GEOTECHNICAL REPORT

JACOBS AVENUE LEVEE EVALUATION PROJECT CITY OF EUREKA, CALIFORNIA

Prepared For:

Humboldt County Public Works Department

CGI TECHNICAL SERVICES INC.

COUNTY OF HUMBOLDT
The Home of the Redwoods

CGI TECHNICAL SERVICES INC.

July 25, 2016
CGI: 15-1949.03

Mr. Hank Seemann
Deputy Director - Environmental Services
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
1106 Second Street
Eureka, California 95501

Subject: **Geotechnical Report**
Jacobs Avenue Levee Evaluation Project
Eureka, California

Dear Mr. Seemann:

CGI Technical Services, Inc. (CGI), is pleased to submit this geotechnical report to Humboldt County Public Works Department for the Jacobs Avenue Levee Evaluation Project, located in Eureka, California. This report is being submitted in accordance with the Agreement for Professional Services established between CGI and the County.

This report summarizes the geotechnical engineering analyses performed to evaluate the levee and its ability to function in accordance with current United Stated Army Corps of Engineers performance guidelines and presents remedial-concept recommendations, where appropriate. In addition, this report also discusses field explorations performed, laboratory test results, and general subsurface conditions encountered at the site during this study.

We appreciate the opportunity to perform this study. If you have any questions pertaining to this report, or if we may be of further service, please contact us at (530) 244-6277 at your earliest convenience.

Regards,

CGI TECHNICAL SERVICES, INC.

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EXECUTIVE SUMMARY

The purpose of our investigation was to explore subsurface conditions at the project site to aid Humboldt County, City of Eureka, and affected private landowners in evaluating the ability of the Jacobs Avenue Levee system to function in accordance with current FEMA and U.S. Army Corps of Engineers (USACE) performance criteria. To achieve this objective, CGI performed subsurface exploration, laboratory testing, and engineering analyses in accordance with the standards of FEMA (2008), and USACE (2013, 2010a, 2008, 2005, 2003, and 2000a).

The following paragraphs summarize the analyses that were performed to assess the geotechnical aspects of the levee system and include brief summaries of our findings. It should be noted that our analyses were limited to addressing the geotechnical aspects of flood control protection for the 100-year recurrence interval (or 1% annual chance exceedance) coastal stillwater flood event for the Jacobs Avenue Levee system. Information prepared by Northern Hydrology & Engineering regarding the hydrologic and hydraulic aspects of the levee system was provided to us by Humboldt County utilized as applicable.

On the basis of field observations, subsurface exploration, laboratory testing and engineering analyses performed for this investigation, the existing Jacobs Avenue Levee system is marginally capable of providing flood control protection to adjacent improvements. Based on our analyses, all of the sections evaluated were susceptible to seepage-related failure or instability under steady state conditions. Furthermore, seismically-induced settlement values were estimated to be relatively small; however, they would impinge upon the minimum USACE specified freeboard along the levee.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Levee Prism Geometry & Freeboard. The landside and waterside slope inclinations were observed to exceed inclinations recommended by the USACE for levee systems. Those inclinations are to be at 2:1 and 3:1 or flatter for landside and waterside slopes, respectively. In addition, with the exception of local areas, the crown width of the levee was deficient of the minimum 12 feet specified by the USACE. Furthermore, minimum freeboard along the levee was deficient for much of the alignment (freeboard is the vertical distance between the top of the levee and the water surface elevation for the 1% annual chance exceedance flood). Mitigation measures to correct the levee geometry and freeboard consist of widening, raising, and grading the levee to meet minimum USACE specifications.

Vegetation and Erosion. Vegetation is present on the waterside and landslide slopes and locally on the crest of the levee. The vegetation includes seasonal grasses, shrubs, brambles, and trees that are locally dense. Mitigation for vegetation consists of implementation of a vegetation reduction program.

Erosion was locally observed along the waterside slope of the levee in areas where rip-rap is not present, in gaps within rip-rap, in areas where rip-rap is relatively thin, and in areas where high tides extend above rip-rap. The erosion appears to be caused by wind-generated waves lapping against the slope and generally creates over-steepened slopes. Mitigation for the erosion is to remove rip-rap in areas of erosion, restore the inclinations to meet USACE standards, place filter fabric on the eroded area, and replace the rip-rap with sufficient amounts of properly sized rip-rap that extends to a minimum height of mean high water.

Liquefaction and Seismic Settlement Potential. Based on our analysis, there is a potential for liquefaction and seismically induced dry settlement of the pervious foundation material during the design seismic event. The maximum estimated liquefaction and seismically induced dry settlements are approximately 4 inches and less than 1 inch, respectively. Also, there is a high risk of lateral spreading to occur with estimated lateral displacement of up to 63 inches. Mitigation options for liquefaction include stone columns, rammed aggregate piers, and compaction grouting.

Permeability and Seepage. For our seepage evaluation, the potential for underseepage and through-seepage was evaluated for steady-state flood stage conditions. Based on the results of our seepage analyses, all of the cross sections have underseepage exit gradients that are lower than 0.5, which is the maximum threshold established by the USACE . However, through-seepage was projected to intersect the landside slope of the levee above the landside toe at all cross sections, which does not meet UASCE requirements. Mitigation options for through-seepage include construction of a cutoff trench and/or a landside seepage berm.

In addition, penetrations of the levee should be assessed to evaluate composition of backfill materials surrounding the penetrations. If those materials do not consist of relatively fat clay or a Portland cement concrete (PCC) material, then unacceptable seepage forces are likely to occur along the penetrations.

Slope Stability. Our slope stability analyses indicated that the slopes evaluated are generally stable to marginally stable for most of the conditions discussed in section 8.3 under static conditions but predominately unstable under pseudo-static (seismic) conditions. For pseudo-static slope stability analyses, undrained residual strength parameters were estimated for potentially liquefiable strata. However, a number of conditions do not meet the threshold established by USACE. Many of those conditions are anticipated to be mitigated if the geometry of the levee is reconstructed to meet USACE standards.

Seismic Deformation. Based on the results of pseudo-static slope stability analyses, at least 36 inches of seismic displacements are anticipated for the design seismic event. If mitigations for the levee geometry and liquefaction potential are implemented, then seismic deformation will be mitigated. Otherwise, mitigation options include increasing the strength of soils within the levee and/or construction of stability berms.

OPINION REGARDING GEOTECHNICAL ASPECTS OF LEVEE CERTIFICATION

Based on the results of our study, the levee system's ability to provide flood protection in its present state is not sufficient considering nearly all conditions evaluated at the five cross section locations.

Based on the results of our evaluation, it is our opinion that the geotechnical aspects of the levee system are unlikely to be certifiable relative to FEMA and USACE standards.

1 INTRODUCTION

CGI Technical Services, Inc. (CGI), is pleased to present this report providing the results of studies performed for the Jacobs Avenue Levee Evaluation Project, located in the City of Eureka, California. This study was performed for the Humboldt County Department of Public Works (County). Funding for this study was provided by the California Department of Water Resources Local Levee Assistance Program, Humboldt County, City of Eureka, and affected private landowners, with laboratory testing provided as a cost-share by Caltrans.

The purpose of the project was to collect and analyze selected geotechnical information in order to estimate the stability of the levee foundation and embankment, and to evaluate the potential for settlement, through-seepage, underseepage, or erosion to cause instability. Available information prior to this study was not sufficient to assess these risks for the Jacobs Avenue Levee. The results of the project will assist the County, City of Eureka, and private landowners in assessing the risks associated with the levee system and in determining whether the levee meets the embankment and foundation stability criteria of FEMA's National Flood Insurance Program standards at 44 CFR 65.10.

The following sections present our understanding of the project, the purpose of this study, and the findings, conclusions, and recommendations of this study. Our services were performed in general conformance with our proposal dated April 24, 2015.

1.1 PROJECT UNDERSTANDING

The Jacobs Avenue levee system extends along the northern margin of the Eureka Slough from Highway 101 east for about 5,100 feet to a tie-in point near Airport Road. The location of the levee is shown on Plate 1 – Site Location Map. The levee is an earthen embankment. Prior to this study, it was unknown whether the levee embankment was constructed with an impervious core, and whether levee foundation soils included an impervious layer. The levee is slightly to heavily vegetated, predominately with seasonal weeds, shrubs, and few trees. Intertidal mud flats are present at low tide at the waterside toe of the levee.

As shown on Plate 2 – Levee Details, the levee currently protects 31 properties from the Eureka Slough, located south of the levee. Most of those properties operate as commercial businesses; however, one property is a County corporate yard, one is a mini-storage facility, and another as a residential trailer park. The Eureka Slough is a wetland area that connects Freshwater Creek with Humboldt Bay and is, thus, subject to tidal influences from the bay and floodwaters from the creek.

The area behind Jacobs Avenue Levee was given a Flood Zone "C" rating by FEMA on the 1986 flood insurance rate map ([FIRM]; FEMA, 1986), even though technical studies documenting the stability and freeboard of the levee had not been performed. This rating designated the area behind the levee as having minimal flood hazards under the base flood condition (the "1% annual chance exceedance probability" or "100-year recurrence interval" flood level). We understand that FEMA's current policies require levee owners to provide technical studies documenting the stability and freeboard of the levee to support certification and accreditation in accordance with FEMA's National Flood Insurance Program standards in 44 CFR 65.10. Based on the lack of sufficient documentation for the Jacobs Avenue Levee, FEMA rezoned the area protected by the levee as "Zone A – Special Hazard Area" on preliminary FIRM maps (FEMA, 2015a; FEMA, 2015b), which are expected to become effective in 2016.

The geotechnical evaluation of the Jacobs Avenue levee system is a subtask of work being performed for the overall evaluation of the levee system. Hydrologic, hydraulic, bathymetric, and topographic services were performed by others.

1.2 PROJECT HISTORY

We understand that the Jacobs Avenue levee was a privately built embankment constructed by the initial landowner, Frank Herrick (McKamee et al., 2014). The actual date that the levee was constructed is uncertain with some sources claiming it occurred prior to 1931 (Walters, 2011).

Once the levee was constructed, we understand that the landside property was initially utilized predominately for agricultural purposes. Aerial photographs taken up until early 1948 show the lands as fallow aside from fences, eight billboards adjacent to Highway 101, and a small structure at the western end of the property near the bridge crossing the slough. In addition, a drainage ditch is present adjacent and parallel to the 1948 alignment of Highway 101. That drainage ditch was emptied into the slough by a ditch extending across property where the Lazy J Mobile Home Park currently is located. A concrete penetration extended through the levee connecting the ditch to the Eureka Slough. In late 1948, construction had begun on a livestock auction yard and facility sited about where The Farm Store is currently located.

We understand that the property was subdivided by Harold Hilfiker in 1949 (Walters, 2011) to create 31 individual parcels on about 45 acres. Aerial photographs from 1950 show three pads had been developed onto the landside properties but no structures had been established on those pads. In addition, the 1950 photographs show the auction yard as completed and an unpaved access road present approximately along the same alignment as Jacobs Avenue. By 1953, about 8 of the parcels show construction of structures or other development.

Between 1953 and 1956, the previously described drainage ditch extending across the Lazy J Mobile Home Park had been relocated to east of the auction yard, to where the current drainage channel is present adjacent to Airport Road. The bridge at Airport Road and the concrete penetration both have 1954 marked in their concrete, likely indicating the year in which those structures were constructed. However, the concrete levee penetration for the new channel cannot be discerned in aerial photographs from 1956 and 1972 but that might be due to the relatively poor resolution of the 1956 photograph. The 1956 photographs do show that the former drainage channel has been filled and the mobile home park constructed. It is unclear how the concrete penetration was abandoned.

By 1957, about half of the parcels had been developed with commercial structures. By 1990, the Jacobs Avenue area had been almost fully developed and appeared to be similar to how the area looks today.

Because of the subdivided lots, levee maintenance became the responsibility of the individual landowners of the parcels abutting the levee. No comprehensive program to maintain the entire levee has been established (Mattson, 2011). Maintenance records for the levee were not available (and likely don't exist). However, we understand that in the 1980s, a number of the parcel owners worked with the City of Eureka to improve sections of the eastern portion of the levee (McNamee et al., 2014). It appears that those improvements included raising a portion of the levee, increasing its width, and locally placing rip-rap and rock armoring to improve protection along the waterside levee slope.

Limitations of the parcel-by-parcel maintenance of the levee by the individual landowners have been recognized, prompting discussions of establishing a levee district (Mattson, 2011). In 2012, the Humboldt County Board of Supervisors authorized the Public Works Department to work with the parcel owners protected by the levee to explore formation of a levee district in accordance with Water Code Section 70000. We understand that after further consideration, formation of a new levee district was problematic and that the existing Humboldt County Flood Control District was found capable as serving as the funding recipient for grant funds from DWR to assess the stability of the levee system (Mattson, 2014). The results of the technical studies will help inform future discussion regarding potential district formation.

1.3 PURPOSE & SCOPE OF SERVICES

The purpose of our investigation was to explore subsurface conditions at the project site to aid the County in evaluating the ability of the Jacobs Avenue Levee system to function in accordance with current USACE performance criteria. To achieve this objective, CGI performed subsurface exploration, laboratory testing, and engineering analyses.

Levee stability evaluations utilize standards established by the USACE's National Flood Risk Management Program through various policy letters, engineering circulars, and engineering manuals (USACE, 2010a). The primary USACE standards utilized during this study consist of the following:

- Engineering Circular 1110-2-6067, Certification of Levee Systems for the NFIP (2010a);
- REF10L0 Rev 2, Geotechnical Levee Practice (2008);
- ETL 1110-2-569, Design Guidance for Levee Underseepage (2005);
- EM 1110-2-1902, Slope Stability (2003);
- EM 1110-2-1913, Design and Construction of Levees (2000a);
- EM 1110-2-301, Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams (2000b);
- EM 1110-2-1914, Design, Construction, and Maintenance of Relief Wells (1992); and
- EM 1110-2-1901, Determination of Permeability of Soil (1986).

References for those standards are included in Section 10.0 of this report. The scope of work for this study included the following:

1.1.1 Data Review, Site Reconnaissance, and Access Coordination

In preparation for the field exploration program, CGI performed site reconnaissance, and reviewed historic data, aerial photographs, and other documents, maps, and existing geologic and geotechnical literature relevant to the site. In addition, we met with County representatives at the site to discuss exploration and cross section locations in the field.

Relevant geotechnical data from previous reports prepared by the USACE and local consultants, including site and subsurface descriptions, groundwater data, laboratory test results, drill hole logs, and as-built plans, were reviewed during the study. Further details regarding previous reports are presented in Section 3.0 and in Appendix A.

Prior to performing drill holes and cone penetrometer test (CPT) soundings, CGI obtained drilling permits from the County and contacted Underground Service Alert (USA) to help identify potential buried utility conflicts at the proposed exploration locations, as required by California law. In addition, we marked all exploration locations and worked with the County to coordinate access onto private properties.

1.1.2 Field Exploration

Field exploration consisted of advancing a total of 18 subsurface explorations at selected locations along the levee alignment. In total, we performed the following explorations for this study:

Table 1-1 – Explorations Performed for Study

Exploration Type	Total Advanced
Cone Penetrometer Soundings	11
Rotary Mud Drilling	7

The field exploration program was performed in November 2015 and January 2016. Locations of explorations are presented on Plates 3.1 through 3.4 – Cross Section & Exploration Locations. Additional information regarding the field exploration program are presented in Section 3.0 and Appendix B.

1.1.3 Laboratory Testing

Laboratory testing was performed for CGI by Caltrans on selected soil samples obtained during the field exploration program. The types and numbers of tests were chosen to help classify and characterize selected subsurface soil characteristics and engineering properties. Further details regarding the laboratory testing program are presented in Section 4.0 and in Appendix C.

1.1.4 Geotechnical Analyses and Evaluation

Using data obtained from the data review, field exploration, and laboratory testing programs, CGI performed geotechnical analyses, as specified in the scope of work, at 5 cross sections established along the length of the Jacobs Avenue Levee system. The analyses were consistent with geotechnical criteria specified by the USACE in EM 1110-2-1913 (USACE, 2000a), REFP10L0 (USACE, 2008) and EM 1110-2-569 (USACE, 2005). This report summarizes the geotechnical analyses and presents recommendations for remedial action where applicable. The following analyses were performed:

- Seismic Design Criteria (Section 6.0)
- Liquefaction Potential (Section 8.1)
- Permeability and Seepage (Section 8.2)
- Slope Stability (Section 8.3)
- Seismic Deformation (Section 8.4)
- Settlement (Section 8.5)

1.2 *Authorization*

This study was authorized by the County in the Agreement for Professional Services under County Project No. 251059.

1.3 *Limitations*

The factual findings for this investigation, described herein, are applicable for the project description as contained in Section 1.1. The factual information presented in this report was documented by CGI solely for the County for use in evaluating the ability of the existing Jacobs Avenue Levee system within the project extent to function in accordance with current USACE performance criteria. Although information contained in this report may be of some use for other purposes, it may not contain sufficient information for other parties or other uses.

The scope of services did not include any environmental assessments for the presence or absence of hazardous/toxic materials in surface water, groundwater, or atmosphere. Any statements, or absence of statements, in this report or data presented herein regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous/toxic assessment.

In performing our professional services, we have used generally accepted geologic and geotechnical engineering principles and have applied that degree of care and skill ordinarily exercised under similar circumstances, by reputable geotechnical engineers and engineering geologists currently practicing in this or similar localities. No other warranty, either express or implied, is made.

2.0 SITE DESCRIPTION

The Jacobs Avenue Levee system is approximately 5,100 feet long and is located entirely on the right (north) side of the Eureka Slough, as shown on Plate 2. The levee system consists of one contiguous embankment located south of Jacobs Avenue, within the City of Eureka. We understand from the County that the eastern terminus of the levee intersects a former railroad embankment situated parallel to Airport Road. The starting point for our stationing is located beyond this intersection, near a bridge on Airport Road crossing a drainage ditch. Based on discussion with the County, we understand that the levee begins at approximately Station 10+30. The western terminus of the levee intersects Highway 101 at Station 61+00. The approximate center point of the levee has the following coordinates:

TABLE 2.1 – PROJECT LOCATION

	Degrees, Minutes. Seconds	Decimal Degrees
Latitude	40° 48’ 12.3”	40.803403°
Longitude	-124° 7’ 45.9”	-124.129414°

Those coordinates were utilized, where necessary, for analyses within this report.

The overall levee configuration varies between the western and eastern segments, as discussed below. Refer to Plates 8.1 and 8.2 – Levee Topography, for elevations and topographic relief of the site

2.1 *EASTERN LEVEE SEGMENT (STATION 10+30 TO 42+00)*

The eastern section of the levee, extending from Stations 10+30 to about 42+00 (see Plate 2) ranges in height from about 6 to 9 feet above ground surface and has a crown width ranging from about 7 to 12 feet. The waterside slopes are inclined at about 1:1 (horizontal:vertical) to 2.5:1, with local areas, especially near the toe of slope, being vertical to near vertical. Landside slopes have slope inclinations ranging from about 1.5:1 to about 2:1.

Rip rap and concrete rubble have been placed at the toe of the waterside slope from about Station 10+50 to 35+90. An interior drainage ditch is located along the landside toe of slope from about Station 24+00 to 42+00. Chain link fences extend along most of the levee crest, with some intermittent gaps, such as at about Station 32+00.

Two penetrations are present along this segment of the levee. At about Station 12+00, a concrete gate structure is present that penetrates the levee and controls inland drainage into the Eureka Slough. We understand that Caltrans services and operates that gate at this time. At about Station 18+50 is another concrete penetration that at one time served the inland drainage control now being served by the penetration at Station 12+00, but that was abandoned sometime between 1953 and 1956. The methods used to abandon this penetration are unknown but, based on the waterside facing of the structure, appears to have consisted of placing concrete to reduce the potential of flows through the penetration.

The eastern levee segment described herein, is generally moderately to heavily vegetated with seasonal grasses, shrubs, brambles and local trees. Locally, brush is sufficiently thick to limit access or observation of the levee. Some property owners have maintained the levee relatively free of vegetation, such as between about Stations 10+00 and 20+00.

2.2 *WESTERN LEVEE SEGMENT (STATION 42+00 TO 61+00)*

The western section of the levee extends from Stations4 2+00 to the western levee terminus at Highway 101. The western levee ranges in height from about 5 feet to 8 feet above ground surface. The levee crown in this section ranges in width from about 3 to 5 feet. Landside and waterside slopes range in inclinations from about 1:1 to 3:1. At lower tides, an intertidal bench is visible at the toe of the waterside slope.

An interior drainage ditch is located along the landside toe of slope along this entire levee segment. Chain link fences extend along most of the levee crest or landside toe of levee along the entire segment.

Two penetrations are reportedly present along this segment of the levee, as shown on Plate 2. One penetration is located at about Station 46+00 and the other near the western terminus of the levee. The penetrations were not observed during this study, even at relatively low tides, and we have no record on how they were constructed. They may be obscured by intertidal sediments. Both penetrations likely drain the inland ditch that extends along the landside toe of levee slope along the entire length of this levee segment and a portion of the eastern levee segment.

The western levee segment described herein, is generally moderately to heavily vegetated with seasonal grasses, shrubs, brambles and local trees. Locally, brush is sufficiently thick to limit access or observation of the levee. Some property owners have maintained the levee relatively free of vegetation, such as at about Station 42+00, where the County has periodically reduced vegetation thicknesses.

3.0 FIELD EXPLORATION

3.1 *FIELD EXPLORATION PLANNING*

3.1.1 Review of Previous Reports

No previous geotechnical reports or information specific to construction of the levee were available for review during the course of this study. A feasibility study was performed by Winzler and Kelly Consulting Engineers (1985) to repair and/or reconstruct the Jacobs Avenue Levee. Current hydrologic analyses were performed for the levee system by Northern Hydrology & Engineering (NHE) and made available during this study.

Those data consisted of:

- Technical Memorandum, Jacobs Avenue Levee Bathymetric, Hydrologic and Hydraulic Study (NHE, 2016);
- Feasibility Study, Jacobs Avenue Dike, Winzler and Kelly Consulting Engineers, (Winzler, 1985)

These documents and additional reports are referenced in Section 10 of this report.

3.1.2 Exploration Plan

CGI prepared an exploration plan for performing and executing the subsurface exploration for this study. The plan was described, in general, in our proposal to provide geotechnical services for this study, and in greater detail in maps forwarded to the County on November 3, 2015. The work plan, spreadsheet, and maps detailed the following:

- Exploration numbers, locations and methods, including:
- Station number for each exploration;
- Relative locations on the levee, levee toe, or offsets for each exploration;
- Target depths of each exploration;
- Dates or date ranges that each exploration were to be performed; and
- Methods of destruction of each exploration following completion.

This information was used for landowner notification by the County, as discussed in Section 3.1.3. In addition, a health and safety work plan was prepared for field personnel during exploration.

3.1.3 Site Access & Permitting

Exploration for this project was performed on private and public properties. Public properties included lands or easements controlled by the County. Private lands owned by five individuals/companies were located in areas of our exploration along proposed cross section lines. The County secured permission to access and explore private properties at selected locations along the levee system.

Well and Boring permits from Humboldt County Division of Environmental Health were required for the exploration performed for this study. Two Well and Boring permits were acquired for this project: one for cone penetrometer test soundings (CPT) and one for drilling. In addition, permits from the California Coastal Commission, California Fish & Wildlife Service, California Regional Water Quality Control Board (North Coast Region), State Water Resources Control Board, and the USACE were obtained for this study. The County, with some assistance from CGI, acquired all permits for this project.

3.1.4 Site Visit and Utility Clearance

Prior to mobilizing exploration equipment to the site, each exploration location was visually inspected for the presence of overhead and underground utilities, and then marked with white paint, as required by Underground Service Alert (USA). Following the marking of the exploration locations, USA was contacted a minimum of 48 hours prior to subsurface investigation of the site. A total of five USA ticket numbers, as well as clearance dates, expiration dates, and call-back-to-extend dates, were obtained for the project and documented in the project file.

No utility conflicts were identified at proposed exploration locations. No manmade subsurface obstructions were encountered during our field exploration program. It should be noted that other buried utilities and structures not located by USA or observed by CGI may be present along the project extent.

3.2 *Exploration Program*

The field exploration program completed by CGI for the Jacobs Avenue Levee Evaluation project consisted of advancing subsurface explorations using CPT and rotary-wash drill holes. The following sections discuss those exploration services.

3.2.1 Subsurface Exploration

The locations of drill holes advanced for this investigation are shown on Plate 3.1 through 3.4. Information for each exploration including total exploration depth are tabulated in Table 3.1.

3.3 *Reference Datum*

The following reference datums were used for this project:

Horizontal Datum. The horizontal datum reference for this project is California State Plane, Zone 1, North American Datum 83 (NAD83, feet).

Vertical Datum. The vertical datum reference for this project is the North American Vertical Datum of 1988 (NAVD88, feet).

Coordinates and elevations for the exploration locations were estimated by CGI during exploration performed in November 2015 and January 2016, using a Garmin *etrex* hand-held global positioning system receiver.

TABLE 3.1 – SUBSURFACE EXPLORATION SUMMARY			
Exploration No.	Exploration Depth (feet)	Start Date	Completion Date
CPT-10L	50.4	11/19/15	11/19/15
CPT-10off	25.6	11/19/15	11/19/15
CPT-20L	25.5	11/19/15	11/19/15
CPT-30C	75.4	11/20/15	11/20/15
CPT-30off	25.6	11/19/15	11/19/15
CPT-30W	22.3	11/22/15	11/22/15
CPT-42L	50.9	11/20/15	11/20/15
CPT-42off	25.6	11/20/15	11/20/15
CPT-56C	20.1	11/21/15	11/21/15
CPT-56L	23.7	11/20/15	11/20/15
CPT-56W	16.7	11/21/15	11/21/15
DH-10L	26.5	1/14/16	1/14/16
DH-20off	26.5	1/13/16	1/16/16
DH-30C	51.5	1/12/16	1/12/16
DH-30L	26.5	1/13/16	1/13/16
DH-42L	26.5	1/12/16	1/12/16
DH-56L	26.5	1/11/16	1/11/16
DH-56off	26.5	1/14/16	1/14/16

One drill hole was advanced through the levee crest (Station 32+00) to depths of 50 feet. Limited clearance and access, limited crown width, and vegetation cover prevented drilling though the levee crest at the other four cross sections.

Soil samples were obtained at selected depth intervals within the drill holes using California modified split-spoon, Standard Penetration Test (SPT), and Shelby tube samplers. A CGI engineering geologist logged the drill holes as they were advanced. All samples were transmitted to Caltrans District 1 laboratory for testing, with some samples later being delivered to Caltrans Translab facility in Sacramento, California.

Eleven CPT soundings were performed for this study. The depths of the CPT soundings ranged from about 17 to 75 feet. Planned depths of CPT soundings in the levee crown was a minimum of 50 feet, which was achieved during this study. Planned depths of CPT soundings in explorations aside from the levee crown was 25 feet, which was achieved in those CPT sounding except at CPT-30W, CPT-56L, CPT-56W, which extended to depths ranging from about 17 to 24 feet.

3.4 *Investigation Derived Cuttings Disposal*

All drill holes were destroyed using cement-grout. The grout was placed through tremie tubes extended to the hole bottom and extracted as the grout was being placed to reduce the potential for bridging or collapse of the holes prior to grout placement. Because those holes were backfilled using cement grout, the cuttings required disposal. The cuttings were barreled for the County's disposal.

CPT soundings displace soil materials during the sounding process and do not generate cuttings that require disposal.

4.0 LABORATORY TESTING PROGRAM

All laboratory testing for this project was performed by Caltrans, District 1 based on testing schedules prepared by CGI. The majority of the testing was performed in the District 1 laboratory with some samples forwarded to Caltrans Translab facility located in Sacramento.

The purpose of the laboratory testing program was to supplement field classification of soils and provide relevant physical indices and engineering properties of the subsurface materials. The primary objectives of the program were to:

- Classify and characterize sampled subsurface materials;
- Evaluate the existing in situ conditions; and
- Develop relevant consolidation, strength, and permeability estimates of selected subsurface materials.

To meet these objectives, various tests were performed on selected samples. Test types are generally grouped into the following categories: classification/index tests, moisture content/density evaluations, consolidation tests, permeability tests, relevant strength tests, and subgrade characterization tests. Classification/index and subgrade characterization tests were performed on both disturbed and relatively undisturbed samples, including 2.4-inch diameter drive (i.e., ring) samples, 3-inch diameter Shelby tubes, Standard Penetration Test (SPT) samples, and bulk samples. Density evaluations, consolidation tests, permeability tests and strength tests were typically performed only on relatively undisturbed ring and/or Shelby tube samples.

The numbers of the various tests conducted for the Jacobs Avenue Levee Evaluation are listed in Table 4.1.

TABLE 4.1 – SUMMARY OF LABORATORY TESTS PERFORMED ON SELECTED SAMPLES

Laboratory Testing	Number of Tests	ASTM Test Designation[1]
In-Situ Moisture Content	16	ASTM D2216
In-Situ Dry Density	24	ASTM D7263b
Sieve Analysis with #200 Wash	28	ASTM D422
Atterberg Limits	9	ASTM D4318
Modified Proctor	1	ASTM D1557
Consolidation (Incremental Load Control)	2	ASTM 2435
Flexible Membrane Permeability	3	ASTM D5084
Direct Shear	5	ASTM D3080

[1] ASTM International , latest edition.

Laboratory test results are tabulated or presented graphically in Appendix C. Various laboratory test results are tabulated versus depth on the individual drill hole logs (Plates B-2.1 through B-2.7). Test results that cannot be conveniently tabulated or plotted versus depth on logs are also provided in Appendix C. Test results in this category include: grain-size curves, plasticity charts, direct shear, permeability, consolidation, and compaction test results.

5.0 GEOLOGIC AND SUBSURFACE CONDITIONS

5.1 *Regional Setting*

The project site is located in the Coast Ranges Geologic/Geomorphic Province of Northern California. The Coast Ranges province consists of an approximately 50-mile wide range of mountains extending from Santa Barbara County approximately 400 miles northward into Shasta and Humboldt Counties (Hinds, 1952). It is bounded to the north and east by the Klamath Mountains province, to the south by the Transverse Ranges province, to the southeast by the Great Valley province, and to the west by the Pacific Ocean.

The project region occupies a complex geologic environment characterized by high rates of active tectonic deformation and seismicity. The area lies immediately north of the Mendocino Triple Junction, which is the location of intersection of three crustal plates (e.g., the North American, Pacific, and Gorda plates). North of Cape Mendocino, the Gorda plate is being actively subducted beneath North America, along what is commonly referred to as the Cascadia subduction zone, which is located west and offshore of the study area. In Humboldt County, stresses from the offshore subduction zone are manifested on-land as a series of northwest-trending, southeast-vergent thrust faults, and intervening folds (i.e., "fold and thrust belt"). The geomorphic landscape of the project region is largely a manifestation of the active tectonic processes and the setting in this dynamic coastal environment.

Basement rock within the Eureka region consists of the Cretaceous-Jurassic Franciscan Formation (McLaughlin et al., 2000). The Franciscan Formation is a sequence of metasedimentary, metavolcanic, metamorphic, and ultramafic rocks that have been and are continuing to be accreted to the North American plate during subduction of the Pacific plate. As a consequence, the Franciscan Formation has been mapped as three broad belts (Eastern, Central, and Coastal belts) that become younger from east to west (McLaughlin et al., 2000).

The project is situated on Neogene-age overlapping sediments that rest on the Yager Terrane of the Coastal Belt (McLaughlin et al., 2000). The Yager Terrane is composed of Late Cretaceous argillite, sandstone, and conglomerate (McLaughlin et al., 2000). The Neogene-age materials consist of sediments of the Plio-Pleistocene-age Hookton and Yager Formations.

In turn, the region is juxtaposed to the relatively older Central Belt of the Franciscan Formation, located east of the site. In the project region, it is composed of intercalated blocks of sandstone and shale turbidites, chert, limestone, and metabasalts (McLaughlin et al., 2000), often in a matrix of sheared argillite.

5.2 *Local Geologic Setting*

Coastal margins in the project area reflect the late Quaternary history of sea level changes and tectonic deformation. During most of the late Quaternary, sea level was lower than its present position, resulting in a shoreline located farther to the west, and a lower fluvial base level to which coastal wave-cut platforms and all coastal streams would be graded. During these low sea levels, wave-cut platforms and streams within the coastal valleys around Humboldt County would be incised. In addition, wave-cut platforms would be exposed and uplifted during the low sea level stands, creating marine terraces along the coastal zone. It is thought that sea level reached its current high level in the mid-Holocene, about 6,000 years ago. As such, most of the near-surface sediments filling the Eureka Slough and Humboldt Bay would be anticipated to be mid-Holocene in age, or younger. A geologic map of the project area is shown on Plate 5 – Regional Geologic Map.

The Jacobs Avenue Levee is itself underlain by a mixture of Holocene-age intercalated bay muds, estuarian deposits, and alluvial deposits. The bay muds and estuarian deposits consist of marine and terrestrial fat clay, organic clays, and elastic silts. Interspersed with those fine-grained sediments are silts, sands, and trace fine gravel alluvial layers associated with high flow events from Freshwater Creek and other unnamed tributaries confluencing with the Eureka Slough. In addition, some littoral granular deposits associated with tsunamis that have affected Humboldt Bay might also be present within the quaternary near-surface sediments.

Directly underlying the near-surface sediments are Quaternary-age marine terrace deposits and the Hookton Formation. McLaughlin et al. (2000) map marine terrace deposits projecting beneath the Holocene-age sediments in the project area but Kelley (1984) and Kilbuorne et al. (1980) indicate that the Hookton Formation directly underlies the younger sediments.

5.3 *Geomorphology*

The Eureka Slough is 20.8 miles long with 80 percent of its shoreline composed of artificial structures mainly composed of dikes/levees with a minor component of roadway (Laird et al, 2013). Thus, the slough is largely fortified and contained by artificial structures. Prior to fortifying the shoreline, the slough consisted of a number of intertidal channels draining into the slough, which discharges into Humboldt Bay. This is illustrated on Plate 6 – Former Tidal Channels and Improvements Circa 1950. As can be seen on that plate, at least 10 intertidal channels in the project area were truncated by construction of the levee, yet remained on the landside of the impoundment.

The slough is a sinuous channel fed by moderately to highly sinuous drainages. At high tide, the slough is a single channel but at low tide, the channel becomes bifurcated exposing intertidal bars south of the western two-thirds of the levee alignment.

Comparison of historical topographic maps dated between 1921 and 2015 indicate that the slough channel has remained relatively stable during that period of time with slight channel variations in the eastern third of the study area. Some of this change was likely due to erosion prior to construction of the levee.

5.4 *Subsurface Conditions*

As previously noted, the project field exploration program included CPT soundings and rotary-wash drill holes along the crest of the levee, at the landside and waterside toes, and at landside levee offset locations within the project extent. Subsurface conditions were explored to a depth of up to approximately 75 feet below ground surface (see Section 3.0 for details of the field exploration program). Subsurface conditions are described and illustrated in the drill hole logs (see Appendix B). The logs have also been projected onto cross sections to depict subsurface conditions across and along the levee system. See Plate 2 shows cross section locations and those cross sections are presented on Plates 4.1 through 4.5 – Geologic Cross Sections. Five transverse cross sections were created by projecting exploration logs onto the topography along the cross sections.

5.4.1 Earth Materials

Subsurface conditions are generally similar throughout the project site, although some variability is seen along the levee system. In general, the embankment materials within the levee were relatively similar along the length of the levee system, whereas foundation soils are relatively variable. Earth materials encountered within the levee embankment and in the foundation soils are discussed in the following sections. Logs of the explorations for this study are presented in Appendix B. Laboratory data for earth materials are presented in Appendix C.

Levee Embankment Materials. Levee embankment thicknesses appear to range from about less than 3 feet to up to about 9 feet, as estimated from cross sections presented on Plates 4.1 through 4.5. A total of 3 explorations, consisting of rotary-wash drill holes (1) and CPT soundings (2), were advanced through the levee embankment materials to sample and characterize selected geotechnical conditions within the embankments.

Subsurface conditions within levee embankment materials were observed to be generally consistent throughout the levee system. The explorations encountered gravelly silt, to silt within the levee at all sections. The embankment materials were generally moist to wet with depth and ranged from slightly stiff to stiff. The embankment was not constructed with an impervious core (normally clay), which is standard practice for an engineered levee. The lack of a low-permeability core allows the potential for water to seep through the embankment more readily and can lead to piping, through seepage, and other factors which can lead to destabilization of a levee. An impermeable core will typically eliminate or significantly reduce the potential for seepage forces to adversely affect a levee, which is why impervious cores are design and constructed into levee systems.

Foundation Soils. Prior to this study, it was uncertain whether impervious blanket materials and pervious foundation soils are present beneath the levee embankment. It was found that the levee foundation is composed of an impervious blanket layer overlying pervious material. The impervious blanket materials reduce the ability of seepage movement beneath the levee from occurring quickly or with great volume, thus, inhibiting seepage forces from destabilizing the foundation beneath the levee. Impervious blanket materials typically reduce the seepage exit gradients, which, in turn reduce the potential for piping of sediments from the foundation layer underlying the levee.

The following sections discuss foundation soils encountered during this study.

Impervious Foundation Blanket Materials. Fine-grained materials consisting of sandy silt to clayey silt are present beneath the levee embankment soils. These soils vary in thickness from 5 to 17 feet. As shown on Plates 4.1 through 4.5, impervious materials were encountered on both the landside and waterside of the levee at each location explored.

Pervious Foundation Materials. Subsurface exploration indicated pervious foundation soils consisting of silty sand to sand are present beneath the impervious blanket materials. These pervious foundation materials consisted of loose to dense, wet, poorly- to well-graded sand, silty sand, sand with silt, sand with silt. The pervious foundation soils were not fully penetrated by explorations performed for this study.

5.4.2 Groundwater

Depths to groundwater were measured in CPT soundings advanced during this study. The observed groundwater levels varied from about 1.8 to 7.9 feet below ground surface at crown locations and 0.0 to 3.7 below ground surface at other locations. Because drilling was performed using rotary-wash methods, groundwater depths were not observable during the time-frame available for exploration at each drill hole. Table 5.1 summarizes the groundwater levels observed in the field.

TABLE 5-1 – GROUNDWATER LEVEL OBSERVATIONS IN STUDY EXPLORATIONS

Station & Measurement Date	Groundwater Elevations (feet below ground surface)			
	Offset	Landside Toe	Crest	Waterside Toe
Station 10+75	3.7	2.7		
Date	11-19-15	11-19-15		
Station 21+50		2.0		
Date		11-19-15		
Station 32+00	1.8		7.9	1.7
Date	11-19-15		11-20-15	11-22-15
Station 42+00	2.5	2.5		
Date	11-20-15	11-20-15		
Station 56+00		2.9	1.8	0.0
Date		11-20-15	11-21-15	11-21-15

Groundwater levels in the project area were also researched through the California Department of Water Resources (2015) and through the California State Water Resources Control Board Geotracker database (2015). Neither database had groundwater data sources located within 1,000 feet of the study site.

In general, groundwater levels were measured to be at relatively consistent depths beneath the ground surface along the levee system. Some variations in depths to water were observed; however, in a depositional environment that has the potential to have significant changes in soil types over relatively short distances, variations in groundwater depths should be anticipated. None of the variations measured during this study imply the presence of a significant aquitard or aquiclude impeding horizontal groundwater flow through sediments in the vicinity of the levee system. Variations in groundwater levels and soil moisture conditions can occur as a result of rainfall, runoff, and other factors. Therefore, groundwater conditions should be assumed to fluctuate.

6.0 SEISMIC DESIGN CRITERIA

6.1 *Strong Ground Motion*

As part of our geotechnical analyses, a probabilistic seismic hazard evaluation was conducted with the aid of the United States Geological Survey (USGS) 2008 Interactive Deaggregation (beta) website. The USGS website provides probabilistic estimates of seismic hazards using three-dimensional earthquake sources. In accordance with ETL 1110-2-580 (USACE, 2013), we utilized the website to determine the peak ground acceleration estimated to have approximately 1 percent annual chance of exceedance (Statistical Return Period ≈ 100 years).

Based on correlations developed by Sykora (1987), shear wave velocity data were estimated for the subsurface conditions encountered at the site. The average shear wave velocity for the upper 100 feet was estimated to be approximately 155 meters per second (m/s), based on data collected from exploration CPT-30C.

The peak ground acceleration was calculated by the USGS website using equally-weighted averages of three (3) attenuation relationships: Boore and Atkinson (2008), Campbell and Bozorgnia (2008), and Chiou and Youngs (2008). For the purposes of our evaluation, the site coordinates (latitude and longitude) for the Jacobs Avenue Levee project site were estimated to be 40.803 degrees north latitude and 124.129 degrees west longitude.

According to the USGS website, the peak horizontal ground acceleration (PHGA) for the project site is estimated to be approximately 0.25g, corresponding to deaggregated modal and mean magnitudes of 6.99 and 6.91, respectively. Based on the deaggregation graph generated by the USGS website, a magnitude 9.0 event also contributed a relatively large percentage to the estimated seismic hazard. Therefore, we considered a magnitude 9.0 earthquake with a PHGA of 0.25g as the design seismic event for our evaluation of the levee system.

6.2 *Surface Fault Rupture*

The State of California designates faults as active, potentially active, and inactive depending on the recency of surface fault rupture that can be substantiated for a fault. Table 6.1 presents the current California fault activity ratings.

TABLE 6.1 – FAULT ACTIVITY RATINGS

Fault Activity Rating	Geologic Period of Last Rupture	Time Interval (Years)
Active	Holocene	Within last 11,000 Years
Potentially Active	Quaternary	>11,000 to 1.6 Million Years
Inactive	Pre-Quaternary	Greater than 1.6 Million Years

The California Geologic Survey (CGS) evaluates the activity rating of a fault in fault evaluation reports (FER). FERs compile available geologic and seismologic data, and evaluate if a fault should be zoned as active, potentially active, or inactive. If an FER evaluates a fault as active, then it is typically incorporated into a Special Studies Zone in accordance with the Alquist-Priolo Earthquake Hazards Act (AP). AP Special Studies Zones require site-specific evaluation of fault location and require a structure setback if the fault is found traversing a project site.

The site is not located within an Alquist-Priolo Earthquake Fault Zone and no active faults are known to pass through the project site (McLaughlin et al. 2000; Kelley et al., 19804; Kilbourne et al., 1980; Jennings, 1994; Hart & Bryant, 1997; Jennings & Bryant, 2010). However, a number of regional and local faults traverse the project region. The closest of these faults is the potentially active Freshwater fault located about 2.2 miles east of the site. A number of active faults are located relatively nearby: the Faylor fault (4.7 miles northeast); Mad River fault (5 miles northeast); Little Salmon fault (5.7 miles southwest); and Fickle Hill fault (6.2 miles northeast), as shown on Plate 7 – Regional Fault Map.

In addition to the continental faulting noted above, the project area rests above the Cascadia subduction zone. West of the site, off the coast of California, the oceanic crust of the Gorda plate is being subducted beneath the continental crust of the Pacific Plate, in an area known as the Gorda Escarpment. The descending ramp caused by that subduction, called the Cascadia Subduction zone, extends beneath the project area at a depth of about 9 to 12 miles (McLaughlin et al., 2000). That ramp is capable of storing elastic stress that periodically causes earthquakes that could affect the project area.

7.0 CROSS SECTIONS FOR ANALYSES

Five cross sections were selected for seepage and stability analysis, as shown on Plates 3.1 through 3.4. Cross sections are shown on Plates 4.1 through 4.5. Selected cross sections are located an average of about 1,000 feet apart. Cross sections are named based upon their approximate station number along the levee alignment. Those stationings are shown on Plate 2. Table 7.1 presents cross section station names and the corresponding stations established during this study along the Jacobs Avenue Levee crown and corresponding stationing for hydrologic cross sections presented by NHE (2016).

TABLE 7.1 – CROSS SECTION STATION NUMBERS

Cross Section Name	Station Number	
	Actual Station No.	NHE (2016)
10+75	11+50	8228
21+50	21+50	7477
32+00	31+80	6323
42+00	42+40	5262
56+00	56+10	3572

Cross section topography was estimated based on LiDAR, site specific survey, and bathymetry data provided by the County for the study area. Subsurface conditions were modeled as levee fill overlying fine- and coarse-grained alluvial deposits, which were designated as impervious and pervious foundation materials, respectively. The following paragraphs describe levee subsurface conditions modeled in seepage and slope stability analyses. Beneath the levee, alluvium was modeled as pervious material or as impervious material (blanket) overlying a pervious substratum.

Levee Embankment. No project plans and specifications were available to show details of how the levee was constructed. The levee appears to be constructed from material derived locally, possibly through dredging or drag lining sediments from Eureka Slough. As previously discussed, the levee embankment does not appear to have an impervious core or a zoned embankment having low-permeability soils placed on the waterside levee face, both of which are utilized consistently in levee construction. For our modeling of seepage and stability, we used no core and a uniform embankment with engineering properties obtained from testing materials sampled during this study.

Impervious Blanket. Soils encountered directly beneath the levee embankment materials consisted of sandy to clayey silt. These materials have relatively low hydraulic conductivity and range in thickness from 5 to about 17 feet.

Pervious Material. Pervious materials consisting of silty sand and sand are present beneath the impervious blanket materials. We modeled these materials as extending unobstructed beneath the impervious materials at each cross section.

Rip-rap & Cobble Armoring. Armoring consisting of concrete fragments, cobbles and boulders were observed mainly at the eastern half of the levee waterside face; however they were not included in cross sections modeled during this study due to the relatively minimal influence those materials will have on slope stability and seepage.

Design Water Surfaces. For existing conditions, creek water surfaces were modeled to generally correspond with groundwater measurements collected during our field exploration program, field observations and mean high elevations provided by NHE (2016). Groundwater elevations were estimated based on data collected during our field exploration efforts, between November 19 and January 14, 2016; groundwater data are presented in Table 5.1 and on Plates 4.1 through 4.5.

For flood-stage conditions, water surfaces were modeled to represent 100-yr coastal stillwater flood as defined by NHE (2016).

8.0 GEOTECHNICAL ANALYSES

8.1 *Liquefaction*

Liquefaction triggering analyses were performed for CPT soundings advanced through the levee crest. The computer program LiqIT (Geologismiki, 2006) was used to:

1) Perform the liquefaction triggering analyses according to the 1998 National Center for Earthquake Engineering Research (NCEER) guidelines (NCEER, 1998), and
2) Estimate seismic settlement using Ishihara and Yoshimine (1992).

The results of the analyses are presented on individual plots in Appendix D.

Liquefaction analyses were performed as follows:

- In accordance with ETL 1110-2-580 (USACE, 2013), groundwater depths corresponding to the median annual water surface elevation were assumed to approximate existing phreatic conditions.
- Liquefaction triggering was evaluated for a PHGA of 0.25g and a moment magnitude of 9.0, corresponding to a statistical return period of 108 years. As noted in Section 6.1, a magnitude 9.0 event is estimated to be the modal event for the deaggregated seismic hazard and contributed a relatively large percentage to the estimated seismic hazard. It should be noted that the minimum magnitude scaling factor defined by NCEER (1998) was applied in our analyses because values are not defined for magnitudes greater than 8.5.
- Liquefaction analyses are based on estimates of two values: the cyclic stress ratio (CSR), which characterizes the seismic demand on the soil, and the cyclic resistance ratio (CRR), which characterizes the soil's capacity to resist liquefaction. CSR and CRR versus depth were calculated using 1998 NCEER guidelines (NCEER, 1998).
- Seismic settlement resulting from potential liquefaction was estimated for each drill hole advanced through the levee crest using procedures presented in Ishihara and Yoshimine (1992).

8.1.1 Liquefaction Triggering Analyses per NCEER (1998)

NCEER (1998) guidelines (Youd and Idriss, 2001) present deterministic liquefaction triggering procedures based on SPT and CPT data. The factor of safety (FS) against liquefaction is computed as the ratio of CRR to CSR. The results of the analyses are presented on the liquefaction plots (Appendix D). Those analyses found that the factor of safety against liquefaction was less than 1.0 in the drill holes evaluated. At location 30C the FS was less than 1.0 between the depth increments of about 31 to 36 feet and 40 to 42 feet beneath the levee crown. At location 56C the FS was less than 1.0 between the depth increments of about 5 to 7 feet and 21 to 25 feet beneath the levee crown.

8.1.2 Seismic Settlement per Ishihara and Yoshimine (1992)

Seismic settlement resulting from liquefaction was estimated using procedures presented in Ishihara and Yoshimine (1992). The procedure relates volumetric strain to the FS against liquefaction and normalized N values. Estimated volumetric strains are multiplied by layer thickness to obtain incremental settlement in each liquefiable layer. The increments are summed from the bottom of the exploration to the ground surface. On the basis of our analysis, we estimate the potential magnitude of seismically induced settlement to be up to about 3.42 to 4.36 inches. Cumulative seismic settlement versus depth estimates are presented in Appendix D.

8.1.3 Lateral Spreading

Lateral spreading is defined as lateral earth movement of liquefied soils, or soil riding on a liquefied soil layer, down slope toward an unsupported slope face, such as a creek bank, or an inclined slope face. In general, lateral spreading has been observed on low to moderate gradient slopes, but has been noted on slopes inclined as flat as one degree.

Evaluations using methods of NCEER (1997) in the program LIQit, lateral spreading magnitudes were estimated for the site. Those estimates indicate that up to 63 inches of lateral displacement could occur during the modeled seismic event.

8.1.4 Seismically Induced Dry Settlement per Pradel (1998)

Seismically induced dry settlement can occur in association with liquefaction, or in soils not prone to liquefaction (above the water table) that are loose to medium dense. Seismically induced dry settlement differs from settlement resulting from liquefaction of saturated granular materials, discussed above.

We estimated the potential for seismically induced dry settlement to occur at the site using procedures presented in Pradel (1998). In general, the granular materials encountered in our field explorations ranged from loose to very dense sandy silt, silty sand, sand, sand with gravel, gravelly sand, gravel with sand, sandy gravel, and gravel. The loose to medium dense granular materials may be susceptible to dry seismic settlement. Because the high fine content in the upper layers and the relatively limited thicknesses of material above modeled groundwater, we estimate the potential magnitude of seismically induced dry settlement to be less than one inch.

8.1.5 Results

The results of our seismically induced settlement analyses are summarized in Table 8.1 below, and presented graphically in Appendix D.

TABLE 8.1 – SEISMICALLY INDUCED SETTLEMENT ANALYSES RESULTS		
Section Station Number	**Liquefaction-Induced Settlement (inches)**	**Seismically-Induced Dry Settlement (inches)**
10+75	Not Evaluated	<1
21+50	Not Evaluated	<1
32+00	3.42	<1
42+00	Not Evaluated	<1
56+00	4.36	<1

8.2 *Permeability and Seepage*

The potential for seepage to influence the stability of a levee is dependent upon a number of factors that include:

1. The geometry of the levee;
2. The composition and engineering properties of the levee and foundation soils; and
3. The elevation of the water being retained by the levee.

The geometry and composition of the levee evaluated during this study are discussed in Sections 5.0 and 7.0 of this report. The water surface elevations of the 100-year flood event are discussed below. Estimated water surface elevations along the Jacobs Avenue Levee correspond to freeboards ranging from 0.70 to 2.55.

Two potential seepage pathways were evaluated:

1. Through-seepage, where water flows through the levee embankment and daylights on the landside face of the levee; and
2. Underseepage, where water flows through the levee foundation soils and daylights at the landside ground surface.

Analyses were performed using the finite element modeling program SLIDE (Rocscience, 2016).

Our approach to seepage analyses utilized generalized parameters that could be applied to all of the sections evaluated. Those parameters were derived from site observation and laboratory testing.

In accordance with EM 1110-2-1913 (USACE, 2000a), seepage analyses were performed for steady-state seepage during a full flood event. As noted above, water surfaces for coastal stillwater flood-stage conditions were modeled to represent the 100-yr water surface elevations, as defined by NHE (2016). Groundwater elevations for existing conditions were estimated on the basis of data collected during our field exploration, which are presented in Table 5.1 and on Plates 4.1 through 4.5. and water elevation representing mean high water (MHW) provided by NHE (2016)

8.2.1 Through-Seepage Analyses

The potential for through-seepage was estimated at each section by review of seepage analyses output to determine if the estimated phreatic surface emerges on the landside slope during the design flood event. As noted in USACE (2000a), seepage exiting on the landside slope could potentially decrease the stability of the slope as a result of sloughing or internal erosion of the slope.

8.2.2 Underseepage Analyses

Acceptance criteria have been established by the USACE to reduce the potential impacts of levee underseepage (USACE, 2005). Those criteria specify that underseepage beneath an existing levee is acceptable if the exit gradient is 0.5 or less, which would provide a factor of safety against seepage-related failures of at least about 1.6 (USACE, 2005).

If cross sections are modeled with landside impervious foundation (i.e. blanket) material, average exit gradients were estimated by dividing the difference in total head across the thickness of the blanket material by the thickness of the stratum. Factors of safety for underseepage estimated below are based on an assumed critical gradient value of approximately 0.8 for impervious and pervious foundation materials.

For steady-state seepage analyses, the landside extent of the seepage models was defined by the lesser of the perpendicular horizontal distance to the valley basin limits (bedrock slope), a distance of 2,000 feet from the levee centerline, or established groundwater condition (Arcata Bay).

To simulate the general hydrogeologic conditions we anticipate during a flood event, estimated groundwater elevations were applied as boundary conditions at the landside boundary to model the Arcata Bay groundwater levels which are the defining hydrologic limit conditions.

8.2.3 Results

The results of our seepage analyses for the five cross sections are summarized below.

TABLE 8.2 – SUMMARY OF RESULTS FOR SEEPAGE ANALYSES				
Section	Potential for Through-Seepage Estimated	Approximate Daylight Height Above Landside Toe (ft)	Exit Gradient at Landside Toe	
			Steady-State	Factor of Safety
10+75	Yes	2.1	0.2	3.8
21+50	Yes	2.5	0.3	2.5
32+00	Yes	1.9	0.4	1.9
42+00	Yes	2.9	0.2	3.8
56+00	Yes	1.4	0.2	3.8

8.3 *Slope Stability*

Slope stability analyses were performed for the five cross sections along the Jacobs Avenue Levee. The analyses were performed using the limit equilibrium program SLIDE (Rocscience, 2016). Our approach to slope stability analyses assumed generalized parameters for all of the sections evaluated. In addition, slope stability analyses focused on failure surfaces that intersected the levee crest. Shallow failure surfaces typically cut only a small portion of the levee slope and typically do not pose substantial threat to the integrity and safety of the levees (DWR, 2013).

8.3.1 USACE Acceptable Slope Stability Criteria

The USACE has established minimum factor of safety (FS) thresholds for levee slope stability conditions (USACE, 2000a). The FS against slope failure is estimated by calculating the forces resisting slope failure divided by the forces causing slope failure. Thus, a FS of greater than 1 implies a stable slope, a FS less than 1 implies a failing slope, and a FS equal to 1 implies that a slope is on the verge of failure.

The conditions for analysis specified by the USACE consist of four slope stability cases:

- Case I – End of Construction;
- Case II – Sudden Drawdown;
- Case III – Steady Seepage from Full Flood Stage; and
- Case IV – Earthquake.

Case I represents approximate as-constructed embankment conditions that would be present at the time when levee construction is just completed. Under this scenario, fine-grained soils (impervious embankment and foundation soils) are modeled using undrained (more likely unsaturated) shear strength parameters, whereas granular soils (pervious soils) are modeled using drained shear strength parameters. Slope stability analyses for this case are performed for both the landside and waterside slopes. Case I is typically not performed for existing levees.

Case II represents the scenario when a prolonged flood stage saturates the levee embankment and then recedes faster than the soil can drain (rapid drawdown). Slope stability analyses for this case are performed on the waterside slopes.

Conditions for **Case III** occur when a prolonged flood stage allows steady state seepage flow to occur through the levee. Under this scenario, the landside slope stability is evaluated.

Case IV represents the effects of earthquake forces on the levee stability.

The USACE (2000, 2013) has established minimum FS values for each levee slope stability case evaluated. Those allowable minimum FS values, presented in Table 8.3 below, were referenced in our interpretation of slope stability analyses discussed herein.

TABLE 8.3 – MINIMUM ACCEPTABLE FACTOR OF SAFETY VALUES

Case	Minimum Factor of Safety
Case I – End of Construction	1.30 to 1.50*
Case II – Rapid Drawdown	1.00 to 1.20**
Case III – Steady State Seepage	1.40
Case IV – Earthquake (pseudo-static)	1.00

* Frequently loaded levee
** FS of 1.0 applies to pool levels prior to drawdown for conditions where these water levels are unlikely to persist for long periods preceding drawdown. FS of 1.2 applies to pool levels likely to persist prior to drawdown.

8.3.2 Methodology

Shear strength parameters applied to each slope stability case noted above were derived from observation site condition, laboratory test results and applicable correlations. For our stability analyses of existing conditions and landside slope conditions during a full flood event, drained shear strength parameters were assigned to the subsurface materials. Phreatic surfaces and pore pressures used for slope stability analyses of full flood and rapid drawdown conditions were based on steady-state seepage results.

Rapid drawdown slope stability evaluations used the three-stage method, as described in Appendix G of EM 1110-2-1902 (USACE, 2003), and programmed into SLIDE. The three-stage method uses both drained and consolidated-undrained shear strength parameters, estimated as described in Appendix G of EM 1110-2-1902 (USACE, 2003) and DWR (2015).

For pseudo-static stability analyses of slopes with soils considered to be potentially liquefiable during the design seismic event, undrained residual strength parameters were estimated for potentially liquefiable strata according to the empirical correlation proposed by Seed and Harder (1990). Potential liquefaction is discussed in Section 8.1 and estimated undrained residual strength values for potentially liquefiable strata are presented in Appendix E.

We performed screening-level pseudo-static slope stability analyses by applying a horizontal seismic coefficient equal to approximately half of the estimated PGHA [i.e. 0.5×0.25g = 0.127g (rounded up to 0.13g]. If the estimated FS for the initial pseudo-static slope stability analyses was less than 1.0, we performed a seismic deformation analysis to estimate the levee's performance during the design seismic event. If the FS was estimated to be equal to or greater than 1.0, minimal or negligible seismic displacements are anticipated for the design seismic event and post-earthquake slope stability analyses were not performed (DWR, 2013).

8.3.3 Results

The results of our slope stability analyses for the three cross sections evaluated are summarized in Table 8.4 and presented graphically in Appendix E.

TABLE 8.4 – SUMMARY OF SLOPE STABILITY ANALYSES RESULTS

Section	Levee Slope	Factor of Safety For Each Case Evaluated			
		Existing Conditions	Seepage During a Full Flood Event	Rapid Drawdown	Pseudo-static
10+75	Landside	1.36	1.08		1.10
	Waterside	1.04		0.98	0.80
21+50	Landside	1.78	1.27		1.34
	Waterside	1.32		1.34	0.92
32+00	Landside	1.47	1.16		1.10
	Waterside	1.36		1.36	1.03
42+00	Landside	1.74	1.33		1.23
	Waterside	1.04		1.04	0.83
56+00	Landside	1.90	1.47		1.36
	Waterside	1.75		1.75	1.31

8.4 *Seismic Deformation*

As shown in Table 8.4, the estimated factor of safety for the screening-level pseudo-static slope stability analyses were lower than 1.0 for three of the sections evaluated. Therefore, slope stability analyses were performed to estimate seismic deformation. That displacement is estimated to be higher than 3 feet.

8.5 *Settlement*

In addition to liquefaction-induced settlement analyses, as discussed above, a qualitative evaluation of static settlement was also performed. The potential for static settlement can arise through several cases, including consolidation of underlying soils due to fill or structural loads at the ground surface; subsidence due to removal of groundwater or other subsurface fluids, such as petroleum; and hydroconsolidation due to saturation of collapsible soils.

Due to the age of the levee (on the order of 84 to 114 years or more for most of the project site and about 35 years for the eastern levee section where modifications were made in the 1980s), it is very likely that all of the consolidation of underlying soils has already taken place in response to the weight of the levee fill material. Additional settlements are possible if fill or structural loads are placed on or in close proximity to the levees.

The project site is not in an area where the withdrawal of groundwater or other subsurface fluids is known to have caused subsidence. There is a potential for settlement to occur under the levees if sufficient lowering of the groundwater table were to occur in close proximity to the project site.

Two scenarios that could induce such settlement are construction dewatering and large-scale pumping of groundwater for industrial, agricultural, or municipal purposes.

Hydroconsolidation, or hydrocollapse, is a phenomenon associated with soils that are prone to relatively rapid settling when subjected to wetting or saturation. Near-surface deposits of dry, porous soils where the particles are cemented with soluble salts are particularly vulnerable to hydrocollapse. The results of our subsurface exploration and laboratory testing did not indicate the presence of such soils within or below the levees.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 *Identified Deficiencies and Relative Severity*

As noted in the sections below, a number of deficiencies have been identified for the Jacobs Avenue Levee. The sections below provide details of the deficiencies and conceptual mitigation measures for reducing the flood protection risks associated with those deficiencies. The following table lists the identified deficiencies in decreasing order of relative corrective urgency, based on our opinion of risks posed by the deficiencies.

TABLE 9.1 – LEVEE DEFICIENCIES IN ORDER OF PERCEIVED URGENCY FOR MITIGATION

Urgency	Deficiency
Most Urgent	Levee Prism Geometry and Freeboard
↕	Slope Stability
	Seepage
	Erosion
	Vegetation Management
	Liquefaction
Least Urgent	Seismic Deformation

In addition, it should be noted that our evaluations are based upon hydrologic conditions as they exist at this time. Sea levels will continue to rise over time, which will adversely affect many aspects of levee stability including freeboard, seepage, and slope stability. These possible future changes could have additional future economic impacts on landowners located adjacent to the levee due to future mitigation measures needed to keep the levee stable.

9.2 *Levee Prism Geometry & Freeboard*

The geometry of the levee prism does not meet USACE standards for most of the levee alignment. These standards require a minimum of 3:1 waterside slopes, 2:1 landside slopes, and a 12-foot wide levee crown. For most of the levee, the waterside and landside levee slopes are too steep and the crown varies from about 12 feet wide at Station 10+50 to less than 3 feet wide at about Station 56+00. Many of the deficiencies noted for erosion, seepage, and slope stability are likely related to the lack of adequate levee prism geometry.

In addition, the freeboard is locally deficient along the levee, based on the hydrologic evaluations provided to us. A minimum of one-foot of freeboard is required above the maximum wave run-up or height of the one-percent wave, whichever is greater, and under no circumstances should freeboard be less than 2 feet above the 100-year stillwater surge elevation.

Mitigation for establishing an acceptable levee prism and freeboard consists of grading the levee to establish an acceptable geometry. Most likely this would consist of leaving the levee waterside toe in place and grading towards the north to avoid environmental impacts and permitting issues associated with grading work in the Eureka Slough. It is anticipated that soil materials meeting applicable specifications would need to be imported to the site to accomplish the grading. Impacts to some landowner improvements, such as buildings currently close to the levee landside toe, would occur and could require construction of retaining walls or demolition of those structures.

Many of the defects noted in the sections below are related to the lack of appropriate levee prism geometry and would likely be improved or eliminated if the levee geometry was reconstructed to meet USACE standards. Thus, we have ranked implementation of mitigations for levee prism geometry as the relatively most urgent mitigation associated with Jacobs Avenue Levee.

9.3 *Vegetation and Erosion*

According to USACE (2000b), terrain within 15 feet of the levee should be free of vegetation. Based on our observations, there is vegetation along portions of the waterside and landside levee slope areas. This vegetation includes seasonal grasses, shrubs, brambles, and trees.

According to the USACE, vegetation in these areas has the potential to compromise the functionality of the levee and limit access for operations and maintenance (USACE, 2009a and 2009b). In our opinion, based on observations at the site, the waterside vegetation, while not desirable according to the USACE, might not be an adverse condition to the stability of the levee system. The vegetation could induce more turbulent water and cause some mounding effect during high flows; however, the slough generally has relatively slack or low velocity waters, thus mounding and turbulent waters pose relatively low risks to the project. In addition, the vegetation appears to have helped anchor foundation soils along the waterside levee toes and likely helps stabilize channel banks, thus reducing erosion within these areas.

While the vegetation treatments should attempt to address specifications developed by the USACE, it is a much more complex issue that we understand is currently under consideration and development at the national and state level. Until updated guidelines are developed, we recommend that the levee owner initiate reasonable efforts to reduce vegetation along the waterside and landside levee faces and toes, but avoid treatments that would remove the vegetation that provides slope stability benefits.

We noted localized areas of erosion along the waterside levee slope along the levee. The erosion is discontinuous and occurs in areas where rip-rap is absent, and also in rip-rapped areas containing gaps in the rip-rap, insufficient amounts of rip-rap, or insufficient height of rip-rap. The erosion appears to be occurring due to wind generated waves lapping onto the waterside face of the levee are relatively high tides. In general, the erosion, where it occurs, is on the order of about a foot deep and creates a near-vertical face in the levee face embankment. In general, it is our opinion that the severity of the erosion is relatively low based on the localized nature of the erosion. However, regular monitoring for changing conditions is recommended.

Mitigation of the erosion would consist of removal of existing rip-rap in eroded areas, grading of the levee on the waterside to meet geometric standards, placement of a geotextile filter fabric, then placement of properly sized rip-rap onto the filter fabric. The rip-rap should extend to sufficient height to be above mean high tides.
The current state of erosion and vegetation on the levee slopes does not pose an imminent threat to the stability of the levee. Thus, in Section 9.1, they are ranked relatively low in regards to perceived urgency, based on the information available to us at this time.

9.4 *Liquefaction and Seismically Induced Dry Settlement*

There is a likely potential for liquefaction and seismically induced dry settlement of the pervious foundation material at the project site during the design seismic event, as described in Section 8.1 of this report. The maximum estimated liquefaction and seismically induced dry settlements are approximately 4.36 inches and less than 1 inch, respectively. In addition, there is a risk of lateral displacement in the order of 63 inches due to lateral spreading.

In our opinion, the need for remedial action should be based on an assessment of risk posed to adjacent improvements. The estimated levee settlement due to liquefaction and seismically induced dry settlement is anticipated to result in freeboards of less than 2 feet at any cross section evaluated.

It should be noted that the probability of a high-water flood event and design seismic event occurring simultaneously is considered to be relatively low. However, due to the tidal nature of the adjacent slough, the levee could be exposed to high water levels relatively soon if levee slopes settle during or after the design seismic event.

Based on these conclusions, it is our opinion that mitigations measures for liquefaction are necessary for the Jacobs Avenue Levee system. However, in the event of an earthquake prior to any mitigation measure, we recommend that the levees be inspected for signs of settlement, cracking, or failure as soon as possible following the earthquake and repaired as soon as conditions will allow.

Mitigation measures for liquefaction risks vary in scope and cost for settlement and lateral spreading. In general, mitigation of liquefaction-induced settlement is relatively less expensive and simpler than mitigation measures for lateral spreading. Both liquefaction phenomenon are mitigated using similar techniques; however, settlement mitigations are performed more locally, whereas, lateral spreading requires a regional mitigation which would encompass much of the landside areas located between the levee and Jacobs Avenue.

Mitigation measures for liquefaction (both settlement and lateral spreading) consist of ground modification methods, such as the installation of stone columns, rammed aggregate piles (geopiers), and injection grouting. Deep dynamic compaction (DDC) is an additional method but due to the presence of existing structures and buried infrastructure that would be damaged by DDC, this method has been excluded.

Ground modification methods typically involve the penetration of the liquefiable zone with materials that lateral displace and densify those liquefiable soils to reduce the potential for liquefaction to occur. For stone columns and geopiers, this typically consists of the drilling of a pilot hole to a target depth, then the placement of gravel within the drill hole. For stone columns, the gravel is vibrated into place as it is placed. For geopiers, the aggregate is rammed as it is placed. With displacement or compaction grouting, a pilot hole is advanced to a target depth then grout is injected under pressure to displace the adjacent soils. In all cases, the materials placed within the holes displace and densify the adjacent soils.

Typically, the locations of each of the above noted mitigations are made on a grid spacing. The distance between each mitigation point and the depth of mitigation are typically determined by the specialty subcontractor based on subsurface information developed for the area of concern. For mitigating settlement, the grid spacing would likely occur along the levee alignment to a nominal distance on the landside and waterside of the levee. For lateral spreading, the grid spacing would encompass the same area as for settlement and also much of the area between the levee and Jacobs Avenue.

Liquefaction has a high potential to destabilize the levee, potentially rendering it ineffective as a flood control improvement. However, liquefaction only occurs when there is a relatively strong near-field earthquake, which happens relatively infrequently. So, while the consequence to the levee from liquefaction is high, the probability of occurrence is low for any given year. Thus, we have ranked the urgency for mitigation as relatively low because the likelihood of liquefaction to occur soon is considered low.

9.5 *Permeability and Seepage*

9.5.1 Underseepage

The steady state seepage analyses resulted in estimated vertical exit gradients ranging from about 0.2 to 0.4 at the levee landside toe, for the conditions analyzed at each of the five cross section locations. According to USACE (2005), the allowable FS for underseepage corresponds to a maximum exit gradient of 0.5. Therefore, each of the sections evaluated have a FS greater than that required by the USACE and are considered stable. Based on these conclusions, it is our opinion that mitigations measures for underseepage are not necessary for the Jacobs Avenue Levee system.

That being said, there are no data for the backfill surrounding the penetrations that cross the levee or the former channels that were present prior to levee construction and that cross the levee alignment, as shown on Plate 6. That backfill in these areas should be exposed to assess the composition and characteristics of the materials. If relatively plastic clay or PCC materials were not used to backfill around the penetrations and former channels then mitigations to reduce the potential for underseepage along the backfill need to be developed. Those mitigations can include:

- Removal and replacement of the backfill using highly plastic clay or controlled low strength material (lean cement slurry); or
- Place low permeability trench plugs at selected location

9.5.2 Through-Seepage

The steady state seepage analyses indicated through-seepage develops within each of the five cross sections evaluated. All sections resulted in the phreatic surface encountering the landside levee slope face.

If the levee prism is reconstructed to USACE standards, as discuss in Section 9.2, then daylight height above landside may be reduced or through-seepage may not continue to be a deficiency, depending on the characteristics of the fill materials being placed. Soil material criteria should be established prior to grading to reduce the potential for through seepage.

If recommendations in Section 9.2 are not implemented, then through-seepage can be mitigated using a cutoff trench or seepage berm.

Cutoff Trenches. A cutoff trench reduces the potential for through-seepage by blocking seepage paths through the embankment and foundation materials. A cutoff trench is typically a minimum of three feet wide and extends to a depth of about 1.5 times the levee height below the bottom of the levee; however, the configuration of the cutoff trench should be designed for site-specific conditions. The cutoff trench is filled with low permeable materials such as bentonite, cement slurry, or low permeability soils.

Landside Seepage Berm. Landside berms are constructed on the landward side of embankments to reduce the potential for through seepage by lengthening seepage paths. The berms also reduce the potential for sloughing of the landside face and can be used as an emergency source of borrow materials for repair of the levee. Berms are composed of impervious or semi-pervious material, sand, or free-draining gravel. However, the configuration (thickness and width) of berms should be designed for site-specific conditions and may require significant space, which locally along the Jacobs Avenue Levee, could impinge upon landside improvements.

Seepage can pose significant risks to the stability of a levee and is an on-going condition at

Jacobs Avenue due to tidal fluctuations. It is also one of the relatively easiest conditions to mitigate, although those mitigations are relatively expensive. Thus, we have ranked seepage relatively high regarding urgency of mitigation in Section 9.1.

9.6 *Slope Stability*

As discussed in Section 8.3 of this report, slope stability analyses were performed at each cross section for various conditions. The results are discussed relative to each condition below.

Slope instability poses a significant risk to the levee, especially in those areas where the levee width is deficient, such as from about Station 46+00 to the western terminus of the levee at Highway 101. For this reason, we have ranked slope stability as relatively high in urgency for mitigation, as noted in Section 9.1.

9.6.1 Existing

Our slope stability analyses of existing levee conditions estimated factors of safety ranging from approximately 1.36 to 1.90 and 1.04 to 1.75 for the landside and waterside slopes, respectively. Based on our review of historical information and observations during the field exploration program, we understand the levee slopes have not experienced past instability, which is consistent with our estimated factors of safety.

Although a minimum FS is not defined for existing levees in USACE (2000a), our estimated factors of safety for existing levee conditions marginally meet or exceed the minimum end-of-construction FS for a new levee, defined as 1.3 (USACE, 2000a).

9.6.2 Pseudostatic

Our slope stability analyses of existing levee conditions subjected to pseudostatic (i.e. earthquake) loading estimated factors of safety ranging from approximately 1.10 to 1.36 and 0.80 to 1.31 for the landside and waterside slopes, respectively. A minimum FS is not defined for pseudo-static loading conditions in USACE (2000a). There is high risk of lateral spreading in the event of a strong earthquake (see Section 9.4). Based on our review of historical information, there is no information indicating that levee slopes have experienced instability during a seismic event.

At a minimum, it is recommended that the levees be inspected for signs of instability or slope failure as soon as possible following an earthquake and, if necessary, repaired as soon as conditions will allow. If recommendations for reconstruction of the levee prism are implemented as discussed in Section 9.2, it is likely that pseudostatic factors of safety for waterside slopes will exceed 1.0.

9.6.3 Full Flood (Steady State) Event

Our slope stability analyses of existing landside levee slopes, based on steady-state full flood conditions, estimated factors of safety ranging from approximately 1.08 to 1.47.

As noted above, phreatic surfaces and pore pressures modeled in slope stability analyses of full flood conditions were based on the results of our steady-state seepage analyses. It is our opinion that steady state phreatic surfaces are unlikely to develop during the projected duration of a 100-yr flood event. Slope stability analyses of sections with phreatic surfaces more likely to develop during the design flood event duration are anticipated to result in higher estimated factors of safety than the FS values shown in Section 8.3.3, considering full flood conditions.

Therefore, the potential for landside slope failures during the 100-yr flood event is considered to be low to medium. At a minimum, however, it is recommended that the levees be inspected for signs of instability or slope failure during a flood event and, if necessary, repaired as soon as conditions will allow.

9.6.4 Rapid Drawdown

Our slope stability analyses of existing waterside levee slopes following a rapid drawdown of full flood water levels estimated factors of safety ranging from approximately 0.98 to 1.75.

As noted above, phreatic surfaces and pore pressures modeled in slope stability analyses of rapid drawdown conditions were based on the results of our steady-state seepage analyses. It is our opinion that steady state phreatic surfaces are unlikely to develop during the projected duration of a 100-yr flood event. Furthermore, slope stability analyses with phreatic surfaces likely to develop during the design flood event are anticipated to result in higher estimated factors of safety than the FS values shown in Section 8.3.3.

Therefore, the potential for waterside slope failures due to rapid drawdown during the 100-yr flood event is considered to be low to medium except for sections 10+75 and 42+00 where it is considered high (FS=0.98 and 1.04). If recommendations for reconstruction of the levee prism are implemented as discussed in Section 9.2, it is likely that rapid drawdown factors of safety will increase and possibly meet the minimum threshold of 1.4. Following flood events, we recommend that the levees be inspected for signs of instability or slope failure and, if necessary, repaired as soon as conditions will allow.

9.7 *Seismic Deformation*

As noted in Section 8.3.3, the estimated factors of safety for the screening-level pseudostatic slope stability analyses ranged from 0.80 to 1.36 for all of the sections evaluated. Therefore, seismic displacements are anticipated for the design seismic event and post-earthquake slope was estimated to be at least 36 inches.

If mitigations discussed in Section 9.2 and 9.4 are implemented, then the seismic displacement noted above would be eliminated. If those mitigations are not implemented, then mitigation measures to reduce the seismic deformation include modifying the levee prism geometry and reinforcing the levee embankment so that it is stable under pseudostatic conditions. This would involve possibly reinforcing the levee embankment with geogrid, removal and replacement of the levee embankment materials with strong soils, construction of stability berms, etc. Each would involve extensive grading and modification to the levee along its entire length. Utilization of stronger soils and stability berms would require importation of soils. Construction of stability berms would potentially impinge upon landside property improvements and could be required on the waterside slope of the levee, too.

Seismic deformation has a high potential to destabilize the levee, potentially rendering it ineffective as a flood control improvement. However, seismic deformation only occurs when there is a relatively strong near-field earthquake, which happens relatively infrequently. So, while the concequence to the levee from seismic deformation is high, the probability of occurrence is low for any given year. Thus, we have ranked the urgency for mitigation as relatively low because the likelihood of seismic deformation to occur soon is considered low.

9.8 *Static Settlement*

As discussed in Section 8.5, the potential for static settlement to impact the levees is considered to be minimal under the present conditions. Therefore, no remedial actions are considered necessary at this time.

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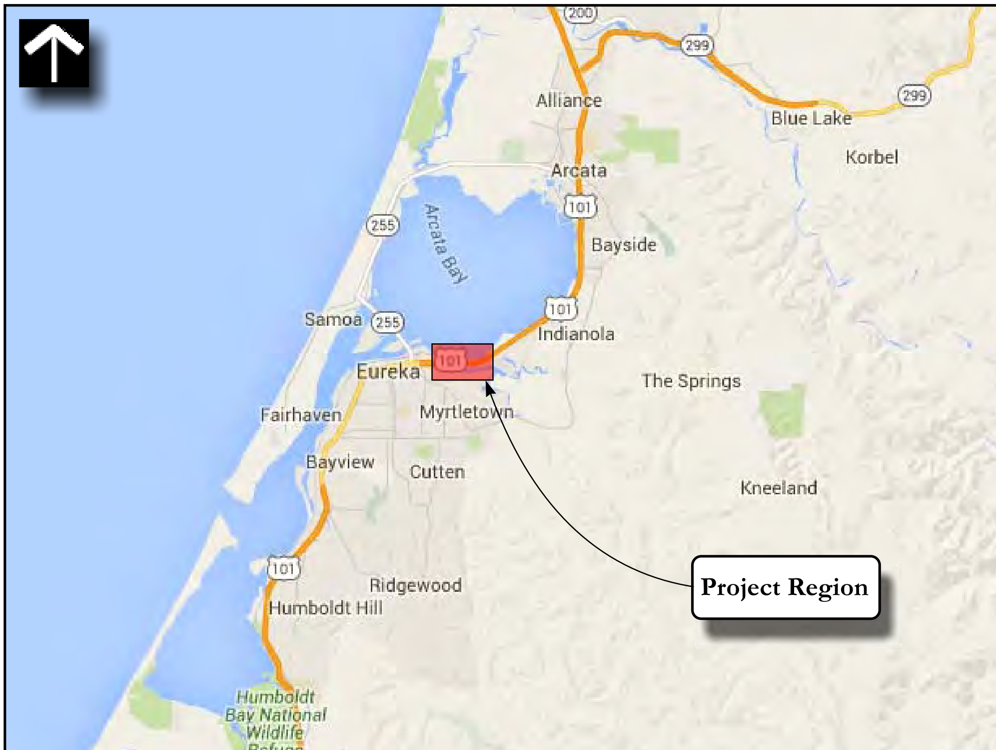
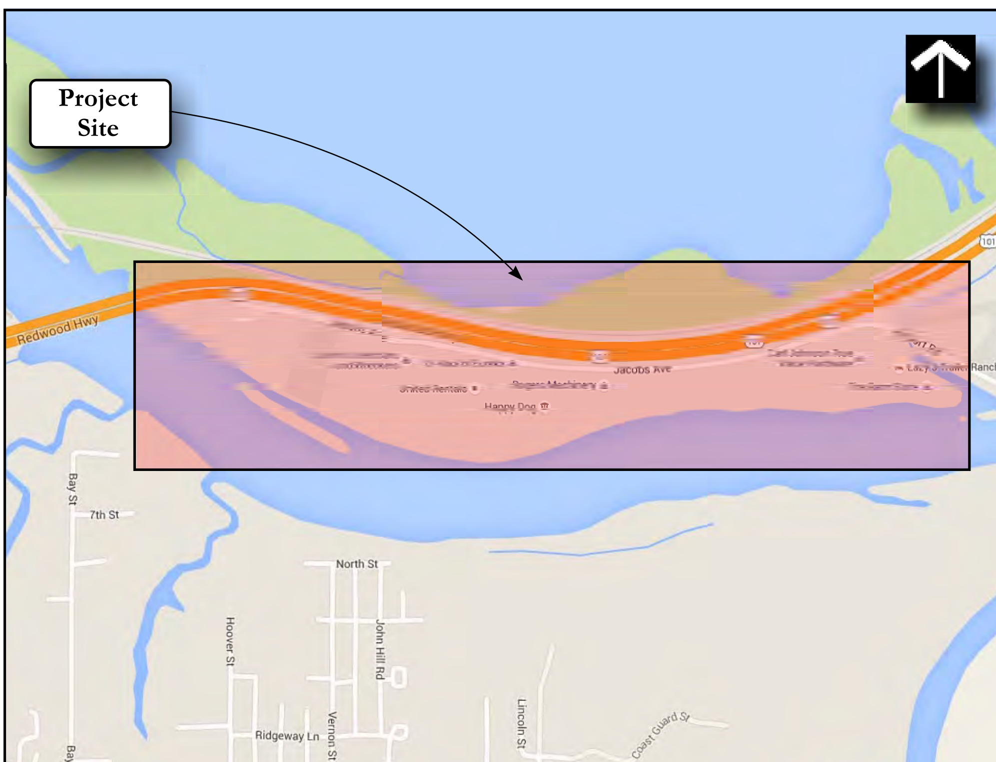
Youd, T. L. and Idriss, I.M. (2001), "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, Co-chairs Youd, T.L. and Idriss, I.M., Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 10, pp. 817-833.





Base maps obtained from Google Maps

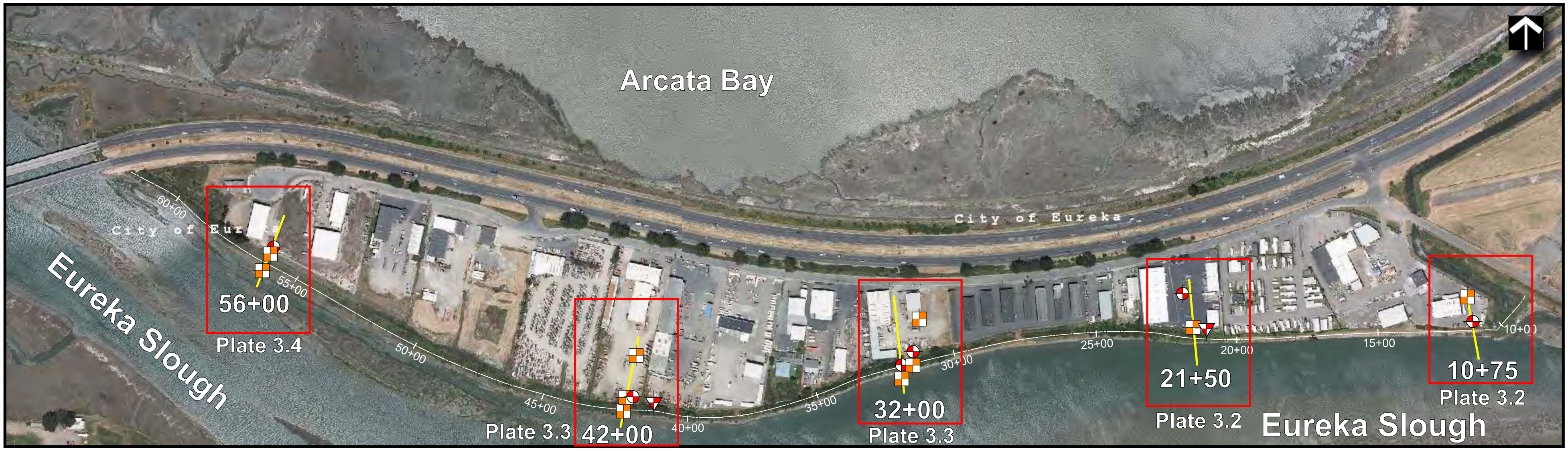
Scale undetermined

CGI TECHNICAL SERVICES INC.	SITE LOCATION MAP JACOBS AVENUE LEVEE EVALUATION PROJCT HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT CITY OF EUREKA, CALIFORNIA	Plate 1
Project No.:15-1949.03		

Base maps obtained from Google Earth

Scale undetermined

CGI Technical Services Inc.	LEVEE DETAILS JACOBS AVENUE LEVEE EVALUATION PROJCT HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT CITY OF EUREKA, CALIFORNIA	Plate 2
Project No.:15-1949.03		



DH-10L — Drill Hole

CPT-30C — Cone Penetrometer Test Sounding

B-2 — Taber Consultants (1985) Boring (very approximate)

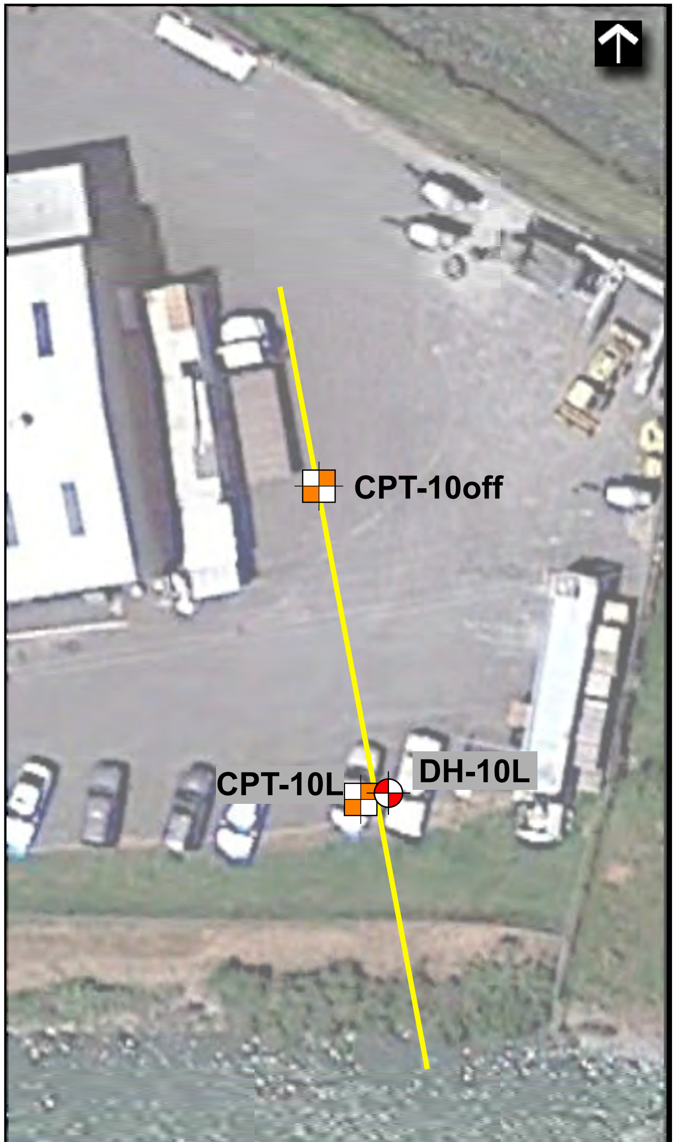
Cross Section Location

Plate 3.4 — Plate number showing greater detail regarding exploration locations

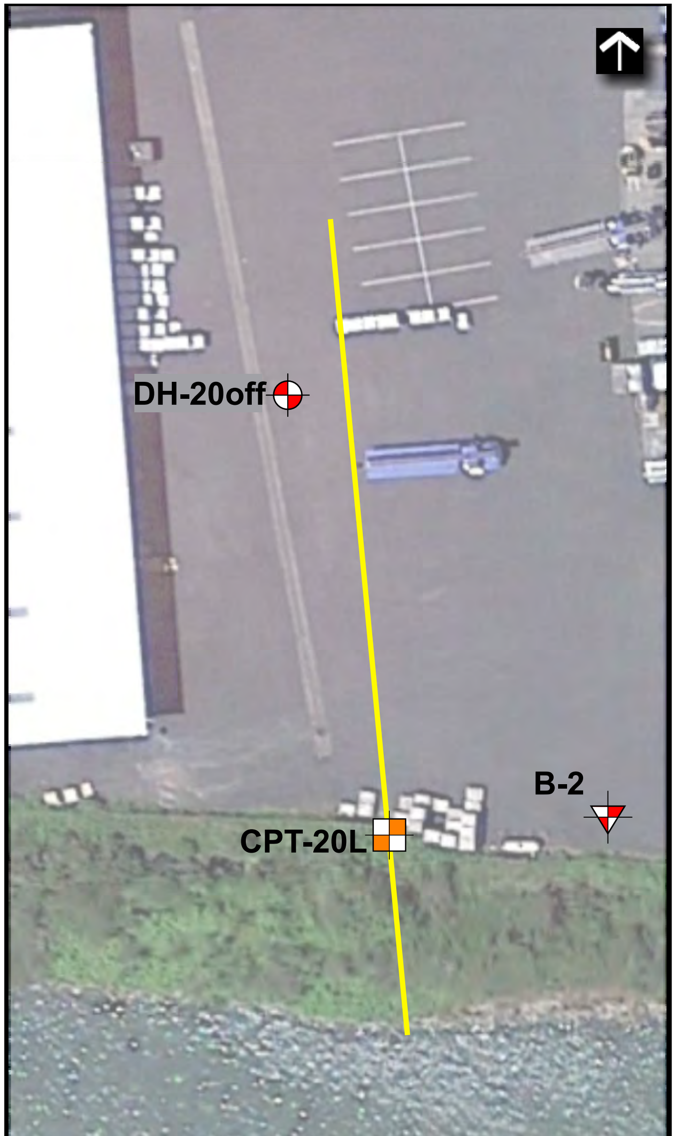
Image from Google Earth

Scale Undetermined

CGI TECHNICAL SERVICES INC.	CROSS SECTION & EXPLORATION LOCATIONS JACOBS AVENUE LEVEE EVALUATION PROJECT HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT CITY OF EUREKA, CALIFORNIA	Plate 3.1
Project No.:15-1949.03		



CROSS SECTION 10+75



CROSS SECTION 21+50

DH-10L Drill Hole

CPT-30C Cone Penetrometer Test Sounding

B-2 Taber Consultants (1985) Boring (very approximate)

Cross Section Location

Image from Google Earth

Scale Undetermined

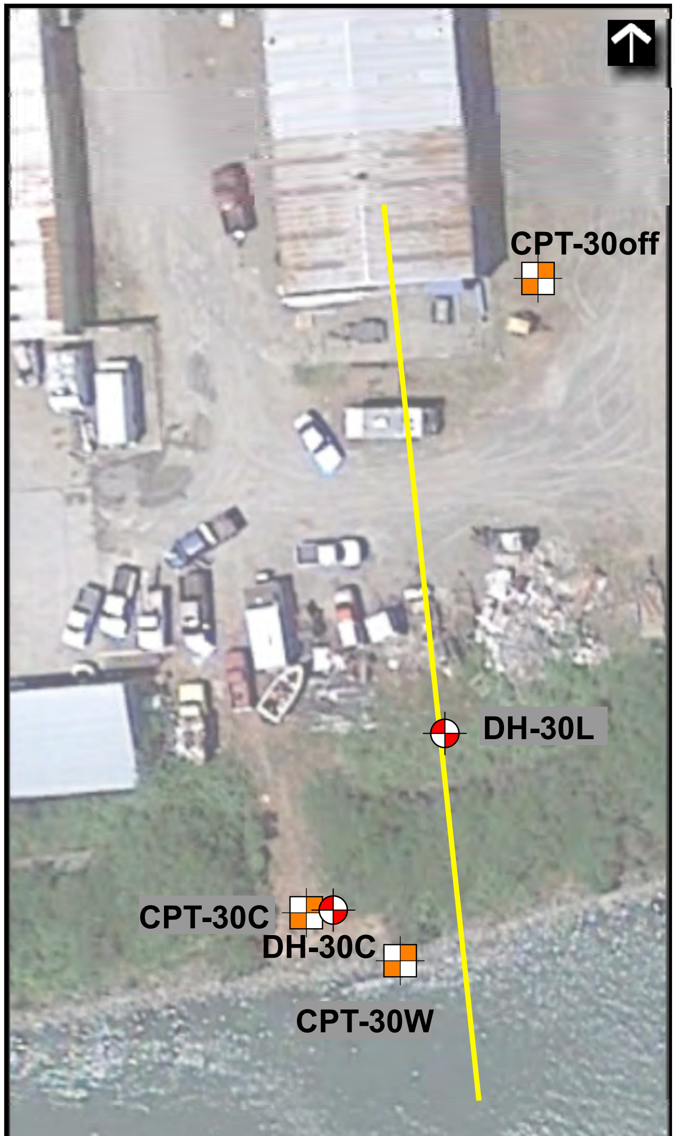
CGI Technical Services Inc.

Project No.:15-1949.03

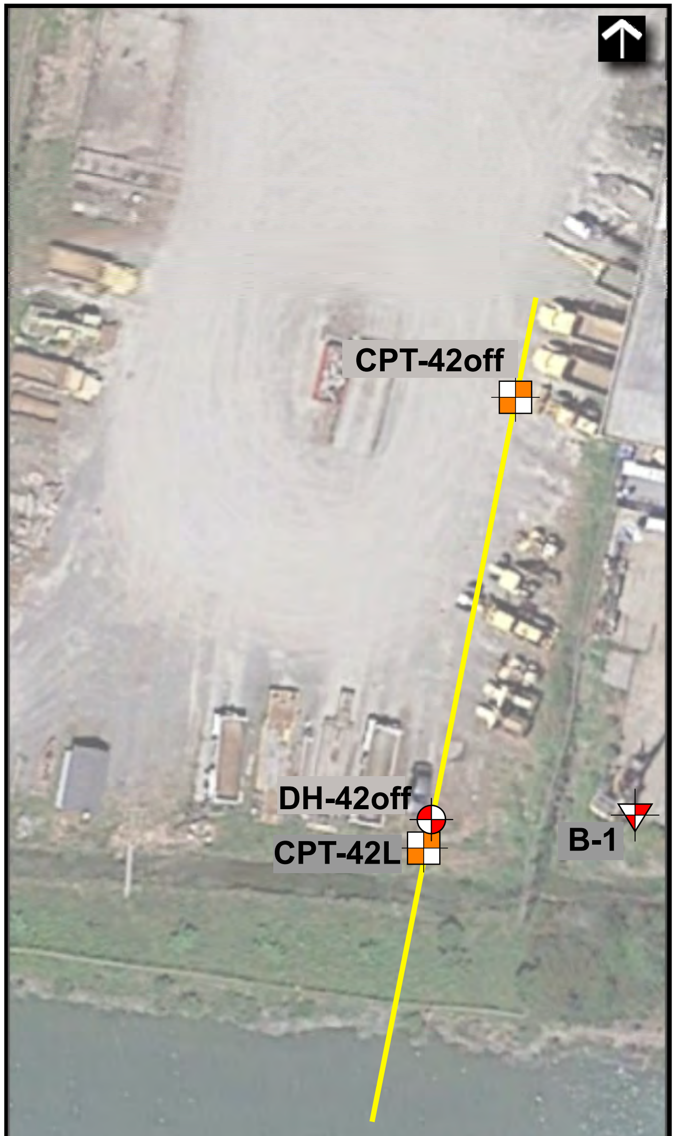
CROSS SECTION & EXPLORATION LOCATIONS
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

Plate

3.2



CROSS SECTION 32+00



CROSS SECTION 42+00

DH-10L Drill Hole

CPT-30C Cone Penetrometer Test Sounding

B-2 Taber Consultants (1985) Boring (very approximate)

Cross Section Location

Image from Google Earth

Scale Undetermined

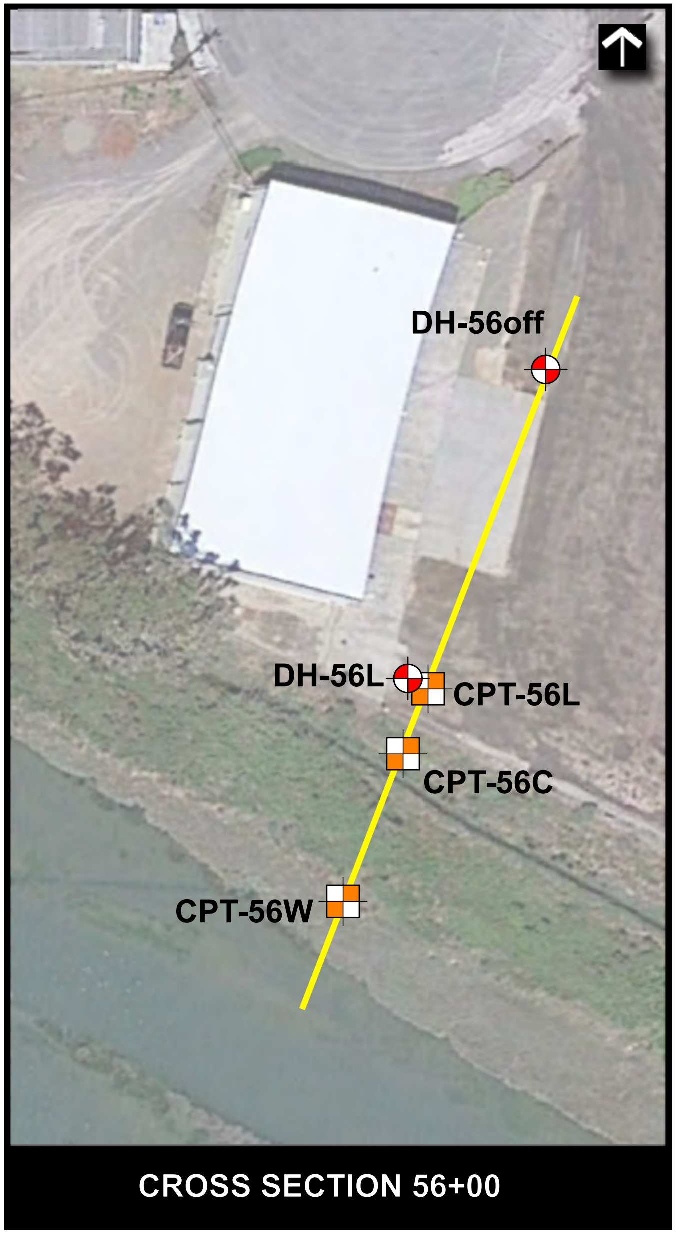
CGI TECHNICAL SERVICES INC.

Project No.:15-1949.03

CROSS SECTION & EXPLORATION LOCATIONS
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

Plate

3.3



DH-10L Drill Hole

CPT-30C Cone Penetrometer Test Sounding

B-2 Taber Consultants (1985) Boring (very approximate)

Cross Section Location

Image from Google Earth

Scale Undetermined

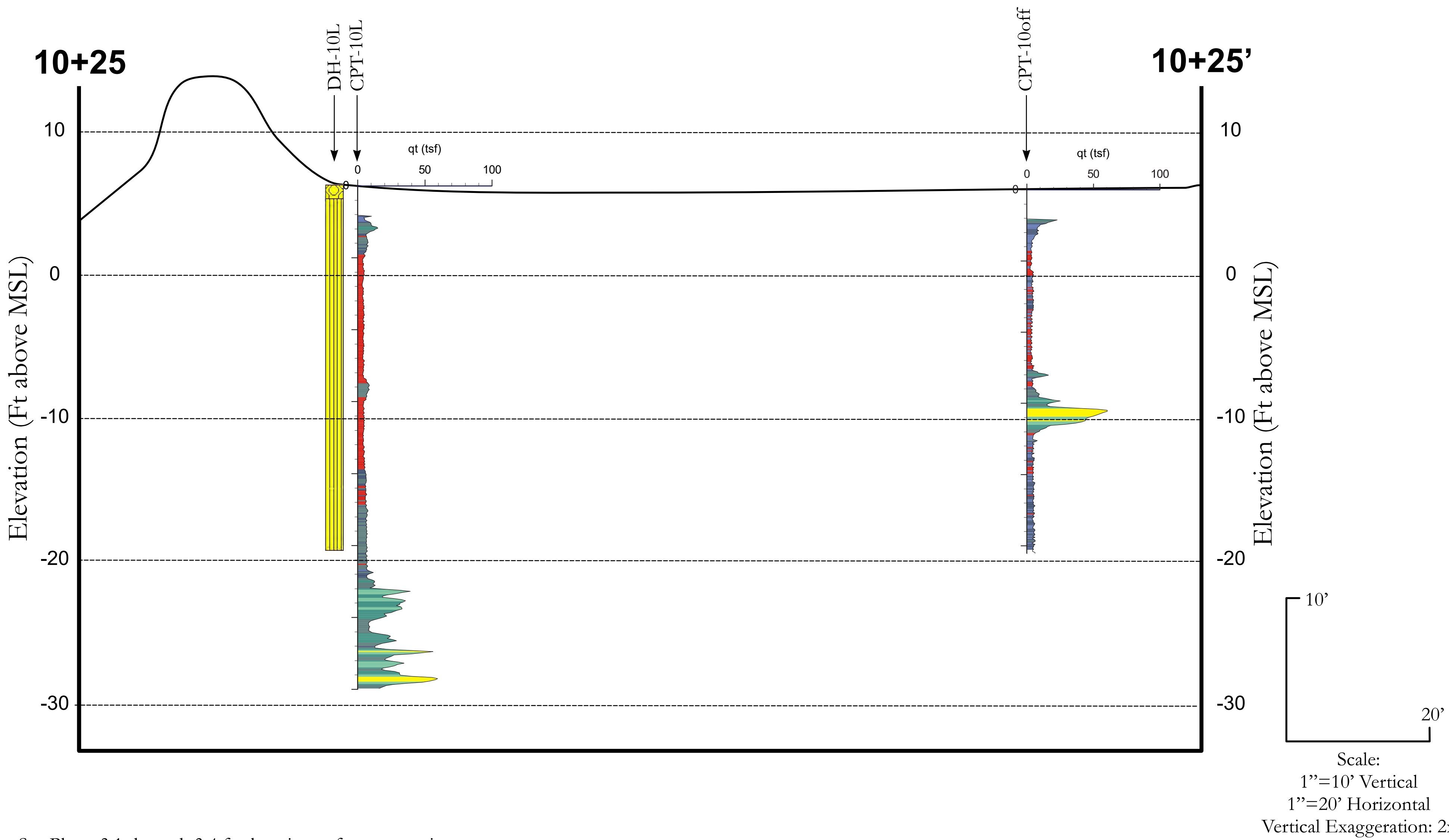
CGI Technical Services Inc.

Project No.:15-1949.03

CROSS SECTION & EXPLORATION LOCATIONS
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

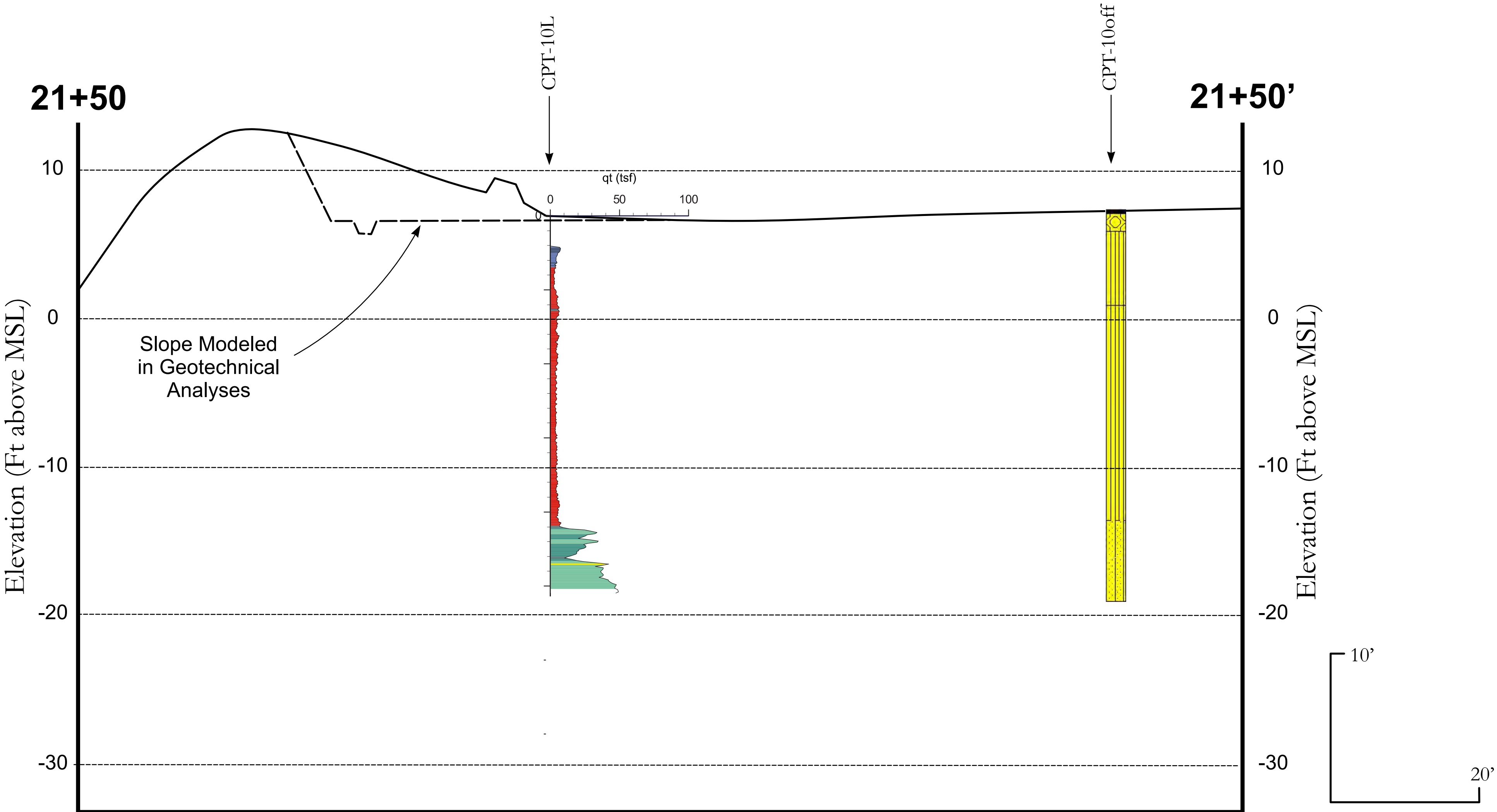
Plate

3.4



See Plates 3.1 through 3.4 for locations of cross sectrions
See Plate 4.6 for legend to colors and symbols

CGI TECHNICAL SERVICES INC.	CROSS SECTION 10+25 JACOBS AVENUE LEVEE EVALUATION PROJECT HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT CITY OF EUREKA, CALIFORNIA	Plate 4.1
Project No.:15-1949.03		



Scale:
1”=10’ Vertical
1”=20’ Horizontal
Vertical Exaggeration: 2x

See Plates 3.1 through 3.4 for locations of cross sectrions
See Plate 4.6 for legend to colors and symbols

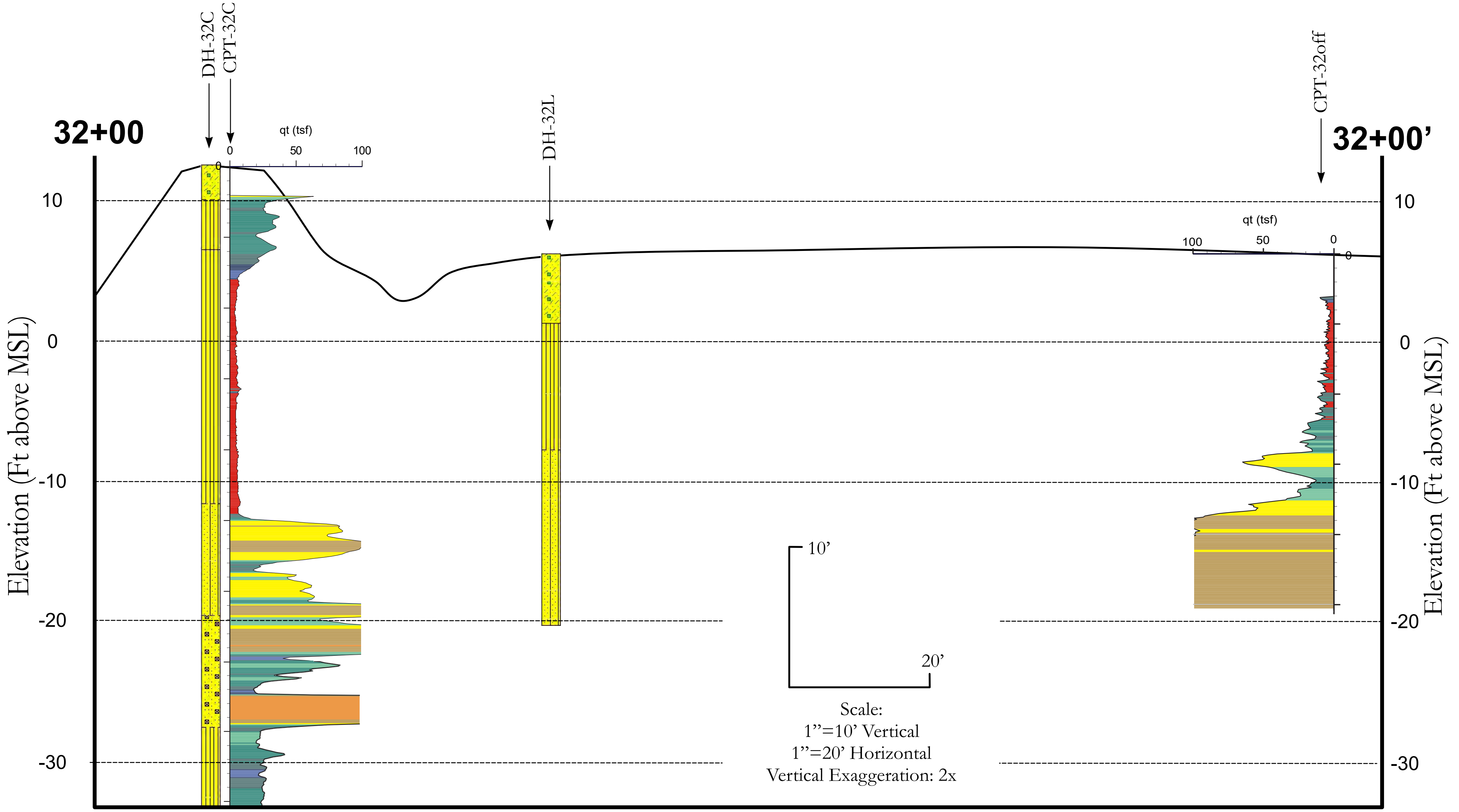
CGI TECHNICAL SERVICES INC.

Project No.:15-1949.03

CROSS SECTION 21+50
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

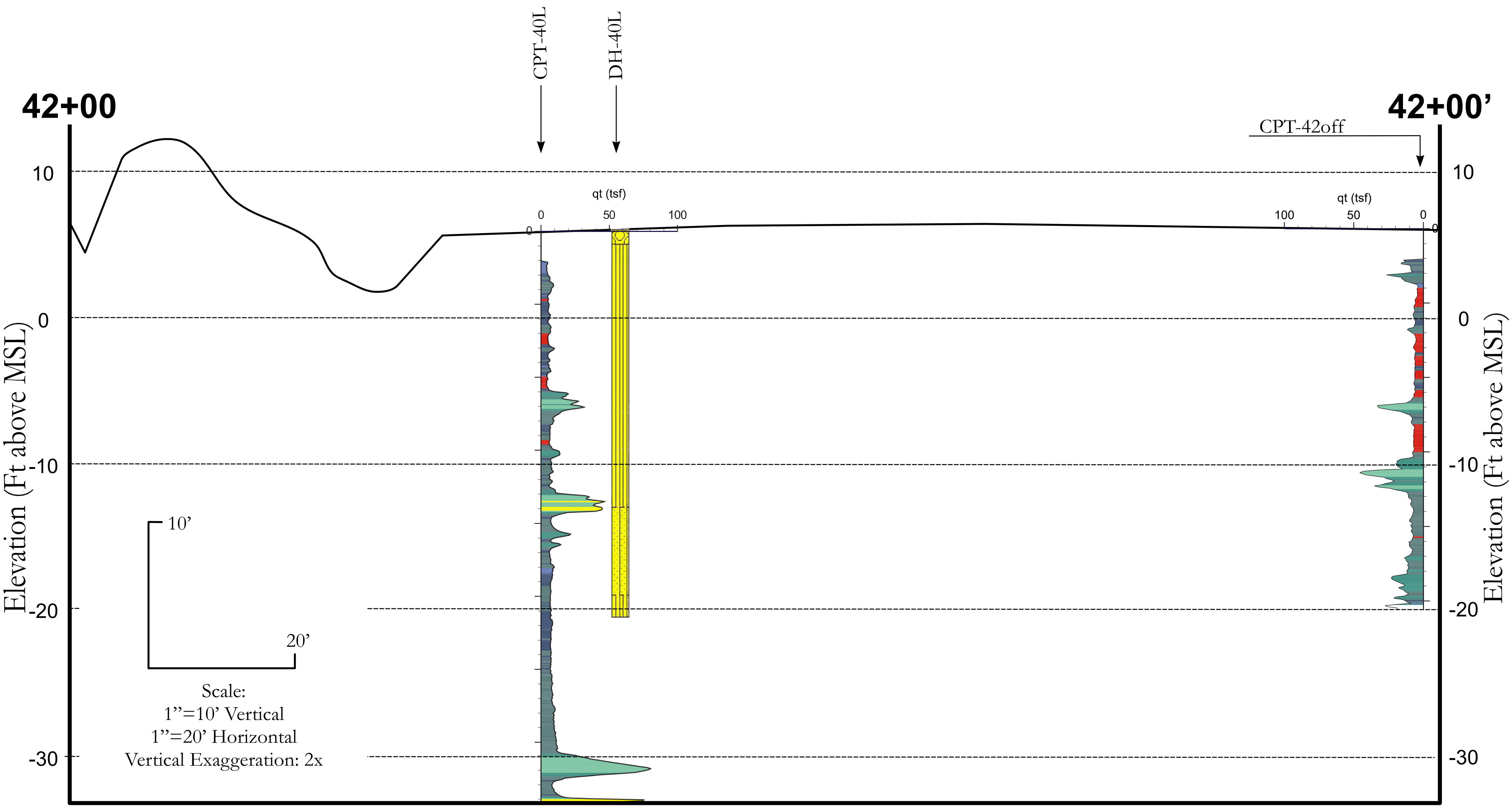
Plate

4.2



See Plates 3.1 through 3.4 for locations of cross sectrions
See Plate 4.6 for legend to colors and symbols

CGI TECHNICAL SERVICES INC.	CROSS SECTION 32+00 JACOBS AVENUE LEVEE EVALUATION PROJECT HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT CITY OF EUREKA, CALIFORNIA	Plate 4.3
Project No.:15-1949.03		



See Plates 3.1 through 3.4 for locations of cross sections
See Plate 4.6 for legend to colors and symbols

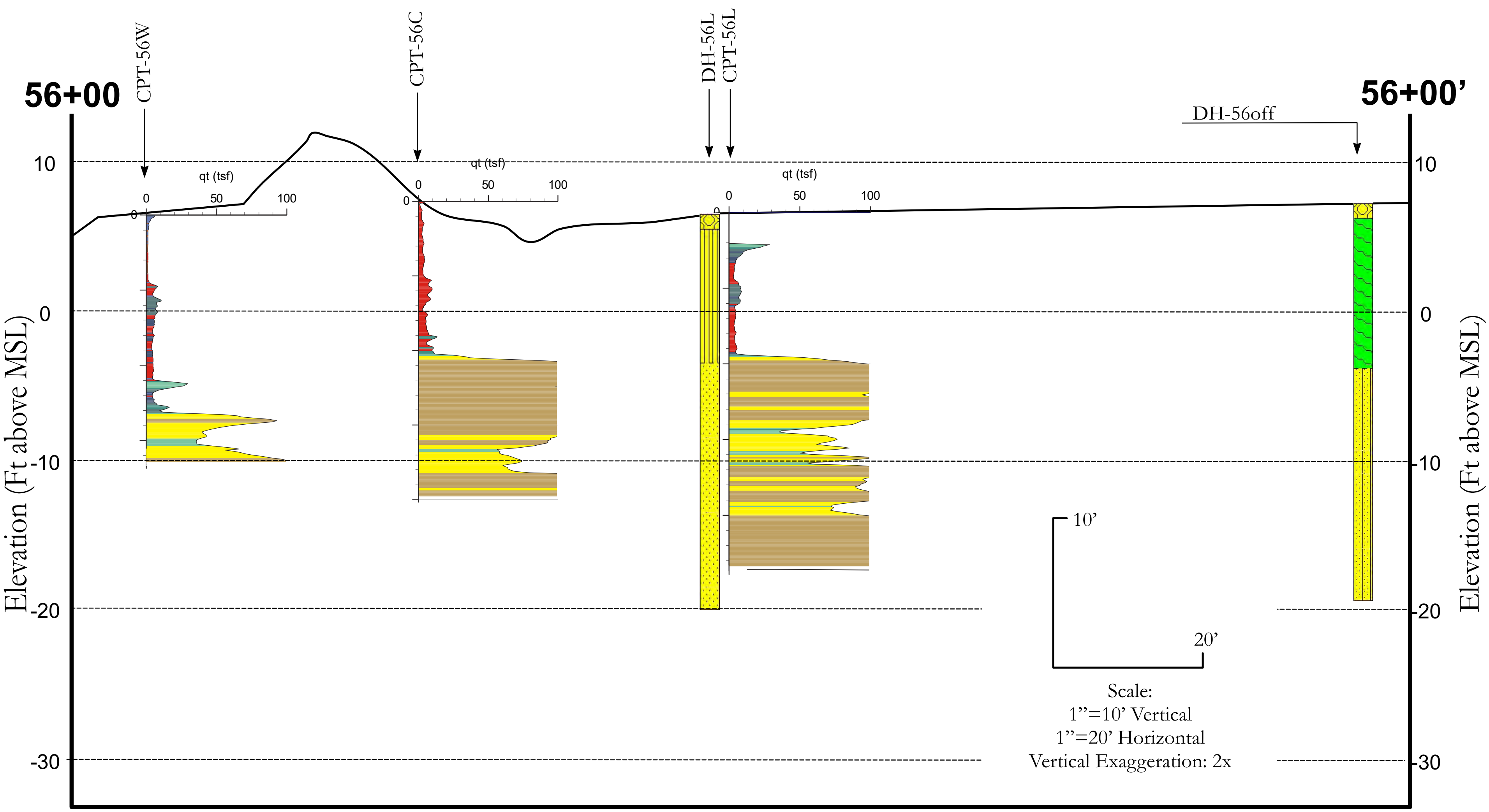
CGI Technical Services Inc.

Project No.:15-1949.03

CROSS SECTION 42+00
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

Plate

4.4



See Plates 3.1 through 3.4 for locations of cross secrtions
See Plate 4.6 for legend to colors and symbols

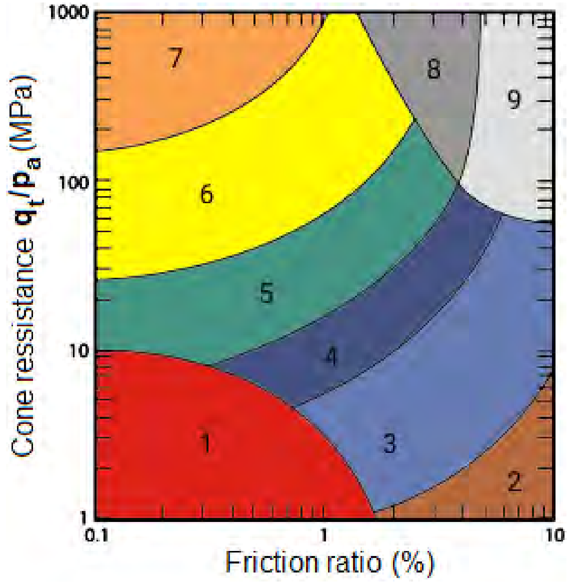
CGI Technical Services Inc.

Project No.:15-1949.03

CROSS SECTION 56+00
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

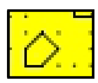
Plate
4.5

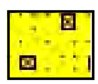
CONE PENETROMETER LEGEND

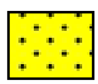


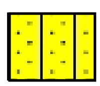
Zone	Soil Behavior Type (SBT)
1	Sensitive, fine grained
2	Organic soils - clay
3	Clay - silty clay to clay
4	Silt mixtures - clayey silt to silty clay
5	Sand mixtures - silty sand to sandy silt
6	Sands - clean sand to silty sand
7	Gravelly sand to dense sand
8	Very stiff sand to clayey sand *
9	Very stiff fine grained *

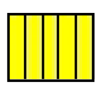
DRILL HOLE LEGEND

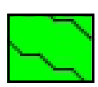
 Aggregate Base

 Gravel

 Sand

 Silty Sand

 Silt

 Clay

Surface elevations noted on cross sections based on survey data provided by Humboldt County unless noted otherwise on individual cross sections.

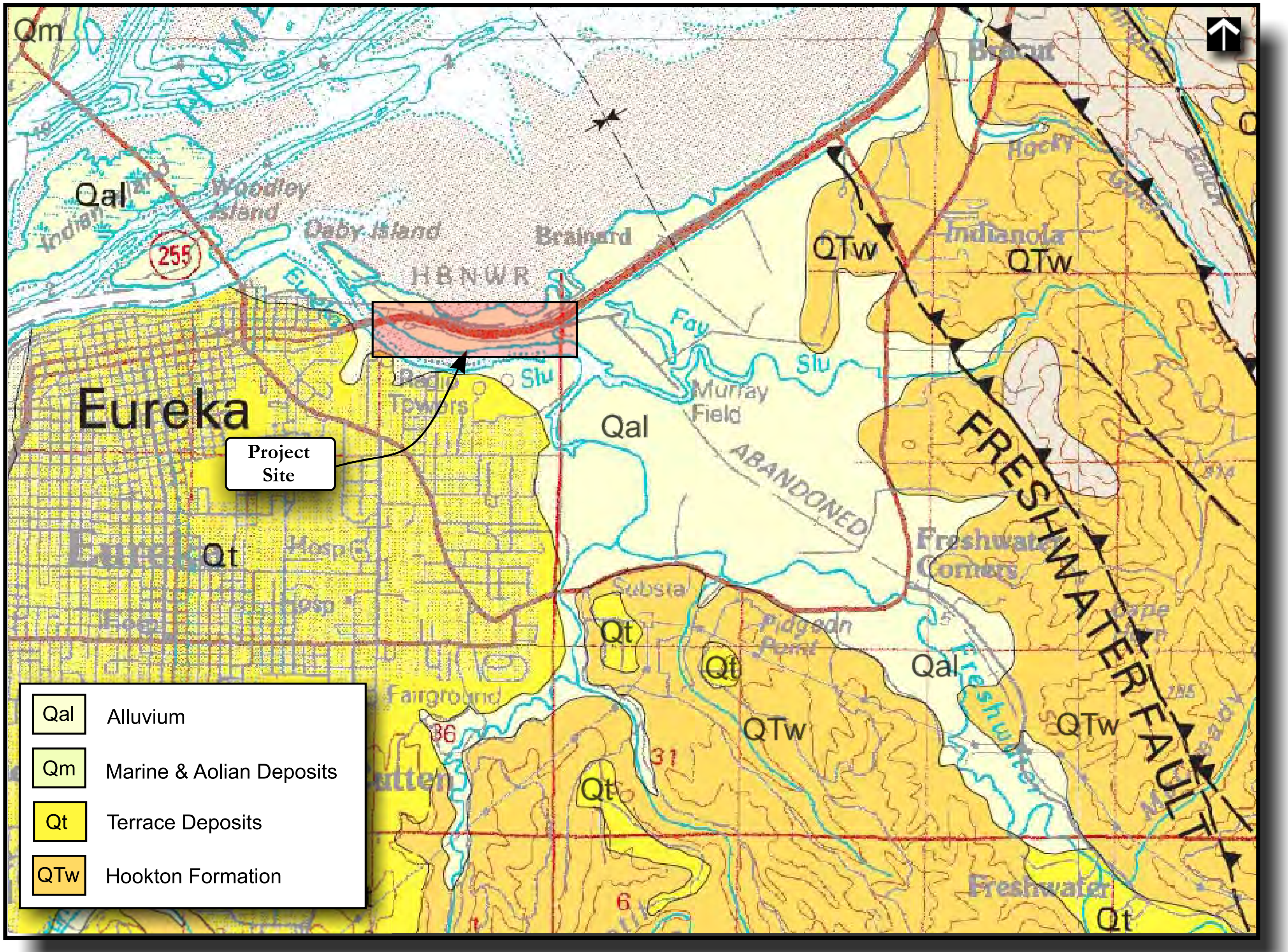
CGI Technical Services Inc.

Project No.:15-1949.03

LEGEND TO CROSS SECTIONS
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

Plate

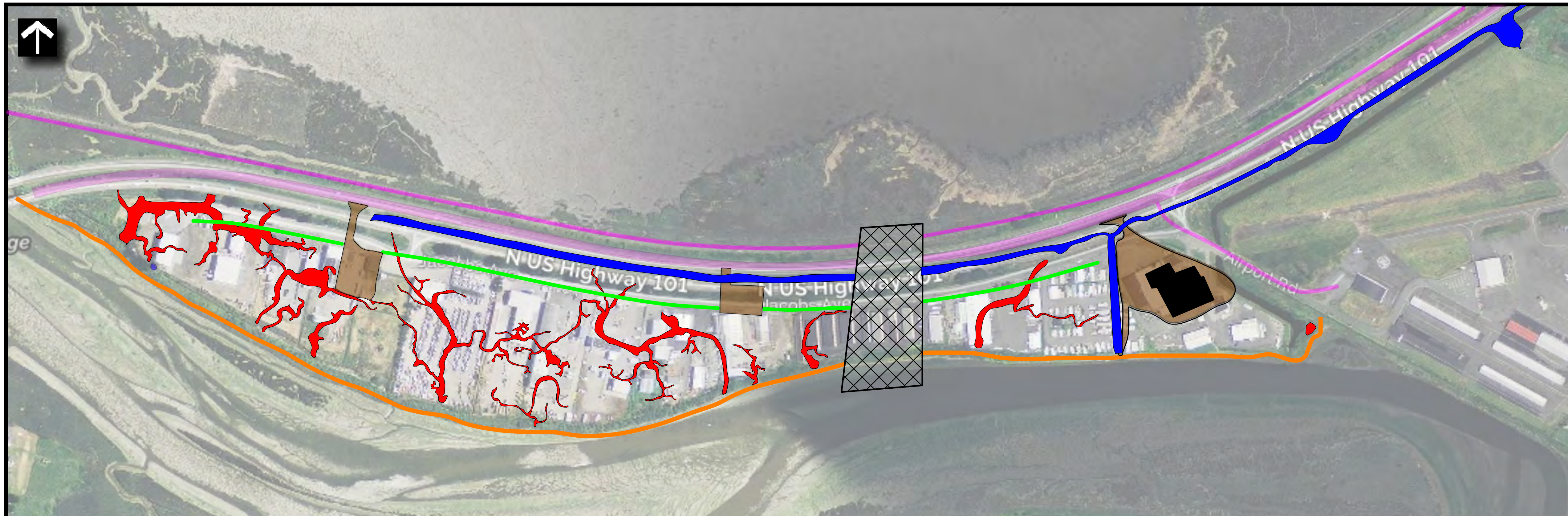
4.6



Base map from McLaughlin et al. (2000)

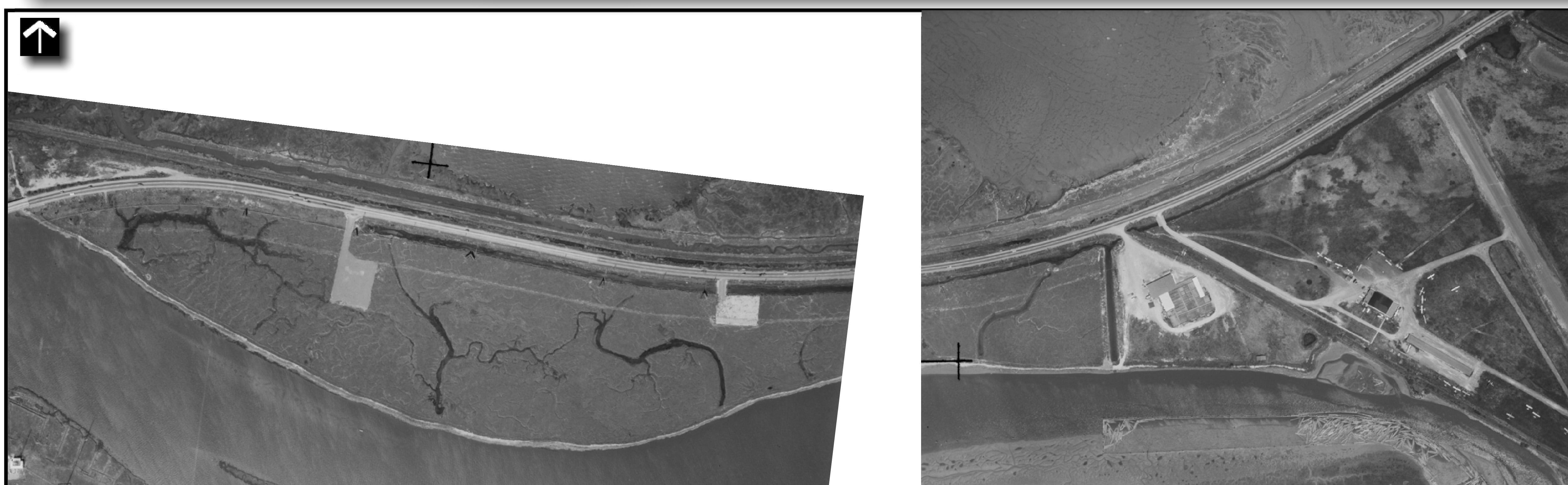
Scale Undetermined

CGI TECHNICAL SERVICES INC.	REGIONAL GEOLOGIC MAP JACOBS AVENUE LEVEE EVALUATION PROJECT HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT CITY OF EUREKA, CALIFORNIA	Plate 5
Project No.:15-1949.03		



FEATURES NOTED ON 1950 AERIAL PHOTOGRAPHS

- Former Tidal Channel
- Former Drainage Channel (easterly segment, east of Airport Road may still be present)
- Former Auction Yard Building
- Road & Railroad Alignment
- Jacobs Avenue Road Alignment
- Levee Alignment
- Graded Building Pad
- Gap in Aerial Photographs



Images: Top - Google Earth; Bottom - from Shuster collection at Humboldt State University

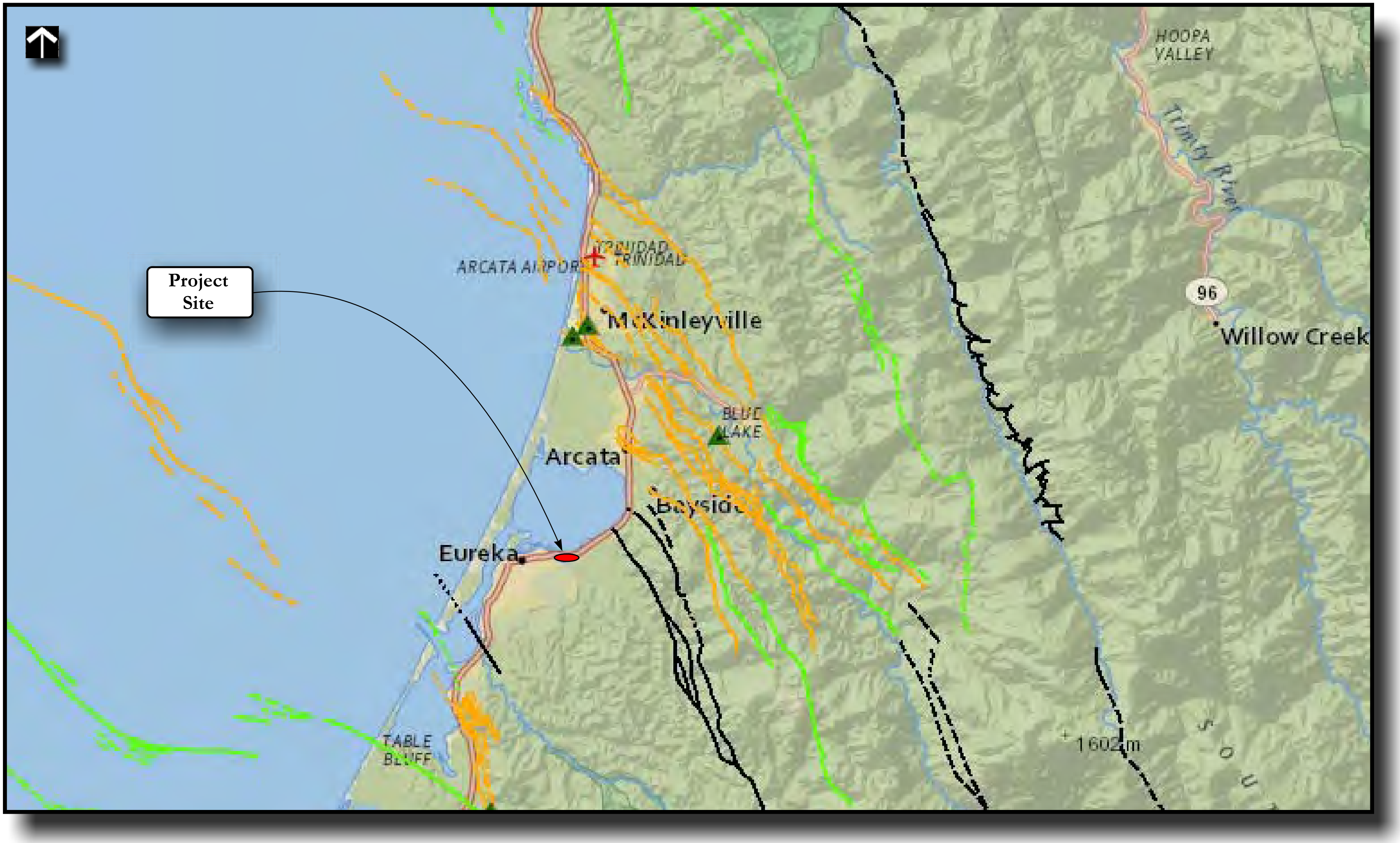
Scale Undetermined

CGI Technical Services Inc.

Project No.:15-1949.03

FORMER TIDAL CHANNELS AND IMPROVEMENTS CIRCA 1950
JACOBS AVENUE LEVEE EVALUATION PROJECT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

Plate 6



Historic Displacement (last 200 years)

Holocene Displacement (last 11,700 years)

Late Quaternary Displacement (last 700,000 years)

Quaternary Fault (last 1.6 million years)

Map from USGS Interactive Fault Map

Scale undetermined

CGI Technical Services Inc. Project No.:15-1949.03	REGIONAL FAULT MAP JACOBS AVENUE LEVEE EVALUATION PROJECT HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT CITY OF EUREKA, CALIFORNIA	Plate 7

Base maps obtained from Google Earth. Topographic information obtained from Humboldt County.

Scale undetermined

CGI Technical Services Inc.

Project No.:15-1949.03

LEVEE TOPOGRAPHY - WESTERN
JACOBS AVENUE LEVEE EVALUATION PROJCT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

Plate

8.1

Base maps obtained from Google Earth. Topographic information obtained from Humboldt County.

Scale undetermined

CGI Technical Services Inc.

Project No.:15-1949.03

LEVEE TOPOGRAPHY - EASTERN
JACOBS AVENUE LEVEE EVALUATION PROJCT
HUMBOLDT COUNTY PUBLIC WORKS DEPARTMENT
CITY OF EUREKA, CALIFORNIA

Plate

8.2

Appendix A

Historical Data

APPENDIX A
HISTORICAL DATA

Attached to this appendix are available historical data related to the Jacobs Avenue Levee. No additional information was obtained during the course of this study pertaining to levee design, construction, or modification.

FEASIBILITY STUDY

JACOBS AVENUE DIKE RECONSTRUCTION

NOVEMBER 1985

Prepared by:

Winzler & Kelly Consulting Engineers
633 Third Street
P.O. Box 1345
Eureka, California 95501
443-8326

85-047-A80

FEASIBILITY STUDY FOR JACOBS AVENUE DIKE RECONSTRUCTION

INTRODUCTION

The scope of this study was to prepare a preliminary design to repair and/or reconstruct an existing dike section in the Jacobs Avenue area, along the northern boundary of the Eureka Slough. The study was to include an evaluation of the feasibility of forming a benefit assessment district in order to provide funding for the construction and to provide ongoing funds for maintenance.

The need for this project was anticipated before and during the preparation of the "City of Eureka Local Coastal Program" dated 17 May 1984 (revised 3 July and 17 July 1984). Chapter VII "Hazards", on pages VII-2 and 3 states the following:

> "In particular the Jacobs Avenue dike has been subject to periodic erosion, and failure could result in inundation of existing commercial and residential development."

Policy 7.3 also states in part the following:

> "The City shall establish a benefit Assessment District for all property adjoining and protected from flooding by the Jacobs Avenue dike. A repair and maintenance program shall be developed and implemented, consistent with Policy 5.8 and Policy 5.14."

The same statement is made in Section D, page VII-5 under "Implementing Actions and Programs."

EXISTING CONDITIONS

The object under consideration in this study is an existing earthen dike generally running in the east-west direction. The study area encompasses the westernmost end which ties into the Highway 101 embankment immediately north of an existing bridge across the slough, and then continues along the northern edge of the slough for a distance of approximately 5200 feet. The dike does extend past this point, and provides protection for Murray Field; however, that portion of the dike was not included in this study.

The existing dike has a top elevation which varies from approximately +9 feet to +13 feet (all elevations cited are based upon the City of Eureka datum), with a crest width varying from 0 to ±10 feet. Side slopes are on the order of 1½:1, or steeper, with some areas approaching near vertical where eroded. The southern slope of the dike has been damaged to varying degrees, from minimal to severe, by erosion. No signs of seepage were noted during field surveys; however, there are numerous signs of burrowing animals and heavy vegetation with a well developed root structure, either of which may very well provide an avenue for seepage. There is an existing drainage ditch along the northern toe of the dike which, due to grade problems, does not readily drain to the existing culverts, and is subject to a standing water situation. This results in a saturated soil condition at the toe, which may eventually contribute to a slope failure if not corrected.

PRELIMINARY RECONSTRUCTION DESIGN

In order to develop a preliminary design the following tasks were performed:

1. A brief hydrological study to set the crest elevation for a new dike section (Attachment 1). The study indicates a top elevation of +12.6 feet (+13 MLLW).

2. Field surveys to establish a P-line, and to approximately locate the dike in relation to existing property boundaries. Cross-sections were taken at approximately 100 foot intervals in order to overlay a new section and calculate approximate quantities of earthwork.

3. A preliminary subsurface investigation was performed by Taber Consultants (Attachment 2). Their report concluded that although the existing foundation material is marginal, adequate support can be obtained for a new dike section.

   It is anticipated that a more detailed geotechnical study would be required prior to a final design.

A preliminary design for a new dike section is presented in Attachment 3, Plan Sheets 1-4. The new dike section typically utilizes the existing dike as a core, and shows some regrading of the northern slope to achieve a 2:1 slope, and regrading of the existing ditch to drain. The 12' crest width would begin at the existing north edge of the dike crest, extend southerly, and then slope toward the slough at 1½:1. The slope on the slough side would consist of a 2' thick layer of RSP. Preliminary calculations indicate that No. 1 backing material per Caltrans Standard Specifications Section 72 will provide the required protection.

ENVIRONMENTAL CONCERNS

Preliminary discussions with the California State Department of Fish & Game local representative, Mr. Herb Pierce indicate no particular problems or environmental concerns in regard to the overall project.

Preliminary contacts with California State Coastal Commission staff, Mr. Gary Berrigan, also indicate no overriding environmental concerns. The City of Eureka will assume the responsibility for compliance with CEQA, which may include a negative declaration.

Issues which would need to be addressed are the repair of the sloughward slope of the dike, which will require some filling of "mudflat" types of areas which have developed over time as a direct result of erosion of the original dike section, the impacts of the repair of existing tidegates, any impacts on site drainage characteristics, and construction of the new dike at the easterly limits of the project.

It must be anticipated that mitigation will be requested for those "mudflat" areas, mentioned above, which will be disturbed as a result of this project. I would estimate that a total of area of approximately one-half acre would be involved.

At a cost of $0.25/s.f. this would result in an added cost of approximately $0.25 x $20,000 = $5,000.

Other than this, the project should essentially be considered a repair of existing facilities for permitting purposes.

RIGHT OF WAY ACQUISITION

Easements for construction and future access for maintenance would be required as shown on Attachment 4.

It is assumed for the purposes of estimating the costs for this project that the required easements can be obtained at minimal cost to the Assessment District, since the property owners derive the benefit of improved flood protection from the project. An estimate of $30,000 is included to cover legal and survey costs to obtain the easements along the frontage of the dike and $2.50 per square foot to obtain the property for the new dike at the east end of the existing dike.

If this should prove to be an erroneous assumption and the Assessment District is forced to purchase the frontage easements, an additional cost range of perhaps $1.50 to $2.50 per square foot must be included in the cost estimate. The total area involved is approximately 5.2 acres (225,000 s.f.) so the added cost would be approximately $337,500 - $562,500, plus costs to finance the additions through bond sales.

COST ESTIMATES (Attachment #5)

A project as described above is estimated at a cost of $875,000 with no frontage right-of-way acquisition costs and $1,400,000 with the additional acquisition costs of 5.2 acres of right-of-way. These costs include construction, right-of-way, engineering, administration, legal, and financial services, but exclude maintenance.

LEGAL PROCEEDING TO FORM A DISTRICT

Information from Mr. Sam Sperry, of Sturgiss, Ness, Brunsell and Sperry indicates that the following steps should be taken to form an assessment district.

1. Hold an information meeting to advise property owners affected.

2. Circulate petition (need signatures representing 60% of the land area).

Once the proper number of signatures has been achieved, the following legal proceedings should begin:

3. File petitions (with certificate that the signatures are valid).

4. City Council must pass a resolution accepting the petitions.

5. File the boundary map.

6. City Council must pass a resolution adopting the boundary map.

7. Resolution approving an engineering agreement.

8. Resolution approving a legal agreement.

9. Resolution of intention to form an assessment district.

10. Preparation of an Engineer's report setting the assessment spread, and plans and specifications for bidding purposes.

11. Resolution accepting the Engineer's report.

12. Hold a public meeting to advise property owners of the preliminary assessment spread.

13. Advertise and accept bids.

14. Reapportion the assessment spread based upon the actual bids for the project.

15. Hold a protest hearing (public meeting).

16. Record the assessment district.

17. Thirty-day cash payment period.

18. Sell bonds.

19. Award the construction project.

EXISTING ASSESSMENTS

One item of concern regarding the formation of a new assessment district is the existing sewer assessments on the affected properties. According to legal counsel, the only avenue to provide liens that are not subservient to the existing liens is to include enough funding in the new district to buy out the existing bonds.

PRELIMINARY ASSESSMENT SPREAD

The equitable distribution of costs in any assessment proceeding can be accomplished by application of any of a number of different formulas. However, the underlying basis for distribution should be based upon benefits received, or realized by the property owner.

For the purposes of spreading the assessments in this project, the costs have been separated into two categories as follows:

A) The estimated cost of earthwork to repair the existing dike section along the slough, which represents approximately 26.7% of the total project costs. These costs were allocated to each affected parcel in direct proportion to the estimated volume of material to be excavated and/or filled on the parcel.

B) The remaining 73.3% of the project cost consists of the new dike at the easterly end of the project, drainage improvements (i.e., culvert and tide gate repairs), and the rock slope protection. These were considered to benefit all parcels, and the costs were spread to all parcels in the following manner:

   1. 75% (of the remaining 73.3%) was spread to each parcel based on the area of the parcel.

   2. 25% (of the remaining 73.3%) was spread to each parcel based upon the length of frontage (along the Eureka slough only).

Three alternate assessment spreads were calculated for the possible situations which may occur. The first case is if all right-of-way land along the dike frontage is donated, considering each parcel will benefit from the proposed improvements. The second case shows the resulting assessment if the property is purchased by the assessment district at $2.50 per square foot. The third case depicts the situation of the property being indirectly purchased by crediting each parcel's assessment $2.50 per square foot.

The formulas used and the resulting assessment spreads are shown in Attachment #5.

PERMIT AGENCIES

The following permitting agencies were contacted regarding this project, and commented as follows:

1. California Coastal Commission

   The Commission will have permit jurisdiction over that portion of the project below the mean high water line (portions of the slough side of the dike), and the City of Eureka will have Coastal Permit jurisdiction over the remainder.

   It is estimated that a 60-day period would be required to obtain the permits.

2. Water Quality Control Board

   Project plans must be submitted for review, and if a determination is made that there are water quality problems, a waste discharge permit may be required.

   Estimate a 45-day time period to obtain the permit.

3. Humboldt Bay Harbor, Recreation and Conservation District

   The HBHRCD jurisdiction extends to the limits of tidal action, and will therefore require a permit.

   Estimate a 30-day time period to obtain the permit.

4. California Department of Fish and Game

   A streambed alteration agreement will be required.

   Estimate a 30-day time period to obtain the permit.

5. Corps of Engineers

   A 404 and/or a Section 10 permit will be required.

   Estimate a 90-day time period to obtain the permits.

There was no indication that there would be any difficulty obtaining the above mentioned permits, other than the need to address some environmental concerns as previously discussed. It is anticipated that all of the permit applications would be processed concurrently, and that perhaps a total of 120 days would be required.

In addition to the above listed agencies, the FAA may become involved due to the proximity of a new dike to an existing runway as proposed along the eastern boundary of Murray Field.

ALTERNATE FUNDING SOURCES

Inquiries were made to the following agencies regarding the possibility of project funding:

1. Corps of Engineers

   Funding would only be available in the event of an emergency (i.e., failure of the existing dike), or if the area were declared a disaster area, or by congressional authorization.

   One condition mentioned was that if the levee has had no maintenance, the Corps of Engineers will not fund repairs.

2. Soil Conservation Service

   A slight possibility of funding under P.L. 566, Small Watershed Protection, exists, but would require a field review by a team from Sacramento, which would apparently take at least one year. Preliminary indication, from the telephone conversations, are that this project would likely not qualify.

3. State of California, Department of Water Quality

   No funding available for dike construction.

Further inquiries into additional sources (or contacts) did not produce any useful information.

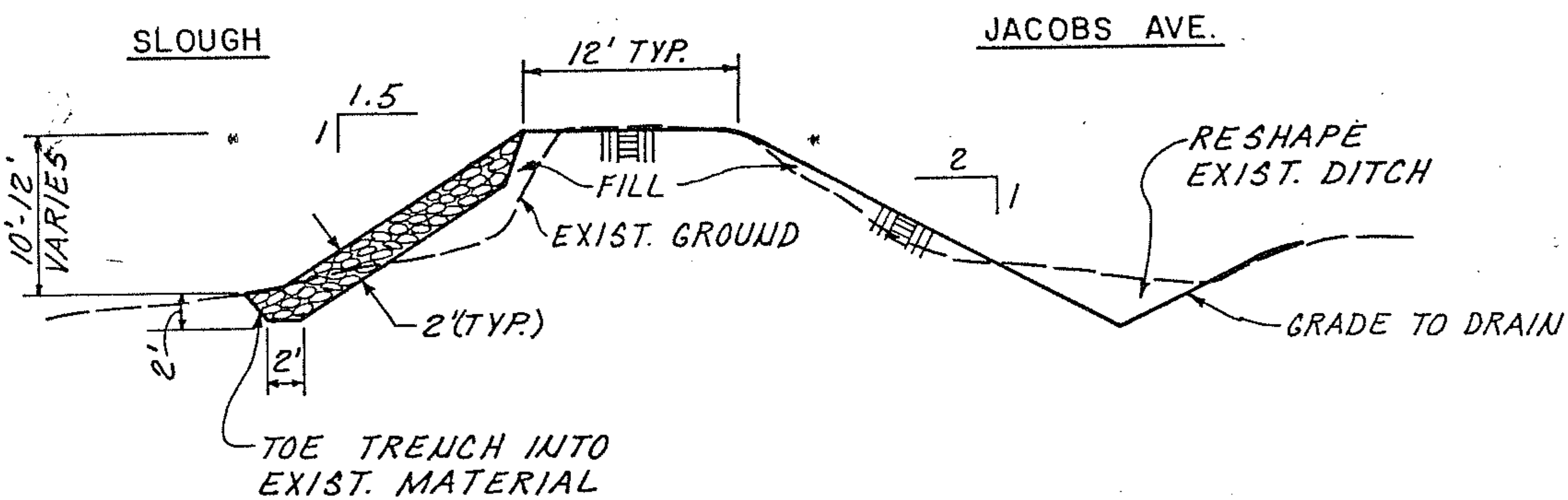
FUTURE MAINTENANCE

It must be recognized that an integral part of this project is to establish an ongoing maintenance program for the repaired dike section. The formation of a reclamation district will allow for periodic assessments of the benefitted properties to offset opeation and maintenance costs.

The estimate of costs for the City of Eureka to perform this work is $4,000 per year. A breakdown of this to each property based on frontage length along the slough is shown in the Assessment Summary in Attachment #5.

INDEX OF ATTACHMENTS

INDEX OF ATTACHMENTS



TYPICAL DIKE REPAIR SECTION

(STA. 10+00 TO STA. 62+13) N.T.S.

1/1

PRELIMINARY HYDROLOGIC STUDY

JACOBS AVENUE DIKE RECONSTRUCTION

The following calculations have been used to determine the appropriate elevation to be used for the top of a reconstructed dike in the Jacobs Avenue area, along the northerly edge of the Eureka Slough.

The study concludes that a proper elevation is +12.6' (City of Eureka datum).

Attachment #1

WINZLER & KELLY
GROUP CONSULTING ENGINEERS

633 Third Street
P.O. Box 1345
Eureka, CA 95501
707-443-8326

By DS Date 3/27 Subject Elevation to set dike along Jacobs Ave. Sheet No. ___ of ___
Client ______ Job. No. ______

A brief hydraulic study has been completed for the Eureka Slough to determine the elevation at which the top of the dike should be. Beginning with the highest estimated water elevation at a known point, the flow from a 100-yr storm is added to it and a backwater surface profile computed. From this maximum elevation, two feet of freeboard is added to arrive at the final elevation for the dike.

Highest est. water level (per U.S. Dept. of Commerce) at approximately the end of F street = 10' above MLLW.

Total flow into the Eureka Slough due to a 100-yr storm = 5200 cfs.

From the backwater computations, elevation increases to 11' above MLLW at Eureka Slough near airport.

11' + 2' of freeboard = 13' above MLLW

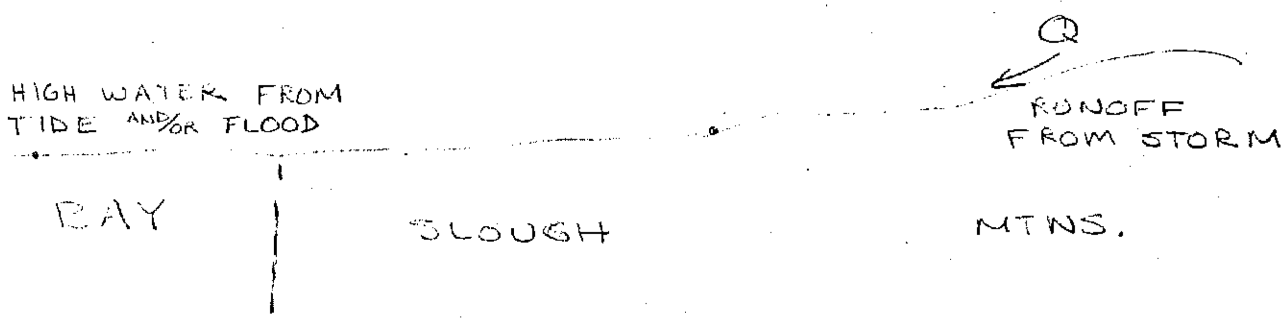
(+12.6' CITY of EUREKA DATUM)

WINZLER & KELLY
GROUP CONSULTING ENGINEERS

633 Third Street
P.O. Box 1345
Eureka, CA 95501
707-443-8326

By ________ Date________ Subject ______________________________ Sheet No. ____ of ____

Client ______________________________ Job. No. __________



Compute a backwater [illegible] profile beginning at known pt. in the bay with the highest possible tide. Use a flow coming into the slough for a 100-yr storm. Add 2' of freeboard to get top elev. of levy.

Calculate Flow at slough for 100-yr storm

$Q = CiA$

$L = 11$ mi $= 58,000$ ft.

Δ el $= 2750 - 10 = 2740$ ft (for forest)

Slope $= 0.0472 = 4.7\% \Rightarrow V = 0.55$ ft/sec

time of con. $= \frac{58,000 \text{ ft}}{0.55 \text{ ft/sec}} = 105,454$ sec $= 29$ hours

Use 10 hours to be conservative. Not all flow will be in yet, [illegible] shorter time

$t_c = 10$ hours $\Rightarrow i = 0.43$

$Q = CiA = 0.35(0.43)(34,547) =$ <u>5200 cfs</u>

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633 Third Street
P.O. Box 1345
Eureka, CA 95501
707-443-8326

By ________ Date ________ Subject ________ Sheet No. ____ of ____

Client ________ Job. No. ________

Plinimiter Area = 0.053 = 1 mi^2 × 12075 = acres

Entire Area = 2.860, 2.862, 2.855 = 34,547 acres

City Area = 0.188 = 2,270 acres (7%)
Country Area = 0.496 = 5,989 acres (17%)
Forest Area = 34,547 − (2270 + 5989) = 26,288 acres (76%)

Use the following "C" coefficients for these areas:
City − C = 0.75
Country − C = 0.40
Forest − C = 0.30

C for entire area = .07(.75) + .17(0.40) + .76 (0.30) = $\boxed{0.35}$

Estimated highest water = 10' above mean lower low water
Flood of 1964 = 6.14 (MLLW)
Begin profile at station Lat. 40° 48'.4, Long 124° 10'.0
where est. 10' occurs.

WINZLER & KELLY
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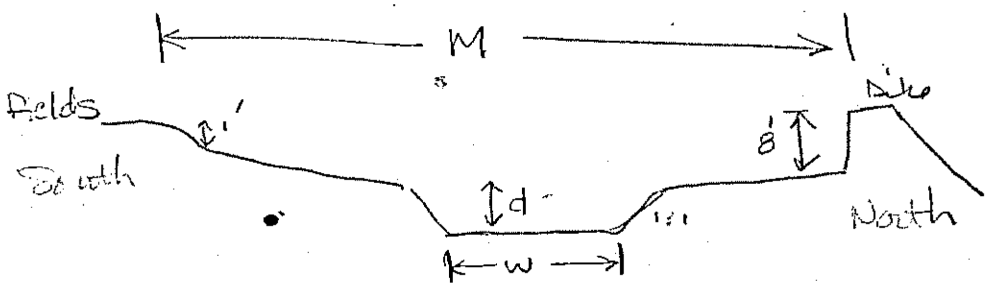
633 Third Street
P.O. Box 1345
Eureka, CA 95501
707-443-8326

By ________ Date________ Subject ______________________ Sheet No. ____ of ____

Client ______________________ Job. No. ________

Stations & areas
all stations 1000' apart



STATION	d (ft)	w (ft)	M (ft)		Area
0	12 (est)	200	290	60 30	2940 ft²
1	11 (est)	180	290	50 60	2585 ft²
2	10 (est.)	190	290	40 60	2400 ft²
3	9	60	230	60 ← el 6	1305 ft²
4	10	100	270	100 ← el 6	1850 ft²
5	12	60	230	60 ← el 6	1740 ft²
6	12	200	360	50 200 110	3360 ft²
7	4.5	120	300	110 120 70	945 ft²
8	6	150	290	140 150	1320 ft²
9	3.5	90	270	180 90	630 ft²
10	3	90	320	230 90	615 ft²
11	2	80	280	200 80	360 ft²
12	1.5	90	270	100 90 80	270 ft²
13	2	90	260	110	350 ft²
14	2	60	250	100	310 ft²
15	2	50	160	80 50 70	210 ft²

Dike Field

WINZLER & KELLY
GROUP CONSULTING ENGINEERS

633 Third Street
P.O. Box 1345
Eureka, CA 95501
707-443-8326

By ______ Date ______ Subject ______ Sheet No. ___ of ___

Client ______ Job. No. ______

ΔL = 1000 O = mud el. at STA O

Q = 520 cfs

STA	S_n^d	A	R	$V^2/2g$	E_n	i_n	S_{n+1}^d (trial)	A	R	$V^2/2g$	E_{n+1}	i_{n+1}	$\frac{1}{2}(i_{n+1}+i_n)$ ($\times 10^{-6}$)	$\frac{1}{L}(E_{n+1}-E_n)$ ($\times 10^{-6}$)
0	22	5390	17.91	.0145	22.0145	4.581×10^{-6}	22.10	5415	17.98	.0143	22.1143	$4.516\ 10^{-6}$	4.549×10^{-6}	100×10^{-6}
							22.01	5392	17.91	.0144	22.0244	$4.578\ 10^{-6}$	4.580	9.9
1	21.01 22.01	4937	16.58	.0172	22.0272	6.055×10^{-6}	21.02 22.02	4940	16.59	.0172	22.0372	$6.043\ 10^{-6}$	6.049	10
2	20.02 22.02	4805	16.13	.0182	22.0382	6.632×10^{-6}	20.03 22.03	4807	16.13	.0182	22.0482	$6.627\ 10^{-6}$	6.630	10
3	19.03 22.03	2759	11.03	.0552	22.0852	1.612×10^{-5}	19.04 22.04	2761	11.04	.0551	22.0951	$3.336\ 10^{-5}$	24.74	9.9
							19.05 22.05	2762	11.04	.0550	22.1050	$3.336\ 10^{-5}$	24.74	19.80
4	20.05 22.05	3709	12.74	.0305	22.0805	1.527×10^{-5}	20.07 22.07	3713	12.75	.0305	22.1005	$1.522\ 10^{-5}$	15.25	20.00
5	22.07 22.07	3200	12.62	.0410	22.1110	3.246×10^{-5}	22.08 22.08	3202	12.63	.0410	22.1210	$2.073\ 10^{-5}$	26.60	10.00
							22.10 22.10	3205	12.64	.0409	22.1409	$2.067\ 10^{-5}$	26.57	29.90
6	22.10 22.10	6188	16.87	.0110	22.1110	3.766×10^{-6}	22.11 22.11	6191	16.88	.0110	22.1210	$3.759\ 10^{-6}$	3.76	10.00
7	14.61 22.11	3068	10.14	.0446	22.1546	3.030×10^{-5}	14.62 22.12	3070	10.15	.0445	22.1645	$3.022\ 10^{-5}$	30.26	9.9
							14.64 22.14	3074	10.16	.0444	22.1844	$3.011\ 10^{-5}$	30.21	29.80
8	16.14 22.14	3551	11.56	.0333	22.1733	1.898×10^{-5}	16.16 22.16	3555	11.58	.0332	22.1932	$1.889\ 10^{-5}$	18.94	19.90
9	13.66 22.16	2459	8.65	.0694	22.2294	10×10^{-5}	13.70 22.20	2466	8.68	.0690	22.2690	10×10^{-5}	100.00	39.60
							13.76 22.26	2477	8.71	.0684	22.3284	10×10^{-5}	100.00	100.00
10	13.26 22.26	2718	8.15	.0568	22.3168	10×10^{-5}	13.36 22.36	2739	8.21	.0560	22.4160	10×10^{-5}	100.00	100.00
11	12.36 22.36	2225	7.60	.0848	22.4448	10×10^{-5}	12.46 22.46	2243	7.66	.0835	22.5435	10×10^{-5}	100.00	100.00
12	11.96 22.46	2153	6.77	.0906	22.5506	10×10^{-5}	12.56 22.56	2261	7.06	.0821	22.6421	10×10^{-5}	100.00	100.00
13	12.56 22.56	2198	8.37	.0869	22.6469	10×10^{-5}	12.66 22.66	2216	8.44	.0855	22.7455	10×10^{-5}	100.00	100.00
14	12.66 22.66	1962	7.80	.1091	22.7691	10×10^{-5}	12.76 22.76	1978	7.86	.1073	22.8673	10×10^{-5}	100.00	100.00
15	12.76 22.76	1340	8.19	.2338	22.9938	21.15×10^{-5}	12.96 22.96	1361	8.31	.2267	23.1867	$20.10\ 10^{-5}$	206.30	192.90
							12.97 22.97	1362	8.32	.2263	23.1963	$20.04\ 10^{-5}$	205.95	202.50

Rounded

STA O = 12' @ LLW

23-12 = 11' above LLW + 2' freeboard = 13' above LLW

941-8801

5/2/64

CALIFORNIA I-4

U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

TIDAL BENCH MARKS

Eureka, Humboldt Bay
Lat. 40° 48'.4; Long. 124° 10'.0

BENCH MARK 1 (1921) is a standard disk, stamped "BM 1 1921 14.911", set in concrete surface of foundation of Bank of America at corner of "E" and Fourth Streets. It is set in concrete base of pillar, at right of steps at "E" Street entrance. Elevation: 18.79 feet above mean lower low water.

BENCH MARK 2 (1921) is a standard disk, stamped "BM 2 1921 43.422", set in top of concrete retaining wall surrounding basement entrance to postoffice building at Fifth and "H" Streets, on west side of building, at north end of retaining wall. It is 6 inches from west wall of building and at about middle of west side. Elevation: 47.30 feet above mean lower low water.

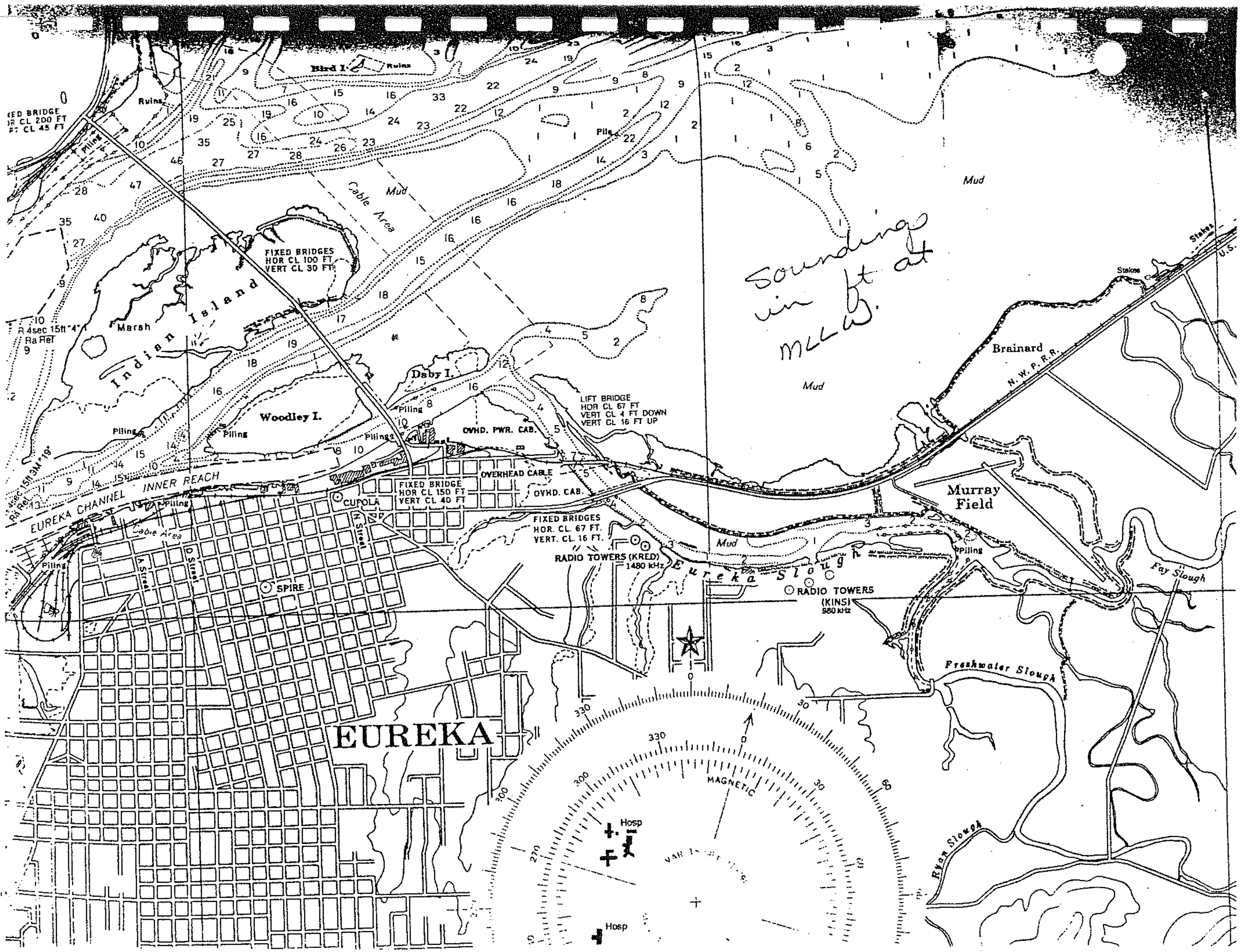
BENCH MARK 4 = 31 (U.S.G.S.) (1906) is a U. S. Geological Survey standard disk, stamped "B 18 1906 29.350", set in granite coping on north side of steps of city hall. Elevation: 33.23 feet above mean lower low water.

BENCH MARK 10 = 44 (U.S.G.S.) (1906) is a standard disk, stamped "B 19 1906 42.470", set vertically in north side of western one of two ornamental concrete posts at bottom of steps to north approach of Humboldt County Courthouse at Fourth and "J" Streets. Elevation: 46.35 feet above mean lower low water.

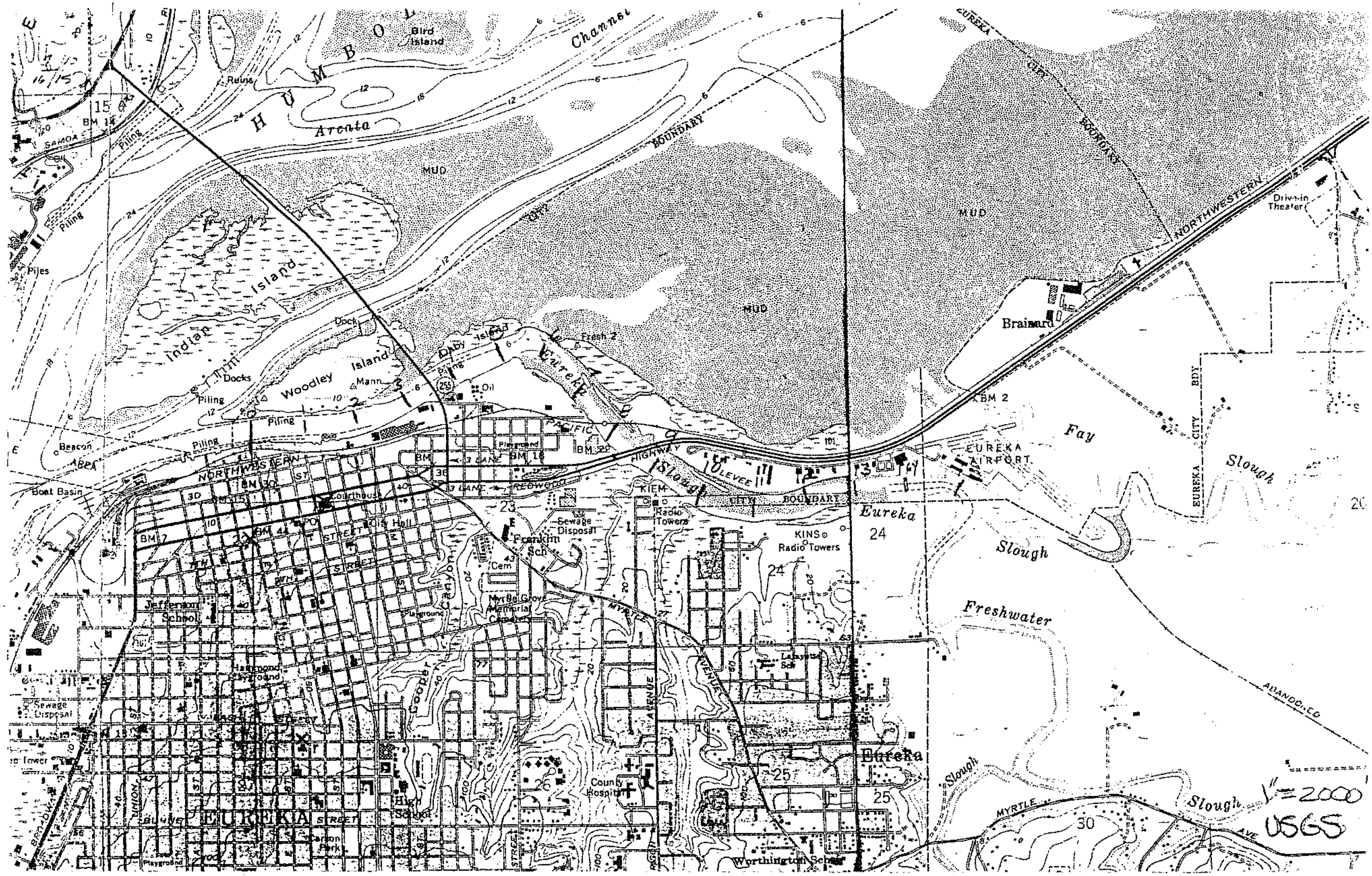
Mean lower low water at Eureka is based on 56 high waters and 55 low waters, September 19 - October 28, 1919, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	Feet
Mean higher high water	6.70
Mean high water	6.00
Mean tide level	3.60
Mean low water	1.20
Mean lower low water	0.00

The estimated highest water level to the nearest half foot is 10 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 3 feet below mean lower low water.



Soundings in ft at MLLW.
EUREKA
EUREKA CHANNEL INNER REACH
Indian Island
Woodley I.
Daby I.
Bird I.
Ruins
Marsh
Mud
Cable Area
FIXED BRIDGES HOR CL 100 FT VERT CL 30 FT
FIXED BRIDGE HOR CL 150 FT VERT CL 40 FT
FIXED BRIDGES HOR. CL. 67 FT. VERT. CL. 16 FT.
LIFT BRIDGE HOR CL 67 FT VERT CL 4 FT DOWN VERT CL 16 FT UP
OVHD. PWR. CAB.
OVERHEAD CABLE
OVHD. CAB.
CUPOLA
SPIRE
A Street
D Street
N Street
RADIO TOWERS (KRED) 1480 kHz
RADIO TOWERS (KINS) 980 kHz
Eureka Slough
Murray Field
Brainard
N. W. P. R. R.
Fay Slough
Freshwater Slough
Ryan Slough
Stakes
Piling
Hosp
MAGNETIC



HUMBOLDT
Arcata Channel
Bird Island
MUD
Indian Island
Woodley Island
Daby Island
Eureka Slough
Fay Slough
Freshwater Slough
Brainard
EUREKA AIRPORT
Drive-in Theater
NORTHWESTERN PACIFIC
HIGHWAY
CITY BOUNDARY
EUREKA CITY BDY
KINS Radio Towers
KIEM Radio Towers
Sewage Disposal
Franklin Sch
Cem
Myrtle Grove Memorial Cemetery
Cooper Canyon
Courthouse
City Hall
Jefferson School
Hammond Playground
High School
County Hospital
Lafayette Sch
Worthington School
Carson Park
EUREKA
MYRTLE AVENUE
Boat Basin
Beacon
Docks
Piling
Reuns
SAMOA
BROADWAY
ABANDONED
1" = 2000
USGS

HBER CONSULTANTS
Engineers & Geologists

536 Galveston Street • West Sacramento, California 95691
West Sacramento (916) 371-1690 • Santa Rosa (707) 575-1568

May 23, 1985

Winzler & Kelly, Consulting Engineers
P.O. Box 1345
Eureka, California 95501

Attention: Mr. Dan Hebert

Subject: Subsurface Feasibility-Level Study 1P2/385/03
Jacobs Avenue Levee
Eureka, California

Gentlemen:

A preliminary subsurface investigation has been made at the above site per the request of Dan Hebert of Winzler & Kelly, engineers for the project. The purpose of this study is to provide preliminary soils information in assessment of project feasibility; additional soils information is expected for project design.

Site/Project Description

The site is located along the north side of Eureka Slough and south of Jacobs Avenue, trending generally east-west between the Highway 101 bridge (west end) and the Eureka Airport (east end). The project is understood to include upgrading/improvement of the existing ±3500 ft of levee.

The existing levee is ±8-10 ft high, ±10 ft wide at crest and has deteriorated due to erosion/slumping; existing embankment slopes are on the order of 1-1/2:1 or steeper (locally near-vertical where eroded). An existing ±2 ft deep drainage ditch runs along the north (land-side) levee toe. No general condition of embankment seepage has been indicated, nor was any noted in this brief review.

It is proposed to upgrade the existing embankment by increasing crest width to ±12 ft (from north embankment hinge) with southerly (slough-side) slopes of 3:1 and northerly (land-side) slopes of 2:1; new levee height would be similar to existing. New south-slope embankment toe is expected to be within the slough at ±elev. 0 to -2, MSL; north-slope toe, along an area of some existing fill at several feet above MSL. Source of new embankment material and construction-procedures have not as yet been defined.

Study Procedures

Office study for this evaluation included review of published geologic/soils data, file information (including soils investigation made for existing "U-Haul" site along Jacobs Avenue) and file air photos (scale 1:20,000, dated August-September, 1958). Field study was limited to two augered, sampled test borings near the northerly levee-toe to depths 17 and 11-ft; each boring was extended as a cone penetration test to depth 24-ft.

"Undisturbed" soil samples were obtained from the borings by means of 2.0-inch OD "standard penetration" and 2.5-inch ID "thin-wall" samplers advanced with standard 350 ft-lb striking force; the cone penetration tests were similarly advanced and provide a continuous record of driving resistance. Bulk samples of existing embankment materials were obtained near each of the boring locations.

The borings were logged and soils field-classified by a geologist on the basis of sampler penetration resistance, drill action, examination of samples and inspection of auger cuttings. Groundwater observations were made in the borings during drilling and upon completion. The borings were backfilled after completion of field study.

Laboratory testing on "undisturbed" samples included moisture content-dry density, unconfined compression and direct shear strength tests; a consolidation test was performed on a sample of very soft "bay mud" material. Tests on bulk samples of existing embankment included gradation tests.

Boring locations are referenced to an air-photo enlargement (scale 1"=200') provided by Winzler & Kelly; elevations, to existing ground surface. No detailed topography or cross-sectional data was available for this evaluation. Locations, details of borings and laboratory test results are shown on Figures 1-3, attached. J. P. Schlosser was field geologist for this project.

Earth Materials/Subsurface Conditions

Three soils units considered significant to levee upgrading are identified in the borings. The uppermost unit--encountered along the north (land) side from ground surface to depth 3-4 ft--consists of a fibrous "crust" of soft sandy and clayey silt. Surficial conditions along the south side (within slough) are not established; a similar soil/root-layer is generally expected, although likely no more than 1-2 ft thick.

The middle-unit soils--encountered below depth 3-4 ft to ±20 ft--consists of very loose to loose sandy silt and very soft clayey silt. Below depth ±20 ft, lowermost-unit materials encountered were of firmer (semicompact/stiff) consistency.

Groundwater was encountered in the borings at depth 2-5 ft; free water is anticipated to be seasonally as high as existing ground surface, with fluctuations likely associated with tide levels in the adjacent slough. Both groundwater levels and materials descriptions are consistent with that encountered in previous exploration at the "U-Haul" site (located ±500 ft east of Boring-1, explored/sampled to depth 25 ft).

Upper-unit soils (identified as local fill and/or partially-dessicated surficial soils) are interpreted as being variable in strength and moderately compressive but--where undisturbed--capable of providing support for low intensity loads. Test results indicate that middle-unit soils (interpreted as weak "bay mud") are of lower strength and highly compressible--but generally capable of supporting superposed low intensity loads. Lowermost-unit soils (interpreted as firmer alluvial soils) are considered adequate for support of loads suitably-imposed upon upper-unit soils.

Existing embankment materials are very fine-grained (79-92% passing 200M sieve) and erodible; where exposed, however, such materials were noted to be very firm and likely derived from off-site sources (i.e., appeared more like light-colored "Hookton" materials than slough "bay-mud").

The site is within an area considered seismically active and subject to severe ground shaking during the life of the levee. The Humboldt County Seismic Safety Element shows the area as being potentially subject to such seismic effects as liquefaction, ground lurching and rapid settlement. In general, however, the substantial amount of fines within the soils sequence reduces the liquefaction potential, and potential for full levee failure due to secondary seismic effects is considered low. No active faults are shown to cross through the levee section.

Conclusions

Based upon the above-described limited data, the site is considered generally stable with support available for proposed new levee embankment. No over-riding site geologic hazards are indicated. With anticipated new-levee width and absence of current seepage problems, no specific requirements for under-seepage control (e.g., cut-off section) are foreseen.

Additional consideration will be required for such elements as toe support/preparation within the slough area (including evaluation of actual strength characteristics), verification of assumed soil parameters and evaluation of new embankment source material (currently undefined). Consideration will also be required regarding construction-procedures, particularly with respect to work within the slough.

Discussion

Foundation Support/Fill Preparation

Support for new embankment along the northerly (land) levee area appears available on surficial upper-unit "crust"; fill preparation should include nominal stripping of fill/debris (without disruption of fibrous root-layer).

Along the southerly (slough) levee area, support is marginal but considered generally available on/within anticipated surficial "crust" and/or weak middle-unit slough soils. Construction methods/procedures within the slough would depend largely upon encountered materials, and it is unlikely that substantial foundation preparation could be performed in this area at anticipated foundation level ($\pm$2 ft below MSL). Use of filter fabric may be desirable at this level to enhance in-situ strength characteristics, particularly if wet, dredged slough material is placed directly upon weak foundation soils.

Settlement

With little or no indicated raise in new embankment height, overall settlement is not expected to be significant. Most settlement from new embankment sections would, however, be differential with respect to the existing; the laboratory consolidation test and experience in the area suggests total settlement under anticipated new embankment load to be on the order of 2-4 inches and to occur relatively rapidly (say, within 2-4 weeks). Additional consideration for design may be required based on actual new levee sections.

Slope Stability

The existing embankment materials appear stable and suitable for incorporation into new levee section. Use of relatively conservative soils parameters for both existing levee/underlying foundation soils and assumed new embankment material (likely dredged slough material) indicate that new levee slopes of 3:1 (slough side) and 2:1 (land side) would be appropriately conservative; results of a preliminary dynamic stability analysis (using pseudo-static horizontal earthquake force of 0.15g) yielded a Factor of Safety = 1.21. Assumed source materials and soil parameters used in analysis should be confirmed as part of future "design-level" study.

Other Considerations

If new embankment source material is derived from within the slough, consideration will be required regarding dredging location/operation so as not to affect new toe area; an off-set clearance from toe of slope would be essential. Slough materials are likely to be expansive under conditions of cyclic wetting/ drying and will require additional consideration in use as new embankment.

Appropriate "bonding" of new embankment to existing will depend on actual source material and construction methods and should be further evaluated upon such definition. The indicated drainage ditch along the existing outer levee toe will require consideration (likely re-location) based upon specific cross-sectional data.

* * * * *

The above information is provided as initial input to project feasibility and preliminary design concepts; final project design is expected to be based upon further project definition and additional subsurface exploration/laboratory testing. Required supplemental exploration is visualized as including $\pm$5-6 test borings along the levee section and several portable test borings within the slough (as possible) at proposed inside new-levee toe; supplemental laboratory testing is visualized as including shear strength, consolidation, classification and expansion tests.

Actual amount of additional exploration/testing would be influenced by cross-sectional data, definition of source materials, site access, etc. It is estimated that costs for design-level study would be on the order of $7000-9000, a significant portion (±$2200) of which is cost for equipment and personnel mobilization from Sacramento; mobilization cost could possibly be reduced by sharing exploration with other study in the area. A more-closely defined scope and cost of design-level study could be provided upon further definition of project parameters.

We trust the above provides the necessary input at this time. Please call if you have any questions on the above or as we may be of further service.

Very truly yours,

TABER CONSULTANTS

R. D. Sowers

R. D. Sowers
R.C.E. 38788
C.E.G. 1104

RDS/ns

Distribution: Client (4)

Attachments:	Figure-1	"Test Boring Logs"
		"Boring Legend"
	Figure-2	"Laboratory Test Results"
	Figure-3	"Location of Field Tests"

MOORE & TABER NORTHERN CALIFORNIA
CONSULTING ENGINEERS AND GEOLOGISTS

TEST BORING LOG

1P2/385/03

TYPE: 3 1/2" AUGER / 2½" Cone Penetrometer

ELEVATION: Exist. ground surface

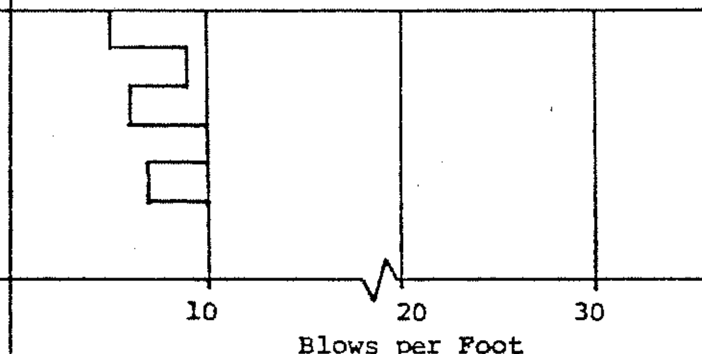
BORING No 1

GWS @ 2-ft depth; 4-24-85

UNCONFINED COMPRESSIVE STRENGTH (TSF)	OTHER TESTS	DRY DENSITY (lbs/cu.ft)	MOISTURE (%)	BLOWS/FOOT 350 ft-lb	SAMPLE SIZE (inches)	SAMPLE No.
	S	90	34	12	2.5	1
	S	84	37	5	2.5	2
0.2		87	34	4	1.4	3
		80	41	9	2.5	4
0.2		83	40	4	1.4	5
		105	22	10	1.4	6
				5		
				9		
				6		
				10		
				7		
				10		
				10		

UNIFIED SOIL CLASS	DESCRIPTION
CL	Soft grey and brown sandy clayey silt with peat stringers
ML	Very loose blue grey clayey sandy silt with shell fragments
ML	Loose dark green grey clayey sandy silt
CL	Very soft dark green grey sandy clayey silt
CL / ML	Soft/loose interlayered blue grey clayey sand and silty sand

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40



The boring logs show subsurface conditions at the dates and locations indicated, and it is not warranted that they are representative of subsurface conditions at other locations and times.

LOGGED BY: JPS

DATE: 4/24/85

MOORE & TABER NORTHERN CALIFORNIA
CONSULTING ENGINEERS AND GEOLOGISTS

TEST BORING LOG

1P2/385/03

TYPE: 3 1/2"AUGER

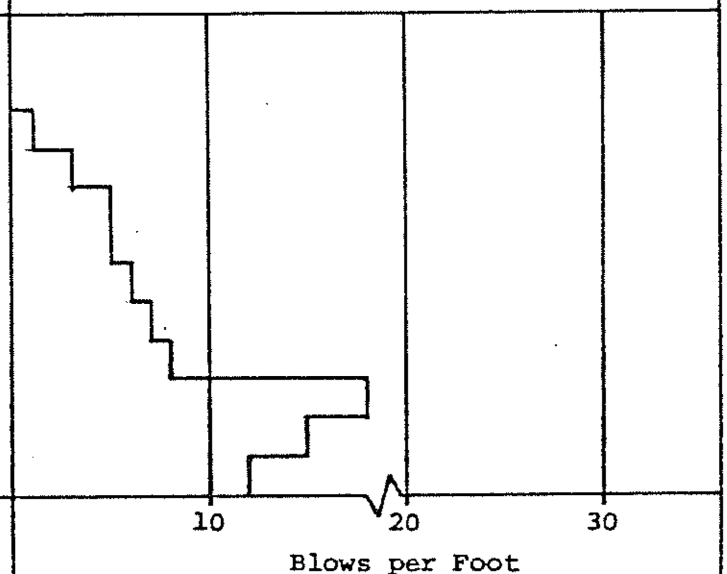
ELEVATION: Exist. ground surface

BORING No 2

UNCONFINED COMPRESSIVE STRENGTH (TSF)	OTHER TESTS	DRY DENSITY (lbs/cu.ft)	MOISTURE (%)	BLOWS/FOOT 350 ft-lb	SAMPLE SIZE (Inches)	SAMPLE No.	UNIFIED SOIL CLASS	Description
		73	46	11	2.5	1	CL	Soft blue grey sandy clayey silt with peat stringers
	C	82	39	5	2.5	2	CL	Very soft dark blue grey very fine sandy clayey silt with scattered peat stringers and shell fragments
0.1		89	33	4	1.4	3		
				5	2.5	4		
				Push				
				Push				
				1				
				3				
				5				
				5				
				6				
				7				
				8				
				18				
				15				
				12				

DEPTH IN FEET: 5, 10, 15, 20, 25, 30, 35, 40

MATERIAL SYMBOL



Seepage encountered at depth ±5 ft, 4-24-85

LOGGED BY: JPS

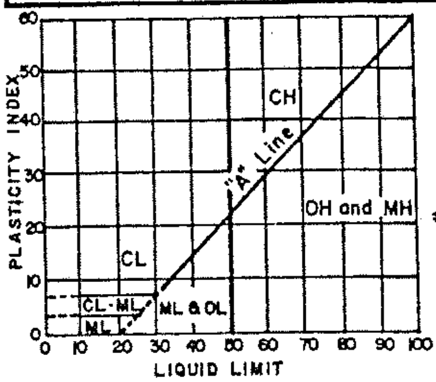
DATE: 4/24/85

FIGURE 1

MOORE & TABER NORTHERN CALIFORNIA
CONSULTING ENGINEERS AND GEOLOGISTS

UNIFIED SOIL CLASSIFICATION

Pt	OH	CH	MH	OL	CL	ML	SC	SM	SP	SW	GC	GM	GP	GW
Highly organic soils	Silts and clays Liquid limit greater than 50			Silts and clays Liquid limit less than 50			Sands with fines >12% fines		Clean sands <5% fines		Gravels with fines >12% fines		Clean gravels <5% fines	
							Sands - more than 50% of coarse fraction is smaller than Nº 4 sieve.				Gravels - more than 50% of coarse fraction is larger than Nº 4 sieve.			
Fine grained soils (More than 50% is smaller than Nº 200 sieve)							Coarse grained soils (More than 50% is larger than Nº 200 sieve)							



LABORATORY CLASSIFICATION CRITERIA

GW and SW - $C_u = \frac{D_{60}}{D_{10}}$ greater than 4 for GW & 6 for SW; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3.

GP and SP - Clean gravel or sand not meeting requirements for GW and SW.

GM and SM - Atterberg limits below "A" line or P. I. less than 4.

GC and SC - Atterberg limits above "A" line with P. I. greater than 7.

Fines (silt or clay)	Fine sand	Medium sand	Coarse sand	Fine gravel	Coarse gravel	Cobbles	Boulders
Sieve sizes	200	40	10	4	3/4"	3"	12"

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

MATERIAL SYMBOLS

- Gravel
- Sand
- Silt
- Clay
- Sandy clay or clayey sand
- Sandy silt or silty sand
- Silty clay or clayey silt
- Peat or organic matter
- Fill material
- Shale
- Sandstone
- Limestone
- Metamorphic rock
- Igneous rock

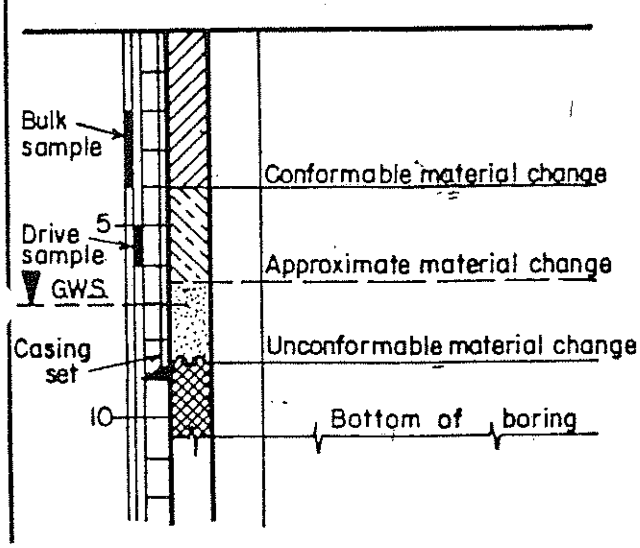
CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

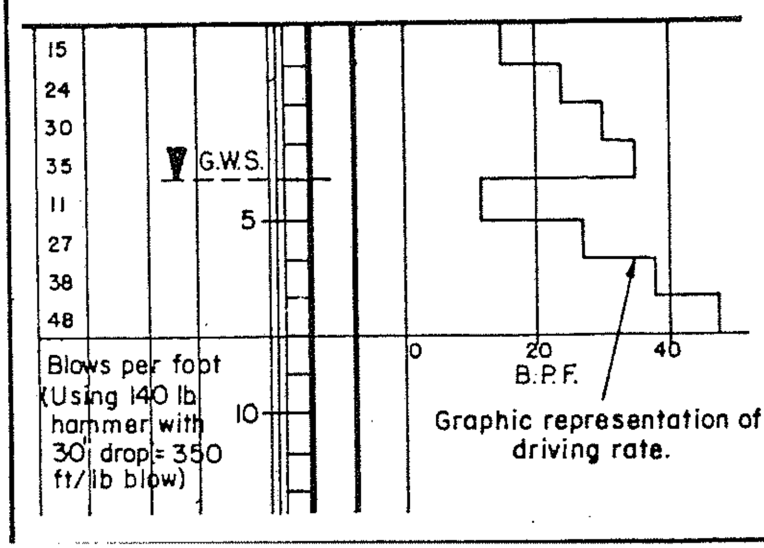
Nº of blows	Granular	Cohesive
0-5	Very loose	Very soft
6-10	Loose	Soft
11-20	Semicompact	Stiff
21-35	Compact	Very stiff
36-70	Dense	Hard
>70	Very dense	Very hard

Where standard penetration test has not been performed, consistencies shown on logs are estimated.

LEGEND OF BORING



LEGEND OF PENETRATION TEST



MOORE & TABER NORTHERN CALIFORNIA
CONSULTING ENGINEERS AND GEOLOGISTS

ient Winzler & Kelly Date April 1985 Job No. 1P2/385/03

Sample No.			Bag A	Bag B				
Sieve opening		Sieve	%	%	%	%	%	%
Inches	m.m.	Size	Passing	Passing	Passing	Passing	Passing	Passing
4.00	101.6	4"						
3.00	76.2	3"						
2.50	63.5	2½"						
2.00	50.8	2"						
1.50	38.1	1½"						
1.00	25.4	1"						
.750	19.1	3/4"						
.500	12.7	½"						
.375	9.52	3/8"						
.312	7.93	5/16"						
.250	6.35	3						
.187	4.67	4						
.157	4.00	5						
.132	3.36	6						
.093	2.38	8						
.078	2.00	10	100	100				
.066	1.68	12						
.049	1.19	16						
.033	.84	20						
.023	.59	30						
.016	.42	40	99	99				
.011	.29	50						
.009	.25	60						
.008	.21	70						
.007	.17	80						
.006	.15	100						
.004	.10	140						
.003	.07	200	79	92				
Sand Equivalent								
Sample Wt. (gr)			872	1047				

SUMMARY OF DIRECT SHEAR TESTS

Boring/ Sample	Test Conditions	Normal Stress (psf)	Peak Values		Ultimate Values	
			Shear Stress (psf)	Displacement (ins)	Shear Stress (psf)	Displacement (ins)
1/1A	2	250	65	.030	37	.130
1/1A	2	750	337	.090	232	.250
1/1A	2	1500	851	.120	720	.250
1/2A	1	500	131	.110	94	.190
1/2A	1	1000	318	.160	290	.250
1/2A	1	2000	1047	.140	991	.250

ALL SAMPLES SHEARED--SPECIMEN TEST CONDITION AS NOTED--IN

STANDARD CIRCULAR SHEAR BOX UNDER STRAIN CONTROL = 0.04 INS/MIN.

Test Condition Notation

1. Natural moisture, unconsolidated
2. Saturated, consolidated at test load

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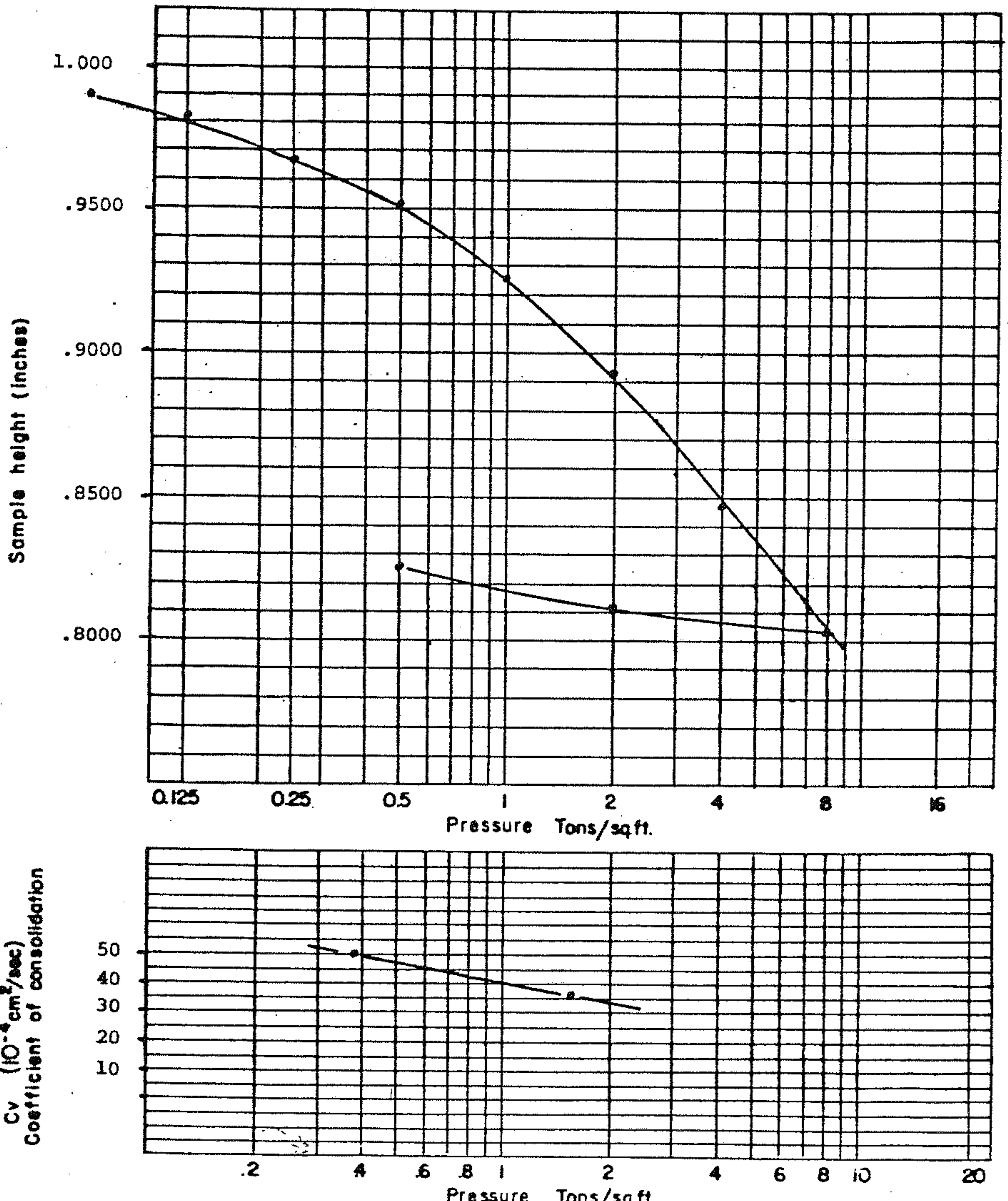
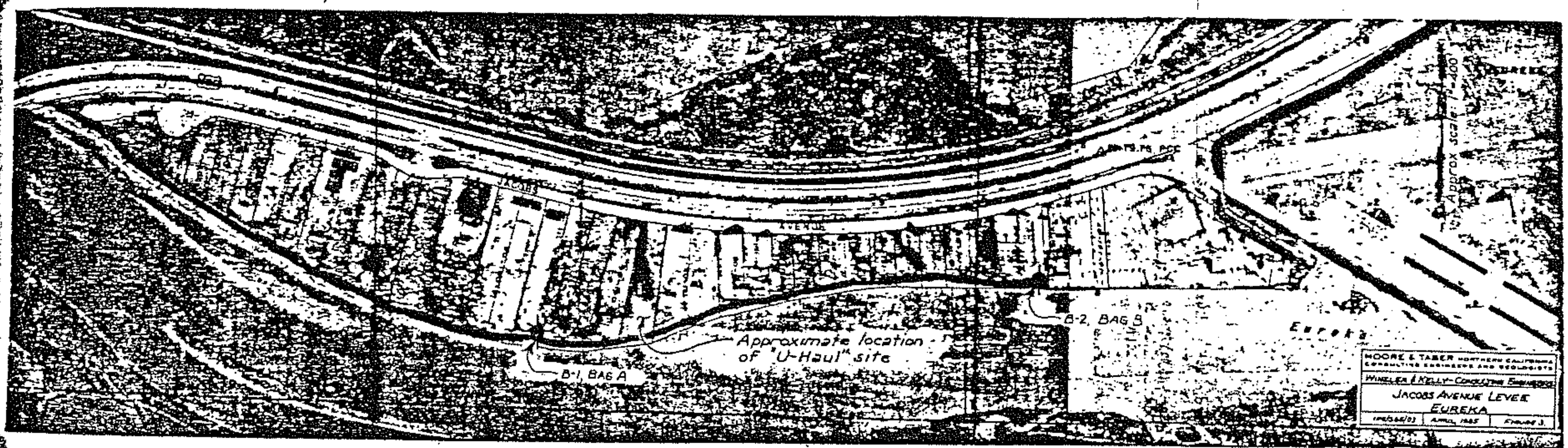
Northern California



Project Jacobs Avenue Levee		No. 1P2/385/03
Client Winzler & Kelly		
Bor./Sample No. 2/2	Depth - ~~Elev.~~ XXXXX 5-ft	Date May, 1985

CONSOLIDATION TEST - PRESSURE CURVES

Figure-2



Approx. scale 1"=400'
Eureka
B-2, BAG B
Approximate location of "U-Haul" site
B-1, BAG A
MOORE & TABER NORTHERN CALIFORNIA
CONSULTING ENGINEERS AND GEOLOGISTS
WINZLER & KELLY-CONSULTING ENGINEERS
JACOBS AVENUE LEVEE
EUREKA
APRIL, 1985
FIGURE 3

FIGURE-3

TABER CONSULTANTS
Engineers & Geologists

536 Galveston Street • West Sacramento, California 95691
West Sacramento (916) 371-1690 • Santa Rosa (707) 575-1568

AUG 12 1985

August 6, 1985

Mr. Dan Hebert
Winzler & Kelly, Consulting Engineers
P.O. Box 1345
Eureka, California 95501

Subject: Proposed Slope Protection
Jacobs Avenue Levee
Eureka, California

1P2/385/03

Dear Mr. Hebert:

The following summarizes our telephone conversation yesterday regarding slope protection along the slough-side of proposed dike slopes for the above project. Reference is made to our preliminary evaluation ("Subsurface Feasibility-Level Study", 1P2/385/03) dated May 23, 1985.

Proposed dike slopes are expected to be constructed from dredged slough materials and be subject to tidal fluctuations of 8-10 ft and erosion from channel currents. Slough materials have not yet been evaluated for their appropriateness as embankment, but our experience indicates these materials to be typically expansive (and subject to deterioration) under conditions of cyclic wetting/ drying and erodible where subjected to concentrated flow. Some form of slope protection (e.g. rock-slope protection, cobble-armored "river-run" gravel, etc) would be expected to be required to avoid otherwise high annual maintenance costs.

Please call if you have any questions on the above.

Very truly yours,

TABER CONSULTANTS

R. D. Sowers

R. D. Sowers

RDS/twf

Distribution: Client (4)

JACOBS AVENUE
PRELIMINARY COST ESTIMATE

WITH NO R/W PURCHASE ALONG DIKE FRONTAGE
(DIKE RECONSTRUCTION AND ASSESSMENT PROCEDURES)

Clear & grub	L.S.	-	$ 23,500
Excavation	4,400 c.y.	$5.20/c.y.	22,900
Fill	9,400 c.y.	$10.00/c.y.	94,000
R.S.P.	7,800 tons	$20.00/ton	156,000
Filter fabric	13,600 s.y.	$1.50/s.y.	20,400
Extend existing culverts	L.S.		15,000
Tide gates	5 ea.	$2,000.00	10,000
Northeast end (new dike)	(Alternate No. 1 on Plan Sheet 4 of 5)		
Right-of-way acquisition	15,250 s.f.	$2.50/s.f.	38,125
Earthwork	3,700 c.y.	$10.00/c.y.	37,000
Relocate storage building and pumphouse	L.S.		15,000
Rebuild fence	800 l.f.	$10.00/ft	8,000
Reconstruct access road to Murray Field	L.S.		35,000
		Subtotal	$ 474,925
		10% Contingency	47,500
		Est. Construction Cost	$ 522,455
		SAY	$ 530,000

Other Costs

A)	R/W acquisition (including surveys & legal)		$ 30,000
B)	Possible mitigation measures		5,000
C)	Engineering		
	Engineer's report for assessment district	10,000	
	Environmental studies	20,000	
	Complete geotechnical	6,000	
	*Design (4%)	21,400	
	Construction Management (8%)	42,800	
			$ 100,200

*Preliminary study provides 50% design

Attachment #5

D)	Bond counsel (2½% up + $1,000,000 & 1% additional after) +2,000 out of pocket		$ 22,000
E)	Financial consultant (1% of total bond amount)		$ 8,000
F)	Bond registration Printing Miscellaneous	$ 15,500 2,000 500	$ 18,000
G)	Bond discount (5%)		$ 40,000
H)	Bond reserve fund (5%)		$ 40,000
	Estimated total project cost		$ 793,200
	SAY		$ 798,000

JACOBS AVENUE
PRELIMINARY COST ESTIMATE

WITH R/W PURCHASE ALONG DIKE FRONTAGE
(DIKE RECONSTRUCTION AND ASSESSMENT PROCEDURES)

Clear & grub	L.S.	-	$ 23,500
Excavation	4,400 c.y.	$5.20/c.y.	22,900
Fill	9,400 c.y.	$10.00/c.y.	94,000
R.S.P.	7,800 tons	$20.00/ton	156,000
Filter fabric	13,600 s.y.	$1.50/s.y.	20,400
Extend existing culverts	L.S.		15,000
Tide gates	5 ea.	$2,000.00	10,000
Northeast end (new dike)	(Alternate No. 1 on Plan Sheet 4 of 5)		
Right-of-way acquisition	15,250 s.f.	$2.50/s.f.	38,125
Earthwork	3,700 c.y.	$10.00/c.y.	37,000
Relocate storage building and pumphouse	L.S.		15,000
Rebuild fence	800 l.f.	$10.00/ft	8,000
Reconstruct access road to Murray Field	L.S.		35,000
		Subtotal	$ 474,925
		10% Contingency	47,500
		Est. Construction Cost	$ 522,455
		SAY	$ 530,000

Other Costs

A)	R/W acquisition (including surveys & legal)		$ 30,000
B)	R/W purchase along dike frontage		$ 524,375
C)	Possible mitigation measures		5,000
D)	Engineering		
	Engineer's report for assessment district	10,000	
	Environmental studies	20,000	
	Complete geotechnical	6,000	
	*Design (4%)	21,400	
	Construction Management (8%)	42,800	
			$ 100,200

*Preliminary study provides 50% design

E)	Bond counsel (2½% up to $1,000,000 & 1% additional after) +2,000 out of pocket		$ 31,000
F)	Financial consultant (1% of total bond amount)		$ 14,000
G)	Bond registration	$ 15,500	
	Printing	2,000	
	Miscellaneous	500	
			$ 18,000
H)	Bond discount (5%)		$ 70,000
IH)	Bond reserve fund (5%)		$ 70,000
	Estimated total project cost		$1,392,575
		SAY	$1,400,000

ASSESSMENT SPREAD EXAMPLE
(CASE ASSUMING R/W PURCHASE ALONG DIKE FRONTAGE)

ESTIMATED TOTAL PROJECT $798,000

EARTHWORK - 24.6% OF CONSTRUCTION COST ESTIMATE

PROPOSED FORMULA

The Assessment Spread is based upon the three factors shown below. A) is the cost of the earthwork required to reconstruct the dike, the cost of which is spread based upon the estimated volume per each parcel.

The balance of the project cost is spread based upon B) area (75% of balance), and C) length of frontage along the slough (25% of balance).

A) Earthwork

1. Excavation = $0.048 \times 798{,}000 = \$38{,}304 \times \frac{1}{3{,}947} = \$9.704/\text{cy}$

2. Fill = $0.198 \times 798{,}000 = \$158{,}004 \times \frac{1}{8{,}983} = \$17.59/\text{cy}$

B) Area = $0.75\ (798{,}000-196{,}308) = \$451{,}269 \times \frac{1}{39.10\ \text{ac}} = \$11{,}541/\text{ac}$

C) Frontage = $0.25\ (798{,}000-196{,}308) \times \frac{1}{4{,}840} = \$31.08/\text{lf}$

Assessment = excavation on parcel ($9.704/cy) + fill on parcel ($17.59/cy) + area ($11,541/ac) + frontage length ($31.08/lf).

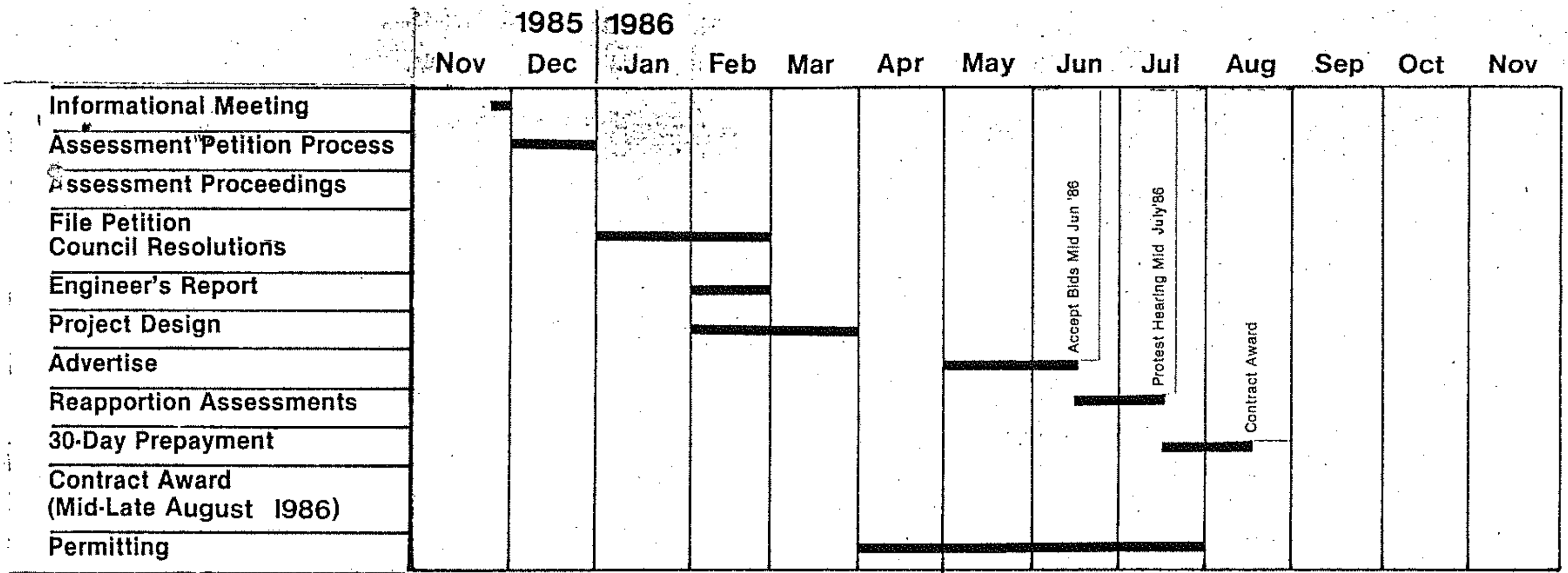
Attachment #5

ASSESSMENT CALCULATION EXAMPLE

AP#	Excavation Quantity (cy)	$9.704/ cy	Fill Quantity (cy)	$17.59/ cy	Area (ac)	$11,541/ ac	Frontage l.f.	$31.08/ lf	Portion of Assessment to Fund Construction $	Increase in Assessm't to Provide Funds for R/W Purchase	Estimated Total Assessment	Less Amount Received for R/W Purchase @ $2.50/s.f.	Estimated Net Cost
14-071-03	98	951	177	3,113	0.94	10,849	110	3,419	18,332	13,830	32,162	13,750	18,412
-06	204	1,980	1,010	17,766	1.25	14,426	440	12,675	47,847	36,095	83,942	55,000	28,942
-08	78	757	185	3,254	0.75	8,656	100	3,108	15,775	11,901	27,676	12,500	15,176
-10	0	0	0	0	0.37	4,270	0	0	4,270	3,222	7,492	-	7,492
-12	0	0	0	0	0.11	1,270	0	0	1,270	957	2,227	-	2,227
-13	85	825	185	3,254	0.39	4,501	100	3,108	11,688	8,818	20,506	12,500	8,006
-14	28	272	143	2,515	0.28	3,231	50	1,554	7,572	5,713	13,285	6,250	7,035
-15	State Property		0	0	--	0	0	0	0	0	0	0	0
14-081-02	667	6,473	659	11,592	4.68	54,012	400	12,432	84,509	63,753	148,262	50,000	98,262
-03	264	2,562	346	6,086	2.1	24,236	210	6,527	39,411	29,733	69,144	26,250	42,894
14-091-02	County Property		-	0	--	0	-	0	0	0	0	0	0
-03	263	2,552	337	5,928	2.62	30,237	200	6,216	44,933	33,950	78,883	25,000	53,883
-06	185	1,795	335	5,893	1.2	13,850	135	4,196	25,734	19,412	45,146	16,875	28,271
-07	139	1,349	210	3,694	1.28	14,772	110	3,419	23,234	17,529	40,763	13,750	27,013
-08	467	4,532	422	7,423	3.9	45,010	300	9,324	66,289	50,010	116,299	37,500	78,799
14-131-01	147	1,426	443	7,792	1.08	12,464	139	4,320	26,002	19,619	45,621	17,375	28,246
-02	215	2,086	687	12,084	1.82	21,005	283	8,796	43,971	33,171	77,142	35,375	41,767
-05	41	398	247	4,345	0.52	6,001	101	3,139	13,883	10,473	24,356	12,625	11,731
-06	71	689	183	3,219	0.5	5,771	106	3,294	12,973	9,787	22,760	13,250	9,510
-07	74	718	165	2,902	0.5	5,771	100	3,108	12,499	9,430	21,929	12,500	9,429
-08	187	1,815	400	7,036	1.06	12,233	198	6,154	27,238	20,548	47,786	24,750	23,036
-09	0	0	0	0	0.3	3,462	0	0	3,462	2,612	6,074	0	6,074
-10	66	640	246	4,327	0.69	7,963	102	3,170	16,100	12,149	28,249	12,750	15,499
-11	36	349	269	4,732	0.55	6,348	101	3,139	14,568	10,989	25,557	12,625	12,932
14-141-01	74	718	246	4,327	0.50	5,771	100	3,108	13,924	10,505	24,429	12,500	11,929
-02	74	718	274	4,820	0.52	6,001	100	3,108	14,647	11,051	25,698	12,500	13,198
-03	50	485	306	5,383	0.57	6,578	100	3,108	15,554	11,734	27,288	12,500	14,788
-04	152	1,475	603	10,607	1.41	16,273	200	6,216	34,571	26,080	60,651	16,000	44,651
-05	96	932	288	5,066	1.61	18,581	192	5,967	30,546	23,044	53,590	9,600	43,990
-06	74	718	378	6,649	0.63	7,271	100	3,108	17,746	13,388	31,134	12,500	18,634
-07	28	272	37	651	0.45	5,193	45	1,399	7,515	5,670	13,185	2,250	10,935
14-151-01	84	815	202	3,553	6.52	75,247	718	22,315	101,930	76,899	178,829	74,025	104,804
Total	3,947 (cy)	$38,302	8,983	$158,011	39.10 (ac)	$451,253	4,840 (lf)	$150,427	$797,993	602,072	1,400,015	562,500	837,515

ASSESSMENT SUMMARY

AP#	Owner of Records	Annual Maintenace Fee
14-071-03	Kenneth J. Gradek & Donald K. Ling	$ 90.92
-06	Kenneth J. & Maureen J. Gradek & Donald K. & Carol B. Lin	363.64
-08	Kenneth J. & Maureen J. Gradek & Donald K. & Carol B. Ling	82.64
-10	William C. & Juanita C. Thompson	0
-12	William C. & Juanita C. Thompson	0
-13	Donald Ling & Kenneth Gradek	82.64
-14	Columbia Saw Company of California	41.32
-15	State of California	0
14-081-02	Redwood Kenworth Company	330.58
-03	Liquid Air, Inc.	173.55
14-091-02	County of Humboldt	0
-03	Petrelab Distributors, Inc.	165.29
-06	U-Haul Company	111.57
-07	U-Haul Company	90.92
-08	Bobby V. & Judy L. Fox	247.93
14-131-01	Teamsters Local 689	114.88
-02	William R. & Charlotte Greenwood & Thomas B. & Joan N. Crossan	233.88
-05	Laurent W. & Joanne E. Zerlang & Gerald M. Pavlich	83.47
-06	Redwood District Council	87.60
-07	Ronald Harris & Jerry Chapman	
-08	Ethel Brede & R.L. & Vera A. Davis	163.64
-09	Rogers Machinery Company	0
-10	Rogers Machinery Company, Inc.	84.30
-11	Laurence & Joanne Zerlang & Gerald Pavlich	83.47
14-141-01	Ronald Harris & Jerry Chapman	82.64
-02	Jackie Cassatt	82.64
-03	Herbert T. & Claudine I. Bunker	82.64
-04	Edwin G. & Dolores M. George	165.29
-05	Johnson Ranches, Inc.	158.68
-06	Edwin & Dolores George	82.64
-07	Johnson Ranches, Inc.	37.20
14-151-01	Johnson Ranches, Inc.	593.39
Total		$4,000.00



Jacobs Ave Dike Reconstruction

Preliminary Schedule

PRELIMINARY ASSESSMENT SPREAD
(With Cutoff Dike at East End)

AP #	Estimated Construction Assessment	Estimated Increase to Cover R/W Costs	Return on Purchase of R/W @ 2.50/s.f.	Estimated Net Assessment	Estimated Annual Cost (Assumes 30 yrs @ 8%)
14-071-03	17,373	14,021	13,750	17,644	1567.32
-06	45,861	37,004	55,000	27,865	2475.25
-08	14,976	12,088	12,500	14,564	1293.72
-10	3,994	3,223	0	7,217	641.09
-12	1,188	957	0	2,145	190.54
-13	11,153	9,005	12,500	7,658	680.26
-14	5,738	7,325	6,250	6,813	605.20
-15	State Property				
14-081-02	79,908	64,508	50,000	94,416	8386.97
-03	37,309	30,113	26,250	41,172	3657.31
14-091-02	40,803	32,932	25,000	48,735	4329.13
-03	42,460	34,269	25,000	51,729	4595.09
-06	24,439	19,728	16,875	27,292	2424.35
-07	21,987	17,746	13,750	25,983	2308.07
-08	62,595	50,527	37,500	75,622	6717.50
14-131-01	24,773	19,990	17,375	27,388	2432.88
-02	41,877	33,793	35,375	40,295	3579.40
-05	13,250	10,691	12,625	11,316	1005.20
-06	12,359	10,974	13,250	10,083	895.67
-07	11,897	9,603	12,500	9,000	799.47
-08	25,944	17,829	24,750	19,023	1689.81
-09	3,239	2,613	0	5,852	519.83
-10	15,327	12,369	12,750	14,946	1327.65
-11	13,907	11,219	12,625	12,501	1110.46
14-141-01	13,290	10,725	12,500	11,515	1022.88
-02	13,987	11,288	12,500	12,775	1134.80
-03	14,856	11,988	12,500	14,344	1274.18
-04	32,951	26,590	16,000	43,541	3867.75
-05	28,943	23,353	9,600	42,696	3792.68
-06	16,963	13,956	12,500	18,419	1639.16
-07	7,094	5,725	2,250	10,569	938.84
14-151-01	96,061	77,500	74,025	99,536	8841.78
Totals	796,502	643,652	587,500	852,654	

ESTIMATED TOTAL ASSESSMENT 1,440,154

Attachment #1

PRELIMINARY ASSESSMENT SPREAD
(Without Cutoff Dike at East End)

AP #	Estimated Construction Assessment	Estimated Increase to Cover R/W Costs	Return on Purchase of R/W @ 2.50/s.f.	Estimated Net Assessment	Estimated Annual Cost (Assumes 30 yrs @ 8%)
14-071-03	12,823	13,921	13,750	12,994	1154.26
-06	36,137	42,455	55,000	23,592	2095.68
-08	11,185	12,138	12,500	10,823	961.41
-10	2,716	2,949	-	5,665	503.22
-12	808	876	-	1,684	149.59
-13	8,601	9,336	12,500	5,437	482.97
-14	5,617	6,095	6,250	5,462	485.19
-15	State Property				
14-081-02	58,791	63,816	50,000	72,607	6,450.00
-03	27,510	29,861	26,250	31,121	2,764.48
14-09[illegible]-02	29,197	31,689	25,000	35,886	3,187.75
-03	30,972	33,617	25,000	39,589	3,516.69
-06	18,530	20,112	16,875	21,767	1,933.56
-07	16,201	17,586	13,750	20,037	1,779.89
-08	45,509	49,394	37,500	57,403	5,099.11
14-131-01	19,148	20,785	17,375	22,558	2,003.83
-02	32,018	34,704	35,375	31,347	2,784.55
-05	10,201	11,072	12,625	8,648	768.20
-06	9,379	10,180	13,250	6,309	560.43
-07	8,992	9,761	12,500	6,253	555.45
-08	19,846	21,542	24,750	16,638	1,477.95
-09	2,203	2,390	-	4,593	408.00
-10	11,666	12,662	12,750	11,578	1,028.47
-11	10,734	11,648	12,625	9,757	866.71
14-141-01	10,299	11,178	12,500	8,977	797.43
-02	10,898	11,826	12,500	10,224	908.20
-03	11,577	12,565	12,500	11,642	1,034.16
-04	25,432	27,605	16,000	37,037	3,290.00
-05	21,181	22,986	9,600	34,567	3,070.59
-06	13,382	14,521	12,500	15,403	1,368.25
-07	5,053	5,483	2,250	8,286	736.04
14-151-01	66,416	72,075	35,900	102,591	9,113.16
Totals	$593,022	$646,828	$549,375	690,475	

ESTIMATED TOTAL ASSESSMENT $1,239,850

Attachment #2

Appendix B

Subsurface Exploration

APPENDIX B
SUBSURFACE EXPLORATION

The subsurface exploration program for this study consisted of the advancement of 11 cone penetrometer soundings and 7 exploratory drill holes at selected locations at the project site, as on Plates 3.1 through 3.4.

The cone penetrometer soundings were advanced between November 19 and November 22, 2015 using a Geoprobe 6625CPT track mounted rig provided by California Push Technologies. Depths of those CPT soundings ranged from 16.7 to 75.4 feet below the existing ground surface.

The CPTs were performed using an electric cone penetrometer with a diameter of approximately 15 square centimeters. The instrumented cone is hydraulically pushed into the ground at a rate of about 2 centimeters per second (cm/s). Cone penetration resistance (q_c), and sleeve resistance (f_s) were monitored continuously during penetration and recorded. The friction ratio (FR) was computed for each value of q_c and f_s recorded. CPT data and soil classifications were used in conjunction with drill hole information to estimate soil boundaries encountered at the site. CPT logs and explanations of services are attached to this appendix.

Each CPT hole was backfilled with cement-bentonite grout pumped through open-ended CPT casing from the surface to the bottom of the hole and filled upward. When grout returned to the surface, the grout hose was removed, CPT casing pulled, and the holes were topped off with additional grout as needed.

The drill holes were advanced on January 11 through January 14, 2016 using a Mobile Drill B-59 drill rig provided by Diamond Core Drilling of Shasta Lake, California. The drill holes were advanced using rotary-wash methods.

Select samples of soils were collected from selected depth increments in each drill hole using California modified split-spoon, Standard Penetration Test (SPT), and/or Shelby tube samplers. California modified split-spoon and SPT samplers were driven by a 140-pound hammer situated on the drill rig, in accordance with standard test method ASTM D1586-11. Shelby tubes were hydraulically pushed into the underlying sediments to obtain samples, in accordance with standard test method ASTM D1587-15. Bulk samples were also obtained at selected depth intervals. Sample types and depths are presented on Plates B2.1 through B-2.7. All samples were delivered to Caltrans District 1 laboratory for testing. The results of the testing procedures are attached within Appendix B.

The exploration logs describe the earth materials encountered. The logs also show the location, exploration number, date of exploration, and the names of the logger and equipment used. A CGI geologist, using ASTM 2488 for visual soil classification, logged the explorations. The boundaries between soil types shown on the logs are approximate because the transition between different soil layers may be gradual and may change with time. The drill holes were backfilled with bentonite chips. Where asphaltic concrete was disturbed, the holes were patched using asphaltic concrete patching materials or quick-set concrete died to match the existing pavement color.

The drill hole logs are presented as Plates B-2.1 through B-2.7. A legend to the drill hole logs is presented as Plate B-1.1.

LOG OF EXPLORATION: Expl. No.

PROJECT: CGI's Project Name	**EXPL. VENDOR:** Expl. SubcontractorB	**SURFACE ELEVATION:** Expl. Elevation
PROJECT NO.: CGI's Project No.	**EXPL. METHOD:** Method of Expl.	**TOTAL DEPTH OF HOLE:** Total Depth of Expl.
LOCATION: General Location	**LOGGED BY:** CGI's Logger	**DEPTH TO WATER:** Depth to Water
START DATE: Date Started	**CHECKED BY:** CGI's Reviewer	**BACKFILLED WITH:** Backfill Materials
END DATE: Date Finished	**HAMMER TYPE:** Type of Sample Hammer	

Depth (ft)	**Material Symbol**	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0			1			SAMPLES/BLOW COUNT SYMBOLS KEY Bulk Soils Sample							
			2	(24)		California modified split spoon sampler (CMSS) Brackets on blow counts indicates CMSS sample							CMSS: 2-3/8" ID, 3" OD, Driven
5			3	50:5"		Standard penetration test (SPT) sample and blow count							SPT: 1-3/8" ID, 2" OD, Driven
						No sample recovery							Blow counts are recorded as the number of blows required for one foot of sampler penetration using a 140-lb hammer falling 30 inches. Typically, sampler is driven 18" and the initial 6" discarded.
						LITHOLOGIC GRAPHICS DESCRIPTIONS FOR SOILS MATERIALS (per ASTM D2487 & D2488)							
10					GW	well graded GRAVEL							
					GP	poorly graded GRAVEL							
					GM	silty GRAVEL							
					GC	clayey GRAVEL							
15					SW	well graded SAND							Initial water level measurement
					SP	poorly graded SAND							Water level after initial measurement (may not represent stabilized water levels)
					SM	silty SAND							
					SC	clayey SAND							
20					ML	low plasticity SILT							
					MH	high plasticity SILT							
					CL	lean CLAY							Lab Abbreviations DS-direct shear; C-consolidation; GS-sieve; EI-Expansion Index; PI-Plasticity; UC-Unconfined; SC-soil chem.; SE-sand equiv.; R-R value; P-curve; PP-pocket penetrometer.
25					CH	fat CLAY							
					PT	organic soils or peat							
					OL	organic SILTS or CLAYS with low plasticity							
					OH	organic SILTS or CLAYS with high plasticity							
30					RX	ROCK							

CGI TECHNICAL SERVICES INC.

The log and data presented are a simplification of actual conditions encountered at the given location and time of exploration. Subsurface conditions may differ at other locations and with the passage of time.

PLATE NO.: B-1.1

LOG OF EXPLORATION: DH-10L

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	6.5 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	26.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	E. Cortez	**DEPTH TO WATER:**	1 Foot
START DATE:	January 14, 2016	**CHECKED BY:**	J.Bianchin	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 14, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0			af	ARTIFICAL FILL (af) Aggregate Base (1 foot)							
	1	(19)	ML		▼			17.2			
				ALLUVIUM (Qal) Clayey SILT, grey, wet, very soft to soft, with shell fragments.							
5	2	(3)				86.2	36.0	46.2			
10	3	Push				79.8	42.1		40	14	DS, Perm
15	4	Push				78.7	42.4				Consol
20	5	(4)				72.3	49.5				
				At 22 feet: with trace shell fragments.							
25	6	2					50.0	98.7			
				Bottom of Drill Hole at a Depth of 26.5 Feet							

CGI Technical Services Inc.

The log and data presented are a simplification of actual conditions encountered at the given location and time of exploration. Subsurface conditions may differ at other locations and with the passage of time.

PLATE NO.: B-2.1

LOG OF EXPLORATION: DH-20off

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	6.5 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	26.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	E. Cortez	**DEPTH TO WATER:**	1 Foot
START DATE:	January 13, 2016	**CHECKED BY:**	J.Bianchin	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 13, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	Material Symbol	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0					af	ASPHALTIC CONCRETE (4 inches)	▼						
			1	(16)	CH	AGGREGATE BASE (14 inches)				7.9	25.2	5	
						ARTIFICIAL FILL (af) CLAY, greyish brown mottled black and olive grey, moist, very stiff, with trace fine sand and wood chips. Becomes medium stiff with depth and sand and wood chips decrease with depth.		60.8	62.8				
5			2	(5)									
						ALLUVIUM (Qal) - Bay Mud CLAY, grey, wet, very soft to soft, with shell fragments and some woody debris fragments.							
10			3	Push				80.1	42.0	90.1			
15			4	(4)				82.4	39.9		26.7	3	
20			5	(5)									
						Silty SAND, grey, wet, loose, fine grained.							
						At 23.5 feet: becomes medium dense.							
25			6	(28)				104.8	23.9	18.6			
						Bottom of Drill Hole at a Depth of 26.5 Feet							

CGI Technical Services Inc.

The log and data presented are a simplification of actual conditions encountered at the given location and time of exploration. Subsurface conditions may differ at other locations and with the passage of time.

PLATE NO.: B-2.2

LOG OF EXPLORATION: DH-30L

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	6 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	26.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	E. Cortez	**DEPTH TO WATER:**	1 Foot
START DATE:	January 13, 2016	**CHECKED BY:**	J.Bianchin	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 13, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	Material Symbol	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0			1	(25)	af	ARTIFICIAL FIL (af) Silty SAND with Gravel, greyish brown, wet, medium dense, with fine to coarse rounded gravel, organics, and roots in upper 6 inches. At 2 feet: becomes mottled reddish yellow, has fine to medium rounded gravel, coal, and wood chips.	▼	89.5	30.9	21.3			GS
5			2	Push	ML	ALLUVIUM (Qal) SILT, grey, wet, soft, with shell fragments.		86.1	36.0				
10			3	(4)		At 10 feet: soft					33	9	PI
15			4	23	SM	Silty SAND, grey, wet, medium dense, fine grained.			24.8	10.8			GS
						At 17.5 feet: becomes dense.							
20			5	(37)				102.2	25.0	16.9			GS
25			6	10		At 24 feet: becomes greyish brown At 26 fete: becomes moderate yellowish brown, olive grey, and black, with some fine rounded gravel and trace clay.			22.6				
						Bottom of Drill Hole at a Depth of 26.5 Feet							

CGI TECHNICAL SERVICES INC.

The log and data presented are a simplification of actual conditions encountered at the given location and time of exploration. Subsurface conditions may differ at other locations and with the passage of time.

PLATE NO.: B-2.3

LOG OF EXPLORATION: DH-30C

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	12.5 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	51.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	E. Cortez	**DEPTH TO WATER:**	7 Feet
START DATE:	January 12, 2016	**CHECKED BY:**	J.Bianchin	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 12, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	**Material Symbol**	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0			B1		GC	ARTIFICIAL FILL (af) Clayey GRAVEL, greyish brown, wet, medium dense, with fine to coarse rounded gravel, organics, and roots in upper 6 inches.							Curve
			1	(11)	ML	SILT, greyish brown mottled moderate yellowish brown, moist, stiff, with trace fine sand.					30	7	PI
5			2	(8)									DS, Perm
					ML	ALLUVIUM (Qal) Sandy SILT, dark grey, wet, very soft, with shell fragments and roots in upper feet.	▼						
10			3	Push				88.3	34.9				
15			4	Push				81.6	40.8	74.6	26	3	PI, Consol, DS
20			5	Push				81.9	40.3	93.0			GS
					SM	Silty SAND, dark grey, wet dense, fine grained.							
25			6	(36)				108.3	24.3				
						At 28 feet: with shell fragments.							
30			7	18					20.1				

CGI Technical Services Inc.

The log and data presented are a simplification of actual conditions encountered at the given location and time of exploration. Subsurface conditions may differ at other locations and with the passage of time.

PLATE NO.: B-2.4

LOG OF EXPLORATION: DH-30C

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	12.5 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	51.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	E. Cortez	**DEPTH TO WATER:**	7 Feet
START DATE:	January 12, 2016	**CHECKED BY:**	J.Bianchin	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 12, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	**Material Symbol**	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
					GP	GRAVEL with Sand, dark grey, wet, medium dense, fine to medium grained with subrounded to subangular fine to medium gravel.							
35			8	(19)				113.1	19.3				
40			9	12	ML	SILT, grey, wet, stiff.			29.5				GS
45			10	(44)		At 45 feet: with fine to medium subrounded gravel and calcareous fragments.				59.2			GS
50			11	16					30.1				
						Bottom of Drill Hole at a Depth of 51.5 Feet							

LOG OF EXPLORATION: DH-42L

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	6 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	26.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	J.Bianchin	**DEPTH TO WATER:**	1 Foot
START DATE:	January 12, 2016	**CHECKED BY:**	A.Bahloul	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 12, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	Material Symbol	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0					af ML	ARTIFICIAL FILL (af) Aggregate Base (1 foot)	▼						
						ALLUVIUM (Qal) Clayey SILT, grey, wet, soft, plastic, with fine sand.							
5			1	Push				87.5	33.8	64.7			GS
10			2	Push	SM/ ML								
						At 12.5 feet: no sand.							
15			3	(12)		At 15 feet: medium stiff, plastic.		85.6	37.5 35.9	69.6 77.4			GS GS
			4	16					23.3	31.6			GS
20			5	20		Silty SAND, grey, wet, medium dense, fine to medium grained, with trace to moderate shell fragments, and strong organic odor, interbedded with Silty CLAY to CLAY, grey, wet, medium stiff, plastic.			30.0	39.3			GS
25			6	4	ML	SILT, moderate brown, wet, soft, plastic, with abundant wood fragments and organic debris, and strong organic odor.			21.4	42.7			GS
						Bottom of Drill Hole at a Depth of 26.5 Feet							

CGI TECHNICAL SERVICES INC.

The log and data presented are a simplification of actual conditions encountered at the given location and time of exploration. Subsurface conditions may differ at other locations and with the passage of time.

PLATE NO.: B-2.5

LOG OF EXPLORATION: DH-56L

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	6.5 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	26.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	J.Bianchin	**DEPTH TO WATER:**	1 Foot
START DATE:	January 11, 2016	**CHECKED BY:**	A.Bahloul	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 11, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	Material Symbol	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0					af	ARTIFICIAL FILL (af) Aggregate Base (1 foot)	▼						
					ML	ALLUVIUM (Qal) Clayey SILT, olive grey, wet, soft, plastic, with abundant wood fragments, charcoal, and organic debris, and very thin laminations of clayey silt.							
			1	(3)				125.3	8.0	8.3			GS
5			2	Push				87.2	35.2	68.6	26	3	GS, PI
10			3	24	SM/ SP	SAND, grey, wet, medium dense, fine grained.			24.0	9.8			GS
15			4	(27)		At 15 feet: with trace to moderate silt.		101.7	25.3	20.3			GS
20			5	22		At 20 feet: with trace to moderate shell fragments.			22.3	12.0			GS
25			6	(50:5.5")		At 25 feet: moderate yellowish brown, fine to medium grained.		112.4 110.5	19.9 20.0	11.6 8.6			GS GS
						Bottom of Drill Hole at a Depth of 26.5 Feet							

CGI Technical Services Inc.

The log and data presented are a simplification of actual conditions encountered at the given location and time of exploration. Subsurface conditions may differ at other locations and with the passage of time.

PLATE NO.: B-2.6

LOG OF EXPLORATION: DH-56off

PROJECT:	Jacobs Avenue Levee	**EXPL. VENDOR:**	Diamond Core Drilling	**SURFACE ELEVATION:**	6.5 Feet
PROJECT NO.:	15-1949.03	**EXPL. METHOD:**	Mud Rotary	**DEPTH OF HOLE:**	26.5 Feet
LOCATION:	Eureka, California	**LOGGED BY:**	E.Cortez	**DEPTH TO WATER:**	1 Foot
START DATE:	January 14, 2016	**CHECKED BY:**	J.Bianchin	**BACKFILLED WITH:**	Cement Grout
END DATE:	January 14, 2016	**HAMMER TYPE:**	140-Lb		

Depth (ft)	Material Symbol	Sample	Sample No.	Blow Count (blows/ft)	USCS Symbol	Material Description	Water Table	Unit Dry Weight, pcf	Water Content, %	% Passing No. 200	Liquid Limit	Plasticity Index	Notes & Assigned Laboratory
0					af	ARTIFICIAL FILL (af) Aggregate Base (1 foot)							
			1	(25)	CH		▼	131.9	8.7	21.2			GS
			2	7		ALLUVIUM (Qal) CLAY, grey, wet, soft with strong organic odor and interbedded laminations of black silty clay.			57.3 56.6	39.5 13.3			GS GS
5													
			3	Push									
10			4	(6)							31	6	PI
					SM	Clayey SILT, grey, wet, loose, fine grained, with trace to moderate shell fragments.							
15			5	31					22.3	11.5			GS
						At 16.5 feet: dense							
						At 18 feet: very dense							
20			6	(50:3")									DS, Perm
						At 23 feet: medium dense with occassional layers of woody fragments and organic debris, and having a strong organic odor.							
25			7	14					28.5	14.4			GS
						Bottom of Drill Hole at a Depth of 26.5 Feet							

PRESENTATION OF SITE INVESTIGATION RESULTS

Jacobs Avenue Levee

Prepared for:

CGI Technical Services Inc.

CPT Inc. Job No: 15-56025

Project Start Date: 19-Nov-2015
Project End Date: 22-Nov-2015
Report Date: 30-Nov-2015

Prepared by:

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CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Introduction

The enclosed report presents the results of the site investigation program conducted by CPT Inc. for CGI Technical Services Inc. along the Jacobs Avenue Levee. The program consisted of 11 cone penetration tests (CPT).

Project Information

Project	
Client	CGI Technical Services Inc.
Project	Jacobs Avenue Levee
CPT Inc. project number	15-56025

A map from Google earth including the CPT test locations is presented below.

Rig Description	Deployment System	Test Type
CPT track rig (GPT1)	20 ton rig cylinder	CPT

Coordinates		
Test Type	Collection Method	EPSG Reference
CPT	Consumer Grade GPS	32610

Cone Penetration Test (CPT)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.
Additional plots	Expanded scale CPT plots and advanced CPT plots with Ic, Su(Nkt) and N1(60).

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (psi)
447:T1500F15U500	AD447	15	225	1500	15	500
Cone AD447 was used for all CPT soundings.						

Interpretation Tables	
Additional information	The Soil Behaviour Type (SBT) classification chart (Robertson et al., 1986 presented by Lunne, Robertson and Powell, 1997) was used to classify the soil for this project. A detailed set of CPT interpretations were generated and are provided in Excel format files in the release folder. The CPT interpretations are based on values of corrected tip (q_t), sleeve friction (f_s) and pore pressure (u_2). Soils were classified as either drained or undrained based on the Soil Behaviour Type (SBT) classification chart (Robertson et al., 1986 presented by Lunne, Robertson and Powell, 1997). Calculations for both drained and undrained parameters were included for materials that classified as silt (Zone 6) and sandy silt (Zone 7). Soils classifying as undefined (Zone 0) were treated as undrained.

Limitations

This report has been prepared for the exclusive use of CGI Technical Services Inc. (Client) for the project titled “Jacobs Avenue Levee”. The report’s contents may not be relied upon by any other party without the express written permission of CPT Inc. CPT Inc. has provided site investigation services, prepared the factual data reporting, and provided geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

The information presented in the report document and the accompanying data set pertain to the specific project, site conditions and objectives described to CPT Inc. by the Client. In order to properly understand the factual data, assumptions and calculations, reference must be made to the documents provided and their accompanying data sets, in their entirety.

The cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd. of Richmond, British Columbia, Canada.

CPT Inc.'s piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and a geophone sensor for recording seismic signals. All signals are amplified down hole within the cone body and the analog signals are sent to the surface through a shielded cable.

The penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 mm diameter over a length of 32 mm with tapered leading and trailing edges) located at a distance of 585 mm above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is 6 mm thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. Our calibration criteria also meet or exceed those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

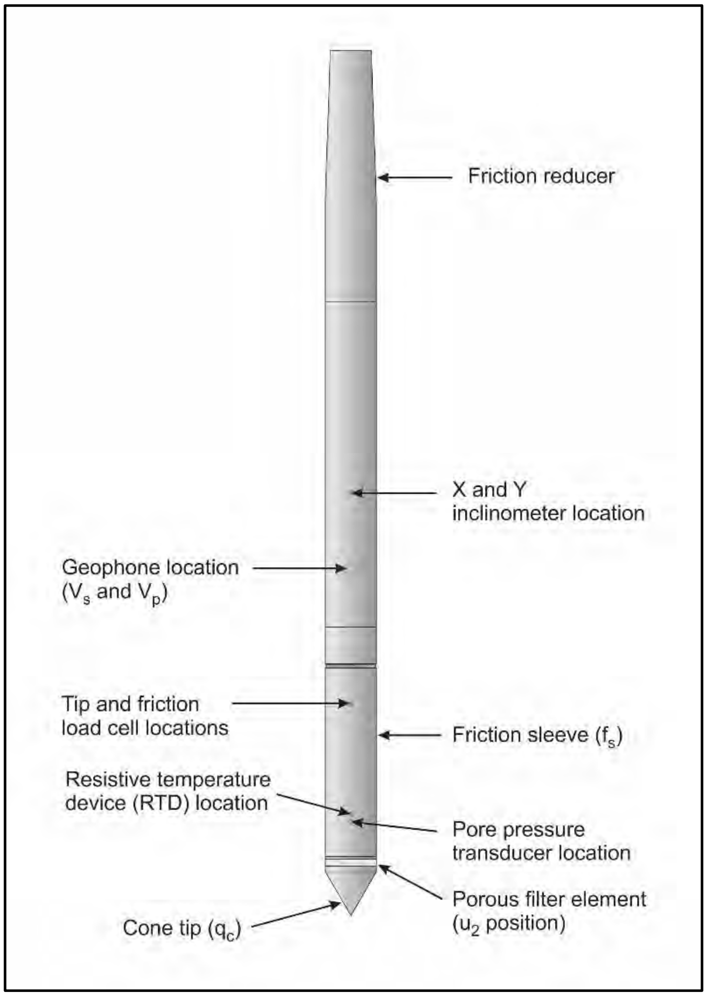

Figure CPTu. Piezocone Penetrometer (15 cm^2)

The data acquisition systems consist of a Windows based computer and a signal conditioner and power supply interface box with a 16 bit (or greater) analog to digital (A/D) converter. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording intervals are either 2.5 cm or 5.0 cm depending on project requirements; custom recording intervals are possible. The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to CPT Inc.'s CPT operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with either glycerin or silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of 2 cm/s, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to CPT Inc.'s cone penetration testing procedures:

- Each filter is saturated in silicone oil or glycerin under vacuum pressure prior to use
- Recorded baselines are checked with an independent multi-meter
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of the piezocone data and associated calculated parameters for this report are based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson (1990) and Robertson (2009). It should be noted that it is not always possible to accurately identify a soil type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al, 1986:

$$q_t = q_c + (1-a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for CPT Inc. probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all CPT Inc. piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of files with calculated geotechnical parameters were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the methods used is also included in the data release folder.

For additional information on CPTu interpretations and calculated geotechnical parameters, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

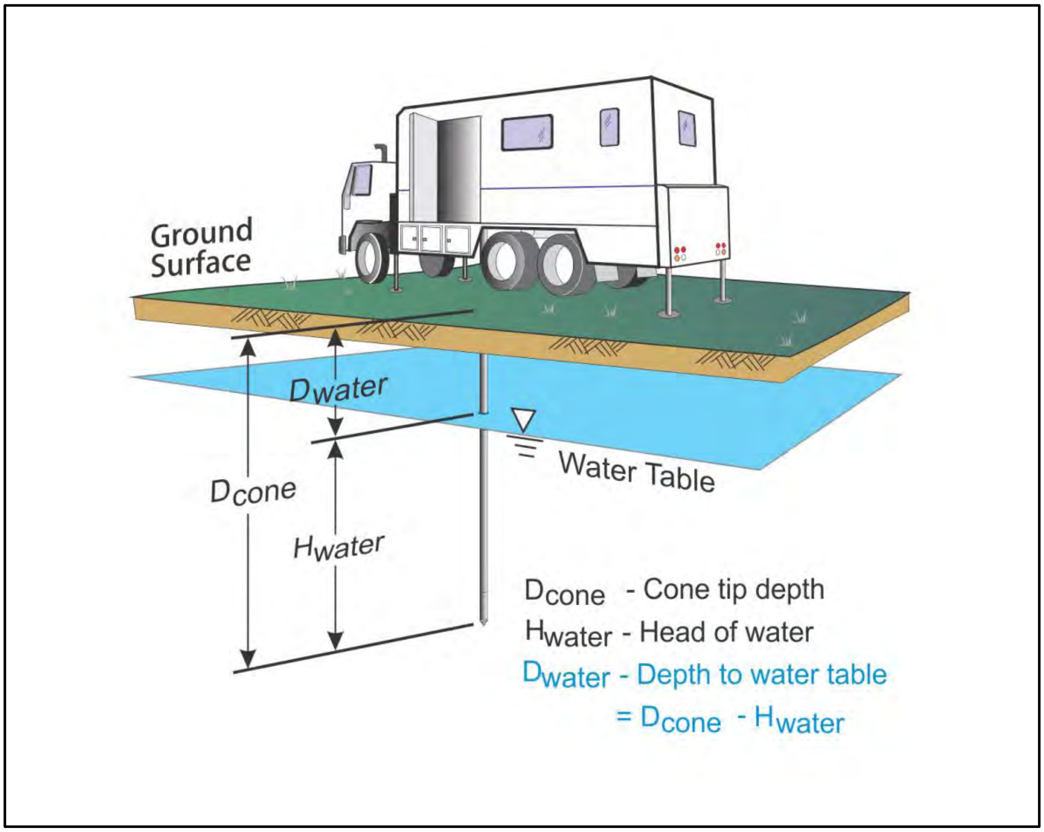

Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behavior.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

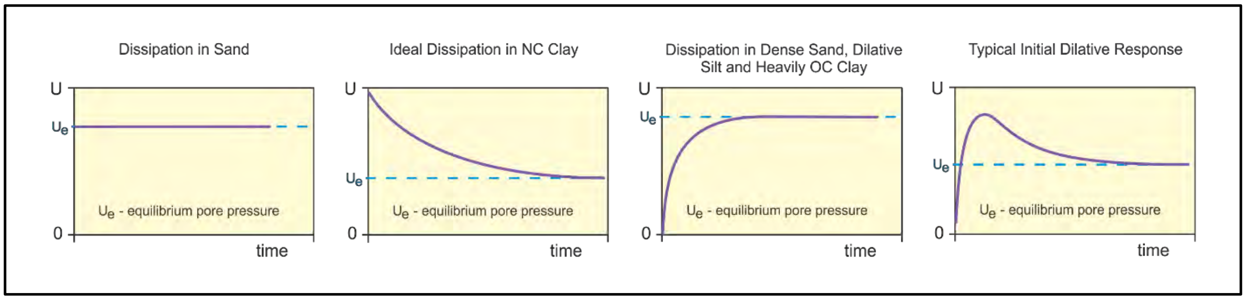

Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve of Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM, West Conshohocken, US.

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Jones, G.A. and Van Zyl, D.J.A., 1981, “The piezometer probe: a useful investigation tool”, Proceedings, 10th International Conference on Soil Mechanics and Foundation Engineering, Vol. 3, Stockholm: 489-495.

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Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158.

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Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, “Use of Piezometer Cone Data”, Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

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Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, “An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils”, Canadian Geotechnical Journal, 36(2): 369-381.

Teh, C.I., and Houlsby, G.T., 1991, “An analytical study of the cone penetration test in clay”, Geotechnique, 41(1): 17-34.

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Cone Penetration Test Plots with Expanded Scales
- Advanced Cone Penetration Test Plots with Ic, Su(Nkt) and N1(60)
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Cone Penetration Test Summary and
Standard Cone Penetration Test Plots

CALIFORNIA PUSH
TECHNOLOGIES
INCORPORATED

Job No: 15-56025
Client: CGI Technical Services Inc.
Project: Jacobs Avenue Levee
Start Date: 19-Nov-2015
End Date: 22-Nov-2015

CONE PENETRATION TEST SUMMARY

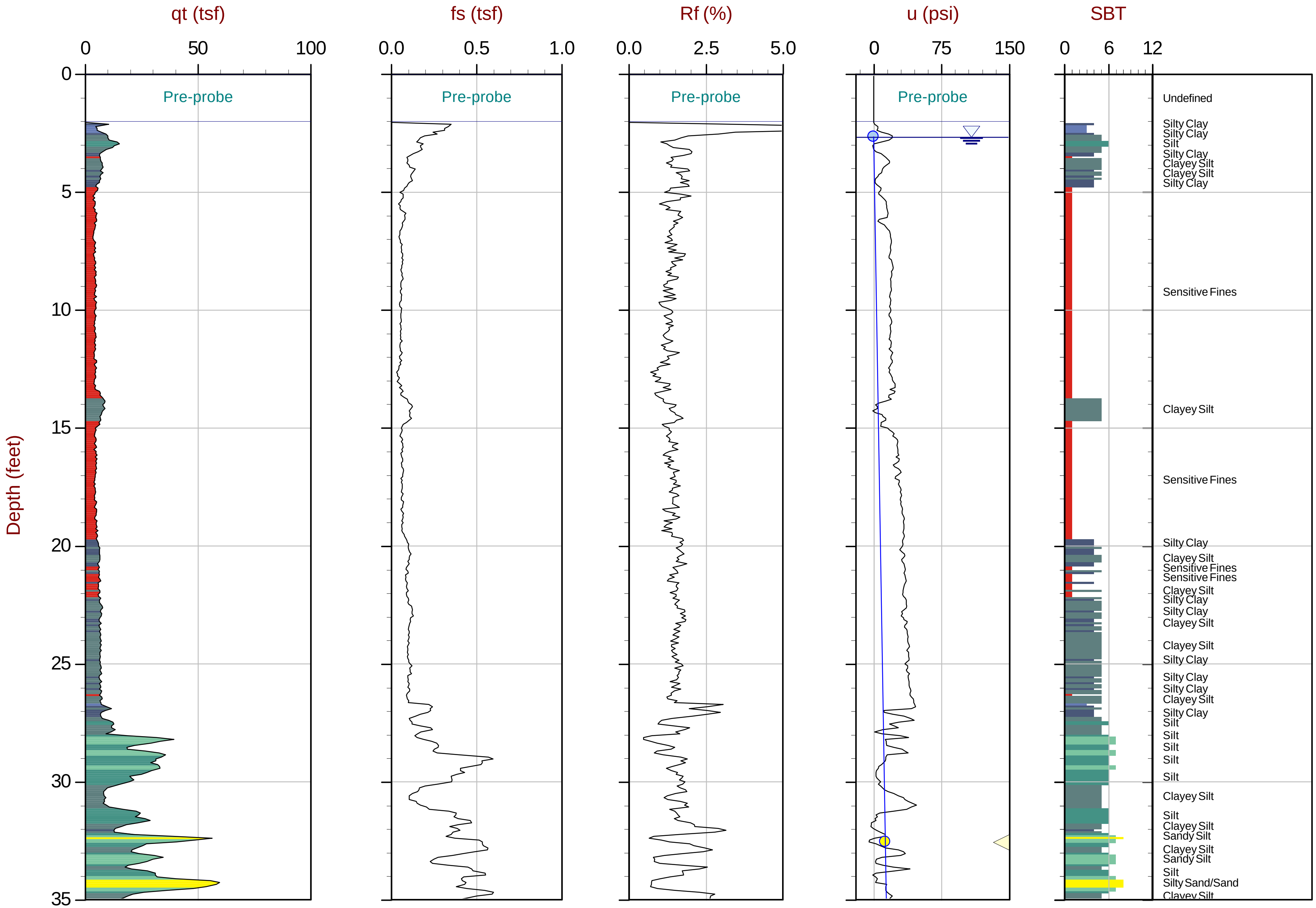
Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Northing[2] (m)	Easting (m)	Refer to Notation Number
CPT-10L	15-56025_CP10L	19-Nov-2015	447:T1500F15U500	2.7	50.36	4517603	405439	
CPT-10off	15-56025_CP10off	19-Nov-2015	447:T1500F15U500	3.7	25.59	4517625	405434	
CPT-20L	15-56025_CP20L	19-Nov-2015	447:T1500F15U500	2.0	25.51	4517599	405439	
CPT-30C	15-56025_CP30C	20-Nov-2015	447:T1500F15U500	7.9	75.38	4517557	404808	
CPT-30off	15-56025_CP30off	19-Nov-2015	447:T1500F15U500	1.8	25.59	4517621	404824	
CPT-30W	15-56025_CP30W	22-Nov-2015	447:T1500F15U500	1.7	22.31	4517549	404814	3
CPT-42L	15-56025_CP42L	20-Nov-2015	447:T1500F15U500	2.5	50.93	4517531	404500	3
CPT-42off	15-56025_CP42off	20-Nov-2015	447:T1500F15U500	2.5	25.59	4517551	404510	3
CPT-56C	15-56025_CP56C	21-Nov-2015	447:T1500F15U500	1.8	20.10	4517692	404105	
CPT-56L	15-56025_CP56L	20-Nov-2015	447:T1500F15U500	2.9	23.70	4517699	404099	
CPT-56W	15-56025_CP56W	21-Nov-2015	447:T1500F15U500	0.0	16.73	4517675	404100	3

1. The assumed phreatic surface was based on pore pressure dissipation tests unless otherwise noted. Hydrostatic conditions were assumed for the calculated parameters.
2. Coordinates were collected with a consumer grade GPS device with datum WGS84/UTM Zone 10 North.
3. The phreatic surface was estimated using the dynamic pore pressure response.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 09:18
Site: Jacobs Avenue Levee

Sounding: CPT-10L
Cone: 447:T1500F15U500



Max Depth: 15.350 m / 50.36 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517603m E: 405439m
Sheet No: 1 of 2

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

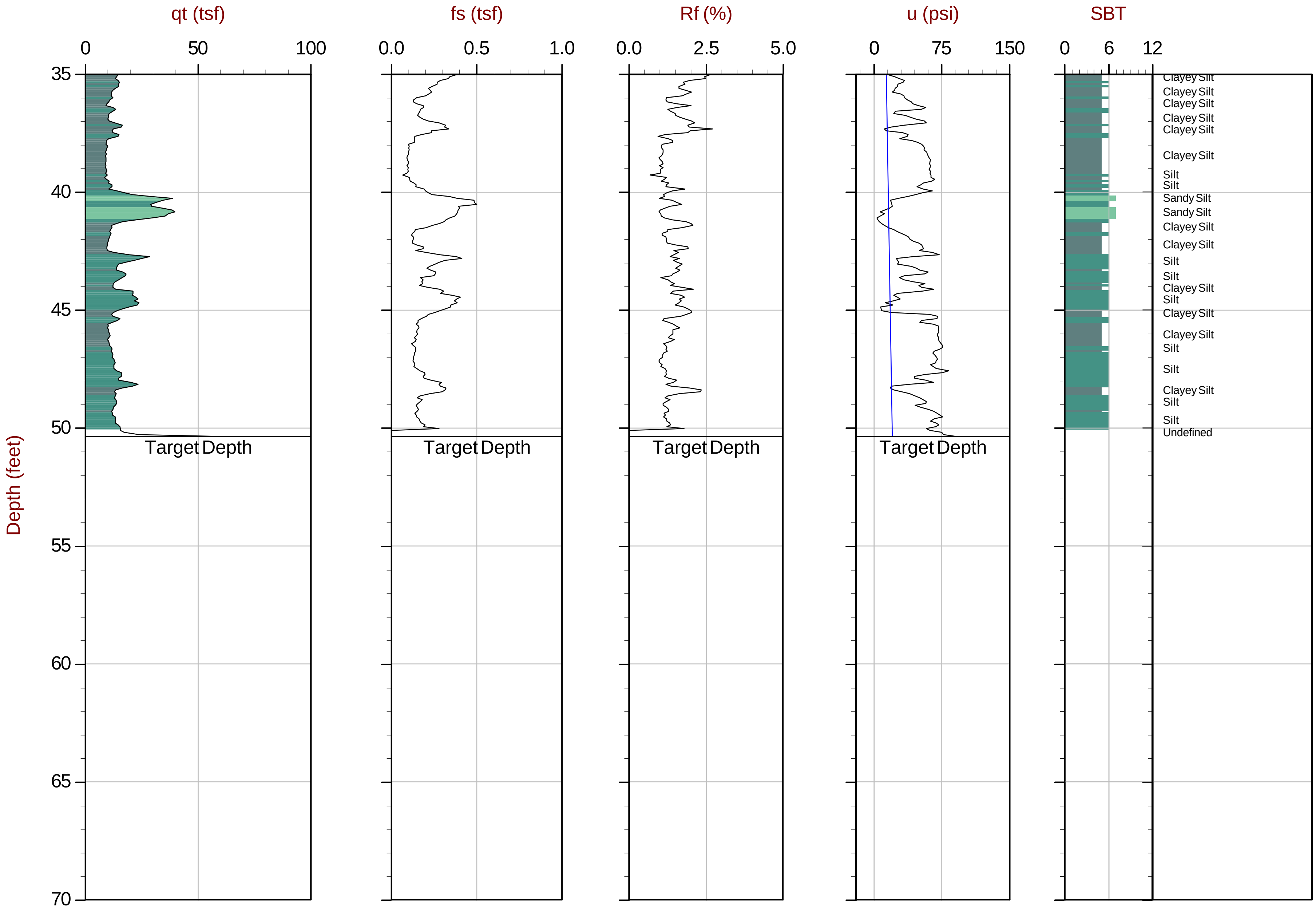
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 09:18
Site: Jacobs Avenue Levee

Sounding: CPT-10L
Cone: 447:T1500F15U500



Max Depth: 15.350 m / 50.36 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10L.COR
Unit Wt: SBT Zones

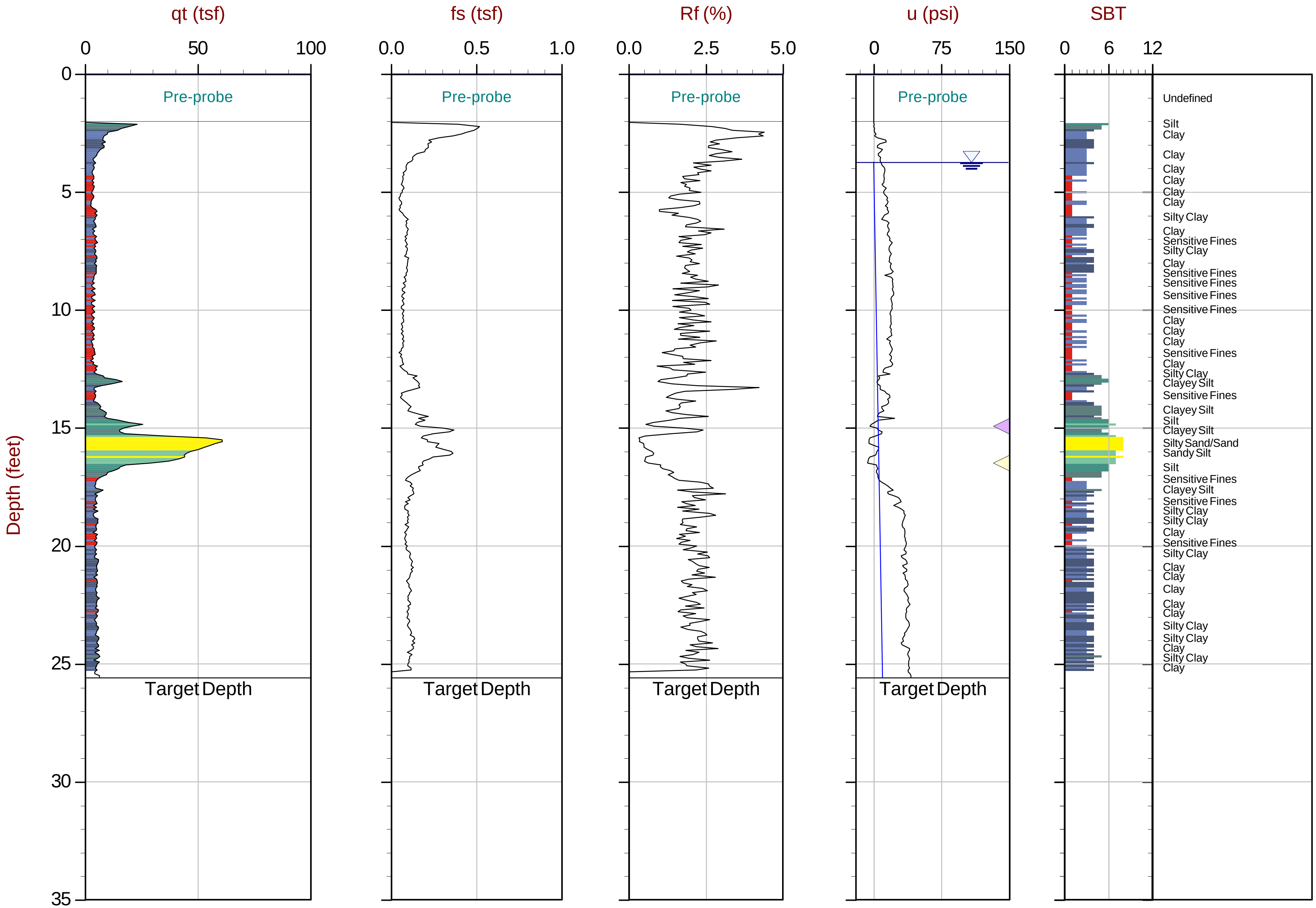
SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517603m E: 405439m
Sheet No: 2 of 2

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 08:08
Site: Jacobs Avenue Levee
Sounding: CPT-10off
Cone: 447:T1500F15U500



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Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10OFF.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517625m E: 405434m
Sheet No: 1 of 1

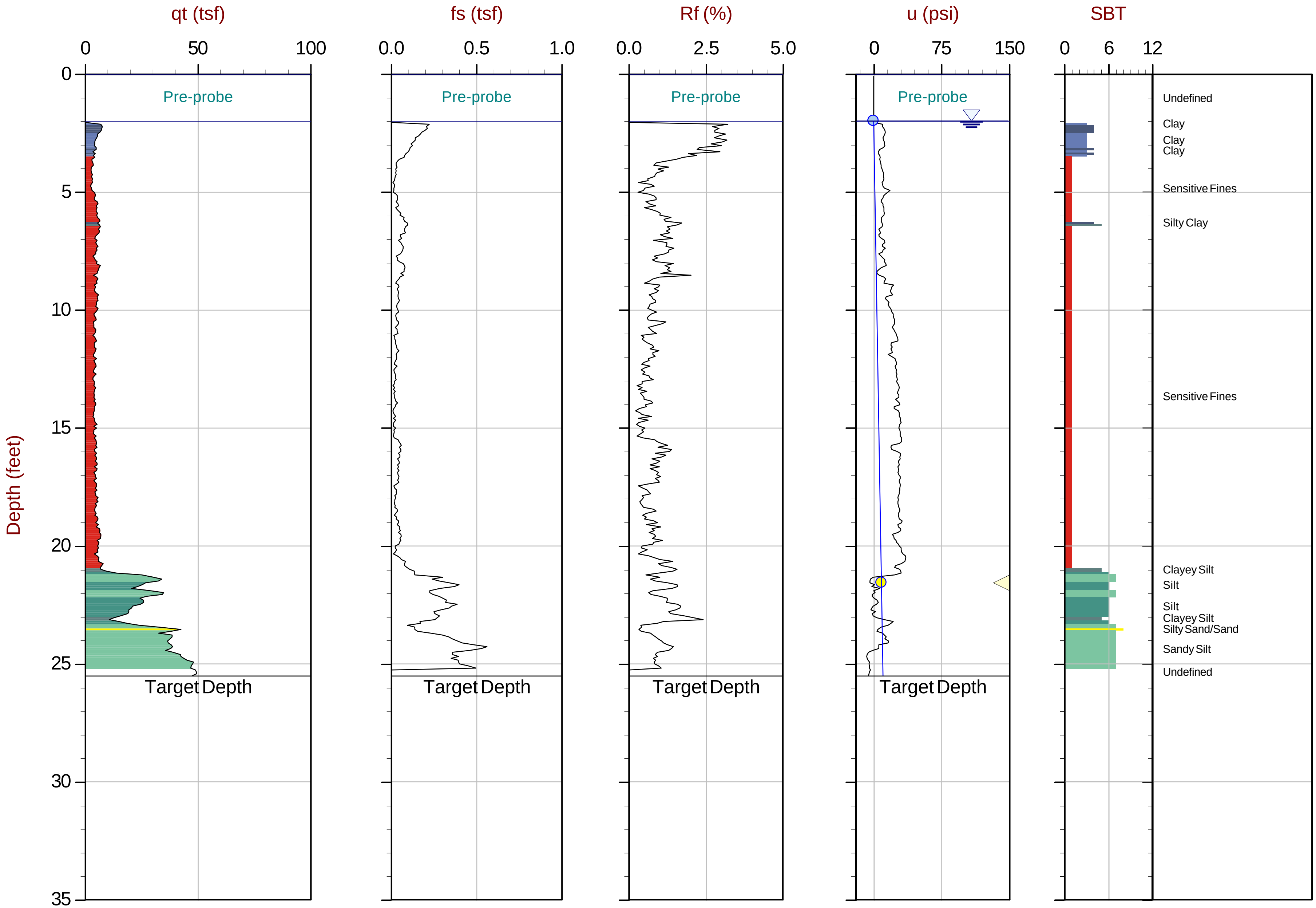
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 10:50
Site: Jacobs Avenue Levee
Sounding: CPT-20L
Cone: 447:T1500F15U500



Max Depth: 7.775 m / 25.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP20L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517599m E: 405439m
Sheet No: 1 of 1

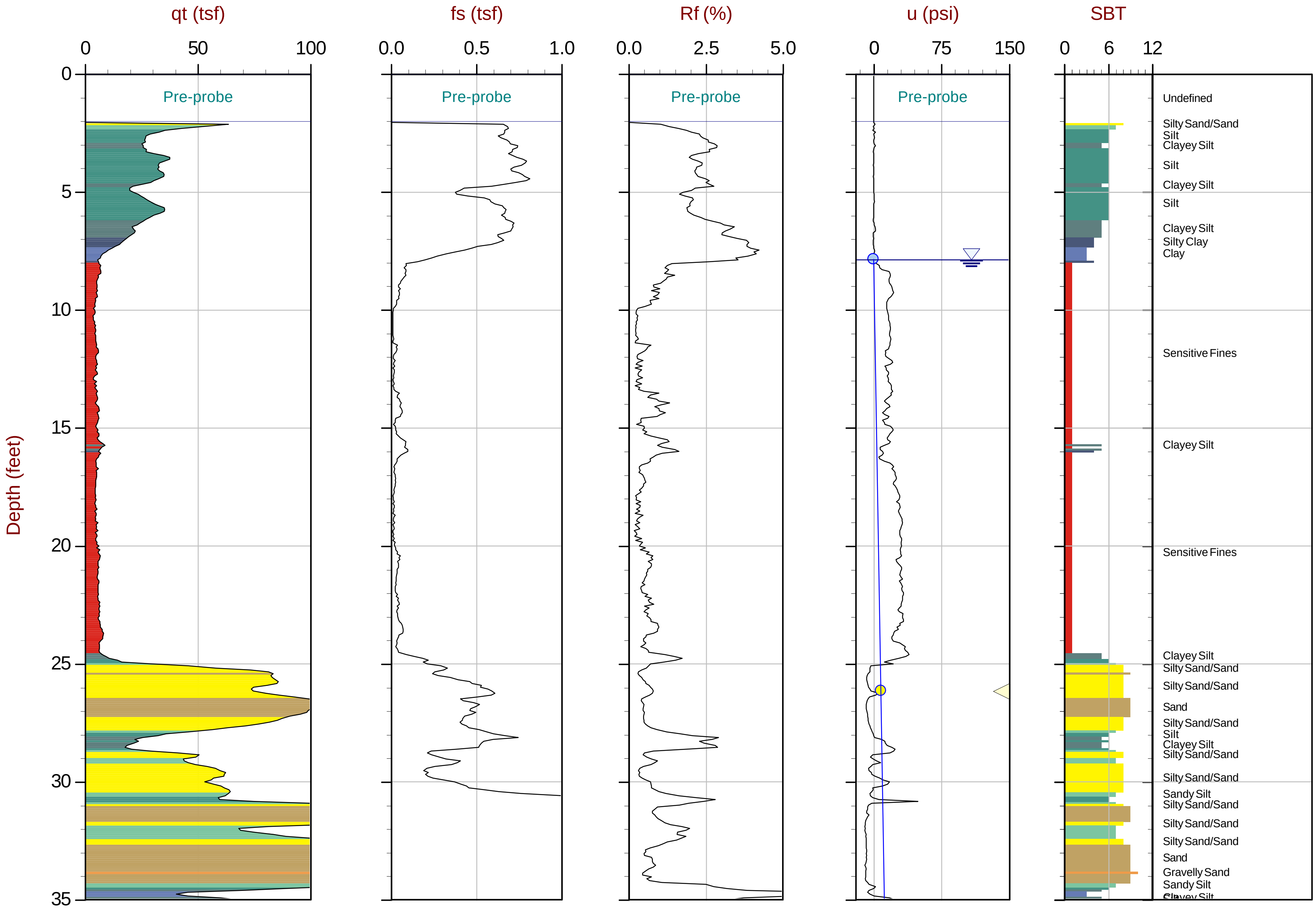
Equilibrium Pore Pressure (Ueq) — Assumed Ueq — Dissipation, Ueq achieved — Dissipation, Ueq not achieved — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee

Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 1 of 3

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

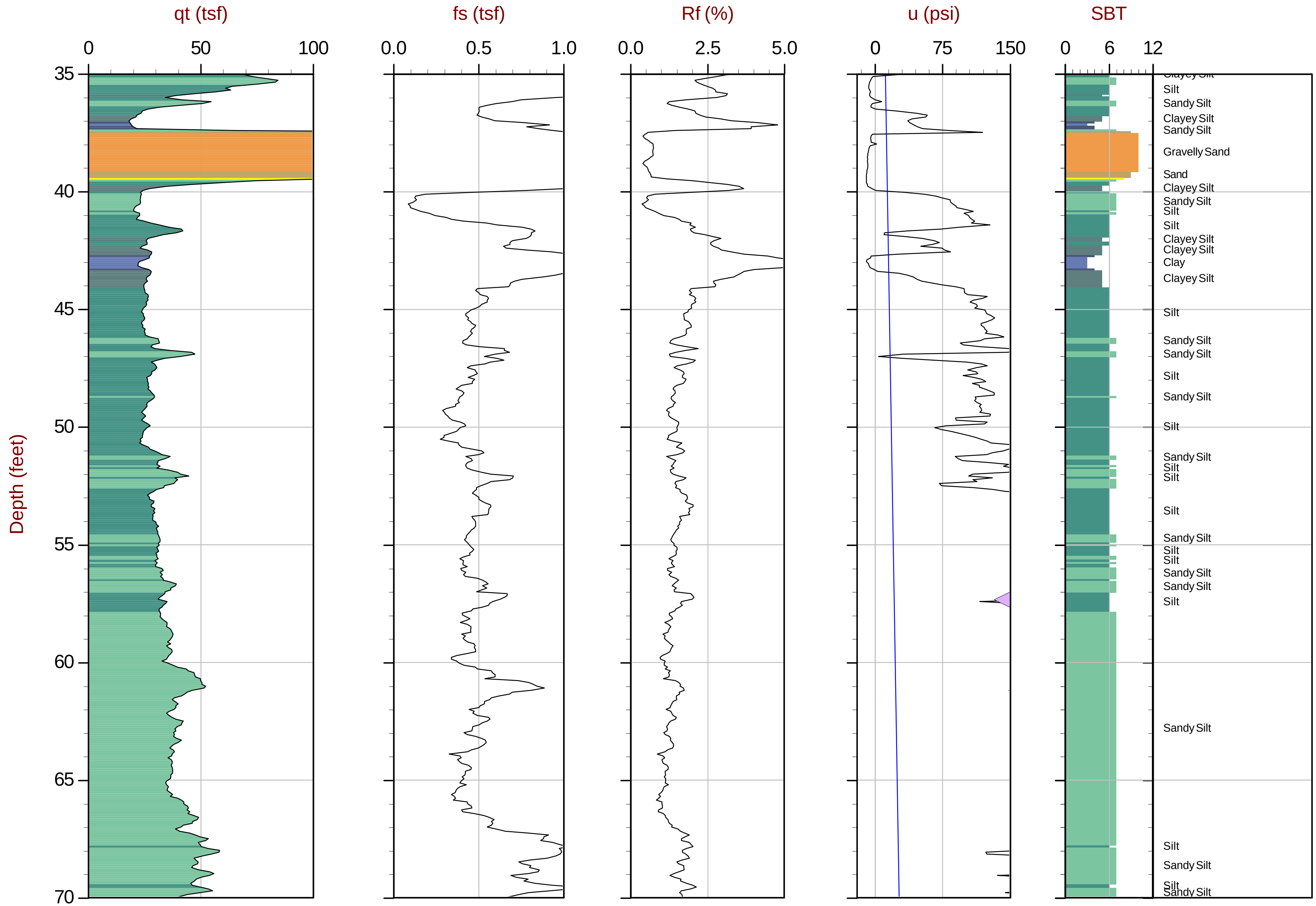
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee

Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 2 of 3

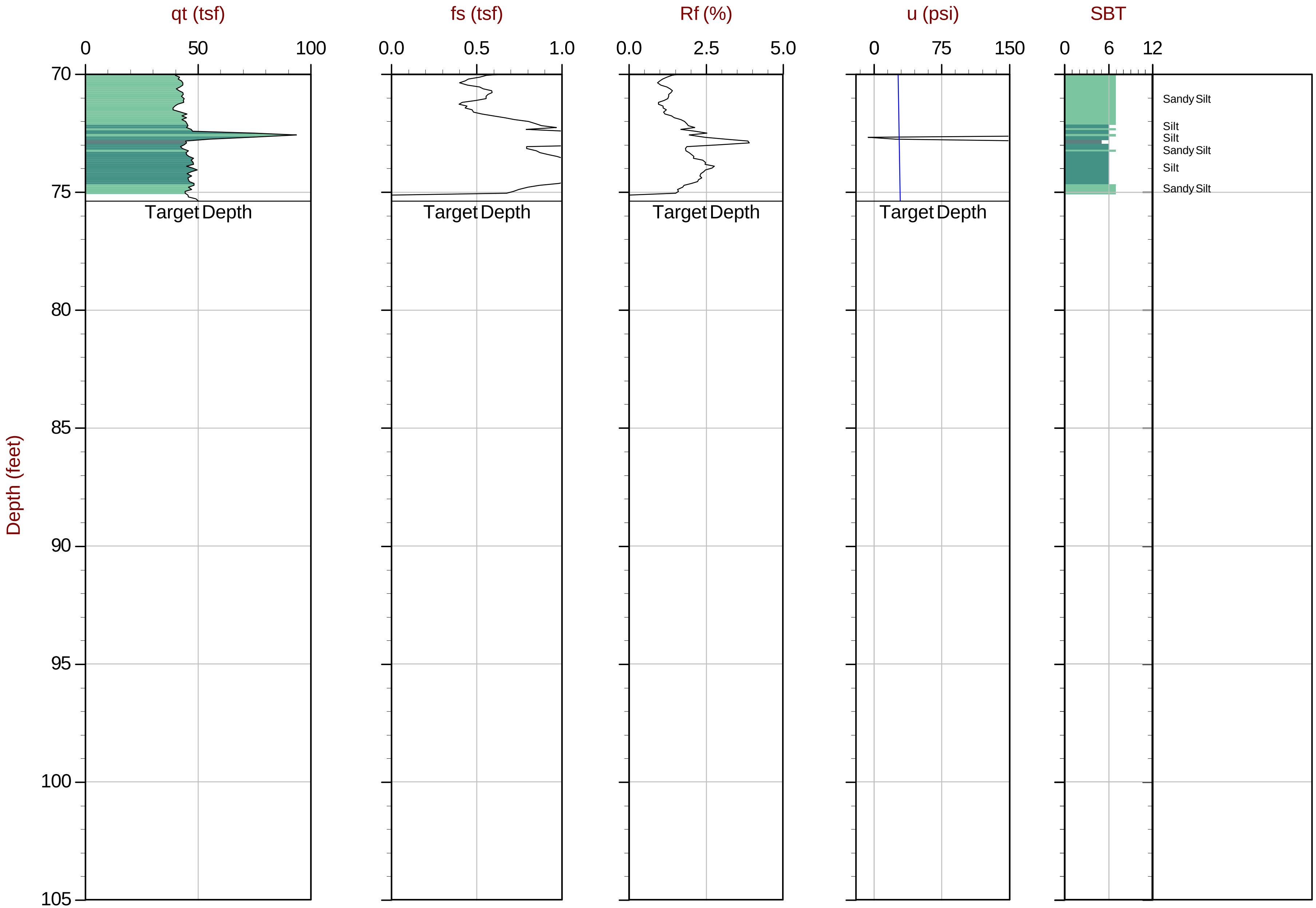
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee
Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 3 of 3

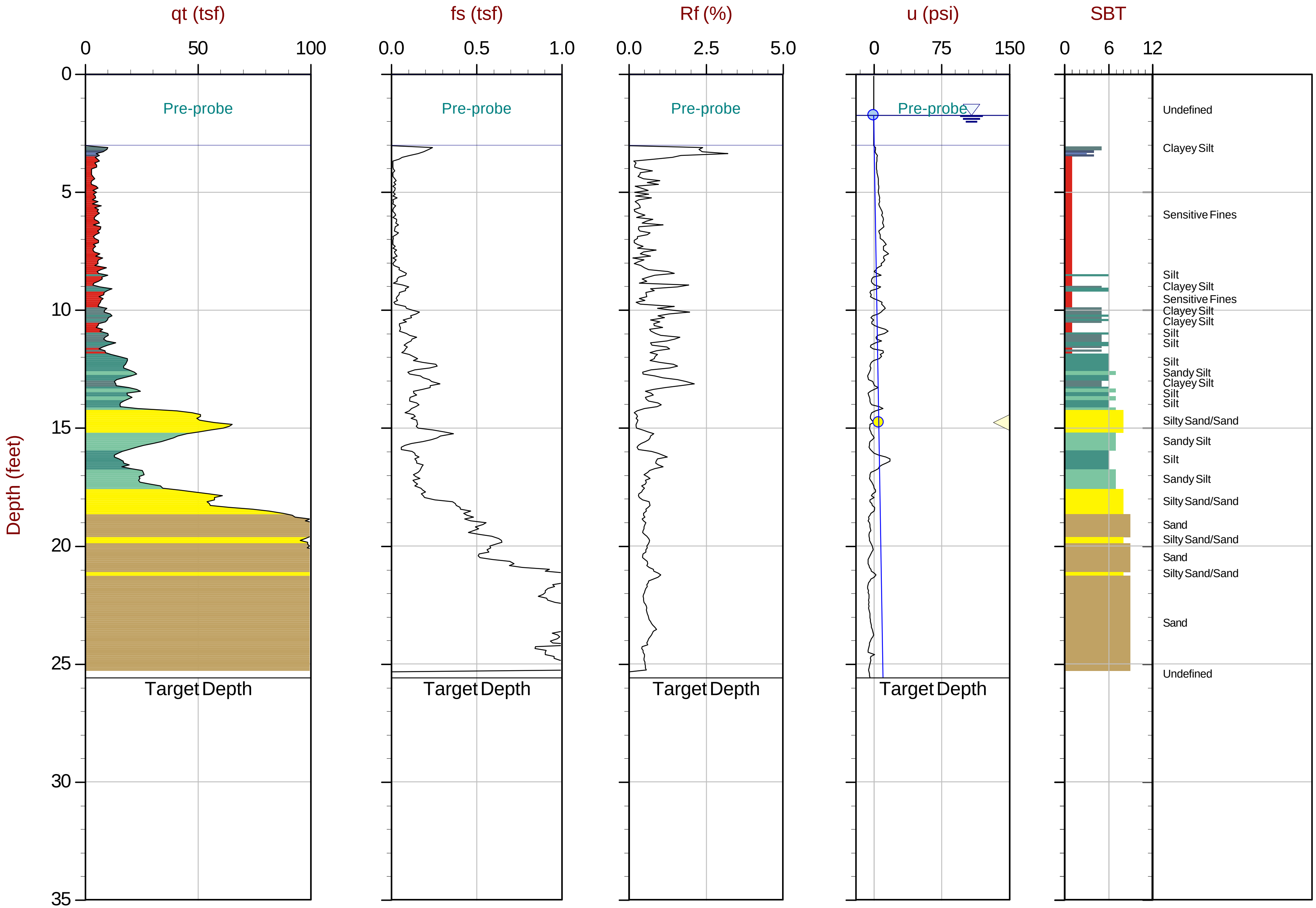
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 12:04
Site: Jacobs Avenue Levee

Sounding: CPT-30off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30OFF.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517621m E: 404824m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

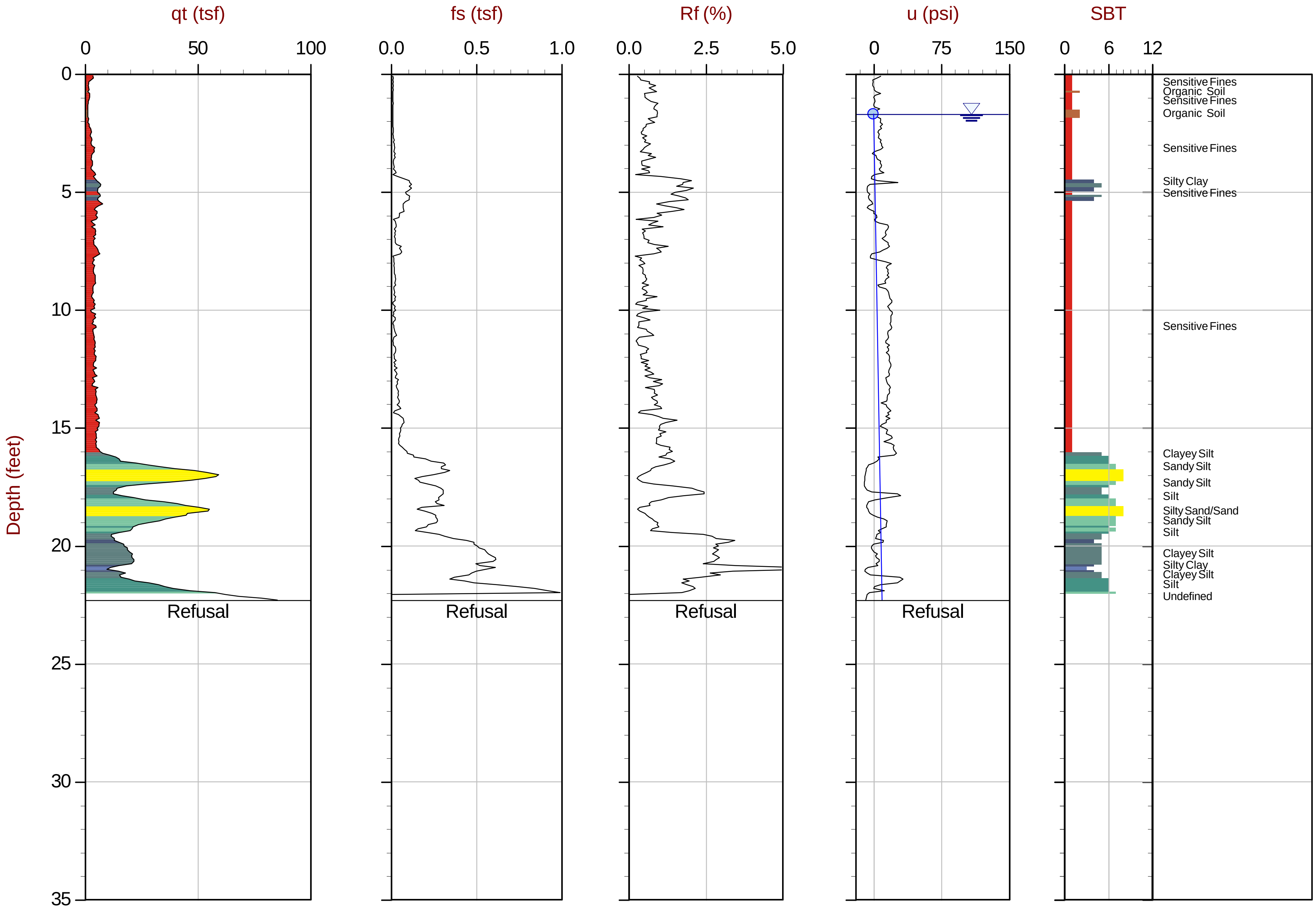
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:22:15 13:59
Site: Jacobs Avenue Levee

Sounding: CPT-30W
Cone: 447:T1500F15U500



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Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30W.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517549m E: 404814m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

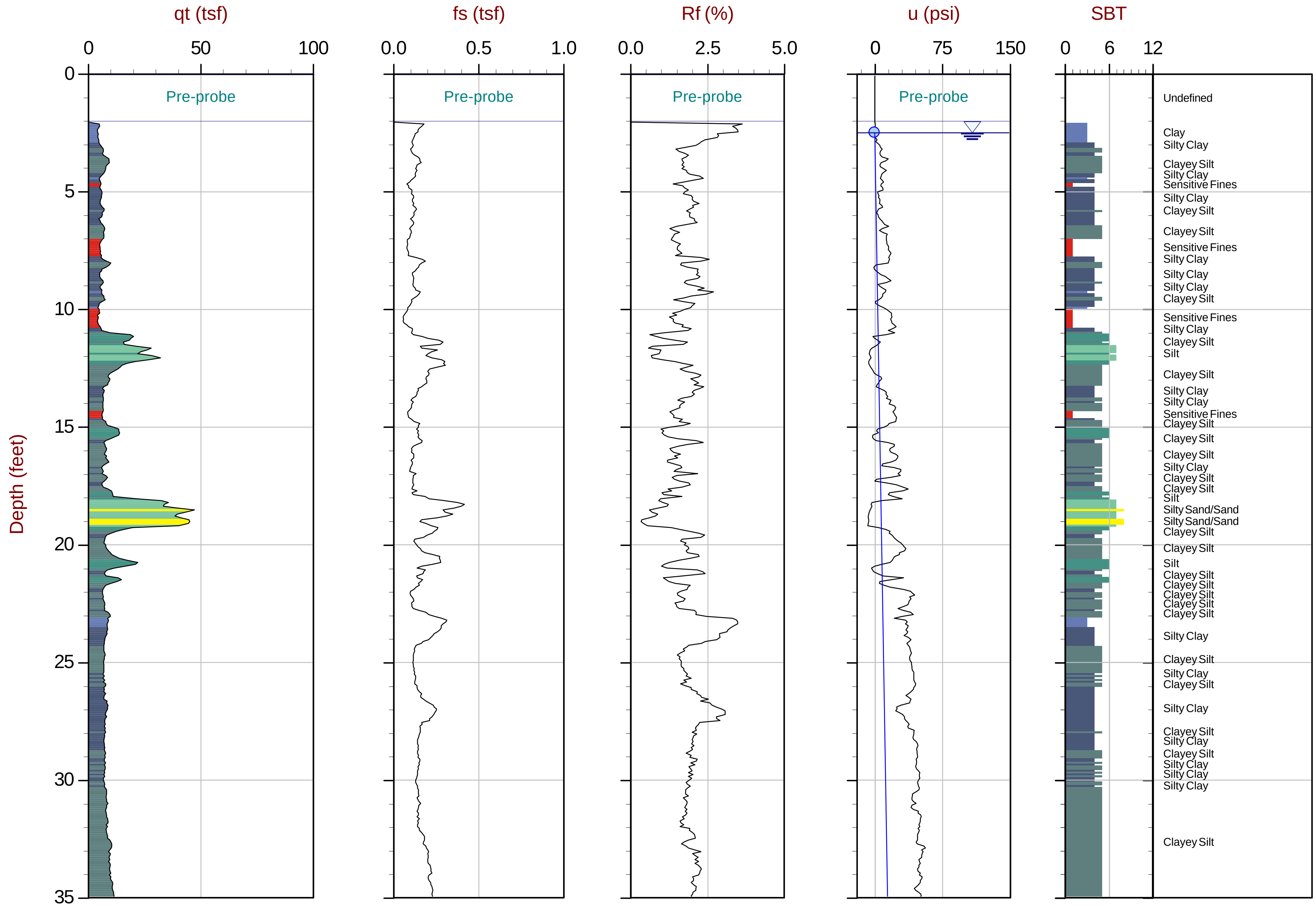
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 07:55
Site: Jacobs Avenue Levee

Sounding: CPT-42L
Cone: 447:T1500F15U500



Max Depth: 15.525 m / 50.93 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517531m E: 404500m
Sheet No: 1 of 2

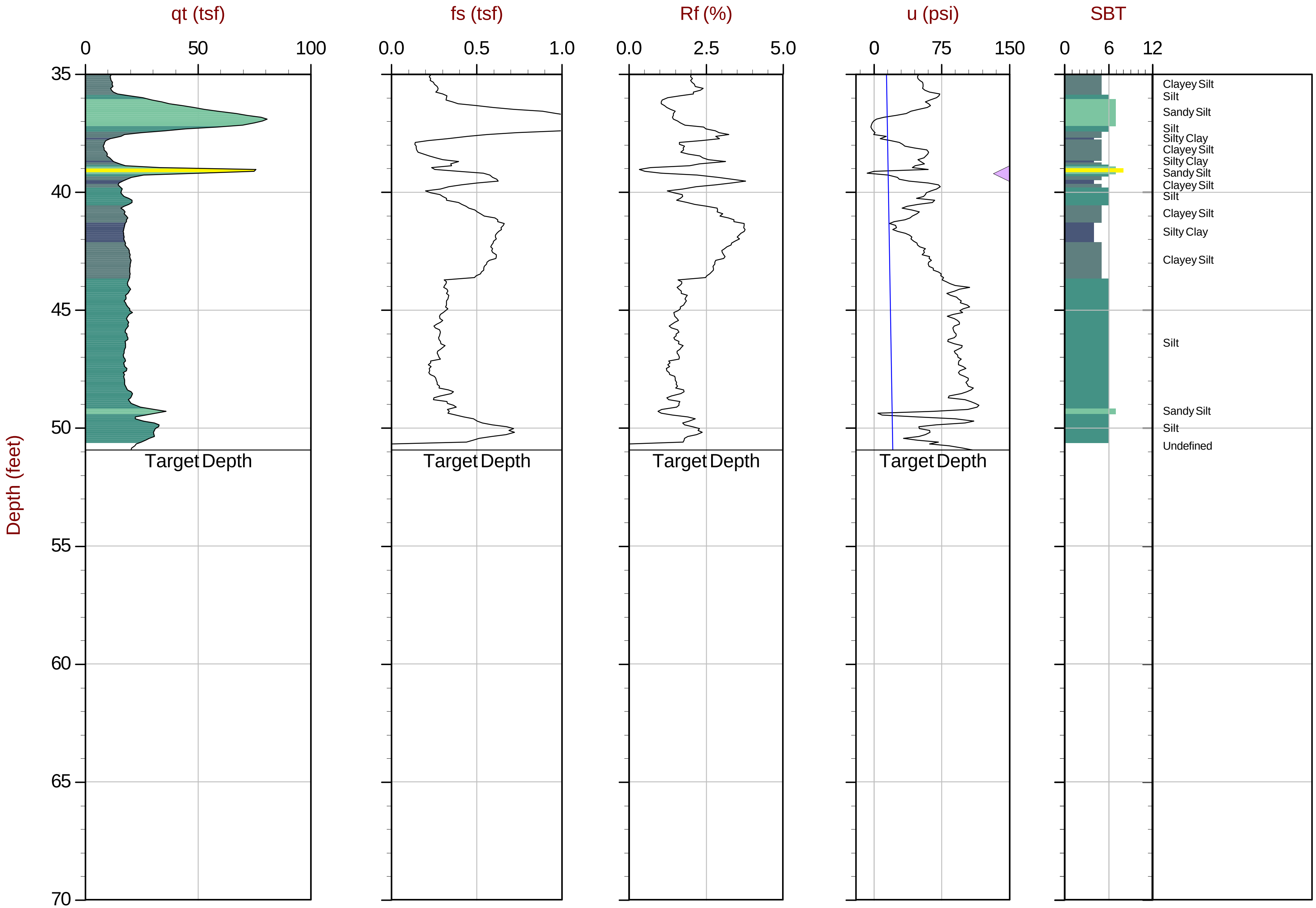
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025 | Sounding: CPT-42L
Date: 11:20:15 07:55 | Cone: 447:T1500F15U500
Site: Jacobs Avenue Levee



Max Depth: 15.525 m / 50.93 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517531m E: 404500m
Sheet No: 2 of 2

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

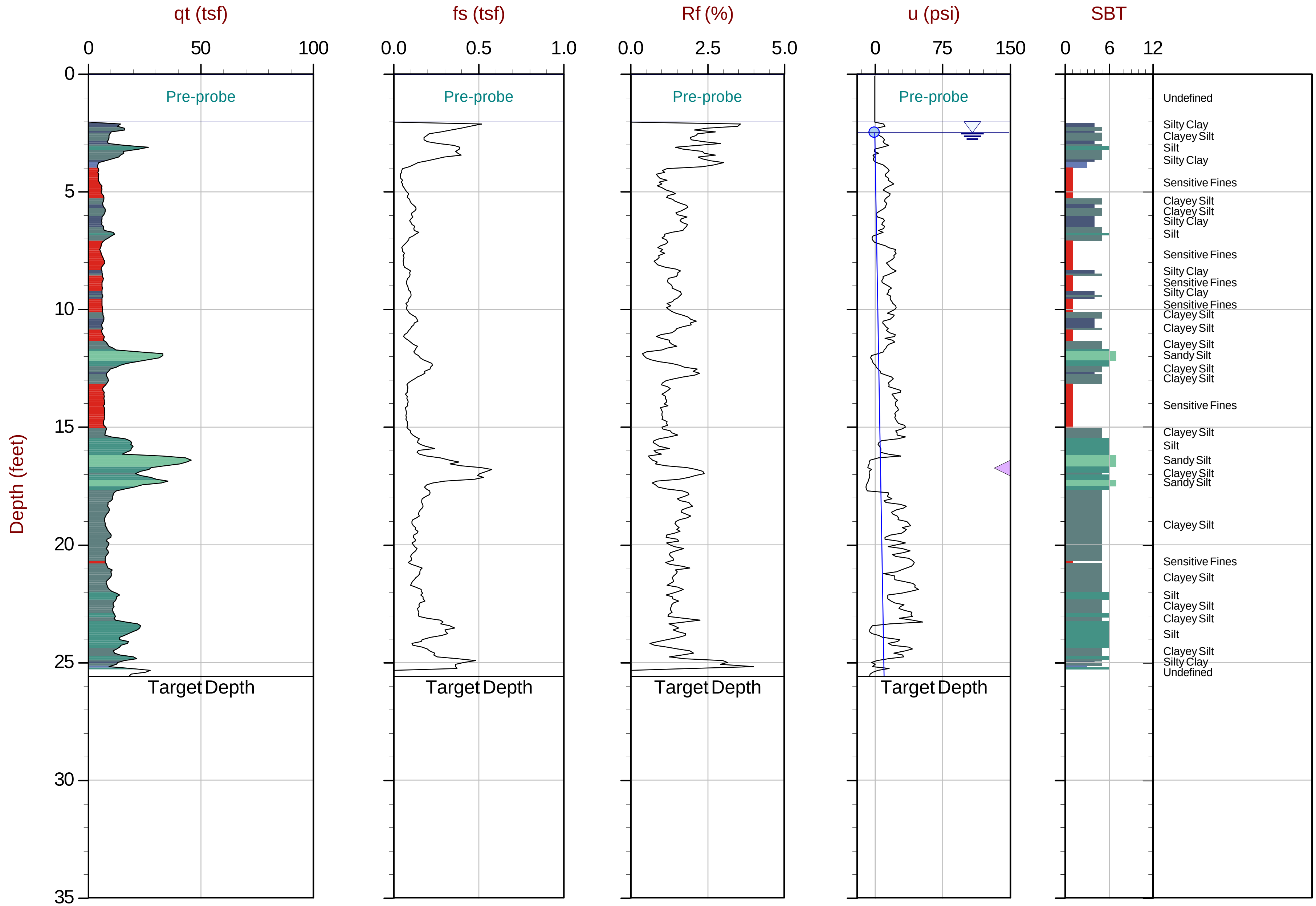
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 09:36
Site: Jacobs Avenue Levee

Sounding: CPT-42off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42OFF.COR
Unit Wt: SBT Zones

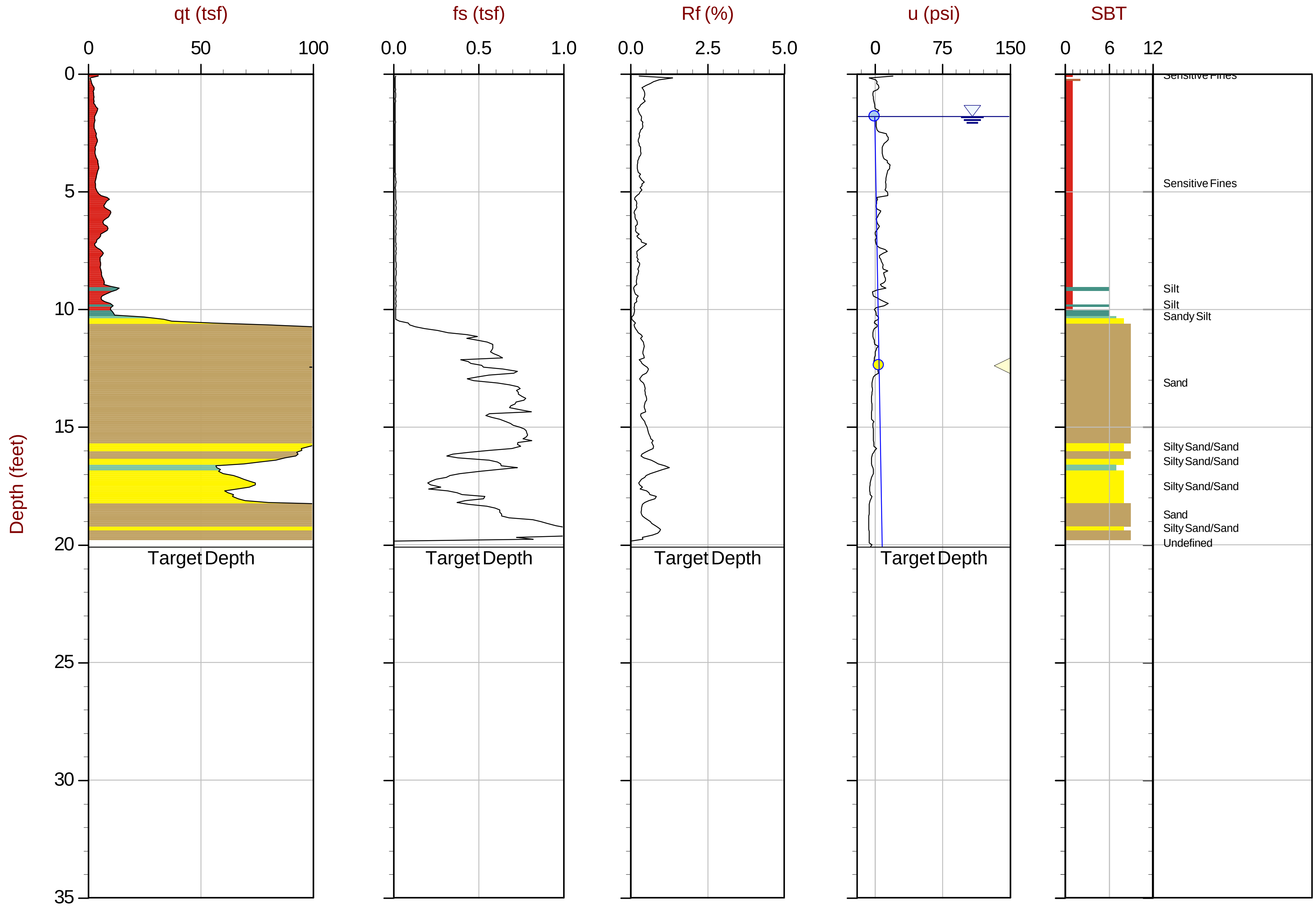
SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517551m E: 404510m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:21:15 09:36
Site: Jacobs Avenue Levee
Sounding: CPT-56C
Cone: 447:T1500F15U500



Max Depth: 6.125 m / 20.09 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56C.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517692m E: 404105m
Sheet No: 1 of 1

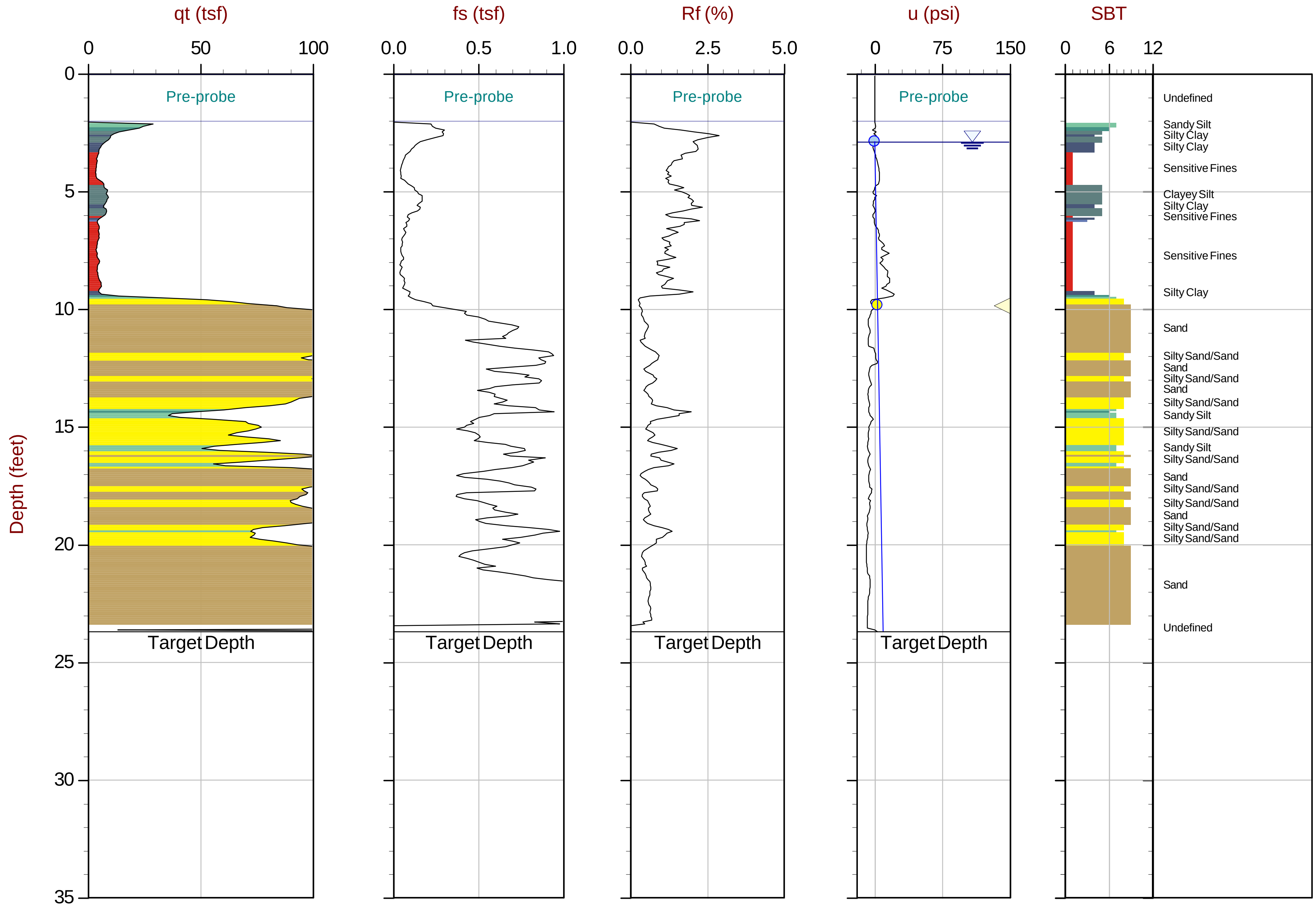
Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 10:53
Site: Jacobs Avenue Levee
Sounding: CPT-56L
Cone: 447:T1500F15U500



Max Depth: 7.225 m / 23.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517699m E: 404099m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

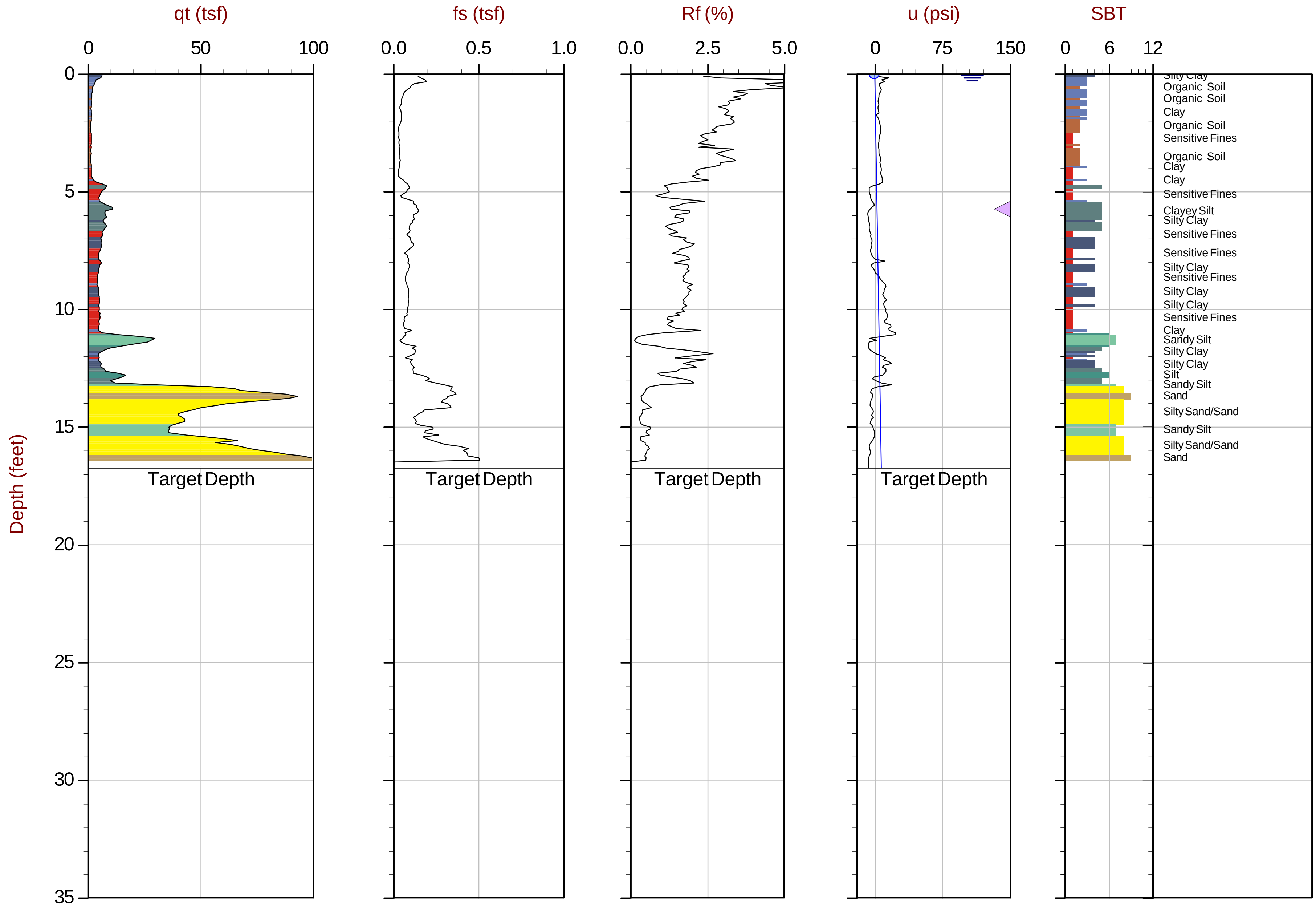
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:21:15 12:10
Site: Jacobs Avenue Levee

Sounding: CPT-56W
Cone: 447:T1500F15U500



Max Depth: 5.100 m / 16.73 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56W.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517675m E: 404100m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

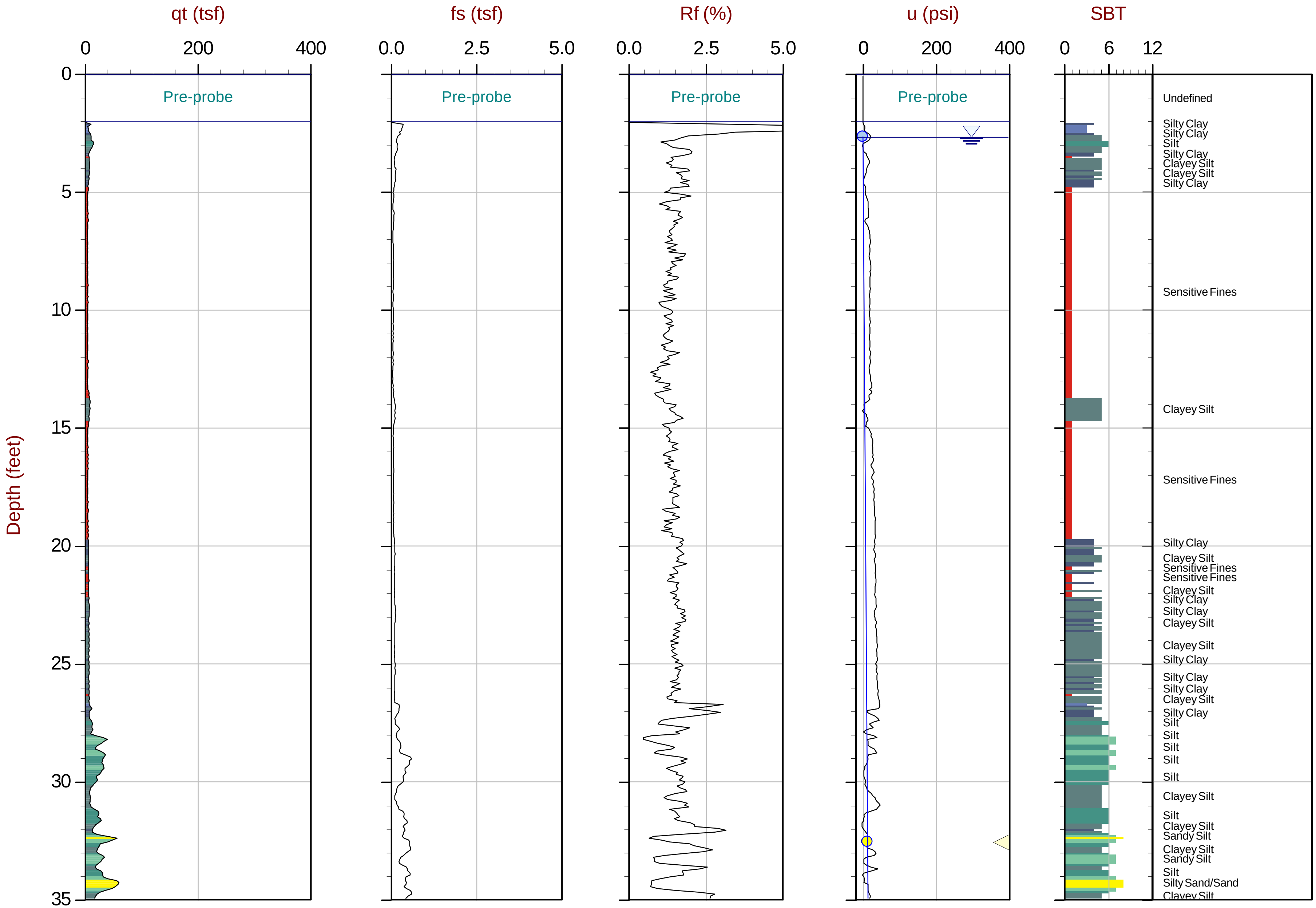
Cone Penetration Test Plots with Expanded Scales

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 09:18
Site: Jacobs Avenue Levee
Sounding: CPT-10L
Cone: 447:T1500F15U500



Max Depth: 15.350 m / 50.36 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517603m E: 405439m
Sheet No: 1 of 2

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

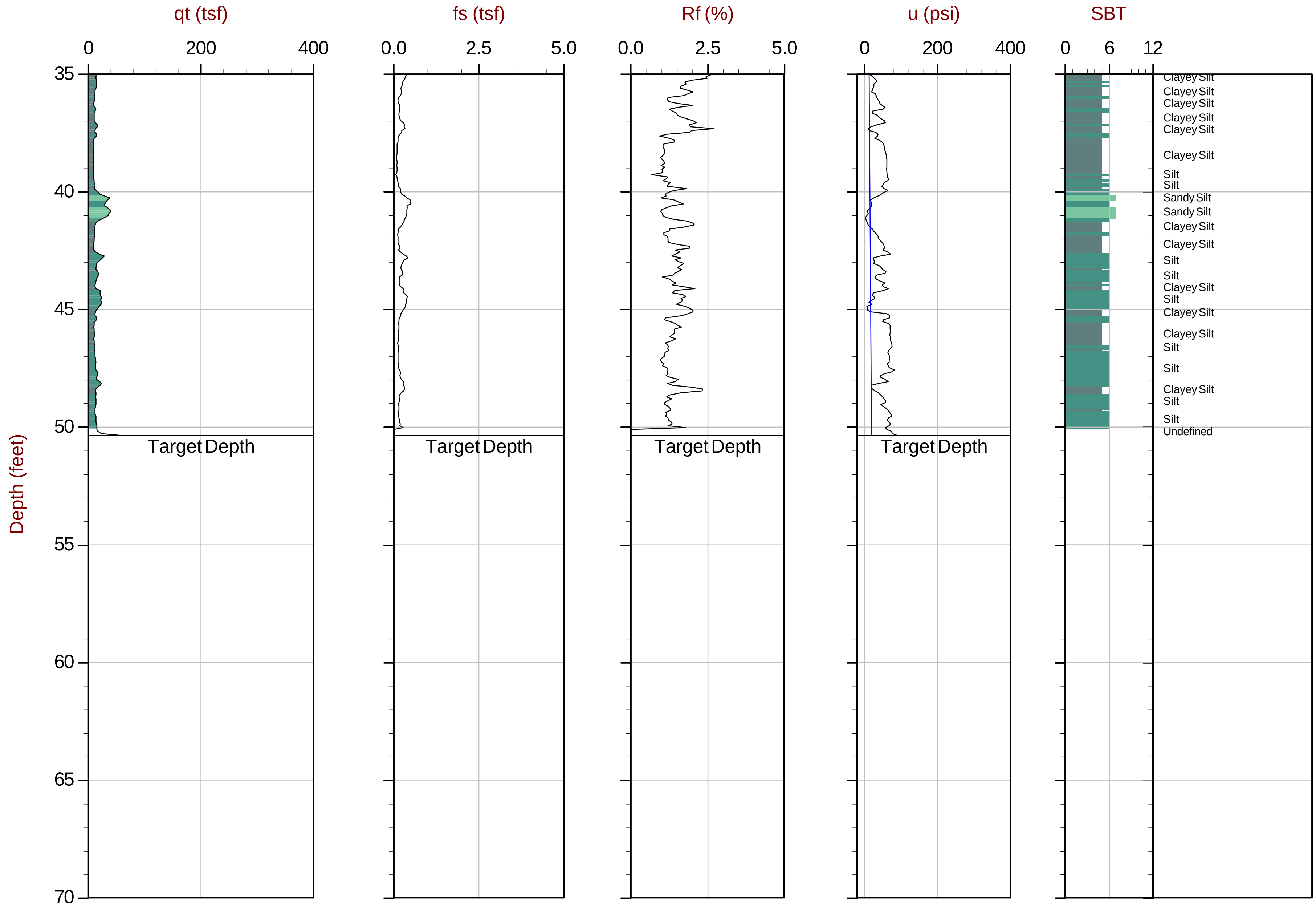
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 09:18
Site: Jacobs Avenue Levee

Sounding: CPT-10L
Cone: 447:T1500F15U500



Max Depth: 15.350 m / 50.36 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10L.COR
Unit Wt: SBT Zones

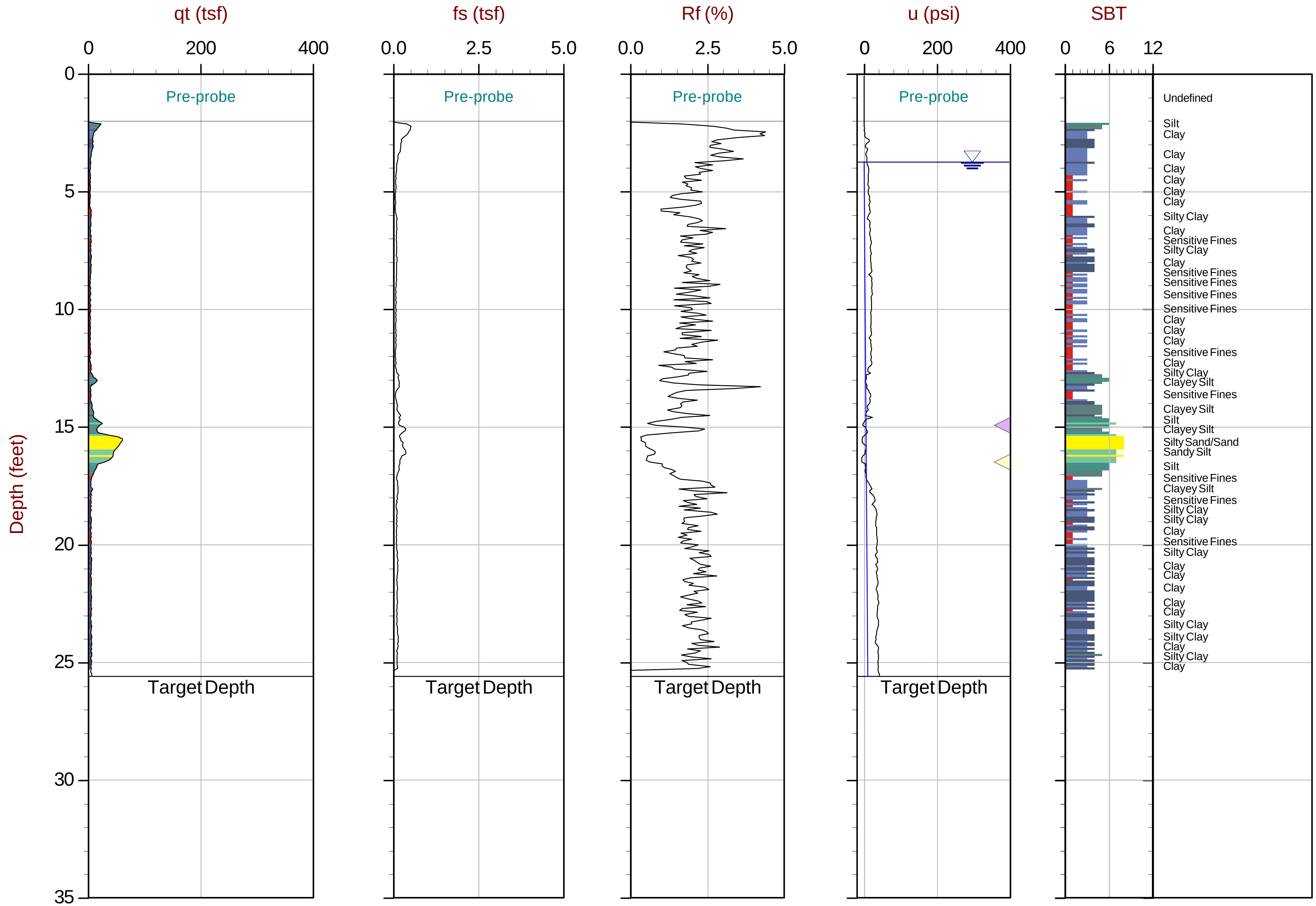
SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517603m E: 405439m
Sheet No: 2 of 2

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 08:08
Site: Jacobs Avenue Levee
Sounding: CPT-10off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10OFF.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517625m E: 405434m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

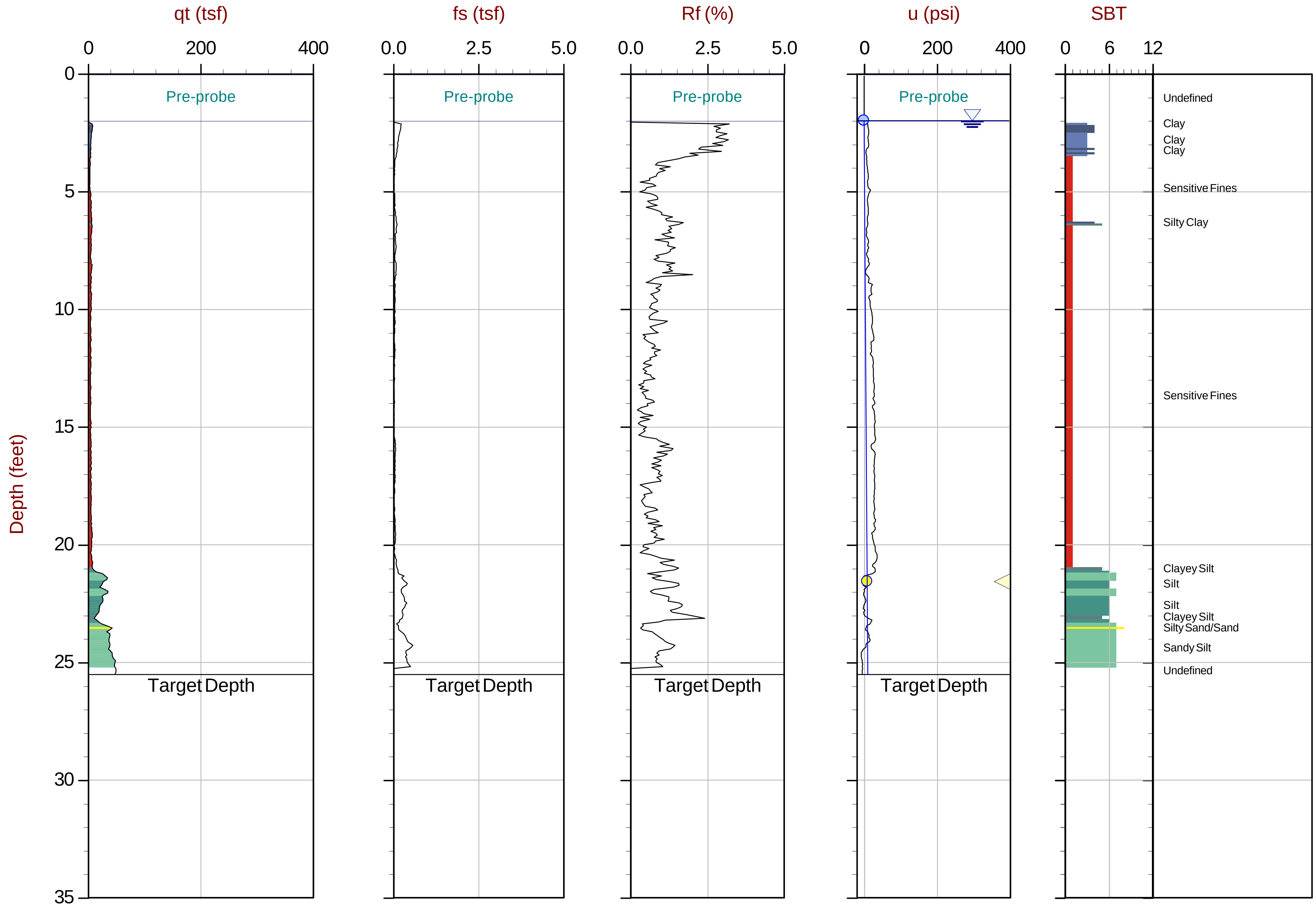
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CPT CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 10:50
Site: Jacobs Avenue Levee

Sounding: CPT-20L
Cone: 447:T1500F15U500



Max Depth: 7.775 m / 25.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP20L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517599m E: 405439m
Sheet No: 1 of 1

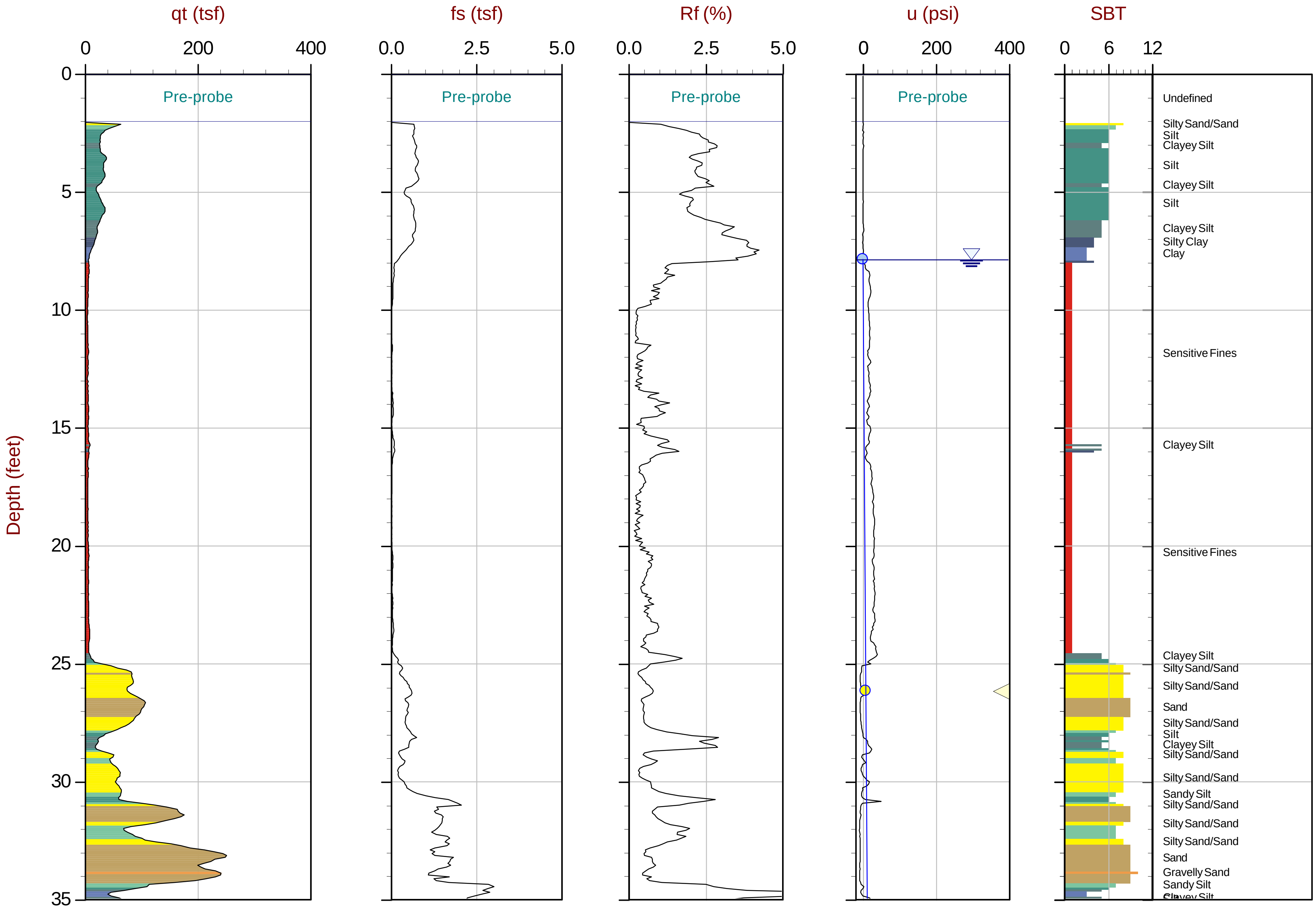
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee

Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 1 of 3

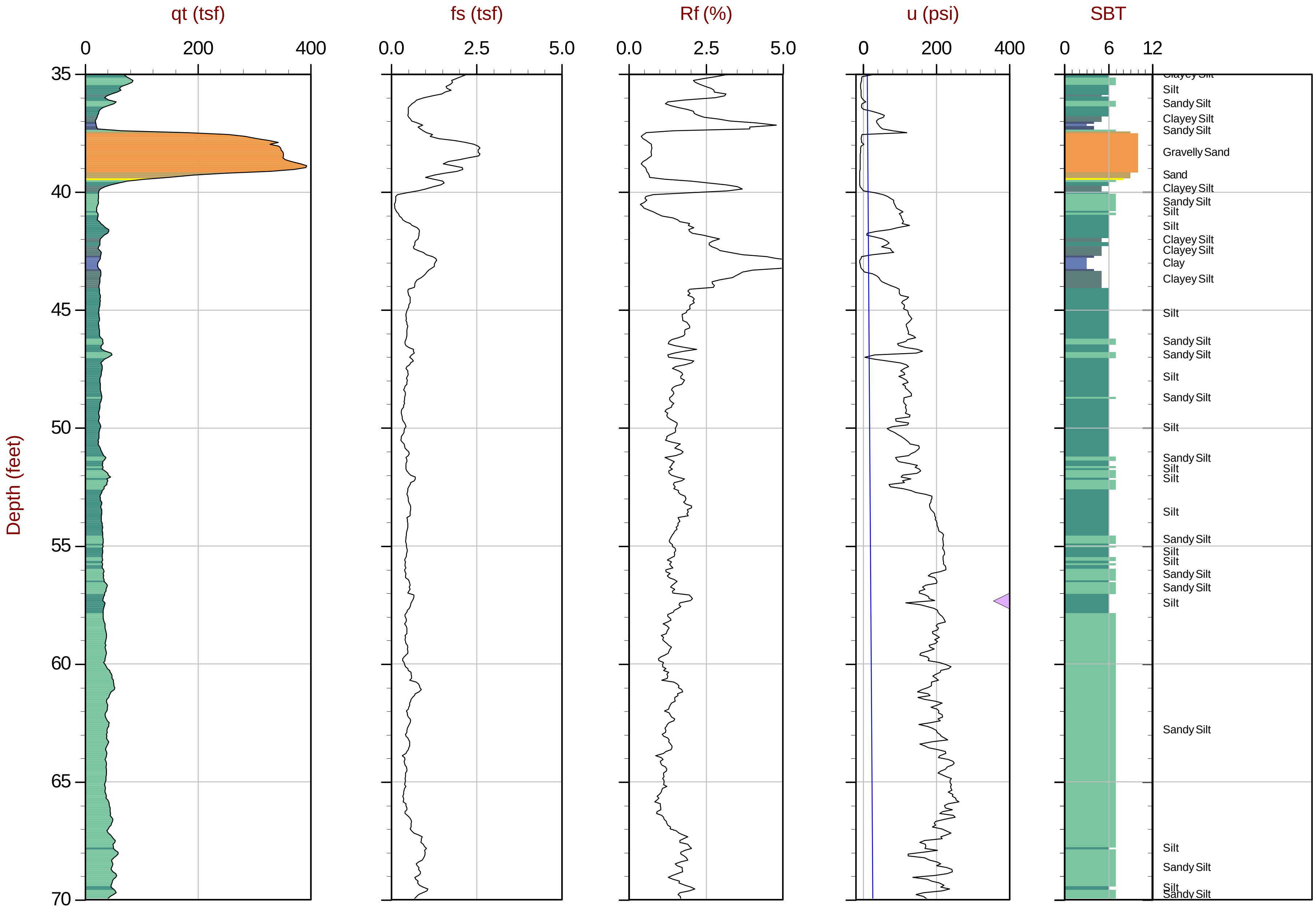
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee

Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 2 of 3

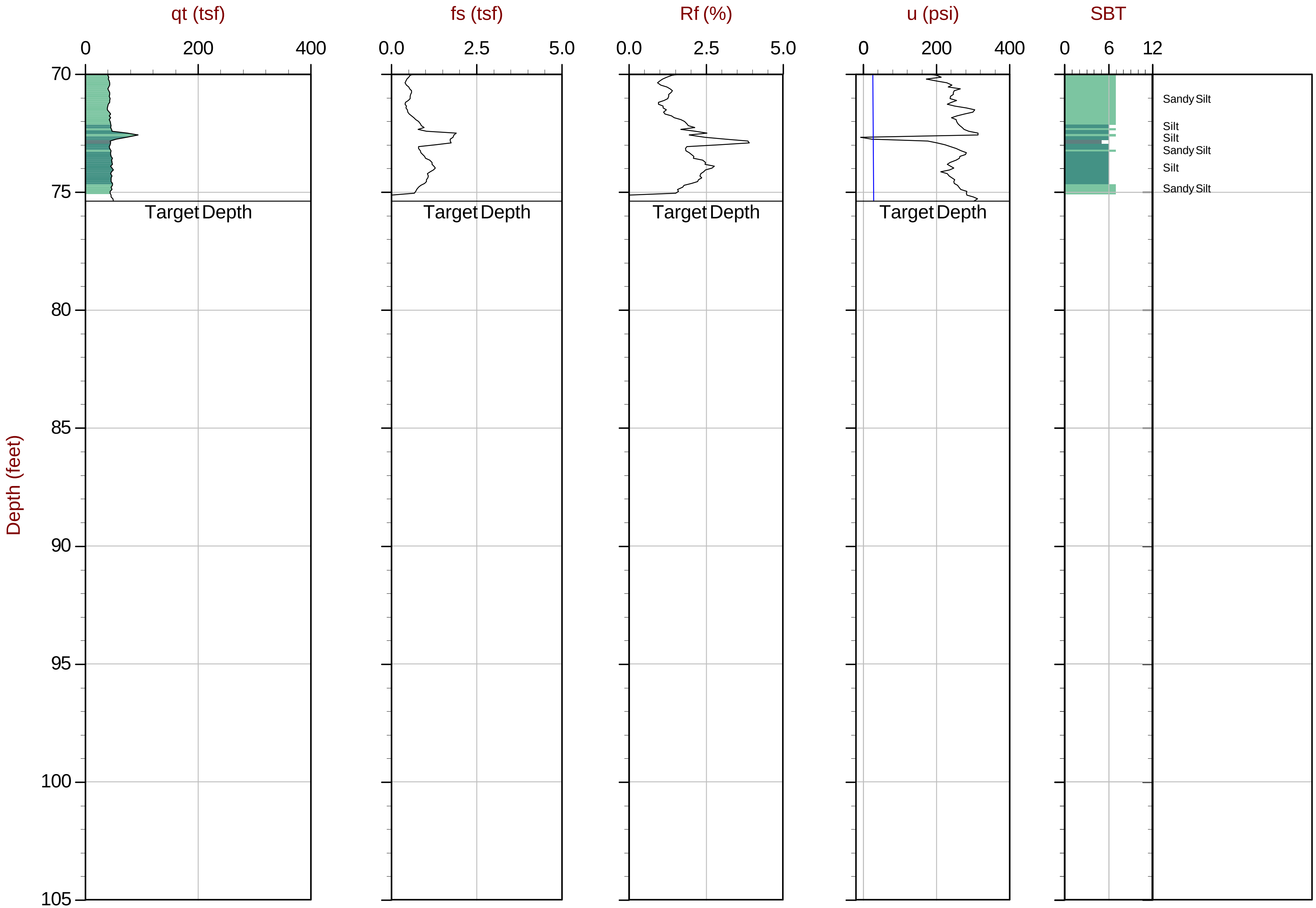
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee
Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 3 of 3

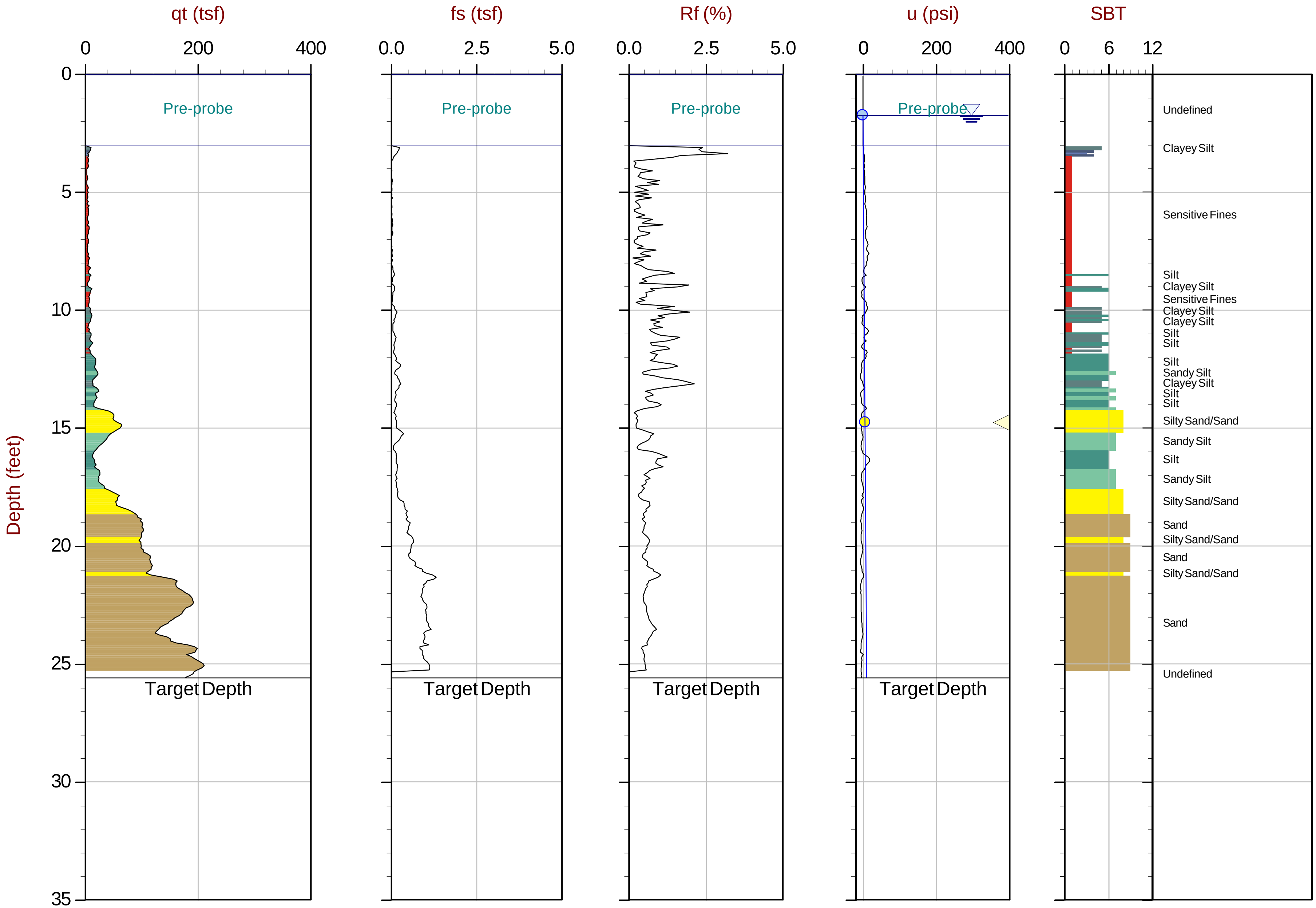
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 12:04
Site: Jacobs Avenue Levee
Sounding: CPT-30off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30OFF.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517621m E: 404824m
Sheet No: 1 of 1

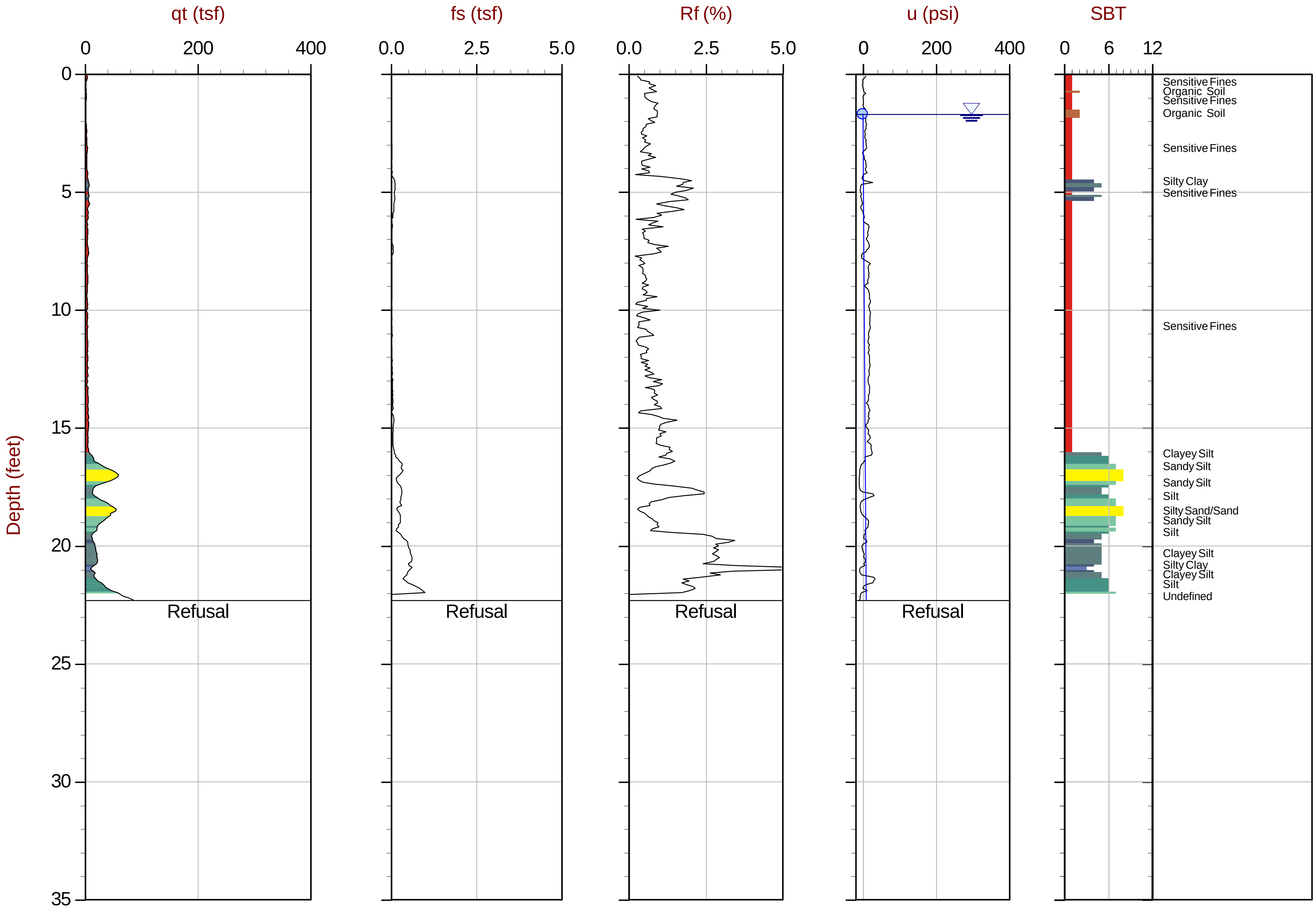
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:22:15 13:59
Site: Jacobs Avenue Levee
Sounding: CPT-30W
Cone: 447:T1500F15U500



Max Depth: 6.800 m / 22.31 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30W.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517549m E: 404814m
Sheet No: 1 of 1

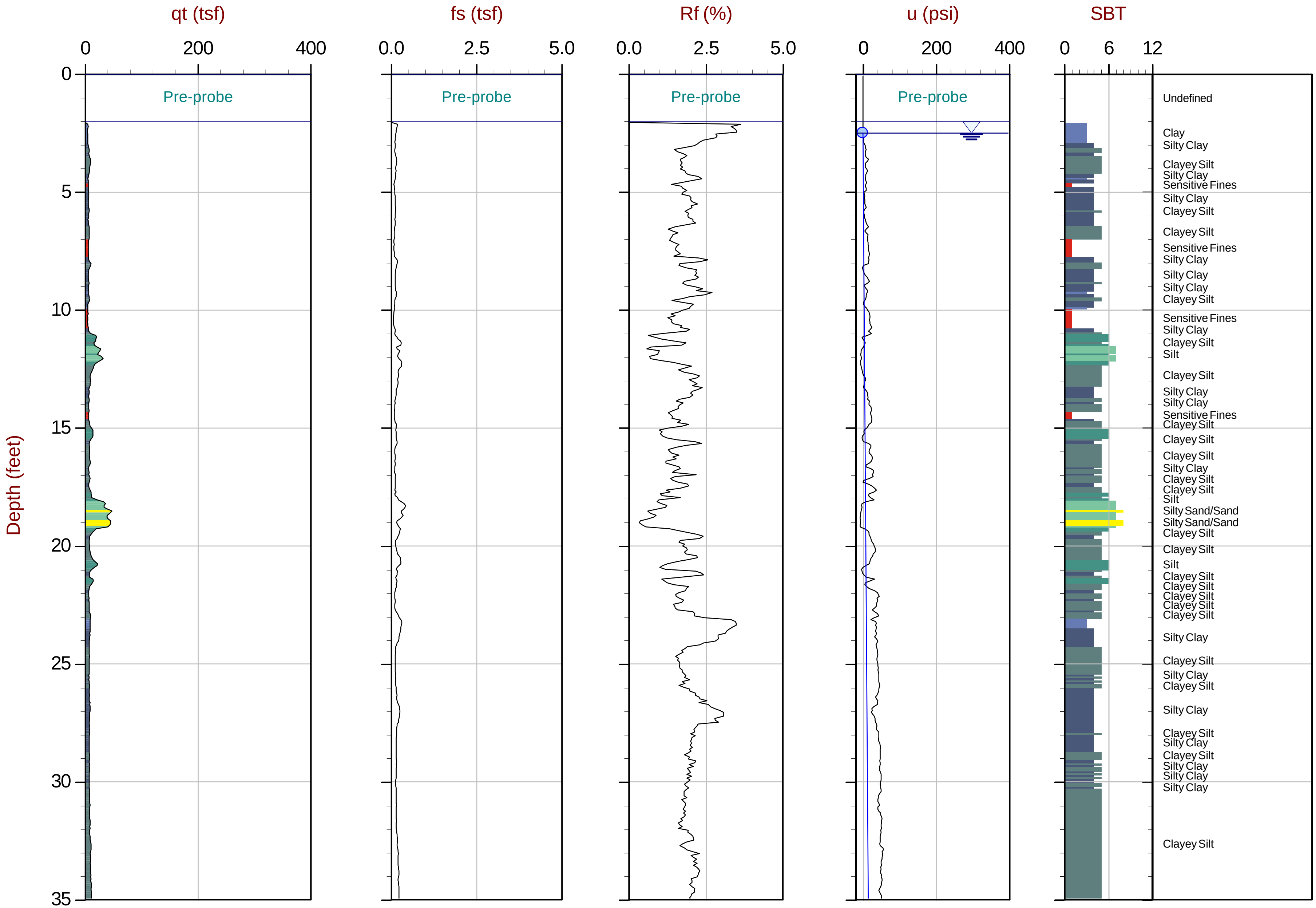
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 07:55
Site: Jacobs Avenue Levee

Sounding: CPT-42L
Cone: 447:T1500F15U500



Max Depth: 15.525 m / 50.93 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517531m E: 404500m
Sheet No: 1 of 2

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

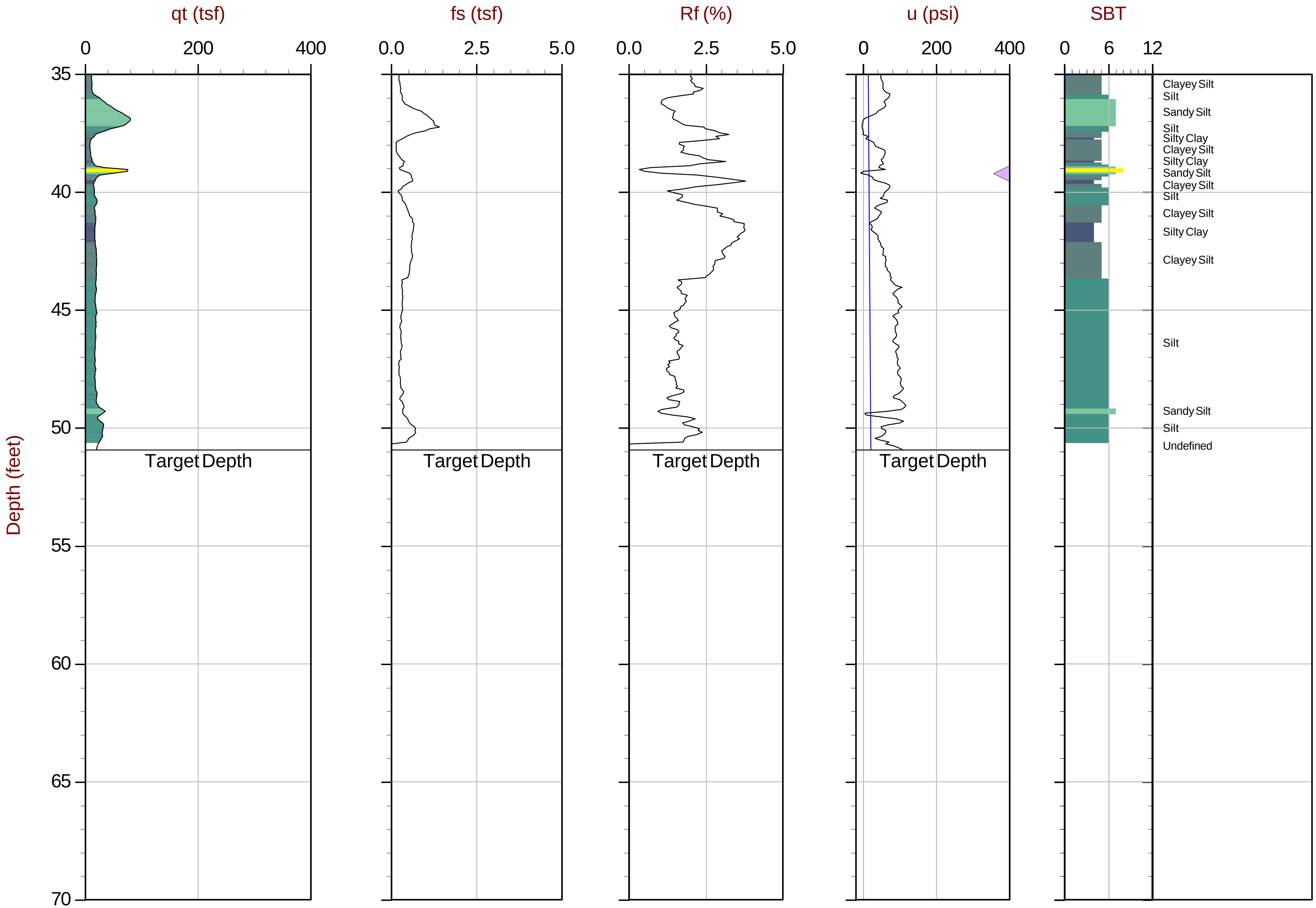
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 07:55
Site: Jacobs Avenue Levee

Sounding: CPT-42L
Cone: 447:T1500F15U500



Max Depth: 15.525 m / 50.93 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517531m E: 404500m
Sheet No: 2 of 2

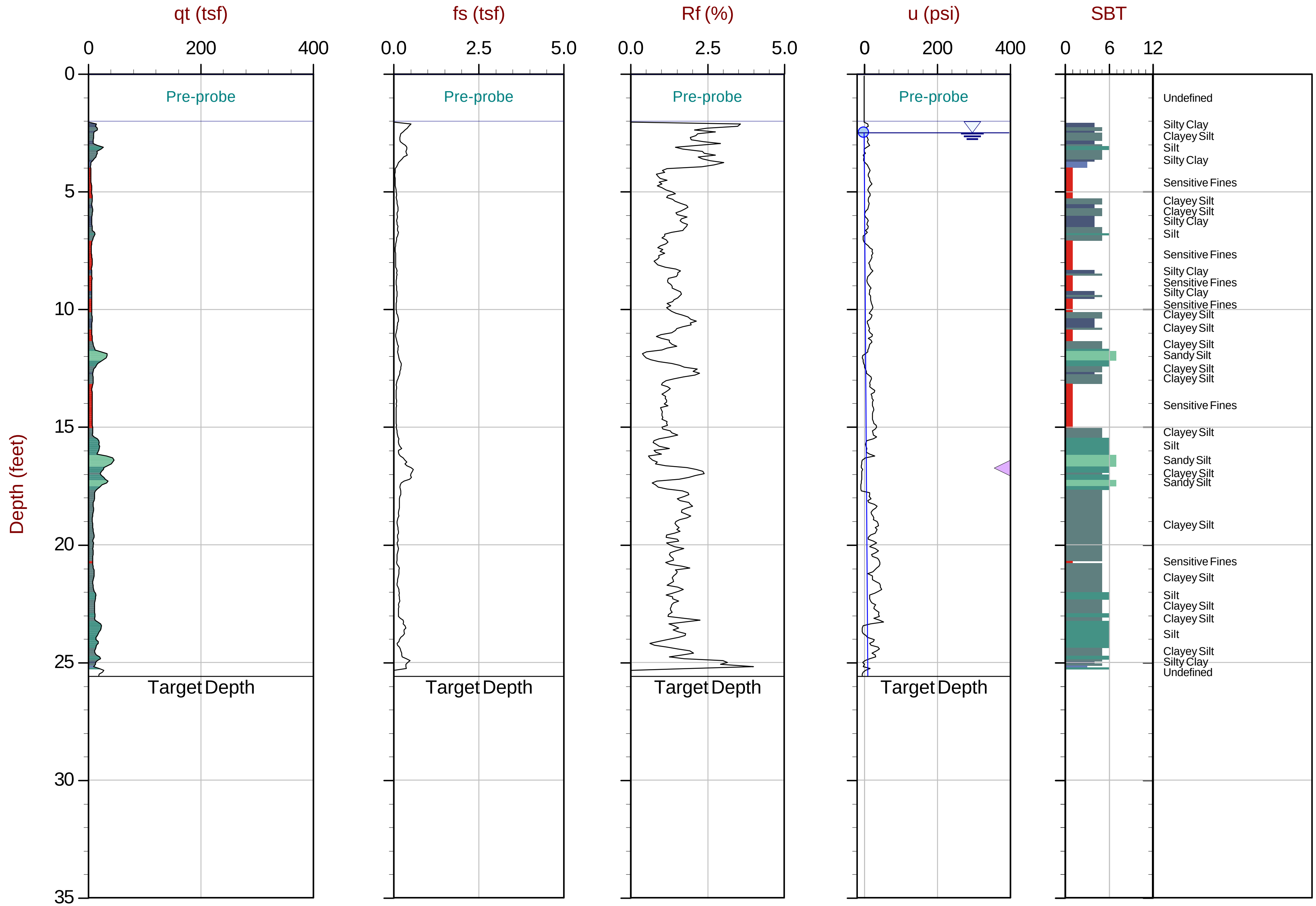
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 09:36
Site: Jacobs Avenue Levee
Sounding: CPT-42off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42OFF.COR
Unit Wt: SBT Zones

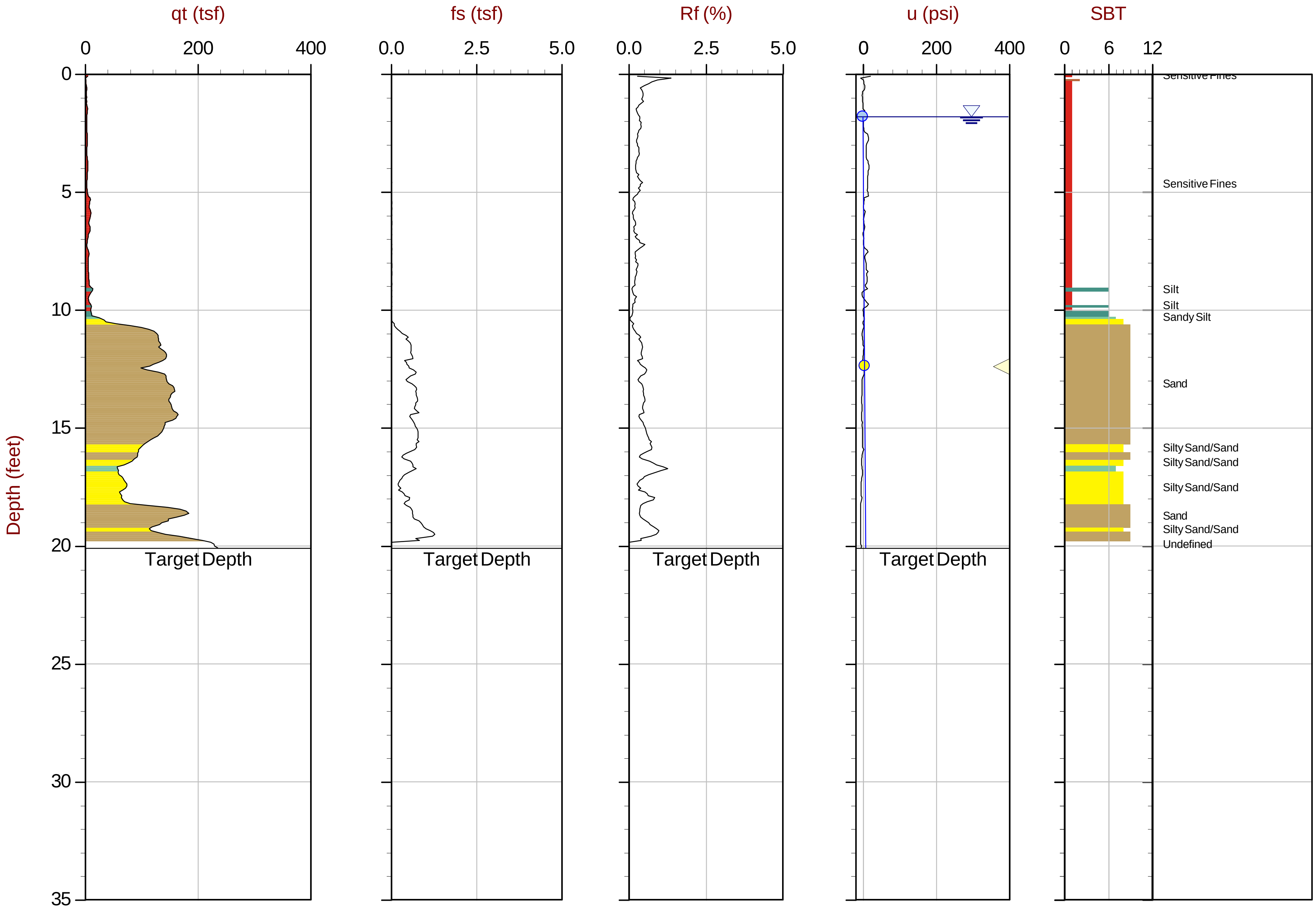
SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517551m E: 404510m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:21:15 09:36
Site: Jacobs Avenue Levee
Sounding: CPT-56C
Cone: 447:T1500F15U500



Max Depth: 6.125 m / 20.09 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56C.COR
Unit Wt: SBT Zones

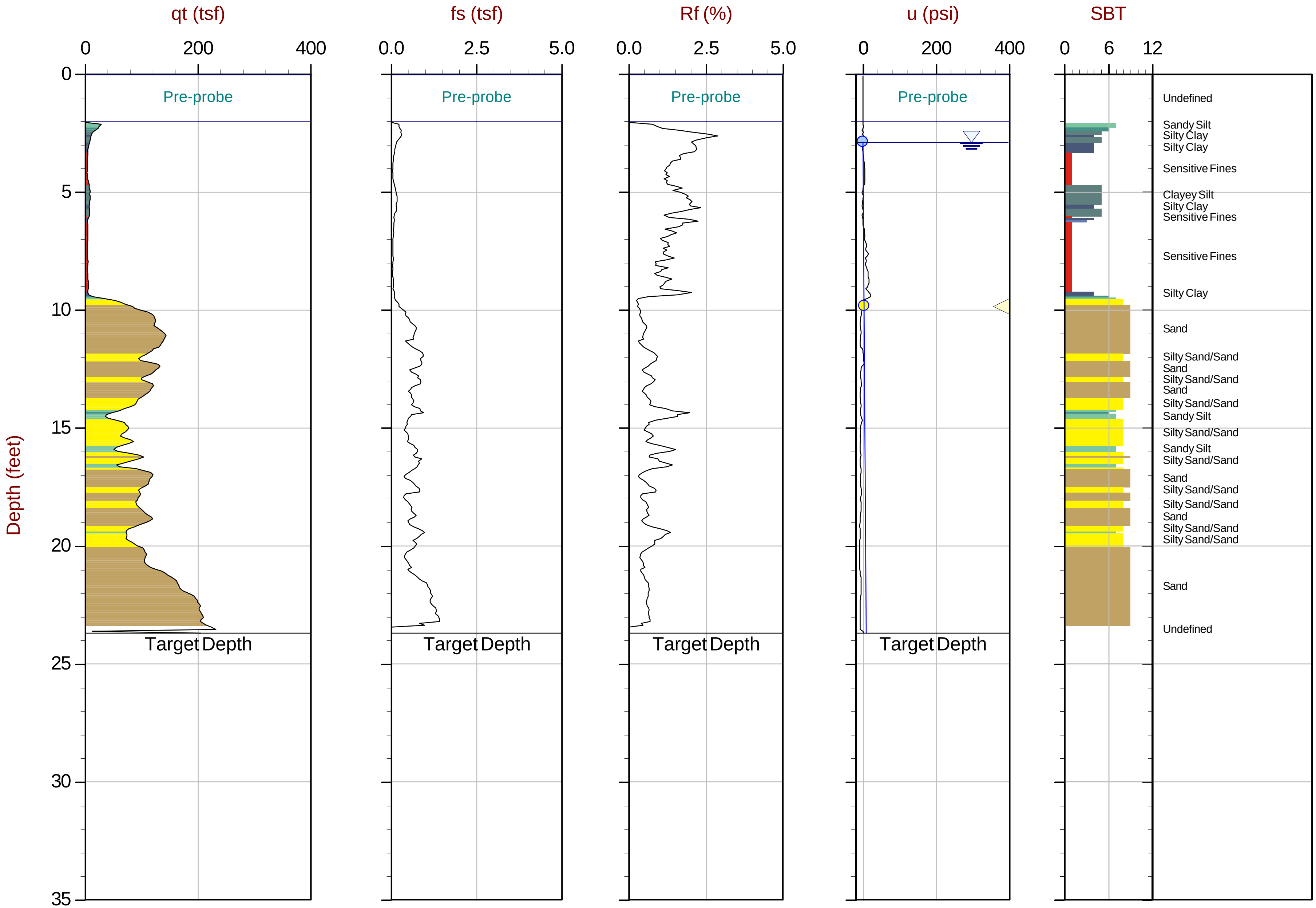
SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517692m E: 404105m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 10:53
Site: Jacobs Avenue Levee
Sounding: CPT-56L
Cone: 447:T1500F15U500



Max Depth: 7.225 m / 23.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56L.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517699m E: 404099m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

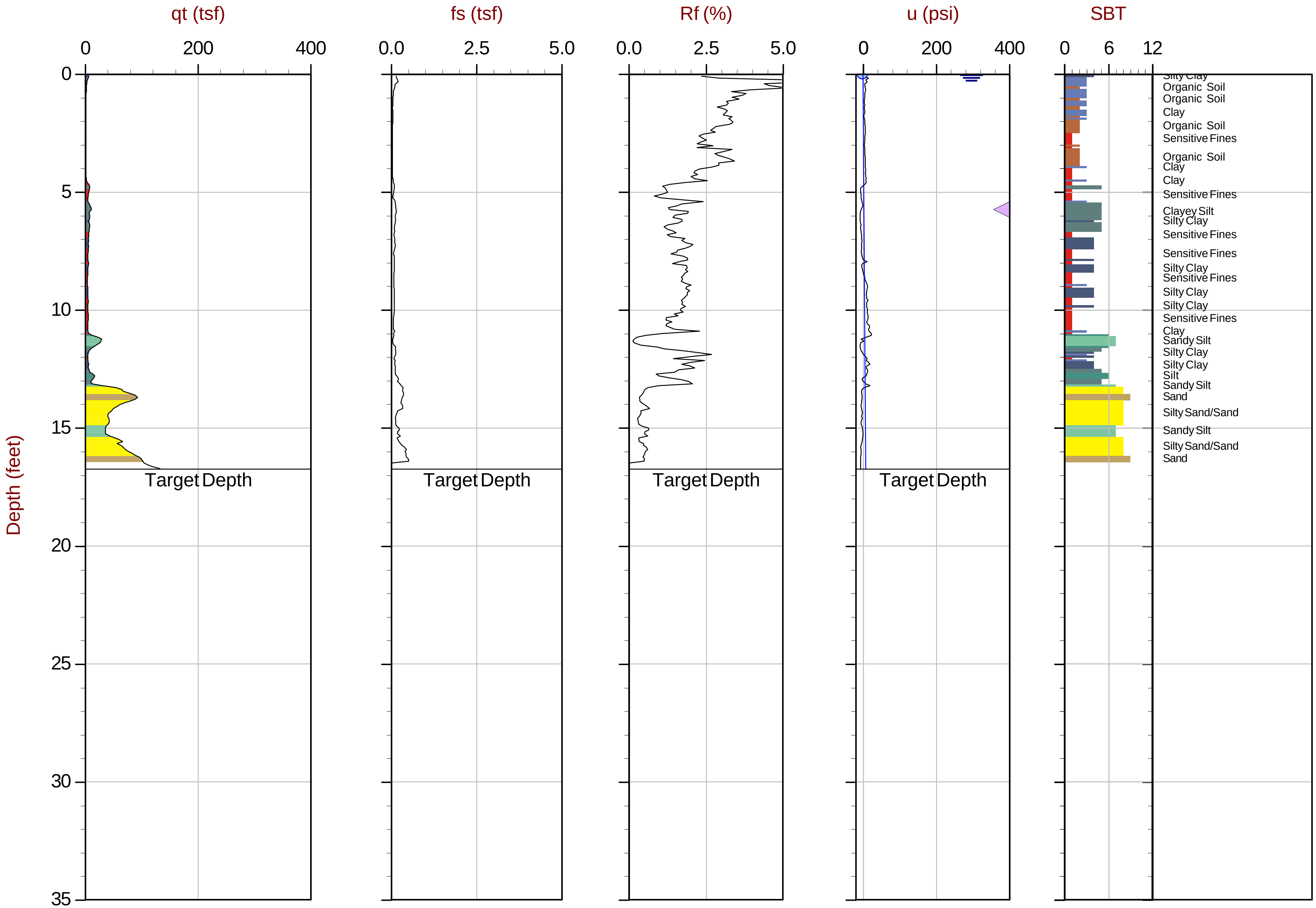
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:21:15 12:10
Site: Jacobs Avenue Levee

Sounding: CPT-56W
Cone: 447:T1500F15U500



Max Depth: 5.100 m / 16.73 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56W.COR
Unit Wt: SBT Zones

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517675m E: 404100m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Advanced Cone Penetration Test Plots with Ic, Su(Nkt) and N1(60)

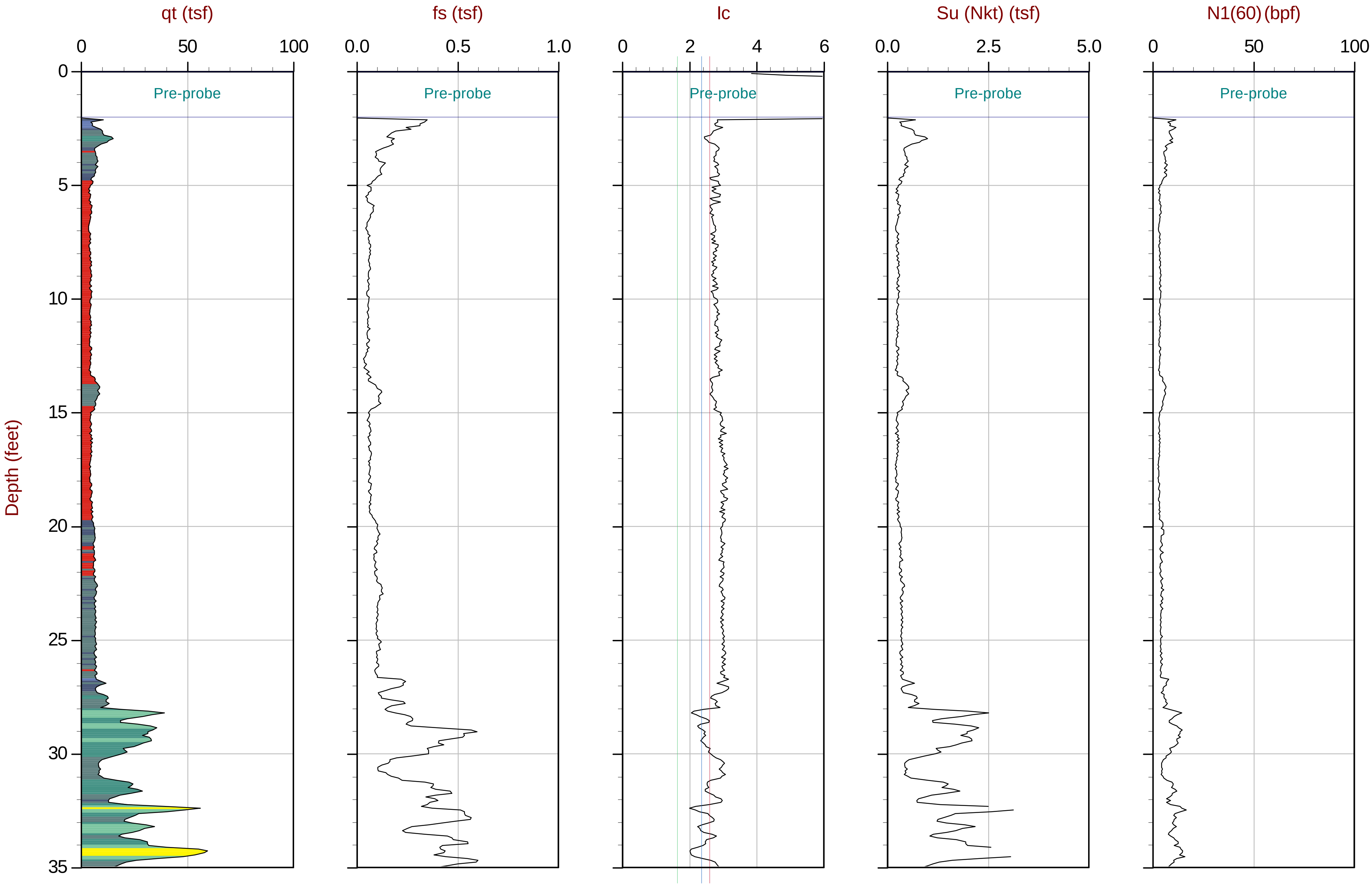
CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 09:18
Site: Jacobs Avenue Levee

Sounding: CPT-10L
Cone: 447:T1500F15U500



Max Depth: 15.350 m / 50.36 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10L.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517603m E: 405439m
Sheet No: 1 of 2

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

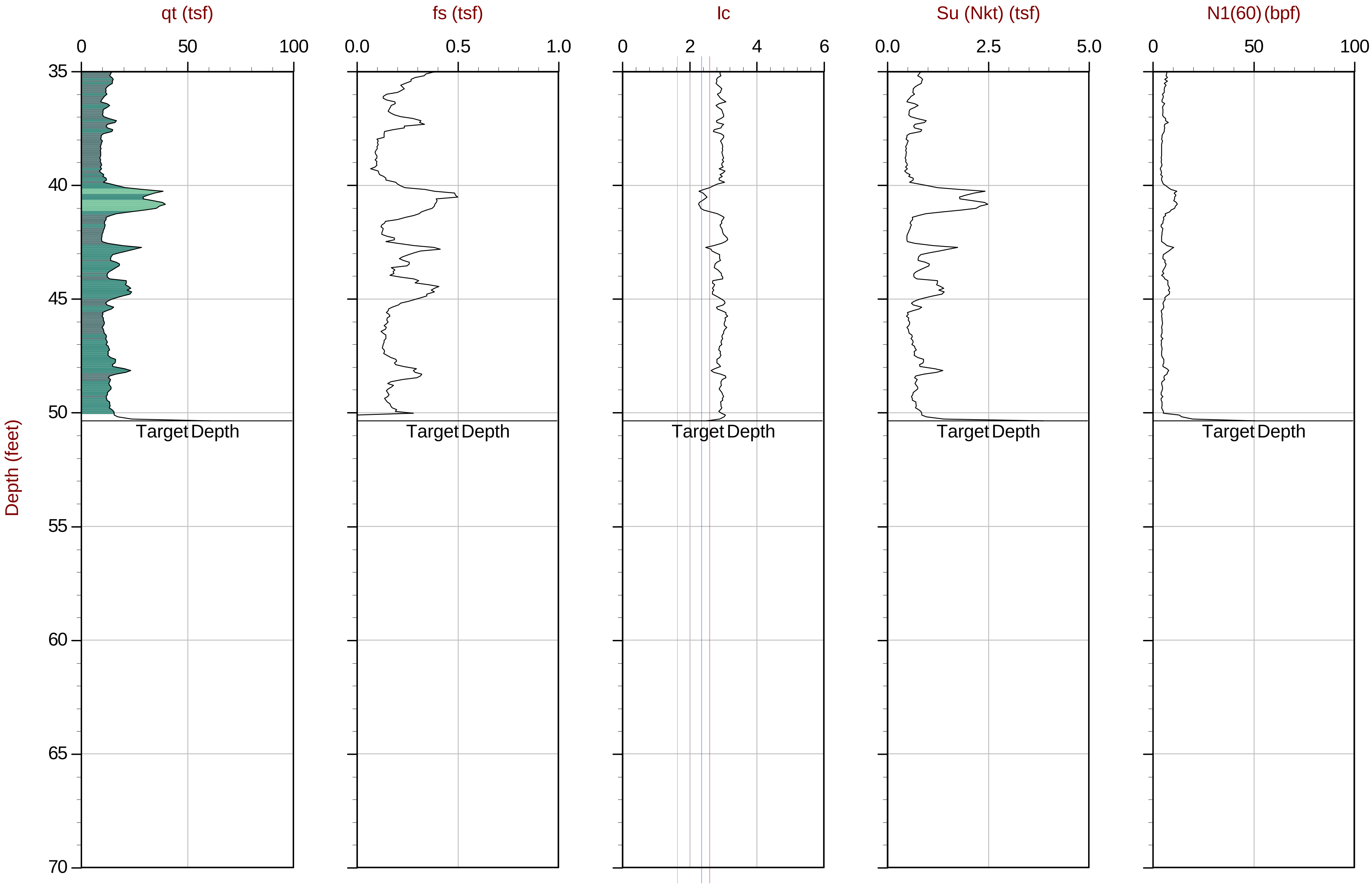
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 09:18
Site: Jacobs Avenue Levee

Sounding: CPT-10L
Cone: 447:T1500F15U500



Max Depth: 15.350 m / 50.36 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10L.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517603m E: 405439m
Sheet No: 2 of 2

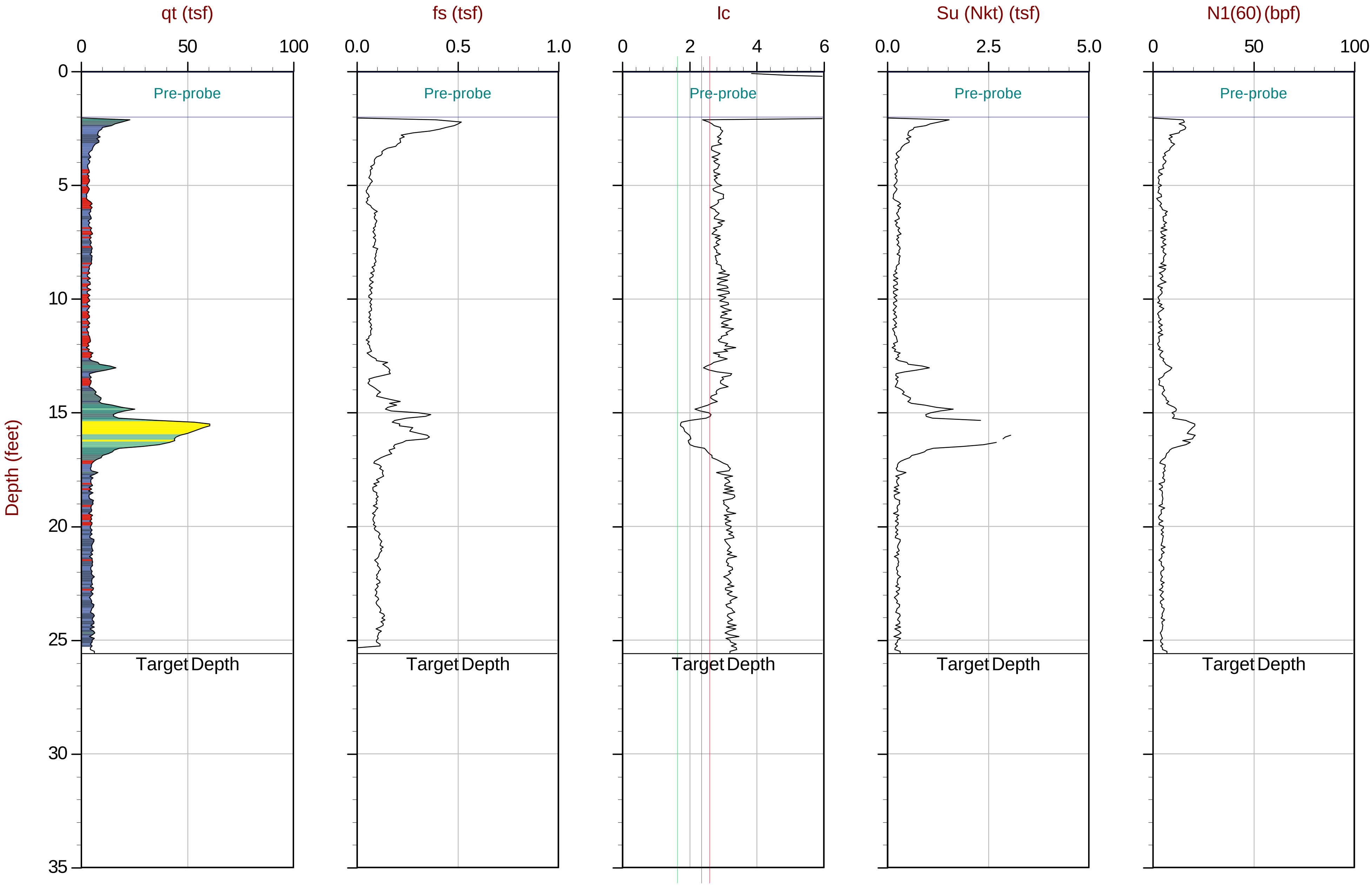
Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 08:08
Site: Jacobs Avenue Levee
Sounding: CPT-10off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP10OFF.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517625m E: 405434m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

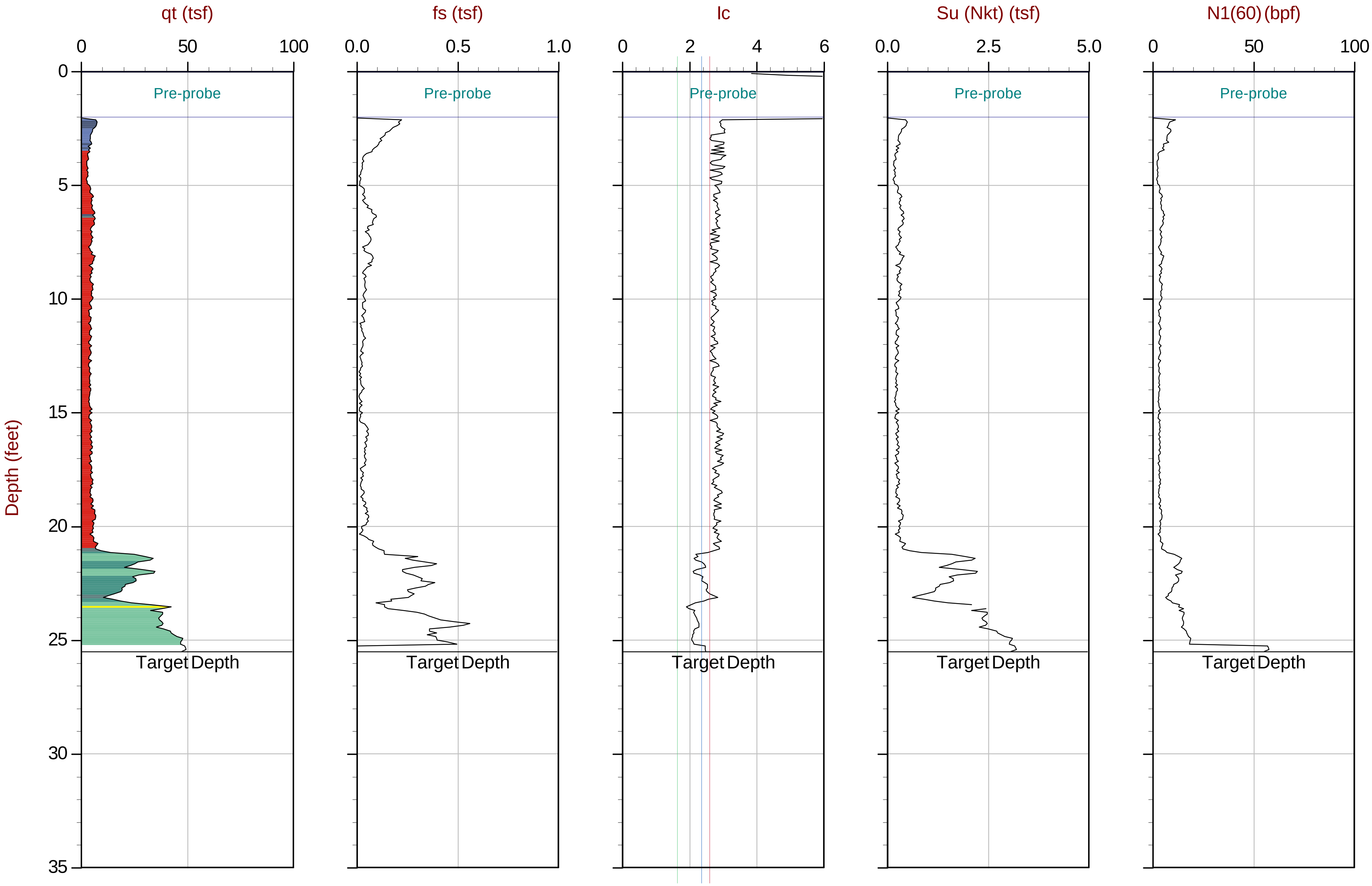
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 10:50
Site: Jacobs Avenue Levee

Sounding: CPT-20L
Cone: 447:T1500F15U500



Max Depth: 7.775 m / 25.51 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP20L.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517599m E: 405439m
Sheet No: 1 of 1

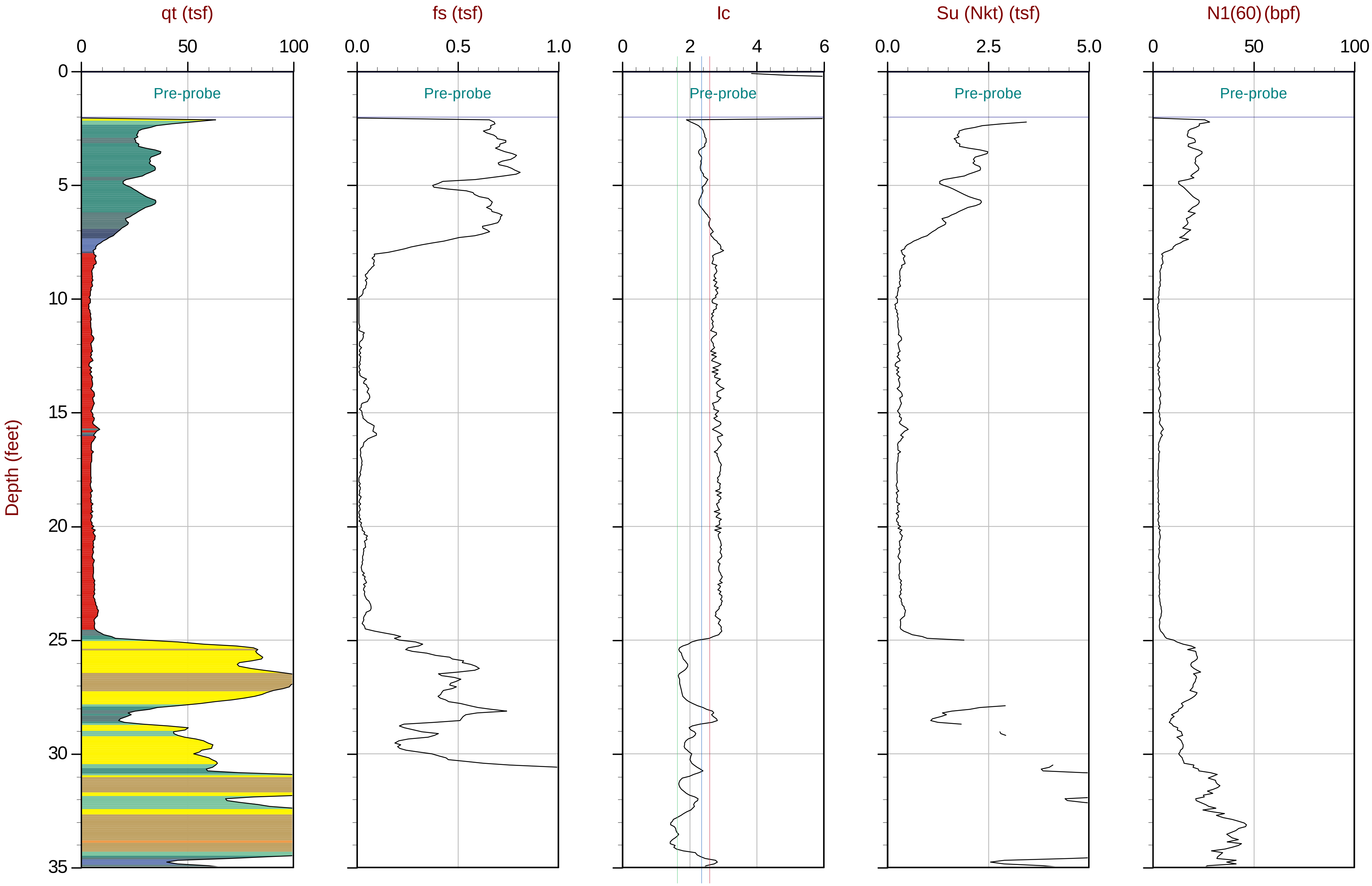
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee
Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 1 of 3

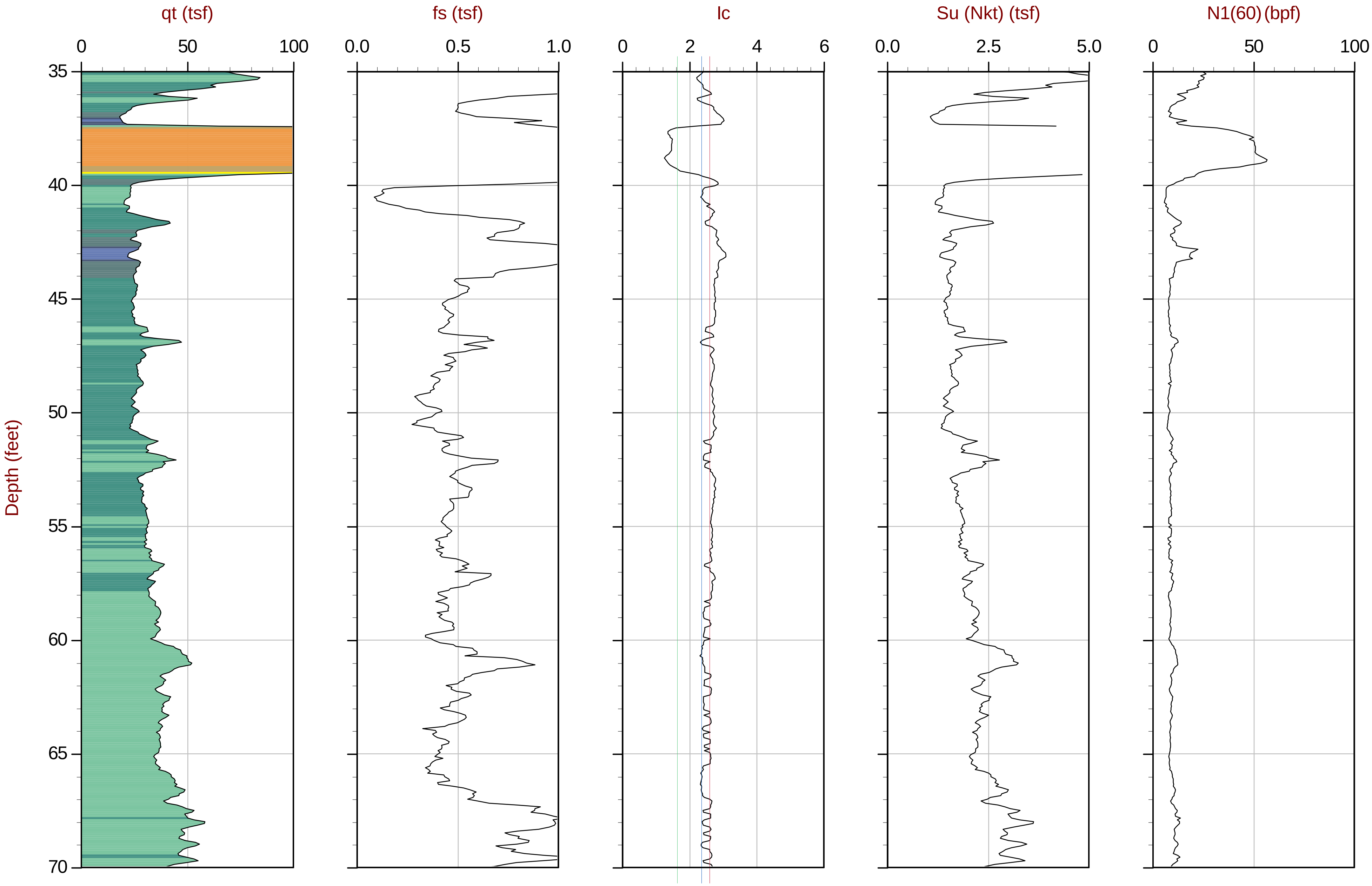
Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee

Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 2 of 3

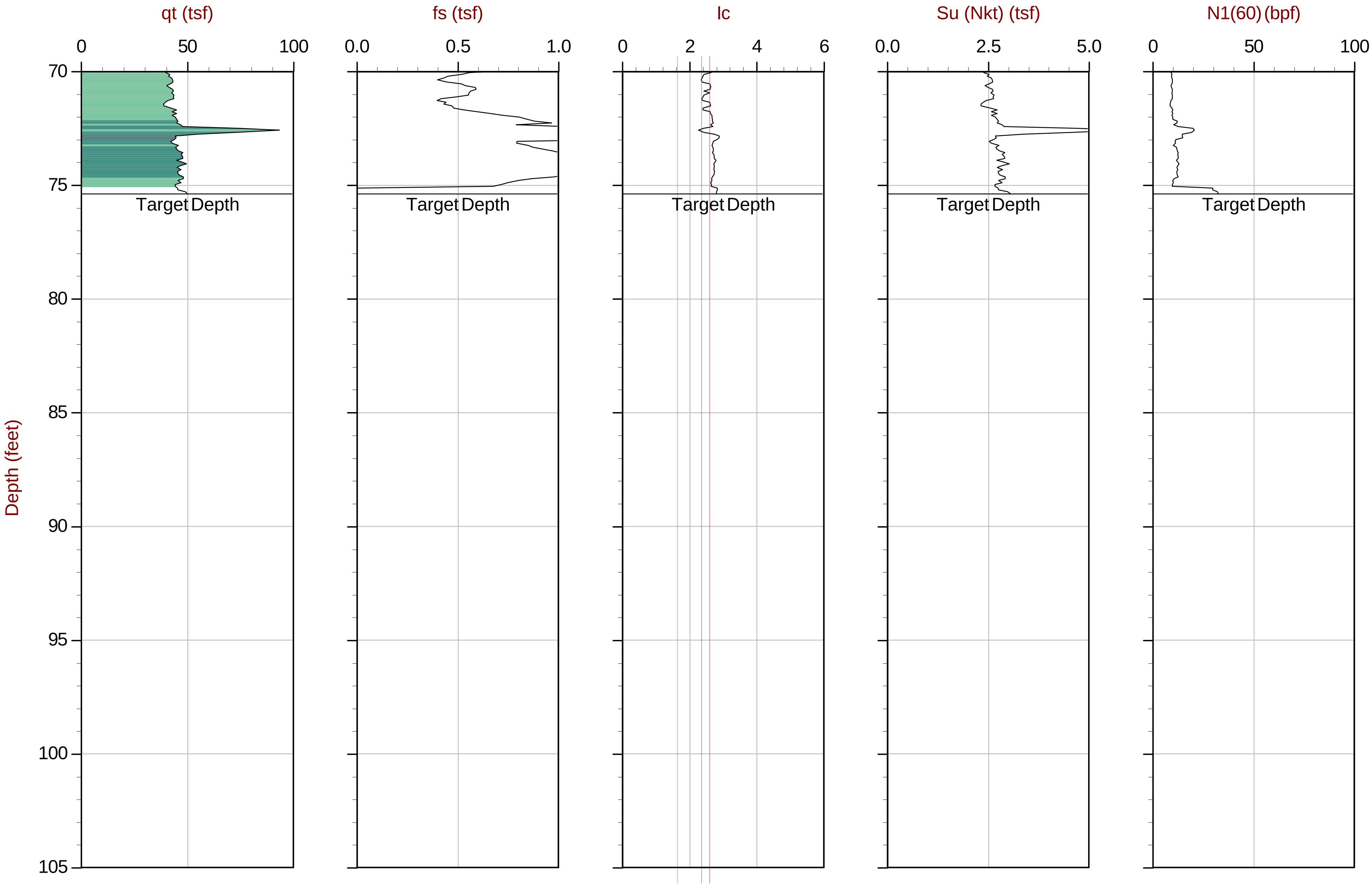
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 12:07
Site: Jacobs Avenue Levee

Sounding: CPT-30C
Cone: 447:T1500F15U500



Max Depth: 22.975 m / 75.38 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30C.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517557m E: 404808m
Sheet No: 3 of 3

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

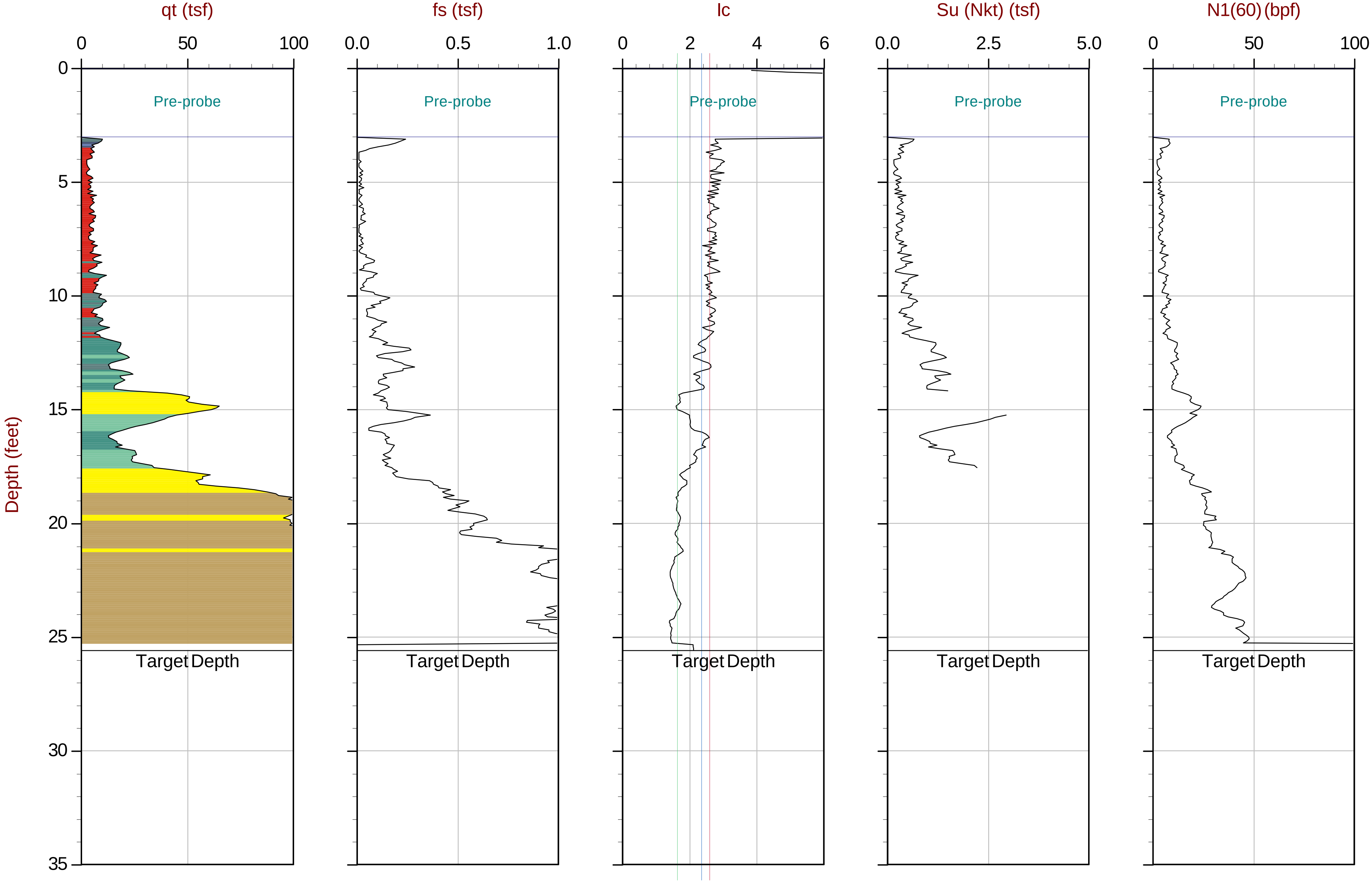
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:19:15 12:04
Site: Jacobs Avenue Levee

Sounding: CPT-30off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30OFF.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517621m E: 404824m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

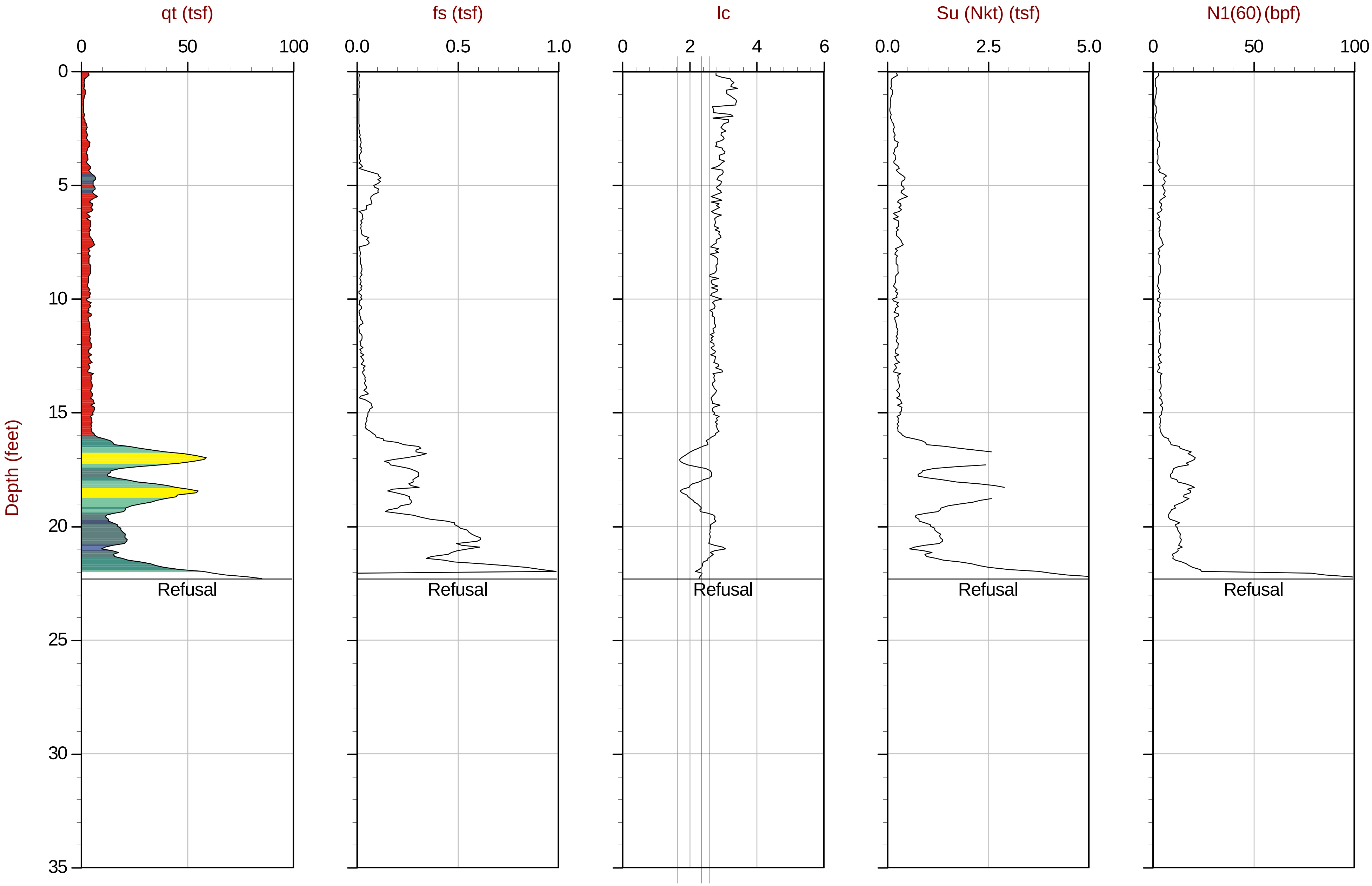
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:22:15 13:59
Site: Jacobs Avenue Levee

Sounding: CPT-30W
Cone: 447:T1500F15U500



Max Depth: 6.800 m / 22.31 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP30W.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517549m E: 404814m
Sheet No: 1 of 1

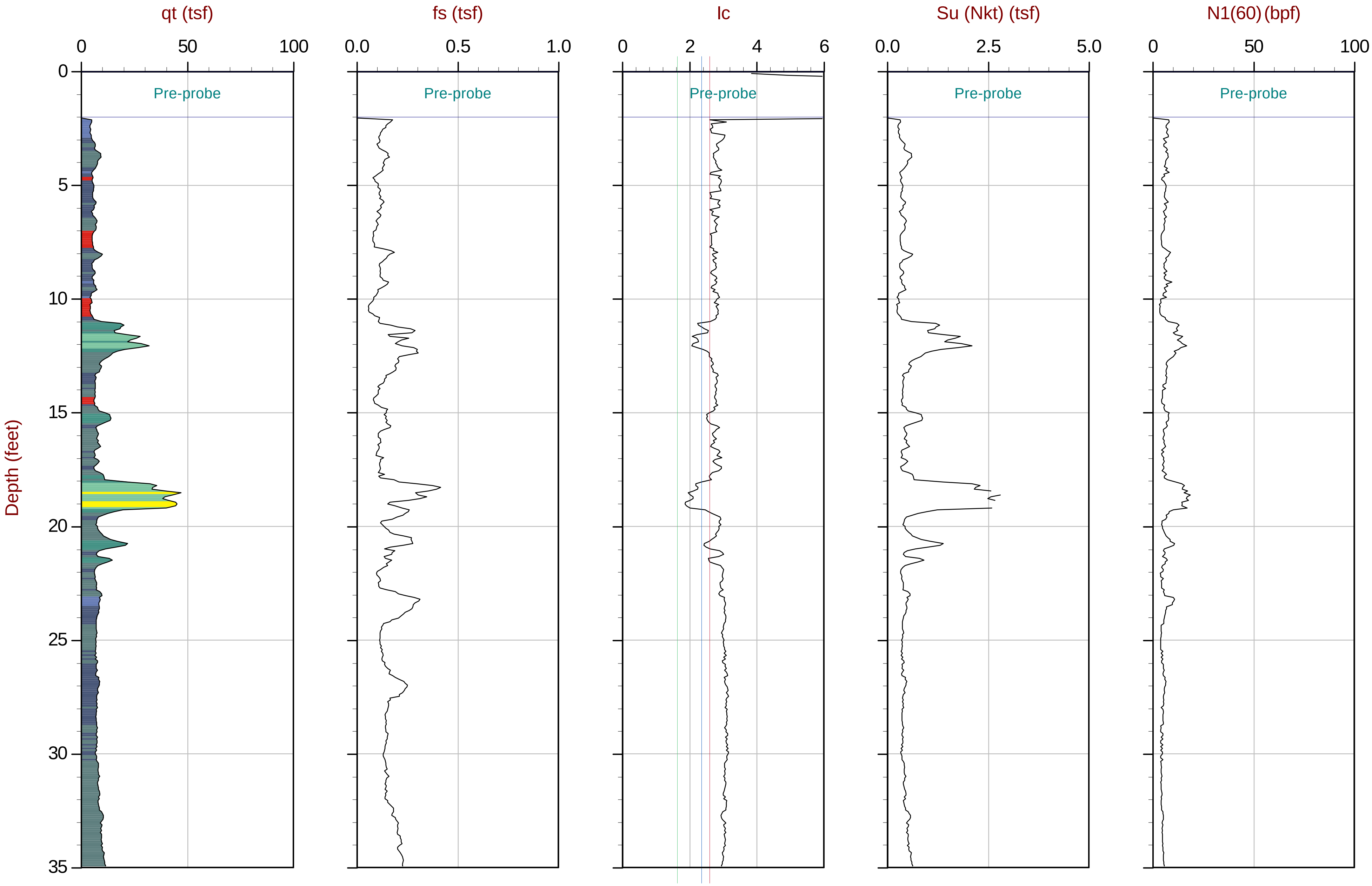
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 07:55
Site: Jacobs Avenue Levee

Sounding: CPT-42L
Cone: 447:T1500F15U500



Max Depth: 15.525 m / 50.93 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42L.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517531m E: 404500m
Sheet No: 1 of 2

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

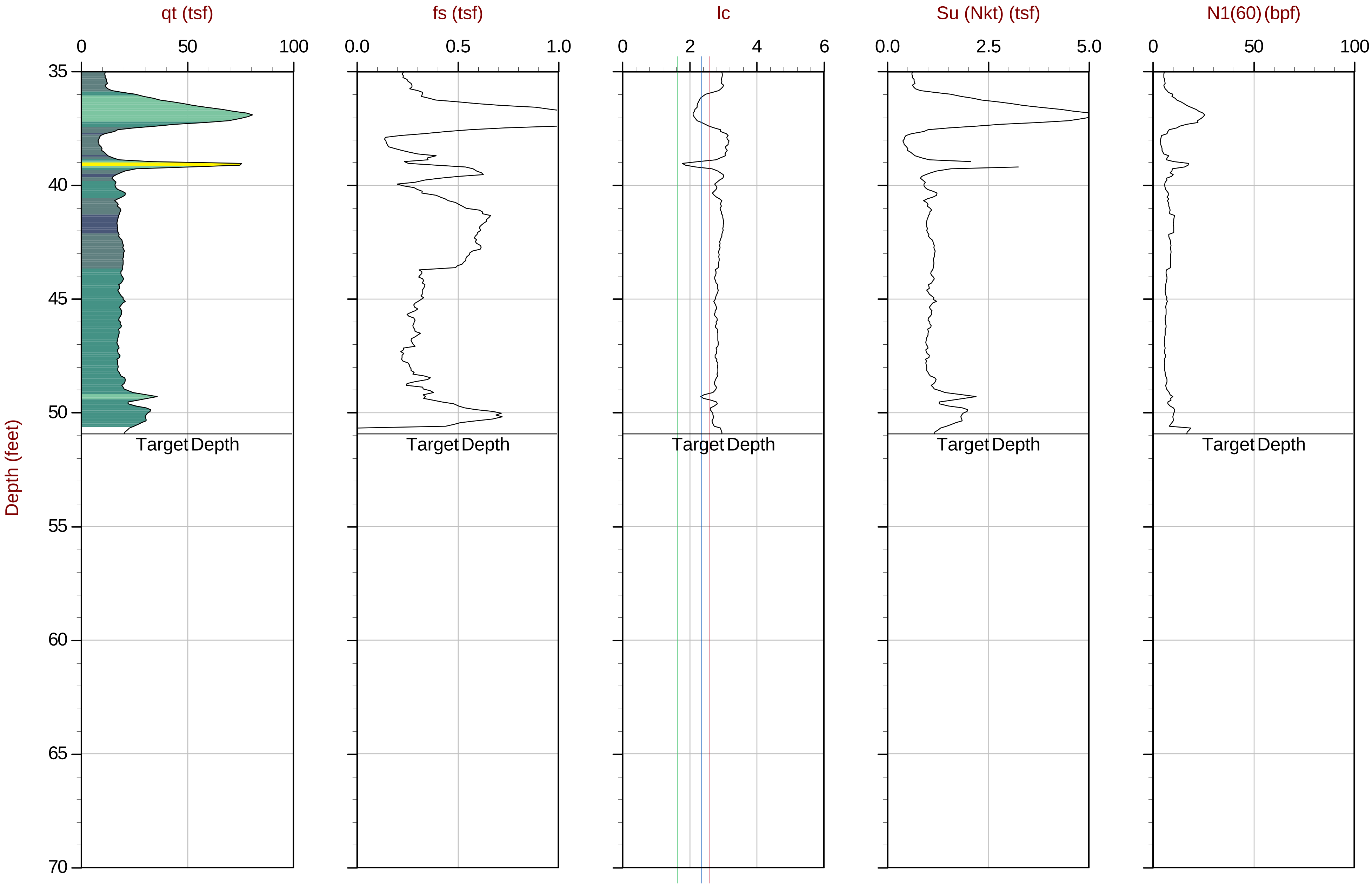
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 07:55
Site: Jacobs Avenue Levee

Sounding: CPT-42L
Cone: 447:T1500F15U500



Max Depth: 15.525 m / 50.93 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42L.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517531m E: 404500m
Sheet No: 2 of 2

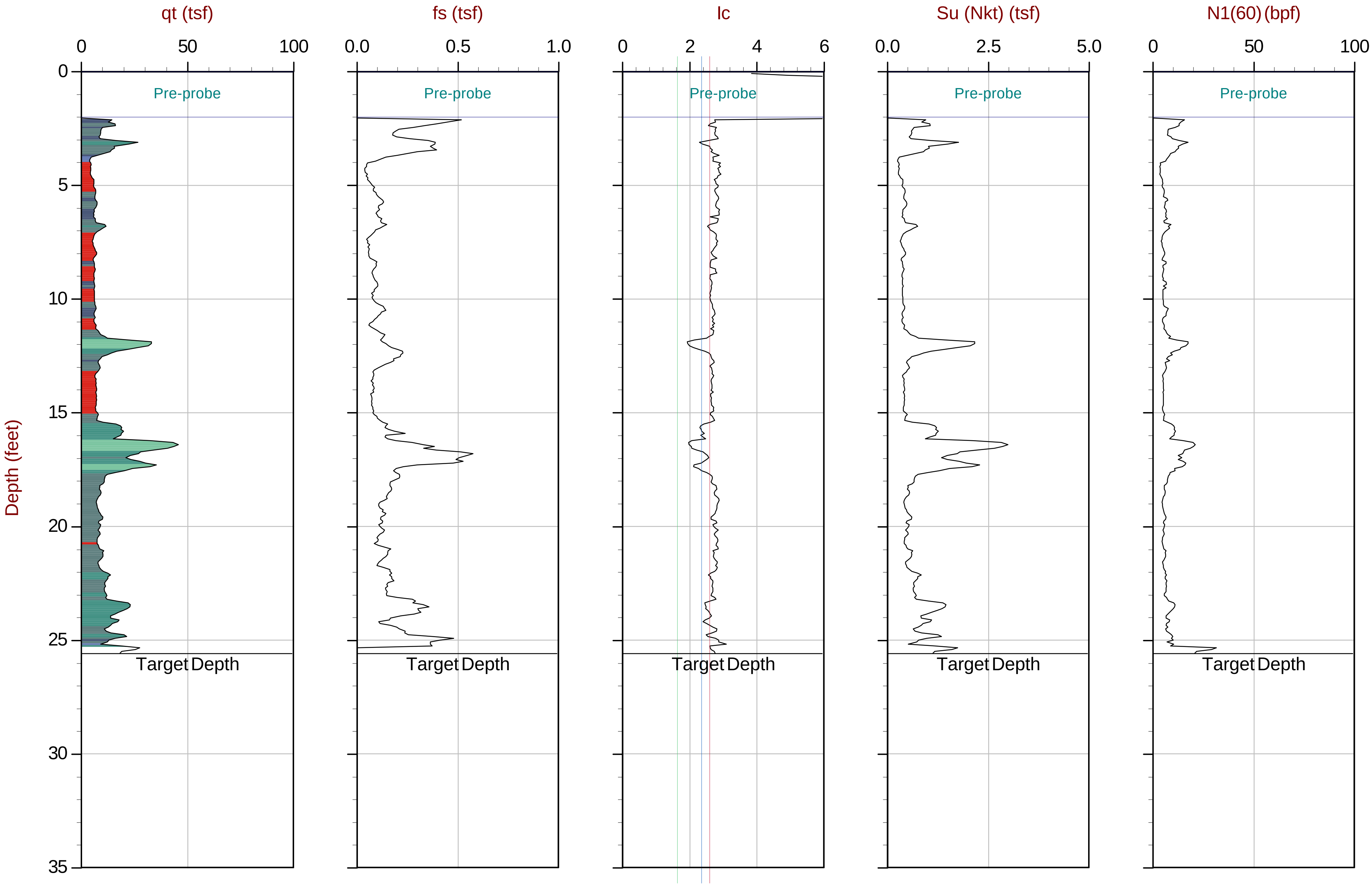
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 09:36
Site: Jacobs Avenue Levee
Sounding: CPT-42off
Cone: 447:T1500F15U500



Max Depth: 7.800 m / 25.59 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP42OFF.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

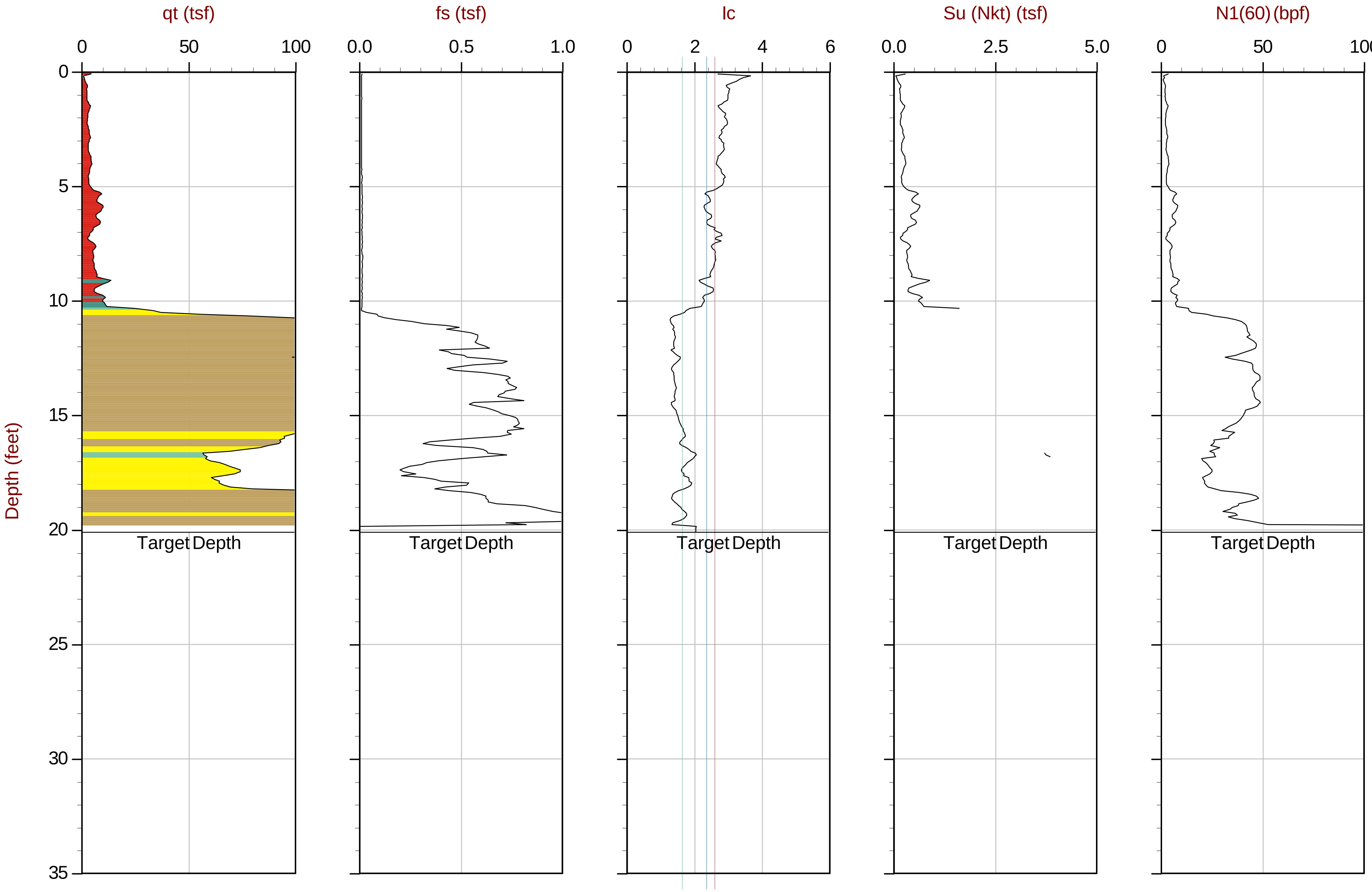
SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517551m E: 404510m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:21:15 09:36
Site: Jacobs Avenue Levee
Sounding: CPT-56C
Cone: 447:T1500F15U500



Max Depth: 6.125 m / 20.09 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56C.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517692m E: 404105m
Sheet No: 1 of 1

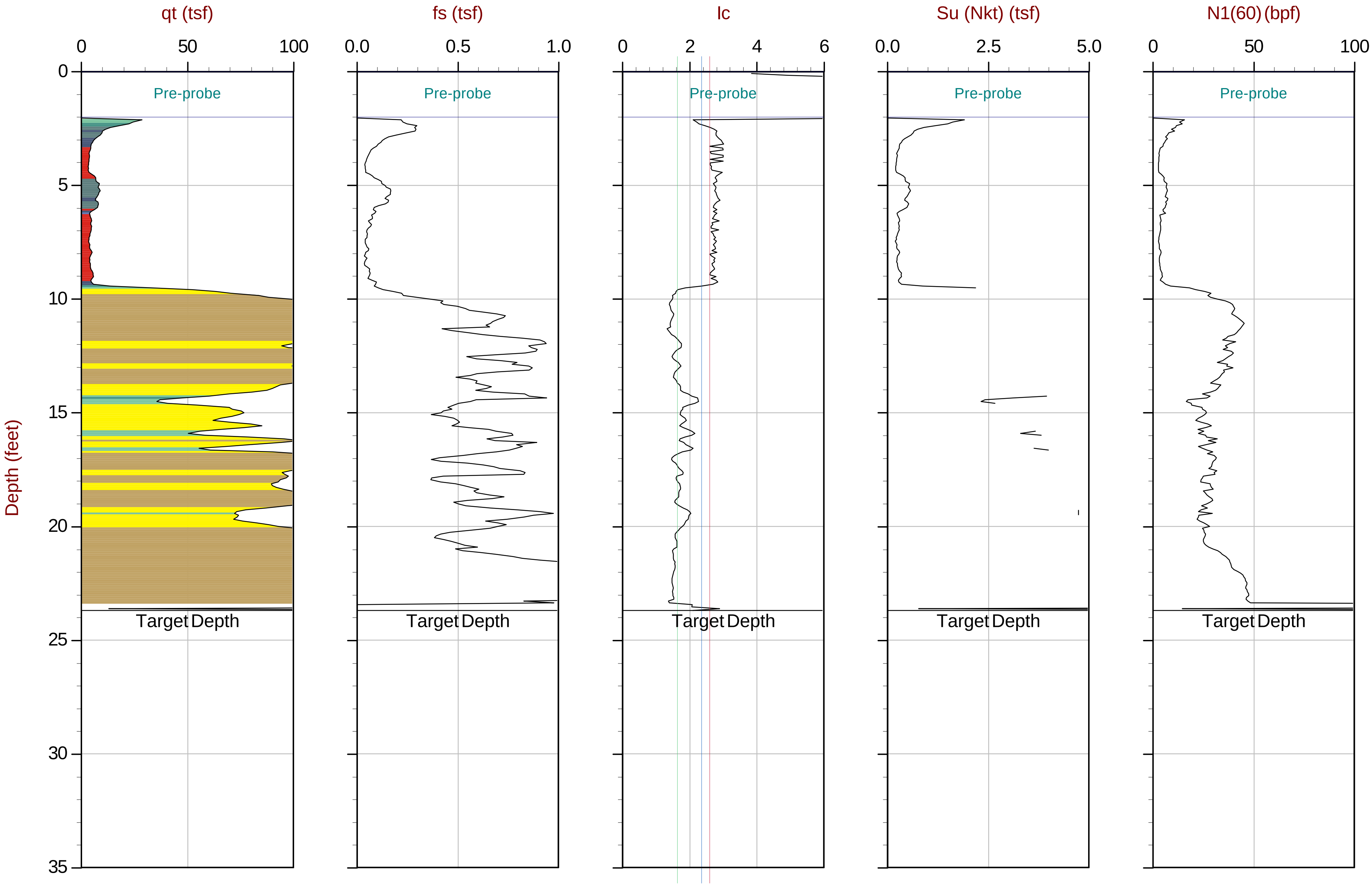
Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:20:15 10:53
Site: Jacobs Avenue Levee
Sounding: CPT-56L
Cone: 447:T1500F15U500



Max Depth: 7.225 m / 23.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56L.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517699m E: 404099m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) — Assumed Ueq — Dissipation, Ueq achieved — Dissipation, Ueq not achieved — Hydrostatic Line

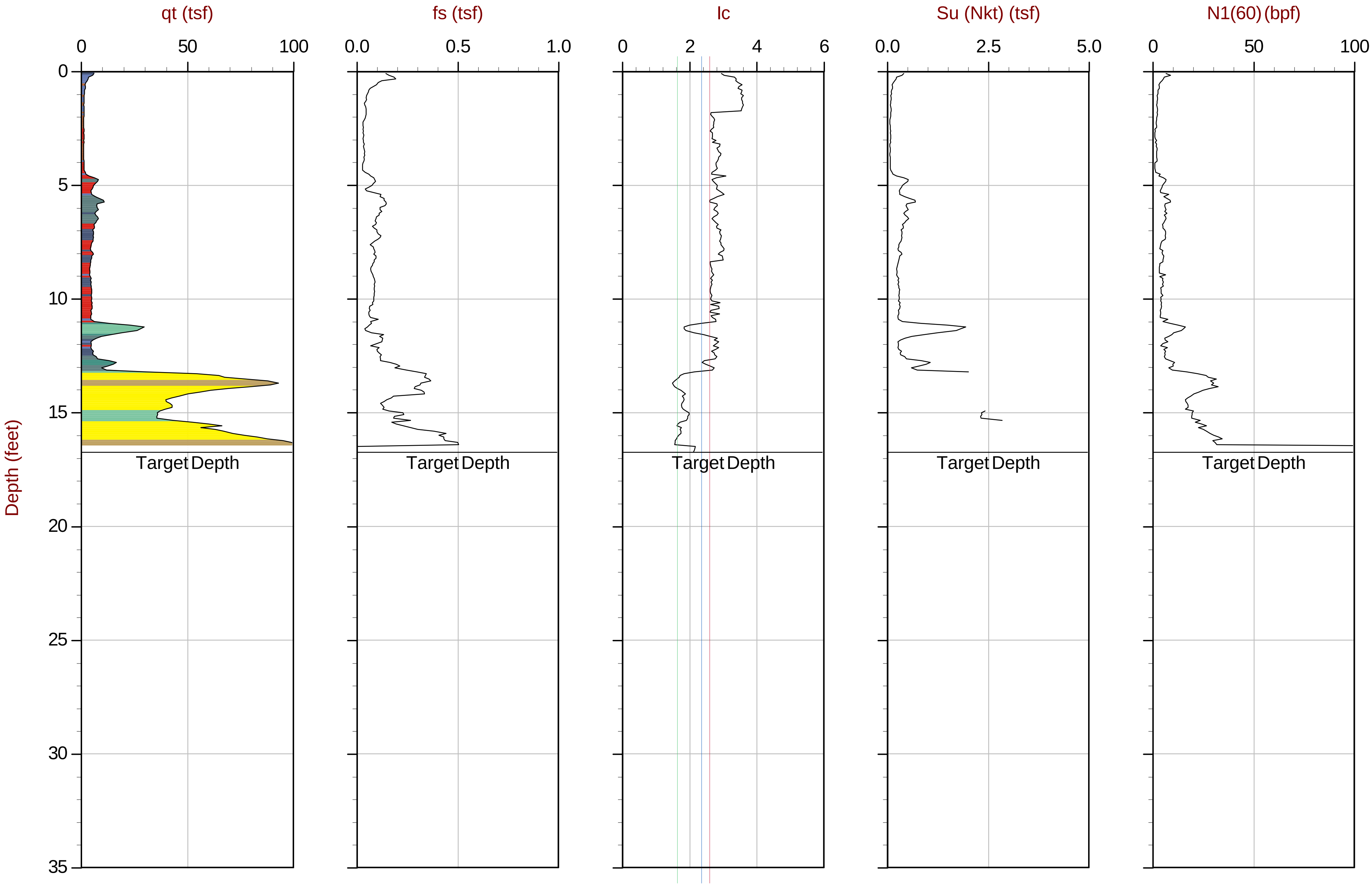
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11:21:15 12:10
Site: Jacobs Avenue Levee

Sounding: CPT-56W
Cone: 447:T1500F15U500



Max Depth: 5.100 m / 16.73 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 15-56025_CP56W.COR
Unit Wt: SBT Zones
Su Nkt: 15.0

SBT: Robertson and Campanella, 1986
Coords: UTM 10T N: 4517675m E: 404100m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Pore Pressure Dissipation Summary and
Pore Pressure Dissipation Plots

CALIFORNIA PUSH
TECHNOLOGIES
INCORPORATED

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Job No: 15-56025
Client: CGI Technical Services Inc.
Project: Jacobs Avenue Levee
Start Date: 19-Nov-2015
End Date: 22-Nov-2015

CPTu PORE PRESSURE DISSIPATION SUMMARY

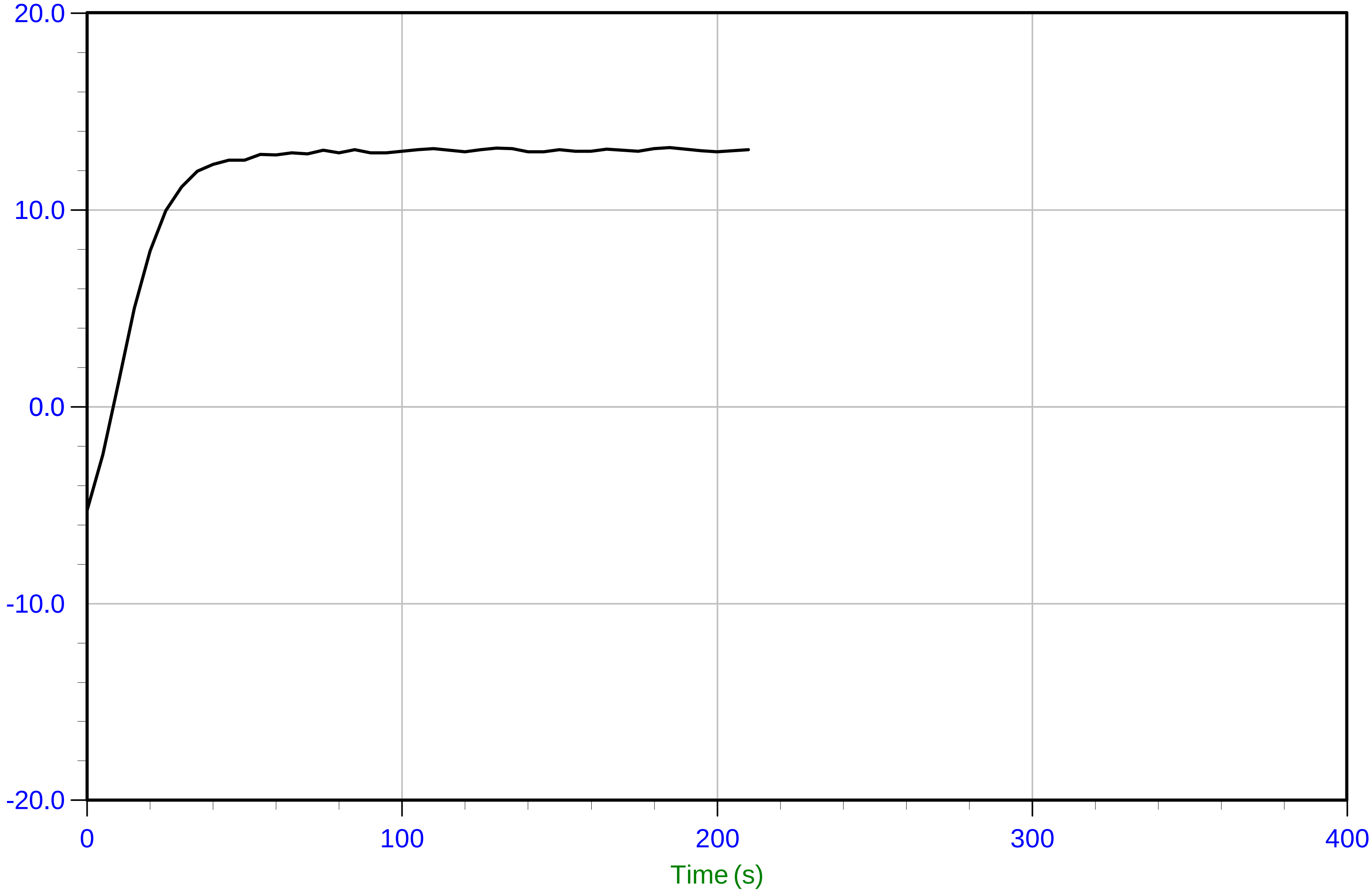
Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (psi)	Calculated Phreatic Surface (ft)
CPT-10L	15-56025_CP10L	15	210	32.56	13.0	2.7
CPT-10off	15-56025_CP10off	15	250	14.93	Not Achieved	
CPT-10off	15-56025_CP10off	15	585	16.49	5.5	3.7
CPT-20L	15-56025_CP20L	15	345	21.57	8.5	2.0
CPT-30C	15-56025_CP30C	15	855	26.16	7.9	7.9
CPT-30C	15-56025_CP30C	15	350	57.33	Not Achieved	
CPT-30off	15-56025_CP30off	15	280	14.76	5.6	1.8
CPT-42L	15-56025_CP42L	15	370	39.21	Not Achieved	
CPT-42off	15-56025_CP42off	15	400	16.73	Not Achieved	
CPT-56C	15-56025_CP56C	15	315	12.39	4.6	1.8
CPT-56L	15-56025_CP56L	15	205	9.84	3.0	2.9
CPT-56W	15-56025_CP56W	15	305	5.74	Not Achieved	

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11/19/2015 09:18
Site: Jacobs Avenue Levee

Sounding: CPT-10L
Cone: 447:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-56025_CP10L.PPF
Depth: 9.925 m / 32.562 ft
Duration: 210.0 s

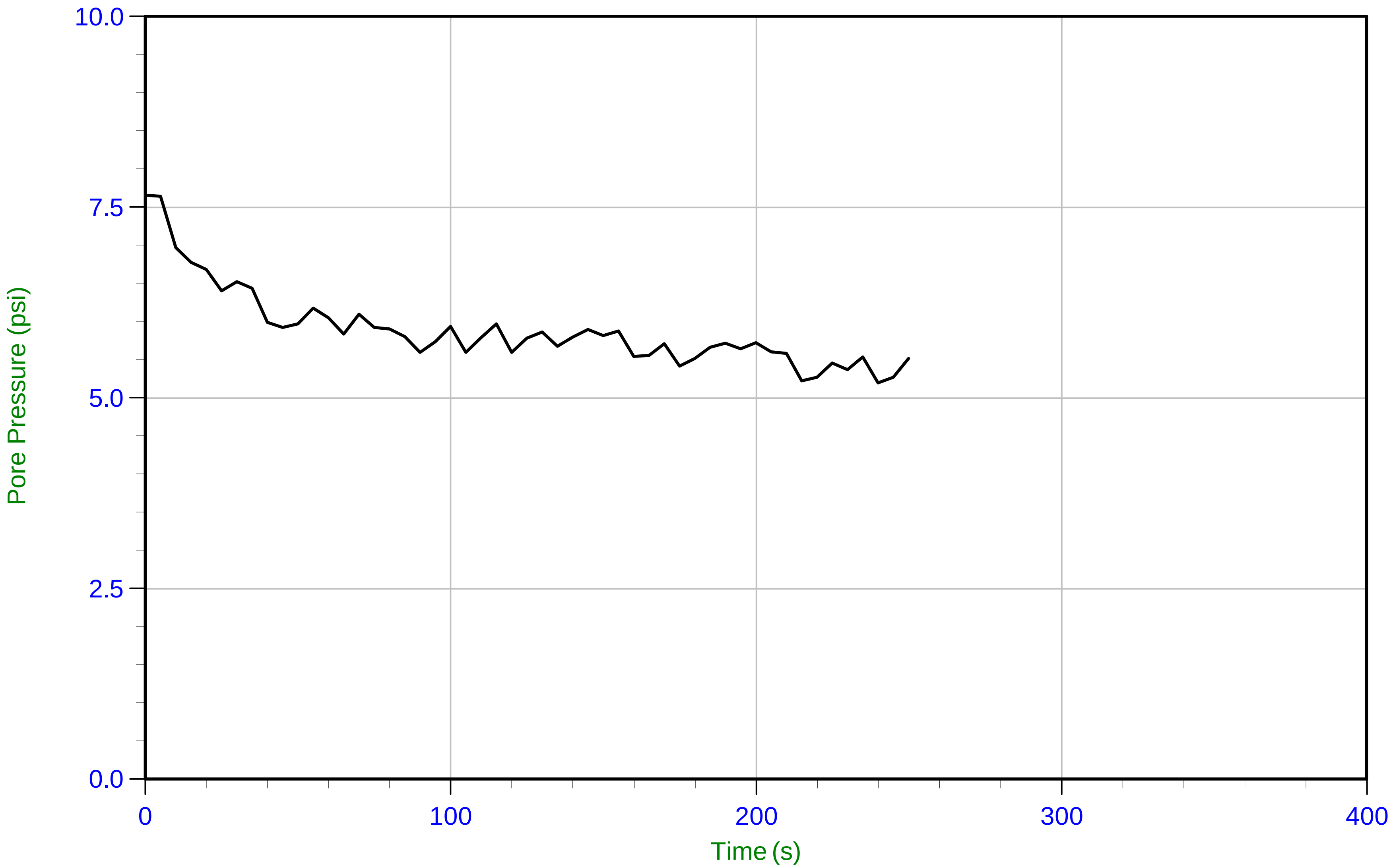
U Min: -5.3 psi
U Max: 13.2 psi

WT: 0.812 m / 2.664 ft
Ueq: 13.0 psi

CGI Technical Services Inc.

Job No: 15-56025
Date: 11/19/2015 08:08
Site: Jacobs Avenue Levee

Sounding: CPT-10off
Cone: 447:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

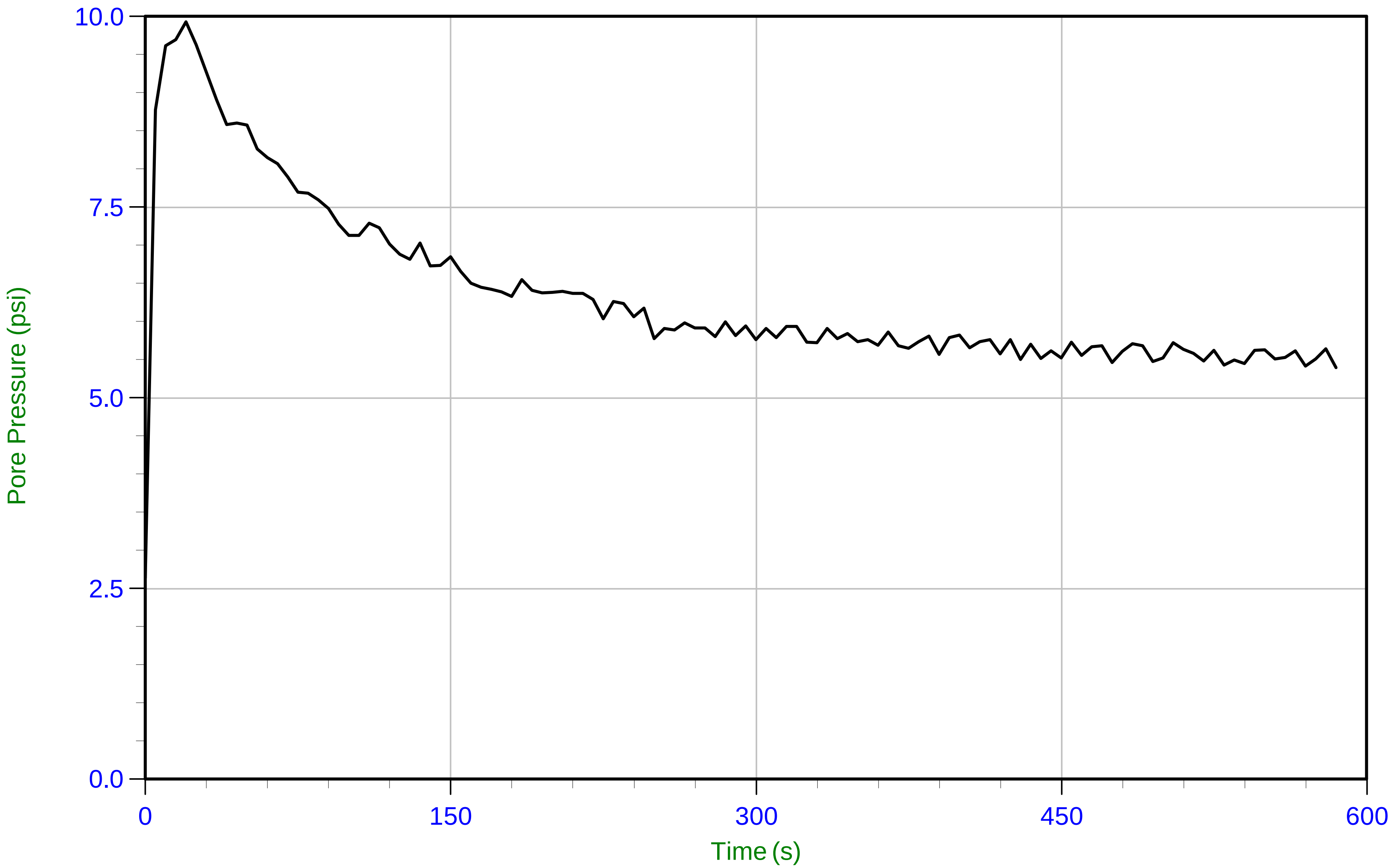
Filename: 15-56025_CP10off.PPF
Depth: 4.550 m / 14.928 ft
Duration: 250.0 s

U Min: 5.2 psi
U Max: 7.7 psi

CGI Technical Services Inc.

Job No: 15-56025
Date: 11/19/2015 08:08
Site: Jacobs Avenue Levee

Sounding: CPT-10off
Cone: 447:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

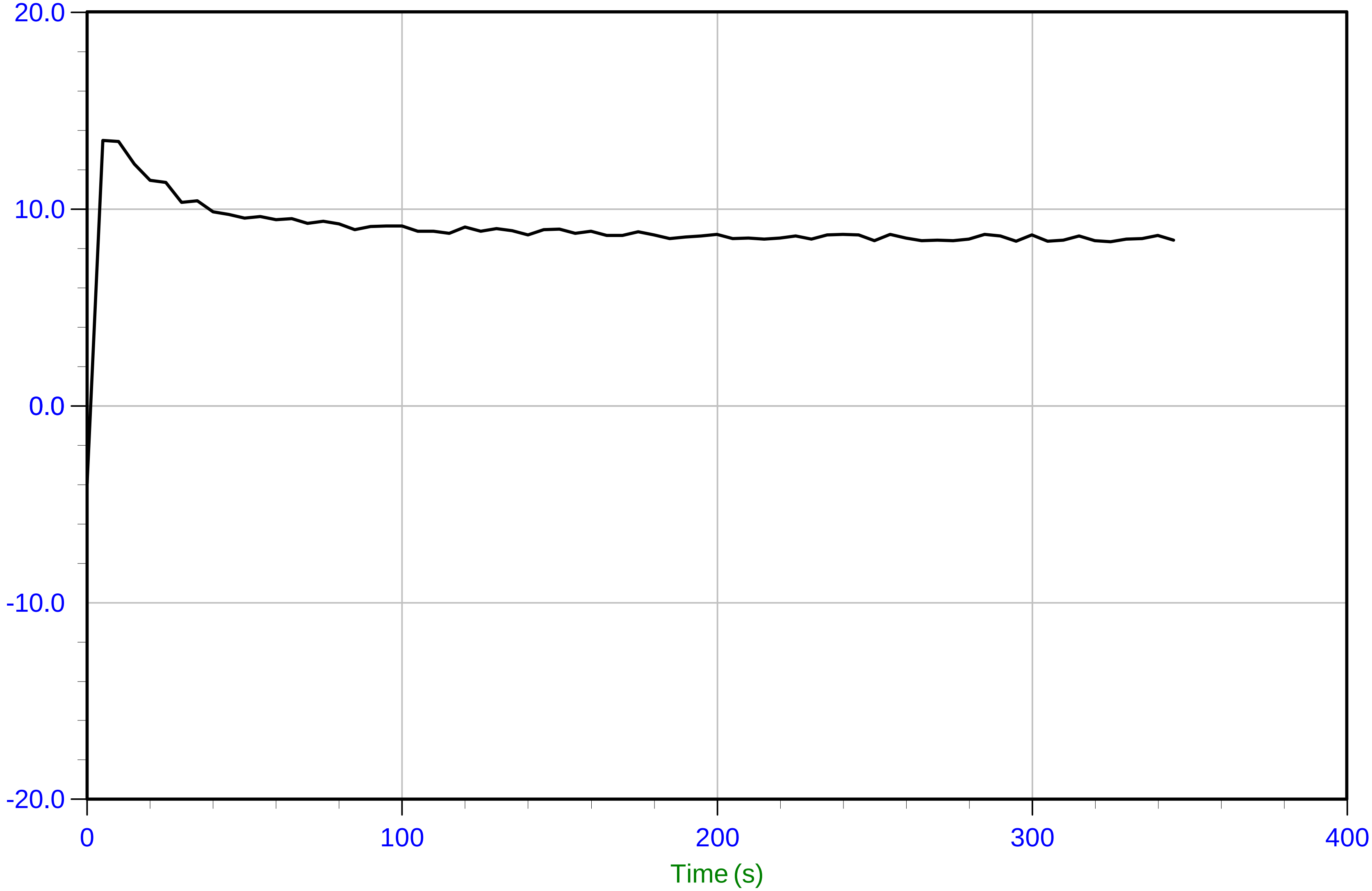
Filename: 15-56025_CP10off.PPF
Depth: 5.025 m / 16.486 ft
Duration: 585.0 s

U Min: 2.6 psi
U Max: 9.9 psi

WT: 1.136 m / 3.727 ft
Ueq: 5.5 psi

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.	Job No: 15-56025	Sounding: CPT-20L
	Date: 11/19/2015 10:50	Cone: 447:T1500F15U500
	Site: Jacobs Avenue Levee	Cone Area: 15 sq cm



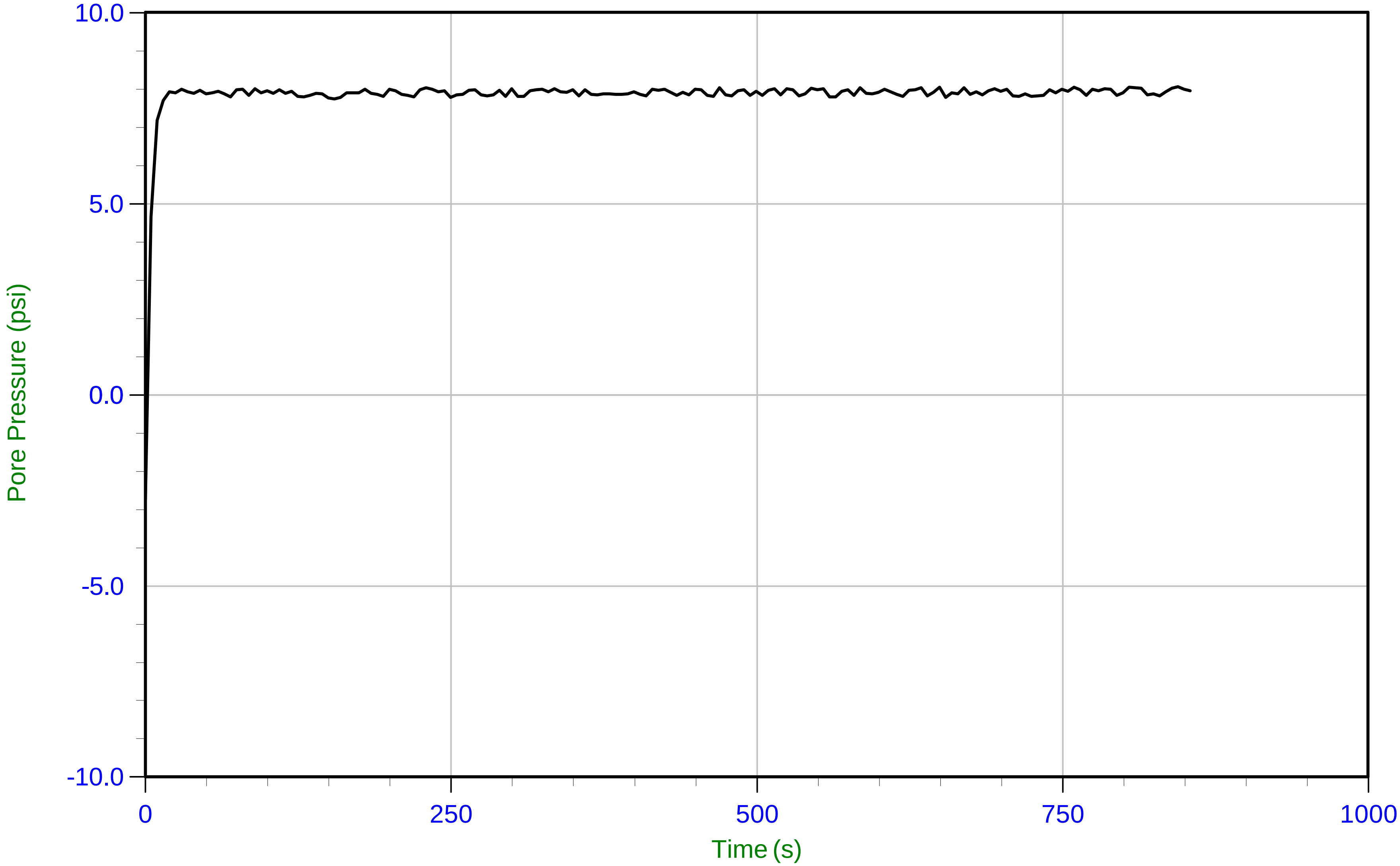
Trace Summary:

Filename: 15-56025_CP20L.PPF	U Min: -4.0 psi	WT: 0.605 m / 1.985 ft
Depth: 6.575 m / 21.571 ft	U Max: 13.5 psi	Ueq: 8.5 psi
Duration: 345.0 s		

CGI Technical Services Inc.

Job No: 15-56025
Date: 11/20/2015 12:07
Site: Jacobs Avenue Levee

Sounding: CPT-30C
Cone: 447:T1500F15U500
Cone Area: 15 sq cm



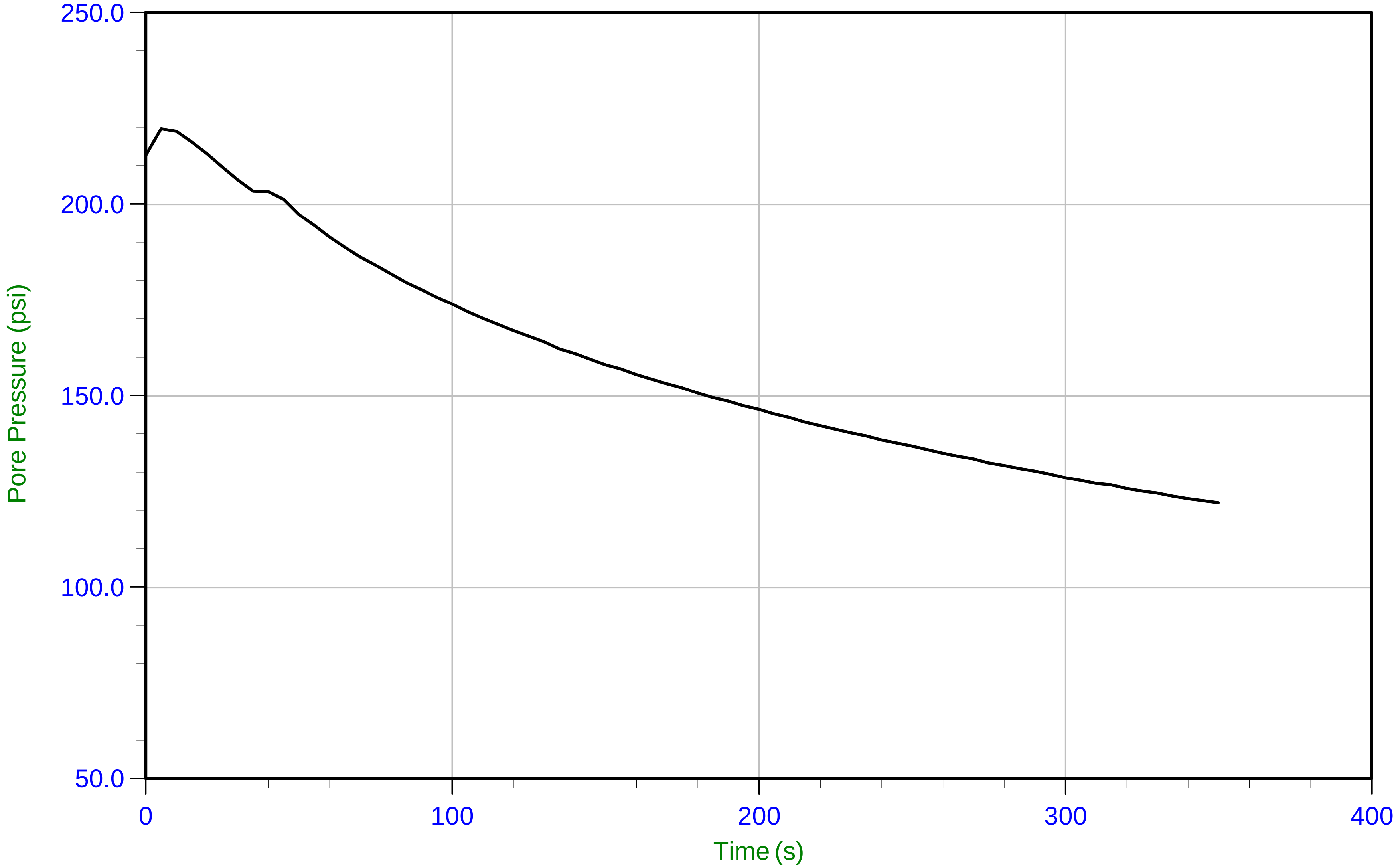
Trace Summary:

Filename: 15-56025_CP30C.PPF
Depth: 7.975 m / 26.164 ft
Duration: 855.0 s

U Min: -2.7 psi
U Max: 8.1 psi

WT: 2.397 m / 7.864 ft
Ueq: 7.9 psi

CGI Technical Services Inc.	Job No: 15-56025	Sounding: CPT-30C
	Date: 11/20/2015 12:07	Cone: 447:T1500F15U500
	Site: Jacobs Avenue Levee	Cone Area: 15 sq cm



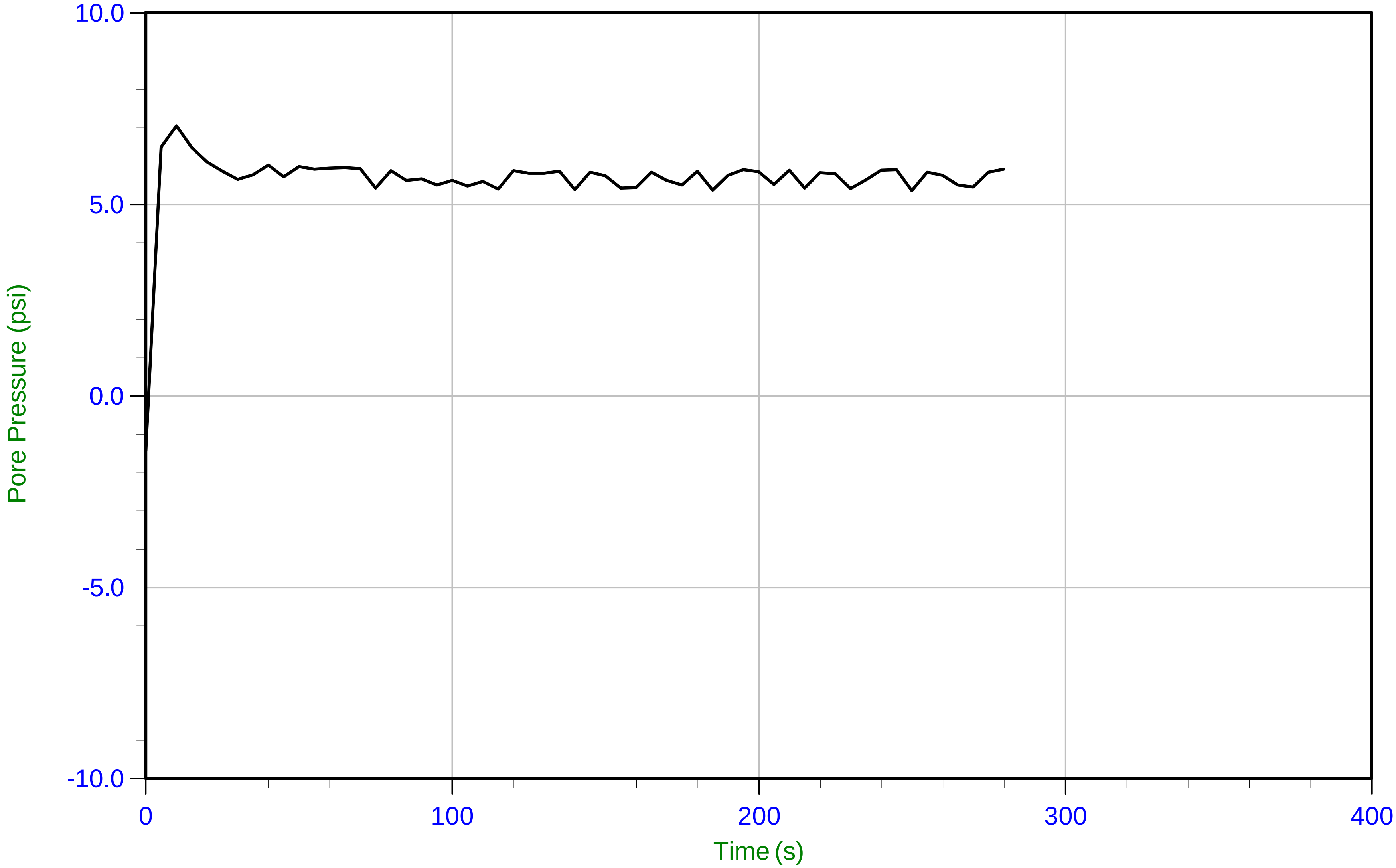
Trace Summary:

Filename: 15-56025_CP30C.PPF
Depth: 17.475 m / 57.332 ft
Duration: 350.0 s

U Min: 122.1 psi
U Max: 219.6 psi

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.	Job No: 15-56025	Sounding: CPT-30off
	Date: 11/19/2015 12:04	Cone: 447:T1500F15U500
	Site: Jacobs Avenue Levee	Cone Area: 15 sq cm



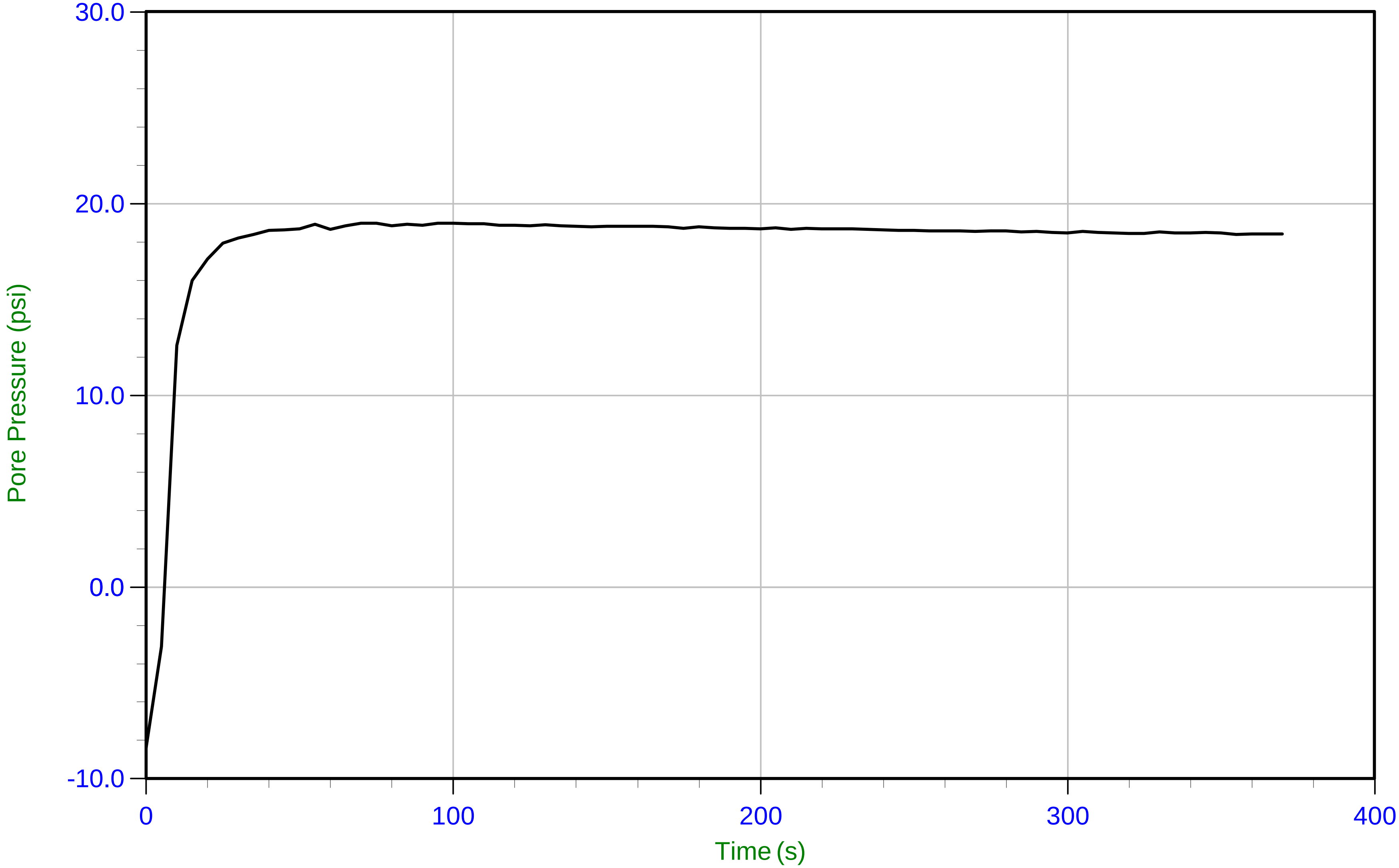
Trace Summary:

Filename: 15-56025_CP30off.PPF	U Min: -1.5 psi	WT: 0.533 m / 1.749 ft
Depth: 4.500 m / 14.764 ft	U Max: 7.0 psi	Ueq: 5.6 psi
Duration: 280.0 s		

CGI Technical Services Inc.

Job No: 15-56025
Date: 11/20/2015 07:55
Site: Jacobs Avenue Levee

Sounding: CPT-42L
Cone: 447:T1500F15U500
Cone Area: 15 sq cm



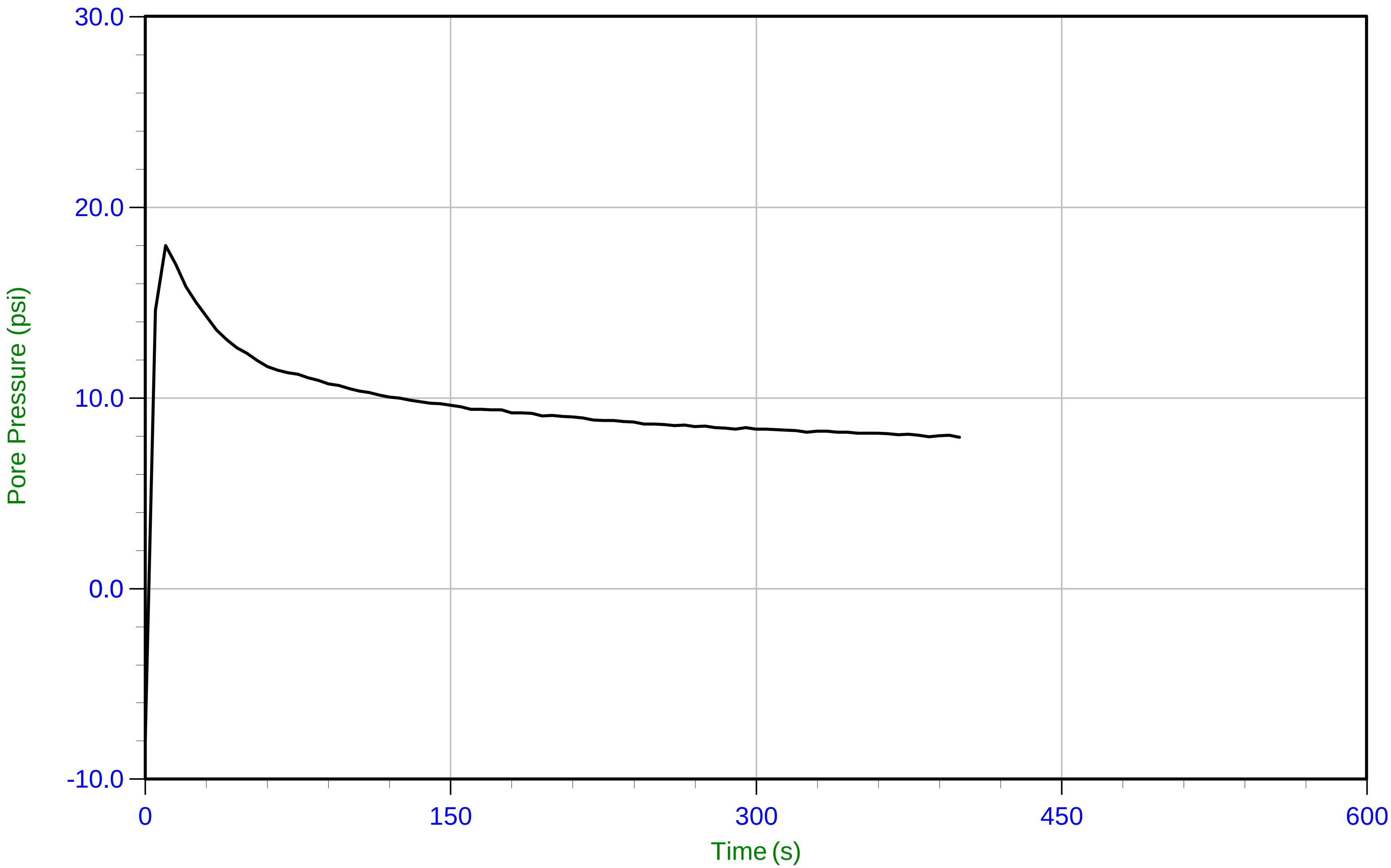
Trace Summary:

Filename: 15-56025_CP42L.PPF
Depth: 11.950 m / 39.206 ft
Duration: 370.0 s

U Min: -8.4 psi
U Max: 19.0 psi

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.	Job No: 15-56025 Date: 11/20/2015 09:36 Site: Jacobs Avenue Levee	Sounding: CPT-42off Cone: 447:T1500F15U500 Cone Area: 15 sq cm



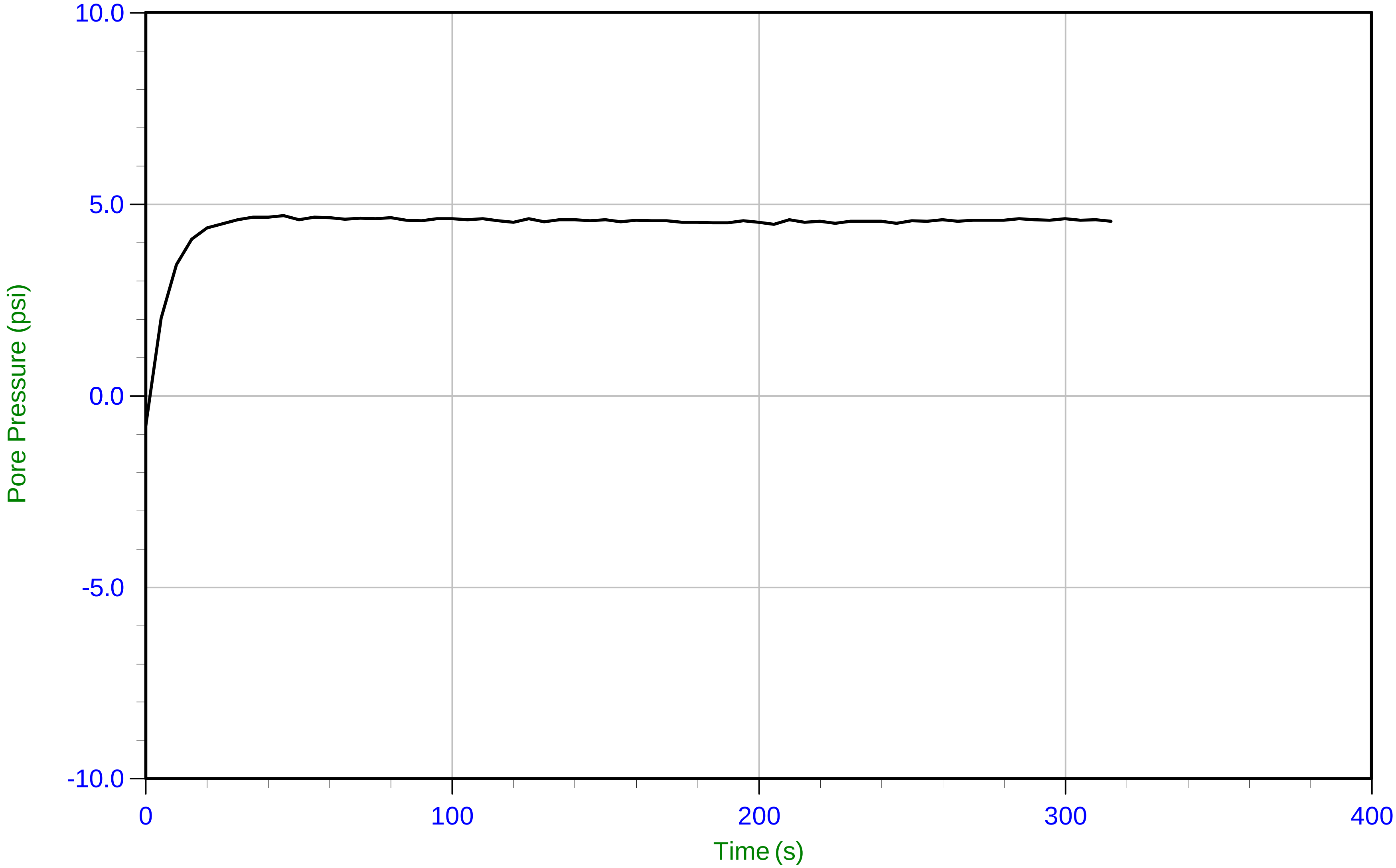
Trace Summary:

Filename: 15-56025_CP42off.PPF
Depth: 5.100 m / 16.732 ft
Duration: 400.0 s

U Min: -7.9 psi
U Max: 18.0 psi

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.	Job No: 15-56025 Date: 11/21/2015 09:36 Site: Jacobs Avenue Levee	Sounding: CPT-56C Cone: 447:T1500F15U500 Cone Area: 15 sq cm



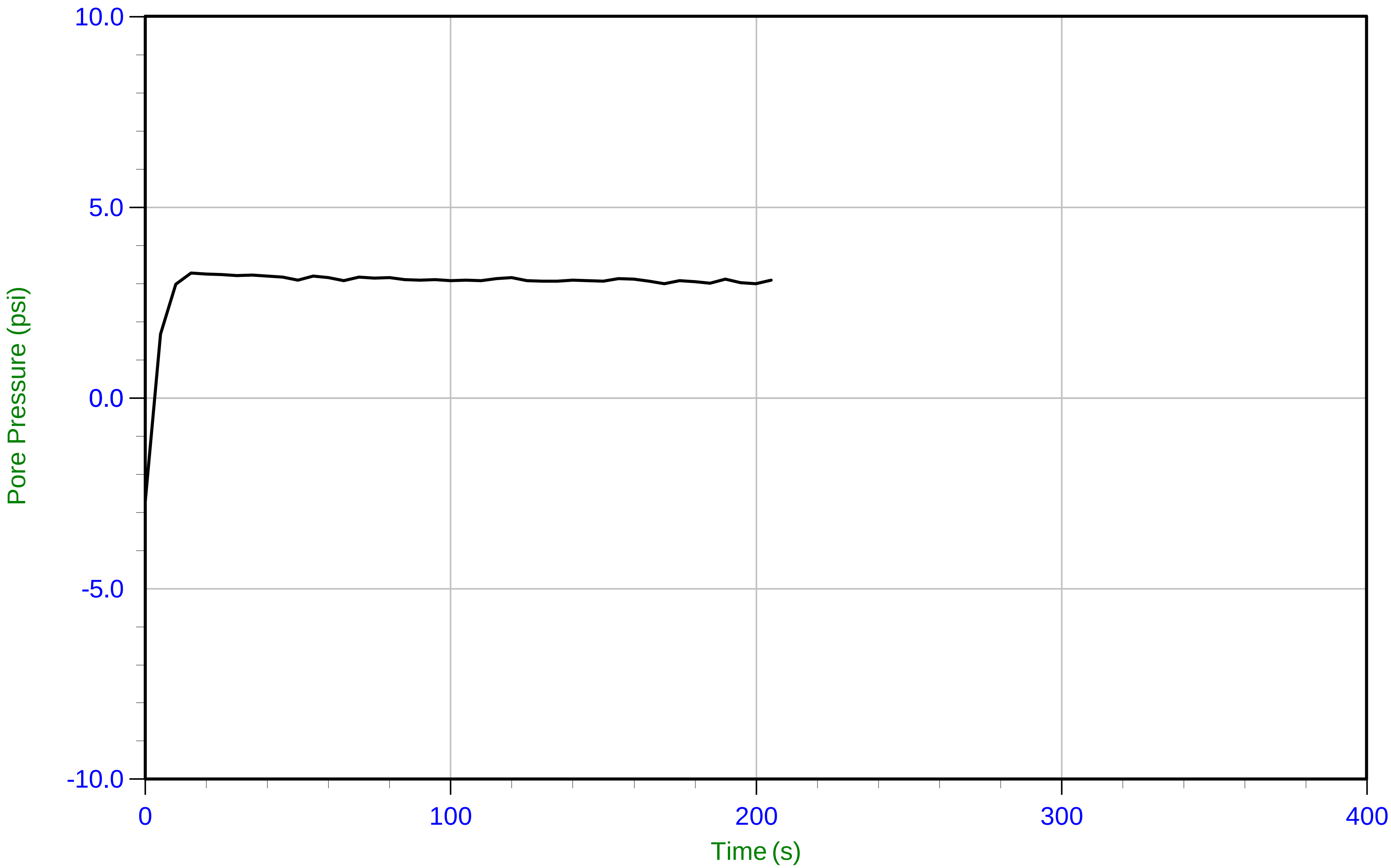
Trace Summary:

Filename: 15-56025_CP56C.PPF	U Min: -0.8 psi	WT: 0.549 m / 1.801 ft
Depth: 3.775 m / 12.385 ft	U Max: 4.7 psi	Ueq: 4.6 psi
Duration: 315.0 s		

CGI Technical Services Inc.

Job No: 15-56025
Date: 11/20/2015 10:53
Site: Jacobs Avenue Levee

Sounding: CPT-56L
Cone: 447:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-56025_CP56L.PPF
Depth: 3.000 m / 9.842 ft
Duration: 205.0 s

U Min: -2.7 psi
U Max: 3.3 psi

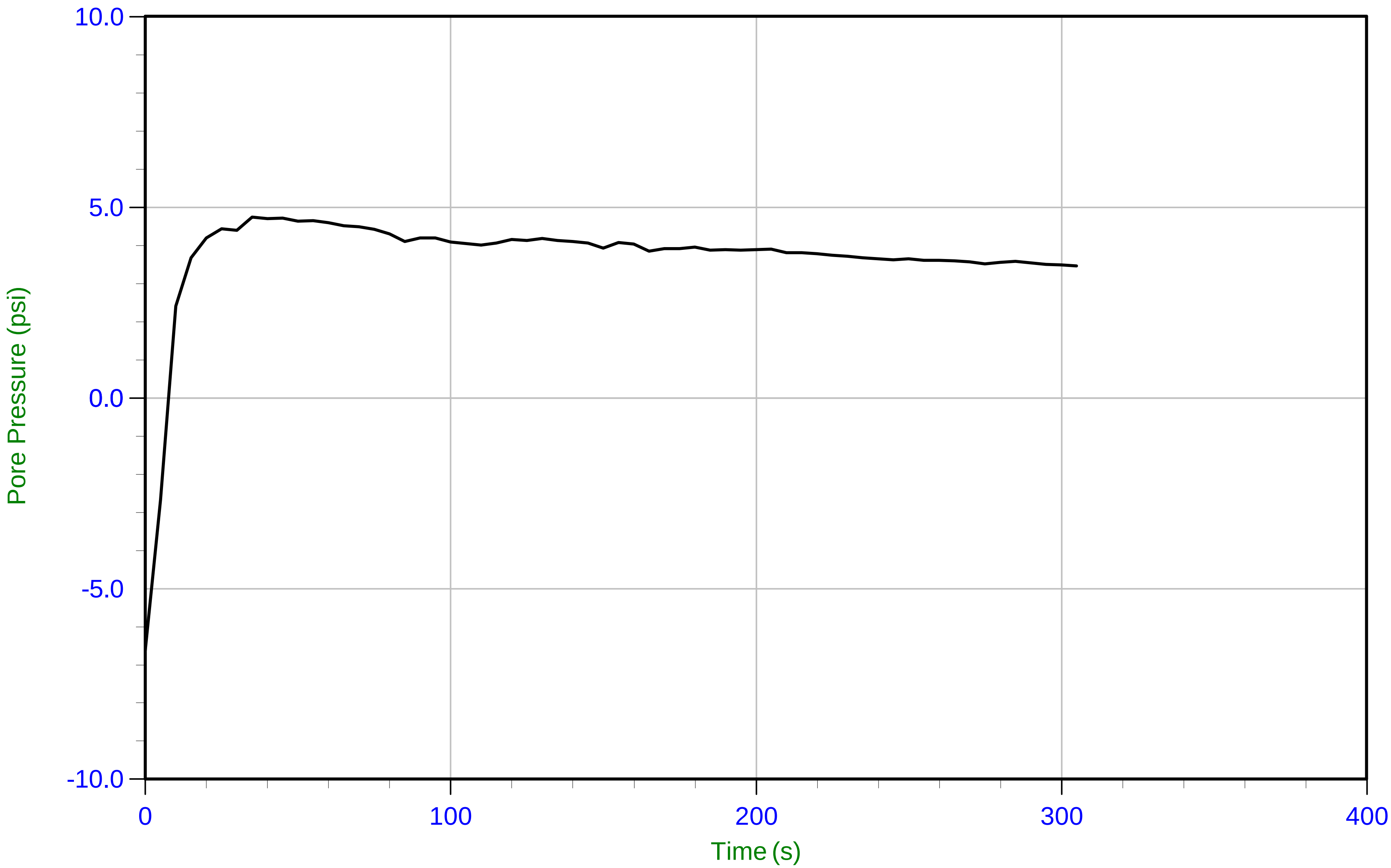
WT: 0.879 m / 2.884 ft
Ueq: 3.0 psi

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

CGI Technical Services Inc.

Job No: 15-56025
Date: 11/21/2015 12:10
Site: Jacobs Avenue Levee

Sounding: CPT-56W
Cone: 447:T1500F15U500
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-56025_CP56W.PPF
Depth: 1.750 m / 5.741 ft
Duration: 305.0 s

U Min: -6.6 psi
U Max: 4.7 psi

Appendix C

Laboratory Testing

APPENDIX C
LABORATORY TESTING

Laboratory Analyses

Laboratory tests were performed on selected bulk soil samples to estimate engineering characteristics of the various earth materials encountered. Testing was performed under procedures described in one of the following references:

- ASTM Standards for Soil Testing, latest revision;
- Lambe, T. William, Soil Testing for Engineers, Wiley, New York, 1951;
- Laboratory Soils Testing, U.S. Army, Office of the Chief of Engineers, Engineering Manual No. 1110-2-1906, November 30, 1970.

Plasticity Index Tests

Atterberg Limits (plastic limit, liquid limit, and plasticity index) tests were performed on nine selected samples in accordance with standard test method ASTM D4318. The results of the test tests are presented on the drill hole log and attached to this appendix.

Grain Size Distribution

Grain size distribution was determined for 28 selected soil samples in accordance with standard test method ASTM D422. The grain size distribution data are attached to this appendix.

In Situ Moisture Density Relations

Dry density estimates and/or moisture content evaluations were performed on selected soil samples collected during this study. Tests were performed using standard test methods ASTM D2216 for moisture content or ASTM D2937 for dry unit weights. The results are presented on the Log of Drill Hole.

Moisture Density Relations

The compaction characteristics of one selected bulk soil sample was estimated in accordance with standard test method ASTM D1557. The results of the compaction test are attached to this appendix.

Consolidation

Two consolidation tests were performed on selected relatively undisturbed samples of soils using standard test method ASTM D2435. The results of the tests are attached to this appendix.

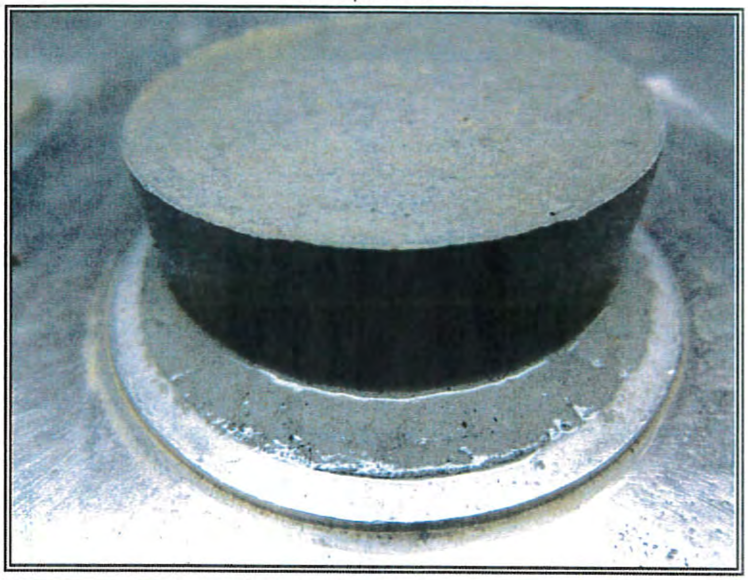
Direct Shear

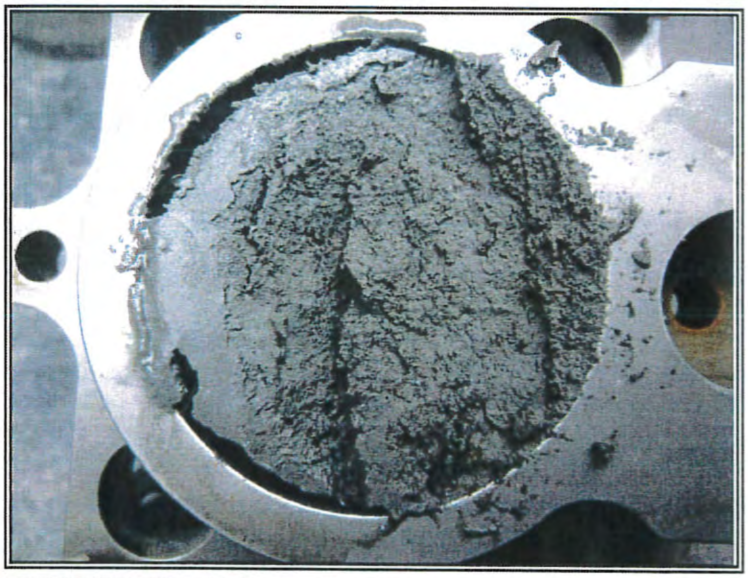
Five direct shear tests were performed on selected relatively undisturbed samples using standard test method ASTM D3080. The results of the tests are attached to this appendix.

Permeability

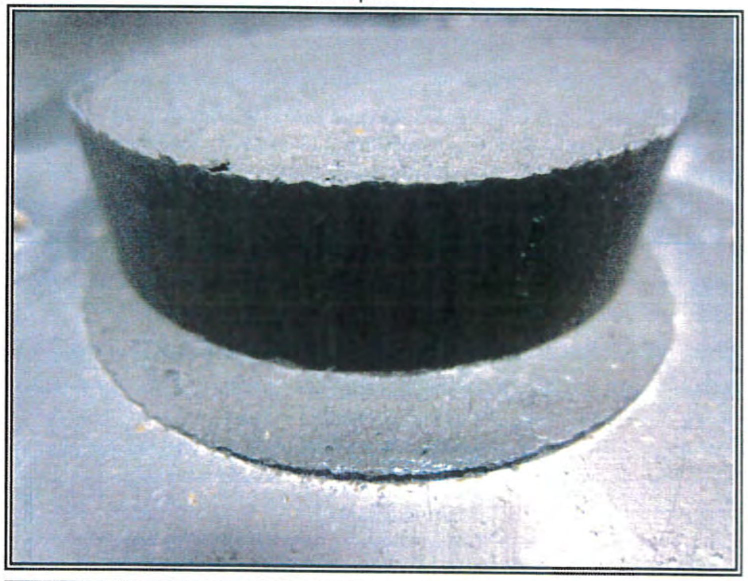
Three permeability tests were performed on selected samples using standard test method ASTM D5084. The results of the tests are attached to this appendix.

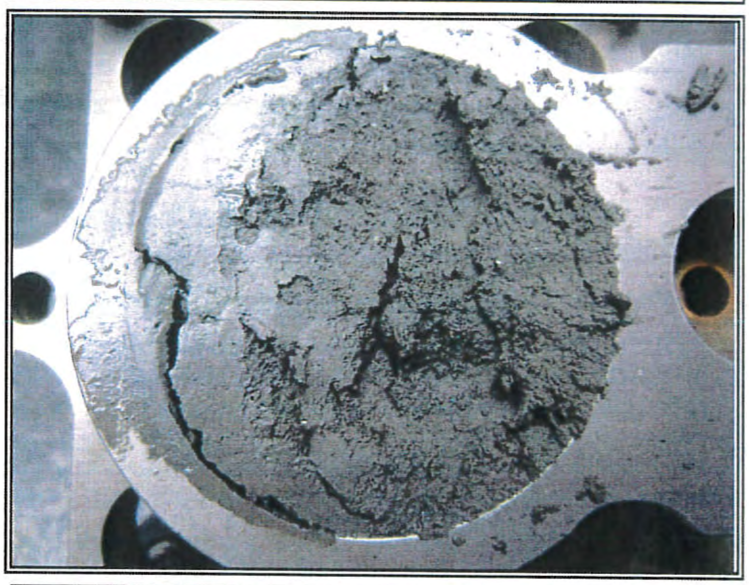
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 10L-3a
Test Specimen A

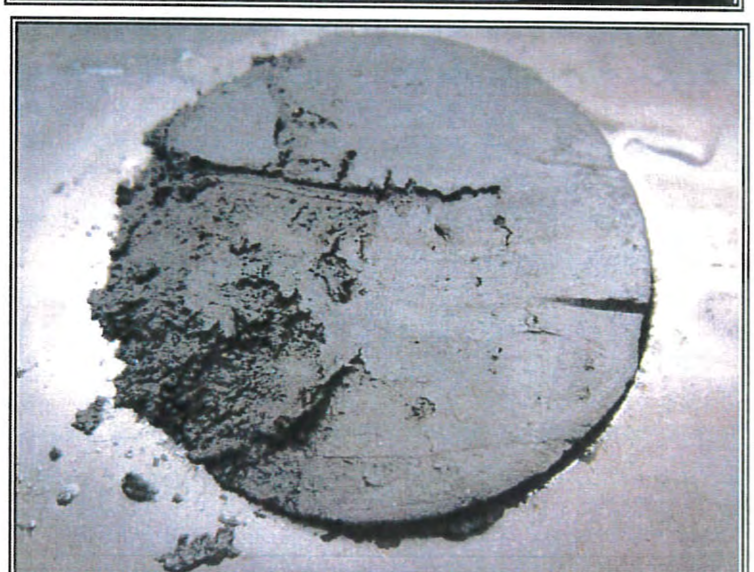




DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 10L-3a
Test Specimen B

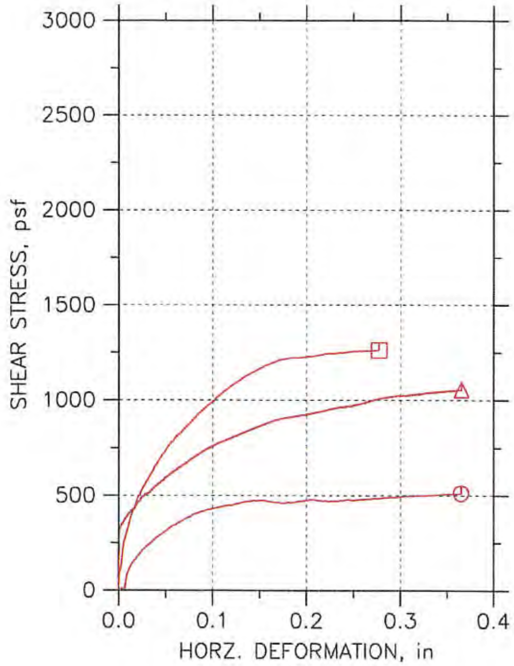


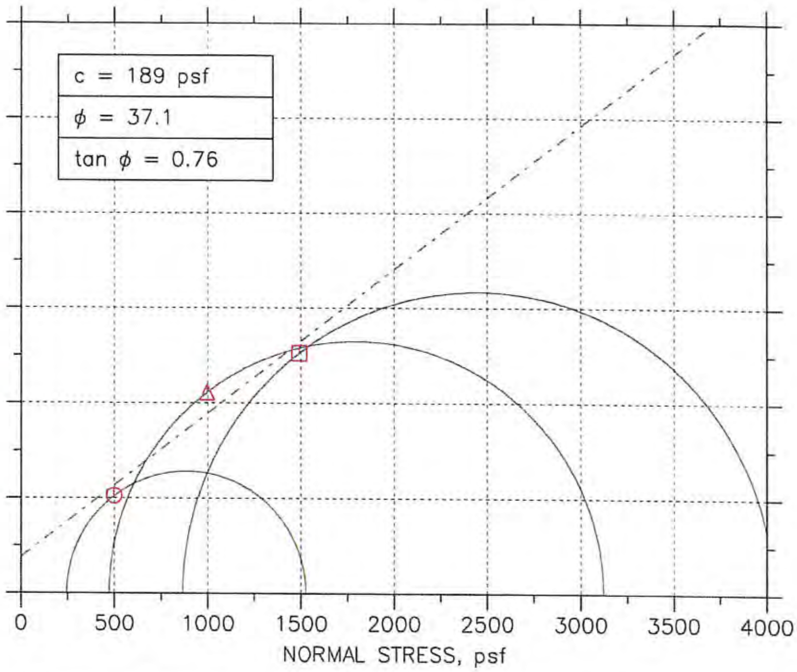


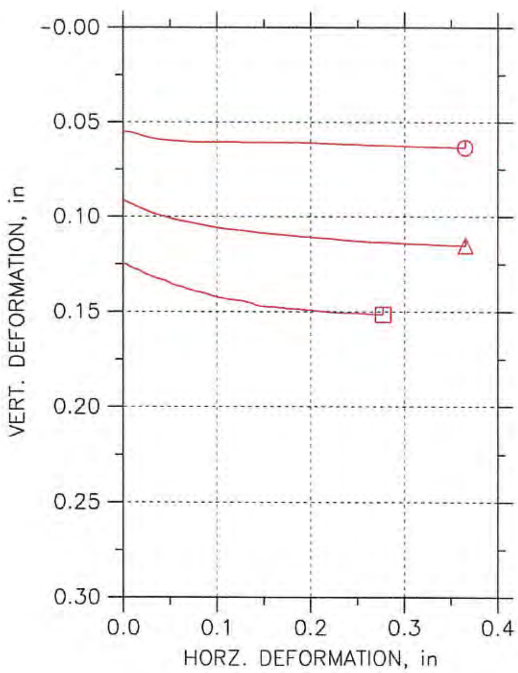


DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 10L-3a
Test Specimen C

DIRECT SHEAR TEST REPORT





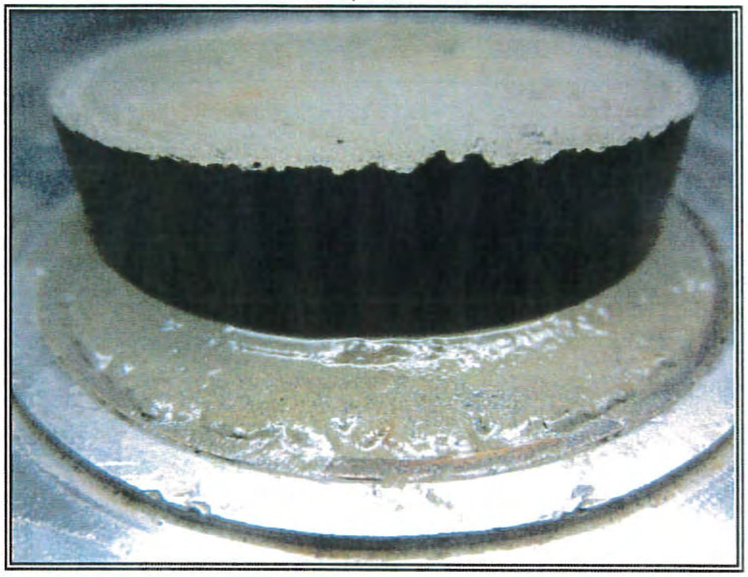


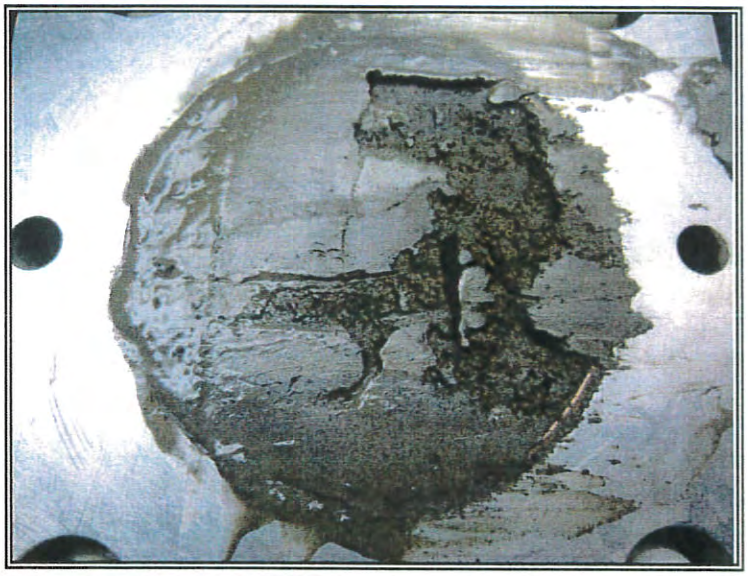
Symbol		⊙	△	⊡	
Test No.		DS16-15A	DS16-15B	DS16-15C	
Sample No.		2	2	2	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.375	2.375	2.375	
	Area, in^2	4.4301	4.4301	4.4301	
	Height, in	1.014	1.011	0.99	
	Water Content, %	34.71	40.05	41.02	
	Dry Density, pcf	86.985	80.974	79.565	
	Saturation, %	99.93	99.98	99.01	
	Void Ratio	0.93776	1.0816	1.1185	
Consol. Height, in		0.96231	0.92006	0.87577	
Consol. Void Ratio		0.83898	0.89435	0.87403	
Final	Water Content, %	30.13	30.46	28.71	
	Dry Density, pcf	92.815	91.421	93.974	
	Saturation, %	99.68	97.48	97.68	
	Void Ratio	0.81604	0.84373	0.79364	
Normal Stress, psf		498.98	996.71	1493.2	
Max. Shear Stress, psf		510.56	1055.6	1263.3	
Ult. Shear Stress, psf		510.56	1055.6	1263.3	
Time to Failure, min		181.58	180.99	154.76	
Disp. Rate, in/min		0.002	0.002	0.002	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

Project: Jacobs Avenue Levee
Location:
Project No.: 01-0F2703
Boring No.: 30C
Sample Type:
Description: Moist, Light Gray with Light Brown, Firm, Silty Clay with Organics and Voids.
Remarks: ASTM D 3080. Sample description is not a soil classification.

Thu, 28-APR-2016 16:52:03

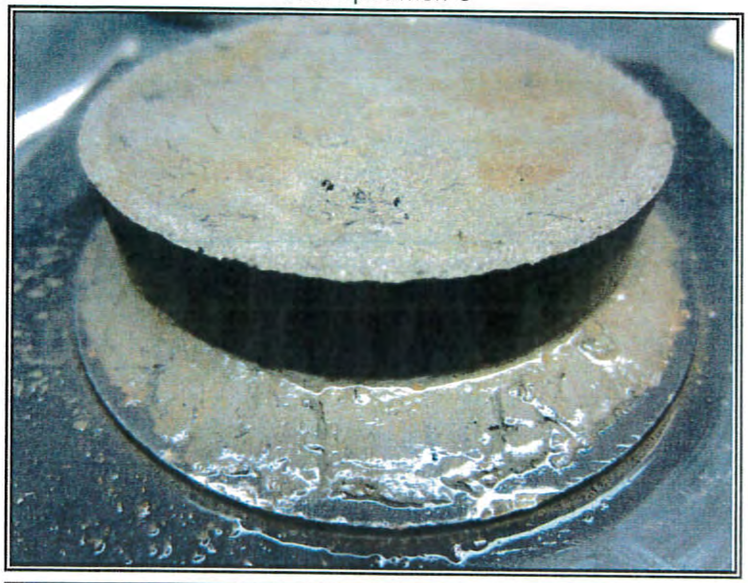
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_2
Test Specimen A

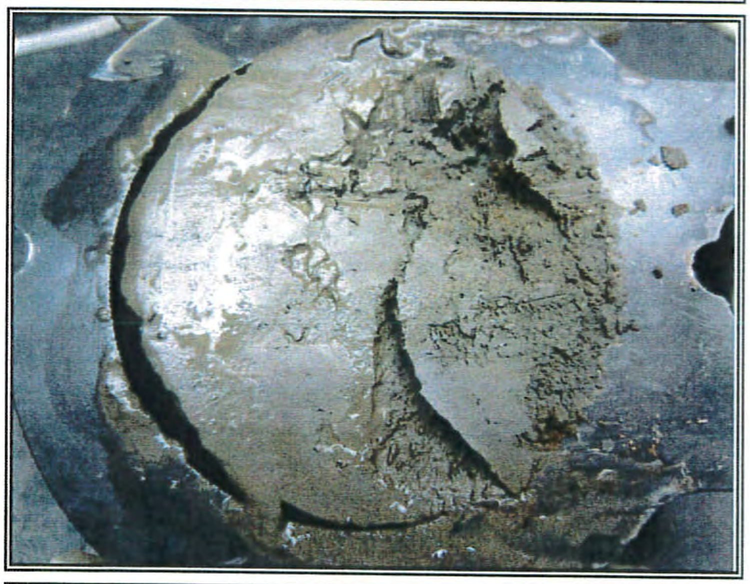




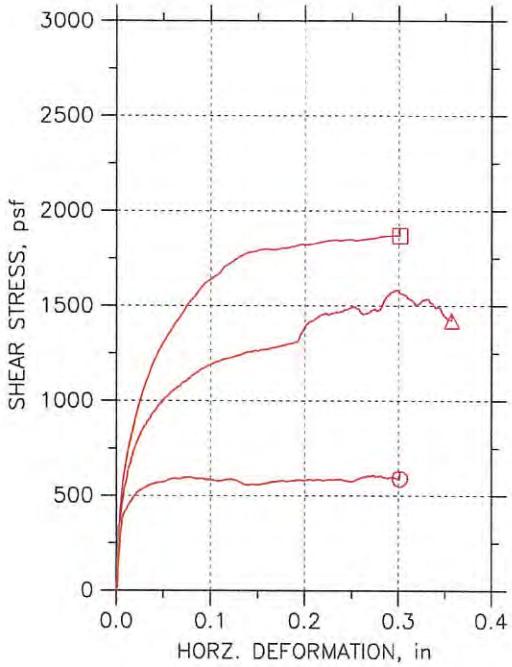
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_2
Test Specimen B

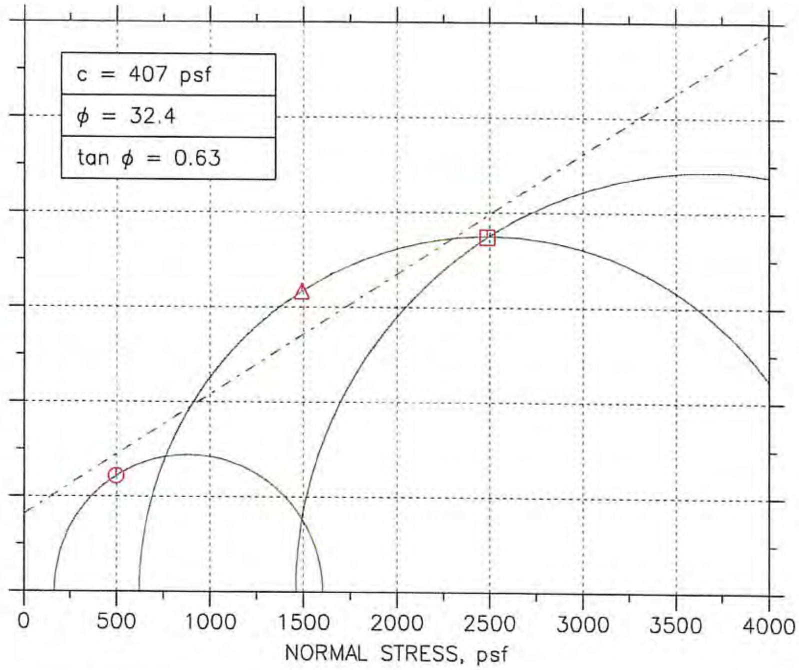
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_2
Test Specimen C

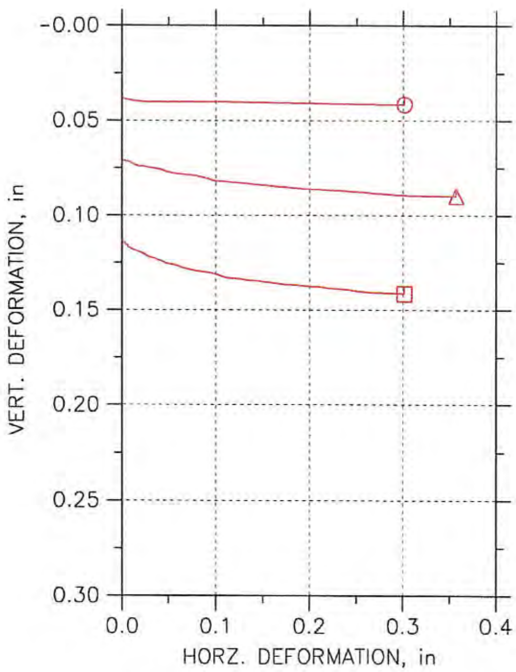




DIRECT SHEAR TEST REPORT







	Symbol	○	△	□	
	Test No.	DS16-16A	DS16-16B	DS16-16C	
	Sample No.	3-a	3-a	3-a	
	Shape	Circular	Circular	Circular	
Initial	Dimension, in	1.944	1.944	1.944	
Initial	Area, in^2	2.9681	2.9681	2.9681	
Initial	Height, in	1.016	1.003	1.004	
Initial	Water Content, %	40.40	38.98	40.44	
Initial	Dry Density, pcf	80.572	82.103	80.513	
Initial	Saturation, %	99.90	99.95	99.85	
Initial	Void Ratio	1.092	1.053	1.0935	
	Consol. Height, in	0.98068	0.93827	0.89291	
	Consol. Void Ratio	1.0193	0.92048	0.86188	
Final	Water Content, %	37.16	32.12	29.49	
Final	Dry Density, pcf	84.035	90.216	93.728	
Final	Saturation, %	99.75	99.88	99.72	
Final	Void Ratio	1.0058	0.86834	0.79835	
	Normal Stress, psf	497.44	1491.9	2487.4	
	Max. Shear Stress, psf	607.51	1582.4	1869.9	
	Ult. Shear Stress, psf	588.86	1421.7	1868.6	
	Time to Failure, min	69.956	76.253	75.004	
	Disp. Rate, in/min	0.004	0.004	0.004	
	Implied Specific Gravity	2.70	2.70	2.70	
	Liquid Limit	---	---	---	
	Plastic Limit	---	---	---	
	Plasticity Index	---	---	---	

Project: Jacobs Avenue Levee

Location:

Project No.: 01-0F2703

Boring No.: 30C

Sample Type:

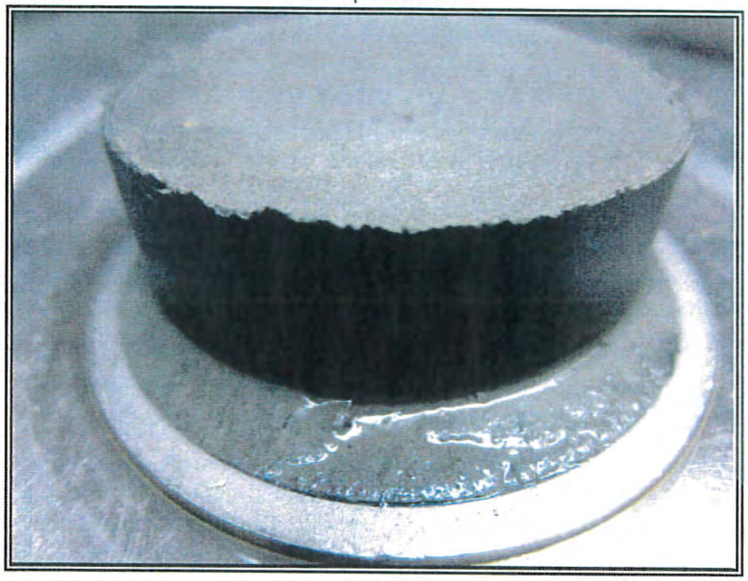
Description: Moist, Light Gray with Light Brown, Firm, Silty Clay with Organics and Voids.

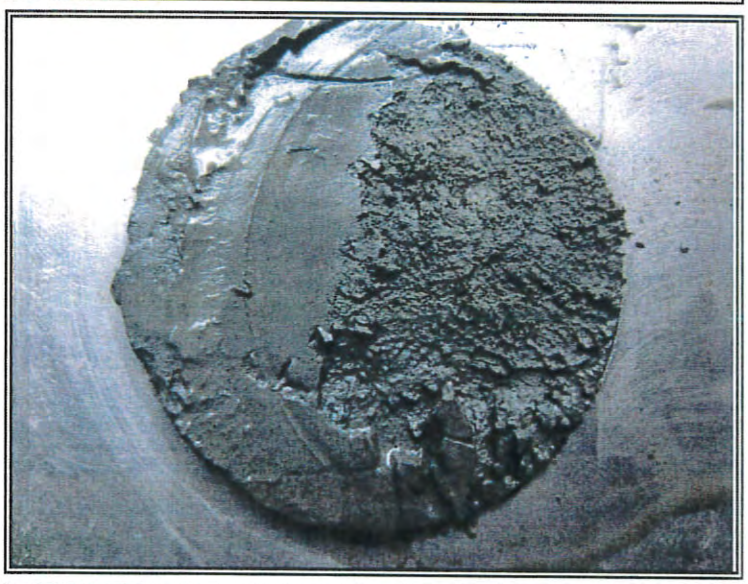
Remarks: ASTM D 3080. Sample description is not a soil classification.

5/2/16

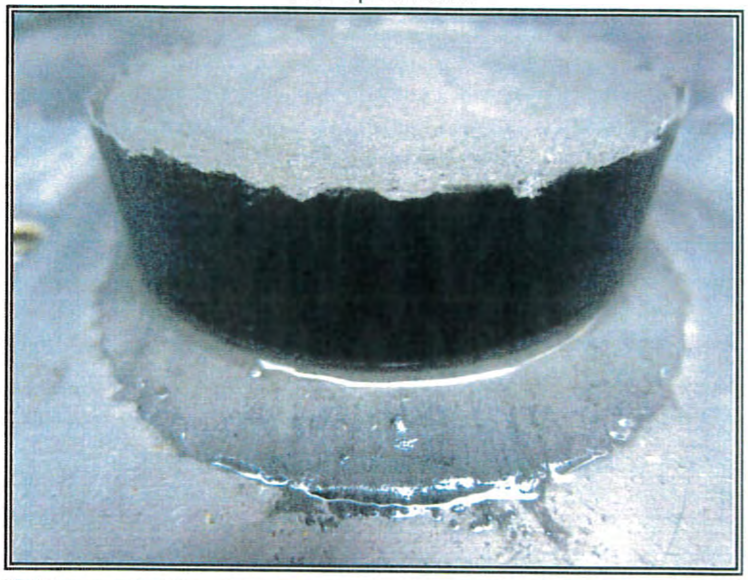
Thu, 28-APR-2016 16:54:03

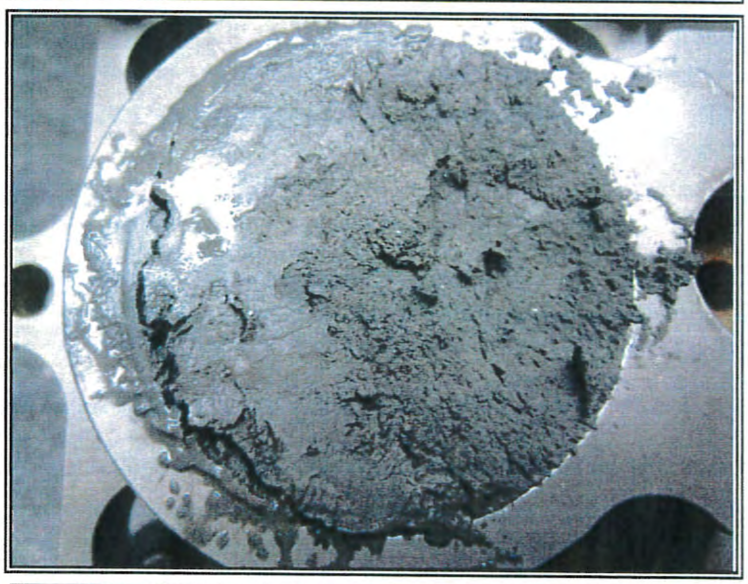
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_3-a
Test Specimen A



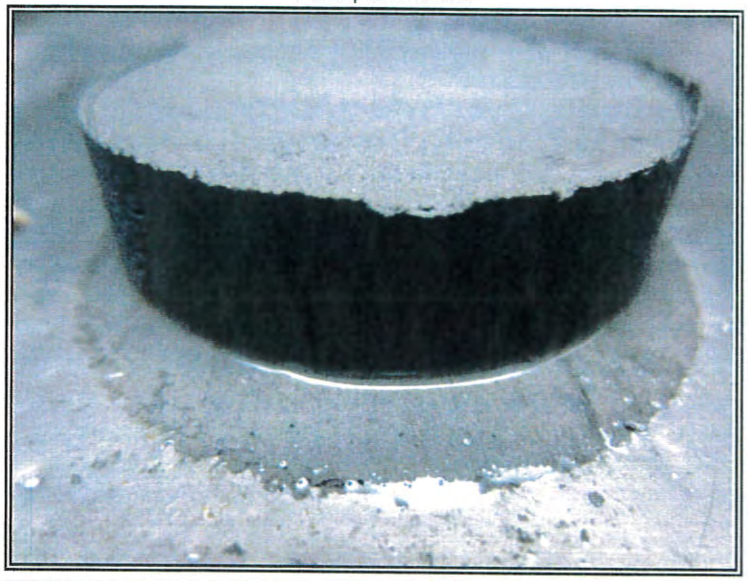


DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_3-a
Test Specimen B

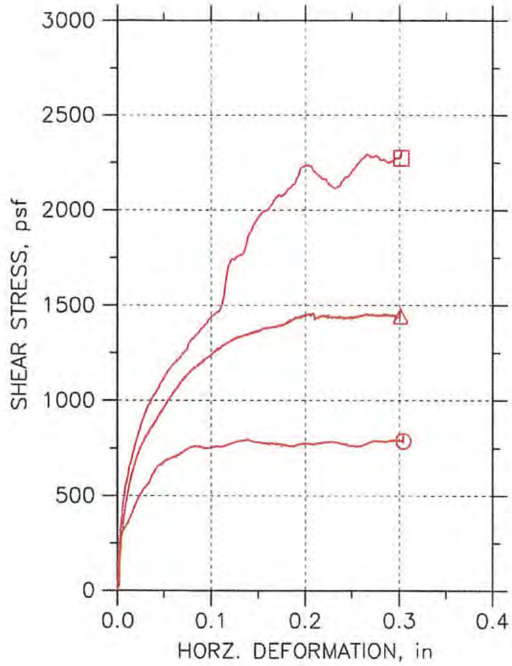


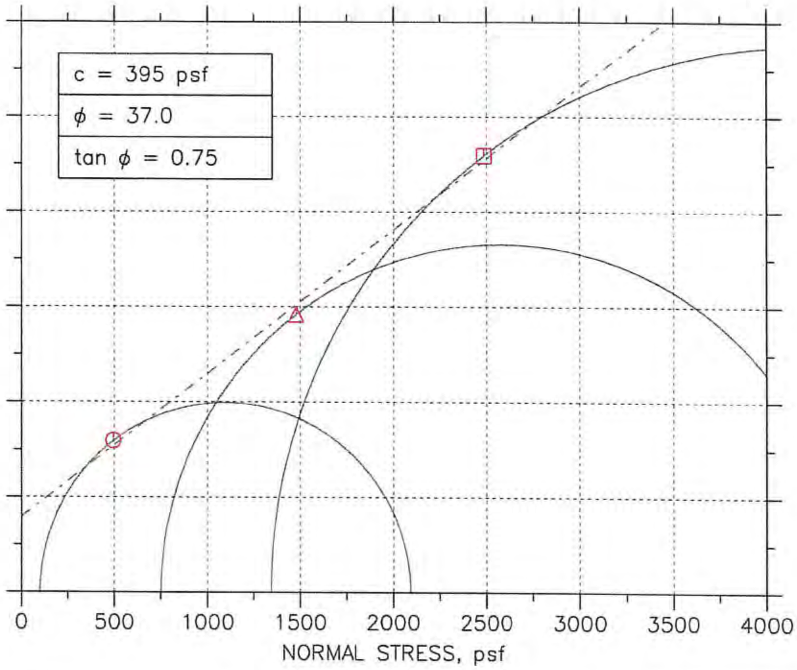


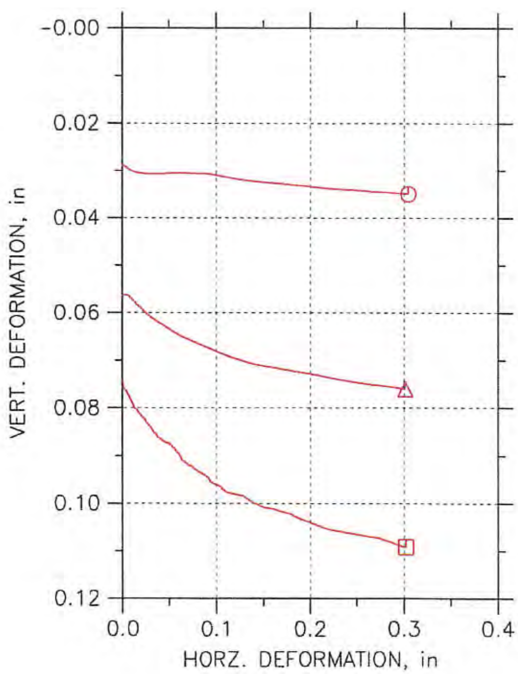
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_3-a
Test Specimen C



DIRECT SHEAR TEST REPORT







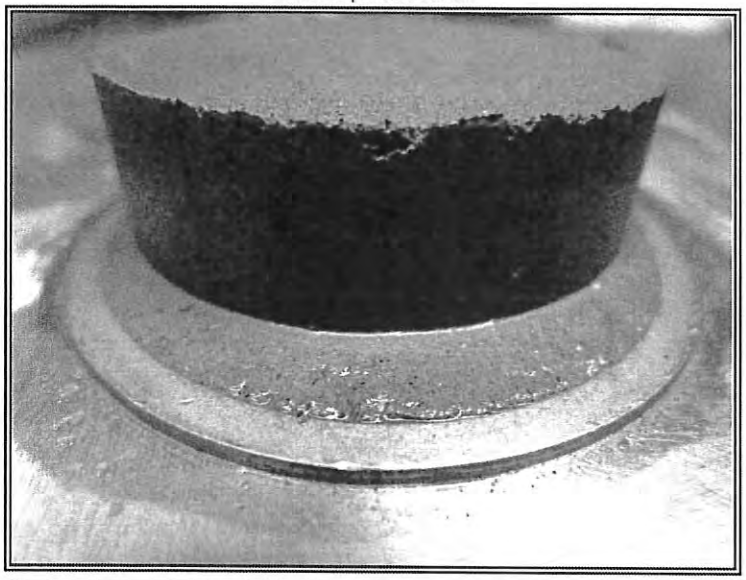
Symbol		○	△	□	
Test No.		DS16-17A	DS16-17B	DS16-17C	
Sample No.		4-a	4-a	4a	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	1.944	1.944	1.944	
	Area, in^2	2.9681	2.9681	2.9681	
	Height, in	1.013	1.003	1.009	
	Water Content, %	41.13	41.19	44.02	
	Dry Density, pcf	79.823	79.595	76.959	
	Saturation, %	99.89	99.50	99.85	
	Void Ratio	1.1116	1.1177	1.1902	
Consol. Height, in		0.98746	0.94738	0.93684	
Consol. Void Ratio		1.0584	1.0002	1.0336	
Final	Water Content, %	38.41	35.37	35.21	
	Dry Density, pcf	82.683	86.126	86.306	
	Saturation, %	99.86	99.78	99.75	
	Void Ratio	1.0386	0.95708	0.95299	
Normal Stress, psf		496.51	1479.3	2487.4	
Max. Shear Stress, psf		794.91	1459.3	2295.9	
Ult. Shear Stress, psf		785.14	1444.2	2275	
Time to Failure, min		70.14	107.31	133.95	
Disp. Rate, in/min		0.002	0.002	0.002	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

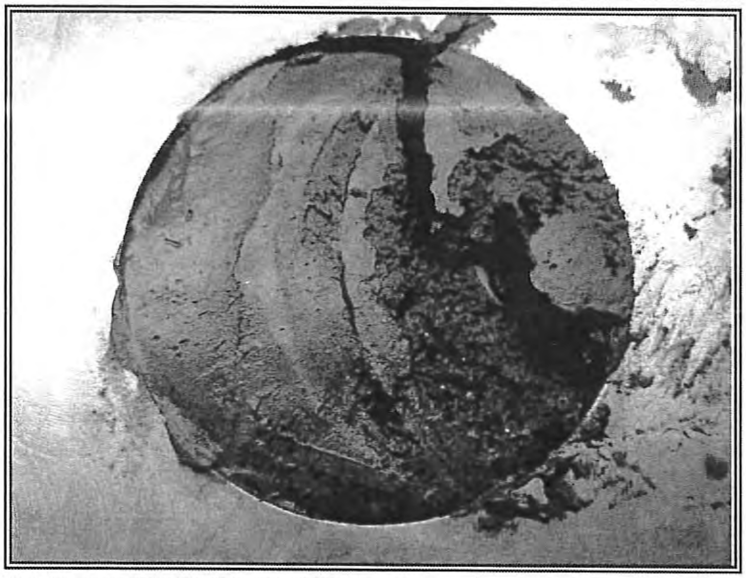
Project: Jacobs Avenue Levee
Location:
Project No.: 01-0F2703
Boring No.: 30C
Sample Type:
Description: Moist, Gray, Firm, Silty Clay.
Remarks: ASTM D 3080. Sample description is not a soil classification.

5/2/16

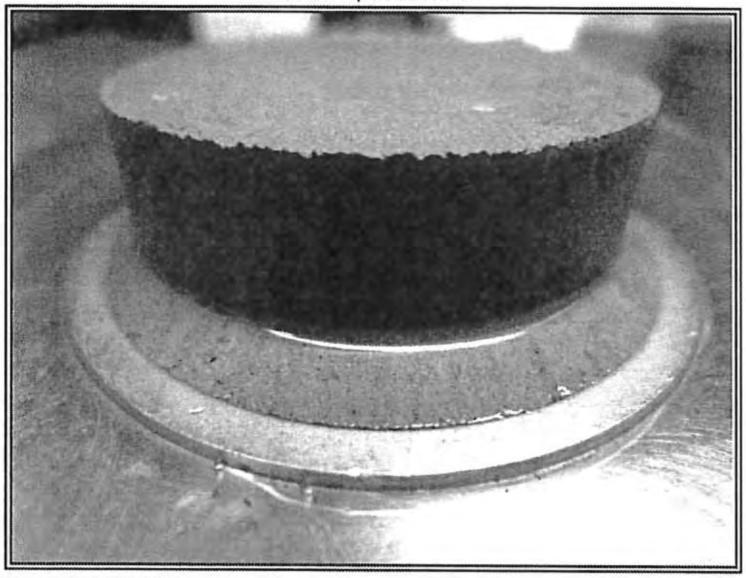
Thu, 28-APR-2016 16:55:05

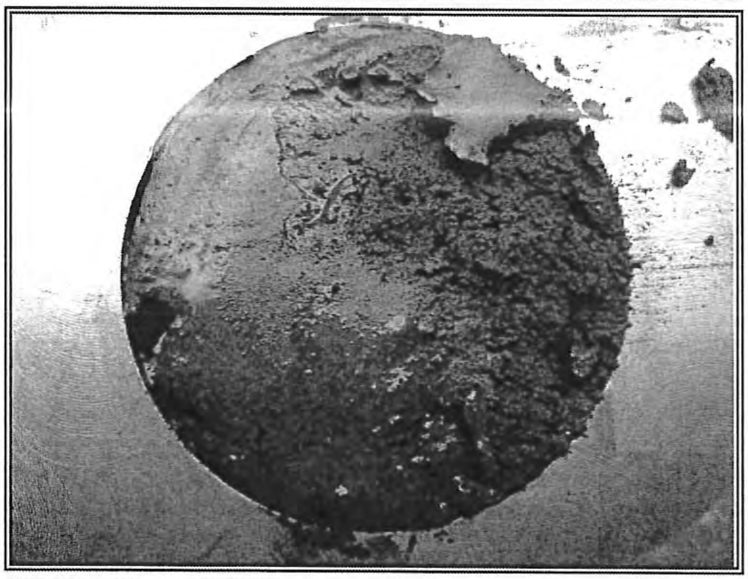
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_4-a
Test Specimen A

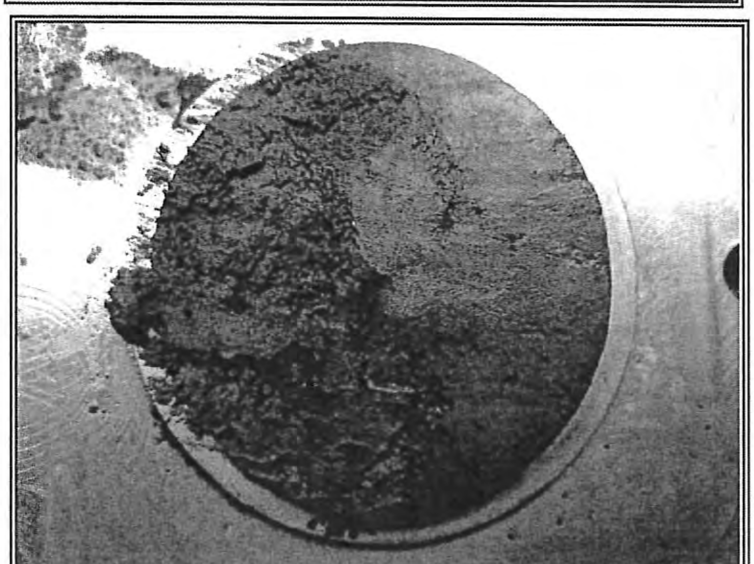




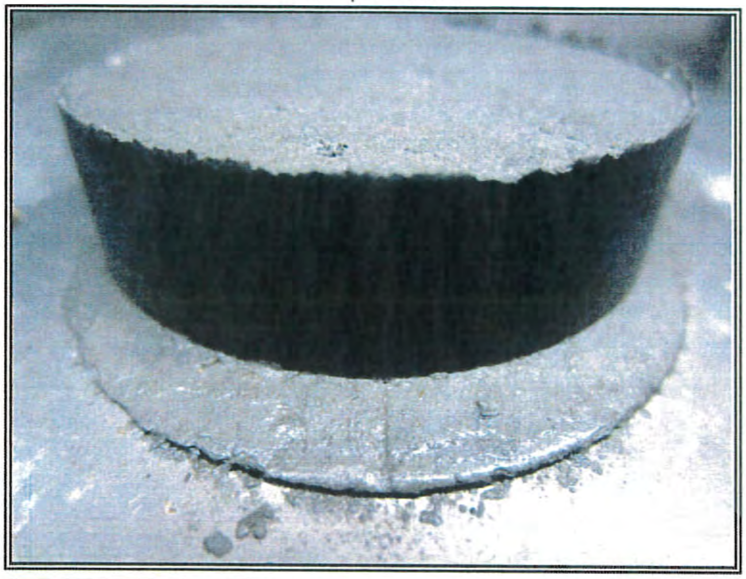
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_4-a
Test Specimen B

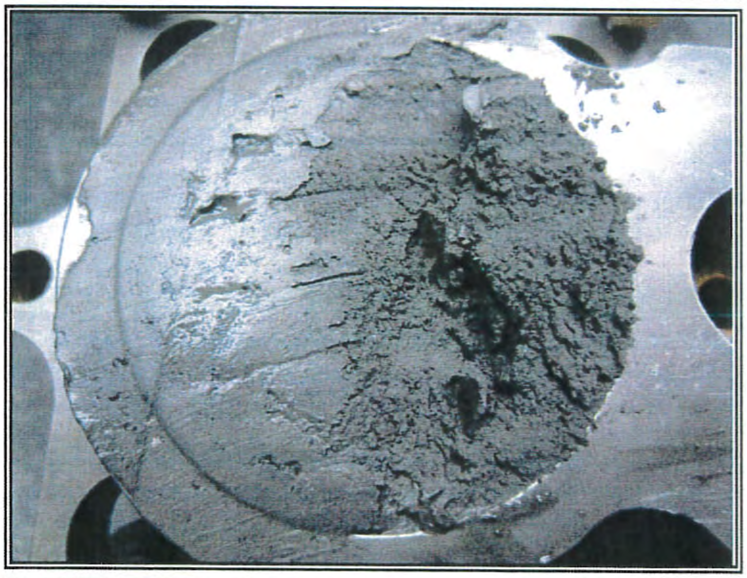




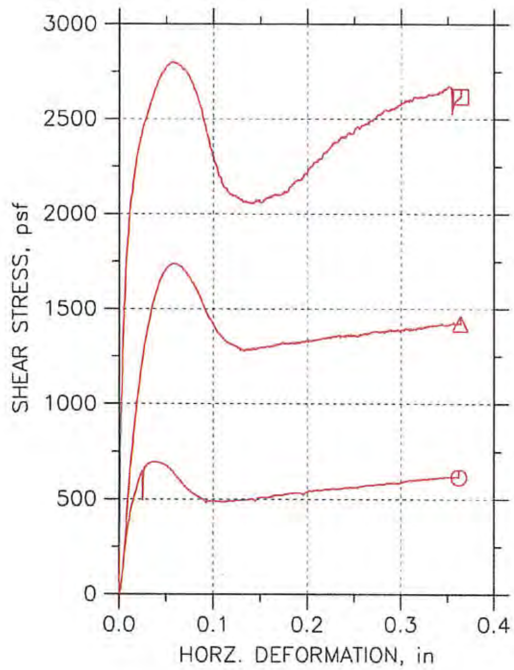


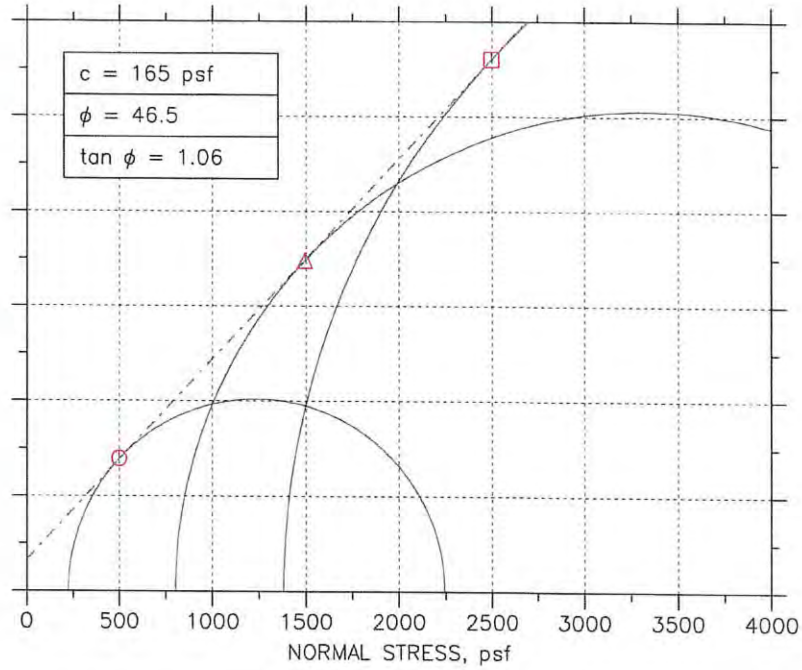
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 30C_4-a
Test Specimen C

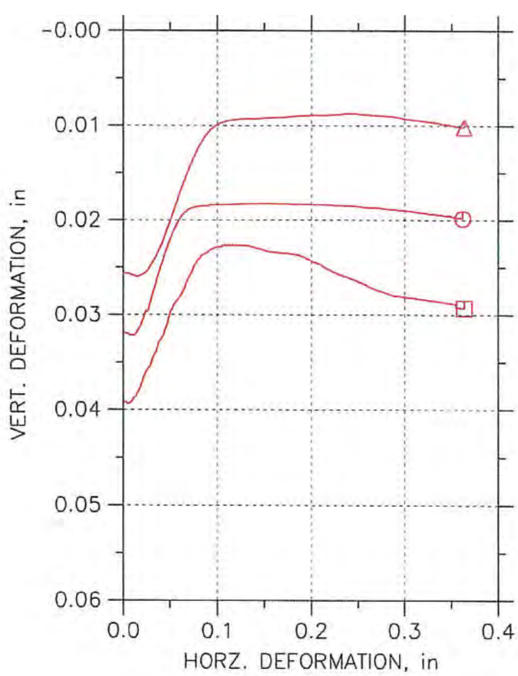




DIRECT SHEAR TEST REPORT





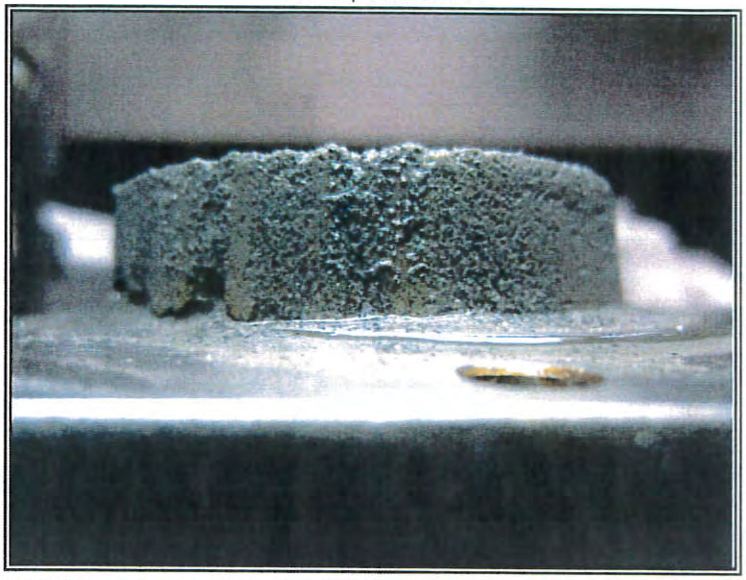


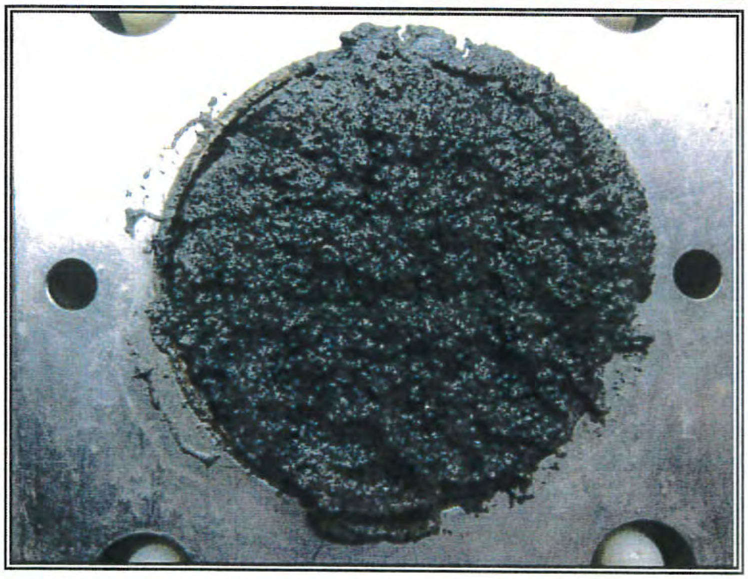
		○	△	□	
Symbol		○	△	□	
Test No.		DS16-18A	DS16-18B	DS16-18B	
Sample No.		6C	6C	6C	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.375	2.375	2.375	
	Area, in^2	4.4301	4.4301	4.4301	
	Height, in	1	1	1	
	Water Content, %	20.19	20.52	20.72	
	Dry Density, pcf	107.93	106.61	105.62	
	Saturation, %	97.04	95.36	93.90	
	Void Ratio	0.56172	0.58099	0.5958	
Consol. Height, in		0.97499	0.98039	0.96763	
Consol. Void Ratio		0.52266	0.55	0.54415	
Final	Water Content, %	19.59	20.67	20.32	
	Dry Density, pcf	110.12	107.71	108.81	
	Saturation, %	99.68	98.82	99.93	
	Void Ratio	0.53067	0.56484	0.54902	
Normal Stress, psf		500.23	1495.1	2496.3	
Max. Shear Stress, psf		694.43	1740	2800.6	
Ult. Shear Stress, psf		613.51	1422.2	2617.7	
Time to Failure, min		8.0632	10.076	10.304	
Disp. Rate, in/min		0.006	0.006	0.006	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

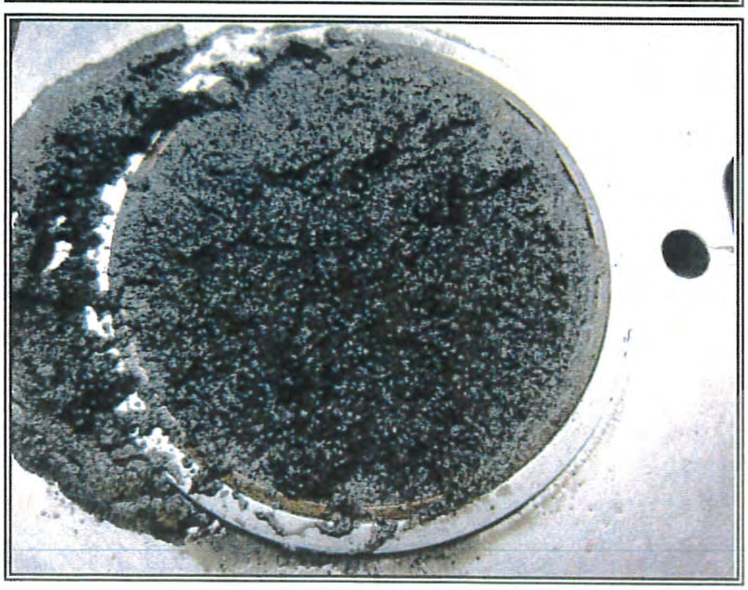
Project: Jacobs Avenue Levee	
Location:	
Project No.: 01-0F2703	
Boring No.: 56-off	
Sample Type:	
Description: Moist, Light Gray, Dense, Sand with Clay/Silt.	
Remarks: ASTM D 3080. Sample description is not a soil classification.	5/2/16

Fri, 29-APR-2016 12:53:10

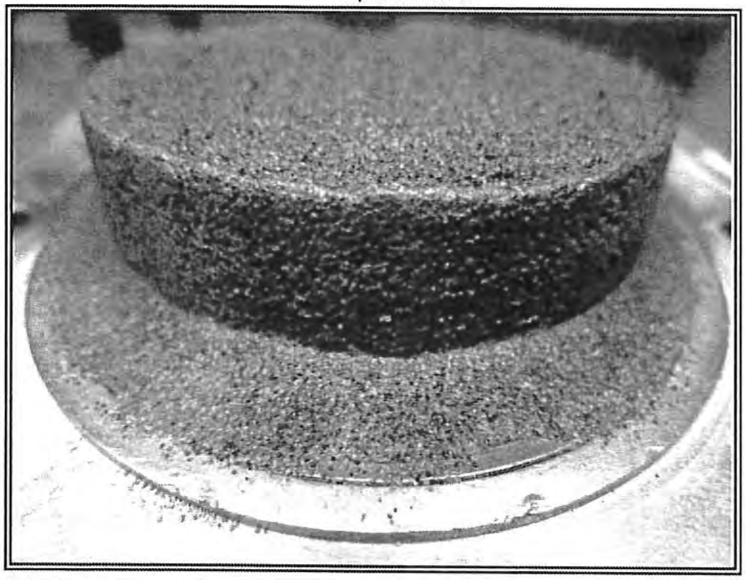
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 56-off_6C
Test Specimen A

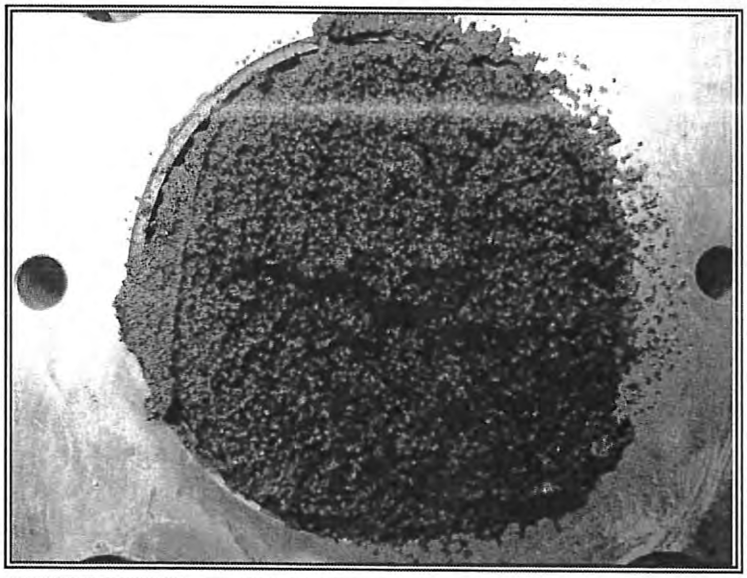


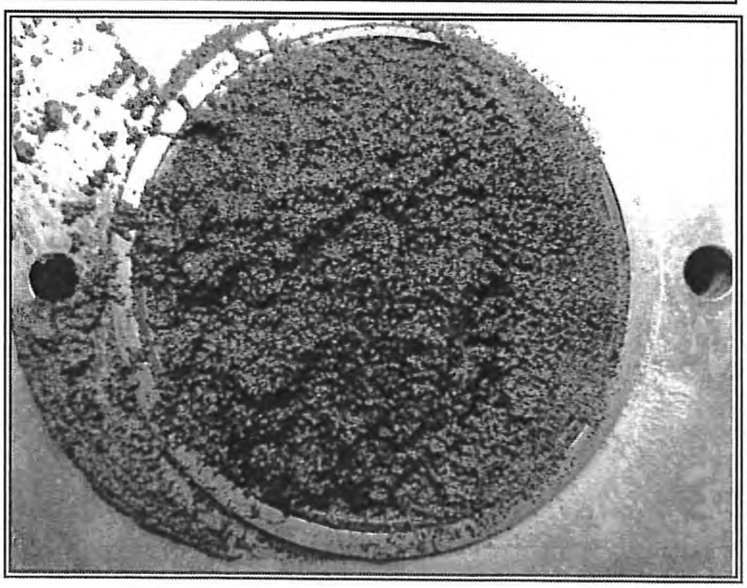




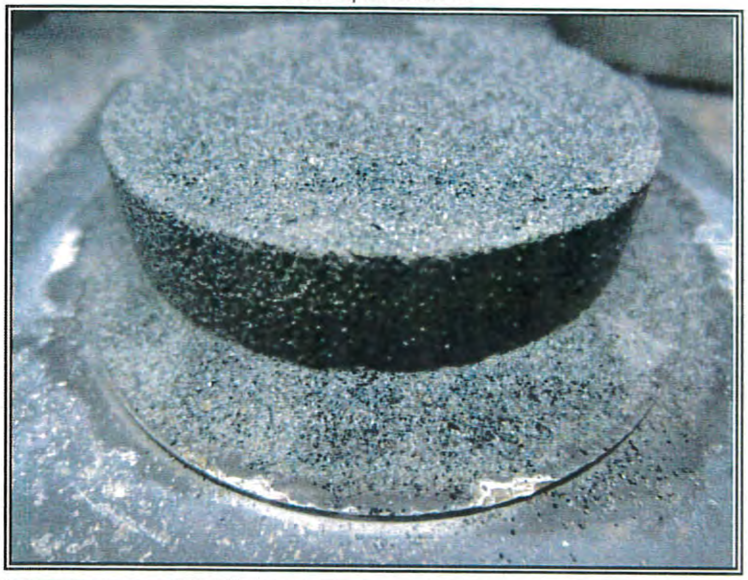
DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 56-off_6C
Test Specimen B







DIRECT SHEAR
JOB : 01-0F2703
SAMPLE : 56-off_6C
Test Specimen C



STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY

Falling Head Permeability

Job # 01-0F2703

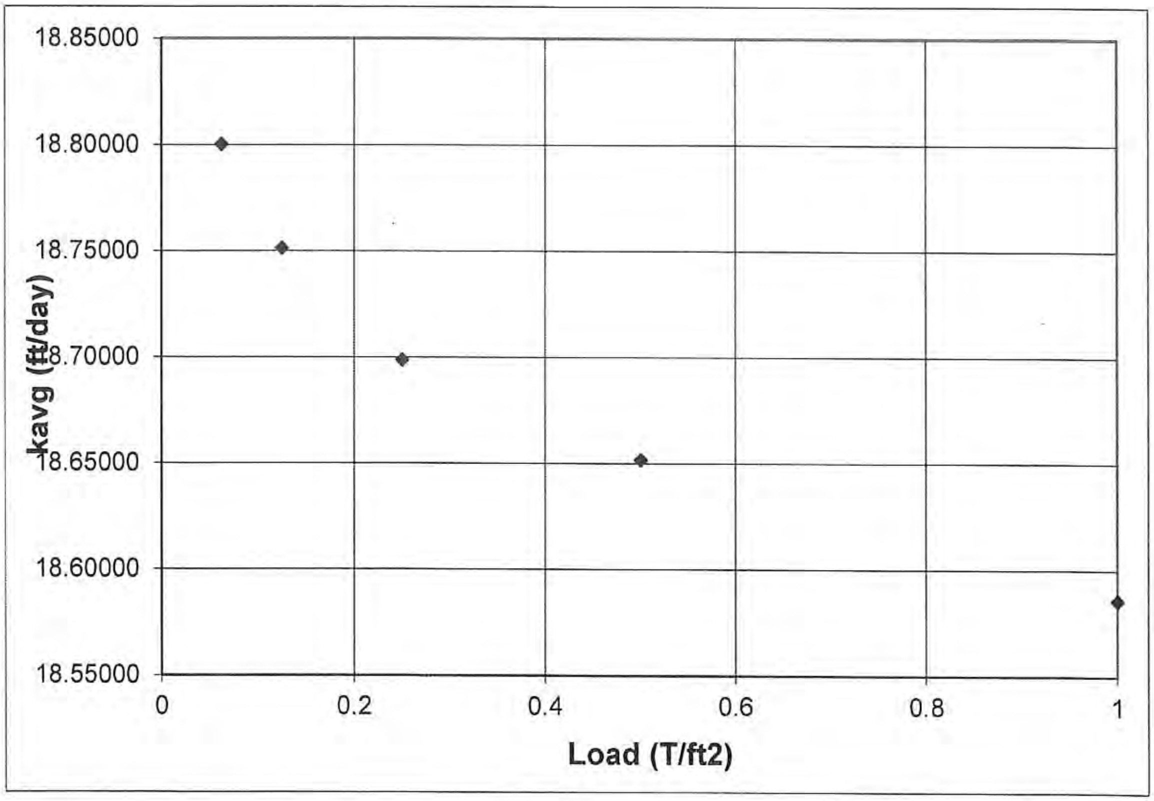
Date 4/6/2016

Sample # 56-Off-6B

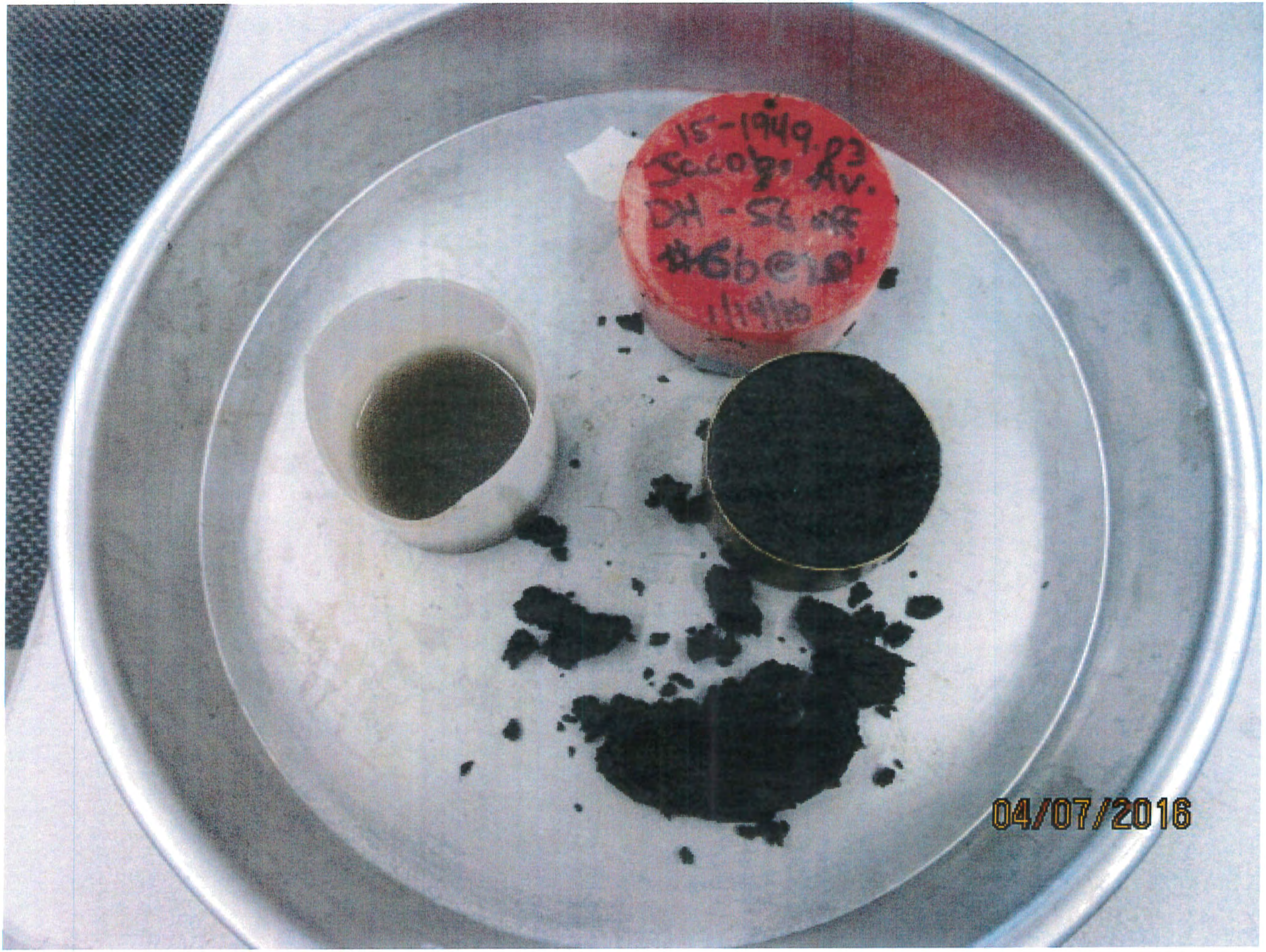
Tested By LP
Calc By LP
Checked By [illegible] 4/26/16

Wet Unit Weight = 118.34 pcf
Dry Unit Weight = 92.71 pcf

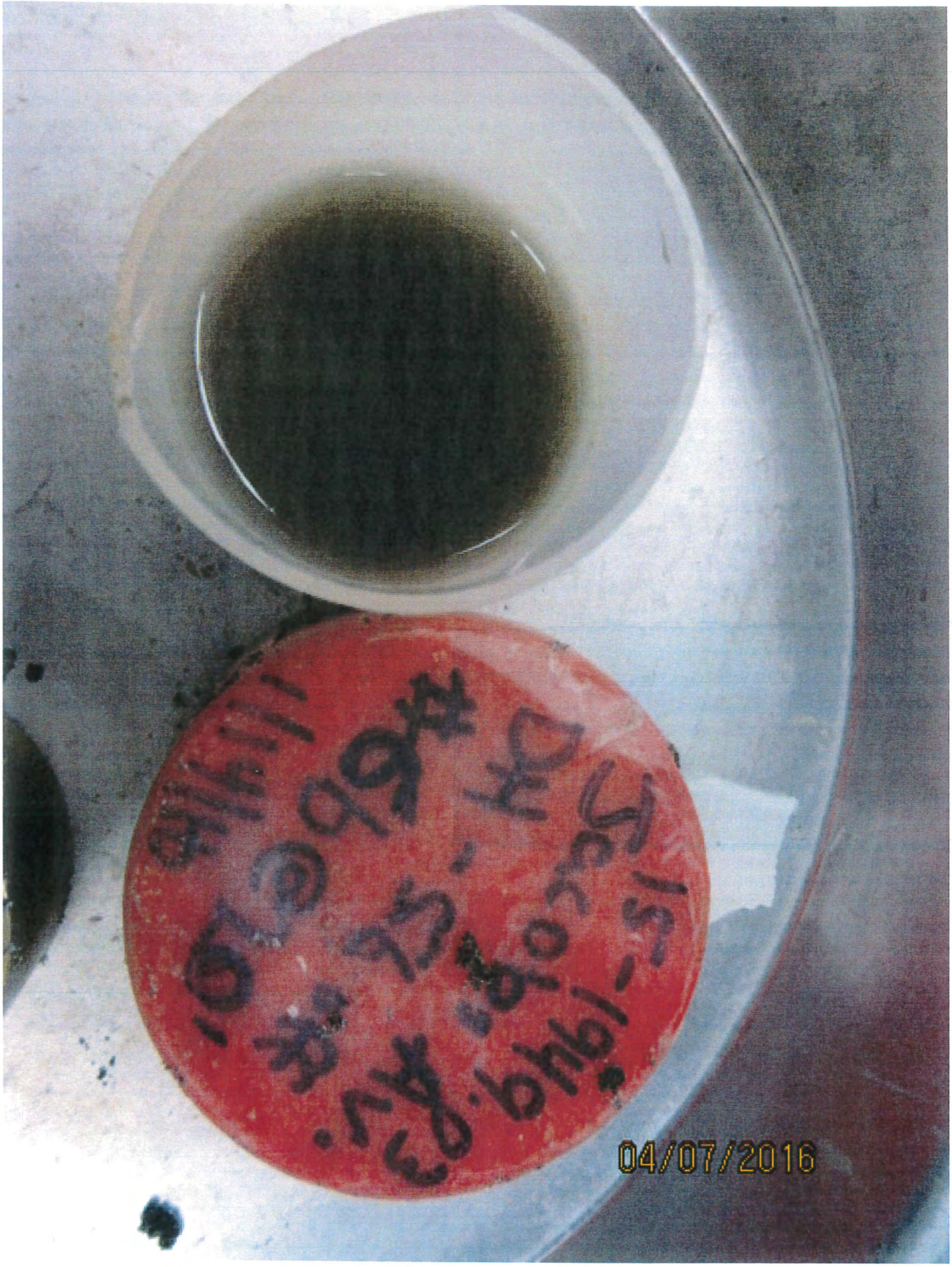
Load (T/ft2)	kavg (ft/day)
1/16	18.80005
1/8	18.75117
1/4	18.69852
1/2	18.65152
1	18.58572

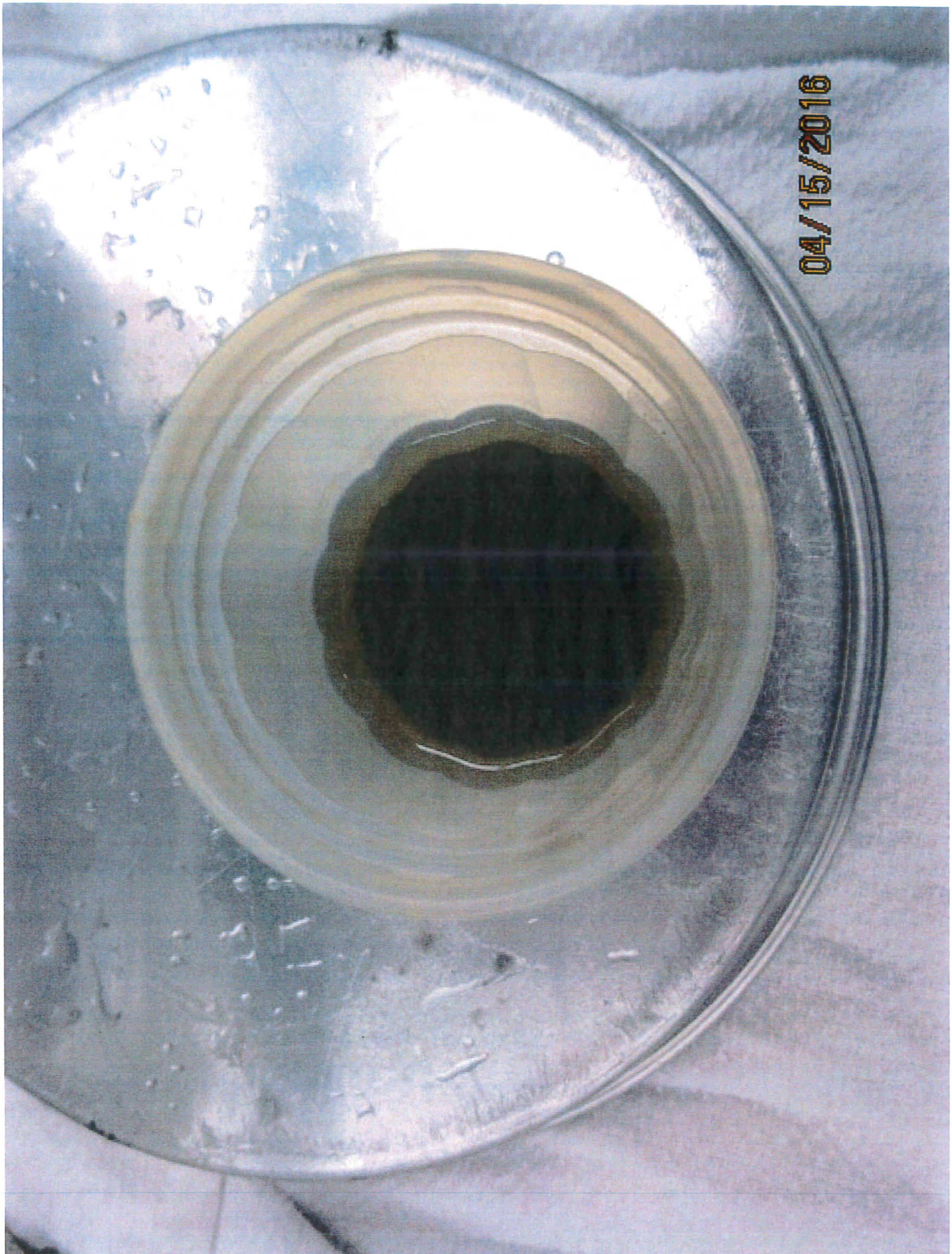


Sample Description:
Moist, gray, loose fine sand. Test specimen was trimmed from a 2 1/2" tube sample. At the end of the falling head test, it was observed that the water collected have some soil particles that flowed out of the valve as shown on the photos attached.


04/07/2016


15-1949.03
Jacobi Av.
1/14/16
04/07/2016


04/07/2016
15-1949.83
Jacobi Av.
11/9/16


04/15/2016


04/15/2016

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY

Falling Head Permeability

Job # 01-0F2703

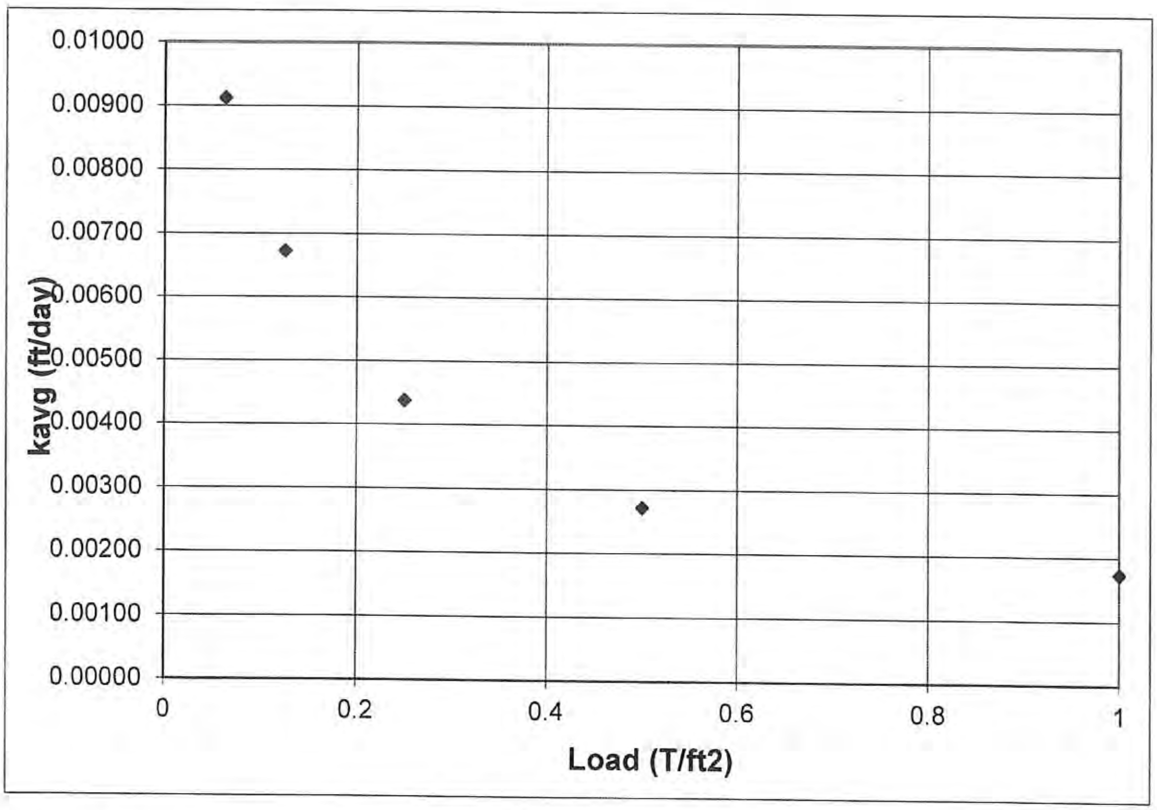
Date 4/6/2016

Sample # 30C-1B

Tested By LP
Calc By LP
Checked By [illegible] 4/26/16

Wet Unit Weight = 112.56 pcf
Dry Unit Weight = 86.16 pcf

Load (T/ft2)	kavg (ft/day)
1/16	0.00912
1/8	0.00672
1/4	0.00438
1/2	0.00272
1	0.00173



Sample Description:
Moist, brown, medium stiff clay with silt. Test specimen was trimmed from a 2 1/2" tube sample. Soil sample has a small amount of white plaster.

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY

Falling Head Permeability

Job # 01-0F2703

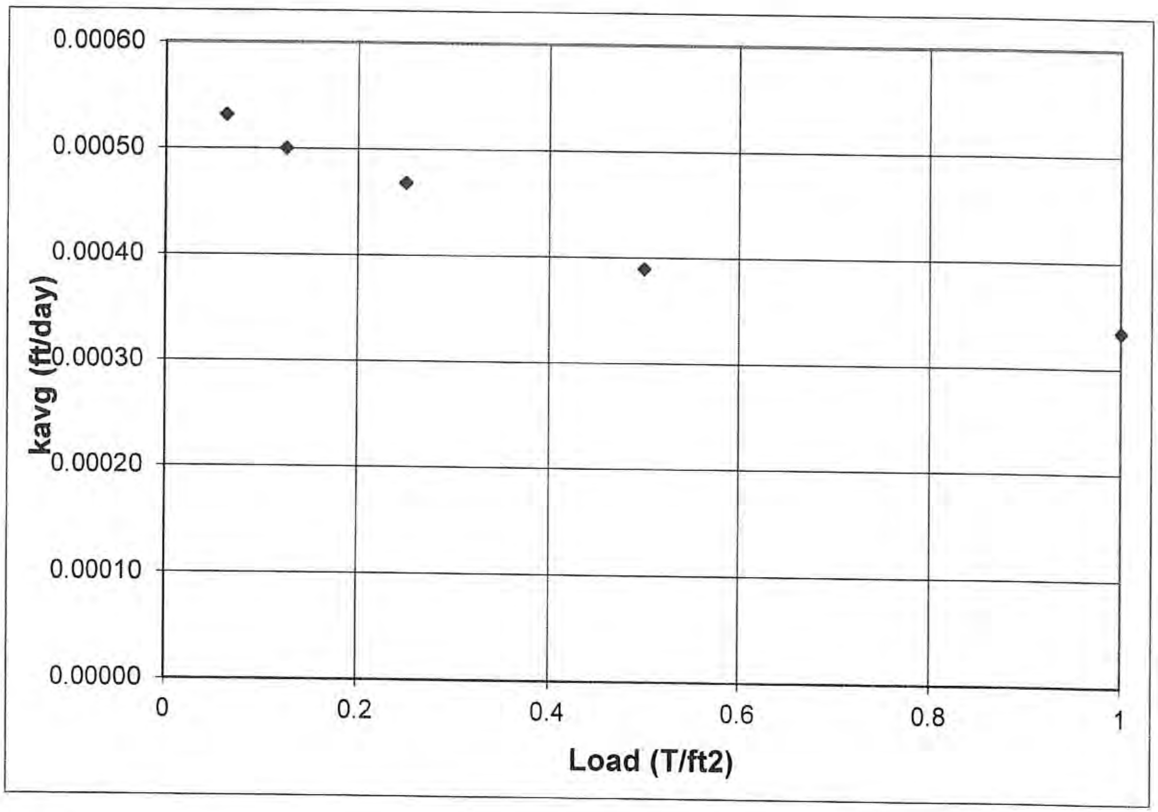
Date 4/15/2016

Sample # 30C-3-b

Tested By LP
Calc By LP
Checked By [signature] 12/26/16

Wet Unit Weight = 117.32 pcf
Dry Unit Weight = 84.33 pcf

Load (T/ft2)	kavg (ft/day)
1/16	0.00053
1/8	0.00050
1/4	0.00047
1/2	0.00039
1	0.00033



Sample Description:
Moist, gray, very soft clay. Test specimen was trimmed from a shelby tube.

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY

Falling Head Permeability

Job # 01-0F2703

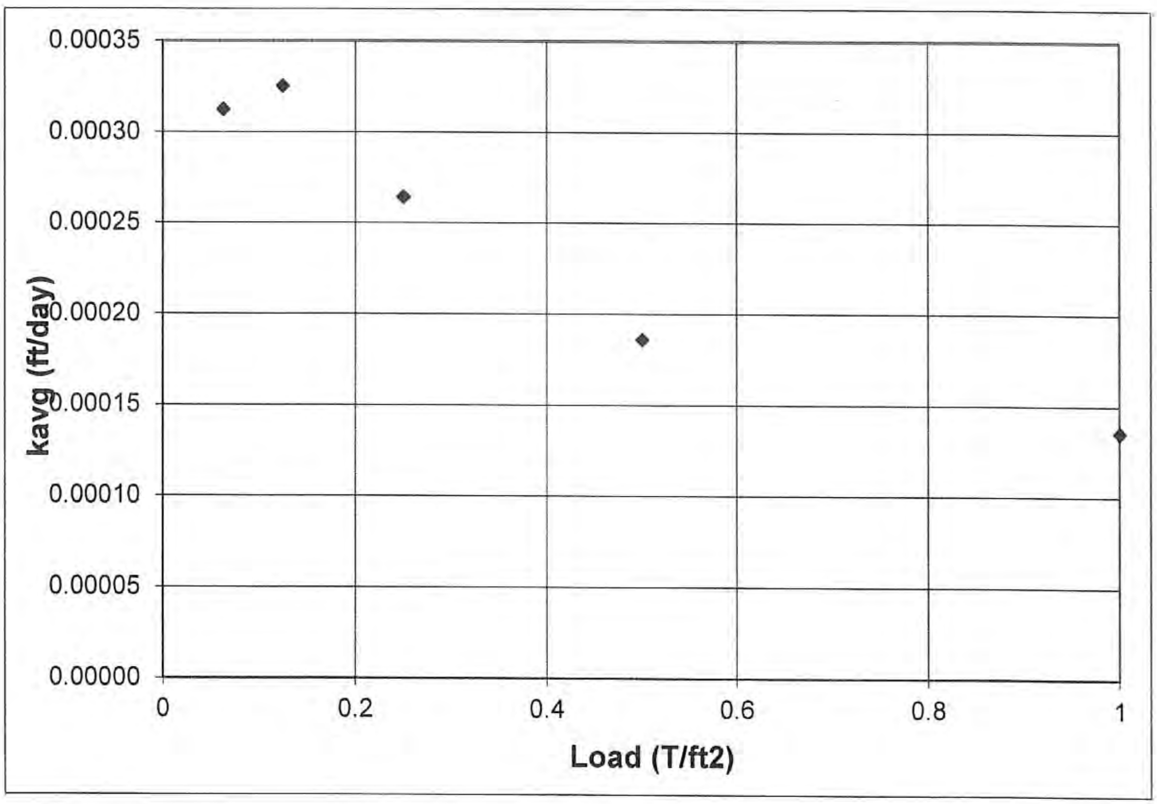
Date 4/15/2016

Sample # 10L-3-b

Tested By LP
Calc By LP
Checked By [signature] 10/26/16

Wet Unit Weight = 103.62 pcf
Dry Unit Weight = 65.72 pcf

Load (T/ft2)	kavg (ft/day)
1/16	0.00031
1/8	0.00033
1/4	0.00026
1/2	0.00019
1	0.00014



Sample Description:
Moist, gray, very soft clay. Test specimen was trimmed from a shelby tube.

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Jacobs Avenue Leveee
Boring No.: 30C-4
Sample No.: b
Test No.: 16-013-G5

Location:
Tested By: AZM
Test Date: 4/26/16
Sample Type: Shelby Tube

Project No.: 01-0F2703
Checked By: GL16-026
Depth: 15-17.5
Elevation: JP 5/2/16

Soil Description: Moist, dark grey, very soft, silt w/organic
Remarks: Specimen description is not a soil classification.

Measured Specific Gravity: 2.74
Initial Void Ratio: 1.09
Final Void Ratio: 0.875

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 0.75 in
Specimen Diameter: 1.94 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	94.100	94.100	90.100	90.100
Wt. Container + Dry Soil, gm	75.100	75.100	75.100	75.100
Wt. Container, gm	27.300	27.300	27.300	27.300
Wt. Dry Soil, gm	47.800	47.800	47.800	47.800
Water Content, %	39.75	39.75	31.38	31.38
Void Ratio	---	1.09	0.875	---
Degree of Saturation, %	---	99.72	98.40	---
Dry Unit Weight, pcf	---	81.802	91.340	---

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Jacobs Avenue Leveee
Boring No.: 30C-4
Sample No.: b
Test No.: 16-013-G5

Location:
Tested By: AZM
Test Date: 4/26/16
Sample Type: Shelby Tube

Project No.: 01-0F2703
Checked By: GL16-026
Depth: 15-17.5
Elevation:

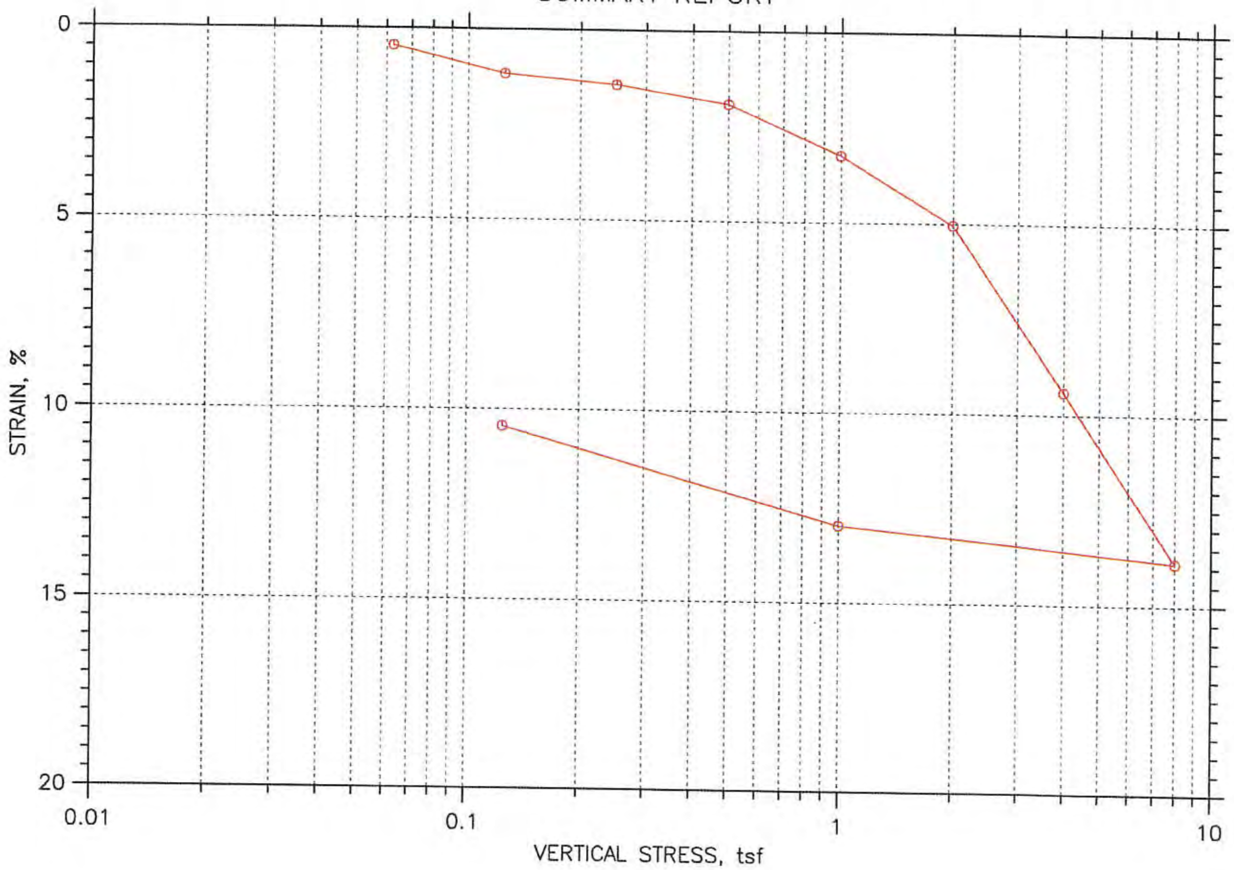
Soil Description: Moist, dark grey, very soft, silt w/organic
Remarks: Specimen description is not a soil classification.
Displacement at End of Increment

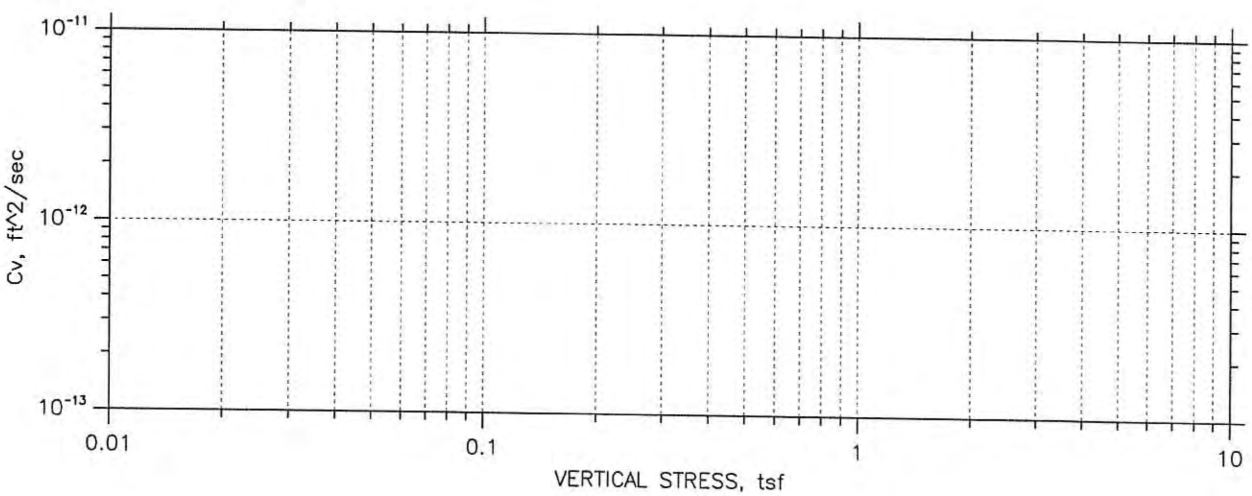
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft^2/sec	Mv 1/tsf	k ft/day
1	0.0625	0.003410	1.08	0.455	4.872	2.82e-006	7.27e-002	5.53e-004
2	0.125	0.008768	1.07	1.17	3.251	4.18e-006	1.14e-001	1.29e-003
3	0.250	0.01078	1.06	1.44	3.786	3.55e-006	2.15e-002	2.06e-004
4	0.500	0.01435	1.05	1.91	8.956	1.49e-006	1.90e-002	7.65e-005
5	1.00	0.02424	1.03	3.23	2.978	4.40e-006	2.64e-002	3.13e-004
6	2.00	0.03779	0.988	5.04	3.979	3.19e-006	1.81e-002	1.55e-004
7	4.00	0.07044	0.897	9.39	4.975	2.39e-006	2.18e-002	1.40e-004
8	8.00	0.1040	0.803	13.9	2.471	4.36e-006	1.12e-002	1.32e-004
9	1.00	0.09727	0.822	13.0	1.569	6.59e-006	1.29e-003	2.29e-005
10	0.125	0.07832	0.875	10.4	3.804	2.83e-006	2.89e-002	2.20e-004

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft^2/sec	Mv 1/tsf	k ft/day	Ca %
1	0.0625	0.003410	1.08	0.455	0.000	0.00e+000	7.27e-002	0.00e+000	0.00e+000
2	0.125	0.008768	1.07	1.17	0.743	4.24e-006	1.14e-001	1.31e-003	0.00e+000
3	0.250	0.01078	1.06	1.44	0.669	4.67e-006	2.15e-002	2.70e-004	0.00e+000
4	0.500	0.01435	1.05	1.91	0.858	3.61e-006	1.90e-002	1.86e-004	0.00e+000
5	1.00	0.02424	1.03	3.23	0.407	7.47e-006	2.64e-002	5.31e-004	0.00e+000
6	2.00	0.03779	0.988	5.04	0.566	5.21e-006	1.81e-002	2.54e-004	0.00e+000
7	4.00	0.07044	0.897	9.39	0.851	3.24e-006	2.18e-002	1.90e-004	0.00e+000
8	8.00	0.1040	0.803	13.9	0.527	4.75e-006	1.12e-002	1.43e-004	0.00e+000
9	1.00	0.09727	0.822	13.0	0.332	7.23e-006	1.29e-003	2.52e-005	0.00e+000
10	0.125	0.07832	0.875	10.4	0.674	3.71e-006	2.89e-002	2.89e-004	0.00e+000

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-005
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		
	Displacement at End of Increment		

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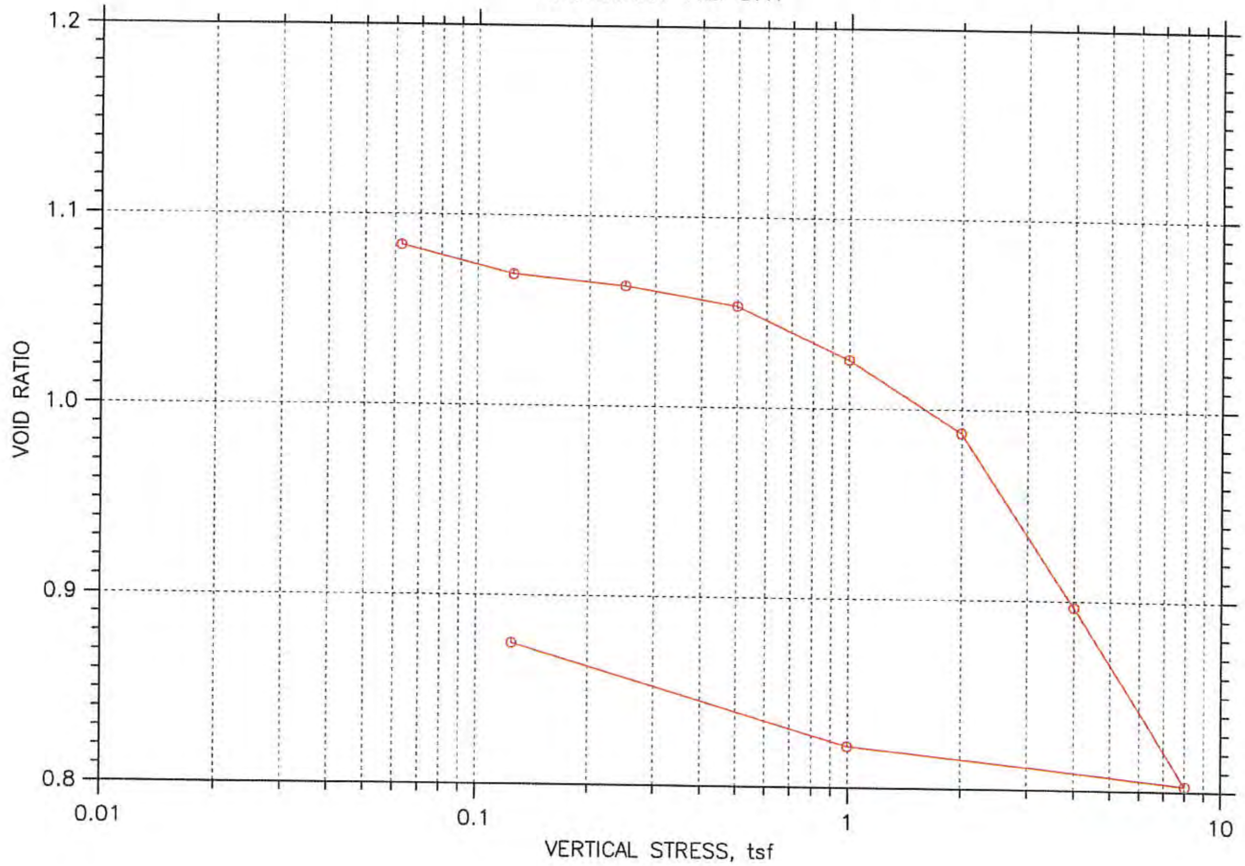
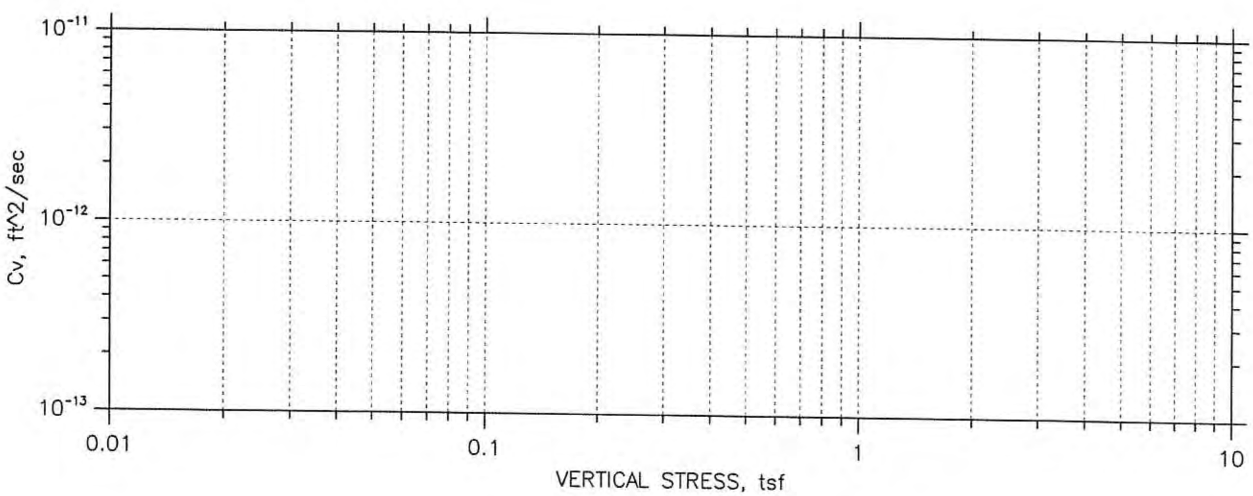
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



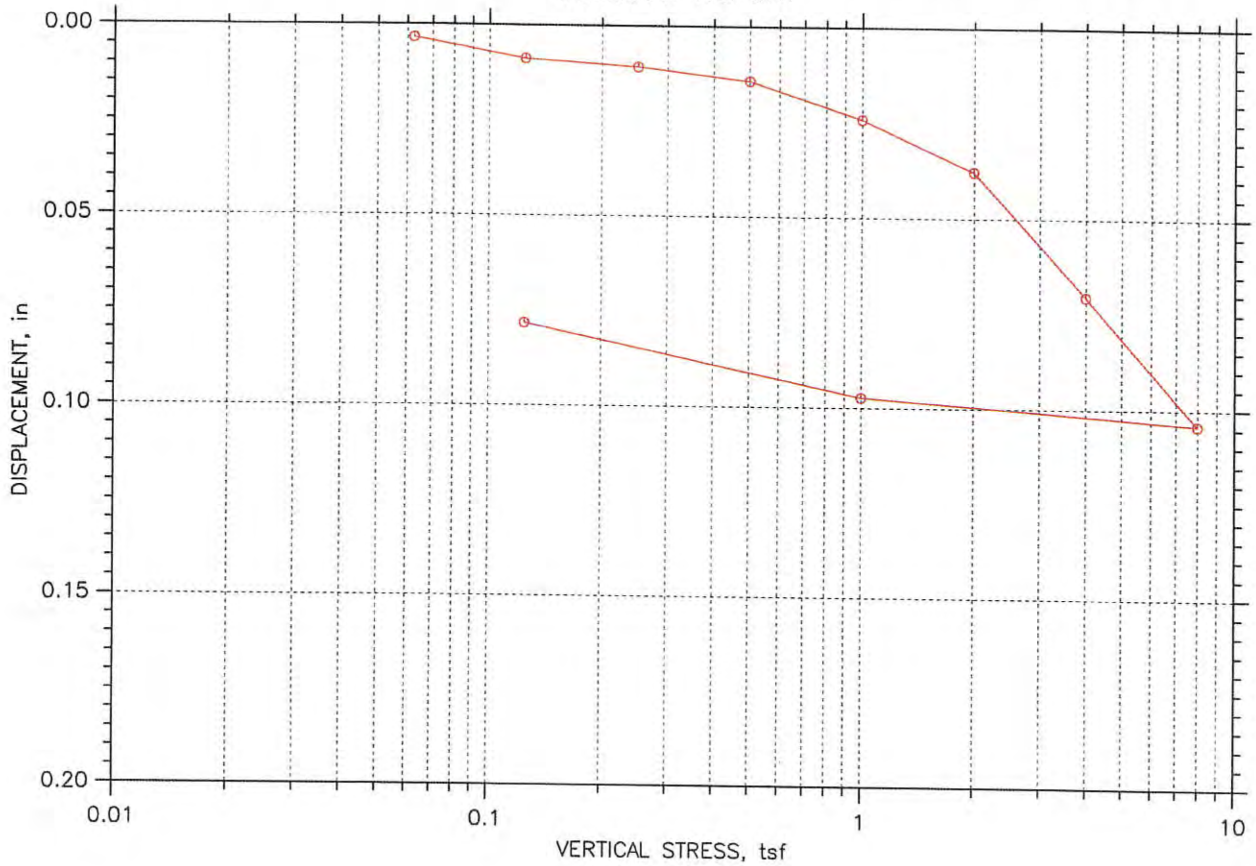


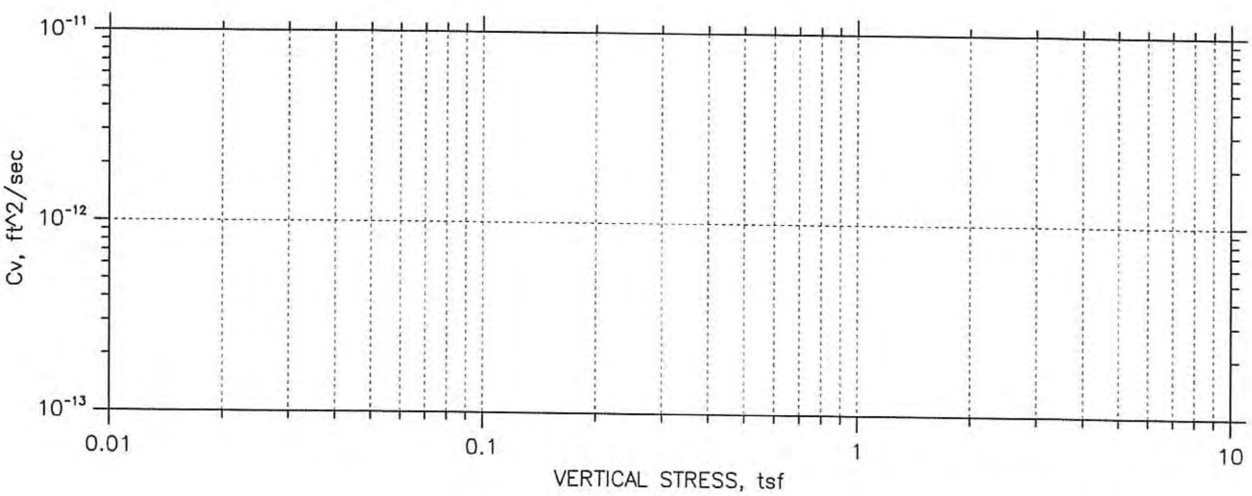
	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		
	Displacement at End of Increment		

Mon, 02-MAY-2016 15:08:36

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



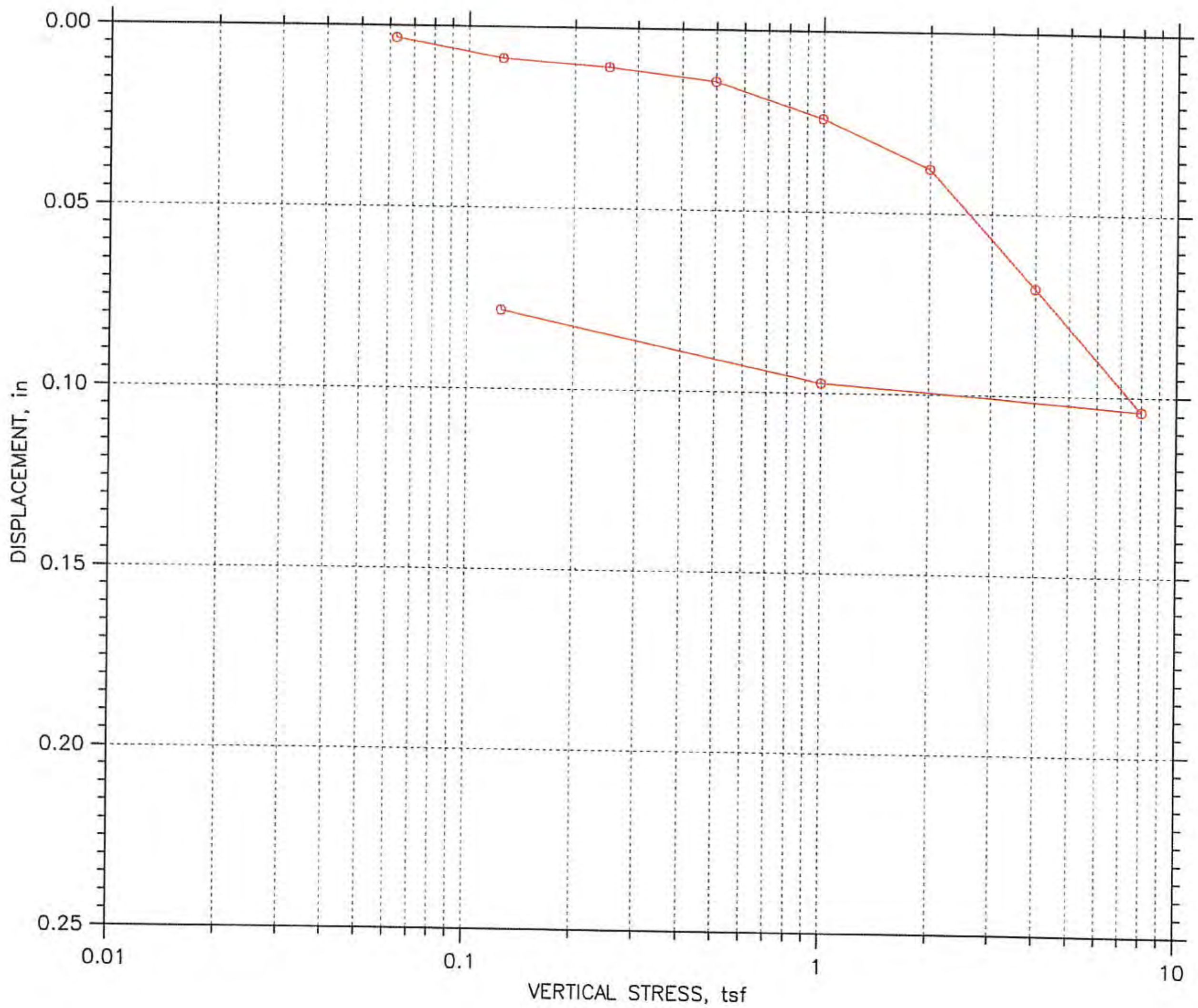


	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		
	Displacement at End of Increment		

Mon, 02-MAY-2016 15:09:19

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure: 0 tsf				Water Content, %	39.75	31.38
Preconsolidation Pressure: 0 tsf				Dry Unit Weight, pcf	81.802	91.34
Compression Index: 0				Saturation, %	99.72	98.40
Diameter: 1.944 in		Height: 0.75 in		Void Ratio	1.09	0.87
LL: ---	PL: ---	PI: ---	GS: 2.74			

	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		
	Displacement at End of Increment		

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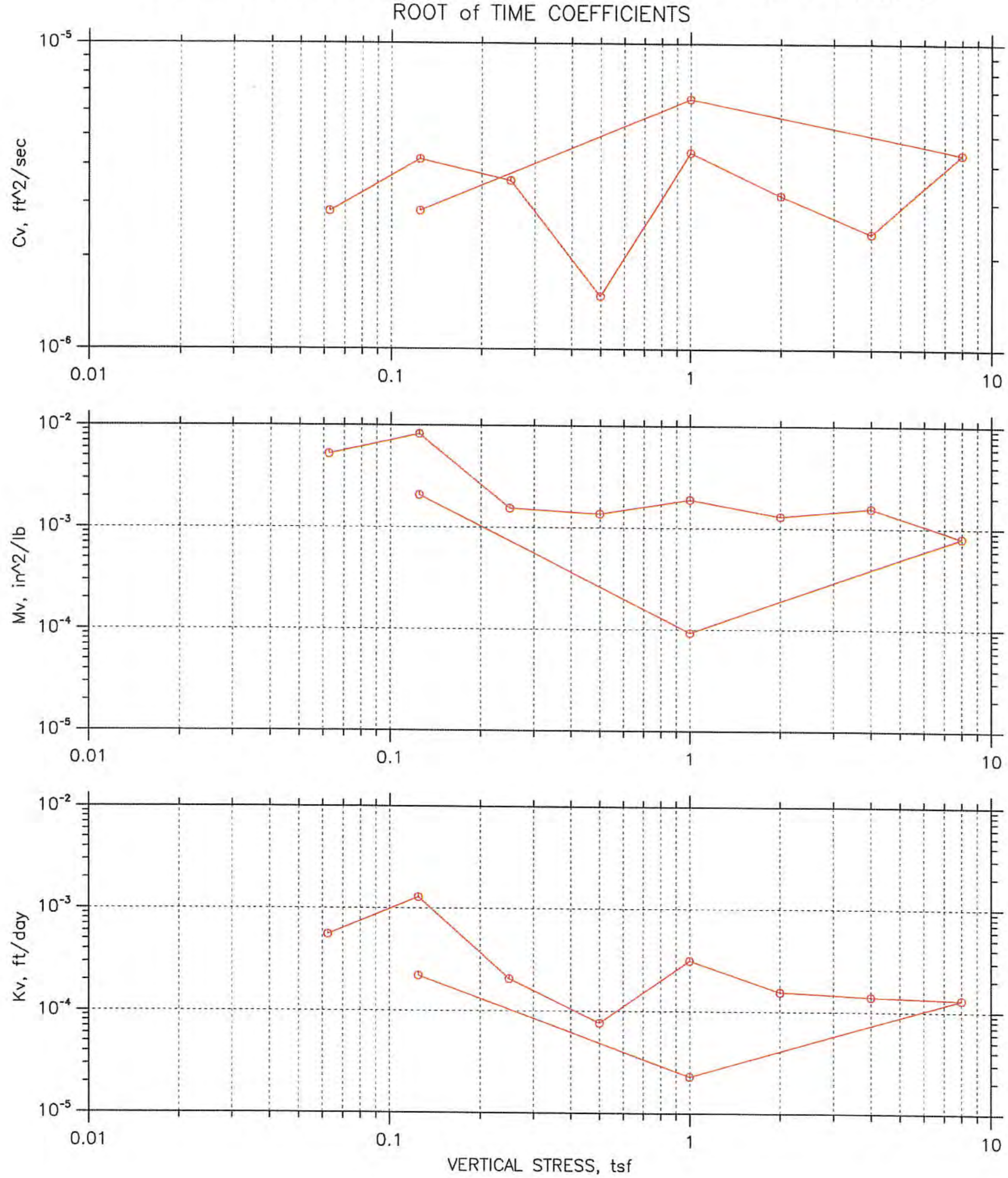
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

ROOT of TIME COEFFICIENTS

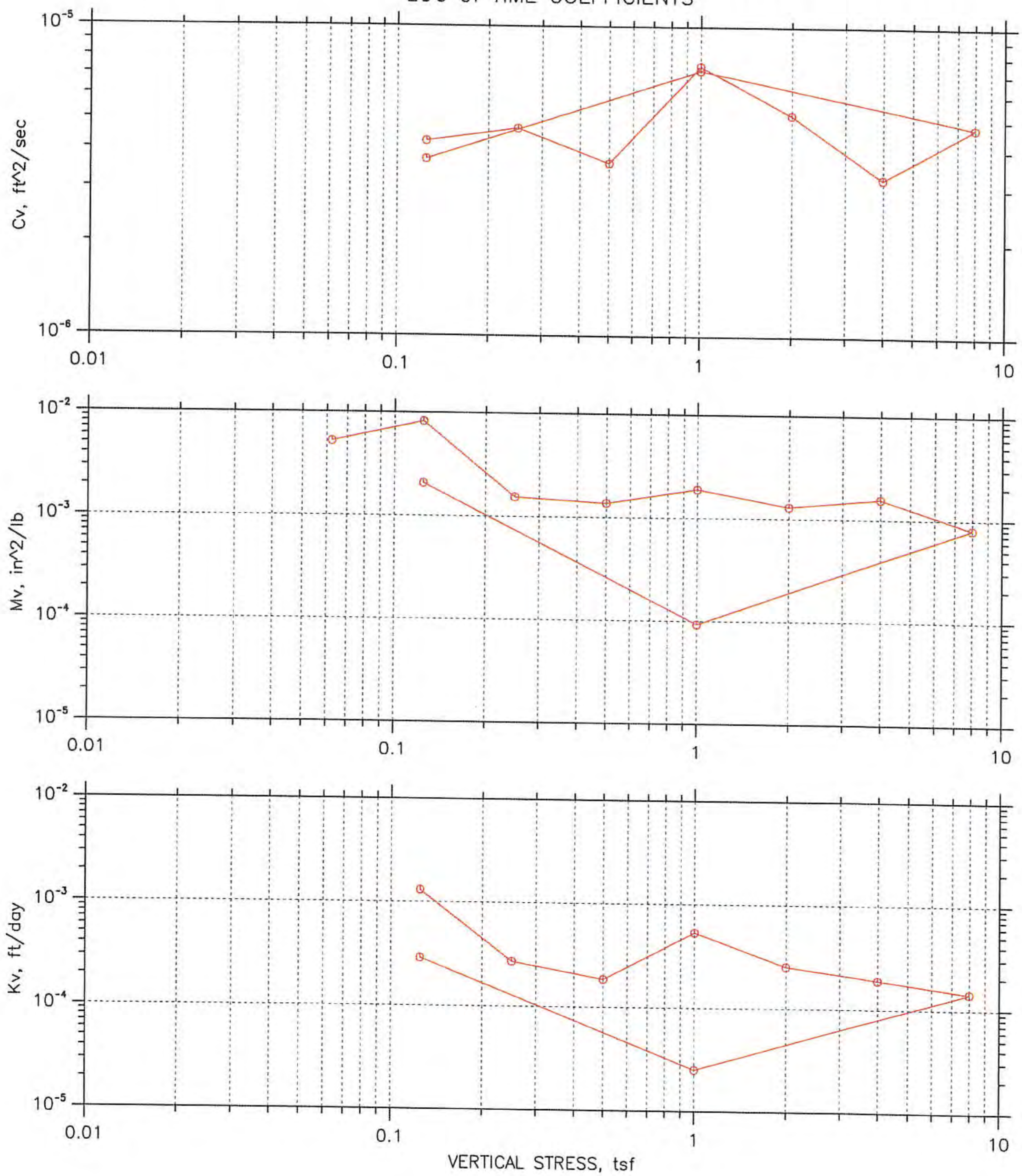


	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		
	Displacement at End of Increment		

Mon, 02-MAY-2016 15:09:19

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

LOG of TIME COEFFICIENTS



	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		
	Displacement at End of Increment		

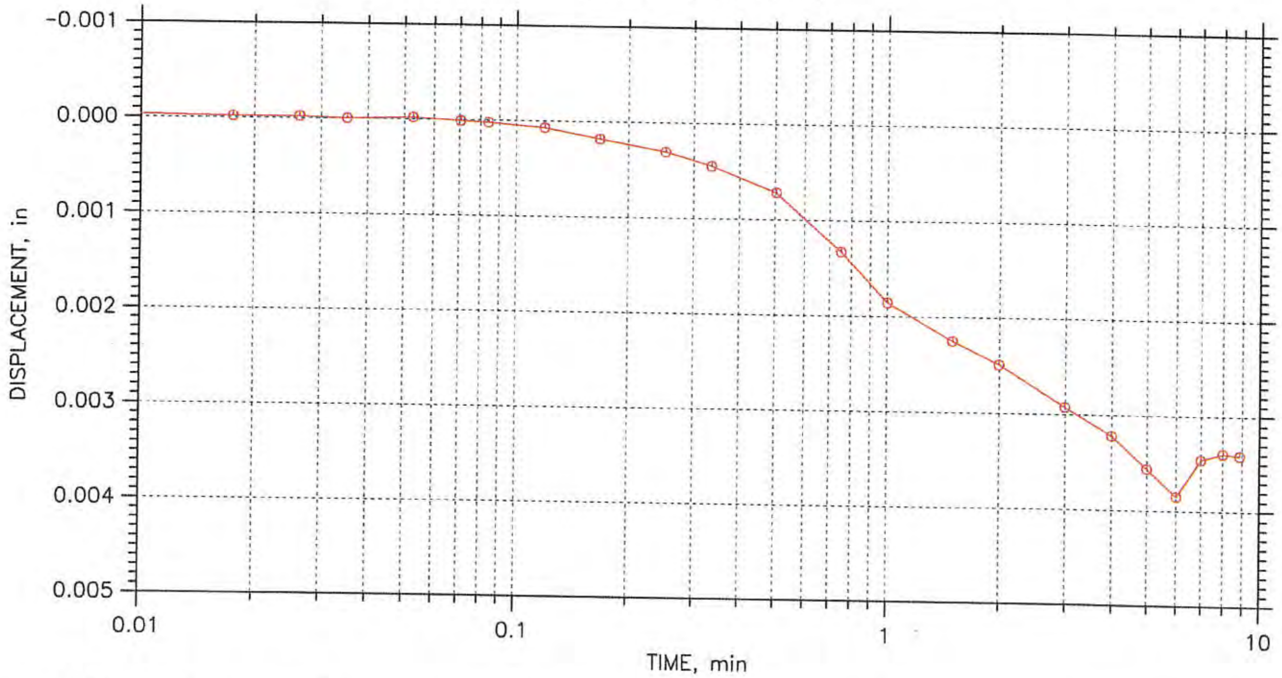
Mon, 02-MAY-2016 15:09:20

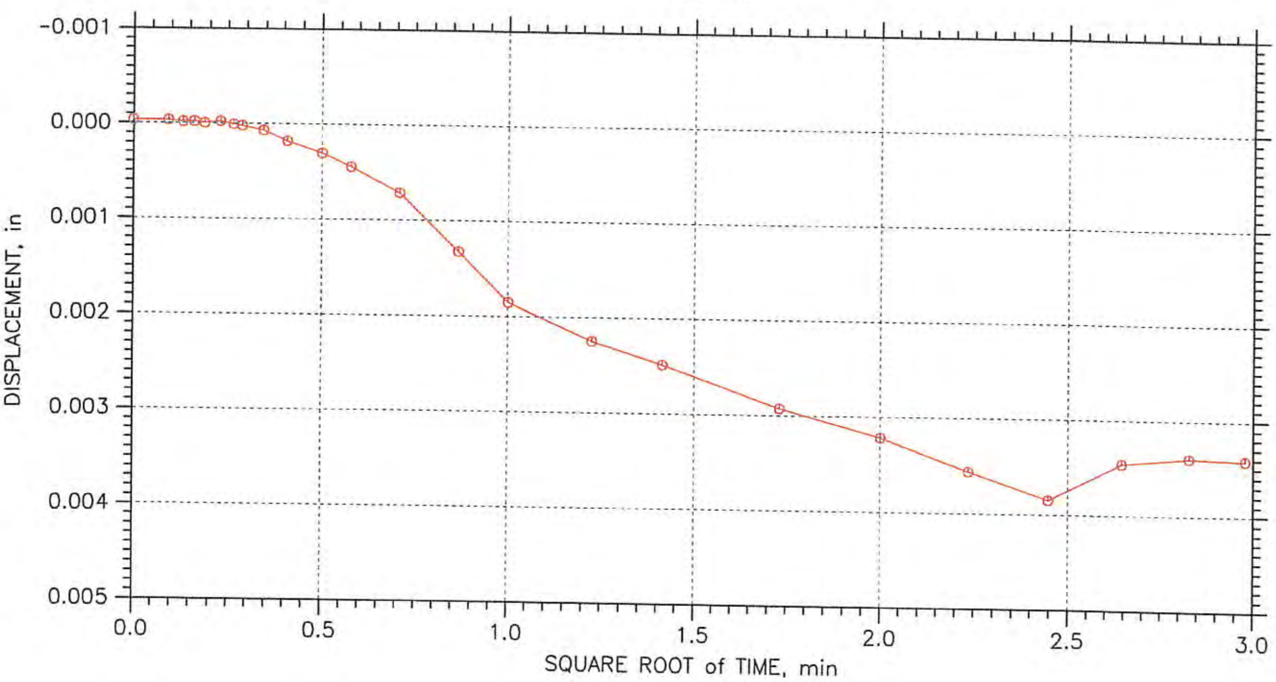
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 1 of 10

Stress: 0.0625 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

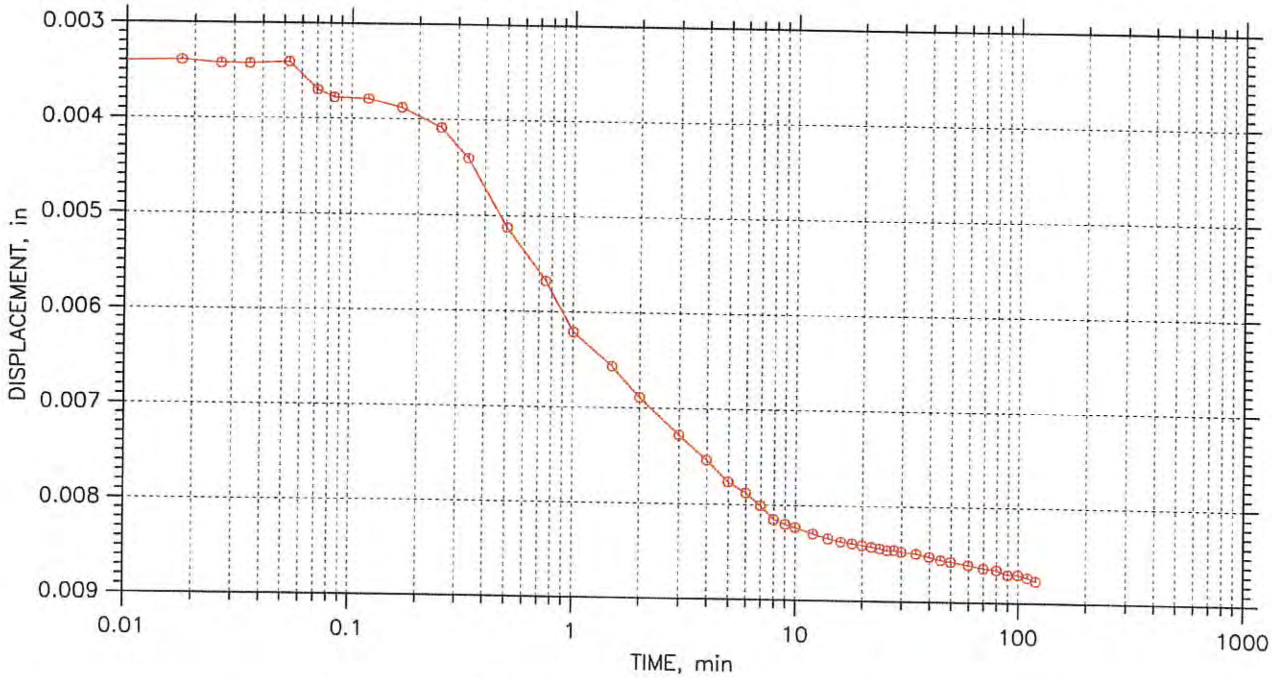
Mon, 02-MAY-2016 15:09:20

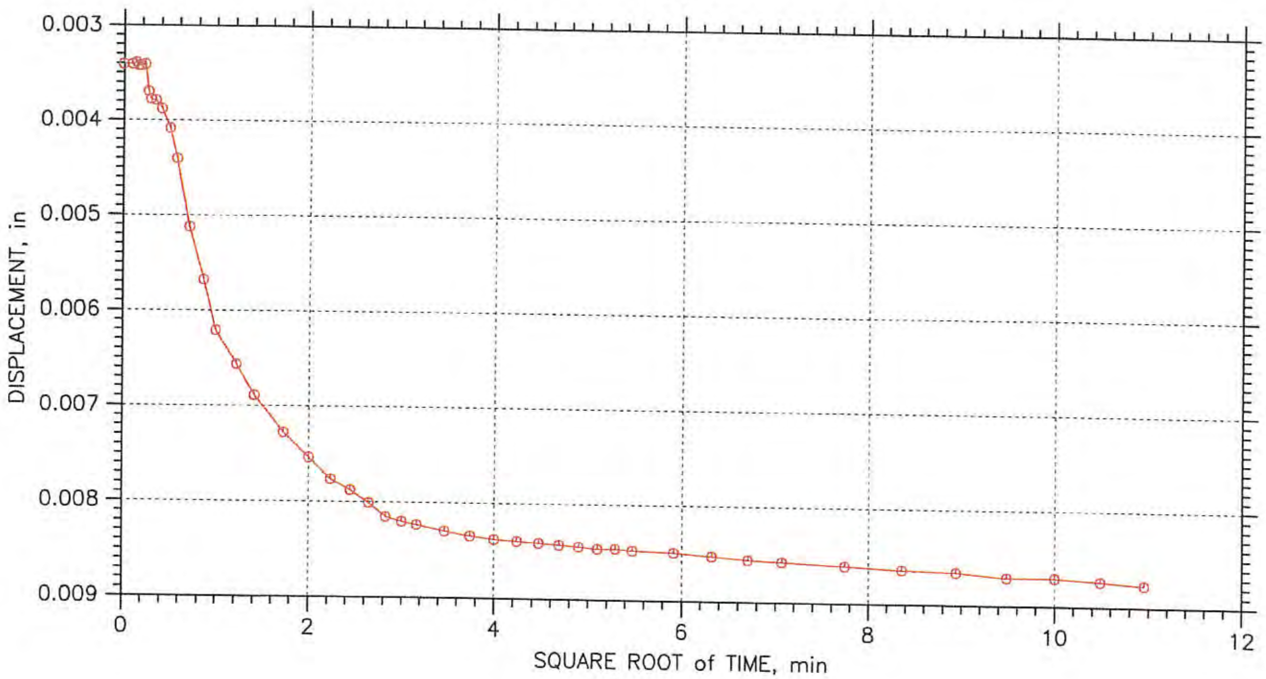
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 2 of 10

Stress: 0.125 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

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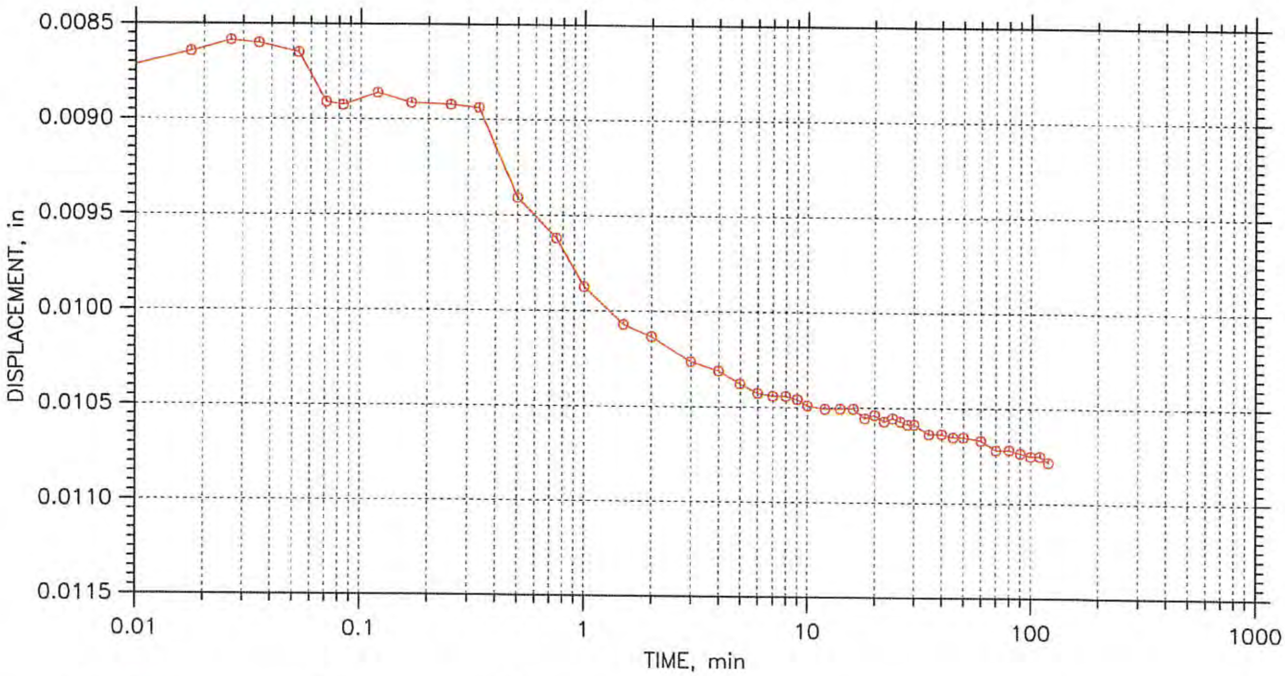
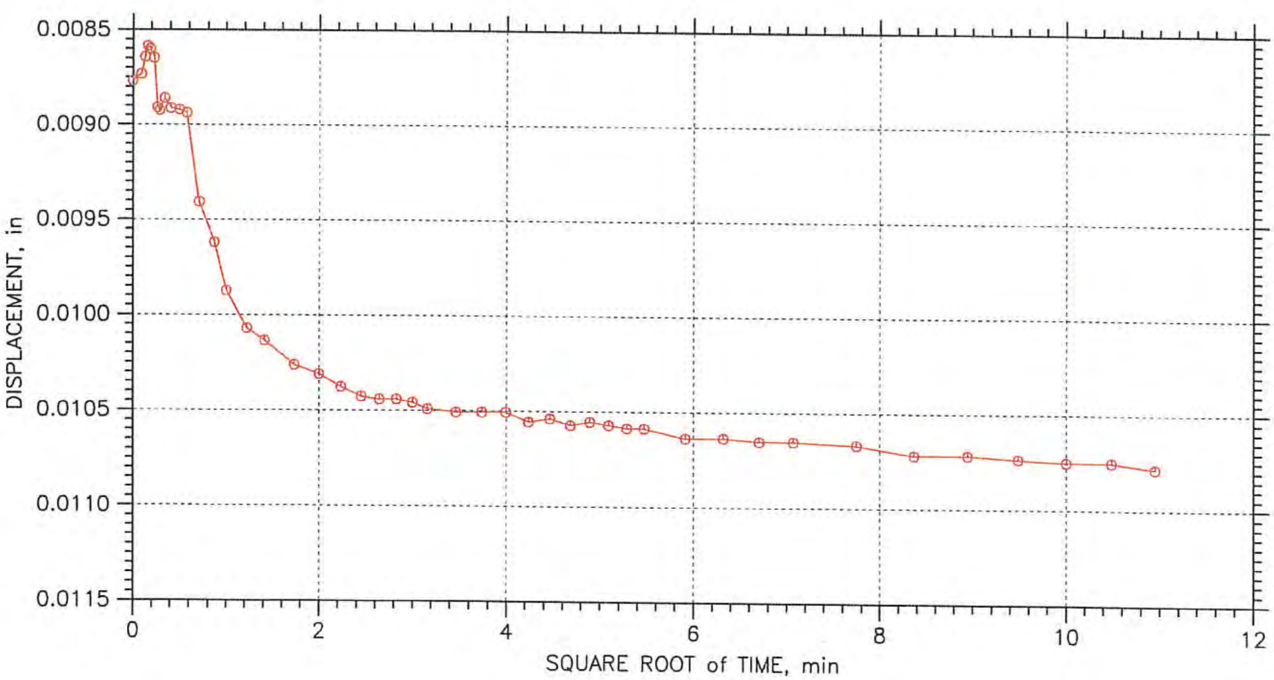
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 3 of 10

Stress: 0.25 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

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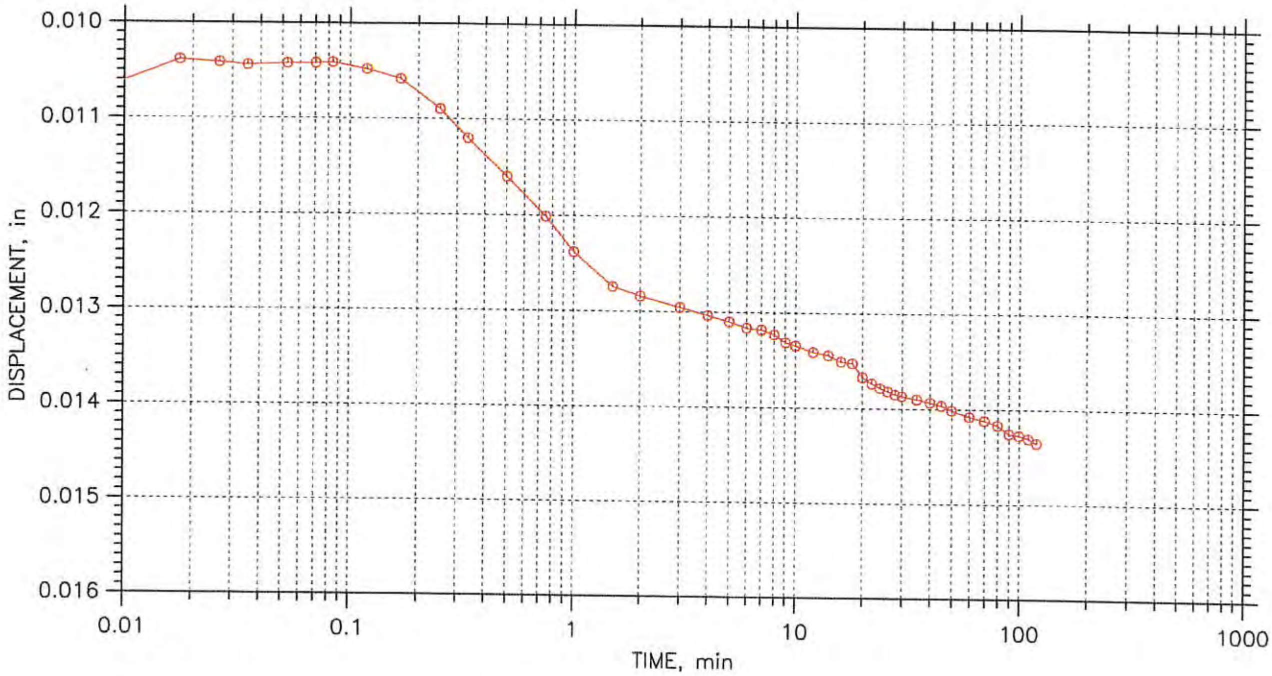
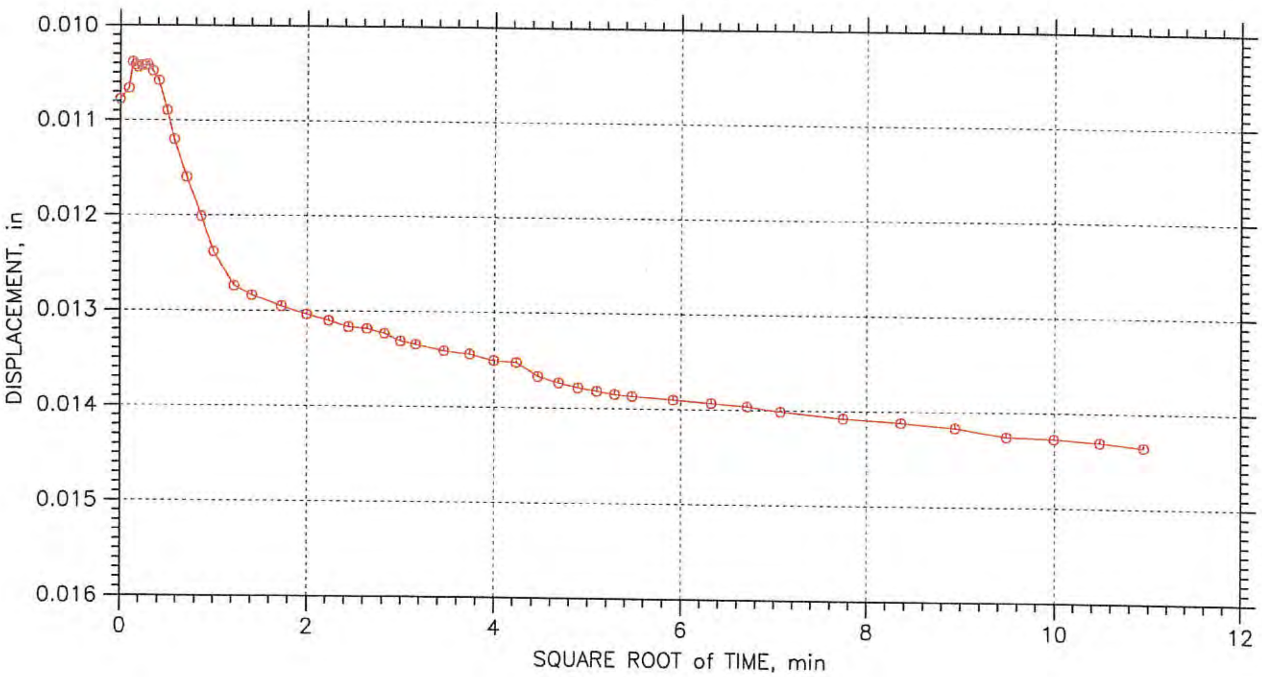
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 4 of 10

Stress: 0.5 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

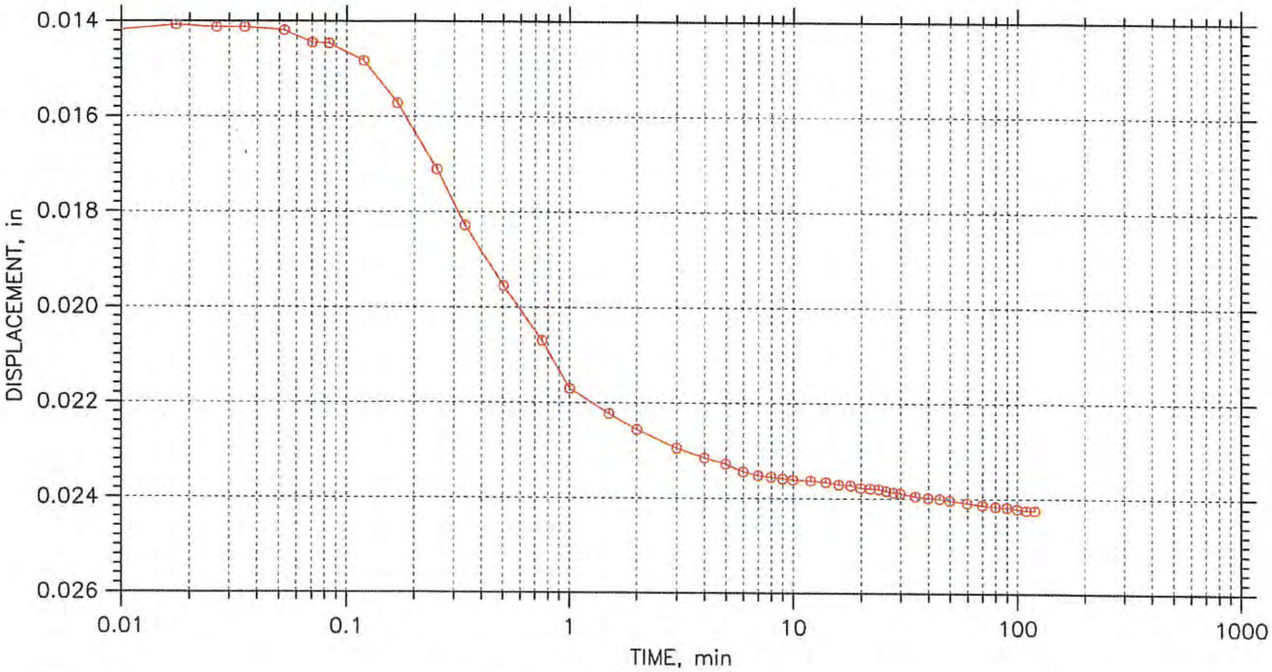
Mon, 02-MAY-2016 15:09:20

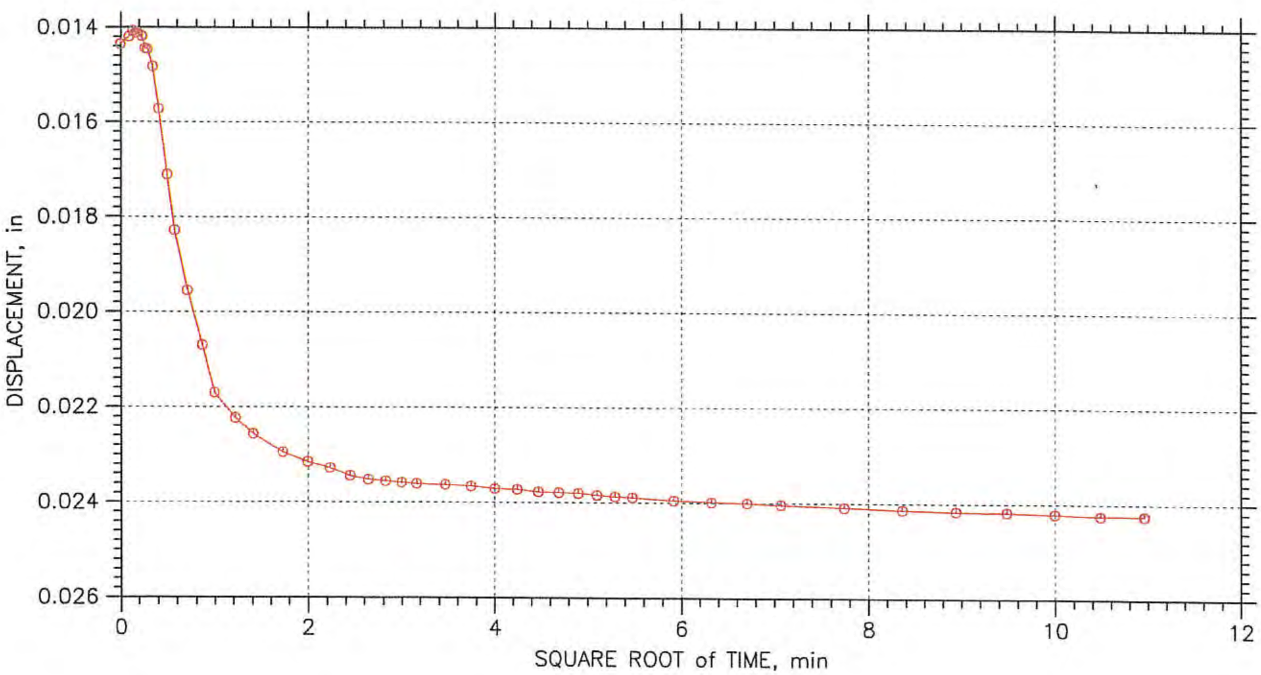
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 5 of 10

Stress: 1 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

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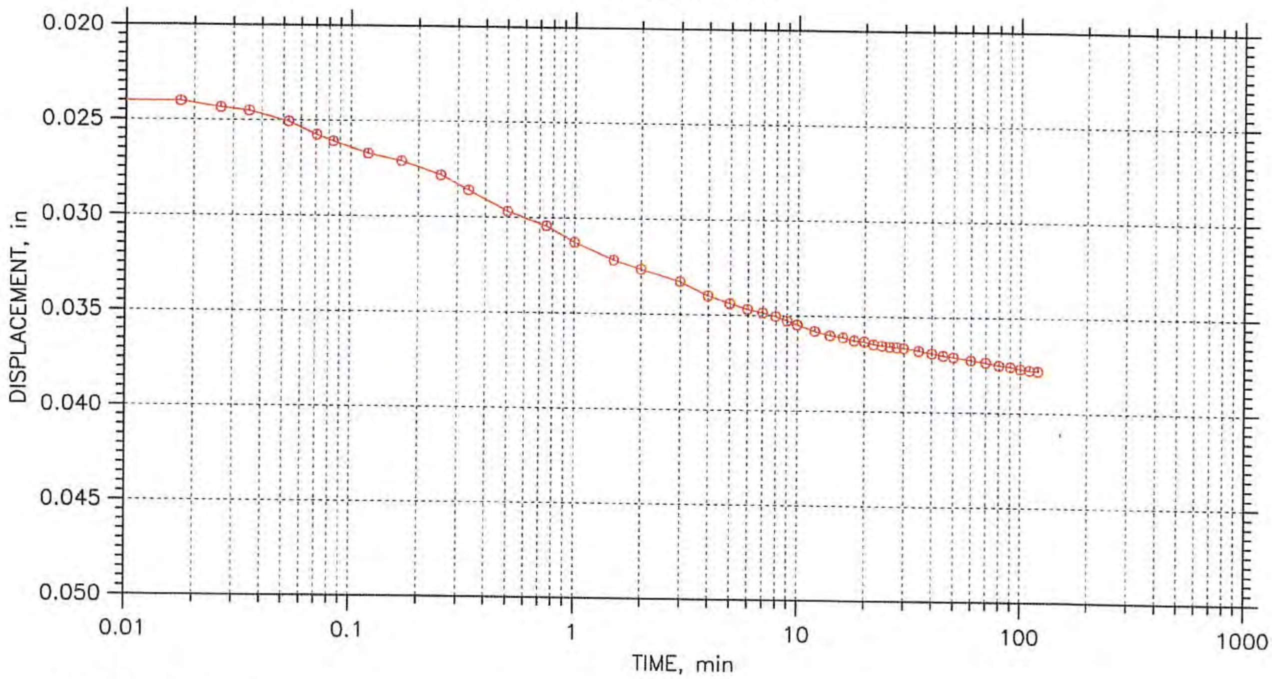
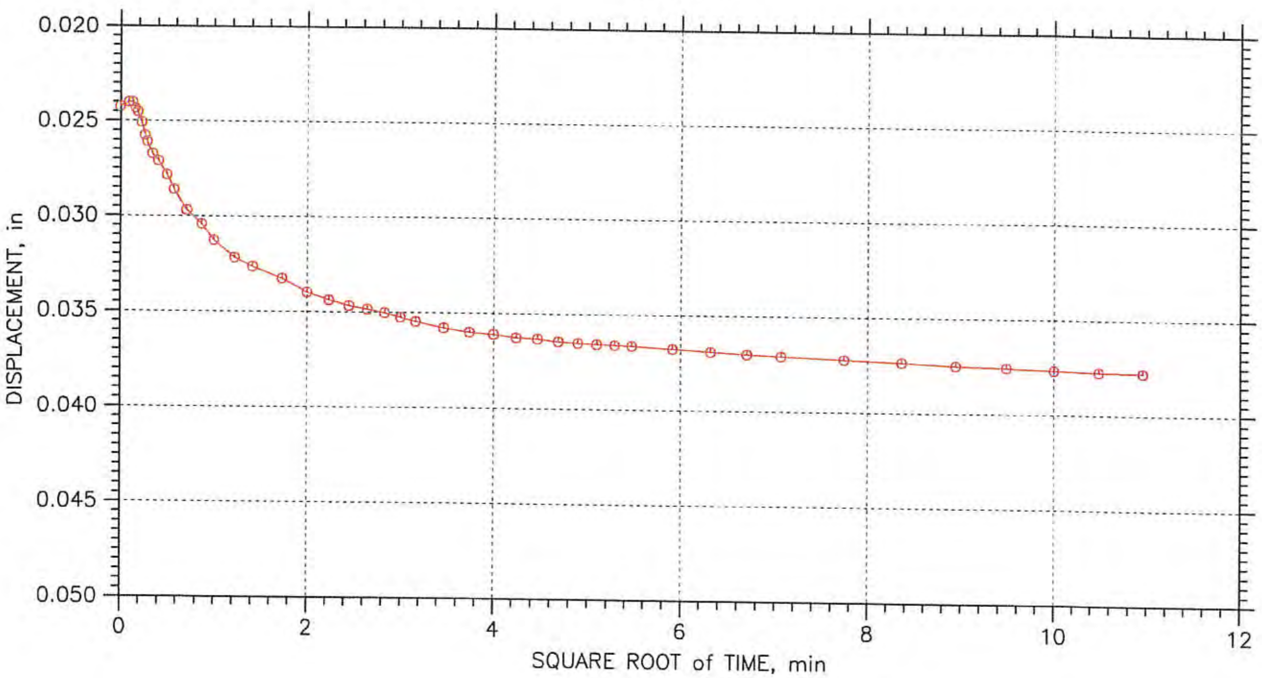
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 6 of 10

Stress: 2 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

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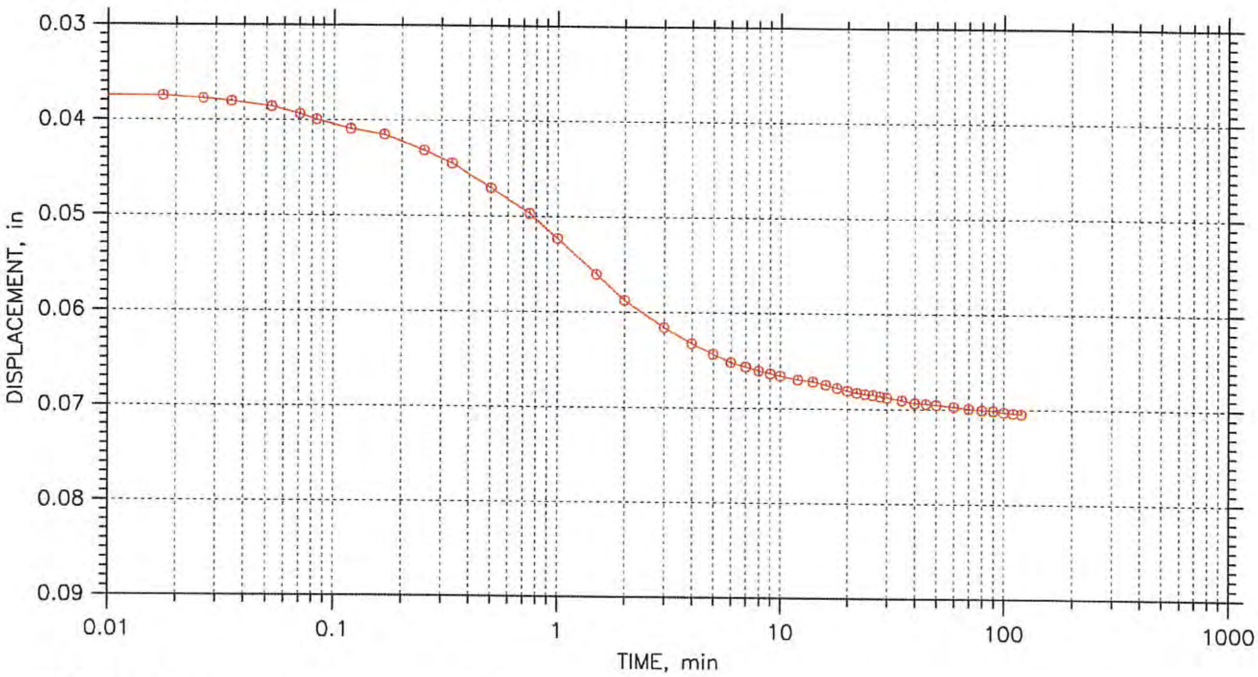
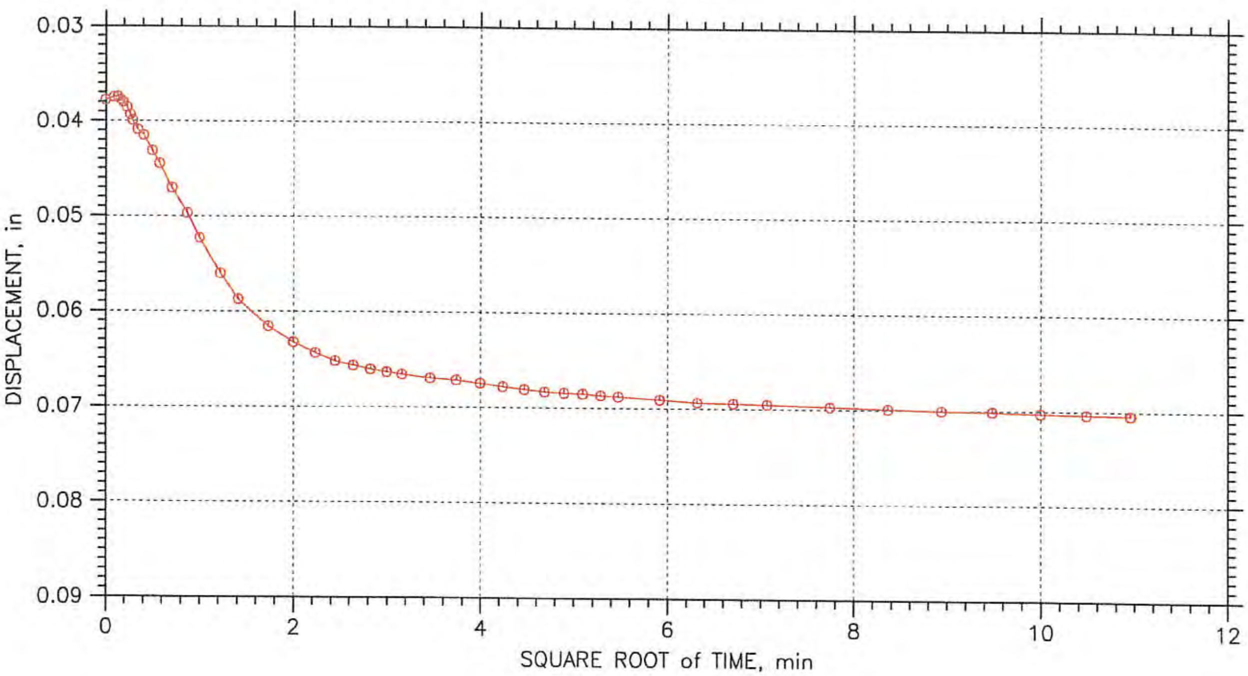
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 7 of 10

Stress: 4 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

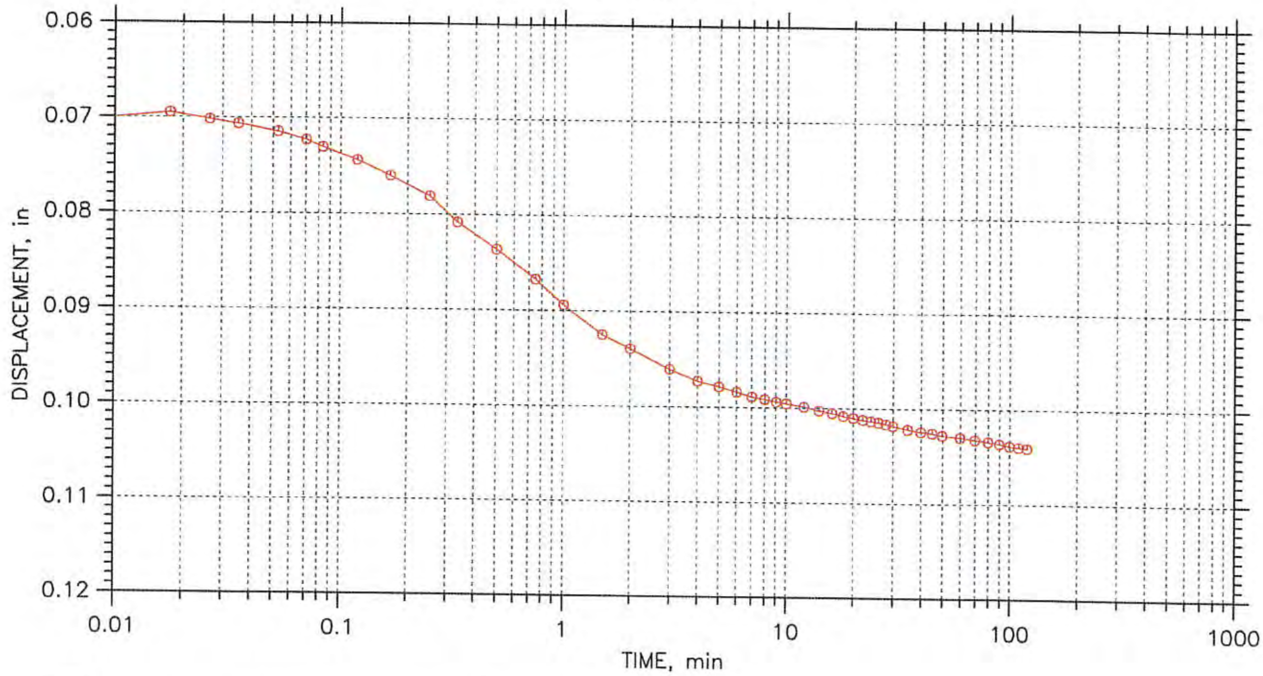
Mon, 02-MAY-2016 15:09:21

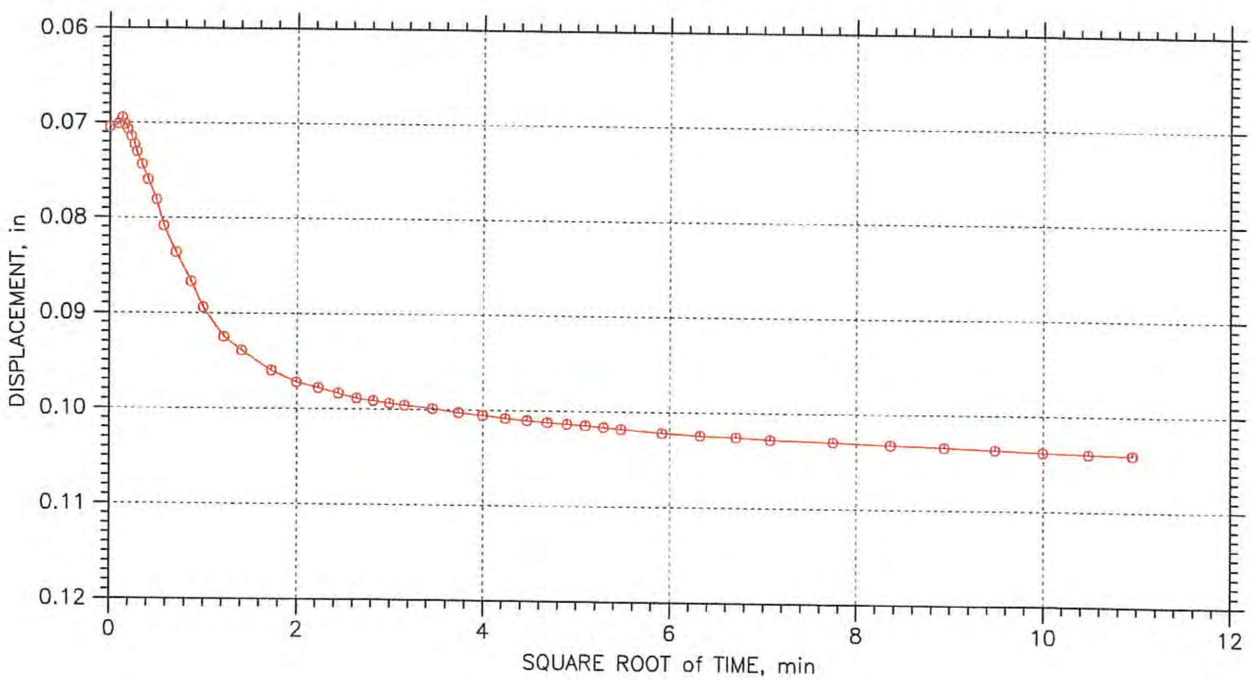
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 8 of 10

Stress: 8 tsf





Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
Description: Moist, dark grey, very soft, silt w/organic		
Remarks: Specimen description is not a soil classification.		

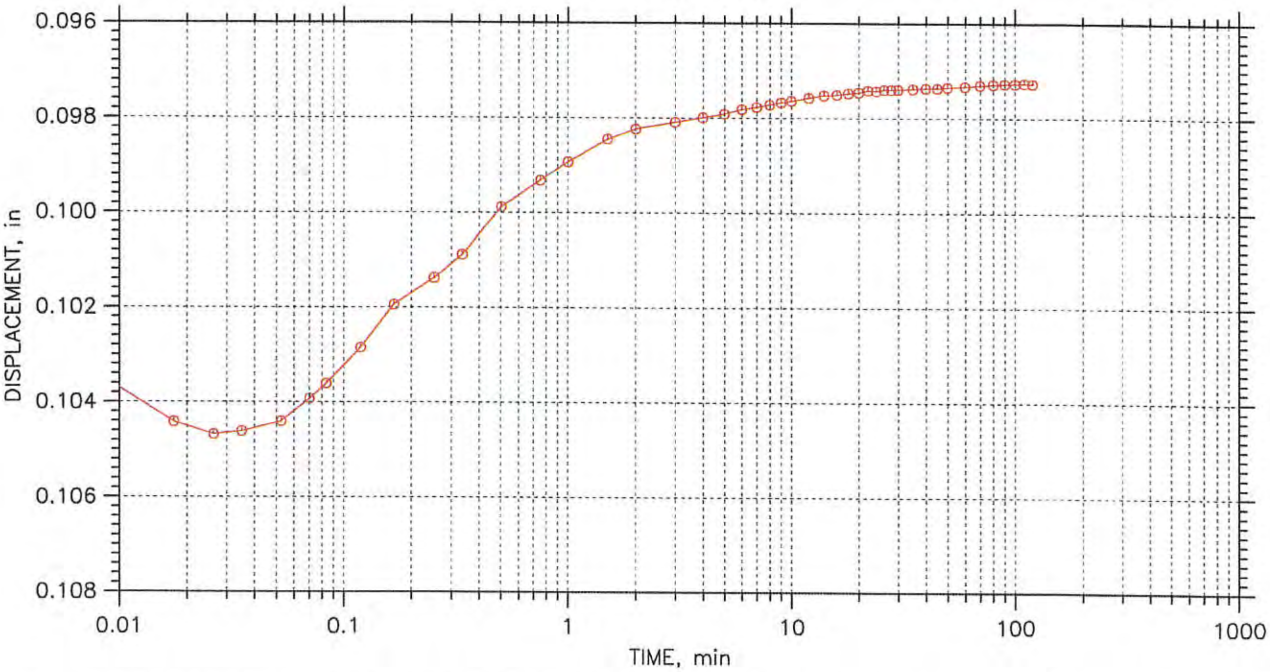
Mon, 02-MAY-2016 15:09:21

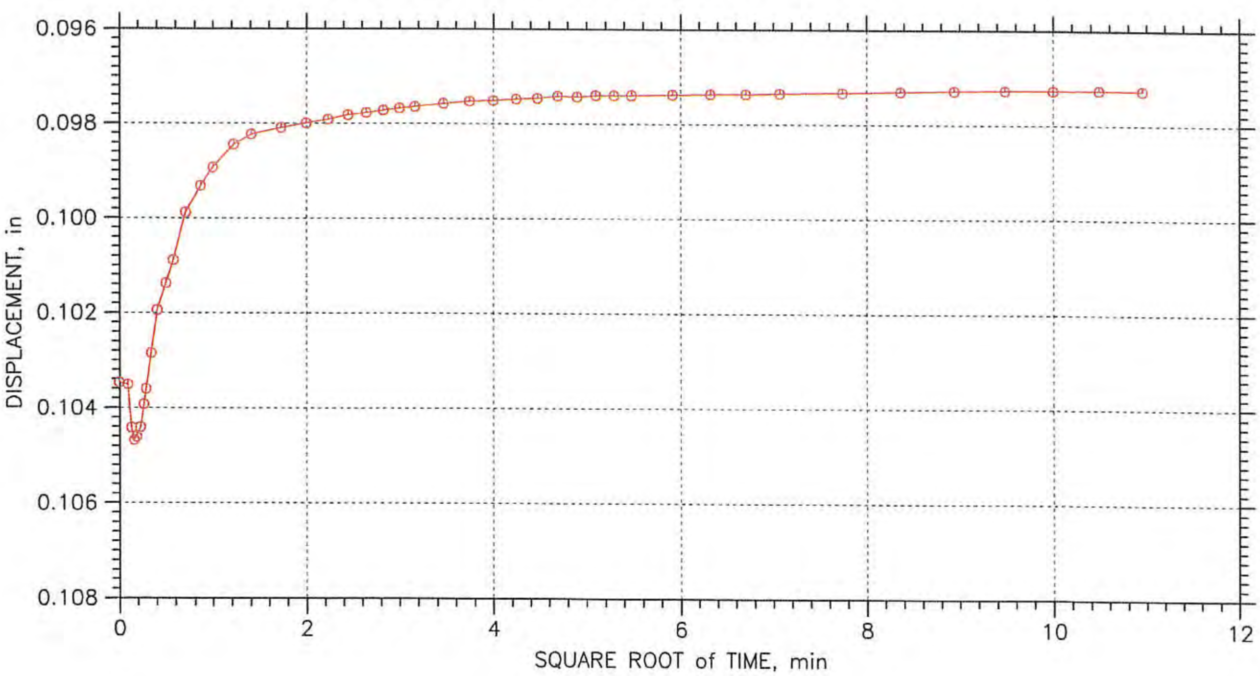
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 9 of 10

Stress: 1 tsf





	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

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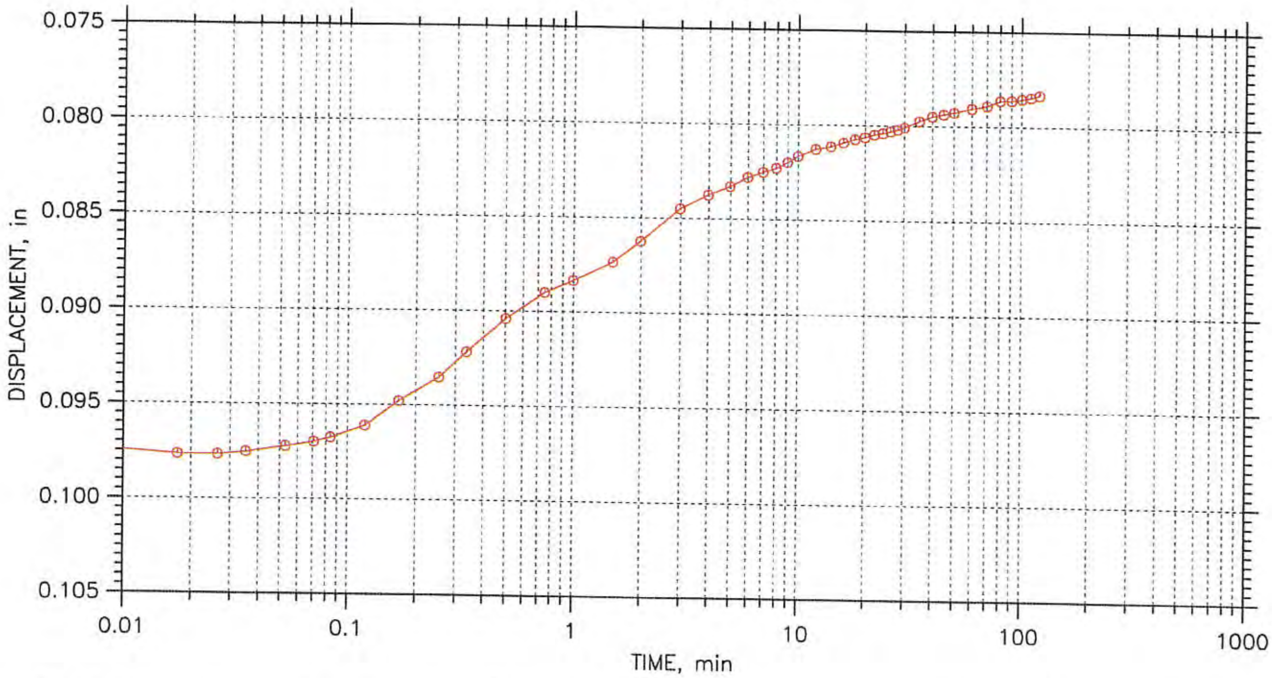
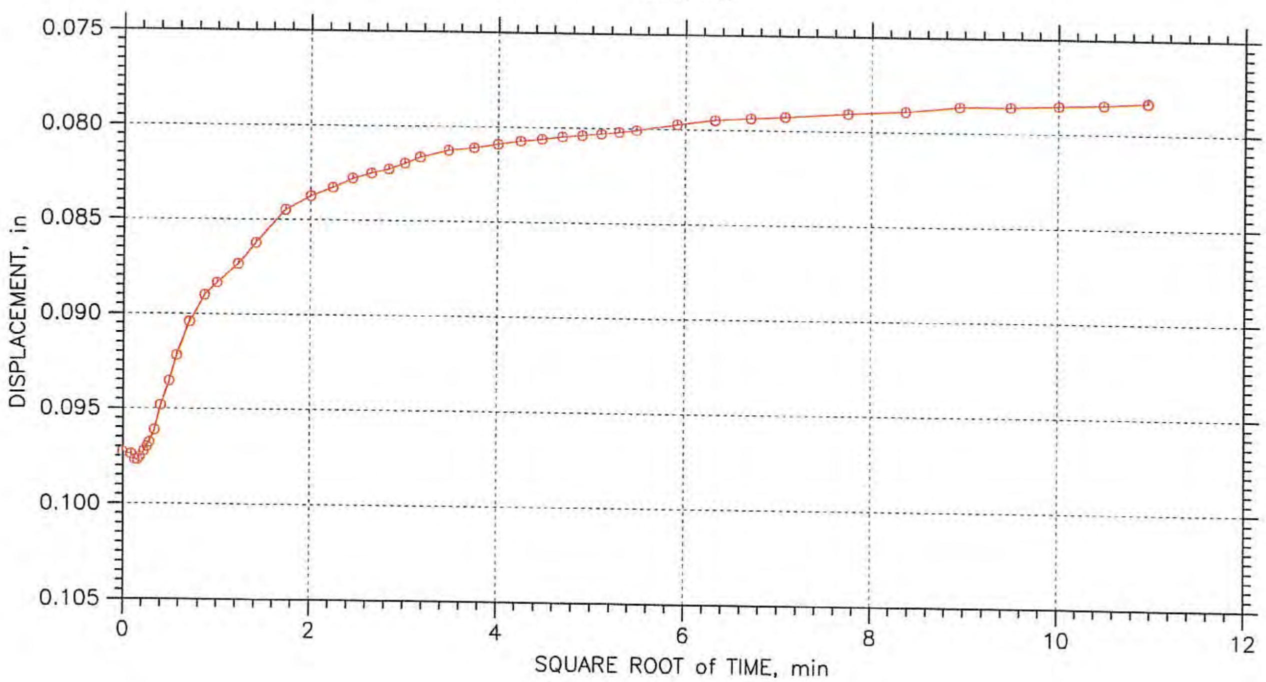
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 10 of 10

Stress: 0.125 tsf

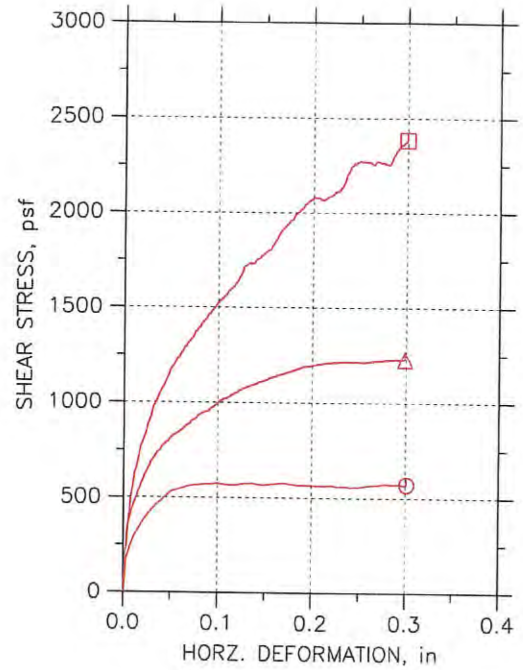


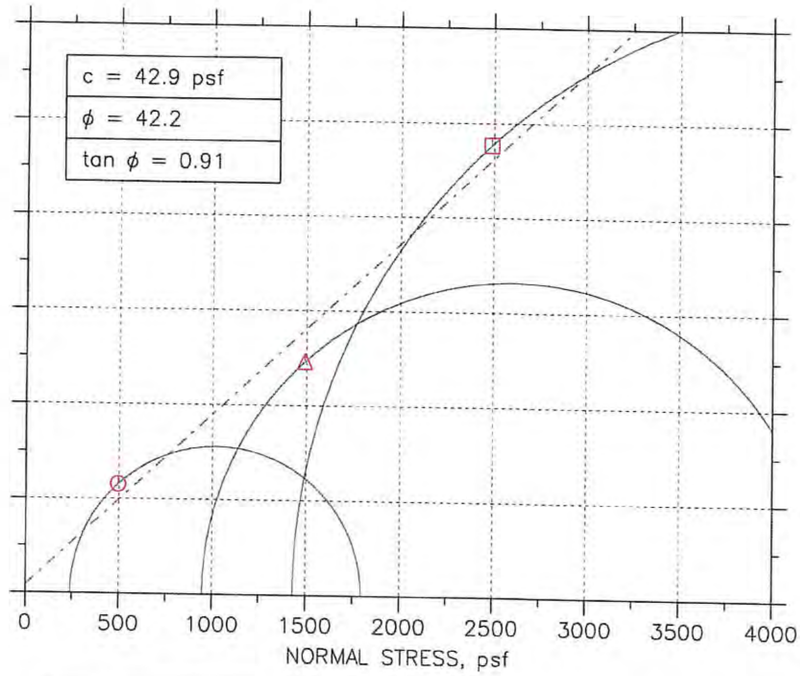


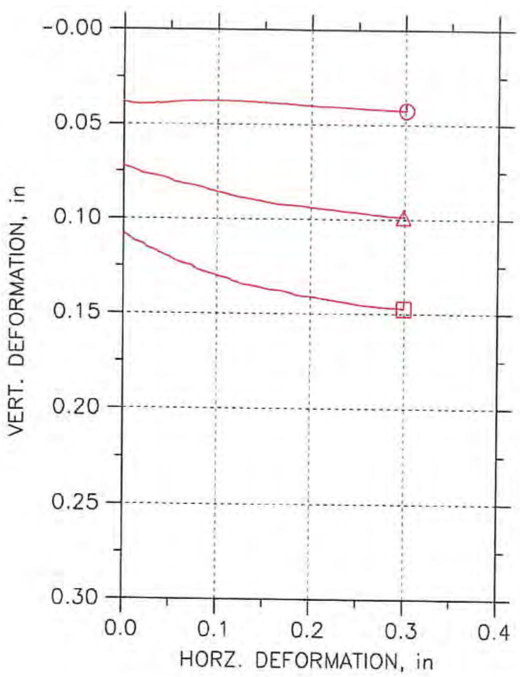
	Project: Jacobs Avenue Leveee	Location:	Project No.: 01-0F2703
	Boring No.: 30C-4	Tested By: AZM	Checked By: GL16-026
	Sample No.: b	Test Date: 4/26/16	Test No.: 16-013-G5
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks: Specimen description is not a soil classification.		

Mon, 02-MAY-2016 15:09:22

DIRECT SHEAR TEST REPORT







Symbol		○	△	□	
Test No.		DS16-14A	DS16-14B	DS16-14C	
Sample No.		3-a	3-a	3-a	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	1.944	1.944	1.944	
	Area, in^2	2.9681	2.9681	2.9681	
	Height, in	1.002	1.003	0.99	
	Water Content, %	46.76	52.26	49.73	
	Dry Density, pcf	74.422	69.831	71.798	
	Saturation, %	99.82	99.81	99.63	
	Void Ratio	1.2648	1.4138	1.3476	
Consol. Height, in		0.9669	0.93604	0.88514	
Consol. Void Ratio		1.1855	1.2526	1.099	
Final	Water Content, %	43.20	43.43	36.84	
	Dry Density, pcf	77.743	77.471	84.356	
	Saturation, %	99.86	99.74	99.64	
	Void Ratio	1.1681	1.1757	0.99814	
Normal Stress, psf		496.51	1491.9	2487.4	
Max. Shear Stress, psf		576.42	1229.6	2382.1	
Ult. Shear Stress, psf		570.2	1227	2382.1	
Time to Failure, min		36.009	75.742	76.405	
Disp. Rate, in/min		0.004	0.004	0.004	
Implied Specific Gravity		2.70	2.70	2.70	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	
Plasticity Index		---	---	---	

Project: Jacobs Avenue Levee

Location:

Project No.: 01-0F2703

Boring No.: 10L

Sample Type:

Description: Moist, Med Gray, Firm, Silty Clay.

Remarks: ASTM D 3080. Sample description is not a soil classification.

5/2/16

Thu, 28-APR-2016 11:15:26

DIVISION OF
ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY
5900 Folsom Boulevard
Sacramento, CA 95819

Date: 5/3/2016

To: David Waterman / DMLab

From: Lilibeth C. Purta / (916) 227-5239

RE: Laboratory Test Report -- EA: 01-0F2703
Project: 0115000098
GL 16-026

Final test results.

Note: All remaining test specimens will be disposed of in 30 calendar days from the release date of the final test results.

AASHTO R18

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Jacobs Avenue Levee
Boring No.: 10L
Sample No.: 4
Test No.: 16-012-G4

Location:
Tested By: AZM
Test Date: 4/26/16
Sample Type: Shelby Tube

Project No.: 01-0F2703
Checked By: GL16-026
Depth: 15-17.5 jp 5/2/16
Elevation:

Soil Description: Moist, dark grey, very soft, silt w/organic
Remarks:

Measured Specific Gravity: 2.78
Initial Void Ratio: 1.09
Final Void Ratio: 0.804

Liquid Limit: ---
Plastic Limit: ---
Plasticity Index: ---

Initial Height: 0.75 in
Specimen Diameter: 1.94 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID		RING		
Wt. Container + Wet Soil, gm	95.200	95.200	90.200	90.200
Wt. Container + Dry Soil, gm	76.200	76.200	76.200	76.200
Wt. Container, gm	27.600	27.600	27.600	27.600
Wt. Dry Soil, gm	48.600	48.600	48.600	48.600
Water Content, %	39.09	39.09	28.81	28.81
Void Ratio	---	1.09	0.804	---
Degree of Saturation, %	---	99.88	99.72	---
Dry Unit Weight, pcf	---	83.171	96.331	---

One-Dimensional Consolidation by ASTM D 2435 - Method B

Project: Jacobs Avenue Levee
Boring No.: 10L
Sample No.: 4
Test No.: 16-012-G4

Location:
Tested By: AZM
Test Date: 4/26/16
Sample Type: Shelby Tube

Project No.: 01-0F2703
Checked By: GL16-026
Depth: 15-17.5
Elevation:

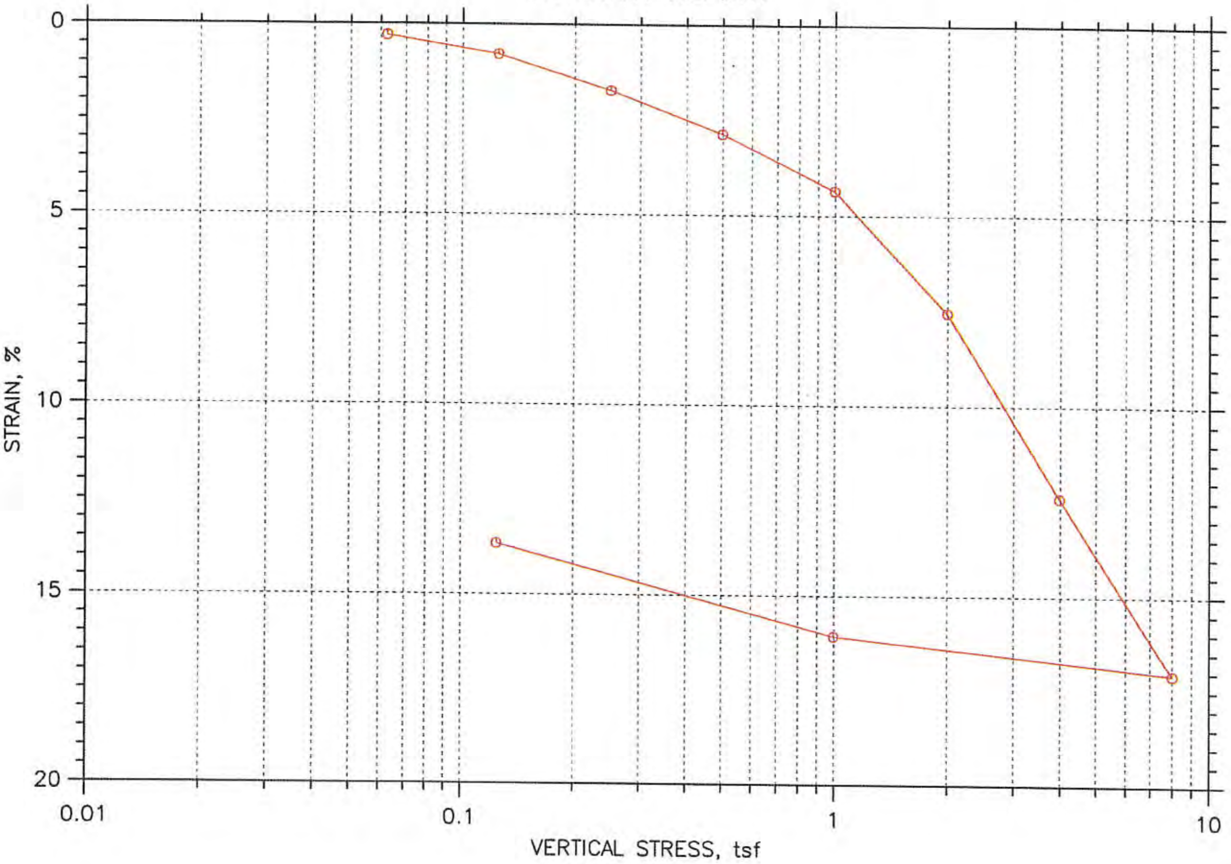
Soil Description: Moist, dark grey, very soft, silt w/organic
Remarks:
Displacement at End of Increment

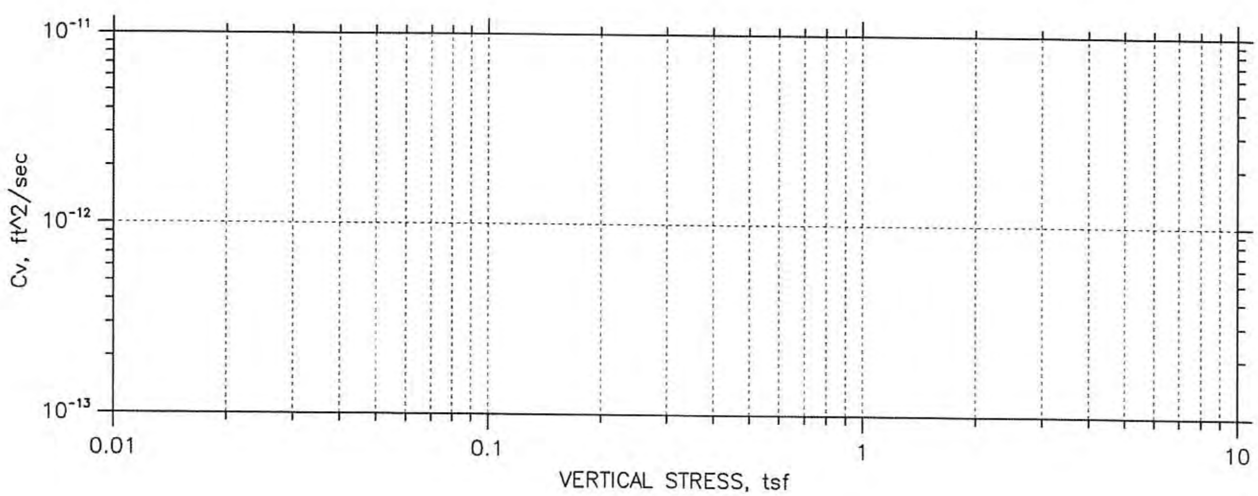
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Sq.Rt T90 min	Cv ft^2/sec	Mv 1/tsf	k ft/day
1	0.0625	0.002220	1.08	0.296	4.740	2.90e-006	4.74e-002	3.71e-004
2	0.125	0.005929	1.07	0.791	538.406	2.54e-008	7.91e-002	5.41e-006
3	0.250	0.01302	1.05	1.74	5.818	2.31e-006	7.56e-002	4.72e-004
4	0.500	0.02150	1.03	2.87	4.822	2.73e-006	4.52e-002	3.33e-004
5	1.00	0.03259	0.999	4.35	4.436	2.89e-006	2.96e-002	2.31e-004
6	2.00	0.05662	0.932	7.55	5.865	2.08e-006	3.20e-002	1.80e-004
7	4.00	0.09304	0.830	12.4	5.957	1.88e-006	2.43e-002	1.23e-004
8	8.00	0.1279	0.733	17.1	4.931	2.04e-006	1.16e-002	6.38e-005
9	1.00	0.1205	0.754	16.1	2.853	3.37e-006	1.41e-003	1.28e-005
10	0.125	0.1025	0.804	13.7	15.686	6.38e-007	2.75e-002	4.73e-005

	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	Log T50 min	Cv ft^2/sec	Mv 1/tsf	k ft/day	Ca %
1	0.0625	0.002220	1.08	0.296	0.000	0.00e+000	4.74e-002	0.00e+000	0.00e+000
2	0.125	0.005929	1.07	0.791	0.000	0.00e+000	7.91e-002	0.00e+000	0.00e+000
3	0.250	0.01302	1.05	1.74	0.000	0.00e+000	7.56e-002	0.00e+000	0.00e+000
4	0.500	0.02150	1.03	2.87	0.000	0.00e+000	4.52e-002	0.00e+000	0.00e+000
5	1.00	0.03259	0.999	4.35	1.144	2.60e-006	2.96e-002	2.08e-004	0.00e+000
6	2.00	0.05662	0.932	7.55	1.737	1.63e-006	3.20e-002	1.41e-004	0.00e+000
7	4.00	0.09304	0.830	12.4	1.527	1.70e-006	2.43e-002	1.11e-004	0.00e+000
8	8.00	0.1279	0.733	17.1	0.967	2.41e-006	1.16e-002	7.56e-005	0.00e+000
9	1.00	0.1205	0.754	16.1	0.000	0.00e+000	1.41e-003	0.00e+000	0.00e+000
10	0.125	0.1025	0.804	13.7	3.892	5.97e-007	2.75e-002	4.43e-005	0.00e+000

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



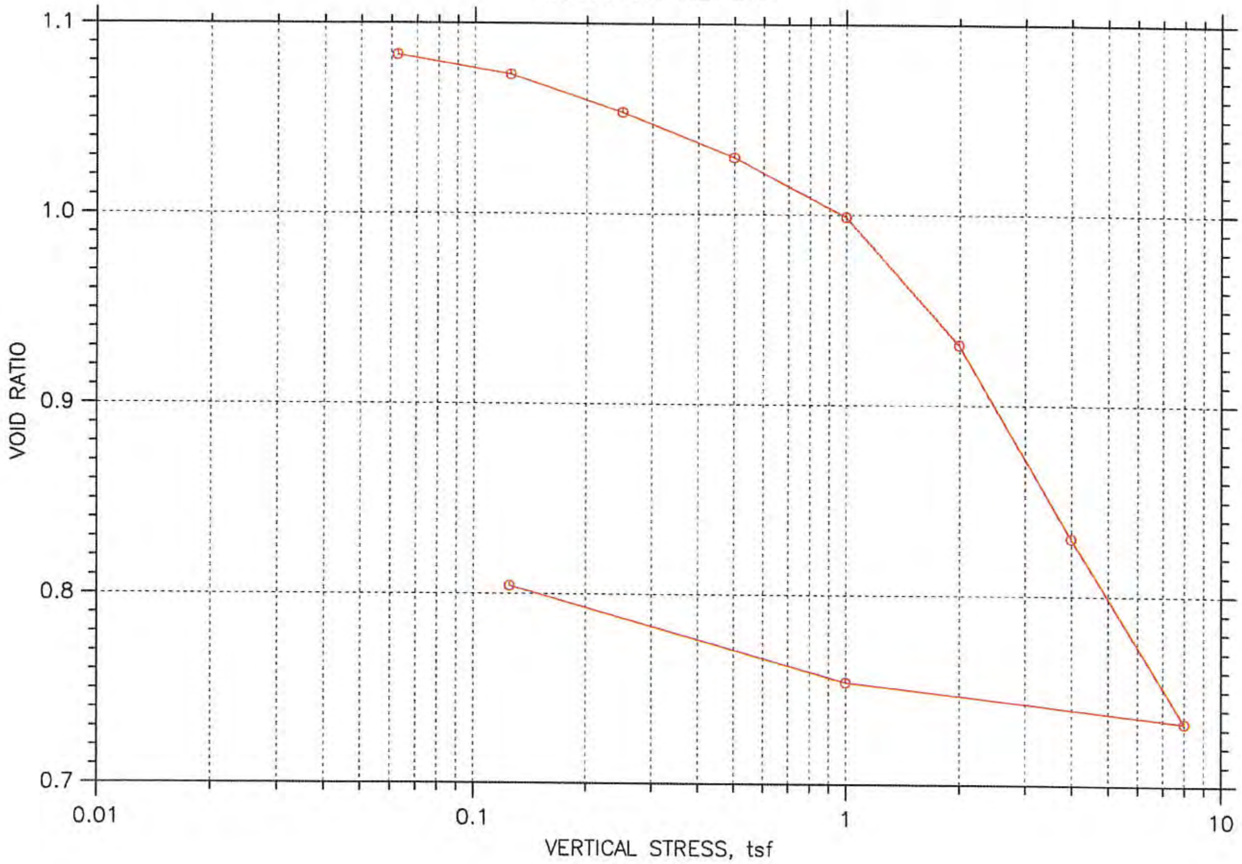


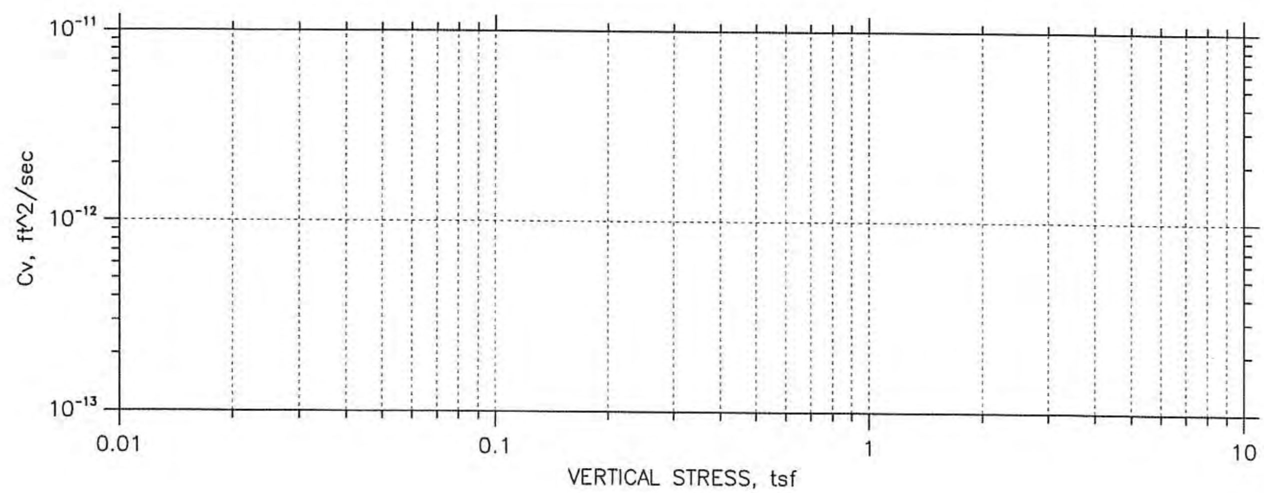
	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		
	Displacement at End of Increment		

Mon, 02-MAY-2016 15:20:35

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



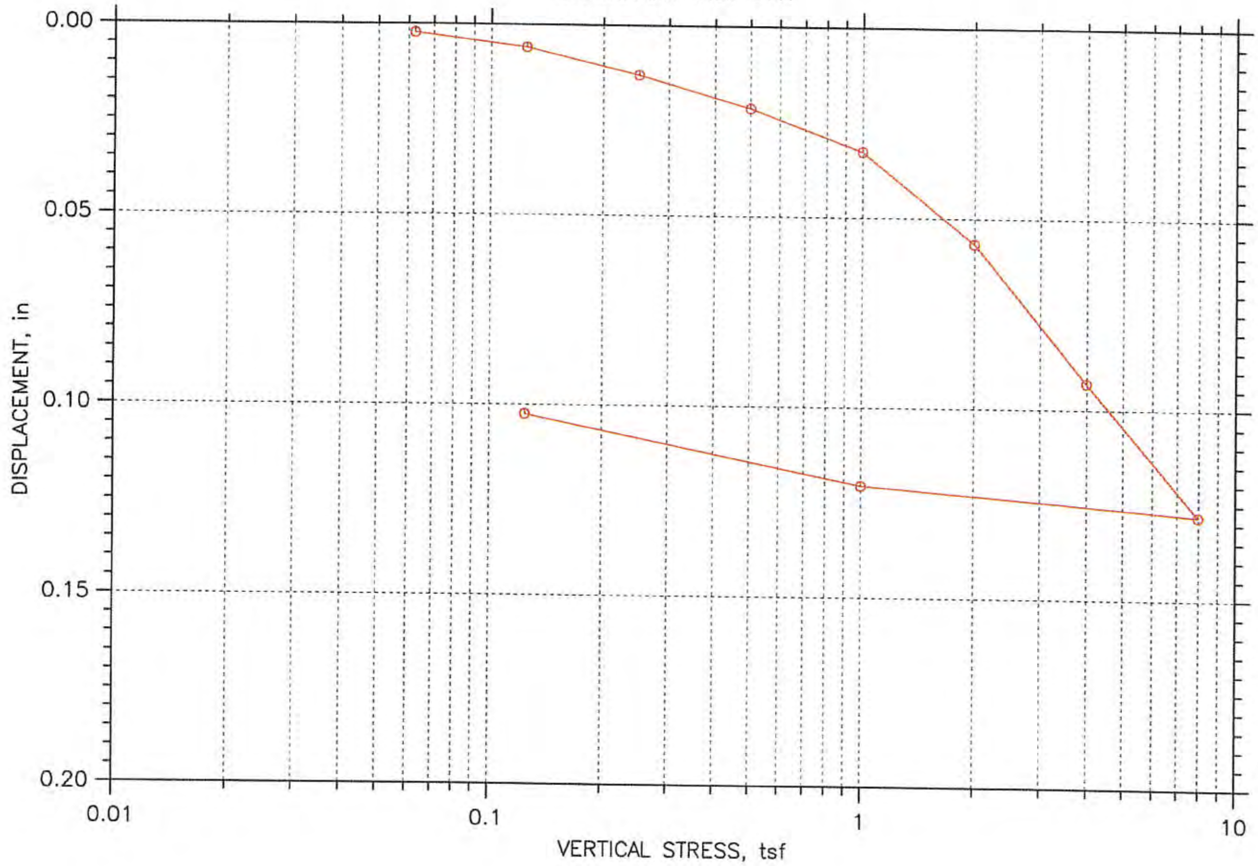


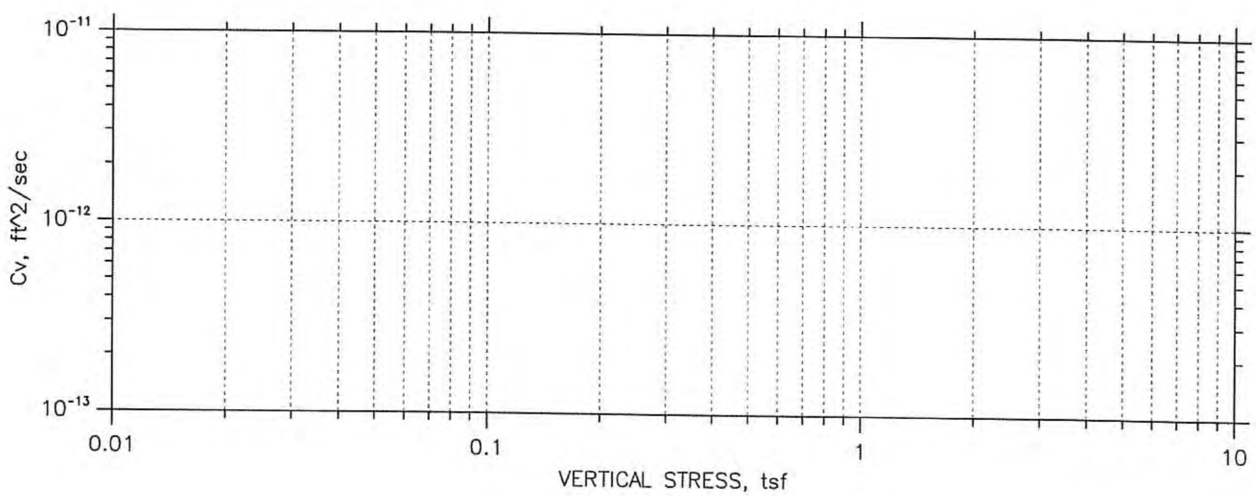
	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		
	Displacement at End of Increment		

Mon, 02-MAY-2016 15:19:15

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

SUMMARY REPORT



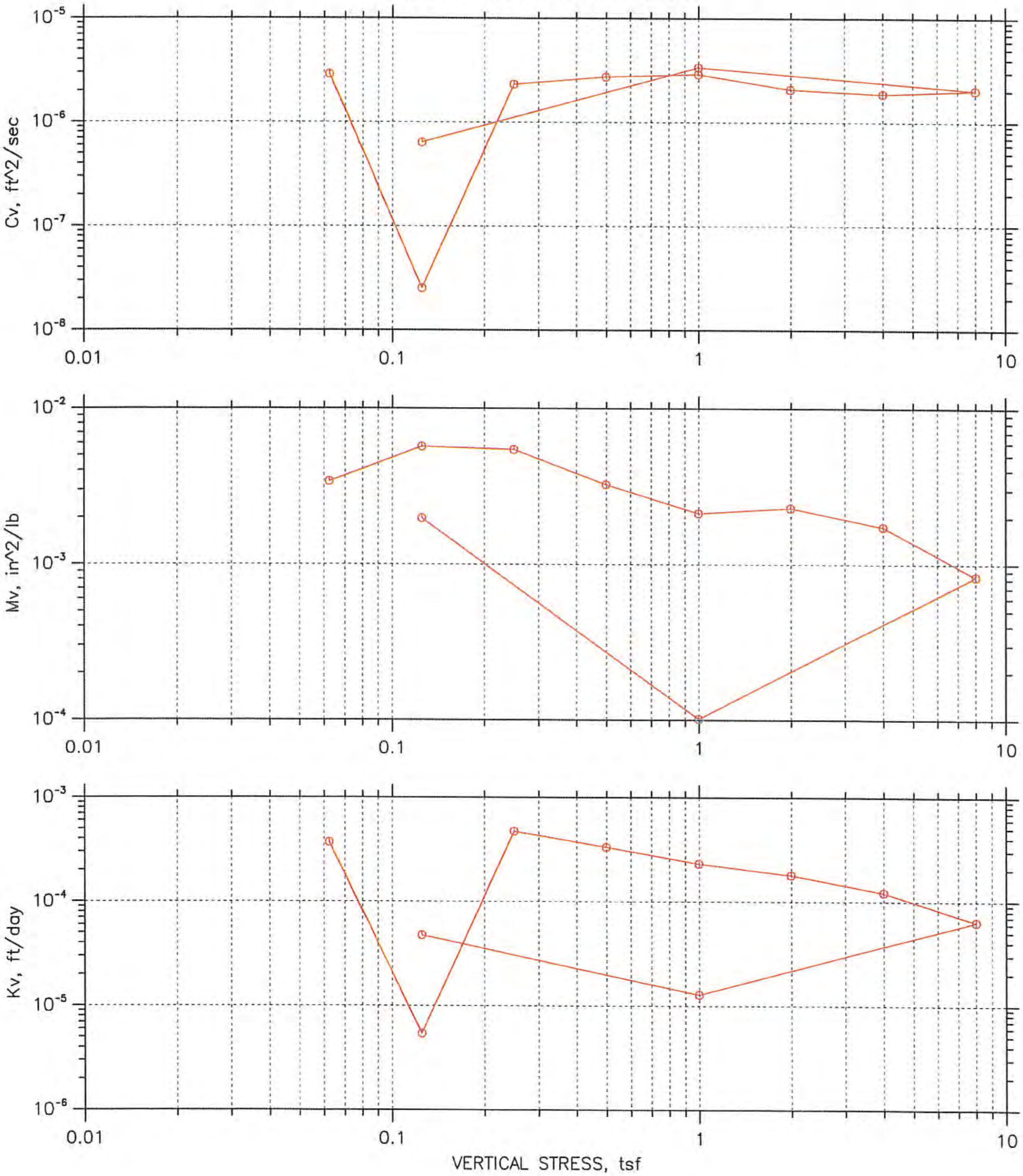


	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		
	Displacement at End of Increment		

Mon, 02-MAY-2016 15:21:03

One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

ROOT of TIME COEFFICIENTS

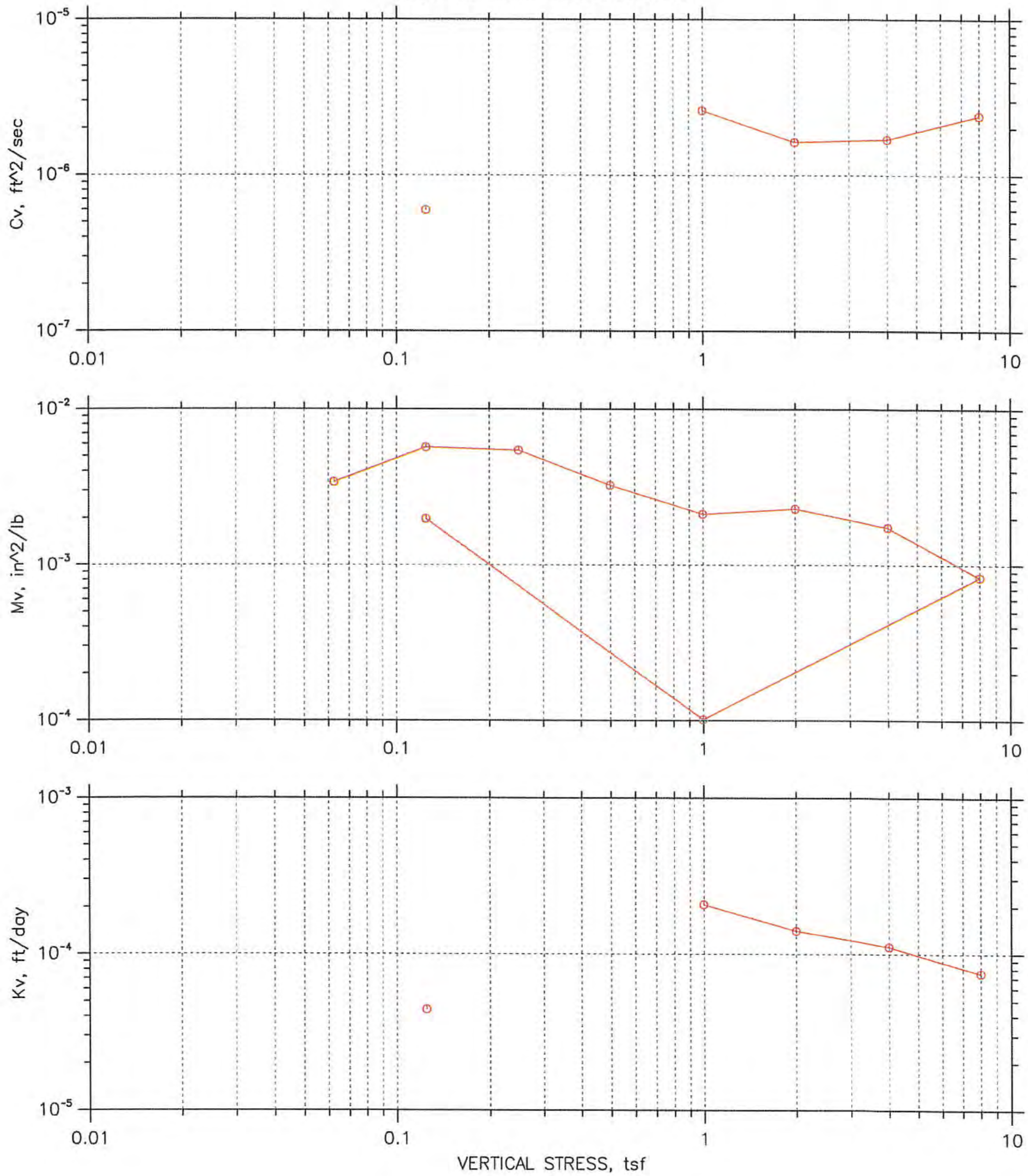


	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		
	Displacement at End of Increment		

Mon, 02-MAY-2016 15:21:03

One-Dimensional Consolidation by ASTM D 2435 ⇹ Method B

LOG of TIME COEFFICIENTS



	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		
	Displacement at End of Increment		

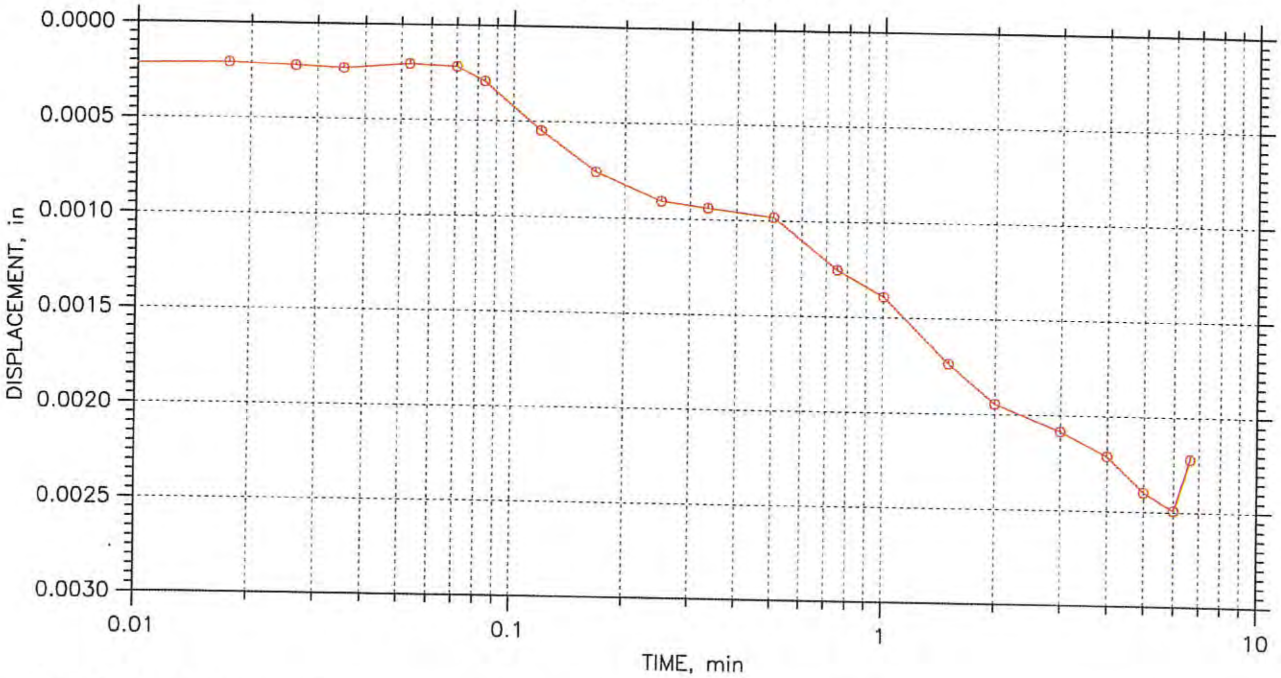
Mon, 02-MAY-2016 15:21:03

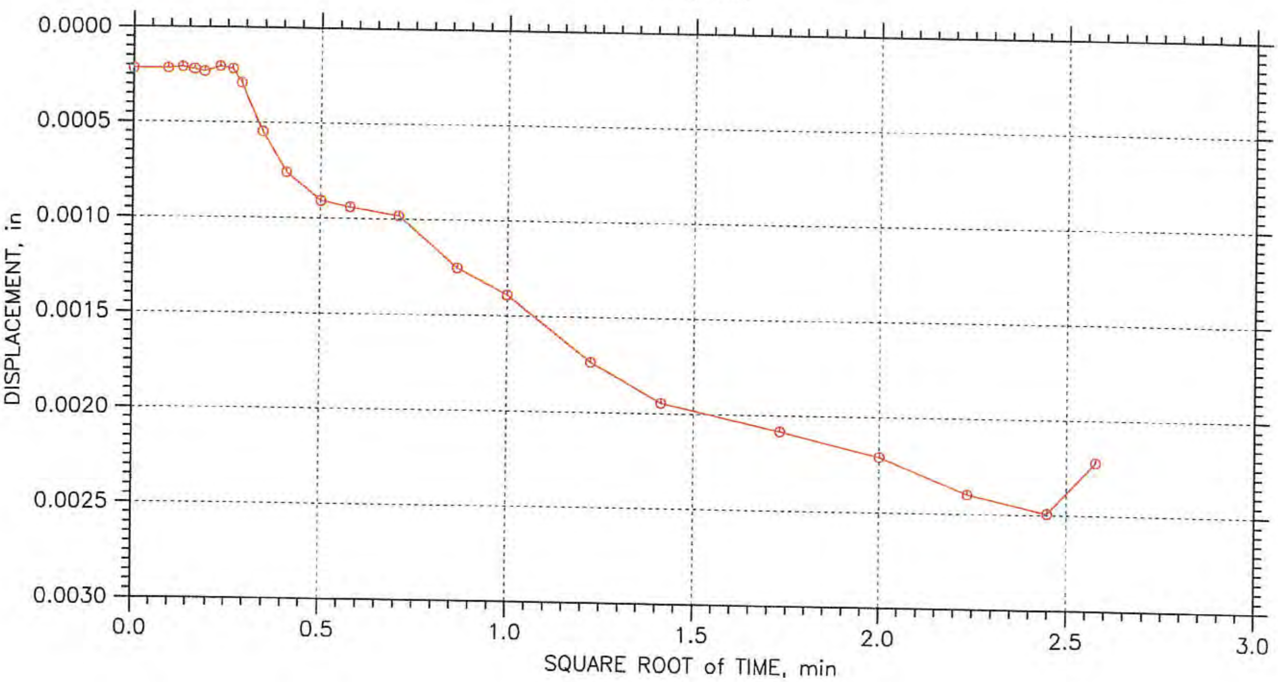
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 1 of 10

Stress: 0.0625 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

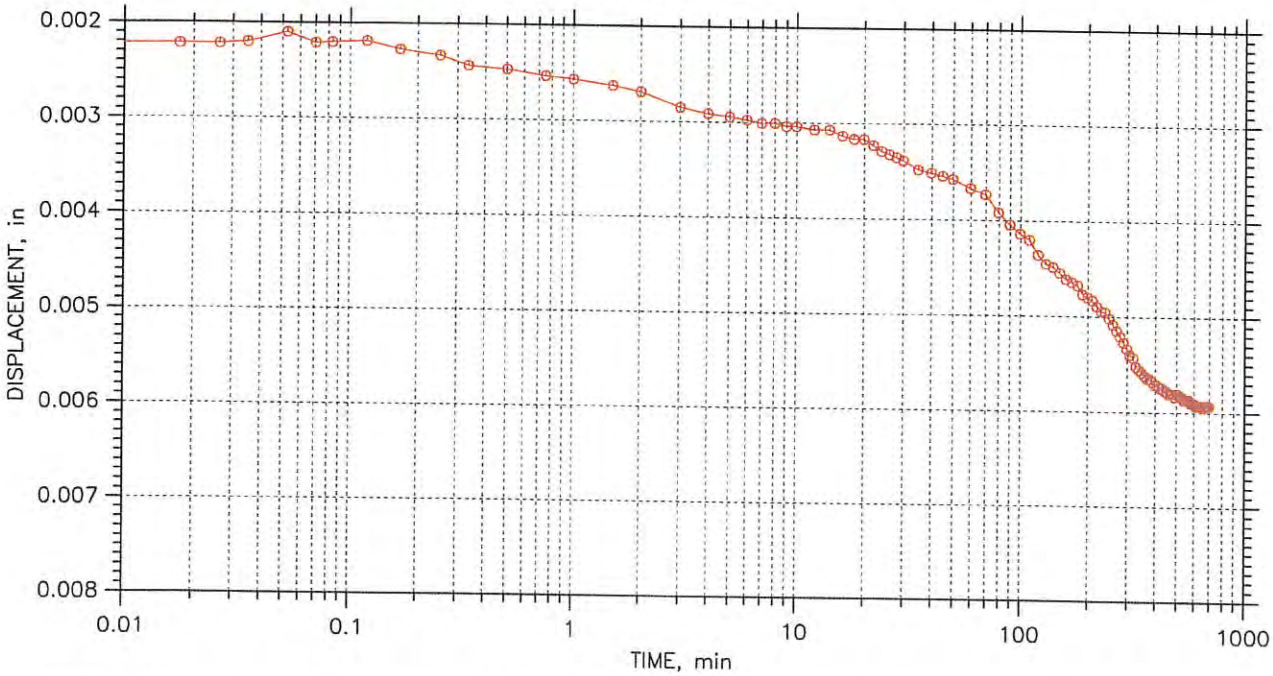
Mon, 02-MAY-2016 15:21:03

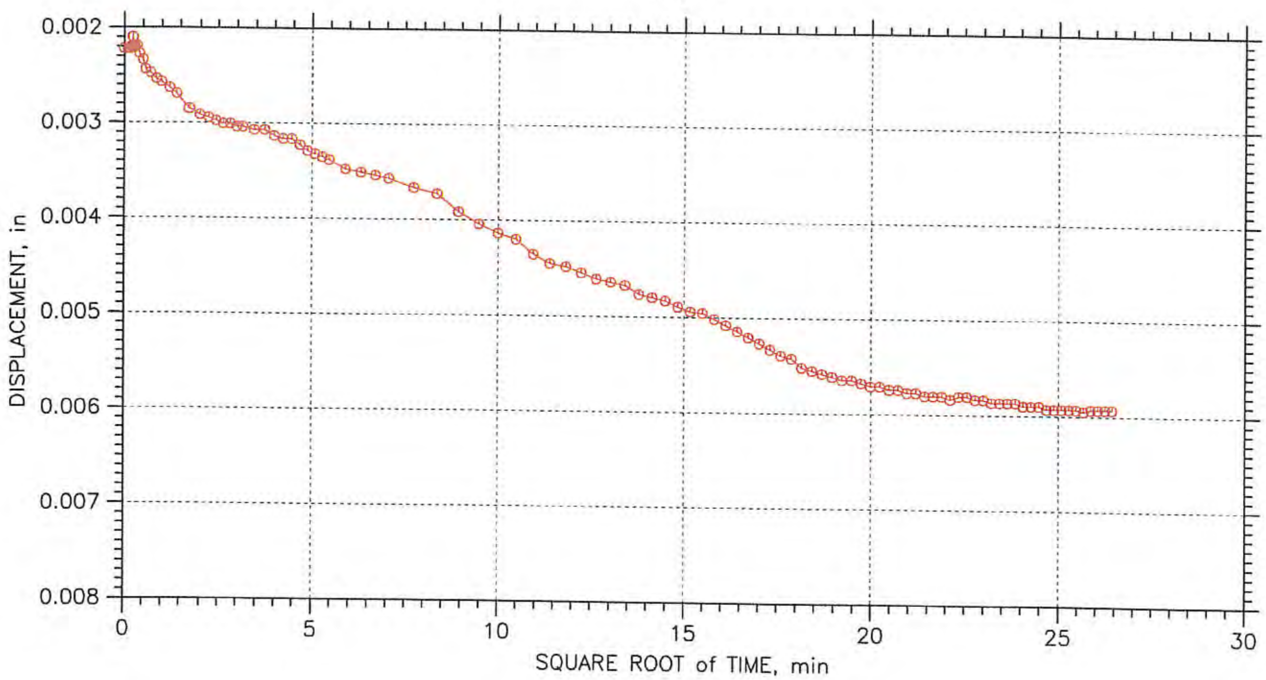
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 2 of 10

Stress: 0.125 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

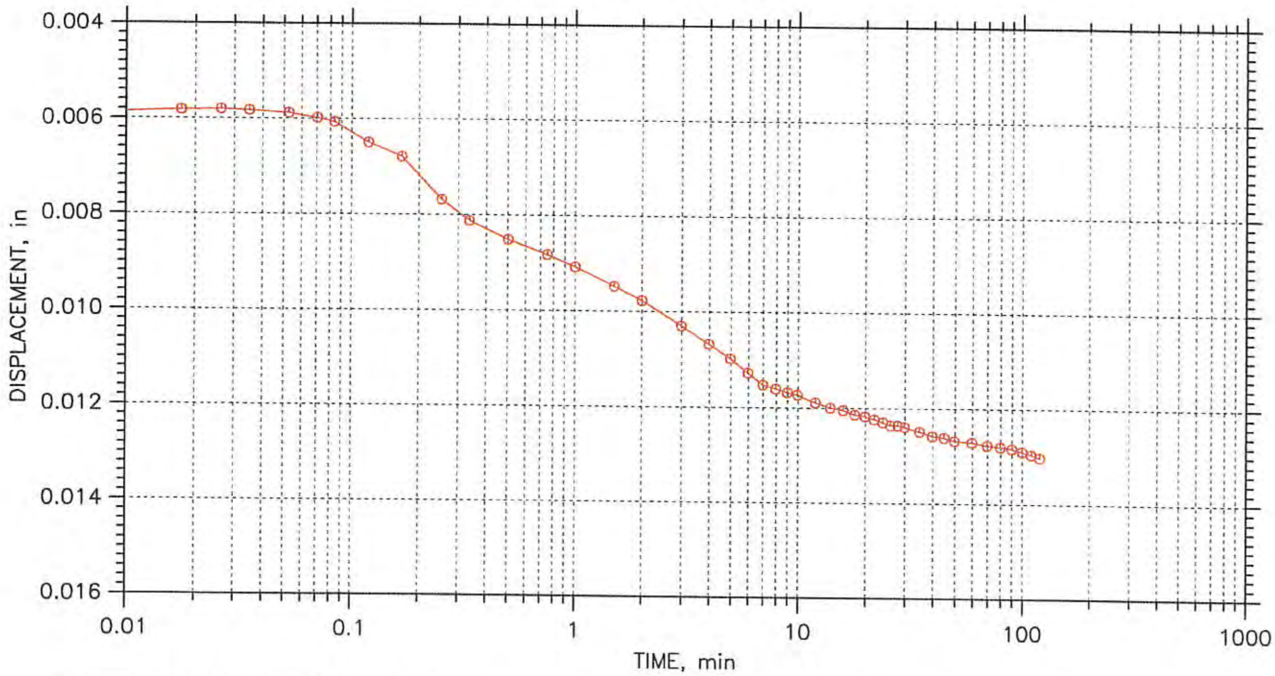
Mon, 02-MAY-2016 15:21:03

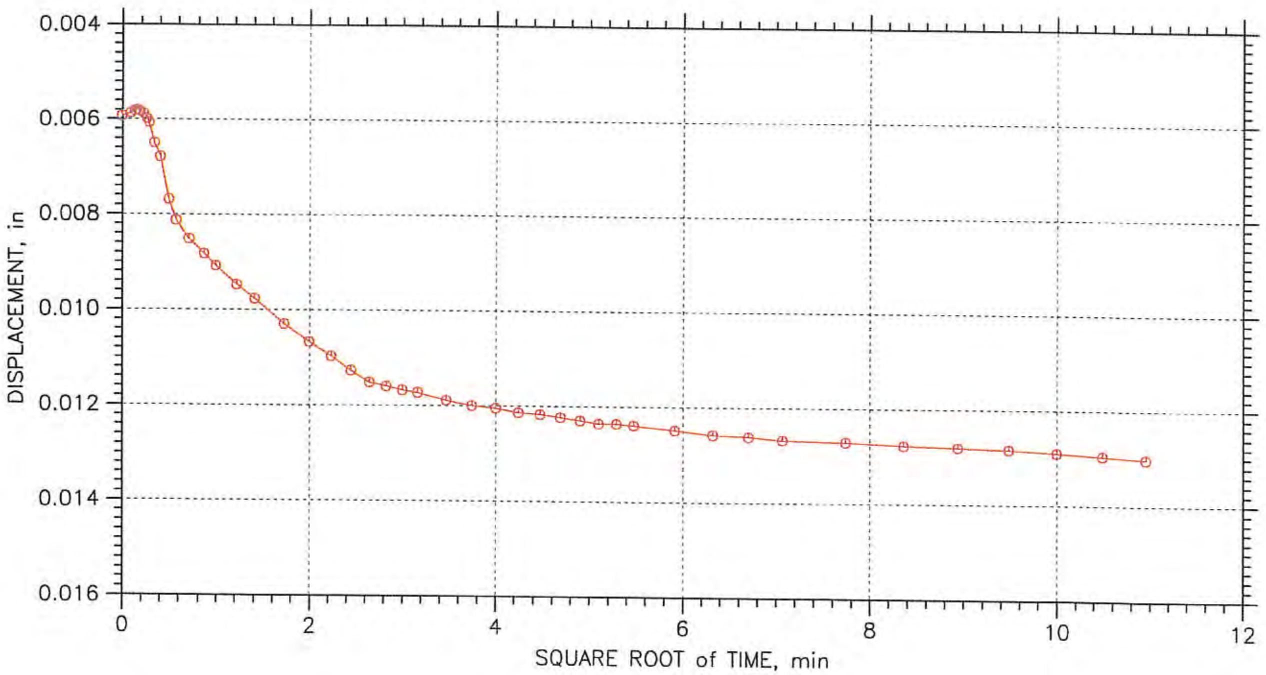
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 3 of 10

Stress: 0.25 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

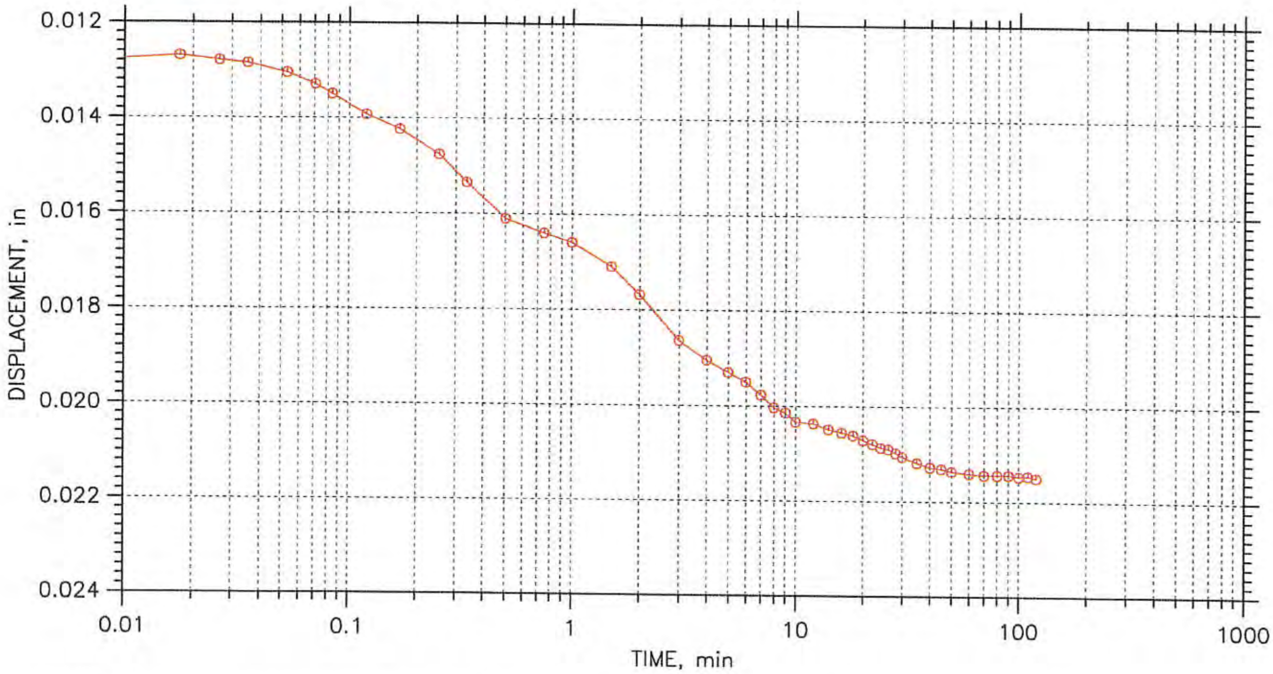
Mon, 02-MAY-2016 15:21:04

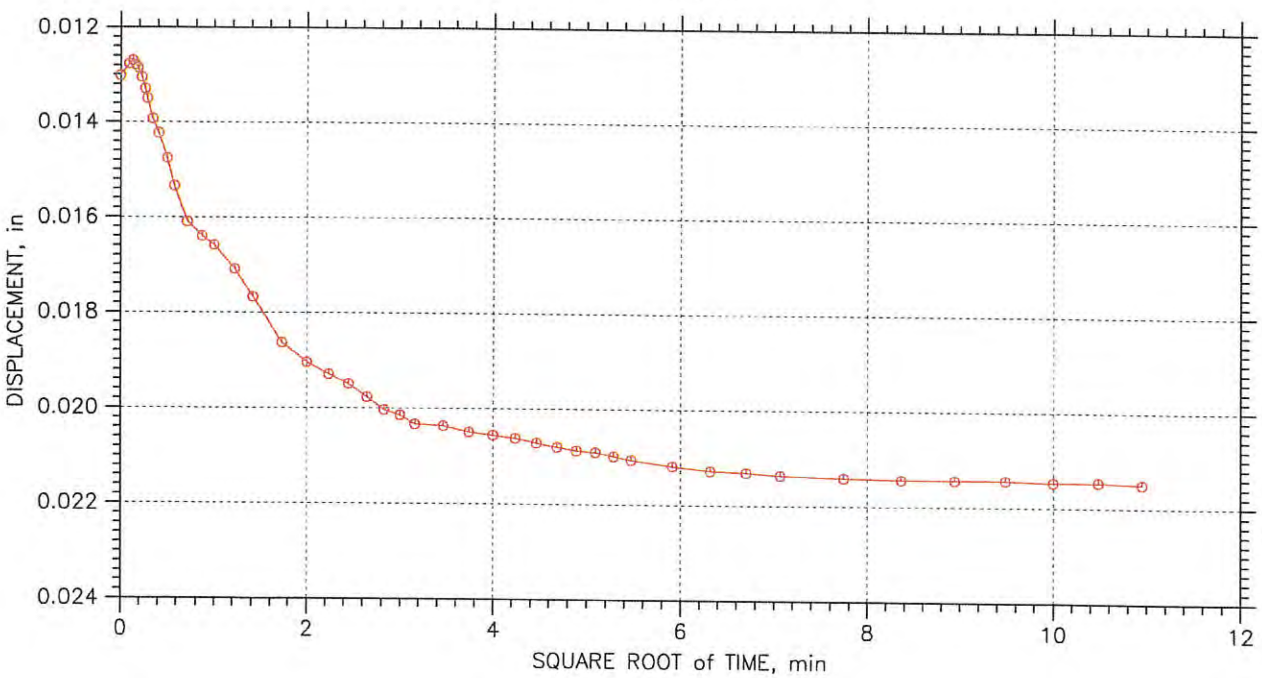
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 4 of 10

Stress: 0.5 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

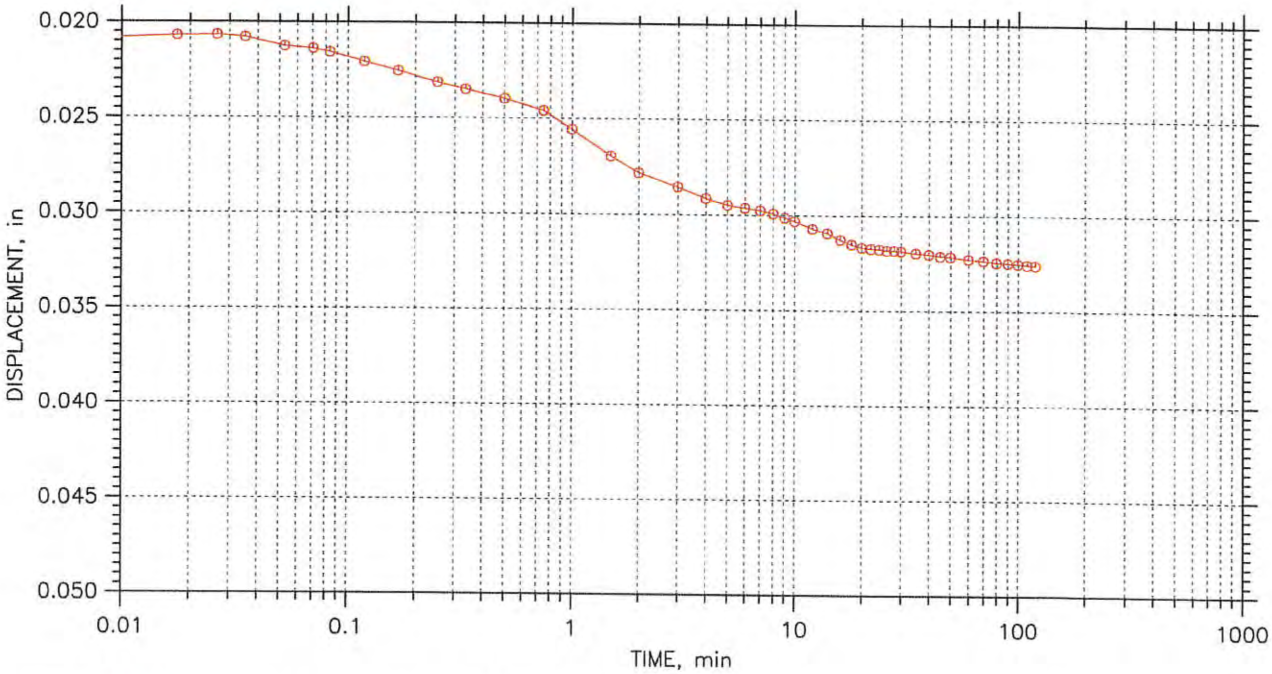
Mon, 02-MAY-2016 15:21:04

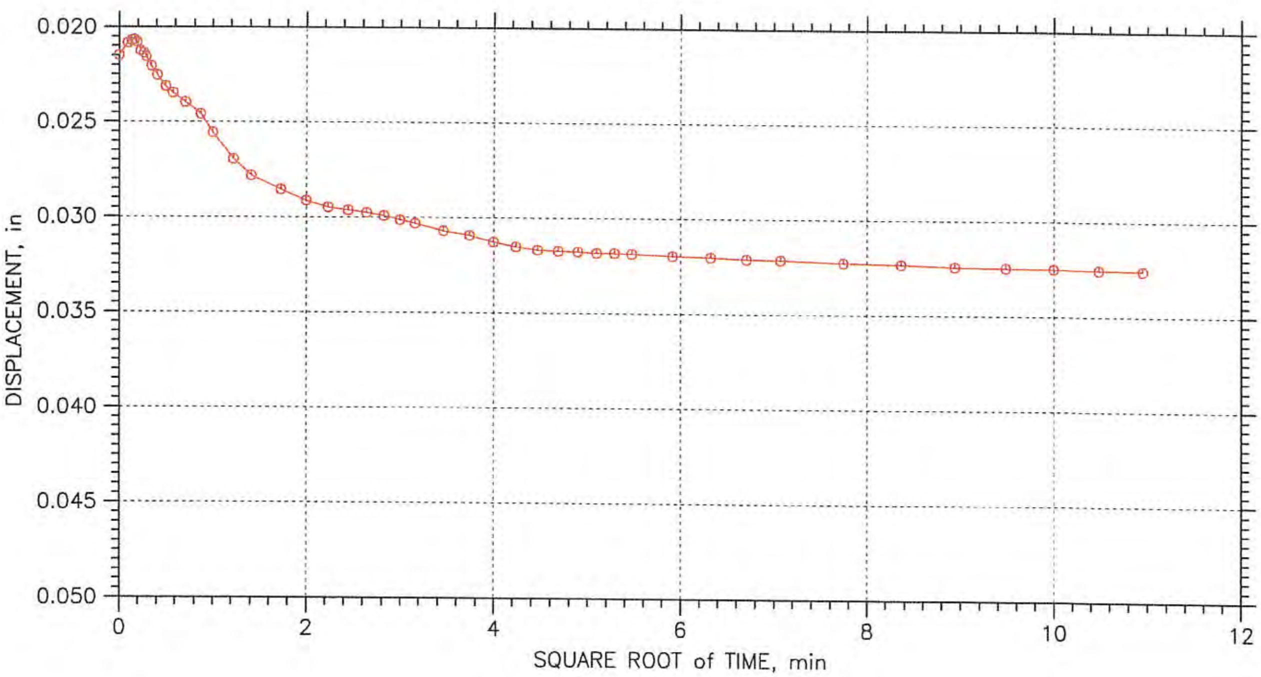
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 5 of 10

Stress: 1 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

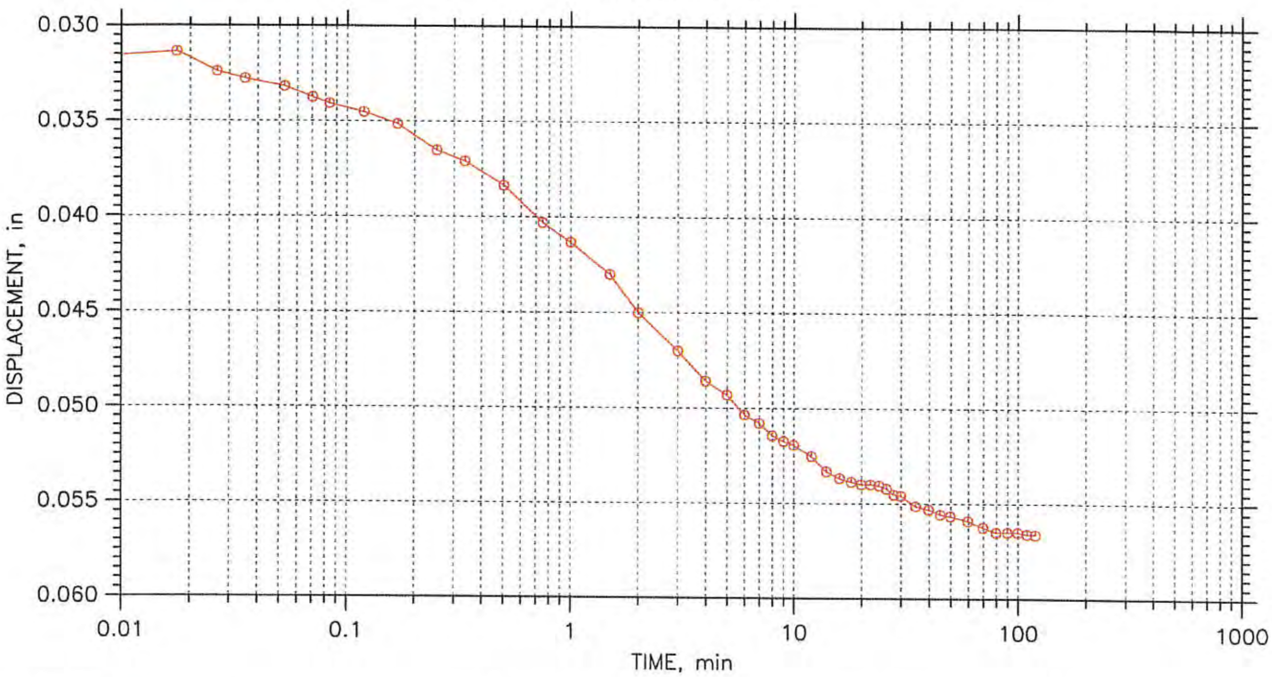
Mon, 02-MAY-2016 15:21:04

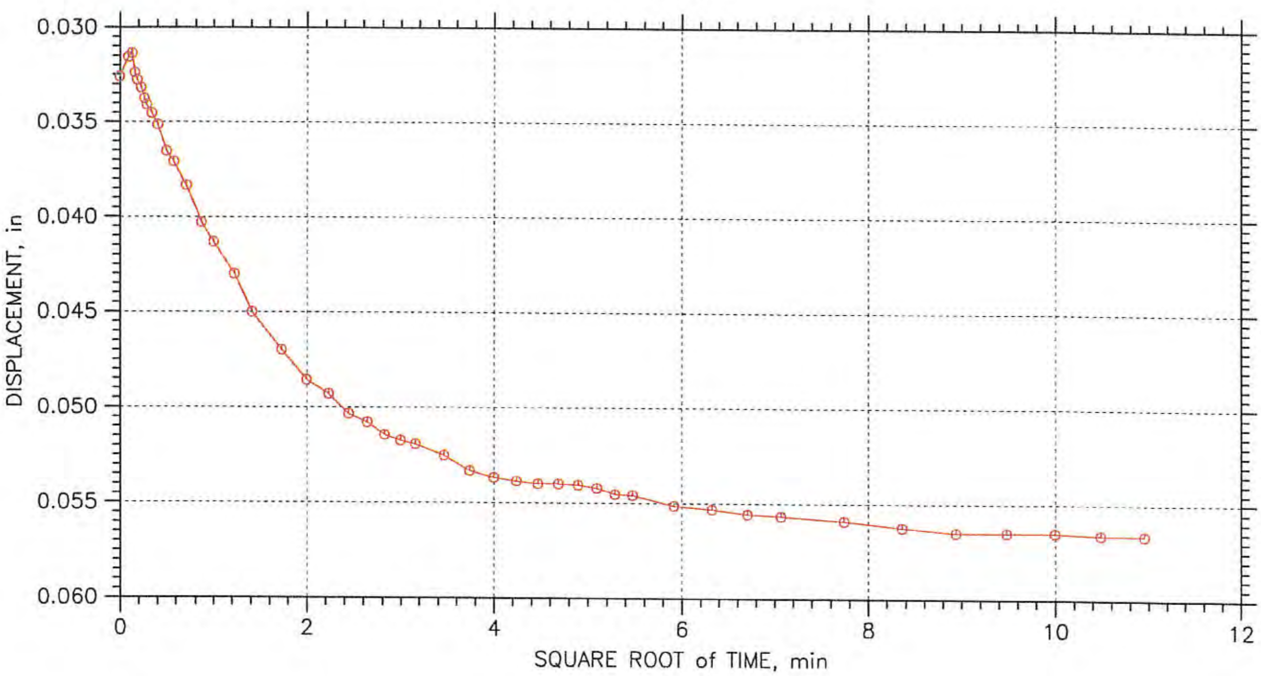
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 6 of 10

Stress: 2 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

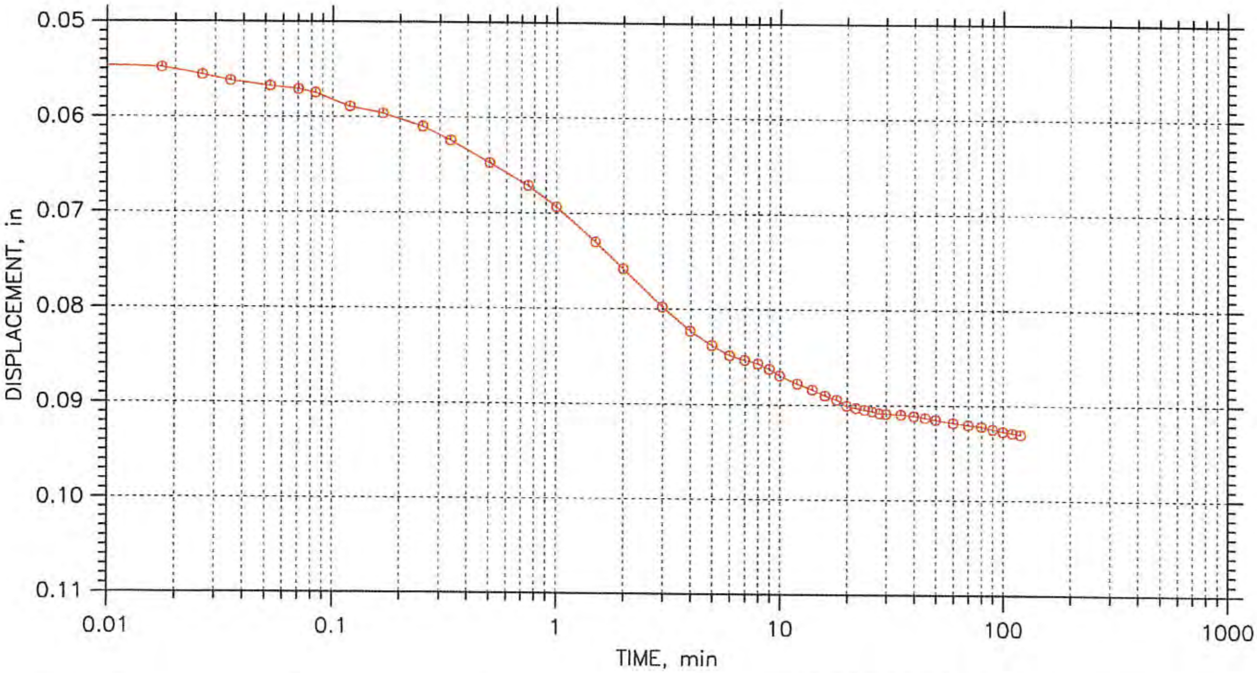
Mon, 02-MAY-2016 15:21:04

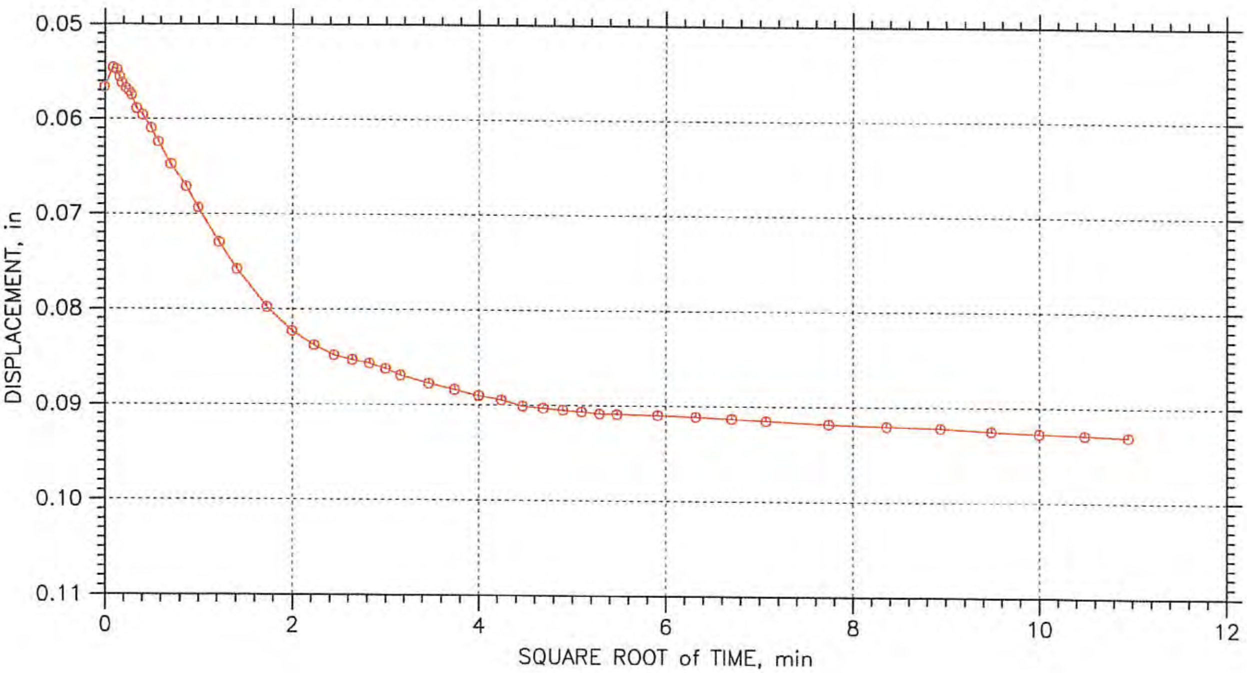
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 7 of 10

Stress: 4 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

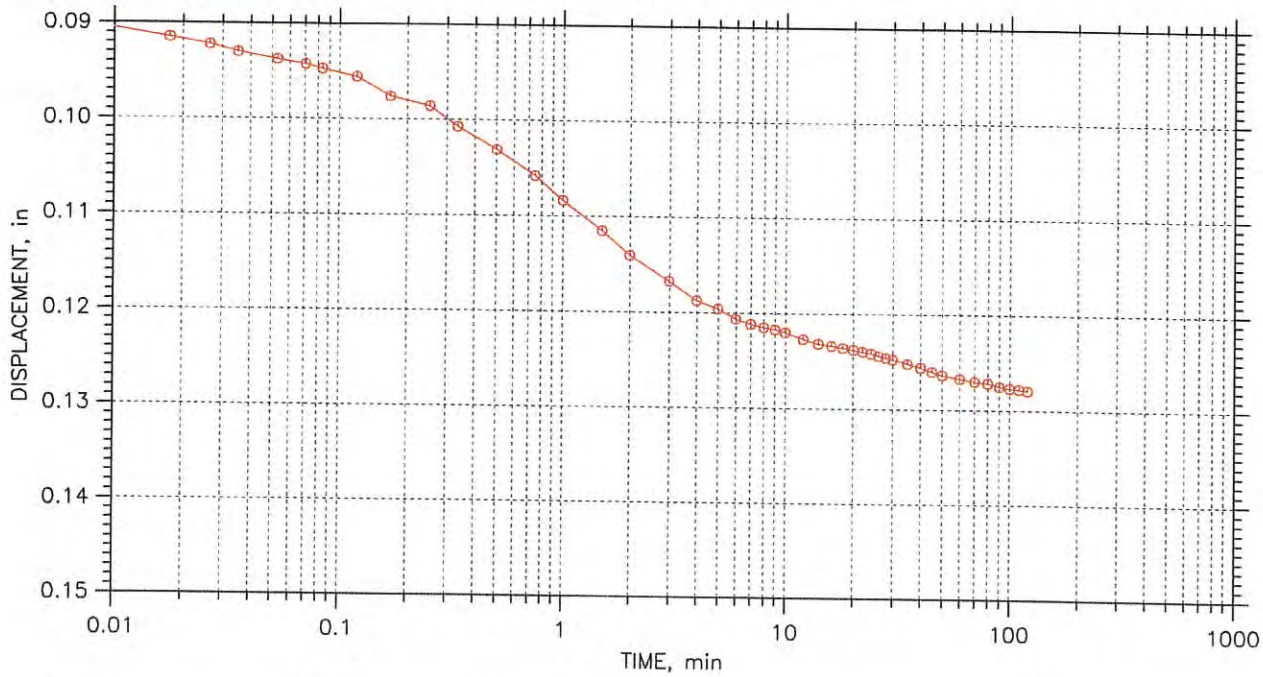
Mon, 02-MAY-2016 15:21:05

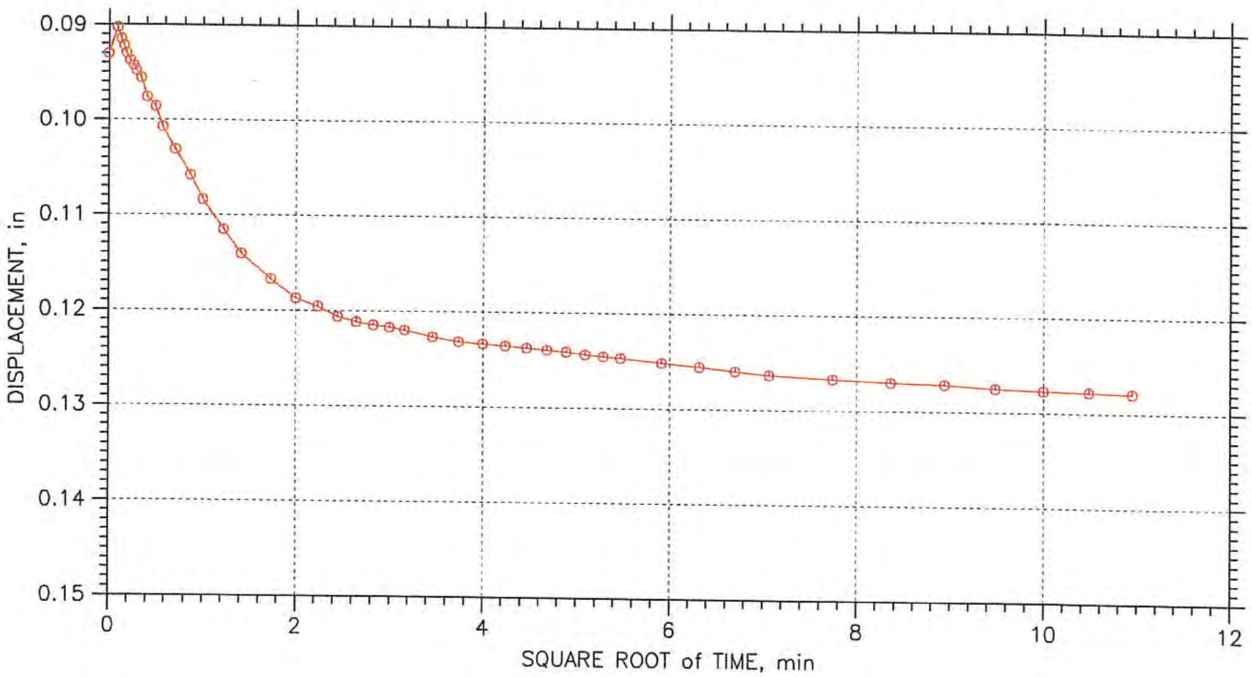
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 8 of 10

Stress: 8 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

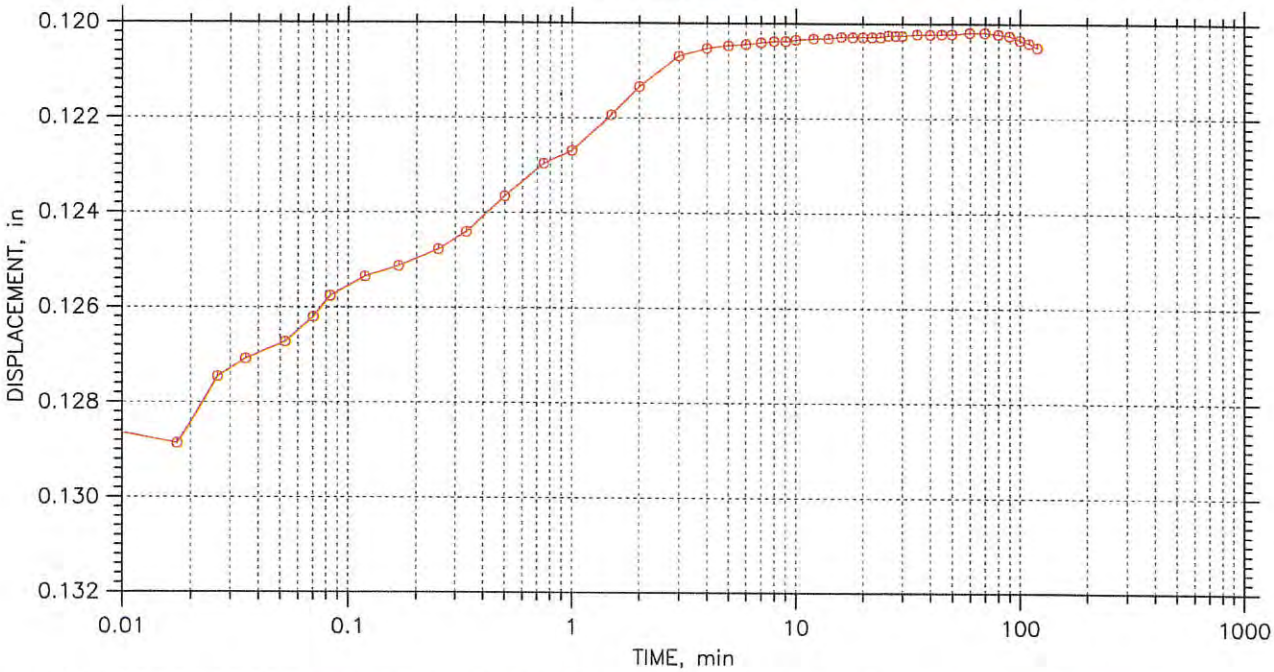
Mon, 02-MAY-2016 15:21:05

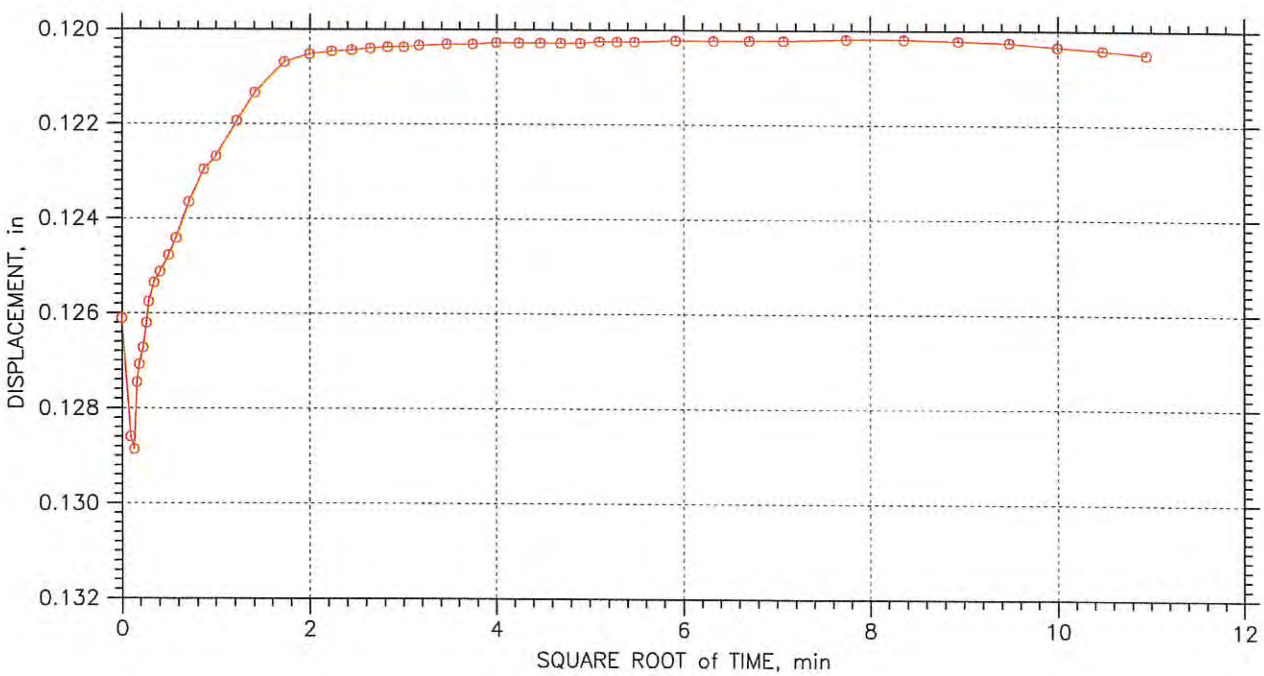
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 9 of 10

Stress: 1 tsf





Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
Description: Moist, dark grey, very soft, silt w/organic		
Remarks:		

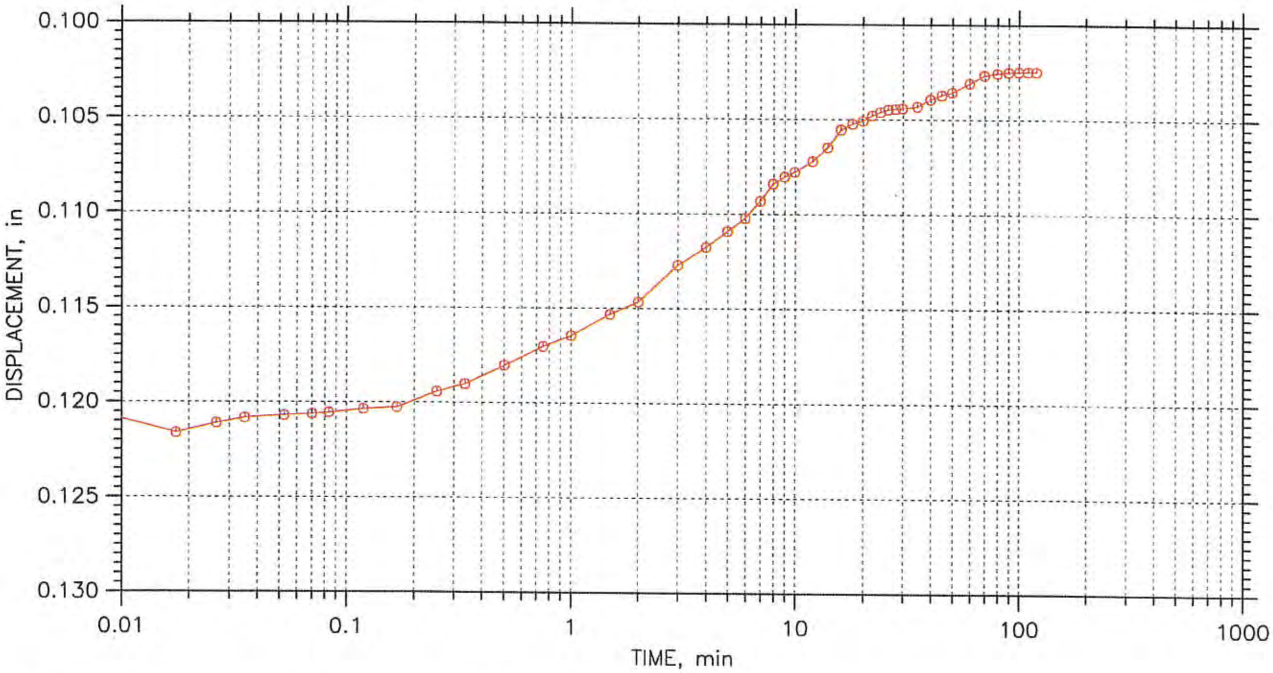
Mon, 02-MAY-2016 15:21:05

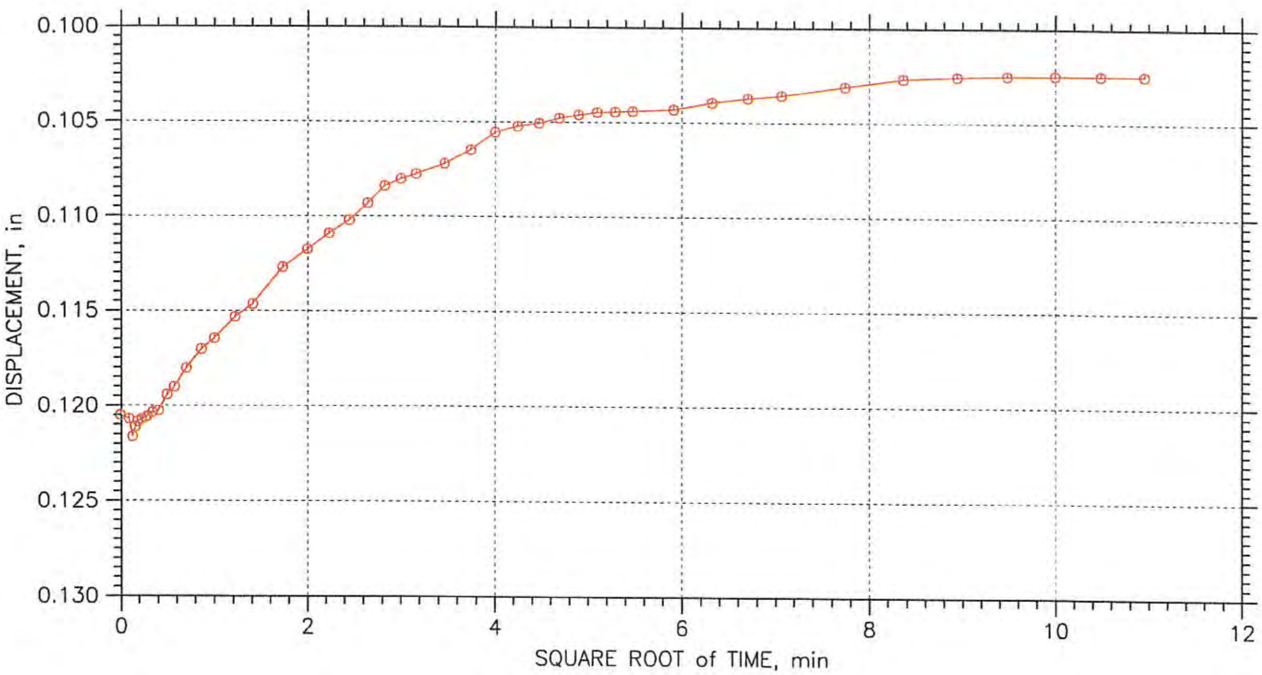
One-Dimensional Consolidation by ASTM D 2435 ⇔ Method B

TIME CURVES

Constant Load Step 10 of 10

Stress: 0.125 tsf





	Project: Jacobs Avenue Levee	Location:	Project No.: 01-0F2703
	Boring No.: 10L	Tested By: AZM	Checked By: GL16-026
	Sample No.: 4	Test Date: 4/26/16	Test No.: 16-012-G4
	Depth: 15-17.5	Sample Type: Shelby Tube	Elevation:
	Description: Moist, dark grey, very soft, silt w/organic		
	Remarks:		

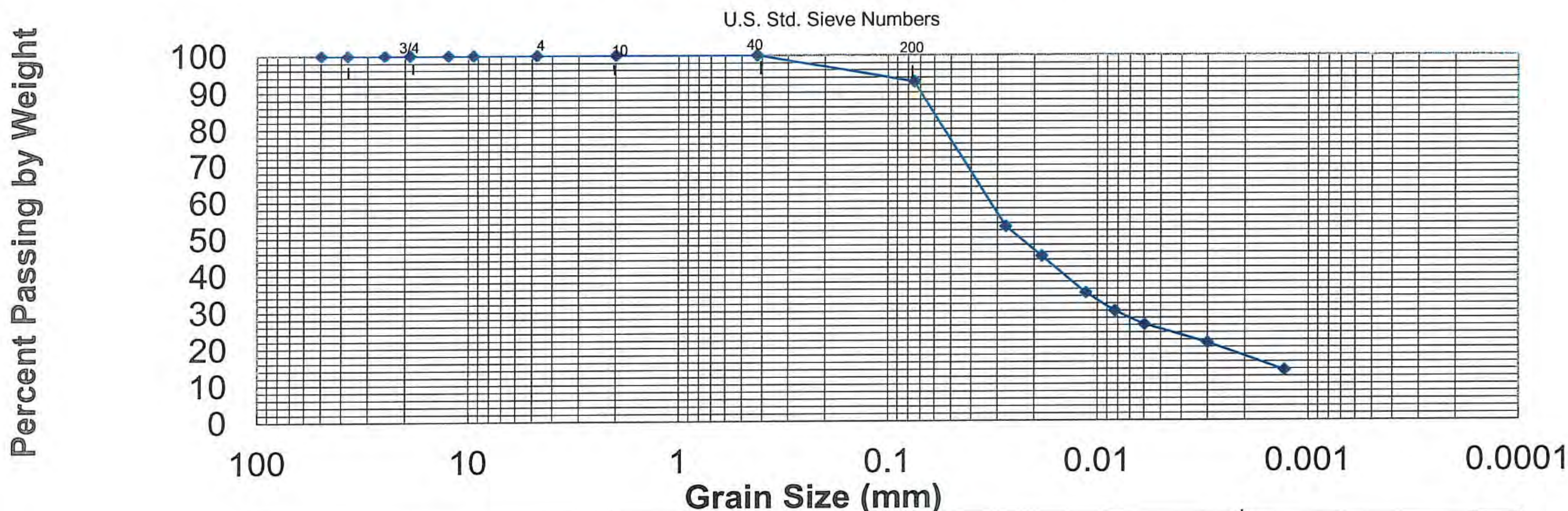
Mon, 02-MAY-2016 15:21:05

Project Name: **Jacob's Avenue Levee**
Boring ID:
Sample Depth:
Sample Number:

Project Number: **56-OFF-4B**
Lab # : 61124
Checked By: Darla Ghidinelli
Date : 3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0273	0.0184	#REF!	0.0114	0.0083	0.0060	0.0030	0.0013
PERCENT PASSING	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	92.8	53.0	44.9	#REF!	34.9	29.9	26.2	21.2	13.7

Gradation Test Results



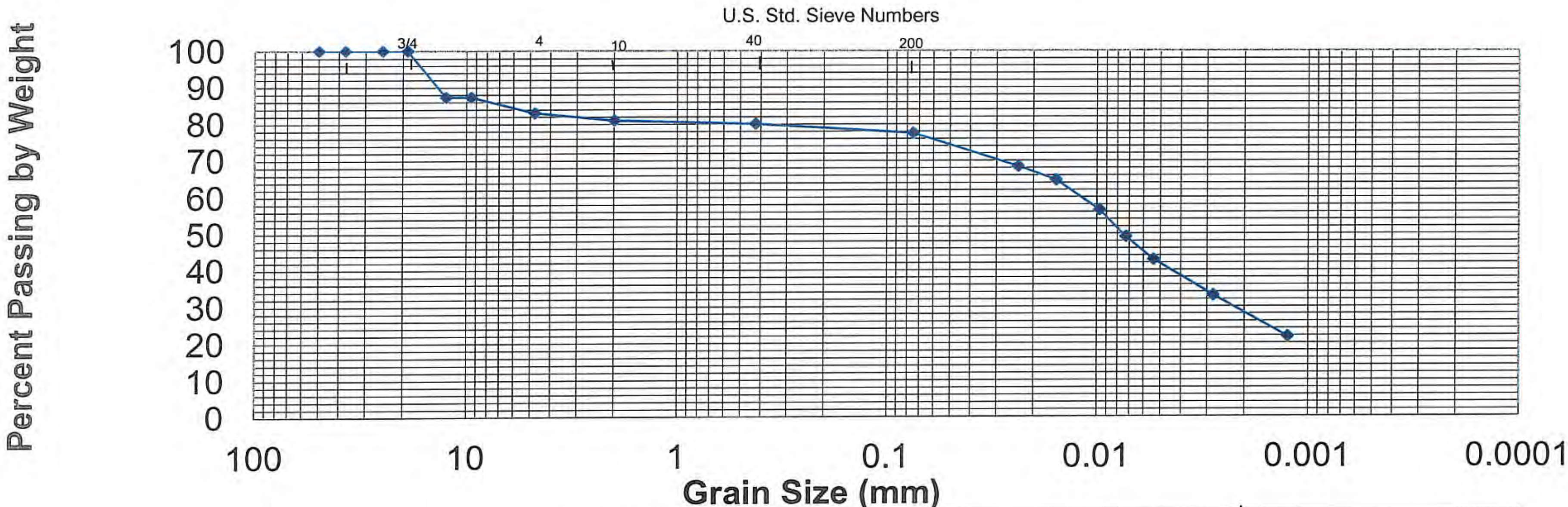
GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

% Gravel 0.0 **% Sand 7.2** **% Silt 75.3** **% Clay 17.5**

Project Name:	Jacob's Avenue Levee	Project Number:	56L-1
Boring ID:		Lab # :	61124
Sample Depth:		Checked By:	Darla Ghidinelli
Sample Number:		Date :	3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0237	0.0157	#REF!	0.0097	0.0073	0.0054	0.0028	0.0012
PERCENT PASSING	100.0	100.0	100.0	100.0	87.3	87.3	83.0	81.0	80.0	77.4	68.3	64.6	#REF!	56.5	49.1	42.8	33.0	21.7

Gradation Test Results



GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

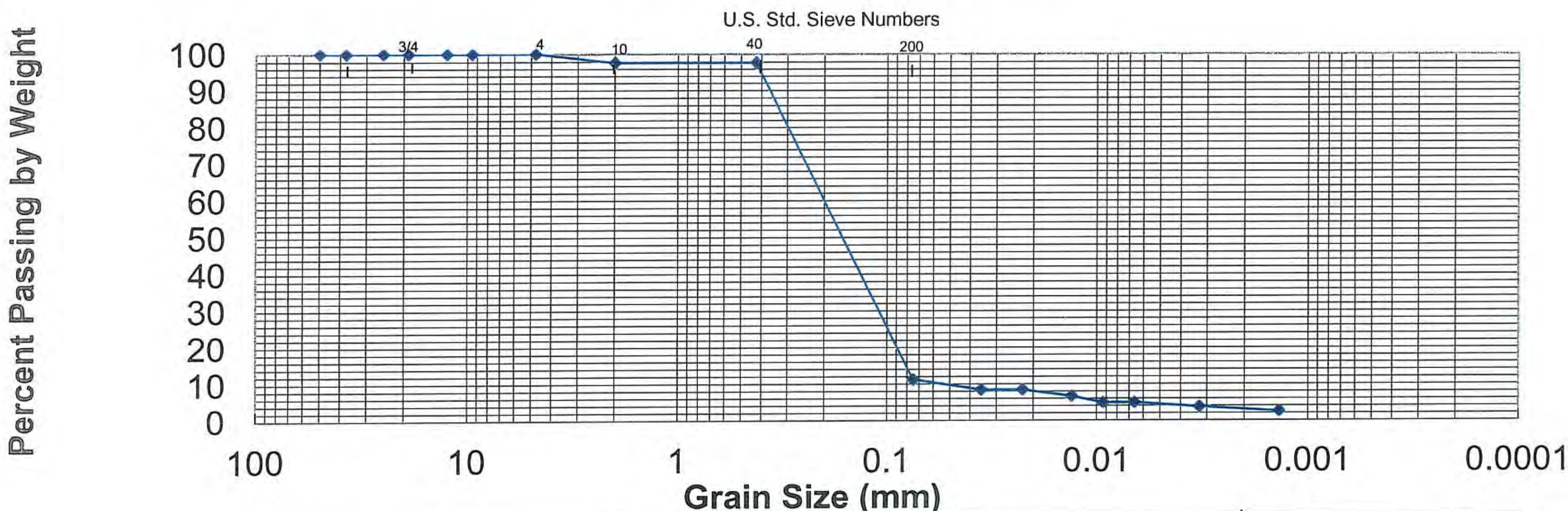
% Gravel 19.0 **% Sand 3.6** **% Silt 49.4** **% Clay 28.0**

Project Name: **Jacob's Avenue Levee**
Boring ID:
Sample Depth:
Sample Number:

Project Number: **30L-5B**
Lab # : 61124
Checked By: Darla Ghidinelli
Date : 3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0356	0.0226	#REF!	0.0132	0.0094	0.0066	0.0033	0.0014
PERCENT PASSING	100.0	100.0	100.0	100.0	100.0	100.0	100.0	97.7	97.7	11.2	8.4	8.4	#REF!	6.6	4.8	4.8	3.6	2.4

Gradation Test Results



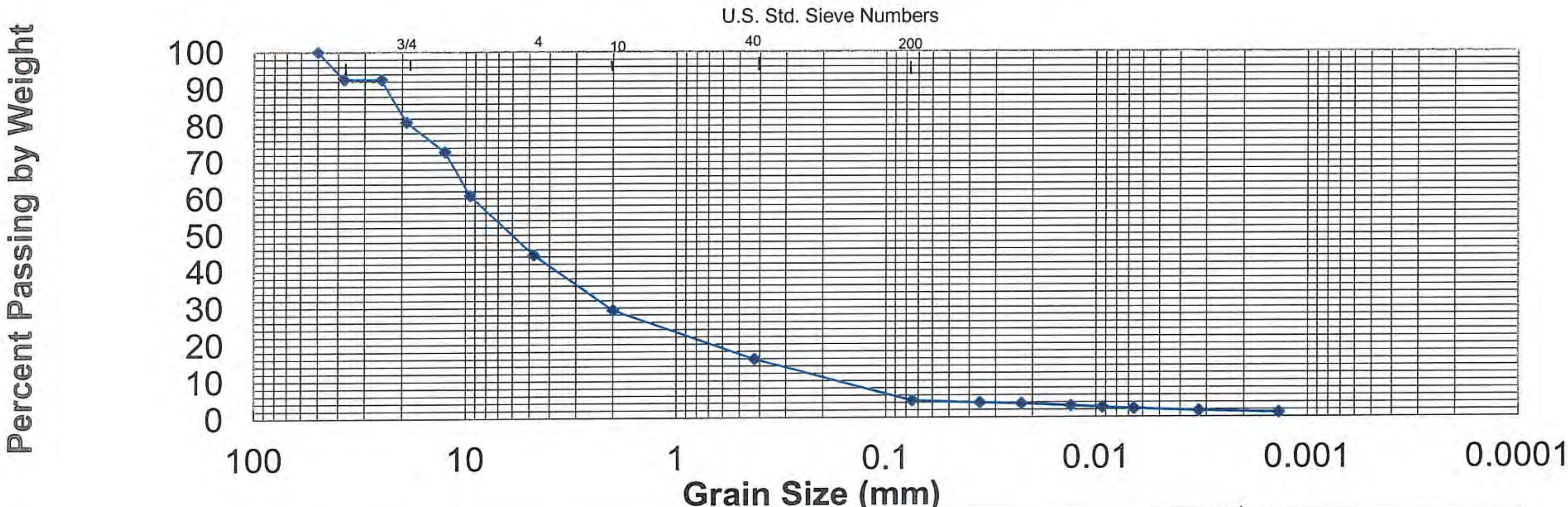
GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

% Gravel 2.3 **% Sand 86.5** **% Silt 8.2** **% Clay 3.0**

Project Name:	Jacob's Avenue Levee	Project Number:	10L-1B
Boring ID:		Lab # :	61124
Sample Depth:		Checked By:	Darla Ghidinelli
Sample Number:		Date :	3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0358	0.0227	#REF!	0.0132	0.0093	0.0066	0.0033	0.0014
PERCENT PASSING	100.0	92.5	92.5	81.0	72.8	60.8	44.5	29.4	15.9	4.5	3.9	3.6	#REF!	3.0	2.6	2.2	1.6	1.1

Gradation Test Results



GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

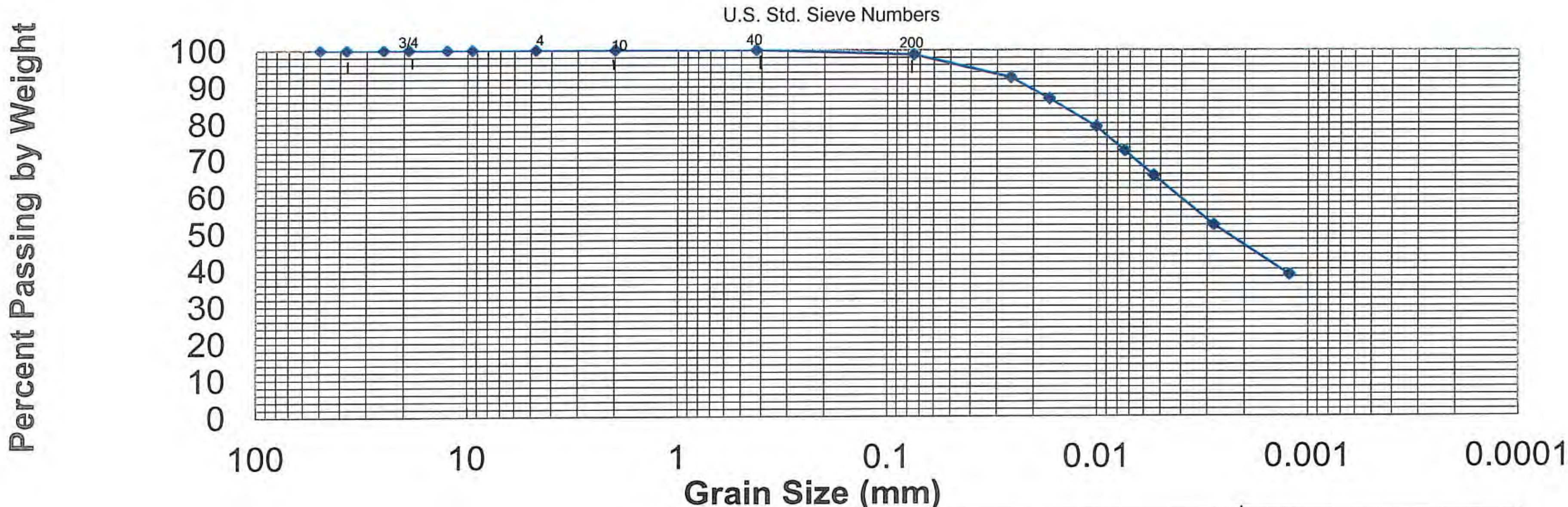
% Gravel 70.6 **% Sand 24.9** **% Silt 2.8** **% Clay 1.7**

Project Name:	Jacob's Avenue Levee
Boring ID:	
Sample Depth:	
Sample Number:	

Project Number:	10-L-6
Lab # :	61124
Checked By:	Darla Ghidinelli
Date :	3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0259	0.0169	#REF!	0.0102	0.0074	0.0054	0.0028	0.0012
PERCENT PASSING	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	98.7	92.5	86.7	#REF!	79.0	72.3	65.5	52.0	38.5

Gradation Test Results



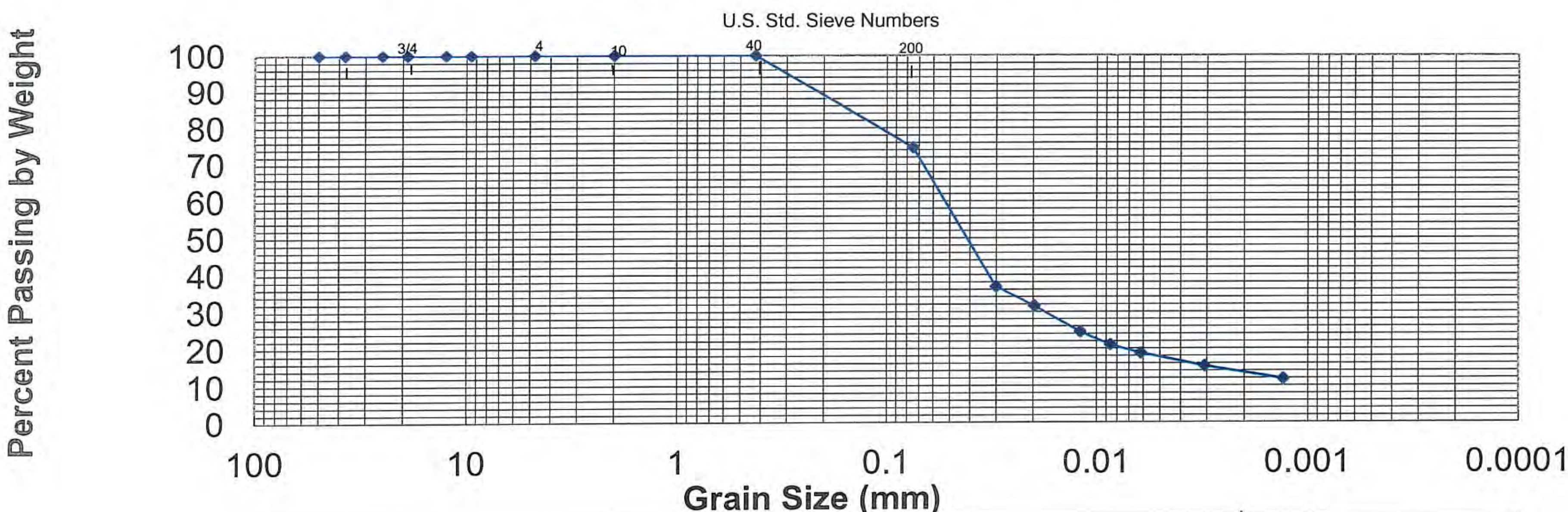
GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

% Gravel 0.0 % Sand 1.3 % Silt 52.2 % Clay 46.5

Project Name:	Jacob's Avenue Levee	Project Number:	**30C-4**
Boring ID:		Lab # :	61124
Sample Depth:		Checked By:	Darla Ghidinelli
Sample Number:		Date :	3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0302	0.0198	#REF!	0.0120	0.0086	0.0062	0.0031	0.0013
PERCENT PASSING	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	74.6	36.7	31.5	#REF!	24.5	21.0	18.7	15.2	11.7

Gradation Test Results



GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

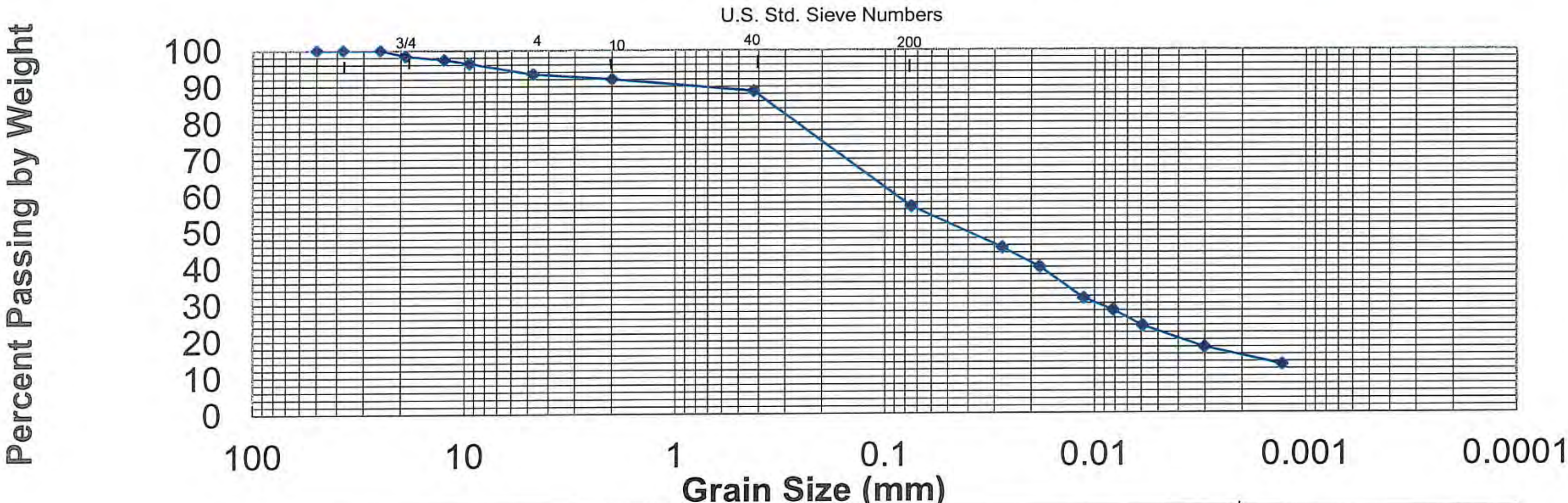
% Gravel 0.0 **% Sand 25.4** **% Silt 60.8** **% Clay 13.8**

Project Name:	Jacob's Avenue Levee
Boring ID:	
Sample Depth:	
Sample Number:	

Project Number:	20-OFF-1C
Lab # :	61124
Checked By:	Darla Ghidinelli
Date :	3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0276	0.0183	#REF!	0.0113	0.0082	0.0059	0.0030	0.0013
PERCENT PASSING	100.0	100.0	100.0	98.4	97.4	96.3	93.4	92.0	88.7	56.9	45.3	40.0	#REF!	31.3	28.0	23.7	17.8	13.0

Gradation Test Results



GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

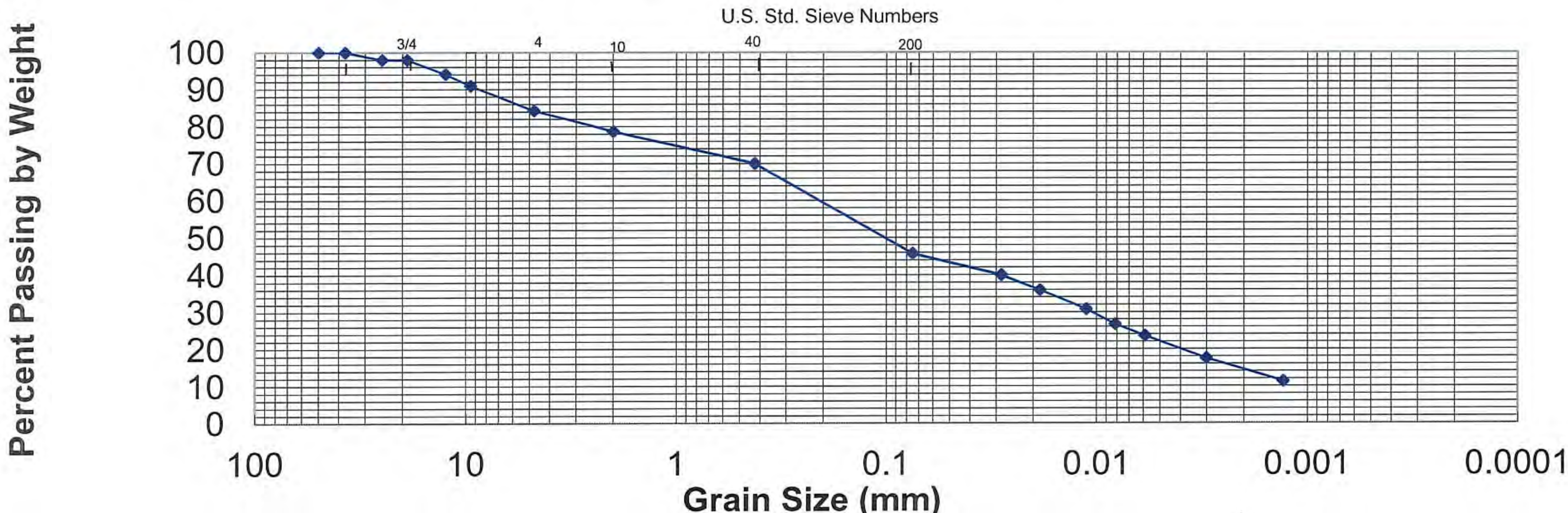
% Gravel 8.0 **% Sand 35.1** **% Silt 41.2** **% Clay 15.7**

Project Name:	Jacob's Avenue Levee	
Boring ID:		
Sample Depth:		
Sample Number:		

Project Number:	**30L-1B**
Lab # :	61124
Checked By:	Darla Ghidinelli
Date :	3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0284	0.0186	#REF!	0.0112	0.0082	0.0059	0.0030	0.0013
PERCENT PASSING	100.0	100.0	98.0	98.0	94.1	90.9	84.3	78.7	70.0	45.7	39.9	35.8	#REF!	30.7	26.6	23.5	17.4	11.2

Gradation Test Results



GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

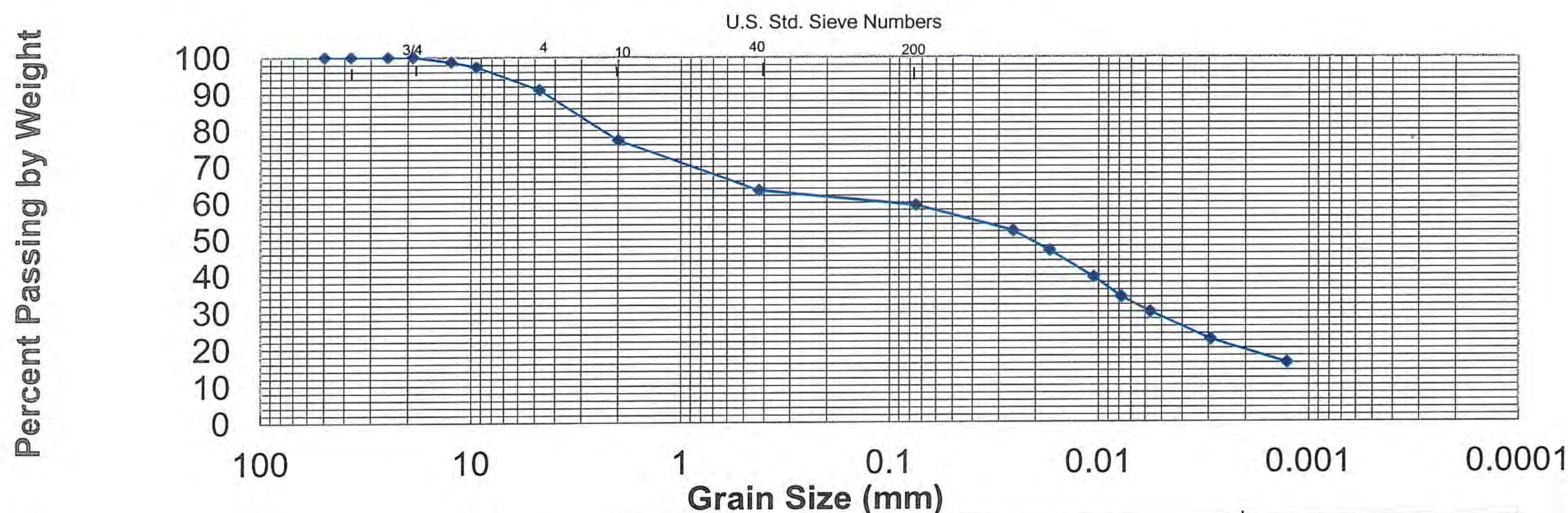
% Gravel 21.3 **% Sand 33.0** **% Silt 31.5** **% Clay 14.2**

Project Name: **Jacob's Avenue Levee**
Boring ID:
Sample Depth:
Sample Number:

Project Number: **30C-10**
Lab # : 61124
Checked By: Darla Ghidinelli
Date : 3/25/2016

SIEVE	2"	1.5"	1"	0.75"	0.5"	0.375"	#4	#10	#40	#200								
SIEVE SIZE (mm)	50	37.50	25.00	19.00	12.5	9.5	4.75	2.00	0.425	0.075	0.0256	0.0171	#REF!	0.0106	0.0078	0.0057	0.0029	0.0013
PERCENT PASSING	100.0	100.0	100.0	100.0	98.6	97.3	91.0	77.1	63.4	59.2	52.1	46.7	#REF!	39.3	33.9	29.8	22.3	15.9

Gradation Test Results



GRAVEL (>2mm)	SAND		SILT	CLAY
	Coarse	Fine		

% Gravel 22.9 **% Sand 17.9** **% Silt 40.4** **% Clay 18.8**

VOLUMETRIC METHOD—B 61124 · #104-4

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1749.1			
	TARE PLUS DRY SOIL		1372.9			
	WATER	M_w	376.2			
	TARE		484.6			
	DRY SOIL	M_d	888.3			
WATER CONTENT		w	42.4 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER		16.860			
	INSIDE DIAMETER OF CYLINDER	D	7.294			
MASS IN GRAMS	WET SOIL AND TARE		1749.1			
	TARE		484.6			
	WET SOIL	M_t	1264.5			
	DRY SOIL[A]	M_d	888.3			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF CYLINDER)	V	704.50			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	112.00			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	78.68			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG ______ CHECKED BY ST ______

61124 10L-0

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE 3-17-16 JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1025.4			
	TARE PLUS DRY SOIL		777.0			
	WATER	M_w	248.4			
	TARE		274.9			
	DRY SOIL	M_d	502.1			
WATER CONTENT		w	49.5 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	15.191			
	INSIDE DIAMETER OF CYLINDER	D	6.025			
MASS IN GRAMS	WET SOIL AND TARE		1025.4			
	TARE		274.9			
	WET SOIL	M_t	750.5			
	DRY SOIL[A]	M_d	502.1			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF CYLINDER)	V	433.1			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	108.1			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	72.3			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY ST

61124 30C-8

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE 3-17-16 JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1051.5			
	TARE PLUS DRY SOIL		923.9			
	WATER	M_w	127.6			
	TARE		261.8			
	DRY SOIL	M_d	662.1			
WATER CONTENT		w	19.3 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H_s				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	12.448			
	INSIDE DIAMETER OF CYLINDER	D	6.113			
MASS IN GRAMS	WET SOIL AND TARE		1051.5			
	TARE		261.8			
	WET SOIL	M_t	789.7			
	DRY SOIL[A]	M_d	662.1			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	365.3			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	134.9			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	113.1			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY JT

VOLUMETRIC METHOD—B

61124 30C-6

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE 3-16-16 JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1090.9			
	TARE PLUS DRY SOIL		918.5			
	WATER	M_w	172.4			
	TARE		209.2			
	DRY SOIL	M_d	709.3			
WATER CONTENT		w	24.3 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H_s				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	14.03			
	INSIDE DIAMETER OF CYLINDER	D	6.09			
MASS IN GRAMS	WET SOIL AND TARE		1090.9			
	TARE		209.2			
	WET SOIL	M_t	881.7			
	DRY SOIL[A]	M_d	709.3			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	408.68			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	134.6			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	108.3			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY D. Ghidinelli CHECKED BY [signature]

VOLUMETRIC METHOD—B 61124 #30C-3

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE 3-16-16 JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1851.5			
	TARE PLUS DRY SOIL		1499.2			
	WATER	M_w	352.3			
	TARE		488.5			
	DRY SOIL	M_d	1010.7			
WATER CONTENT		w	34.9 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H$				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	17.20			
	INSIDE DIAMETER OF CYLINDER	D	7.27			
MASS IN GRAMS	WET SOIL AND TARE		1851.5			
	TARE		488.5			
	WET SOIL	M_t	1363.0			
	DRY SOIL[A]	M_d	1010.7			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	713.98			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	119.1			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	98.3			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY JT

61124 20-0ff-4C

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

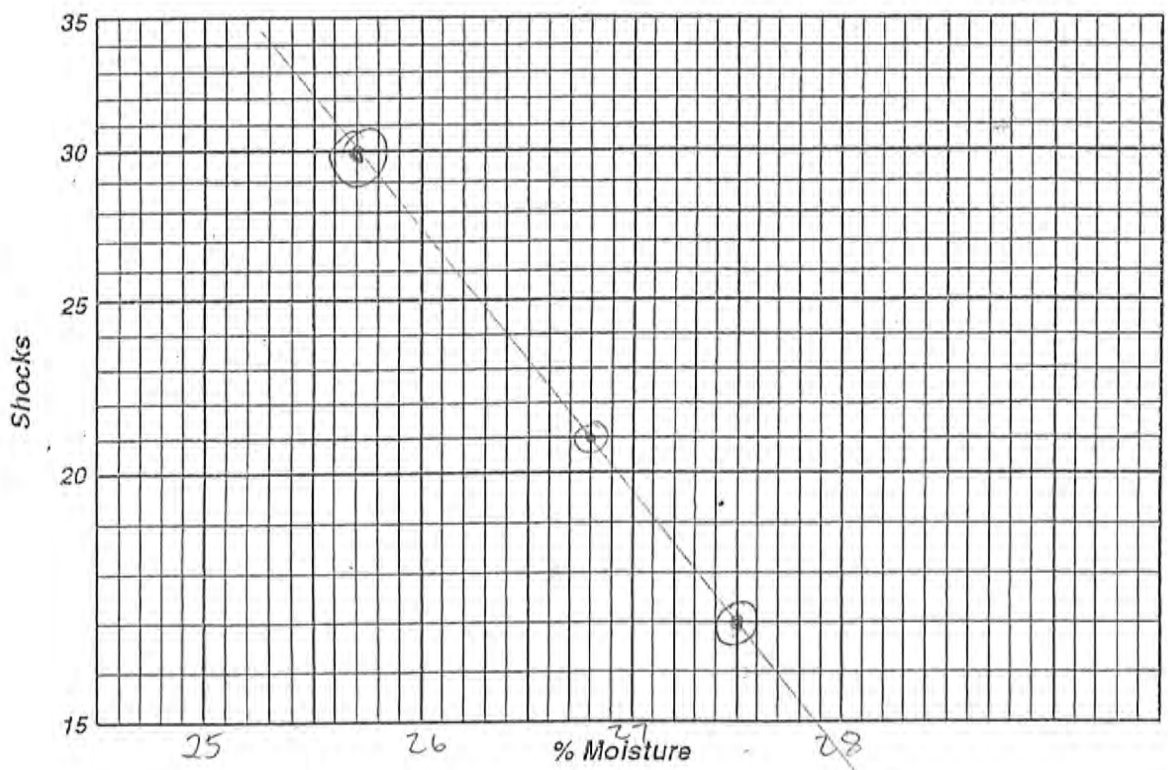
ATTERBERG LIMITS

MR-0233 (REV. 5/93)

Jacob's Avenue Levee

JOB NUMBER 61124 20-OFF-4C	LIQUID LIMIT 27
SAMPLE NUMBER	PLASTIC LIMIT 24
	PLASTICITY INDEX 3

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	2	4	12	15		
Number of shocks	17	21	30			
Weight of glass & wet soil	38.53	36.93	39.67	33.59		
Weight of glass & dry soil	35.75	34.46	36.94	32.12		
Weight of glass	25.65	25.23	26.32	25.98		
Weight of dry soil	10.10	9.23	10.62	6.14		
Weight of water	2.78	2.47	2.73	1.47		
Moisture (percent)	27.5	26.8	25.7	23.9		



REMARKS:

DATE	TEST BY	CHECKED BY
3-24-16	Darla Ghidinelli	38477

FM 93 1812 M

61124 36-Off

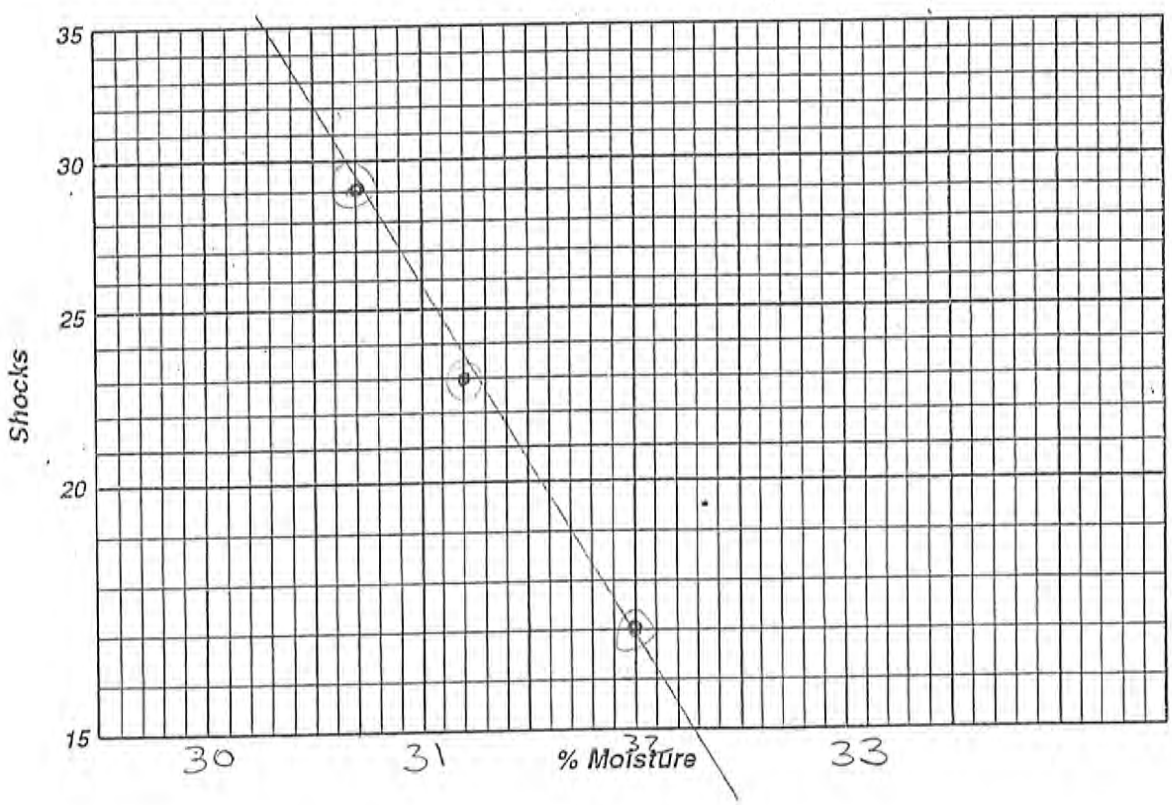
STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
ATTERBERG LIMITS
MR-0233 (REV. 5/93)

LIQUID LIMIT	31
PLASTIC LIMIT	25
PLASTICITY INDEX	6

JOB NUMBER

SAMPLE NUMBER 56-Off-4B

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	10	11	14	15		
Number of shocks	29	23	17			
Weight of glass & wet soil	38.57	36.25	39.50	33.42		
Weight of glass & dry soil	35.57	33.76	36.33	31.95		
Weight of glass	25.79	25.79	26.43	25.98		
Weight of dry soil	9.78	7.97	9.90	5.97		
Weight of water	3.00	2.49	3.17	1.47		
Moisture (percent)	30.7	31.2	32.0	24.6		



REMARKS:

DATE 3-23-16

TEST BY Darla Ghidinelli

CHECKED BY TAUSCHER

FM 93 1812 M

VOLUMETRIC METHOD—B

61124 30C-4

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE 3-17-16 JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1575.9			
	TARE PLUS DRY SOIL		1245.0			
	WATER	M_w	330.9			
	TARE		433.8			
	DRY SOIL	M_d	811.2			
WATER CONTENT		w	40.8 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	Hs				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	14.876			
	INSIDE DIAMETER OF CYLINDER	D	7.285			
MASS IN GRAMS	WET SOIL AND TARE		1575.9			
	TARE		433.8			
	WET SOIL	M_t	1142.1			
	DRY SOIL[A]	M_d	811.2			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	620.1			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	114.9			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	81.6			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY D. Ghidinelli CHECKED BY TRINSCHER

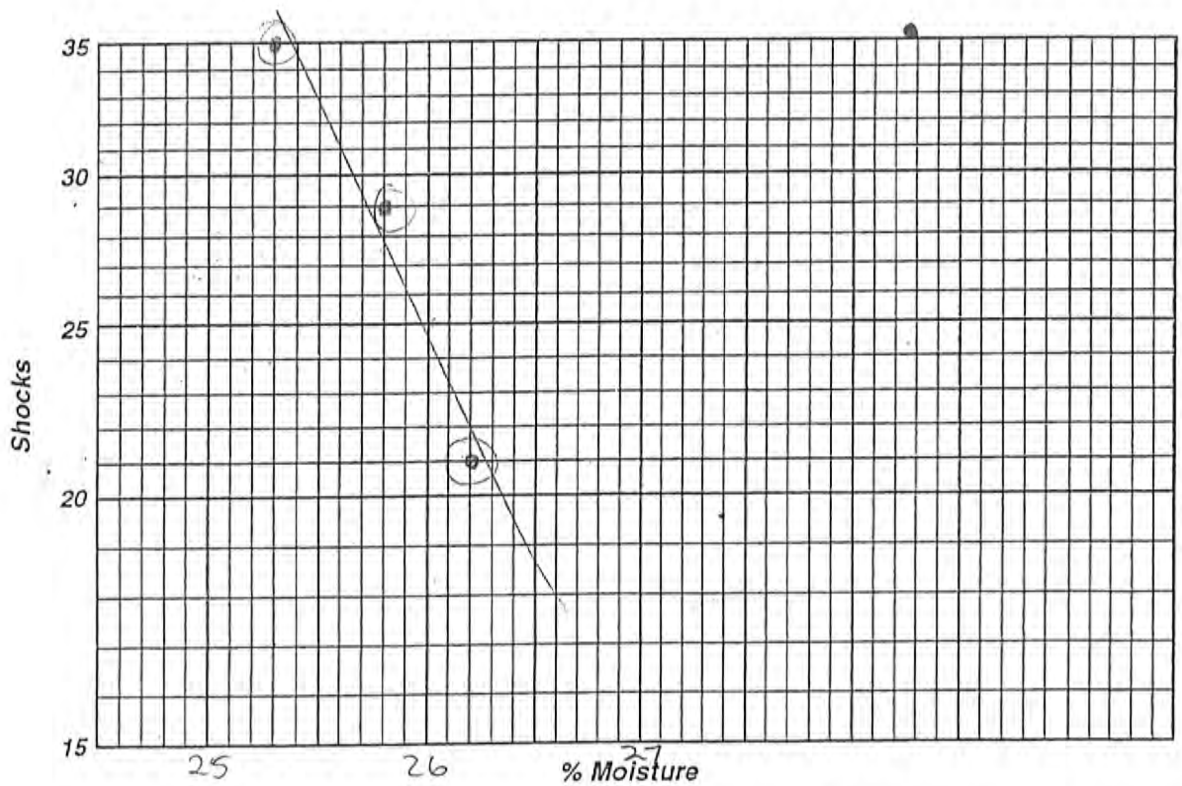
STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ATTERBERG LIMITS

MR-0233 (REV. 5/93)

JOB NUMBER 41124-	LIQUID LIMIT 26
SAMPLE NUMBER 30-C-4	PLASTIC LIMIT 23
	PLASTICITY INDEX 3

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	1B	2B	3B	4B		
Number of shocks	21	29	35			
Weight of glass & wet soil	42.36	38.60	38.63	33.03		
Weight of glass & dry soil	38.88	36.20	35.96	31.64		
Weight of glass	25.58	26.89	25.40	25.61		
Weight of dry soil	13.3	9.31	10.56	6.03		
Weight of water	3.48	2.40	2.67	1.39		
Moisture (percent)	26.2	25.8	25.3	23.1		



REMARKS:

DATE 3-23-16	TEST BY Darla Ghidinelli	CHECKED BY TAUSCHER

FM 93 1812 M

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

61124 20 off-1

ATTERBERG LIMITS

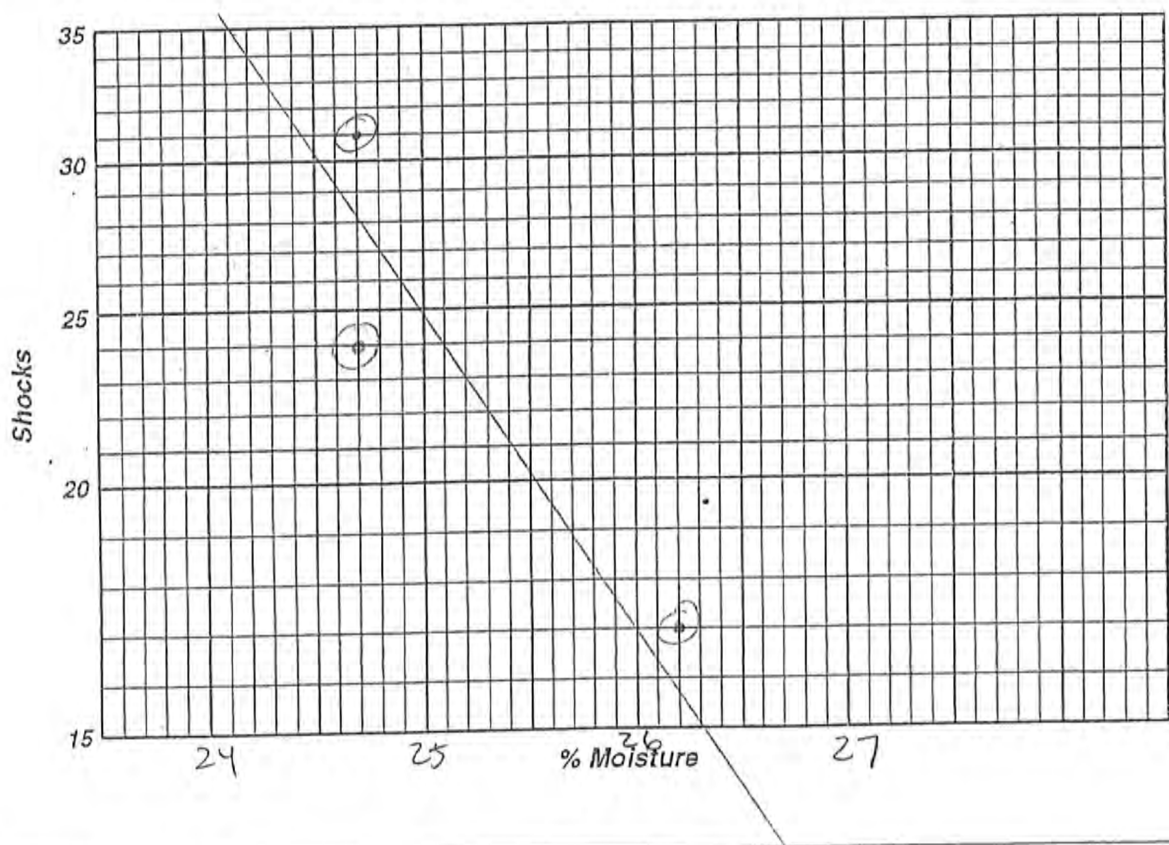
MR-0233 (REV. 5/93)

LIQUID LIMIT	25
PLASTIC LIMIT	20
PLASTICITY INDEX	5

JOB NUMBER

SAMPLE NUMBER 20-off-1C

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	*I*	*II*	*III*	*I*	*II*	*Avg.*
Watch glass number	6	9	12	16		
Number of shocks	17	24	31	31.70		
Weight of glass & wet soil	39.84	38.57	41.17	32.92		
Weight of glass & dry soil	36.84	35.77	38.23	31.70		
Weight of glass	25.37	24.42	26.33	25.56		
Weight of dry soil	11.47	11.35	11.90	6.14		
Weight of water	3.00	2.800	2.94	1.22		
Moisture (percent)	26.2	24.7	24.7	19.9		



REMARKS:

DATE	TEST BY	CHECKED BY
3-23-16	Darla Ghidinelli	TAUSCHER

FM 93 1812 M

61124 30C

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ATTERBERG LIMITS

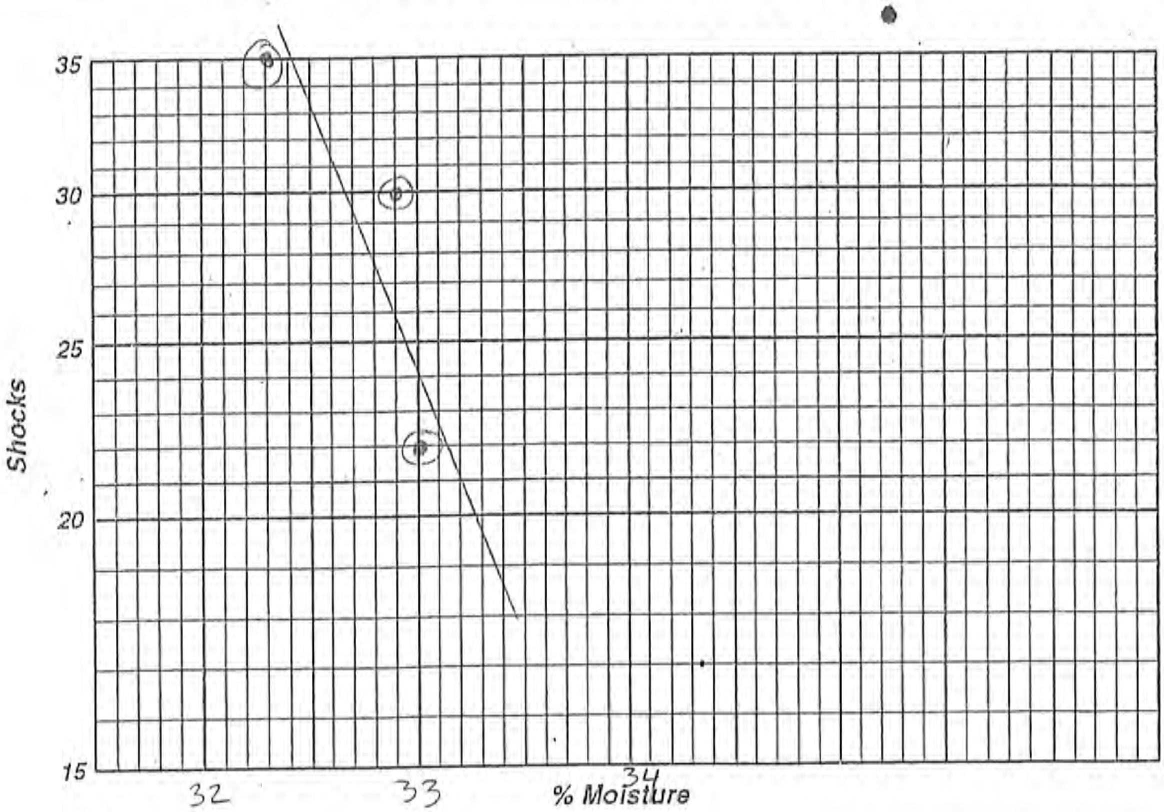
MR-0233 (REV. 5/93)

LIQUID LIMIT	33
PLASTIC LIMIT	25
PLASTICITY INDEX	8

JOB NUMBER

SAMPLE NUMBER 30C-10

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	1	2	4	8		
Number of shocks	22	30	35			
Weight of glass & wet soil	39,48	37.27	37.20	31.49		
Weight of glass & dry soil	36.00	34.39	34.28	30.32		
Weight of glass	25.46	25.64	25.23	25.59		
Weight of dry soil	10.54	8.75	9.05	4.73		
Weight of water	3.48	2.88	2.92	1.17		
Moisture (percent)	33.0	32.9	32.3	24.7		



REMARKS:

DATE	TEST BY	CHECKED BY
3-23-16	Darla Ghidinelli	Thurscher

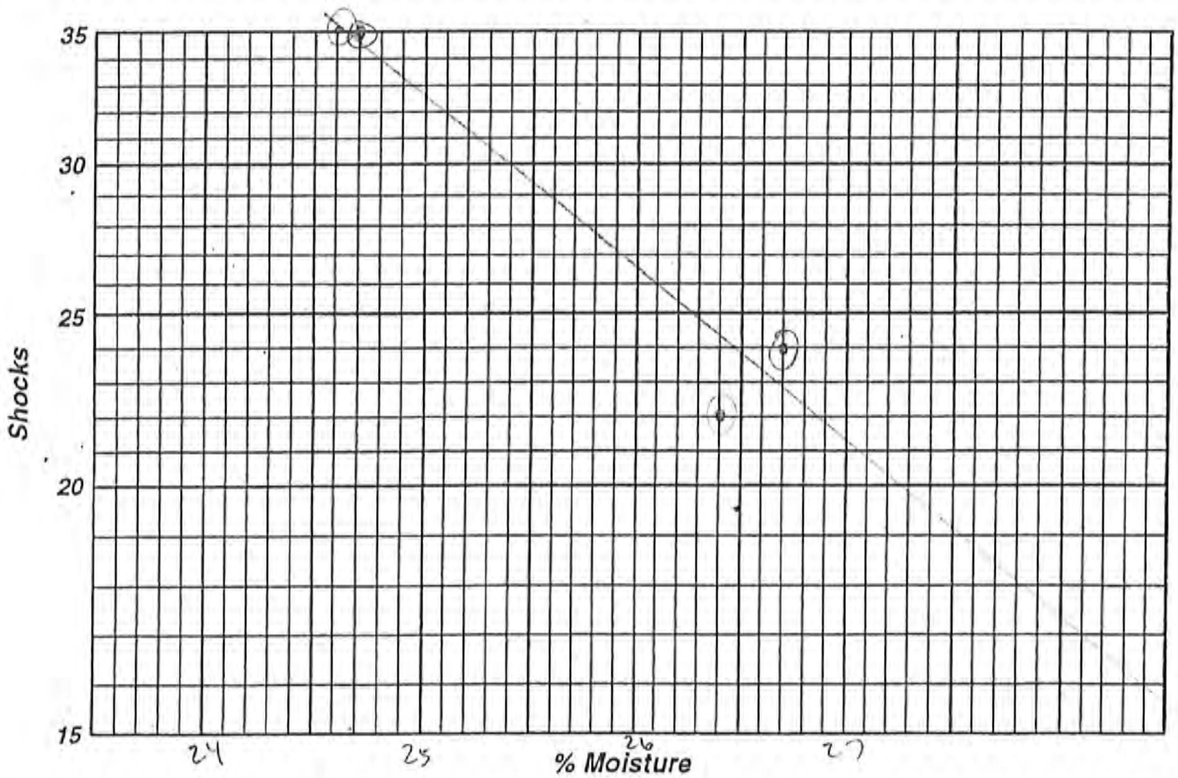
FM 93 1812 M

56L 2

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
ATTERBERG LIMITS
MR-0233 (REV. 5/93)

JOB NUMBER 61124 56L-2	LIQUID LIMIT 26
SAMPLE NUMBER	PLASTIC LIMIT 23
	PLASTICITY INDEX 3

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	5	13	19	40		
Number of shocks	22	24	35			
Weight of glass & wet soil	39.30	39.21	36.53	27.76		
Weight of glass & dry soil	36.30	36.29	34.33	26.36		
Weight of glass	24.95	25.35	25.41	20.23		
Weight of dry soil	11.35	10.94	8.92	6.13		
Weight of water	3.0	2.92	2.20	1.4		
Moisture (percent)	26.4	26.7	24.7	22.8		



REMARKS:

DATE	TEST BY	CHECKED BY
3-24-16	Dana Ghidinelli	TRUSCHKE

FM 93 1812 M

61124 #10L-3

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE 3-16-16 JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT

SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1739.1			
	TARE PLUS DRY SOIL		1366.0			
	WATER	M_w	373.1			
	TARE		479.7			
	DRY SOIL	M_d	886.3			
WATER CONTENT		w	42.1 %	%	%	%

WEIGHT-VOLUME RELATIONS

SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	16.757			
	INSIDE DIAMETER OF CYLINDER	D	7.255			
MASS IN GRAMS	WET SOIL AND TARE		1739.1			
	TARE		479.1			
	WET SOIL	M_t	1260.0			
	DRY SOIL[A]	M_d	886.3			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	692.7			
	~~DRY SOIL = M_d / G_s~~	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	113.5			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	79.84			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF ~~CYLINDER~~ SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY Tauschel CHECKED BY Darla Ghidinelli

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102-3
61124

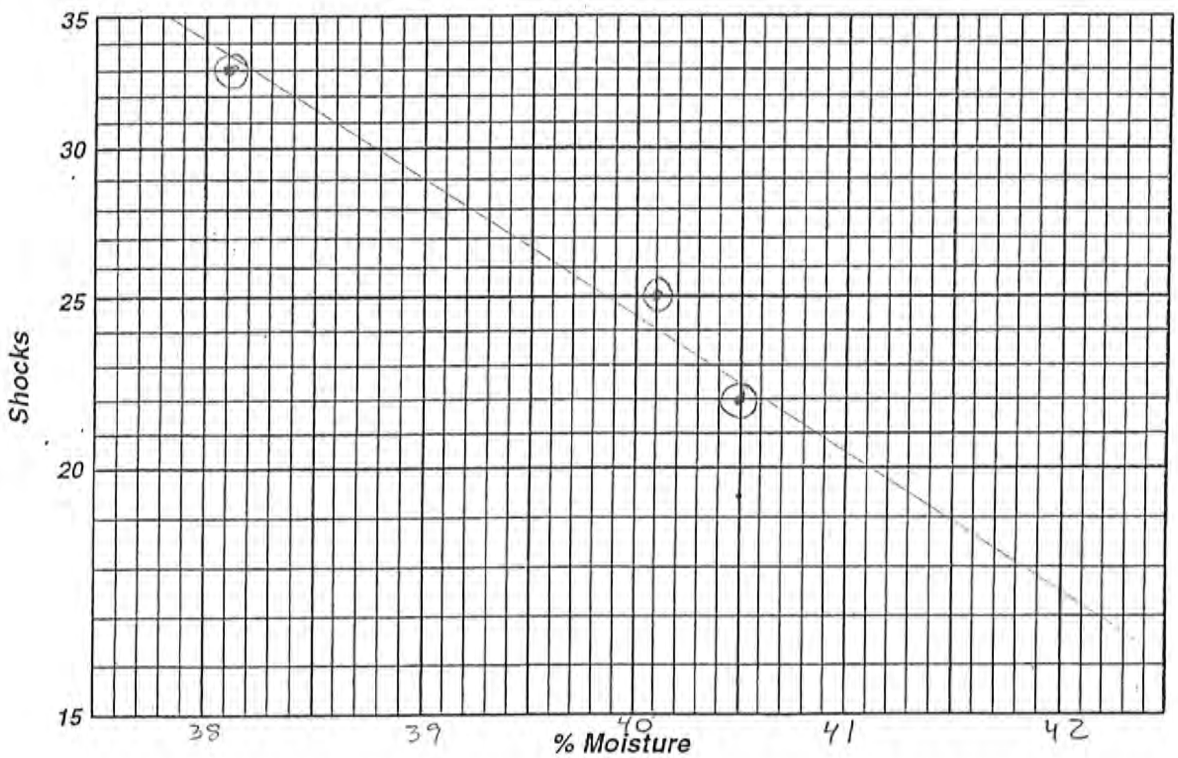
STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ATTERBERG LIMITS

MR-0233 (REV. 5/93)

JOB NUMBER	LIQUID LIMIT 40
SAMPLE NUMBER	PLASTIC LIMIT 26
	PLASTICITY INDEX 14

	LIQUID LIMIT (Referee Method)			69 89 PLASTIC LIMIT		
Trial Number	I	II	III	~~I~~	II	Avg.
Watch glass number	1B	2B	3B	~~4B~~	2	
Number of shocks	22	25	33			
Weight of glass & wet soil	37.52	37.13	34.21	~~30.78~~	32.76	
Weight of glass & dry soil	34.08	34.20	31.78	~~29.71~~	31.29	
Weight of glass	25.58	26.89	25.40	~~25.61~~	25.65	
Weight of dry soil	8.50	7.31	6.38	~~4.1~~	5.64	
Weight of water	3.44	2.93	2.43	~~1.07~~	1.47	
Moisture (percent)	40.5	40.1	38.1	~~26.1~~	26.1	



REMARKS:

DATE	TEST BY	CHECKED BY
3-24-16	Darla Ghirdinelli	TAUSCHER

FM 93 1812 M

61124 30L-3

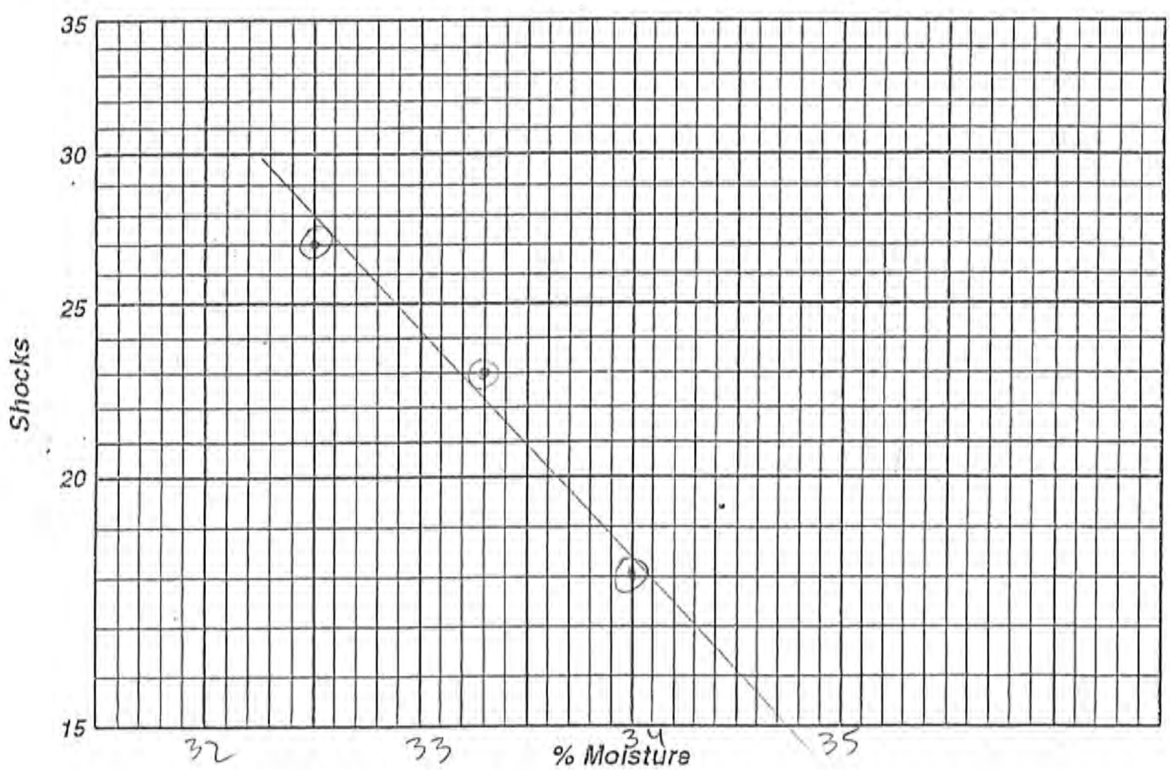
STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ATTERBERG LIMITS

MR-0233 (REV. 5/93)

	LIQUID LIMIT 33
JOB NUMBER	PLASTIC LIMIT 24
SAMPLE NUMBER 30L-3	PLASTICITY INDEX 9

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	9	11	14	16		
Number of shocks	18	23	27			
Weight of glass & wet soil	34.20	35.59	37.45	33.27		
Weight of glass & dry soil	31.72	33.14	34.75	31.76		
Weight of glass	24.42	25.79	26.43	25.56		
Weight of dry soil	7.30	7.35	8.32	6.2		
Weight of water	2.48	2.45	2.70	1.51		
Moisture (percent)	34.0	33.3	32.5	24.4		



REMARKS:

DATE	TEST BY DG	CHECKED BY [illegible]

FM 93 1812 M

TEST NO. 61124 20 off-3

Grade		S.E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
CARD NUMBER C 898804
TL-0101 (REV. 10/97) 7541-6002-4

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 20-off-3
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 10' - 12.5'
LOCATION OF SOURCE
Hole: 20-off Sample #3
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Shelby Tube
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON
Jacobs Avenue Levee

Date Rec'd.: 2-4-16
Calc. By: DG, JT
Completed: 4-4-16
Reported:

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8	100									
16	100									
30	100									
50	100									
100	96									
200	90.1									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

#20-off-3

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT							
SAMPLE OR SPECIMEN NO.							
TARE NO.							
MASS IN GRAMS	TARE PLUS WET SOIL		2115.1				
	TARE PLUS DRY SOIL		1662.5				
	WATER	M_w	452.6				
	TARE		585.3				
	DRY SOIL	M_d	1077.2				
WATER CONTENT		w	42.0 %	%	%	%	

WEIGHT-VOLUME RELATIONS							
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H					
CYLINDER NO.							
CENTIMETERS	HEIGHT OF CYLINDER	H	20.33				
	INSIDE DIAMETER OF CYLINDER	D	7.25				
MASS IN GRAMS	WET SOIL AND TARE		2115.1				
	TARE		585.3				
	WET SOIL	M_t	1529.8				
	DRY SOIL[A]	M_d	1077.2				
SPECIFIC GRAVITY OF SOIL		G_s					
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	839.27				
	DRY SOIL = M_d / G_s	V_s					
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	113.74				
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	80.09				
VOID RATIO = $(V - V_s) / V_s$		e					
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%	
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%	

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$

VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

Dry Unit Wt. = 80.1 lbs/ft3

Moisture = 36.0%

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG ______ CHECKED BY JT ______

6112.4 30C-1A

STATE OF CALIFORNIA / DEPARTMENT OF TRANSPORTATION
ATTERBERG LIMITS
MR-0233 (REV. 5/93)

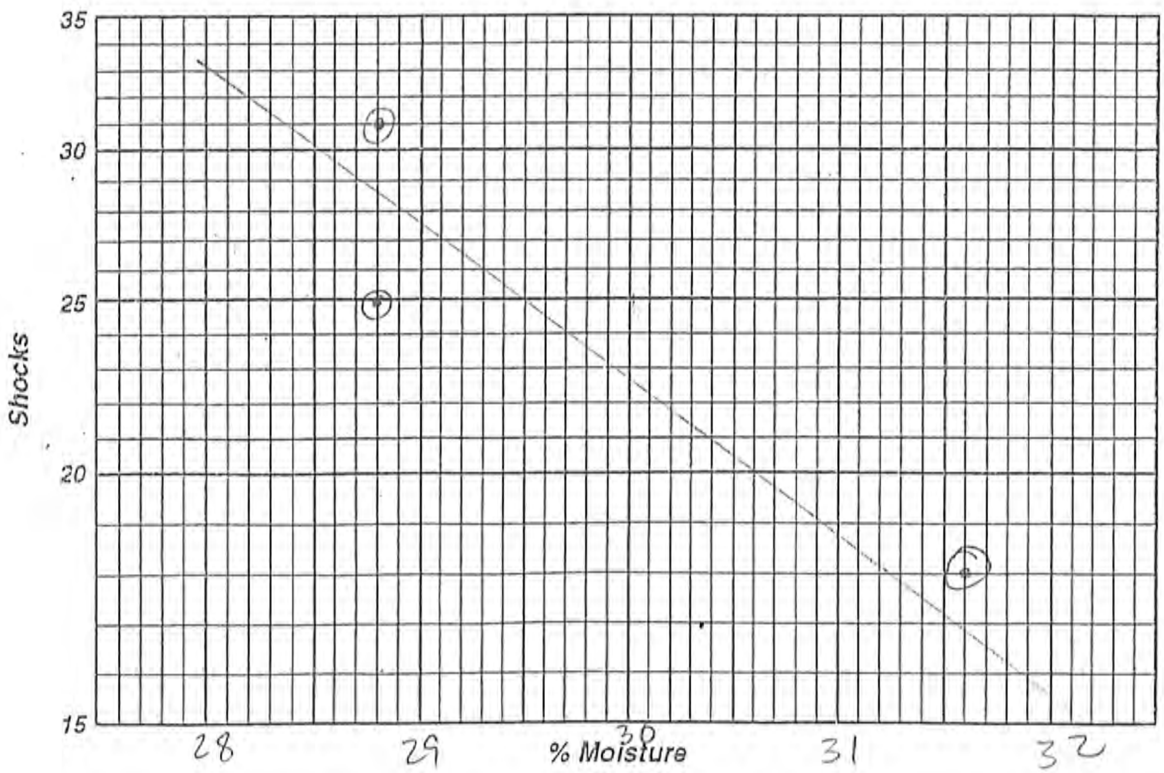
Jacob's Avenue Levee

LIQUID LIMIT	30
PLASTIC LIMIT	23
PLASTICITY INDEX	7

JOB NUMBER
61124 30C-1A

SAMPLE NUMBER

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	1	6	8	10		
Number of shocks	18	25	31			
Weight of glass & wet soil	33.67	36.89	36.68	33.37		
Weight of glass & dry soil	31.70	34.32	33.98	31.96		
Weight of glass	25.46	25.39	24.59	25.79		
Weight of dry soil	6.24	8.93	9.39	6.17		
Weight of water	1.97	2.57	2.70	1.41		
Moisture (percent)	31.6	28.8	28.8	22.9		



REMARKS:

DATE	TEST BY	CHECKED BY
3-24-16	Daria Ghidinelli	TAUSCHER

FM 93 1812 M

61124

TEST NO. 30C-B

Grade	C F	S. E.		L.A.R.T.	100 500
Sample Prep	S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Shawn Tauscher
Completed:
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 908250

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30C-B
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF: Soil
FOR USE IN:
SAMPLE FROM: Jacobs Ave, Levee
DEPTH: 0 - 2.5'
LOCATION OF SOURCE: Hole: 30C Sample # B
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS): 3
AND IS ONE OF A GROUP OF: 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS: Test: Max Density, Att. Limits + mech. Analysis

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED: 1-11-16 thru 1-14-16
BY: CGI
TITLE
DIST, CO, RTE, PM
LIMITS: Jacobs Ave Levee
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"	100									
2 1/2	98									
2	96									
1 1/2	92									
1	82									
3/4	74									
1/2	66									
3/8	61									
3	–									
4	53									
8	46									
16	41									
30	37									
50	32									
100	25									
200	20.6									
S. E.										
Sp. Gr. - C										
Sp. Gr. - F										
% Abs.										
Dur. - C										
Dur. - F										
LART - 1										
LART - 5										
% Crsh'd.										
Color.										
Clean.										

Comments:
T90 Liquid Limit 29
Plastic Limit 23
Plastic Index 6

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

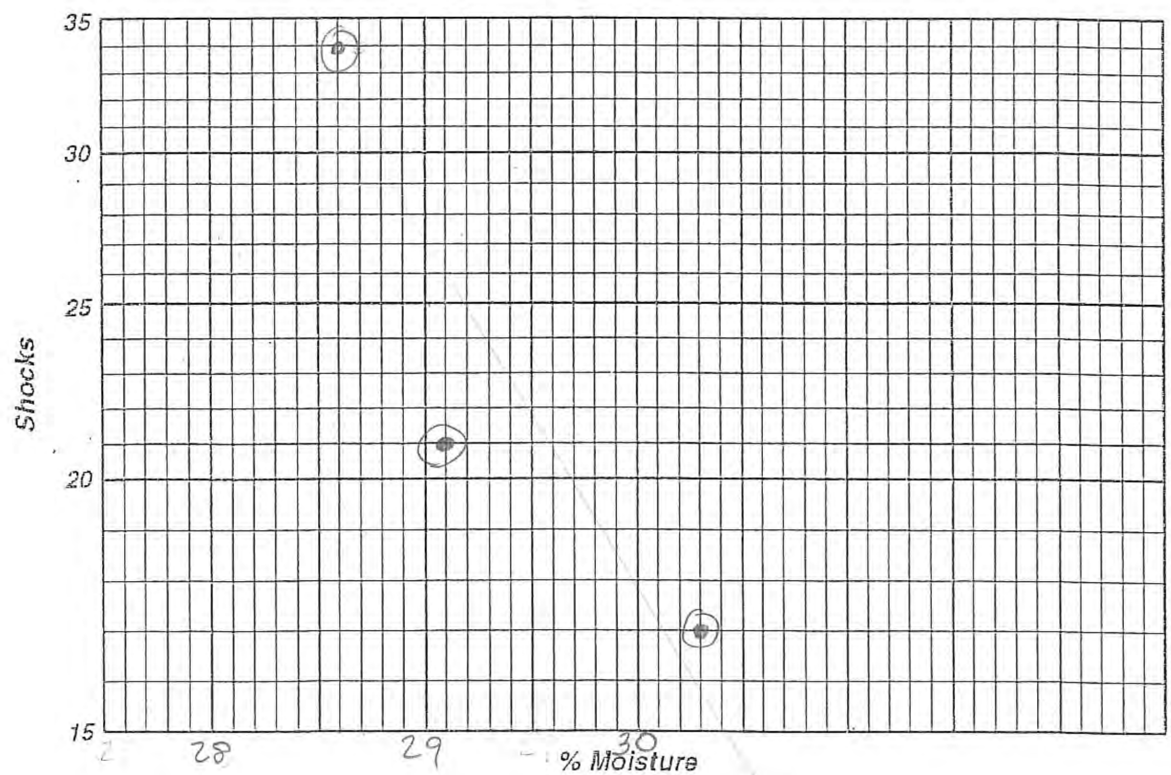
STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ATTERBERG LIMITS

MR-0233 (REV. 5/93)

Jacob's Avenue Levee	LIQUID LIMIT 29
JOB NUMBER 61124	PLASTIC LIMIT 23
SAMPLE NUMBER 30C-B	PLASTICITY INDEX 6

	LIQUID LIMIT (Referee Method)			PLASTIC LIMIT		
Trial Number	I	II	III	I	II	Avg.
Watch glass number	2	5	6	8		
Number of shocks	17	21	34			
Weight of glass & wet soil	37.58	36.48	39.37	32.21		
Weight of glass & dry soil	34.80	33.88	36.26	30.78		
Weight of glass	25.64	24.93	25.37	24.59		
Weight of dry soil	9.16	8.95	10.89	6.19		
Weight of water	2.78	2.60	3.11	1.43		
Moisture (percent)	30.3	29.1	28.6	23.1		



REMARKS:

DATE	TEST BY	CHECKED BY
4-13-16	Darla Ghidinelli	TAUSCHER

FM 93 1812 M

State of California | **RELATIVE COMPACTION TEST – NUCLEAR** | Department of Transportation

~~Job Stamp~~ Jacobs Ave. Levee Sample: 30C-13	Contract	Test No.
	Type of Material	
	Material From	
	Impact by	Nuclear by
	Date	Date
Show test location and area limits	Non Biased Plan No.	Gage No.

Notes:
Optimum moisture = 8%
Maximum wet density prior to rock correction = 2.13g/cc
Maximum wet density following rock correction = 2.23g/cc

IN-PLACE TEST BY NUCLEAR

	Site	Den. Ct. ___ "D.T.	Std. Count Density
A	1		
	2		
	3		Σ
	4		F X̄
			Moist Count
	5		1
			2
	6		3
			4
	7		5
			6
	8		7
			8
B	Σ		Σ
C	X̄		G X̄
CR(C/F)			CR(G/I)
D	X̄ Den. gm/cc		H X̄ H_2O g/cc
E	X̄ Den. Corr. for Moist** ±		

**E = D ± Diff. Bet. X̄ Moist. Fr. Common TM & H

Percent Relative* Compaction		Spec.	Individual	
			Moving Av.	

*E/K for 10% ≤ + 3/4"; E/W for > 10% + 3/4"

If Common Test Maximum is used (X̄) K or W = | X̄ H_2O =

From Tests | Dated

Remarks:

IMPACT TEST DATA

J	Initial Wet Weight of Test Specimen (Grams)	2500			
	Specimen	1	2	3	4
	Water Adjustment	8%	10%	6%	
	Tamper Reading	11.1	11.5	11.2	
K	Wet Density (gm/cc)	2.13	2.06	2.12	

K From Table 1 Test Method 216. Highest Density is Test Max.

L	+ 3/4" Agg. Adj.
% + 3/4" (Q)	Adj.
20 or less	1.00
21-25	0.99
26-30	0.98
31-35	0.97
36-40	0.96
41-45	0.95
46-50	0.94

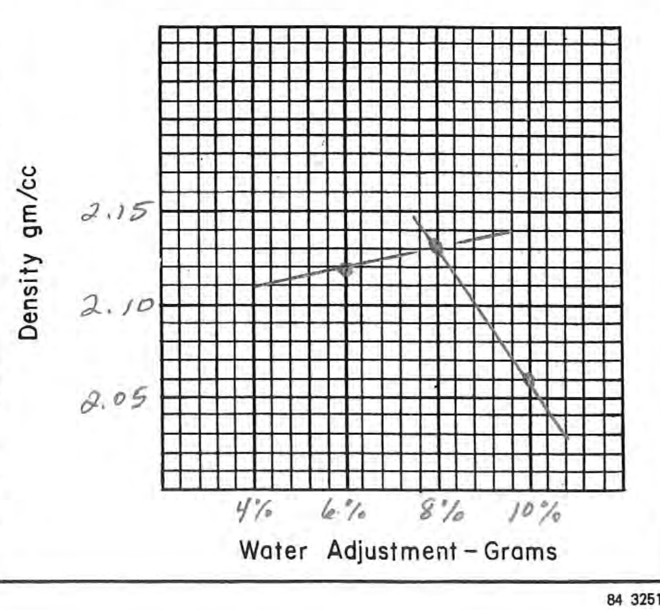
Std. Count Moist.

Σ

I X̄

SAMPLE FOR ROCK CORRECTION

M	Total Sample Wt. (gm)		58541
N	+ 3/4" Wt. in Air (gm)		14933
O	+ 3/4" Wt. in Water (gm)		9286
P	+ 3/4" Vol. (cc)	(N–O)	5647
Q	% + 3/4"	100(N/M)	25.5
R	% – 3/4"	(100–Q)	74.5
S	Density of + 3/4"	(N/P)	2.64
T	% + 3/4" / Den. of + 3/4"	(Q/SL)	9.86
U	% – 3/4" / Den. of – 3/4"	(R/K)	34.98
V	Sum of T and U	(T+U)	44.84
W	Adjusted Density gm/cc	(100/V)	2.23



TL-2148 (Rev. 6/82) | 84 32517

TEST NO. 61124 20-off-1B

Grade	C F R	S. E.		L.A.R.T. 100 500	
Sample Prep	S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

- ☐ PRELIMINARY TESTS
- ☐ PROCESS TESTS
- ☐ ACCEPTANCE TESTS
- INDEPENDENT ASSURANCE TESTS
  - ☐ DIST. LAB
  - ☐ TRANS. LAB
- ☐ SPECIAL TESTS

SAMPLE SENT TO:
- ☐ HDQTRS. LAB
- ☐ BRANCH LAB
- ☐ DIST. LAB

FIELD NO. 20-off-1B
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 1'
LOCATION OF SOURCE
Hole: 20-off Sample #1B
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: ~~[illegible]~~
Coarse & fine Grading
COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON
Jacobs Ave Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1	100									
3/4	83									
1/2	71									
3/8	62									
3	—									
4	47									
8	37									
16	29									
30	21									
50	15									
100	10									
200	7.9									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

- ☐ Dist. Engr. ☐ Constr. Dept.
- ☐ Dist. Mtls Engr. ☐ Accounting
- ☐ Res Engr., or Maint. Supt.
- ☐ H.Q. Const., Bridge or Maint.
- ☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 30C-7

Grade	S.E.	L.A.R.T. 100 500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30C-7
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 30'
LOCATION OF SOURCE
Hole: 30C Sample #7
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Small Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: In-Situ Moisture

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON
Jacobs Ave Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By:
Completed:
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8										
16										
30										
50										
100										
200										
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU Moisture= 20.1%

Combined Grading Represents

%by Wt.	%by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03

1-12-16

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 30C-11

Grade	S.E.	L.A.R.T. 100 500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By:
Completed:
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30C-11
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 50'
LOCATION OF SOURCE
Hole: 30C Sample #11
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Small Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: In-Situ Moisture

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8										
16										
30										
50										
100										
200										
S.E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU Moisture = 30.1%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03

1-12-16

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 30L-6

Grade	C F	S. E.		L.A.R.T.	100 500
Sample Prep	R S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30L-6
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 25'
LOCATION OF SOURCE
Hole: 30L Sample: 6
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Small Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: In-Situ Moisture

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By:
Completed:
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8										
16										
30										
50										
100										
200										
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU MOISTURE = 22.6%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E Combined	

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949-03
1-13-16

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 10L-1-C

Grade	S.E.	L.A.R.T. 100/500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 10L-1-C
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 1 Foot 9 Inches
LOCATION OF SOURCE Hole: 10L Sample #1C
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve | AND IS ONE OF A GROUP OF 1 | SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE | TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY | DATE NEEDED
REMARKS Test: Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON Jacobs Ave. Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 2-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2	78									
1	74									
3/4	70									
1/2	63									
3/8	59									
3										
4	48									
8	45									
16	34									
30	28									
50	23									
100	19									
200	17.2									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 30C-9

Grade	CRS	S.E.		L.A.R.T.	100/500
Sample Prep		Cleanness		% Crushed	
Durability	CF	Sp. Gr.	CF		

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30C-9
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 40'
LOCATION OF SOURCE
Hole: 30C Sample #9
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Small Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: In-Situ Moisture + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2	97									
3/8	93									
3										
4	83									
8	82									
16	81									
30	81									
50	80									
100	79									
200	77.4									
S.E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU Moisture = 29.5%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03
1-12-16

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 30L-4

Grade	C F R	S.E.		L.A.R.T. 100 500	
Sample Prep	S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Shawn Tauscher, DG
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30L-4
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 15'
LOCATION OF SOURCE
Hole: 30L Sample #4

THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 small Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)

OWNER OR MANUFACTURER

TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED

REMARKS
Test: In-situ moisture + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM

LIMITS

CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100									
8	100									
16	100									
30										
50	99									
100	26									
200	10,8									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:
In-situ Moisture = 24.8%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03

1-13-16

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 42L-6

Grade	C F	S.E.		L.A.R.T.	100 500
Sample Prep	R C S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

- ☐ PRELIMINARY TESTS
- ☐ PROCESS TESTS
- ☐ ACCEPTANCE TESTS
- INDEPENDENT ASSURANCE TESTS
  - ☐ DIST. LAB
  - ☐ TRANS. LAB
- ☐ SPECIAL TESTS

SAMPLE SENT TO: ☐ HDQTRS. LAB ☐ BRANCH LAB ☐ DIST. LAB

FIELD NO. 42L-6

DIST. LAB NO. 61124

LOT NO.

SHIPMENT NO.

P.O. OR REQ. NO.

AUTHORIZATION NO.

SAMPLE OF Soil

FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 25'

LOCATION OF SOURCE Hole: 42L Sample #6

THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 5gm Bag AND IS ONE OF A GROUP OF 1 SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)

OWNER OR MANUFACTURER

TOTAL QUANTITY AVAILABLE

TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY

DATE NEEDED

REMARKS

Test: In-Situ Moisture & Grading

COVER ADDITIONAL INFORMATION WITH LETTER

DATE SAMPLED 1-11-16 thru 1-14-16

BY CGZ TITLE

DIST, CO, RTE, PM

LIMITS

CONT. NO.

FED. NO.

RES. ENGR. OR SUPT.

ADDRESS

CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16

Calc. By: Shawn Tauscher

Completed: 4-4-16

Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100									
8	98	Bark								
16	87	Bark								
30	75	Bark								
50	66									
100	54									
200	42.7									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

In-SITU Moisture = 21.4%

Combined Grading Represents

%by Wt.	%by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

- ☐ Dist. Engr. ☐ Constr. Dept.
- ☐ Dist. Mtls Engr. ☐ Accounting
- ☐ Res Engr., or Maint. Supt.
- ☐ H.Q. Const., Bridge or Maint.
- ☐ H.Q. Lab. ☐

15-1919.03

1-12-16 JB

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 42L-5

Grade		S. E.		L.A.R.T. 100 500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

CARD NUMBER C 898804

TL-0101 (REV. 10/97) 7541-6002-4

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 42L-5
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 20'
LOCATION OF SOURCE
Hole: 42L Sample #5
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Sm Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Darla Ghirdinelli
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8	100									
3										
4	99	Shells								
8	99	Shells								
16	99	Shells								
30	99									
50	98									
100	66									
200	39.3									
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU MOISTURE 30.0%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03

1-12-16 JB

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 42L-3B

Grade		S.E.		L.A.R.T. 100 500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 42L-3B
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 15'
LOCATION OF SOURCE
Hole: 42L Sample # 3B
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 small bag ~~[illegible]~~ AND IS ONE OF A GROUP OF 1 SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
IN-SITU
Test: Moisture ~~Density~~ + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Darla Ghidinelli
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100									
8	100									
16	100									
30	100									
50	100									
100	94									
200	77.4									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU MOISTURE = 35.4%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E Combined	

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03
1-12-16 JAB

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 42L-4

Grade	C/F/R	S. E.		L.A.R.T. 100/500
Sample Prep	S/C	Cleanness		% Crushed
Durability	C/F	Sp. Gr.	C/F	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 42L-4
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 18'
LOCATION OF SOURCE
Hole: 42L Sample #4
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sm. bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: In-Situ Moisture & Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Darla Ghidinelli
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3	100									
4	99	Shells								
8	98	shells								
16	97	shells								
30	97	shells								
50	92									
100	41									
200	31.6									
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
In-SITU MOISTURE = 23.3%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E Combined	

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03

1-12-16 JAB

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 56L-5C

Grade	C F	S. E.		L.A.R.T. 100 500	
Sample Prep	R S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 56L-5C
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 20'
LOCATION OF SOURCE
Hole: 56L Sample # 5C
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 5gal. Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: In-situ moisture + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1	100									
3/4	99	Shells								
1/2	99									
3/8	99									
3										
4	99									
8	98									
16	98									
30	97									
50	90									
100	21									
200	12.0									
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU Moisture = 22.3%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03
1-11-16 JB

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 56L-3

Grade	S.E.	L.A.R.T. 100 500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

CARD NUMBER C 898804

TL-0101 (REV. 10/97) 7541-6002-4

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO: ☐ HDQTRS. LAB ☐ BRANCH LAB ☐ DIST. LAB

FIELD NO. 56L-3
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 10'
LOCATION OF SOURCE Hole: 56L Sample #3
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Sm. Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS Test: In-situ moisture & Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Darla Ghidinelli
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	A Specs.	B	B Specs.	C	C Specs.	D	D Specs.	E	E Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8	100	Shells								
3	–									
4	100	Shells								
8	100									
16	100									
30	100									
50	97									
100	20									
200	9.8									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
In-situ Moisture = 24%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

1-11-16 JAB

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 56-Off-2A

Grade	S.E.	L.A.R.T. 100/500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD CARD NUMBER C 898804

TL-0101 (REV. 10/97) 7541-6002-4

- ☐ PRELIMINARY TESTS
- ☐ PROCESS TESTS
- ☐ ACCEPTANCE TESTS
- INDEPENDENT ASSURANCE TESTS
  - ☐ DIST. LAB
  - ☐ TRANS. LAB
- ☐ SPECIAL TESTS

SAMPLE SENT TO: ☐ HDQTRS. LAB ☐ BRANCH LAB ☐ DIST. LAB

FIELD NO. 56-Off-2A

DIST. LAB NO. 61124

LOT NO.

SHIPMENT NO.

P.O. OR REQ. NO.

AUTHORIZATION NO.

SAMPLE OF Soil

FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 2.5'

LOCATION OF SOURCE

Hole: 56-Off Sample # 2A

THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Sm. Bag — AND IS ONE OF A GROUP OF 1 — SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)

OWNER OR MANUFACTURER

TOTAL QUANTITY AVAILABLE — TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY — DATE NEEDED

REMARKS

Test: In-situ moisture & Grading

COVER ADDITIONAL INFORMATION WITH LETTER

DATE SAMPLED 1-11-16 thru 1-14-16

BY CGZ TITLE

DIST, CO, RTE, PM

LIMITS

CONT. NO.

FED. NO.

RES. ENGR. OR SUPT.

ADDRESS

CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON Jacobs Avenue Levee

Date Rec'd.: 2-4-16

Calc. By: Darla Ghidinelli

Completed: 4-4-16

Reported:

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4	100									
1/2	92									
3/8	87									
3	—									
4	74									
8	64									
16	57									
30	51									
50	45									
100	19									
200	13.3									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:

IN-SITU MOISTURE = 56.6

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E Combined	

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 56-0ff-2B

Grade	C F	S. E.		L.A.R.T.	100 500
Sample Prep	S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 56-0ff-2B
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 2.5'
LOCATION OF SOURCE
Hole: 56-off Sample #2B
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Sm. Bag | AND IS ONE OF A GROUP OF 1 | SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE | TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY | DATE NEEDED
REMARKS
Test: In-situ moisture + grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Darla Ghidinelli
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4	100									
1/2	98									
3/8	98									
3	—									
4	97									
8	90									
16	78									
30	67									
50	57									
100	46									
200	39.5									
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU MOISTURE 57.3%

Combined Grading Represents

%by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 56-OFF-7

Grade		S.E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 56-off-7
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 25'
LOCATION OF SOURCE
Hole: 56-off Sample #7
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sm. Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: In-situ moisture + grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: Darla Ghidinelli
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8	100									
3										
4	99	Shells								
8	98	Shells	& Bark							
16	98	Shells &	Bark							
30	98	Shells &	Bark							
50	96	Sand &	Bark							
100	29									
200	14.4									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:
IN-SITU MOISTURE 28.5%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E Combined	

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03
1-14-16

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124 56-OFF-5

Grade		S. E.		L.A.R.T. 100 500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, JT
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 56-OFF-5
DIST. LAB NO. 61124
LOT NO.

SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil

FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 15'

LOCATION OF SOURCE

Hole: 56-Off Sample #5

THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Sm. Bag
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)

OWNER OR MANUFACTURER

TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED

REMARKS

Test: In-situ moisture + grading

COVER ADDITIONAL INFORMATION WITH LETTER

DATE SAMPLED 1-11-16 thru 1-14-16

BY CGI
TITLE

DIST, CO, RTE, PM

LIMITS

CONT. NO.

FED. NO.

RES. ENGR. OR SUPT.

ADDRESS

CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100									
8	99									
16	99									
30	99									
50	96									
100	19									
200	11.5									
S. E.										
Sp. Gr. - C										
Sp. Gr. - F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:

IN-SITU MOISTURE = 22.3%

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls. Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

15-1949.03
1-14-16

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

TEST NO. 61124   20-Off-4B

Grade		S.E.		L.A.R.T. 100 500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

- ☐ PRELIMINARY TESTS
- ☐ PROCESS TESTS
- ☐ ACCEPTANCE TESTS
- INDEPENDENT ASSURANCE TESTS
  - ☐ DIST. LAB
  - ☐ TRANS. LAB
- ☐ SPECIAL TESTS

SAMPLE SENT TO:
- ☐ HDQTRS. LAB
- ☐ BRANCH LAB
- ☐ DIST. LAB

FIELD NO. 20-off-4B

DIST. LAB NO. 61124

LOT NO.

SHIPMENT NO.

P.O. OR REQ. NO.

AUTHORIZATION NO.

SAMPLE OF Soil

FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 15'

LOCATION OF SOURCE

Hole: 20-Off   Sample # 4B

THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve   AND IS ONE OF A GROUP OF 1   SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)

OWNER OR MANUFACTURER

TOTAL QUANTITY AVAILABLE   TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY   DATE NEEDED

REMARKS

Test: Moisture Density

COVER ADDITIONAL INFORMATION WITH LETTER

DATE SAMPLED 1-11-16 thru 1-14-16

BY CGI   TITLE

DIST, CO, RTE, PM

LIMITS

CONT. NO.

FED. NO.

RES. ENGR. OR SUPT.

ADDRESS

CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Soil, Jacobs Ave. Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16

Calc. By: DG, ST

Completed: 4-4-16

Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8										
16										
30										
50										
100										
200										
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color..										
Clean.										

Comments:

Moisture Density

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

- ☐ Dist. Engr. ☐ Constr. Dept.
- ☐ Dist. Mtls Engr. ☐ Accounting
- ☐ Res Engr., or Maint. Supt.
- ☐ H.Q. Const., Bridge or Maint.
- ☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

61124 20off-4B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ____ DATE 3-16-16 JOB NO. ____

LOCATION Jacobs Avenue Levee

BORING NO. ____ SAMPLE NO. ____ DEPTH/ELEV. ____

DESCRIPTION OF SAMPLE ____

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1071.2			
	TARE PLUS DRY SOIL		844.1			
	WATER	M_w	227.1			
	TARE		274.7			
	DRY SOIL	M_d	569.4			
WATER CONTENT		w	39.9 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	15.044			
	INSIDE DIAMETER OF CYLINDER	D	6.041			
MASS IN GRAMS	WET SOIL AND TARE		1071.2			
	TARE		274.7			
	WET SOIL	M_t	796.5			
	DRY SOIL[A]	M_d	569.4			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF CYLINDER)	V	431.19			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	115.27			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	82.4			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ____ COMPUTED BY DG CHECKED BY ST

TEST NO. 61124 20-off-6

Grade		S.E.		L.A.R.T. 100 500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 20-Off-6
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 25'
LOCATION OF SOURCE
Hole: 20-Off Sample # 6
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density & Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Ave. Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG • ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8	100									
16	100									
30	100									
50	98									
100	30									
200	18.6									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

1046.1 g
14.23 from top
no pantare

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

61124 200ff-6

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION (VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1046.1			
	TARE PLUS DRY SOIL		884.0			
	WATER	M_w	162.1			
	TARE		207.1			
	DRY SOIL	M_d	676.9			
WATER CONTENT		w	23.9 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	Hs				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	13.747			
	INSIDE DIAMETER OF CYLINDER	D	6.109			
MASS IN GRAMS	WET SOIL AND TARE		1046.1			
	TARE		207.1			
	WET SOIL	M_t	839.0			
	DRY SOIL[A]	M_d	676.9			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF CYLINDER)	V	402.94			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	129.9			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	104.8			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY, % = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$

VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY ST

TEST NO. 61124 56-OFF-1C

Grade		S. E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 56-Off-1C
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 1'
LOCATION OF SOURCE
Hole: 56-Off Sample #1C
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve AND IS ONE OF A GROUP OF 1 SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density & Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2	100									
1 1/2	86									
1	86									
3/4	86									
1/2	75									
3/8	69									
3	—									
4	57									
8	45									
16	35									
30	26									
50	18									
100	11									
200	8.3									
S. E.										
Sp. Gr. - C										
Sp. Gr. - F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Bolt in Sample
16 g. not included

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

393.4 — #4
31.8 - 200
337.9 - coarse
321.8 w/o Bolt

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

01124 56-044-1C

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1095.3			
	TARE PLUS DRY SOIL		1034.2			
	WATER	M_w	61.1			
	TARE		273.9			
	DRY SOIL	M_d	760.3			
WATER CONTENT		w	8.0 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	13.428			
	INSIDE DIAMETER OF CYLINDER	D	5.993			
MASS IN GRAMS	WET SOIL AND TARE		1095.3			
	TARE		273.9			
	WET SOIL	M_t	821.4			
	DRY SOIL[A]	M_d	760.3			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF CYLINDER)	V	378.78			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	135.3			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	125.3			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY, % = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG ______ CHECKED BY ST ______

TEST NO. 61124 42L-1

Grade	C F	S.E.		L.A.R.T.	100 500
Sample Prep	R S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 42L-1
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 5'-7.5'
LOCATION OF SOURCE
Hole: 42L Sample #1
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Shelby Tube
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density & Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8	100	Rust	+Shells							
16	100	Rust	+Shells							
30	99	Rust	+Shells							
50	99									
100	87									
200	64.7									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:

Combined Grading Represents

%by Wt.	%by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls. Engr ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

MAIL TO SAME DESTINATION AS SAMPLE

#42L-1

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		2217.1			
	TARE PLUS DRY SOIL		1805.6			
	WATER	M_w	411.5			
	TARE		587.8			
	DRY SOIL	M_d	1217.8			
WATER CONTENT		w	33.8 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	20.716			
	INSIDE DIAMETER OF CYLINDER	D	7.307			
MASS IN GRAMS	WET SOIL AND TARE		2217.1			
	TARE		587.8			
	WET SOIL	M_t	1629.3			
	DRY SOIL[A]	M_d	1217.8			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	868.71			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	117.0			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	87.5			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG ______ CHECKED BY ST ______

TEST NO. 61124 42L-3C

Grade		S.E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 42L-3C
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 15'
LOCATION OF SOURCE
Hole: 42L Sample # 3C
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density, Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Grading

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100	Shells								
8	100	Shells								
16	100	Rust								
30	100									
50	99									
100	88									
200	69.6									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E Combined	

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

61124 42L-3C

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		947.3			
	TARE PLUS DRY SOIL		764.1			
	WATER	M_w	183.2			
	TARE		275.5			
	DRY SOIL	M_d	488.6			
WATER CONTENT		w	37.5 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ SAMPLE	H	12.43			
	INSIDE DIAMETER OF CYLINDER	D	6.04			
MASS IN GRAMS	WET SOIL AND TARE		947.3			
	TARE		275.5			
	WET SOIL	M_t	671.8			
	DRY SOIL[A]	M_d	488.6			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	356.2			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	117.7			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	85.6			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

Unit Wt = 117.7 lbs/ft³
Moisture = 37.5%

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY JT

TEST NO. 61124 30C-5

Grade	S.E.	L.A.R.T. 100 500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30C-5
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 20' - 22.5'
LOCATION OF SOURCE
Hole: 30C Sample #5
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Shelby Tube
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density & Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8	100									
16	100									
30	100									
50	99									
100	98									
200	93.0									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd.										
Color..										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

#30C-5

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT							
SAMPLE OR SPECIMEN NO.							
TARE NO.							
MASS IN GRAMS	TARE PLUS WET SOIL		2154.3				
	TARE PLUS DRY SOIL		1704.2				
	WATER	M_w	450.1				
	TARE		587.2				
	DRY SOIL	M_d	1117.0				
WATER CONTENT		w	40.3 %	%	%	%	
WEIGHT-VOLUME RELATIONS							
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H					
CYLINDER NO.							
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ SAMPLE	H	20.512				
	INSIDE DIAMETER OF CYLINDER	D	7.270				
MASS IN GRAMS	WET SOIL AND TARE		2154.3				
	TARE		587.2				
	WET SOIL	M_t	1567.1				
	DRY SOIL[A]	M_d	1117.0				
SPECIFIC GRAVITY OF SOIL		G_s					
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	851.46				
	DRY SOIL = M_d / G_s	V_s					
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	114.85				
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	81.86				
VOID RATIO = $(V - V_s) / V_s$		e					
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%	
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%	

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY D. Ghidinelli CHECKED BY TAUSCHER

TEST NO. 61124 56-off-1B

Grade		S.E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

- ☐ PRELIMINARY TESTS
- ☐ PROCESS TESTS
- ☐ ACCEPTANCE TESTS
- INDEPENDENT ASSURANCE TESTS
  - ☐ DIST. LAB
  - ☐ TRANS. LAB
- ☐ SPECIAL TESTS

SAMPLE SENT TO: ☐ HDQTRS. LAB ☐ BRANCH LAB ☐ DIST. LAB

FIELD NO. 56-off-1B
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 1'
LOCATION OF SOURCE
Hole: 56-off Sample #1B
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve AND IS ONE OF A GROUP OF 1 SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE | TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY | DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON Jacobs Avenue Levee

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4	95									
1/2	86									
3/8	80									
3	–									
4	62									
8	80									
16	65									
30	57									
50	40									
100	27									
200	21.2									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

61124
56-off-1B

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ____ DATE ____ JOB NO. ____

LOCATION Jacobs Avenue Levee

BORING NO. ____ SAMPLE NO. ____ DEPTH/ELEV. ____

DESCRIPTION OF SAMPLE ____

WATER CONTENT

SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1220.3			
	TARE PLUS DRY SOIL		1144.4			
	WATER	M_w	75.9			
	TARE		273.2			
	DRY SOIL	M_d	871.2			
WATER CONTENT		w	8.7 %	%	%	%

WEIGHT-VOLUME RELATIONS

SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ SAMPLE	H	14.436			
	INSIDE DIAMETER OF CYLINDER	D	6.03			
MASS IN GRAMS	WET SOIL AND TARE		1220.3			
	TARE		273.2			
	WET SOIL	M_t	947.1			
	DRY SOIL[A]	M_d	871.2			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	412.26			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	143.4			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	131.9			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ____ COMPUTED BY DG ____ CHECKED BY ST ____

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk

TEST NO. 61124 56L-4

Grade		S.E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 56L-4
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 15'
LOCATION OF SOURCE
Hole: 56L Sample # 4

THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve | AND IS ONE OF A GROUP OF 1 | SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)

OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE | TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY | DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, 27
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8	100	wood								
16	100									
30	100									
50	97									
100	38									
200	20.3									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

61124 56L-4

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT							
SAMPLE OR SPECIMEN NO.							
TARE NO.							
MASS IN GRAMS	TARE PLUS WET SOIL		970.9				
	TARE PLUS DRY SOIL		830.6				
	WATER	M_w	140.3				
	TARE		275.3				
	DRY SOIL	M_d	555.3				
WATER CONTENT		w	25.3 %	%	%	%	

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	11.921 cm			
	INSIDE DIAMETER OF CYLINDER	D	6.032 cm			
MASS IN GRAMS	WET SOIL AND TARE		970.9			
	TARE		275.3			
	WET SOIL	M_t	695.6			
	DRY SOIL[A]	M_d	555.3			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) Sample	V	340.66			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	127.42			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	101.72			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

Dry Unit Wt = 101.7 lbs/ft³
Moisture = 25.3%

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY ST

TEST NO. 61124 56L-2

Grade	S.E.	L.A.R.T. 100 500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

- ☐ PRELIMINARY TESTS
- ☐ PROCESS TESTS
- ☐ ACCEPTANCE TESTS

INDEPENDENT ASSURANCE TESTS
- ☐ DIST. LAB
- ☐ TRANS. LAB

☐ SPECIAL TESTS

SAMPLE SENT TO: ☐ HDQTRS. LAB ☐ BRANCH LAB ☐ DIST. LAB

FIELD NO. 56L-2
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 4.9' - 7.4'
LOCATION OF SOURCE
Hole: 56L Sample #2
THIS SAMPLE IS SHIPPED IN 1 Shelby Tube (NO. CONTAINERS) AND IS ONE OF A GROUP OF 1 SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100	Shells								
8	100	Shells								
16	99	Rust								
30	99									
50	98									
100	86.6									
200	68.6									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

- ☐ Dist. Engr. ☐ Constr. Dept.
- ☐ Dist. Mtls Engr. ☐ Accounting
- ☐ Res Engr., or Maint. Supt.
- ☐ H.Q. Const., Bridge or Maint.
- ☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

61124 S6L-C

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		2082.3			
	TARE PLUS DRY SOIL		1684.4			
	WATER	M_w	397.9			
	TARE		555.3			
	DRY SOIL	M_d	1129.1			
WATER CONTENT		w	35.2 %	%	%	%

WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	19.438			
	INSIDE DIAMETER OF CYLINDER	D	7.276			
MASS IN GRAMS	WET SOIL AND TARE		2082.3			
	TARE		555.3			
	WET SOIL	M_t	1527.0			
	DRY SOIL[A]	M_d	1129.1			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~ sample)	V	808.21			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	117.90			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	87.18			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG, ______ CHECKED BY ST

TEST NO. 61124 30L-1C

Grade	S.E.	L.A.R.T. 100/500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

LABORATORY RECORD OF TESTS ON

Jacobs Ave. Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30L-~~1C~~ 1B
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 1'
LOCATION OF SOURCE
Hole: 30L Sample # ~~1C~~ 1B
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4	100									
1/2	93									
3/8	91									
3	—									
4	84									
8	75									
16	65									
30	54									
50	44									
100	29									
200	21.3									
S.E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

6112Y 30L-1C

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1026.1			
	TARE PLUS DRY SOIL		832.3			
	WATER	M_w	193.8			
	TARE		204.6			
	DRY SOIL	M_d	627.7			
WATER CONTENT		w	30.9 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. − ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	15.17			
	INSIDE DIAMETER OF CYLINDER	D	6.06			
MASS IN GRAMS	WET SOIL AND TARE		1026.1			
	TARE		204.6			
	WET SOIL	M_t	821.5			
	DRY SOIL[A]	M_d	627.7			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~ SAMPLE)	V	437.54			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	117.16			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	89.57			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY ST

TEST NO. 61124 56L-6B

Grade		S.E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 56L-6B
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 25'
LOCATION OF SOURCE
Hole 56L Sample #6B
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8	100	shells	& RUST							
16	100	"	"							
30	100	RUST								
50	92									
100	20									
200	11.6									
S.E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

61124 56L-6B

VOLUMETRIC METHOD—B

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1101.8			
	TARE PLUS DRY SOIL		964.1			
	WATER	M_w	137.7			
	TARE		273.8			
	DRY SOIL	M_d	690.3			
WATER CONTENT		w	19.9 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ SAMPLE		13.504			
	INSIDE DIAMETER OF CYLINDER	D	6.01			
MASS IN GRAMS	WET SOIL AND TARE		1101.8			
	TARE		273.8			
	WET SOIL	M_t	828.0			
	DRY SOIL[A]	M_d	690.3			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	383.1			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	134.87			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	112.44			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DB ______ CHECKED BY JT ______

TEST NO. 61124 56L-6A

Grade	C F R	S. E.		L.A.R.T.	100 500
Sample Prep	S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

- ☐ PRELIMINARY TESTS
- ☐ PROCESS TESTS
- ☐ ACCEPTANCE TESTS
- INDEPENDENT ASSURANCE TESTS
  - ☐ DIST. LAB
  - ☐ TRANS. LAB
- ☐ SPECIAL TESTS

SAMPLE SENT TO:
- ☐ HDQTRS. LAB
- ☐ BRANCH LAB
- ☐ DIST. LAB

FIELD NO. 56L-6A
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 25'
LOCATION OF SOURCE
Hole: 56L Sample #6A
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve | AND IS ONE OF A GROUP OF 1 | SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE | TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY | DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON
Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100									
8	100									
16	100									
30	99									
50	91									
100	16									
200	8.6									
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

- ☐ Dist. Engr. ☐ Constr. Dept.
- ☐ Dist. Mtls Engr. ☐ Accounting
- ☐ Res Engr., or Maint. Supt.
- ☐ H.Q. Const., Bridge or Maint.
- ☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

*61124 56L-6A

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ____________ DATE ____________ JOB NO. ____________

LOCATION Jacobs Avenue Levee

BORING NO. ____________ SAMPLE NO. ____________ DEPTH/ELEV. ____________

DESCRIPTION OF SAMPLE ____________

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		1176.4			
	TARE PLUS DRY SOIL		1026.2			
	WATER	M_w	150.2			
	TARE		275.0			
	DRY SOIL	M_d	751.2			
WATER CONTENT		w	20.0 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ SAMPLE	H	14.860			
	INSIDE DIAMETER OF CYLINDER	D	6.029			
MASS IN GRAMS	WET SOIL AND TARE		1176.4			
	TARE		275.0			
	WET SOIL	M_t	901.4			
	DRY SOIL[A]	M_d	751.2			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	424.23			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	132.59			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	110.49			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ____________ COMPUTED BY DG ____________ CHECKED BY JT ____________

TEST NO. 61124 10L-2

Grade		S.E.		L.A.R.T. 100 500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

LABORATORY RECORD OF TESTS ON

Jacobs Ave. Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DB, ST
Completed:
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 10L-2
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN

SAMPLE FROM Jacobs Avenue Levee

DEPTH 5 Foot 6 Inches

LOCATION OF SOURCE
Hole: 10L Sample #2

THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve | AND IS ONE OF A GROUP OF 1 | SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)

OWNER OR MANUFACTURER

TOTAL QUANTITY AVAILABLE | TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY | DATE NEEDED

REMARKS
Test: Moisture Density & Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2	82									
3/8	77									
3	—									
4	75									
8	75									
16	75									
30	74									
50	72									
100	61									
200	46.2									
S. E.										
Sp. Gr. - C										
Sp. Gr. - F										
% Abs.										
Dur. - C										
Dur. - F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

61124 10L-2

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		977.7			
	TARE PLUS DRY SOIL		778.1			
	WATER	M_w	199.6			
	TARE		224.2			
	DRY SOIL	M_d	553.9			
WATER CONTENT		w	36.0 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. – ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ SAMPLE	V	14.005			
	INSIDE DIAMETER OF CYLINDER	D	6.037			
MASS IN GRAMS	WET SOIL AND TARE		977.7			
	TARE		224.2			
	WET SOIL	M_t	753.5			
	DRY SOIL[A]	M_d	553.9			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	400.88			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	117.3			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	86.22			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY ST

TEST NO. 61124 30L-5C

Grade		S.E.		L.A.R.T. 100/500	
Sample Prep		Cleanness		% Crushed	
Durability		Sp. Gr.			

LABORATORY RECORD OF TESTS ON

Jacobs Avenue Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CARD

TL-0101 (REV. 10/97) 7541-6002-4

CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30L-5C
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 20'
LOCATION OF SOURCE
Hole: 30L Sample: 5C
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 sleeve
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density + Grading

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4	100									
8	100									
16	100									
30	—									
50	99									
100	37									
200	16.9									
S.E.										
Sp.Gr.-C										
Sp.Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

6112Y 30L-5C

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT							
SAMPLE OR SPECIMEN NO.							
TARE NO.							
MASS IN GRAMS	TARE PLUS WET SOIL		1093.6				
	TARE PLUS DRY SOIL		915.3				
	WATER	M_w	178.3				
	TARE		202.5				
	DRY SOIL	M_d	712.8				
WATER CONTENT		w	25.0 %	%	%	%	
WEIGHT-VOLUME RELATIONS							
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H					
CYLINDER NO.							
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ SAMPLE	H	14.75				
	INSIDE DIAMETER OF CYLINDER	D	6.13				
MASS IN GRAMS	WET SOIL AND TARE		1093.6				
	TARE		202.5				
	WET SOIL	M_t	891.1				
	DRY SOIL[A]	M_d	712.8				
SPECIFIC GRAVITY OF SOIL		G_s					
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	435.31				
	DRY SOIL = M_d / G_s	V_s					
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	127.7				
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	102.2				
VOID RATIO = $(V - V_s) / V_s$		e					
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%	
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%	

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG CHECKED BY ST

TEST NO. 61124 20-OFF-2

Grade	S.E.	L.A.R.T. 100/500
Sample Prep	Cleanness	% Crushed
Durability	Sp. Gr.	

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 20-Off-2
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 3'
LOCATION OF SOURCE
Hole: 20-Off Sample #2
THIS SAMPLE IS SHIPPED IN 1 sleeve (NO. CONTAINERS) AND IS ONE OF A GROUP OF 1 SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
Test: Moisture Density

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGZ
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON
Jacobs Ave Levee

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8										
16										
30										
50										
100										
200										
S. E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.- C										
Dur.- F										
LART-1										
LART-5										
% Crsh'd										
Color.										
Clean.										

Comments:
Moisture Density.

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const, Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

*61124 20-off-2

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ________ DATE 3-16-16 JOB NO. ________

LOCATION Jacobs Avenue Levee

BORING NO. ________ SAMPLE NO. ________ DEPTH/ELEV. ________

DESCRIPTION OF SAMPLE ________

WATER CONTENT

SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		924.7			
	TARE PLUS DRY SOIL		648.5			
	WATER	M_w	276.2			
	TARE		208.6			
	DRY SOIL	M_d	439.9			
WATER CONTENT		w	62.8 %	%	%	%

WEIGHT-VOLUME RELATIONS

SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF CYLINDER	H	15.14			
	INSIDE DIAMETER OF CYLINDER	D	6.16			
MASS IN GRAMS	WET SOIL AND TARE		924.7			
	TARE		208.6			
	WET SOIL	M_t	716.1			
	DRY SOIL[A]	M_d	439.9			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF CYLINDER)	V	451.2			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	99.0			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	60.8			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ________ COMPUTED BY DG CHECKED BY ST

TEST NO. 61124 30L-2

Grade	C F	S. E.		L.A.R.T.	100 500
Sample Prep	R S	Cleanness		% Crushed	
Durability	C F	Sp. Gr.	C F		

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
SAMPLE IDENTIFICATION CARD
TL-0101 (REV. 10/97) 7541-6002-4
CARD NUMBER C 898804

☐ PRELIMINARY TESTS
☐ PROCESS TESTS
☐ ACCEPTANCE TESTS
INDEPENDENT ASSURANCE TESTS
☐ DIST. LAB
☐ TRANS. LAB
☐ SPECIAL TESTS

SAMPLE SENT TO:
☐ HDQTRS. LAB
☐ BRANCH LAB
☐ DIST. LAB

FIELD NO. 30L-2
DIST. LAB NO. 61124
LOT NO.
SHIPMENT NO.
P.O. OR REQ. NO.
AUTHORIZATION NO.

SAMPLE OF Soil
FOR USE IN
SAMPLE FROM Jacobs Avenue Levee
DEPTH 5'-7.5'
LOCATION OF SOURCE
Hole: 30L Sample #2
THIS SAMPLE IS SHIPPED IN (NO. CONTAINERS) 1 Shelby Tube
AND IS ONE OF A GROUP OF 1
SAMPLES REPRESENTING (TONS, GALS, BBLS, STA, ETC.)
OWNER OR MANUFACTURER
TOTAL QUANTITY AVAILABLE
TEST RESULTS DESIRED ☐ NORMAL ☐ PRIORITY
DATE NEEDED
REMARKS
TEST: MOISTURE DENSITY

COVER ADDITIONAL INFORMATION WITH LETTER
DATE SAMPLED 1-11-16 thru 1-14-16
BY CGI
TITLE
DIST, CO, RTE, PM
LIMITS
CONT. NO.
FED. NO.
RES. ENGR. OR SUPT.
ADDRESS
CONTRACTOR

MAIL TO SAME DESTINATION AS SAMPLE

LABORATORY RECORD OF TESTS ON

Soil Jacobs Ave. Levee

Date Rec'd.: 2-4-16
Calc. By: DG, ST
Completed: 4-4-16
Reported:

☐ Preliminary ☐ Process ☐ Acceptance ☐ Ind. Assur.

GRADING ANALYSIS

Sieve Size	A	Specs.	B	Specs.	C	Specs.	D	Specs.	E	Specs.
3"										
2 1/2										
2										
1 1/2										
1										
3/4										
1/2										
3/8										
3										
4										
8										
16										
30										
50										
100										
200										
S.E.										
Sp. Gr.-C										
Sp. Gr.-F										
% Abs.										
Dur.-C										
Dur.-F										
LART-1										
LART-5										
% Crsh'd.										
Color.										
Clean.										

Comments:

Moisture Density

Combined Grading Represents

% by Wt.	% by Vol.	Test No.	Description
		A	
		B	
		C	
		D	
		E	Combined

☐ Dist. Engr. ☐ Constr. Dept.
☐ Dist. Mtls Engr. ☐ Accounting
☐ Res Engr., or Maint. Supt.
☐ H.Q. Const., Bridge or Maint.
☐ H.Q. Lab. ☐

SOURCE	CHARGE	EXPENDITURE AUTHORIZATION	SPECIAL DESIGNATION (USE WHEN APPLICABLE)	OBJECT	MSA

VOLUMETRIC METHOD—B

#302-2

UNIT WEIGHTS, VOID RATIO, POROSITY, AND DEGREE OF SATURATION
(VOLUMETRIC METHOD—B)

NAME ______ DATE ______ JOB NO. ______

LOCATION Jacobs Avenue Levee

BORING NO. ______ SAMPLE NO. ______ DEPTH/ELEV. ______

DESCRIPTION OF SAMPLE ______

WATER CONTENT						
SAMPLE OR SPECIMEN NO.						
TARE NO.						
MASS IN GRAMS	TARE PLUS WET SOIL		2016.8			
	TARE PLUS DRY SOIL		1626.3			
	WATER	M_w	390.5			
	TARE		542.3			
	DRY SOIL	M_d	1084.0			
WATER CONTENT		w	36.0 %	%	%	%
WEIGHT-VOLUME RELATIONS						
SAMPLE HEIGHT	CYL. HT. - ("A" + "B")	H_s				
CYLINDER NO.						
CENTIMETERS	HEIGHT OF ~~CYLINDER~~ sample	H	18.917 cm			
	INSIDE DIAMETER OF CYLINDER	D	7.272 cm			
MASS IN GRAMS	WET SOIL AND TARE		2016.8			
	TARE		542.3			
	WET SOIL	M_t	1474.5			
	DRY SOIL[A]	M_d	1084.0			
SPECIFIC GRAVITY OF SOIL		G_s				
VOLUME IN CC	WET SOIL (VOLUME OF ~~CYLINDER~~) SAMPLE	V	785.69			
	DRY SOIL = M_d / G_s	V_s				
LBS PER CU FT	WET UNIT WEIGHT = $(M_t / V) \times 62.4$	γ_m	117.11			
	DRY UNIT WEIGHT = $(M_d / V) \times 62.4$	γ_d	86.09			
VOID RATIO = $(V - V_s) / V_s$		e				
POROSITY,% = $[(V - V_s) / V] \times 100$		n	%	%	%	%
DEGREE OF SATURATION = $[V_w / (V - V_s)] \times 100$		S	%	%	%	%

VOLUME OF SAMPLE $V = (\pi D^2 H) / 4$
VOLUME OF WATER = $V_w = M_w$ / SPECIFIC GRAVITY OF WATER[B]

[A] IF NOT MEASURED ON ENTIRE SPECIMEN, MAY BE COMPUTED AS FOLLOWS: $M_d = M_t / (1 + 0.01w)$

Dry Unit Wt. = 86.1 lbs/ft3
Moisture = 36.0%

[B] SPECIFIC GRAVITY OF WATER IN METRIC SYSTEM = 1 (APPROX)

REMARKS ______ COMPUTED BY DG ______ CHECKED BY ST ______

Appendix D

Liquefaction Analyses

APPENDIX D
LIQUEFACTION ANALYSES

Liquefaction analyses were performed using subsurface profiles estimated from explorations at the site along with laboratory test results from selected samples. The analyses were performed using the computer program LiqIT (2006). Results of those analyses are attached.

CGI Technical Services Inc.

CGI Technical Services, Inc.
1612 Wedding Way
Redding, CA 96003
currygroup.com

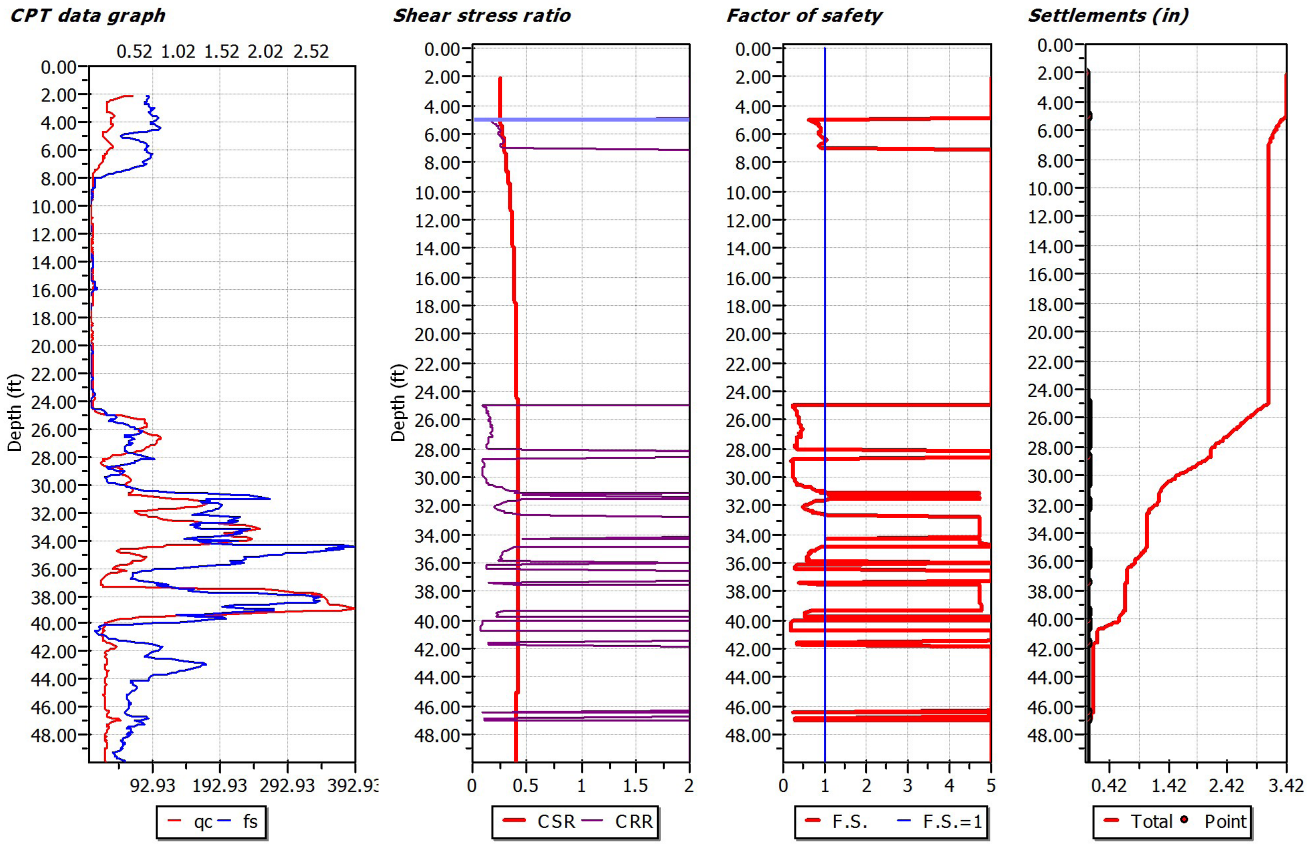
LIQUEFACTION ANALYSIS REPORT

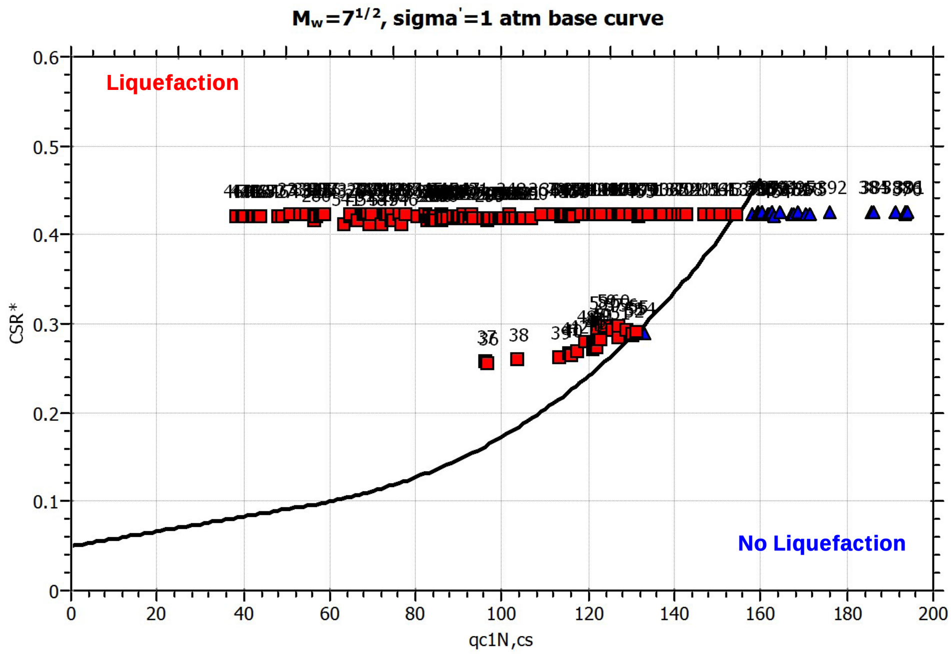
Project title : Jacob Drive Levee

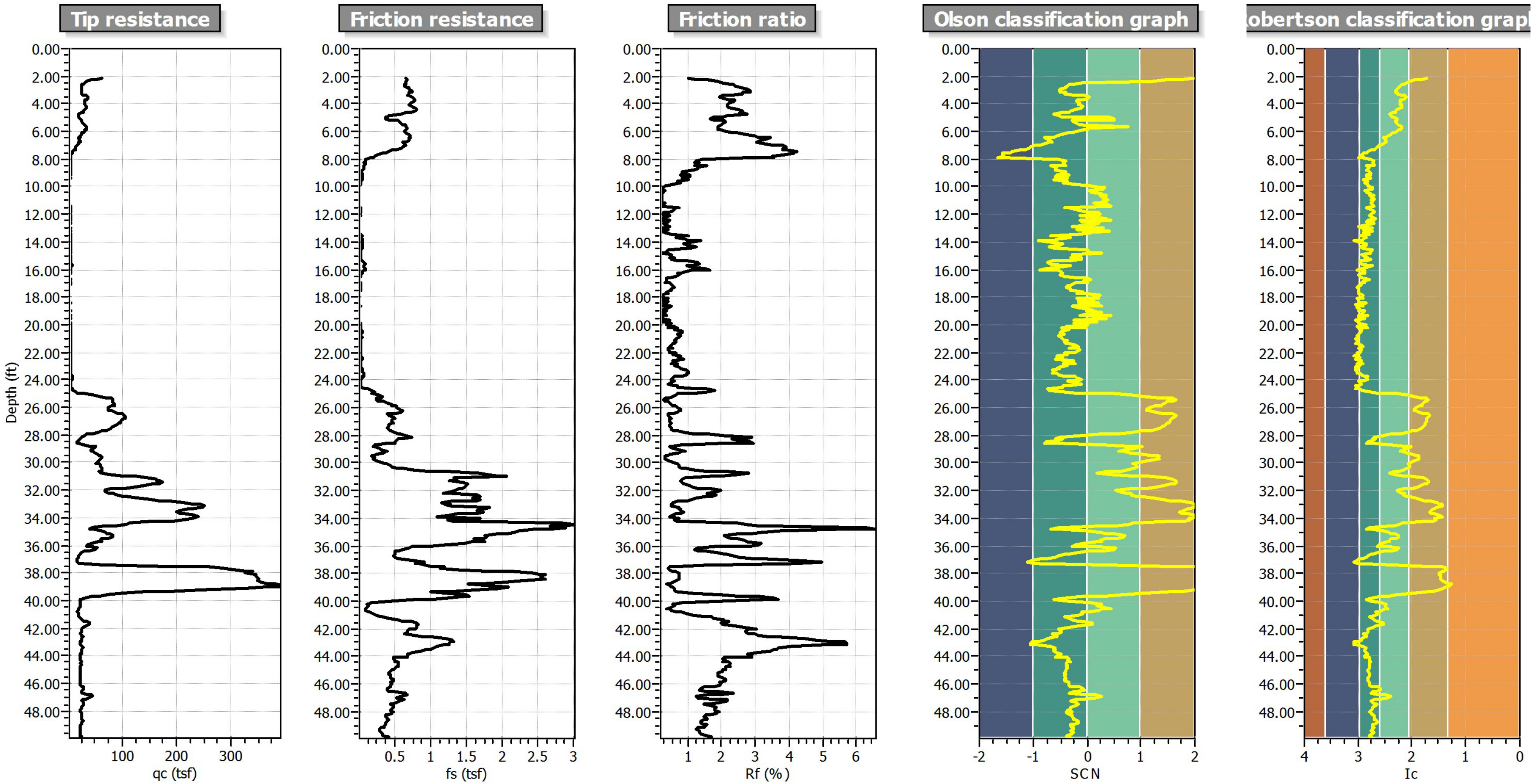
Project subtitle : 30C

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	5.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	9.00
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.25 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00







Soil type index legend

Gravelly sand to dense sand	Silt mixtures: clayey silt to silty clay
Sands: clean sand to silty sand	Clays: silty clay to clay
Sand mixtures: silty sand to sandy silt	Organic soils: peats

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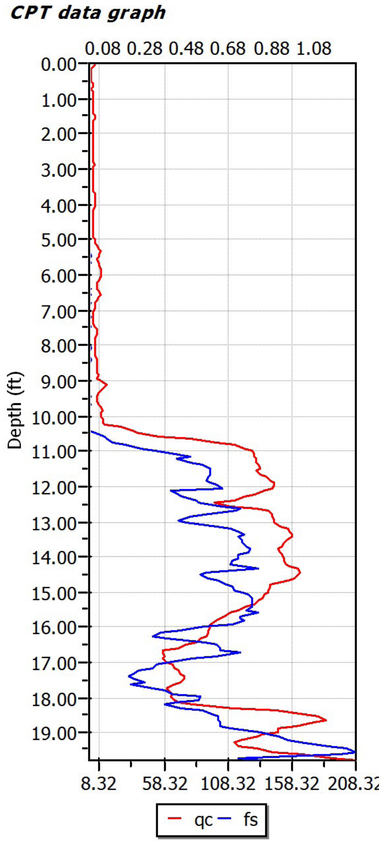
LIQUEFACTION ANALYSIS REPORT

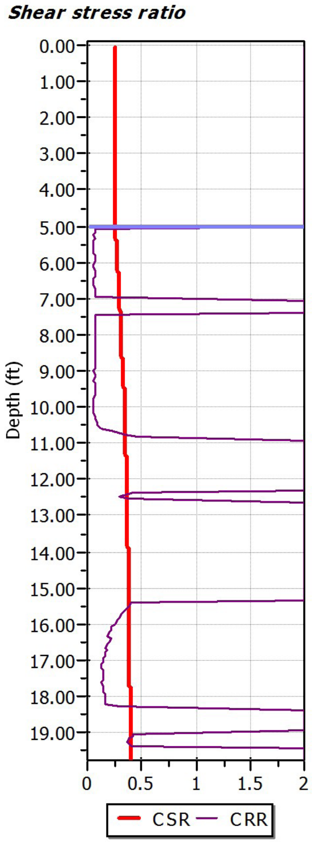
Project title : Jacob Drive Levee

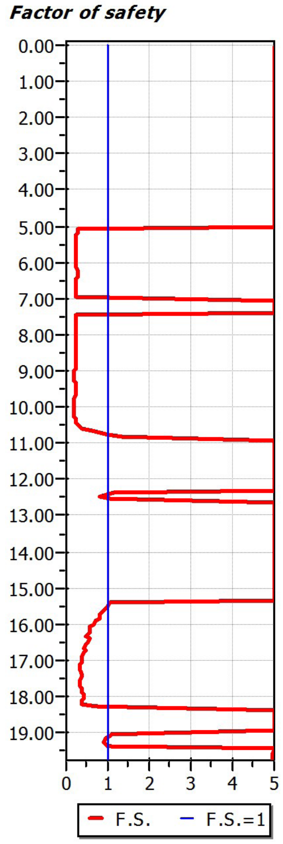
Project subtitle : 56C

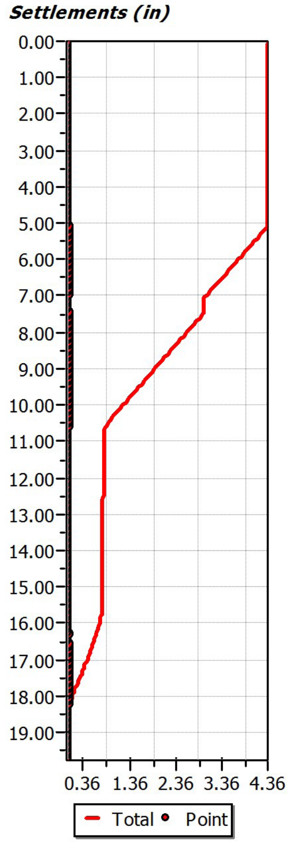
Input parameters and analysis data

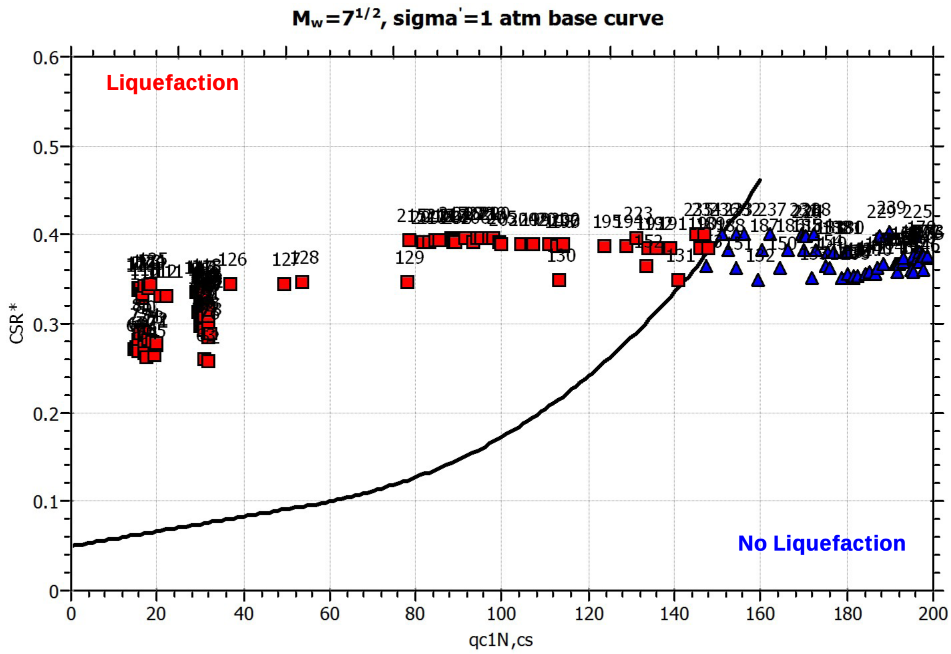
In-situ data type:	Cone Penetration Test	Depth to water table:	5.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	9.00
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.25 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00

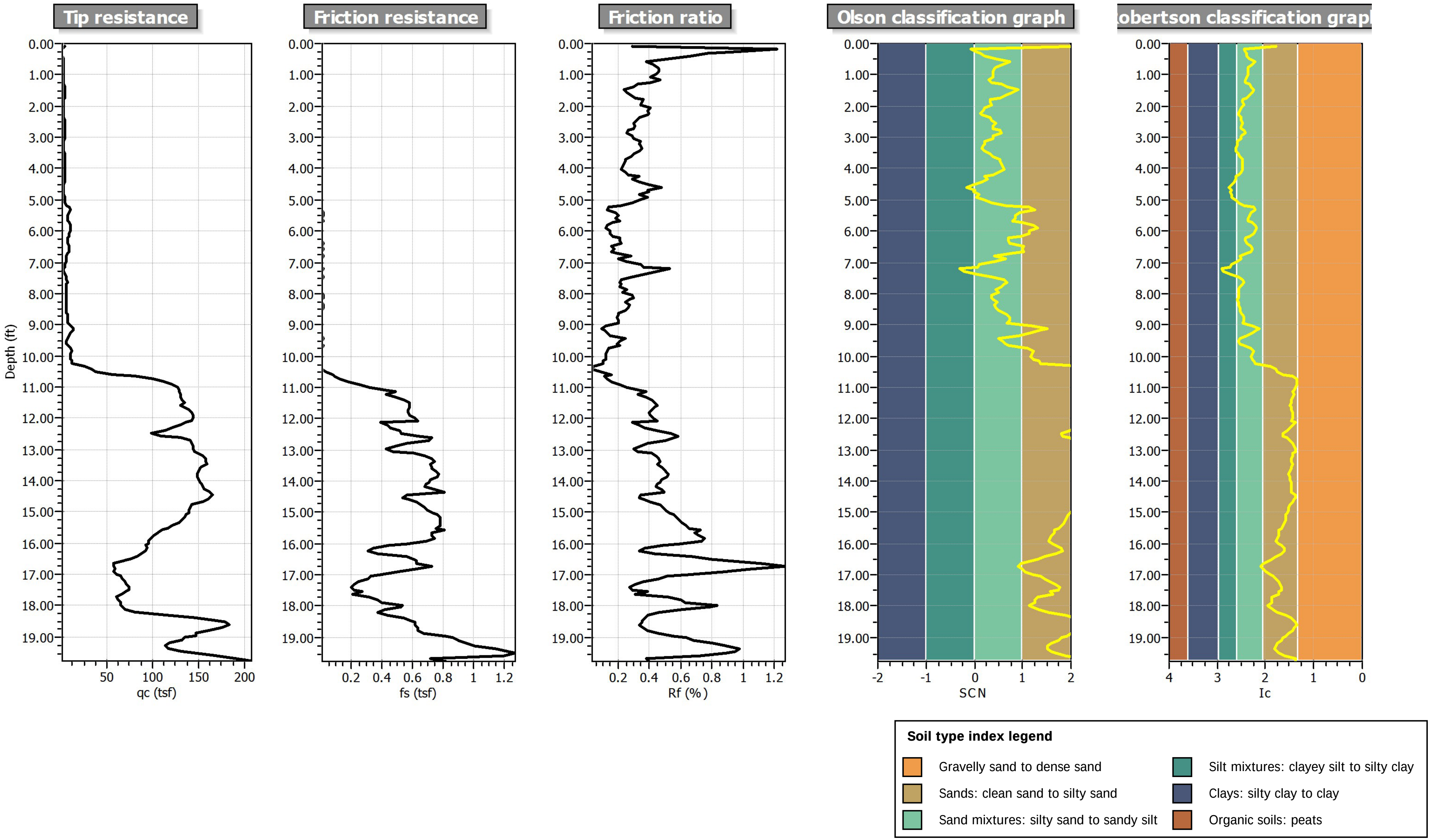











Tip resistance
Friction resistance
Friction ratio
Olson classification graph
obertson classification grapl
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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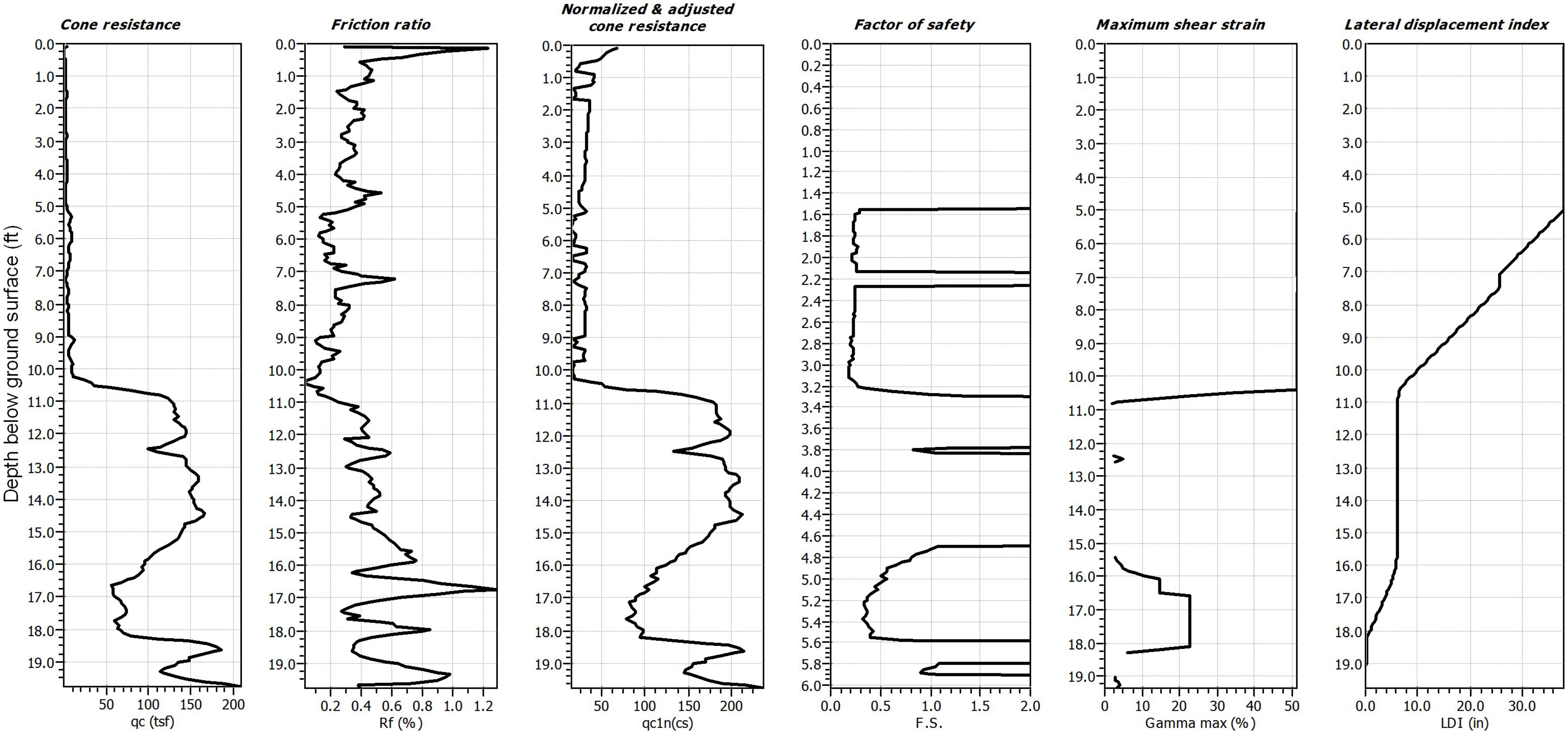
LATERAL DISPLACEMENTS ESTIMATION DUE TO SOIL LIQUEFACTION[1]

Geometric parameters: Level ground (or gently sloping) with free face
Total lateral displacement estimation: 62.43 in



q_c: Measured cone resistance
R_f: Friction ratio
q_{cNcs}: Normalized & adjusted cone resistance

F.S.: Factor of safety
Gamma max: Maximum cyclic shear strain
LDI: Lateral displacement index

[1] This method was developed using the NCEER methods (SPT and CPT) and other methods will produce slightly different results

:: Lateral displacement index calculation ::

Point ID	q_c (tsf)	q_{c1N}	R_f (%)	$q_{c1N,cs}$	F.S.	D_r	$Gamma_{max}$ (%)	LDI (in)
1	4.07	68.44	0.30	68.44	5.00	54.48	0.00	0.00
2	0.82	24.57	1.23	63.09	5.00	20.68	0.00	0.00
3	1.06	23.22	0.96	55.90	5.00	18.80	0.00	0.00
4	1.29	22.11	0.79	51.19	5.00	17.19	0.00	0.00
5	1.51	21.44	0.67	48.02	5.00	16.17	0.00	0.00
6	1.92	22.37	0.53	45.12	5.00	17.57	0.00	0.00
7	2.61	24.83	0.39	24.83	5.00	21.01	0.00	0.00
8	2.57	23.24	0.43	23.24	5.00	18.83	0.00	0.00
9	2.23	19.60	0.46	19.60	5.00	13.21	0.00	0.00
10	2.39	19.59	0.47	19.59	5.00	13.20	0.00	0.00
11	2.41	18.73	0.47	41.14	5.00	11.71	0.00	0.00
12	2.51	18.35	0.45	40.43	5.00	11.04	0.00	0.00
13	2.44	17.08	0.42	38.91	5.00	8.66	0.00	0.00
14	2.55	17.18	0.48	40.52	5.00	8.87	0.00	0.00
15	2.48	15.94	0.42	38.03	5.00	6.38	0.00	0.00
16	3.05	17.73	0.34	17.73	5.00	9.89	0.00	0.00
17	3.37	18.38	0.30	18.38	5.00	11.09	0.00	0.00
18	4.21	20.86	0.24	20.86	5.00	15.27	0.00	0.00
19	3.92	19.26	0.26	19.26	5.00	12.63	0.00	0.00
20	3.52	17.44	0.29	17.44	5.00	9.35	0.00	0.00
21	3.21	15.84	0.32	35.62	5.00	6.19	0.00	0.00
22	2.77	13.82	0.38	35.66	5.00	1.67	0.00	0.00
23	2.82	13.62	0.37	35.38	5.00	1.19	0.00	0.00
24	2.93	13.65	0.36	35.07	5.00	1.26	0.00	0.00
25	2.72	12.65	0.42	35.99	5.00	0.00	0.00	0.00
26	2.58	11.77	0.41	34.99	5.00	0.00	0.00	0.00
27	2.49	11.17	0.42	34.91	5.00	0.00	0.00	0.00
28	2.57	11.17	0.41	34.62	5.00	0.00	0.00	0.00
29	2.97	12.21	0.35	34.07	5.00	0.00	0.00	0.00
30	3.11	12.39	0.34	33.80	5.00	0.00	0.00	0.00
31	3.38	12.94	0.31	33.50	5.00	0.00	0.00	0.00
32	3.22	12.20	0.33	33.42	5.00	0.00	0.00	0.00
33	3.30	12.19	0.32	33.22	5.00	0.00	0.00	0.00
34	3.77	13.30	0.28	32.92	5.00	0.41	0.00	0.00
35	3.90	13.41	0.27	32.75	5.00	0.69	0.00	0.00
36	3.40	11.79	0.31	32.76	5.00	0.00	0.00	0.00
37	3.37	11.49	0.31	32.64	5.00	0.00	0.00	0.00
38	2.93	10.06	0.36	32.76	5.00	0.00	0.00	0.00
39	3.00	10.08	0.36	32.59	5.00	0.00	0.00	0.00
40	2.93	9.71	0.37	31.39	5.00	0.00	0.00	0.00
41	2.86	9.35	0.38	30.22	5.00	0.00	0.00	0.00
42	3.01	9.59	0.36	31.00	5.00	0.00	0.00	0.00
43	3.38	10.39	0.32	31.92	5.00	0.00	0.00	0.00
44	3.59	10.76	0.30	31.73	5.00	0.00	0.00	0.00
45	4.06	11.75	0.26	31.52	5.00	0.00	0.00	0.00
46	4.07	11.60	0.26	31.42	5.00	0.00	0.00	0.00
47	4.19	11.71	0.25	31.31	5.00	0.00	0.00	0.00
48	4.35	11.92	0.24	31.20	5.00	0.00	0.00	0.00
49	4.47	12.03	0.24	31.10	5.00	0.00	0.00	0.00
50	4.06	10.90	0.26	31.02	5.00	0.00	0.00	0.00
51	3.74	10.02	0.29	30.99	5.00	0.00	0.00	0.00
52	3.57	9.56	0.36	29.59	5.00	0.00	0.00	0.00
53	3.43	9.03	0.32	27.95	5.00	0.00	0.00	0.00
54	3.28	8.60	0.37	26.61	5.00	0.00	0.00	0.00
55	3.00	7.87	0.44	24.34	5.00	0.00	0.00	0.00

:: Lateral displacement index calculation (continued) ::

Point ID	q_c (tsf)	q_{c1N}	R_f (%)	$q_{c1N,cs}$	F.S.	D_r	$Gamma_{max}$ (%)	LDI (in)
56	2.92	7.63	0.53	23.61	5.00	0.00	0.00	0.00
57	3.09	7.86	0.43	24.30	5.00	0.00	0.00	0.00
58	3.05	7.66	0.43	23.69	5.00	0.00	0.00	0.00
59	3.01	7.41	0.37	22.91	5.00	0.00	0.00	0.00
60	3.35	8.14	0.43	25.19	5.00	0.00	0.00	0.00
61	3.92	9.26	0.36	28.65	5.00	0.00	0.00	0.00
62	4.52	10.44	0.31	31.79	0.30	0.00	51.20	0.50
63	5.50	12.31	0.23	31.15	0.29	0.00	51.20	0.50
64	8.39	17.74	0.15	17.74	0.25	9.92	51.20	0.50
65	9.45	19.58	0.13	19.58	0.25	13.18	51.20	0.50
66	8.16	17.24	0.19	17.24	0.24	8.98	51.20	0.50
67	7.45	15.84	0.21	15.84	0.24	6.18	51.20	0.50
68	6.98	14.82	0.20	14.82	0.23	3.98	51.20	0.50
69	7.17	15.16	0.22	15.16	0.23	4.73	51.20	0.50
70	8.31	17.14	0.18	17.14	0.23	8.78	51.20	0.50
71	9.79	19.66	0.14	19.66	0.24	13.32	51.20	0.50
72	9.89	19.71	0.13	19.71	0.24	13.40	51.20	0.50
73	9.48	18.97	0.15	18.97	0.24	12.13	51.20	0.50
74	8.96	17.93	0.15	17.93	0.23	10.27	51.20	0.50
75	7.79	15.76	0.18	15.76	0.22	6.01	51.20	0.51
76	6.59	13.53	0.23	31.72	0.27	0.99	51.20	0.50
77	6.55	13.39	0.23	31.68	0.27	0.63	51.20	0.50
78	6.96	14.10	0.23	32.13	0.27	2.33	51.20	0.50
79	8.27	16.30	0.17	16.30	0.22	7.13	51.20	0.50
80	8.75	17.13	0.18	17.13	0.22	8.76	51.20	0.50
81	8.30	16.20	0.16	16.20	0.22	6.93	51.20	0.50
82	6.88	13.62	0.20	31.14	0.26	1.19	51.20	0.50
83	5.40	10.91	0.30	31.94	0.26	0.00	51.20	0.50
84	5.41	10.77	0.22	29.92	0.25	0.00	51.20	0.50
85	4.75	9.52	0.28	30.41	0.25	0.00	51.20	0.50
86	3.78	7.65	0.39	24.45	5.00	0.00	0.00	0.00
87	3.62	7.30	0.41	23.31	5.00	0.00	0.00	0.00
88	2.84	5.75	0.62	18.37	5.00	0.00	0.00	0.00
89	2.88	5.76	0.53	18.39	5.00	0.00	0.00	0.00
90	3.78	7.49	0.42	23.93	5.00	0.00	0.00	0.00
91	5.15	10.01	0.32	31.72	0.25	0.00	51.20	0.50
92	5.96	11.36	0.24	30.68	0.24	0.00	51.20	0.50
93	6.55	12.36	0.23	31.14	0.25	0.00	51.20	0.50
94	6.00	11.32	0.23	30.62	0.24	0.00	51.20	0.50
95	5.21	9.82	0.23	29.58	0.24	0.00	51.20	0.50
96	5.15	9.71	0.28	30.57	0.24	0.00	51.20	0.50
97	5.20	9.72	0.25	30.03	0.24	0.00	51.20	0.50
98	5.43	10.16	0.32	31.93	0.24	0.00	51.20	0.50
99	5.39	10.04	0.33	31.90	0.24	0.00	51.20	0.50
100	5.13	9.49	0.30	30.95	0.24	0.00	51.20	0.50
101	5.33	9.77	0.27	30.41	0.24	0.00	51.20	0.50
102	5.57	10.18	0.30	31.32	0.24	0.00	51.20	0.50
103	5.73	10.41	0.29	31.28	0.24	0.00	51.20	0.50
104	5.72	10.32	0.27	30.79	0.23	0.00	51.20	0.50
105	5.88	10.50	0.22	29.84	0.23	0.00	51.20	0.50
106	6.42	11.38	0.22	30.31	0.23	0.00	51.20	0.50
107	6.80	11.96	0.21	30.33	0.23	0.00	51.20	0.50
108	7.08	12.39	0.21	30.76	0.23	0.00	51.20	0.50
109	6.79	11.86	0.22	30.69	0.23	0.00	51.20	0.50
110	9.69	16.43	0.13	16.43	0.19	7.40	51.20	0.50

:: Lateral displacement index calculation (continued) ::

Point ID	q_c (tsf)	q_{c1N}	R_f (%)	$q_{c1N,cs}$	F.S.	D_r	$Gamma_{max}$ (%)	LDI (in)
111	13.55	22.36	0.10	22.36	0.21	17.55	51.20	0.50
112	12.44	20.61	0.12	20.61	0.20	14.86	51.20	0.50
113	10.02	16.78	0.14	16.78	0.19	8.08	51.20	0.50
114	7.88	13.32	0.16	30.02	0.22	0.45	51.20	0.50
115	6.17	10.55	0.27	30.92	0.23	0.00	51.20	0.50
116	5.75	9.76	0.23	29.54	0.22	0.00	51.20	0.50
117	5.74	9.67	0.21	29.05	0.22	0.00	51.20	0.50
118	7.24	12.14	0.23	30.89	0.22	0.00	51.20	0.50
119	9.54	15.65	0.15	15.65	0.19	5.78	51.20	0.50
120	10.98	17.81	0.13	17.81	0.19	10.05	51.20	0.50
121	10.02	16.25	0.13	16.25	0.19	7.02	51.20	0.50
122	9.72	15.73	0.13	15.73	0.18	5.94	51.20	0.50
123	10.63	17.07	0.13	17.07	0.19	8.64	51.20	0.50
124	11.16	17.78	0.11	17.78	0.19	10.00	51.20	0.50
125	11.74	18.58	0.11	18.58	0.19	11.45	51.20	0.51
126	24.62	37.03	0.05	37.03	0.23	34.21	51.20	0.50
127	33.53	49.27	0.03	49.27	0.26	43.63	51.20	0.50
128	37.01	53.74	0.10	53.74	0.27	46.50	34.10	0.34
129	55.10	78.11	0.16	78.11	0.36	58.85	22.70	0.22
130	79.80	113.25	0.12	113.25	0.62	71.11	12.89	0.13
131	99.44	140.99	0.13	140.99	0.98	78.34	3.39	0.03
132	112.74	159.55	0.16	159.55	1.31	82.42	1.84	0.02
133	121.58	171.69	0.21	171.69	5.00	84.84	0.00	0.00
134	126.74	178.56	0.25	178.56	5.00	86.14	0.00	0.00
135	129.04	181.35	0.34	181.35	5.00	86.65	0.00	0.00
136	129.54	181.60	0.38	181.60	5.00	86.69	0.00	0.00
137	130.53	182.53	0.33	182.53	5.00	86.86	0.00	0.00
138	130.26	181.70	0.38	181.70	5.00	86.71	0.00	0.00
139	132.33	184.16	0.42	184.16	5.00	87.15	0.00	0.00
140	134.43	186.63	0.44	186.63	5.00	87.59	0.00	0.00
141	129.97	179.95	0.45	179.95	5.00	86.39	0.00	0.00
142	134.15	185.32	0.44	185.32	5.00	87.36	0.00	0.00
143	139.00	191.59	0.42	191.59	5.00	88.46	0.00	0.00
144	142.19	195.53	0.40	195.53	5.00	89.13	0.00	0.00
145	143.98	197.52	0.41	197.52	5.00	89.47	0.00	0.00
146	144.29	197.48	0.43	197.48	5.00	89.46	0.00	0.00
147	142.75	194.89	0.45	194.89	5.00	89.02	0.00	0.00
148	137.32	186.99	0.29	186.99	5.00	87.66	0.00	0.00
149	129.75	176.20	0.34	176.20	5.00	85.70	0.00	0.00
150	121.25	164.20	0.38	164.20	5.00	83.37	0.00	0.00
151	114.06	154.04	0.46	154.04	1.15	81.26	2.39	0.02
152	98.45	132.83	0.54	133.32	0.82	76.37	4.81	0.05
153	109.81	147.57	0.59	147.57	1.04	79.84	2.98	0.03
154	130.28	174.86	0.56	174.86	5.00	85.44	0.00	0.00
155	140.53	188.27	0.51	188.27	5.00	87.88	0.00	0.00
156	143.12	191.32	0.39	191.32	5.00	88.41	0.00	0.00
157	143.62	191.55	0.34	191.55	5.00	88.45	0.00	0.00
158	144.26	191.97	0.30	191.97	5.00	88.53	0.00	0.00
159	145.25	192.86	0.33	192.86	5.00	88.68	0.00	0.00
160	148.50	196.75	0.41	196.75	5.00	89.34	0.00	0.00
161	155.18	205.18	0.44	205.18	5.00	90.72	0.00	0.00
162	157.33	207.58	0.47	207.58	5.00	91.11	0.00	0.00
163	157.94	207.92	0.47	207.92	5.00	91.16	0.00	0.00
164	158.74	208.52	0.46	208.52	5.00	91.25	0.00	0.00
165	154.04	201.87	0.48	201.87	5.00	90.18	0.00	0.00

:: Lateral displacement index calculation (continued) ::

Point ID	q_c (tsf)	q_{c1N}	R_f (%)	$q_{c1N,cs}$	F.S.	D_r	$Gamma_{max}$ (%)	LDI (in)
166	151.87	198.57	0.49	198.57	5.00	89.64	0.00	0.00
167	150.64	196.52	0.50	196.52	5.00	89.30	0.00	0.00
168	148.17	192.86	0.53	192.86	5.00	88.68	0.00	0.00
169	148.52	192.90	0.52	192.90	5.00	88.69	0.00	0.00
170	150.68	195.30	0.48	195.30	5.00	89.09	0.00	0.00
171	152.43	197.15	0.47	197.15	5.00	89.40	0.00	0.00
172	153.08	197.57	0.45	197.57	5.00	89.48	0.00	0.00
173	154.21	198.61	0.44	198.61	5.00	89.65	0.00	0.00
174	156.98	201.77	0.48	201.77	5.00	90.17	0.00	0.00
175	162.65	208.65	0.50	208.65	5.00	91.28	0.00	0.00
176	164.85	211.04	0.34	211.04	5.00	91.65	0.00	0.00
177	162.74	207.89	0.33	207.89	5.00	91.16	0.00	0.00
178	160.70	204.84	0.36	204.84	5.00	90.67	0.00	0.00
179	154.66	196.69	0.41	196.69	5.00	89.33	0.00	0.00
180	141.97	180.09	0.47	180.09	5.00	86.42	0.00	0.00
181	141.77	179.46	0.49	179.46	5.00	86.30	0.00	0.00
182	140.22	177.12	0.50	177.12	5.00	85.87	0.00	0.00
183	139.23	175.50	0.54	175.50	5.00	85.57	0.00	0.00
184	137.21	172.59	0.56	172.59	5.00	85.01	0.00	0.00
185	135.56	170.15	0.58	170.15	5.00	84.54	0.00	0.00
186	132.74	166.25	0.59	166.25	5.00	83.78	0.00	0.00
187	128.33	160.35	0.62	160.35	5.00	82.59	0.00	0.00
188	122.02	152.32	0.64	152.64	1.07	80.89	2.80	0.03
189	116.05	145.08	0.66	147.72	0.99	79.28	3.30	0.03
190	111.04	139.42	0.74	146.08	0.96	77.97	3.49	0.03
191	105.83	132.57	0.70	139.02	0.86	76.31	4.44	0.04
192	102.01	127.92	0.72	136.02	0.81	75.13	4.94	0.05
193	98.74	124.03	0.76	134.12	0.79	74.11	6.36	0.06
194	94.72	118.79	0.74	128.93	0.72	72.68	8.18	0.08
195	94.99	117.91	0.60	123.73	0.66	72.44	10.54	0.10
196	92.65	114.07	0.49	114.07	0.56	71.35	14.50	0.14
197	93.28	113.93	0.38	113.93	0.56	71.31	14.50	0.14
198	92.32	112.53	0.34	112.53	0.55	70.90	14.50	0.14
199	87.57	107.07	0.44	107.07	0.50	69.25	14.50	0.14
200	83.39	103.51	0.68	114.29	0.56	68.14	14.50	0.14
201	76.12	95.22	0.81	110.69	0.53	65.38	14.50	0.14
202	69.39	87.30	0.92	106.69	0.50	62.52	22.70	0.22
203	56.75	72.27	1.14	99.60	0.44	56.28	22.70	0.22
204	57.24	73.06	1.29	104.52	0.48	56.64	22.70	0.22
205	58.74	74.22	1.07	99.46	0.44	57.16	22.70	0.22
206	57.96	72.62	0.89	93.34	0.40	56.44	22.70	0.22
207	60.08	74.30	0.66	88.84	0.37	57.19	22.70	0.22
208	64.51	78.85	0.52	89.10	0.37	59.16	22.70	0.22
209	67.15	81.54	0.47	81.54	0.33	60.26	22.70	0.22
210	69.18	83.20	0.37	83.20	0.34	60.93	22.70	0.22
211	71.71	85.64	0.31	85.64	0.35	61.88	22.70	0.22
212	74.28	88.17	0.27	88.17	0.37	62.84	22.70	0.22
213	74.28	88.16	0.30	88.16	0.36	62.84	22.70	0.22
214	71.63	85.55	0.39	85.55	0.35	61.85	22.70	0.22
215	66.18	78.69	0.32	78.69	0.32	59.09	22.70	0.22
216	60.67	73.16	0.53	84.59	0.35	56.68	22.70	0.22
217	62.16	75.04	0.61	88.15	0.36	57.52	22.70	0.22
218	64.64	77.88	0.64	91.24	0.38	58.75	22.70	0.22
219	64.25	77.95	0.85	96.90	0.42	58.78	22.70	0.22
220	66.72	80.56	0.81	97.93	0.42	59.87	22.70	0.22

:: Lateral displacement index calculation (continued) ::

Point ID	q_c (tsf)	q_{c1N}	R_f (%)	$q_{c1N,cs}$	F.S.	D_r	$Gamma_{max}$ (%)	LDI (in)
221	69.75	83.28	0.61	95.28	0.40	60.96	22.70	0.22
222	80.14	94.41	0.47	94.41	0.40	65.10	14.50	0.14
223	112.45	131.10	0.40	131.10	0.73	75.94	6.22	0.06
224	145.97	170.26	0.38	170.26	5.00	84.57	0.00	0.00
225	168.13	195.96	0.36	195.96	5.00	89.20	0.00	0.00
226	178.89	208.22	0.35	208.22	5.00	91.21	0.00	0.00
227	184.27	214.15	0.34	214.15	5.00	92.13	0.00	0.00
228	175.85	203.95	0.36	203.95	5.00	90.52	0.00	0.00
229	162.21	187.70	0.39	187.70	5.00	87.78	0.00	0.00
230	147.25	169.98	0.46	169.98	5.00	84.51	0.00	0.00
231	147.25	169.68	0.56	169.68	5.00	84.45	0.00	0.00
232	135.70	156.00	0.64	156.00	1.08	81.68	2.73	0.03
233	131.96	151.90	0.69	154.31	1.05	80.80	2.89	0.03
234	118.77	137.53	0.81	147.01	0.94	77.52	3.68	0.04
235	113.58	131.87	0.90	145.01	0.91	76.13	3.95	0.04
236	117.27	136.17	0.99	151.20	1.00	77.19	3.22	0.03
237	129.79	149.92	0.96	162.24	4.98	80.37	0.00	0.00
238	143.01	164.19	0.90	172.43	4.98	83.37	0.00	0.00
239	166.66	189.63	0.73	189.63	4.97	88.12	0.00	0.00
240	188.85	214.70	0.39	214.70	4.97	92.22	0.00	0.00
241	208.26	236.52	0.40	236.52	4.97	95.41	0.00	0.00

q_c : Measured cone resistance
q_{c1N} : Adjusted cone resistance to an effective overburden stress of 100 kPa
R_f : Friction ration
$q_{c1N,cs}$: Adjusted and corrected cone resistance due to fines
F.S. : Calculated factor of safety against liquefaction
D_r : Calculated relative density
$Gamma_{max}$: Calculated maximum cyclic shear strain
LDI : Lateral displacement index

Appendix E

Slope Stability Analyses

APPENDIX E
SLOPE STABILITY EVALUATIONS

METHODS OF ANALYSIS

Computer-aided slope stability analyses were performed using the computer program SLIDE 6.0. SLIDE 6.0 was developed by Rocscience, Inc. (2012) and offers a wide variety of limit-equilibrium procedures. Those include the Modified Bishop, the Simplified and Corrected Janbu, Corps of Engineers #1 and #2, GLE/Morgenstern-Price, Lowe-Karafiath, and the Spencer methods. Those limit-equilibrium procedures are all "method of slices", but they differ from the Ordinary Method of Slices (Fellenius method – also included within SLIDE 6.0) in:

1. The simplifying assumptions that have been made achieve static determinacy; and
2. The particular conditions of equilibrium that are satisfied.

SLIDE 6.0 allows the use of any or all of the methods listed above because they better satisfy limit equilibrium conditions. A summary of the equilibrium conditions satisfied by each of these procedures and the type of failure surface for which each is useful is presented in the following table.

EQUILIBRIUM CONDITIONS SATISFIED BY PROCEDURES

Procedure of Analysis	Overall			Individual Slices			
	Moment	Vertical Force	Horizontal Force	Moment	Vertical Force	Horizontal Force	Slip Surface
Ordinary Method of Slices (Fellenius)	Yes	No	No	No	No	No	Circular Arc
Modified Bishop	Yes	(Yes)[1]	No	No	Yes	No	General Shape[2]
Simplified Janbu	No	(Yes)[1]	(Yes)[1]	No	Yes	Yes	General Shape
Spencer	Yes	(Yes)[1]	(Yes)[1]	Yes	Yes	Yes	General Shape

Per Wright (1969); (Yes)[1] - Parentheses indicate that this condition of equilibrium is implicitly satisfied as a result of the direct consideration of other equilibrium conditions; [2] – The original presentation of this procedure was for circular surfaces only.

Ordinary Method of Slices. From the above table, it is apparent that for circular failures, the Ordinary Method of Slices (Fellenius method) satisfies overall moment equilibrium, but does not satisfy individual slice moment equilibrium, or horizontal or vertical force equilibrium. Sherard et al. (1963), have suggested that the Fellenius method of slices might also be applied to non-circular surfaces; however, for noncircular surfaces that method would not, in general, satisfy any of the equilibrium conditions (Wright, 1969).

The Ordinary Method of Slices has been widely used by practicing engineers for many years because of its simplicity, but it has long been known to grossly underestimate (and in some cases overestimate) the factor of safety. Lambe and Whitman (1969) report that in some cases the Ordinary Method of Slices may underestimate the factor of safety by about 10 to 15 percent, but in other problems (particularly for noncircular slip surfaces) the error may be as much as 60 percent. With the development of high-speed computers, this approximate method has largely been replaced by more accurate methods that better satisfy equilibrium conditions. The Ordinary Method of Slices remains an acceptable method for performing hand-calculated estimates of slope stability for conditions where accurate solutions are not required.

Modified Bishop Method. The Modified Bishop Method assumes that the normal and weight forces act through a point on the center of the base of each slice and that there are no interslice shear forces. The resulting equation can be demonstrated to satisfy vertical force equilibrium as well as overall moment equilibrium for circular shear surfaces. The Modified Bishop Method is relatively simple to perform on a calculator, although the necessary iterations make it more suitable for use on a computer system. In spite of the necessary iterations, the Modified Bishop Method typically converges rapidly, therefore, it requires little computer time to perform.

Fredlund and Krahn (1977) have shown that the Modified Bishop Method typically estimates factors of safety that are typically within a few percent of those obtained from more rigorous methods that satisfy complete moment and force equilibrium.

Simplified Janbu Method. Although the simplifying assumption made in the Simplified Janbu Method is the same as that made for the Modified Bishop Method, the conditions of equilibrium that are satisfied are not the same. The Simplified Janbu Method satisfies vertical and horizontal force equilibrium for individual slices and for the overall shear surface while assuming that there are no interslice shear forces. An advantage of the Simplified Janbu Method is its suitability for the analysis of noncircular failure surfaces. While retaining a rapid computational speed, the Simplified Janbu Method yields factors of safety that are closer to those obtained by more rigorous methods (such as the Spencer Method) than those obtained from the Ordinary Method of Slices.

Spencer Method. The Spencer Method assumes that the normal forces are located at the center of the base of each slice and that all side forces are parallel. The result is an equation that satisfies complete moment and force equilibrium. Although the Spencer Method was directly applicable to a circular shear surface, the procedure may be readily extended to slip surfaces of a general shape (Wright, 1969).

Because of the complexity of the procedure, the Spencer Method is suitable only for computer-aided slope stability analyses. Although the Spencer Method typically yields a relatively accurate estimate of the factor of safety for a slope, its solution requires several iterations. Consequently, considerable time is needed to perform the analyses on a personal computer. Therefore, the Spencer Method is commonly used to refine the factor of safety for a critical failure plane that has been located by a search, which has used a more time-efficient method of analysis such as the Modified Bishop Method or Simplified Janbu procedure.

ANALYSES PERFORMED

Introduction. Analyses were performed on cross sections shown in the report text. To calculate the stability of the earth materials exposed in the slope, it is necessary to know the: 1) surface and subsurface landslide geometry, 2) soil properties (unit weight and shear strength of the soil materials present), and 3) phreatic water level (groundwater) conditions.

Surface and Subsurface Geometry. Data for the surface geometry of the project area were obtained from topographic information obtained from site specific survey performed along evaluated cross sections. Subsurface stratigraphic information was obtained from observations of materials within drill holes advanced during this study.

Engineering Properties. Laboratory direct shear tests were used to help estimate the shear strength characteristics of the earth materials at the site. Different engineering properties apply for varying earth materials exposed in the slope. A summary of the input parameters for the soil units used in the analyses is presented in the text of the report.

Piezometric Water Level. The elevations of groundwater beneath the site are discussed in the text of the report.

Slide Analysis Information

Jacob Ave. Levee Evaluation, Humboldt County, California

Project Summary

File Name: STA 10+75_Existing_Conditions, Median Annual WSE, Landside
Last saved with Slide version: 6.039
Project Title: Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis: Cross Section 10+75, Existing Conditions, Landside
Author: AB/JB
Date Created: 2016

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Slope Search
Number of Surfaces: 5000
Upper Angle: Not Defined
Lower Angle: Not Defined
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: 0
Minimum Depth: 1

Material Properties

Property	Pervious Fill	Impervious Foundation	Pervious Foundation
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	120
Cohesion [psf]	20	50	0
Friction Angle [deg]	30	30	32
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

List Of Coordinates

Water Table

X	Y
-50	6.3
-8.23439	6.3
18.282	5.5641
160	5.3

External Boundary

X	Y
-50	3.5
-50	0
-50	-50
-33.244	-50
160	-50
160	0
160	5.3
124.162	5.38939
112.032	5.38939
100.612	5.6211
79.866	5.4831
56.903	5.4481
35.862	5.5641
18.282	5.5641
15.604	5.9131

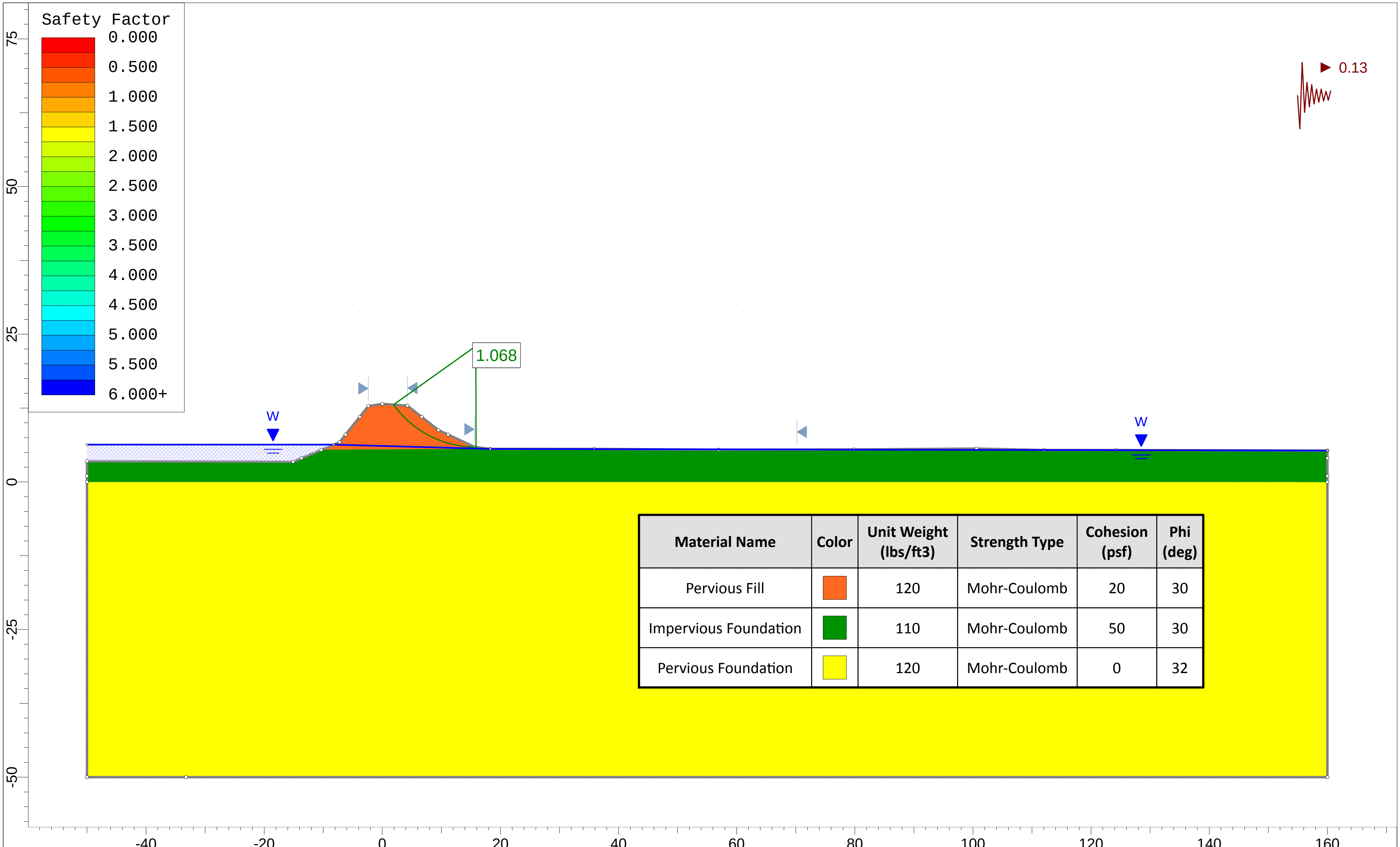
9.513	8.7561
4.248	12.9021
0	13.2051
-2.368	12.8261
-7.245	6.7171
-10.346	5.40978
-15.106	3.4031

Material Boundary

X	Y
-10.346	5.40978
18.282	5.5641

Material Boundary

X	Y
-50	0
160	0

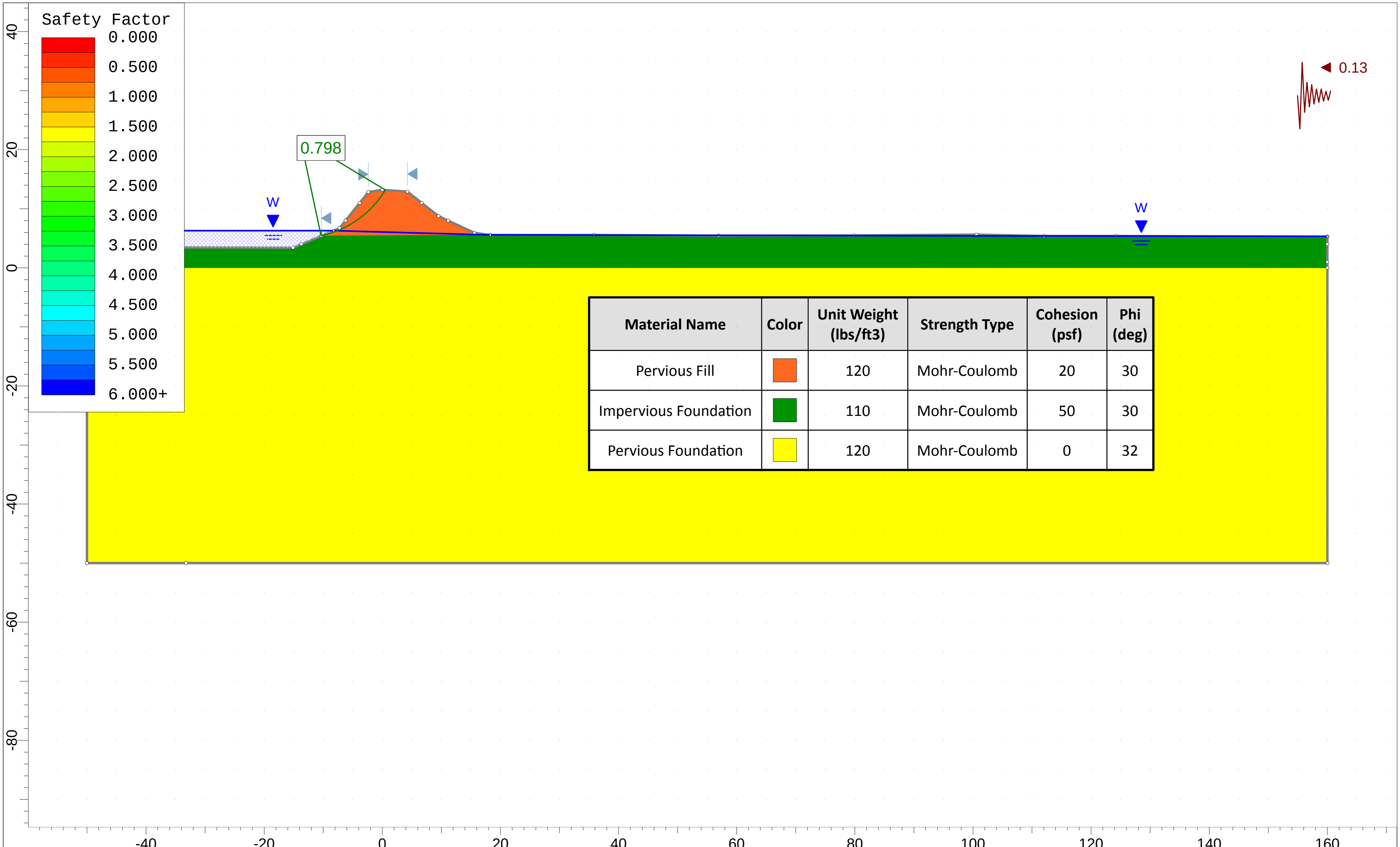


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 10+75, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/8/2016
	STA 10+75_EQ_Conditions, Median Annual WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project
Jacob Ave. Levee Evaluation, Humboldt County, California

Analysis Description: Cross Section 10+75, Existing Conditions, Waterside

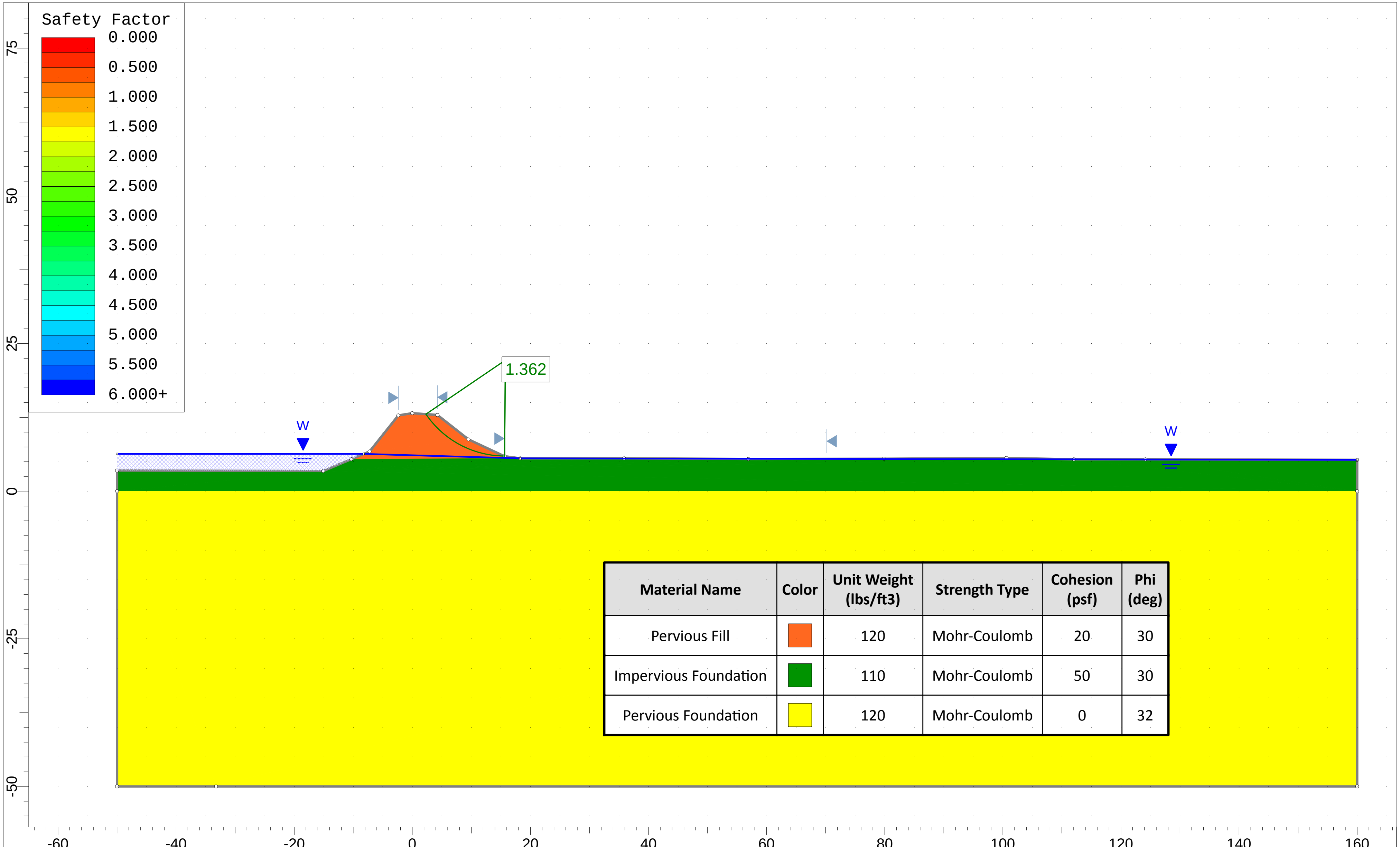
Drawn By AB/JB

Scale 1:270

Company

Date 6/8/2016

STA 10+75_EQ_Conditions, Median Annual WSE, Waterside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

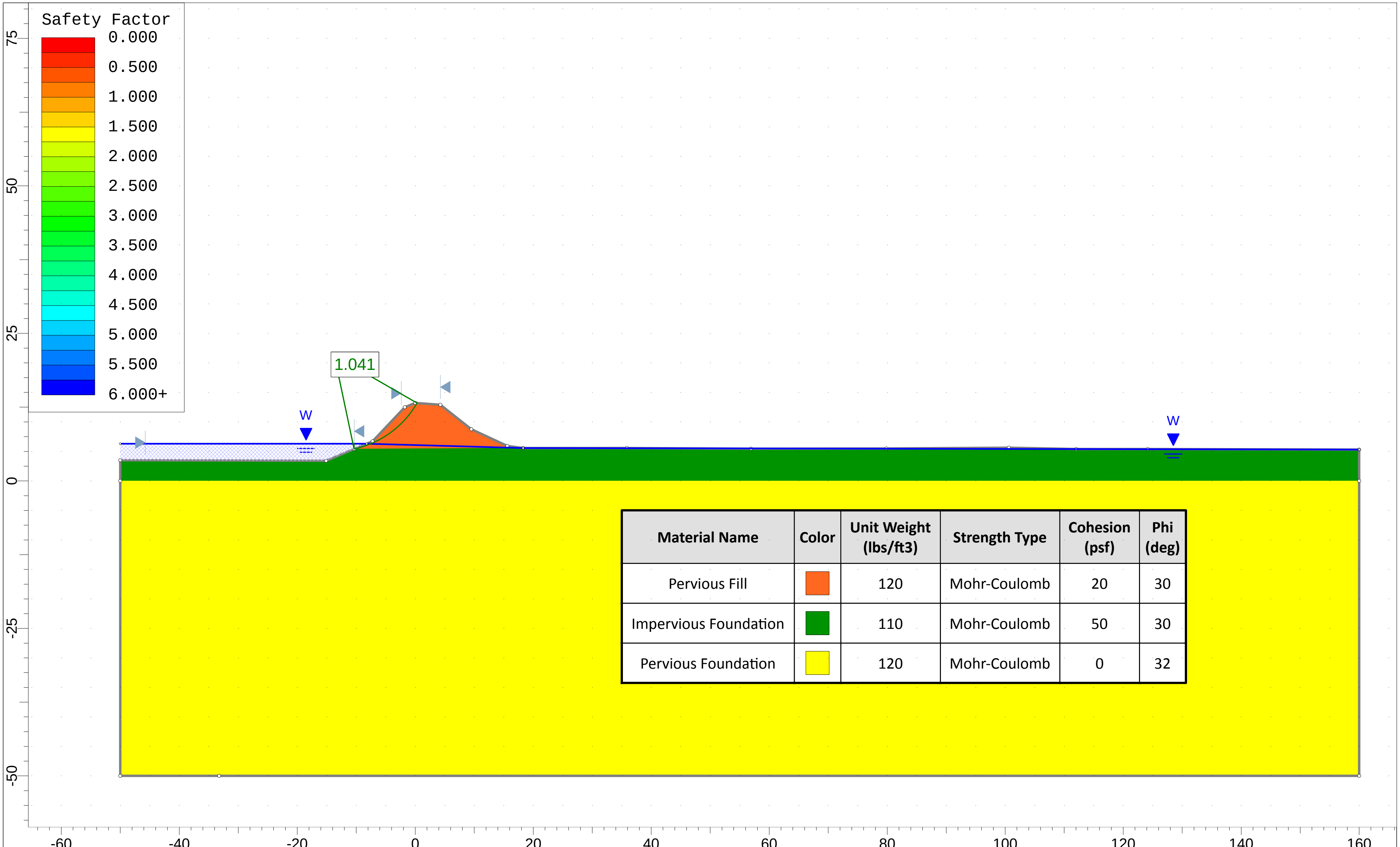
Project
Jacob Ave. Levee Evaluation, Humboldt County, California

Analysis Description:
Cross Section 10+75, Existing Conditions, Landside

Drawn By AB/JB
Scale 1:270
Company

Date 6/7/2016

STA 10+75_Existing_Conditions, Median Annual WSE, Landside.slim

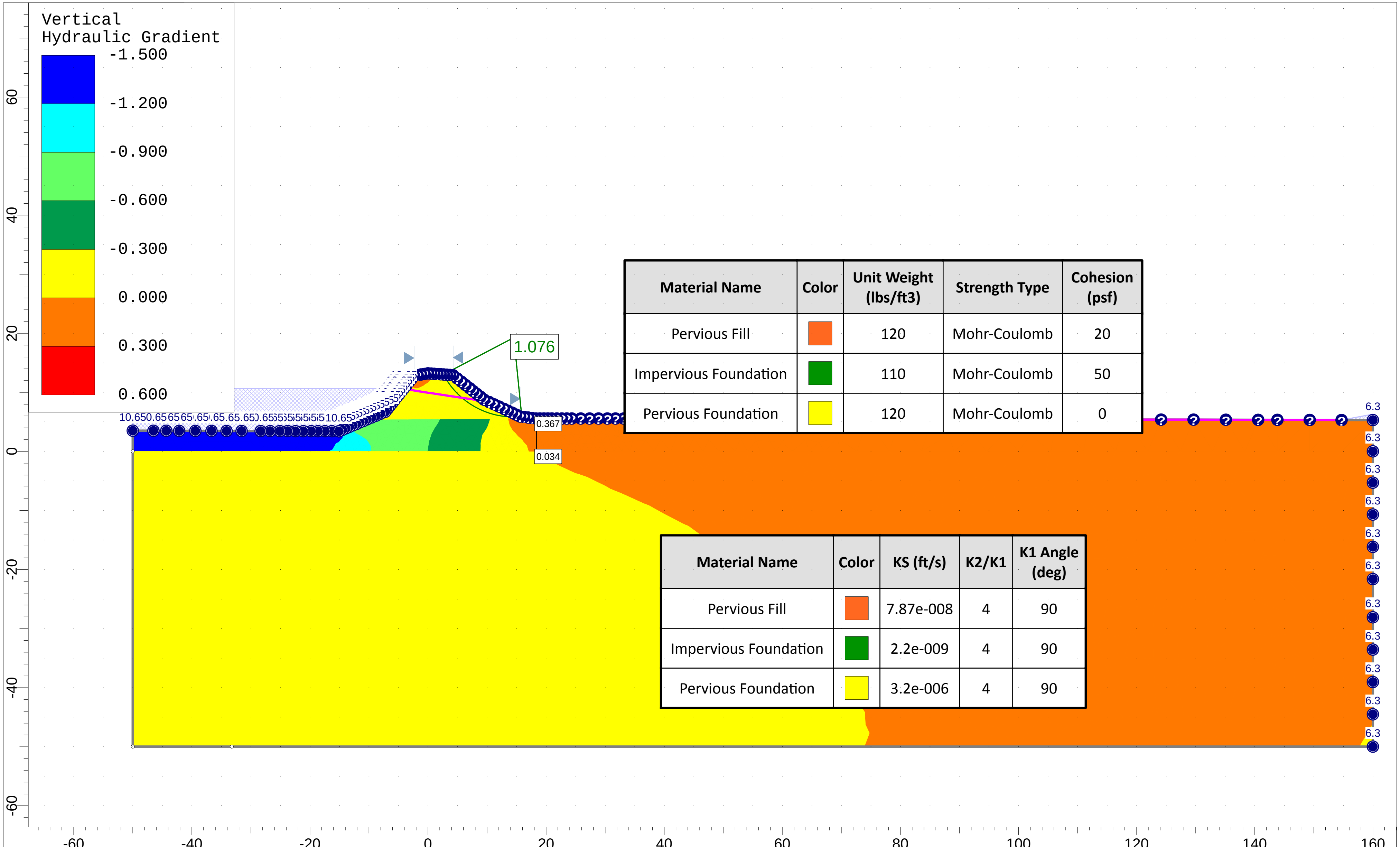


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 10+75, Existing Conditions, Waterside
Drawn By AB/JB	*Scale* 1:270 — *Company*
Date 6/8/2016	STA 10+75_Existing_Conditions, Median Annual WSE, Waterside.slim



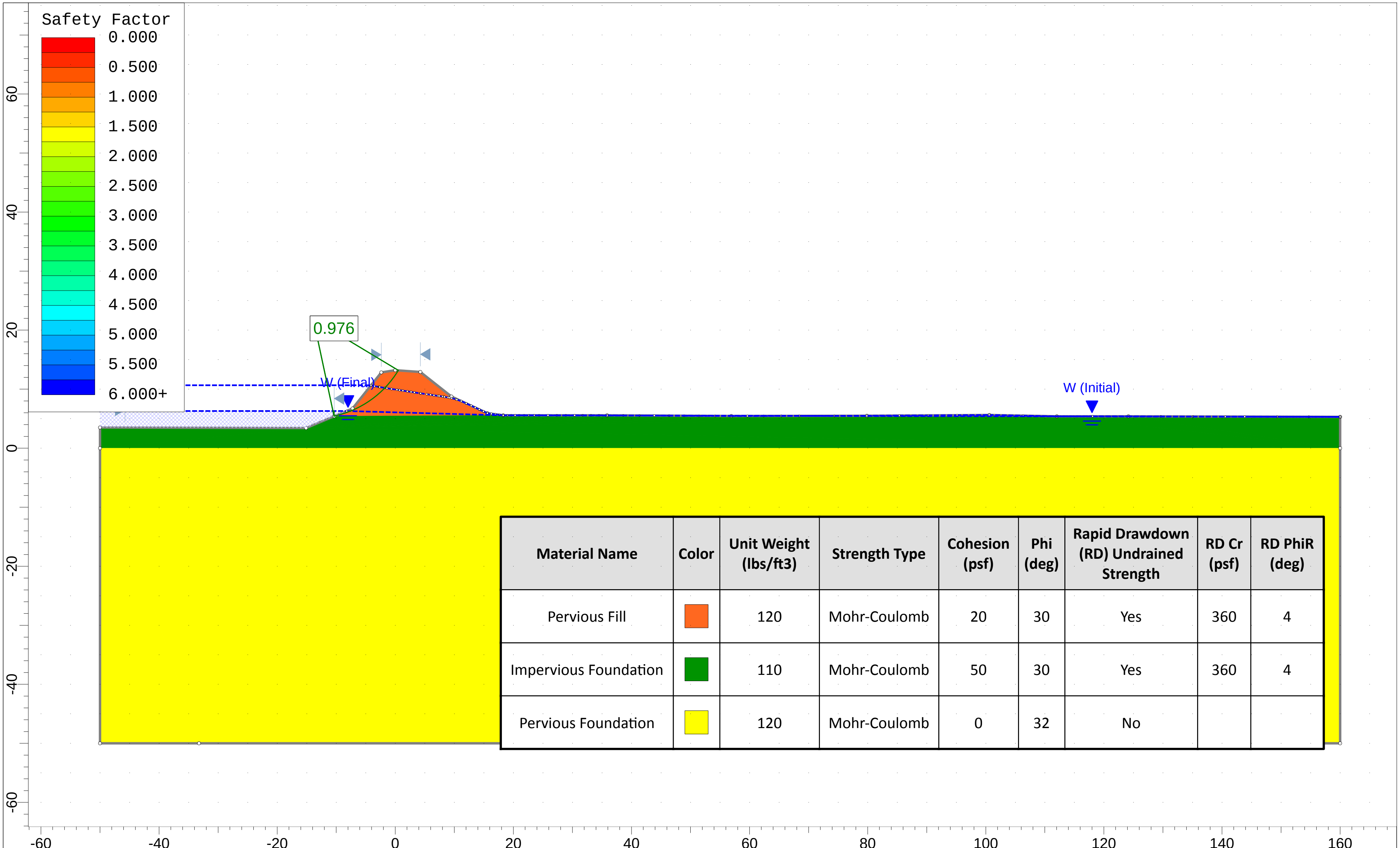
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)
Pervious Fill		120	Mohr-Coulomb	20
Impervious Foundation		110	Mohr-Coulomb	50
Pervious Foundation		120	Mohr-Coulomb	0

Material Name	Color	KS (ft/s)	K2/K1	K1 Angle (deg)
Pervious Fill		7.87e-008	4	90
Impervious Foundation		2.2e-009	4	90
Pervious Foundation		3.2e-006	4	90

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 10+75, Flood Stage Conditions, Landside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/7/2016
	STA 10+75_Flood_Stage_Conditions, 100-yr WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)
Pervious Fill		120	Mohr-Coulomb	20	30	Yes	360	4
Impervious Foundation		110	Mohr-Coulomb	50	30	Yes	360	4
Pervious Foundation		120	Mohr-Coulomb	0	32	No		

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 10+75, Rapid Drawdown Conditions, Waterside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/7/2016
	STA 10+75_Rapid Drawdown, Waterside.slim

Slide Analysis Information

Jacobs Ave. Levee Evaluation, Humboldt County, California

Project Summary

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Last saved with Slide version: 6.039
Project Title: Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis: Cross Section 21+50, Existing Conditions, Landside
Author: AB/JB
Date Created: 2016

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Slope Search
Number of Surfaces: 5000
Upper Angle: Not Defined
Lower Angle: Not Defined
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: 0
Minimum Depth: 1

Material Properties

Property	Pervious Fill	Impervious Foundation	Pervious Foundation
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	120
Cohesion [psf]	20	50	0
Friction Angle [deg]	30	30	32
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

List Of Coordinates

Water Table

X	Y
-100	6.31
-15.6377	6.31
14.9642	4.83941
18.4118	4.83941
500	4.83941

External Boundary

X	Y
-100	-4.5
-100	-70
500	-70
500	-0.88
500	7.12
165.809	6.5044
139.779	6.0974
114.955	5.6984
91.143	5.4024
65.285	5.1204
19.3411	5.4159
17.206	4.0914
16.034	4.0914
14.0914	5.44966

11.8	5.4644
8.72306	7
-3.55271e-015	11.3534
-3.308	11.3144
-4.917	10.9424
-14.0408	7
-16.014	6.1474
-16.9301	5.4644
-21.4977	2.05887
-23.824	0.3244

Material Boundary

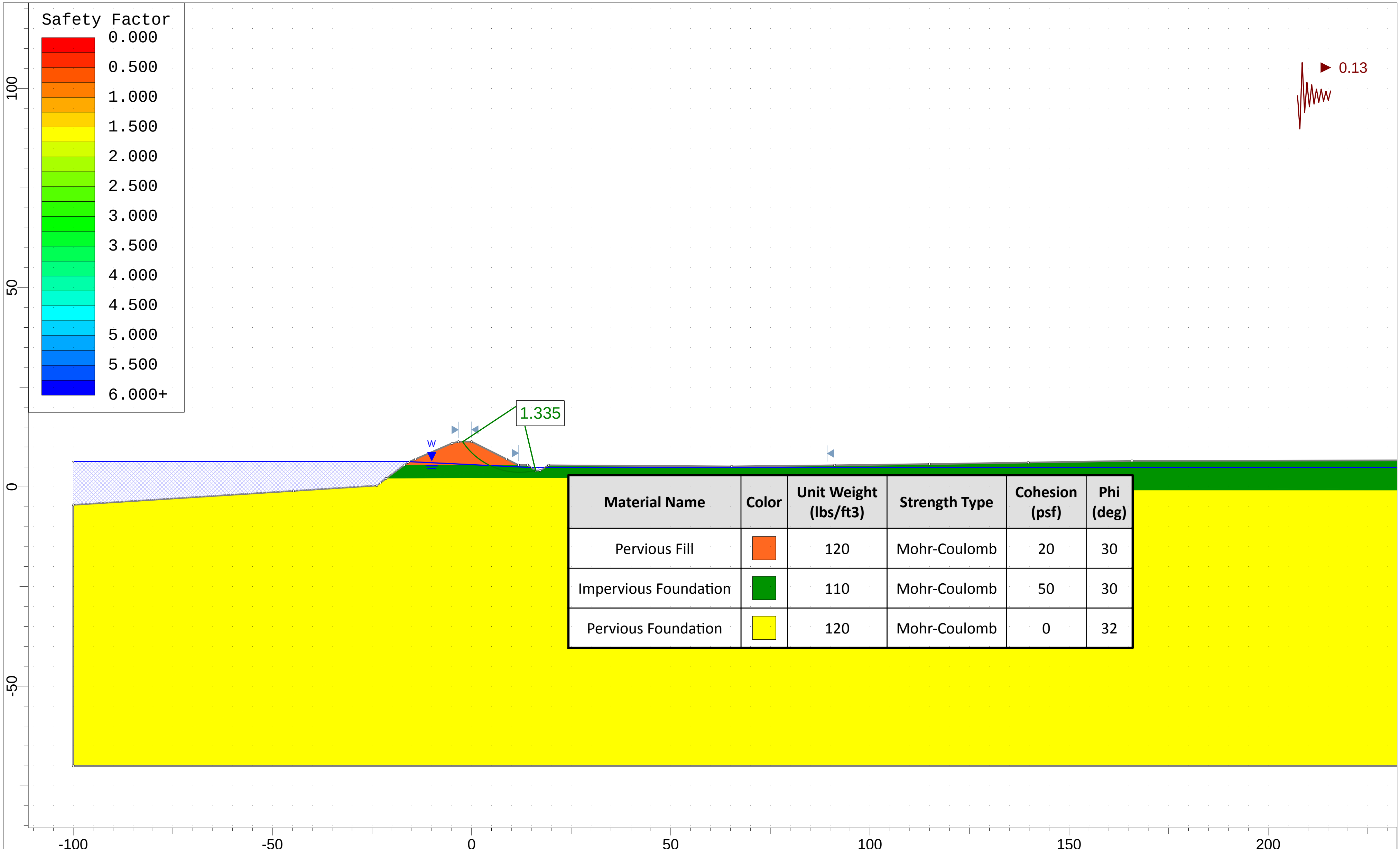
X	Y
-21.4977	2.05887
39.499	2.2884
114.938	-0.8236
500	-0.88

Material Boundary

X	Y
-14.0408	7
8.72306	7

Material Boundary

X	Y
-16.9301	5.4644
11.8	5.4644

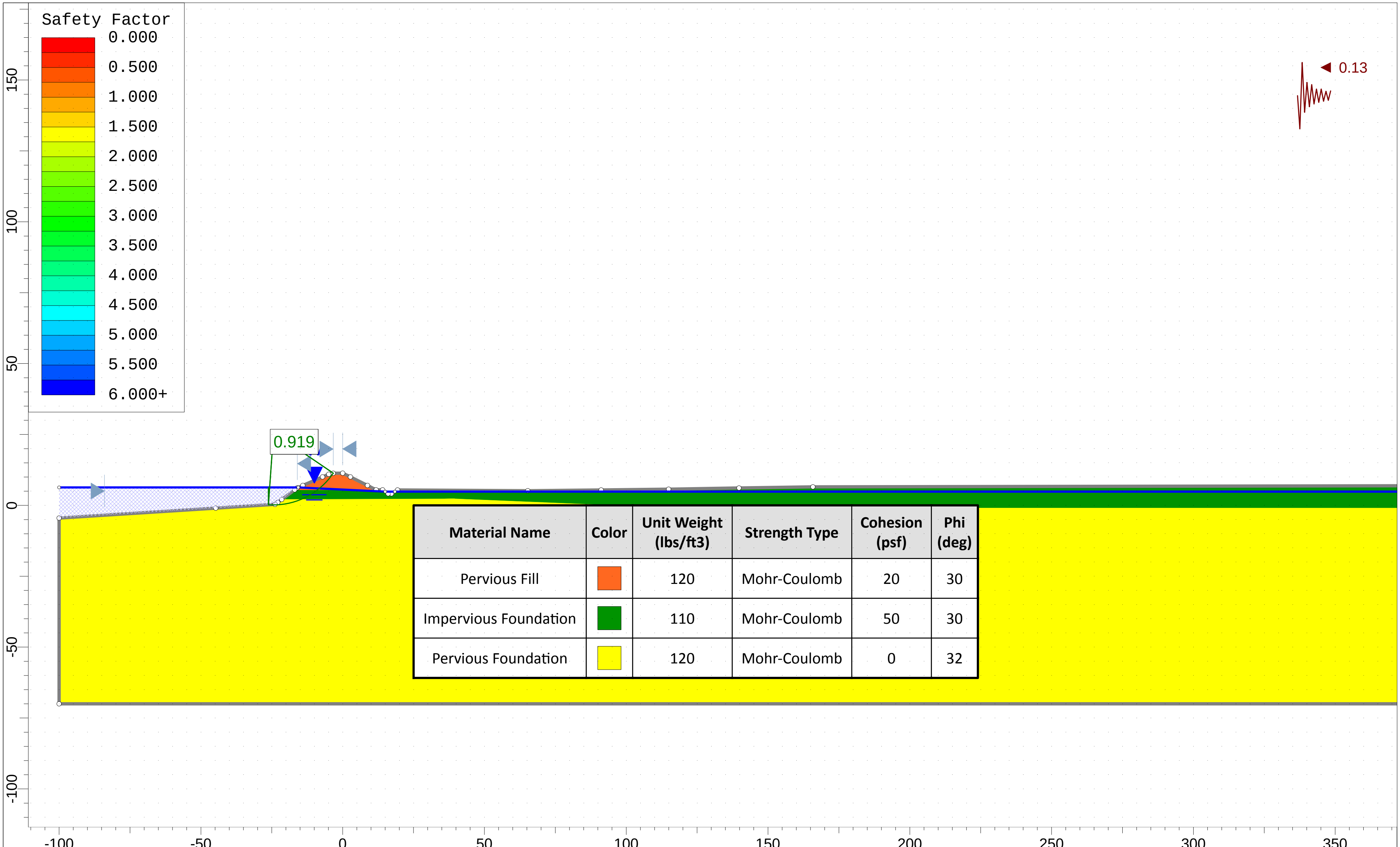


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 21+50, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:400
Company	
Date	6/8/2016
	STA 21+50_EQ_Conditions, Median Annual WSE, Landside.slim

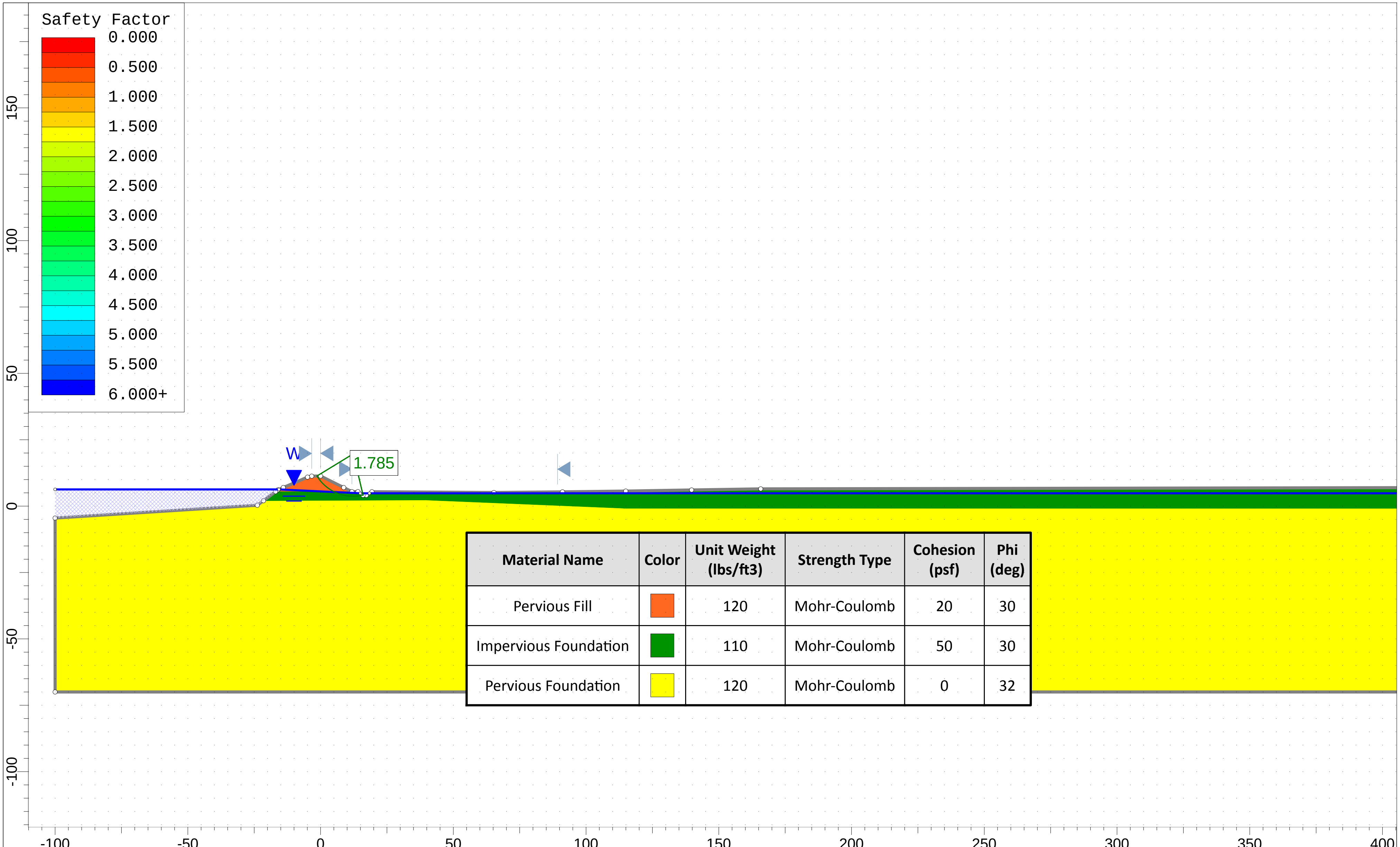


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 21+50, Existing Conditions, Waterside
Drawn By	AB/JB
Scale	1:562
Company	
Date	6/8/2016
	STA 21+50_EQ_Conditions, Median Annual WSE, Waterside.slim

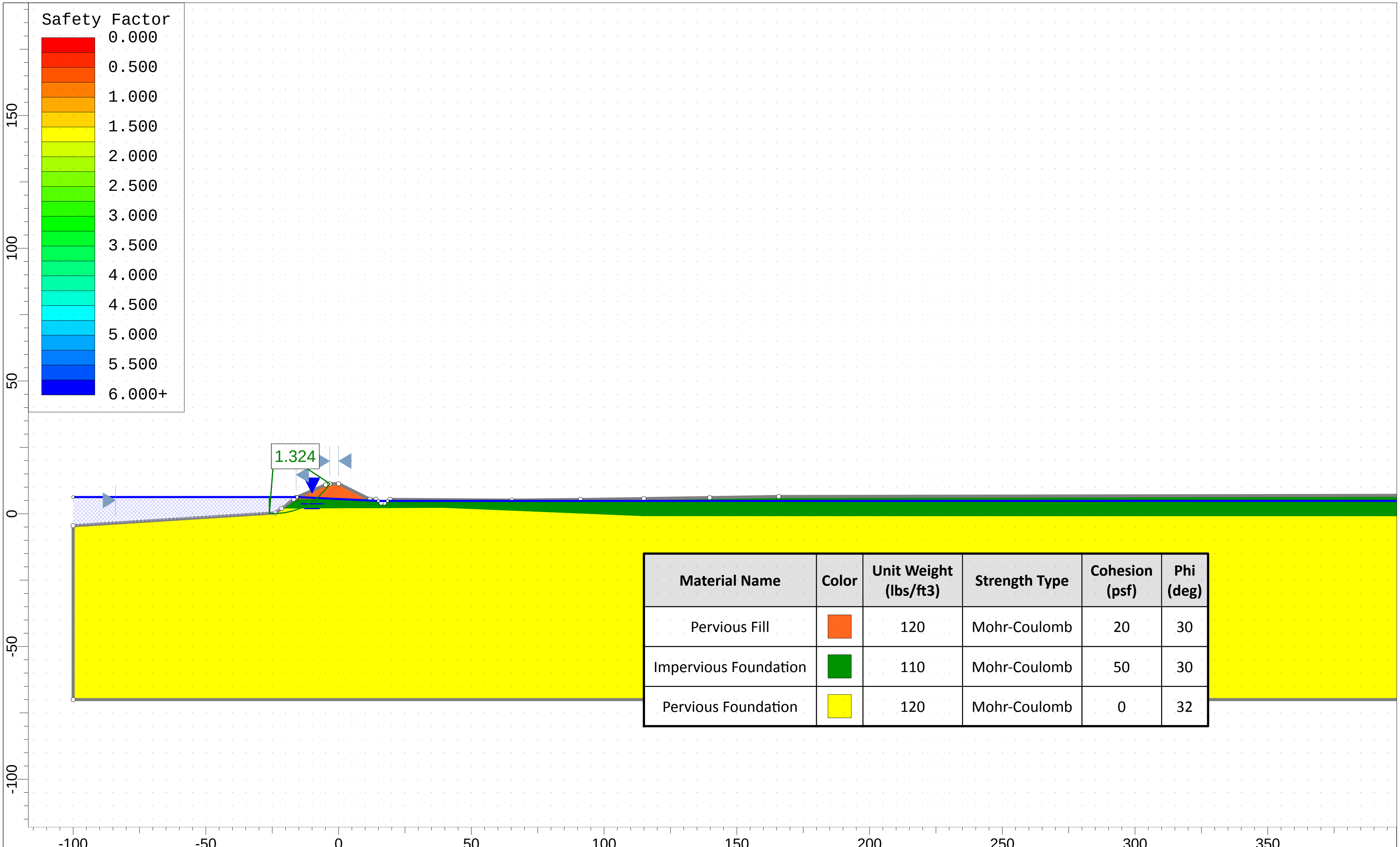


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 21+50, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:600
Company	
Date	6/7/2016
	STA 21+50_Existing_Conditions, Median Annual WSE, Landside.slim

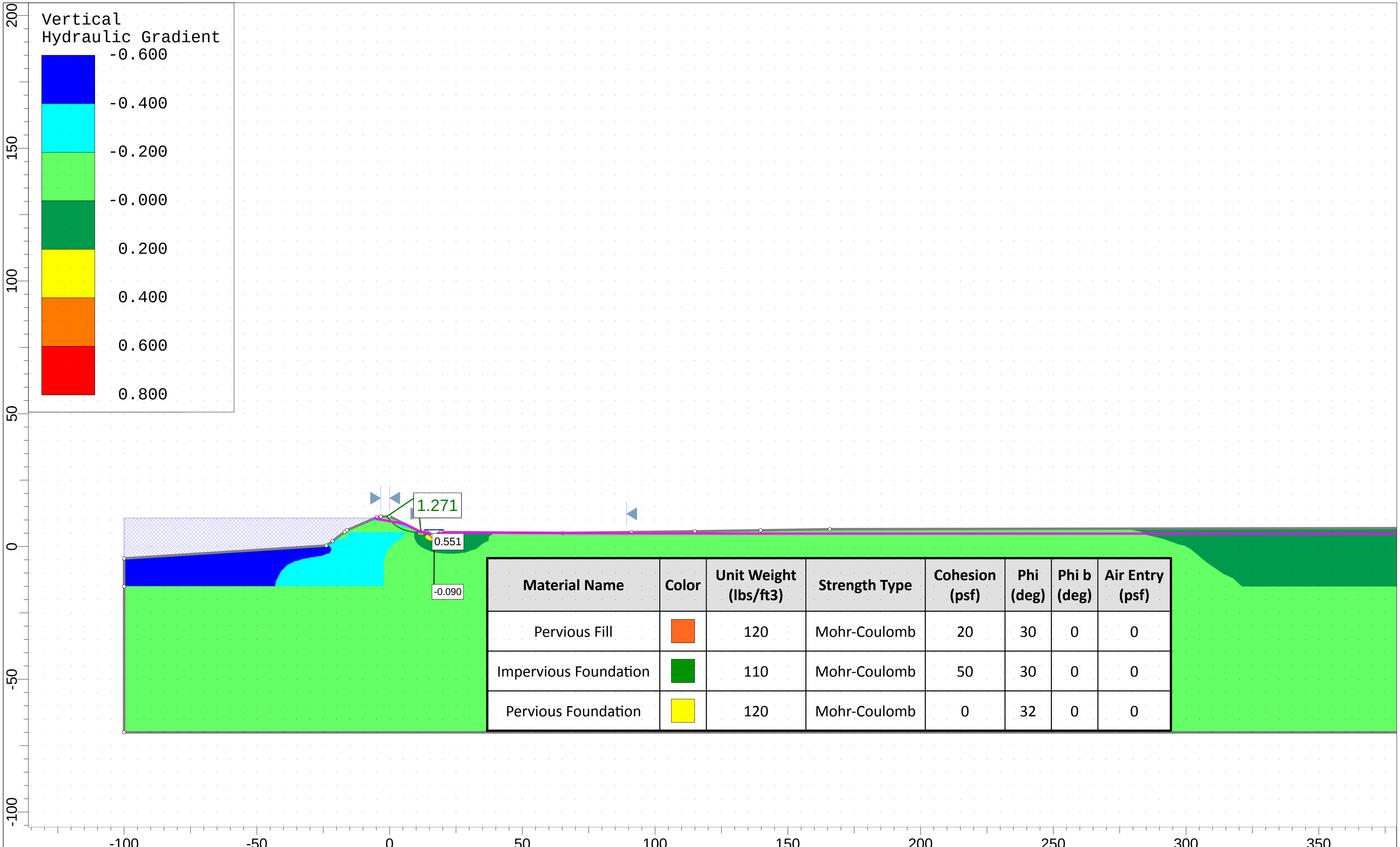


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 21+50, Existing Conditions, Waterside
Drawn By	AB/JB
Scale	1:600
Company	
Date	6/7/2016
	STA 21+50_Existing_Conditions, Median Annual WSE, Waterside.slim

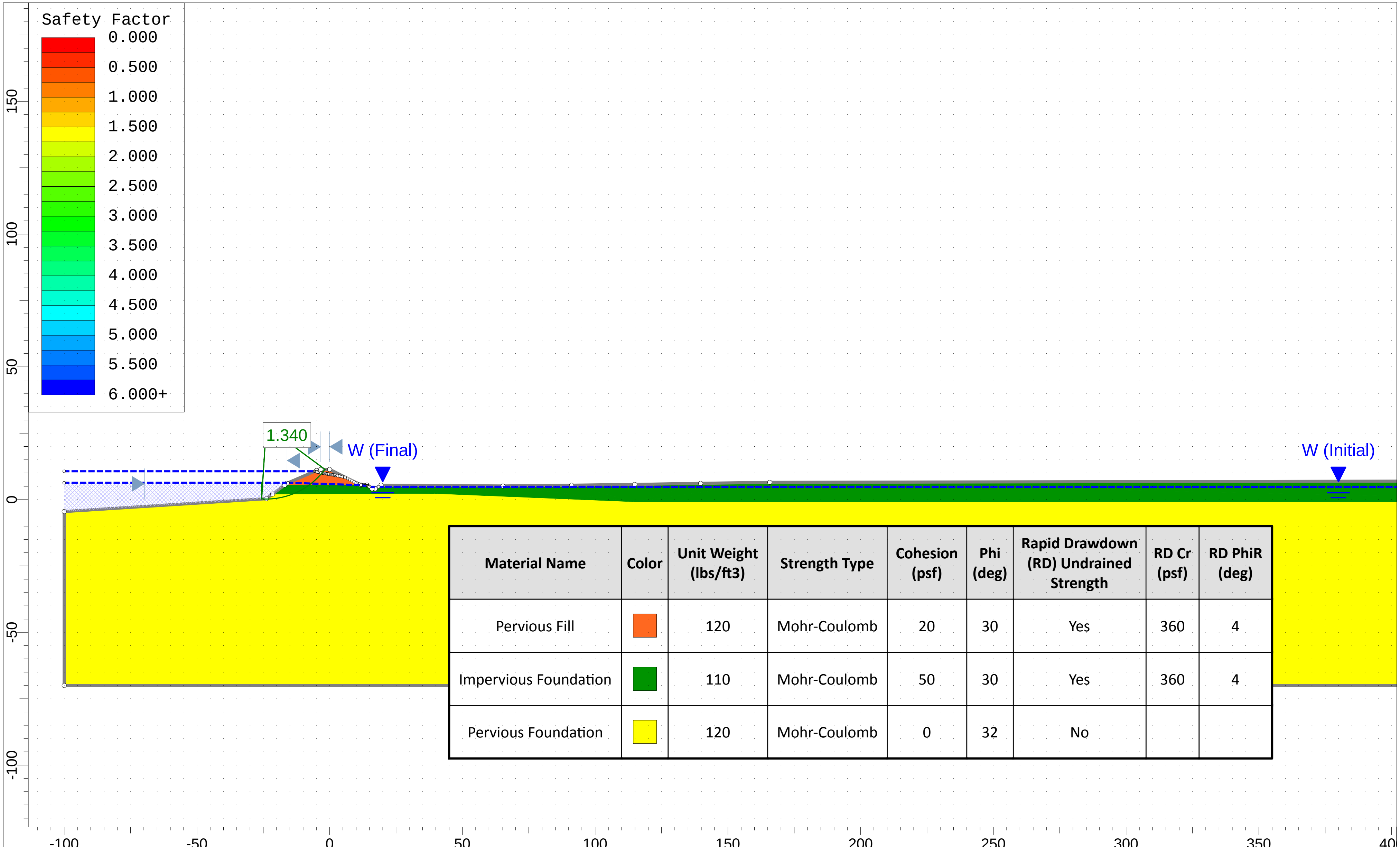


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Phi b (deg)	Air Entry (psf)
Pervious Fill		120	Mohr-Coulomb	20	30	0	0
Impervious Foundation		110	Mohr-Coulomb	50	30	0	0
Pervious Foundation		120	Mohr-Coulomb	0	32	0	0

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 21+50, Flood Stage Conditions, Landside
Drawn By	AB/JB
Scale	1:600
Company	
Date	6/7/2016
	STA 21+50_Flood_Stage_Conditions, 100-yr WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)
Pervious Fill		120	Mohr-Coulomb	20	30	Yes	360	4
Impervious Foundation		110	Mohr-Coulomb	50	30	Yes	360	4
Pervious Foundation		120	Mohr-Coulomb	0	32	No		

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 21+50, Rapid Drawdown Conditions, Waterside
Drawn By	AB/JB
Scale	1:600
Company	
Date	6/7/2016
	STA 21+50_Rapid Drawdown, Waterside.slim

Slide Analysis Information

Jacobs Ave. Levee Evaluation, Humboldt County, California

Project Summary

File Name: STA 32+00_Existing_Conditions, Median Annual WSE, Landside
Last saved with Slide version: 6.039
Project Title: Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis: Cross Section 32+00, Existing Conditions, Landside
Author: AB/JB
Date Created: 2016

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Slope Search
Number of Surfaces: 5000
Upper Angle: Not Defined
Lower Angle: Not Defined
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: 0
Minimum Depth: 1

Material Properties

Property	Pervious Fill	Impervious Foundation	Pervious Foundation
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	120
Cohesion [psf]	20	50	0
Friction Angle [deg]	30	30	32
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

List Of Coordinates

Water Table

X	Y
-100	6.33
-10.9601	6.33
22.755	4.508
25.2151	3.49998
32.3558	3.5
34.928	4.508
41.886	5.2
48.962	5.713
500	5.713

External Boundary

X	Y
-100	0
-100	-13.236
-100	-50
500	-50
500	-5.907
500	6.48
160.044	6.33
147.737	6.33
144.452	6.33
122.877	6.456

48.962	5.713
41.886	5.2
34.928	4.508
30.456	2.764
27.636	2.508
22.755	4.508
16.56	6.425
8.638	11.912
0	12.2334
-3.411	11.094
-13.6166	4.48569
-15.205	3.344

Material Boundary

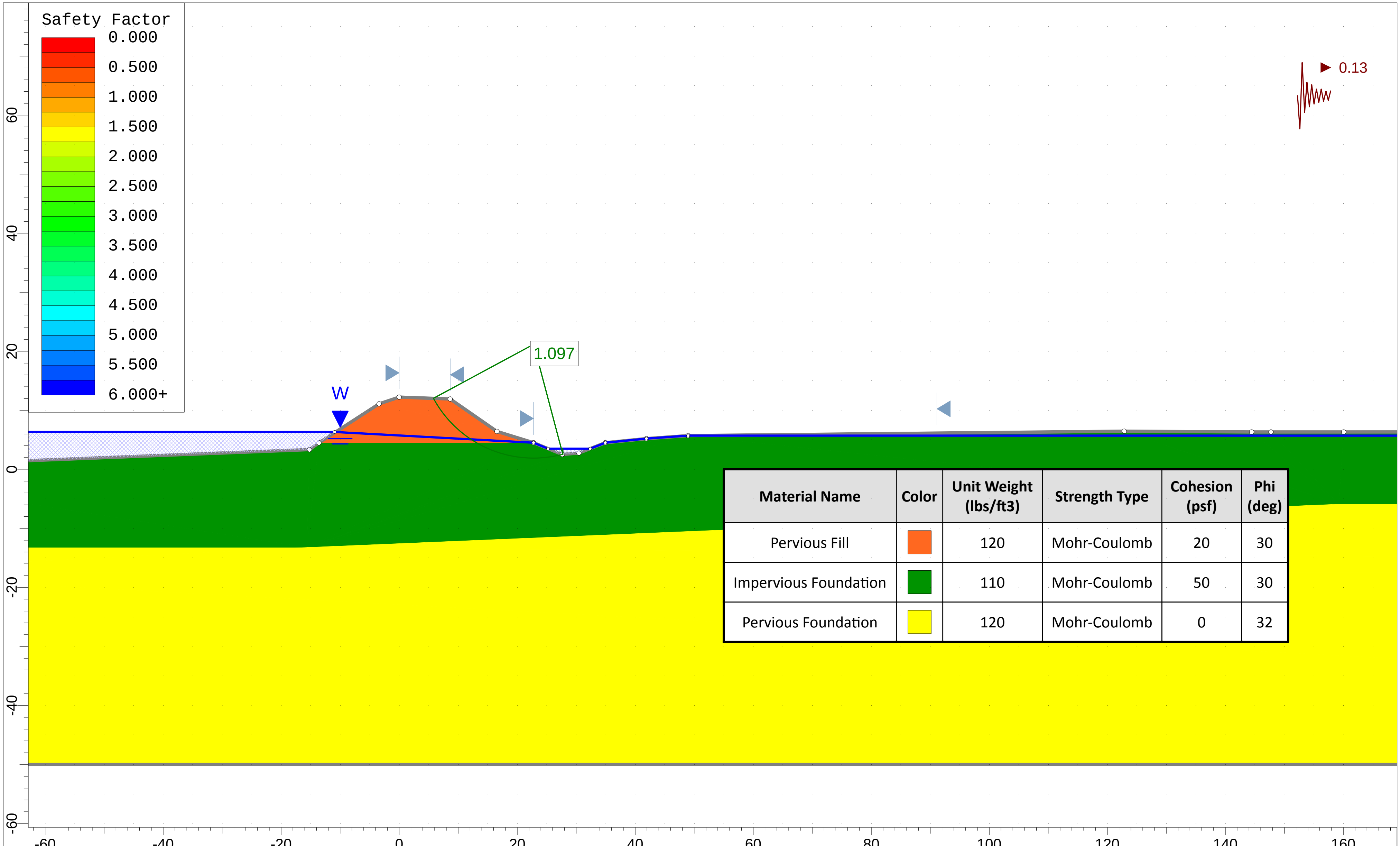
X	Y
-13.6166	4.48569
22.755	4.508

Material Boundary

X	Y
-15.631	-13.236
159.224	-5.907
500	-5.907

Material Boundary

X	Y
-100	-13.236
-15.631	-13.236

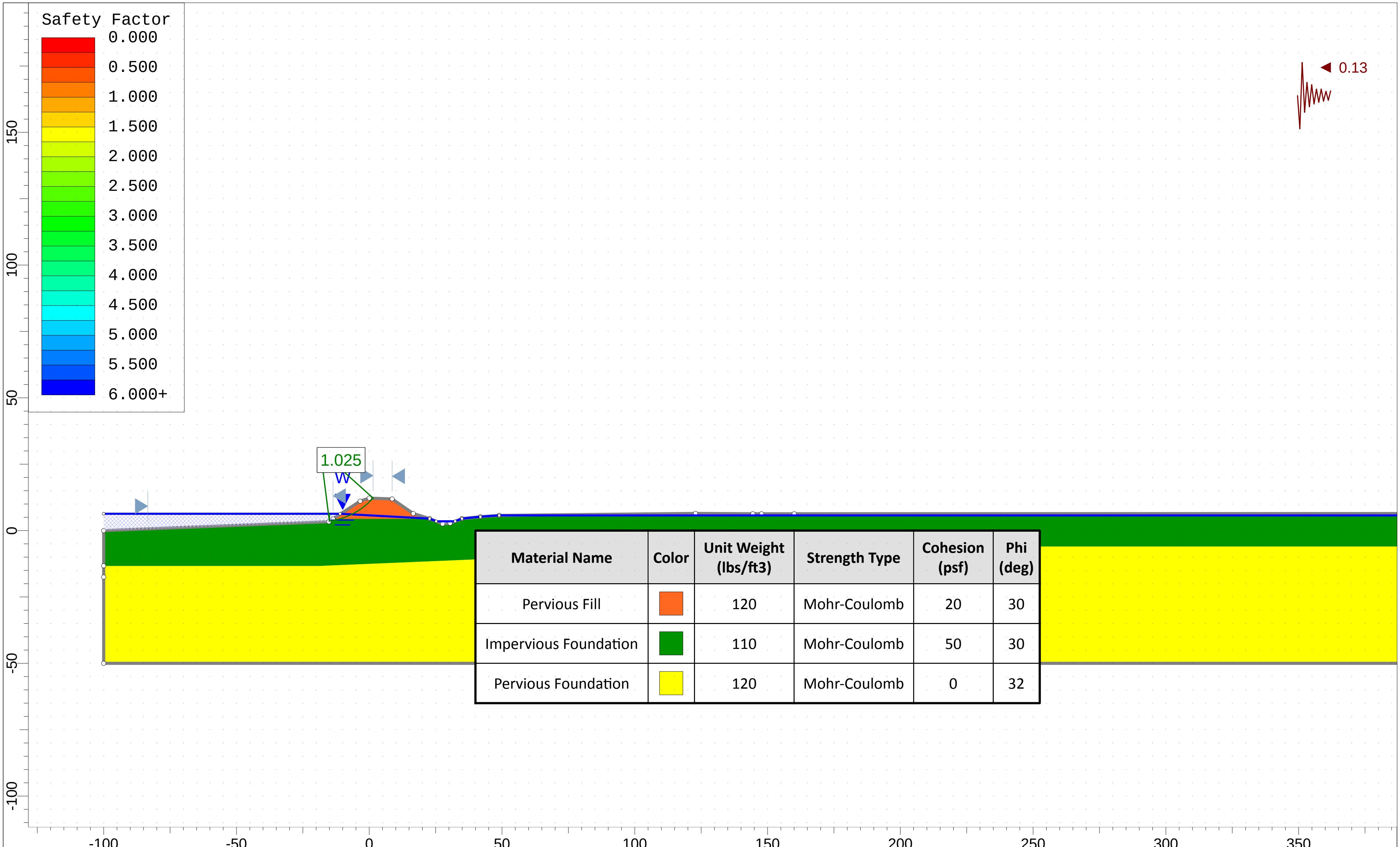


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 32+00, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/8/2016
	STA 32+00_EQ_Conditions, Median Annual WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project
Jacob Ave. Levee Evaluation, Humboldt County, California

Analysis Description:
Cross Section 32+00, Existing Conditions, Waterside

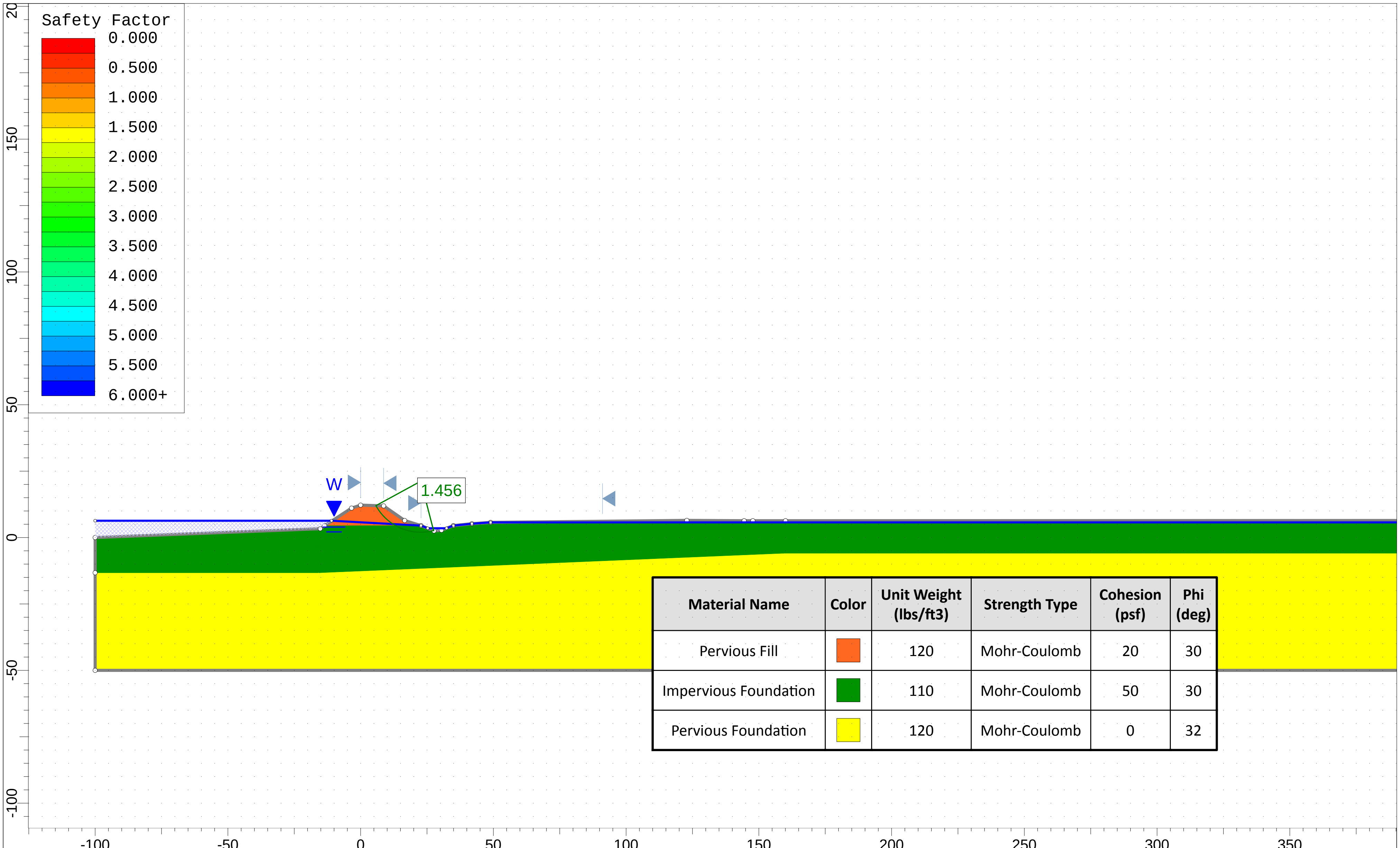
Drawn By AB/JB

Scale 1:600

Company

Date 6/8/2016

STA 32+00_EQ_Conditions, Median Annual WSE, Waterside.slim

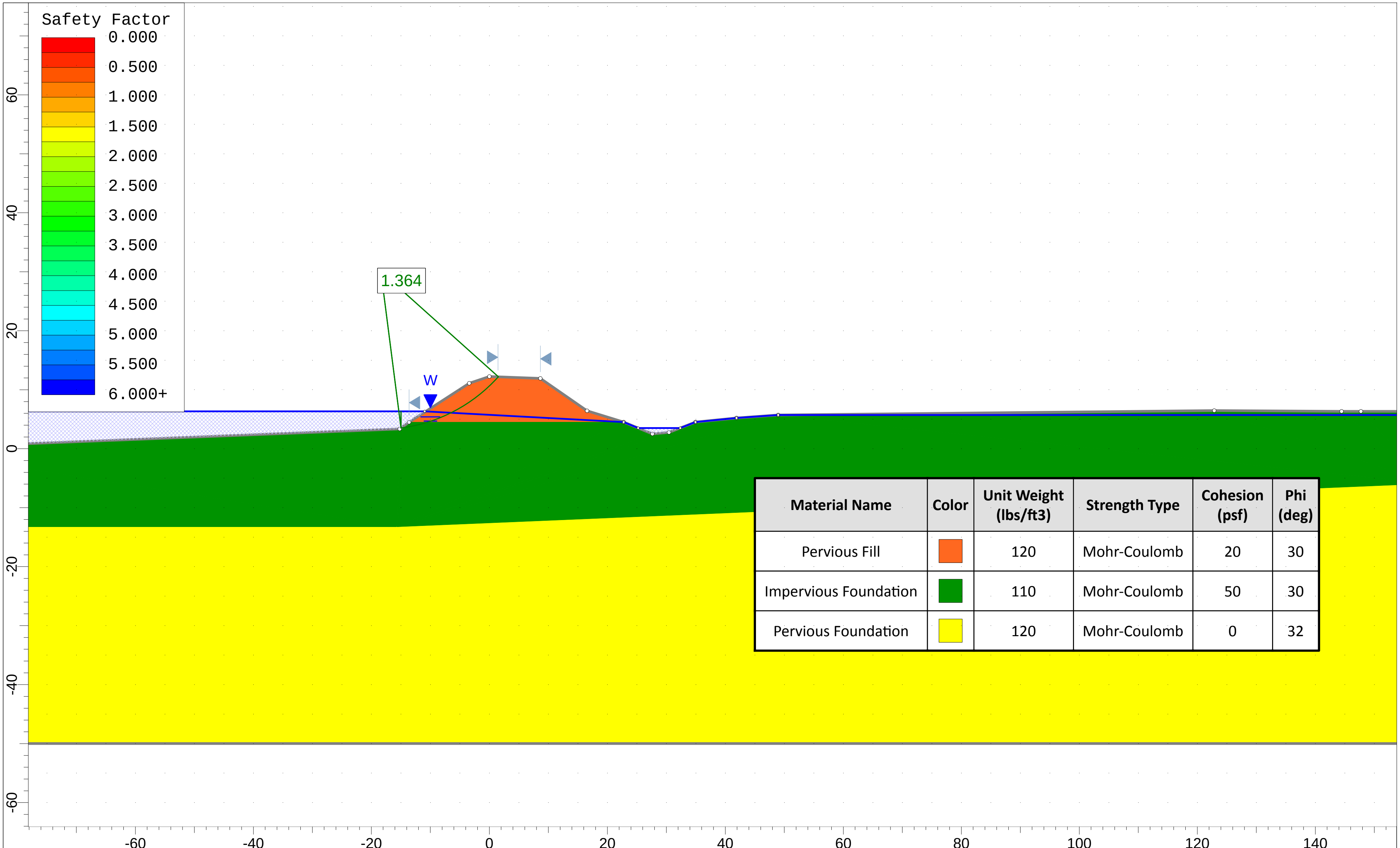


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 32+00, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:600
Company	
Date	6/7/2016
	STA 32+00_Existing_Conditions, Median Annual WSE, Landside.slim

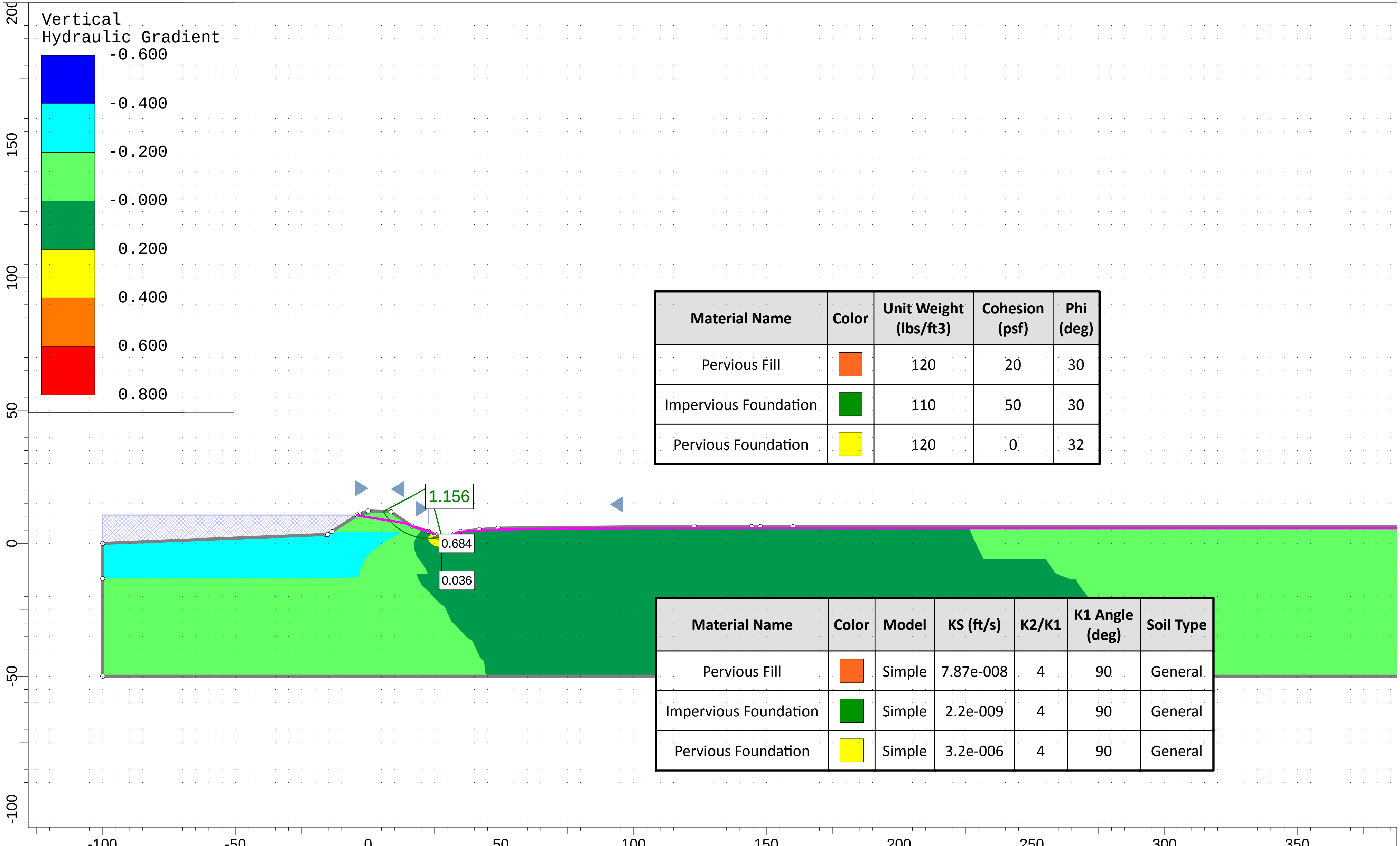


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 32+00, Existing Conditions, Waterside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/8/2016
	STA 32+00_Existing_Conditions, Median Annual WSE, Waterside.slim



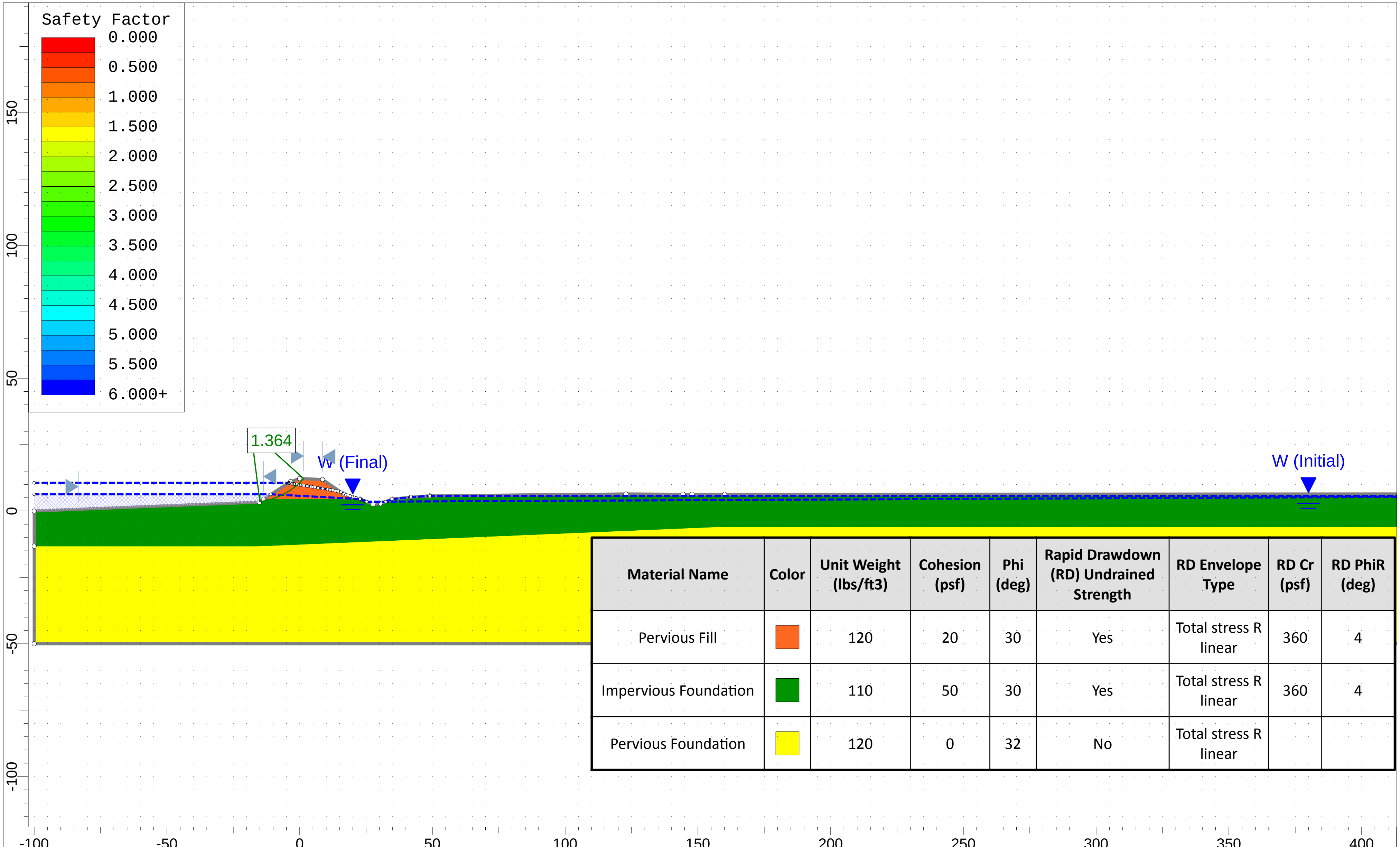
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Pervious Fill		120	20	30
Impervious Foundation		110	50	30
Pervious Foundation		120	0	32

Material Name	Color	Model	KS (ft/s)	K2/K1	K1 Angle (deg)	Soil Type
Pervious Fill		Simple	7.87e-008	4	90	General
Impervious Foundation		Simple	2.2e-009	4	90	General
Pervious Foundation		Simple	3.2e-006	4	90	General

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 32+00, Flood Stage Conditions, Landside
Drawn By AB/JB	*Scale* 1:600 · *Company*
Date 6/8/2016	STA 32+00_Flood_Stage_Conditions, 100-yr WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Envelope Type	RD Cr (psf)	RD PhiR (deg)
Pervious Fill		120	20	30	Yes	Total stress R linear	360	4
Impervious Foundation		110	50	30	Yes	Total stress R linear	360	4
Pervious Foundation		120	0	32	No	Total stress R linear		

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 32+00, Rapid drawdown Conditions, Waterside
Drawn By	AB/JB
Scale	1:600
Company	
Date	6/7/2016
	STA 32+00_Rapid Drawdown, Waterside.slim

Slide Analysis Information

Jacob Ave. Levee Evaluation, Humboldt County, California

Project Summary

File Name: STA 42+00_Existing_Conditions, Median Annual WSE, Landside
Last saved with Slide version: 6.039
Project Title: Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis: Cross Section 42+00, Existing Conditions, Landside
Author: AB/JB
Date Created: 2016

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Slope Search
Number of Surfaces: 5000
Upper Angle: Not Defined
Lower Angle: Not Defined
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: 0
Minimum Depth: 1

Material Properties

Property	Pervious Fill	Impervious Foundation	Pervious Foundation
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	120
Cohesion [psf]	20	50	0
Friction Angle [deg]	30	30	32
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

List Of Coordinates

Water Table

X	Y
-500	6.33
-9.71672	6.33
21.3804	4.68
860	4.68

External Boundary

X	Y
-500	-40
860	-40
860	-11
860	4.68
836.556	5.7166
811.083	9.3306
775.801	9.1586
736.078	12.2566
662.071	12.4286
618.699	7.4376
543.143	6.4046
288.455	6.2196
52.699	6.2196
45.987	6.007
38.017	5.798

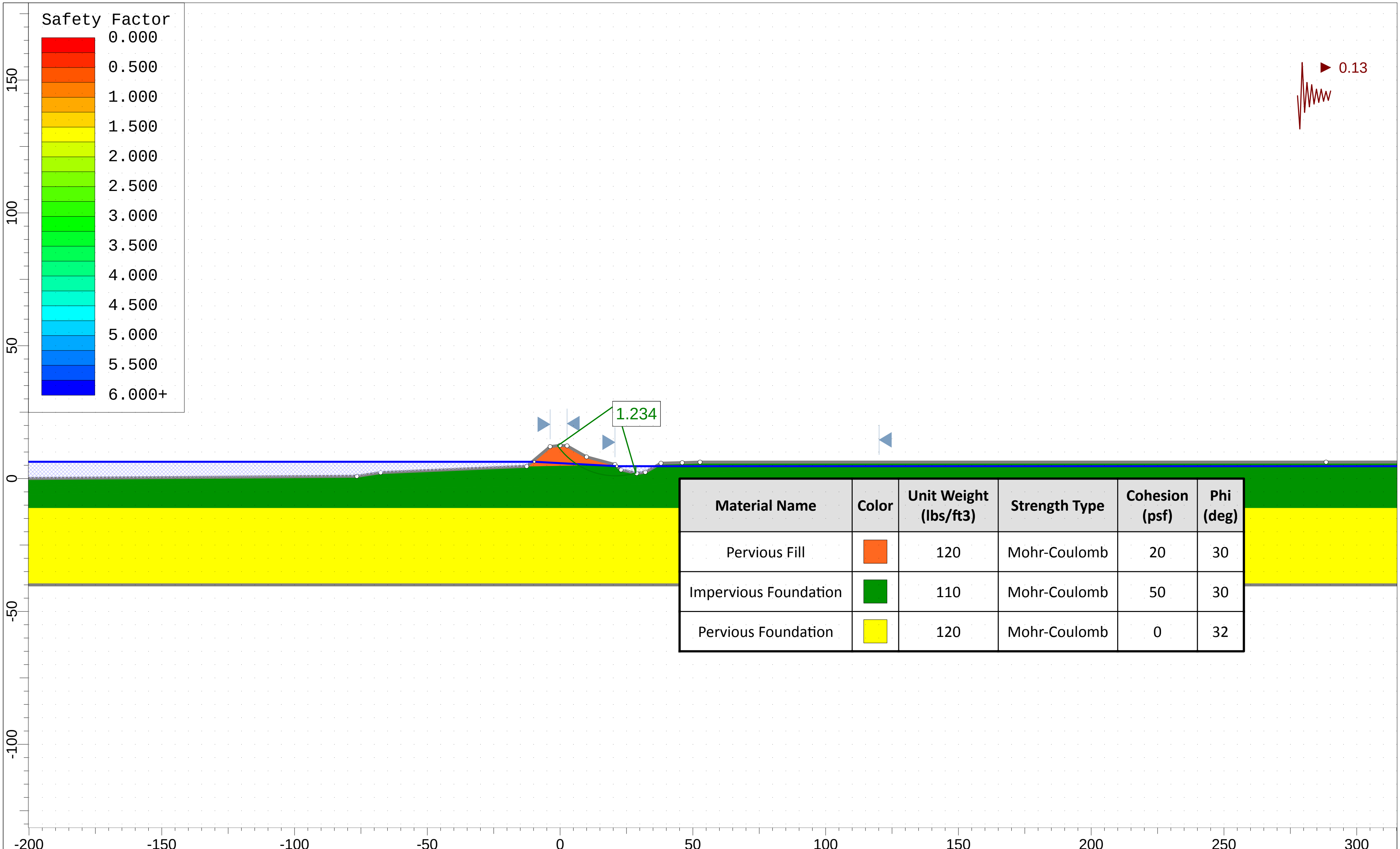
32.086	2.42
28.858	1.971
22.939	3.301
20.68	5.2996
9.938	8.168
2.60639	12.323
-0.032	12.5
-3.73197	12.044
-12.605	4.63
-67.606	2.2606
-76.556	0.8836
-204.296	0.0236
-269.354	-0.1484
-296.547	1.4006
-345.121	3.2676
-377.03	2.9576
-450.917	0.4796
-500	0
-500	-11

Material Boundary

X	Y
-500	-11
860	-11

Material Boundary

X	Y
-12.605	4.63
20.68	5.2996

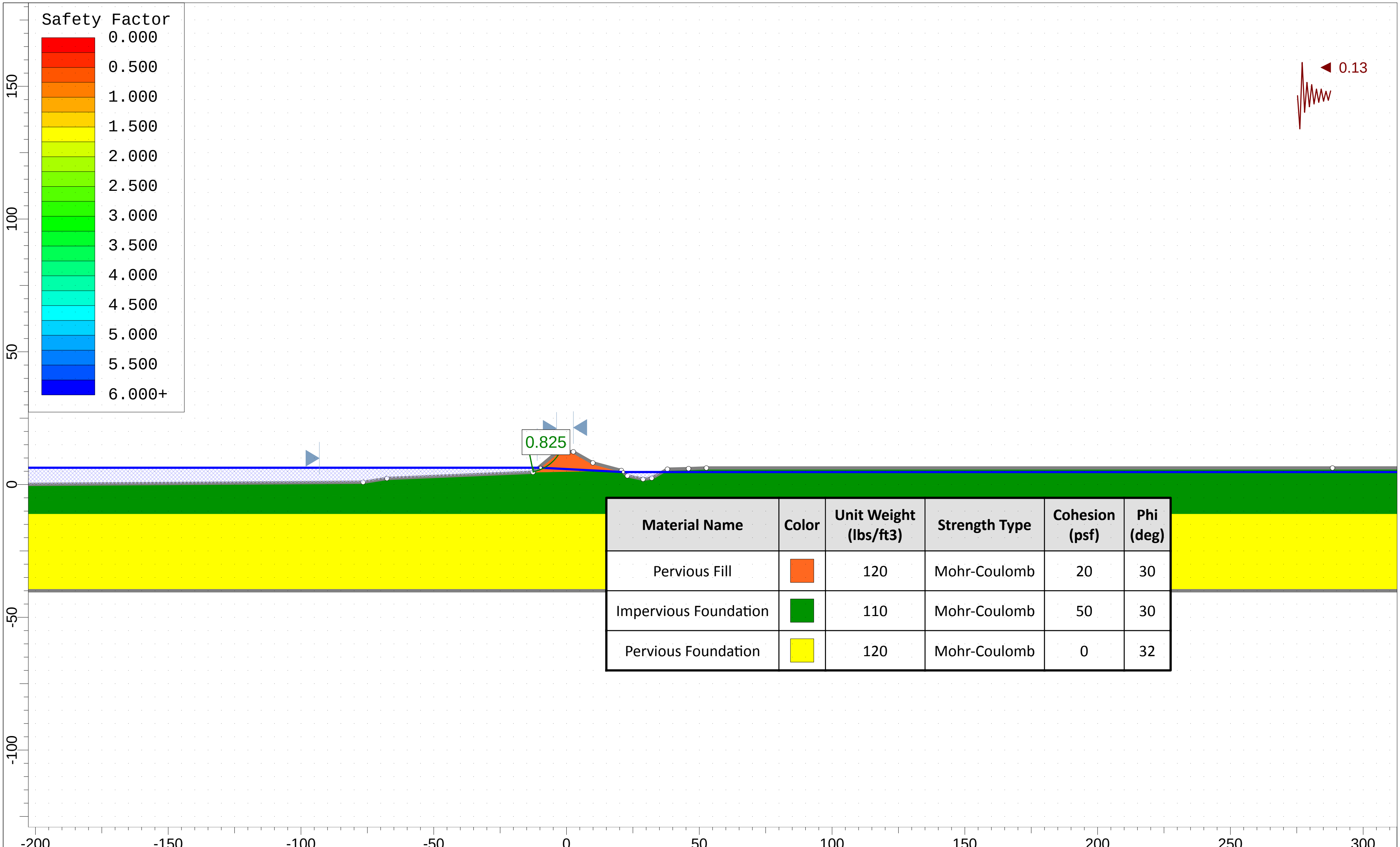


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 42+00, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:600
Company	
Date	6/8/2016
	STA 42+00_EQ_Conditions, Median Annual WSE, Landside.slim

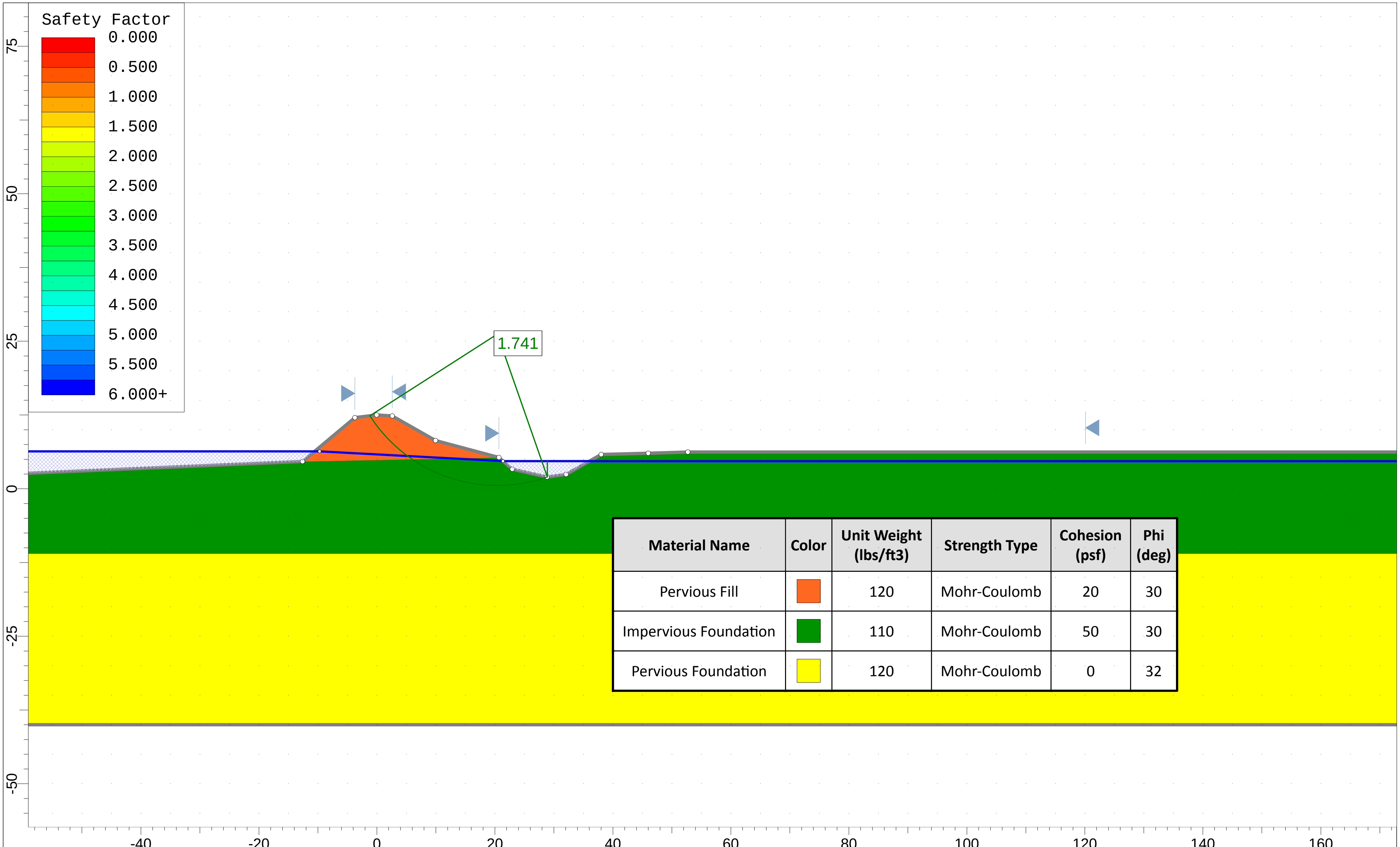


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California		
Analysis Description:	Cross Section 42+00, Existing Conditions, Waterside		
Drawn By	AB/JB	*Scale* 1:600	*Company*
Date	6/8/2016	STA 42+00_EQ_Conditions, Median Annual WSE, Waterside.slim	

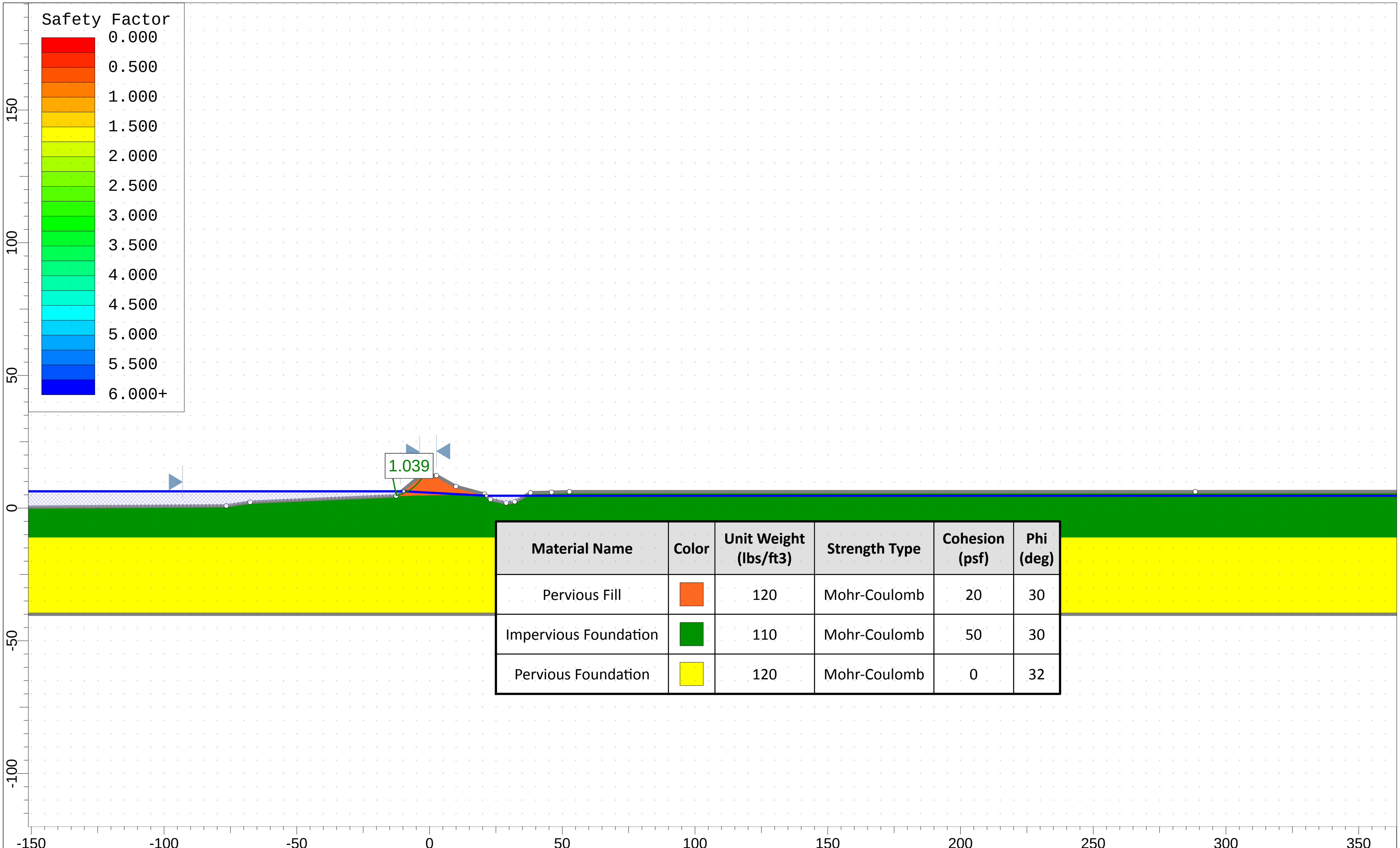


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 42+00, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/8/2016
	STA 42+00_Existing_Conditions, Median Annual WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

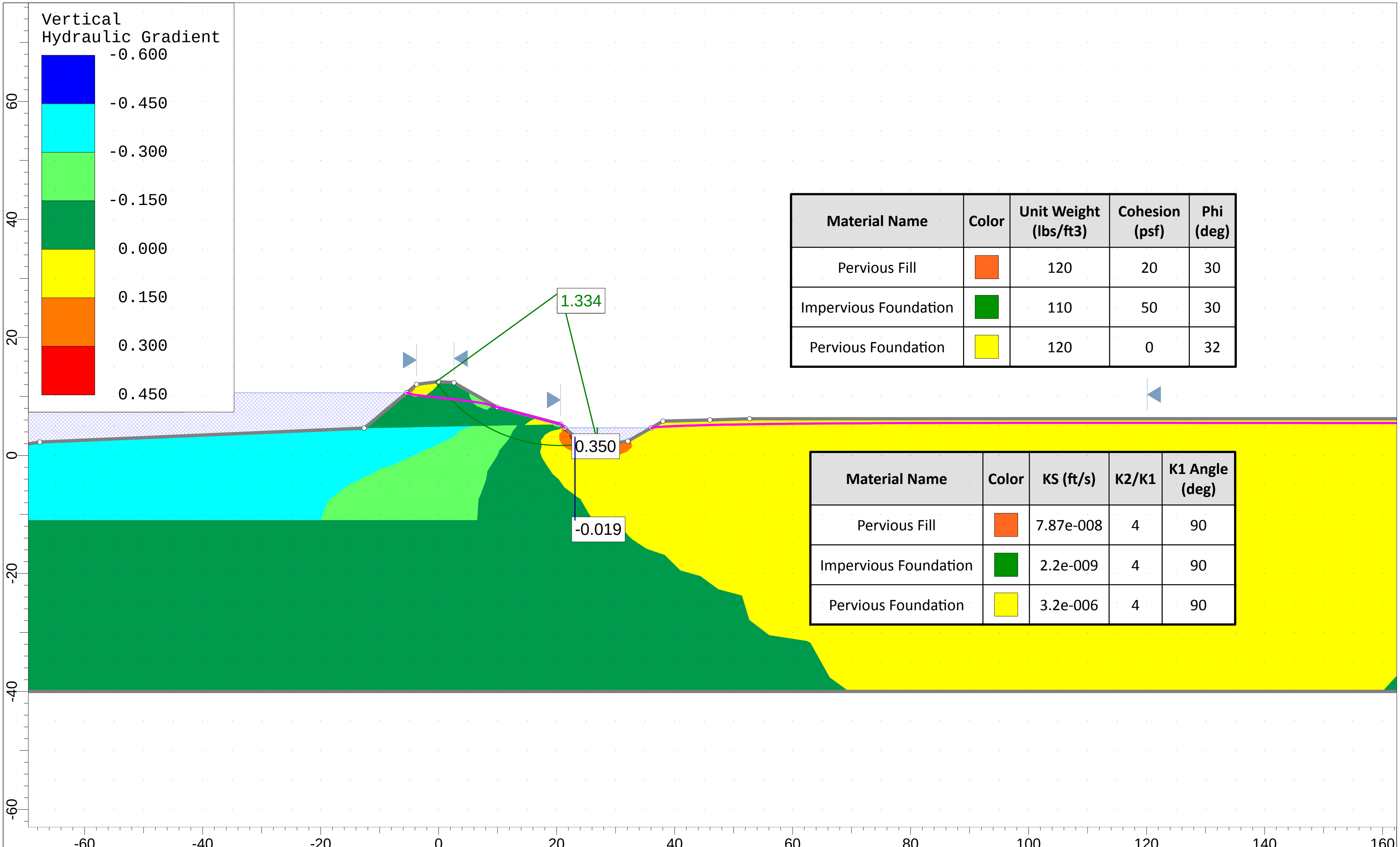
SLIDEINTERPRET 6.039

Project
Jacob Ave. Levee Evaluation, Humboldt County, California

Analysis Description:
Cross Section 42+00, Existing Conditions, Waterside

Drawn By AB/JB
Scale 1:600
Company

Date 6/8/2016
STA 42+00_Existing_Conditions, Median Annual WSE, Waterside.slim



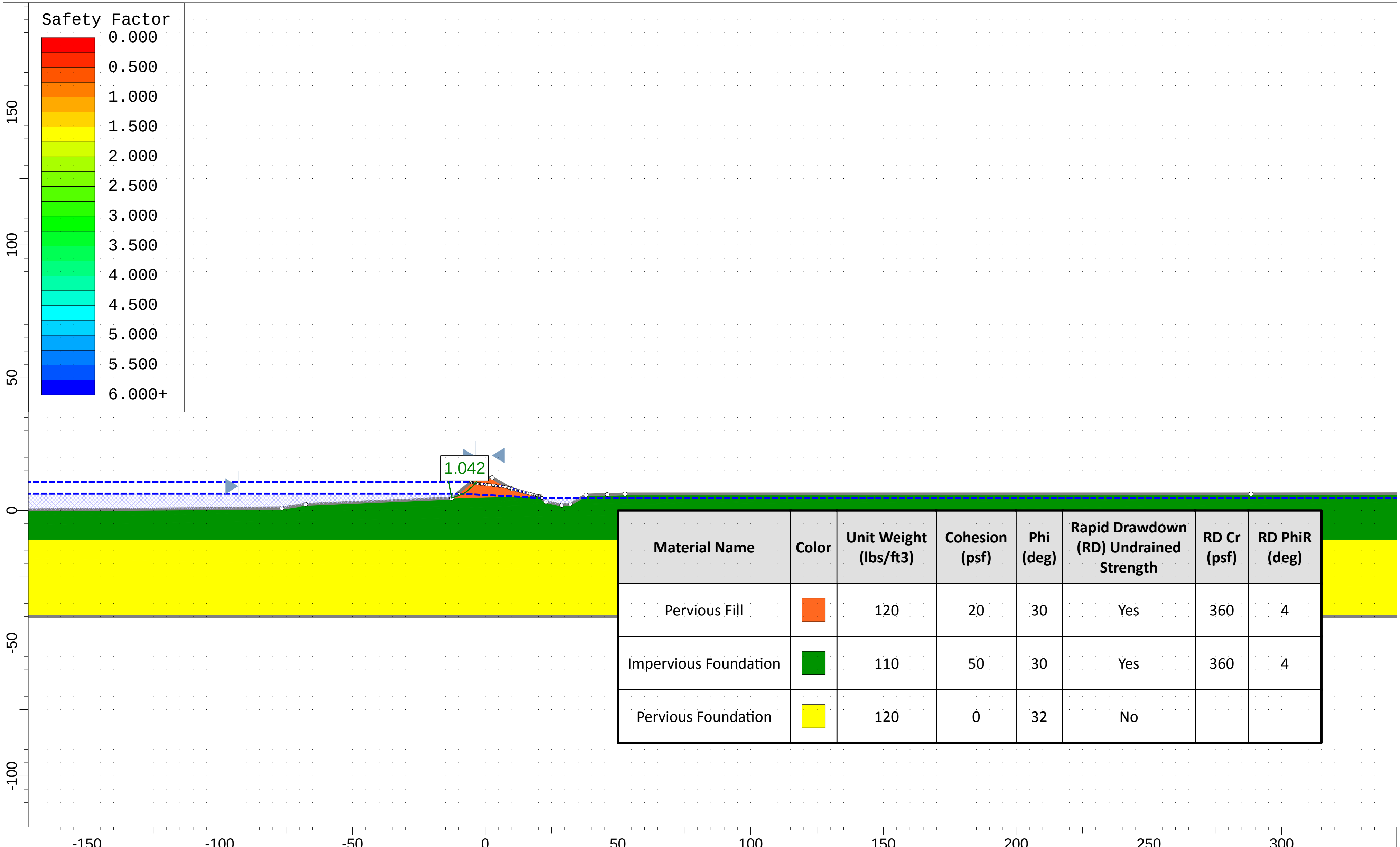
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Pervious Fill		120	20	30
Impervious Foundation		110	50	30
Pervious Foundation		120	0	32

Material Name	Color	KS (ft/s)	K2/K1	K1 Angle (deg)
Pervious Fill		7.87e-008	4	90
Impervious Foundation		2.2e-009	4	90
Pervious Foundation		3.2e-006	4	90

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 42+00, Flood Stage Conditions, Landside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/8/2016
	STA 42+00_Flood_Stage_Conditions, 100-yr WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)
Pervious Fill		120	20	30	Yes	360	4
Impervious Foundation		110	50	30	Yes	360	4
Pervious Foundation		120	0	32	No		

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project Jacobs Ave. Levee Evaluation, Humboldt County, California

Analysis Description: Cross Section 42+00, Rapid Drawdown Conditions, Waterside

Drawn By AB/JB | *Scale* 1:600 | *Company*

Date 6/7/2016 | STA 42+00_Rapid Drawdown, Waterside.slim

Slide Analysis Information
Jacob Ave. Levee Evaluation, Humboldt County, California

Project Summary

File Name: STA 56+00_Existing_Conditions, Median Annual WSE, Landside
Last saved with Slide version: 6.039
Project Title: Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis: Cross Section 56+00, Existing Conditions, Landside
Author: AB/JB
Date Created: 2016

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Slope Search
Number of Surfaces: 5000
Upper Angle: Not Defined
Lower Angle: Not Defined
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: 0
Minimum Depth: 1

Material Properties

Property	Pervious Fill	Impervious Foundation	Pervious Foundation
Color			
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	120	110	120
Cohesion [psf]	20	50	0
Friction Angle [deg]	30	30	32
Water Surface	Water Table	Water Table	Water Table
Hu Value	1	1	1

List Of Coordinates

Water Table

X	Y
-681	6.34
680	6.34

External Boundary

X	Y
-681	7.55
-681	-6.7
-681	-40
680	-40
680	-4.5
680	7.6
648.882	6.34
628.272	6.34
614.675	6.838
559.022	13.169
528.935	13.388
458.905	11.313
397.662	7.602
395.035	7.874
85.35	6.314
78.687	6.314
25.905	6.883

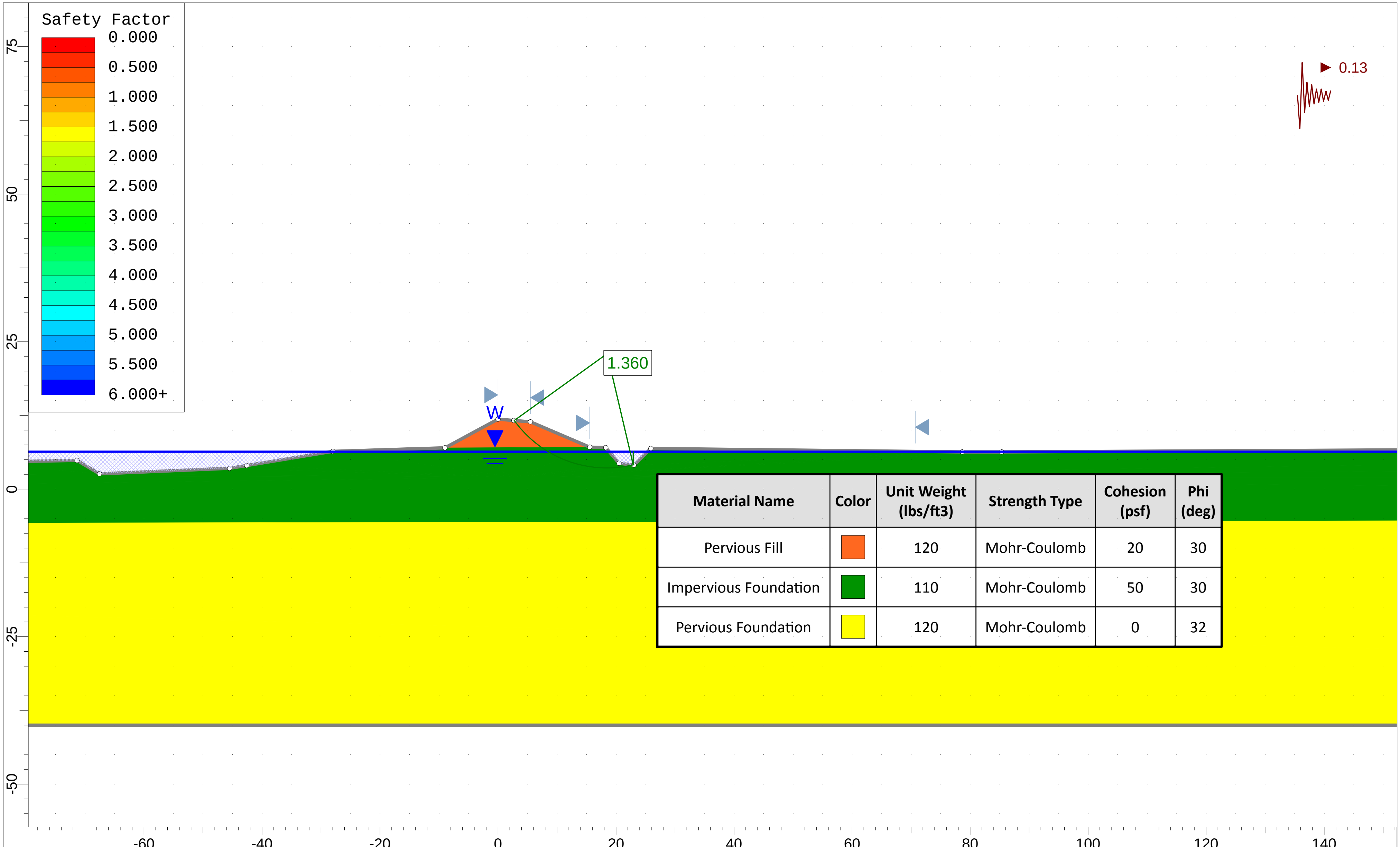
23.051	4.071
20.523	4.38
18.2608	7.03909
15.5417	7.12134
5.5	11.4
2.67498	11.6311
0	11.85
-9	7
-28	6.4
-45.461	3.524
-67.543	2.599
-71.343	4.859
-89.214	4.551
-104.518	2.291
-233.397	2.599
-265.154	3.935
-358.537	4.756
-423.86	1.983
-547.11	1.983
-607.092	8.556

Material Boundary

X	Y
-681	-6.7
680	-4.5

Material Boundary

X	Y
-9	7
15.5417	7.12134



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

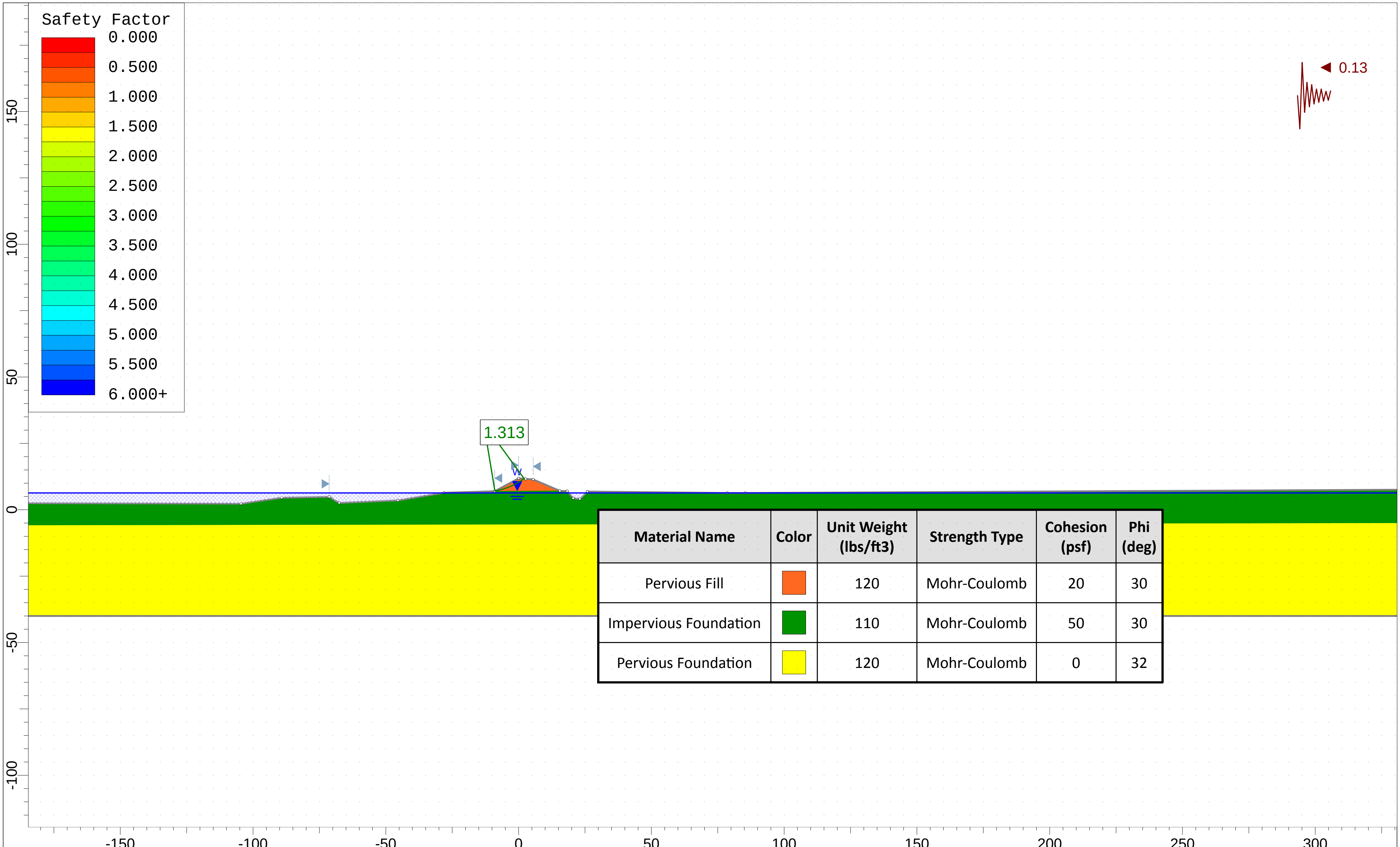
SLIDEINTERPRET 6.039

Project Jacobs Ave. Levee Evaluation, Humboldt County, California

Analysis Description: Cross Section 56+00, Existing Conditions, Landside

Drawn By AB/JB | *Scale* 1:270 | *Company*

Date 6/8/2016 | STA 56+00_EQ_Conditions, Median Annual WSE, Landside.slim

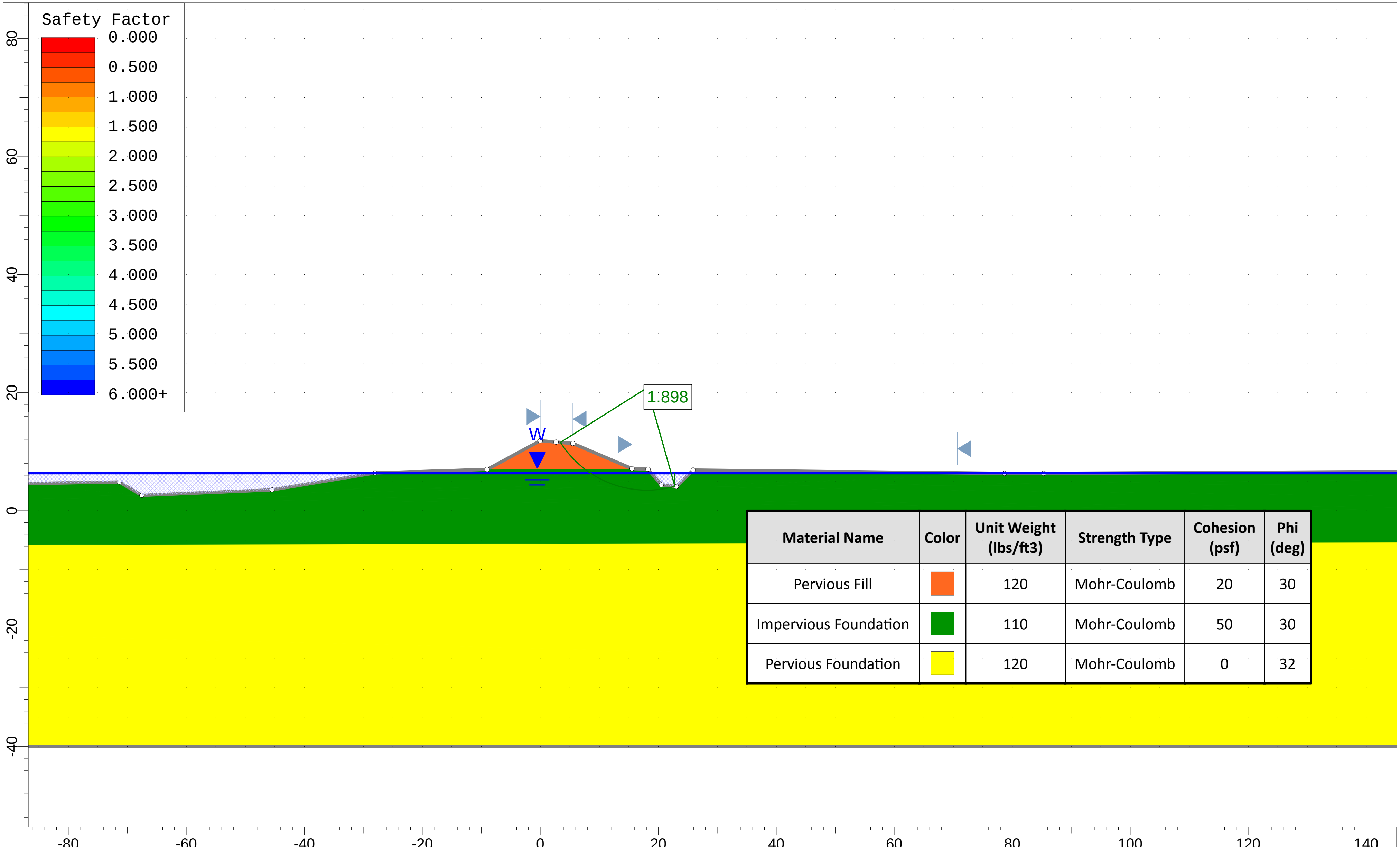


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California		
Analysis Description:	Cross Section 56+00, Existing Conditions, Waterside		
Drawn By AB/JB	*Scale* 1:600	*Company*	
Date 6/8/2016	STA 56+00_EQ_Conditions, Median Annual WSE, Waterside.slim		

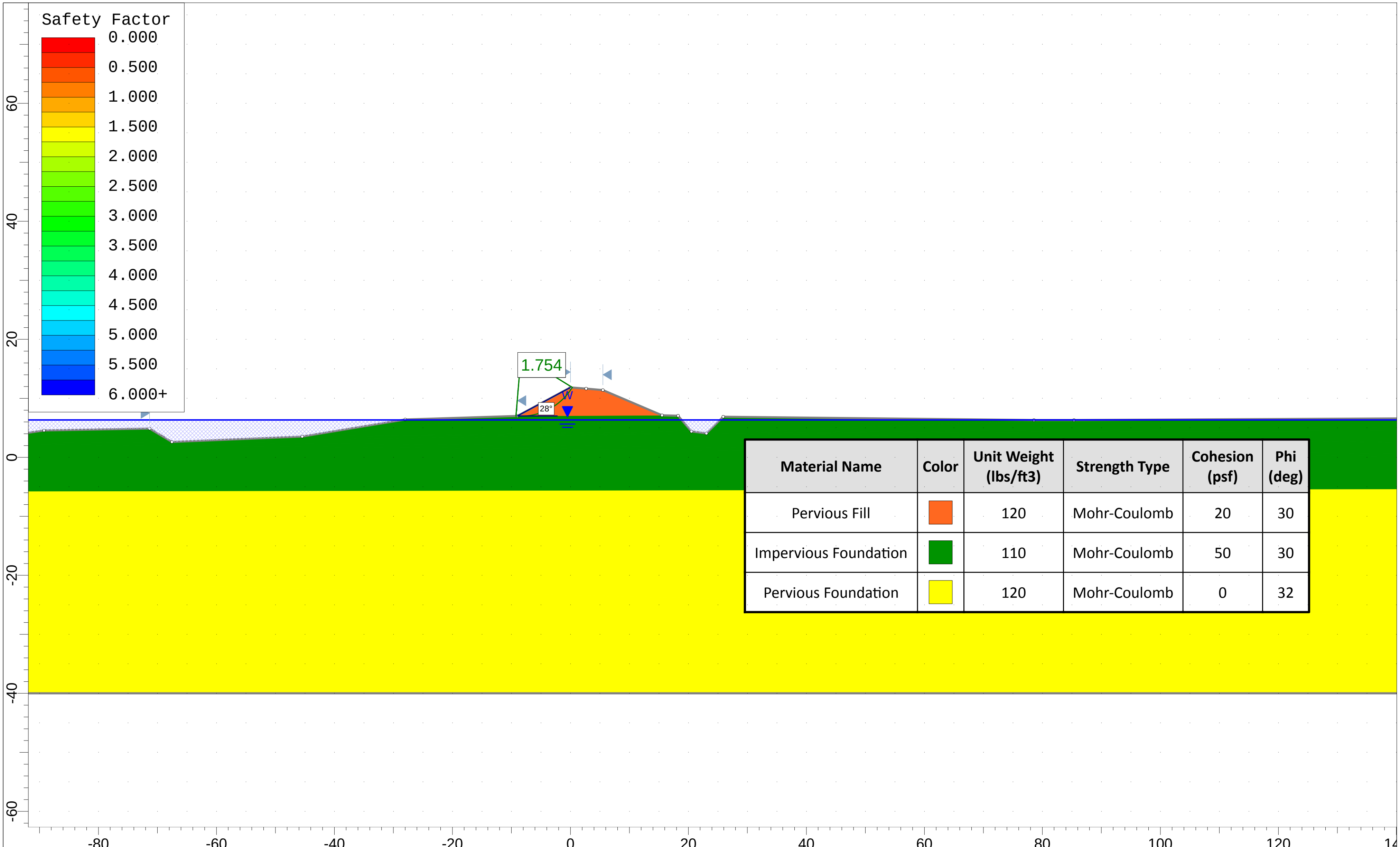


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 56+00, Existing Conditions, Landside
Drawn By	AB/JB
Scale	1:270
Company	
Date	6/8/2016
	STA 56+00_Existing_Conditions, Median Annual WSE, Landside.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Pervious Fill		120	Mohr-Coulomb	20	30
Impervious Foundation		110	Mohr-Coulomb	50	30
Pervious Foundation		120	Mohr-Coulomb	0	32

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project
Jacob Ave. Levee Evaluation, Humboldt County, California

Analysis Description:
Cross Section 56+00, Existing Conditions, Waterside

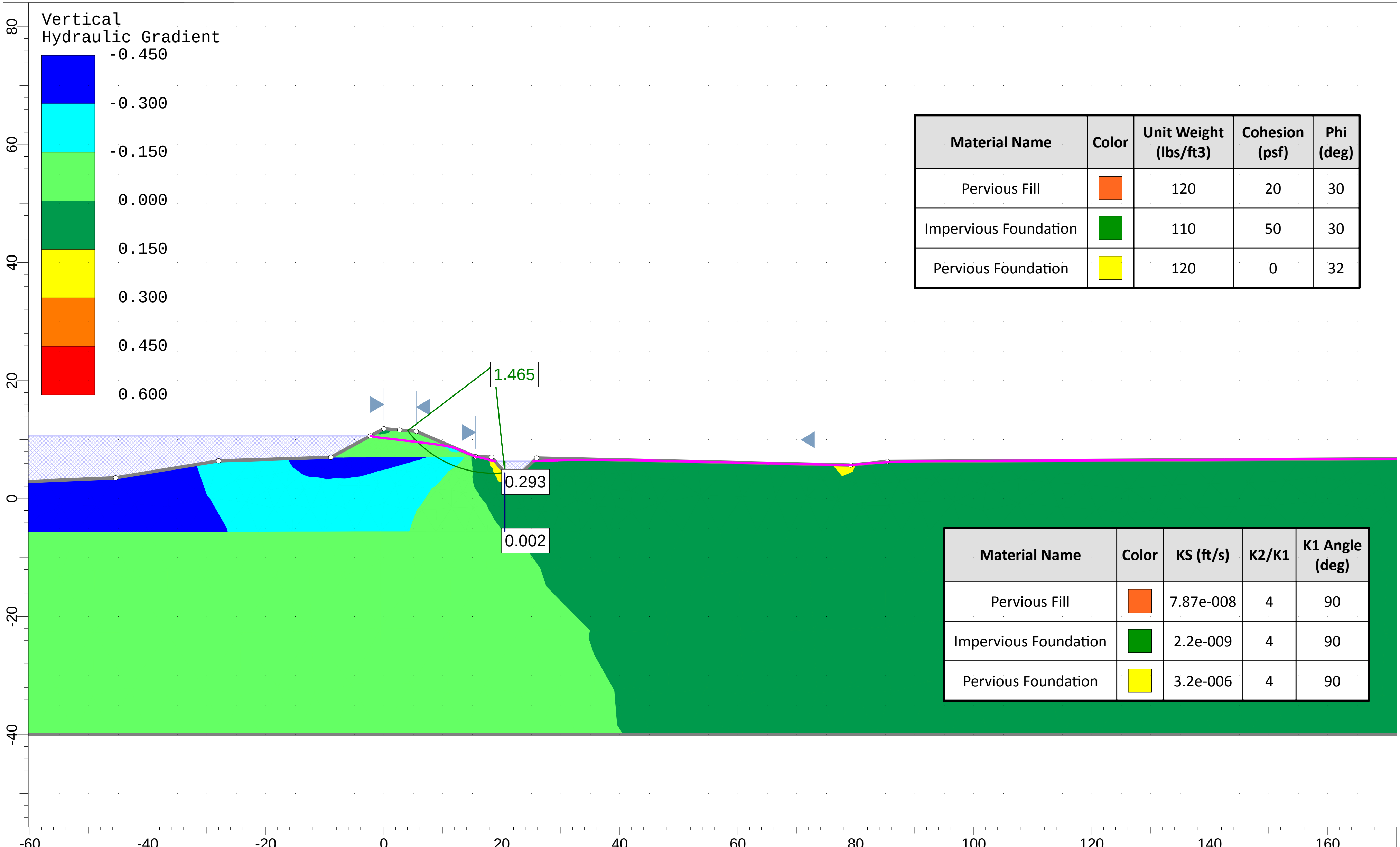
Drawn By AB/JB

Scale 1:270

Company

Date 6/8/2016

STA 56+00_Existing_Conditions, Median Annual WSE, Waterside.slim



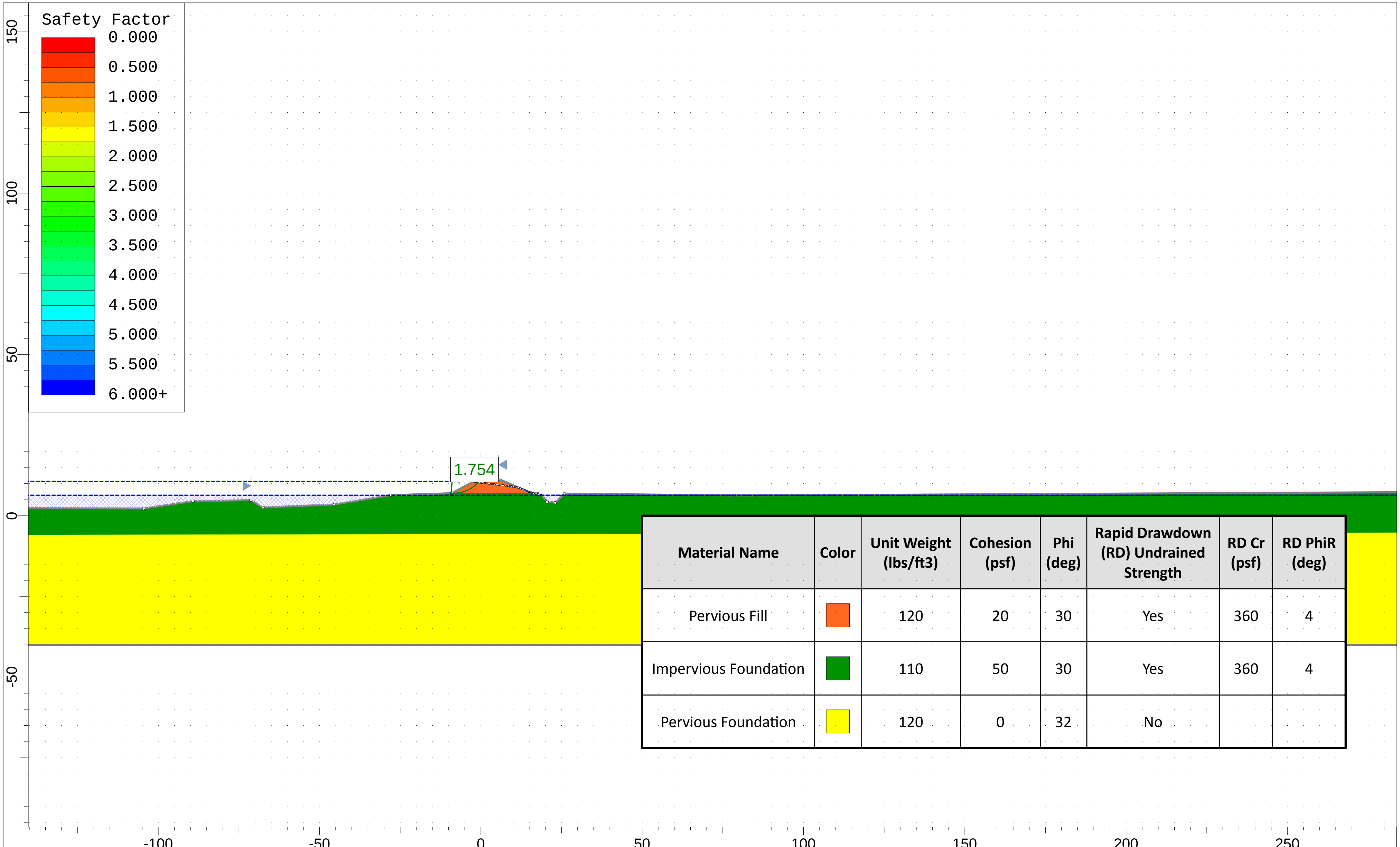
Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Pervious Fill		120	20	30
Impervious Foundation		110	50	30
Pervious Foundation		120	0	32

Material Name	Color	KS (ft/s)	K2/K1	K1 Angle (deg)
Pervious Fill		7.87e-008	4	90
Impervious Foundation		2.2e-009	4	90
Pervious Foundation		3.2e-006	4	90

CGI TECHNICAL SERVICES INC.

SLIDEINTERPRET 6.039

Project	Jacob Ave. Levee Evaluation, Humboldt County, California		
Analysis Description:	Cross Section 56+00, Flood Stage Conditions, Landside		
Drawn By AB/JB	*Scale* 1:270	*Company*	
Date 6/8/2016	STA 56+00_Flood_Stage_Conditions, 100-yr WSE, Landside.slim		



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)	Rapid Drawdown (RD) Undrained Strength	RD Cr (psf)	RD PhiR (deg)
Pervious Fill		120	20	30	Yes	360	4
Impervious Foundation		110	50	30	Yes	360	4
Pervious Foundation		120	0	32	No		

CGI Technical Services Inc.

SLIDEINTERPRET 6.039

Project	Jacobs Ave. Levee Evaluation, Humboldt County, California
Analysis Description:	Cross Section 56+00, Rapid Drawdown, Waterside
Drawn By	AB/JB
Scale	1:494
Company	
Date	6/7/2016
	STA 56+00_Rapid Drawdown, Waterside.slim

Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007

SEE NOTES BELOW FOR GUIDANCE IN THE USE OF SPREADSHEET

Input Parameters			
Yield Coefficient (ky)	0.02		Based on pseudostatic analysis
Initial Fundamental Period (Ts)	0.06	seconds	1D: Ts=4H/Vs 2D: Ts=2.6H/Vs
Degraded Period (1.5Ts)	0.09	seconds	
Moment Magnitude (Mw)	9.0		
Spectral Acceleration (Sa(1.5Ts))	0.4	g	

Additional Input Parameters		
Probability of Exceedance #1 (P1)	84	%
Probability of Exceedance #2 (P2)	50	%
Probability of Exceedance #3 (P3)	16	%
Displacement Threshold (d_threshold)	5	cm

Intermediate Calculated Parameters			
Non-Zero Seismic Displacement Est (D)	95.52	cm	eq. (5) or (6)
Standard Deviation of Non-Zero Seismic D	0.66		

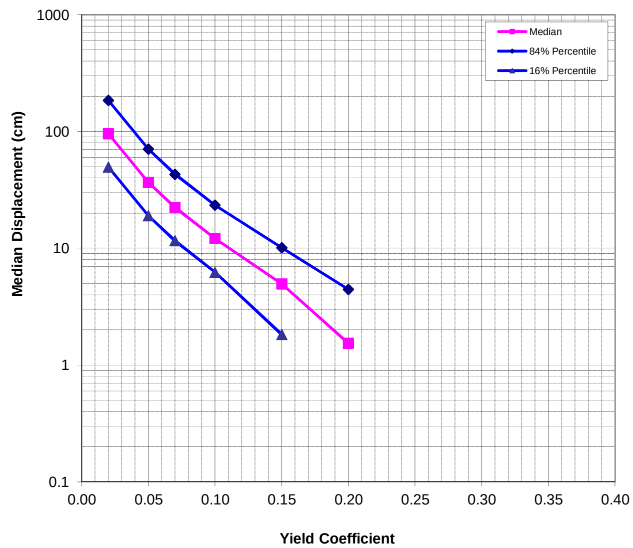
Results			
Probability of Negligible Displ. (P(D=0))	0.000		eq. (3)
D1	49.55	cm	calc. using eq. (7)
D2	95.52	cm	calc. using eq. (7)
D3	184.13	cm	calc. using eq. (7)
P(D>d_threshold)	1.000		eq. (7)

Notes

1. Values highlighted in blue are input parameters
2. Probability of Exceedance is the desired probability of exceeding a particular displacement value.
3. Displacements D1, D2, and D3 correspond to P1, P2, and P3, respectively.
   (e.g., the probability of exceeding displacement D1 is P1)
4. Calculated seismic displacements are due to deviatoric deformation only (add in volumetrically induced movement).
5. ky may range between 0.01 and 0.5, Ts between 0 and 2 s, Sa between 0.002 and 2.7 g, M between 4.5 and 9
6. Rigid slope is assumed for Ts < 0.05 s
7. When a value for D is not calculated, D is < 1cm
8. ky may be estimated using the simplified equations shown below.
9. Examples of how Ts is estimated are shown below.
10. Vs = weighted avg. shear wave velocity for the sliding mass, e.g., for 2 layers, Vs = [(h1)(Vs1) + (h2)(Vs2)]/(h1 + h2)

Dependence on ky

ky	P(D="0")	D (cm)	Dmedian (cm)	D1 (cm)	D3 (cm)
0.020	0.00	95.5	95.5	184.1	49.5
0.05	0.00	36.6	36.6	70.5	19.0
0.07	0.00	22.3	22.3	43.0	11.6
0.1	0.01	12.2	12.1	23.4	6.2
0.15	0.12	5.5	4.9	10.1	1.8
0.2	0.40	3.0	1.5	4.4	<1
0.3	0.86	1.1	<1	<1	<1
0.4	0.98	0.5	<1	<1	<1



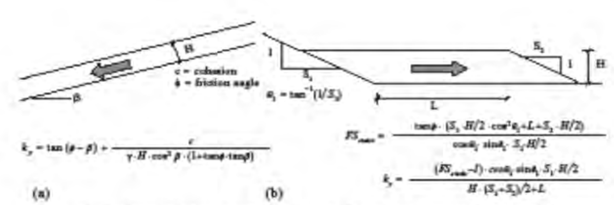


Fig. 14.1. Simplified estimates of the yield coefficient: (a) shallow sliding and (b) deep sliding

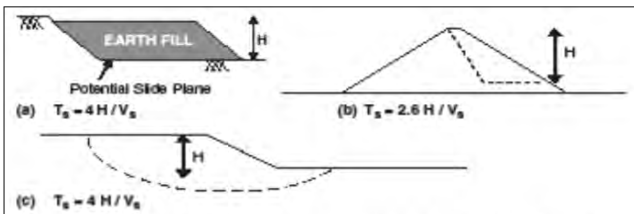


Fig. 14.4. Estimating the initial fundamental period of potential sliding blocks

Figures from Bray, J.D. (2007) "Chapter 14: Simplified Seismic Slope Displacement Procedures," Earthquake Geotechnical Engineering, 4th Inter. Conf. on Earthquake Geotechnical Engineering - Invited Lectures, in Geotechnical, Geological, and Earthquake Engineering Series, Vol. 6, Pitilakis, Kyriazis D., Ed., Springer, Vol. 6, pp. 327-353.