizontal fill surface. Geotextile reinforcements are to be placed within three inches of the design elevations and extend the length as shown on the elevation view unless otherwise directed by ENGEO.

Replace or repair any geotextile reinforcement damaged during construction. Grade and compact backfill to ensure the reinforcement remains taut. Geotextile soil reinforcement must be tested to the required design values using the following ASTM test methods.

TABLE III-1: Geotextile Soil Reinforcements

PROPERTY	TEST
Elongation at break, percent	ASTM D 4632
Grab breaking load, lb, 1-inch grip (min) in each direction	ASTM D 4632
Wide width tensile strength at 5 percent strain, lb/ft (min)	ASTM D 4595
Wide width tensile strength at ultimate strength, lb/ft (min)	ASTM D 4595
Tear strength, lb (min)	ASTM D 4533
Puncture strength, lb (min)	ASTM D 6241
Permittivity, sec^{-1} (min)	ASTM D 4491
Apparent opening size, inches (max)	ASTM D 4751
Ultraviolet resistance, percent (min) retained grab break load, 500 hours	ASTM D 4355

PART IV - EROSION CONTROL MAT

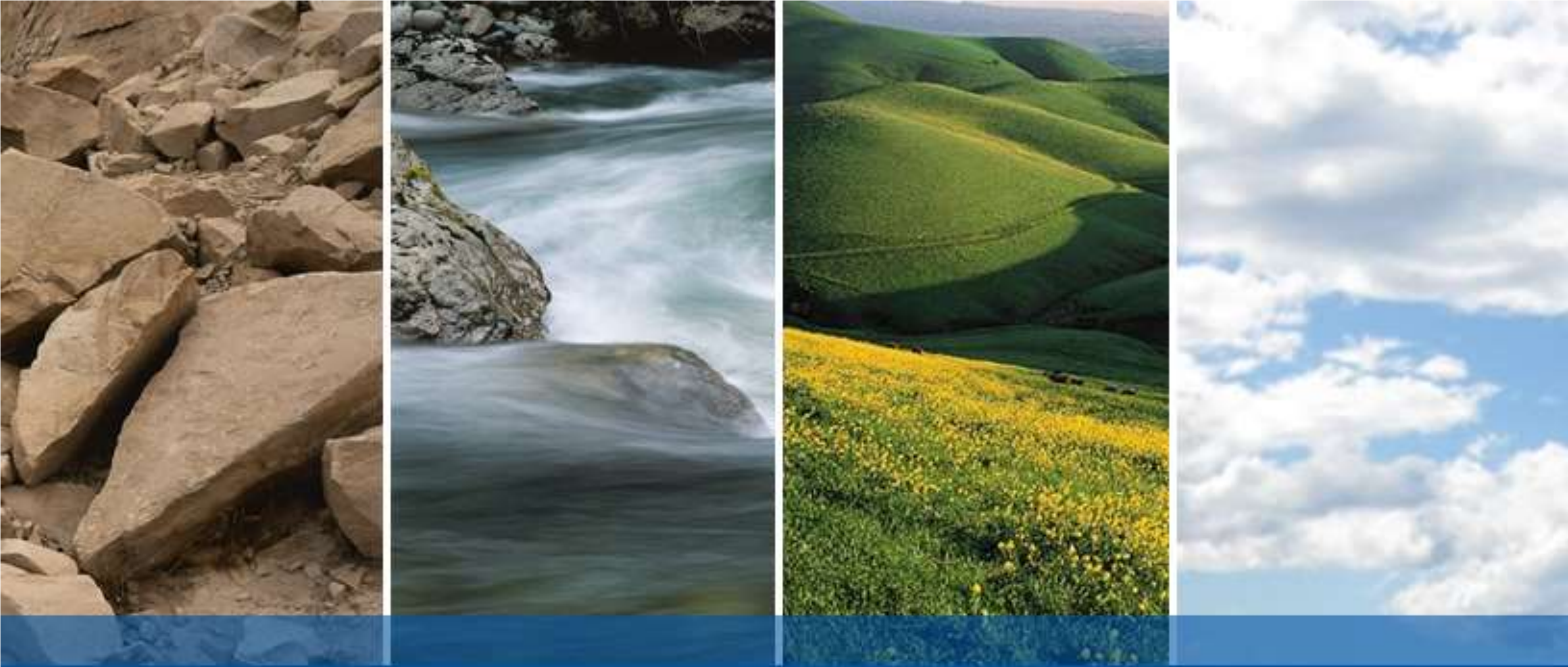
Work shall consist of furnishing and placing a synthetic erosion control mat and/or degradable erosion control blanket for slope face protection and lining of runoff channels. The specific erosion control material and supplier shall be pre-approved by ENGEO.

The Contractor shall submit a manufacturer's certification that the erosion mat/blanket supplied meets the criteria specified when the material was approved by ENGEO. The manufacturer's certification shall include a submittal package of documented test results that confirm the property values. Jute mesh shall consist of processed natural jute yarns woven into a matrix, and netting shall consist of coconut fiber woven into a matrix. Erosion control blankets shall be made of processed natural fibers that are mechanically, structurally, or chemically bound together to form a continuous matrix that is surrounded by two natural nets.

The Contractor shall check the erosion control material upon delivery to ensure that the proper material has been received. During periods of shipment and storage, the erosion mat shall be protected from temperatures greater than 140°F, mud, dirt, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the erosion mat/blanket shall be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be removed by cutting out a section of the mat. The remaining ends should be overlapped and secured with ground anchors. Any erosion mat/blanket damaged during storage or installation shall be replaced by the Contractor at no additional cost to the Owner.

Erosion control material suppliers shall provide a qualified and experienced representative onsite, to assist the Contractor and ENGEO personnel at the start of construction. If there is more than one slope on a project, this criterion will apply to construction of the initial slope only. The representative shall be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s). The erosion control material shall be placed and anchored on a smooth graded, firm surface approved by the Engineer. Anchoring terminal ends of the erosion control material shall be accomplished through use of key trenches. The material in the trenches shall be anchored to the soil on maximum 1½ foot centers. Topsoil, if required by construction drawings, placed over final grade prior to installation of the erosion control material shall be limited to a depth not exceeding 3 inches.

Erosion control material shall be anchored, overlapped, and otherwise constructed to ensure performance until vegetation is well established. Anchors shall be as designated on the construction drawings, with a minimum of 12-inch length, and shall be spaced as designated on the construction drawings, with a maximum spacing of 4 feet.



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