FINAL REPORT

TENMILE TAILING STORAGE FACILITY
3 DAM SEEPAGE AND STABILITY ANALYSES
CLIMAX MINE
CLIMAX, COLORADO

Prepared for
Climax Molybdenum Company
Highway 91 – Fremont Pass
Climax, CO 80429

February 2012

URS Corporation
8181 East Tufts Avenue
Denver, CO 80237

Project No. 22242095.10001

TABLE OF CONTENTS

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

The Climax Molybdenum Company (Climax) is initiating milling operations and will resume tailing placement at the presently inactive Tenmile Tailing Storage Facility (TSF) at the Climax Mine. URS Corporation (URS) was requested by Climax to perform an independent check of the seepage and stability analyses for the Tenmile TSF's decant pond area and embankment (3 Dam) to satisfy the Colorado Division of Reclamation, Mining and Safety (DRMS) third-party review requirements prior to initiating deposition activities. This report presents a summary of our analysis and findings. For purposes of this report, the decant pond area and embankment will be referred to collectively as 3 Dam.

PREVIOUS ANALYSES

URS completed stability analyses for the inactive Robinson, Tenmile and Mayflower TSF embankments (1 Dam, 3 Dam and 5 Dam, respectively) in 2007. Following this, Climax contracted AMEC Earth and Environmental, Inc. (AMEC) to perform stability analyses specifically for the 2008 start-up at 3 Dam. Stability analyses were completed for the operating and post-closure conditions and reported in 2009. Climax requested DRMS review the proposed seismic design criteria of both 3 Dam and 5 Dam in 2008. The design criteria proposed consists of the Operating Basis Earthquake (OBE) for the operating period of the facility, and the Maximum Credible Earthquake (MCE) for the post-closure operating condition. The OBE was calculated using probabilistic methods considering a 7.0 magnitude earthquake with a 475-year return period. The calculated associated ground motions are 0.06g. These design criteria were accepted by DRMS in a letter to Climax dated February 14, 2008.

Other reports and field investigations have been completed by URS, Woodward-Clyde (heritage firm to URS), and by others prior to 2007. These reports, although not specifically discussed within this report, were used to supplement data collected in the URS 2007 report.

2007 Probabilistic Seismic Hazard Analysis

A probabilistic seismic hazard analysis (PSHA) was completed in 2007 for the Climax Mine site. The results of the PSHA serve as the primary characterization of seismic sources in the area. The ground motions developed in the PSHA were used in the analyses completed in 2007 and 2009 by URS and AMEC, respectively.

URS 2007 Analyses

URS completed geotechnical investigations of 1 Dam, 3 Dam and 5 Dam. The work scope included reviewing existing data, performing a geotechnical field investigation, and completing stability analyses of each tailing dam for existing elevations and proposed future height elevations.

The field investigation included test hole drilling, piezometer installation and advancing cone penetrometer testing with pore pressure measurement (CPTU) soundings. Selected samples were tested for index and engineering properties. Results of the investigation were used in liquefaction potential and slope stability analyses.

The liquefaction potential analysis showed the potential for liquefaction during the OBE as low. Slope stability analyses included steady-state and post-earthquake loading conditions for the existing dam height and undrained and post-earthquake loading conditions for the future design elevation. Results of the analyses show the dam meets minimum recommended factors-of-safety of 1.5 and 1.0 for steady-state and post-earthquake loading conditions.

AMEC 2009 Analyses

AMEC completed seepage and stability analyses for 3 Dam in 2009. The seepage analysis was used to estimate steady-state seepage rates and predict phreatic levels within the impoundment at the future design elevation. Slope stability analyses included steady-state, seismic, and post-earthquake loading conditions for the future design elevation. The modeled phreatic surface from the seepage analysis was used for the slope stability analysis. The post-earthquake analysis was performed using undrained conditions under the normal operating pool. Seismic loading was evaluated using a pseudo-static approach. Results of the analyses show the dam meets minimum recommended factors-of-safety of 1.5 and 1.0 for steady-state and post-earthquake loading conditions.

SEEPAGE ANALYSES

A two-dimensional seepage analysis was performed to evaluate the effects of deposition on the phreatic conditions of the existing 3 Dam. The model was calibrated to the existing measured phreatic surface and estimated seepage flows. The maximum section was modeled for the analysis based on the subsurface conditions and location of existing piezometers. Three cases were analyzed for this report and include:

- Case 1: Calibration of Existing Conditions
- Case 2: Steady-State Model (Estimated Future Conditions)
- Case 3: Transient Model (Deposition Conditions at Estimated Future Conditions)

The resulting phreatic surface from the calibration model closely aligns with the observed current phreatic conditions. The results from Case 2 show little difference between the outflows currently observed at the toe of 3 Dam and the calculated outflow. The resulting Case 3 phreatic surface also showed little difference to outflows currently observed at the dam toe and generally matched the Case 2 phreatic surface. The resulting surface from Case 3 was used in the stability analyses completed for the raised dam case. The calculated phreatic surface is higher than that modeled by AMEC in 2009.

STABILITY ANALYSES

An independent stability analysis for operating conditions at 3 Dam was completed for steady-state and post-earthquake loading conditions for the existing dam and the raised dam. Stability was evaluated at the study section representing the maximum dam section. Results of our stability analyses are presented in Table ES-1 and show 3 Dam meets minimum recommended factors of safety for steady-state and post-earthquake loading conditions.

Table ES-1
CALCULATED THEORETICAL FACTORS-OF-SAFETY

Loading Condition	Design Section	Failure Surface	Calculated Minimum FS	Minimum Recommended FS
Static Drained (Steady-State)	Existing Conditions (Elevation 11,107)	Circular	2.0	1.5
		Noncircular	2.1	
	Future Design Elevation (Elevation 11,120)	Circular	2.0	
		Noncircular	2.1	
Post-Earthquake	Existing Conditions (Elevation 11,107)	Circular	1.2	1.0
		Noncircular	1.2	
	Future Design Elevation (Elevation 11,120)	Circular	1.2	
		Noncircular	1.2	

CONCLUSIONS AND RECOMMENDATIONS

Our completed analyses confirm the results of the operating condition analyses performed by AMEC in 2009.

We recommend the following actions be taken upon the resumption of tailing deposition:

- Perform beach profile sampling to evaluate newly deposited tailing. Evaluate the whole tailing gradation as it compares to past whole tailing gradations.
- Evaluate the tailing beach and beach topography to verify that the material aggrades in a manner consistent with that anticipated in the original design.
- Collect samples of the deposited tailing and evaluate the material properties to verify that it is consistent with that envisioned in the design.
- Maintain the decant pond at least 500 feet from the crest under normal conditions.
- Implement weekly review of the data from currently installed piezometers during start-up. Piezometric data review may be decreased to a monthly basis as deemed appropriate by the Engineer of Record (EOR) and based on weekly reading reviews.
- Install additional piezometers, as deemed necessary, along the crest and face of the dam to evaluate the phreatic surface and changes resulting from tailing deposition. Frequency and location of piezometer installation will be established during regularly scheduled inspections.

The Climax Molybdenum Company (Climax) is initiating milling operations and will resume tailing placement on the presently inactive Tenmile Tailing Storage Facility (TSF) at the Climax Mine. URS Corporation (URS) was requested by Climax to perform an independent check of the seepage and stability analyses completed by others for the Tenmile TSF pond area and embankment (3 Dam) to satisfy the Colorado Division of Reclamation, Mining and Safety (DRMS) third-party review requirements prior to initiating deposition activities. This report presents a summary of our analyses and findings. For purposes of this report, the decant pond area and embankment will be referred to as 3 Dam. Presented below is a brief project background, followed by our scope of work and a summary of the report organization.

1.1 PROJECT BACKGROUND

Climax Mine has generally been on standby since 1980, with short, intermittent, multiple-month mining and milling cycles. The Climax Mine established plans to begin active mining operations at Climax in 2007. Work to restart operations was delayed in 2008 because of unfavorable market conditions. Improving economic conditions and rising commodity prices through 2009 and 2010 led to a renewed initiative to restart Climax Mine.

Climax has currently committed to resume milling in early 2012. Tailing deposition will begin initially at the Tenmile TSF and continue for a period of about 2 to 4 years, after which time operations will transition to the Mayflower TSF for the remaining mine life.

1.2 SCOPE OF WORK

Climax requested that URS perform an independent check of the AMEC Earth and Environmental (AMEC) 2009 stability analysis considering the current geometry and planned upstream raise to 3 Dam. Our work included preparing a revised seepage analysis for the current proposed geometry calibrated to current piezometric levels and seepage conditions. We then used the model to estimate future phreatic levels during deposition for the future design elevation. The results of the seepage analyses were used to complete a slope stability evaluation for the operating condition for existing and future design elevation of 3 Dam.

The final dam crest elevation used in our analyses is 11,120 feet. This is an estimated elevation based on mine production forecasts and existing dam and pond geometry. The actual final dam crest elevation is anticipated to be within 5 feet of this elevation.

The results of our analyses are summarized in this report along with recommendations for operating the dam.

1.3 REPORT ORGANIZATION

This report presents a summary of previous analyses and our current geotechnical analyses completed for 3 Dam. The report is organized into the following sections:

Section 1 – Introduction

Section 2 – Previous Analyses

Section 3 – Seepage Analyses

Section 4 – Stability Analyses

Section 5 – Conclusions and Recommendations

Section 6 – General Information

Section 7 – References

This report also includes tables, figures and one appendix that contains geotechnical data from the 2007 URS report.

URS completed stability analyses for the inactive Robinson, Tenmile and Mayflower TSF embankments (1 Dam, 3 Dam and 5 Dam, respectively) in 2007. Following this, Climax contracted AMEC to perform stability analyses specifically for start-up at 3 Dam. Results of the AMEC stability analyses were reported in 2009.

Climax requested DRMS review the proposed seismic design criteria of both 3 Dam and 5 Dam tailing dams in 2008. The design criteria proposed consists of the Operating Basis Earthquake (OBE) for the operating period of the facility, and the Maximum Credible Earthquake (MCE) for the post-closure operating condition. The OBE was calculated using probabilistic methods considering a 7.0 magnitude earthquake with a 475-year return period. The calculated associated ground motions are 0.06g. These design criteria were accepted by DRMS in a letter to Climax dated February 14, 2008.

Other reports and field investigations have been completed by URS, Woodward-Clyde Consultants (heritage firm to URS), and by others prior to 2007 including a seepage analyses completed by URS in 2003. These other reports, although not specifically discussed within this report, were used to supplement data collected in the URS 2007 report. Presented below is a summary of recent analyses completed for the dam.

2.1 2007 PROBABILISTIC SEISMIC HAZARD ANALYSIS

A probabilistic seismic hazard analysis (PSHA) was completed in 2007 for the Climax Mine site. The PSHA included a review of historic seismicity, identification of potential earthquake sources, a site-specific paleoseimogenic evaluation, and a probabilistic analysis generating ground motions and associated return periods. A number of faults have been mapped within 100 kilometers of the area, with the Mosquito Fault being the most active fault, located approximately 3 kilometers from the site. The results of the PSHA serve as the primary characterization of seismic sources in the area. The ground motions developed in the PSHA corresponding to a 475-year return period were used in the analyses completed by AMEC and URS. A summary of these analyses is presented below.

2.2 2007 URS ANALYSES

URS completed geotechnical investigations of 1 Dam, 3 Dam and 5 Dam. The work scope included reviewing existing data, performing a geotechnical field investigation, and completing stability analyses of each tailing dam for existing elevations and proposed future elevations. We have included a copy of the geotechnical field data and laboratory test results in Appendix A. These data form the basis of our prior and current analyses, as well as AMEC's 2009 analyses.

Field Investigation

Field investigations for each dam included cone penetration test (CPTU) soundings and geotechnical test holes at each dam, including 3 Dam, the focus of this current report. CPTU soundings were advanced into the subsurface tailing at 3 Dam in August 2006.

Selected CPTU soundings were collocated with test holes to allow correlation with measured in situ parameters such as standard penetration tests (SPT) and laboratory tests performed on selected tailing samples. Eight CPTU soundings were advanced into 3 Dam and two geotechnical test holes were drilled. The information collected from CPTU soundings and drilled test holes was used to develop an understanding of the internal dam characteristics, the dam construction methods used, as well as historic tailing deposition patterns and practices. Figure 2-1 presents a plan view of 3 Dam showing the test hole and sounding locations included in the 2006 field investigation. Soundings located near or at the crest were advanced between 200 and 225 feet, while soundings advanced further upstream, near the edge of the then-current decant pond, had total depths ranging from 100 to 105 feet. The remaining soundings, advanced in the mid-slope bench, ranged in depth from 92 to 196 feet. The test holes were drilled to depths between 130 and 225 feet. Summary logs presenting the test hole data and CPT soundings data are provided in Appendix A.

Laboratory Investigation

The geotechnical evaluation found that the tailing material contained within 3 Dam generally classified as silty sands, sandy silts, silts, and poorly graded sands (SM, SM-SP, SP, ML). Laboratory testing was performed on selected samples collected during the field investigation. The laboratory tests measured the physical and index properties of the tailing including gradation analyses, hydrometer analyses, water contents, Atterberg limits and specific gravity measurements. Laboratory tests were also conducted to measure the engineering properties of the tailing and included permeability, consolidation, and shear strength. Laboratory test results are provided in Appendix A.

Geotechnical Analyses

Geotechnical analyses performed included liquefaction analyses and slope stability analyses. Liquefaction analyses were completed and the results show that the potential for liquefaction for the design earthquake was low.

Slope stability analyses for 3 Dam were performed at the maximum dam cross-section for the following conditions:

- Steady-state seepage loading conditions for existing height (2006 conditions)
- Post-earthquake loading conditions for existing height
- Undrained loading conditions for future height (elevation 11,120)
- Post-earthquake loading conditions for future height

Internal geometry of the section and material properties were based on the data collected during the 2006 field and laboratory investigations, previous investigations, and previous stability analyses. A seepage analysis was not completed for the 2007 URS report. Future phreatic conditions were estimated based on a seepage analysis completed in 2003, then-current piezometric ranges, and our understanding of how the dam behaves. The results of the stability analyses are as follows:

Table 2-1
SUMMARY OF URS 2007 STABILITY ANALYSES RESULTS

Dam Configuration	Steady-State FS	Undrained FS	Post-Earthquake FS
Existing Height (2006)	2.0	--	1.1
Future Design Elevation	1.8	1.2	1.0
Minimum Recommended FS	**1.5**	**N/A**	**1.0**

2.3 2009 AMEC ANALYSES

AMEC completed seepage and stability analyses in support of the Climax 2010 project in 2009. AMEC reviewed historic design and construction drawings to establish input parameters for their seepage and stability models. AMEC also reviewed historic drawings and other reports to establish a revised internal geometry for the dam.

Seepage Analyses

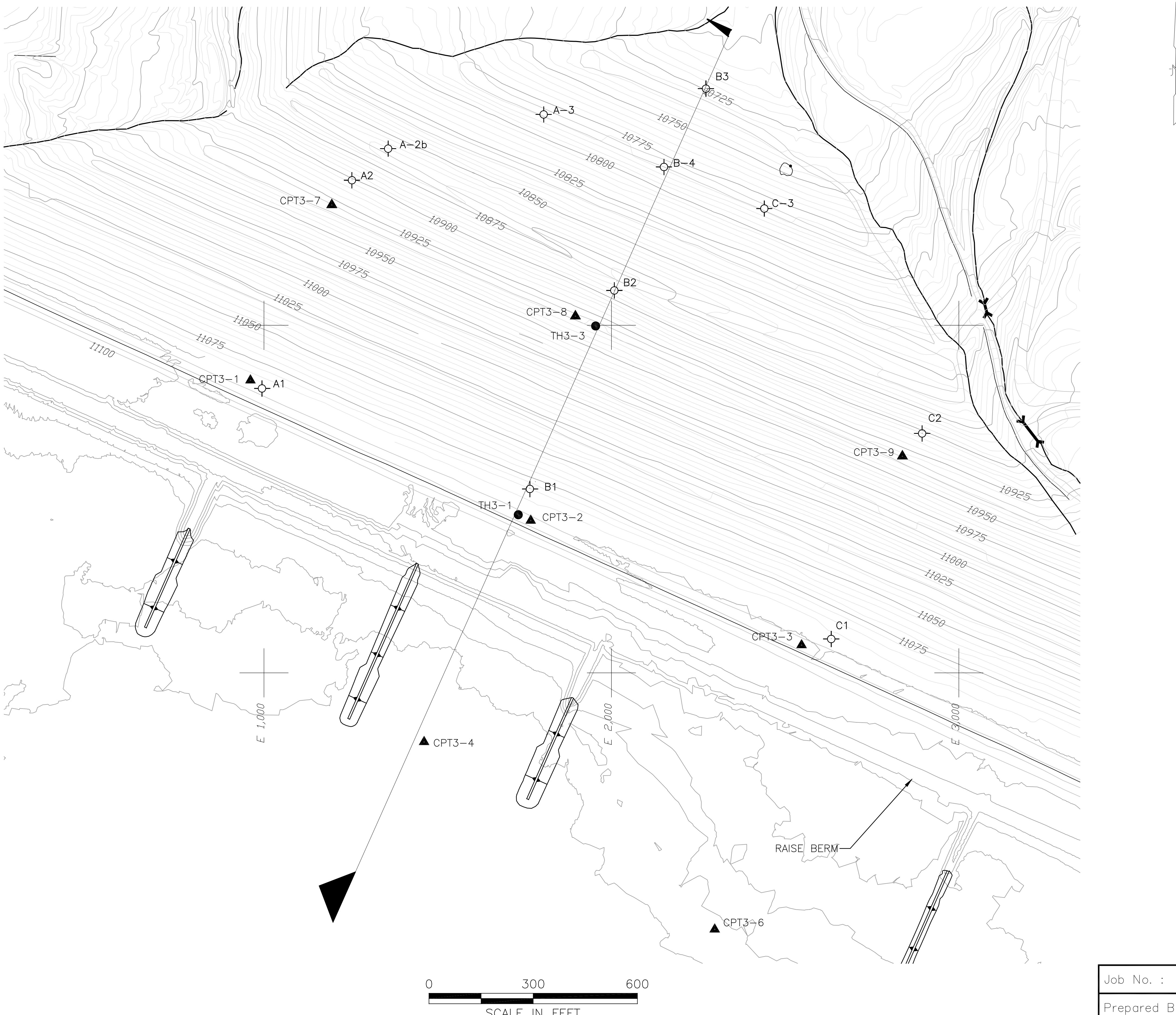
AMEC completed a seepage model for 3 Dam to estimate steady-state seepage rates and predicted phreatic water levels within the impoundment at the future design elevation. The results were used for the stability model.

Slope Stability Analyses

AMEC completed slope stability analyses for steady-state, seismic, and post-earthquake loading conditions for the future design elevation. The modeled phreatic surface from the seepage analysis was used for the slope stability analysis. The post-earthquake analysis was performed using undrained conditions under the normal operating pool. Seismic loading was evaluated using a pseudo-static approach. The results of the AMEC stability analyses are as follows:

Table 2-2
SUMMARY OF AMEC 2009 STABILITY ANALYSES RESULTS

Dam Configuration	Steady-State FS	Pseudo-Static OBE FS	Post-Earthquake FS
Future Design Elevation	2.5	1.7	1.9
Minimum Recommended FS	**1.5**	**N/A**	**1.0**



LEGEND

- ● TH3-1 — TEST HOLE LOCATION/PIEZOMETER INSTALLED DURING 2006 URS INVESTIGATION
- ▲ CPT3-3 — CPTU SOUNDING COMPLETED DURING 2006 URS INVESTIGATION
- A1 — PIEZOMETERS FROM PREVIOUS INVESTIGATIONS

NOTES:

1. BASE TOPOGRAPHY PROVIDED BY CLIMAX MOLYBDENUM COMPANY FROM 2006 AERIAL AND 2011 GROUND SURVEYS.
2. CROSS-SECTION IS SHOWN ON FIGURES PRESENTED IN SECTIONS 3 AND 4.

Job No. : 22242095	3 DAM PLAN VIEW TEST HOLE AND CPTU LOCATIONS
Prepared By : KJW	
Date : FEBRUARY 2012	

N:\Projects\22242095_Climax_Startup_Proj\Sub_00\9.0_Constr_Design\Plan_Sheets\FIG 2-1Dam 3.dwg

A two-dimensional seepage analysis was performed to model the impacts of tailing deposition on the pore pressure conditions in the existing 3 Dam. The seepage model was developed and calibrated to existing conditions at the maximum section, as shown on Figure 2-1. This section was selected for the analysis based on the subsurface conditions and location of existing piezometers. Details of the seepage modeling, including analysis approach and methodology, model development, input parameters, boundary conditions, and results are discussed in the following sections.

3.1 APPROACH AND METHODOLOGY

The SEEP/W program (Version 7.17, Geo-Slope, Inc.) was used for the analyses (GEO-SLOPE 2007). SEEP/W is a finite element software package that can be used to simulate the flow and pore water distribution within porous media. The program simulates both saturated and unsaturated flow of water, under steady-state or transient conditions, and is therefore ideally suited to analyzing flow of water through the embankment and foundation soils.

Steady-state refers to the condition of a flow system where influx (i.e., water moving into the system) is equal to discharge and there is no change in water stored in the system over time.

Transient seepage refers to a model where a change in boundary conditions is applied to an initial starting condition over a specified period of time. The influx into the system does not equal the discharge of the system in a transient analysis. The resulting recharge, in influx over time, can be evaluated relative to the initial condition.

Three cases were evaluated for the maximum section:

- **Case 1** – *Calibration of Existing Conditions* – Calibrate the material properties under steady-state conditions to estimate a phreatic condition representative of the current 2011 raise berm crest elevation of 11,107 feet, phreatic and seepage conditions. The seepage model was then calibrated based on observed phreatic and decant pond levels.
- **Case 2** – *Steady-State Model* – Develop a steady-state model to represent the long-term conditions at the future design crest elevation of 11,120 feet. The analysis was performed for a decant pond located 500 feet upstream of the crest (raise berm), which corresponds to the recommended minimum beach width under normal conditions.
- **Case 3** – *Transient Model* – Develop a transient model to represent temporary active future deposition from the crest of the embankment at the future design crest elevation of 11,120 feet. The transient analysis was performed for 180 days, which corresponds to the anticipated maximum deposition time in any one area. The Case 2 calculated phreatic condition was used as an initial condition to evaluate changes or re-charge of the phreatic condition due to deposition upstream of the crest.

A flux section was incorporated in the analyses for each analyzed case to calculate the unit discharge. Each case and applied boundary conditions are described in more detail below.

3.2 MODEL DEVELOPMENT AND MATERIAL PROPERTIES

A two-dimensional seepage model was constructed at the maximum dam section as shown on Figure 2-1. Details of the external and internal geometry for this section are discussed in Section 4.3.1 since the same model was used. The analyzed cross-section is shown on Figure 3-1.

Material properties used for the seepage analyses include saturated hydraulic permeabilities, horizontal to vertical permeability ratios, hydraulic conductivity and volumetric water content functions. Material properties were developed using laboratory data, field testing data, historical performance, published values, and engineering judgment. We reviewed the material properties used in the 2003 URS and 2009 AMEC seepage analyses when selecting properties for the current analysis.

The material properties were then validated against laboratory data from the 2007 URS report. Twenty-three gradations were performed on the 3 Dam tailing sands for the 2007 URS report. These gradations were evaluated using six established equations relating gradation to vertical hydraulic conductivity (k_v) including Kozeny-Carmen, modified Hazen, Lincoln, Slichter, Hinds, and Chapuis. The results of this analysis are presented on Figure 3-2, along with the selected design value for the tailing sands. The selected design value appears to match well with the range of values calculated from the six methods listed above.

The tailing sand and other input parameter properties were further calibrated for the current seepage analyses based on review of slope geometry, and recent piezometer and seepage outflow data. The calibrated material properties for the current seepage analysis are presented in Table 3-1.

Table 3-1
SUMMARY OF MATERIAL PROPERTIES USED IN SEEPAGE ANALYSES

Material	Horizontal Hydraulic Conductivity k_h		Anisotropy Ratio k_h/k_v
	(cm/s)	(ft/s)	
Tailing Sand	3.0×10^{-4}	1.0×10^{-5}	1
Tailing Slime	7.0×10^{-5}	2.3×10^{-6}	10
Starter Dam	1.4×10^{-3}	4.6×10^{-5}	4
Glacial Foundation Material	6.1×10^{-3}	2.0×10^{-4}	1
Bedrock	3.0×10^{-6}	9.9×10^{-8}	1

The analyses were calibrated to observed phreatic levels (Case 1) located at the maximum section. Piezometers B-4, B-3, B-2, and B-1, as shown on Figure 2-1, were used to calibrate the current analysis. The saturated permeabilities and anisotropic permeability ratios were adjusted from the previous URS and AMEC models until the predicted conditions were similar to observed phreatic conditions as shown on Figure 3-1. The 2003 seepage analysis modeled the tailing dam founded on bedrock, whereas the AMEC analysis was founded on a glacial material. The current analysis models the tailing dam founded on glacial foundation material as the AMEC model foundation was corroborated with recently located historical drawings. Adjustments to the saturated permeability and anisotropic permeability ratios were performed to account for the starter dam and the glacial foundation material that was added to the current seepage analysis. Although these properties are similar to those used in previous URS and AMEC analyses, the saturated permeability and anisotropic permeability ratios were adjusted so the observed and predicted phreatic conditions were more similar.

The total discharge from the calibrated model was estimated to range between 650 and 1,600 gpm. This seepage outflow generally corresponds with the observed seepage outflow of approximately 1,200 gpm and within the limits of the model and known material properties.

Case 1: Calibration of Existing Conditions

The objective of Case 1 was to calibrate the seepage model under steady-state conditions to the maximum sustained phreatic conditions recorded between October 1998 and July 2011 in the B-line piezometers and observed seepage rates at the toe of the embankment recorded between January 2011 and September 2011. Boundary conditions applied to this model include total head nodes assigned upstream of the existing slope crest. The total head nodes correspond to the maximum sustained elevation of the pond at 11,079 feet recorded between January 1996 and January 2010. Review nodes were modeled along the existing downstream slope and downstream of the toe. A cross-section with Case 1 boundary conditions is presented on Figure 3-1.

Case 2: Future Design Crest Elevation with Decant Pond Under Long Term Conditions

The calibrated material properties from Case 1 were used for the Case 2 calculations. Total head nodes were applied 500 feet upstream of the crest of the proposed embankment raise to model the decant pond. This pond distance represents the minimum recommended beach width under normal conditions. The deposited tailing surface was modeled as decreasing at a slope of approximately 0.5 percent towards the interior, which results in an assumed elevation of the decant pond at 11,117.5 feet corresponding to 2.5 feet of freeboard. Total head nodes of 11,117.5 were applied to model the decant pond. Review nodes were modeled along the existing downstream slope from mid-height to the toe. A cross section with Case 2 boundary conditions is presented on Figure 3-1.

Case 3: Active Deposition Under Transient Seepage Conditions

A flux was applied in the area between the crest and the edge of the decant pond from Case 2 to model active deposition during spigotting from the future design crest. The steady-state phreatic condition from the Case 2 analysis was used as the “initial condition” for the transient Case 3 calculations. A unit flux was applied to model active deposition at a rate of 28,000 tpd with 35% solids. The unit flux was applied 30 feet upstream of the embankment crest to be consistent with depositional practices. Review nodes were modeled along the existing downstream slope from mid-height to the toe. A cross section with Case 2 boundary conditions is presented on Figure 3-1.

3.3 RESULTS

The results of the seepage model were used as input into development of the phreatic surface used for the stability analysis. Results for each case are discussed below.

Case 1 Results: Calibration of Existing Conditions

A sustained decant pond elevation of 11,079, approximately 500 feet upstream of the dam crest, was modeled for existing conditions for steady-state seepage conditions. The seepage results and boundary conditions used are presented on Figure 3-1. The resulting phreatic surface from the model closely aligns with the observed current phreatic conditions. The calibrated phreatic surface was about 7 feet below the lowest reading for piezometer B-1, 6 feet above the highest reading for piezometer B-2, and within the range of readings for piezometers B-3 and B-4. The seepage outflow calculated in the model corresponds well to the current observed outflow at the site. Modeled differences are within tolerable calibration limits.

Case 2 Results: Future Design Crest with Decant Pond Under Long Term Conditions

A sustained decant pond elevation of 11,117.5, approximately 500 feet upstream of the dam crest (raise berm crest), was modeled for steady-state conditions for the future design elevation to evaluate long-term steady-state conditions. The seepage results and boundary conditions used are presented on Figure 3-1. There was not a noticeable difference in the seepage outflow from the existing model (Case 1). However, the Case 2's resulting estimated phreatic surface was between 0 and 8 feet below the calibrated phreatic surface from the existing conditions (of Case 1). This drop in the phreatic surface appears to be a result of the stepback to the raise berm (constructed in 2008, for the new deposition) as the stepback of about 225 feet (historic crest to centerline) provides a beach that lies further into the impoundment that results in a drop in the phreatic surface beneath the downstream slope.

Case 3 Results: Active Deposition Under Transient Seepage Conditions

The transient seepage analysis for the future design elevation showed an increase in the phreatic surface for the upper 200 feet (between elevation 11,120 and elevation 10,920) but generally matched the phreatic surface from Case 2. The seepage results and boundary conditions used are presented on Figure 3-1. Deposition had a large effect on the upper portion of the phreatic surface and little effect on the toe phreatic surface condition. There was not a noticeable difference in the seepage outflow from the existing model. Based on the results observed in this model, the stability model used this phreatic surface to reflect active deposition. The current modeled phreatic surface was higher than that modeled by AMEC in 2009.

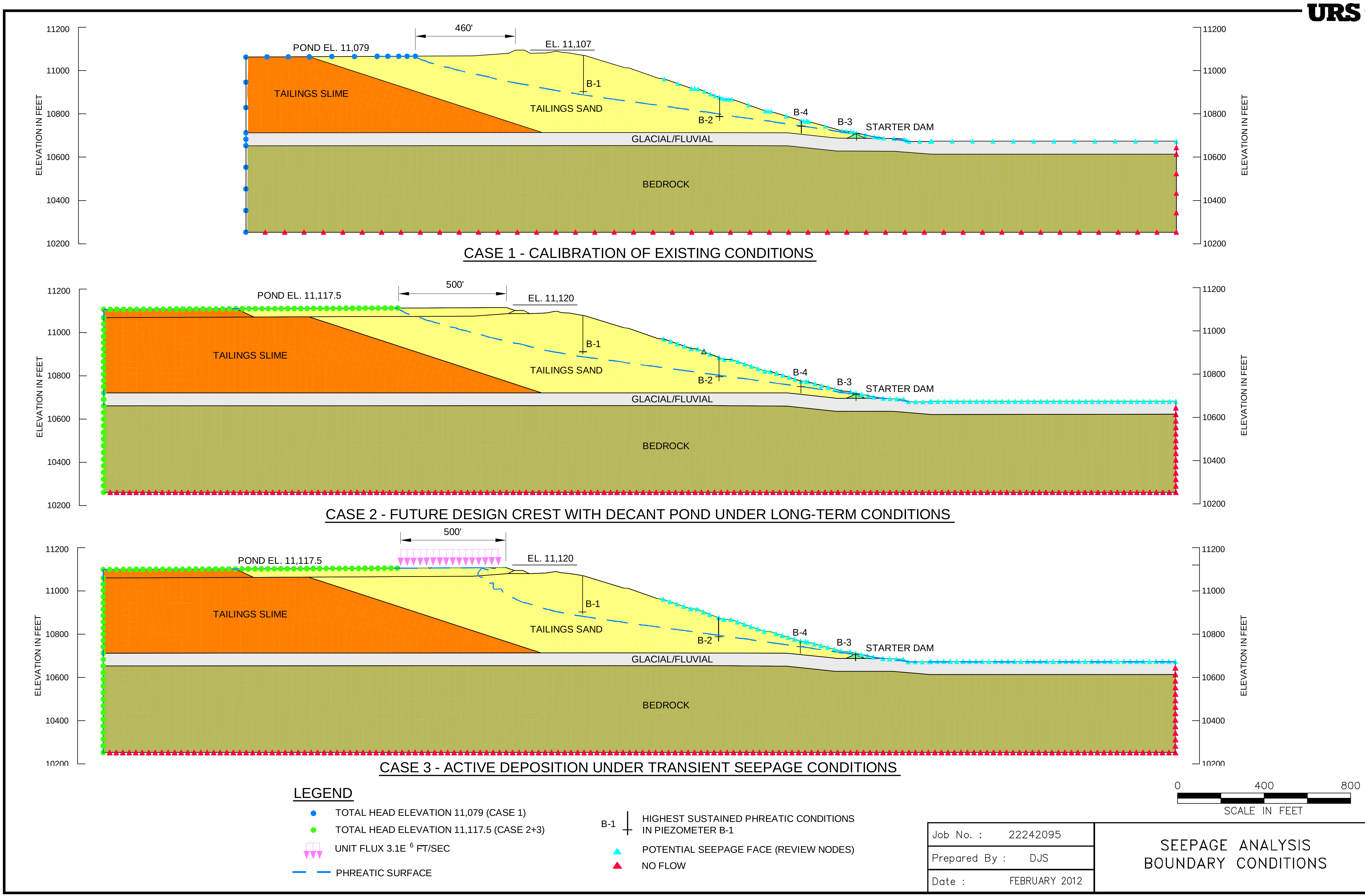
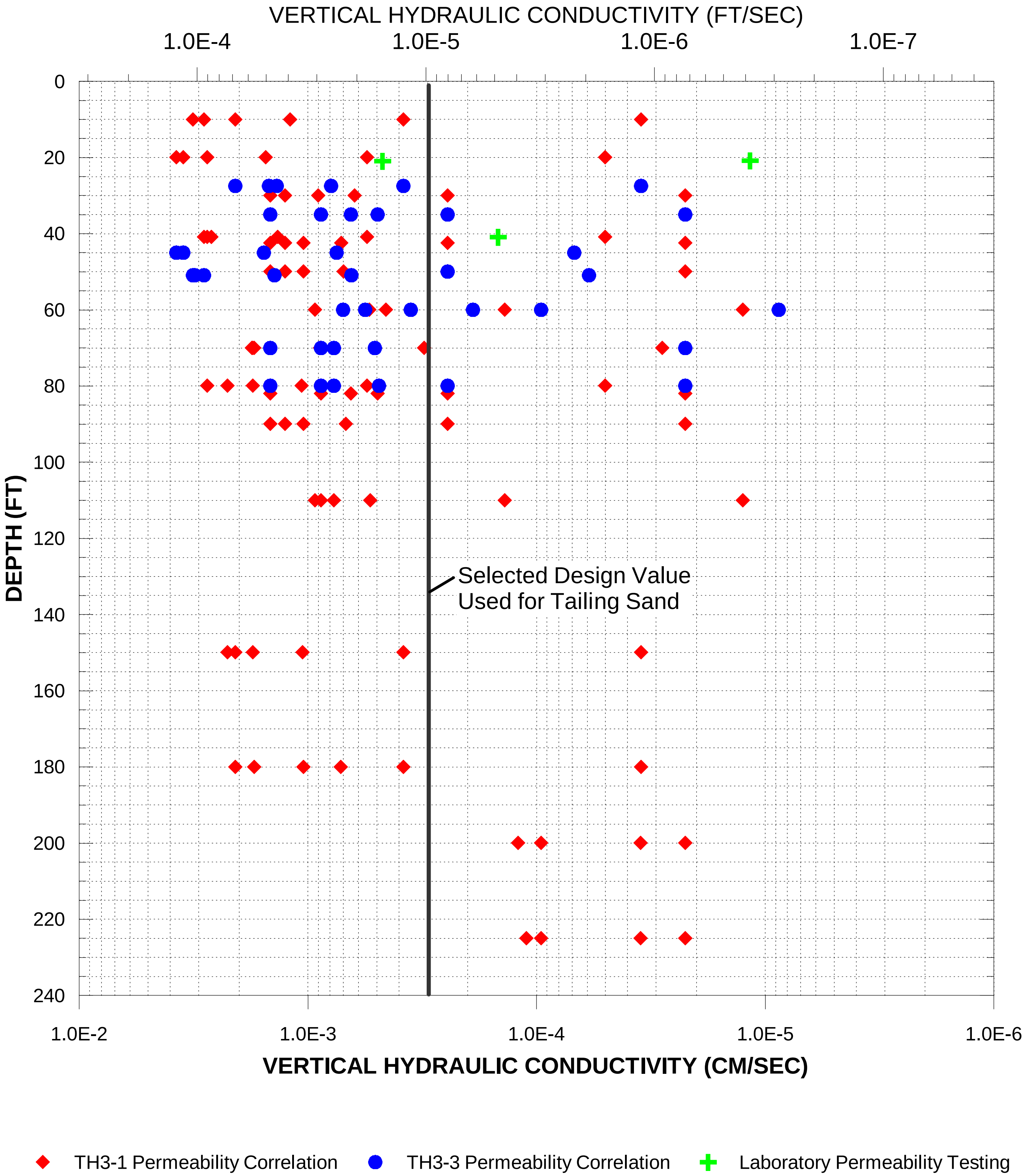


FIG. 3-1

N:\Projects\22242095_Climax_Startup_Proj\Sub_0017.0_CAD_GIS\Report Figures\Seepage\Climax Seepage Figure.dwg



Notes: Hydraulic conductivites shown included correlations using the following methods: Carrier from KozCar EQN, Lincoln EQN, Modified Hazen EQN, Chapuis EQN, Slichter EQN, Justin Hinds EQN; and laboratory data.

Project No. 22242095	Climax Startup Project	Hydraulic Conductivity Summary	FIGURE 3-2
	URS		

N:\Projects\22242095_Climax_Startup_Proj\Sub_00010.0_Calculations_Analysis_Data\3 Dam Seepage Analysis\Referenced Data\Hydraulic Conductivity\Hydraulic Conductivity Correlations.grf Hydraulic Conductivity.xlsx DJS

Slope stability analyses were performed for the existing conditions and the future design elevation, corresponding to crest elevations of 11,107 and 11,120 feet, respectively. The stability of each configuration was evaluated for one study section representing the maximum cross section. Discussions of our approach to the analyses, loading conditions, model development, material properties, and results are presented below.

4.1 APPROACH AND METHODOLOGY

The analyses were performed using UTEXAS4 (Wright, 2008). The program was used to calculate the factor-of-safety (FS) against instability along circular and non-circular shear surfaces. The program assumes that a distinct failure surface occurs in the soil mass. The stability of the slope is calculated in terms of FS. The FS is defined as the ratio of the average available strength and average mobilized shear stress along a given failure surface. Spencer's method of slices was used for the analyses. Spencer's method satisfies conditions of static equilibrium, including horizontal and vertical force imbalance and moment imbalance. Non-circular and circular shear surfaces were identified using the iterative search routines in the program to calculate the FS under each loading condition.

4.2 LOADING CONDITIONS

Our evaluation focused on the operating conditions for 3 Dam. The pertinent loading conditions considered in our analysis are described below.

Steady-State Seepage Loading Condition

The steady-state seepage drained loading condition represents the long-term stability of the dam. Stability analyses were performed using drained shear strengths for the tailing sands, slimes, and cycloned sand. The minimum required FS is 1.5 for the steady-state condition.

Post-Earthquake Loading Condition

A post-earthquake analysis was completed for the operating condition. A liquefaction analysis was performed on 2006 CPTU sounding and test hole data and found the potential for the saturated tailing to liquefy is low.

TABLE 4-1
SUMMARY OF LIQUEFACTION POTENTIAL

Test Hole or Sounding	Observed Depth to Water (2011)	Lowest Observed FS
TH 3-1	166.4	4.49
TH 3-3	108.6	4.32
CPT 3-2	50.7	2.84
CPT 3-4	0	1.18

The post-earthquake loading condition represents an overall decrease in the shear strength of the saturated, unconsolidated materials in a dam. This reduction in strength represents the rearrangement and eventual loss of soil structure in saturated materials that do not liquefy under strong shaking.

4.3 MODEL DEVELOPMENT

Slope stability analyses were performed for the existing dam conditions and the future design elevation at the study section located at the generalized maximum section of 3 Dam, as shown on Figure 2-1. The pore pressure conditions and material properties used in our stability models and analyses are described below.

4.3.1 Model Development

The previous 2007 URS and 2009 AMEC analyses were performed for the cross-section located at the maximum 3 Dam section. Updated seepage and stability analyses were completed considering the existing and future dam elevations. A discussion of geometry is presented below. A plan view of the maximum dam section is shown on Figure 2-1.

External Geometry

The existing external geometry was developed based on topography from the 2011 ground survey data combined with the 2006 aerial survey. The original dam crest ranges in elevation from about 11,095 to 11,100 feet.

A deposition or raise berm was constructed in 2008. The new raise berm was moved upstream (stepped back) from the dam crest about 225 feet (to the approximate berm centerline) and the new berm has a maximum elevation of 11,107 feet. Tailing will be deposited upstream of the berm and the dam will be raised upstream to a future design elevation for 3 Dam of 11,120 feet (approximate). The berm will be raised with a 3 horizontal:1 vertical (3H:1V) slope. The decant pond will be operated at least 500 feet upstream of the raise berm, which is considered the minimum recommended beach width under normal conditions.

Internal Geometry

The cross-section analyzed included the updated internal geometry to reflect newly available information. The bedrock/natural ground contact, glacial-fluvial layer, and starter dam geometry parameters were developed from historic drawings and pre-dam topography provided by Climax. The interface between tailing sands and fine tailing (slimes) was based on CPTU sounding and test hole data from the URS 2007 report. Figures presented in this Section and Section 3 show the internal cross-section geometry.

A high point in the bedrock has been identified based on recently recovered historic documents. The high point in the bedrock effectively raises the ground surface in a small area. We performed a sensitivity analysis to evaluate the high point's effect on the critical failure surfaces and found the high point had negligible impact on the stability results.

4.3.2 Pore Pressure Conditions

The phreatic surface for existing conditions, as calculated in the seepage analysis (Case 1), is closely aligned with observed phreatic conditions; however, the phreatic surface used for the existing height section is based on the actual piezometer readings.

The phreatic surface estimated for the future design elevation section was based on the corresponding seepage analysis that assumes the decant pond is maintained within 500 feet of the dam crest (raise berm crest) deposition occurring continuously for 180 days (Case 3).

4.3.3 Material Properties

The material properties of the fine tailing (slimes), tailing sands, starter dam and bedrock (natural ground) used in the stability analyses were developed for the 2007 URS analyses and were based on engineering judgment, experience with similar materials, published information, and site-specific engineering properties developed from previous site investigations.

Consolidated-drained strength parameters of the various material types were used for the steady-state analyses. These strength parameters represent the long-term, steady-state strength of the materials, assuming fully “drained” conditions. Mobilization of this strength occurs when changes in stress conditions and/or pore pressures are not large or sudden enough to induce excess pore water pressures within the saturated materials.

For post-earthquake loading conditions, consolidated-drained strengths were again used for all materials except the saturated tailing sands and saturated tailing slimes. The peak normalized undrained strength (s_u/p') was used with a 20% reduction applied to account for strain softening of the saturated tailing materials under earthquake loading.

The properties for the glacial-fluvial foundation were developed by AMEC for their 2009 report. The other material properties used were similar to those used in the 2007 URS report (as well as the 2009 AMEC report). The properties used in the stability analyses are summarized in Table 4-2.

Table 4-2
SUMMARY OF MATERIAL PROPERTIES USED IN STABILITY ANALYSES

Material	Unit Weight (pcf)	Drained Shear Strength		Post-Earthquake Shear Strength	
		c' (psf)	φ' (degrees)	c' (psf)	φ' (degrees)
Unsaturated Tailing Sands	110	0	35	0	35
Saturated Tailing Sands	115	0	35	$s_u/p' = 0.36$	
Slimes	110	500	25	$s_u/p' = 0.32$	
Glacial-Fluvial Foundation Material	145	0	35	0	35
Bedrock	150	5,000	50	5,000	50

4.4 RESULTS

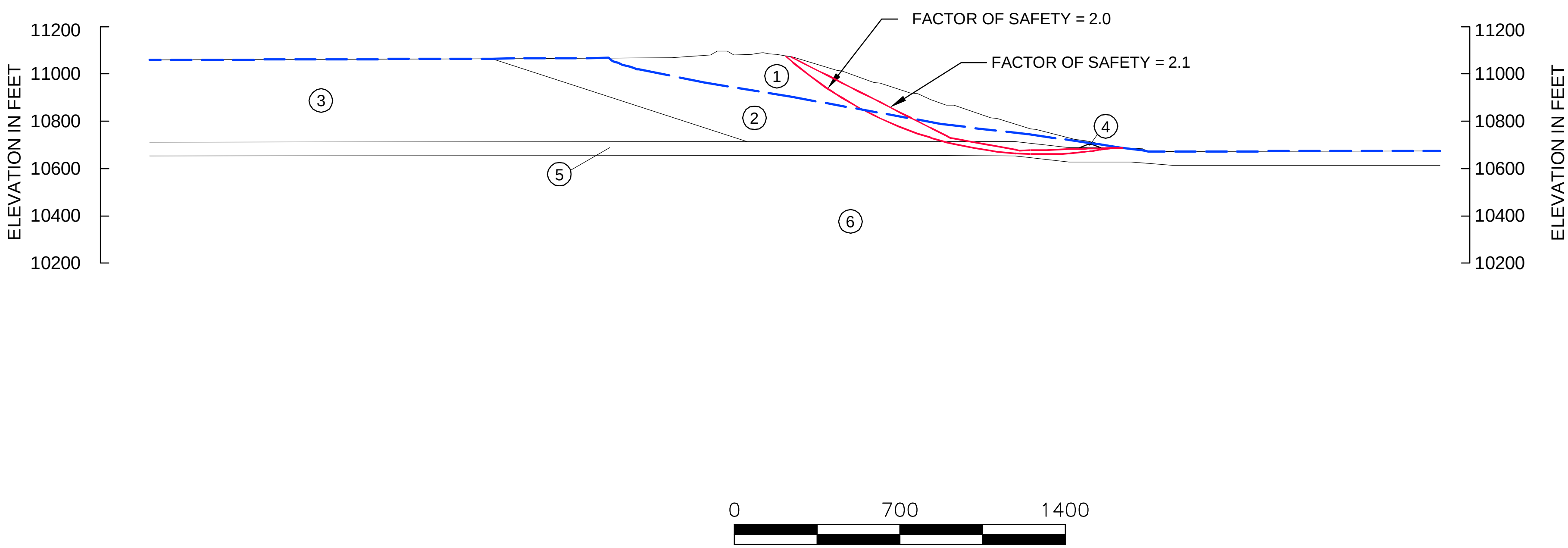
A summary of the stability analyses results for steady-state and post-earthquake loading conditions for the operating dam for existing and future design elevations is presented in Table 4-3. The calculated critical shear surfaces are shown on Figures 4-1 through 4-4. The calculated FS values meet or exceed the minimum recommended values.

Table 4-3
CALCULATED THEORETICAL FACTORS-OF-SAFETY FOR STABILITY ANALYSES

Loading Condition	Design Section	Failure Surface	Calculated Minimum FS	Minimum Recommended FS
Static Drained (Steady-State)	Existing Conditions (Elevation 11,107)	Circular	2.0	1.5
		Noncircular	2.1	
	Future Design Elevation (Elevation 11,120)	Circular	2.0	
		Noncircular	2.1	
Post-Earthquake	Existing Conditions (Elevation 11,107)	Circular	1.2	1.0
		Noncircular	1.2	
	Future Design Elevation (Elevation 11,120)	Circular	1.2	
		Noncircular	1.2	

The results show that our calculated theoretical FS values meet required criteria. The values calculated were less than values calculated by AMEC. The difference is likely the result of a lower phreatic surface modeled by AMEC.

NO.	MATERIAL DESCRIPTION	UNIT WEIGHT (pcf)	COHESION (psf)	FRICTION ANGLE (degrees)
1	UNSATURATED TAILING SANDS	110	0	35
2	SATURATED TAILING SANDS	115	0	35
3	TAILING SLIMES	110	500	25
4	STARTER DAM	145	0	35
5	FOUNDATION	145	0	35
6	BEDROCK	150	5000	50



Job No. : 22242095

Prepared by : BRF

Date : FEBRUARY 2012

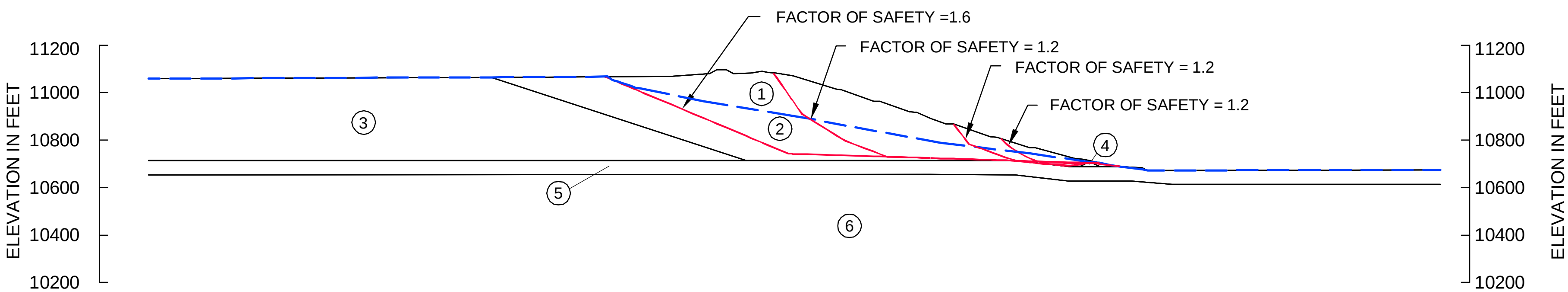
STABILITY ANALYSIS RESULTS
EXISTING CONDITIONS
STEADY-STATE SEEPAGE

FIG. 4-1

N:\Projects\22242095_Climax_Startup_Proj\Sub_00\7.0_CAD_GIS\Report Figures\Stability\Climax Stability Figure.dwg

URS

NO.	MATERIAL DESCRIPTION	UNIT WEIGHT (pcf)	COHESION (psf)	FRICTION ANGLE (degrees)
1	UNSATURATED TAILING SANDS	110	0	35
2	SATURATED TAILING SANDS	115	s_u/p' = 0.36	
3	TAILING SLIMES	110	s_u/p' = 0.32	
4	STARTER DAM	145	0	35
5	FOUNDATION	145	0	35
6	BEDROCK	150	5000	50



0 700 1400

SCALE IN FEET

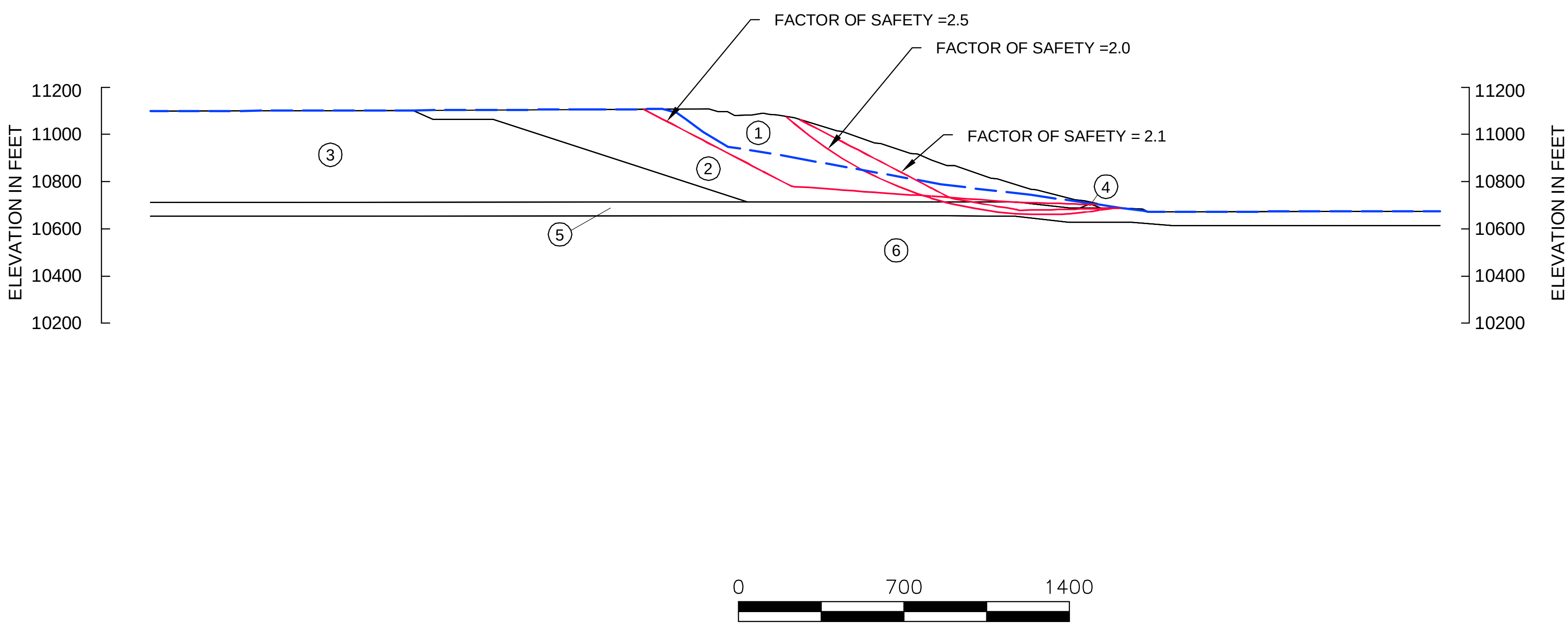
Job No. : 22242095	STABILITY ANALYSIS RESULTS EXISTING CONDITIONS POST-EARTHQUAKE
Prepared by : BRF	
Date : FEBRUARY 2012	

FIG. 4-2

N:\Projects\22242095_Climax_Startup_Proj\Sub_00\7.0_CAD_GIS\Report Figures\Stability\Climax Stability Figure.dwg

URS

NO.	MATERIAL DESCRIPTION	UNIT WEIGHT (pcf)	COHESION (psf)	FRICTION ANGLE (degrees)
1	UNSATURATED TAILING SANDS	110	0	35
2	SATURATED TAILING SANDS	115	0	35
3	TAILING SLIMES	110	500	25
4	STARTER DAM	145	0	35
5	FOUNDATION	145	0	35
6	BEDROCK	150	5000	50

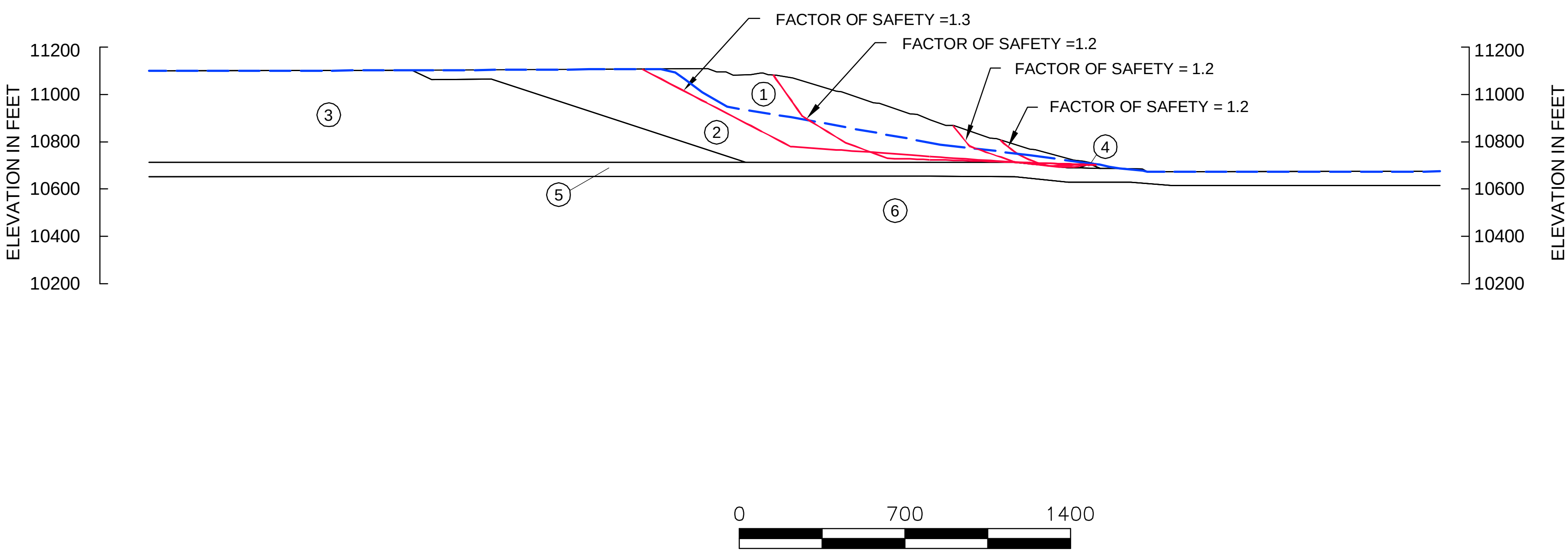


Job No. : 22242095	STABILITY ANALYSIS RESULTS ESTIMATED FUTURE CONDITIONS STEADY-STATE SEEPAGE
Prepared by : BRF	
Date : FEBRUARY 2012	

FIG. 4-3

N:\Projects\22242095_Climax_Startup_Proj\Sub_00\7.0_CAD_GIS\Report Figures\Stability\Climax Stability Figure.dwg

NO.	MATERIAL DESCRIPTION	UNIT WEIGHT (pcf)	COHESION (psf)	FRICTION ANGLE (degrees)
1	UNSATURATED TAILING SANDS	110	0	35
2	UNSATURATED TAILING SANDS	115	$s_u/p' = 0.36$	
3	TAILING SLIMES	110	$s_u/p' = 0.32$	
4	STARTER DAM	145	0	35
5	FOUNDATION	145	0	35
6	BEDROCK	150	5000	50



Job No. : 22242095	STABILITY ANALYSIS RESULTS ESTIMATED FUTURE CONDITIONS POST–EARTHQUAKE
Prepared by : BRF	
Date : FEBRUARY 2012	

FIG. 4–4

N:\Projects\22242095_Climax_Startup_Proj\Sub_00\7.0_CAD_GIS\Report Figures\Stability\Climax Stability Figure.dwg

URS was requested by Climax to perform an independent check of the seepage and stability analyses for 3 Dam to satisfy the DRMS third-party review requirements prior to initiating deposition activities. Seepage analyses were completed for 3 Dam to calibrate the existing phreatic surface and predict future phreatic levels during active deposition. Slope stability analyses for 3 Dam included evaluating steady-state and post-earthquake loading conditions for the existing height and the future design height using current seepage analysis results under the operating conditions.

Presented below is a summary of conclusions followed by recommendations for further actions. Conclusions and recommendations were developed based on the results of the analyses and on our experience with these and other tailing dams.

5.1 CONCLUSIONS

Steady-state seepage and post-earthquake stability analyses were completed for the dam at its existing height for the operating condition. The phreatic surface was based on values calculated using a revised seepage model. Liquefaction analyses completed indicated the material has a low risk for liquefaction under the design earthquake. The stability results for the maximum dam section, presented in Table 4-3, indicate the dam meets or exceeds the minimum FS design criteria.

Steady-state seepage and post-earthquake stability analyses were also completed for the future design height for the design earthquake. The proposed future height is a 13-foot increase to the raise berm that is stepped back from the existing dam crest. The phreatic surface was based on the current seepage model that showed a slight increase in the phreatic surface due to active deposition. Liquefaction analyses completed indicated the material has a low risk for liquefaction under the design earthquake. The stability results for the maximum dam section, presented in Table 4-3, indicate the dam meets or exceeds the minimum FS design criteria.

Our stability analysis results confirm the dam meets steady-state and post-earthquake stability criteria for both existing height and future design elevations under operating conditions.

5.2 RECOMMENDATIONS

The operation of 3 Dam will depend on the proper management of the tailing facility and emplacing tailing with properties envisioned for this dam. With a new mill, it will be important to observe and capture the material properties and changes and evaluate potential impacts tailing operations may have on operation of the facility.

Comparing deposited mill tailing with those presently emplaced is important to the overall successful operation of the facility and part of what is known as the "observational approach." The observational approach consists of evaluating the in-place tailing properties with those modeled in the original analysis. It is an iterative process that occurs throughout the life of the dam. With this in mind, we recommend the following actions when deposition resumes:

- Perform beach profile sampling to evaluate newly deposited tailing. Evaluate the whole tailing gradation as it compares to past whole tailing gradations.
- Evaluate the tailing beach and beach topography to verify that the material aggrades in a manner consistent with that anticipated in the original design.

- Collect samples of the deposited tailing and evaluate the material properties to verify that it is consistent with that envisioned in the design.
- Maintain the decant pond at least 500 feet from the crest under normal conditions.
- Implement weekly review of the data from currently installed piezometers during start-up. Piezometric data review may be decreased to a monthly basis as deemed appropriate by the EOR and based on weekly reading reviews.
- Install additional piezometers, as deemed necessary, along the crest and face of the dam to evaluate the phreatic surface and changes resulting from tailing deposition. Frequency and location of piezometer installation will be established during regularly scheduled inspections.

Should variations in the material properties be identified, the source or cause should be reviewed and it may be potentially necessary to revise the stability analyses. The need for updating the stability analyses should be reviewed by the engineer-of-record and implemented as needed in the future.

The recommendations provided above are common to any start-up, expected and planned for at this dam, and typical for construction of an upstream method tailing dam. The recommendations have been discussed with Climax and will be implemented as part of the operations strategy and as part of normal operation and maintenance. Implementation of the recommendations will be addressed in the Tenmile TSF Operations and Maintenance Manual.

Professional judgments are presented in this report. These are based partly on evaluation of technical information gathered and partly on our general experience with similar projects.

It is important to note the condition of a tailing dam is evolutionary in nature and depends on numerous and constantly changing internal and external conditions. It would be incorrect to assume the present condition of a dam will continue to represent the condition of that dam at some point in the future. Only through periodic, updated inspections and ongoing monitoring can unsafe conditions be detected so that corrective action can be taken. Likewise, continued care and maintenance are necessary to minimize the risk of unsafe conditions.

URS services were performed within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession. No warranty, guarantee, or other representation, either expressed or implied, is included or intended in our proposals, contracts, or reports.

AMEC Earth and Environmental, March 2009, *Tailing and Process Water Management, Volumes 1 (Book 1 of 6), Report on Detailed Design*

Chapuis, R.P., 2004, *Predicting the Saturated Hydraulic Conductivity of Sand and Gravel Using Effective Diameter and Ratio,* Canadian Geotechnical Journal, Volume 41, pp. 787 - 795

Geo-Slope, 2007, *Seepage Modeling with SEEP/W, Version 7.17, Geo-Slope International, Ltd., Calgary, Alberta, Canada*

Robertson, P.K., 1990, *Soil Classification using the Cone Penetration Test,* Canadian Geotechnical Journal, Volume 27, pp.151 – 158

Robertson, P.K., and Wride, C.E., *1998, Evaluating Cyclic Liquefaction Potential using the Cone Penetration Test,* Canadian Geotechnical Journal, Volume 35, pp.442 – 459

Robertson, P.K., 2009, *Interpretation of Cone Penetration Tests – A Unified Approach,* Canadian Geotechnical Journal, Volume 46, No. 11, pp.1337 – 1355

URS Corporation, May 2003, *Mayflower and Tenmile Tailing Dams, Decant and Crest Berms, Climax Mine, Climax, Colorado*

URS Corporation, January 2007, *Slope Stability Evaluation, Robinson, Tenmile and Mayflower Tailing Dams, Climax Mine, Climax, Colorado*

Wright, S.G., 2008, *UTEXAS4: A Computer Program for Slope Stability Calculations, Ensoft, Inc., Austin, Texas*

Appendix A

Geotechnical Data from 2007 URS Report

URS

LEGEND

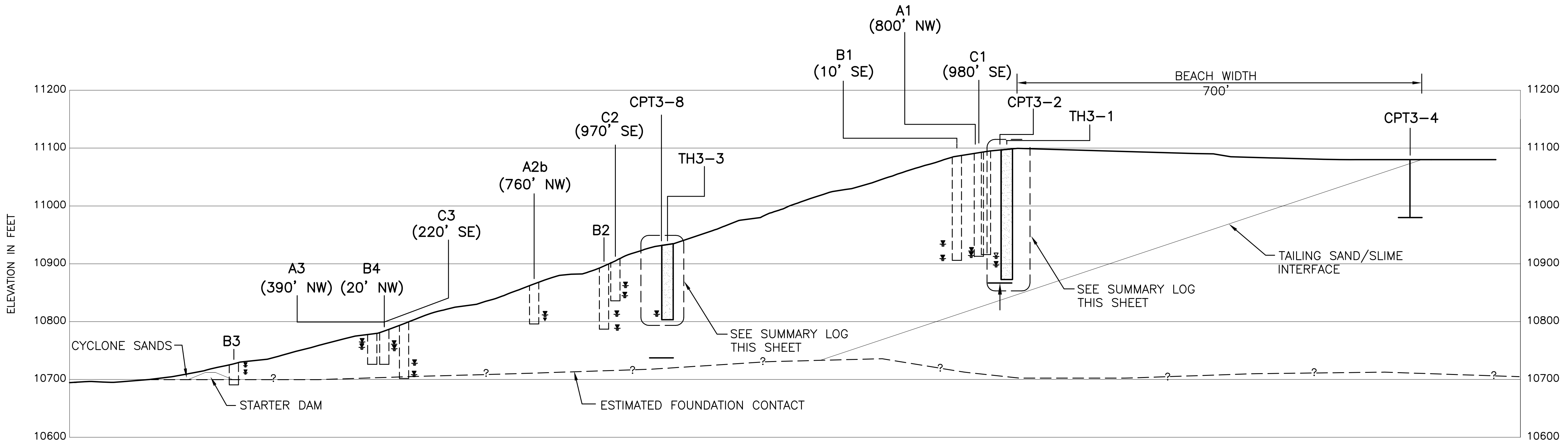
- ● TH3-1 TEST HOLE LOCATION/PIEZOMETER INSTALLED DURING 2006 URS INVESTIGATION
- ▲ CPT3-3 CPTU SOUNDING COMPLETED DURING 2006 URS INVESTIGATION
- A1 PIEZOMETERS FROM PREVIOUS INVESTIGATIONS

NOTES:

1. BASE TOPOGRAPHY PROVIDED BY CLIMAX MOLYBDENUM COMPANY FROM 2006 AERIAL AND 2011 GROUND SURVEYS.
2. CROSS-SECTION IS SHOWN ON FIGURES PRESENTED IN SECTIONS 3 AND 4.

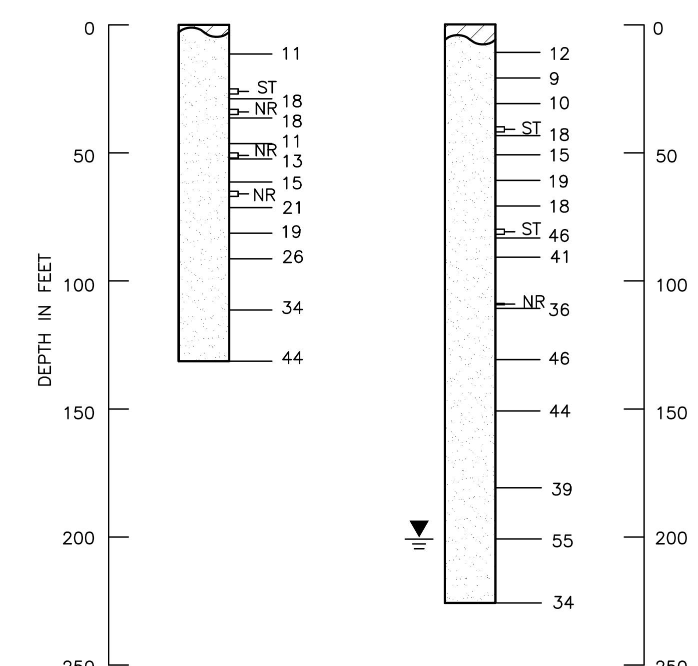
Job No. : 22242095	3 DAM PLAN VIEW TEST HOLE AND CPTU LOCATIONS
Prepared By : KJW	
Date : FEBRUARY 2012	

N:\Projects\22242095_Climax_Startup_Proj\Sub_00\9.0_Constr_Design\Plan_Sheets\FIG 2-1Dam 3.dwg



SECTION B

0 100 200 400
SCALE IN FEET



SUMMARY LOGS

NOTES:

1. REFER TO FIGURE 2 FOR SECTION LOCATION.
2. SUBSURFACE CONDITIONS FOR PIEZOMETERS NOT INSTALLED DURING THIS INVESTIGATION ARE NOT SHOWN.
3. CONE PENETRATION TESTING (CPT) PERFORMED BETWEEN AUGUST 8 AND 14, 2006.
4. TEST HOLES (TH SERIES) DRILLED AND PIEZOMETERS INSTALLED BETWEEN SEPTEMBER 11 AND 26, 2006.
5. WATER LEVELS SHOWN ARE HIGHEST AND LOWEST RECORDED MEASUREMENTS FROM 2004 TO 2005. PIEZOMETER DATA PROVIDED BY CLIMAX MINE.
6. ORIGINAL FOUNDATION CONTACT BASED ON TEST HOLE DATA AND PREVIOUS INVESTIGATIONS. ACTUAL CONTACT MAY VARY FROM THOSE SHOWN.

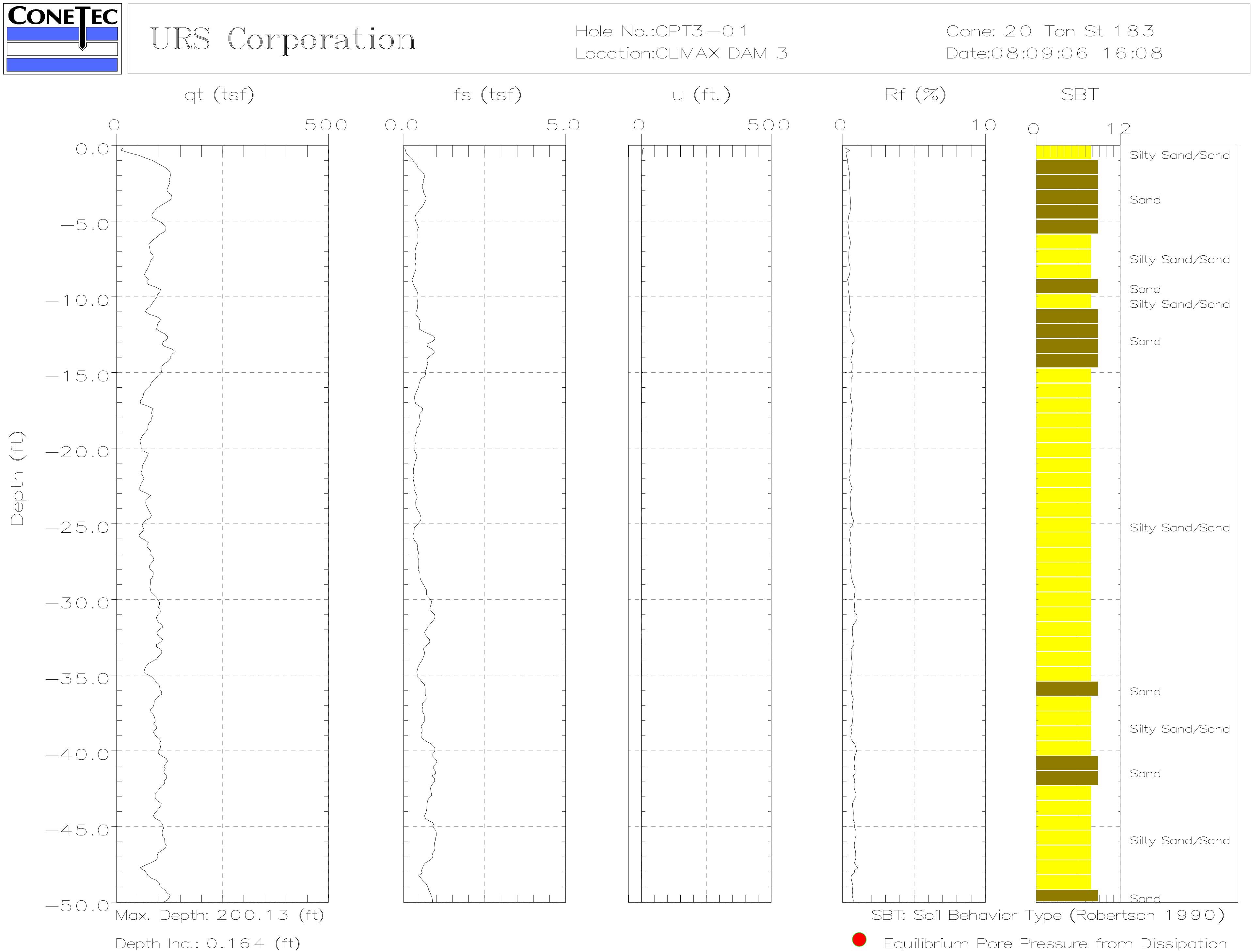
LEGEND

- LOOSE TO VERY DENSE, MOIST TO VERY MOIST, LIGHT TO MEDIUM GRAY TO LIGHT BROWN TO BROWN SILTY MEDIUM TO FINE SAND WITH OCCASSIONAL LENSES OF POORLY GRADED SAND AND SANDY SILT
- CAP MATERIAL
- 7 — INDICATES 7 BLOWS OF A 140-LB HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SPLIT BARREL SAMPLER 12 INCHES.
- 50/11 — INDICATES 50 BLOWS OF A 140-LB HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2-INCH DIAMETER SPLIT BARREL SAMPLER 11 INCHES
- ST — INDICATES A 3-INCH DIAMETER THIN WALLED TUBE SAMPLE WAS OBTAINED AT THE DEPTH SHOWN USING A SHELBY TUBE SAMPLER
- CPT SOUNDING
- EXISTING PIEZOMETER PROJECTED ONTO CROSS SECTION
- MEASURED WATER LEVEL IN EXISTING PIEZOMETERS (SEE NOTE 5)
- ESTIMATED WATER LEVEL FROM CPT SOUNDING DATA.
- REFUSAL (DRILL OR CPT)
- NR — NO RECOVERY

Job No. : 22238824	3 DAM CROSS-SECTION
Prepared By : KJY	
Date : DEC. 2006	CLIMAX MINE

URS

N:\Projects\22242095_Climax_Startup_Proj\Sub_00\12.0_Word_Proc\3 Dam Seepage-Stability\Final\APPENDIX B (JOHN)\DAM 3 SECTION FIG5.dwg

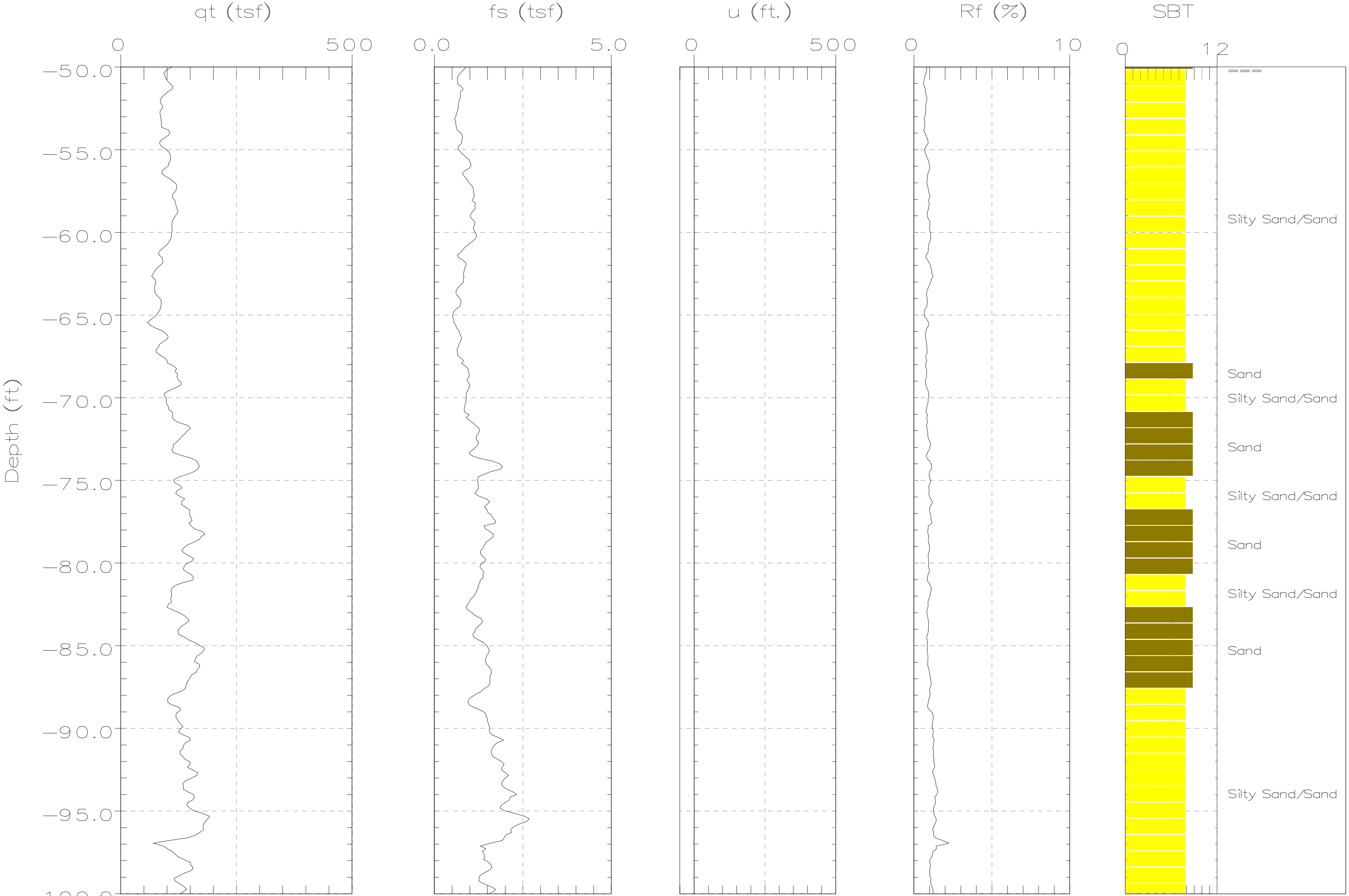


CONETEC
URS Corporation
Hole No.:CPT3-01
Location:CLIMAX DAM 3
Cone: 20 Ton St 183
Date:08:09:06 16:08
qt (tsf)
fs (tsf)
u (ft.)
Rf (%)
SBT
Depth (ft)
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Max. Depth: 200.13 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-01
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 16:08



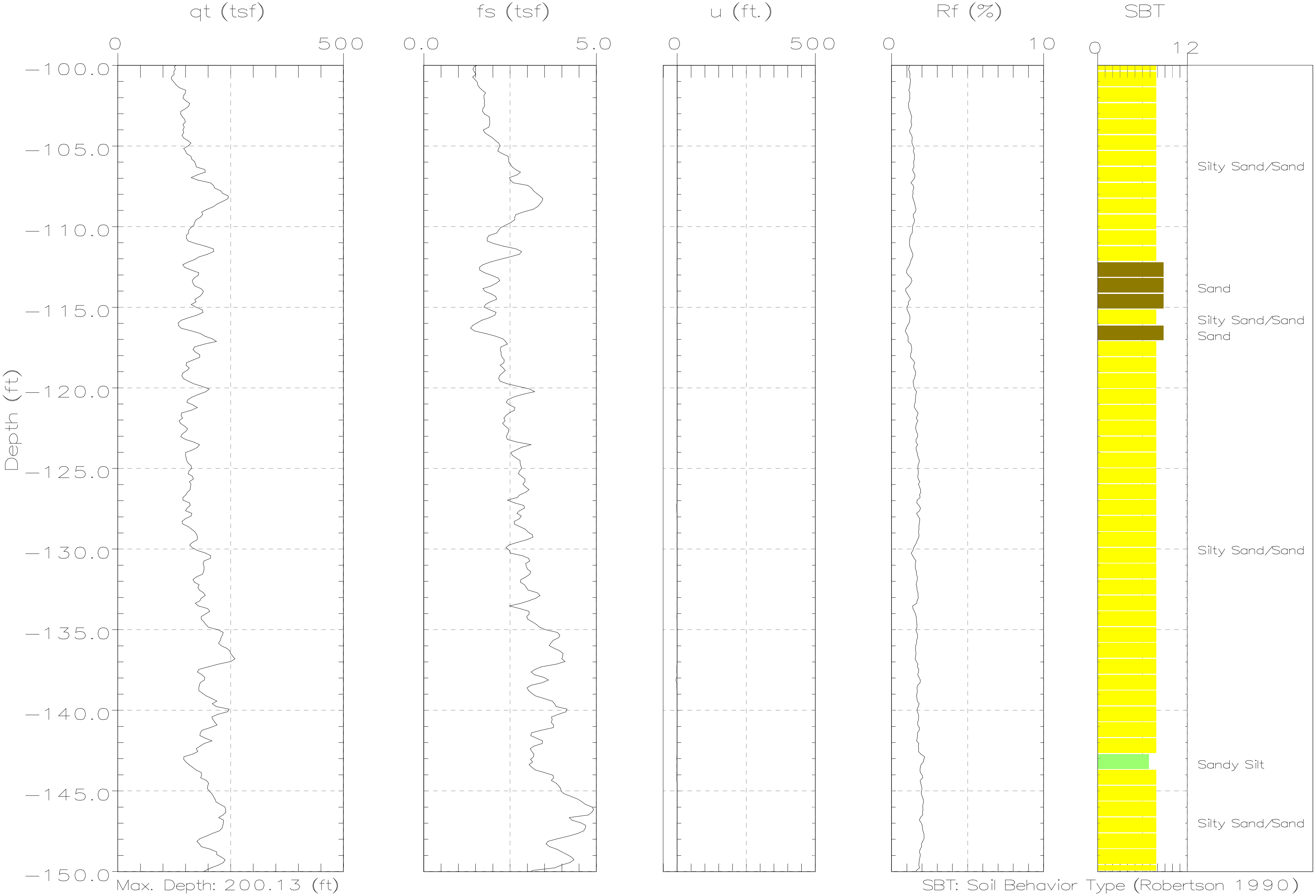
Max. Depth: 200.13 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-01
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 16:08



Max. Depth: 200.13 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

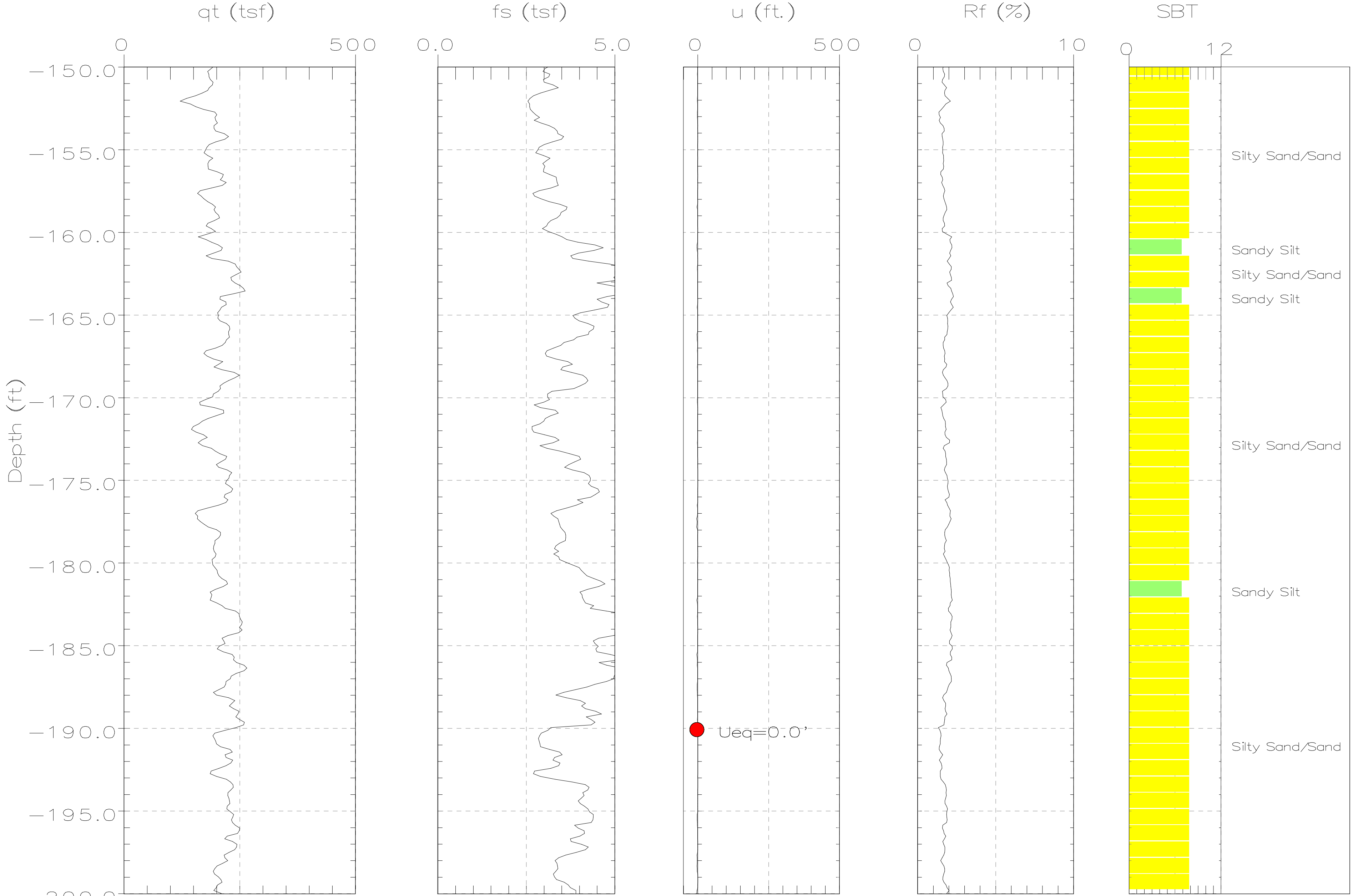
Equilibrium Pore Pressure from Dissipation

ConeTec

URS Corporation

Hole No.:CPT3-01
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 16:08



Max. Depth: 200.13 (ft)

Depth Inc.: 0.164 (ft)

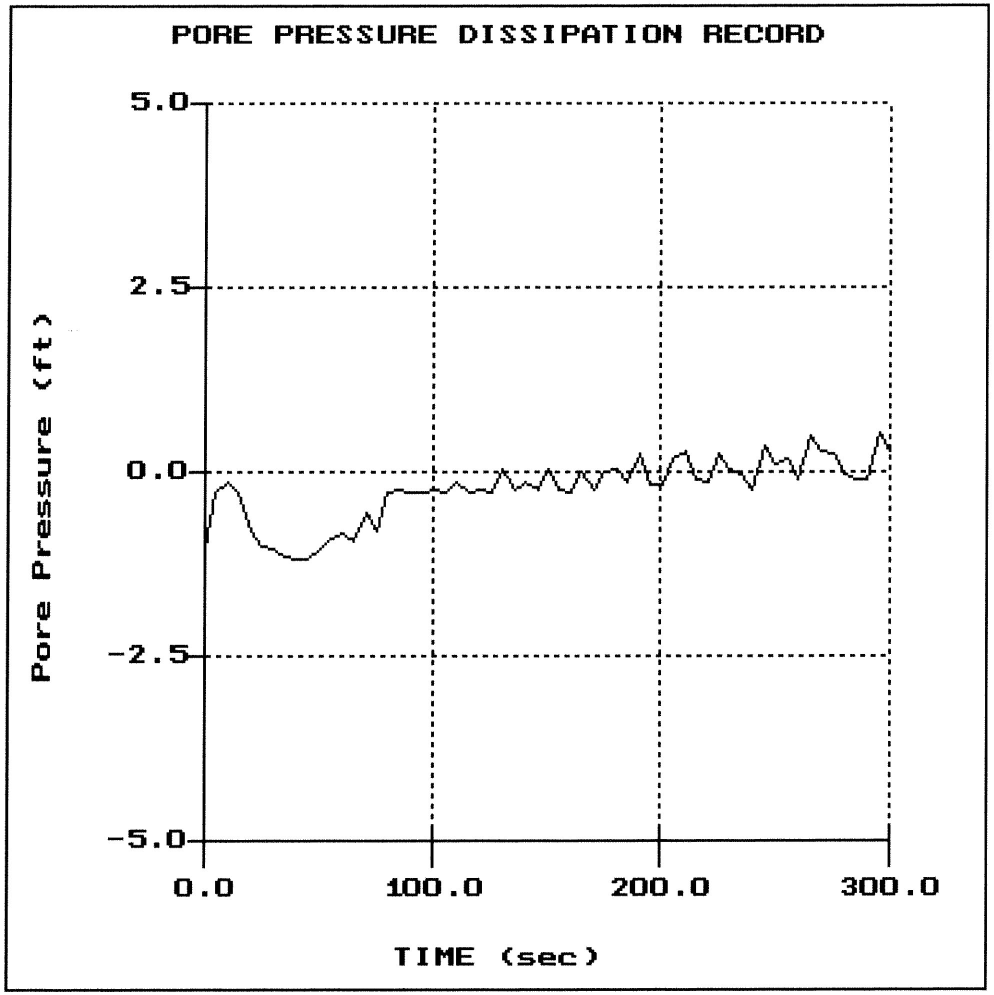
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-01
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 16:08



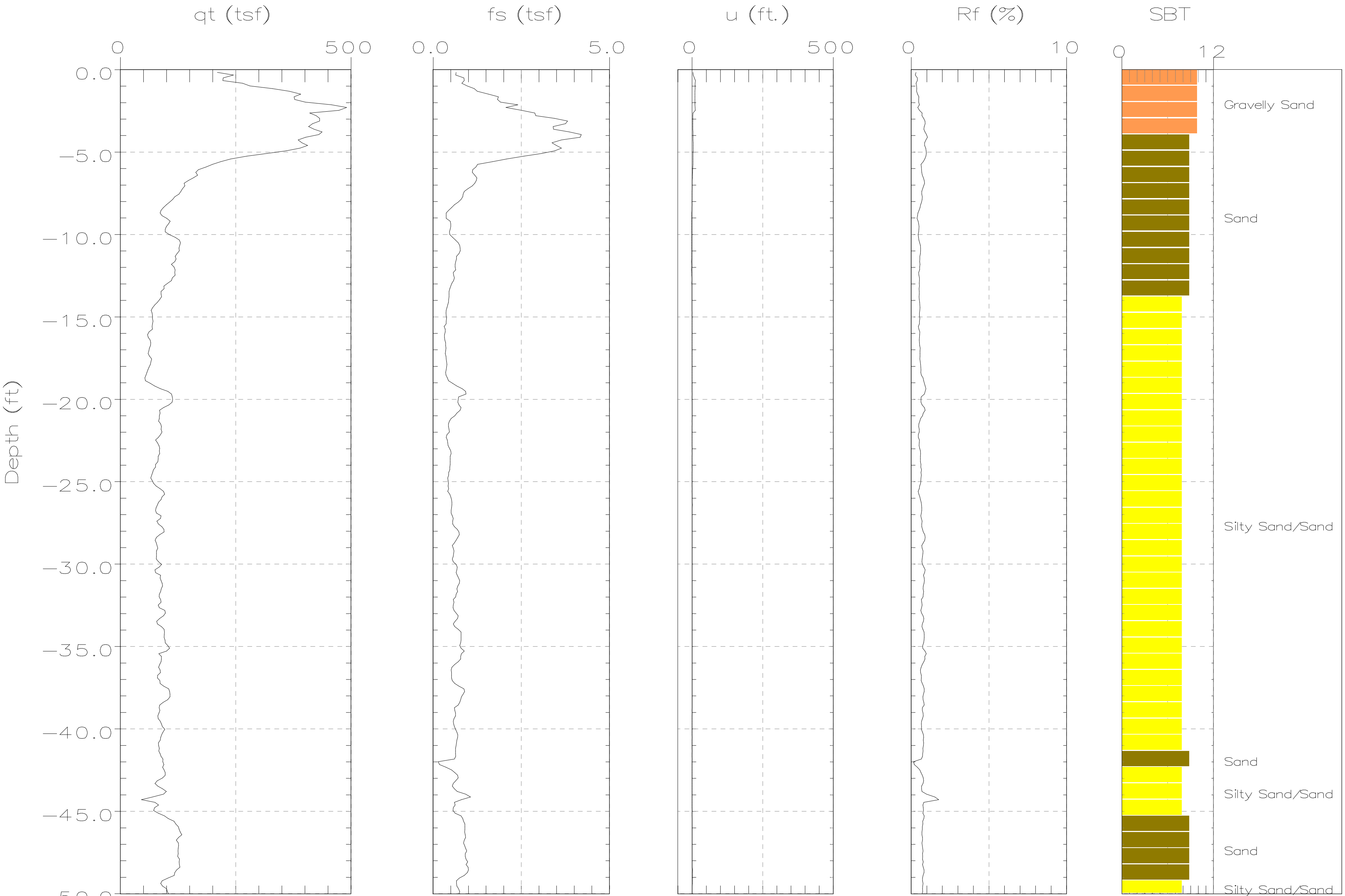
File: 393C301.PPD
Depth (m): 57.95
(ft): 190.12
Duration : 300.0s
U-min: -1.17 45.0s
U-max: 0.52 295.0s

CONETEC

URS Corporation

Hole No.:CPT3-02
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:10:06 07:37



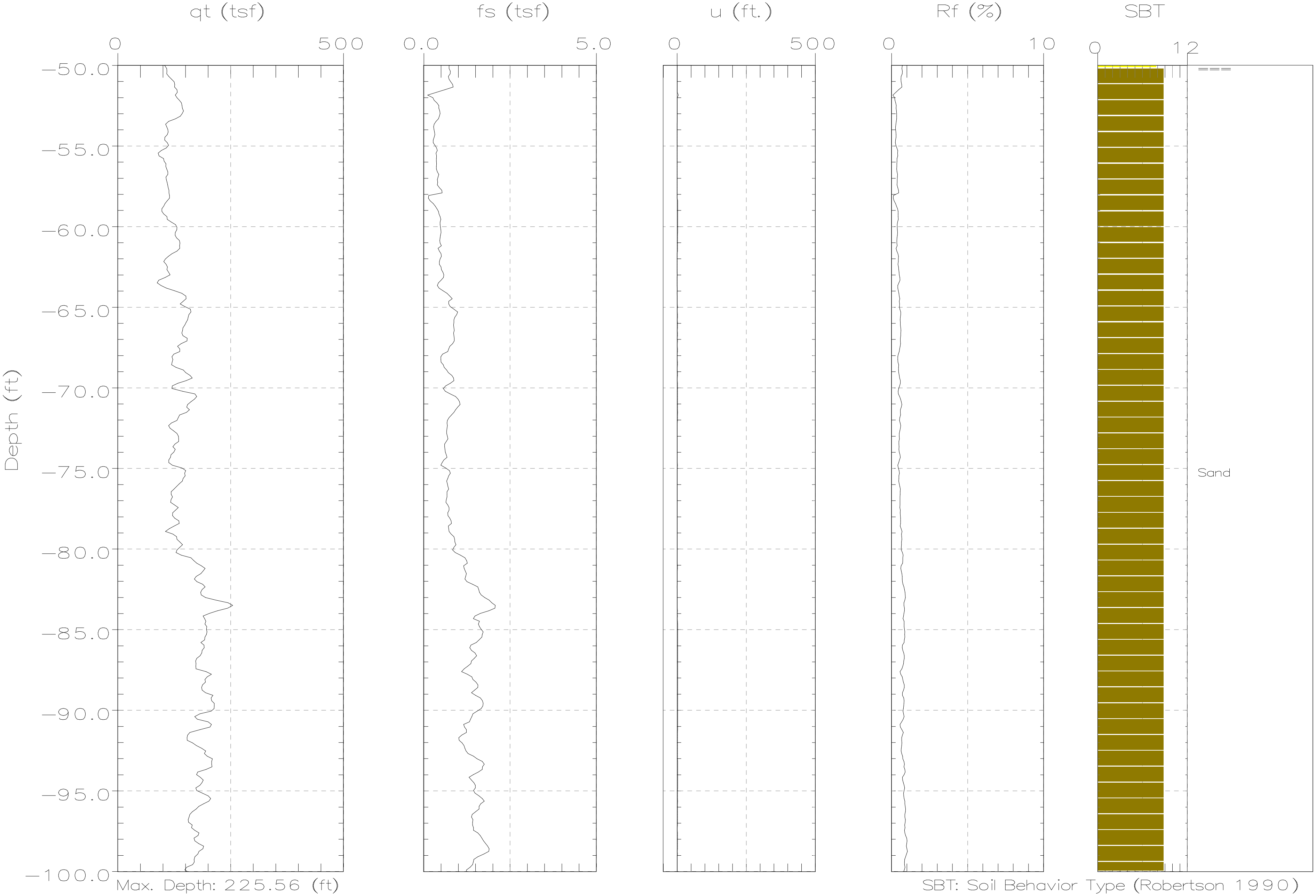
Max. Depth: 225.56 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-02
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:10:06 07:37



Max. Depth: 225.56 (ft)

Depth Inc.: 0.164 (ft)

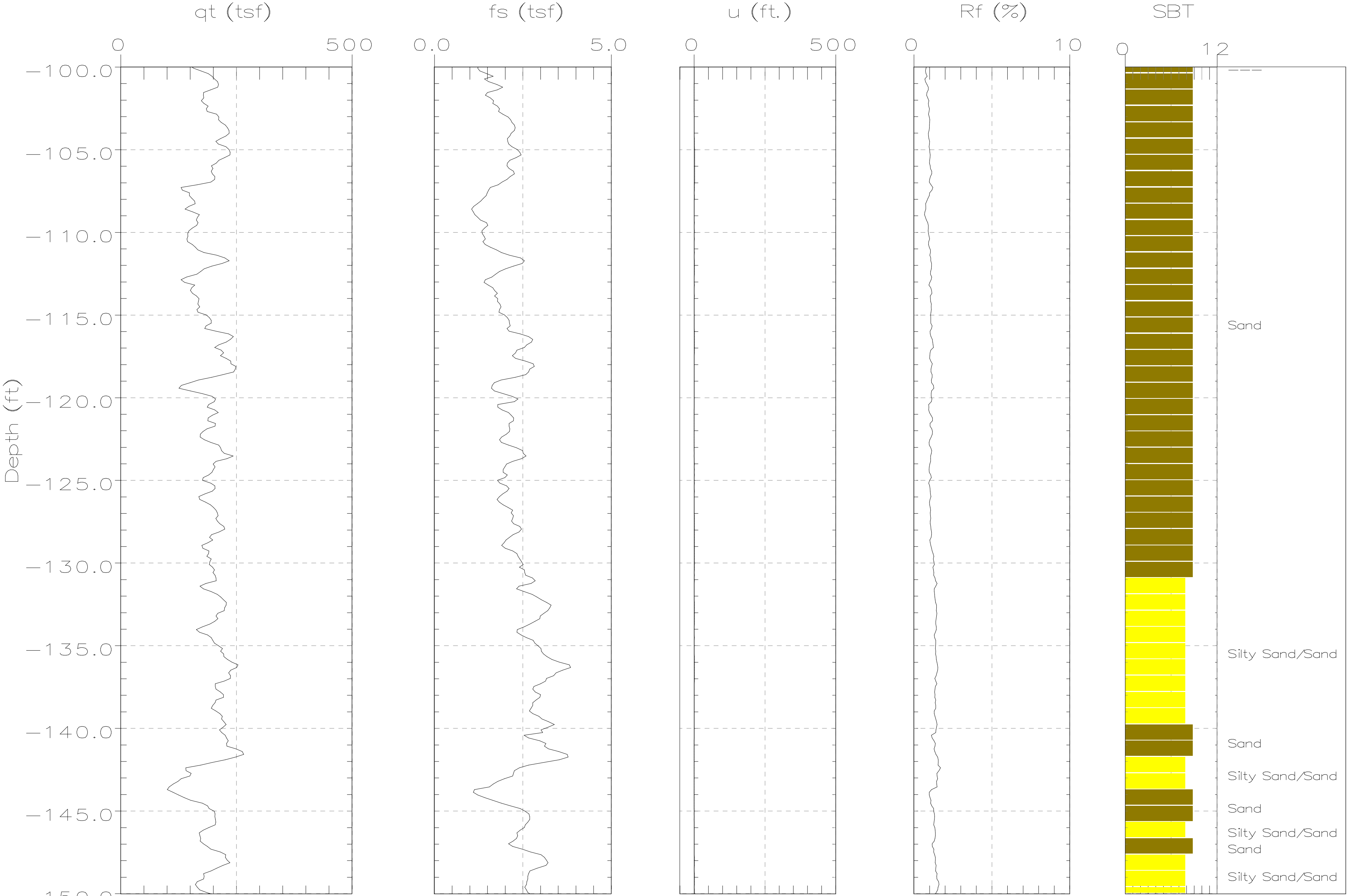
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-02
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:10:06 07:37



Max. Depth: 225.56 (ft)
Depth Inc.: 0.164 (ft)

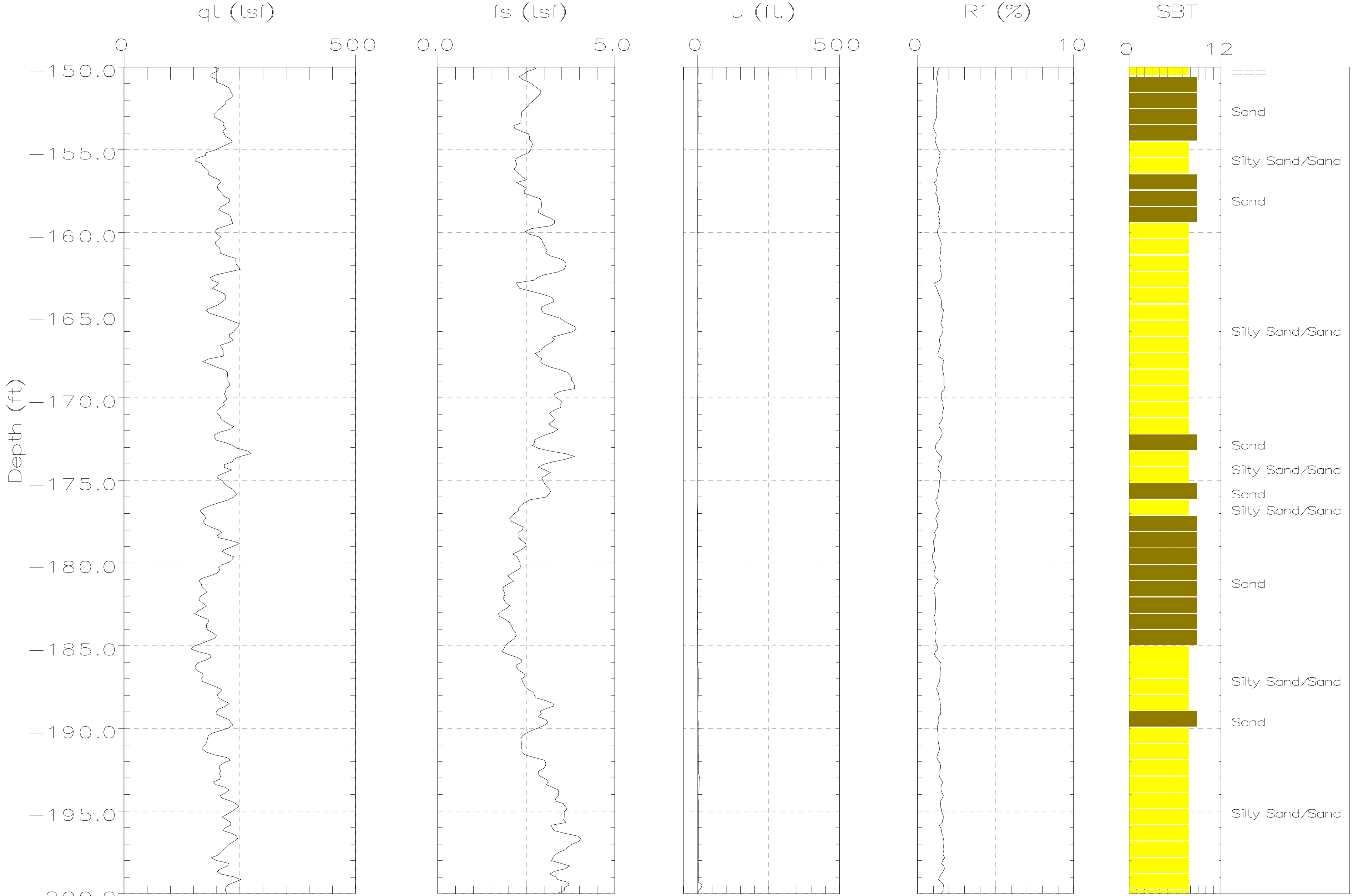
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-02
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:10:06 07:37



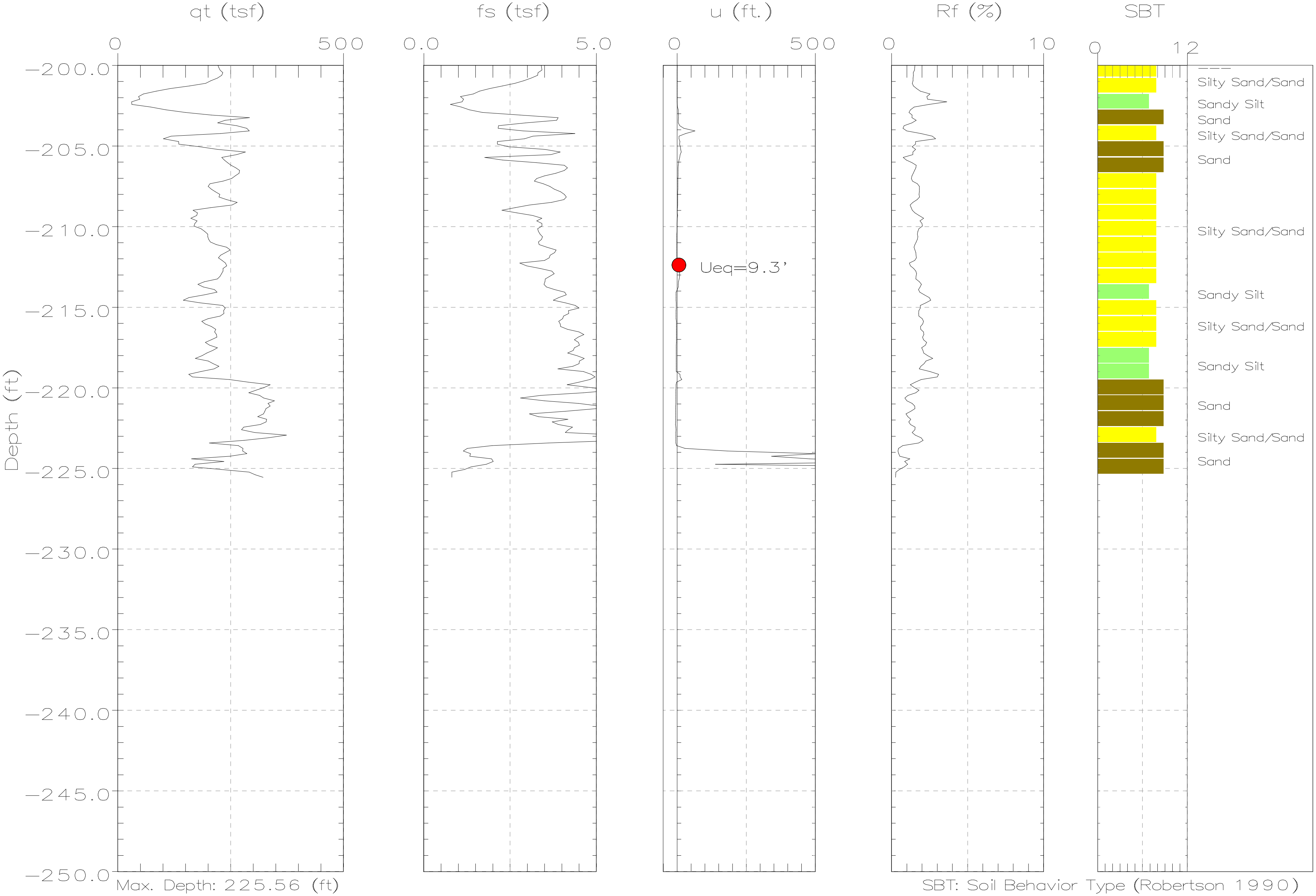
Max. Depth: 225.56 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-02
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:10:06 07:37



Max. Depth: 225.56 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

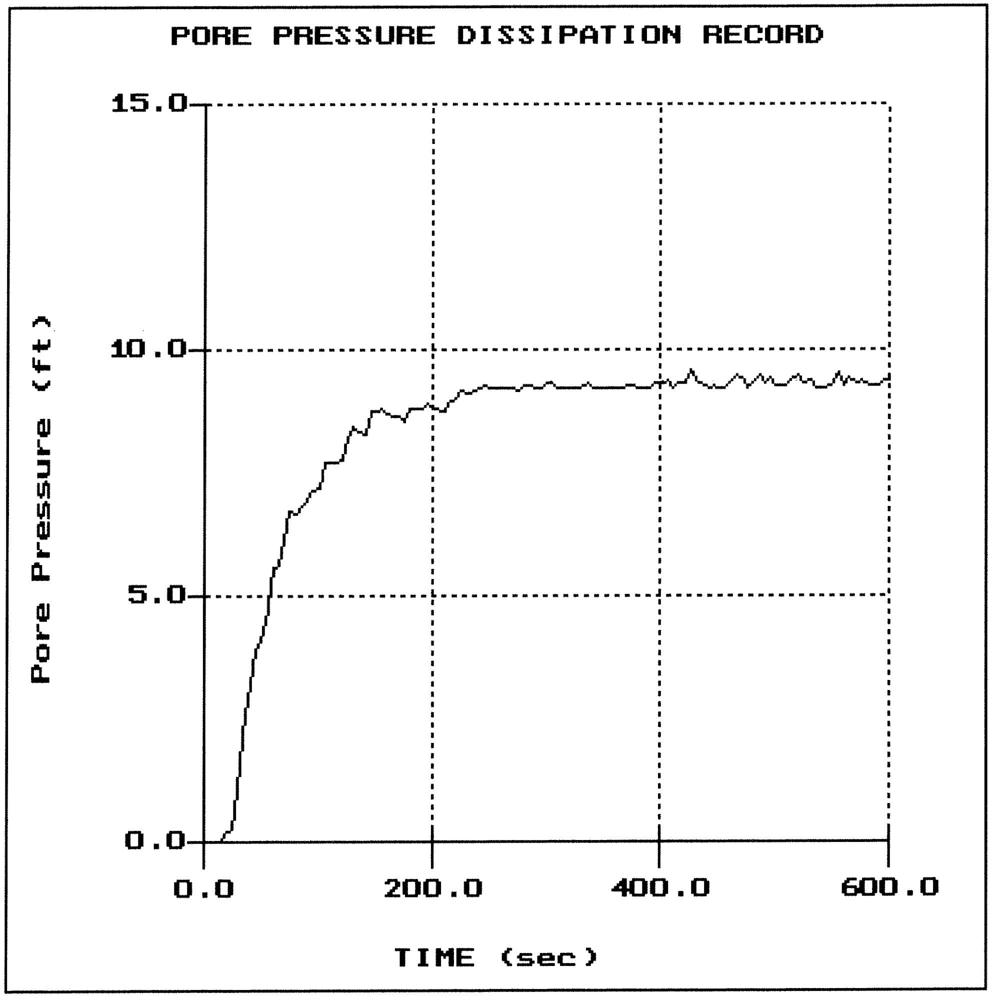
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-02
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:10:06 07:37

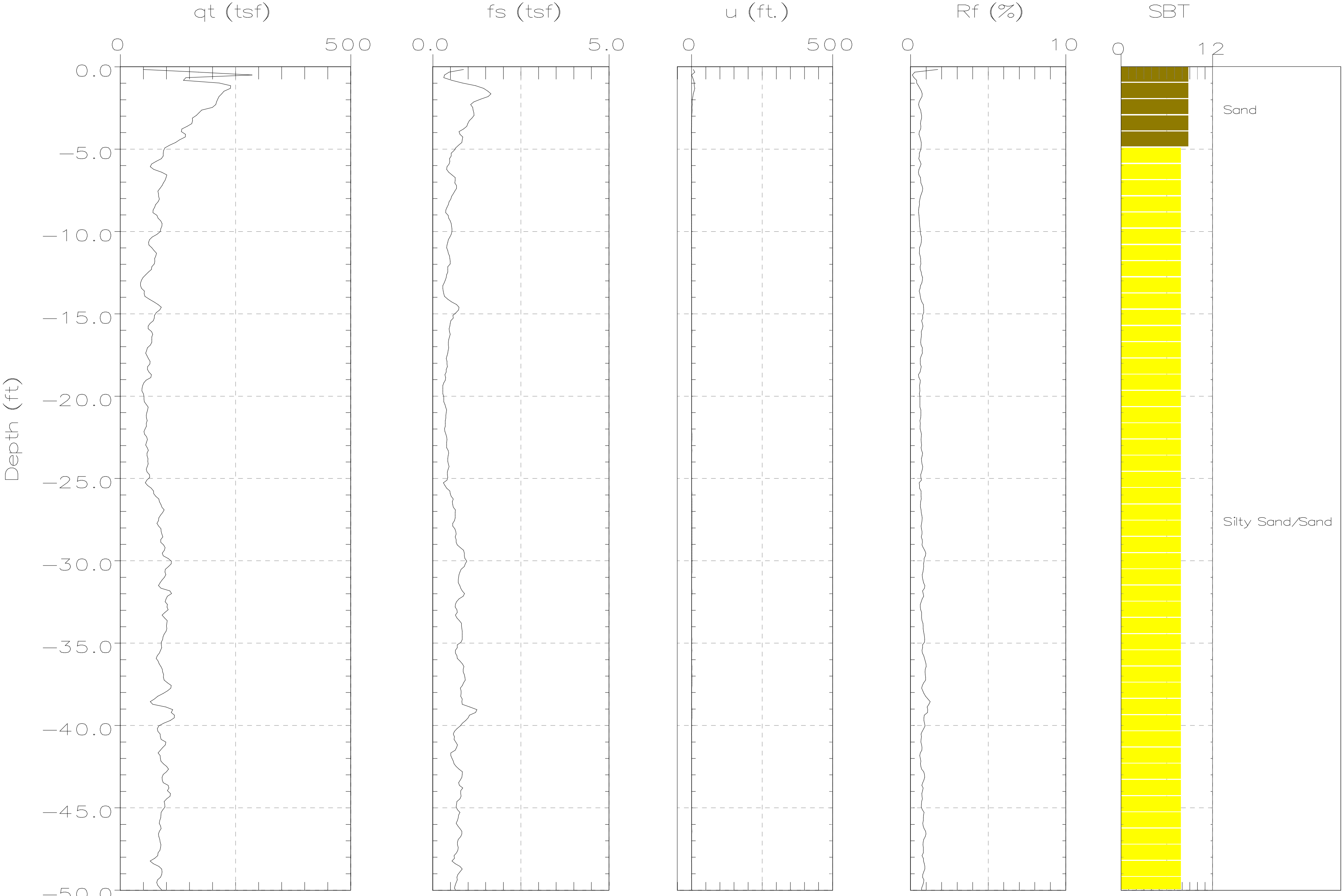
File: 393C302.PPD
Depth (m): 64.75
(ft): 212.43
Duration : 600.0s
U-min: -0.99 0.0s
U-max: 9.57 425.0s



URS Corporation

Hole No.:CPT3-03
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 13:59



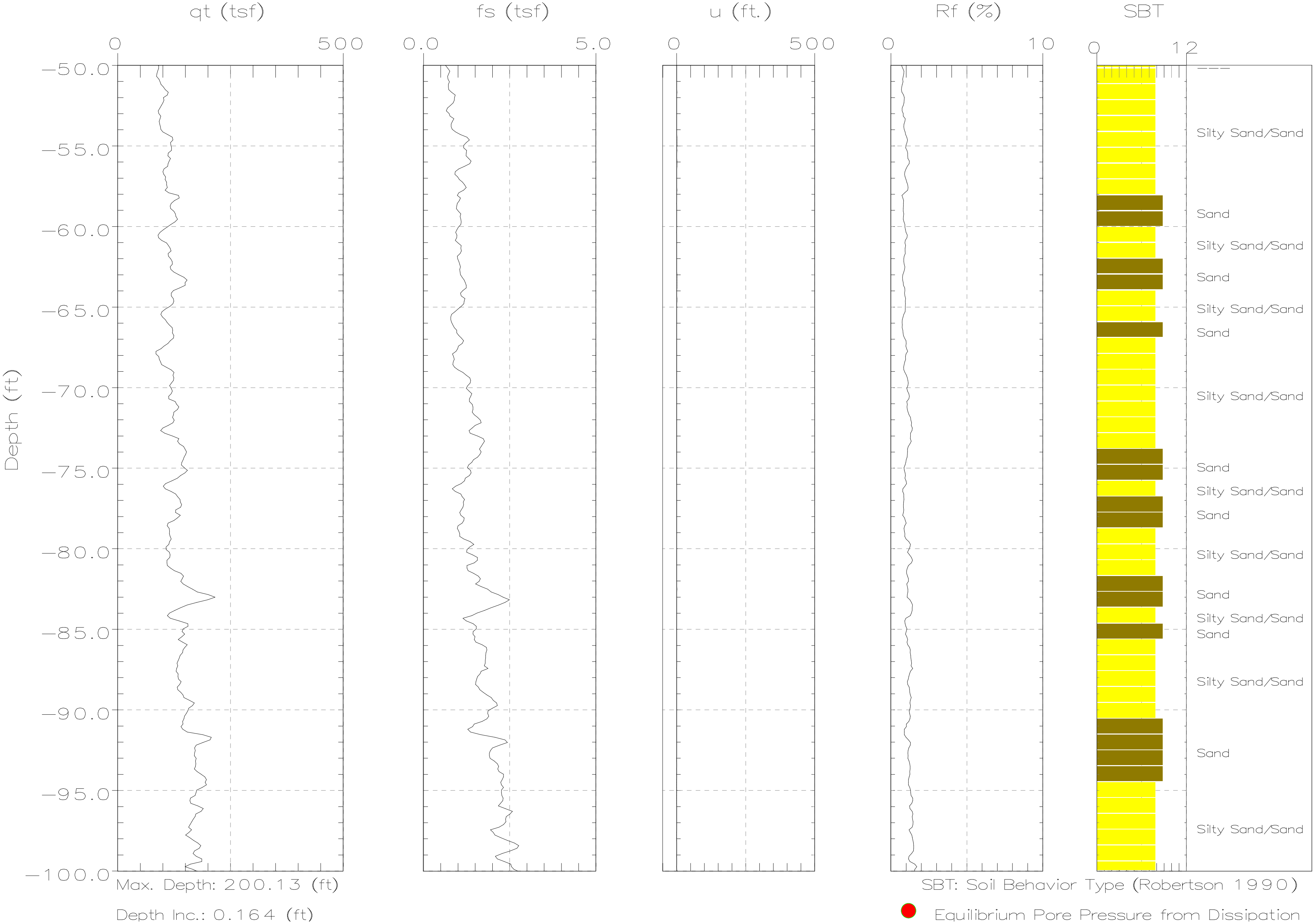
Max. Depth: 200.13 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-03
Location:CLIMAX DAM 3

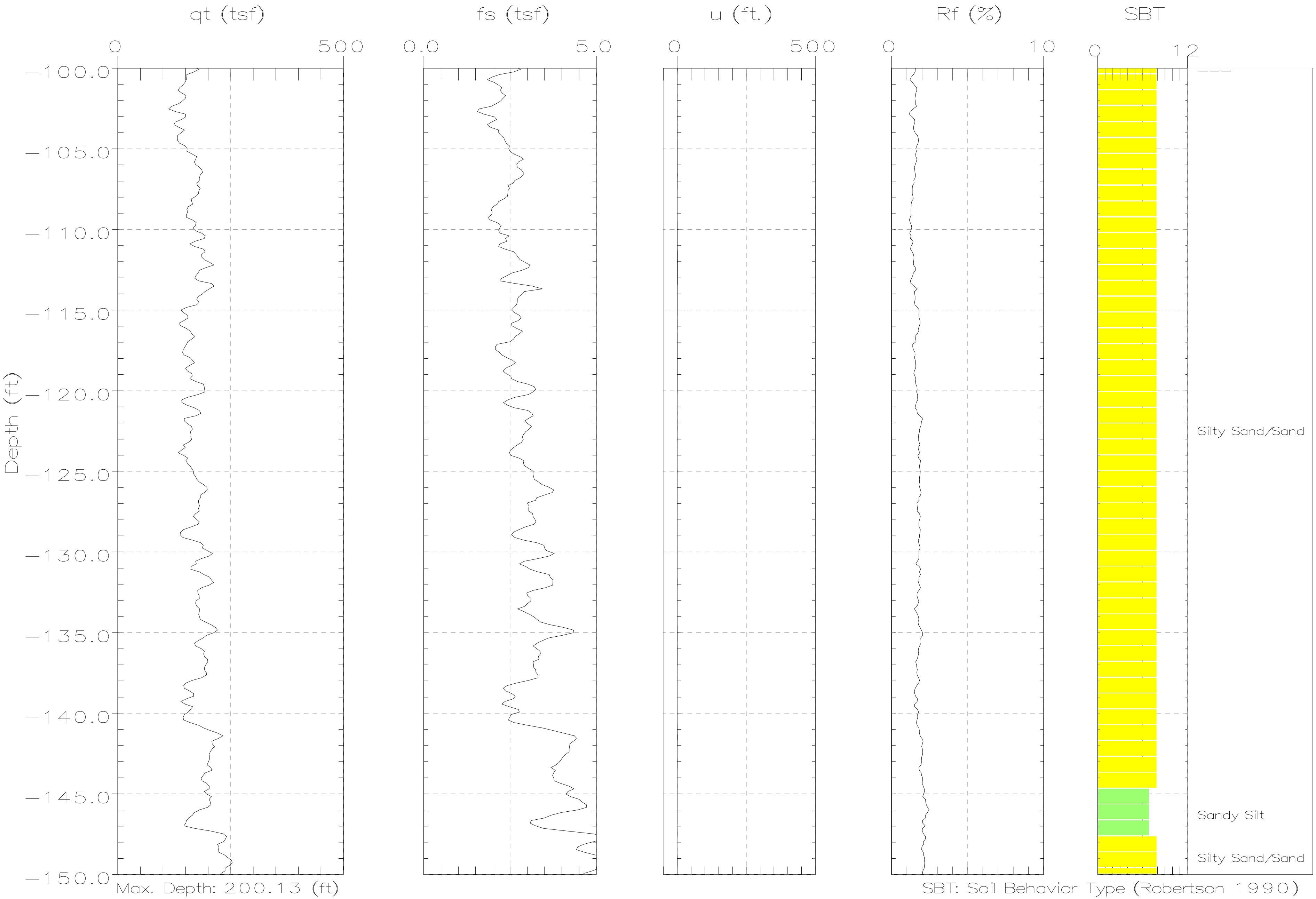
Cone: 20 Ton St 183
Date:08:09:06 13:59



URS Corporation

Hole No.:CPT3-03
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 13:59



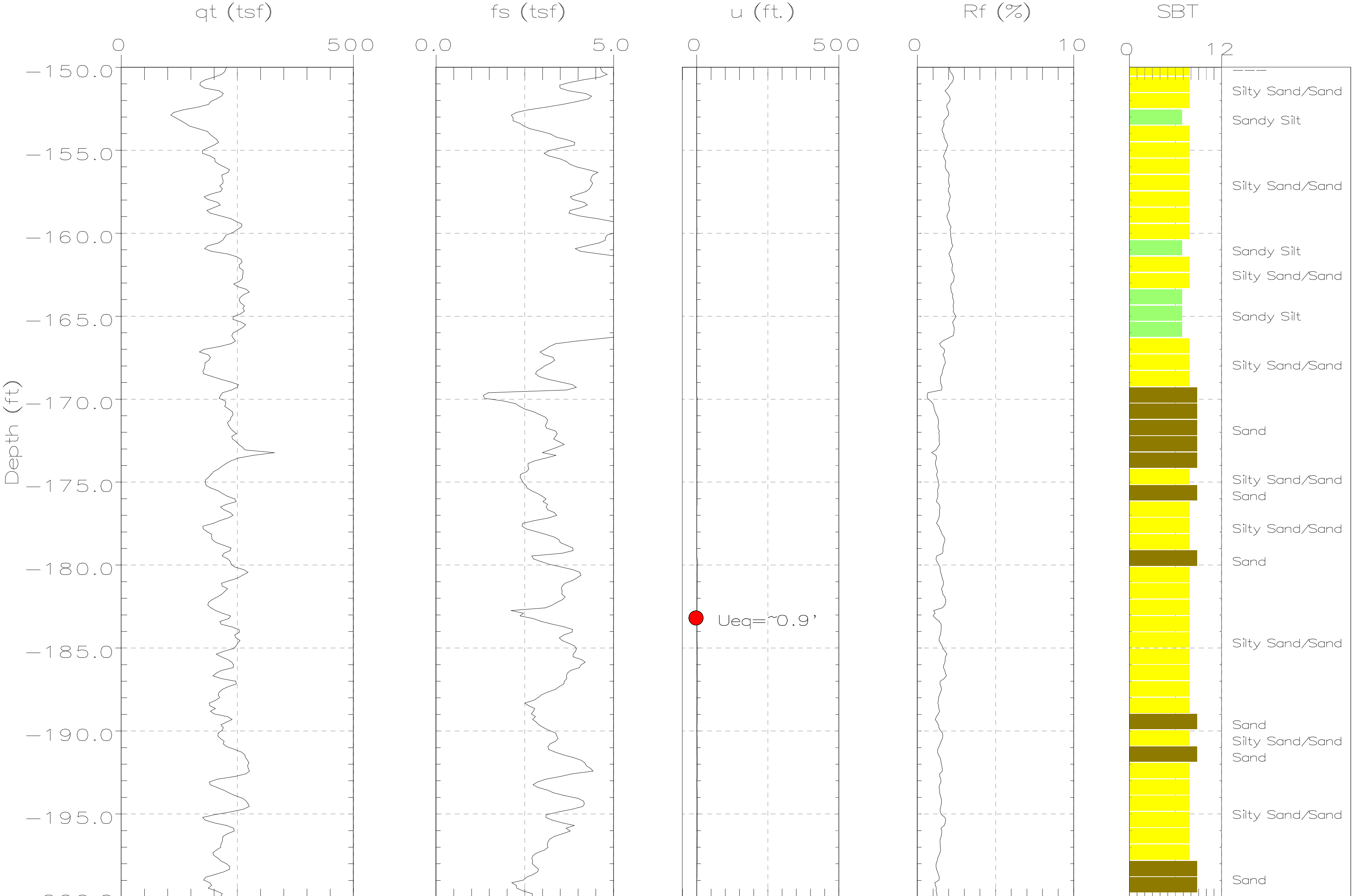
Max. Depth: 200.13 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-03
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 13:59



Max. Depth: 200.13 (ft)

Depth Inc.: 0.164 (ft)

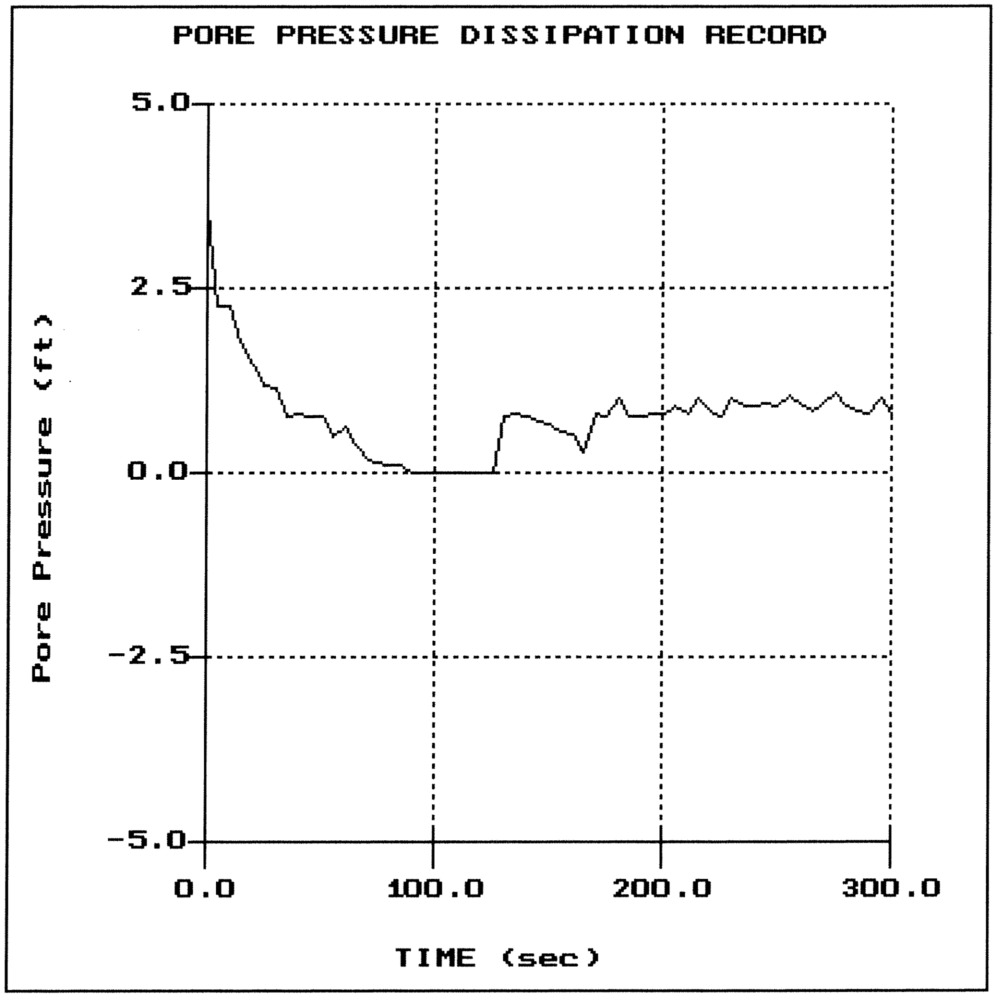
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-03
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 13:59

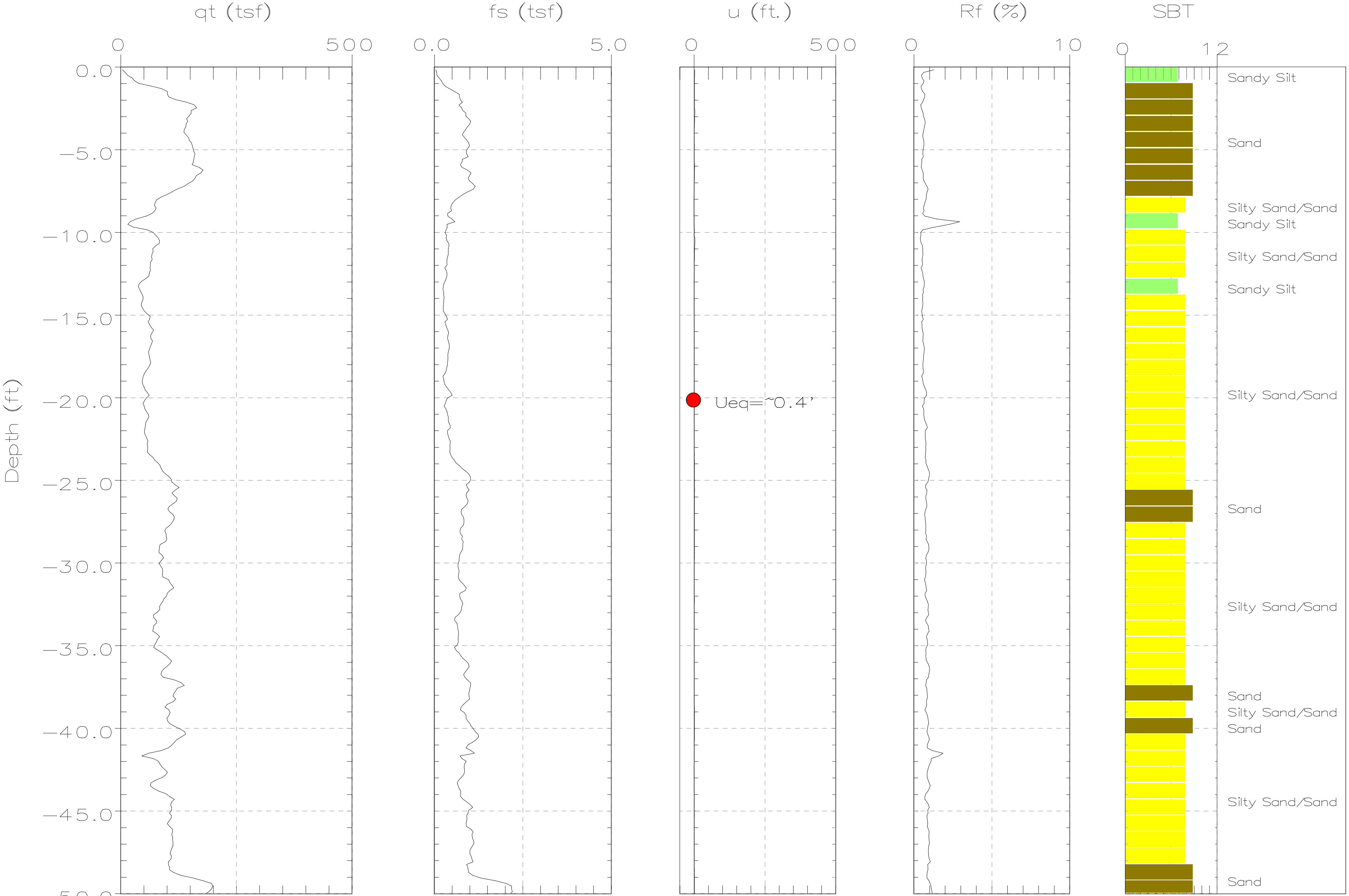


File: 393C303.PPD
Depth (m): 55.85
(ft): 183.23
Duration : 300.0s
U-min: 0.00 125.0s
U-max: 3.57 0.0s

URS Corporation

Hole No.:CPT3-04
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 12:32



Max. Depth: 100.06 (ft)
Depth Inc.: 0.164 (ft)

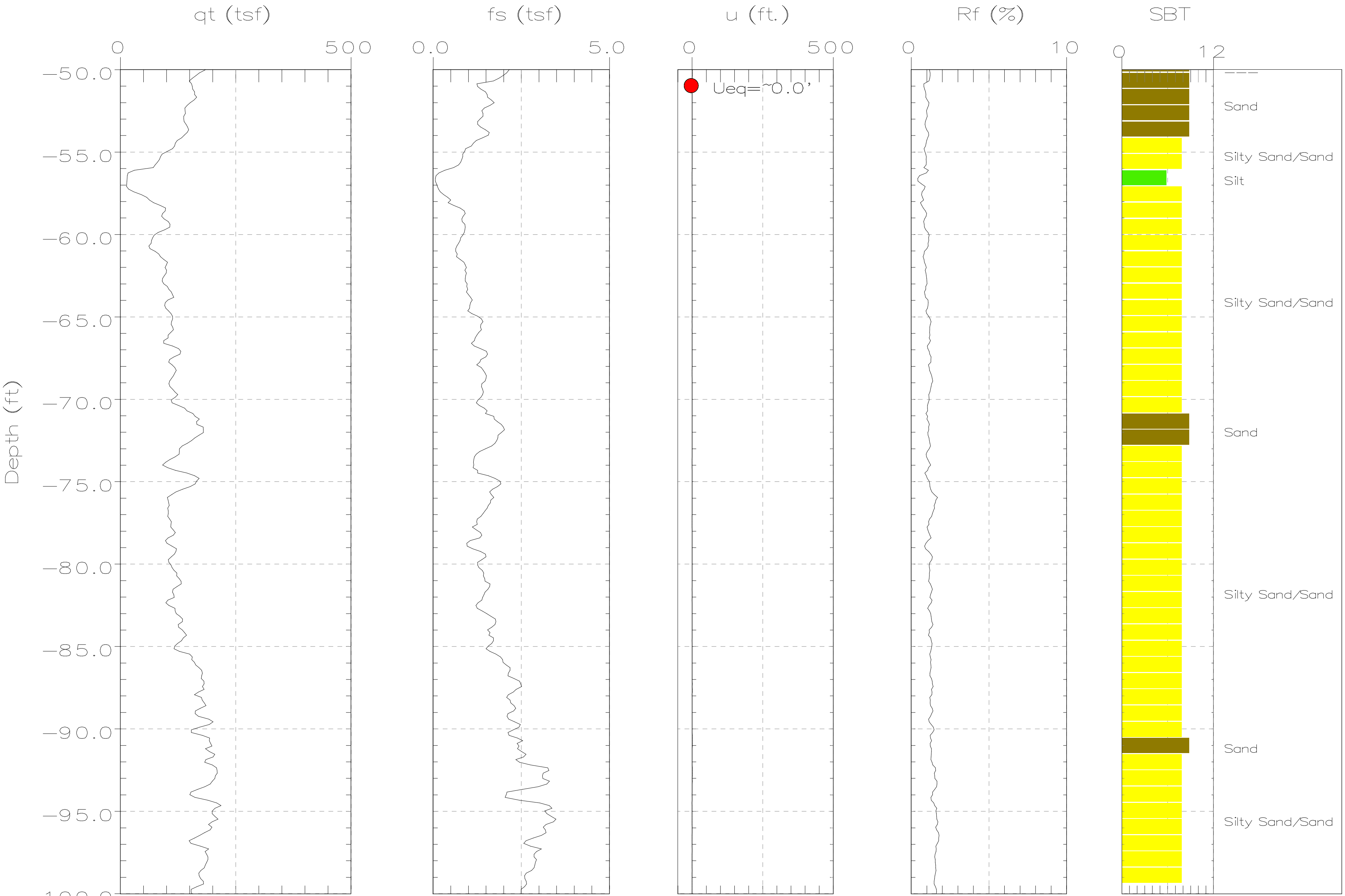
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

CONETEC

URS Corporation

Hole No.:CPT3-04
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 12:32



Max. Depth: 100.06 (ft)

Depth Inc.: 0.164 (ft)

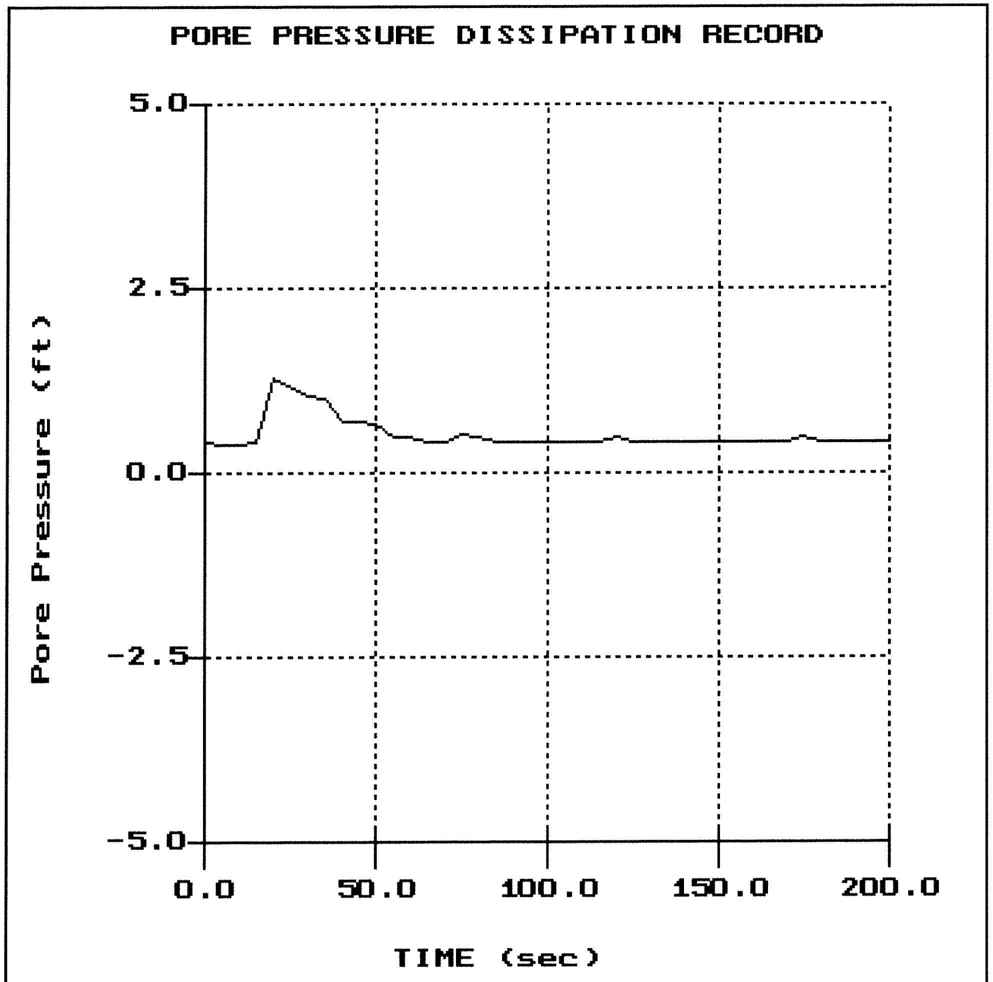
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-04
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 12:32



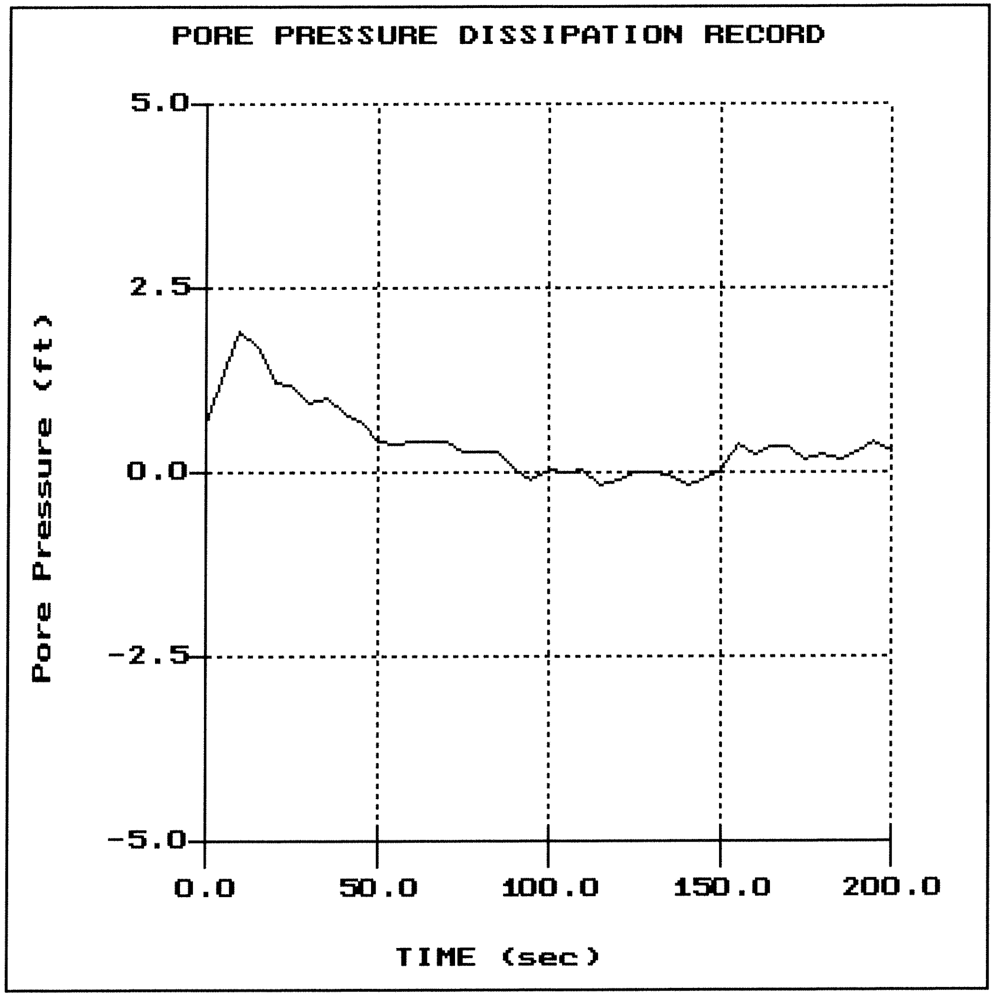
File: 393C304.PPD
Depth (m): 6.15
(ft): 20.18
Duration : 200.0s
U-min: 0.38 10.0s
U-max: 1.27 20.0s

URS Corporation

Hole No.:CPT3-04
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 12:32

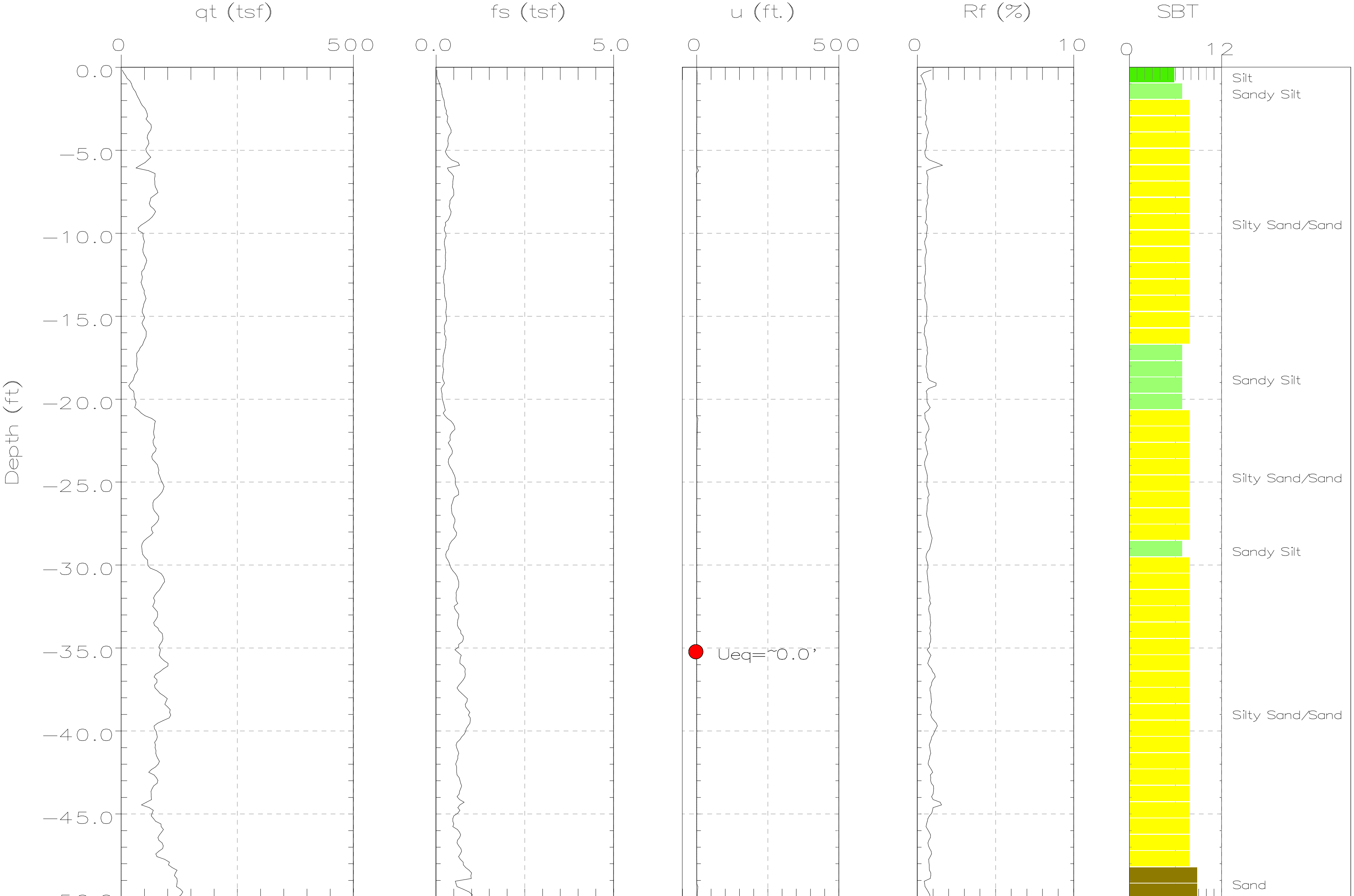
File: 393C304.PPD
Depth (m): 15.55
(ft): 51.02
Duration : 200.0s
U-min: -0.19 140.0s
U-max: 1.92 10.0s



URS Corporation

Hole No.:CPT3-06
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 08:15



Max. Depth: 104.99 (ft)

Depth Inc.: 0.164 (ft)

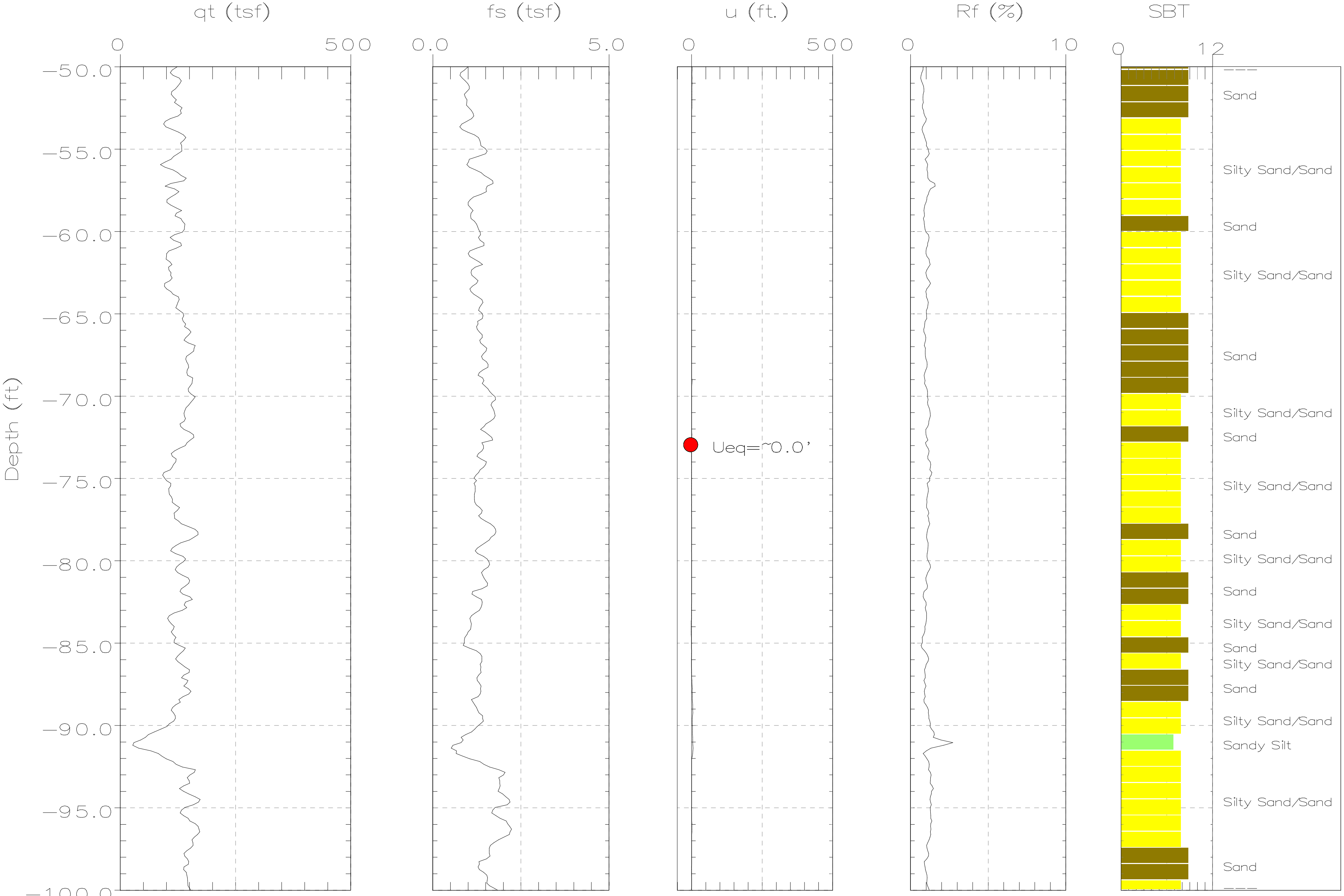
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-06
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 08:15



Max. Depth: 104.99 (ft)

Depth Inc.: 0.164 (ft)

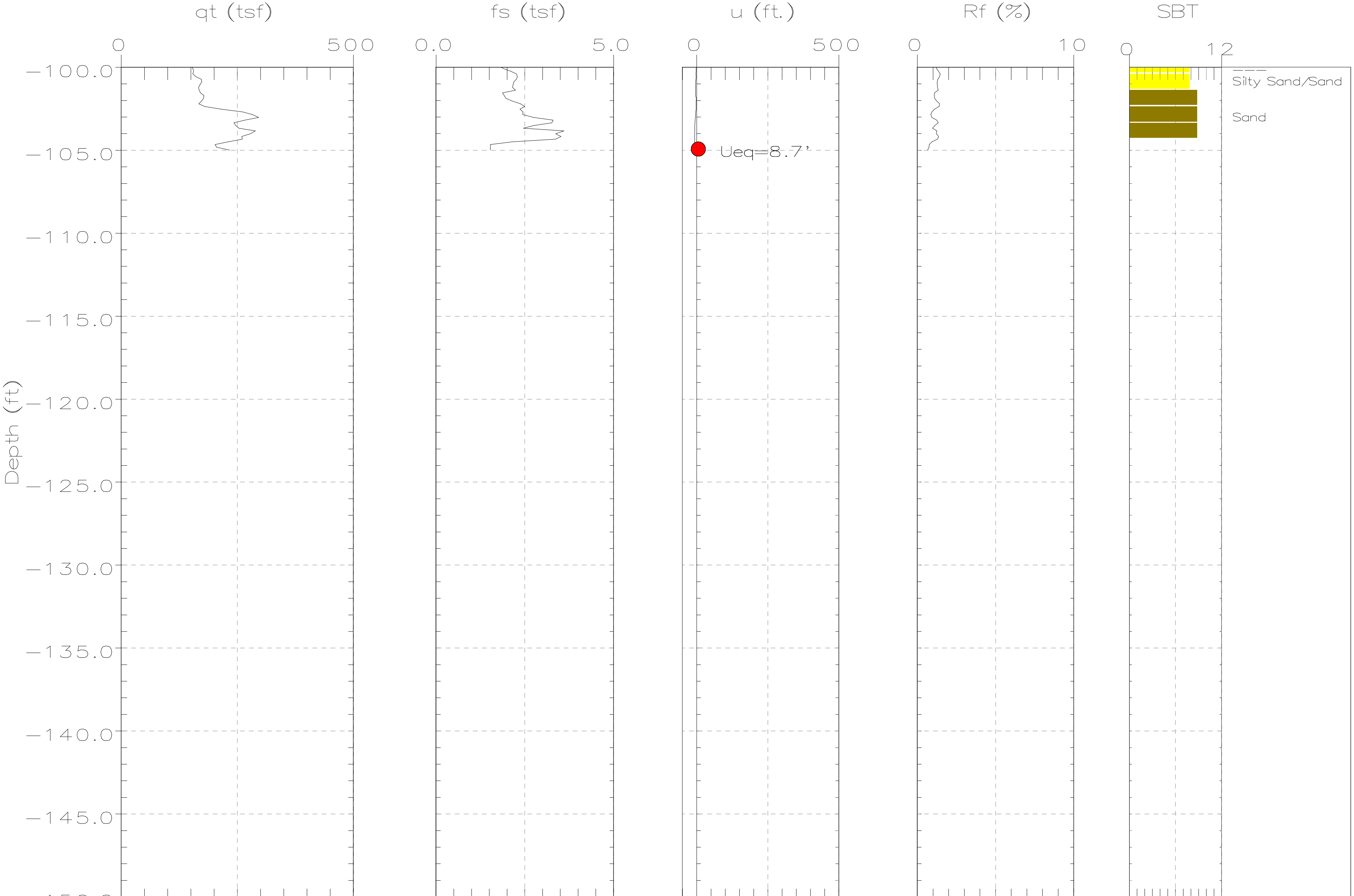
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-06
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 08:15



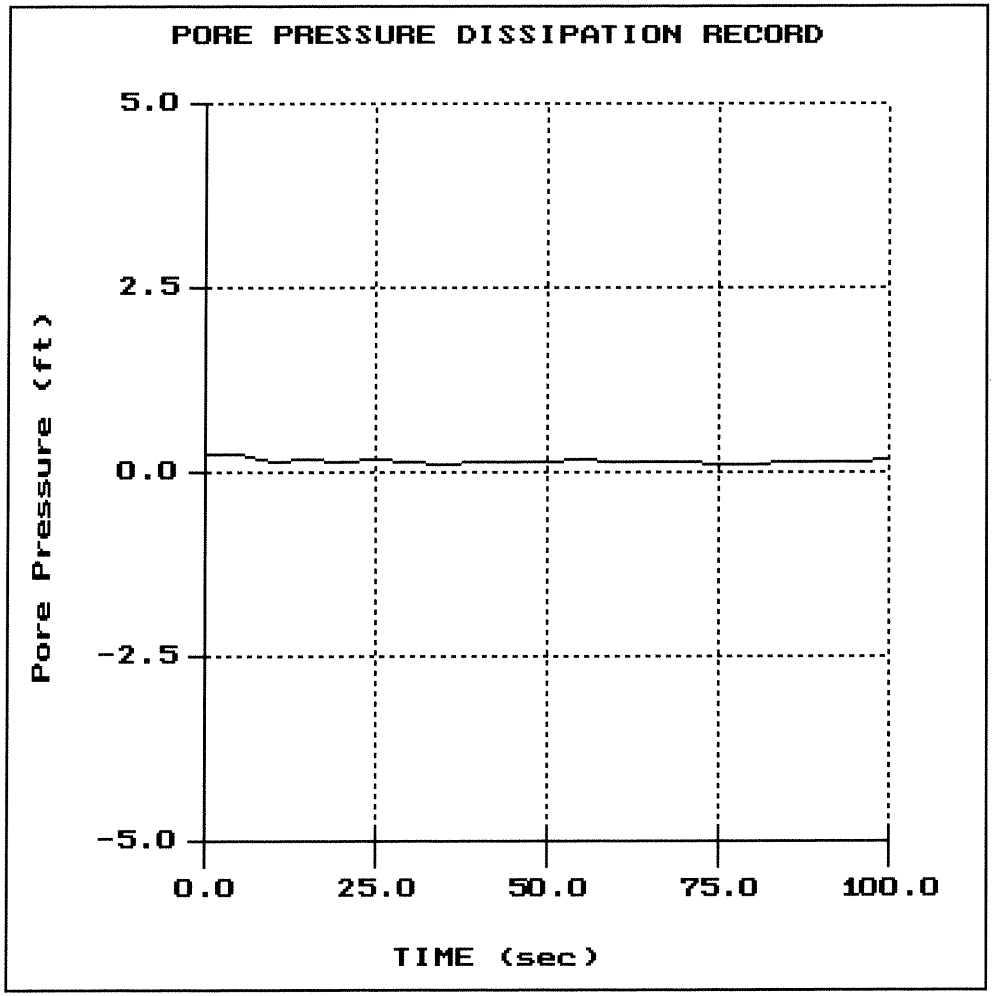
Max. Depth: 104.99 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-06
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 08:15

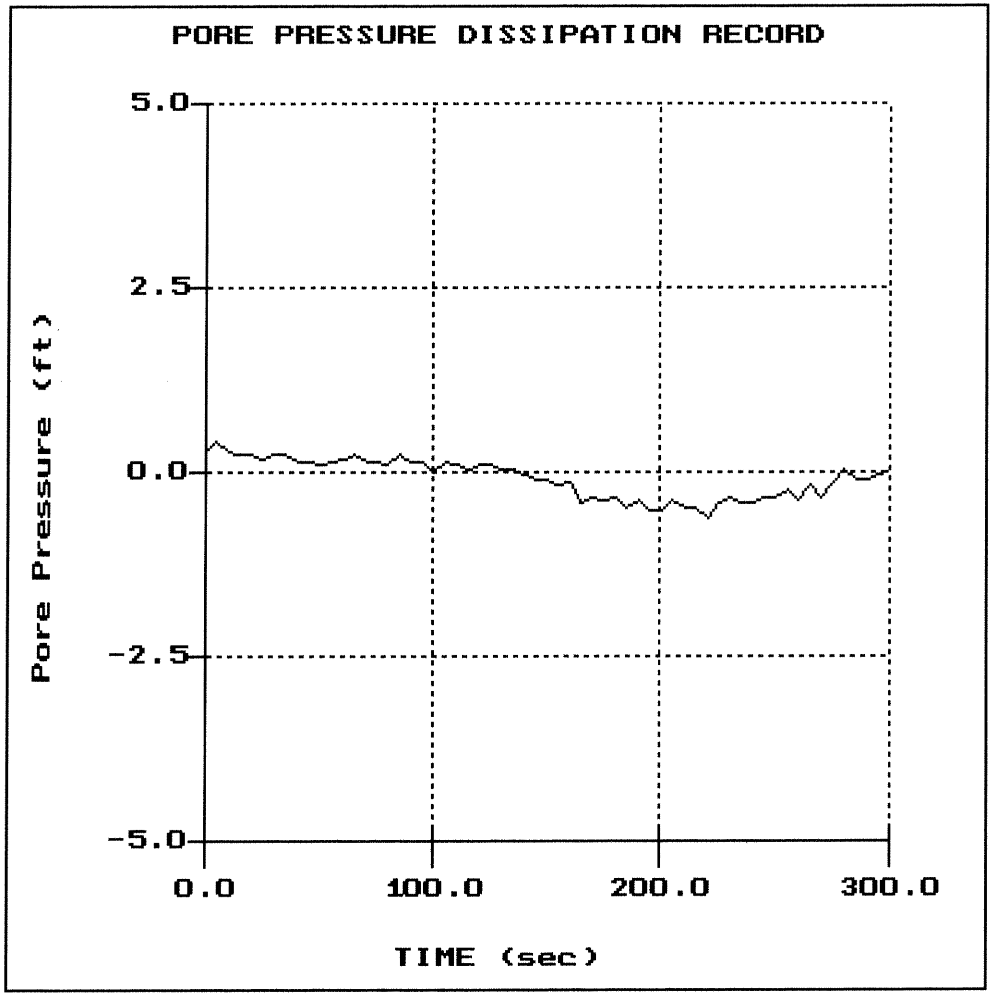


File: 393C306.PPD
Depth (m): 10.75
(ft): 35.27
Duration : 100.0s
U-min: 0.09 80.0s
U-max: 0.23 5.0s

URS Corporation

Hole No.:CPT3-06
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 08:15



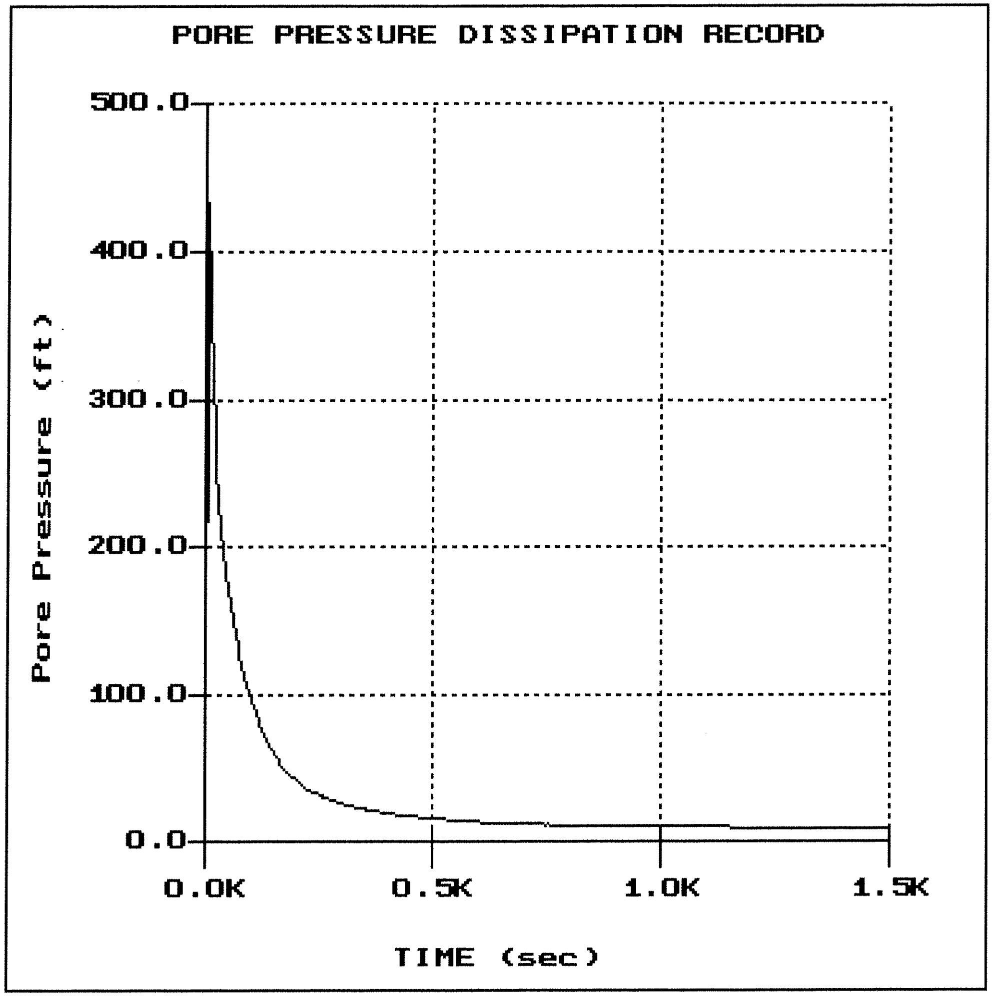
File: 393C306.PPD
Depth (m): 22.25
(ft): 73.00
Duration : 300.0s
U-min: -0.61 220.0s
U-max: 0.42 5.0s

URS Corporation

Hole No.:CPT3-06
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:09:06 08:15

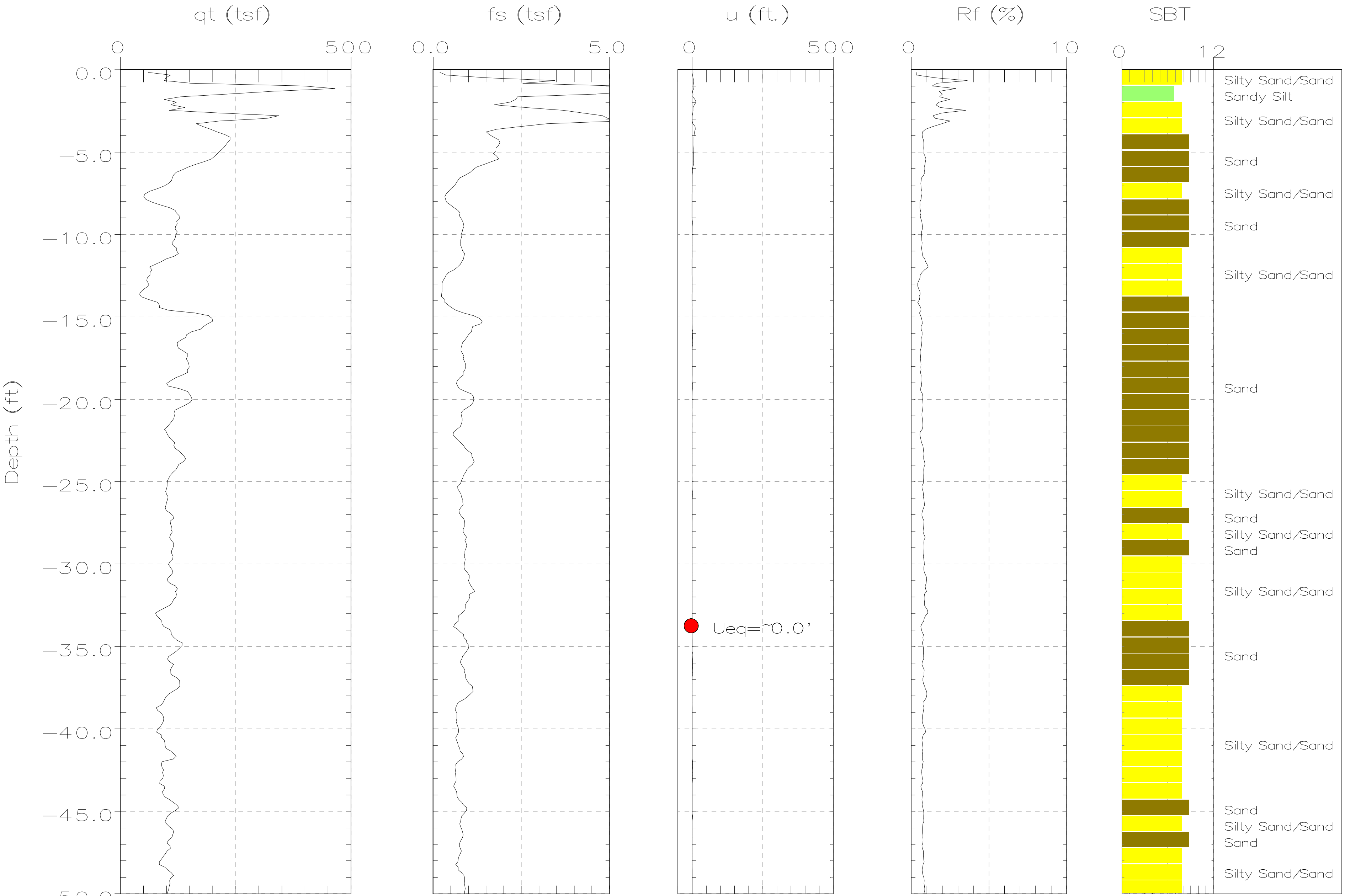
File: 393C306.PPD
Depth (m): 32.00
(ft): 104.99
Duration : 1500.0s
U-min: -5.91 0.0s
U-max: 433.15 5.0s



URS Corporation

Hole No.:CPT3-07
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 07:37

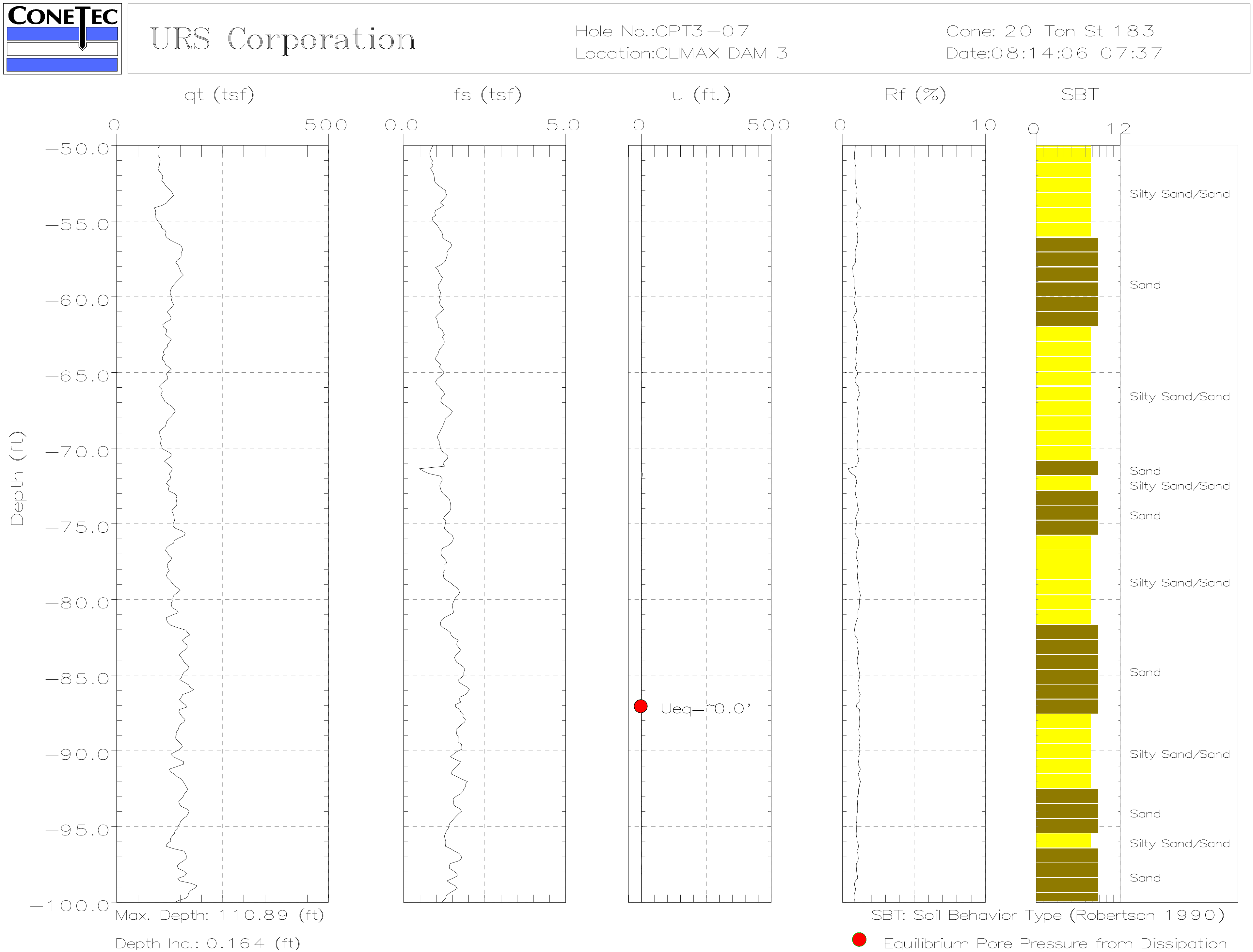


Max. Depth: 110.89 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

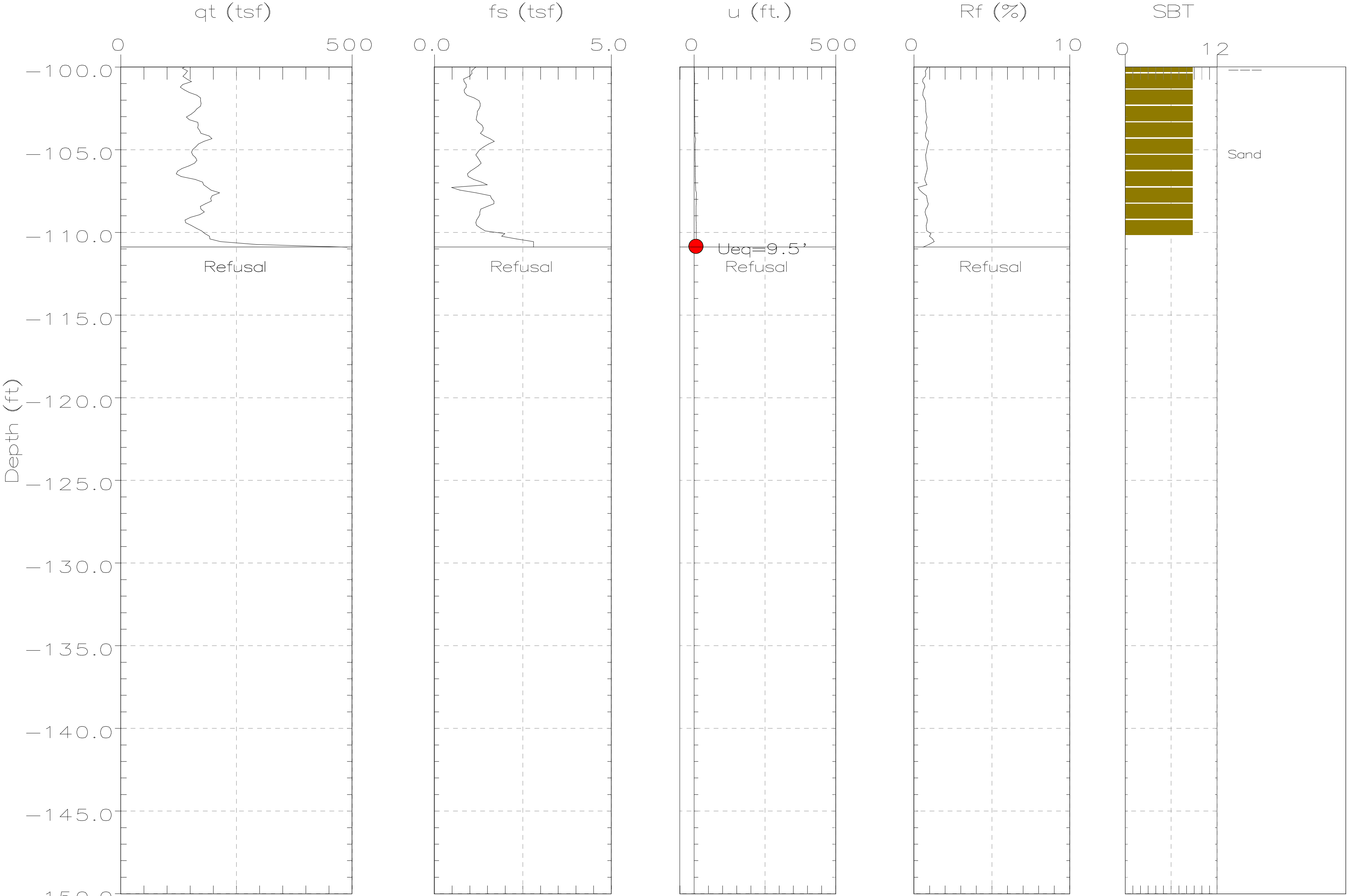


ConeTec
URS Corporation
Hole No.:CPT3-07
Location:CLIMAX DAM 3
Cone: 20 Ton St 183
Date:08:14:06 07:37
qt (tsf)
fs (tsf)
u (ft.)
Rf (%)
SBT
Depth (ft)
Silty Sand/Sand
Sand
Ueq=~0.0'
Max. Depth: 110.89 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-07
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 07:37



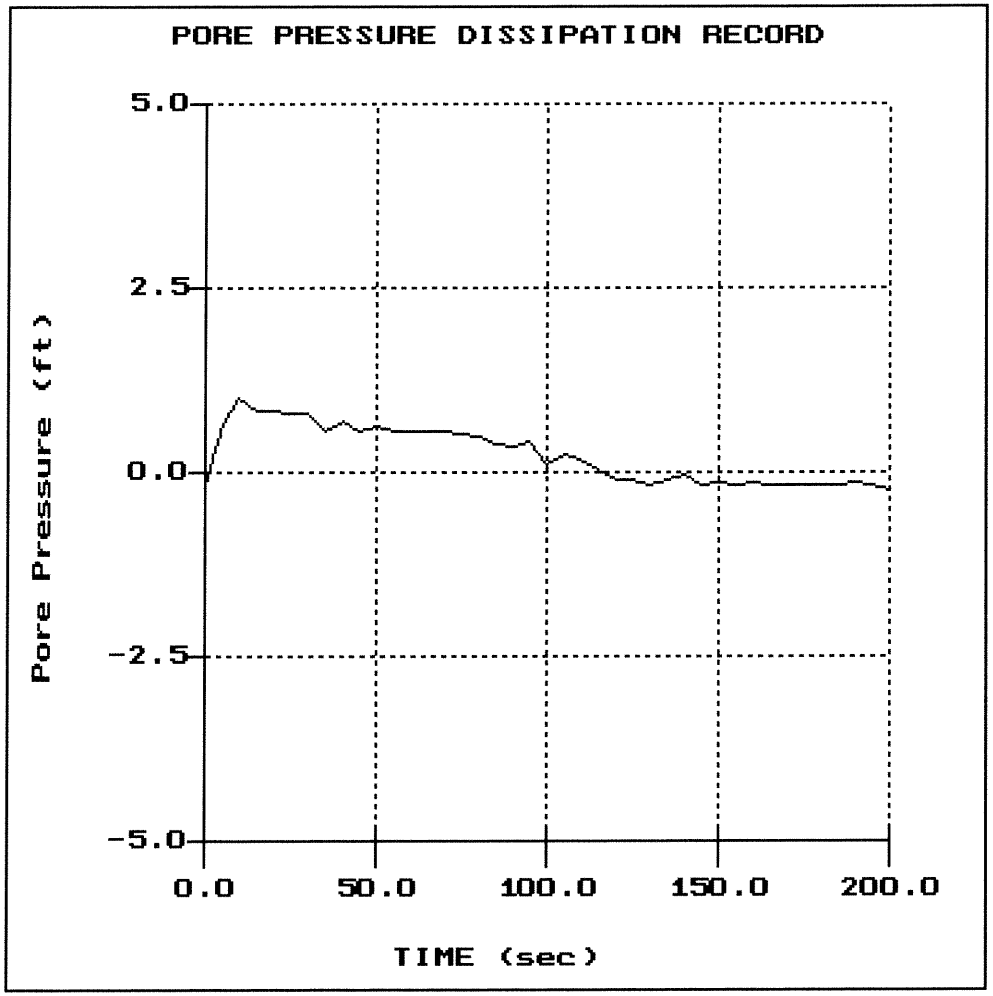
Max. Depth: 110.89 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3-07
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 07:37

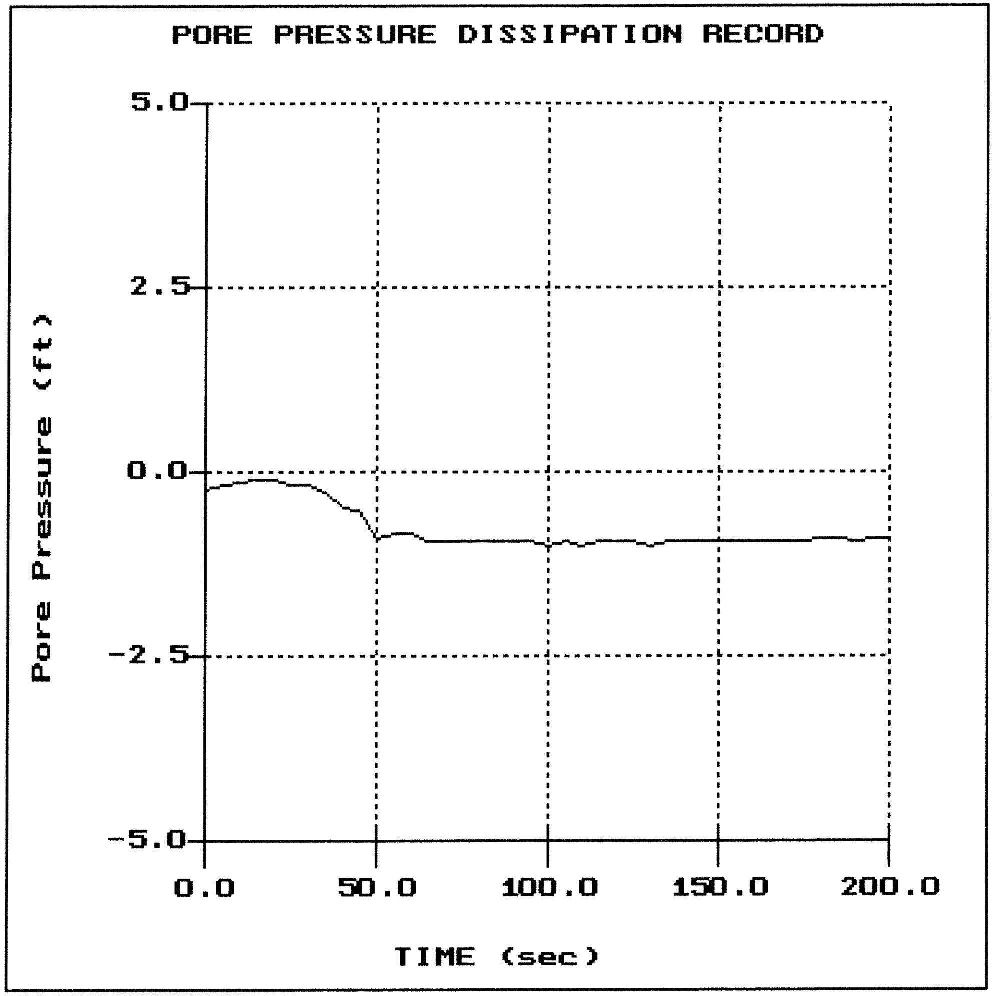


File: 393C307.PPD
Depth (m): 10.30
(ft): 33.79
Duration : 200.0s
U-min: -0.23 200.0s
U-max: 0.99 10.0s

URS Corporation

Hole No.:CPT3-07
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 07:37

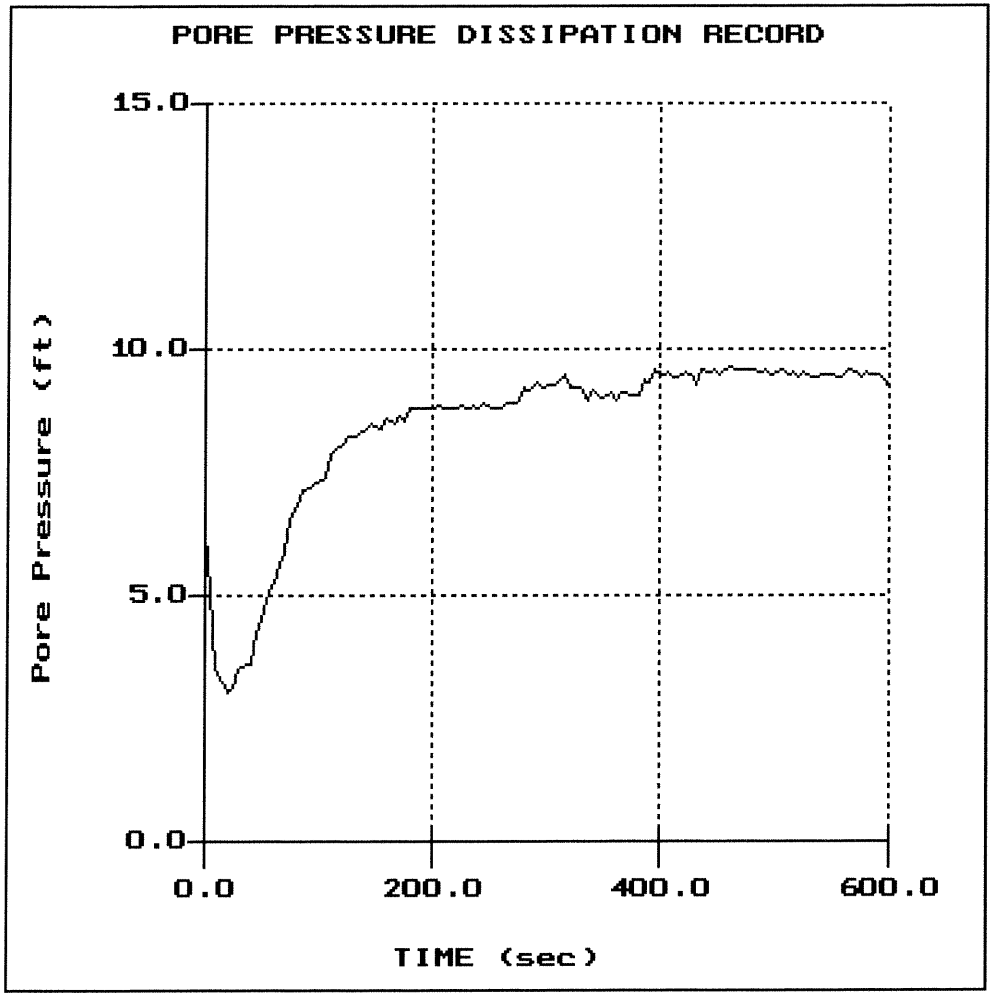


File: 393C307.PPD
Depth (m): 26.55
(ft): 87.11
Duration : 200.0s
U-min: -0.99 130.0s
U-max: -0.09 20.0s

URS Corporation

Hole No.:CPT3-07
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 07:37

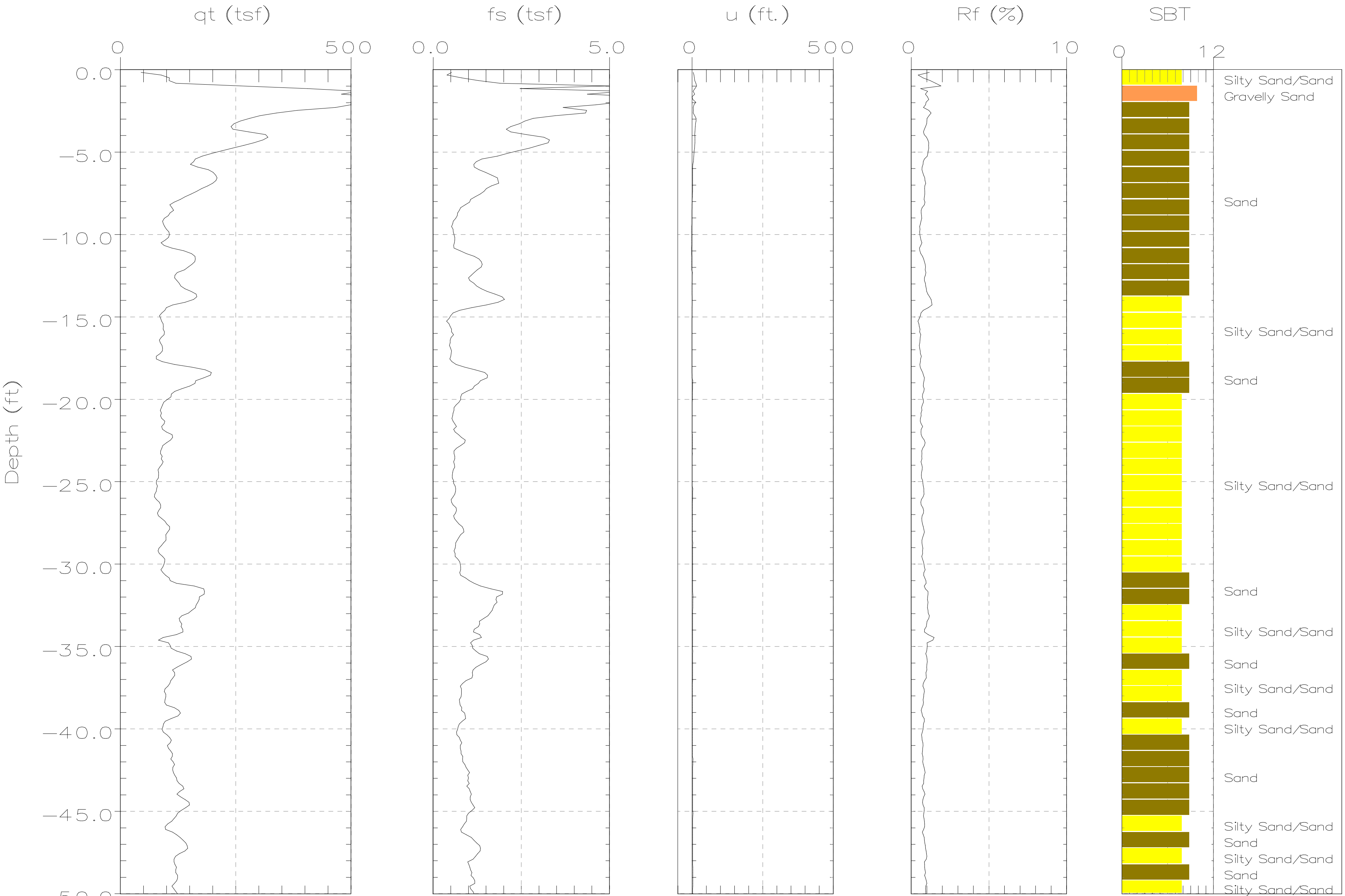


File: 393C307.PPD
Depth (m): 33.80
(ft): 110.89
Duration : 600.0s
U-min: 3.00 20.0s
U-max: 9.62 460.0s

URS Corporation

Hole No.:CPT3-08
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 09:07

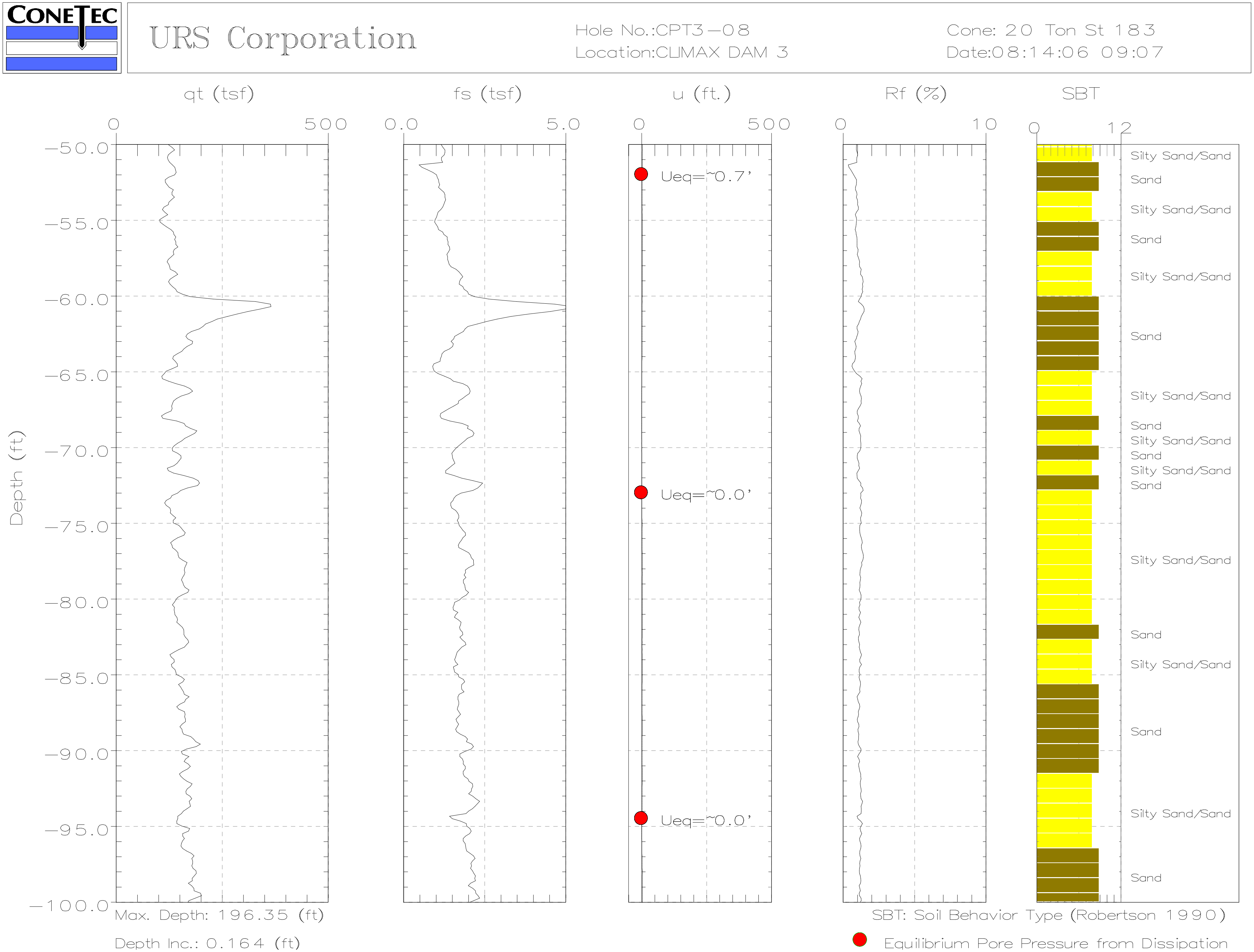


Max. Depth: 196.35 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation



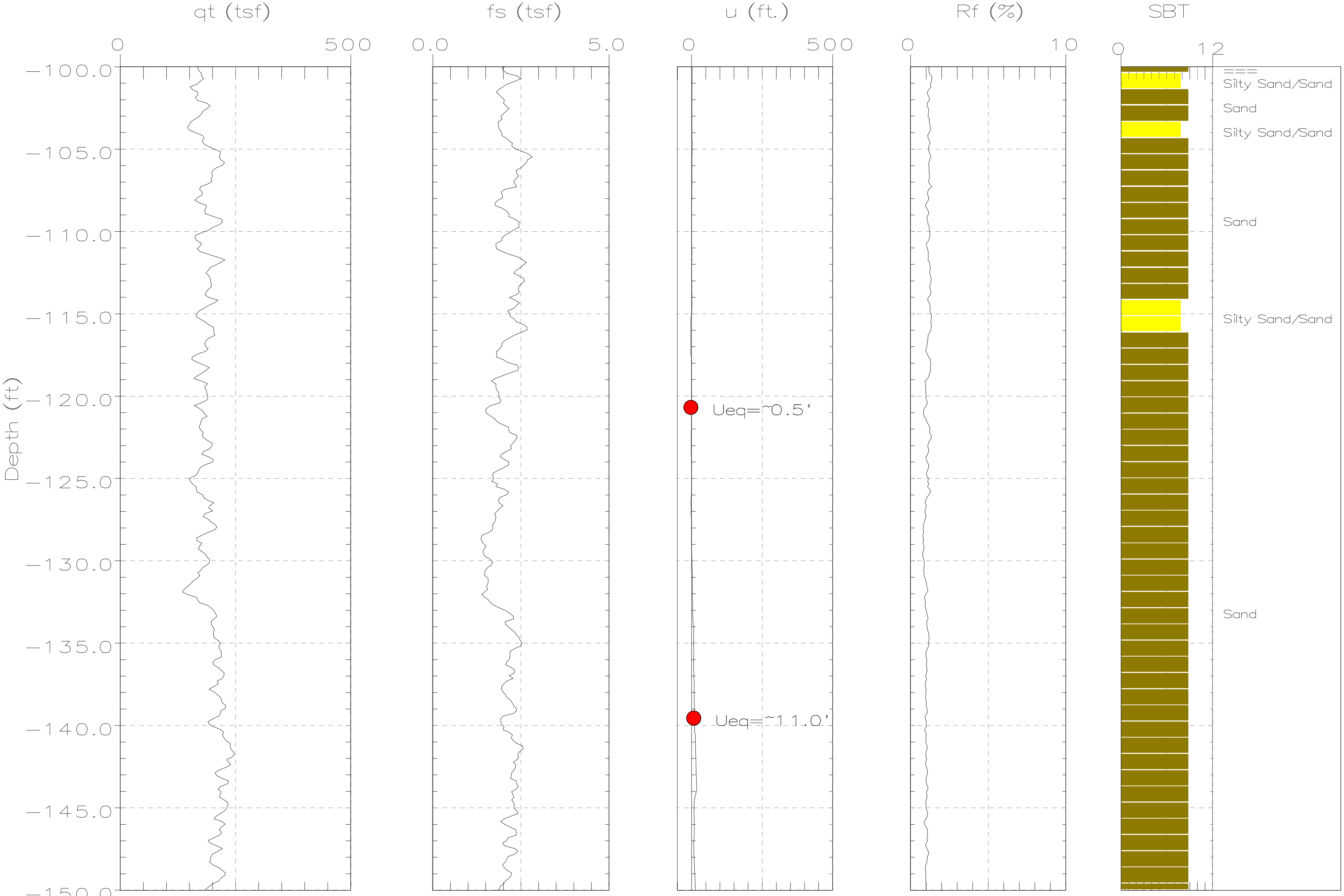
URS Corporation
Hole No.:CPT3-08
Location:CLIMAX DAM 3
Cone: 20 Ton St 183
Date:08:14:06 09:07
qt (tsf)
fs (tsf)
u (ft.)
Rf (%)
SBT
0
500
0.0
5.0
0
500
0
10
0
12
Depth (ft)
-50.0
-55.0
-60.0
-65.0
-70.0
-75.0
-80.0
-85.0
-90.0
-95.0
-100.0
Ueq=~0.7'
Ueq=~0.0'
Ueq=~0.0'
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Silty Sand/Sand
Sand
Max. Depth: 196.35 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)
Equilibrium Pore Pressure from Dissipation

CONETEC

URS Corporation

Hole No.:CPT3-08
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 09:07



Max. Depth: 196.35 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

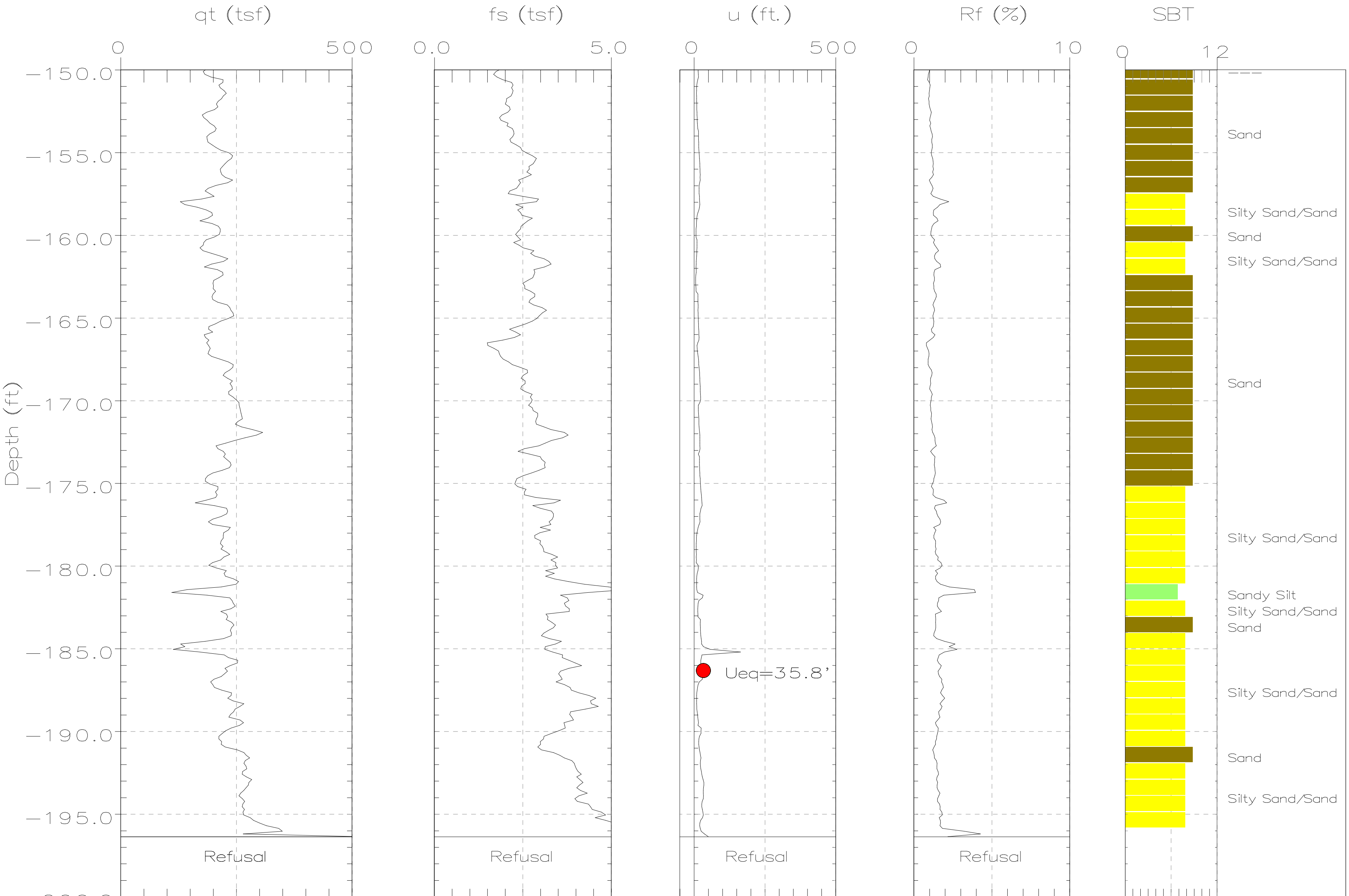
Equilibrium Pore Pressure from Dissipation

CONETEC

URS Corporation

Hole No.:CPT3-08
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 09:07



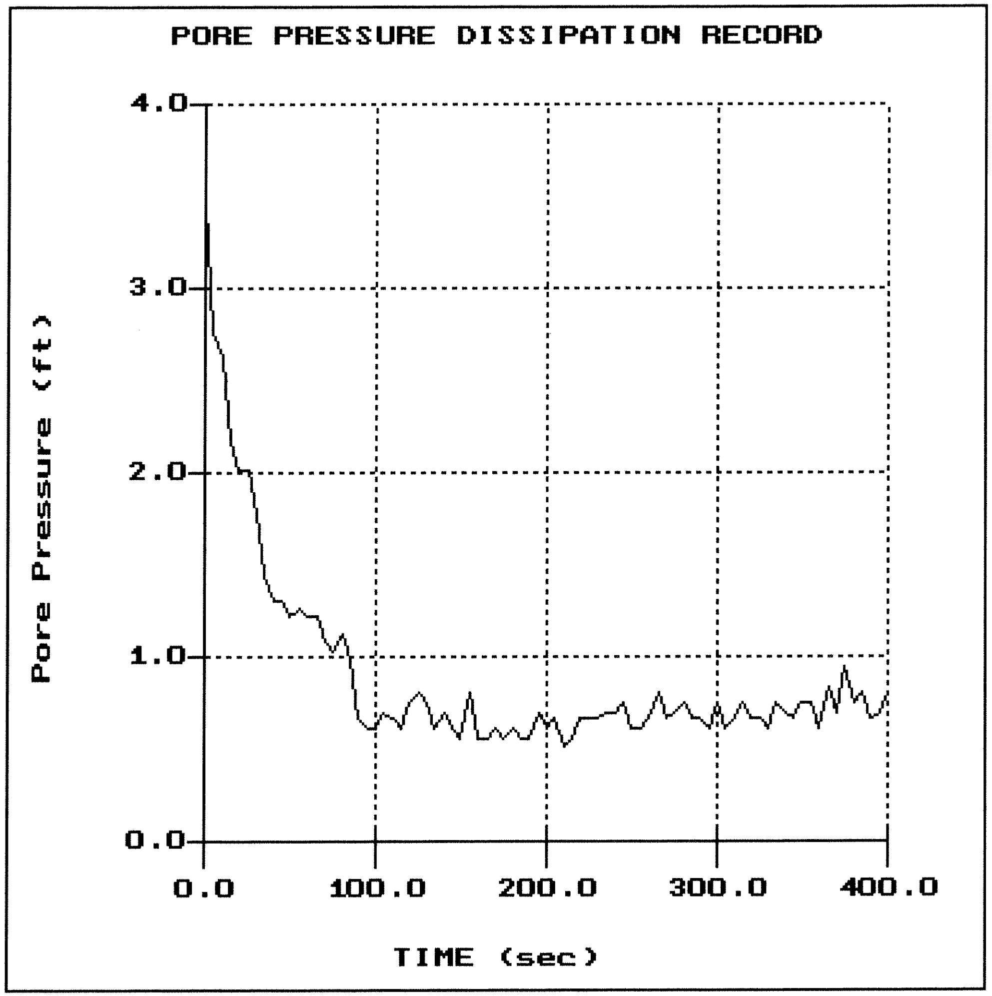
Max. Depth: 196.35 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation	Hole No.:CPT3-08 Location:CLIMAX DAM 3	Cone: 20 Ton St 183 Date:08:14:06 09:07

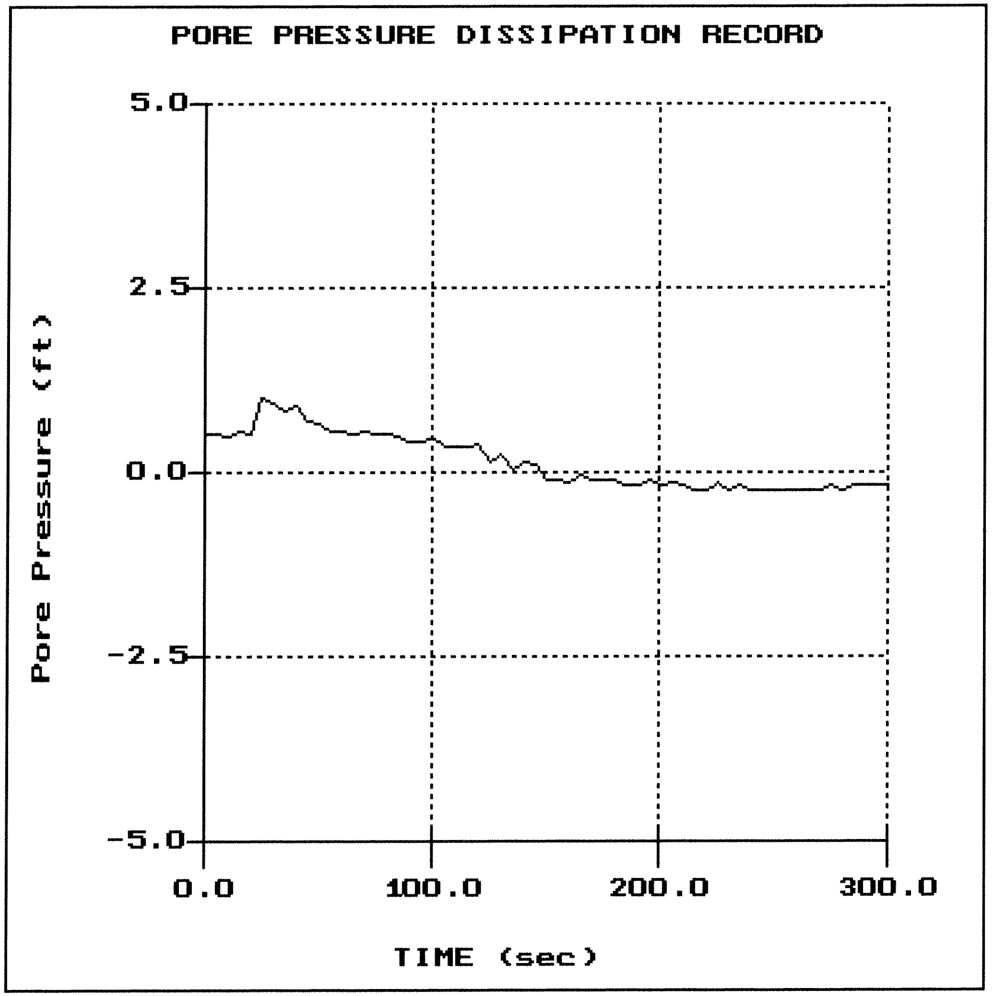


File: 393C308.PPD
Depth (m): 15.85
(ft): 52.00
Duration : 400.0s
U-min: 0.52 210.0s
U-max: 3.47 0.0s

URS Corporation

Hole No.:CPT3-08
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 09:07

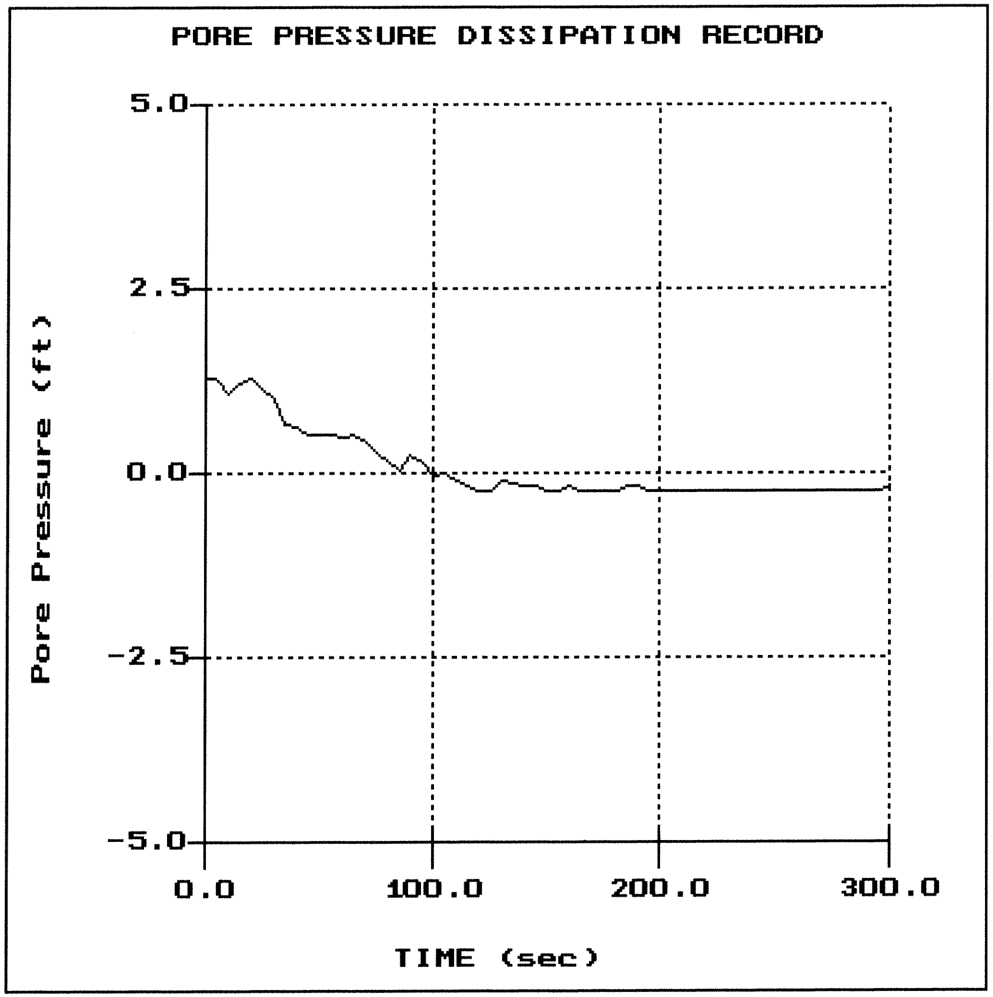


File: 393C308.PPD
Depth (m): 22.25
(ft): 73.00
Duration : 300.0s
U-min: -0.23 280.0s
U-max: 0.99 25.0s

URS Corporation

Hole No.:CPT3-08
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 09:07

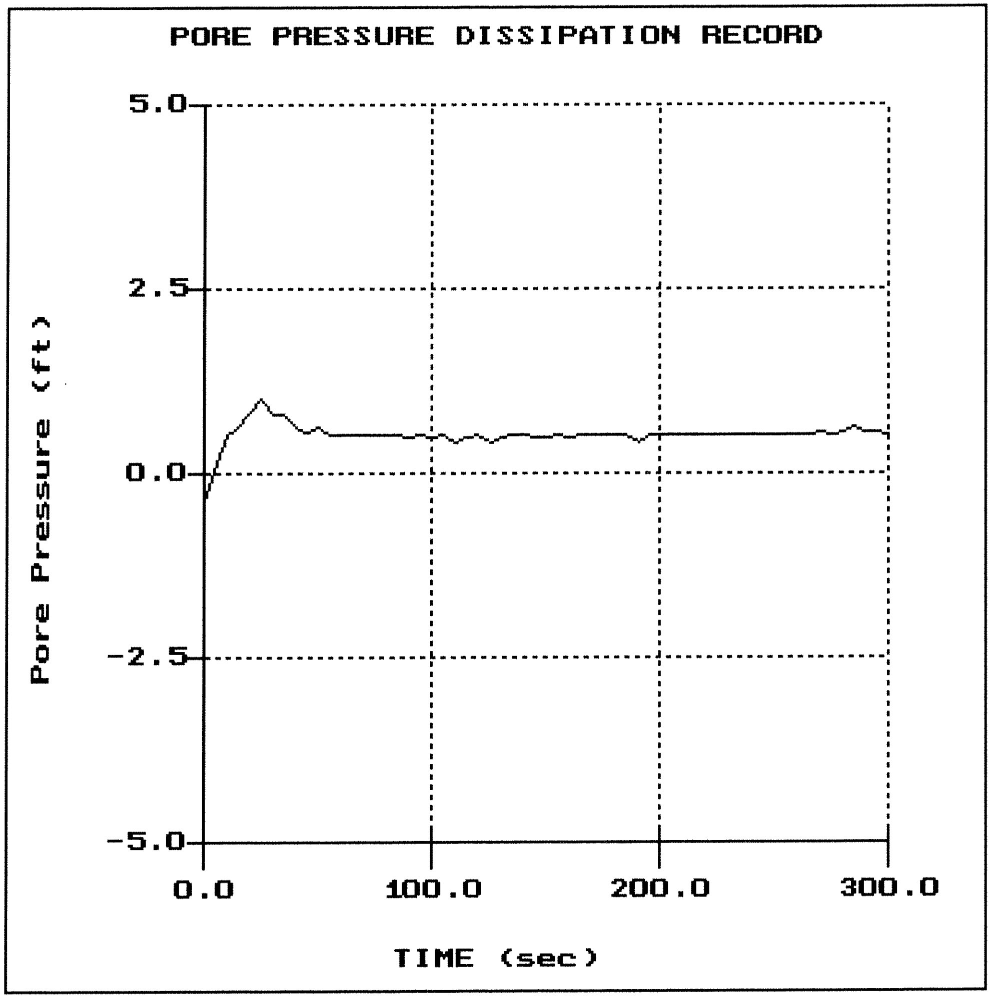


File: 393C308.PPD
Depth (m): 28.80
(ft): 94.49
Duration : 300.0s
U-min: -0.23 295.0s
U-max: 1.27 20.0s

URS Corporation

Hole No.:CPT3-08
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 09:07

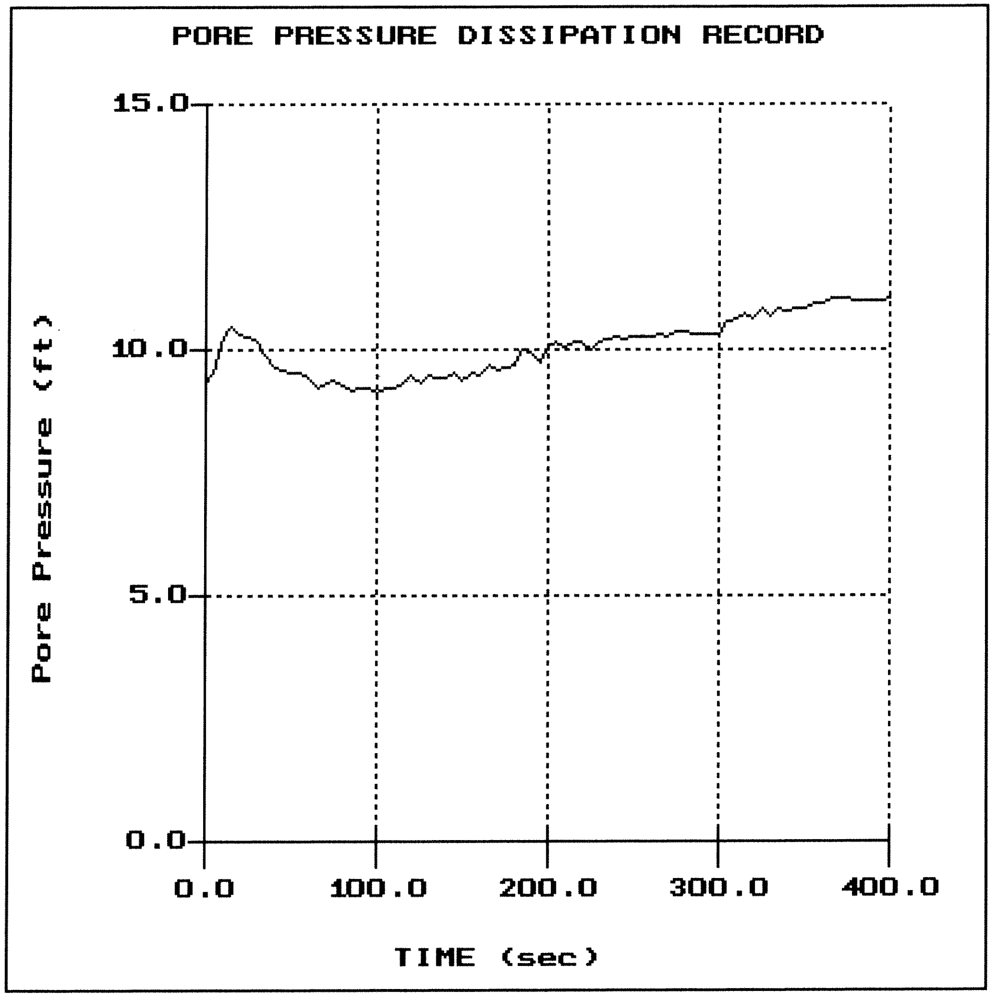


File: 393C308.PPD
Depth (m): 36.80
(ft): 120.73
Duration : 300.0s
U-min: -0.38 0.0s
U-max: 0.99 25.0s

URS Corporation

Hole No.:CPT3-08
Location:CLIMAX DAM 3

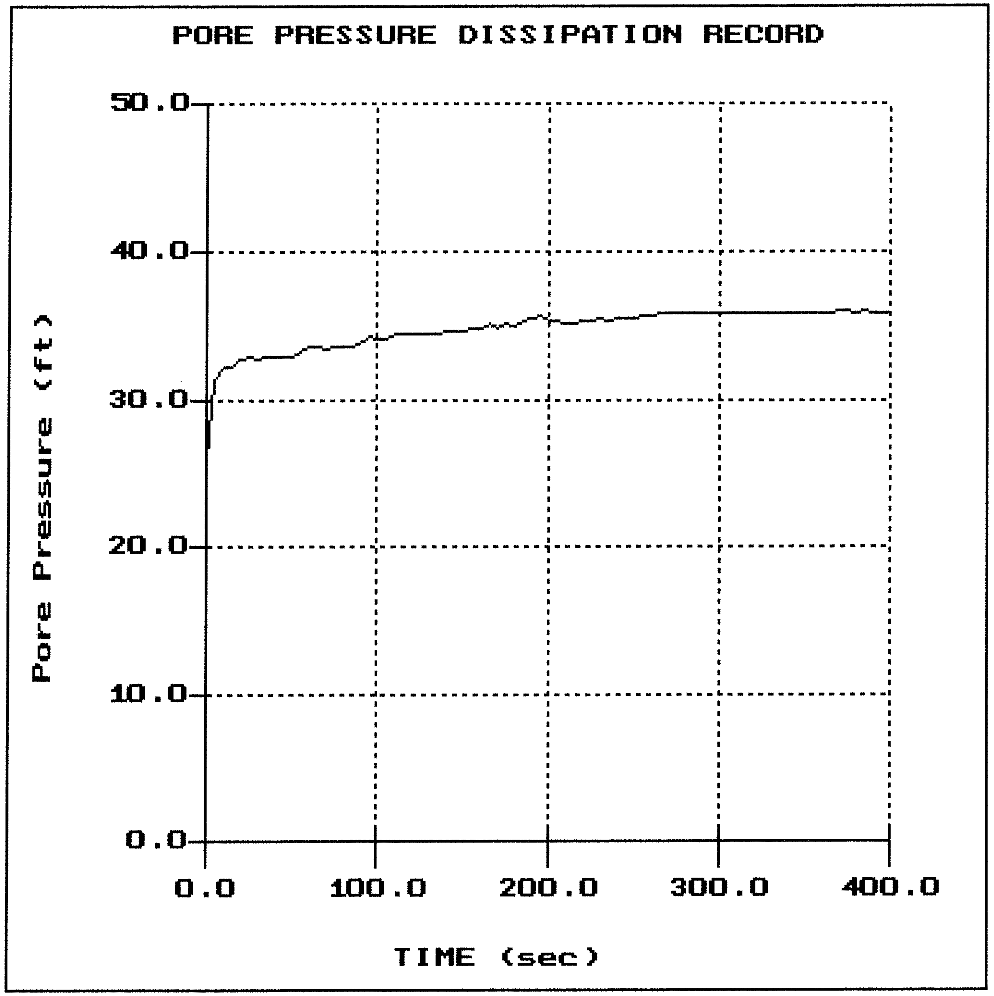
Cone: 20 Ton St 183
Date:08:14:06 09:07



File: 393C308.PPD
Depth (m): 42.55
(ft): 139.60
Duration : 400.0s
U-min: 9.10 100.0s
U-max: 11.03 400.0s

URS Corporation	Hole No.:CPT3-08 Location:CLIMAX DAM 3	Cone: 20 Ton St 183 Date:08:14:06 09:07

File: 393C308.PPD
Depth (m): 56.80
(ft): 186.35
Duration : 400.0s
U-min: 25.76 0.0s
U-max: 35.99 385.0s

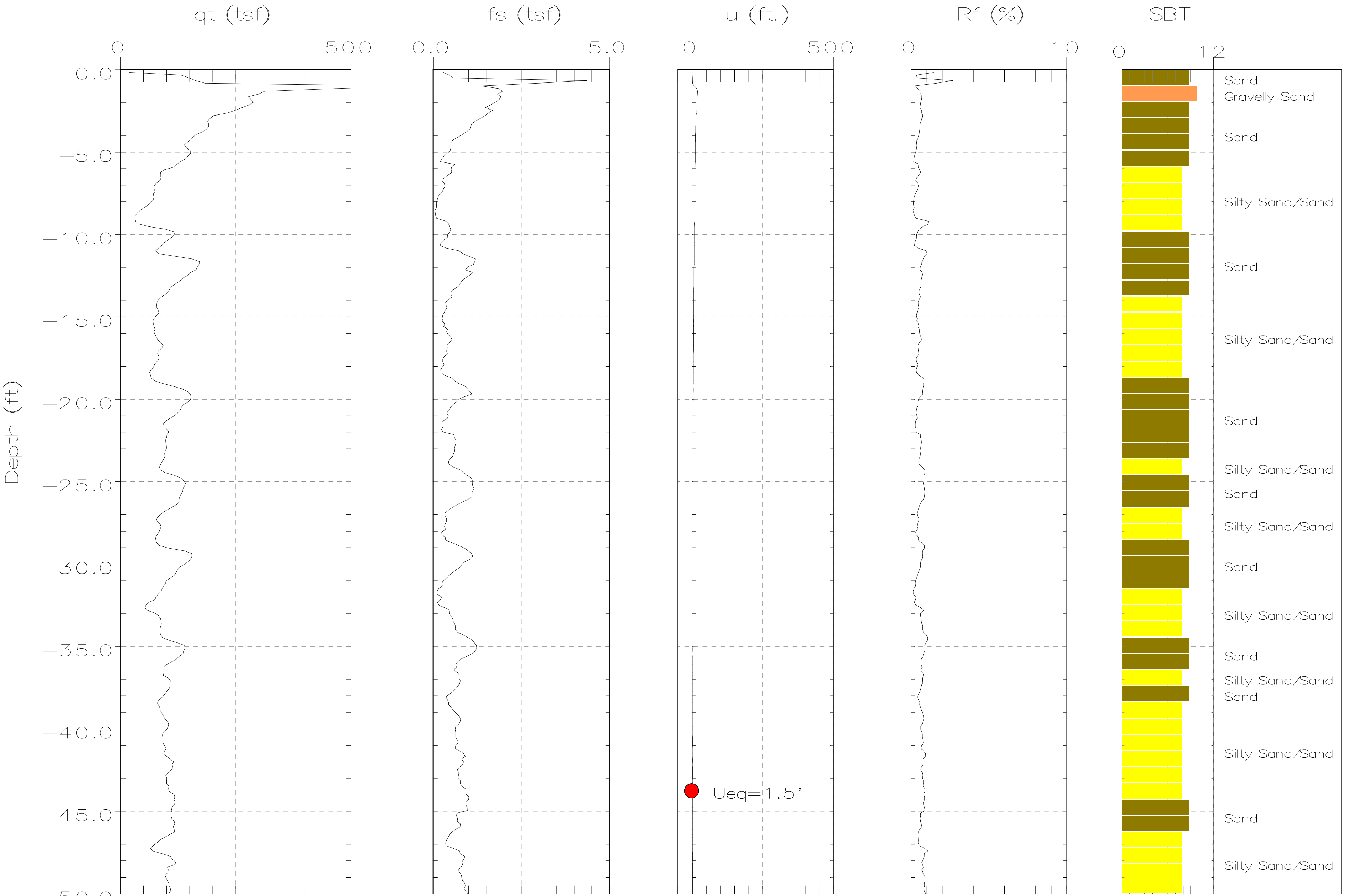


CONETEC

URS Corporation

Hole No.:CPT3-09
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 11:40



Max. Depth: 91.53 (ft)

Depth Inc.: 0.164 (ft)

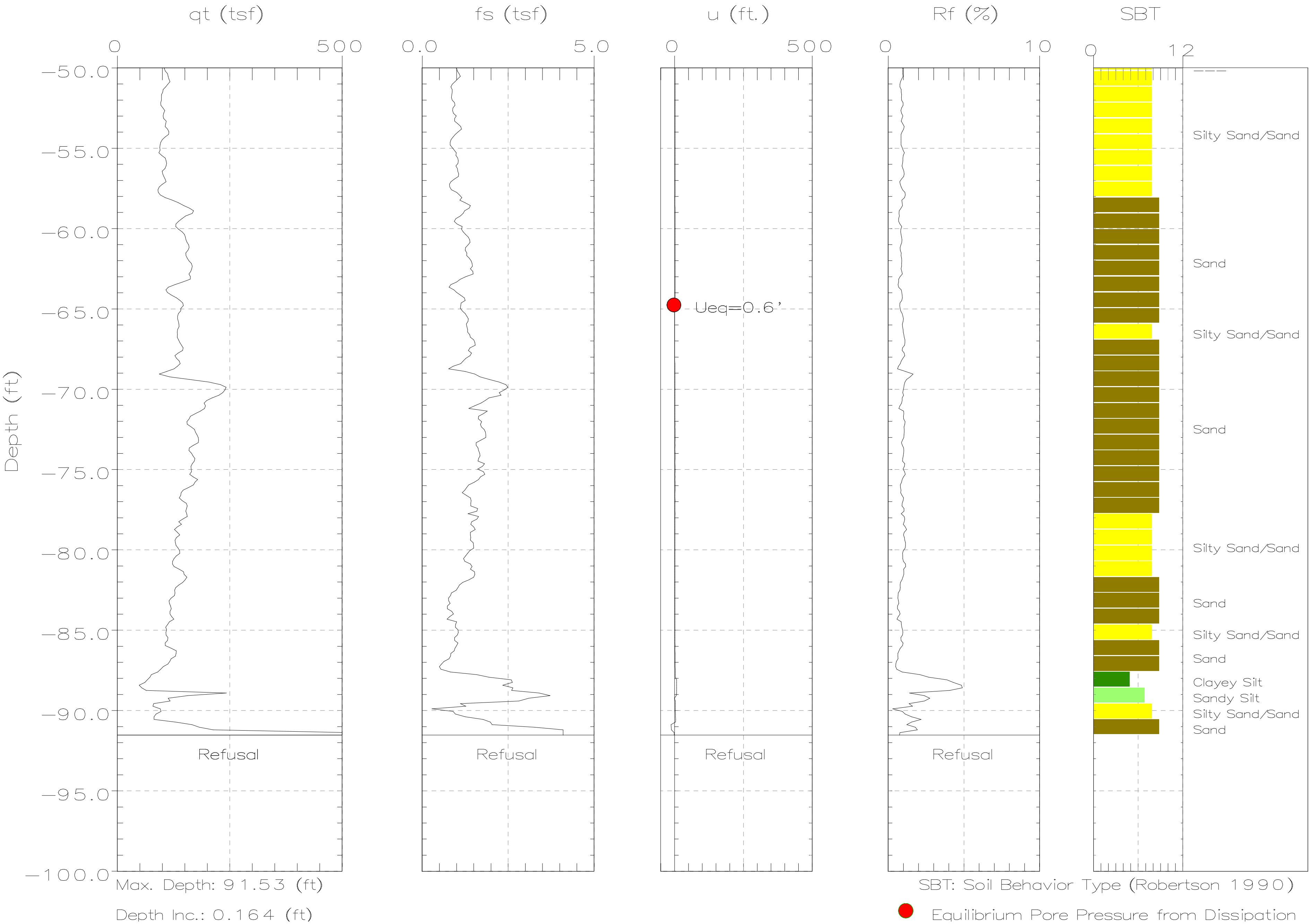
SBT: Soil Behavior Type (Robertson 1990)

Equilibrium Pore Pressure from Dissipation

URS Corporation

Hole No.:CPT3−09
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 11:40

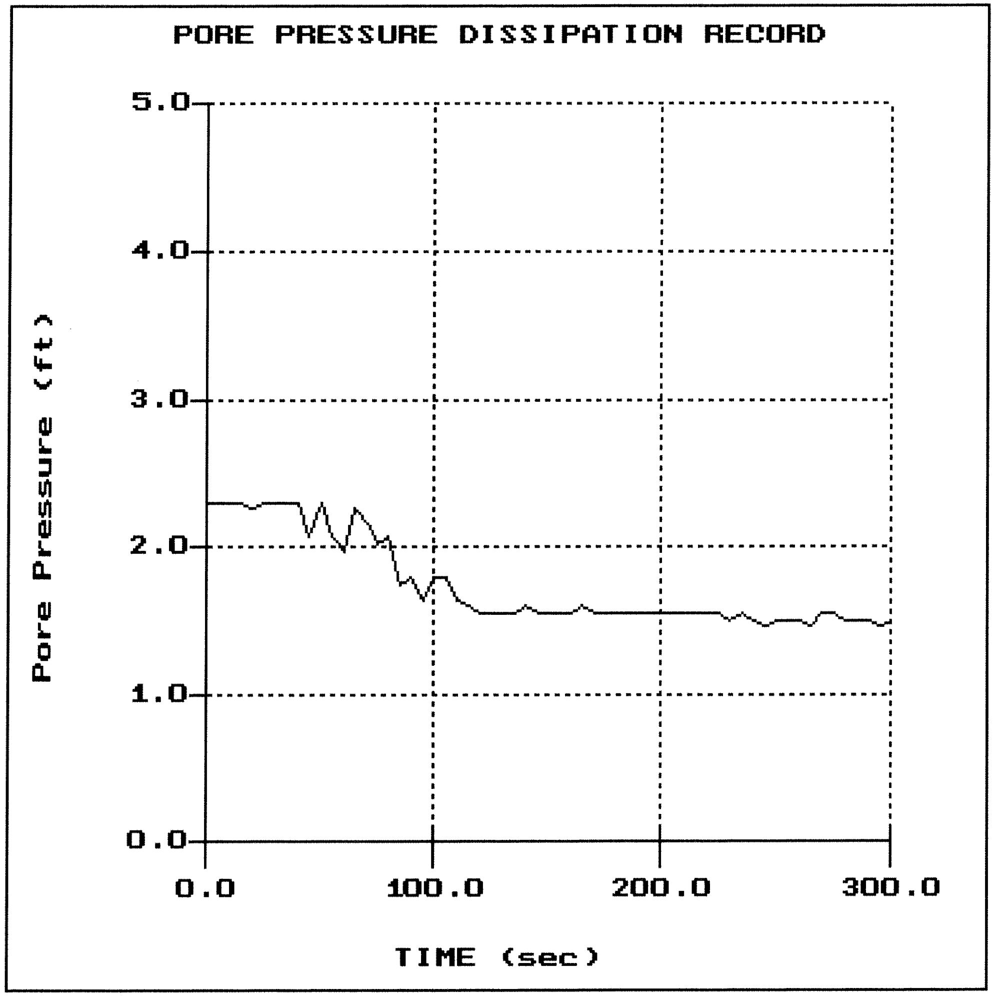


URS Corporation

Hole No.:CPT3-09
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 11:40

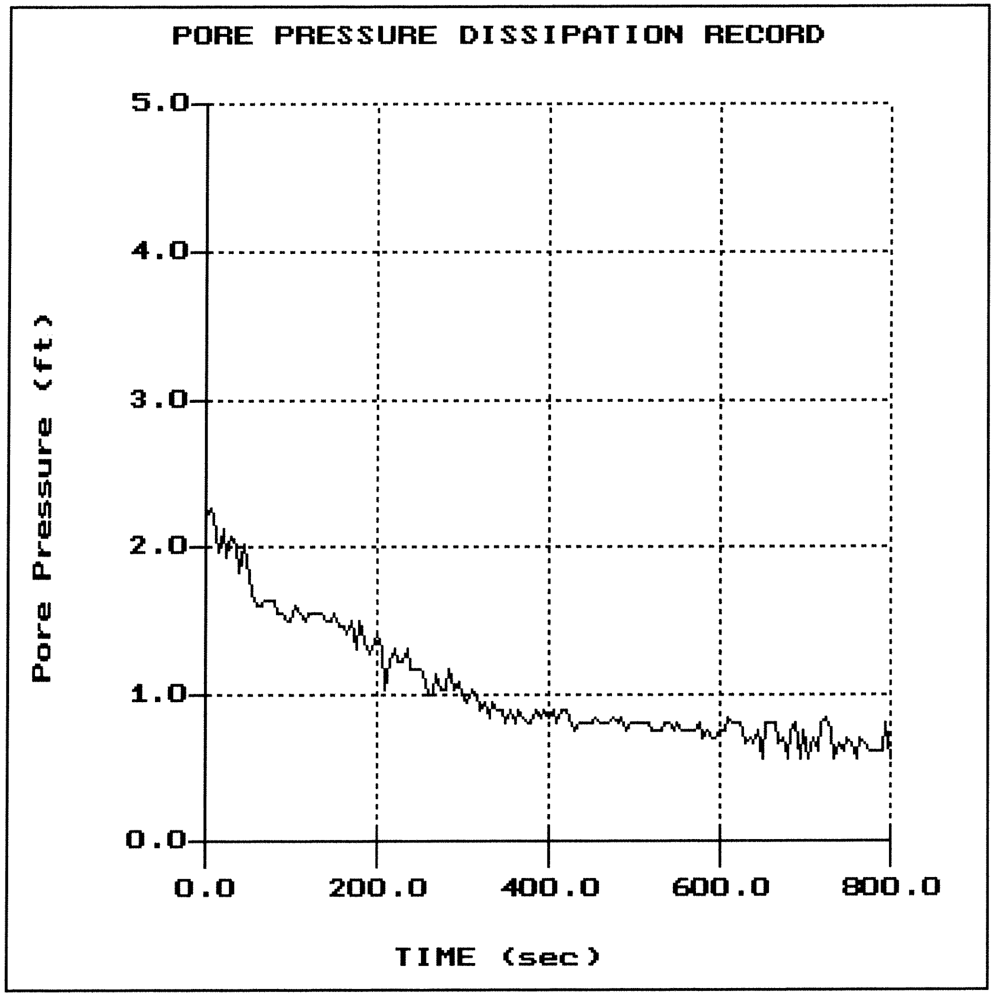
File: 393C309.PPD
Depth (m): 13.35
(ft): 43.80
Duration : 300.0s
U-min: 1.45 295.0s
U-max: 2.30 50.0s



URS Corporation

Hole No.:CPT3-09
Location:CLIMAX DAM 3

Cone: 20 Ton St 183
Date:08:14:06 11:40



File: 393C309.PPD
Depth (m): 19.75
(ft): 64.80
Duration : 810.0s
U-min: 0.42 805.0s
U-max: 2.25 5.0s

Shear Wave Velocity Calculations

Job No.: 06-393
Client: URS Corporation
CPT No.: CPT3-02
Location Climax Mine - Dam 3
Date: 8/10/06

Geophone Offset (m): 0.20
Source Offset (18") (m): 0.46

Test Depth (m)	Geophone Depth (m)	Ray Path (m)	Incremental Distance (m)	Time Interval (ms)	Interval Velocity (m/s)	Interval Depth (m)	Interval Velocity (ft/s)	Interval Depth (ft)
0.75	0.55	0.72						
6.75	6.55	6.57	5.85	25.52	229	3.55	752	11.6
12.75	12.55	12.56	5.99	26.55	226	9.55	740	31.3
18.75	18.55	18.56	6.00	25.38	236	15.55	775	51.0
24.75	24.55	24.55	6.00	22.42	268	21.55	878	70.7
30.75	30.55	30.55	6.00	21.54	279	27.55	914	90.4
36.75	36.55	36.55	6.00	20.99	286	33.55	937	110.0
42.85	42.65	42.65	6.10	19.19	318	39.60	1043	129.9
49.75	49.55	49.55	6.90	22.47	307	46.10	1007	151.2
54.75	54.55	54.55	5.00	16.21	308	52.05	1012	170.7
60.75	60.55	60.55	6.00	20.97	286	57.55	938	188.8
66.75	66.55	66.55	6.00	17.98	334	63.55	1095	208.4

SUMMARY FOR STATIC CIU' TRIAXIAL TESTS SPECIMENS

Test No	Boring No	Sample Section No	Depth / Elev (ft)	USCS Group Symbol / Gs	w_o / w_c (%)	$\gamma_{t,o}$ / $\gamma_{t,c}$ (pcf)	$\gamma_{d,o}$ / $\gamma_{d,c}$ (pcf)	$\sigma'_{c,max}$ (ksf) / OCR	$\sigma'_{v,c}$ (ksf) / $K_c = \sigma'_{v,c} / \sigma'_{h,c}$	$\varepsilon_{a,c}$ / $\varepsilon_{v,c}$ (%)	B factor (%) / ε_{rate} (%/hr)	ε_a (%)	$\frac{\sigma_1 - \sigma_3}{2}$ (ksf)	$\frac{\sigma'_1 + \sigma'_3}{2}$ (ksf)	σ'_1 / σ'_3	A factor	ϕ' for c'=0
												at Peak Deviator Stress / at Peak Obliquity					
T2646	TH3-1	A	40.4	SP-SM	10.4	104.4	94.6	12.00	12.00	1.1	97.9	11.6	10.29	17.23	3.96	0.245	36.6
				(2.70)	25.2	125.6	100.4	1.0	1.00	5.8	1.1	8.2	9.62	15.91	4.06	0.297	37.2
T2647	TH3-1	B	40.9	SP-SM	14.0	109.2	95.8	24.00	24.00	1.0		10.9	16.07	26.17	4.18	0.433	37.9
				(2.70)	26.4	124.4	98.4	1.0	1.00	2.6	1.3	8.0	15.86	25.79	4.19	0.444	37.9
T2648	TH3-1	C	41.4	SP-SM	20.8	113.0	93.5	48.00	48.00	2.3		12.6	32.33	50.34	4.59	0.464	40.0
				(2.70)	21.9	129.1	105.9	1.0	1.00	11.7	1.5	7.7	29.97	45.44	4.87	0.543	41.3

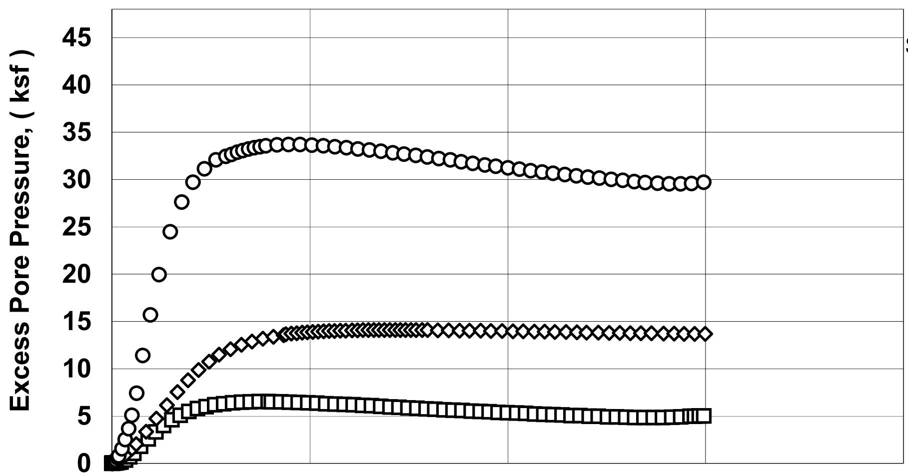
Test No	Description of Material Tested and Remarks
T2646	SP-SM, brown f. SAND, trace silt; thin CL-ML layer noted.
T2647	SP-SM, brown m-f SAND, trace silt.
T2648	SP-SM, brown m-f SAND, trace silt.

Strength Envelope Summary

Test Series	Failure Criteria	ϕ' (deg)	c' (ksf)	α' (deg)	a' (ksf)	Correlation Coefficient
1	1	39.3	0.000	32.3	0.000	--
	2	40.2	0.000	32.8	0.000	--

Failure Criteria: 1 - Peak Deviator Stress; 2 - Peak Obliquity

Project No. 22238824	**Climax Mine** **3 Dam**	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements TH3-1 40-41.5 SUMMARY	November 2006
URS Corporation			

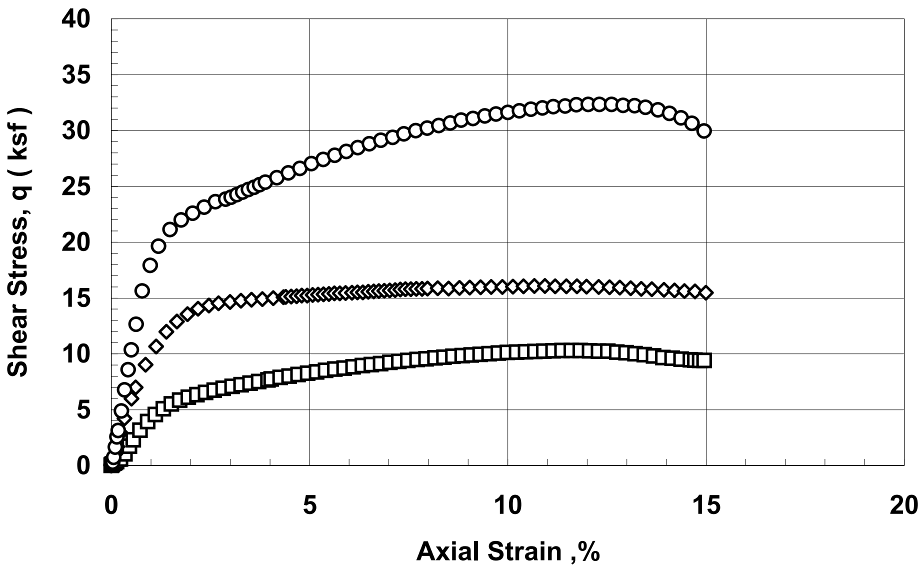


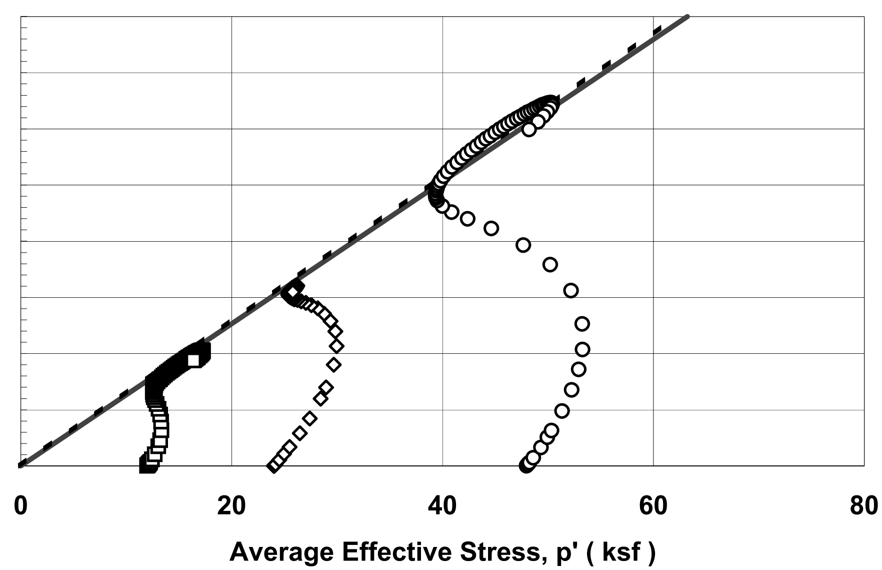
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c (ksf)
□	T2646	TH3-1	A	40.4	10.4	104.4	12.00
◊	T2647	TH3-1	B	40.9	14.0	109.2	24.00
○	T2648	TH3-1	C	41.4	20.8	113.0	48.00

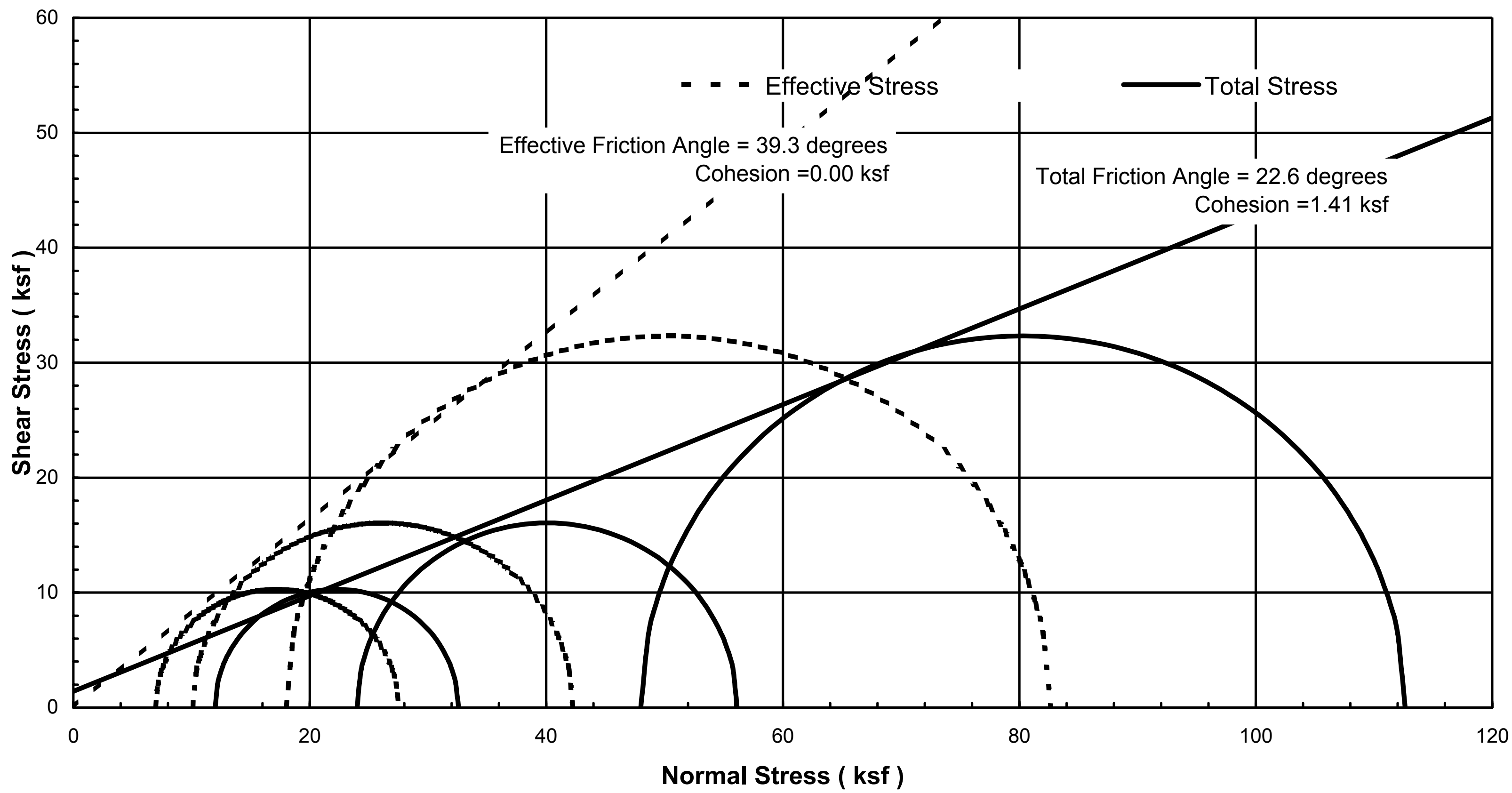
SERIES SUMMARY

Notation	Failure Criteria	c' (ksf)	Φ' (degrees)
solid line	Peak Deviator Stress	0.00	39.3
dotted line	Peak Obliquity	0.00	40.2

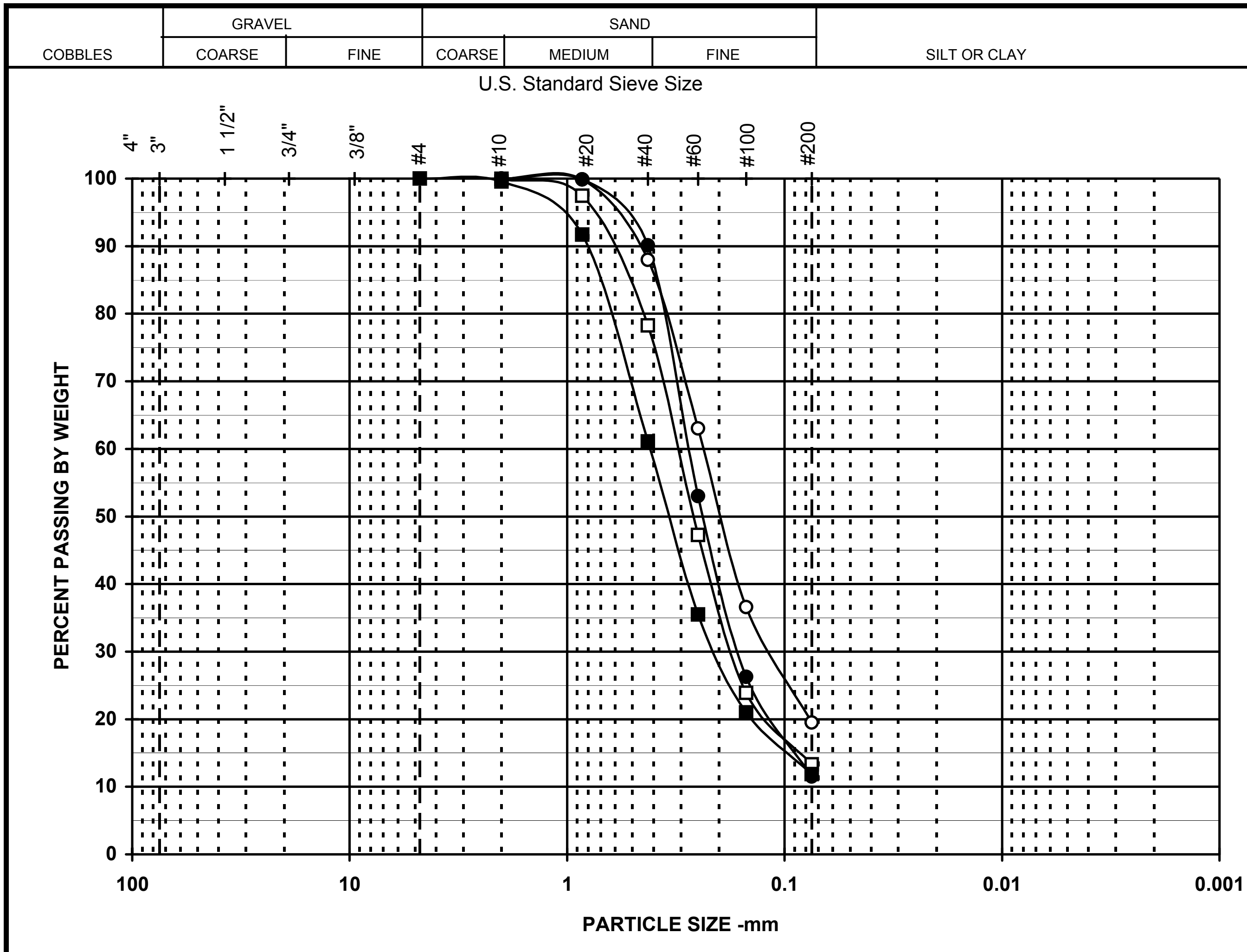




Prepared by: C. Jordan Checked by: G. Thomas	Project No. 22238824	**Climax Mine** **3 Dam**	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements TH3-1 40-41.5 SUMMARY
	URS Corporation		Figure 1 November 2006



Project No. 22238824	Climax Mine 3 Dam	Mohr Circles of Total and Effective Stresses at Peak CIU' Triaxial Test	Figure 2
URS Corporation		TH3-1 40-41.5 SUMMARY	November 2006



Symbol	□	■	○	●
Boring	TH3-1	TH3-1	TH3-1	TH3-1
Sample				
Spec				
Depth	10-11.5	20-21.5	30	40.9
% +3"				
% Gravel				
% SAND	86.7	88.1	80.5	88.5
% FINES	13.3	11.9	19.5	11.5
% -2µ				
Cc		1.8		1.4
Cu		7.0		4.2
LL				np
PL				np
PI				
USCS	SM	SW-SM	SM	SP-SM
w (%)	19.4	19.3	22.9	

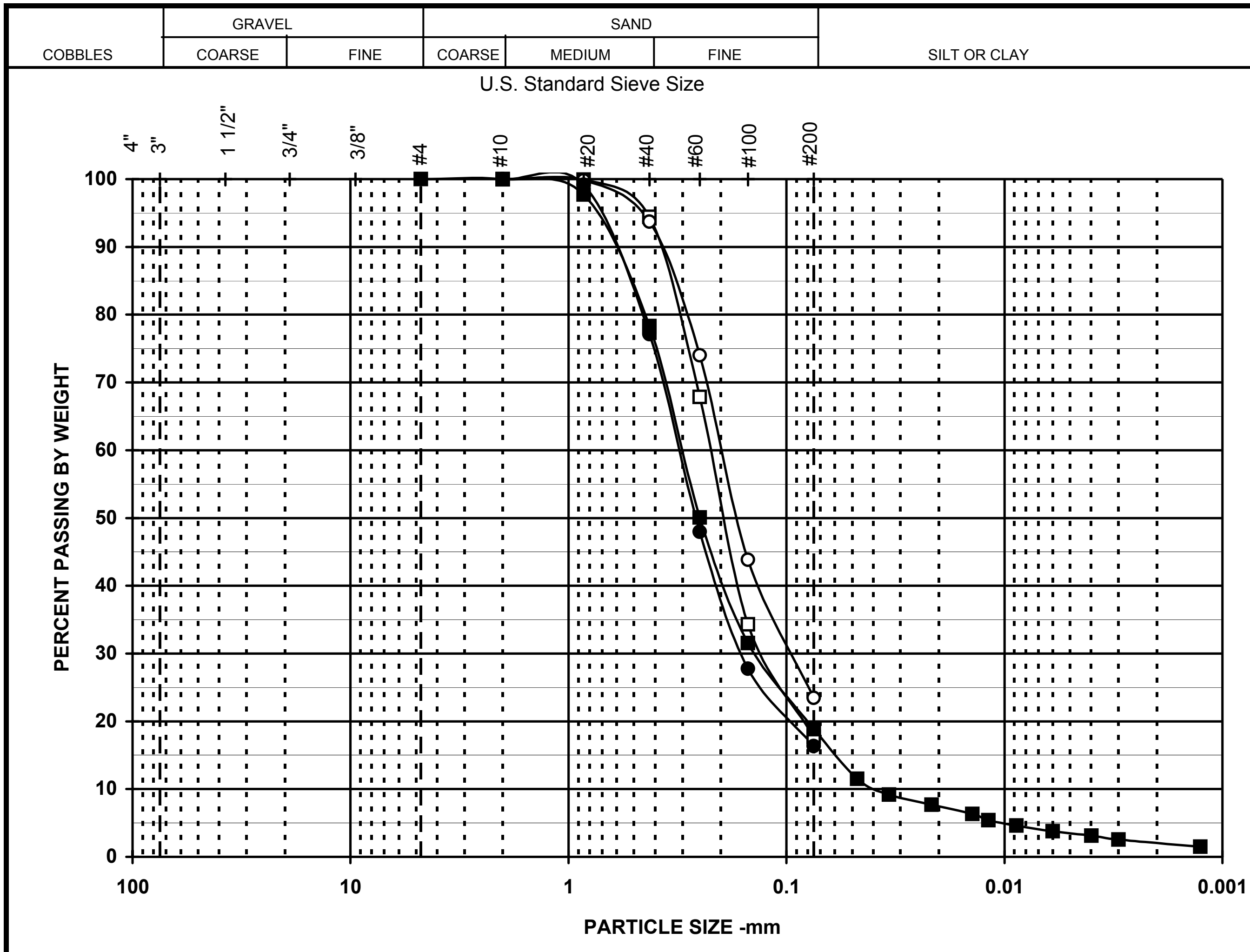
Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4		100.0		
10	100.0	99.5	100.0	100.0
20	97.5	91.7	99.9	99.9
40	78.3	61.1	88.0	90.1
60	47.2	35.5	63.0	53.0
100	23.9	21.0	36.6	26.3
200	13.3	11.9	19.5	11.5

SYMBOL	DESCRIPTION AND REMARKS
□	light brown m-f SAND, some silt.
■	brown m-f SAND, trace silt.
○	brown m-f SAND, some silt.
●	brown m-f SAND, trace silt.

PARTICLE SIZE DISTRIBUTION
Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation



Symbol	□	■	○	●
Boring	TH3-1	TH3-1	TH3-1	TH3-1
Sample				
Spec				
Depth	42.5-44	50-51.5	60-61.5	70-71.5
% +3"				
% Gravel				
% SAND	82.4	81.1	76.6	83.7
% FINES	17.6	18.9	23.4	16.3
% -2µ		2		
Cc				
Cu				
LL		np		
PL		np		
PI				
USCS	SM	SM	SM	SM
w (%)	14.1		20.2	19.6

Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4				
10	100.0	100.0	100.0	100.0
20	99.9	97.7	99.8	99.2
40	94.4	78.3	93.7	77.1
60	67.9	50.1	74.0	47.9
100	34.3	31.5	43.8	27.8
200	17.6	18.9	23.4	16.3

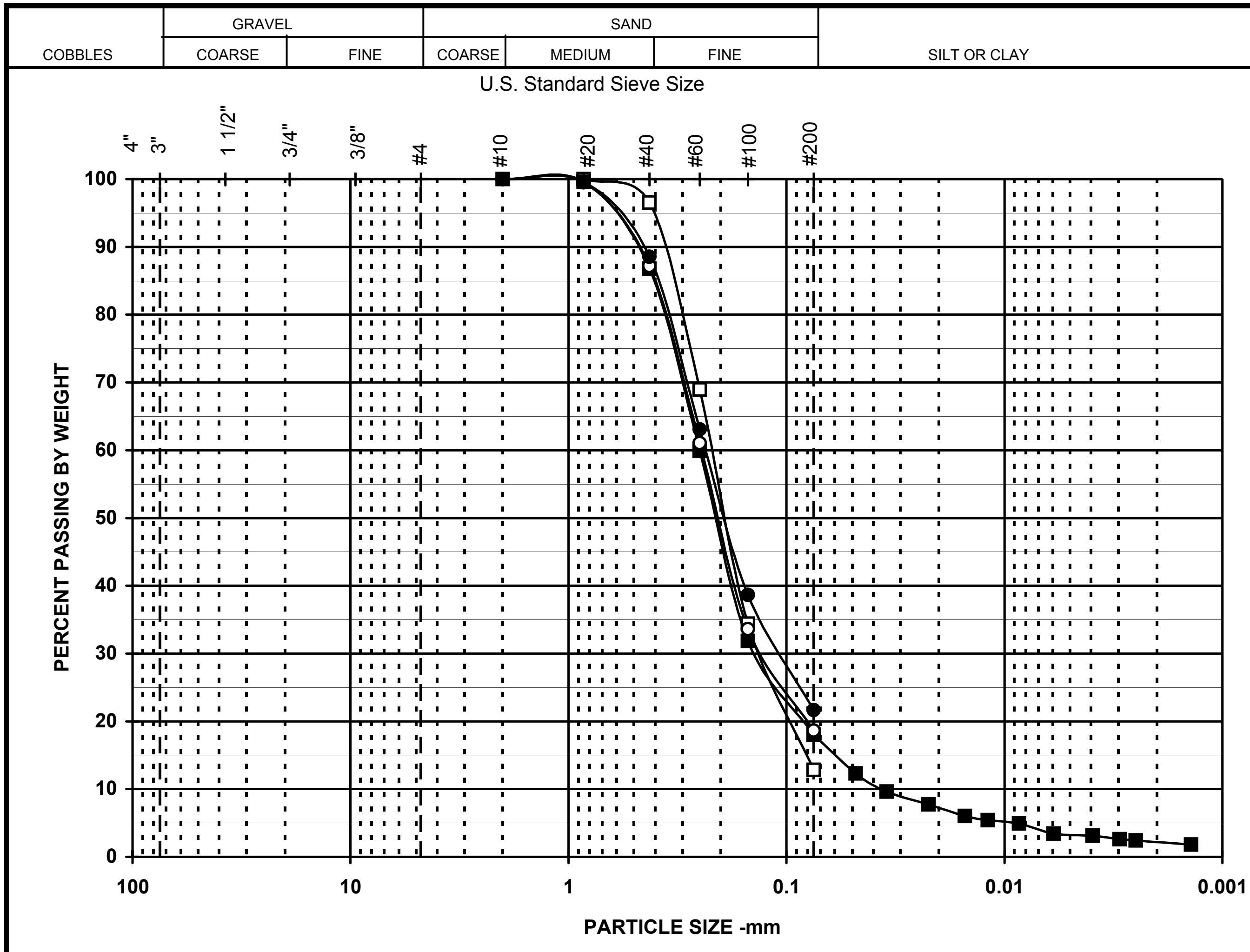
SYMBOL	DESCRIPTION AND REMARKS
□	light brown f. SAND, some silt, trace m. sand.
■	brown m-f SAND, some silt.
○	light brown f. SAND, some silt, trace m. sand.
●	brown m-f SAND, some silt.

PARTICLE SIZE DISTRIBUTION

Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation



Symbol	□	■	○	●
Boring	TH3-1	TH3-1	TH3-1	TH3-1
Sample				
Spec				
Depth	80-82.5	82-83.5	90-91.5	110-111.5
% +3"				
% Gravel				
% SAND	87.2	82.0	81.4	78.3
% FINES	12.8	18.0	18.6	21.7
% -2μ		2		
Cc				
Cu				
LL	np			
PL	np			
PI				
USCS	SM	SM	SM	SM
w (%)			17.0	19.5

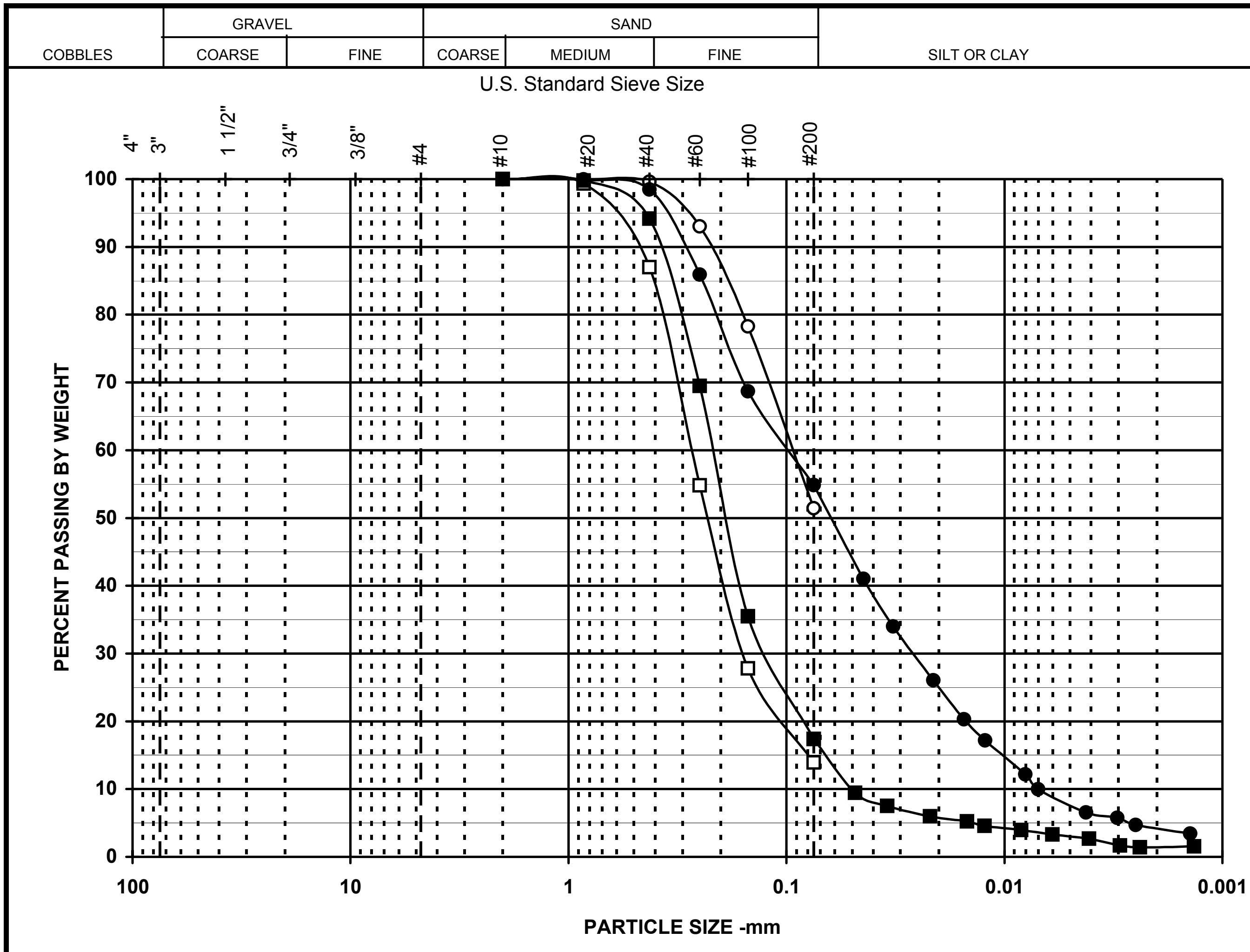
Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4				
10		100.0	100.0	100.0
20	100.0	99.6	99.5	99.6
40	96.5	86.8	87.2	88.6
60	69.0	59.9	61.1	63.0
100	34.4	31.8	33.6	38.6
200	12.8	18.0	18.6	21.7

SYMBOL	DESCRIPTION AND REMARKS
□	gray f. SAND, some silt, trace m. sand.
■	brown m-f SAND, some silt.
○	brown m-f SAND, some silt.
●	brown m-f SAND, some silt.

PARTICLE SIZE DISTRIBUTION
Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation



Symbol	□	■	○	●
Boring	TH3-1	TH3-1	TH3-1	TH3-1
Sample				
Spec				
Depth	150-151.5	180-181.5	200-201.5	225-226.5
% +3"				
% Gravel				
% SAND	86.1	82.6	48.6	45.1
% FINES	13.9	17.4	51.4	54.9
% -2μ		1		4
Cc				
Cu				
LL				np
PL				np
PI				
USCS	SM	SM	CL	ML
w (%)	18.8		20.7	

Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4				
10	100.0	100.0		100.0
20	99.3	99.8	100.0	99.9
40	87.0	94.2	99.6	98.5
60	54.8	69.5	93.0	85.9
100	27.8	35.5	78.2	68.7
200	13.9	17.4	51.4	54.9

SYMBOL	DESCRIPTION AND REMARKS
□	brown f. SAND, some silt, trace m. sand.
■	brown m-f SAND, some silt.
○	brown f. sandy CLAY.
●	brown-gray f. sandy SILT.

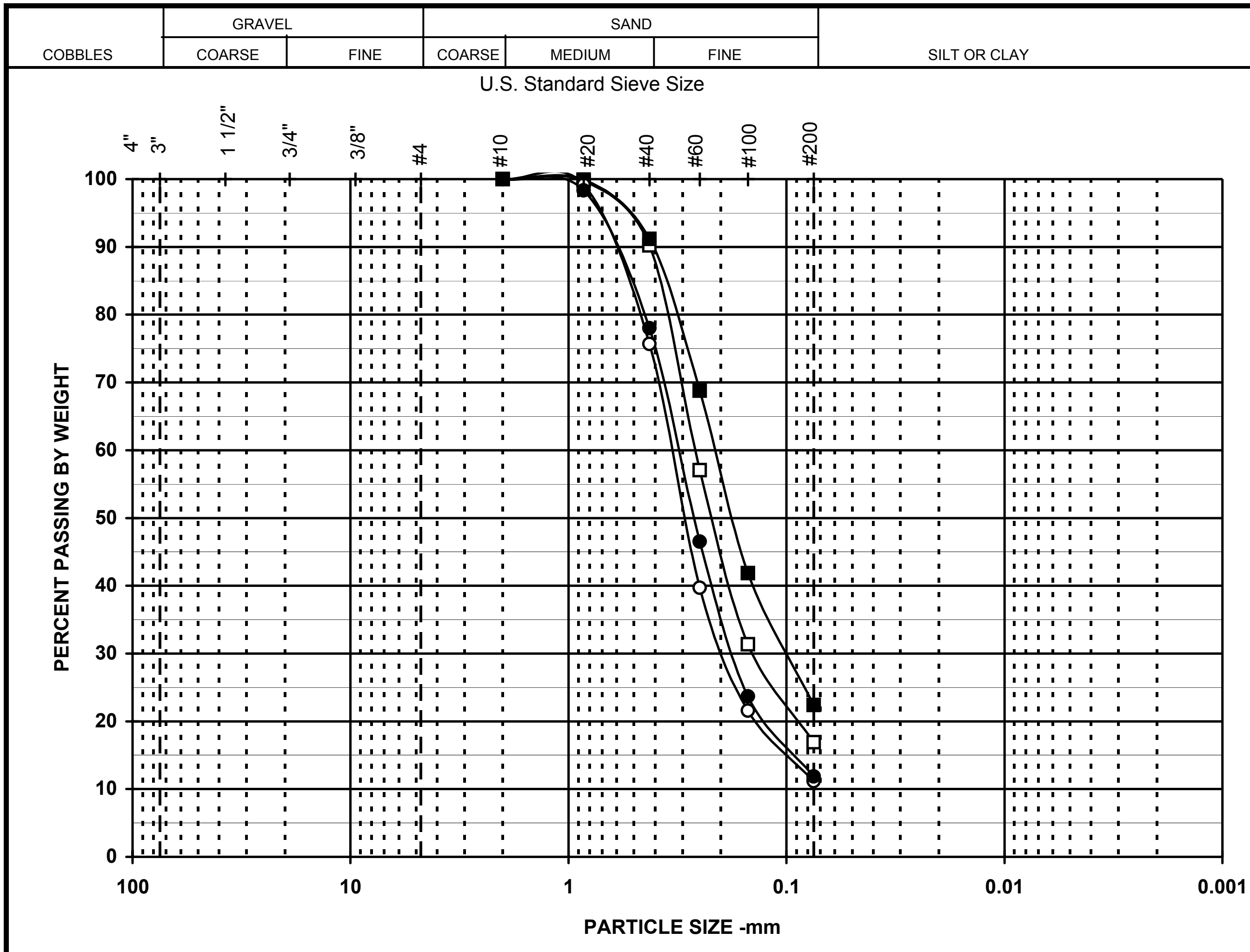
PARTICLE SIZE DISTRIBUTION

Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation

siev1_31d.xls 12/11/2006



SYMBOL	DESCRIPTION AND REMARKS
□	brown m-f SAND, some silt.
■	gray m-f SAND, some silt.
○	brown m-f SAND, trace silt.
●	light brown m-f SAND, trace silt.

Symbol	□	■	○	●
Boring	TH3-3	TH3-3	TH3-3	TH3-3
Sample				
Spec				
Depth	27.5-29	35-36.5	45-46.5	50.9-61
% +3"				
% Gravel				
% SAND	83.1	77.6	88.8	88.2
% FINES	16.9	22.4	11.2	11.8
% -2μ				
Cc			1.7	1.5
Cu			5.2	5.1
LL				
PL				
PI				
USCS	SM	SM	SP-SM	SP-SM
w (%)	13.7	16.6	19.9	18.1

Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4				
10	100.0	100.0	100.0	100.0
20	99.7	99.9	99.2	98.3
40	90.2	91.2	75.7	78.0
60	57.1	68.8	39.7	46.5
100	31.3	41.8	21.6	23.7
200	16.9	22.4	11.2	11.8

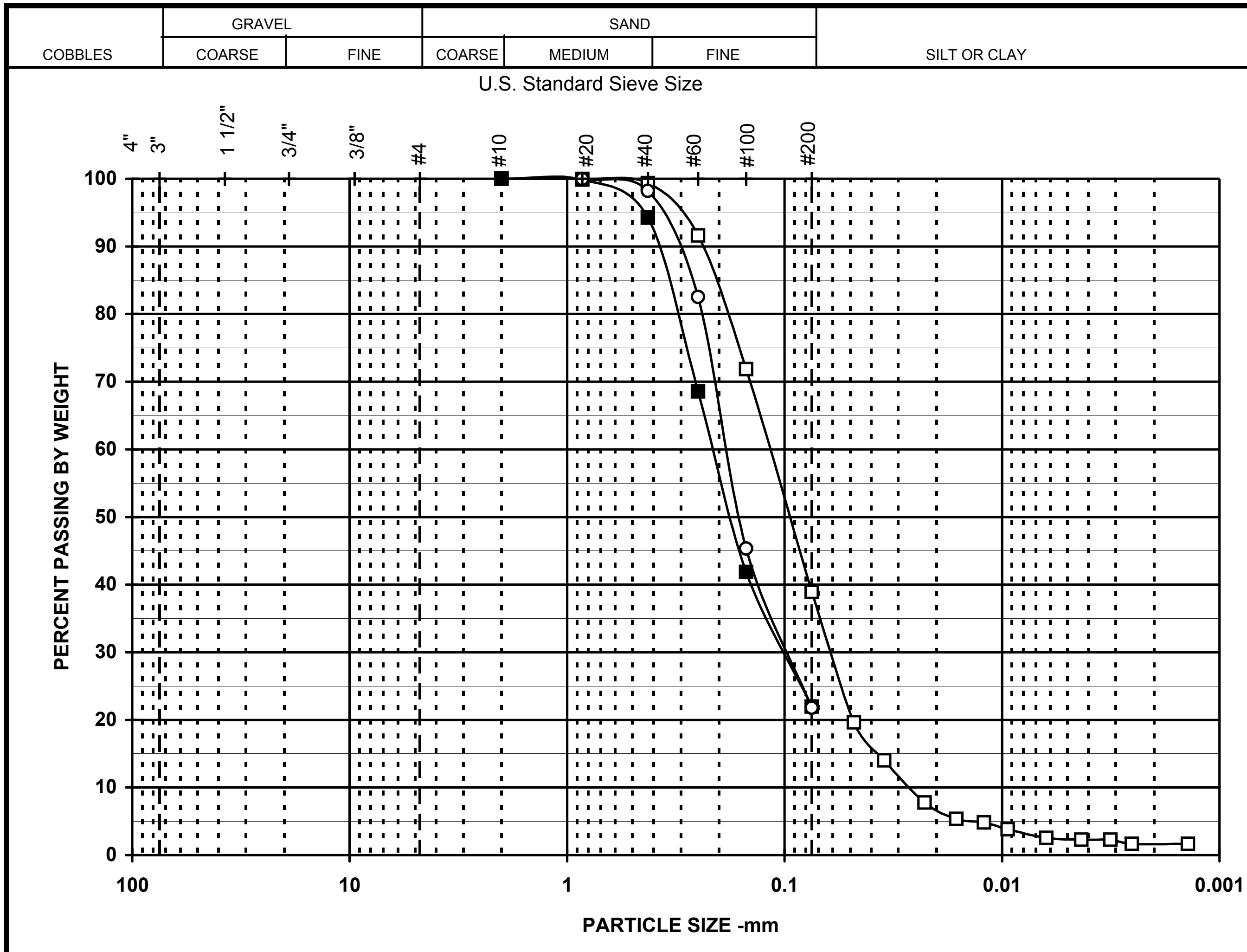
PARTICLE SIZE DISTRIBUTION

Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation

siev1_33a.xls 12/11/2006



SYMBOL	DESCRIPTION AND REMARKS
□	brown silty f. SAND.
■	brown f. SAND, some silt, trace m. sand.
○	brown f. SAND, some silt, trace m. sand.
●	

Symbol	□	■	○	●
Boring	TH3-3	TH3-3	TH3-3	
Sample				
Spec				
Depth	60-61.5	70-71.5	80-81.5	
% +3"				
% Gravel				
% SAND	61.1	78.1	78.2	
% FINES	38.9	21.9	21.8	
% -2µ	2			
Cc				
Cu				
LL				
PL				
PI				
USCS	SM	SM	SM	
w (%)		25.6	21.5	

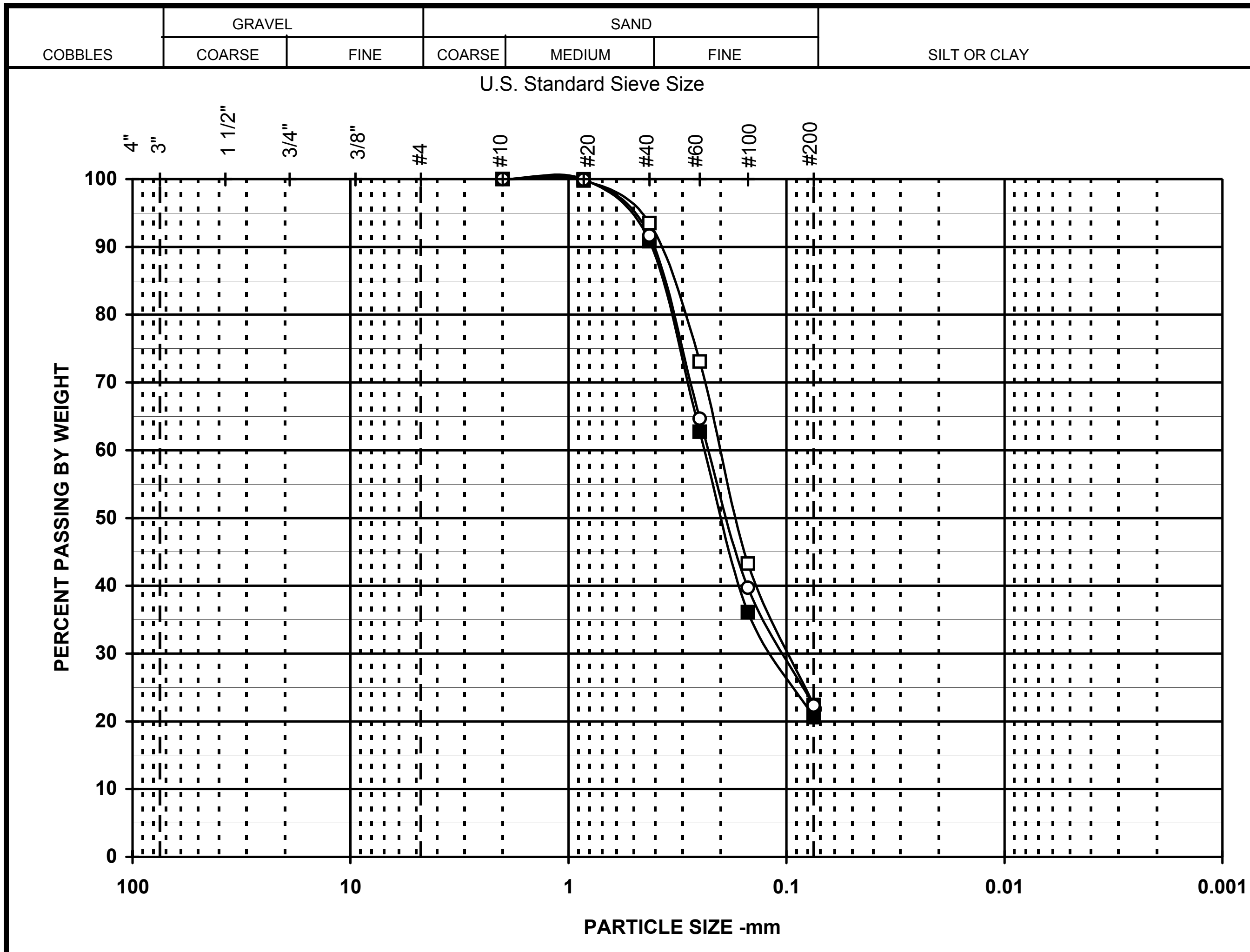
Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4				
10	100.0	100.0		
20	100.0	99.9	100.0	
40	99.4	94.2	98.2	
60	91.6	68.6	82.5	
100	71.8	41.9	45.3	
200	38.9	21.9	21.8	

PARTICLE SIZE DISTRIBUTION
Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation

sievl_33b.xls 12/11/2006



Symbol	□	■	○	●
Boring	TH3-3	TH3-3	TH3-3	
Sample				
Spec				
Depth	90-91.5	110-111.5	130-131.5	
% +3"				
% Gravel				
% SAND	77.6	79.4	77.7	
% FINES	22.4	20.6	22.3	
% -2μ				
Cc				
Cu				
LL				
PL				
PI				
USCS	SM	SM	SM	
w (%)	20.2	18.2	20.5	

Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4				
10	100.0	100.0	100.0	
20	99.8	99.9	99.9	
40	93.5	90.8	91.6	
60	73.1	62.7	64.6	
100	43.3	36.1	39.7	
200	22.4	20.6	22.3	22.3

SYMBOL	DESCRIPTION AND REMARKS
□	brown m-f SAND, some silt.
■	light brown m-f SAND, some silt.
○	light brown m-f SAND, some silt.
●	

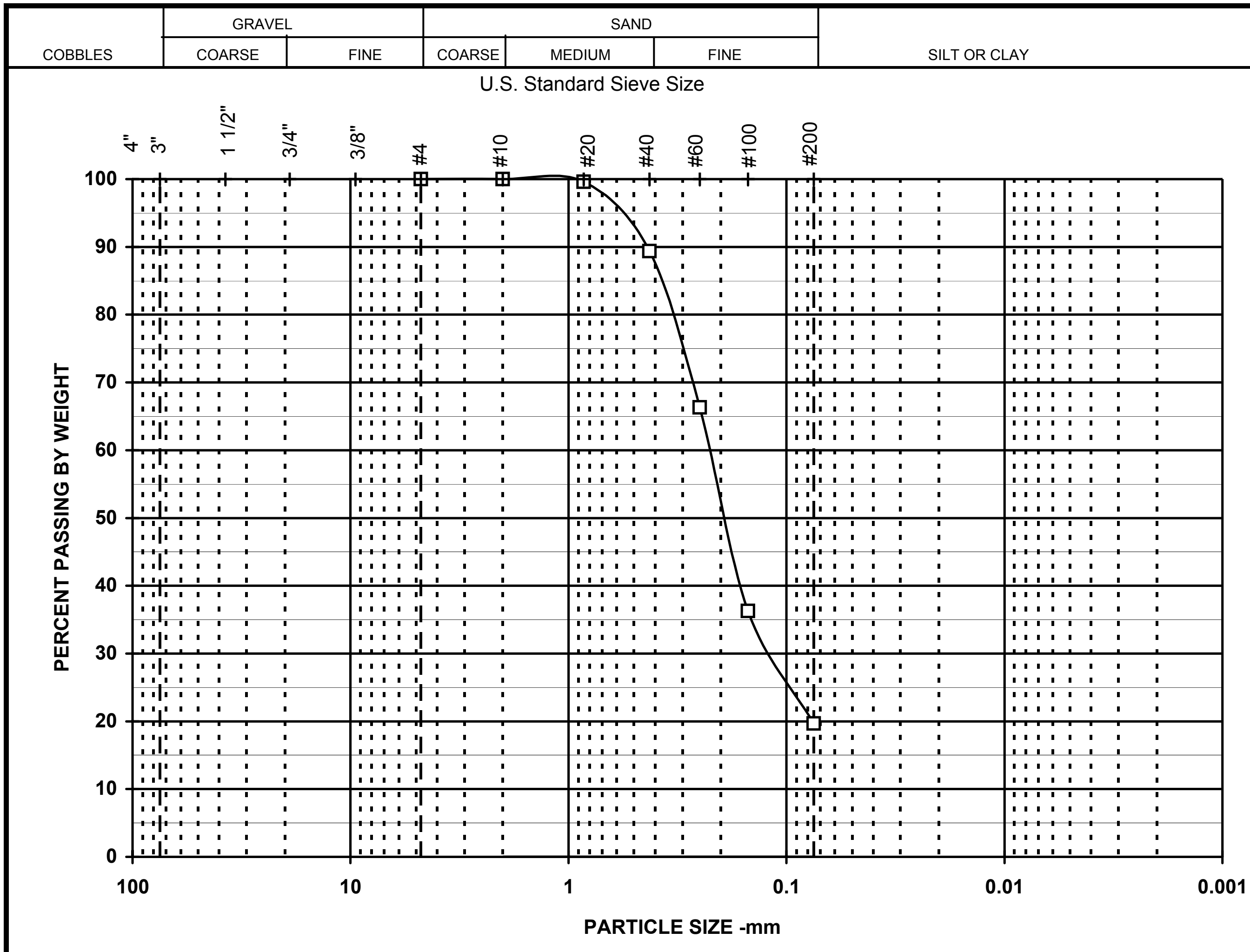
PARTICLE SIZE DISTRIBUTION

Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation

siev1_33c.xls 12/11/2006



Symbol	□	■	○	●
Boring	3 Dam			
Sample	Composite			
Spec				
Depth				
% +3"				
% Gravel				
% SAND	80.3			
% FINES	19.7			
% -2µ				
Cc				
Cu				
LL				
PL				
PI				
USCS	SM			
w (%)	18.6			

Particle Size	PERCENT FINER			
(Sieve #)	□	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4	100.0			
10	100.0			
20	99.6			
40	89.4			
60	66.3			
100	36.3			
200	19.7			

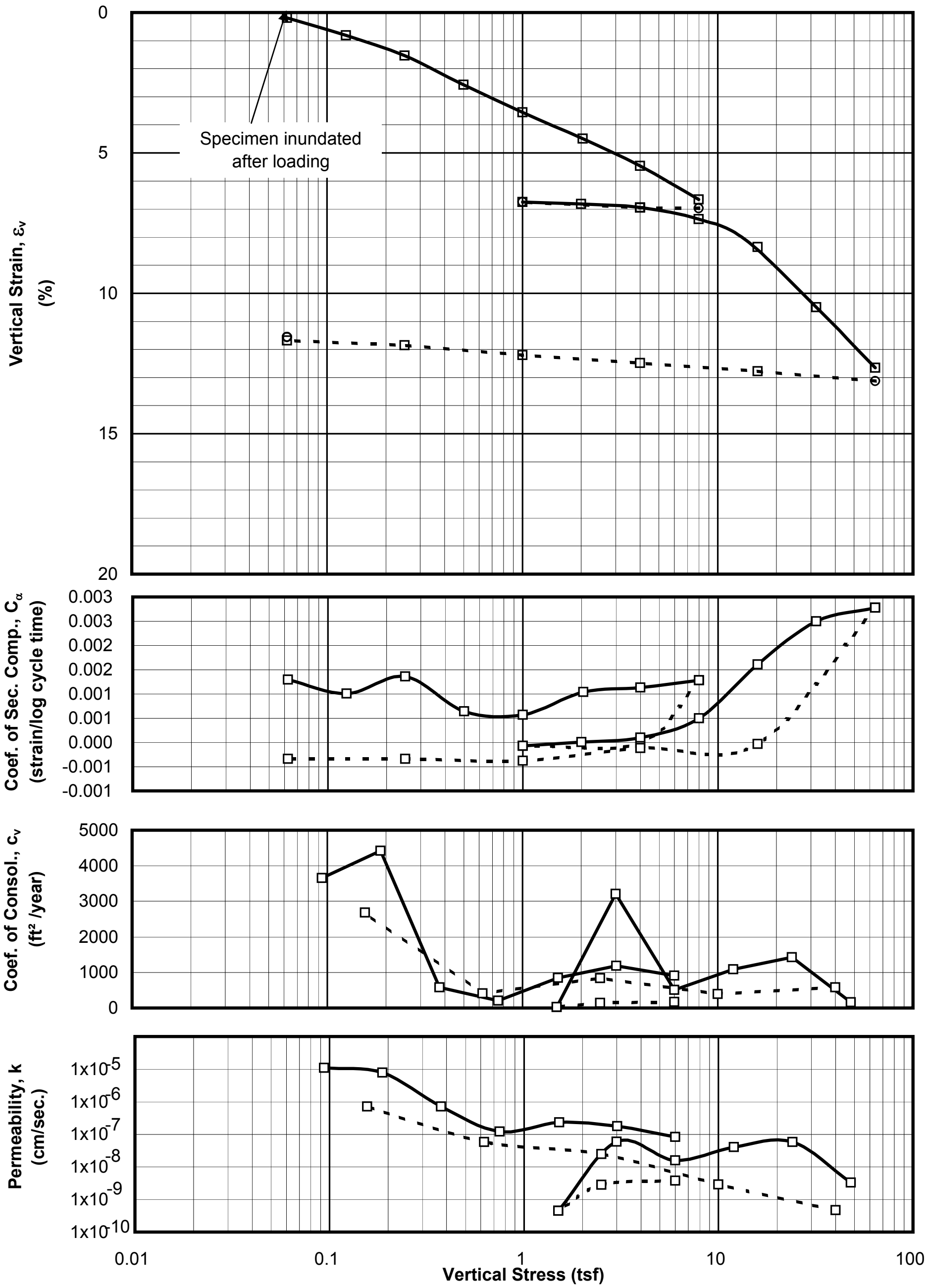
SYMBOL	DESCRIPTION AND REMARKS
□	brown m-f SAND, some silt.
■	
○	
●	

PARTICLE SIZE DISTRIBUTION

Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation



SAMPLE INFORMATION

Boring: TH3-1
Sample: Bot
Depth: 80-82.5 feet
Elevation:
Type: 3-inch thin wall tube
Description: SM
gray f. SAND, some silt, trace m. sand.
PI = NP

SPECIMEN INFORMATION

(NOTE: Initial and final states refer to beginning and end of test)

Initial height:	0.62	inch
Diameter:	2.50	inch

Initial water content:	18.7	%
Initial total unit weight:	105.6	pcf
Initial dry unit weight:	89.0	pcf
Initial void ratio:	0.898	
Initial degree of saturation:	56	%
Final water content:	21.8	%
Final total unit weight:	121.7	pcf
Final dry unit weight:	99.9	pcf
Final void ratio:	0.690	
Final degree of saturation:	85	% (measured specific gravity = 2.71)

TEST SUMMARY

Construction Method:	Casagrande (Log)
Estimated preconsolidation stress (tsf):	9.0 (Range: 8.8 to 9.7)
Estimated in situ effective overburden stress (tsf):	
Compression Ratio (strain per log cycle stress):	0.071
Compression Index (void ratio per log cycle stress):	0.135
Swell Ratio (strain per log cycle stress):	0.003
Swell Index (void ratio per log cycle stress):	0.006
Recompression Ratio (strain per log cycle stress):	0.006
Recompression Index (void ratio per log cycle stress):	0.011
Remarks:	

LEGEND: □ End of primary o End of Stage ———— Loading - - - - - - Unloading

Test Date: 11/2/06 Tested By: RV Checked By: GET

	Climax Mine 3 Dam	ONE DIMENSIONAL CONSOLIDATION TEST Boring: TH3-1 Depth: 80-82.5 feet
URS Corporation	Project No. 22238824	November 2006

PROJECT:	Climax Mine				
PROJECT NO.:	22238824	Initial height:	0.619 inch	Final height:	0.541 inch
BORING:	TH3-1	Initial water content:	18.7 %	Final water content:	21.8 %
SAMPLE:	Bot	Initial dry density:	89.0 pcf	Final dry density:	99.9 pcf
TEST:	C06232	Initial total density:	105.6 pcf	Final total density:	121.7 pcf
DEPTH, feet:	80-82.5	Initial saturation:	56 %	Final saturation:	85 %
BY:	RV	Initial void ratio:	0.898	Final void ratio:	0.690
TEST DATE:	11/2/2006			Final strain:	12.7 %

EQUIPMENT:
Load Frame No.: 6
Ring Diameter: 2.5 inch

SPECIMEN DESCRIPTION: SM
gray f. SAND, some silt, trace m. sand.

G	LL	PL	PI
2.705	np	np	np

Load No.	Load (tsf)	d_{100} (inch)	t_{100} Strain (%)	t_{100} Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	c_v (ft²/year)	C_α (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)
1	0.063	0.0012	0.187	0.894	0.295	0.892	29.62	0.0013	33.37	2.68E-08
2	0.125	0.0050	0.807	0.882	1.130	0.876	3654.65	0.0010	10.08	1.09E-05
3	0.250	0.0095	1.540	0.869	2.119	0.858	4421.78	0.0014	17.05	7.82E-06
4	0.500	0.0159	2.572	0.849	2.758	0.845	575.26	0.0006	24.23	7.16E-07
5	1.00	0.0220	3.555	0.830	3.711	0.827	204.18	0.0006	50.85	1.21E-07
6	2.04	0.0279	4.496	0.812	4.755	0.808	845.42	0.0010	110.50	2.31E-07
7	4.00	0.0339	5.468	0.794	5.760	0.788	1181.88	0.0011	201.81	1.77E-07
8	8.00	0.0413	6.663	0.771	6.977	0.765	910.41	0.0013	334.62	8.21E-08
9	4.00	0.0430	6.948	0.766	6.946	0.766	173.49	0.0000	1404.42	3.73E-09
10	1.00	0.0418	6.754	0.770	6.749	0.770	143.05	-0.0001	1549.59	2.79E-09
11	2.00	0.0422	6.819	0.768	6.828	0.768	22.62	0.0000	1534.80	4.45E-10
12	4.00	0.0430	6.941	0.766	6.994	0.765	3206.56	0.0001	1647.50	5.87E-08
13	8.00	0.0456	7.354	0.758	7.498	0.756	510.35	0.0005	967.15	1.59E-08
14	16.0	0.0517	8.352	0.739	8.778	0.731	1083.66	0.0016	801.70	4.08E-08
15	32.0	0.0650	10.497	0.699	11.153	0.686	1427.44	0.0025	745.93	5.77E-08
16	64.0	0.0784	12.654	0.658	13.124	0.649	160.62	0.0028	1484.05	3.27E-09
17	16.0	0.0792	12.782	0.655	12.763	0.656	579.43	0.0000	37323.40	4.68E-10
18	4.00	0.0773	12.486	0.661	12.458	0.661	388.38	-0.0001	4052.11	2.89E-09
19	1.00	0.0755	12.196	0.666	12.096	0.668	836.74	-0.0004	1034.35	2.44E-08
20	0.250	0.0734	11.847	0.673	11.782	0.674	411.81	-0.0003	214.63	5.79E-08
21	0.063	0.0724	11.682	0.676	11.553	0.679	2678.92	-0.0003	114.06	7.09E-07

SUMMARY FOR STATIC CIU' TRIAXIAL TESTS SPECIMENS

Test No	Boring No	Sample	USCS Group Symbol / Gs	w_o / w_c (%)	$\gamma_{t,o}$ / $\gamma_{t,c}$ (pcf)	$\gamma_{d,o}$ / $\gamma_{d,c}$ (pcf)	$\sigma'_{c,max}$ (ksf) / OCR	$\sigma'_{v,c}$ (ksf) / $K_c = \frac{\sigma'_{v,c}}{\sigma'_{h,c}}$	$\varepsilon_{a,c}$ / $\varepsilon_{v,c}$ (%)	B factor (%) / ε_{rate} (%/hr)	at Peak Deviator Stress / at Peak Obliquity: ε_a (%)	$\frac{\sigma_1 - \sigma_3}{2}$ (ksf)	$\frac{\sigma'_1 + \sigma'_3}{2}$ (ksf)	σ'_1 / σ'_3	A factor	ϕ' for c'=0
T2662	3 Dam	Composite	SM	22.1	109.4	89.6	12.00	12.00	2.3	95.4	14.9	6.60	11.49	3.70	0.538	35.1
			(2.70)	25.1	125.7	100.5	1.0	1.00	10.8	1.1	14.3	6.51	11.31	3.71	0.552	35.1
T2663	3 Dam	Composite	SM	24.9	112.5	90.1	48.00	48.00	4.3	95.7	14.9	17.01	29.28	3.77	1.050	35.5
			(2.70)	22.0	129.0	105.8	1.0	1.00	14.8	1.3	10.5	15.91	27.21	3.82	1.153	35.8
T2669	3 Dam	Composite	SM	29.0	120.7	93.6	25.42	25.42	2.9		14.9	10.45	19.09	3.42	0.803	33.2
			(2.70)	24.3	126.5	101.7	1.0	1.00	8.0	1.2	12.8	9.99	18.24	3.42	0.859	33.2

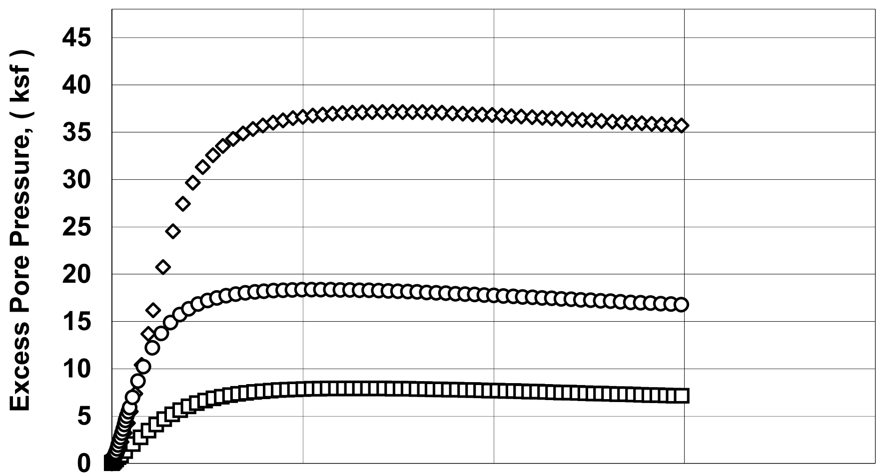
Test No	
T2662	SM, brown m-f SAND, some silt.
T2663	SM, brown m-f SAND, some silt.
T2669	SM, brown m-f SAND, some silt.

Strength Envelope Summary

Test Series	Failure Criteria	ϕ' (deg)	c' (ksf)	α' (deg)	a' (ksf)	Correlation Coefficient
1	1	34.8	0.000	29.7	0.000	--
	2	35.0	0.000	29.8	0.000	--

Failure Criteria: 1 - Peak Deviator Stress
2 - Peak Obliquity

Project No. 22238824	**Climax Mine** **3 Dam**	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements 3 Dam Composite SUMMARY	November 2006
URS Corporation			

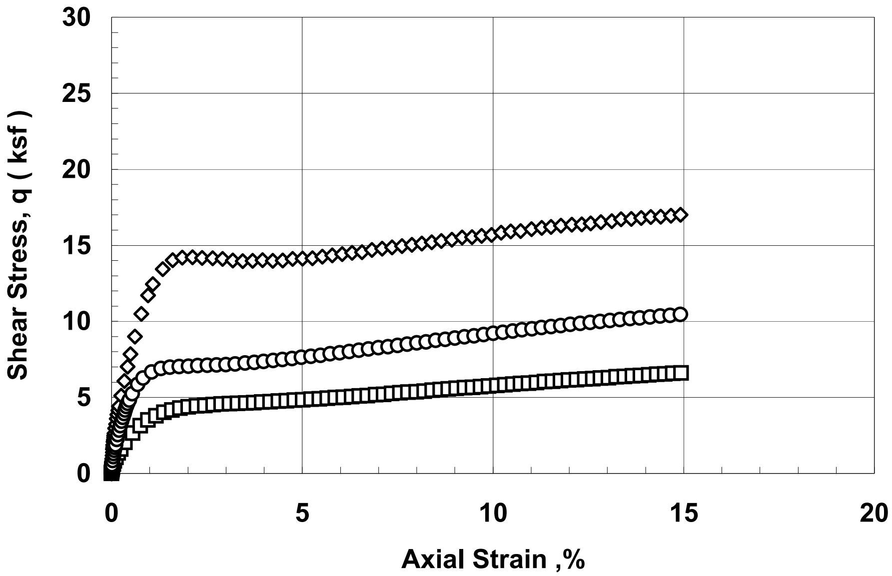


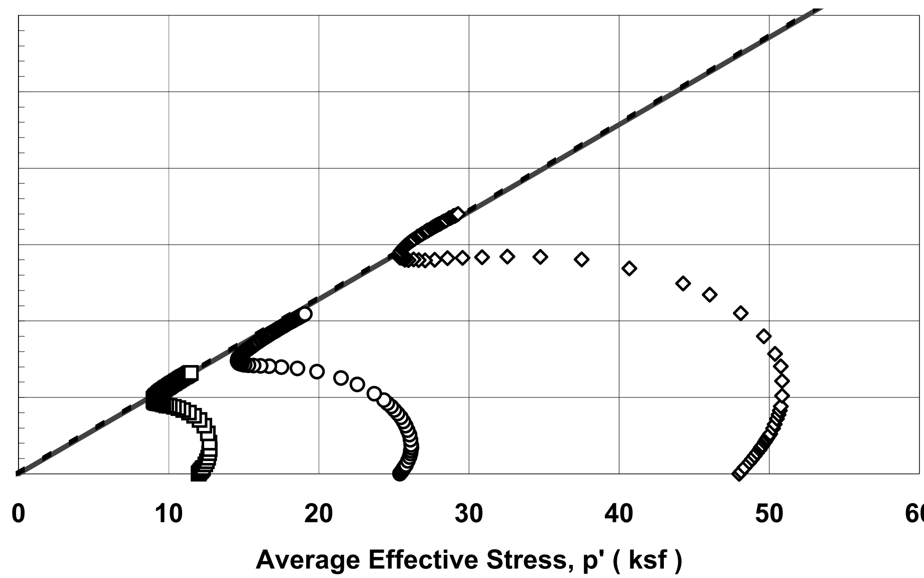
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	w_o (%)	γ_{to} (pcf)	σ'_c (ksf)
□	T2662	3 Dam	Composite	22.1	109.4	12.00
◊	T2663	3 Dam	Composite	24.9	112.5	48.00
○	T2669	3 Dam	Composite	29.0	120.7	25.42

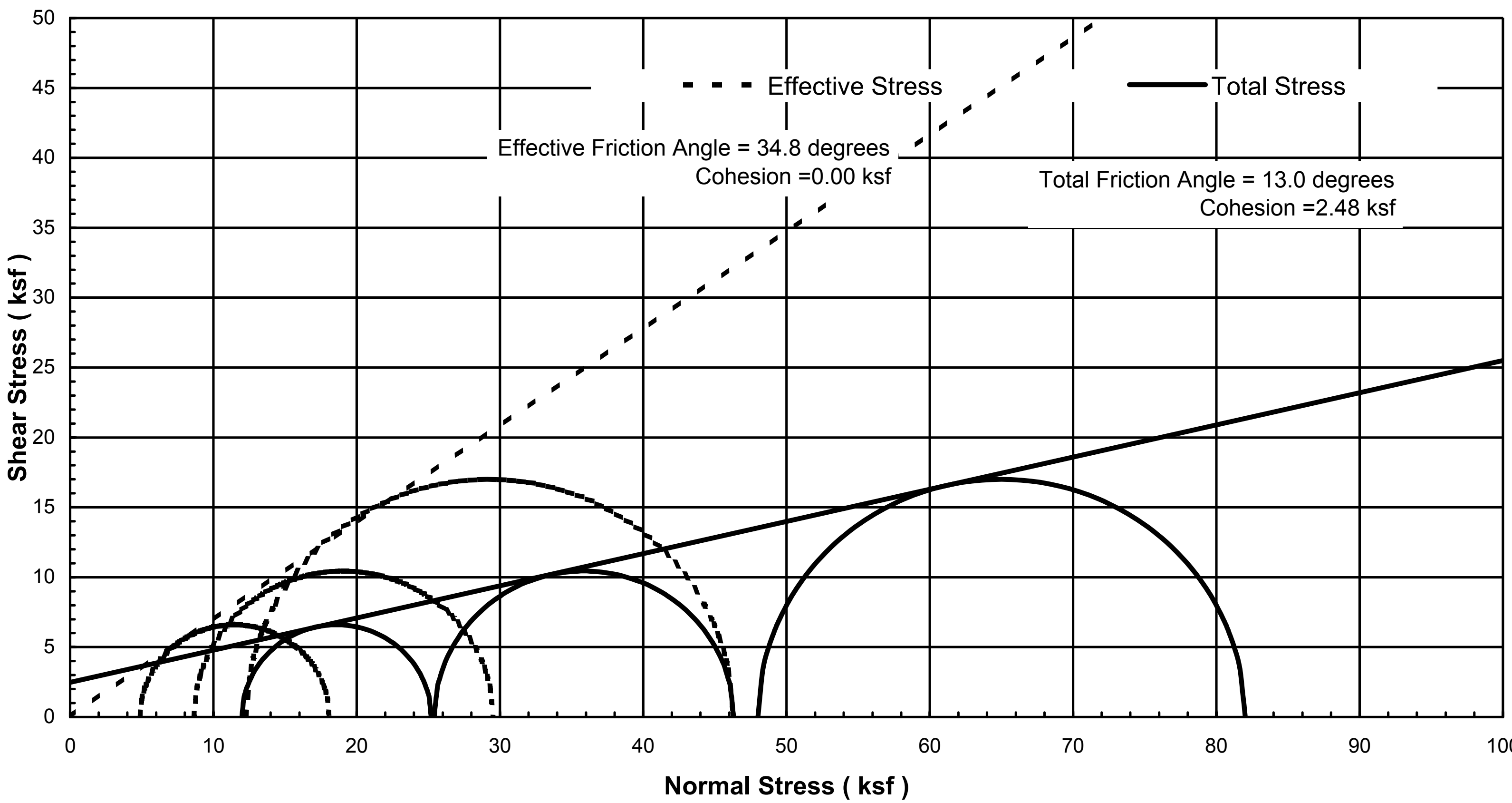
SERIES SUMMARY

Notation	Failure Criteria	c' (ksf)	Φ' (degrees)
——— (solid)	Peak Deviator Stress	0.00	34.8
······ (dotted)	Peak Obliquity	0.00	35.0

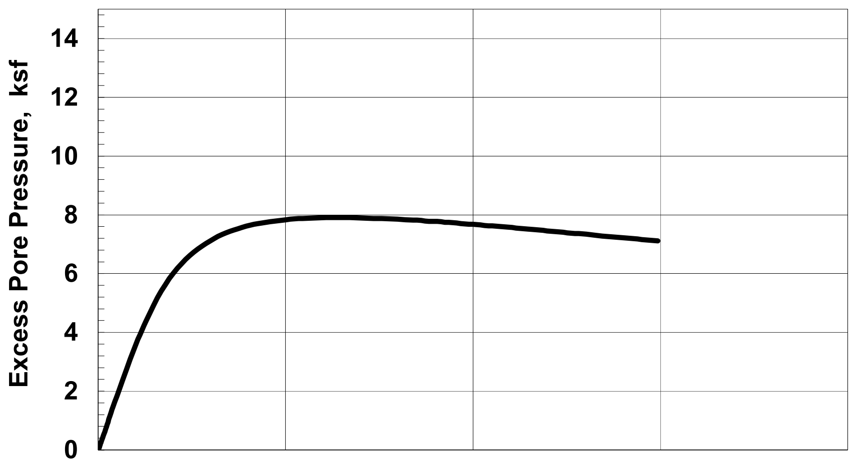




Prepared by: C. Jordan Checked by: G. Thomas	Project No. 22238824	**Climax Mine** **3 Dam**	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements 3 Dam Composite SUMMARY	Figure 1 November 2006
	URS Corporation			



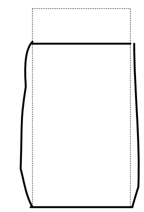
Project No. 22238824	Climax Mine 3 Dam	Mohr Circles of Total and Effective Stresses at Peak CIU' Triaxial Test	Figure 2
URS Corporation		3 Dam Composite SUMMARY	November 2006



SAMPLE INFORMATION
Boring: 3 Dam Sample: Composite Depth: ft
Type: Slurry Sedimented
Description: SM, brown m-f SAND, some silt.

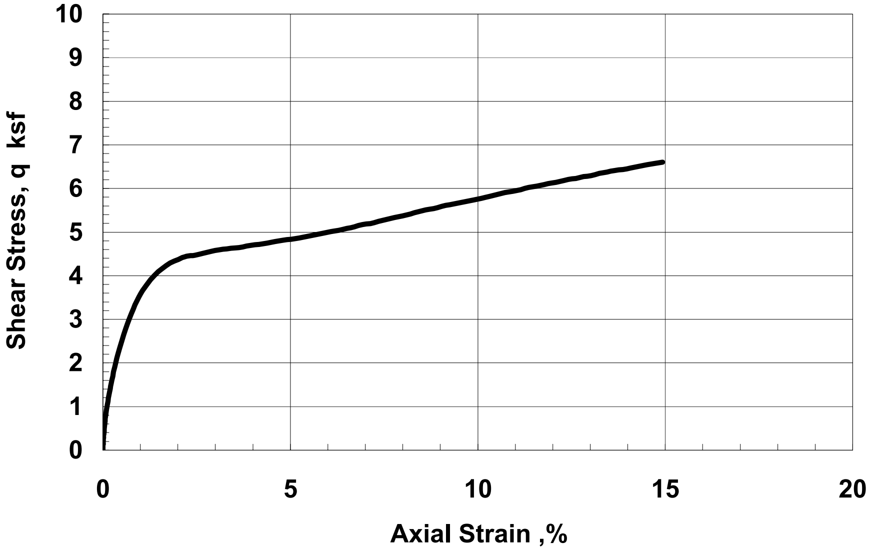
SPECIMEN INFORMATION (Initial)
Height: 4.05 inch Diameter: 1.98 inch Area: 3.07 in²
Water Content: 22.1 % Total Unit Weight: 109.4 pcf

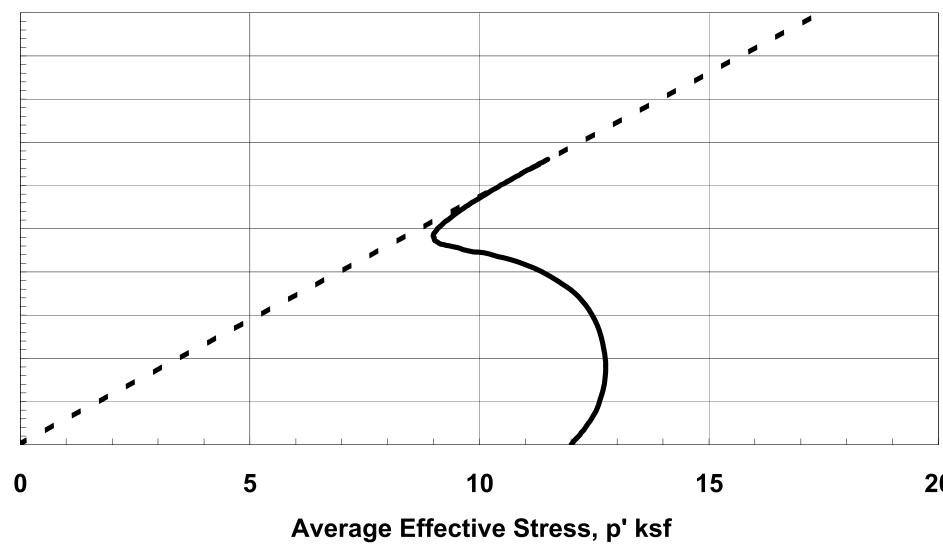
TEST SUMMARY
Consolidation Stresses: 12.00 ksf vertical, 12.00 ksf lateral
Water Content: 25.1 % Total Unit Weight: 125.7 pcf
B Coefficient: 95.4 Strain Rate: 0.018 %/min
Peak Shear Strength: 6.60 ksf @ 14.9 % Strain
Peak Effective Friction Angle: 35.1°



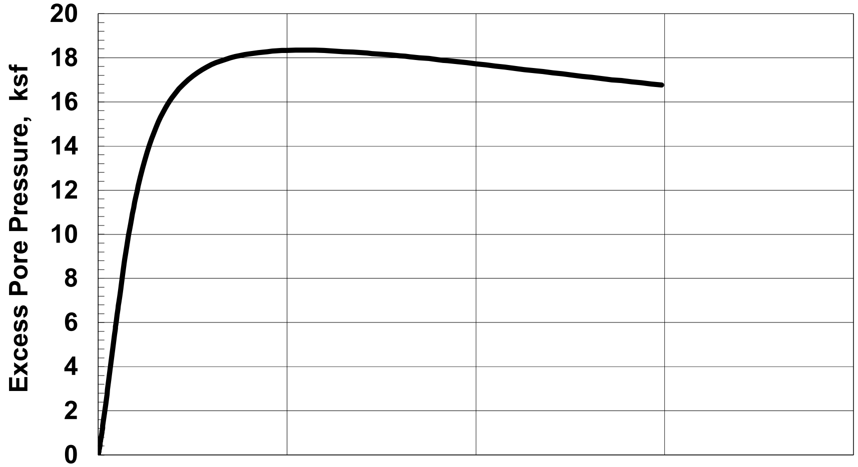
Failure Sketch

REMARKS:





Test by: DT	Project No. 22238824	Climax Mine 3 Dam	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	URS Corporation		Boring 3 Dam Composite	December-06



SAMPLE INFORMATION

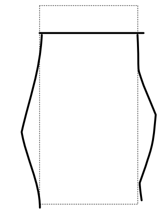
Boring: 3 Dam Sample: Composite Depth: ft
Type: Slurry Sedimented
Description: SM, brown m-f SAND, some silt.

SPECIMEN INFORMATION (Initial)

Height: 4.03 inch Diameter: 1.98 inch Area: 3.07 in²
Water Content: 29.0 % Total Unit Weight: 120.7 pcf

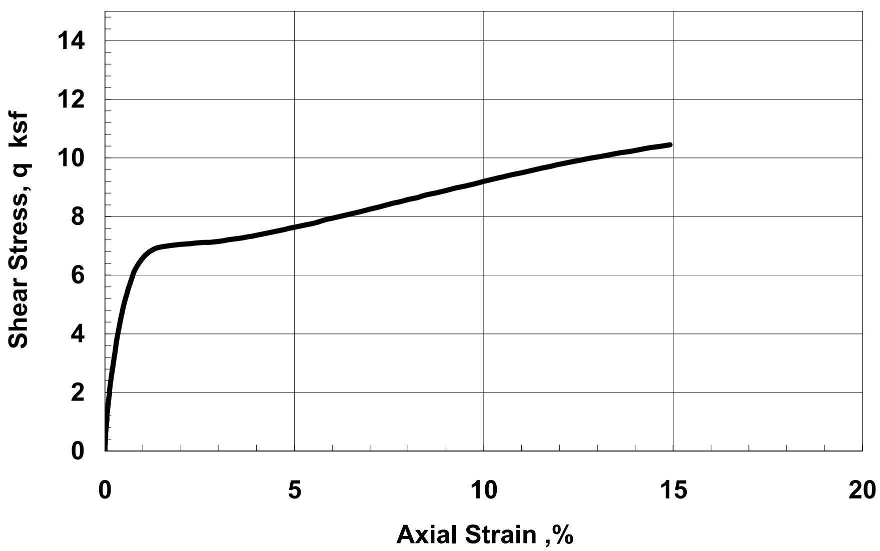
TEST SUMMARY

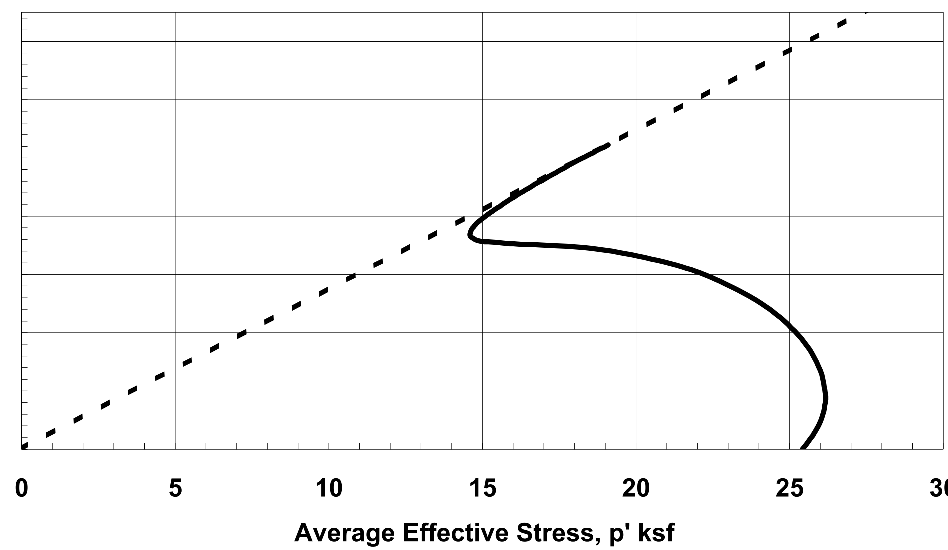
Consolidation Stresses: 25.42 ksf vertical, 25.42 ksf lateral
Water Content: 24.3 % Total Unit Weight: 126.5 pcf
B Coefficient: Strain Rate: 0.021 %/min
Peak Shear Strength: 10.45 ksf @ 14.9 % Strain
Peak Effective Friction Angle: 33.2°



Failure Sketch

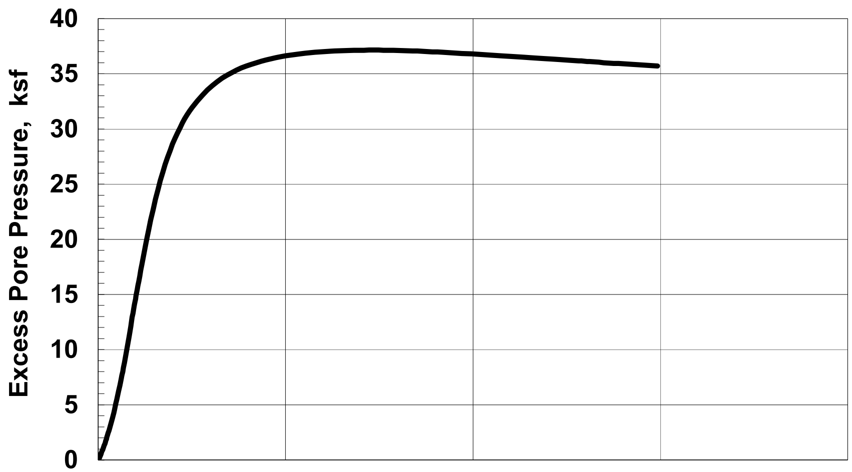
REMARKS:





Test by: DT
Checked by: GET

Project No. 22238824	Climax Mine 3 Dam	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
URS Corporation		Boring 3 Dam Composite	December-06



SAMPLE INFORMATION

Boring: 3 Dam   Sample: Composite   Depth: ft
Type: Slurry Sedimented
Description: SM, brown m-f SAND, some silt.

SPECIMEN INFORMATION (Initial)

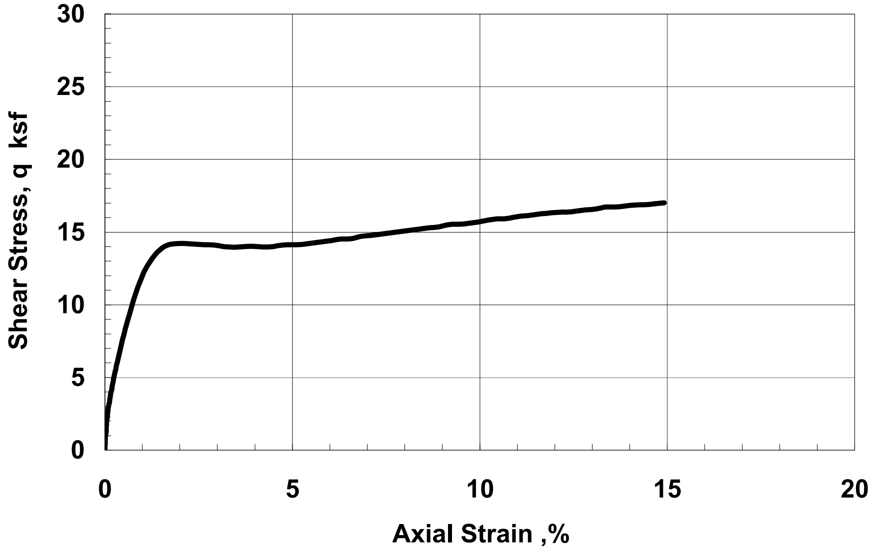
Height: 4.05 inch   Diameter: 1.98 inch   Area: 3.07 in²
Water Content: 24.9 %   Total Unit Weight: 112.5 pcf

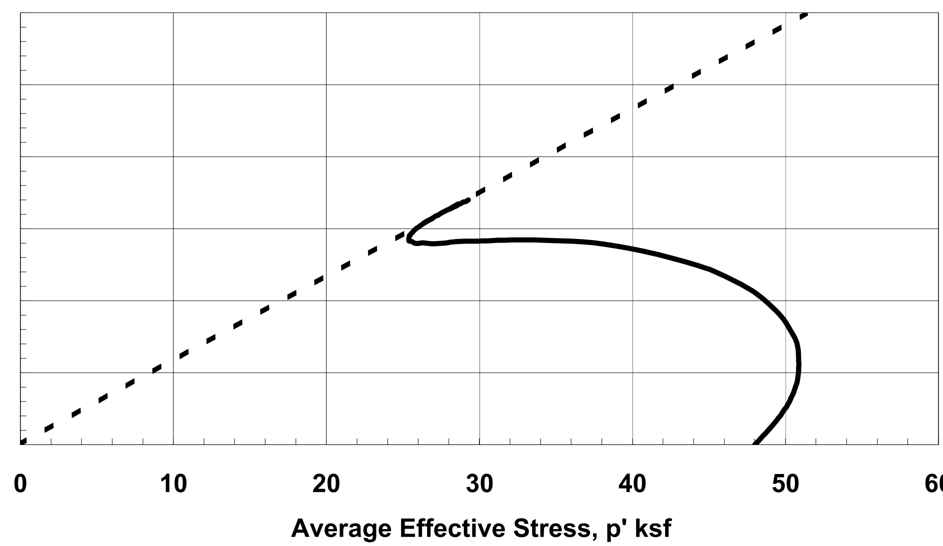
TEST SUMMARY

Consolidation Stresses: 48.00 ksf vertical, 48.00 ksf lateral
Water Content: 22.0 %   Total Unit Weight: 129.0 pcf
B Coefficient: 95.7   Strain Rate: 0.022 %/min
Peak Shear Strength: 17.01 ksf @ 14.9 % Strain
Peak Effective Friction Angle: 35.8°

Failure Sketch

REMARKS:





Test by: DT	Project No. 22238824	Climax Mine 3 Dam	CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements	
Checked by: GET	**URS Corporation**		Boring 3 Dam Composite	December-06

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - 90

Project No.:	22238824	BORING: TH3-1		Test No.:	T2647
Project Name:	Climax Mine	SAMPLE: B	DEPTH: 40.9		

Specimen - Apparatus set-up - Test Information Cell No. H-2 Apparatus No. 2 Stage No.: 8

Preliminary Length/Area Calculations

Lo =	6.003	in	Lo=	15.247	cm
dLc=	0.061	in	Ao =	40.29	cm^2
Lc=	5.942	in	Vo =	614.24	cm^3
			Lc=	15.092	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	18.73	cm^3
			Vc =	595.52	cm^3
Sc =	0.382	cm^{-1}	Ac=	39.459	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or	
	x	with stones or		Stones with filter paper or	top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination	
3) During saturation: Water flushed up sides of specimen to remove ai	x	No		Yes	
4) During consolidation:	x	Top and bottom drainage or		Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation	
6) Permeant: water used	x	Tap		Distilled	
or		Demineralized		0.005 N calcium sulfate (CaSO4)	

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3214

Consol Stage- Trial No.	Temp. ° C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	20.8	11/3/2006	09	28	00	216.7	50.0	53.00	45.22	1.00	1.50E-04
final	20.8	11/3/2006	09	28	13			49.00	46.50		1.47E-04
1	RT = 0.985	dT =	0.22 min			σ'_c =	24 ksf	0.298	0.296	io= 6.5	0%
initial	20.8	11/3/2006	00	00	00	216.7	50.0	53.00	45.22	1.00	1.50E-04
final	20.8	11/3/2006	00	00	13			49.00	46.50		1.47E-04
2	RT = 0.985	dT =	0.22 min			σ'_c =	24 ksf	0.298	0.296	io= 6.5	0%
initial	20.8	11/3/2006	00	00	00	216.7	50.0	53.00	45.22	1.00	1.50E-04
final	20.8	11/3/2006	00	00	13			49.00	46.50		1.47E-04
3	RT = 0.985	dT =	0.22 min			σ'_c =	24 ksf	0.298	0.296	io= 6.5	0%
initial	20.8	11/3/2006	00	00	00	216.7	50.0	53.00	45.22	1.00	1.50E-04
final	20.8	11/3/2006	00	00	13			49.00	46.50		1.47E-04
4	RT = 0.985	dT =	0.22 min			σ'_c =	24 ksf	0.298	0.296	io= 6.5	0%

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 15.092 cm ε_{axial} = 1.0%

Ac = 39.623 cm^2

Vc= 598.00 cm^3 ε_{vol} = 2.6%

Sc = 0.381 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	14.00	109.2	95.8	49.7
PreTest	26.43	124.4	98.4	100.0

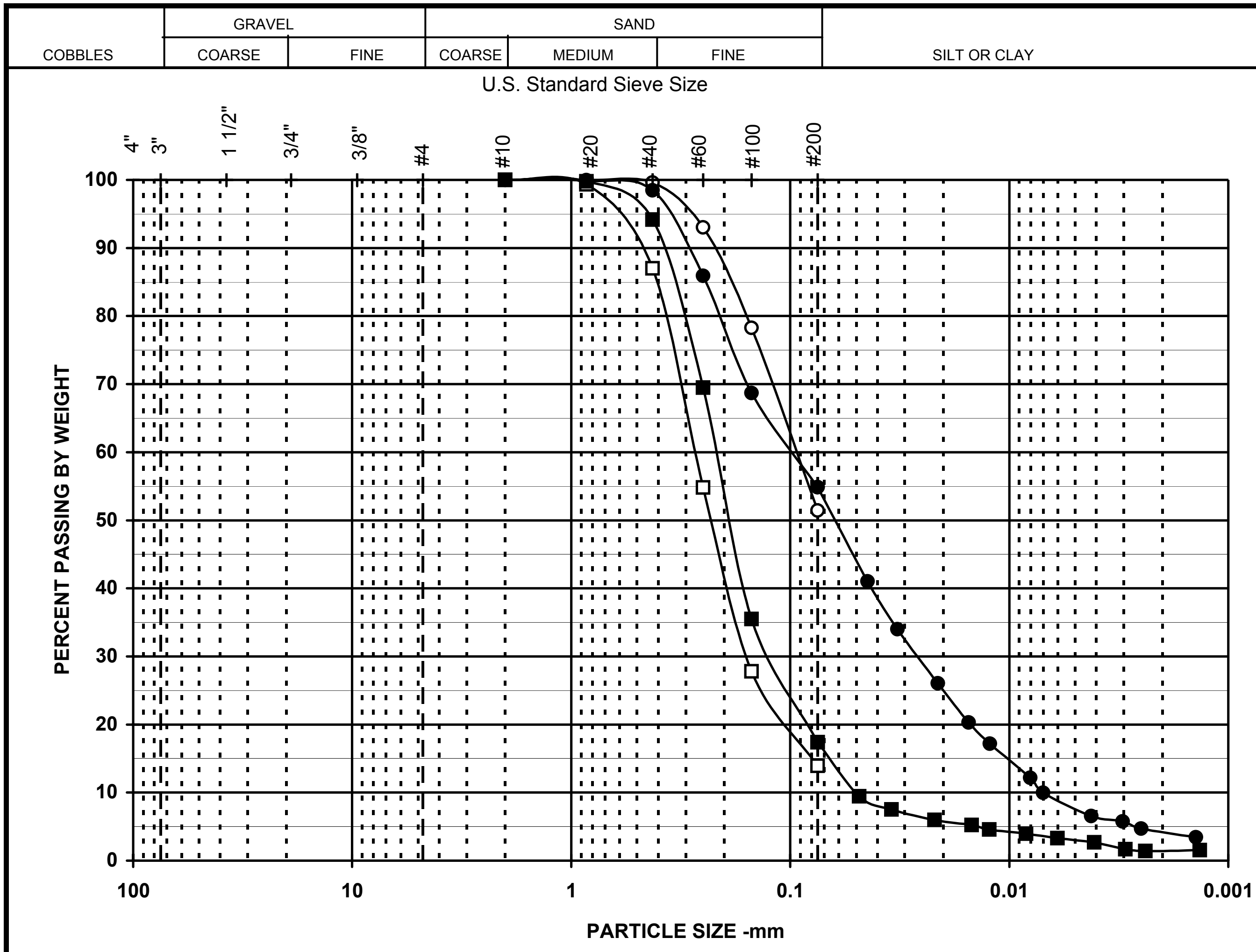
HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **1.47E-04** cm/sec

(i_o)ave = 6.5

Tested By: DT Reviewed By: GET



SYMBOL	DESCRIPTION AND REMARKS
□	brown f. SAND, some silt, trace m. sand.
■	brown m-f SAND, some silt.
○	brown f. sandy SILT.
●	brown-gray f. sandy SILT.

Symbol	□	■	○	●
Boring	TH3-1	TH3-1	TH3-1	TH3-1
Sample				
Spec				
Depth	150-151.5	180-181.5	200-201.5	225-226.5
% +3"				
% Gravel				
% SAND	86.1	82.6	48.6	45.1
% FINES	13.9	17.4	51.4	54.9
% -2µ		1		4
Cc				
Cu				
LL				np
PL				np
PI				
USCS	SM	SM	ML	ML
w (%)	18.8		20.7	

Particle Size (Sieve #)	PERCENT FINER □	■	○	●
4"				
3"				
1 1/2"				
3/4"				
3/8"				
4				
10	100.0	100.0		100.0
20	99.3	99.8	100.0	99.9
40	87.0	94.2	99.6	98.5
60	54.8	69.5	93.0	85.9
100	27.8	35.5	78.2	68.7
200	13.9	17.4	51.4	54.9

PARTICLE SIZE DISTRIBUTION
Climax Mine 3 Dam

Project No. 22238824	December 2006	Figure

URS Corporation

siev1_31d.xls 12/13/2006

Project No.: 22238824 File: SumDAM3.xls

Climax Mine
3 Dam
LABORATORY TESTING DATA SUMMARY

BORING	DEPTH	IDENTIFICATION TESTS										PERMEABILITY	STRENGTH			CONSOLIDATION		REMARKS
NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	(cm/sec)	Type Test & Stress	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	INITIAL CONDITIONS VOID RATIO (-)	INITIAL CONDITIONS SATUR-ATION (%)	
TH-3-1	10-11.5	19.4				SM	13.3											
TH-3-1	20-21.5	19.3				SW-SM	11.9											
TH-3-1	30	22.9				SM	19.5											
TH-3-1	40-42.5								103.9									
	40.4	10.4				SP-SM			104.4	94.6			CIU'@12	10.3	11.6			T2646
TH-3-1	40.9	14.0	np	np	np	SP-SM	11.5		109.2	95.8		1.5E-4	CIU'@24	16.1	10.9			T2647
	41.4	20.8				SP-SM			113.0	93.5			CIU'@48	32.3	12.6			T2648
TH-3-1	42.5-44	14.1				SM	17.6											
TH-3-1	50-51.5		np	np	np	SM	18.9	2										
TH-3-1	60-61.5	20.2				SM	23.4											
TH-3-1	70-71.5	19.6				SM	16.3											
TH-3-1	80-82.5	18.7	np	np	np	SM	12.8		105.6	89.0	2.705					0.898	56	C06232
TH-3-1	82-83.5					SM	18.0	2										
TH-3-1	90-91.5	17.0				SM	18.6											
TH-3-1	110-111.5	19.5				SM	21.7											
TH-3-1	150-151.5	18.8				SM	13.9											
TH-3-1	180-181.5					SM	17.4	1										
TH-3-1	200-201.5	20.7				ML	51.4											
TH-3-1	225-226.5		np	np	np	ML	54.9	4										
TH-3-3	27.5-29	13.7				SM	16.9											
TH-3-3	35-36.5	16.6				SM	22.4											
TH-3-3	45-46.5	19.9				SP-SM	11.2											
TH-3-3	50.9-61	18.1				SP-SM	11.8											
TH-3-3	60-61.5		np	np	np	SM	38.9	2										
TH-3-3	70-71.5	25.6				SM	21.9											
TH-3-3	80-81.5	21.5				SM	21.8											
TH-3-3	90-91.5	20.2				SM	22.4											
TH-3-3	110-111.5	18.2				SM	20.6											
TH-3-3	130-131.5	20.5				SM	22.3											
3 Dam	Composite					SM	19.7						CIU'			Slurry sedimented Triaxials		

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.

Prepared by: RV Reviewed by: GET Date: 12/13/2006