SEISMIC STABILITY EVALUATIONS OF CHESBRO, LENIHAN, STEVENS CREEK, AND UVAS DAMS (SSE2)

PHASE A: STEVENS CREEK AND LENIHAN DAMS

STEVENS CREEK DAM

SITE INVESTIGATIONS AND LABORATORY TESTING DATA REPORT

(REPORT No. SC-1)

Prepared for

SANTA CLARA VALLEY WATER DISTRICT
5750 Almaden Expressway
San Jose, CA 95118

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TERRA / GeoPentech
a Joint Venture

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1.1 GENERAL

In May 2010, the Santa Clara Valley Water District (District) retained Terra / GeoPentech (TGP), a joint venture of Terra Engineers, Inc. and GeoPentech, Inc., to complete seismic stability evaluations of Chesbro, Lenihan, Stevens Creek and Uvas Dams. These evaluations were required by the Division of Safety of Dams (DSOD) as part of their Phase III screening process of the State's dams located in highly seismic environments. The evaluations are also a vital part of the District's Dam Safety Program (SCVWD, 2005). Phase A of the project includes work on Stevens Creek and Lenihan Dams and has a planned completion date of 2012. Phase B of the project includes work on Chesbro and Uvas Dams and is scheduled to begin in 2012 and to finish by the end of 2013. The general scope of the project consists of the field, laboratory, and office studies required to evaluate the seismic stability of the four referenced dams.

This report documents the site investigation and laboratory testing program conducted at Stevens Creek Dam in support of the seismic stability evaluation of the dam. This is a data report, and as such the report describes the work that was done and presents the results of the site investigations and laboratory testing. Interpretation of these results and development of parameters for the seismic stability evaluation will be the subject of a separate report on Site Characterization (Terra / GeoPentech, 2012).

1.2 PURPOSE AND SCOPE OF FIELD EXPLORATIONS AND LABORATORY TESTING

Our review of available geotechnical data and the results of our preliminary seismic deformation analyses of the dam allowed us to identify the need for supplemental data to address the key geotechnical issues associated with the seismic stability evaluation, as documented in our Work Plan (Terra / GeoPentech, 2010). The purpose of the site investigation and laboratory testing program described herein is to collect these supplemental data.

Specifically, the program is focused on gathering additional geotechnical data to supplement the existing data and address the following key issues:

1. The areal extent and thickness of soils left in place between the base of the dam embankment and the bedrock;
2. The liquefaction potential and residual strength of the soils left in place beneath the dam;
3. The ability of the soils left in place to accommodate dynamic drainage and reduce the potential for the buildup of pore pressure in the alluvium as a result of earthquake loading;
4. The ability of the soils left in place to act as a horizontal drainage layer beneath the embankment as evidenced by piezometric levels within these soils;
5. The distribution of piezometric levels (and direction of seepage forces) within the dam embankment; and
6. The engineering properties of the embankment materials.

The scope of the site investigation and laboratory testing program was initially described in the Work Plan (Terra / GeoPentech, 2010) and included two phases. Phase 1 consisted of sonic borings, installation of Casagrande piezometers in the sonic borehole and index property testing on samples of embankment and foundation soils recovered from the sonic borings. Phase 2 included mud rotary borings, down-hole geophysical logging of the boreholes, installation of vibrating wire piezometers, and laboratory testing on intact samples from the borings for index and engineering properties. The scope of the Phase 2 program was later modified based on an evaluation of the key findings of the Phase 1 investigations and on discussions with the District and DSOD. The modifications to the Phase investigations are documented in an addendum to the Work Plan (Terra / GeoPentech, 2011a).

The major modifications to the proposed scope of the Phase 2 investigations consist of the following:

1. Adding a pilot program of Cone Penetrometer Tests (CPTs) to confirm that penetration of the embankment and foundation materials could be achieved and to check on the reasonableness of the test results;
2. Reducing the number of proposed mud rotary borings from five to three;
3. Adding five Becker Penetration Test (Becker) borings;
4. Reducing the number and relocating some of the proposed vibrating wire piezometers, and adding two standpipe piezometers at the toe of the dam; and
5. Adding CPTs following successful completion of the pilot program.

All of the above modifications were approved by DSOD except for the addition of the CPTs.

The results of the Phase 2 investigations were discussed at a review meeting with the District and DSOD on August 15, 2011 when it was agreed to proceed with additional investigations (Phase 3) in an attempt to improve the characterization of the alluvium under the dam. The scope of the Phase 3 investigations requested by DSOD is described in Addendum II to the Work Plan (Terra / GeoPentech, 2011b). The Phase 3 investigations were aimed at confirming the higher density of the alluvium under the dam that was indicated by the results of the Phase 2 investigations. The Phase 3 investigations were divided into two sub-phases (3A and 3B), as discussed in Addendum II to the Work Plan.

Phase 3A was aimed at measuring shear wave velocity in the alluvium under the dam and at the toe and included one mud-rotary boring with OYO suspension logging and three CPTs with seismic cone measurements. Phase 3B included one BPT under the dam, and possibly another BPT at the toe, to collect additional BPT blow counts in the alluvium. The implementation of Phase 3B was dependent on the results of Phase 3A and the availability of funds.

The results of the Phase 3A investigations were discussed at a review teleconference with the District and DSOD on January 17, 2012. DSOD stated during this teleconference that, in their opinion, the measurements of shear wave velocity were inconclusive and did not confirm the higher density of the alluvium under the dam. As a result, DSOD would not allow the use of higher $(N_1)_{60}$ values under the embankment than at the toe in the seismic deformation analyses. A consensus was then reached that no additional investigations were required and Phase 3B was not implemented.

1.3 ORGANIZATION OF REPORT

This report contains three sections in addition to this introduction and six appendices. Section 2 describes the site investigations and Section 3 describes the laboratory testing program. Section 4 is a list of references. The appendices contain the logs of the borings and piezometers (Appendix A), the laboratory test results (Appendix B), the results of the CPTs (Appendix C), the results of the down-hole geophysical logging (Appendix D), the results of Standard Penetration Test (SPT) energy calibration (Appendix E), and the results of the Becker hammer dynamic monitoring (Appendix F).

2.1 GENERAL

The site investigations were divided into three phases. Phase 1 included the drilling of five borings using a sonic rig and the installation of a Casagrande piezometer in each of the sonic borings. Phase 2 consisted of the following:

1. Pilot program of three CTPs;
2. Drilling of three mud rotary borings with SPT energy calibration;
3. OYO down-hole geophysical logging in each of the three mud rotary borings;
4. Drilling of eight Becker borings;
5. Hammer energy monitoring on three of the Becker borings; and
6. Installation of vibrating wire piezometers and standpipe piezometers.

Phase 3 included drilling of one mud-rotary boring with OYO down-hole geophysical logging and completion of CPTs with seismic cone shear wave velocity measurements at three locations.

The locations of the borings and CPTs are shown in plan on Figure 1. The borings, piezometers and observation wells are shown on the sections contained in Figure 2. As shown on Figure 1, explorations were completed on the crest of the dam, downstream of the toe, and at two locations on the downstream slope. Access roads and working platforms were constructed by the District using 1-inch crushed stone to allow access to the locations on the downstream slope of the dam where borings were completed. The following sections describe the various field explorations for Phases 1, 2, and 3. The boring and piezometer logs and results of the associated laboratory and field tests are contained in Appendices A through F as indicated hereinafter.

2.2 PHASE 1 FIELD EXPLORATIONS

2.2.1 Sonic Borings

Five sonic borings were completed by Boart Longyear at the locations shown on Figures 1 and 2. Logs of the sonic borings are included in Appendix A. Work began on Monday November 15, 2010 and was completed on Wednesday November 24, 2010. The borings were logged in the field by Richard Harlan, PG, CEG of TGP with assistance from Patrick Allen of TGP.

The sonic borings were drilled using a Prosonic Model 300T track-mounted sonic drill rig. The borehole was 6 inches in diameter and 4-inch diameter continuous sonic core samples were obtained. The cores were visually examined, classified and logged in the field by Mr. Harlan using the Unified Soil Classification System (ASTM D2487). The cores were photographed, representative samples were selected for laboratory physical and index property tests, and all the remaining core materials were stored in wooden core boxes. Samples selected for laboratory testing were sent to the geotechnical testing laboratory for testing and the core boxes have been stored by TGP at a weatherproof and locked commercial storage facility.

2.2.2 Installation of Casagrande Piezometers

Each sonic boring extended a minimum of 5 feet into rock. A Casagrande hydraulic piezometer was installed upon completion of the borehole with the bottom of the piezometer tip located approximately half a foot above the bottom of the alluvial soils that overly the Santa Clara Formation bedrock. A schematic of the piezometer installation is shown on the sonic boring logs contained in Appendix A and separate logs summarizing the installation details for each Casagrande piezometer are also included in Appendix A. Table 1 contains a summary of piezometer locations and installation details.

Initial readings on the Casagrande piezometers showed that the piezometric levels were within the alluvium and that the saturated thickness of the alluvium varies from less than one foot to about six feet. The saturated thickness of the alluvium and piezometric level at the piezometers are tabulated below based on measurements made on December 16, 2010.

Piezometer Number	Groundwater Head, ft	Saturated Thickness of Alluvium, ft	Nominal Location and Formation
SC-101	420.6	0.2	Sta 7+50 10’ D/S Younger Alluvium
SC-102	419.8	0.6	Sta 7+50 100’ D/S Younger Alluvium
SC-103	419.2	2.0	Sta 7+50 200’ D/S Younger Alluvium
SC-104	418.5	5.9	Sta 7+50 350’ D/S Younger Alluvium
SC-105	495.0	5.7	Sta 4+00 10’ D/S Older Alluvium

Additional piezometer monitoring data and interpretations of these data are presented in the Site Characterization Report (Terra / GeoPentech, 2012).

Falling head borehole permeability tests were completed on all the Casagrande piezometers. The tests were successful at piezometers SC-101S, SC-102S and SC-105S but were of questionable accuracy at piezometers SC-103S and SC-104S. In these latter piezometers, the water levels fell to the static levels within about one minute which made it very difficult to charge the piezometer and obtain time readings. As a result of this experience, standpipe piezometers with slotted well screens and 2-inch diameter riser pipes were installed at the toe of the dam during the Phase 2 field explorations at the locations of Becker borings SC-106BPT and SC-107 BPT. TGP was able to successfully complete borehole permeability tests in these standpipe piezometers. The results of the falling head borehole permeability tests are summarized in Table 2.

2.3 PHASE 2 FIELD EXPLORATIONS

2.3.1 Pilot Cone Penetrometer Test Program

A pilot CPT program was completed by Gregg Drilling & Testing on January 24, 2011 in order to evaluate the ability of the cone penetrometer to penetrate the gravelly embankment soils and

alluvium at the dam. As shown on Figure 1, three CPT probes were completed, one each at exploration locations SC-101 and SC-105 on the dam crest and one at exploration location SC-104 near the toe of the dam. Richard Harlan of TGP supervised the field operations.

Gregg Drilling & Testing completed the CPT probes using an integrated electronic cone system. The soundings were conducted using a 20-ton capacity cone with a tip area of 15 cm^2 and a friction sleeve area of 225 cm^2. The cone takes measurements of cone bearing, sleeve friction and penetration pore water pressure at 5-cm intervals during penetration to provide a nearly continuous log.

The logs of the CPT soundings are summarized in the report by Gregg Drilling & Testing that is included in Enclosure 1 of Appendix C. In addition to the CPT soundings, pore pressure dissipation tests were conducted at the CPT locations and depths tabulated below. The results of these tests are included in Appendix C (Enclosure 1).

CPT Number	Corresponding Boring Number	Depth of Pore Pressure Dissipation Test(s), feet
SC-1-CPT	SC-101	137.0
SC-2-CPT	SC-105	57.1 63.3
SC-3-CPT	SC-104	20.0 27.9

2.3.2 Mud Rotary Borings and Down-Hole Geophysical Logging

As shown on Figure 1, mud rotary borings SC-101MR and SC-105MR were completed on the dam crest and mud rotary boring SC-104MR was completed near the toe of the dam. The borings were made by Pitcher Drilling during the period February 10 to February 15, 2011 using a truck-mounted Fraste Multidrill Model XL. The work was supervised in the field by Richard Harlan of TGP. Disturbed samples were obtained using the Standard Penetration Test (SPT) in which the blows were measured for every 1-inch drive increment and intact samples were obtained using 4-inch diameter Pitcher Barrel Samples. The efficiency of the hammer used for the SPT testing was measured at Boring SC-105MR by Gregg Drilling & Testing using a Model PAK Pile Driving Analyzer.

Upon completion of drilling, each boring was logged by GeoVision using OYO P-S suspension logging equipment. The depth of geophysical logging extended to the top of the Santa Clara Formation bedrock in Boring SC-105MR and to a depth 25 feet below the top of the Santa Clara Formation bedrock in Borings SC-101MR and SC-104MR.

The boring logs for the mud rotary borings are contained in Appendix A. The report by GeoVision on the OYO P-S Suspension logging is included as Enclosure 1 in Appendix D, and

the report by Gregg Drilling & Testing on the hammer energy measurements is included as Appendix E.

2.3.3 Becker Borings

The locations of the Becker borings are shown in Figure 1. Becker borings were completed by Great West Drilling during the period from February 14 to February 24, 2011 using a truck-mounted AP1000 Drill Systems Becker Hammer Drill equipped with an ICE -180 diesel hammer that was used to drive a plugged 6.6-inch diameter crowd-out bit with the turbocharger turned on. The work was supervised in the field by Richard Harlan of TGP with assistance from Andrew Dinsick and Patrick Allen of TGP.

Borings SC-102BPT and SC-103BPT are located on the downstream slope and were completed adjacent to sonic borings also made at these locations. Access to these borings with the truck-mounted drill rig required the assistance of tow trucks suitable for towing heavy trucks that were supplied by All Ways Towing as a subcontractor to Great West Drilling. Winching the drill rig both down and up the access road was completed under the direction of Great West Drilling in a slow, deliberate, and carefully planned way that assured the safety of the operation.

Borings SC-104BPT and SC-106BPT through SC-110BPT are located near the toe of the dam. The need for Becker borings was identified in the Addendum to the Work Plan (Terra / GeoPentech, 2011a) and three Becker borings were included in the Addendum to the Work Plan. Three additional Becker borings (SC-108BPT to SC-110BPT) were added to the program to provide more detailed information on the conditions and the variability in the conditions within the alluvium near the toe.

The energy transmitted to the top of the drill string was measured by Abe Construction Services, Inc. for SC-103BPT, SC-104BPT and SC-108BPT using a model PAX Pile Driving Analyzer. One representative hammer blow from each of these borings was analyzed using the CAPWAP computer program to develop a better estimate of the split in resistance to driving between side friction and tip resistance.

The Becker boring logs are included in Appendix A. Reports by Abe Construction Services on the energy measurements during driving and the CAPWAP analyses are included in Appendix F.

2.3.4 Installation of Vibrating Wire Piezometers

Boring SC-102BPT was completed by installing 4 multi-level vibrating wire (VW) piezometers as shown on Figure 2. The procedure for installing these piezometers is described in Section 11.2 of the Work Plan (Terra / GeoPentech, 2010) except that the installation procedure was modified so that the string of vibrating wire piezometers (and associated placement pipe) was installed inside the Becker drill casing after the plug at the bottom of the casing had been removed or knocked out.

The depth and elevations of the vibrating wire piezometer sensors are summarized in Table 3 and also provided on the log of Boring SC-102BPT included in Appendix A.

The monitoring data from these piezometers are presented and evaluated in the Site Characterization Report (Terra / GeoPentech, 2012).

2.3.5 Installation of Standpipe Piezometers

Two-inch diameter standpipe piezometers with slotted well screens were installed upon completion of borings SC-106BPT and SC-107BPT in accordance with the procedures described in the Addendum to the Work Plan (Terra / GeoPentech, 2011a). Details of the installation are provided in the installation logs included in Appendix A.

2.4 PHASE 3 FIELD INVESTIGATIONS

2.4.1 Mud Rotary Boring

As shown on Figure 1, mud-rotary boring SC-103MR was drilled on the lower access road. The boring was drilled by Pitcher Drilling during the period October 12 to October 14, 2011 using a track-mounted Fraste Multidrill Model XL. A tow truck provided by Save-Tow Towing, under subcontract to Pitcher Drilling, assisted the drill rig and support vehicle down and up the access ramp on the downstream slope of the dam. The work was supervised in the field by Richard Harlan of TGP. Disturbed samples were obtained using Standard Penetration Tests (SPTs)and Large Diameter Penetration Tests (LPTs) in which the blows were measured for every 1-inch drive increment.

Upon completion of drilling, the boring was logged by GeoVision using OYO P-S suspension logging equipment. The depth of geophysical logging extended about 70 feet below the top of the Santa Clara Formation. The boring log is contained in Appendix A and the report by GeoVision on the OYO P-S Suspension logging is included as Enclosure 2 in Appendix D.

2.4.2 Cone Penetrometer Tests

CPTs were completed at three locations by Gregg Drilling & Testing on October 27, 2011. As shown on Figure 1, SC-CPT-7 was completed on the crest; and SC-CPT-4, SC-CPT-5, and SC-CPT-5A were completed at the toe. SC-CPT-5A was performed after SC-CPT-5 had to be interrupted to replace the geophone that was suspected of malfunction.

The CPT soundings were completed as in the pilot test described in Section 2.3.1. The logs of the CPT soundings are summarized in the report by Gregg Drilling & Testing that is included in Enclosure 2 of Appendix C.

In addition, shear wave velocity measurements were made using the seismic cone at about 10-foot and 3-foot intervals in the embankment and alluvium, respectively. Also, pore pressures dissipation tests were performed in the alluvium at depths of 24.6 feet and 26.1 feet in SC-CPT-4 and SC-CPT-5A, respectively. The results of the shear wave velocity measurements and pore pressure dissipation tests are also included in Appendix C (Enclosure 2).

3.1 PURPOSE OF GEOTECHNICAL LABORATORY TESTING

The primary purpose of the geotechnical laboratory testing program was to perform extensive physical and index property tests to (a) allow classification of the soil and (b) provide the information on gradation and plasticity to support empirical correlations between penetration resistance and the potential for triggering of liquefaction and residual shear strength. The program also included limited engineering property testing in the form of undrained triaxial compression tests with pore pressure measurements on embankment materials to check the undrained strength measurements and effective strength measurements made by previous investigators, and a consolidation test. Permeability tests and pin hole tests on embankment materials were also considered but determined not to be necessary to complete the seismic stability evaluations.

3.2 SCOPE OF LABORATORY TESTING

The physical and index property testing included the following:

80	Moisture Contents
5	Dry Unit Weights
73	Grain Size Analyses
68	Atterberg Limits
2	Specific Gravity Tesst
1	Consolidation Test
5	Consolidated Undrained Triaxial Compression Tests with Pore Pressure Measurements

The results of all the laboratory tests are contained in Appendix B.

Santa Clara Valley Water District (SCVWD), 2005 (May), Dam Safety Program Report, prepared by Water Utility Operations Division – Infrastructure Planning Unit.

Terra / GeoPentech, a Joint Venture, 2010 (November), Seismic Stability Evaluations of Chesbro, Lenihan, Stevens Creek, and Uvas Dams, Phase A: Stevens Creek and Lenihan Dams, Site Investigations and Laboratory Testing at Stevens Creek Dam, Work Plan, prepared for Santa Clara Valley Water District.

Terra / GeoPentech, a Joint Venture, 2011a (January), Seismic Stability Evaluations of Chesbro, Lenihan, Stevens Creek, and Uvas Dams, Phase A: Stevens Creek and Lenihan Dams, Site Investigations and Laboratory Testing at Stevens Creek Dam, Addendum to Work Plan, prepared for Santa Clara Valley Water District.

Terra / GeoPentech, a Joint Venture, 2011b (September), Seismic Stability Evaluations of Chesbro, Lenihan, Stevens Creek, and Uvas Dams, Phase A: Stevens Creek and Lenihan Dams, Site Investigations and Laboratory Testing at Stevens Creek Dam, Addendum II to Work Plan, prepared for Santa Clara Valley Water District.

Terra / GeoPentech, a Joint Venture, 2012 (to be issued), Seismic Stability Evaluations of Chesbro, Lenihan, Stevens Creek, and Uvas Dams, Phase A: Stevens Creek and Lenihan Dams, Stevens Creek Dam, Site Characterization, Material Properties, and Ground Motions (Report No. SC-2), prepared for Santa Clara Valley Water District.

TABLES

TABLE 1

CASAGRANDE PIEZOMETERS AND STANDPIPE PIEZOMETERS

LOCATIONS AND INSTALLATION DETAILS

Instrument Number	Location	Coordinates [1]		Ground Surface Elevation [2], Ft	Top of Riser Elevation, Ft	Sensing Zone Depth, Ft [3]
		Northing	Easting			
Casagrande Piezometers						
SC-101 S	Crest	1,935,175	6,102,918	557.0	556.83	133.5 – 136.5
SC-102S	Downstream Slope	1,935,259	6,102,921	527.5	528.99	105.5 – 108.5
SC-103 S	Downstream Slope	1,935,351	6,102,926	490.2	491.47	70.5 – 73.3
SC-104 S	Downstream Toe	1,935,507	6,102,930	442.4	442.34	26.9 – 30.0
SC-105 S	Crest	1,935,089	6,102,249	553.4	553.22	61.3 – 64.5
Standpipe Piezometers						
SC-106 BPT	Downstream Toe	1,935,507	6,102,879	443.8	443.64	21.4 – 26.0
SC-107 BPT	Downstream Toe	1,935,500	6,103,006	437.4	437.16	18.0 – 22.5

Notes:

[1] Coordinate Datum is NAD1983

[2] Elevation Datum is NAVD 1988

[3] All sensing zones are located in the alluvium.

TABLE 2

RESULTS OF FALLING HEAD BOREHOLE PERMEABILITY TESTS

Piezometer Number	Measured Permeability cm/sec	Test Date
SC-101S	7.8×10^{-6} 7.8×10^{-6}	11/23/10 11/28/10
SC-102S	2.3×10^{-5} 1.6×10^{-5} 2.3×10^{-5}	11/24/10 11/28/10 12/7/10
SC-103S	2.3×10^{-5} Test Not Possible	11/26/10 4/6/11
SC-104S	Test Not Possible Test Not Possible	11/26/10 4/6/2011
SC-105S	3.1×10^{-6} 3.1×10^{-6}	11/20/2010 11/28/2010
SC-106BPT	2.0×10^{-3} 1.2×10^{-3}	4/6/2011 4/6/2011
SC-107BPT	2.0×10^{-3} 2.3×10^{-3}	4/6/2011 4/6/2011

TABLE 3

VIBRATING WIRE PIEZOMETERS

LOCATIONS AND INSTALLATION DETAILS

Piezometer Number (Serial Number)	Sensor Depth, Ft	Sensor Elevation, Ft	Sensor Location	Pre-Installation Frequency, Hz (Sensor at Surface)	Factory Zero Reading, Hz
VW1 (11-1418)	45.3	482.7	Embankment	2903.8	2902.0
VW2 (11-1419)	66.3	461.7	Embankment	2823.1	2822.5
VW3 (11-1420)	87.3	440.7	Embankment	2885.2	2883.6
VW-4 (11-1421)	98.3	429.7	Alluvium	2828.7	2827.0

Note:

All vibrating wire sensors are installed in borehole SC-102 BPT located at N 1,935,258 E 6,102,931 (NAD1983 datum).

FIGURES

SC-104 S/MR/BPT/CPT

EXPLORATION LOCATION AND NUMBER

S = Sonic Boring

MR = Mud-Rotary Boring

BPT = Becker Penetration Test

1 Casagrande Piezometer in Alluvium at all S Borings

Downhole Geophysical Logging at all MR Borings

4 Vibrating Wire Piezometers at SC-102 BPT

CPT = Cone Penetrometer Test Probe

Standpipe Piezometers at SC-106 BPT and SC-107 BPT

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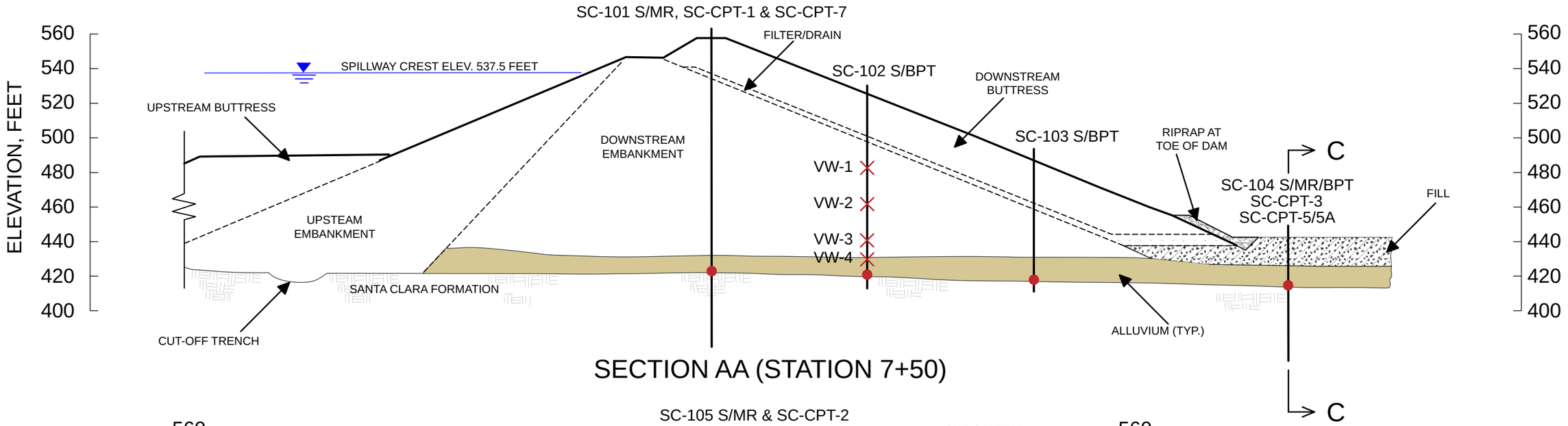
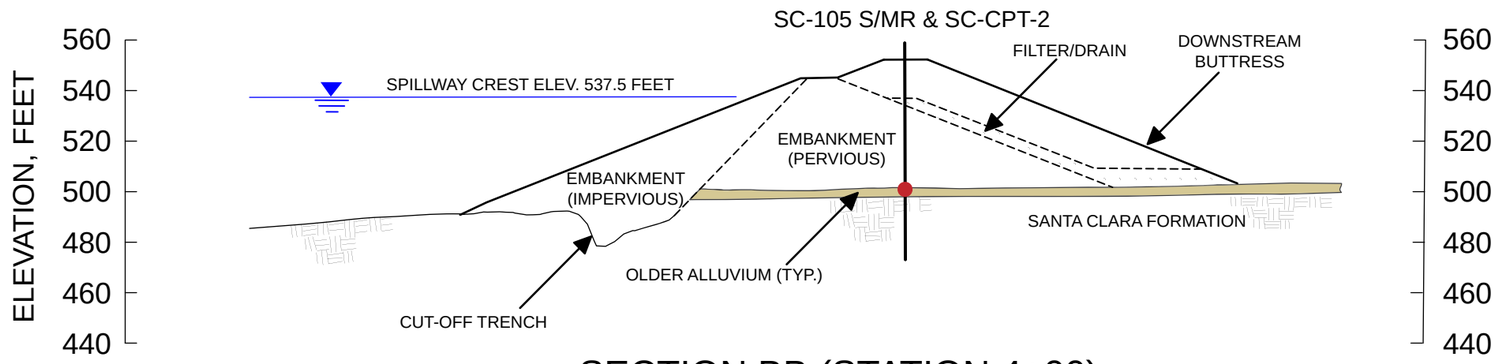
PLAN LOCATIONS OF 2010-2011 FIELD EXPLORATIONS - STEVENS CREEK DAM
SEISMIC STABILITY EVALUATIONS (SSE2)

Figure 1

Rev. 2 11/28/2011 SSE2-R-1SC



SECTION AA (STATION 7+50)



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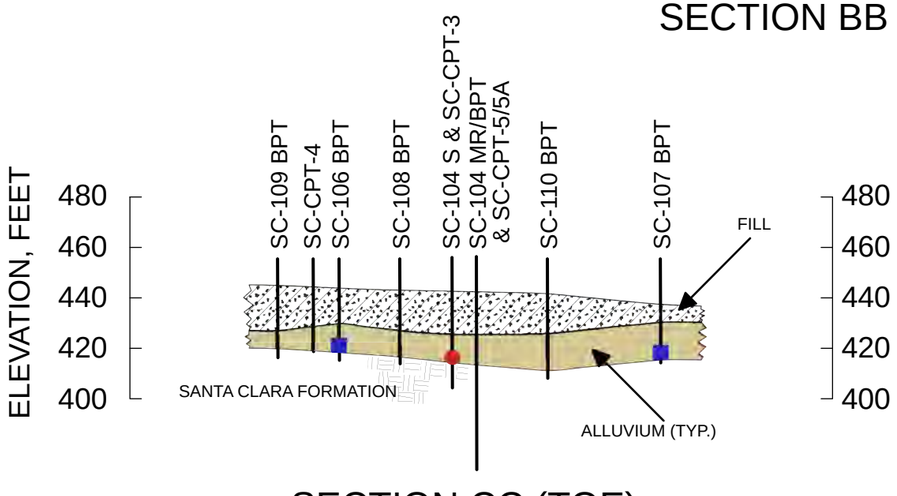
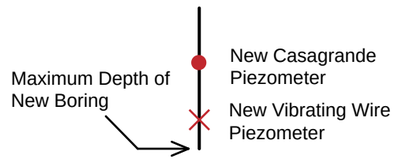
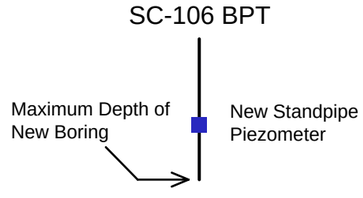
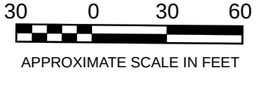


SECTION CC (TOE)

LEGEND







Notes:

1. Elevations of top and bottom of alluvium updated based on new borings.

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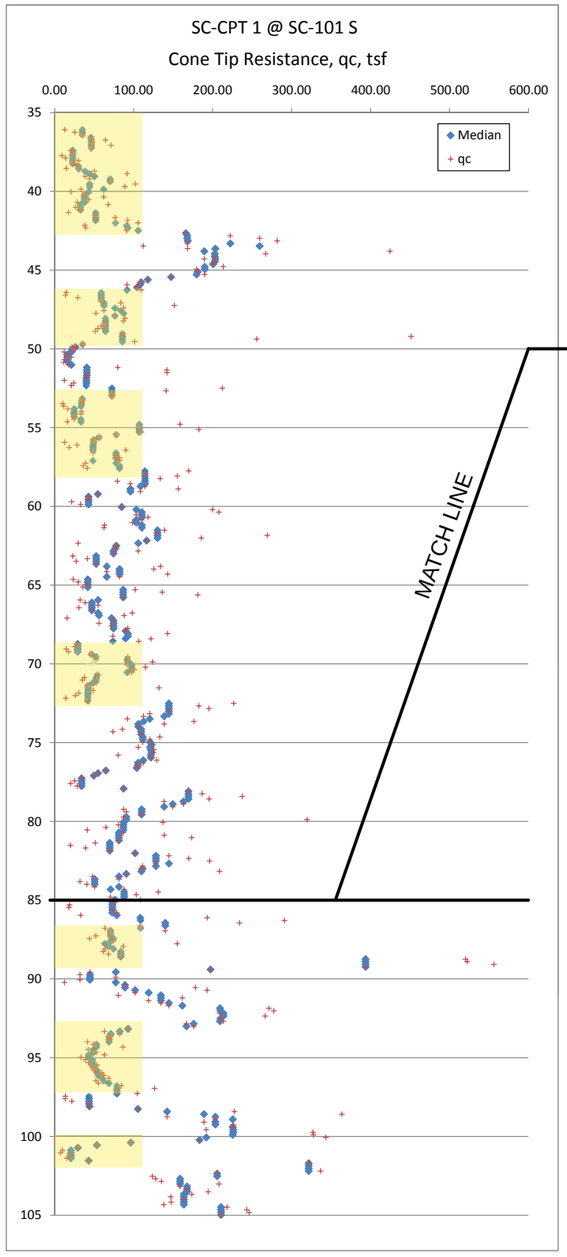
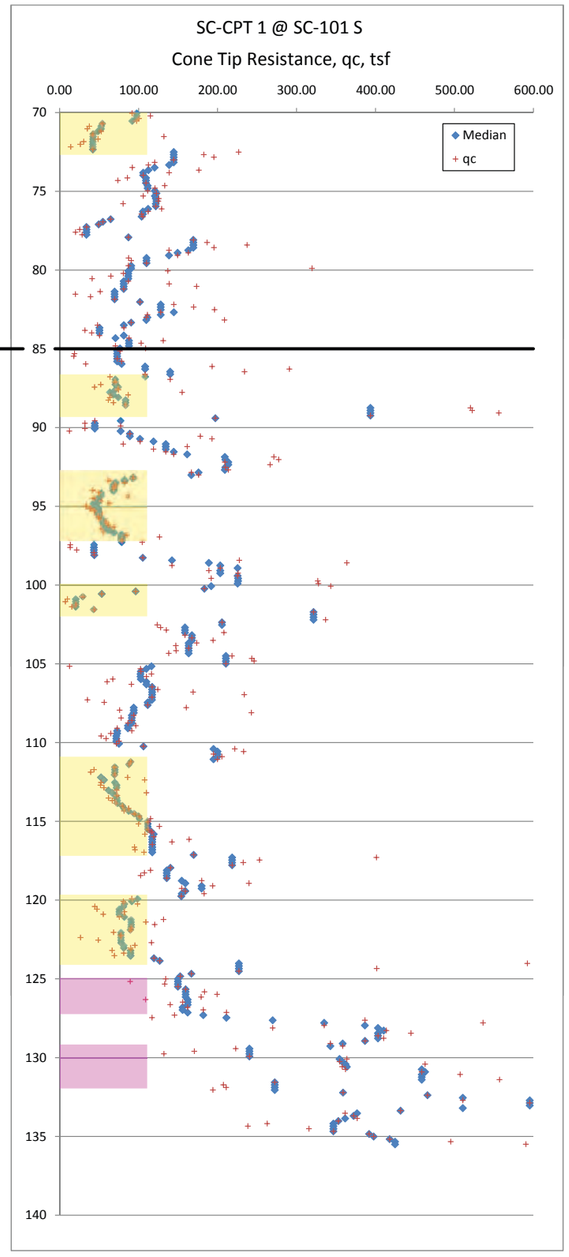
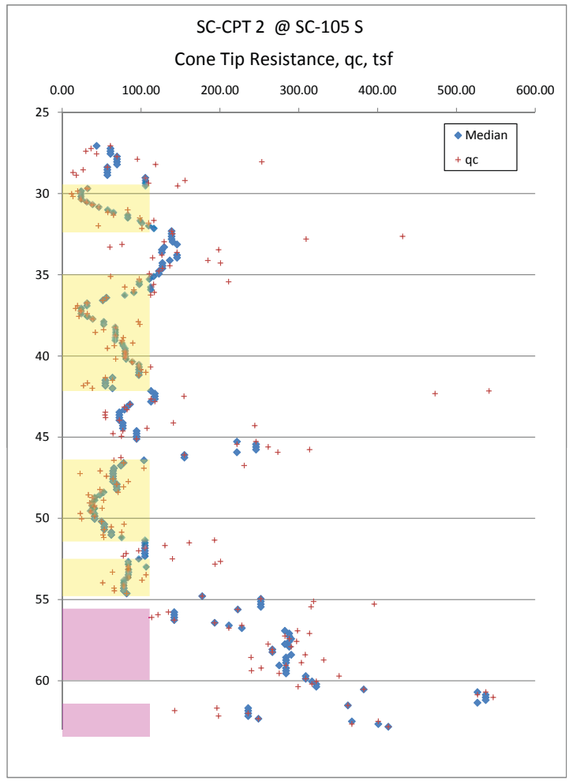
SECTIONS SHOWING LOCATIONS OF FIELD EXPLORATIONS - STEVENS CREEK DAM
SEISMIC STABILITY EVALUATIONS (SSE2)

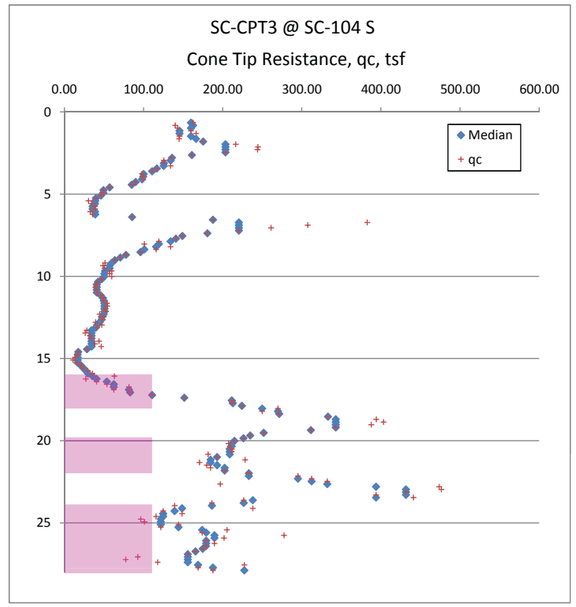
Figure 2





MATCH LINE





NOTES:

1. THE MEDIAN VALUES OF CONE TIP RESISTANCE, qc, ARE PLOTTED FOR EVERY MEASURED VALUE OF qc AND REPRESENT THE MEDIAN VALUES MEASURED IN A 1 FT THICK ZONE EXTENDING 6 INCHES ABOVE AND BELOW THE PLOTTED DEPTH
2. TARGET SAMPLING ZONES WERE SELECTED WHERE THE DIFFERENCES BETWEEN THE MEDIAN VALUES OF qc AND INDIVIDUAL qc MEASUREMENTS APPEAR TO BE RELATIVELY SMALL
3. TARGET SAMPLING ZONES WITHIN THE EMBANKMENT MATERIALS AND ALLUVIUM ARE SHADED YELLOW AND PINK RESPECTIVELY

TERRA / GeoPentech
a Joint Venture

USE OF CPT DATA TO TARGET SAMPLING LOCATIONS - STEVENS CREEK DAM
SEISMIC STABILITY EVALUATIONS (SSE2)

Figure 3

Rev. 0 04/06/2011 SSE2-R-1SC

APPENDIX A

CONTENTS

Page No.

Sonic Borings

Mud Rotary Borings

Becker Borings

Piezometers

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

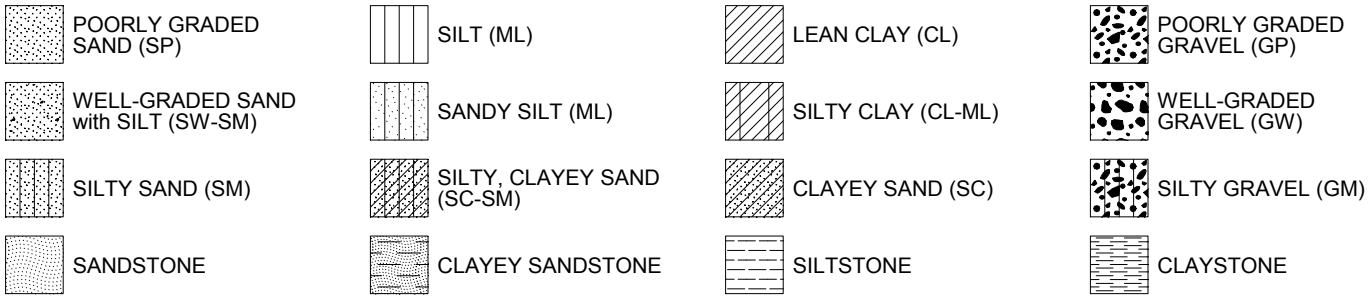
Key to Log of Sonic Boring

Elevation, feet	Depth, feet	SAMPLES: Run Number	SAMPLES: Recovery, ft	SAMPLES: Box Number	SAMPLES: Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	Piezometer Installation Schematic	FIELD NOTES AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12	13	14

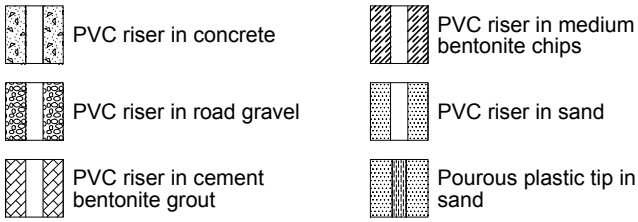
COLUMN DESCRIPTIONS

1. **Elevation:** Elevation in feet referenced to specified datum.
2. **Depth:** Depth in feet below the ground surface.
3. **Run Number** Number of individual sonic coring interval.
4. **Recovery:** Length in feet of material recovered from sonic coring interval.
5. **Box Number:** Box in which material from sonic coring interval or portion thereof is stored.
6. **Bag Sample Interval:** Interval over which a bag sample of core material was collected for possible testing.
7. **Graphic Log:** Graphic depiction of subsurface material encountered. Typical symbols are given below; variations on these symbols are used to indicate secondary soil components.
8. **Material Description:** Description of material encountered; in addition to soil or rock classification, may include color, moisture, relative density/consistency, particle size, and plasticity for soil; texture, weathering, strength, and hardness of bedrock.
9. **% Fines:** Percent of soil by weight passing the #200 sieve as determined per ASTM Method D422.
10. **Liquid Limit:** Liquid Limit (LL) of soil specimen passing the #40 sieve as determined per ASTM Method D4318.
11. **Plasticity Index:** Plasticity Index (PI=LL-PL) of soil specimen passing #40 sieve as determined per ASTM Method D4318.
12. **Moisture Content:** Moisture content, as a percentage of dry weight of specimen, determined per ASTM Method D2216.
13. **Piezometer Installation Schematic:** Graphic depiction of Casagrande piezometer construction (materials used and depths placed) in the sonic boring after completion of drilling; graphic symbols are explained below.
15. **Field Notes and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel. Lab test results other than those listed in columnar format may be recorded using abbreviations below.

TYPICAL MATERIAL GRAPHIC SYMBOLS



TYPICAL WELL GRAPHIC SYMBOLS



OTHER GRAPHIC SYMBOLS

- First water encountered at time of drilling and sampling
- Static water level measured at specified time after drilling
- Change in material properties within a lithologic unit
- Inferred contact between soil strata or gradational change

OTHER LABORATORY TEST ABBREVIATIONS

CONS One-Dimensional Consolidation Test
DUW Dry Unit Weight [pcf]
OC Organic Content Test [% organics]
TX-CIU Isotropically Consolidated Undrained Triaxial Test

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-101S

Date(s) Drilled	**11/18/10 - 11/19/10**	Logged By	**R. Harlan**	Total Depth of Borehole	**142.7 feet**
Drilling Method	**Sonic Core**	Drill Bit Size/Type	**3.9-inch ID / 4.9-inch OD bit; 6-inch OD drive casing**	Surveyed Ground Surface Elevation	**557.0 feet**
Drill Rig Type	**Prosonic 300T**	Drilling Contractor	**Boart Longyear**	Surveyed Location	**N 1,935,175 E 6,102,918**
Groundwater Level(s)	**134.5 ft bgs before piezometer installation, 128.5 ft 1hr after**	Sampling Method	**Bulk, bag samples from core**	Hammer Data	**Not applicable**
Borehole Location	**Approx. Station 7+50, crest**	Borehole Completion	**Casagrande piezometer: 3/4-in. PVC riser, 1.6-in. porous tip 134.8-135.8 ft; #3 sand 133.5-136.5 ft, bentonite 131.5-133.5 ft, grout 1-131.5 ft (see schematic)**		

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	Piezometer Installation Schematic	FIELD NOTES AND OTHER TESTS
	0						**EMBANKMENT**						Start drilling at 1454 on 11/18/10.
555		1	7.0	B-1			CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown, moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, medium plasticity fines [Downstream Buttress Fill]						
	5												
550													
	10												
545		2	10.0	B-2									
	15												
					Bag @16'		SILTY, CLAYEY SAND WITH GRAVEL (SC-SM), moderate yellowish brown, moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 1 inch, low plasticity fines [Downstream Buttress Fill]	33	25	5	6.8		
540	20												
535		3	10.0	B-3									
	25												
530					Bag @27'		POORLY GRADED GRAVEL WITH SAND (GP), light brownish gray, dry, fine to coarse angular to rounded gravel to 1 inch, fine- to coarse-grained sand, trace fines [Filter/Drain Transition Between Buttress Fill and Original Embankment]	5			2.3		
		4	10.0	B-4									
	30												

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

Log of Boring/Piezometer SC-101S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	30						POORLY GRADED GRAVEL WITH SAND (GP), light brownish gray, dry, fine to coarse angular to rounded gravel to 1 inch, fine- to coarse-grained sand, trace fines [Filter/Drain Transition Between Buttress Fill and Original Embankment] (continued)					
525		4	10.0	B-4								
	35						CLAYEY SAND WITH GRAVEL (SC), olive gray, very moist to 35.8 ft, moderate to dark yellowish brown, moist below 35.8 ft, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, occasional gravel to 3 inches, 20-40% low to medium plasticity fines; locally more clayey (CL) and more gravelly (GC) zones [Original Embankment]					
520												
	40											
515		5	10.0	B-5								
	45						Becomes very moist, with occasional dark brown and olive gray pockets and layers					
					Bag @46'			28	26	9	11.1	
510												
	50											
505		6	10.0	B-6								
	55											
					Bag @56'			43	31	10	10.8	
500												End drilling for 11/18/10 at 1655. Resume drilling at 0715 on 11/19/10.
	60											
		7	10.0	B-7								
495												
	65											

Log of Boring/Piezometer SC-101S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
490	65	7	10.0	B-7	Bag @66'		CLAYEY SAND WITH GRAVEL (SC), moderate to dark yellowish brown with occasional dark brown and olive gray pockets and layers, very moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, occasional gravel to 3 inches, 20-40% low to medium plasticity fines; locally more clayey (CL) and more gravelly (GC) zones [Original Embankment] (continued)	16	27	9	9.8	
485	70	8	10.0	B-8								
480	75				Bag @76'			33	26	9	12.1	
475	80	9	10.0	B-9								
470	85				Bag @86'			24	25	7	9.8	
465	90	10	10.0	B-10								
460	95				Bag @96'			20	27	9	9.4	
		11	10.0	B-11			Becomes very moist to wet, locally appears loose/soft					
	100											

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

Log of Boring/Piezometer SC-101S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %		FIELD NOTES AND OTHER TESTS
455							CLAYEY SAND WITH GRAVEL (SC), moderate to dark yellowish brown with occasional dark brown and olive gray pockets/layers, very moist to wet, fine- to coarse-grained sand, fine to coarse gravel mostly to 2 inches, 20-40% low to medium plasticity fines; locally more clayey (CL) and more gravelly (GC) zones [Original Embankment] (continued)						
					Bag @102'			29	27	10	16.1		Bag sample at 102 ft is wet, loose, clayey sand.
		11	10.0	B-11			Becomes very moist, no loose/soft zones						
	105												
450													
	110												
445		12	10.0	B-12									
	115												
					Bag @116'			23	23	4	11.9		
440													
	120												
		13	8.0										Driller raising and re-reaming casing due to binding in moist, clayey hole; additional cuttings from reaming necessitating shorter runs.
435				B-13									
					Bag @124'			26	34	18	10.1		
	125						**COLLUVIUM / RESIDUAL SOIL**						
		14	1.5				SANDY LEAN CLAY WITH GRAVEL (CL), brownish gray with faint dark yellowish brown mottling, damp, medium plasticity fines, fine- to coarse-grained sand, fine angular to subrounded gravel (weathered upper surface of alluvial channel deposits?)						
430					Bag @127'			8			4.4		
							YOUNGER ALLUVIUM						
		15	5.5				WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), brownish gray, damp, fine- to coarse-grained sand, fine to coarse subangular to rounded gravel to 1 inch						
	130						POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC), brownish gray, moist, fine to coarse gravel to 3 inches, few cobbles to 5 inches, fine- to coarse-grained sand, low plasticity fines						
				B-14									
425					Bag @132'			9			3.4		
		16	5.0										
	135												

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-101S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %		FIELD NOTES AND OTHER TESTS
		16	5.0	B-14	Bag @135'		SILTY, CLAYEY SAND WITH GRAVEL (SC-SM), pale yellowish brown, moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 1 inch, rare cobbles to 4 inches, low plasticity fines	15	22	6	5.9		
420					Bag @137'		**SANTA CLARA FORMATION** CLAYEY SANDSTONE WITH GRAVEL, pale to moderate yellowish brown with faint orange and gray mottling, dry, fine- to coarse-grained sand, fine gravel, medium plasticity fines, clay films on sand and gravel surfaces, tight	17	29	14	6.0		Complete Run 17 at 1415. Water in upper core barrel when pulling Run 17 (probably from lower alluvium, which appeared moist but not distinctly wet). End for 11/19/10. Clean out hole to 142.7 ft on 11/20/10 to install piezometer.
		17	3.9	B-15			SILTSTONE, moderate yellowish brown, dry, slightly weathered, friable, low hardness, massive						
140					Bag @140'		CLAYSTONE, dark yellowish brown and grayish brown, dry, slightly weathered, friable, low hardness, little fine-grained sand, occasional gravel, tight	72	36	19	8.3		
415													
							Bottom of boring at 142.7 feet						
	145												
410													
	150												
405													
	155												
400													
	160												
395													
	165												
390													
	170												

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-102S

Date(s) Drilled	**11/22/10**	Logged By	**R. Harlan**	Total Depth of Borehole	**114.6 feet**
Drilling Method	**Sonic Core**	Drill Bit Size/Type	**3.9-inch ID / 4.9-inch OD bit; 6-inch OD drive casing**	Surveyed Ground Surface Elevation	**527.5 feet**
Drill Rig Type	**Prosonic 300T**	Drilling Contractor	**Boart Longyear**	Surveyed Location	**N 1,935,259 E 6,102,921**
Groundwater Level(s)	**97 ft bgs (perched) during drilling; 105.4 ft at 0740 on 11/23/10**	Sampling Method	**Bulk, bag samples from core**	Hammer Data	**Not applicable**
Borehole Location	**Approx. Station 7+50, D/S slope**	Borehole Completion	**Casagrande piezometer: 3/4-in. PVC riser, 1.6-in. porous tip 106.5-107.5 ft; #3 sand 105.5-108.5 ft, bentonite 93.7-105.5 ft, grout 3-93.7 ft (see schematic)**		

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	Piezometer Installation Schematic	FIELD NOTES AND OTHER TESTS
	0						**TEMPORARY ROAD FILL** POORLY GRADED GRAVEL (GP), gray, fine angular gravel to 3/4 inch						Start drilling at 0655 on 11/22/10.
525							**EMBANKMENT** CLAYEY SAND WITH GRAVEL (SC), moderate to dark yellowish brown, moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, 20-40% medium plasticity fines [Downstream Buttress Fill]						
	5	1	8.0	B-1									
520					Bag @8'			35	34	16	11.4		
	10												
515		2	10.0	B-2									
	15												
510					Bag @18'			26	33	18	8.3		
	20												
505		3	10.0	B-3									
	25												
500					Bag @28'			27	32	16	8.9		
	30	4	10.0	B-4			WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), light brownish gray, damp, fine- to coarse-grained sand, fine angular to rounded gravel, nonplastic fines [see next sheet]						

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

Log of Boring/Piezometer SC-102S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	30						WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), light brownish gray, damp, fine- to coarse-grained sand, fine angular to rounded gravel to 1 inch, nonplastic fines; locally more gravelly (GW-GM) zones [Filter/Drain Transition Between Buttress Fill and Original Embankment] (continued)					Spilled part of Run 4 on ground; about 2 ft of SW material not retained.
495					Bag @32'			10			2.2	
		4	10.0	B-4								
	35											
490							CLAYEY SAND WITH GRAVEL (SC), mostly moderate and dark yellowish brown, occasional grayish brown and olive gray zones, very moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, occasional gravel to 3 inches, 20-40% medium plasticity fines; locally more clayey (CL) and more gravelly (GC) zones [Original Embankment]					
	40											
485		5	10.0	B-5								
	45											
480					Bag @48'			23	27	11	9.7	
	50											
475		6	10.0	B-6								
	55											
470												
	60						Olive gray, dark greenish gray, and brownish black, with numerous root fragments to 1 inch diameter					
		7	10.0	B-7								
465					Bag @62'			24	32	15	10.1	
	65											

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-102S

Sheet 3 of 4

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
460	65	7	10.0	B-7			CLAYEY SAND WITH GRAVEL (SC), mostly moderate and dark yellowish brown, occasional grayish brown and olive gray zones, very moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, occasional gravel to 3 inches, 20-40% medium plasticity fines; locally more clayey (CL) and more gravelly (GC) zones [Original Embankment] (continued)					
455	70	8	10.0	B-8								
450	75				Bag @78'			29	32	16	9.8	
445	80	9	10.0	B-9	Bag @82'		Grayish brown, very moist to wet, appears looser/softer	23	30	14	10.4	
440	85				Bag @87'			26	29	14	9.7	
435	90	10	5.0	B-10			Grayish brown, moist Becomes pale yellowish brown Becomes moderate yellowish brown					
430	95	11	5.0				**TOPSOIL(?)*** SILTY SAND (SM), brownish black, moist, fine-grained sand, nonplastic fines, organic odor CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown, moist, fine- to coarse-grained sand, fine gravel, plastic fines; becomes grayish brown at 95.5 ft **YOUNGER ALLUVIUM** SILTY SAND (SM), grayish brown, moist, fine- to medium-grained sand, 30% nonplastic fines, few fine to coarse gravel to 1 inch, trace coarse-grained sand					*Note: Possibly lowermost embankment fill from 94 ft to 97 ft. Trace of free water (perched) at 97 ft.
		12	5.0	B-11	Bag @98'			30	17	NP	13.1	
	100						WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), brownish gray, moist, fine to coarse gravel [see next sheet]					

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-102S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %		FIELD NOTES AND OTHER TESTS
425	0	12	5.0	B-11			WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), brownish gray, moist, fine to coarse angular to subrounded gravel to 3 inches, fine- to coarse-grained sand, low plasticity fines						
					Bag @103'			8			5.2		
							WELL-GRADED SAND WITH CLAY (SW-SC), brownish gray, moist, fine- to coarse-grained sand, few fine gravel to 3/4 inch, low plasticity fines						
105		13	5.0		Bag @105'			8			8.2		
							WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), brownish gray, moist, fine to coarse angular to subrounded gravel to 2 inches, fine- to coarse-grained sand, low plasticity fines; wet below 107 ft, 6-inch cobble at basal contact						Trace of free water in sample from 107-108 ft.
420							**SANTA CLARA FORMATION**						
					Bag @109'		CLAYEY SANDSTONE WITH GRAVEL, moderate yellowish brown, moderately weathered, friable, low hardness, fine- to coarse-grained sand and fine angular to subrounded gravel packed tight within hard clay matrix; yellowish gray below 109 ft	24	27	12	5.2		
110		14	5.0	B-12			SILTSTONE, yellowish gray, slightly weathered, friable, low hardness, minor fine- to coarse-grained sand						
415							CLAYSTONE, brownish gray, slightly weathered, friable, low hardness, some fine- to coarse-grained sand						Complete Run 14 at 1300 on 11/22/10. Clean out hole to 114.6 ft to install piezometer.
	115						**Bottom of boring at 114.6 feet**						
410													
	120												
405													
	125												
400													
	130												
395													
	135												

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-103S

Date(s) Drilled	**11/23/10 - 11/24/10**	Logged By	**R. Harlan**	Total Depth of Borehole	**78.5 feet**
Drilling Method	**Sonic Core**	Drill Bit Size/Type	**3.9-inch ID / 4.9-inch OD bit; 6-inch OD drive casing**	Surveyed Ground Surface Elevation	**490.2 feet**
Drill Rig Type	**Prosonic 300T**	Drilling Contractor	**Boart Longyear**	Surveyed Location	**N 1,935,351 E 6,102,926**
Groundwater Level(s)	**71.19 ft bgs before piezometer installation, 70.1 ft after**	Sampling Method	**Bulk, bag samples from core**	Hammer Data	**Not applicable**
Borehole Location	**Approx. Station 7+50, lower D/S slope**	Borehole Completion	**Casagrande piezometer: 3/4-in. PVC riser, 1.6-in. porous tip 71.5-72.5 ft; #3 sand 70.5-73.3 ft, bentonite 58-70.5 ft, grout 3.5-58 ft (see schematic)**		

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	Piezometer Installation Schematic	FIELD NOTES AND OTHER TESTS
490	0						**TEMPORARY ROAD FILL** POORLY GRADED GRAVEL (GP), gray, fine angular gravel						Start drilling at 1329 on 11/23/10.
							EMBANKMENT CLAYEY SAND WITH GRAVEL (SC), dark yellowish brown, moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 1-1/2 inches, 30-40% medium plasticity fines [Downstream Buttress Fill]						
		1	8.0	B-1									
485	5												
					Bag @9'		Olive gray, gravelly; POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC), mostly fine gravel, fine- to coarse-grained sand, medium plasticity fines	12	34	18	4.2		
480	10	2	10.0	B-2									
475	15				Bag @18'				34	16	28.8		
470	20						Becomes grayish brown						
		3	8.6	B-3									
465	25												
		4	1.4				POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM), yellowish gray, dry, fine to coarse gravel to 1 inch, fine- to coarse-grained sand, nonplastic fines [Filter/Drain?]						Difficult, slow drilling at 26 ft; pull run at 26.6 ft. Run 4 sample appears mixed buttress fill and transition filter/drain.
							CLAYEY SAND WITH GRAVEL (SC), grayish brown to dark yellowish brown, damp, fine- to coarse-grained sand, fine gravel to 3/4 inch, plastic fines [Mixed Buttress Fill / Drain?]						
		5	3.5	B-4			SILTY, CLAYEY GRAVEL WITH SAND (GC-GM), brownish gray, damp, fine gravel to 3/4 inch [see next sheet]						
	30												

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-103S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
460	30	5	3.5				SILTY, CLAYEY GRAVEL WITH SAND (GC-GM), brownish gray, damp, fine angular to subrounded gravel to 3/4 inch, fine- to coarse-grained sand, low plasticity fines [Filter/Drain Transition Between Buttress Fill and Original Embankment] (continued)					
					Bag @32'			14	21	6	4.0	
		6	6.5	B-4								
455	35						CLAYEY GRAVEL WITH SAND (GC), moderate and dark yellowish brown, very moist, fine to coarse angular to subrounded gravel to 2 inches, occasional gravel to 3 inches, fine- to coarse-grained sand, ~20% low to medium plasticity fines [Original Embankment]					
					Bag @37'			21	33	18	8.2	
450	40	7	10.0	B-5								
445	45				Bag @47'			20	27	9	9.0	
440	50	8	10.0	B-6								
435	55				Bag @57'		CLAYEY SAND WITH GRAVEL (SC), moderate and dark yellowish brown, very moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, occasional gravel to 3 inches, 30-40% medium plasticity fines [Original Embankment]	33	32	15	13.8	
							YOUNGER ALLUVIUM					
430	60	9	5.0	B-7			CLAYEY GRAVEL WITH SAND (GC), grayish brown, moist, fine to coarse angular to rounded gravel to 3 inches, fine- to coarse-grained sand, 20-30% medium plasticity fines, few roots					
					Bag @61.5'		SILTY SAND WITH GRAVEL (SM), grayish brown, moist, fine-grained sand, 30-40% nonplastic fines, fine to coarse gravel to 2 inches; below 62 ft, brownish black, nonplastic to low plasticity fines, few roots		18	NP	10.4	
		10	5.0		Bag @63.5'			32	22	2	13.5	
	65						WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), brownish gray, moist, fine to coarse gravel [see next sheet]					

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-103S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %		FIELD NOTES AND OTHER TESTS
425	65	10	5.0	B-7			WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM), brownish gray, moist, fine to coarse angular to rounded gravel to 3 inches, fine- to coarse-grained sand, nonplastic to low plasticity fines						
					Bag @69'		SILTY SAND WITH GRAVEL (SM), brownish gray, wet, fine-to medium-grained sand, ~15% nonplastic fines, fine to coarse subangular to rounded gravel to 2 inches	15	NP	NP	14.8		Wet sample from 68.5-69.5 ft.
420	70	11	5.0				POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM), brownish gray, very moist to wet, fine to coarse angular to rounded gravel to 3 inches, fine- to coarse-grained sand, nonplastic to low plasticity fines	8			5.1		
					Bag @71'								
				B-8			WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), moderate yellowish brown and grayish brown, very moist to wet, fine to coarse gravel to 3 inches, fine- to coarse-grained sand, medium plasticity fines	59	29	13	10.9		
					Bag @73.5'		**SANTA CLARA FORMATION**						
415	75	12	5.0				SANDY CLAYSTONE WITH GRAVEL, moderate yellowish brown, dry to damp, moderately weathered, friable, low hardness, varying amounts of fine- to coarse-grained sand and fine gravel, clay films on some sand and gravel surfaces, tight; yellowish gray below 73.5 ft						
					Bag @77'		CLAYEY SANDSTONE WITH GRAVEL, yellowish gray to pale yellowish brown, damp, slightly weathered, friable, low hardness	34	27	10	9.7		Complete Run 12 at 1650 on 11/23/10.
							Bottom of boring at 78.5 feet						Clean out hole to 78.5 ft on morning of 11/24/10 to install piezometer. No water on tag line.
410	80												
405	85												
400	90												
395	95												
	100												

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-104S

Date(s) Drilled	**11/15/10**	Logged By	**R. Harlan**	Total Depth of Borehole	**38.0 feet**
Drilling Method	**Sonic Core**	Drill Bit Size/Type	**3.9-inch ID / 4.9-inch OD bit; 6-inch OD drive casing**	Surveyed Ground Surface Elevation	**442.4 feet**
Drill Rig Type	**Prosonic 300T**	Drilling Contractor	**Boart Longyear**	Surveyed Location	**N 1,935,507 E 6,102,930**
Groundwater Level(s)	**26 ft bgs during drilling; 29.5 ft prior to piezometer installation**	Sampling Method	**Bulk, bag samples from core**	Hammer Data	**Not applicable**
Borehole Location	**Approx. Station 7+50, D/S toe**	Borehole Completion	**Casagrande piezometer: 3/4-in. PVC riser, 1.6-in. porous tip 28.2-29.2 ft; #3 sand 26.9-30 ft, bentonite 24.4-26.9 ft, grout 1-24.4 ft (see schematic)**		

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	Piezometer Installation Schematic	FIELD NOTES AND OTHER TESTS
440	0	1	8.2	B-1			**FILL** CLAYEY GRAVEL WITH SAND (GC), moderate yellowish brown, damp, fine to coarse subangular to rounded gravel to 3 inches, occasional cobbles to 5 inches, fine- to coarse-grained sand, 20-30% medium plasticity fines						Start drilling at 1028 on 11/15/10.
	5				Bag @6'			33	31	14			
435													
	10	2	8.8	B-2			← Pieces of metal wire ← Pieces of metal wire						
430													
	15				Bag @16'		**RESIDUAL SOIL(?)** CLAYEY SAND WITH GRAVEL (SC), moderate brown, moist, fine- to coarse-grained sand, fine to coarse subangular to subrounded gravel, appears medium dense	13	27	11			
425							**YOUNGER ALLUVIUM** WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), light brownish gray, damp, fine to coarse subangular to subrounded gravel to 3 inches, fine- to coarse-grained sand, 10-15% low to medium plasticity fines; 5-inch yellowish brown sandstone cobble at 16 ft, 4-inch hard, gray, subangular quartzite cobble at 17 ft						
	20	3	10.0	B-3	Bag @21'			9					
420													
	25				Bag @26'		← Becomes wet ▽	7					Free water in sample from 26-28 ft.
415		4	5.0	B-4			CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown, very moist, fine- to coars-grained sand, low plasticity fines, fine gravel to 3/4 inch						
	30				Bag @29'		**SANTA CLARA FORMATION** [see next sheet]	22	27	11			

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-104S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %		FIELD NOTES AND OTHER TESTS
410	30	4	5.0	B-4	Bag @31'		CLAYEY SANDSTONE WITH GRAVEL, light olive gray, dry, fine- to coarse-grained sand, fine to coarse subangular to subrounded gravel to 2 inches, low plasticity fines	18	26	10			
							CLAYSTONE, light olive gray, dry, slightly weathered, friable, low hardness, massive						
405	35	5	5.0		Bag @34'			92	38	20			Complete Run 5 at 1230 on 11/15/10. Clean out hole to 38 ft for piezometer.
							Bottom of boring at 38.0 feet						Piezometer installed on 11/17/10.
400	40												
395	45												
390	50												
385	55												
380	60												
	65												

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-105S

Date(s) Drilled	**11/18/10**	Logged By	**R. Harlan**	Total Depth of Borehole	**72.1 feet**
Drilling Method	**Sonic Core**	Drill Bit Size/Type	**3.9-inch ID / 4.9-inch OD bit; 6-inch OD drive casing**	Surveyed Ground Surface Elevation	**553.4 feet**
Drill Rig Type	**Prosonic 300T**	Drilling Contractor	**Boart Longyear**	Surveyed Location	**N 1,935,089 E 6,103,249**
Groundwater Level(s)	**Possible perched layer 61.5-62 ft**	Sampling Method	**Bulk, bag samples from core**	Hammer Data	**Not applicable**
Borehole Location	**Approx. Station 4+00, crest**	Borehole Completion	**Casagrande piezometer: 3/4-in. PVC riser, 1.6-in. porous tip 62.5-63.5 ft; #3 sand 61.3-64.5 ft, bentonite 59.5-61.3 ft, grout 1-61.3 ft (see schematic)**		

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	Piezometer Installation Schematic	FIELD NOTES AND OTHER TESTS
	0						**EMBANKMENT** GRAVELLY LEAN CLAY WITH SAND (CL), moderate brown, moist, medium plasticity fines, fine to coarse angular to subrounded gravel to 2 inches, fine- to coarse-grained sand [Downstream Buttress Fill]						Start drilling at 0721 on 11/18/10.
550		1	7.0	B-1			CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown, damp, fine- to coarse-grained sand, mostly fine gravel [Downstream Buttress Fill]						
	5						SANDY LEAN CLAY WITH GRAVEL (CL), olive gray, moist, medium plasticity fines, fine- to coarse-grained sand, fine gravel [Downstream Buttress Fill]						
545							CLAYEY GRAVEL WITH SAND (GC), moderate brown, moist, mostly fine gravel with occasional coarse gravel to 2 inches, fine- to coarse-grained sand, medium plasticity fines [Downstream Buttress Fill]						
	10	2	10.0	B-2									
540													
	15				Bag @15'		SANDY LEAN CLAY WITH GRAVEL (CL), moderate brown, moist, low plasticity fines, fine- to coarse-grained sand, mostly fine gravel [Downstream Buttress Fill]	56	27	11	7.1		
535							SILTY SAND WITH GRAVEL (SM), light brownish gray, dry, fine- to coarse-grained sand, fine angular to rounded gravel to 3/4 inch, ~15% nonplastic fines [Filter/Drain Transition Between Buttress Fill and Original Embankment]						About 1 ft of caved material recovered from top of Run 3 not retained.
	20	3	10.0	B-3									
530													
	25				Bag @24'			15	NP	NP	2.2		
							CLAYEY SAND WITH GRAVEL (SC), dark yellowish brown, moist, fine- to coarse-grained sand, fine angular to subrounded gravel, 20-40% medium plasticity fines [Original Embankment]						
525		4	10.0				Becomes moderate brown						
	30			B-4									

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

Log of Boring/Piezometer SC-105S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	30						CLAYEY SAND WITH GRAVEL (SC), moderate brown, moist, fine- to coarse-grained sand, fine angular to subrounded gravel, 20-40% medium plasticity fines [Original Embankment] (continued)					
520		4	10.0	B-4			WELL-GRADED GRAVEL WITH SAND (GW), light brownish gray, dry, fine to coarse gravel to 1 inch, fine- to coarse-grained sand [Original Embankment]					
	35				Bag @36'		CLAYEY SAND WITH GRAVEL (SC) to CLAYEY GRAVEL WITH SAND (GC), dark yellowish brown, moist, fine- to coarse-grained sand, fine to coarse gravel to 2 inches, ~20% low plasticity fines; moderate yellowish brown 36-37 ft [Original Embankment]	21	25	8	9.9	
515												
	40	5	10.0	B-5			Several layers to 6 inches thick of WELL-GRADED SAND WITH GRAVEL (SW)					
510					Bag @44'		SILTY, CLAYEY SAND WITH GRAVEL (SC-SM), dark yellowish brown, moist, fine- to coarse-grained sand, fine to coarse gravel to 1 inch, ~30% low plasticity fines [Original Embankment]	27	25	7	10.5	
	45			B-6			← Brownish black, SANDY CLAY (CL) layer 1/2 inch thick					
505		6	5.0				CLAYEY SAND WITH GRAVEL (SC), dark yellowish brown, moist, fine- to coarse-grained sand, fine to coarse gravel to 1 inch, ~30% low plasticity fines [Original Embankment]					
	50				Bag @50'		Brownish black and greenish gray, SANDY CLAY (CL)	31	25	8	10.1	
500		7	5.0	B-7	Bag @53.5'		**TOPSOIL / COLLUVIUM** SANDY SILT (ML), brownish black, very moist to wet, low plasticity fines, fine- to coarse-grained sand, minor fine gravel, numerous fine rootlets, appears soft		20	4	10.9	Organics=2.8%
	55						**OLDER ALLUVIUM / RESIDUAL SOIL(?)** CLAYEY GRAVEL WITH SAND (GC), olive gray, moist, fine to coarse angular to subrounded gravel to 2 inches, fine- to coarse-grained sand, plastic fines					
495		8	5.0	B-8	Bag @58'		**SANTA CLARA FORMATION (Deeply Weathered)** CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown with gray and orange mottling, damp to moist, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, low plasticity fines	25	25	8	5.8	
	60						▽ Very moist to wet (possibly perched water)					
490		9	5.0		Bag @62'		CLAYEY GRAVEL WITH SAND (GC), moderate yellowish brown with gray and orange mottling, damp to moist, fine to coarse angular to subrounded gravel to 1 inch, fine- to coarse-grained sand, low plasticity fines	15	27	9	5.5	
	65						**SANTA CLARA FORMATION** CLAYEY SANDSTONE WITH GRAVEL [see next sheet]					

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring/Piezometer SC-105S

Elevation, feet	Depth, feet	SAMPLES: Run Number	Recovery, ft	Box Number	Bag Sample Interval	Graphic Log	MATERIAL DESCRIPTION	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %		FIELD NOTES AND OTHER TESTS
	65	9	5.0	B-8	Bag @66'		CLAYEY SANDSTONE WITH GRAVEL, moderate yellowish brown with gray and orange mottling, dry, fine- to coarse-grained sand, fine to coarse angular to subrounded gravel to 2 inches, low plasticity fines, clay films on gravel surfaces, moderately to slightly weathered	30	25	11	4.7		
485													
	70	10	5.0	B-9									Complete Run 10 at 1050 on 11/15/10. Clean out hole to 72.1 ft.
							Bottom of boring at 72.1 feet						Piezometer installed in early afternoon of 11/18/10.
480													
	75												
475													
	80												
470													
	85												
465													
	90												
460													
	95												
455													
	100												

Report: TGP SSE2 SONIC+WELL LOG; File: SCVWD_STEVENS.GPJ; 4/7/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Key to Log of Mud Rotary Boring

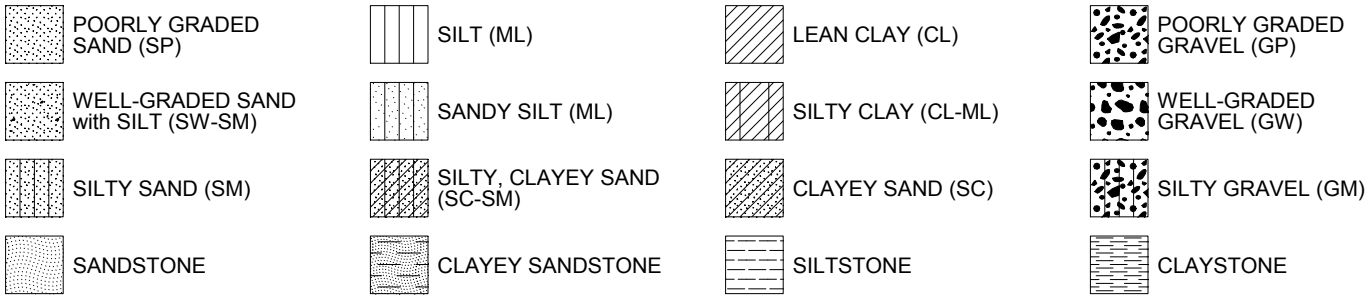
Sheet 1 of 1

Elevation, feet	Depth, feet	SAMPLES: Type	SAMPLES: Number	Blows Per 1-inch Drive Increment	Blows Per 6 inches	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

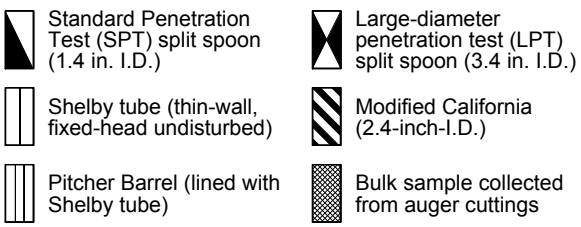
COLUMN DESCRIPTIONS

1. **Elevation:** Elevation in feet referenced to specified datum.
2. **Depth:** Depth in feet below the ground surface.
3. **Sample Type:** Type of soil or rock sample collected at depth interval shown; sampler symbols are explained below.
4. **Sample Number:** Sample identification number.
5. **Blows per 1-inch Drive Increment:** Number of blows required to advance sampler each inch of drive interval using a standard hammer/drop; blows are grouped in 6-inch increments. 1/3" indicates a 3-inch advance with a single hammer blow.
6. **Blows per 6 inches:** Number of blows required to advance sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer dropped 30 inches.
7. **Recovery:** Length in feet of material recovered in sampler.
8. **Graphic Log:** Graphic depiction of subsurface material encountered. Typical symbols are given below; variations on these symbols are used to indicate secondary soil components.
9. **Material Description:** Description of material encountered; in addition to soil or rock classification, may include color, moisture, relative density/consistency, particle size, and plasticity for soil; texture, weathering, strength, and hardness of bedrock.
10. **% Gravel:** Percent of soil by weight retained on the #4 sieve as determined per ASTM Method D422.
11. **% Fines:** Percent of soil by weight passing the #200 sieve as determined per ASTM Method D422.
12. **Liquid Limit:** Liquid Limit (LL) of soil specimen passing the #40 sieve as determined per ASTM Method D4318.
13. **Plasticity Index:** Plasticity Index (PI=LL-PL) of soil specimen passing the #40 sieve as determined per ASTM Method D4318.
14. **Moisture Content:** Moisture content, as a percentage of dry weight of specimen, determined per ASTM Method D2216.
15. **Field Notes and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel. Lab test results other than those listed in columnar format are recorded using abbreviations below.

TYPICAL MATERIAL GRAPHIC SYMBOLS



TYPICAL SAMPLER GRAPHIC SYMBOLS



OTHER GRAPHIC SYMBOLS

- First water encountered at time of drilling and sampling
- Static water level measured at specified time after drilling
- Change in material properties within a lithologic unit
- Inferred contact between soil strata or gradational change

OTHER LABORATORY TEST ABBREVIATIONS

CONS	One-Dimensional Consolidation Test
DUW	Dry Unit Weight [pcf]
Gs	Specific Gravity
OC	Organic Content Test [% organics]
TX-CIU	Isotropically Consolidated Undrained Triaxial Test

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.

2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring SC-101MR

Sheet 1 of 6

Date(s) Drilled	**2/7/11 - 2/9/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**178.0 feet**
Drilling Method	**Mud Rotary**	Drill Bit Size/Type	**5-7/8-in. and 3-7/8-in. tricone bits**	Surveyed Ground Surface Elevation	**557.1 feet**
Drill Rig Type	**Fraste Multidrill XL**	Drilling Contractor	**Pitcher Drilling**	Surveyed Location	**N 1,935,170 E 6,102,926**
Groundwater Level(s)	**Not determined**	Sampling Method	**SPT, Pitcher Barrel (4-in.-dia.)**	Hammer Data	**Automatic hammer; 140 lbs / 30-inch drop**
Borehole Location	**Approx. Station 7+50, dam crest**	Borehole Completion	**Cement-bentonite grout slurry via tremie**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	0							**EMBANKMENT**						Start drilling at 08:58 on 2/7/11 with 6-1/2-in. trash barrel to 1 ft. Drill with 5-7/8-in. tricone bit and bentonite-based drill fluid below 1 ft.
555								CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown, medium dense; fine- to coarse-grained sand, fine to coarse gravel to 1-1/2 inches, low to medium plasticity fines; occasional more gravelly (GC) zones [Downstream Buttress Fill]						
								CLAYEY GRAVEL WITH SAND (GC); rougher drill chatter in interval						
	5		SP-1		9 11 10	0.9								
550														
	10		SP-2		5 12 14	0.8								Full drill fluid return.
545														Rig down from 10:30-12:45; auto hammer jammed.
	15		SP-3	1-3-3-2-2-2 2-2-2-2-2-2 3-2-3-2-3-3	13 12 16	0.6								
540														
	20		SP-4	1-2-1-1-1-2 1-2-3-2-2-2 2-3-2-2-3-3	8 12 15	0.6								
535														
	25		SP-5	1-1-1-3-4-5 6-5-8-6-6-7 7-8-6-7-7-6	15 38 41	1.1		POORLY GRADED GRAVEL WITH SAND (GP), light brownish gray, dense to very dense; fine to coarse angular to rounded gravel to 1 inch, fine- to coarse-grained sand, trace fines [Filter/Drain Transition]						Faster drilling, cleaner cuttings at 22.8 ft.
530														
	30													Set 6-in. casing to 29.3 ft. Smooth drilling, clay in cuttings at 29.8 ft.

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 1/18/2012

Log of Boring SC-101MR

Elevation, feet	Depth, feet	SAMPLES Type	Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	30				280			SANDY LEAN CLAY WITH GRAVEL (CL), moderate yellowish brown, very moist, medium stiff to stiff; medium plasticity fines, fine- to coarse-grained sand, fine gravel [Original Embankment]						4-in. Pitcher Barrel at 30 ft; pull down pressure recorded in psi.
			PB-1		450	2.0					31	15	15.6	
525														
			SP-6	1/2"-1/2"-1/2" 1/2"-1-1-1-1 1-1-1-1-1-2	3 5 7	1.0		CLAYEY SAND WITH GRAVEL (SC), moderate and dark yellowish brown with occasional dark brown and olive gray zones, medium dense; fine- to coarse-grained sand, fine to coarse gravel to 1-1/ 2 inches, medium plasticity fines; contains occasional layers and pockets of more clayey (CL) and more gravelly (GC) material						Extend 6-in. casing to 34.3 ft.
	35													
			SP-7	1-1-1/2"-1-1 1-1-1-1-2-2 2-2-2-1-1-2	5 8 10	0								No recovery in SPT at 35 ft.
520														
														Continued full fluid return.
	40													
			SP-8	1-1-1-1-1-1 1-2-1-2-1-1 2-1-2-1-3-4	6 8 13	1.0								
515														End for 2/7/11. Resume drilling on 2/8/11 at 07:30.
	45													
			SP-9	1/2"-1/2"-1-1 1/2"-1-1-1-1 1-2-1-1-3-2	4 5 10	0.5		SANDY LEAN CLAY WITH GRAVEL (CL), grayish black, firm to stiff, moderately organic						
510														
	50				350									
			PB-2		600	1.9					26	10	16.4	
505					700									Tip of tube dented and torn.
	55													
			SP-10	2-1-1-1-1-1 1-1-1-2-1-2 2-2-2-3-2-3	7 8 14	0.9								
500														
	60													
			SP-11	1-1-2-1/2"-1 2-1-2-3-3-2 2-3-3-3-2-5	6 13 18	0.2								Recover only 0.2 ft of broken gravel fragments to 1-1/2 in., minor clay.
495														
	65													

Log of Boring SC-101MR

Elevation, feet	Depth, feet	SAMPLES Type	Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	65	SP	12	2-2-2-2-2-3 2-2-2-2-2-1 2-2-2-2-2-2	13 11 12	0.7		CLAYEY SAND WITH GRAVEL (SC), moderate and dark yellowish brown with occasional dark brown and olive zones, medium dense; fine- to coarse-grained sand, fine to coarse gravel to 1-1/2 inches, medium plasticity fines; contains occasional layers and pockets of more clayey (CL) and more gravelly (GC) material [Original Embankment] (continued)						
490														
	70	PB	3		600 500	1.3					26	10	11.9	Tip of tube dented and torn.
485														
	75	SP	13	1-1-2-1-2-2 2-2-3-2-2-1 2-2-1-1-1-2	9 12 9	0.2								Smoother, faster drilling 74.5-75.0 ft.
480														
	80	SP	14	1-1-1-2-5-4 3-3-2-2-3-3 2-2-3-2-4-2	14 16 15	0.6								
475														
	85	SP	15	1-1-1-2-1-1 2-1-2-2-2-4 3-2-3-3-3-3	7 13 17	0.9		SANDY LEAN CLAY (CL), stiff						
470														
	90	SP	16	1-2-2-1-2-2 2-2-1-2-3-3 2-2-3-2-3-3	10 13 15	0.4		SILTY, CLAYEY GRAVEL WITH SAND (GC-GM), logged from drilling observations						
465														Pitcher Barrel catching at 92 ft, above PB-4 location.
		PB	4		450 350 700 450	1.5		← Cobble >3 in. in top of PB-4 tube			25	7	13.2	
	95	SP	17	2-1-1-2-2-2 2-2-2-2-2-3 2-3-3-4-3-4	10 13 19	0.7		CLAYEY SAND WITH GRAVEL (SC), moderate and dark yellowish brown, dense; fine- to coarse-grained sand, fine to coarse gravel						Tip of tube dented and torn; sample may be disturbed.
460														
	100							CLAYEY GRAVEL WITH SAND (GC), some cobbles; based on drill action						Rocky, bouncy drilling 98-100 ft.

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
		PB	5		600	1.3		CLAYEY SAND WITH GRAVEL (SC), moderate and dark yellowish brown with occasional dark brown and olive gray zones, dense; fine- to coarse-grained sand, mostly fine gravel, few coarse gravel to 1-1/ 2 inches, low to medium plasticity fines; contains occasional layers and pockets of more clayey (CL) and more gravelly (GC) material [Original Embankment] (continued)	39	17	28	13	15.6	Intermittent rough drilling ; possible disturbed sample.
455														
	105	SP	18	2-2-2-2-1-2 1-2-1-2-2-3 3-2-3-4-6-2	11 11 20	0.5								
450														Less rocky drilling 105-112 ft.
	110	SP	19	2-2-2-2-2-2 2-2-2-2-2-3 3-2-2-7-7-7	12 13 28	0.7		←Brownish black organic material, 2-inch layer						Continued full fluid return.
445		PB	6		600 1200 700	0.4		CLAYEY GRAVEL WITH SAND (GC), dense, some cobbles ←4-inch cobble			29	11	9.4	Pitcher Barrel probably blocked and washing out; torn tip. Minimal recovery, sample retained in plastic bag.
	115	SP	20	3-2-3-4-3-2 3-4-2-3-3-3 4-3-3-4-4-4	17 18 22	0.8								
440								CLAYEY SAND WITH GRAVEL (SC), yellowish brown and grayish brown, dense; fine- to coarse-grained sand, mostly fine gravel, few coarse gravel to 1-1/2 inches, low to medium plasticity fines						End for 2/8/11. Resume on 2/9/11 at 07:40. Mud level in hole at 13.5 ft bgs prior to drilling. Smoother drilling 116-120 ft, occasional chatter.
	120				650								11.3	CONS; DUW=122
		PB	7		750	2.3							11.2 11.2	TX-CIU; DUW=121 TX-CIU; DUW=118 Gs=2.80
435														
		SP	21	3-3-3-3-3-3 3-4-7-6-5-6 3-3-3-2-3-3	18 31 17	0.9		CLAYEY GRAVEL WITH SAND (GC), yellowish brown, dense; fine to coarse gravel, fine- to coarse-grained sand, medium plasticity fines; brownish black, slightly organic at 123.3 ft	42	18	31	13	12.7	
		SP	22	2-2-2-3-2-5 12-13-15-11-8	16 59/5"	0.9			37	23	27	9	8.4	Set 4-in. casing to 124 ft. Drill with 3-7/8-in. tricone below 124 ft.
	125							CLAYEY SAND WITH GRAVEL (SC), yellowish brown, very dense; fine- to coarse-grained sand, fine to coarse gravel, low plasticity fines						
								YOUNGER ALLUVIUM						
430		SP	23	2-2-3-3-3-6 5-6-7-6-5-5 6-5-6-4-3-4	19 34 28	1.2		SILTY SAND (SM), grayish black, dense; fine-grained sand, low plasticity to nonplastic fines, few fine gravel	34	19	19	1	14.4	
		SP	24	4-16-20-20-9-13 6-7-12	82 25/3"	0.8		POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC), dark gray and brownish gray, very dense; fine to coarse gravel to 2 inches, fine- to coarse-grained sand, few plastic fines	7	22			15.2	
	130							SILTY SAND (SM), brownish gray, very dense; fine-grained sand, low plasticity to nonplastic fines, few fine gravel						Start losing water at 130 ft. Extend 4-in. casing to 132 ft.
		SP	25	2-5-3-4-5-7 4-6-6-6-5-5 7-6-6-7-8-7	26 32 41	1.0		CLAYEY GRAVEL WITH SAND (GC), dark gray and brownish gray, very dense; fine to coarse gravel to 2 inches, fine- to coarse-grained sand, low to medium plasticity fines; decomposed rootlet at 132 ft	49	13			9.1	
425														
		SP	26	5-7-7-8-14-8 5-5-4-4-5-4 5-3-4-4-5-3	49 27 24	1.1		**SANTA CLARA FORMATION** [see next sheet]	55	9	22	4	6.7	
	135													

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 1/18/2012

Log of Boring SC-101MR

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
420		SP-27	3-6-7-8-5-8 7-6-9-7-7-8	37 44/6"	0.5		CONGLOMERATE; breaks down to POORLY GRADED GRAVEL WITH SILTY CLAY AND SAND (GP-GC/GM), dark yellowish brown with faint orange and gray mottling, very dense; fine to coarse gravel, fine- to coarse-grained sand, low plasticity fines; iron oxide stains and clay films on gravel surfaces [Santa Clara Formation]	55	11	21	3	8.8	Advance 4-in. casing to 135 ft. Rough drilling to 140 ft. Drive 4-in. casing to 137 ft. Full fluid return after advancing casing. Drill with 3-7/8-in. tricone below 137 ft. Smooth drilling below 140 ft.
	140						CLAYSTONE, SILTSTONE, and SANDY SILTSTONE, gray, yellowish brown, and yellowish gray; assumed finer-grained rock based on cuttings and drill action; occasional gravelly zones						
415													
	145												
410													
	150												Observe minor amounts of angular, fine to medium sand-size rock fragments in return, typically yellowish brown fluid (dissolved silt or siltstone matrix). Occasional gray claystone to sandy claystone clumps.
405													
	155												
400													
	160												
395													
	165												
390							Gravelly zone						Occasional drill chatter 166-167 ft; possibly increased gravel.
	170												

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Log of Boring SC-101MR

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
385							CLAYSTONE, SILTSTONE, and SANDY SILTSTONE, gray, yellowish brown, and yellowish gray; assumed finer-grained rock based on cuttings and drill action; occasional gravelly zones [Santa Clara Formation] (continued)						
	175						Gravelly zone						Drill chatter 175-177 ft; likely gravelly zone.
380							**Bottom of boring at 178.0 feet**						Finish drilling at 16:20 on 2/9/11.
	180												
375													
	185												
370													
	190												
365													
	195												
360													
	200												
355													
	205												

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring SC-103MR

Sheet 1 of 5

Date(s) Drilled	**10/12/11 - 10/14/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**152.0 feet**
Drilling Method	**Mud Rotary**	Drill Bit Size/Type	**4-7/8-in. and 3-7/8-in. tricone bits**	Surveyed Ground Surface Elevation	**489.0 feet**
Drill Rig Type	**Fraste Multidrill XL**	Drilling Contractor	**Pitcher Drilling**	Surveyed Location	**N 1,935,356 E 610,290**
Groundwater Level(s)	**Not determined**	Sampling Method	**SPT and LPT (3.4-in. ID / 3.9-in. OD large-diameter penetration test)**	Hammer Data	**Automatic; 140 lbs (SPT), 300 lbs (LPT), 30-in. drop**
Borehole Location	**Approx. Station 7+30, lower D/S slope**	Borehole Completion	**Cement-bentonite grout slurry via tremie**		

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	0						**TEMPORARY ROAD FILL** POORLY GRADED GRAVEL (GP), gray, fine, angular						Start drilling at 13:05 on 10/12/11. Advance hole to 2 ft using 6-in. garbage barrel; set 5-in.-dia. casing to 4.5 ft.
485							**EMBANKMENT** CLAYEY SAND WITH GRAVEL (SC), dark yellowish brown, dense; fine- to coarse-grained sand, fine to coarse gravel, medium plasticity fines; occasional more gravelly (GC) zones [Downstream Buttress Fill]						
	5												Drill with 4-7/8-in. tricone bit and bentonite-based drill fluid below 4.5 ft. Drill without sampling to 53 ft. Full fluid return; clay and rock chip cuttings in return.
480													
	10												
475													
	15												
470													
	20						Gravelly zone (GC?) Gravelly zone (GC?)						Rough drill chatter 20-20.5 ft and 21-21.5 ft. Slight fluid loss at about 21 ft.
465													
	25						SILTY, CLAYEY GRAVEL WITH SAND (GC-GM), brownish gray; fine gravel, fine- to coarse-grained sand, low plasticity fines [Filter/Drain Transition between Buttress Fill and Original Embankment]						Much faster drilling 25-33 ft.
460													
	30												

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 1/18/2012

Log of Boring SC-103MR

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	30						SILTY, CLAYEY GRAVEL WITH SAND (GC-GM), brownish gray; fine gravel, fine- to coarse-grained sand, low plasticity fines [Filter/Drain Transition] (continued)						
455							CLAYEY GRAVEL WITH SAND (GC), moderate and dark yellowish brown; fine to coarse gravel to 2 inches, occasional gravel to 3 inches, fine- to coarse-grained sand, low to medium plasticity fines; description per SC-103S log and lab testing [Original Embankment]						Slower drilling below 33 ft. Rough drill chatter 33-34 ft. Intermittent rough chatter below 34 ft.
	35												
450													
	40												Continued full fluid return.
445													
	45												Smoother drilling at 47 ft.
440							CLAYEY SAND WITH GRAVEL (SC), moderate and dark yellowish brown; classification based on drill action						
	50						Gravelly zone (GC?)						Resume rougher drilling 49-50 ft. Smoother drilling 50-52.5 ft. Rig chatter below 52.5 ft. Trip rods at 53 ft (desired depth of initial LPT). Rig down at 15:30 to end of 10/12/11; hammer malfunction. Resume on 10/13/11. Water level at 11 ft bgs. Drive LPT sampler (large-diameter penetration test) using 300-lb hammer at 53 ft and at 55.5 ft. Hammer down at 56 ft at 08:50; restart at 11:25. Rods bouncing at 57.5 ft. Hammer failed again at 58.2 ft. Switch to 140-lb hammer for all samples below 58.2 ft. Smoother drilling at 61 ft, rougher at 62.5 ft. LP-3, SP-4, LP-6 met refusal.
435		LP-1	9 12 16	1.1			CLAYEY GRAVEL WITH SAND (GC), moderate and dark yellowish brown, moist, medium dense; fine to coarse angular to subangular gravel to 2 inches, occasional gravel to 3 inches, fine- to coarse-grained sand, low to medium plasticity fines						
	55	LP-2	11 10 17	1.1									
		LP-3	50 25/2"	0.7			**YOUNGER ALLUVIUM** SILTY GRAVEL WITH SAND (GM), brownish gray, moist, very dense; fine to coarse angular to sub-rounded gravel to 3 inches, fine- to coarse-grained sand, ~20-30% low plasticity fines, few roots						
430		SP-4	25 46 31/3"	0.8									
	60						Becomes dark gray						
		LP-5	23 33 42	1.2			SILTY SAND (SM), grayish black, moist, dense to very dense; fine-grained sand, ~30-40% low plasticity fines, slightly organic						
		LP-6	50/5"	0.4			WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), brownish gray, moist, very dense; fine to coarse angular to subrounded gravel and cobbles to 3-1/2 inches [see next sheet]						
425		SP-7	35 45	0.4									
	65												

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 1/18/2012

Log of Boring SC-103MR

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	65	SP-7		17/2"	0.4		WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), brownish gray, moist, very dense; fine to coarse angular to subrounded gravel and cobbles to 3-1/2 inches, fine- to coarse-grained sand, ~10-20% medium plastic fines [Younger Alluvium] (continued)						SPT 63.9-65.1 ft met refusal; bouncing rods. SPT at 66 ft met refusal; bouncing rods at 66.9 ft. Continued full fluid return.
		SP-8		37 38/5"	0.4								
420		SP-9		25 37 49	0.8								
	70	SP-10		45 53/3"	0.4		**SANTA CLARA FORMATION** SANDY CLAYSTONE, moderate yellowish brown, dry to damp, moderately weathered, friable, low hardness, tight; locally includes SILTSTONE, SANDSTONE, and CONGLOMERATE (clayey gravel) layers; gravel are predominantly hard, gray Franciscan graywacke						SPT at 71 ft met refusal. Drill with 3-7/8-in. tricone below 71 ft, starting at 16:12.
415													
	75												Minor amounts of angular, medium sand-sized cuttings and fines in return; occasional clay cuttings.
410							Zone of increased gravel (CONGLOMERATE / clayey gravel) based on drill action						Rockier drilling 78-80 ft.
	80												Reach 80 ft at 16:34 (22 min. to advance 9 ft). Thin out mud and resume drilling at 16:50.
405													
	85						Probably becomes little weathered (gray clay noted in cuttings); continued friable, low hardness						Occasional clay cuttings noted in cuttings.
400													
	90												Reach 90 ft at 17:15 (25 min. to advance 10 ft). Add rod; resume drilling at 17:19.
395													
	95												Continued full fluid return.
390													
	100												End drilling for 10/13/11 at 100 ft at 17:46 (27 min. to advance 10 ft).

Log of Boring SC-103MR

Elevation, feet	Depth, feet	SAMPLES: Type / Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
385	105						CLAYSTONE with lesser layers of SILTSTONE, SANDSTONE, and CONGLOMERATE (clayey gravel) [Santa Clara Formation] (continued) CONGLOMERATE with lesser layers of CLAYSTONE and SANDSTONE; breaks down to CLAYEY GRAVEL (GC), gravel are mostly strong, hard Franciscan graywacke with lesser shale and chert; clayey matrix is friable, low hardness						Resume drilling at 07:45 on 10/14/11. Water level at about 30 ft bgs prior to drilling. Rockier drilling at 101 ft. Occasional gravel-sized fragments in return.
380	110												Reach 110 ft at 08:13 (28 min. to advance 10 ft). Add rod; resume drilling at 08:19.
375	115												
370	120												Reach 120 ft at 08:40 (21 min. to advance 10 ft).
365	125												Continued full fluid return.
360	130						Increased CLAYSTONE, decreased gravel						Smoother drilling 127-129.5 ft. Reach 130 ft at 09:08 (28 min. to advance 10 ft). Resume drilling at 09:11.
355	135												

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Log of Boring SC-103MR

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
							CONGLOMERATE with lesser CLAYSTONE and SANDSTONE layers; breaks down to CLAYEY GRAVEL (GC) [Santa Clara Formation] (continued)						
350	140						CLAYSTONE with lesser gravelly zones						Smooth drilling with occasional rig chatter from 135.8 ft to total depth. Reach 140 ft at 09:37 (26 min. to advance 10 ft). Resume drilling at 09:39. Slower drilling below 141 ft; clay binding up tricone.
345	145												
340	150												Reach 150 ft at 10:10 (31 min. to advance 10 ft). Resume drilling at 10:13.
							Bottom of boring at 152.0 feet						Terminate boring at 10:21 on 10/14/11. Perform OYO and P&S-wave survey. Grout hole via tremie on 10/14/11 after completing downhole testing.
335	155												
330	160												
325	165												
320	170												

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring SC-104MR

Sheet 1 of 3

Date(s) Drilled	**2/14/11 - 2/15/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**71.3 feet**
Drilling Method	**Mud Rotary**	Drill Bit Size/Type	**4-7/8-in. and 3-7/8-in. tricone bits**	Surveyed Ground Surface Elevation	**441.8 feet**
Drill Rig Type	**Fraste Multidrill XL**	Drilling Contractor	**Pitcher Drilling**	Surveyed Location	**N 1,935,505 E 6,102,939**
Groundwater Level(s)	**Not determined**	Sampling Method	**SPT**	Hammer Data	**Automatic hammer; 140 lbs / 30-inch drop**
Borehole Location	**Approx. Station 7+40, D/S toe**	Borehole Completion	**Cement-bentonite grout slurry via tremie**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
440	0							**FILL** CLAYEY GRAVEL WITH SAND (GC), moderate yellowish brown, very loose; fine to coarse gravel to 2 inches, fine- coarse-grained sand, medium plasticity fines						Start drilling at 12:40 on 2/14/11 with 4-7/8-in. tricone bit and bentonite-based drill fluid.
	5	SP	SP-1	0/6" 0/6" 1/6"	0 0 1	0.9								SPT rods settle 8 in. prior to drive at 5 ft.
435								Increase gravel and probably some cobbles (based on drill action) Becomes dark yellowish brown, loose to medium dense						Push 6-in. casing easily to 7 ft; drive casing to 9.5 ft. Drill with 3-7/8-in. tricone below 7 ft. Rough, jerky drilling from 7-10 ft. Coarse gravel jamming bit in casing. Some fluid loss.
	10	SP	SP-2	1-1-1-1-1/2" 1-1-1/2"-1-1 1/2"-1/2"-1/2"	5 5 3	0.9								
430														Extend casing to 14.3 ft.
	15	SP	SP-3	2-2-2-2-2-1 2-2-2-2-1-2 2-2-1-2-2-2	11 11 11	0.1		CLAYEY SAND WITH GRAVEL (SC) to CLAYEY GRAVEL WITH SAND (GC), medium dense; description per SC-104S						Recover only few rock fragments at 15 ft. Drive casing to 16.3 ft.
425		SP	SP-4	1-1-1/2"-1/2" 1/2"-1/2"-1-1 2-2-2-1-3-3	4 4 13	1.1		**YOUNGER ALLUVIUM** CLAYEY SAND WITH GRAVEL (SC), dark yellowish brown with faint orange mottling, loose; fine- to coarse-grained sand, fine to coarse gravel to 1 inch, low plasticity fines; 1/8-inch-thick black organic layer at 18.2 ft	29	28	28	11	15.3	Continued fluid loss in alluvium.
	20	SP	SP-5	1-2-4-5-5-4 4-3-4-6-7-5 4-3-3-3-2-3	21 29 18	1.0		POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM), light brownish gray, medium dense to dense; fine to coarse gravel to 1-1/2 inches, fine- to coarse-grained sand, low plasticity fines	63	7	20	2	7.8	Drive casing to 20.3 ft. Very rough drilling 21-22 ft.
420		SP	SP-6	2-2-2-2-3-5 4-5-3-4-5-5 2-3-2-3-3-3	16 26 16	0.6		POORLY GRADED GRAVEL WITH SAND (GP), light brownish gray, dense; fine to coarse gravel to 1-1/2 inches, fine- to coarse-grained sand, trace fines	75	4			7.3	
	25	SP	SP-7	1-2-2-2-2-2 2-1-0-5-2-2 2-2-2-2-2-3	11 12 13	0.9		WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC), dark yellowish brown, medium dense; fine to coarse gravel to 1-1/2 inches, fine- to coarse-grained sand, low plasticity fines	49	9	26	9	10.7	Out of water. End for 2/14/11 at 16:40. Resume drilling on 2/15/11 at 07:15. Extend casing to 25.3 ft; continued slight fluid loss.
415		SP	SP-8	1-2-2-2-2-3 3-2-2-3-4-3 3-3-3-3-4-4	12 17 20	1.2		SILTY, CLAYEY SAND WITH GRAVEL (SC-SM), dark yellowish brown, dense; fine- to coarse-grained sand, fine gravel, low plasticity fines	17	27	25	6	13.8	
	30							**SANTA CLARA FORMATION** SILTSTONE, light yellowish brown, moderately weathered, friable, low hardness						

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 1/18/2012

Log of Boring SC-104MR

Elevation, feet	Depth, feet	SAMPLES Type Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
410	30	SP-9	2-4-5-5-13-13 15-10-17-8	42 50/4"	0.8		CLAYEY SANDSTONE WITH GRAVEL, light olive gray with faint orange and gray mottling, moderately to slightly weathered, friable, low hardness, tight, clay films and iron oxide staining on some gravel surfaces [Santa Clara Formation]	25	17	28	14	13.1	Drill without sampling using 4-7/8 in. tricone bit to bottom of hole.
405	35						SILTSTONE and CLAYSTONE (based on SC-104S), occasional SANDSTONE and CONGLOMERATE layers (based on localized zones of rougher drill action)						Occasional drill chatter.
400	40												
395	45												Little to no drill fluid loss; bottom of casing still at 25.3 ft in lower alluvium.
390	50												
385	55						Conglomeratic layer						Rough drilling, drill chatter 55-58 ft.
380	60												Smoother drilling below 58 ft.
	65												

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 1/18/2012

Log of Boring SC-104MR

Elevation, feet	Depth, feet	SAMPLES: Type Number	SAMPLES: Blows Per 1-inch Drive Increment	SAMPLES: Blows/6 in. or Pressure, psi	SAMPLES: Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
375	65						SILTSTONE and CLAYSTONE with occasional SANDSTONE and/or CONGLOMERATE layers [Santa Clara Formation] (continued)						
370	70						**Bottom of boring at 71.3 feet**						Finish drilling on 2/15/11.
365	75												
360	80												
355	85												
350	90												
345	95												
	100												

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 1/18/2012

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Boring SC-105MR

Sheet 1 of 3

Date(s) Drilled	**2/10/11 - 2/11/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**79.0 feet**
Drilling Method	**Mud Rotary**	Drill Bit Size/Type	**5-7/8-in. and 3-7/8-in. tricone bits**	Surveyed Ground Surface Elevation	**553.1 feet**
Drill Rig Type	**Fraste Multidrill XL**	Drilling Contractor	**Pitcher Drilling**	Surveyed Location	**N 1,935,080 E 6,103,255**
Groundwater Level(s)	**Not determined**	Sampling Method	**SPT, Pitcher Barrel (4-in.-dia.)**	Hammer Data	**Automatic hammer; 140 lbs / 30-inch drop**
Borehole Location	**Approx. Station 3+90, dam crest**	Borehole Completion	**Cement-bentonite grout slurry via tremie**		

Elevation, feet	Depth, feet	SAMPLES Type	SAMPLES Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	0							**EMBANKMENT**						Start drilling at 15:15 on 2/10/11 with 5-7/8-in. tricone bit and bentonite-based drill fluid.
550								CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown, medium dense; fine- to coarse-grained sand, fine to coarse gravel, ~30-40% medium plasticity fines; occasional more gravelly (GC) zones [Downstream Buttress Fill]						
	5		SP-1	1-1-2-1-2-1 1-1-1-1-1-1 1-1-1-2-2-2	8 6 9	1.2								
545								CLAYEY GRAVEL WITH SAND (GC), moderate yellowish brown; dense; mostly fine gravel, fine- to coarse-grained sand, ~30-40% medium plasticity fines						Drill chatter at 8 ft.
	10		SP-2	1-2-1-2-2-2 3-2-2-3-2-3 3-3-3-4-4-5	10 15 22	1.3								
540								SANDY LEAN CLAY WITH GRAVEL (CL), moderate brown, very stiff; medium plasticity fines, fine- to coarse-grained sand, fine gravel						
	15		SP-3	1-1-2-1-2-3 4-5-7-6-7-6 7-7-5-7-6-7	10 35 39	1.4		WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM), light brownish gray, dense to very dense; mostly fine- to medium-grained sand, little coarse-grained sand, fine gravel, nonplastic fines [Filter/Drain Transition]						Full fluid return.
535								CLAYEY GRAVEL WITH SAND (GC), dark and moderate yellowish brown, medium dense; fine to coarse gravel to 1 inch, fine- to coarse-grained sand; contains more clayey (CL) and more sandy (SC) layers and pockets [Original Embankment]						
	20		SP-4	1-1-2-1-2-1 2-1-2-2-2-2 1-2-2-2-1-2	8 11 10	1.2								Drive 6-in. casing to 19.3 ft. End for 2/10/11. Resume on 2/11/11 at 07:45. Mud level at 5 ft bgs prior to drilling.
530														
	25		PB-1		280 450	2.0								4-in. Pitcher Barrel at 25 ft; pull down pressure recorded in psi. Torn tip. TX-CIU
525			SP-5	1-2-1-1-1-1 3-2-2-2-1-2 2-1-2-2-1-2	7 12 10	0.7								
	30													

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 2/3/2012

Log of Boring SC-105MR

Elevation, feet	Depth, feet	Type	Number	Blows Per 1-inch Drive Increment	Blows/6 in. or Pressure, psi	Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	30	SP	SP-6	1-1-1-1-1-1 2-2-1-1-1-1 2-1-2-2-1-2	6 8 10	0.4		CLAYEY GRAVEL WITH SAND (GC), dark and moderate yellowish brown, medium dense; fine to coarse gravel to 1 inch, fine- to coarse-grained sand; contains more clayey (CL) and more sandy (SC) layers and pockets [Original Embankment] (continued)						
520														
	35													Softer, easier Pitcher Barrel advance to 37 ft, rockier below.
					100			SANDY LEAN CLAY (CL); softer drilling						Gs=2.80
		PB	PB-2		500	1.9							15.4	TX-CIU; DUW=112
515					755								13.4	TX-CIU; DUW=119
	40	SP	SP-7	1-1-1-1-2-1 1-1-2-2-2-1 2-4-3-3-3-2	7 9 17	1.2		CLAYEY SAND WITH GRAVEL (SC), moderate and dark yellowish brown, medium dense; fine- to coarse-grained sand, mostly fine gravel, medium plasticity fines; contains more gravelly (GC) and more clayey (CL) zones						
510														Continued full fluid return.
	45	SP	SP-8	1-1-1-1-2-1 1-2-2-1-2-2 2-1-2-2-3-3	7 10 13	1.0		CLAYEY GRAVEL WITH SAND (GC)						Bouncy drilling 44.5-45.5 ft.
505					500									
		PB	PB-3			1.3		**TOPSOIL / COLLUVIUM** SANDY LEAN CLAY WITH GRAVEL (CL/SC), brownish black, damp, very stiff; medium plasticity fines, fine- to coarse-grained sand, fine gravel			33	15	12.0	Tip of tube torn; angular 3-in. cobble in bottom of recovered sample.
	50	SP	SP-9	3-2-1-2-2-2 3-3-3-3-4-3 3-2-3-3-3-3	12 19 17	1.1		**OLD ALLUVIUM / RESIDUAL SOIL(?)** CLAYEY SAND WITH GRAVEL (SC), light olive gray, dense; fine- to coarse-grained sand, fine to coarse gravel, medium plasticity fines	35	21	28	13	8.3	
500		SP	SP-10	2-4-4-4-3-4 2-3-3-3-3-3 3-6-6-4-4-4	21 17 27	1.0		**SANTA CLARA FORMATION** CLAYEY GRAVEL WITH SAND (GC), moderate yellowish brown with faint orange and gray mottling, dense; fine to coarse gravel, fine-grained sand, low plasticity fines; deeply weathered	43	23	28	11	10.4	
	55	SP	SP-11	1-2-2-2-2-4 4-5-4-5-4-5 9-0-6-5-7-8	13 27 35	1.2		CLAYEY SAND WITH GRAVEL (SC), moderate yellowish brown with distinct gray and orange mottling, very dense; fine- to coarse-grained sand, mostly fine gravel, low plasticity fines; less weathered than above	19	24	26	8	14.1	
495		SP	SP-12	3-5-6-8-6-7 6-11-14	35 31/3"	0.8		SILTY, CLAYEY SAND WITH GRAVEL (SC-SM), moderate yellowish brown with distinct gray and orange mottling, very dense; fine- and coarse-grained sand, mostly fine gravel, low plasticity fines	20	26	26	7	13.5	SPT refusal; bouncing at 58.8 ft.
	60	SP	SP-13		50/6"	0.5		CLAYEY SANDSTONE WITH GRAVEL, moderate yellowish brown with orange and gray mottling, fine- to coarse-grained sand, fine to coarse gravel to 1 inch, moderately to slightly weathered						
490														
	65	SP	SP-14		66/7"	0.6			33	22	31	15	11.5	

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 2/3/2012

Log of Boring SC-105MR

Elevation, feet	Depth, feet	SAMPLES Type Number	SAMPLES Blows Per 1-inch Drive Increment	SAMPLES Blows/6 in. or Pressure, psi	SAMPLES Recovery, feet	Graphic Log	MATERIAL DESCRIPTION	% Gravel (>#4)	% Fines (<#200)	Liquid Limit	Plasticity Index	Moisture Content, %	FIELD NOTES AND OTHER TESTS
	65						CLAYEY SANDSTONE WITH GRAVEL, moderate yellowish brown with orange and gray mottling, fine- to coarse-grained sand, fine to coarse gravel to 1 inch, moderately to slightly weathered [Santa Clara Formation] (continued)						
485		SP-15		50/5"	0.4								Drill without sampling using 4-7/8 in. tricone bit from 67 ft to bottom of hole. Steady drilling with only minor chatter. Continued full fluid return to bottom of hole.
	70												
480													
	75												
475													
							Bottom of boring at 79.0 feet						Finish drilling on 2/11/11.
	80												
470													
	85												
465													
	90												
460													
	95												
455													
	100												

Report: TGP SSE2 SOIL 1INBC+LAB; File: SCVWD_STEVENS.GPJ; 2/3/2012

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-102BPT

Sheet 1 of 4

Date(s) Drilled	**2/14/11 - 2/15/11**	Logged By	**A. Dinsick**	Total Depth of Borehole	**110.3 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**528.0 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,258 E 6,102,931**
Groundwater Level(s)	**Not determined while drilling**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 7+40, D/S slope**	Borehole Completion	**Four vibrating wire piezometers installed: VW1 #11-1418, tip at 45.3 ft; VW2 #11-1419, tip at 66.3 ft; VW3 #11-1420, tip at 87.3 ft; VW4 #11-1421, tip at 98.3 ft**		

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	0	14:00	--	--	**TEMPORARY GRAVEL ROAD FILL 0 FT - 1.5 FT**			
			--	--	Start with closed bit on 2/14/11.			
			--	--	Hammer stalled in top 4 ft; push to 4 ft.			
			--	--	**DOWNSTREAM BERM 1.5 FT - 28.5 FT**			
525			--	--				
			--	--	Start open redrive to 89 ft at 11:30 on 2/15/11.			
			5	4	Average 10 bpf 0-9 ft.			
	5		5	4	Start closed redrive to 93 ft at 15:10 on 2/15/11. Pushed with hammer to 19 ft.			
			5	5				
			11	18				
520		14:09	18	24	Stop.			
		14:15	18	34				
	10		18	26	Open redrive: average 29 bpf 9-19 ft.			
			20	27				
			21	44				
515			20	50				
			21	50				
	15		22	58				
			22	69				
			22	69				
510		14:22	22	66	Stop.			
		14:29	22	78				
	20		24	88	Open redrive: average 36 bpf 19-29 ft.			
			23	101	Closed redrive: average 36 bpf 19-29 ft.			
			24	99				
505			24	99				
			25	107				
	25		25	114				
			26	124				
			25	154				
500					**TRANSITION 28.5 FT - 37 FT (based on SC-102S)**			
		14:42	25	204	Stop. Pull up to 28 ft with 65 tons for redrive.		21	156
		14:55	27	550				
	30							

Blows / Foot: Original Drive, Redrive; 0 100 200 300 400 500

Report: TGP SSE2 BECKER WITH PLOT HIGH; File: SCVWD_STEVENS.GPJ; 4/1/2011

Log of Becker Boring SC-102BPT

Elevation, feet / Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Blows / Foot (Original Drive / Redrive; 0 100 200 300 400 500)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
30		26	528	528	Closed Bit Drive (continued)		25	228
		27	621	621	**TRANSITION (continued)**			
		25	225		Open redrive: average 10 bpf 29-39 ft.			
495		25	124		Closed redrive: average 5 bpf 29-39 ft.			
		25	102					
35		25	104					
		25	107					
		25	106		**ORIGINAL EMBANKMENT 37 FT - 97 FT**			
490	15:30	25	115		Stop. Pull back to 30 ft with 60 tons for redrive.			
	15:44	23	100					
40		24	117					
		24	145		Open redrive: average 11 bpf 39-49 ft.			
		26	118		Closed redrive: pushed with hammer 39-85 ft.			
485		25	123					
		25	149					
45		25	151					
		25	147				25	58
		25	132					
480	16:02	25	159		Stop. Pull back to 46 ft with 65 tons for redrive.			
	16:22	24	118					
50		24	142					
		25	151		Open redrive: average 9 bpf 49-59 ft.			
		25	149					
475		25	147					
		25	163					
55		25	171					
		25	176					
		26	197					
470	16:40	26	206		Stop.			
	17:04	24	156					
60		25	158					
		25	188		Open redrive: average 11 bpf 59-69 ft.			
		25	167					
465		25	189					
		25	210					
65								

Log of Becker Boring SC-102BPT

Elevation, feet / Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE: Time, 24-hr clock	REDRIVE: Bounce Pressure, psig	REDRIVE: Blows/foot (Nb)
65		26	211	Closed Bit Drive (continued)		23	97
		26	224	**ORIGINAL EMBANKMENT (continued)**			
		26	218				
460	17:30	26	220	Stop. End for 2/14/11.		15	165
	07:45	26	312	Resume initial closed bit drive on 2/15/11. Pull back to 68 ft with 75 tons for redrive.			
70		26	279				
		26	244				
		26	281	Open redrive: average 38 bpf 69-79 ft.			
455		26	277				
		27	301				
75		27	336				
		26	307			25	84
		26	330				
450	08:24	26	340	Stop. Pull back to 76 ft with 75 tons for redrive.			
	08:38	26	254				
80		26	241				
		26	298	Open redrive: average 42 bpf 79-89 ft.			
		25	346				
445		25	418				
		26	464				
85	09:09	25	467	Stop. Pull back to 65 ft with 80 tons for redrive.		15	10
	09:30	25	362			15	9
		25	410			15	10
440	10:09	25	500	End initial closed bit drive at 10:15.		15	11
	13:15	19	83	Initial drive with open bit 89-93 ft (13:15-13:20).		15	13
90		19	75			17	17
		20	74			18	26
	13:20	20	79			18	33
435	15:58	19	23	Blows below 93 ft are continuation of initial drive with closed bit.			
		19	41				
95		20	54				
		20	57				
		21	83	**YOUNGER ALLUVIUM 97* FT - 108 FT** [*Probably lowermost embankment fill 94 ft - 97 ft.]			
430	16:10	21	182	Stop.			
100	16:20	21	425				

Blows / Foot: Original Drive, Redrive; 0 100 200 300 400 500

Log of Becker Boring SC-102BPT

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Blows / Foot (0 100 200 300 400 500; Original Drive; Redrive)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
			21	236		Closed Bit Drive (continued)			
			21	253		**YOUNGER ALLUVIUM (continued)**			
			21	484		Observe 1/4+ inch of rebound.			
425			21	446					
			21	382					
	105		21	202					
			21	208					
			21	204					
420						**SANTA CLARA FORMATION 108 FT - 110.3 FT**			
		16:56	21	160		Stop. Pull back to 105 ft with 50 tons for redrive.		10	13
		17:10	21	--					
	110	17:15	21	300/3"	501				
						Total Depth = 110.3 feet			
						Four vibrating wire piezometers grouted in place in hole:			
415						VW1 Serial #11-1418, tip set at 45.3 feet			
						VW2 Serial #11-1419, tip set at 66.3 feet			
	115					VW3 Serial #11-1420, tip set at 87.3 feet			
						VW4 Serial #11-1421, tip set at 98.3 feet			
410									
	120								
405									
	125								
400									
	130								
395									
	135								

Report: TGP SSE2 BECKER WITH PLOT HIGH; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-103BPT

Sheet 1 of 3

Date(s) Drilled	**2/17/11 - 2/18/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**74.5 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**489.6 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,353 E 6,102,918**
Groundwater Level(s)	**Not determined while drilling**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 7+60, D/S slope**	Borehole Completion	**Backfilled with cement-bentonite grout placed by tremie**		

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	0	13:00	--	--	**TEMPORARY GRAVEL ROAD FILL 0 FT - 2 FT**			
			--	--	Start with closed bit on 2/17/11. Push without driving to 4.5 ft			
			--	--	**DOWNSTREAM BERM 2 FT - 26.5 FT**			
			--	--				
185		13:07	15	3	Start hammer at 4.5 ft.			
	5		15	4	Conduct PDA measurements 4.5-29 ft.			
			14	6				
			14	20				
		13:12	14	25	Stop.			
180		13:22	14	24				
	10		16	25				
			18	20				
			20	26				
			20	37				
175			21	28				
	15		21	32				
			22	35	Redrive open bit 16-29 ft at 14:47-15:01 (2/17).	14:47		1
			22	35				5
		13:28	23	40	Stop.	14:48		10
170		13:41	23	41		14:56	13	15
	20		23	42			13	28
			25	45			13	28
			24	57			14	32
			23	68			15	35
165			23	82			15	38
	25		24	85			15	47
			25	131	**TRANSITION 26.5 FT - 36 FT**		17	59
			25	340			18	93
		14:00	26	840	Stop. Initial drive with open bit 29-37 ft.	15:01	18	103
160		15:10	16	50	Redrive closed bit 29-37 ft at 16:20-16:28 (2/17).	16:20	25	110
	30							

Blows / Foot: Original Drive, Redrive; 0 50 100 150 200 250

Report: TGP SSE2 BECKER WITH PLOT MED; File: SCVWD_STEVENS.GPJ; 4/1/2011

Log of Becker Boring SC-103BPT

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	30		16	30	Open Bit Drive (continued)		25	155
			17	27	**TRANSITION (continued)**		24	132
			16	30			24	126
			16	31			23	72
155			15	43			22	60
	35		16	40	**ORIGINAL EMBANKMENT 36 FT - 59 FT**		22	63
		15:13	16	40	Stop open bit.	16:28	23	74
		16:28	22	80	Resume driving closed bit at 37 ft.			
			20	69	Conduct PDA measurements 37-74.5 ft.			
150		16:31	20	58				
	40	16:40	22	56				
			23	69				
			24	83				
			23	93				
145			21	87				
	45		21	93				
			22	90				
			22	91				
			22	83				
140		16:49	22	78				
	50	17:02	23	75	After reaming with open bit, redrive closed bit 50.5-59 ft at 10:28-10:38 (2/18).	10:28		2
			23	74			13	2
			24	95			13	3
			24	105			13	2
135			24	121			13	3
	55		24	110			13	2
			24	107			13	4
			25	100	**YOUNGER ALLUVIUM 59 FT - 73 FT**		12	3
		17:12	25	104	End for 2/17/11.	12:38	17	35
130		10:51	22	65	Resume on 2/18/11. At 08:15, pull closed bit and rods with 70 tons 59-39 ft and with 30 tons above 39 ft.			
	60		21	59	Lower open bit to 20 ft, push to 43 ft, and drive to 49 ft.			
			20	43	Lower closed bit to 43 ft, push 43-50.5 ft, redrive to 59 ft, then resume driving closed bit at 10:51.			
			21	38				
			22	30				
125	65	10:55	--	74	Stop to reset throttle.			

Blows / Foot: Original Drive, Redrive; 0 50 100 150 200 250

Log of Becker Boring SC-103BPT

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	65		22	107	Closed Bit Drive (continued)			
			23	109	**YOUNGER ALLUVIUM (continued)**			
			22	95				
			22	80				
120			23	67				
	70	11:01	22	59	Stop.			
		11:12	21	74				
			22	113				
			22	185	**SANTA CLARA FORMATION 73 FT - 74.5 FT**			
115		11:21	21	315/6"	Distinct increase in penetration resistance at 73.7 ft.			
	75				**Total Depth = 74.5 feet (refusal)**			
					Pull rods up to 69 feet (requires 37 tons to pull 74.5-73 feet, then pull free above 73 feet). Knock out bit plug and tremie grout backfill with bit at 69 feet.			
110	80							
105	85							
100	90							
95	95							
90	100							

Blows / Foot: Original Drive, Redrive; 0 50 100 150 200 250; 251

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-104BPT

Sheet 1 of 2

Date(s) Drilled	**2/21/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**30.8 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**442.4 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,513 E 6,102,937**
Groundwater Level(s)	**Not determined while drilling**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 7+40, D/S slope**	Borehole Completion	**Backfilled with cement-bentonite grout placed by tremie**		

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	0	13:26	15	19	Start driving with closed bit.			
			16	20	**FILL 0 FT - 17 FT**			
440			15	17				
			15	14	Hammer does not stall 0-9 ft.			
			16	15	[Note: Compare bpf 0-9 ft with penetration resistance of SC-108BPT, which is located 35 ft left.]			
	5		16	16				
			14	15				
435			12	12				
		13:28	12	11	Stop.			
		13:37	14	2	Bounce pressure after initial drive drops off rapidly.			
	10		14	5	Hammer stalls 9-14 ft; weak blows.			
			14	5	Redrive 11-14 ft; rods settle to 13 ft.	13:43	--	--
430			10	20			--	--
		13:41	8	20	Stop.	N/R	12	10
		N/R	--	14	Intermittent hammer stalling, weak blows 14-19 ft.			
	15		13	10				
			12	11	**YOUNGER ALLUVIUM 17 FT - 28.5 FT**			
425			14	20				
		13:46	14	17				
		13:55	18	28	Stop.			
	20		18	26				
			18	26	[Note: SC-104BPT 10 ft right of SC-104S, appears to be directly over original pre-construction thalweg, so top alluvium probably lower.]			
420			19	28				
			18	34				
	25		17	30				
			17	25				
			18	24	Redrive 26-29 ft; rods settle 26-28.2 ft.	14:01	--	--
415			21	34			--	--
		13:58	24	88	**SANTA CLARA FORMATION 28.5 FT - 30.8 FT** Stop.	14:02	16	18
		14:09	21	102				
	30							

Blows / Foot: Original Drive, Redrive; 0 20 40 60 80 100; 102

Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-104BPT

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Blows / Foot (● Original Drive, ⧓ Redrive; 0 20 40 60 80 100)	Comments	REDRIVE: Time, 24-hr clock	REDRIVE: Bounce Pressure, psig	REDRIVE: Blows/foot (Nb)
	30	14:14	24	300/9"	●	**SANTA CLARA FORMATION (continued)**			
						Total Depth = 30.8 feet (refusal)			
410						Tremie grout backfill to ground surface.			
	35								
405									
	40								
400									
	45								
395									
	50								
390									
	55								
385									
	60								
380									
	65								

Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-106BPT

Sheet 1 of 1

Date(s) Drilled	**2/22/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**29.0 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**443.8 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,507 E 6,102,879**
Groundwater Level(s)	**19.85 ft bgs in well 2/23/11**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 8+00, D/S toe**	Borehole Completion	**Standpipe piezometer: 2-in. PVC riser, 2-in. 0.020-in. slotted screen 22-23.6 ft; 10/20 sand 21.4-26 ft, bentonite 11.4-21.4 ft, grout 1-11.4 ft (see schematic)**		

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	0	11:27	10	15	Start driving with closed bit.			
			11	13	**FILL 0 FT - 14 FT**			
			8	9				
440			8	7				
			7	7	Hammer stalling, weak blows 2-9 ft.			
	5		8	1				
			5	1	Settling under weight of rods 6.2-6.9 ft.			
			4	1				
435		11:33	8	2	Stop.			
		11:39	9	7	Hammer stalling, weak blows 9-14 ft.			
	10		10	10				
			15	19				
			15	13				
430			16	13	**YOUNGER ALLUVIUM 14 FT - 25.5 FT**			
	15		15	21				
			14	10				
			16	14	Redrive 16-19 ft; push rods to 18.5 ft.	11:44	--	--
			15	16			--	--
425		11:41	15	16		11:45	4	1
		11:51	17	18	Stop. Pull back to 16 ft with 7 tons for redrive.			
	20		17	16				
			17	19				
			18	20				
420			18	45				
			18	27	**SANTA CLARA FORMATION 25.5 FT - 29 FT**			
	25		23	40	Redrive 25-28.5 ft; push to 26.2 ft.			
			25	110	Distinct increase in penetration resistance at 25.5 ft.		5	1
			24	190			5	7
415		N/R	25	200/6"	Stop. Pull back to 25 ft with 37 tons for redrive.		22	35/6"
	30				**Total Depth of Boring = 28.5 feet; Well = 29.0 feet**			

Blows / Foot: ● Original Drive; ⊠ Redrive; 0 20 40 60 80 100

Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-107BPT

Sheet 1 of 1

Date(s) Drilled	**2/23/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**23.2 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**437.4 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,500 E 6,103,006**
Groundwater Level(s)	**Not determined while drilling**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 6+73, D/S toe (77 ft right of SC-104S)**	Borehole Completion	**Standpipe piezometer: 2-in. PVC riser, 2-in. 0.020-in. slotted screen 19.4-21 ft; 10/20 sand 18-22.5 ft, bentonite 22.5-23.2 ft, 7-18 ft, grout 1-7 ft (see schematic)**		

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	0	15:45	18	23	Start driving with closed bit.			
			15	18	**FILL 0 FT - 7 FT**			
435			13	11				
			10	7				
			12	7	No hammer stalling.			
	5		13	7				
			15	14	**YOUNGER ALLUVIUM 7 FT - 22 FT**			
430		15:47	16	25	Stop.			
		15:53	18	26				
			17	18				
	10		19	20				
			19	30				
425			20	38				
			20	35				
			20	31				
	15		21	37	Redrive 15-18 ft; no apparent cave.	16:00	12	13
			19	46			15	11
420		15:57	19	40	Stop. Pull back to 15 ft with 20 tons for redrive.	16:01	19	31
		N/R	19	35				
			19	29				
	20		20	30	Redrive 20-23 ft.	N/R	13	12
			21	33			15	16
415			26	123	**SANTA CLARA FORMATION 22 FT - 23.2 FT**			
		16:12	--	120/2"	Abrupt increase in penetration resistance at 22 ft. Stop. Pull back to 20 ft with 20 tons for redrive.	16:15	20	60
					Total Depth of Boring = 23.2 feet			
	25							
410								
	30							

Blows / Foot: Original Drive, Redrive; 0 20 40 60 80 100

Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

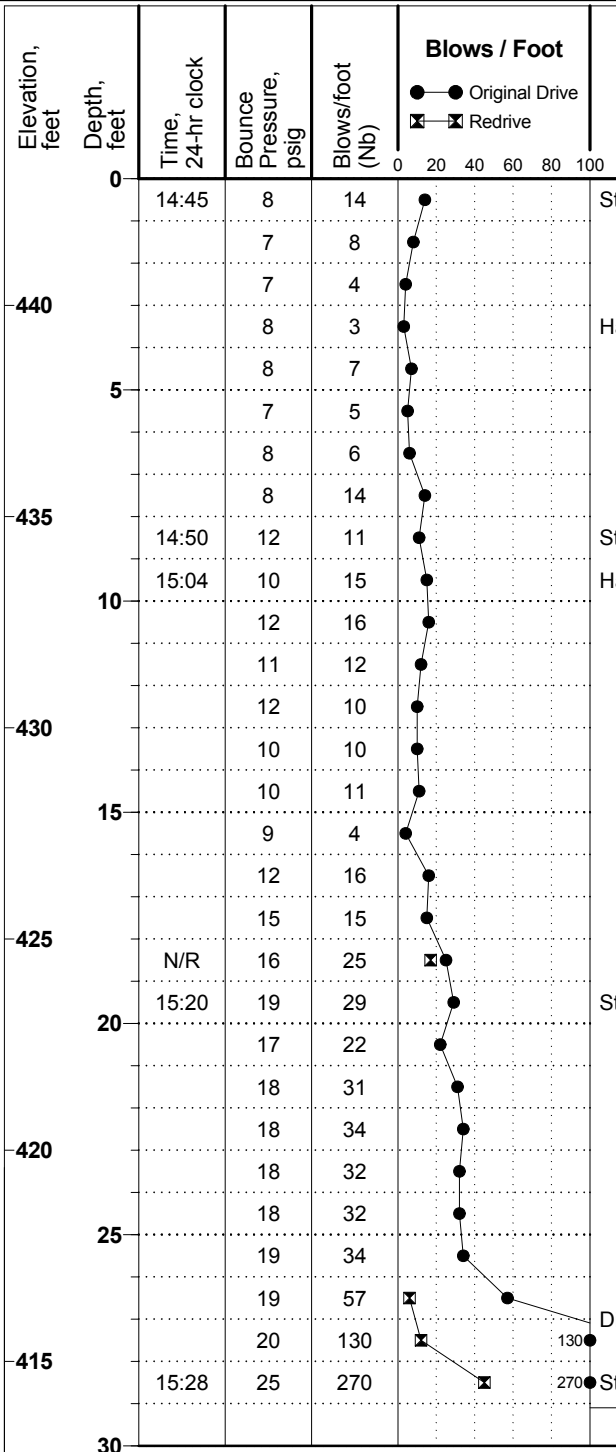
TERRA / GeoPentech
a Joint Venture

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-108BPT

Sheet 1 of 1

Date(s) Drilled	**2/21/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**29.1 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**443.0 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,506 E 6,102,903**
Groundwater Level(s)	**Not determined while drilling**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 7+75, D/S toe (25 ft left of SC-104BPT)**	Borehole Completion	**Backfilled with cement-bentonite grout placed by tremie**		



Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	0	14:45	8	14	Start driving with closed bit.			
			7	8	**FILL 0 FT - 16 FT**			
			7	4				
440			8	3	Hammer stalling, weak blows 0-7.2 ft.			
			8	7				
	5		7	5				
			8	6				
			8	14				
435		14:50	12	11	Stop.			
		15:04	10	15	Hammer stalling intermittently, weak blows 9-16 ft.			
	10		12	16				
			11	12				
			12	10				
430			10	10				
			10	11				
	15		9	4	**YOUNGER ALLUVIUM 16 FT - 26.5 FT**			
			12	16	Redrive 16-19 ft; push with hammer to 18.2 ft.	15:12	--	--
			15	15	Blows for 18.2-19 ft likely through caved material.		--	--
425		N/R	16	25		15:15	13	17
		15:20	19	29	Stop. Pull back to 16 ft with 7 tons for redrive.			
	20		17	22				
			18	31				
			18	34				
420			18	32				
			18	32				
	25		19	34	Redrive 25-29 ft; push with hammer to 26 ft.	N/R	--	--
			19	57	**SANTA CLARA FORMATION 26.5 FT - 29.1 FT**		8	6
			20	130	Distinct increase in penetration resistance at 26.5 ft.		12	12
415		15:28	25	270	Stop. Pull back to 25 ft (to 28.5 ft with 32 tons) for redrive.	15:37	18	45
	30				**Total Depth of Boring = 29.1 feet**			

Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-109BPT

Sheet 1 of 1

Date(s) Drilled	**2/22/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**29.0 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**445.1 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,508 E 6,102,856**
Groundwater Level(s)	**Not determined while drilling**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 8+25, D/S toe (75 ft left of SC-104S)**	Borehole Completion	**Backfilled with cement-bentonite grout placed by tremie**		

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
445	0	13:35	12	12	Start driving with closed bit.			
			13	22	**FILL 0 FT - 18 FT**			
			11	12				
			11	12				
			9	8				
440	5		7	4				
			9	9	Some hammer stalling 6-8.5 ft.			
			12	9				
		13:37	14	24	Stop.			
		13:43	18	26				
435	10		15	20				
			14	17				
			13	12				
			13	15				
			12	11				
430	15		11	9				
			N/R	3	Redrive 16-19 ft; push with hammer to 18.3 ft.		--	--
			N/R	6			--	--
		13:45	16	19	**YOUNGER ALLUVIUM 18 FT - 25 FT**		5	3
		N/R	17	27	Stop. Pull back to 16 ft with 7 tons for redrive.			
425	20		17	26				
			15	21				
			15	21				
			16	25	Redrive 23-29 ft.	14:02	10	8
			19	35			15	18
420	25		21	47	**SANTA CLARA FORMATION 25 FT - 29 FT**		16	24
			23	74	Formation moderately weathered to 28 ft.		16	34
			21	51			18	47
		13:58	24	150	Formation less weathered below 28 ft.	14:05	19	80
	30				Stop. Pull back to 23 ft for redrive.			
					Total Depth of Boring = 29.0 feet			

Blows / Foot: Original Drive, Redrive; 0 20 40 60 80 100

Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

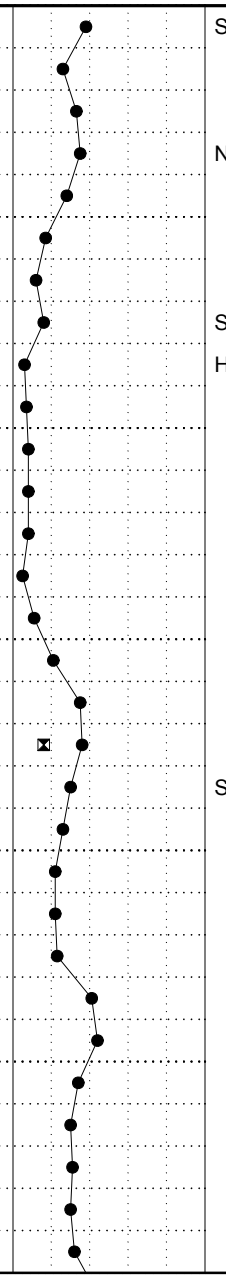
SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-110BPT

Sheet 1 of 2

Date(s) Drilled	**2/23/11**	Logged By	**R. Harlan**	Total Depth of Borehole	**33.5 feet**
Drilling Method	**Becker Hammer**	Drill Bit Size/Type	**6.6-inch-OD crowd-out closed bit**	Surveyed Ground Surface Elevation	**441.6 feet**
Drill Rig Type	**AP-1000**	Drilling Contractor	**Great West Drilling**	Surveyed Location	**N 1,935,513 E 6,102,962**
Groundwater Level(s)	**Not determined while drilling**	Sampling Method	**No sampling performed**	Hammer Data	**Link Belt 180 with full throttle**
Borehole Location	**Approx. Station 7+20, D/S toe (32 ft right of SC-104S)**	Borehole Completion	**Backfilled with cement-bentonite grout placed by tremie**		

Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	0	07:51	17	38	Start driving with closed bit.			
					FILL 0 FT - 15.5 FT			
440			17	26				
			19	33				
			17	35	No hammer stalling 0-7.5 ft.			
			13	28				
	5		12	17				
435			10	12				
		07:56	9	16	Stop. Hammer stalls at 7.5 ft.			
		N/R	10	6	Hammer stalling, weak blows 8-15.5 ft.			
			11	7				
	10		12	8				
430			10	8				
			9	8				
			9	5				
			9	11	Redrive 14-18 ft; settles under rod weight to 15 ft.		--	--
	15		12	21	Push with hammer to 17.5 ft; blows in caved material.		--	--
			16	35	**YOUNGER ALLUVIUM 15.5 FT - 30.5 FT**		--	--
425		08:14	16	36			15	16
		08:31	17	30	Stop. Pull back to 14 ft for redrive.			
			18	26				
	20		17	22				
420			18	22				
			19	23				
			21	41				
			21	44				
	25		20	34				
415			19	30				
		08:34	19	31				
		08:40	19	30	Redrive 28-33.5 ft; push with hammer to 31.8 ft.	08:47	--	--
	30		19	32			--	--



Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Log of Becker Boring SC-110BPT

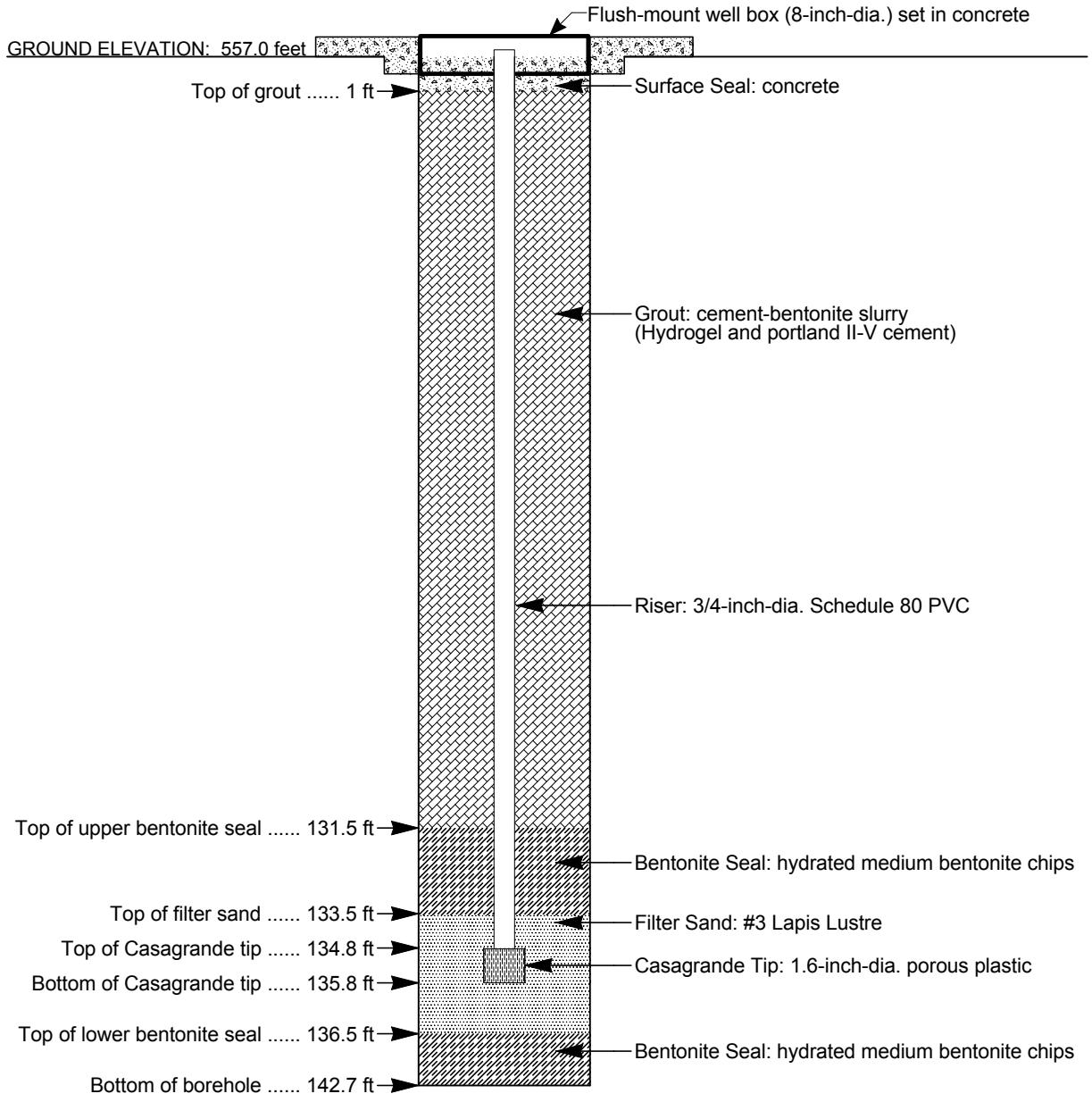
Elevation, feet	Depth, feet	Time, 24-hr clock	Bounce Pressure, psig	Blows/foot (Nb)	Blows / Foot (● Original Drive, ⊠ Redrive; 0 20 40 60 80 100)	Comments	REDRIVE Time, 24-hr clock	REDRIVE Bounce Pressure, psig	REDRIVE Blows/foot (Nb)
	30		23	44		**SANTA CLARA FORMATION 30.5 FT - 33.5 FT**		--	--
410			23	105	105			--	--
			24	107	107	Redrive 28-33.5 ft; push with hammer to 31.8 ft.		16	29
		08:45	--	100/6"		Stop. Pull back to 28 ft for redrive.	08:50	16	35
						Total Depth of Boring = 33.5 feet			
	35					Tremie grout backfill to ground surface. Four batches of grout and six 50-lb sacks of bentonite chips required to seal hole. Hole is very pervious, taking more grout than other toe borings (three batches and one to two bags of bentonite chips).			
405									
	40								
400									
	45								
395									
	50								
390									
	55								
385									
	60								
380									
	65								

Report: TGP SSE2 BECKER WITH PLOT; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Casagrande Piezometer Installation in Boring SC-101S

Date/Time Installed	**11/20/10**	Location	**Approx. Station 7+50, crest; N 1,935,175 E 6,102,918**		
Installed By	**Boart Longyear**	Observed By	**R. Harlan**	Total Hole Depth	**142.7 feet**
Screened Interval	**134.8 ft - 135.8 ft**	Completion Zone:	**133.5 ft - 136.5 ft**		
Water Level Observations	**134.5 ft bgs before piezometer installation, 128.5 ft bgs 1hr after piezometer installed**				
Remarks	**Refer to Log of Boring / Piezometer SC-101S for lithology**				



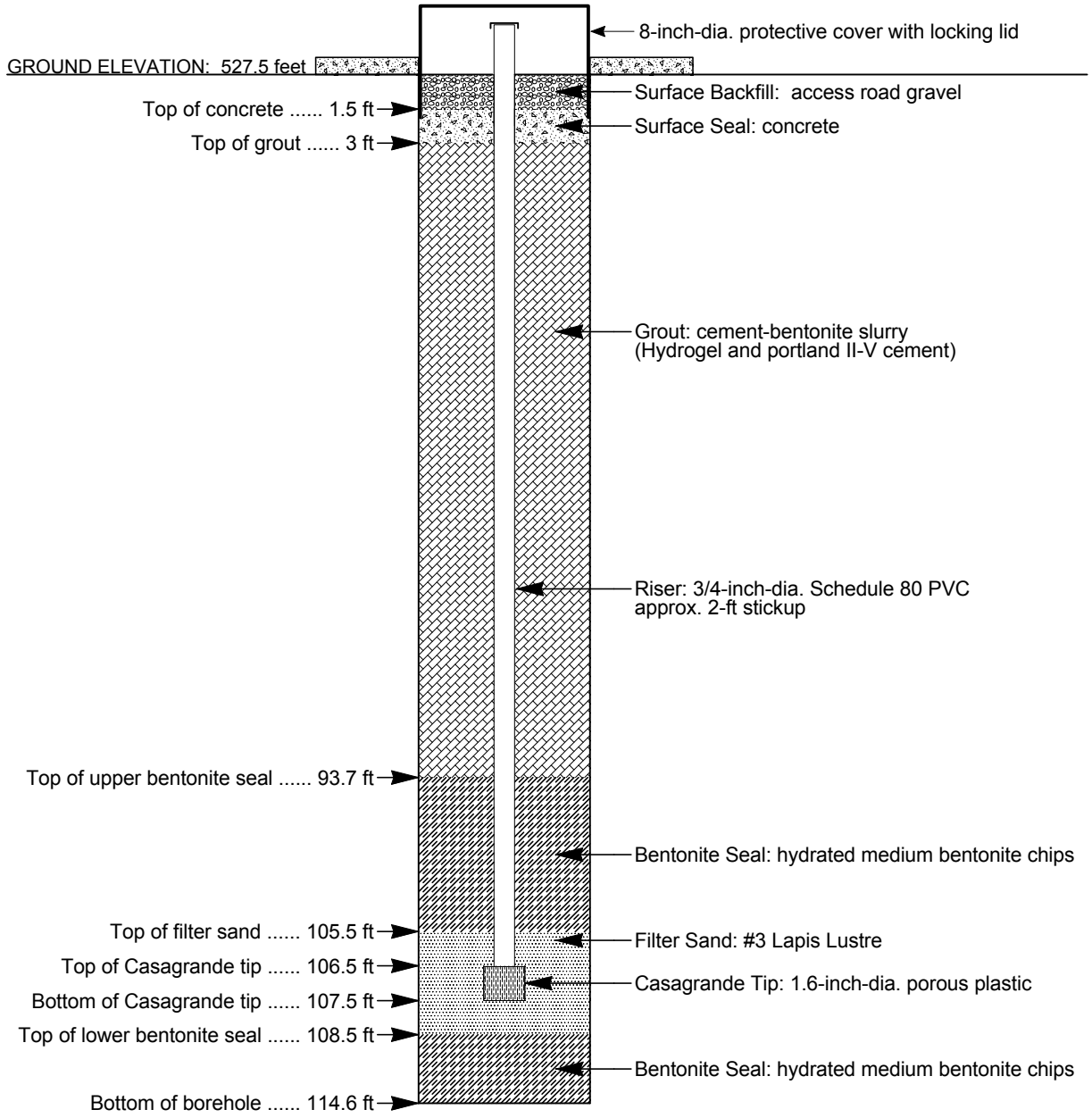
NOTE: DIAGRAM IS NOT TO SCALE

Report: TGP SSE2 WELL NTS; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Casagrande Piezometer Installation in Boring SC-102S

Date/Time Installed	**11/22/10 - 11/23/10**	Location	**Approx. Station 7+50, D/S slope; N 1,935,259 E 6,102,921**		
Installed By	**Boart Longyear**	Observed By	**R. Harlan**	Total Hole Depth	**114.6 feet**
Screened Interval	**106.5 ft - 107.5 ft**	Completion Zone:	**105.5 ft - 108.5 ft**		
Water Level Observations	**97 ft bgs (perched) during drilling; 105.4 ft at 0740 on 11/23/10**				
Remarks	**Refer to Log of Boring / Piezometer SC-102S for lithology**				



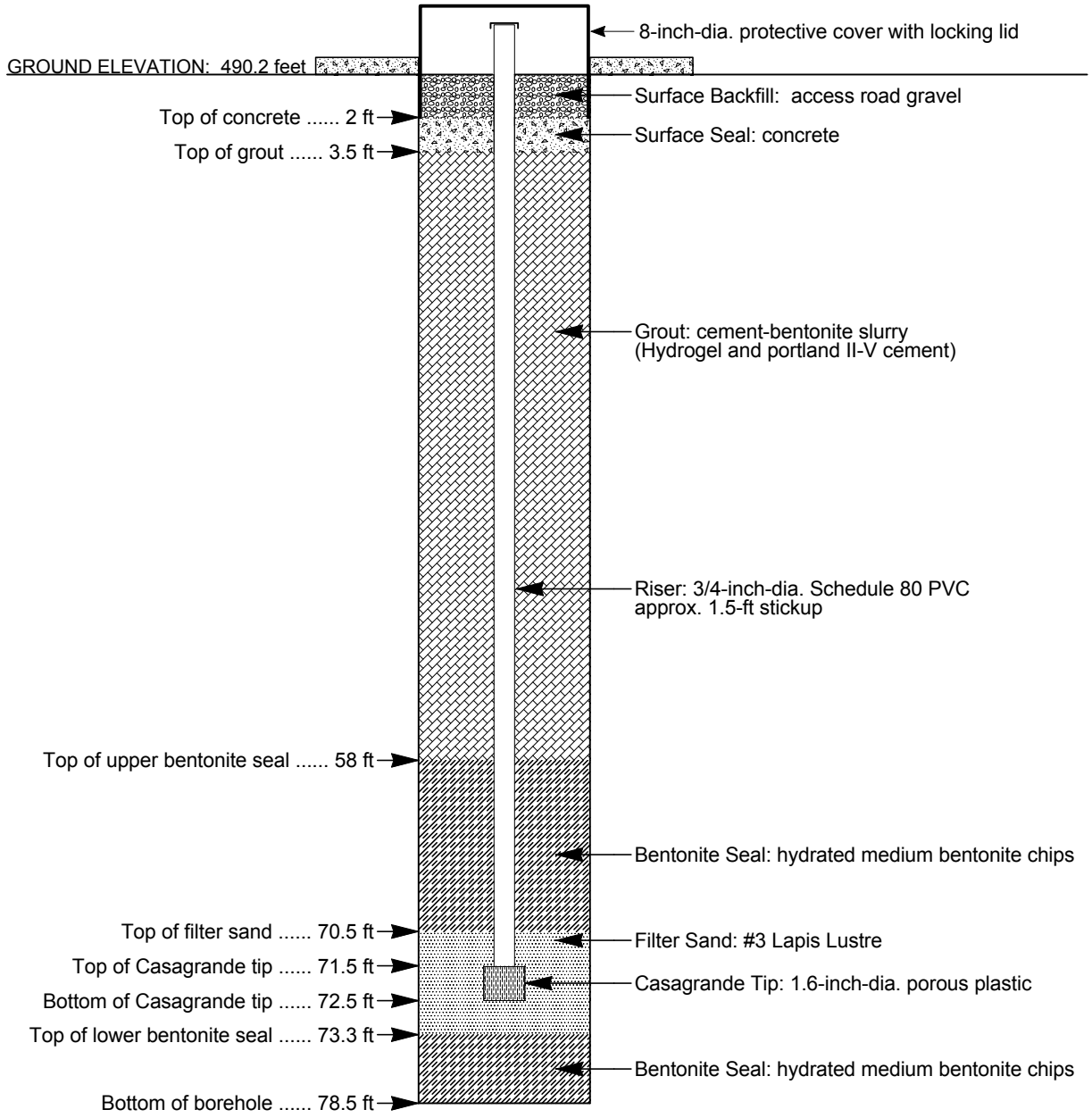
NOTE: DIAGRAM IS NOT TO SCALE

Report: TGP SSE2 WELL NTS; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Casagrande Piezometer Installation in Boring SC-103S

Date/Time Installed	**11/24/10**	Location	**Approx. Station 7+50, lower D/S slope; N 1,935,351 E 6,102,926**		
Installed By	**Boart Longyear**	Observed By	**R. Harlan / P. Allen**	Total Hole Depth	**78.5 feet**
Screened Interval	**71.5 ft - 72.5 ft**	Completion Zone:	**70.5 ft - 73.3 ft**		
Water Level Observations	**71.19 ft bgs before piezometer installation, 70.1 ft after**				
Remarks	**Refer to Log of Boring / Piezometer SC-103S for lithology**				



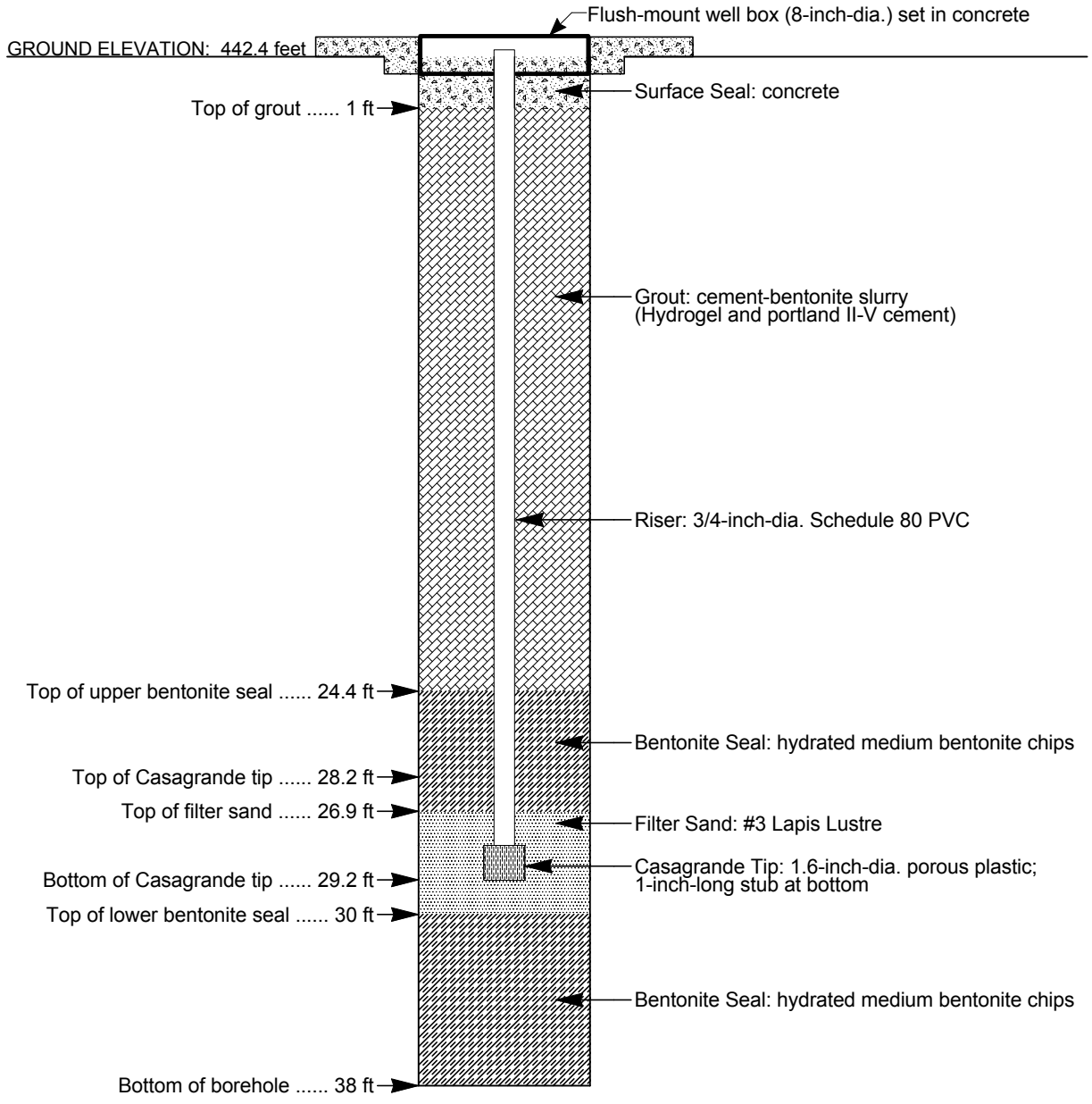
NOTE: DIAGRAM IS NOT TO SCALE

Report: TGP SSE2 WELL NTS; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Casagrande Piezometer Installation in Boring SC-104S

Date/Time Installed	**11/17/10**	Location	**Approx. Station 7+50, D/S toe; N 1,935,507 E 6,102,930**		
Installed By	**Boart Longyear**	Observed By	**R. Harlan**	Total Hole Depth	**38.0 feet**
Screened Interval	**28.2 ft - 29.2 ft**	Completion Zone:	**26.9 ft - 30 ft**		
Water Level Observations	**26 ft bgs during drilling; 29.5 ft immediately prior to piezometer installation**				
Remarks	**Refer to Log of Boring / Piezometer SC-104S for lithology**				



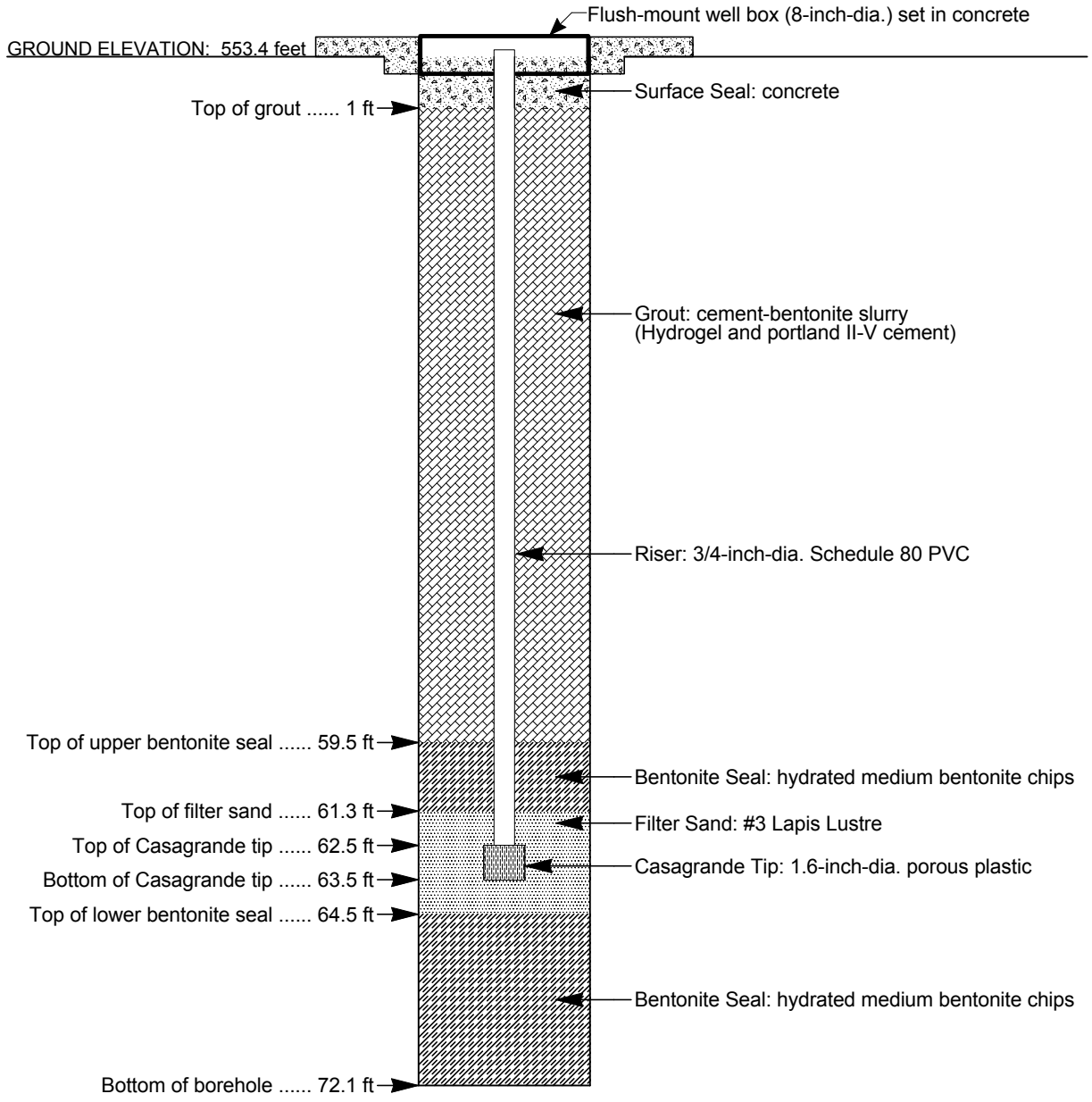
NOTE: DIAGRAM IS NOT TO SCALE

Report: TGP SSE2 WELL NTS; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Casagrande Piezometer Installation in Boring SC-105S

Date/Time Installed	**11/18/10**	Location	**Approx. Station 4+00, crest; N 1,935,089 E 6,103,249**		
Installed By	**Boart Longyear**	Observed By	**R. Harlan**	Total Hole Depth	**72.1 feet**
Screened Interval	**62.5 ft - 63.5 ft**	Completion Zone:	**61.3 ft - 64.5 ft**		
Water Level Observations	**Possible perched layer 61.5-62 ft**				
Remarks	**Refer to Log of Boring / Piezometer SC-105S for lithology**				



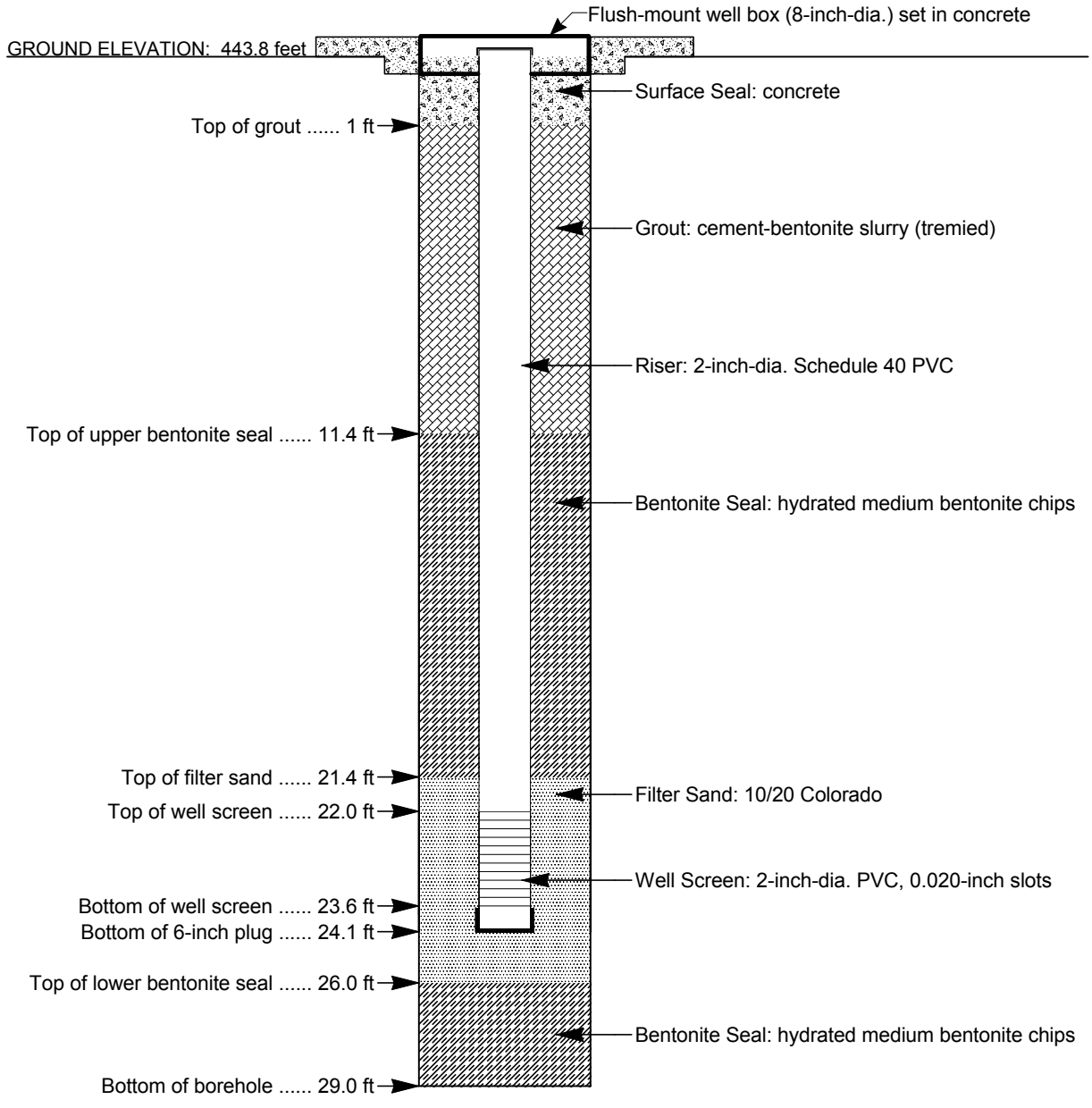
NOTE: DIAGRAM IS NOT TO SCALE

Report: TGP SSE2 WELL NTS; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Standpipe Piezometer Installation in Boring SC-106BPT

Date/Time Installed	**2/23/11 (11:20 - 13:30)**	Location	**Station 8+00, D/S toe; N 1,935,507 E 6,102,879**		
Installed By	**Great West Drilling**	Observed By	**R. Harlan**	Total Hole Depth	**29.0 feet**
Screened Interval	**22.0 ft - 23.6 ft**	Completion Zone:	**21.4 ft - 26.0 ft**		
Water Level Observations	**19.85 ft bgs in well 2/23/11**				
Remarks	**Refer to Log of Becker Boring SC-106BPT for approximate lithology**				



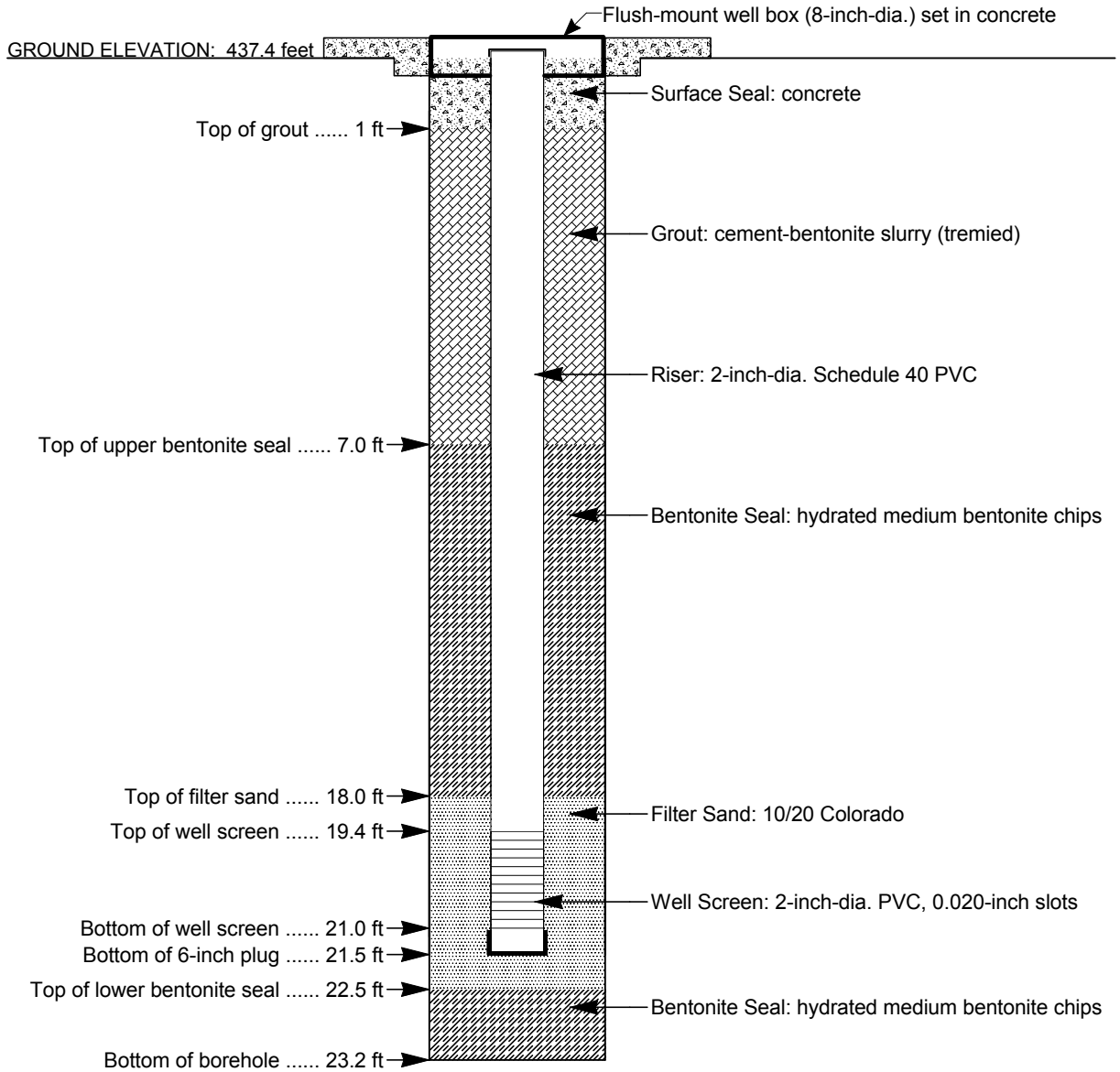
NOTE: DIAGRAM IS NOT TO SCALE

Report: TGP SSE2 WELL NTS; File: SCVWD_STEVENS.GPJ; 4/1/2011

SANTA CLARA VALLEY WATER DISTRICT
SEISMIC SAFETY EVALUATIONS (SSE2)

Standpipe Piezometer Installation in Boring SC-107BPT

Date/Time Installed	**2/24/11**	Location	**Station 6+73, D/S toe; N 1,935,500 E 6,103,006**		
Installed By	**Great West Drilling**	Observed By	**R. Harlan**	Total Hole Depth	**23.2 feet**
Screened Interval	**19.4 ft - 21.0 ft**	Completion Zone:	**18.0 ft - 22.5 ft**		
Water Level Observations	**Not determined while drilling**				
Remarks	**Refer to Log of Becker Boring SC-107BPT for approximate lithology**				



NOTE: DIAGRAM IS NOT TO SCALE

Report: TGP SSE2 WELL NTS; File: SCVWD_STEVENS.GPJ; 4/1/2011

APPENDIX B

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Table

Figures

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information				USCS Group Symbol	In Situ Moisture Content, %	In Situ Dry Unit Weight, pcf	Sieve			Atterberg Limits			Other Tests
Boring Number	Sample Number	Depth, feet	Elevation, feet				Gravel, % > #4	Sand, %	Fines, % < #200	LL	PL	PI	
SC-101MR	PB-1	30-32.5	526.1	CL	15.6					31	16	15	
SC-101MR	PB-2	50-52.5	506.1	SC	16.4					26	16	10	
SC-101MR	PB-3	70-72.5	486.1	SC	11.9					26	16	10	
SC-101MR	PB-4	93-95.5	463.1	GC-GM	13.2					25	18	7	
SC-101MR	PB-5	100-102.5	456.1	SC	15.6		39	44	17	28	15	13	
SC-101MR	PB-6	112-114.3	444.1	GC	9.4					29	18	11	
SC-101MR	PB-7	120-122.5	437.1	SC	11.3	121.5							CONS
SC-101MR	PB-7	120.9-121.6	436.2	SC	11.2	120.6							TX-CIU
SC-101MR	PB-7	121.6-122.3	435.5	SC	11.2	118.1							TX-CIU
SC-101MR	PB-7	122.3-122.5	435.1	SC									Gs=2.80
SC-101MR	SP-21	122.5-124	434.1	GC	12.7		42	39	18	31	18	13	
SC-101MR	SP-22	124-124.9	433.0	SC	8.4		37	40	23	27	18	9	
SC-101MR	SP-23	126.5-128	430.3	SM	14.4		34	47	19	19	18	1	
SC-101MR	SP-24	129-129.8	428.1	SM	15.2		7	70	22				
SC-101MR	SP-25	131-132.5	425.6	GC	9.1		49	38	13				
SC-101MR	SP-26	133.5-135	423.1	GP-GC	6.7		55	37	9	22	18	4	
SC-101MR	SP-27	136-137	420.9	GP-GM	8.8		55	34	11	21	18	3	
SC-104MR	SP-4	17.5-19	423.8	SC	15.3		29	43	28	28	17	11	
SC-104MR	SP-5	20-21.5	421.3	GP-GM	7.8		63	30	7	20	18	2	
SC-104MR	SP-6	22.5-24	418.8	GP	7.3		75	21	4				
SC-104MR	SP-7	25-26.5	416.3	GW-GC	10.7		49	42	9	26	17	9	
SC-104MR	SP-8	27.5-29	413.8	SC-SM	13.8		17	56	27	25	19	6	
SC-104MR	SP-9	30-30.8	411.7	SC	13.1		25	58	17	28	14	14	
SC-105MR	PB-1	26-27	527.1	GC									TX-CIU
SC-105MR	PB-2	36-38.3	517.1	GC									Gs=2.80
SC-105MR	PB-2	36.7-37.4	516.4	GC	15.4	112.0							TX-CIU
SC-105MR	PB-2	37.4-38.1	515.7	GC	13.4	119.3							TX-CIU
SC-105MR	PB-3	48-50.3	504.1	CL/SC	12.0					33	18	15	
SC-105MR	SP-9	50.3-51.8	502.3	SC	8.3		35	45	21	28	15	13	
SC-105MR	SP-10	53-54.5	499.6	GC	10.4		43	34	23	28	17	11	
SC-105MR	SP-11	55.5-57	497.1	SC	14.1		19	57	24	26	18	8	
SC-105MR	SP-12	58-58.8	495.0	SC-SM	13.5		20	55	26	26	19	7	
SC-105MR	SP-14	64-64.6	489.1	SC	11.5		33	45	22	31	16	15	

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

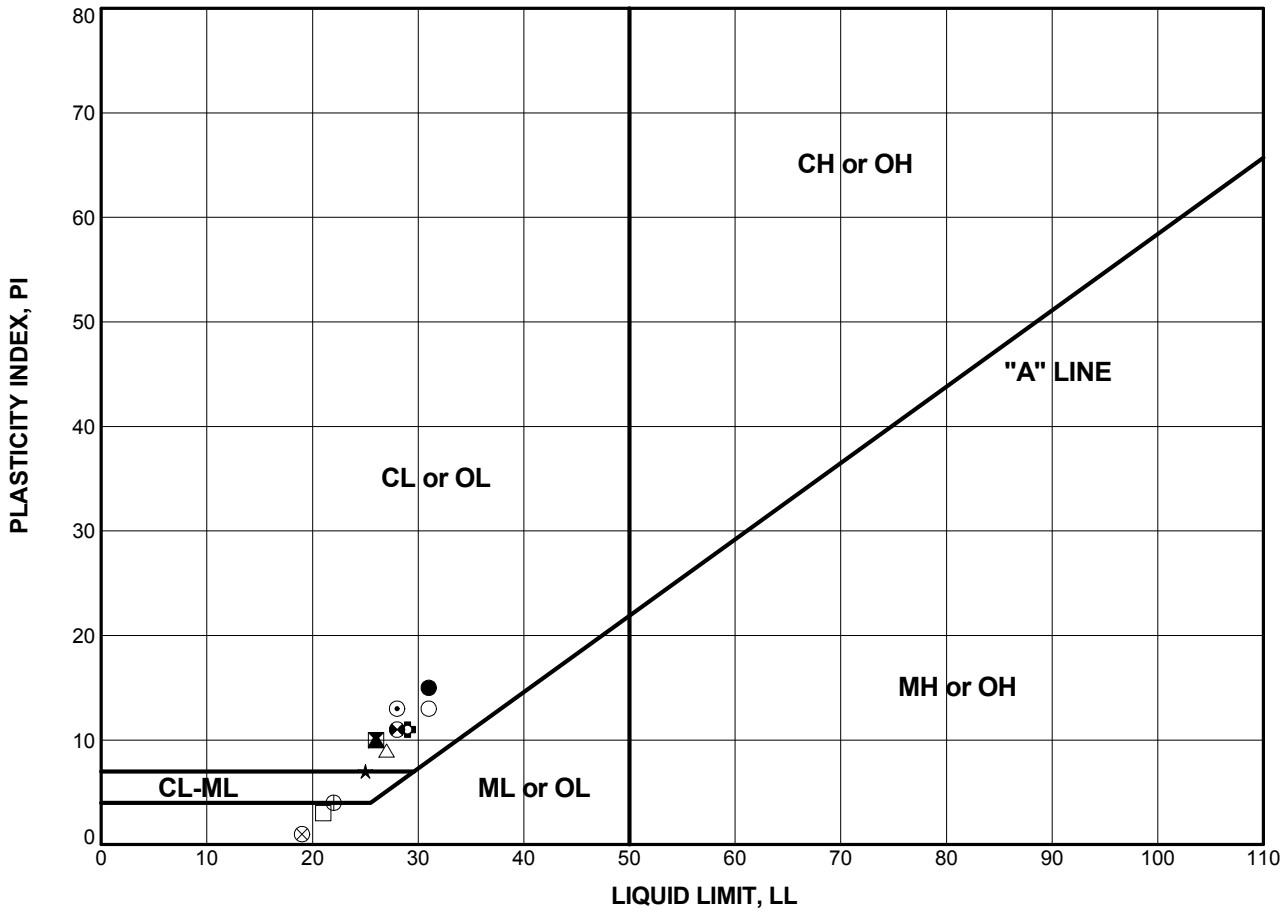
Sample Information				USCS Group Symbol	In Situ Moisture Content, %	In Situ Dry Unit Weight, pcf	Sieve			Atterberg Limits			Other Tests
Boring Number	Sample Number	Depth, feet	Elevation, feet				Gravel, % > #4	Sand, %	Fines, % < #200	LL	PL	PI	
SC-101S	Run 2	16	541.0	SC-SM	6.8		27	40	33	25	20	5	
SC-101S	Run 4	27	530.0	GP	2.3		50	45	5				
SC-101S	Run 5	46	511.0	SC	11.1		36	36	28	26	17	9	
SC-101S	Run 6	56	501.0	SC	10.8		14	43	43	31	21	10	
SC-101S	Run 7	66	491.0	GC	9.8		46	38	16	27	18	9	
SC-101S	Run 8	76	481.0	SC	12.1		26	41	33	26	17	9	
SC-101S	Run 9	86	471.0	GC-GM	9.8		39	37	24	25	18	7	
SC-101S	Run 10	96	461.0	GC	9.4		47	33	20	27	18	9	
SC-101S	Run 11	102	455.0	SC	16.1		21	50	29	27	17	10	
SC-101S	Run 12	116	441.0	GC-GM	11.9		40	38	23	23	19	4	
SC-101S	Run 13	124	433.0	SC	10.1		35	40	26	34	16	18	
SC-101S	Run 15	127	430.0	SW-SM	4.4		30	62	8				
SC-101S	Run 16	132	425.0	GP-GC	3.4		63	27	9				
SC-101S	Run 16	135	422.0	SC-SM	5.9		35	50	15	22	16	6	
SC-101S	Run 17	137	420.0	GC	6.0		55	28	17	29	15	14	
SC-101S	Run 17	140	417.0	CL	8.3		0	28	72	36	17	19	
SC-102S	Run 2	8	519.5	SC	11.4		22	44	35	34	18	16	
SC-102S	Run 3	18	509.5	SC	8.3		34	40	26	33	15	18	
SC-102S	Run 4	28	499.5	SC	8.9		31	42	27	32	16	16	
SC-102S	Run 4	32	495.5	GW-GM	2.2		45	45	10				
SC-102S	Run 6	48	479.5	SC	9.7		37	40	23	27	16	11	
SC-102S	Run 7	62	465.5	SC	10.1		31	45	24	32	17	15	
SC-102S	Run 9	78	449.5	SC	9.8		28	43	29	32	16	16	
SC-102S	Run 9	82	445.5	SC	10.4		33	45	23	30	16	14	
SC-102S	Run 9	87	440.5	SC	9.7		29	45	26	29	15	14	
SC-102S	Run 12	98	429.5	SM	13.1		12	58	30	17	19	NP	
SC-102S	Run 13	103	424.5	GW-GC	5.2		58	34	8				
SC-102S	Run 13	105	422.5	SW-SC	8.2		14	78	8				
SC-102S	Run 14	109	418.5	SC	5.2		31	45	24	27	15	12	
SC-103S	Run 2	9	481.2	GP-GC	4.2		65	24	12	34	16	18	
SC-103S	Run 3	18	472.2	SC	28.8					34	18	16	
SC-103S	Run 6	32	458.2	GC-GM	4.0		44	42	14	21	15	6	
SC-103S	Run 6	37	453.2	GC	8.2		42	37	21	33	15	18	

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information				USCS Group Symbol	In Situ Moisture Content, %	In Situ Dry Unit Weight, pcf	Sieve			Atterberg Limits			Other Tests
Boring Number	Sample Number	Depth, feet	Elevation, feet				Gravel, % > #4	Sand, %	Fines, % < #200	LL	PL	PI	
SC-103S	Run 7	47	443.2	GC	9.0		41	39	20	27	18	9	
SC-103S	Run 8	57	433.2	SC	13.8		28	40	33	32	17	15	
SC-103S	Run 9	61.5	428.7	SM	10.4					18	18	NP	
SC-103S	Run 10	63.5	426.7	SM	13.5		28	40	32	22	20	2	
SC-103S	Run 11	69	421.2	SM	14.8		21	64	15	NP	NP	NP	
SC-103S	Run 11	71	419.2	GP-GM	5.1		63	28	8				
SC-103S	Run 12	73.5	416.7	CL	10.9		5	36	59	29	16	13	
SC-103S	Run 12	77	413.2	SC	9.7		16	50	34	27	17	10	
SC-104S	Run 1	6	436.4	GC			55	12	33	31	17	14	
SC-104S	Run 2	16	426.4	GC			48	39	13	27	16	11	
SC-104S	Run 3	21	421.4	GW-GC			47	44	9				
SC-104S	Run 3	26	416.4	GP-GC			63	30	7				
SC-104S	Run 4	29	413.4	SC			23	54	22	27	16	11	
SC-104S	Run 4	31	411.4	SC			40	42	18	26	16	10	
SC-104S	Run 5	34	408.4	CL			0	8	92	38	18	20	
SC-105S	Run 2	15	538.4	CL	7.1		16	28	56	27	16	11	
SC-105S	Run 3	24	529.4	SM	2.2		31	54	15	NP	NP	NP	
SC-105S	Run 4	36	517.4	GC	9.9		48	32	21	25	17	8	
SC-105S	Run 5	44	509.4	SC-SM	10.5		33	39	27	25	18	7	
SC-105S	Run 6	50	503.4	SC	10.1		30	39	31	25	17	8	
SC-105S	Run 7	53.5	499.9	ML	10.9					20	16	4	OC=2.8%
SC-105S	Run 8	58	495.4	SC	5.8		26	49	25	25	17	8	
SC-105S	Run 9	62	491.4	GC	5.5		47	38	15	27	18	9	
SC-105S	Run 9	66	487.4	SC	4.7		34	36	30	25	14	11	
SC-105S	Run 7	53.5	499.9	ML									OC=2.8%

NOTE: The laboratory tests were performed in general accordance with the following ASTM standards:

Moisture Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Sieving and Hydrometer - ASTM Test Method D422
Percent Passing No. 200 Sieve - ASTM Test Method D1140
Atterberg Limits - ASTM Test Method D4318
Organic Content Test (OC) - ASTM Test Method D2974
One-Dimensional Consolidation Test (CONS) - ASTM Test Method D2435
Specific Gravity (Gs) - ASTM Test Method D854
Isotropically Consolidated Undrained Triaxial Test (TX-CIU) - ASTM Test Method D4767

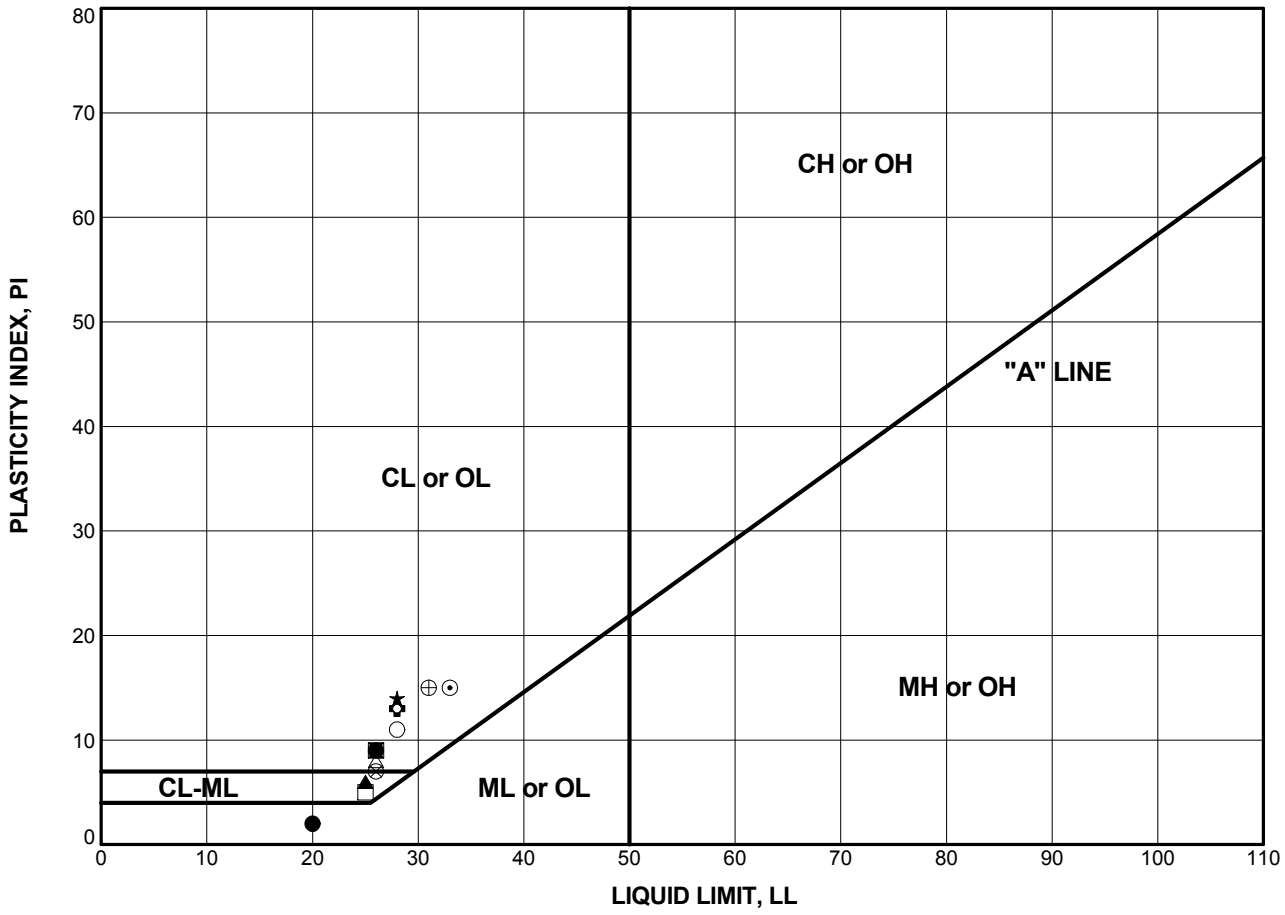


Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
SC-101MR	PB-1	30-32.5	●	15.6	31	16	15	Sandy Lean Clay with Gravel (CL)
SC-101MR	PB-2	50-52.5	⊠	16.4	26	16	10	Clayey Sand with Gravel (SC)
SC-101MR	PB-3	70-72.5	▲	11.9	26	16	10	Clayey Sand with Gravel (SC)
SC-101MR	PB-4	93-95.5	★	13.2	25	18	7	Silty, Clayey Gravel with Sand (GC-GM)
SC-101MR	PB-5	100-102.5	⊙	15.6	28	15	13	Clayey Sand with Gravel (SC)
SC-101MR	PB-6	112-114.3	✿	9.4	29	18	11	Clayey Gravel with Sand (GC)
SC-101MR	SP-21	122.5-124	○	12.7	31	18	13	Clayey Gravel with Sand (GC)
SC-101MR	SP-22	124-124.9	△	8.4	27	18	9	Clayey Sand with Gravel (SC)
SC-101MR	SP-23	126.5-128	⊗	14.4	19	18	1	Silty Sand with Gravel (SM)
SC-101MR	SP-26	133.5-135	⊕	6.7	22	18	4	Gravel with Silty Clay and Sand (GP-GC)
SC-101MR	SP-27	136-137	□	8.8	21	18	3	Gravel with Silt and Sand (GP-GM)
SC-104MR	SP-4	17.5-19	⊛	15.3	28	17	11	Clayey Sand with Gravel (SC)

PLASTICITY CHART

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-1

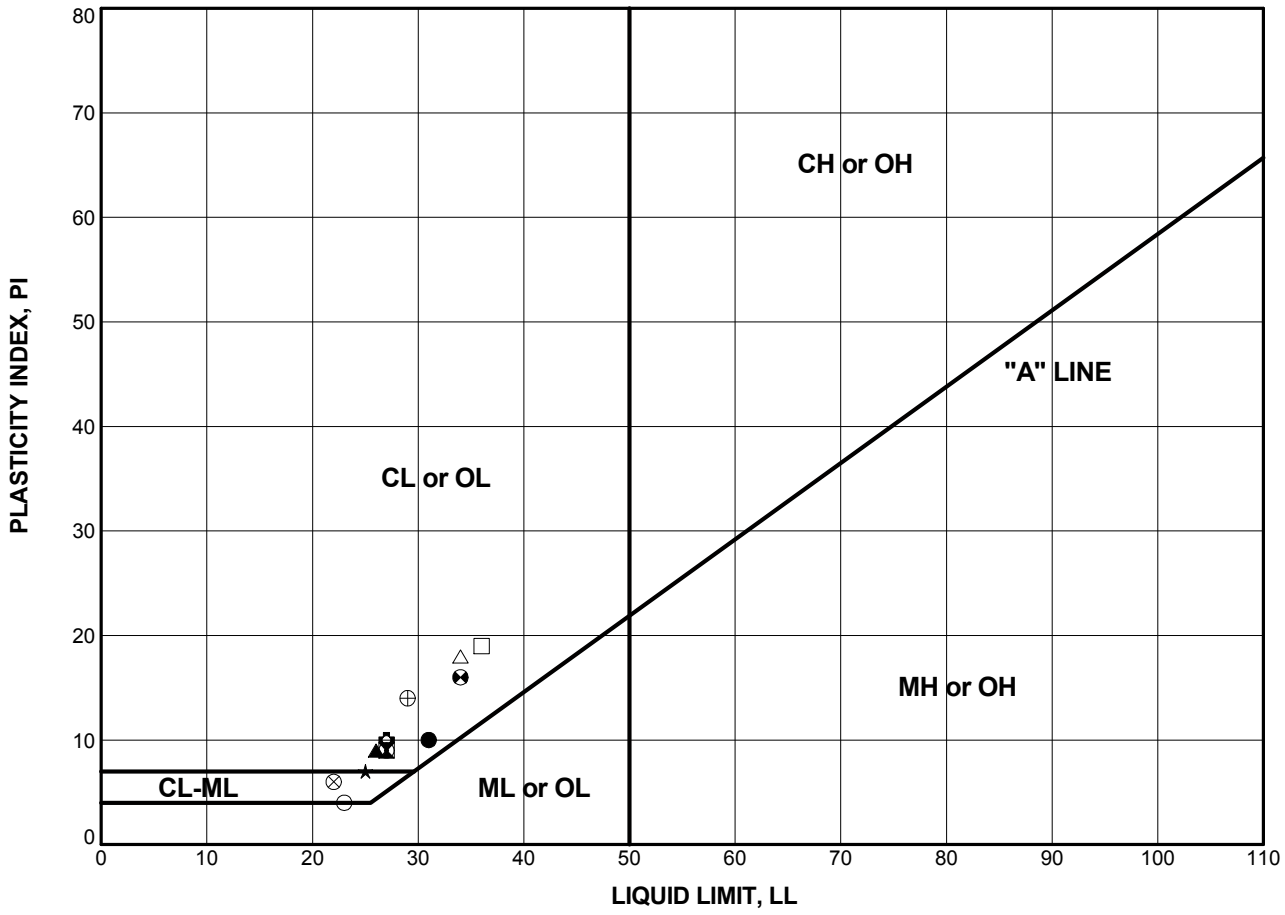


Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
SC-104MR	SP-5	20-21.5	●	7.8	20	18	2	Poorly Graded Gravel with Silt and Sand (GP-GM)
SC-104MR	SP-7	25-26.5	⊠	10.7	26	17	9	Well-Graded Gravel with Clay and Sand (GW-GC)
SC-104MR	SP-8	27.5-29	▲	13.8	25	19	6	Silty, Clayey Sand with Gravel (SC-SM)
SC-104MR	SP-9	30-30.8	★	13.1	28	14	14	Clayey Sand with Gravel (SC) [Sandstone]
SC-105MR	PB-3	48-50.3	⊙	12.0	33	18	15	Clayey Sand with Gravel (SC/CL)
SC-105MR	SP-9	50.3-51.8	✿	8.3	28	15	13	Clayey Sand with Gravel (SC)
SC-105MR	SP-10	53-54.5	○	10.4	28	17	11	Clayey Gravel with Sand (GC)
SC-105MR	SP-11	55.5-57	△	14.1	26	18	8	Clayey Sand with Gravel (SC)
SC-105MR	SP-12	58-58.8	⊗	13.5	26	19	7	Silty, Clayey Sand with Gravel (SC-SM)
SC-105MR	SP-14	64-64.6	⊕	11.5	31	16	15	Clayey Sand with Gravel (SC) [Sandstone]
SC-101S	Run 2	16	□	6.8	25	20	5	Silty, Clayey Sand with Gravel (SC-SM)
SC-101S	Run 5	46	⊛	11.1	26	17	9	Clayey Sand with Gravel (SC)

PLASTICITY CHART

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-2

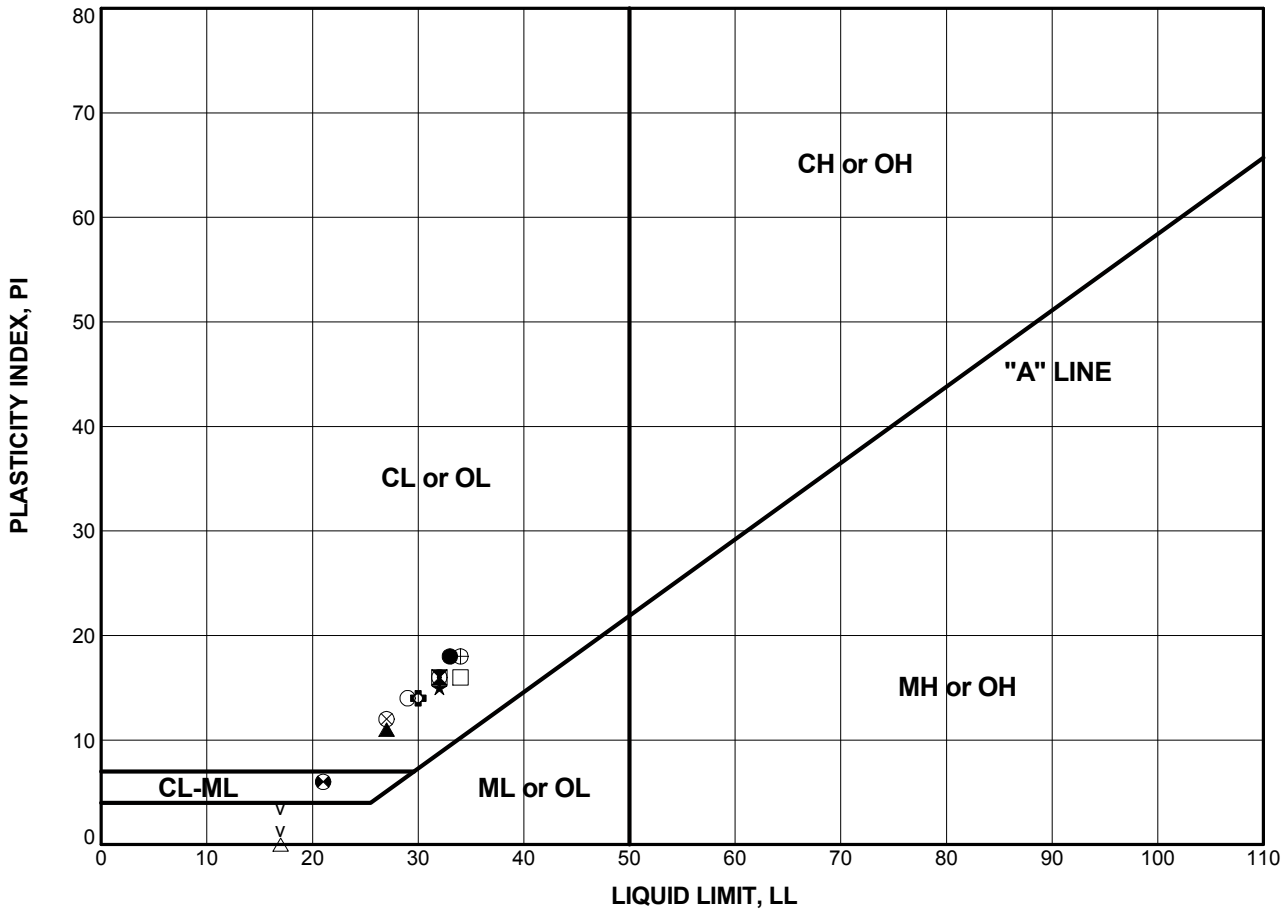


Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
SC-101S	Run 6	56	●	10.8	31	21	10	Clayey Sand (SC)
SC-101S	Run 7	66	⊠	9.8	27	18	9	Clayey Gravel with Sand (GC)
SC-101S	Run 8	76	▲	12.1	26	17	9	Clayey Sand with Gravel (SC)
SC-101S	Run 9	86	★	9.8	25	18	7	Silty, Clayey Gravel with Sand (GC-GM)
SC-101S	Run 10	96	⊙	9.4	27	18	9	Clayey Gravel with Sand (GC)
SC-101S	Run 11	102	✿	16.1	27	17	10	Clayey Sand with Gravel (SC)
SC-101S	Run 12	116	○	11.9	23	19	4	Silty, Clayey Gravel with Sand (GC-GM)
SC-101S	Run 13	124	△	10.1	34	16	18	Clayey Sand with Gravel (SC)
SC-101S	Run 16	135	⊗	5.9	22	16	6	Silty, Clayey Sand with Gravel (SC-SM)
SC-101S	Run 17	137	⊕	6.0	29	15	14	Clayey Gravel with Sand (GC) [Sandstone]
SC-101S	Run 17	140	□	8.3	36	17	19	Lean Clay with Sand (CL) [Claystone]
SC-102S	Run 2	8	☢	11.4	34	18	16	Clayey Sand with Gravel (SC)

PLASTICITY CHART

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-3

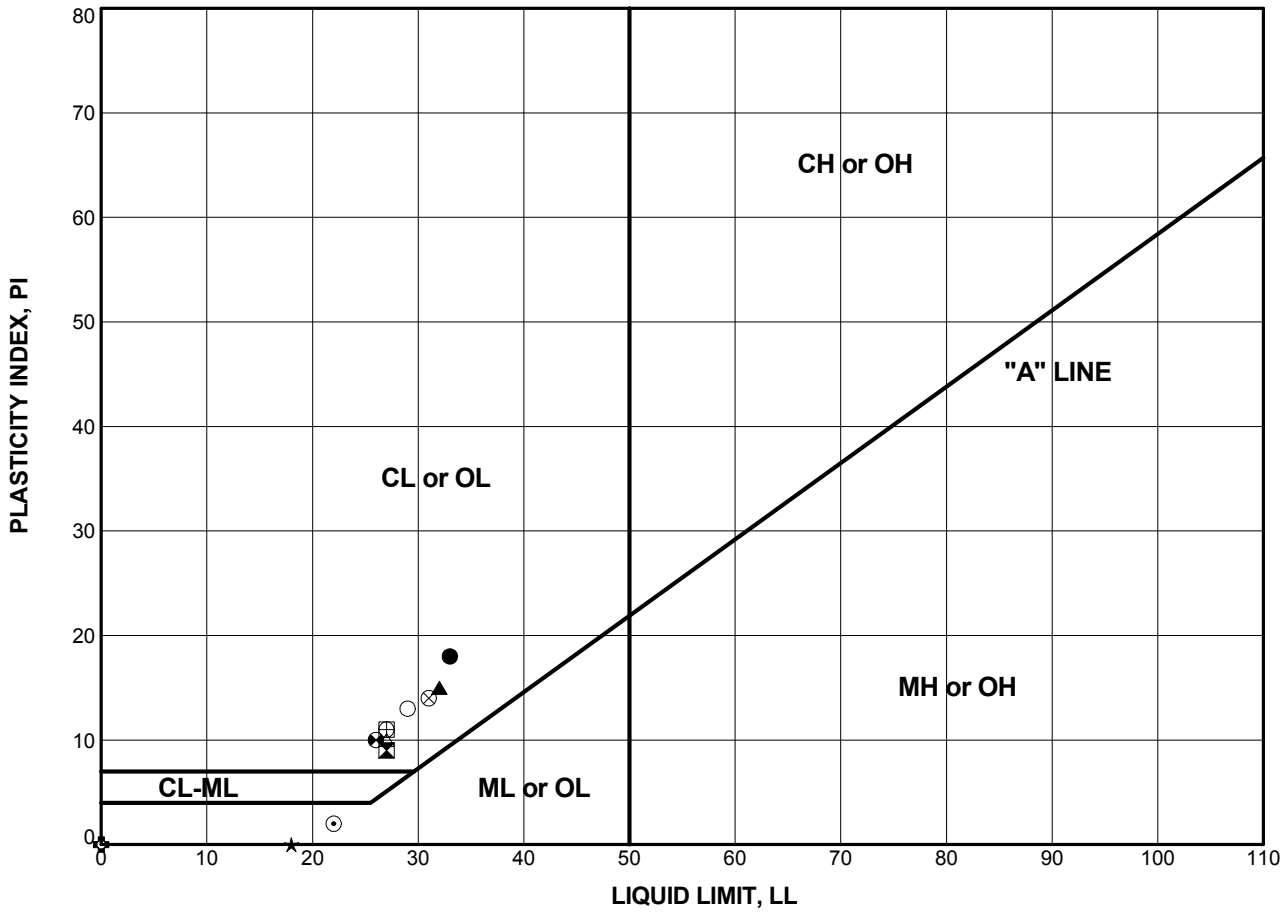


Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
SC-102S	Run 3	18	●	8.3	33	15	18	Clayey Sand with Gravel (SC)
SC-102S	Run 4	28	⊠	8.9	32	16	16	Clayey Sand with Gravel (SC)
SC-102S	Run 6	48	▲	9.7	27	16	11	Clayey Sand with Gravel (SC)
SC-102S	Run 7	62	★	10.1	32	17	15	Clayey Sand with Gravel (SC)
SC-102S	Run 9	78	⊙	9.8	32	16	16	Clayey Sand with Gravel (SC)
SC-102S	Run 9	82	✿	10.4	30	16	14	Clayey Sand with Gravel (SC)
SC-102S	Run 9	87	○	9.7	29	15	14	Clayey Sand with Gravel (SC)
SC-102S	Run 12	98	△	13.1	17	19	NP	Silty Sand (SM)
SC-102S	Run 14	109	⊗	5.2	27	15	12	Clayey Sand with Gravel (SC) [Sandstone]
SC-103S	Run 2	9	⊕	4.2	34	16	18	Poorly Graded Gravel with Clay and Sand (GP-GC)
SC-103S	Run 3	18	□	28.8	34	18	16	Clayey Sand with Gravel (SC)
SC-103S	Run 6	32	⊛	4.0	21	15	6	Silty, Clayey Gravel with Sand (GC-GM)

PLASTICITY CHART

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-4

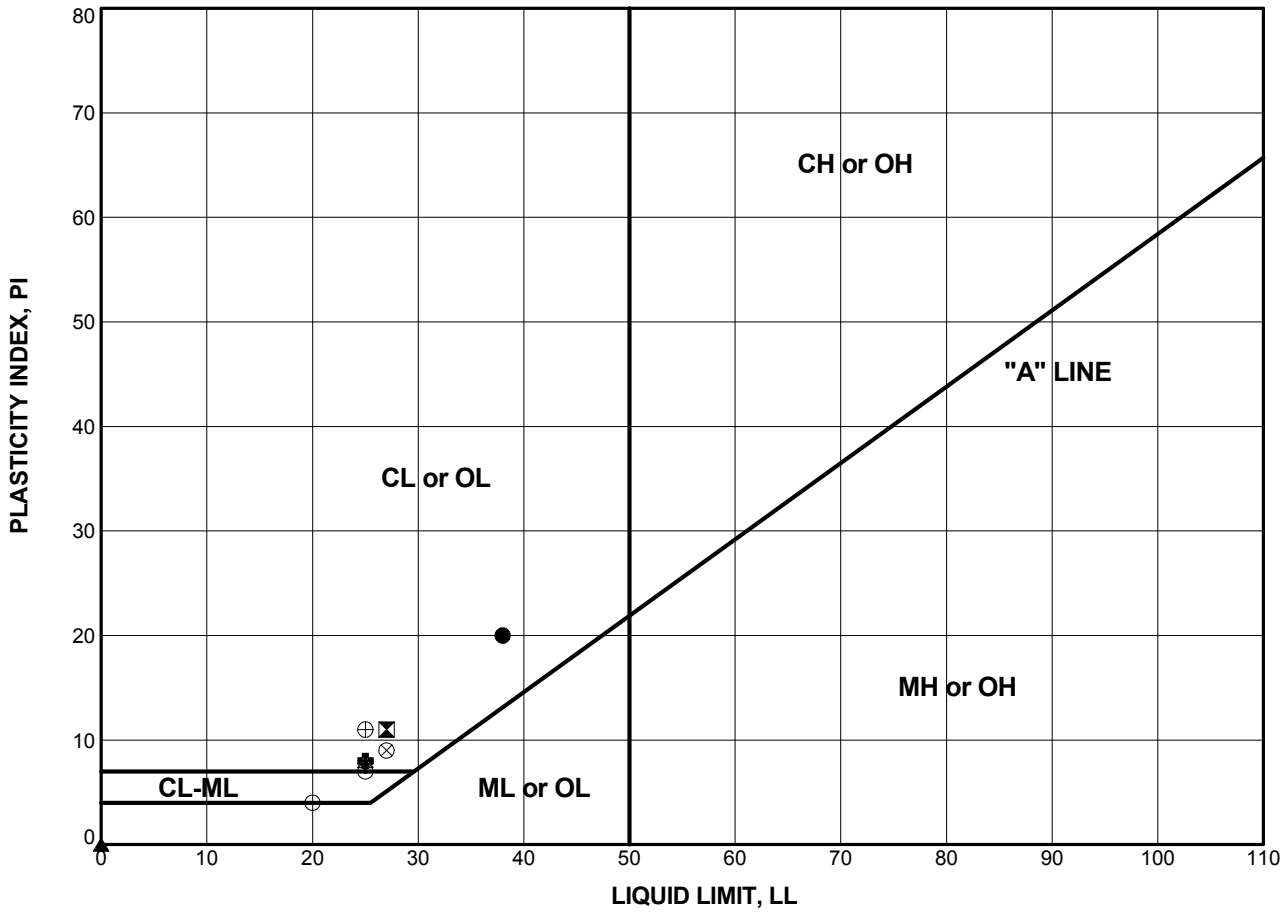


Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
SC-103S	Run 6	37	●	8.2	33	15	18	Clayey Gravel with Sand (GC)
SC-103S	Run 7	47	⧓	9.0	27	18	9	Clayey Gravel with Sand (GC)
SC-103S	Run 8	57	▲	13.8	32	17	15	Clayey Sand with Gravel (SC)
SC-103S	Run 9	61.5	★	10.4	18	18	NP	Silty Sand with Gravel (SM)
SC-103S	Run 10	63.5	⊙	13.5	22	20	2	Silty Sand with Gravel (SM)
SC-103S	Run 11	69	✿	14.8	NP	NP	NP	Silty Sand with Gravel (SM)
SC-103S	Run 12	73.5	○	10.9	29	16	13	Sandy Lean Clay (CL) [Claystone]
SC-103S	Run 12	77	△	9.7	27	17	10	Clayey Sand with Gravel (SC) [Sandstone]
SC-104S	Run 1	6	⊗		31	17	14	Clayey Gravel (GC)
SC-104S	Run 2	16	⊕		27	16	11	Clayey Gravel with Sand (GC)
SC-104S	Run 4	29	□		27	16	11	Clayey Sand with Gravel (SC)
SC-104S	Run 4	31	⧁		26	16	10	Clayey Sand with Gravel (SC) [Sandstone]

PLASTICITY CHART

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-5



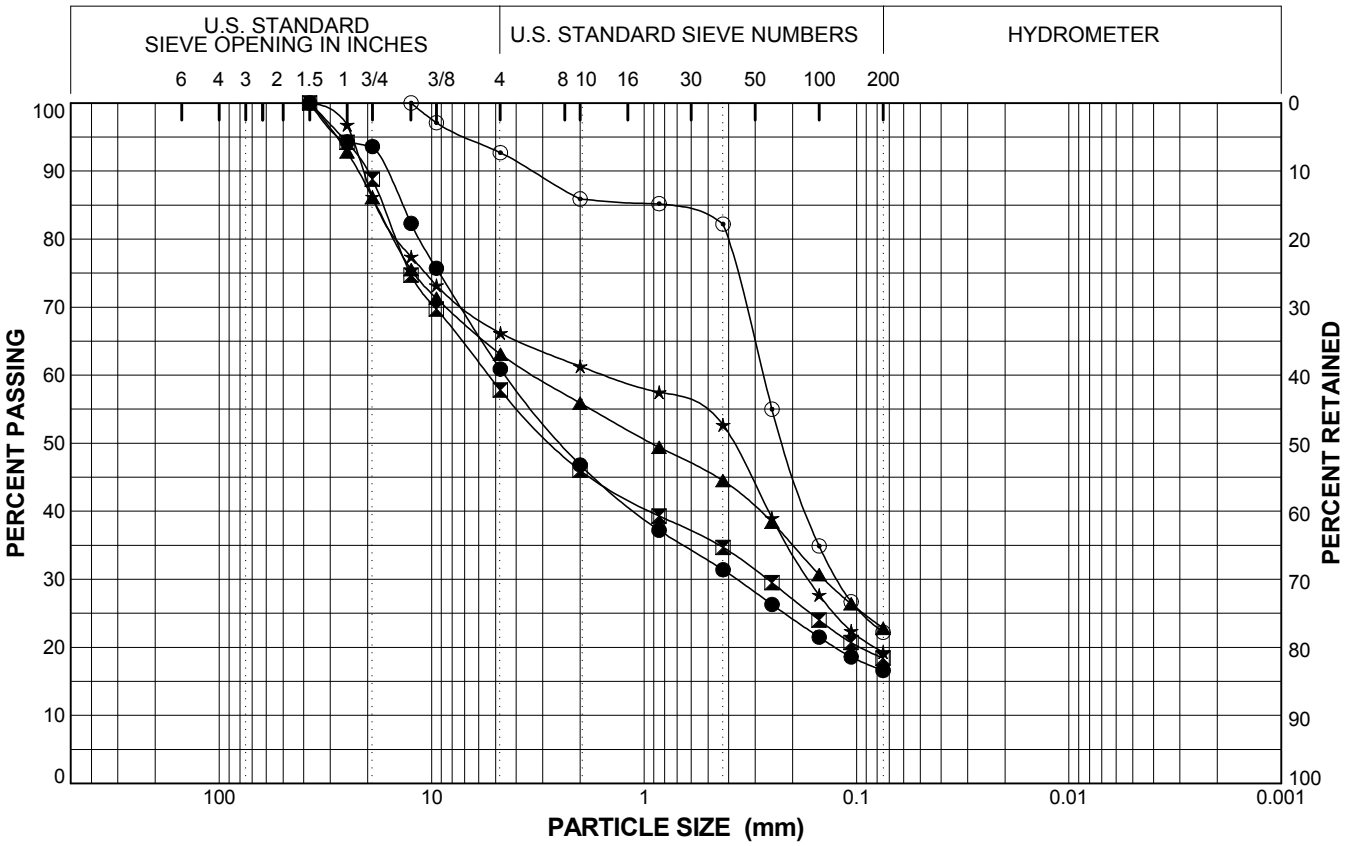
Boring Number	Sample Number	Depth (feet)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
SC-104S	Run 5	34	●		38	18	20	Lean Clay (CL) [Claystone]
SC-105S	Run 2	15	⧓	7.1	27	16	11	Sandy Lean Clay with Gravel (CL)
SC-105S	Run 3	24	▲	2.2	NP	NP	NP	Silty Sand with Gravel (SM)
SC-105S	Run 4	36	★	9.9	25	17	8	Clayey Gravel with Sand (GC)
SC-105S	Run 5	44	⊙	10.5	25	18	7	Silty, Clayey Sand with Gravel (SC-SM)
SC-105S	Run 6	50	✿	10.1	25	17	8	Clayey Sand with Gravel (SC)
SC-105S	Run 7	53.5	○	10.9	20	16	4	Sandy Silt (ML)
SC-105S	Run 8	58	△	5.8	25	17	8	Clayey Sand with Gravel (SC)
SC-105S	Run 9	62	⊗	5.5	27	18	9	Clayey Gravel with Sand (GC)
SC-105S	Run 9	66	⊕	4.7	25	14	11	Clayey Sand with Gravel (SC) [Sandstone]

PLASTICITY CHART

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-6

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



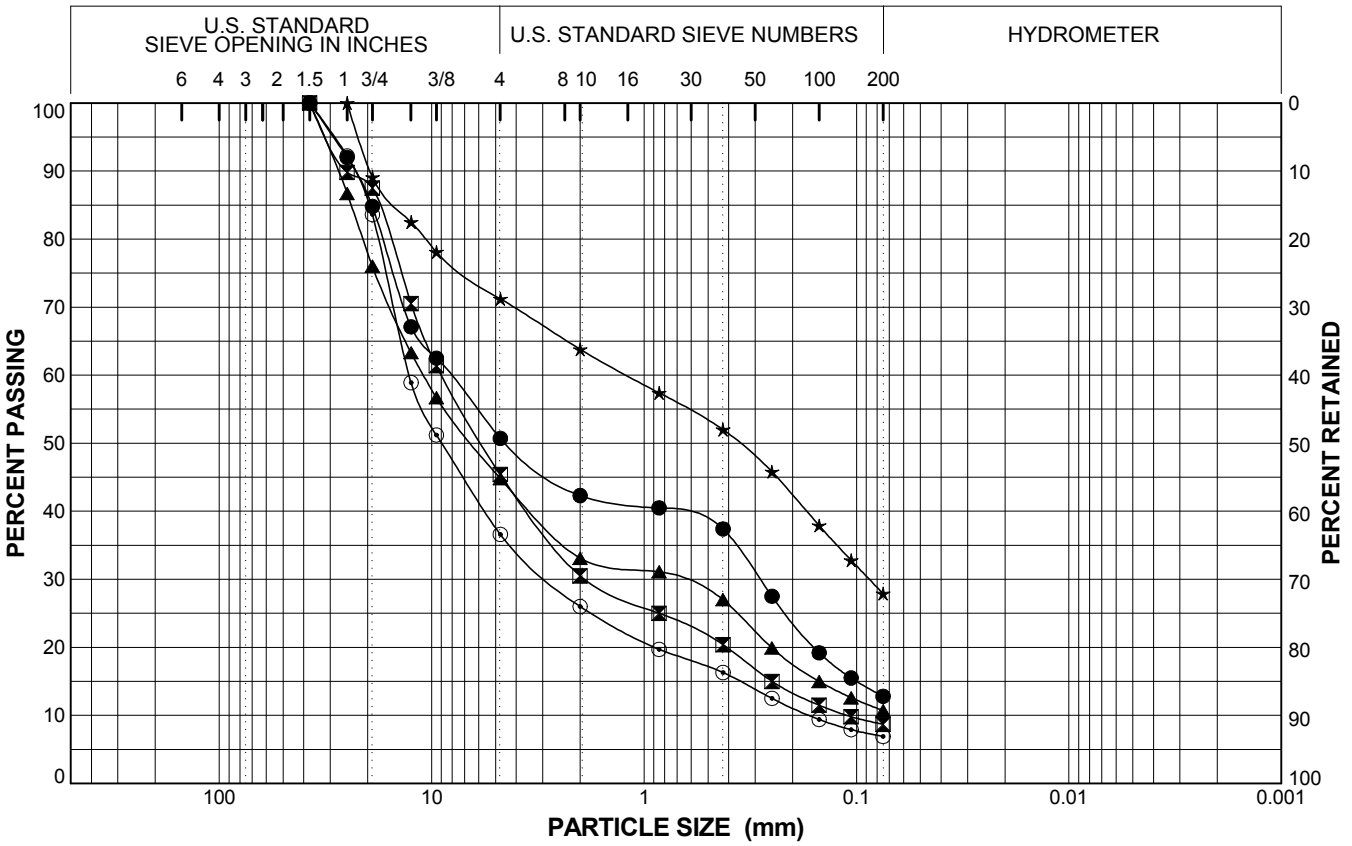
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-101MR	PB-5	100-102.5	●	39	44	17	Clayey Sand with Gravel (SC)
SC-101MR	SP-21	122.5-124	⧓	42	39	18	Clayey Gravel with Sand (GC)
SC-101MR	SP-22	124-124.9	▲	37	40	23	Clayey Sand with Gravel (SC)
SC-101MR	SP-23	126.5-128	★	34	47	19	Silty Sand with Gravel (SM)
SC-101MR	SP-24	129-129.8	⊙	7	70	22	Silty Sand (SM)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-7

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



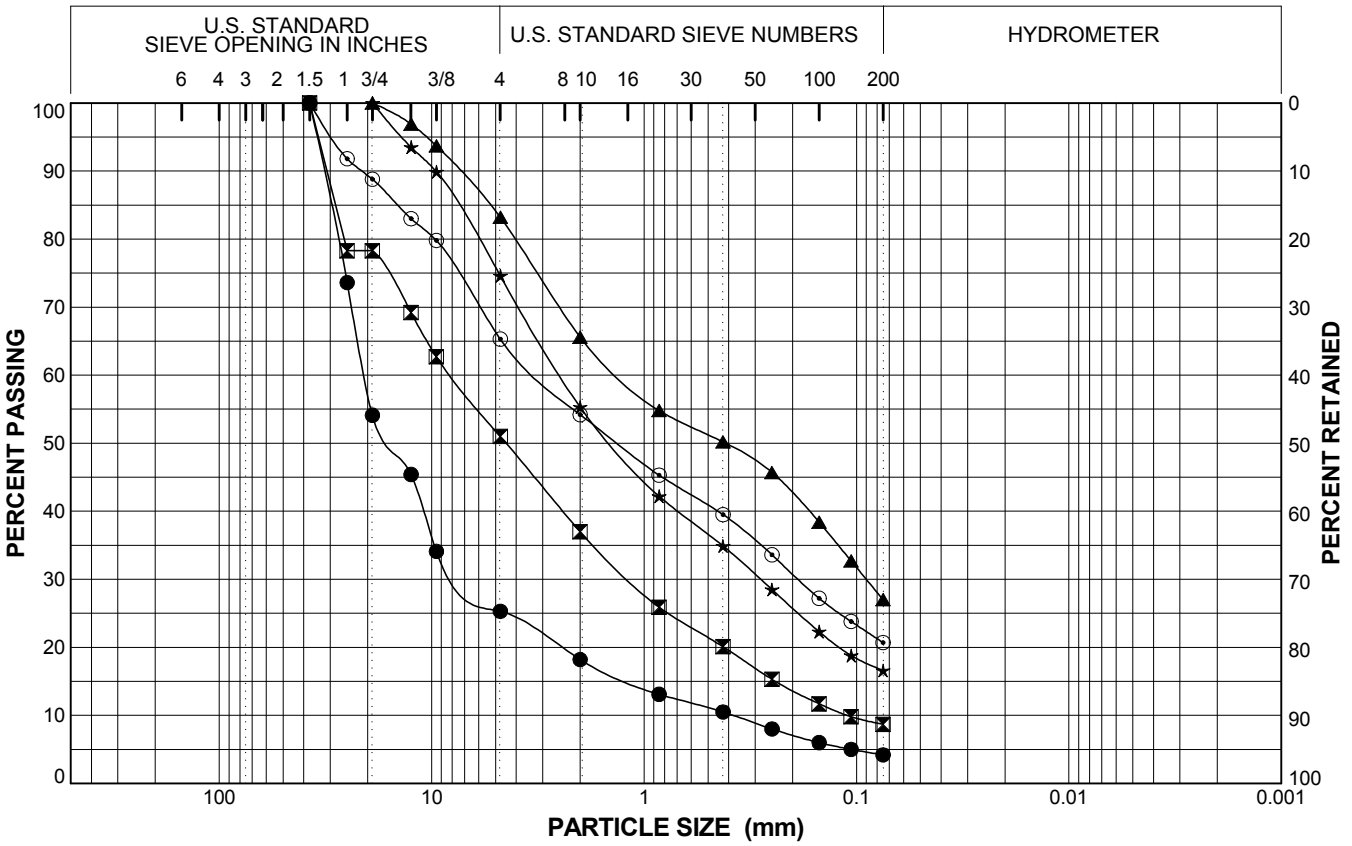
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-101MR	SP-25	131-132.5	●	49	38	13	Clayey Gravel with Sand (GC)
SC-101MR	SP-26	133.5-135	⧓	55	37	9	Gravel with Silty Clay and Sand (GP-GC) [Conglomerate]
SC-101MR	SP-27	136-137	▲	55	34	11	Gravel with Silt and Sand (GP-GM) [Conglomerate]
SC-104MR	SP-4	17.5-19	★	29	43	28	Clayey Sand with Gravel (SC)
SC-104MR	SP-5	20-21.5	⊙	63	30	7	Poorly Graded Gravel with Silt and Sand (GP-GM)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-8

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



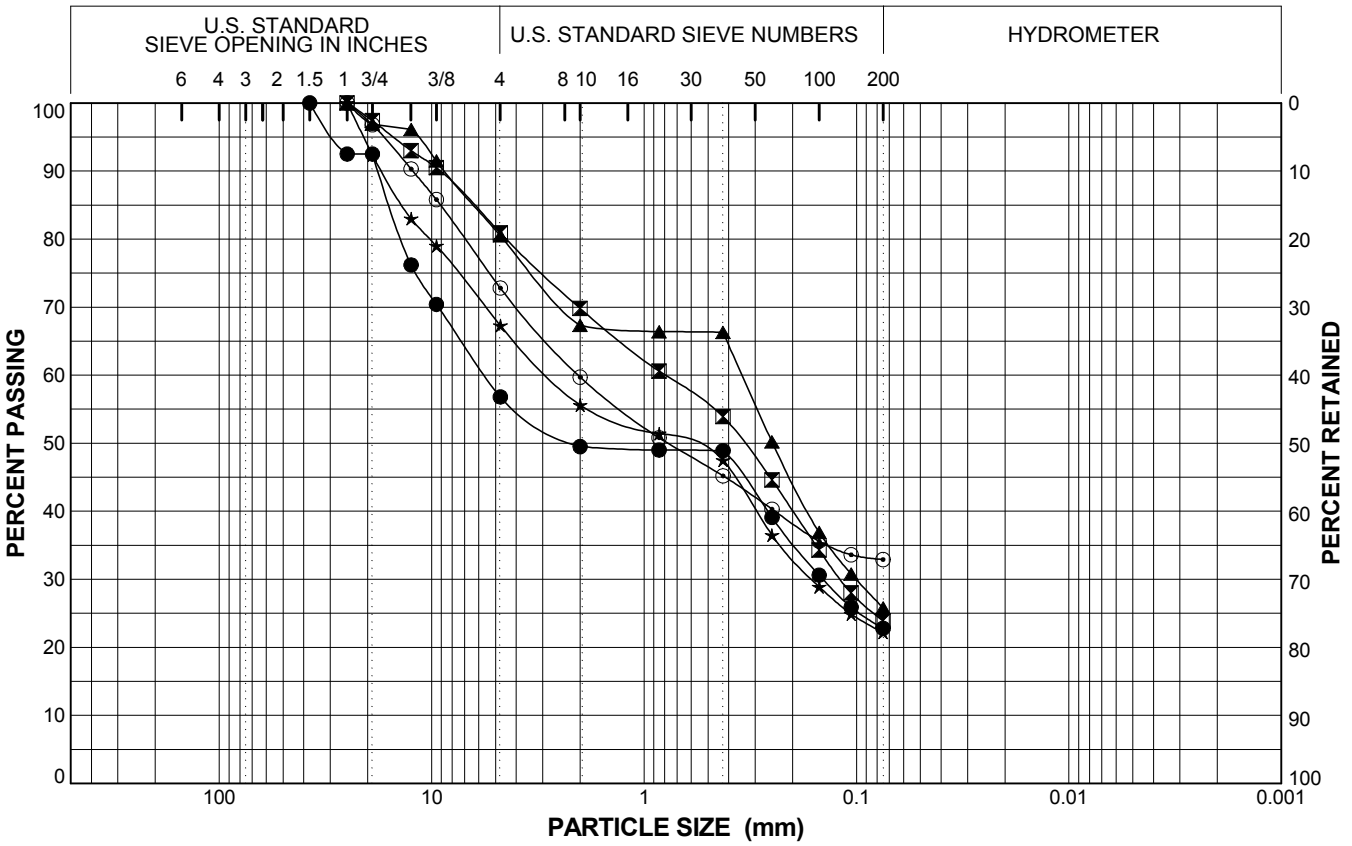
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-104MR	SP-6	22.5-24	●	75	21	4	Poorly Graded Gravel with Sand (GP)
SC-104MR	SP-7	25-26.5	⧓	49	42	9	Well-Graded Gravel with Clay and Sand (GW-GC)
SC-104MR	SP-8	27.5-29	▲	17	56	27	Silty, Clayey Sand with Gravel (SC-SM)
SC-104MR	SP-9	30-30.8	★	25	58	17	Clayey Sand with Gravel (SC) [Sandstone]
SC-105MR	SP-9	50.3-51.8	⊙	35	45	21	Clayey Sand with Gravel (SC)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-9

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



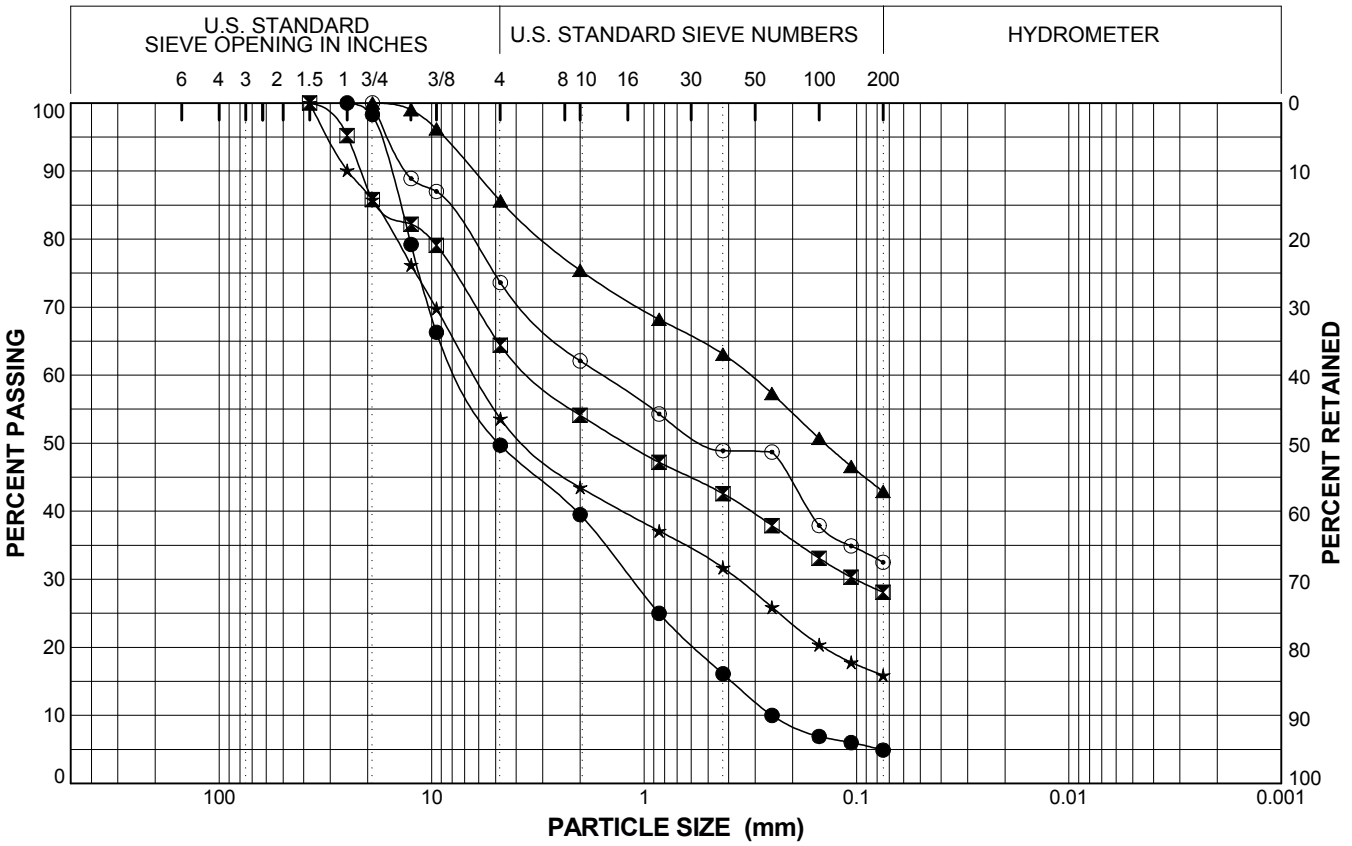
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-105MR	SP-10	53-54.5	●	43	34	23	Clayey Gravel with Sand (GC)
SC-105MR	SP-11	55.5-57	⧓	19	57	24	Clayey Sand with Gravel (SC)
SC-105MR	SP-12	58-58.8	▲	20	55	26	Silty, Clayey Sand with Gravel (SC-SM)
SC-105MR	SP-14	64-64.6	★	33	45	22	Clayey Sand with Gravel (SC) [Sandstone]
SC-101S	Run 2	16	⊙	27	40	33	Silty, Clayey Sand with Gravel (SC-SM)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-10

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



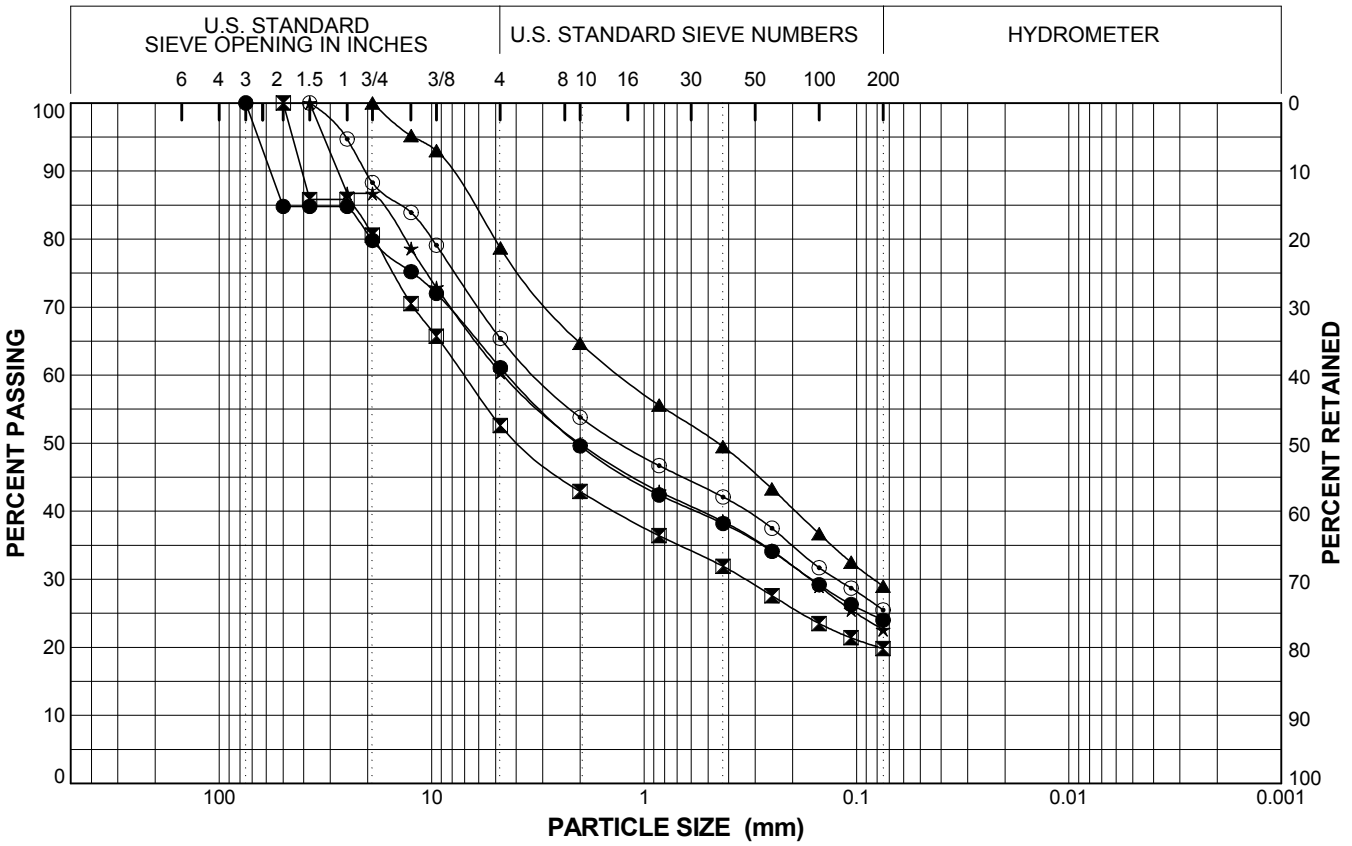
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-101S	Run 4	27	●	50	45	5	Poorly Graded Gravel with Sand (GP)
SC-101S	Run 5	46	⧓	36	36	28	Clayey Sand with Gravel (SC)
SC-101S	Run 6	56	▲	14	43	43	Clayey Sand (SC)
SC-101S	Run 7	66	★	46	38	16	Clayey Gravel with Sand (GC)
SC-101S	Run 8	76	⊙	26	41	33	Clayey Sand with Gravel (SC)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-11

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



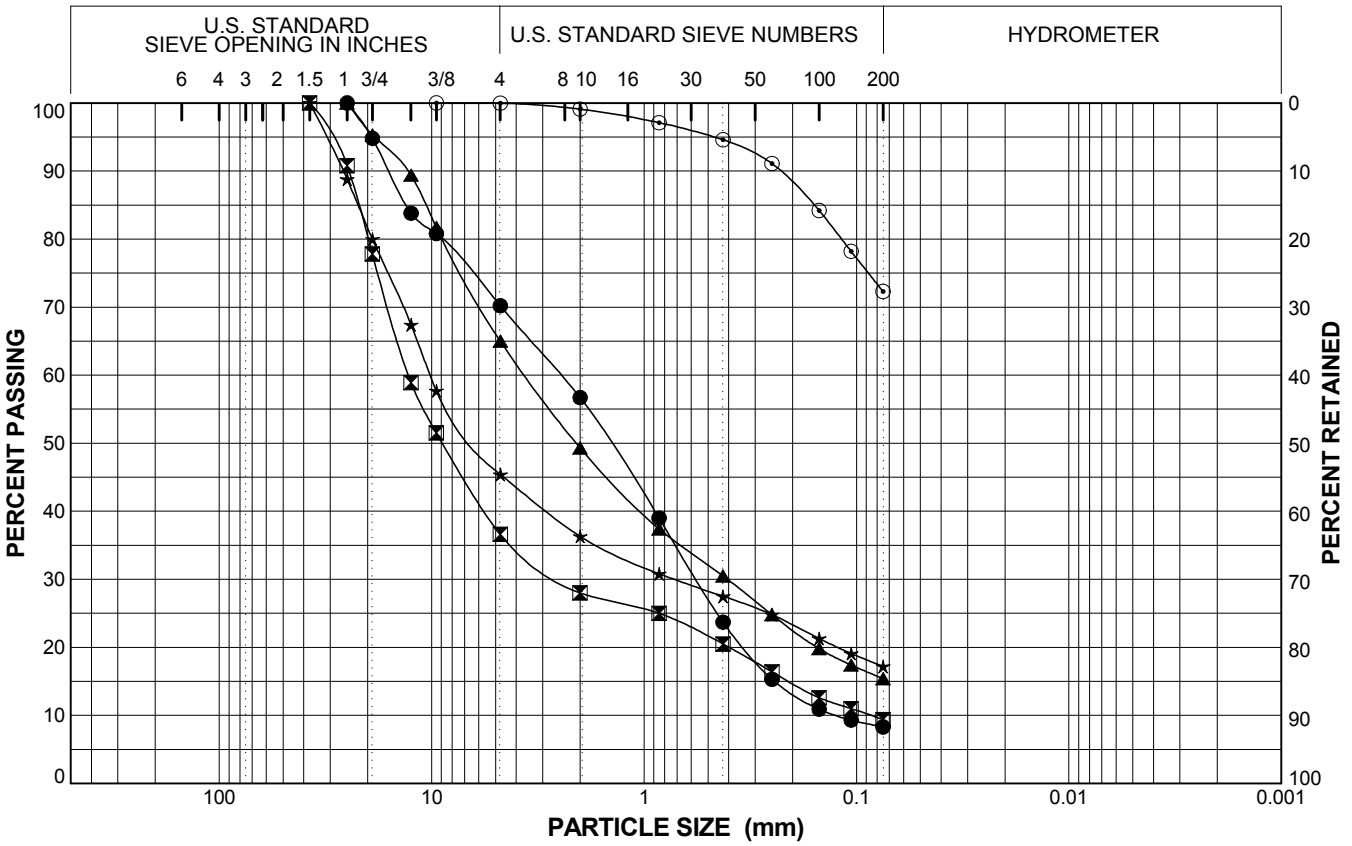
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-101S	Run 9	86	●	39	37	24	Silty, Clayey Gravel with Sand (GC-GM)
SC-101S	Run 10	96	⧓	47	33	20	Clayey Gravel with Sand (GC)
SC-101S	Run 11	102	▲	21	50	29	Clayey Sand with Gravel (SC)
SC-101S	Run 12	116	★	40	38	23	Silty, Clayey Gravel with Sand (GC-GM)
SC-101S	Run 13	124	⊙	35	40	26	Clayey Sand with Gravel (SC)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-12

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



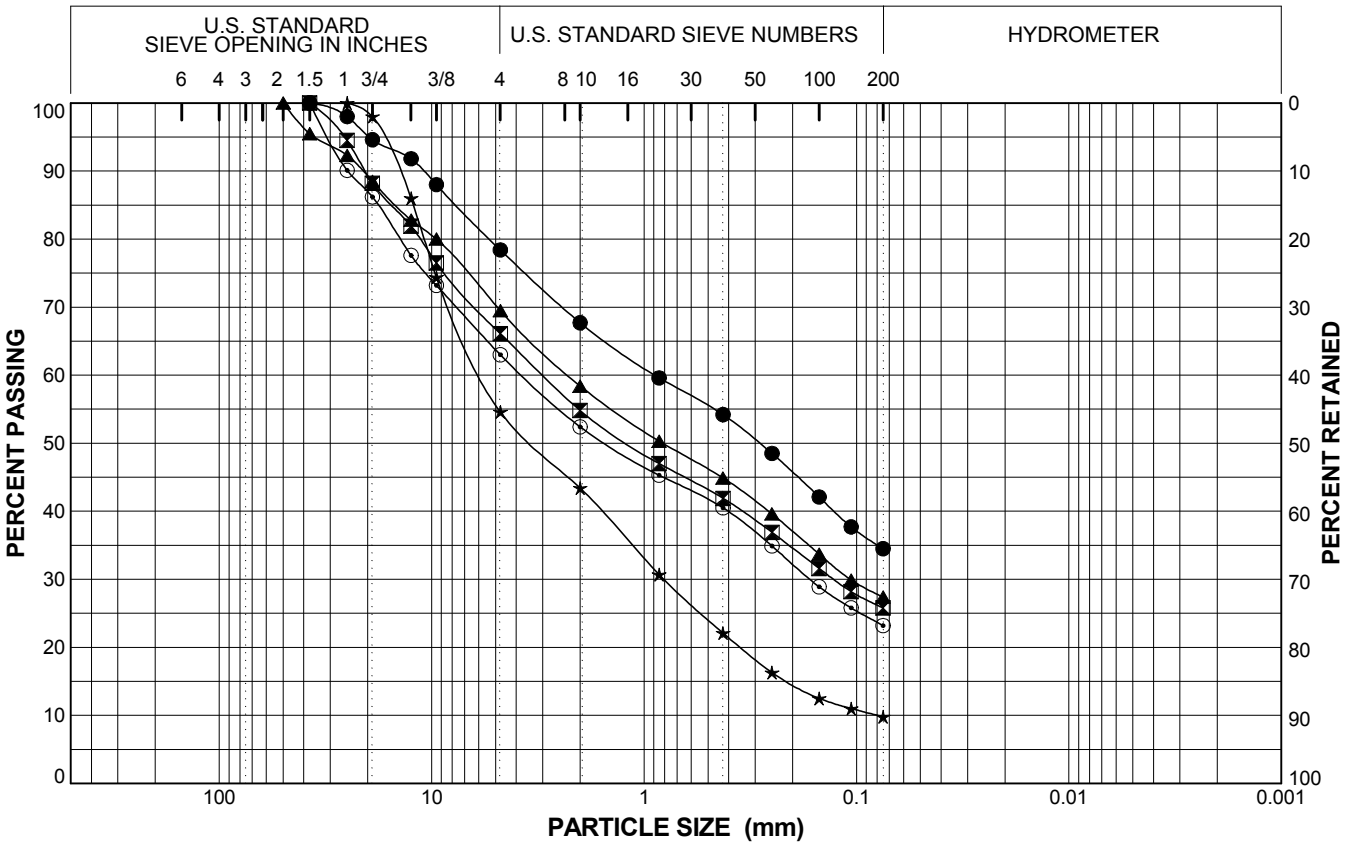
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-101S	Run 15	127	●	30	62	8	Well-Graded Sand with Silt and Gravel (SW-SM)
SC-101S	Run 16	132	⧓	63	27	9	Poorly Graded Gravel with Clay and Sand (GP-GC)
SC-101S	Run 16	135	▲	35	50	15	Silty, Clayey Sand with Gravel (SC-SM)
SC-101S	Run 17	137	★	55	28	17	Clayey Gravel with Sand (GC) [Sandstone]
SC-101S	Run 17	140	⊙	0	28	72	Lean Clay with Sand (CL) [Claystone]

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-13

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



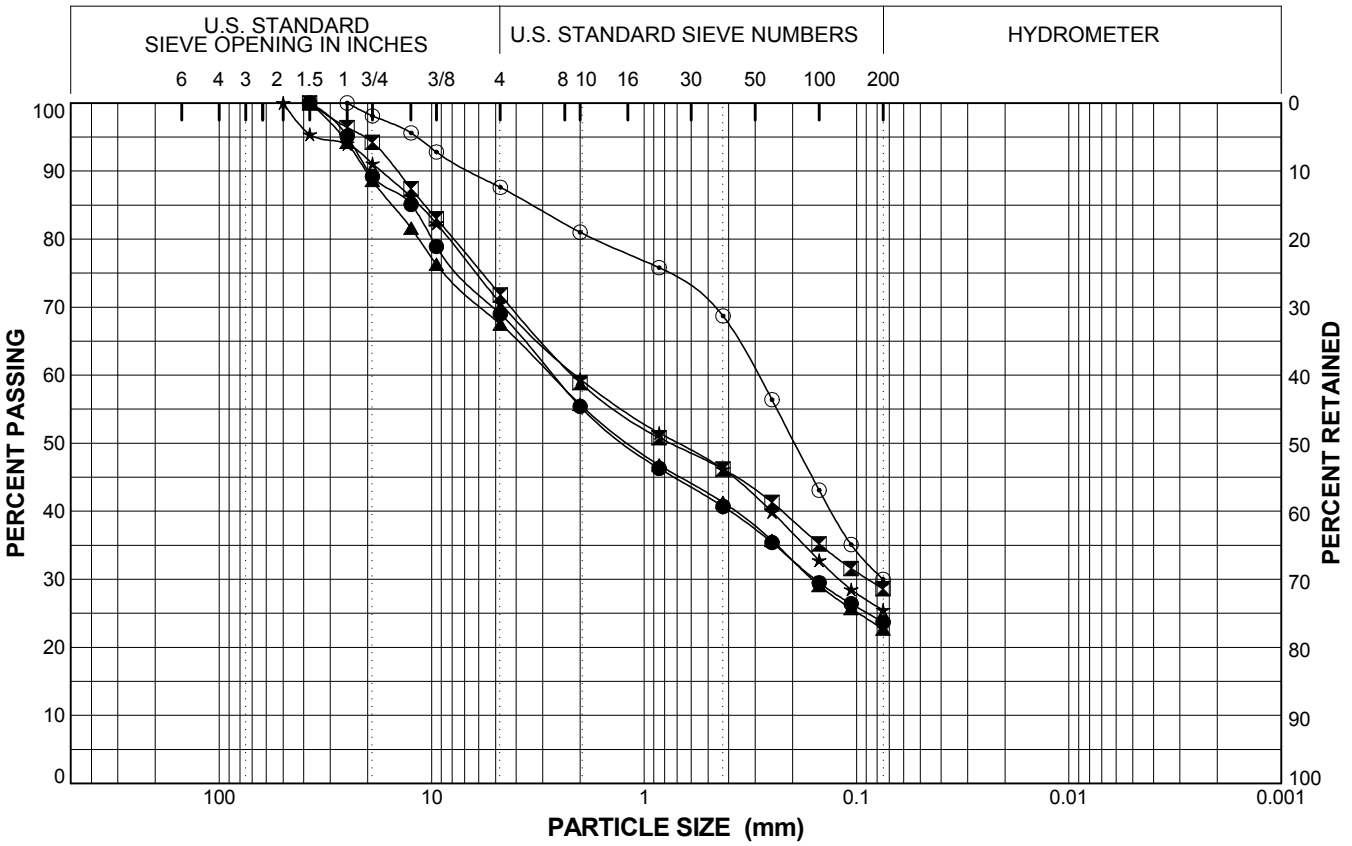
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-102S	Run 2	8	●	22	44	35	Clayey Sand with Gravel (SC)
SC-102S	Run 3	18	⧓	34	40	26	Clayey Sand with Gravel (SC)
SC-102S	Run 4	28	▲	31	42	27	Clayey Sand with Gravel (SC)
SC-102S	Run 4	32	★	45	45	10	Well-Graded Gravel with Silt and Sand (GW-GM)
SC-102S	Run 6	48	⊙	37	40	23	Clayey Sand with Gravel (SC)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-14

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



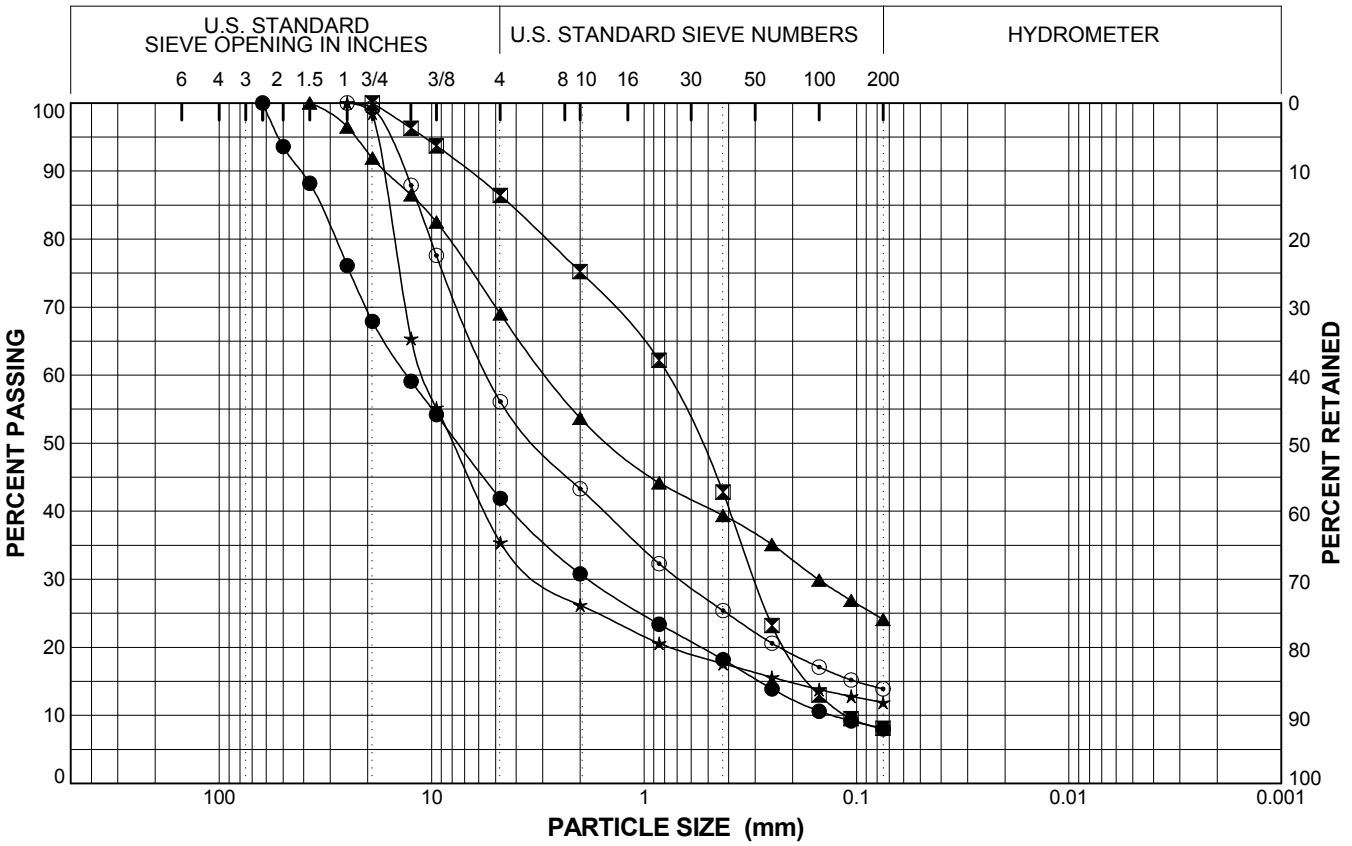
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-102S	Run 7	62	●	31	45	24	Clayey Sand with Gravel (SC)
SC-102S	Run 9	78	⧓	28	43	29	Clayey Sand with Gravel (SC)
SC-102S	Run 9	82	▲	33	45	23	Clayey Sand with Gravel (SC)
SC-102S	Run 9	87	★	29	45	26	Clayey Sand with Gravel (SC)
SC-102S	Run 12	98	⊙	12	58	30	Silty Sand (SM)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-15

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



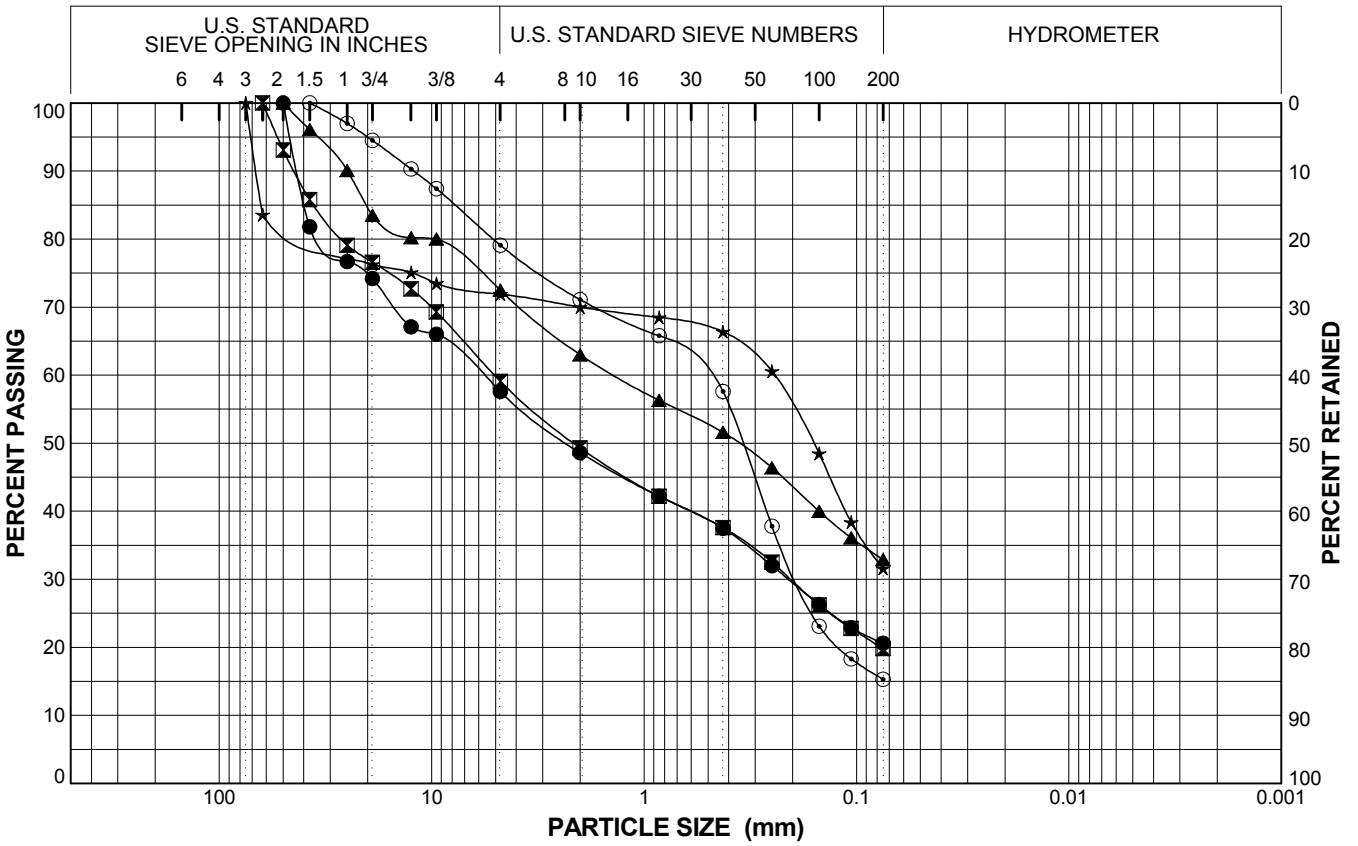
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-102S	Run 13	103	●	58	34	8	Well-Graded Gravel with Clay and Sand (GW-GC)
SC-102S	Run 13	105	⧓	14	78	8	Well-Graded Sand with Clay (SW-SC)
SC-102S	Run 14	109	▲	31	45	24	Clayey Sand with Gravel (SC) [Sandstone]
SC-103S	Run 2	9	★	65	24	12	Poorly Graded Gravel with Clay and Sand (GP-GC)
SC-103S	Run 6	32	⊙	44	42	14	Silty, Clayey Gravel with Sand (GC-GM)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-16

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



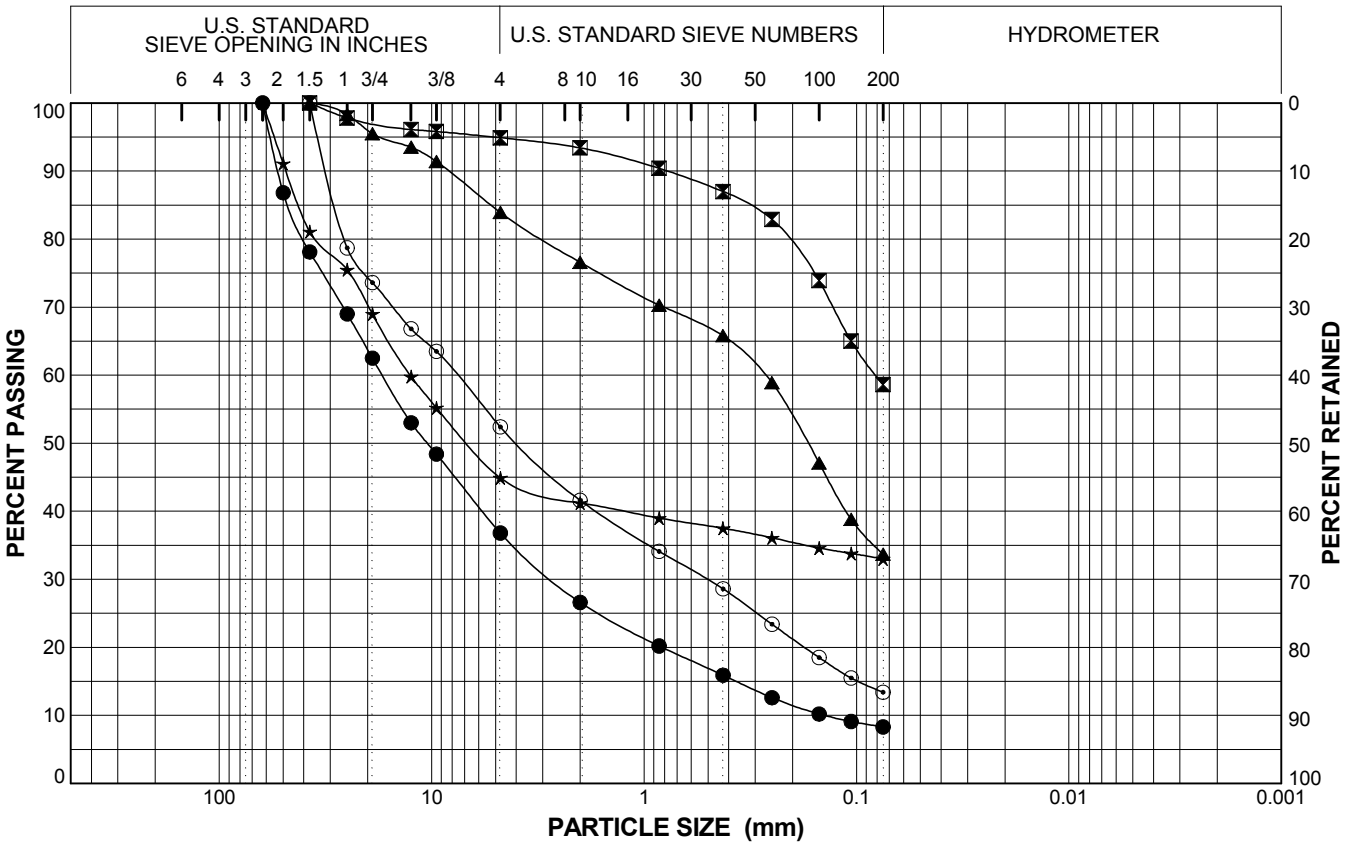
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-103S	Run 6	37	●	42	37	21	Clayey Gravel with Sand (GC)
SC-103S	Run 7	47	⧓	41	39	20	Clayey Gravel with Sand (GC)
SC-103S	Run 8	57	▲	28	40	33	Clayey Sand with Gravel (SC)
SC-103S	Run 10	63.5	★	28	40	32	Silty Sand with Gravel (SM)
SC-103S	Run 11	69	⊙	21	64	15	Silty Sand with Gravel (SM)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-17

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



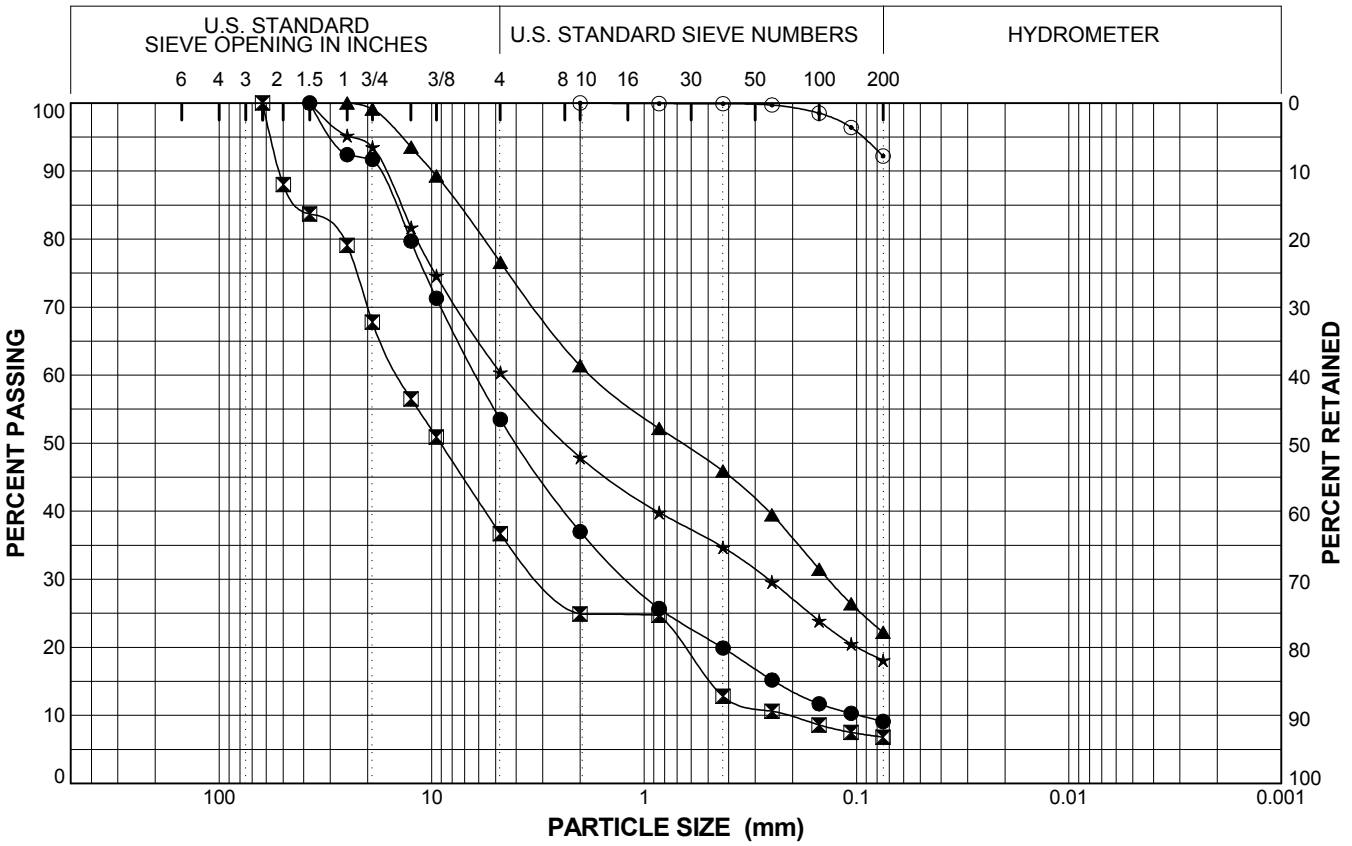
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-103S	Run 11	71	●	63	28	8	Poorly Graded Gravel with Silt and Sand (GP-GM)
SC-103S	Run 12	73.5	⧓	5	36	59	Sandy Lean Clay (CL) [Claystone]
SC-103S	Run 12	77	▲	16	50	34	Clayey Sand with Gravel (SC) [Sandstone]
SC-104S	Run 1	6	★	55	12	33	Clayey Gravel (GC)
SC-104S	Run 2	16	⊙	48	39	13	Clayey Gravel with Sand (GC)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-18

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



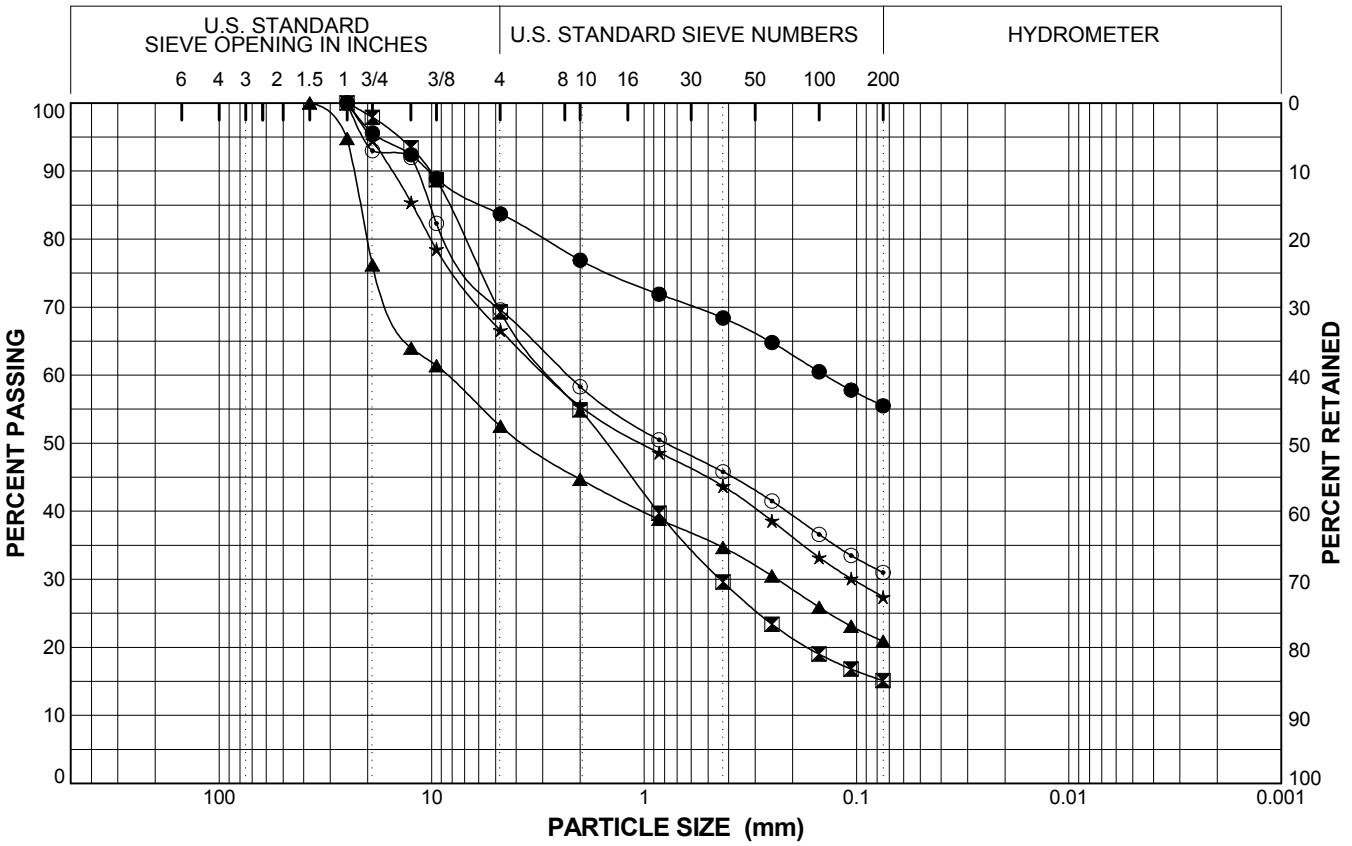
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-104S	Run 3	21	●	47	44	9	Well-Graded Gravel with Clay and Sand (GW-GC)
SC-104S	Run 3	26	⧓	63	30	7	Poorly Graded Gravel with Clay and Sand (GP-GC)
SC-104S	Run 4	29	▲	23	54	22	Clayey Sand with Gravel (SC)
SC-104S	Run 4	31	★	40	42	18	Clayey Sand with Gravel (SC) [Sandstone]
SC-104S	Run 5	34	⊙	0	8	92	Lean Clay (CL) [Claystone]

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-19

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



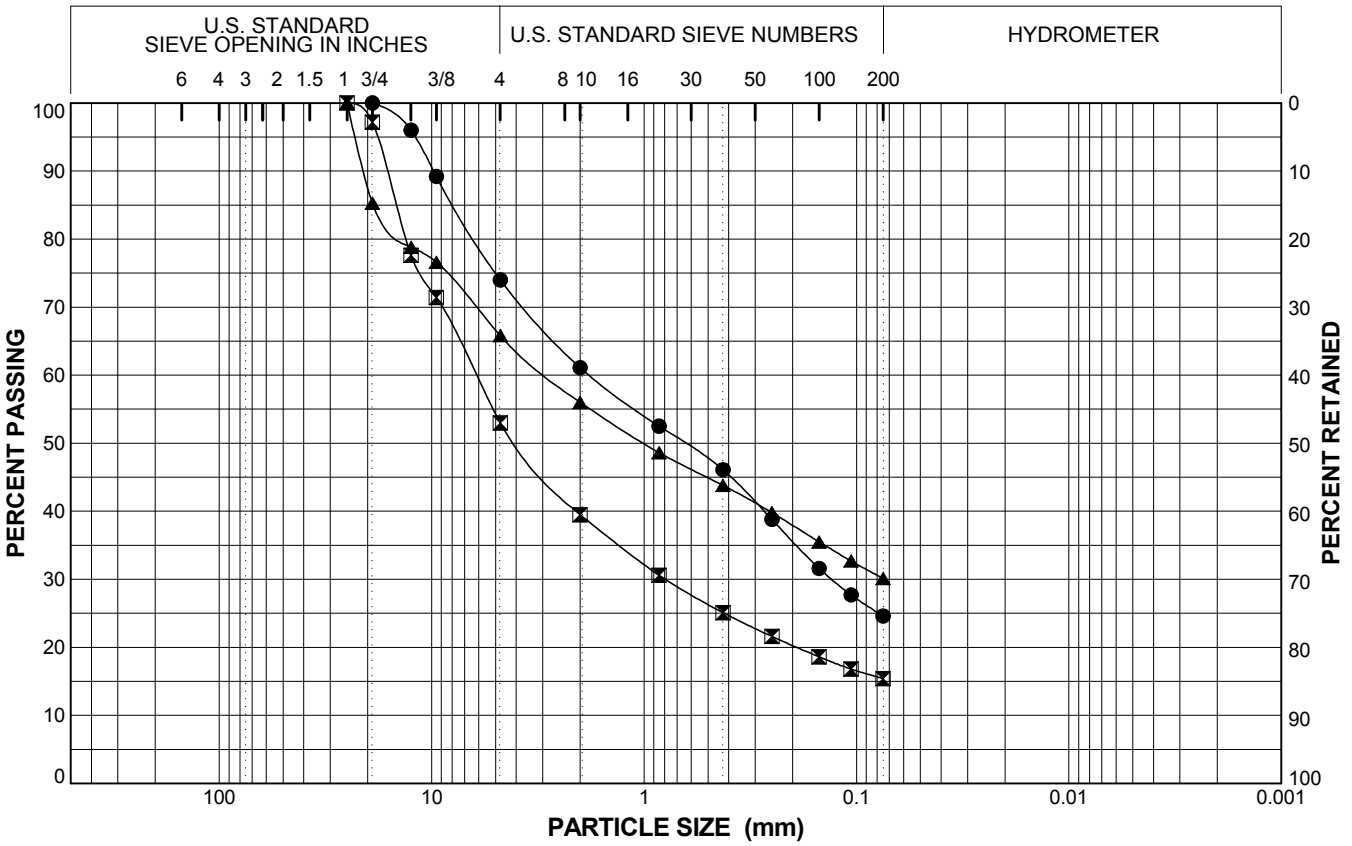
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-105S	Run 2	15	●	16	28	56	Sandy Lean Clay with Gravel (CL)
SC-105S	Run 3	24	⧓	31	54	15	Silty Sand with Gravel (SM)
SC-105S	Run 4	36	▲	48	32	21	Clayey Gravel with Sand (GC)
SC-105S	Run 5	44	★	33	39	27	Silty, Clayey Sand with Gravel (SC-SM)
SC-105S	Run 6	50	⊙	30	39	31	Clayey Sand with Gravel (SC)

PARTICLE SIZE DISTRIBUTION CURVES

SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



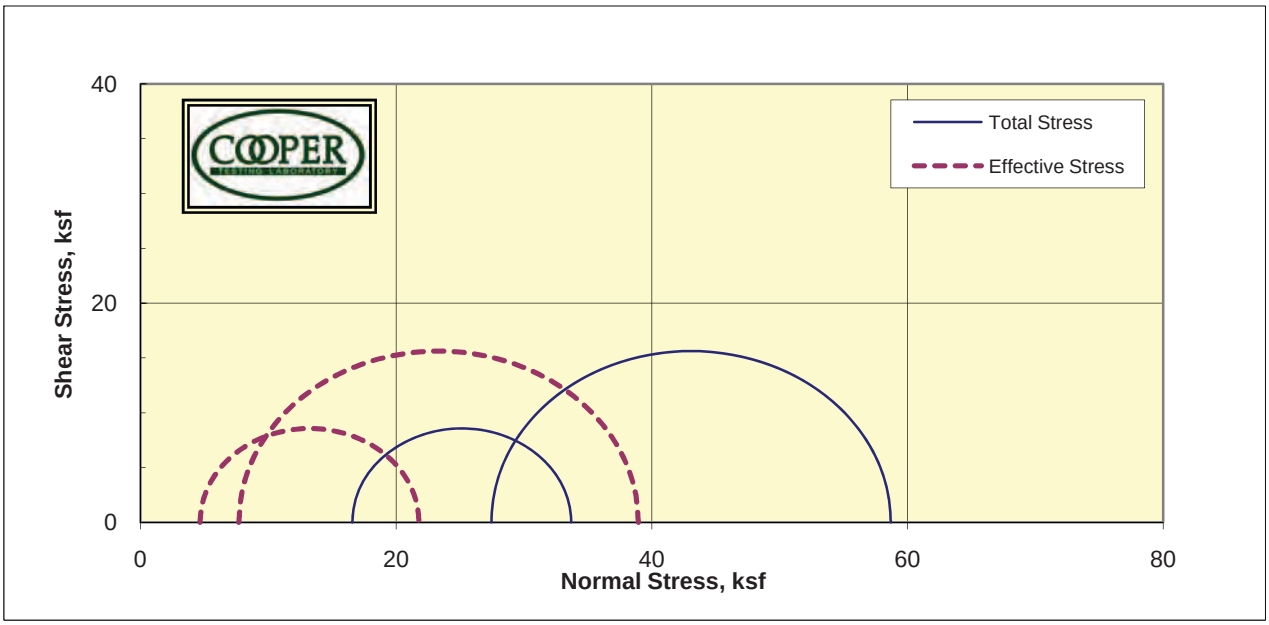
Boring Number	Sample Number	Depth (feet)	Symbol	%G	%S	%F	Classification
SC-105S	Run 8	58	●	26	49	25	Clayey Sand with Gravel (SC)
SC-105S	Run 9	62	⧓	47	38	15	Clayey Gravel with Sand (GC)
SC-105S	Run 9	66	▲	34	36	30	Clayey Sand with Gravel (SC) [Sandstone]

PARTICLE SIZE DISTRIBUTION CURVES

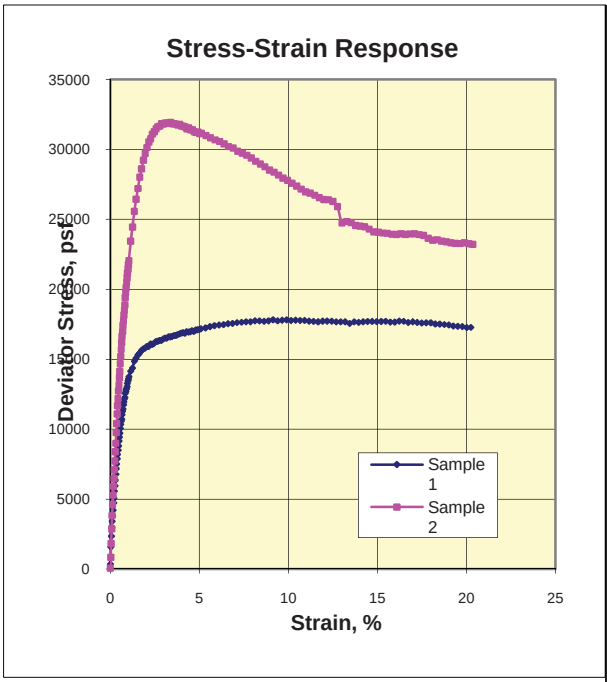
SCVWD Seismic Safety Evaluations (SSE2)
Stevens Creek Dam

Figure B-21

Triaxial Consolidated Undrained with Pore Pressure
ASTM D4767



Total : **Effective:** 41.2 Phi, (deg.) 0 C,(ksf)



Sample:	1	2	3	4
MC, %	11.2	11.2		
DD, pcf	120.6	118.1		
Sat. %	69.7	65.2		
Void Ratio	0.448	0.479		
Diameter in	3.95	3.95		
Height, in	8.00	8.00		
	Final			
MC, %	10.1	10.1		
DD, pcf	136.2	136.2		
Sat. %	100.0	100.0		
Void Ratio	0.283	0.283		
Diameter, in	3.74	3.71		
Height, in	7.91	7.86		
Cell, psi	188.1	261.0		
BP, psi	73.0	70.4		
	Effective Stresses At:			
Strain, %	5.0	5.0		
Deviator ksf	17.123	31.259		
Excess PP	11.903	19.750		
Sigma 1	21.787	38.951		
Sigma 3	4.664	7.692		
P, ksf	13.225	23.322		
Q, ksf	8.562	15.629		
Stress Ratio	4.671	5.064		
Rate in/min	0.0005	0.0005		

Job No.: 414-044 **Date:** 3/24/2011

Client: Engeo BY:DC

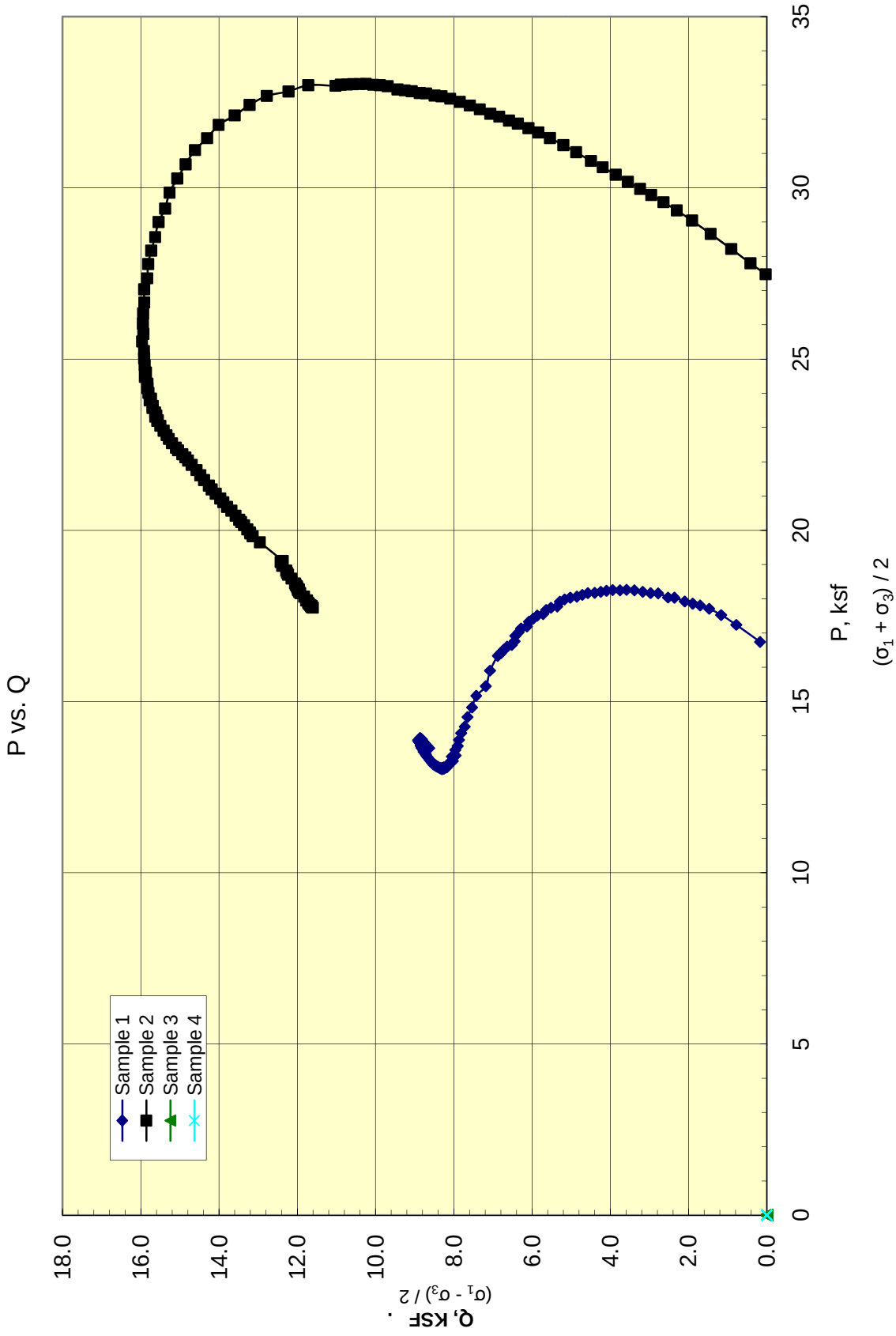
Project: 9144.000.000

Sample 1)	120.9 feet to 121.6 feet	Olive Brown Clayey GRAVEl w/ Sand
Sample 2)	121.6 feet to 122.3 feet	Olive Brown Clayey GRAVEl w/ Sand
Sample 3)		

CU Triaxial Tests with Pore Pressures
Boring SC-101MR
Sample PB-7 @ 120 to 122.5 feet

CU Triaxial Tests - Boring SC-101MR Sample PB-7 (120 to 122.5 feet)

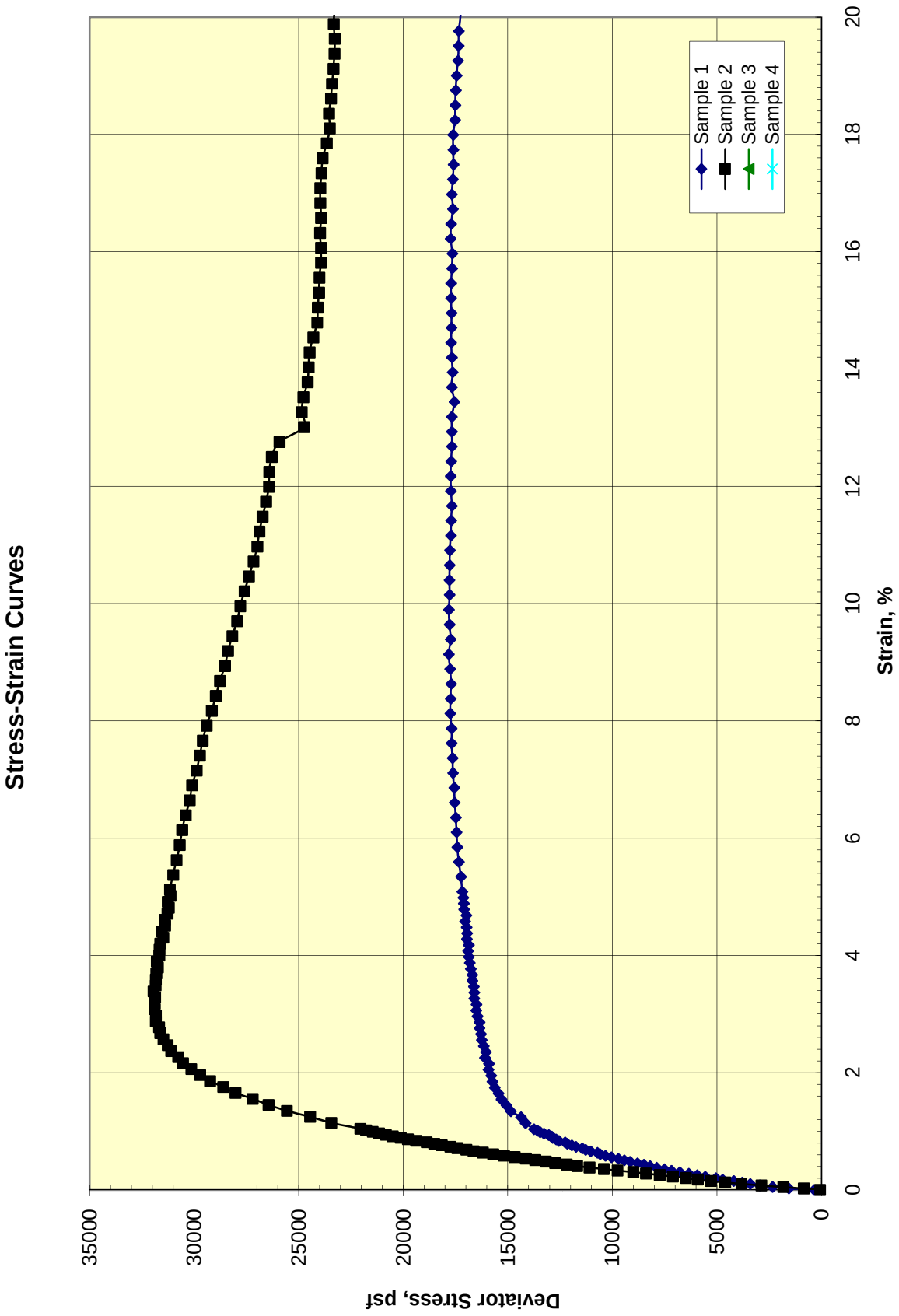
Summary Report



CU Triaxial Tests - Boring SC-101MR Sample PB-7 (120 to 122.5 feet)

Stress Path Plot

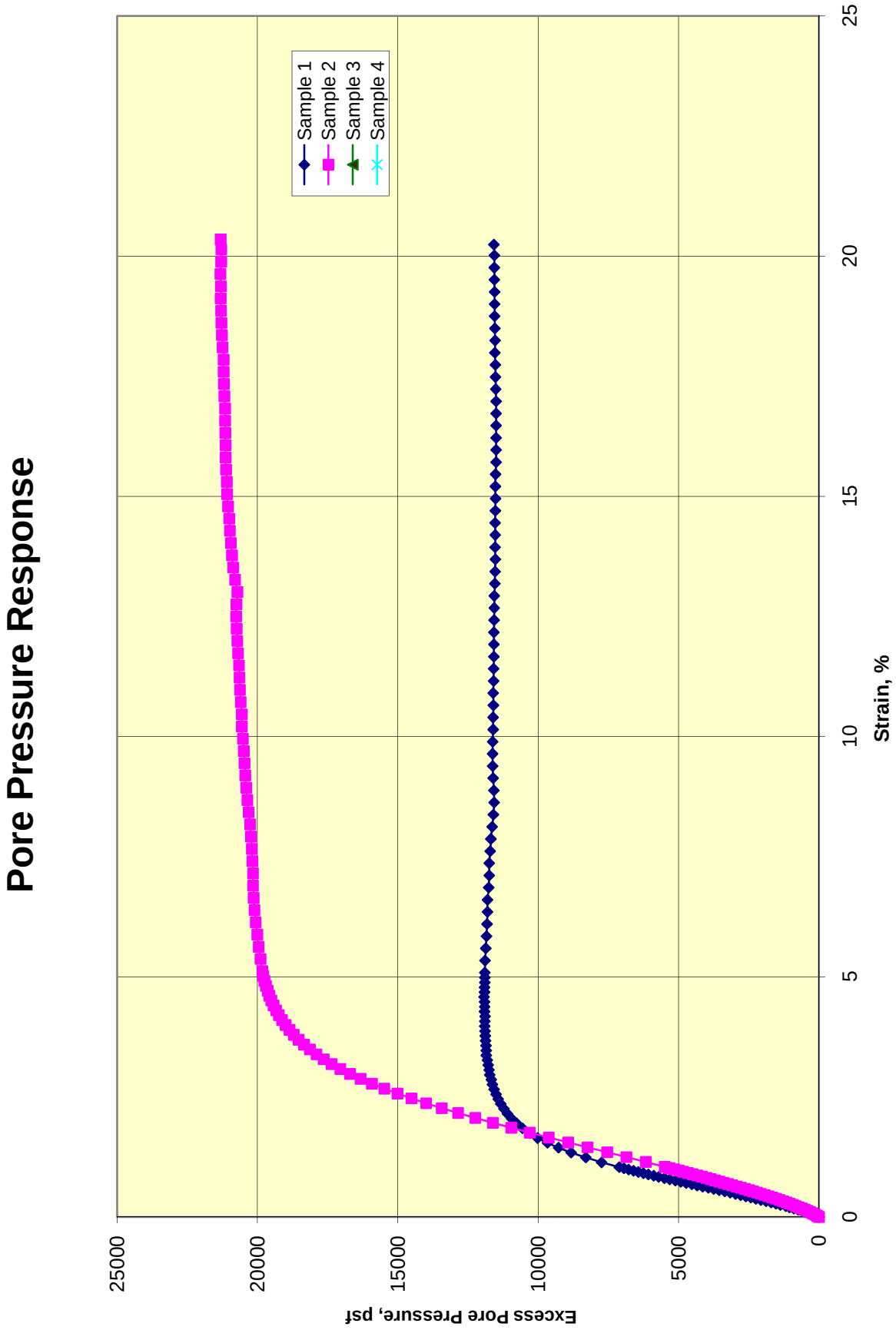
Figure B-22
Sheet 2 of 5



CU Triaxial Tests - Boring SC-101MR Sample PB-7 (120 to 122.5 feet)

Stress-Strain Plot

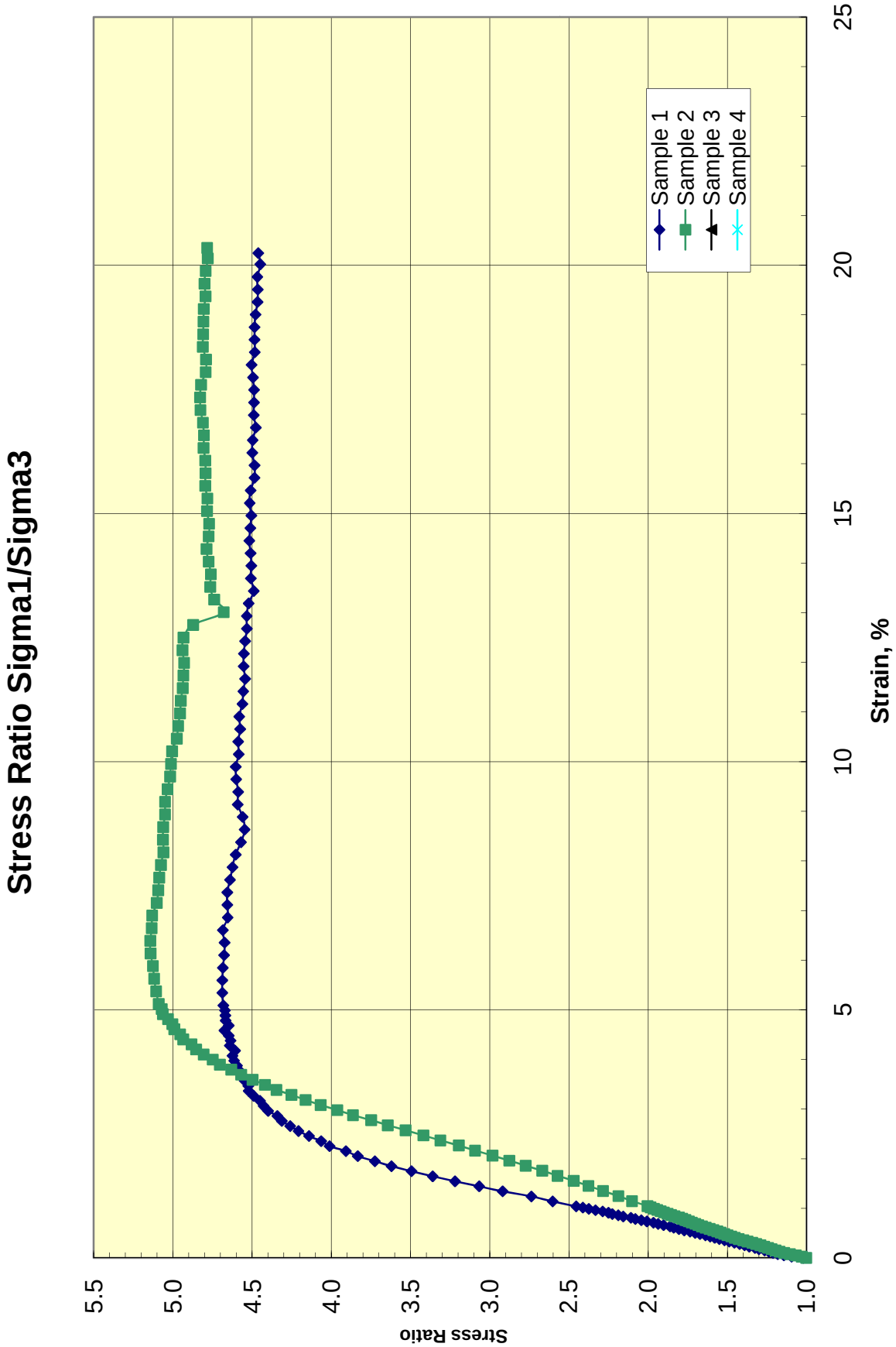
Figure B-22
Sheet 3 of 5



CU Triaxial Tests - Boring SC-101MR Sample PB-7 (120 to 122.5 feet)

Pore Pressure-Strain Plot

Figure B-22
Sheet 4 of 5

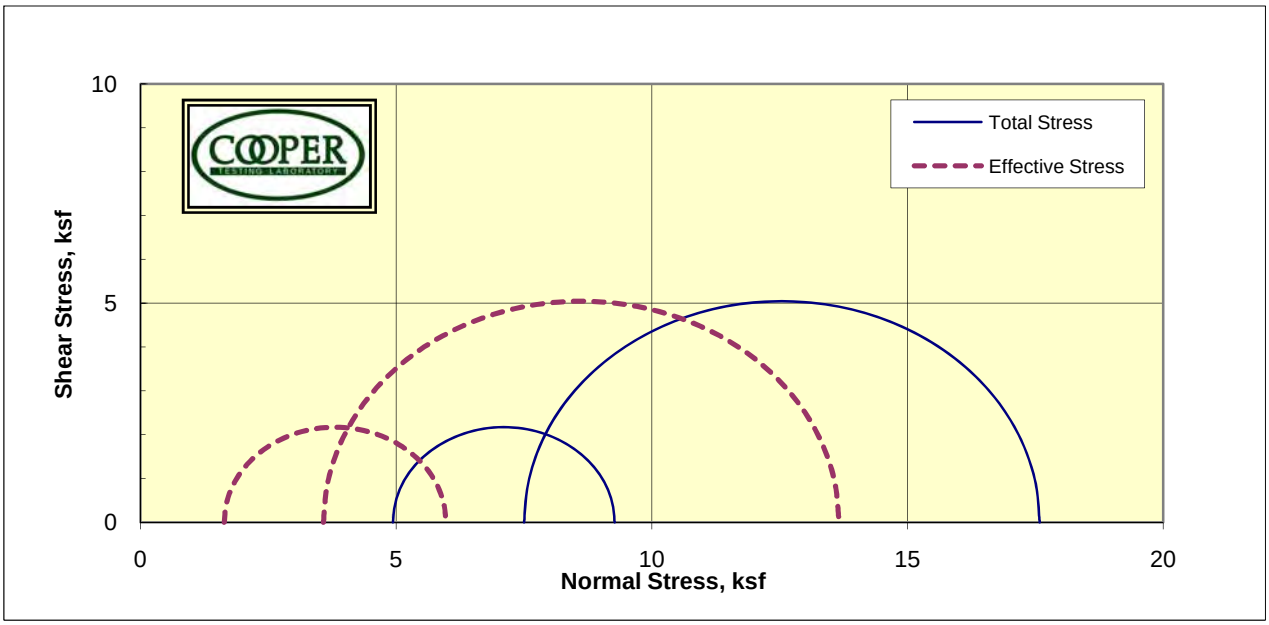


CU Triaxial Tests - Boring SC-101MR Sample PB-7 (120 to 122.5 feet)

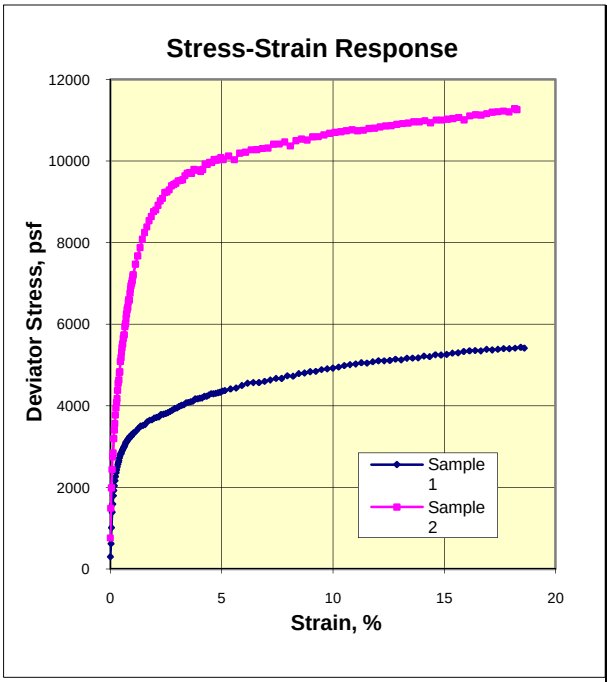
Stress Ratio-Strain Plot

Figure B-22
Sheet 5 of 5

Triaxial Consolidated Undrained with Pore Pressure
ASTM D4767



Total : **Effective:** 35.3 Phi, (deg.) 0 C,(ksf)



Sample:	1	2	3	4
MC, %	15.4	13.4		
DD, pcf	112.0	119.3		
Sat. %	82.4	87.9		
Void Ratio	0.505	0.412		
Diameter in	3.96	3.97		
Height, in	8.09	8.09		
	Final			
MC, %	13.8	12.6		
DD, pcf	122.7	125.7		
Sat. %	100.0	100.0		
Void Ratio	0.373	0.340		
Diameter, in	3.82	3.90		
Height, in	7.91	7.94		
Cell, psi	94.7	112.1		
BP, psi	60.4	60.0		
	Effective Stresses At:			
Strain, %	5.0	5.0		
Deviator ksf	4.337	10.085		
Excess PP	3.299	3.924		
Sigma 1	5.975	13.665		
Sigma 3	1.638	3.580		
P, ksf	3.807	8.622		
Q, ksf	2.169	5.042		
Stress Ratio	3.648	3.817		
Rate in/min	0.0005	0.0005		

Job No.: 414-044 **Date:** 3/31/2011

Client: Engeo BY:DC

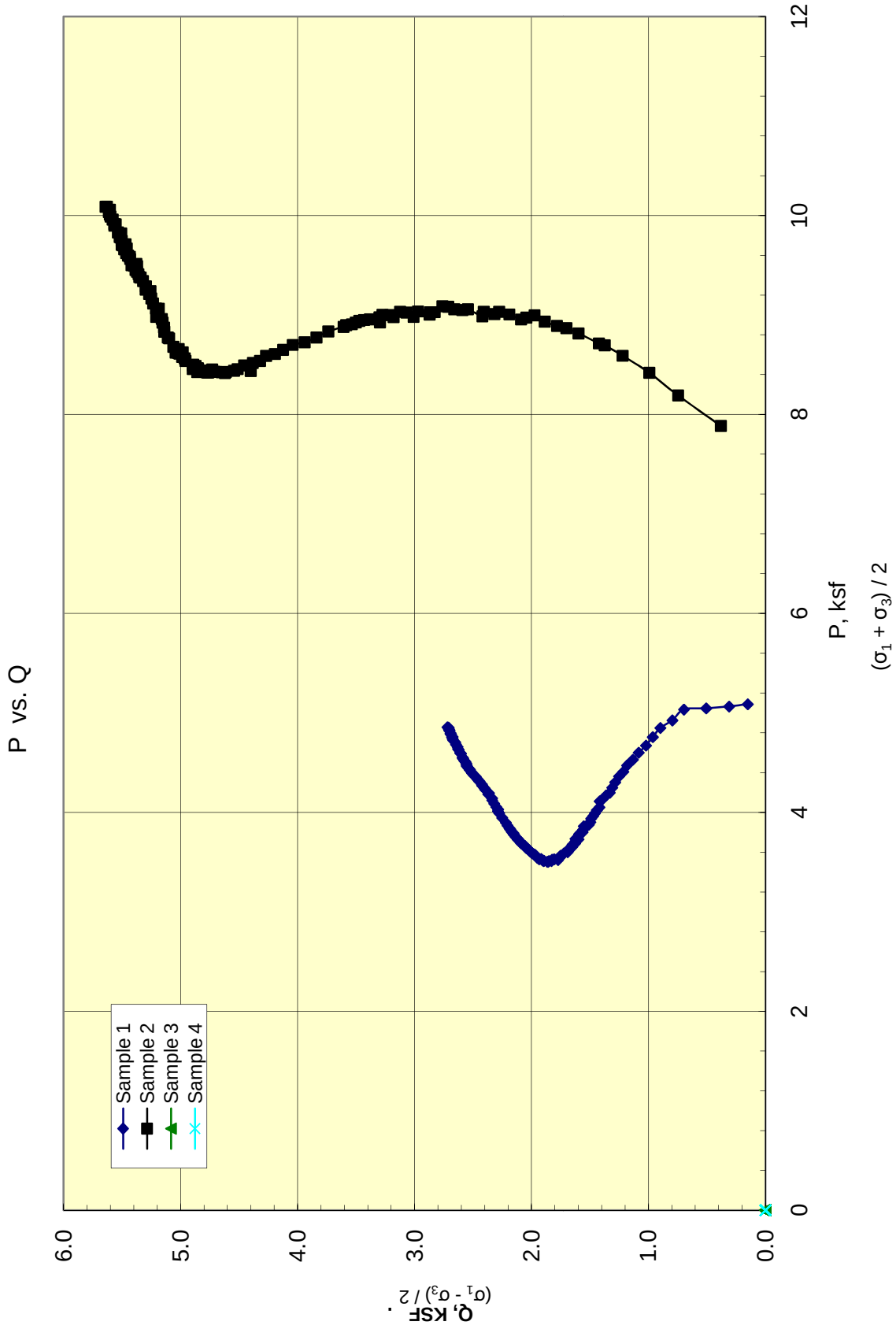
Project: 9144-000-000

Sample 1)	36.7 to 37.4	Olive Brown Clayey GRAVEL w/ Sand
Sample 2)	37.4 to 38.1	Olive Brown Clayey GRAVEL w/ Sand
Sample 3)		

CU Triaxial Tests with Pore Pressures
Boring SC-105MR
Sample PB-2 @ 36 to 38.3 feet

CU Triaxial Tests - Boring SC-105MR Sample PB-2 (36 to 38.5 feet)

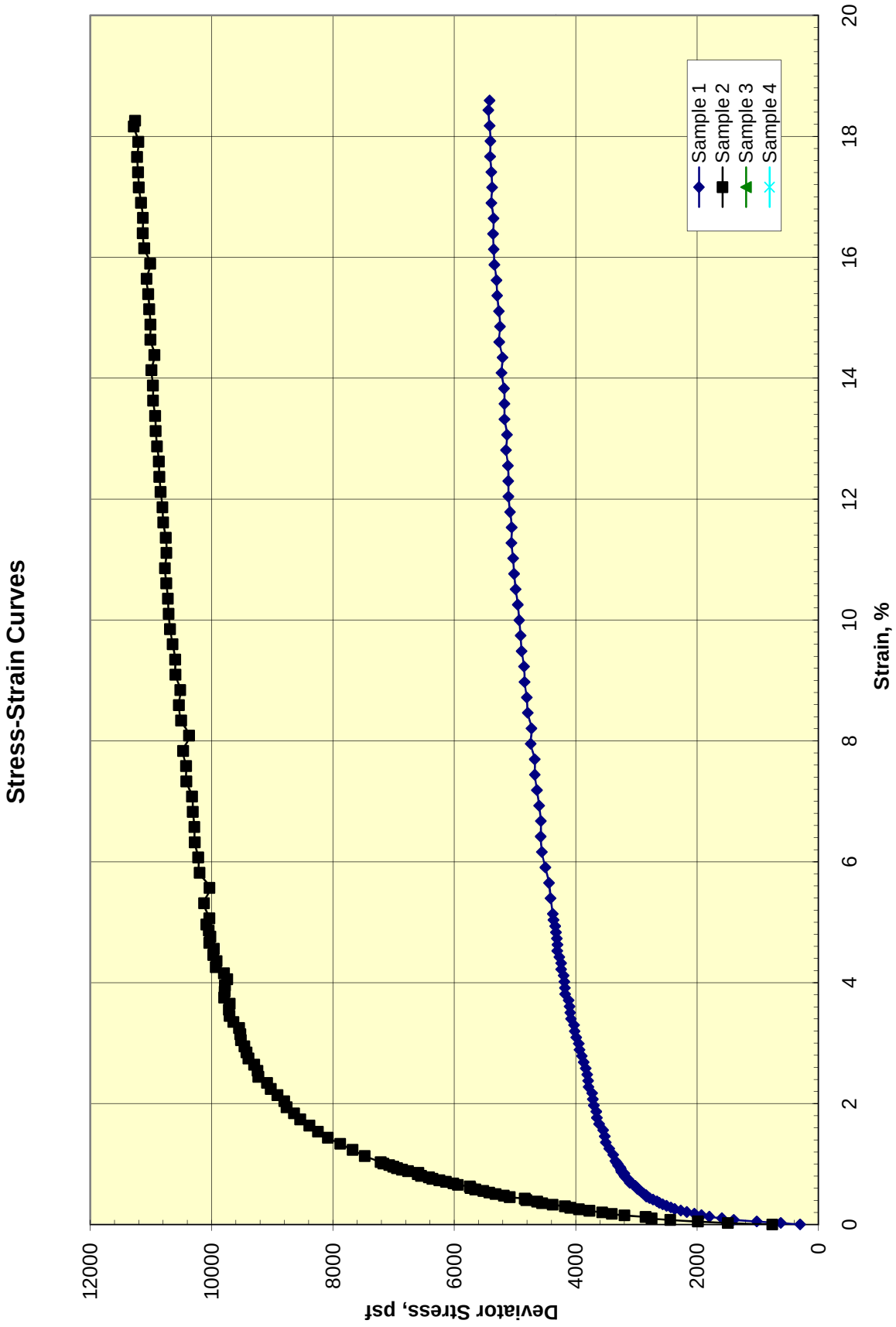
Summary Report



CU Triaxial Tests - Boring SC-105MR Sample PB-2 (36 to 38.5 feet)

Stress Path Plot

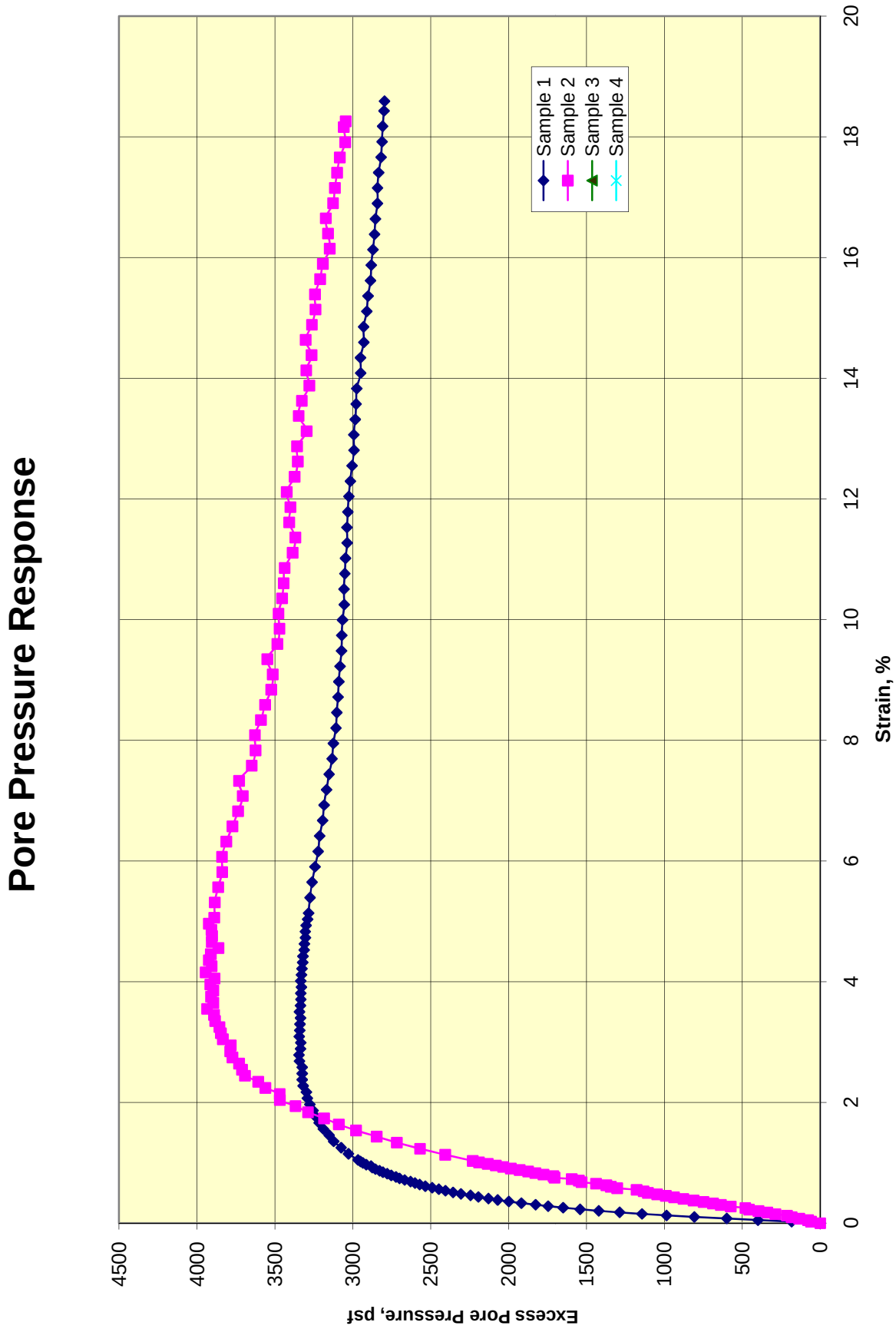
Figure B-23
Sheet 2 of 5



CU Triaxial Tests - Boring SC-105MR Sample PB-2 (36 to 38.5 feet)

Stress-Strain Plot

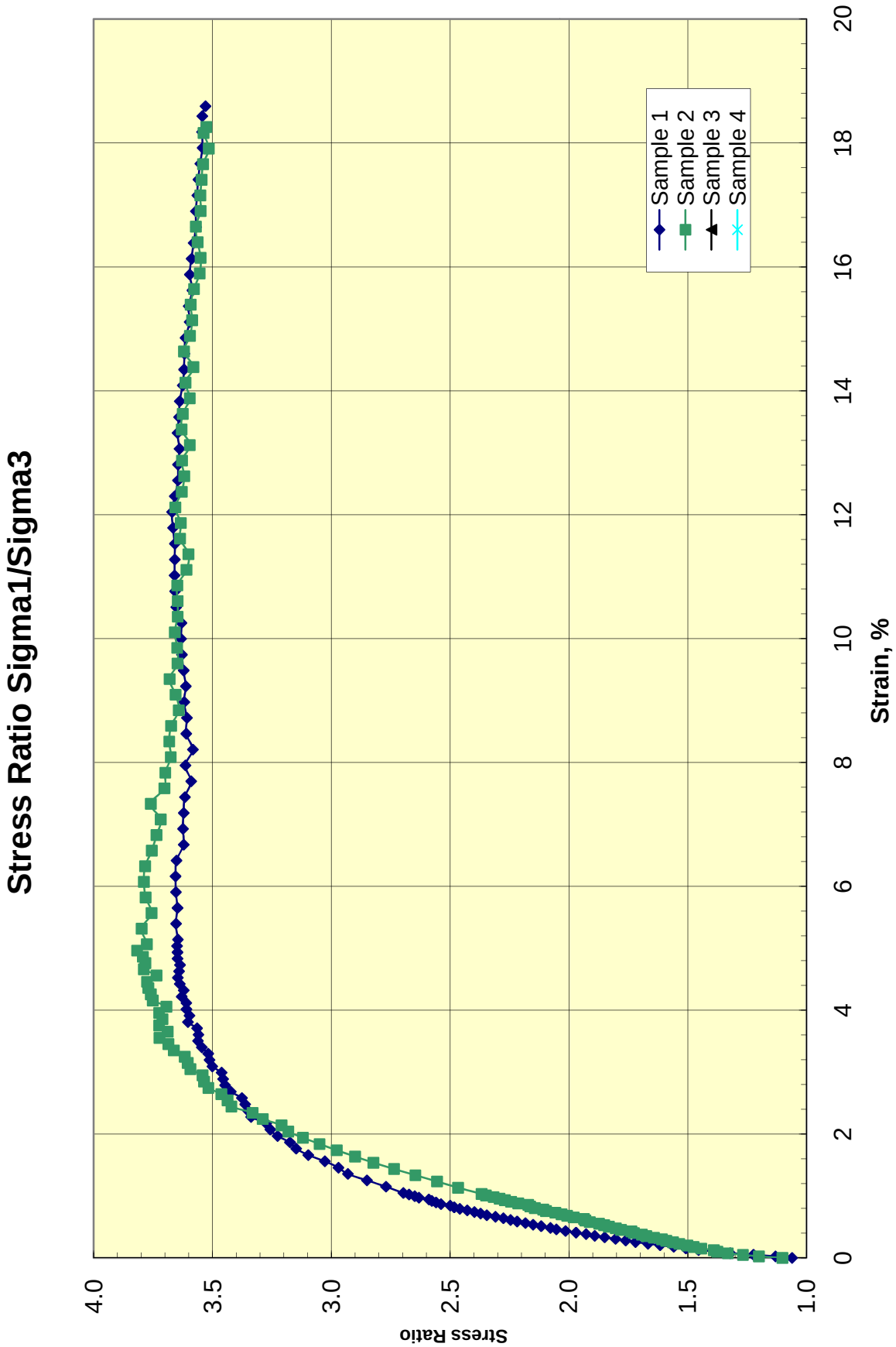
Figure B-23
Sheet 3 of 5



CU Triaxial Tests - Boring SC-105MR Sample PB-2 (36 to 38.5 feet)

Pore Pressure- Strain Plot

Figure B-23
Sheet 4 of 5

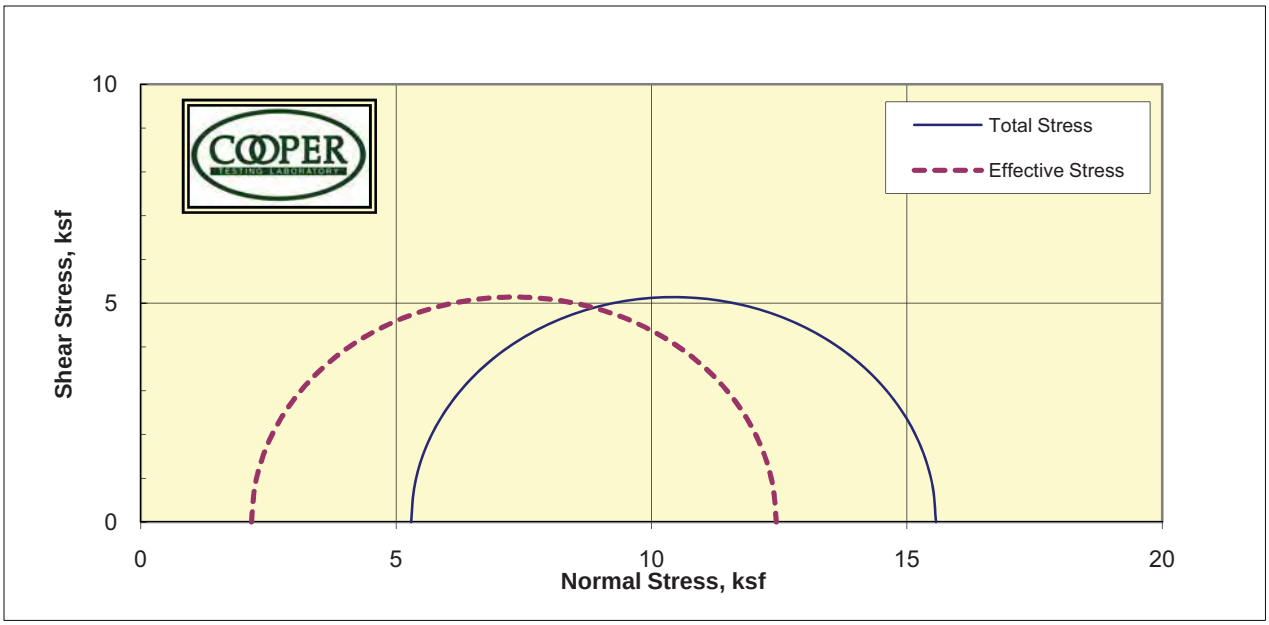


CU Triaxial Tests - Boring SC-105MR Sample PB-2 (36 to 38.5 feet)

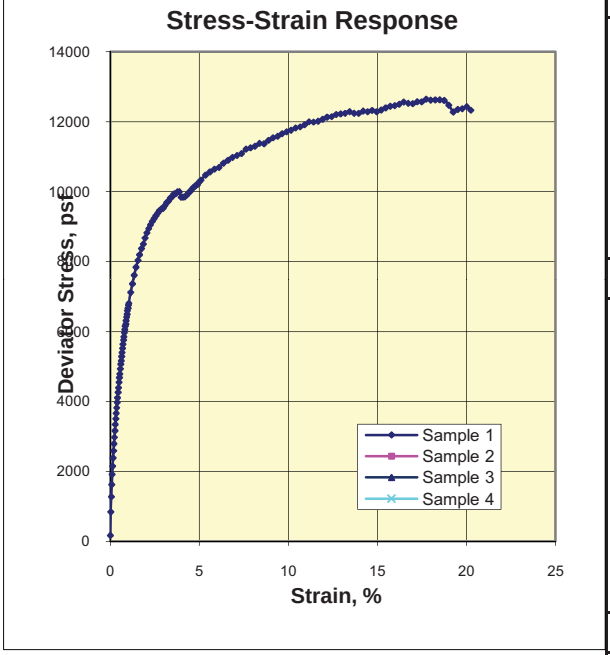
Stress Ratio-Strain Plot

Figure B-23
Sheet 5 of 5

Triaxial Consolidated Undrained with Pore Pressure
ASTM D4767



Total : **Effective:** 44.7 Phi, (deg.) 0 C,(ksf)



Sample:	1	2	3	4
MC, %	13.7			
DD, pcf	122.3			
Sat. %	92.1			
Void Ratio	0.413			
Diameter in	3.96			
Height, in	8.00			
	Final			
MC, %	10.2			
DD, pcf	134.8			
Sat. %	100.0			
Void Ratio	0.283			
Diameter, in	3.79			
Height, in	7.90			
Cell, psi	124.7			
BP, psi	87.9			
	Effective Stresses At:			
Strain, %	5.0			
Deviator ksf	10.277			
Excess PP	3.125			
Sigma 1	12.444			
Sigma 3	2.167			
P, ksf	7.306			
Q, ksf	5.139			
Stress Ratio	5.742			
Rate in/min	0.0005			

Job No.: 414-046 **Date:** 4/18/2011
Client: Engeo BY:DC
Project: 9144.000.000

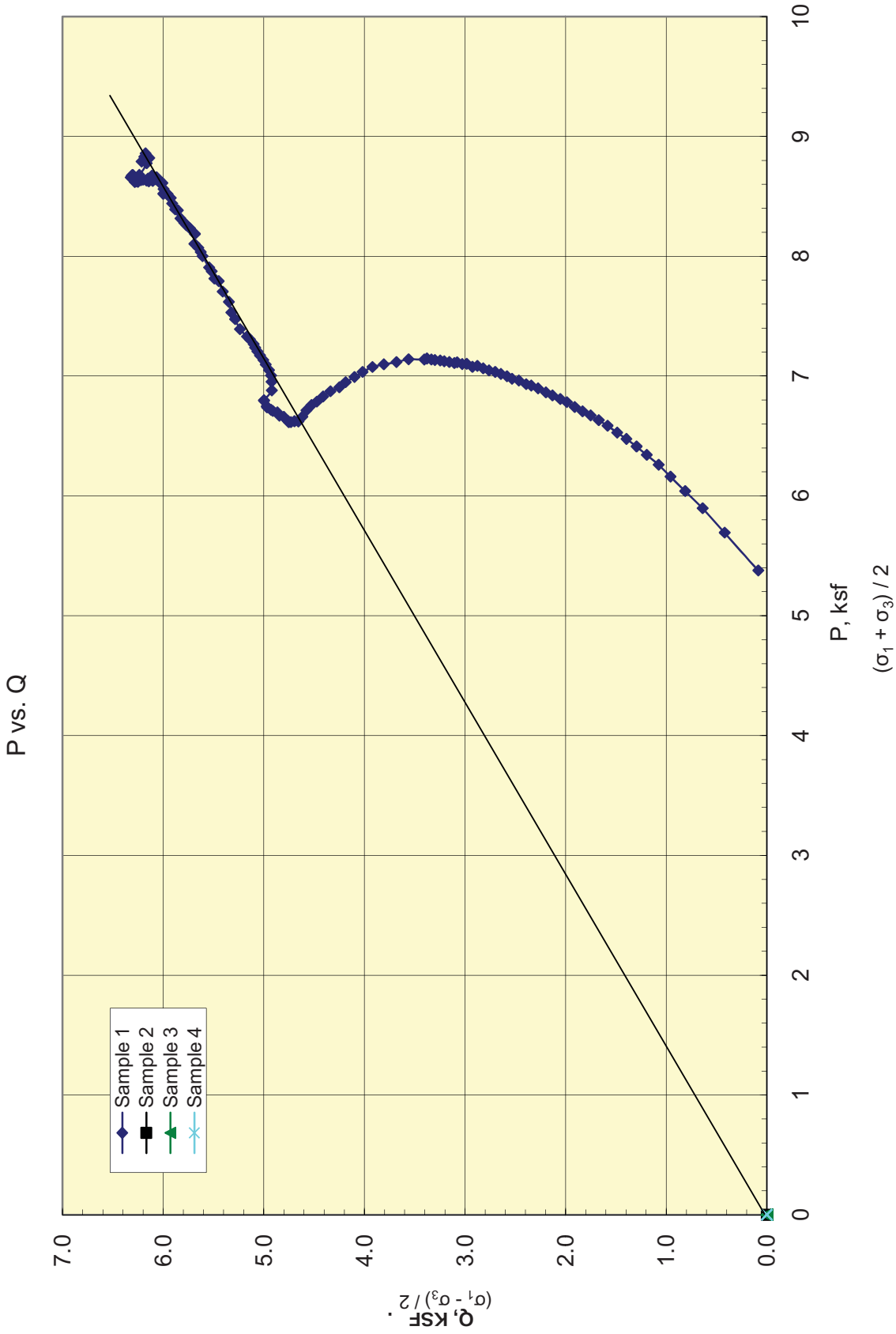
Sample 1)	25 to 27 feet	Brown Clayey GRAVEL w/ Sand
Sample 2)		
Sample 3)		

CU Triaxial Tests with Pore Pressures
Boring SC-105MR
Sample PB-1 @ 25 to 27

CU Triaxial Tests - Boring SC-105MR Sample PB-1 (25 to 27 feet)

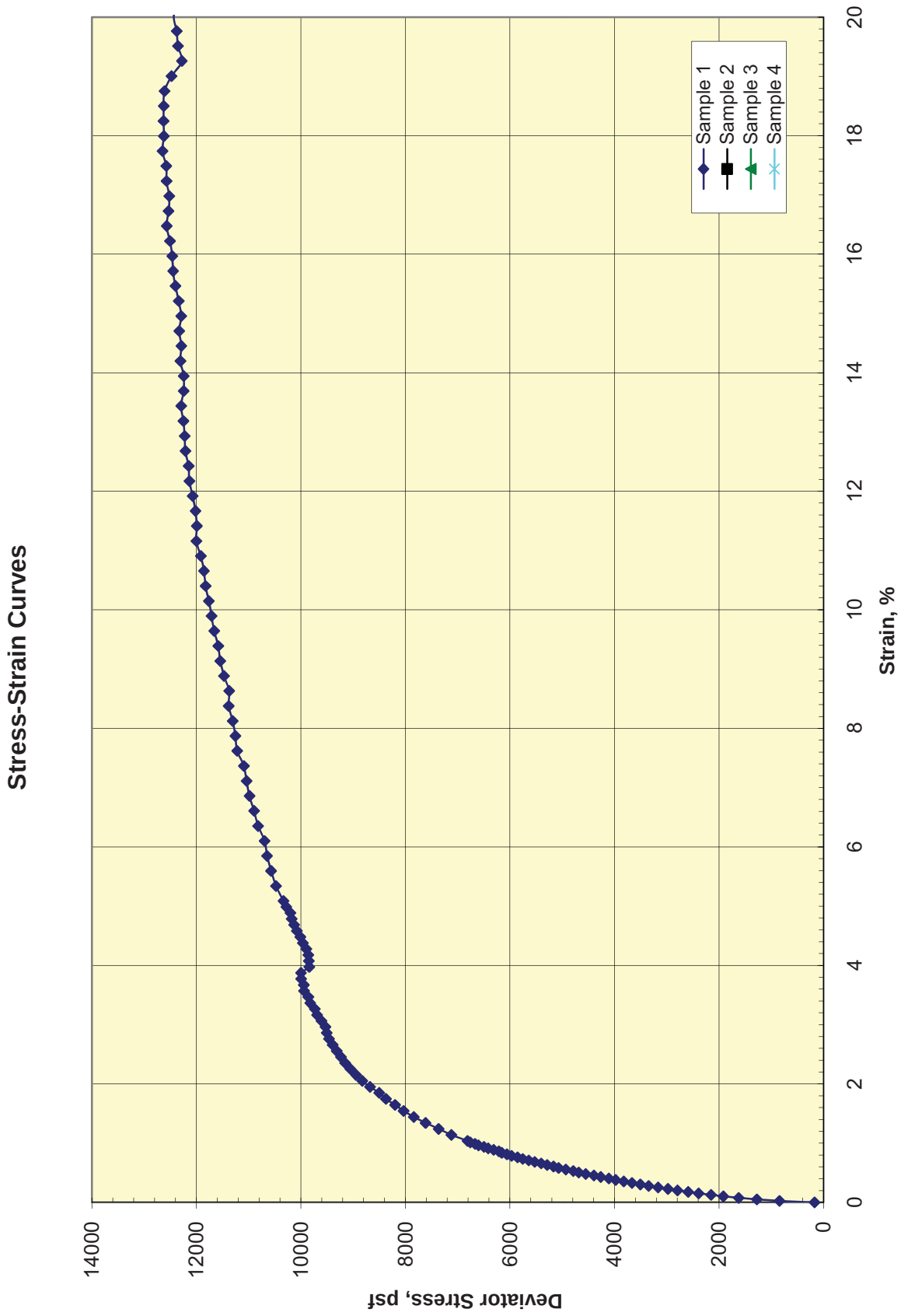
Summary Report

Figure B-24
Sheet 1of 5



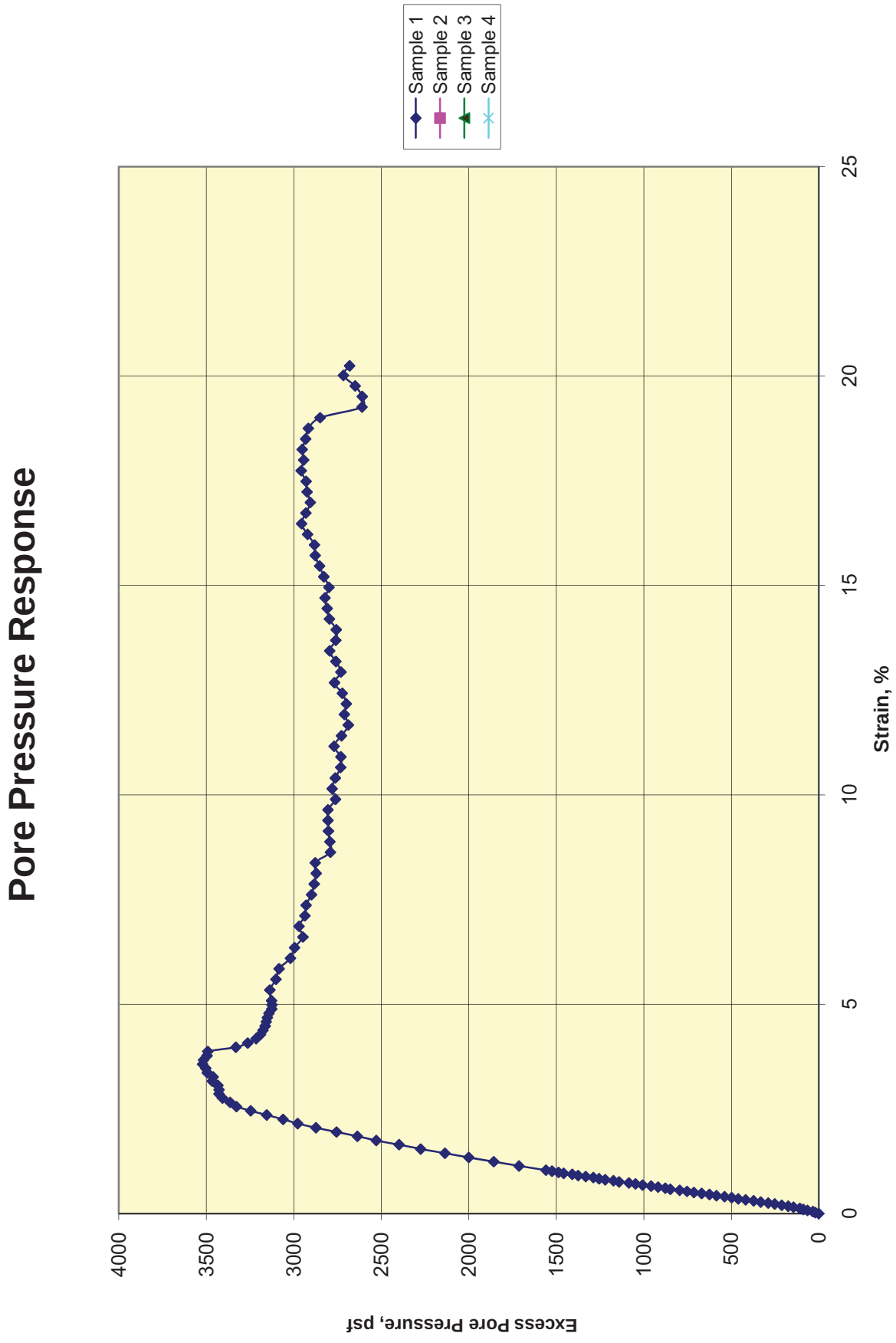
CU Triaxial Tests - Boring SC-105MR Sample PB-1 (25 to 27 feet)
Stress Path Plot

Figure B-24
Sheet 2 of 5



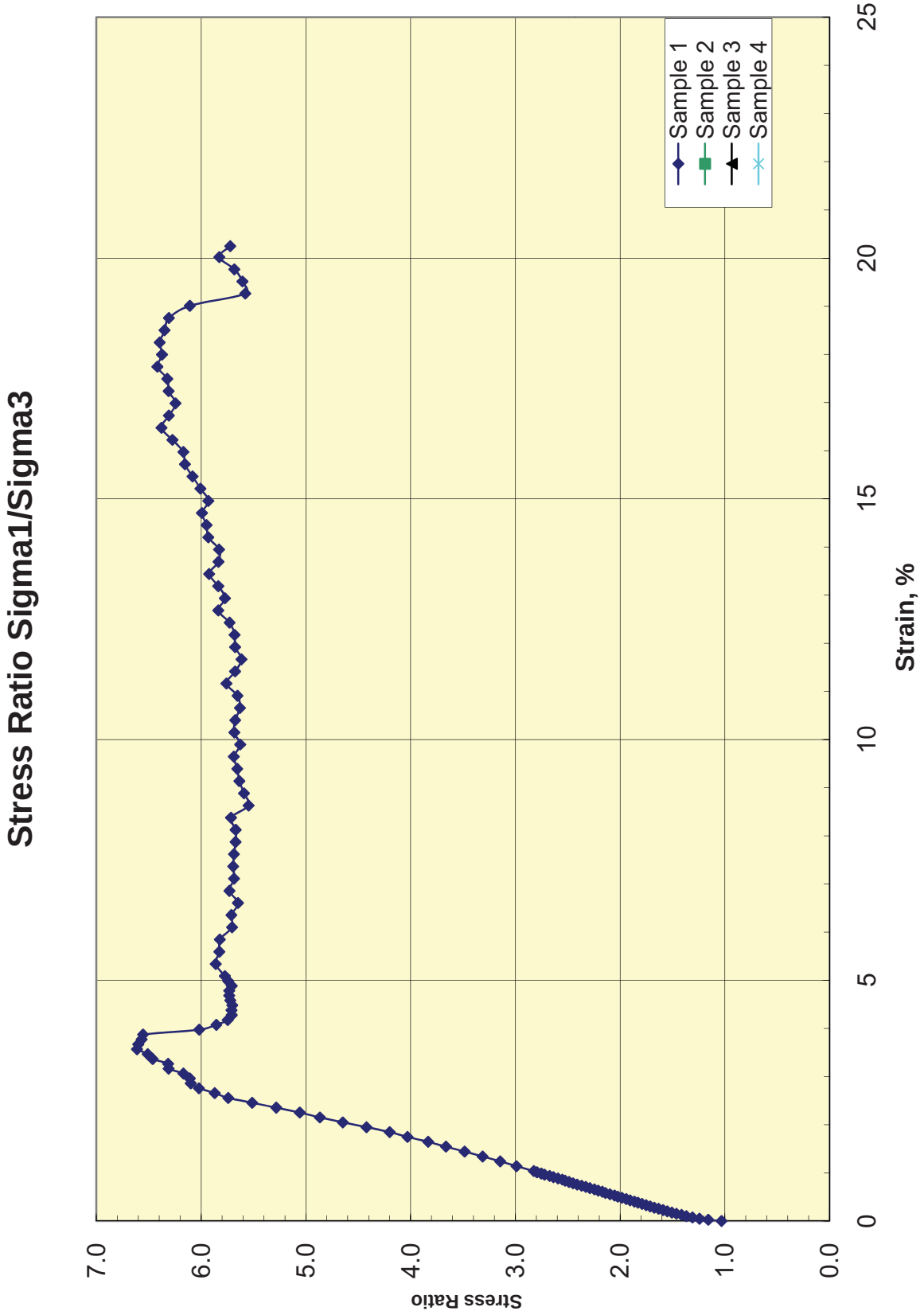
CU Triaxial Tests - Boring SC-105MR Sample PB-1 (25 to 27 feet)
Stress-Strain Plot

Figure B-24
Sheet 3 of 5



CU Triaxial Tests - Boring SC-105MR Sample PB-1 (25 to 27 feet)
Pore Pressure- Strain Plot

Figure B-24
Sheet 4 of 5



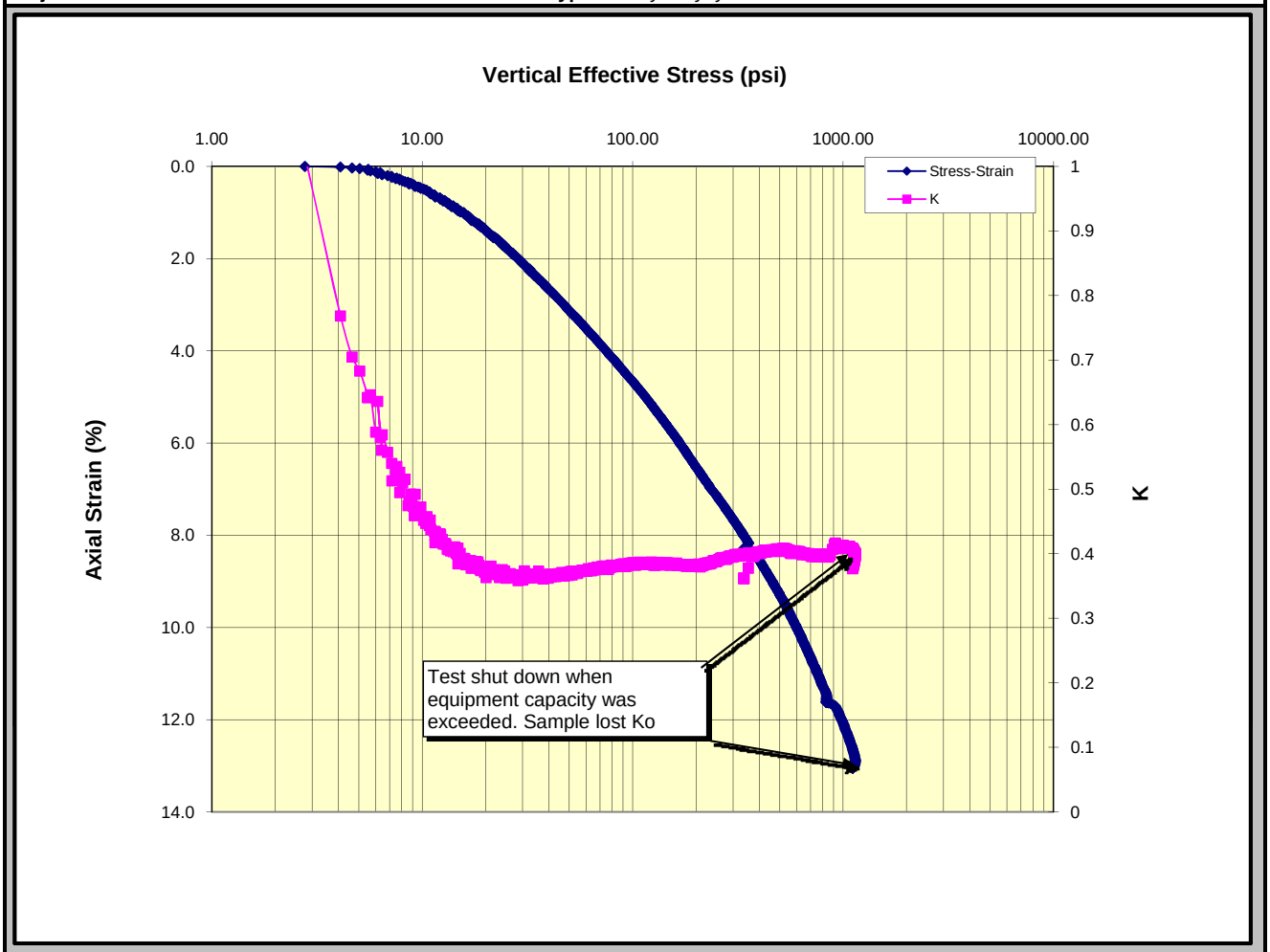
CU Triaxial Tests - Boring SC-105MR Sample PB-1 (25 to 27 feet)
Stress Ratio-Strain Plot

Figure B-24
Sheet 5 of 5

Cooper Testing Labs, Inc.
937 Commercial Street
Palo Alto, CA 94303

K_0 Consolidation Test Report

Job No:	414-044	**Boring**	SC-101	**Date:**	3/29/2011
Client:	Engeo	**Sample**	PB-7	**Tested By:**	MD/DC
Project No:	9144.000.000	**Depth**	120-122.5	**Checked By:**	PJ
Project Name:	Stevens Creek Dam	**Soil Type:**	Gray Clayey GRAVEL with Sand		



Sp. Grav., Ass.	**2.7**	**Initial**	**Final**	**Sample Type:**		Remolded
Moisture Content, %		11.3	7.8	**Remolding Target:**		Remarks: System shut down when the maximum cell transducer value was exceeded. Sample failed and test was discontinued. No rebound is reported.
Dry Density, pcf		121.5	143.7			
Void Ratio		0.439	0.217			
Porosity		30.5	0.2	**Sample Dimensions**		
Degree of Saturation, %		72.0	100	**Initial**	**Final**	
B-Parameter (indication of Sat.		0.98	**Height**	8	6.765489	
Initial Back Pressure: psi		51.31	**Diameter**	3.95	3.95	

Ko Consolidation Test - Boring SC-101MR Sample PB-7 (120 to 122.5 feet)

Figure B-25

APPENDIX C

CONTENTS

Enclosure 1

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

January 25, 2011

Terra Engineers
Attn: Robert Kirby

Subject: CPT Site Investigation
Stevens Creek Dam
Santa Clara, California
GREGG Project Number: 11-012MA

Dear Mr. Kirby:

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

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

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

Sincerely,
GREGG Drilling & Testing, Inc.

Mary Walden
Operations Manager

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (Feet)	Depth of Groundwater Samples (Feet)	Depth of Soil Samples (Feet)	Depth of Pore Pressure Dissipation Tests (Feet)
SC-1-CPT	1/24/11	140	-	-	136.6
SC-2-CPT	1/24/11	63	-	-	57.1, 63.3
SC-3-CPT	1/24/11	29	-	-	27.9

Bibliography

Lunne, T., Robertson, P.K. and Powell, J.J.M., "Cone Penetration Testing in Geotechnical Practice" E & FN Spon. ISBN 0 419 23750, 1997

Roberston, P.K., "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, Vol. 27, 1990 pp. 151-158.

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

Robertson, P.K., R.G. Campanella, D. Gillespie and A. Rice, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8, 1986 pp. 791-803.

Robertson, P.K., Sully, J., Woeller, D.J., Lunne, T., Powell, J.J.M., and Gillespie, D.J., "Guidelines for Estimating Consolidation Parameters in Soils from Piezocone Tests", Canadian Geotechnical Journal, Vol. 29, No. 4, August 1992, pp. 539-550.

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Campanella, R.G. and I. Weemees, "Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies", Canadian Geotechnical Journal, Vol. 27 No. 5, 1990 pp. 557-567.

DeGroot, D.J. and A.J. Lutenegger, "Reliability of Soil Gas Sampling and Characterization Techniques", International Site Characterization Conference - Atlanta, 1998.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, "Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT", 53rd Canadian Geotechnical Conference Montreal, QC October pp. 733-739, 2000.

Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

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

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*. The soundings were conducted using a 20 ton capacity cone with a tip area of 15 cm^2 and a friction sleeve area of 225 cm^2. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80.

The cone takes measurements of cone bearing (q_c), sleeve friction (f_s) and penetration pore water pressure (u_2) at 5-cm intervals during penetration to provide a nearly continuous hydrogeologic log. CPT data reduction and interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored on disk for further analysis and reference. All CPT soundings are performed in accordance with revised (2002) ASTM standards (D 5778-95).

The cone also contains a porous filter element located directly behind the cone tip (u_2), *Figure CPT.* It consists of porous plastic and is 5.0mm thick. The filter element is used to obtain penetration pore pressure as the cone is advanced as well as Pore Pressure Dissipation Tests (PPDT's) during appropriate pauses in penetration. It should be noted that prior to penetration, the element is fully saturated with silicon oil under vacuum pressure to ensure accurate and fast dissipation.

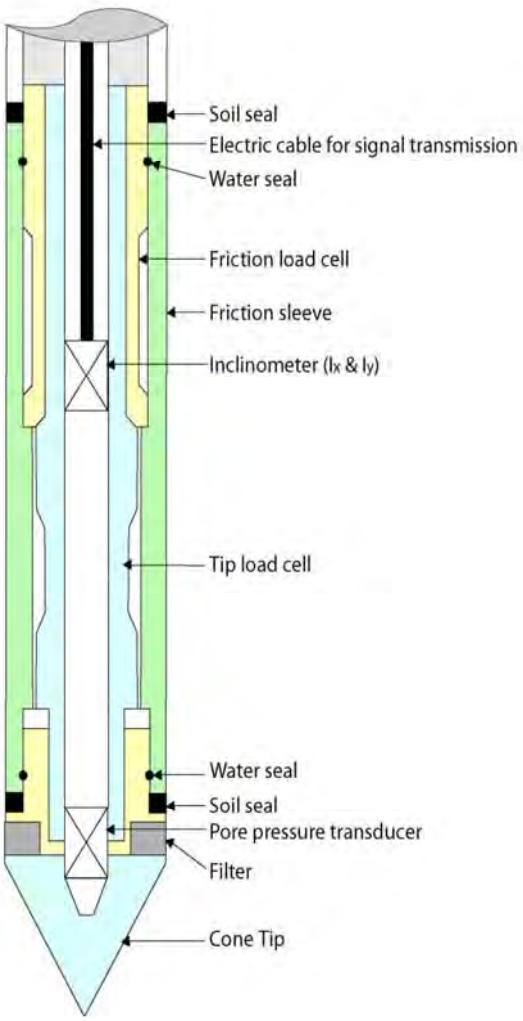


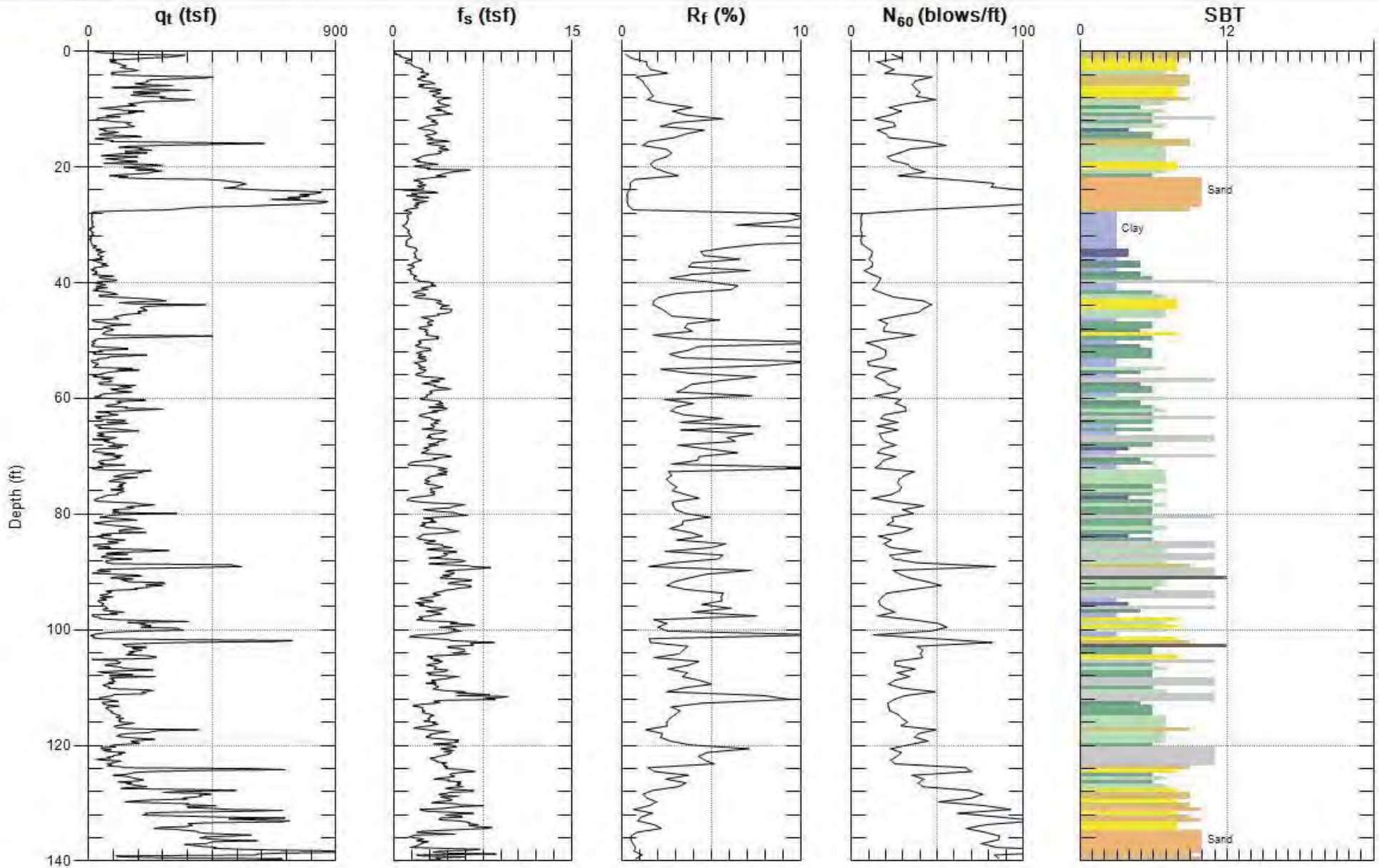
Figure CPT

When the soundings are complete, the test holes are grouted using a Gregg support rig. The grouting procedures generally consist of pushing a hollow CPT rod with a "knock out" plug to the termination depth of the test hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

TERRA ENGINEERS

Site: STEVENS CREEK DAM Engineer: R.KIRBY

Sounding: SC-1-CPT Date: 1/24/2011 09:01



Max. Depth: 140.092 (ft)

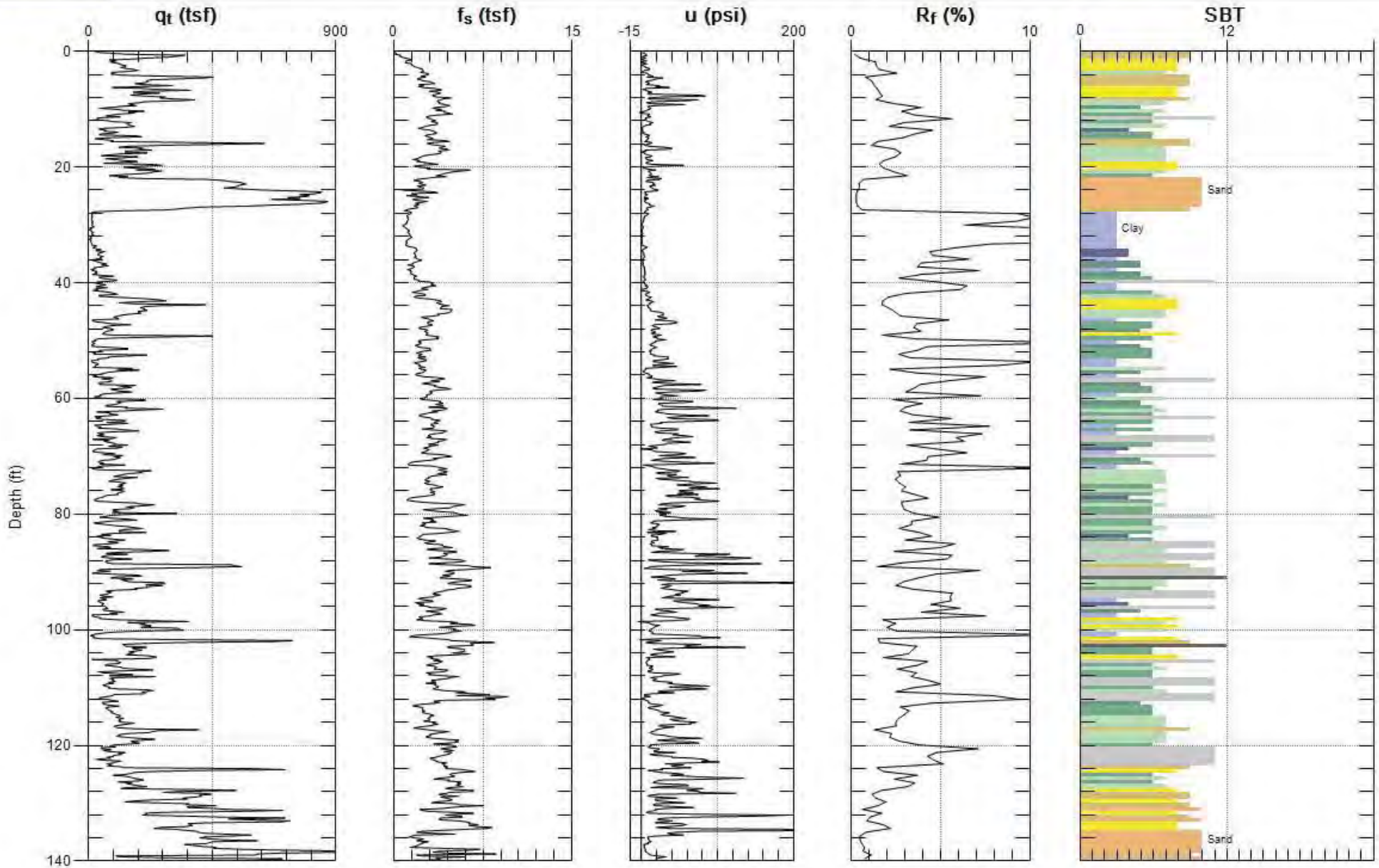
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK DAM Engineer: R.KIRBY

Sounding: SC-1-CPT Date: 1/24/2011 09:01



Max. Depth: 140.092 (ft)

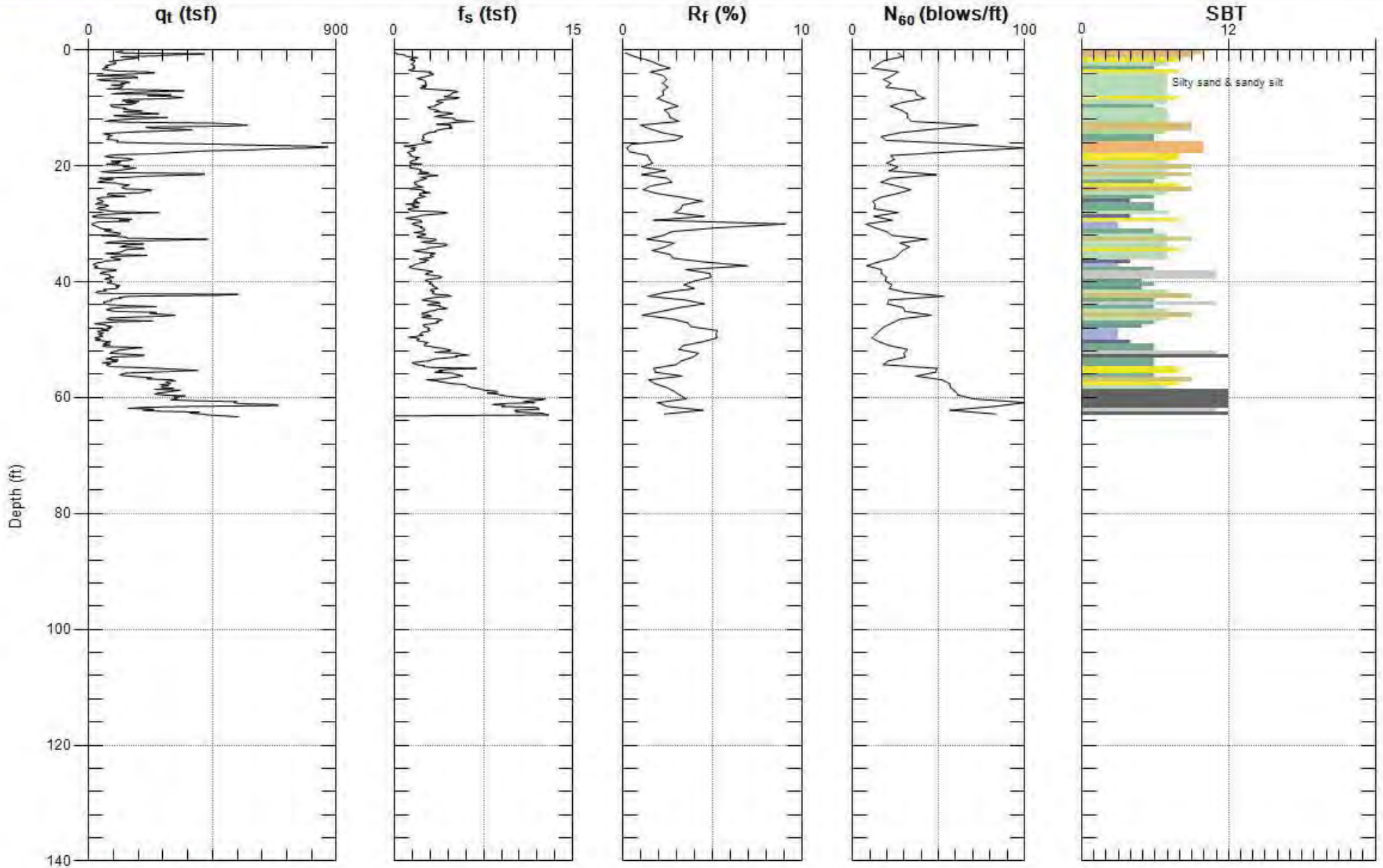
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK DAM Engineer: R.KIRBY

Sounding: SC-2-CPT Date: 1/24/2011 12:00



Max. Depth: 63.320 (ft)

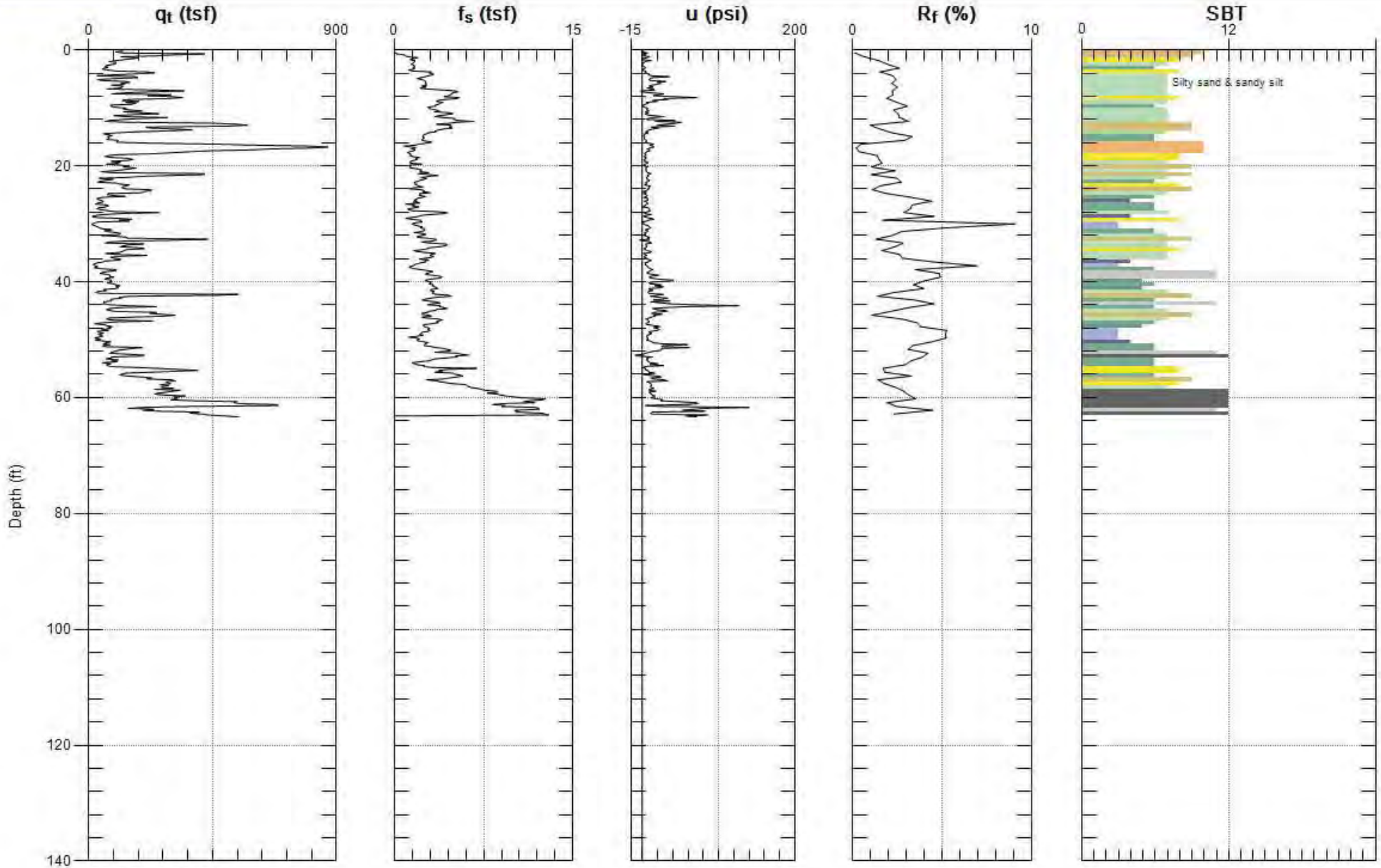
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK DAM Engineer: R.KIRBY

Sounding: SC-2-CPT Date: 1/24/2011 12:00



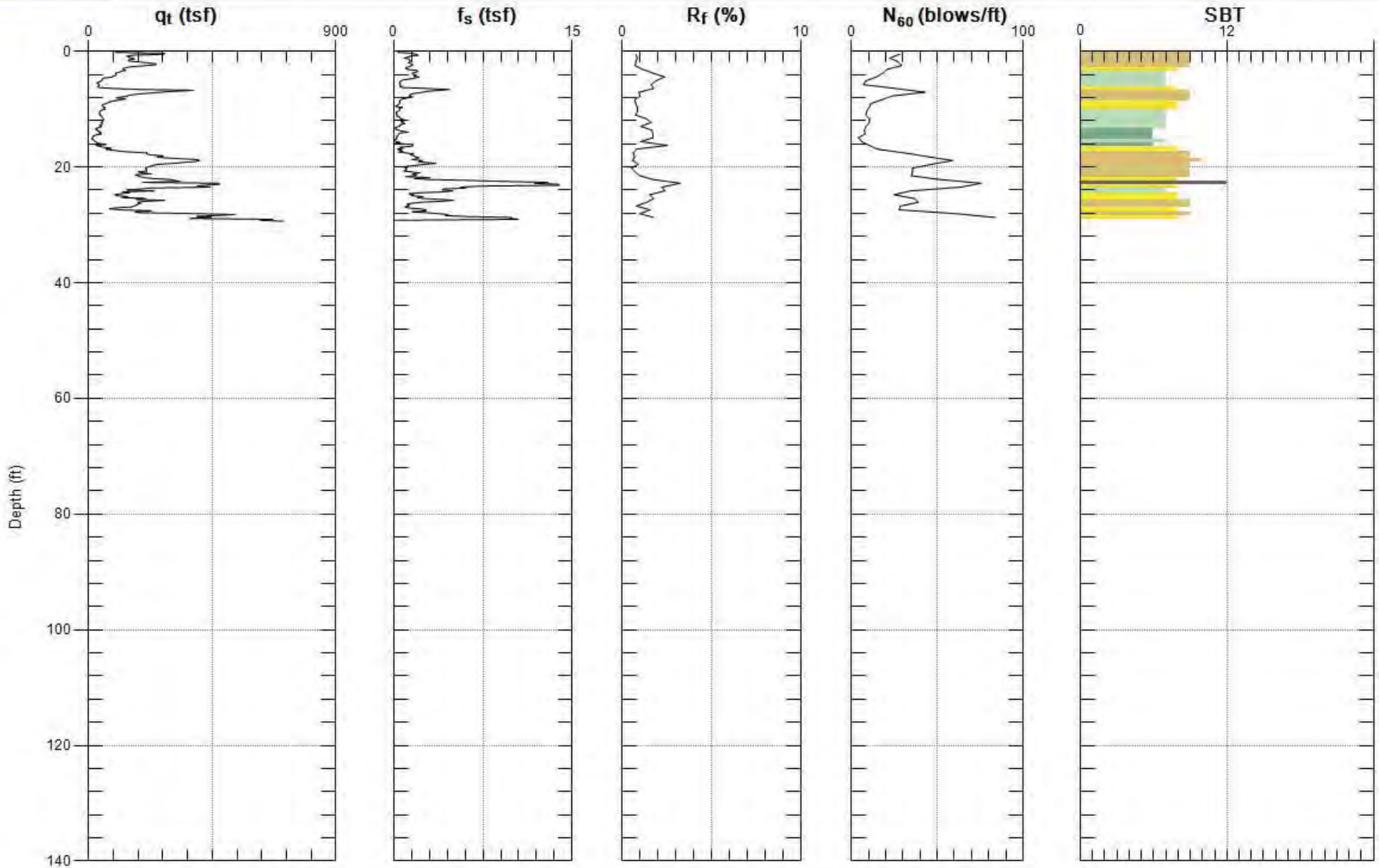
Max. Depth: 63.320 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK DAM Engineer: R.KIRBY

Sounding: SC-3-CPT Date: 1/24/2011 02:05



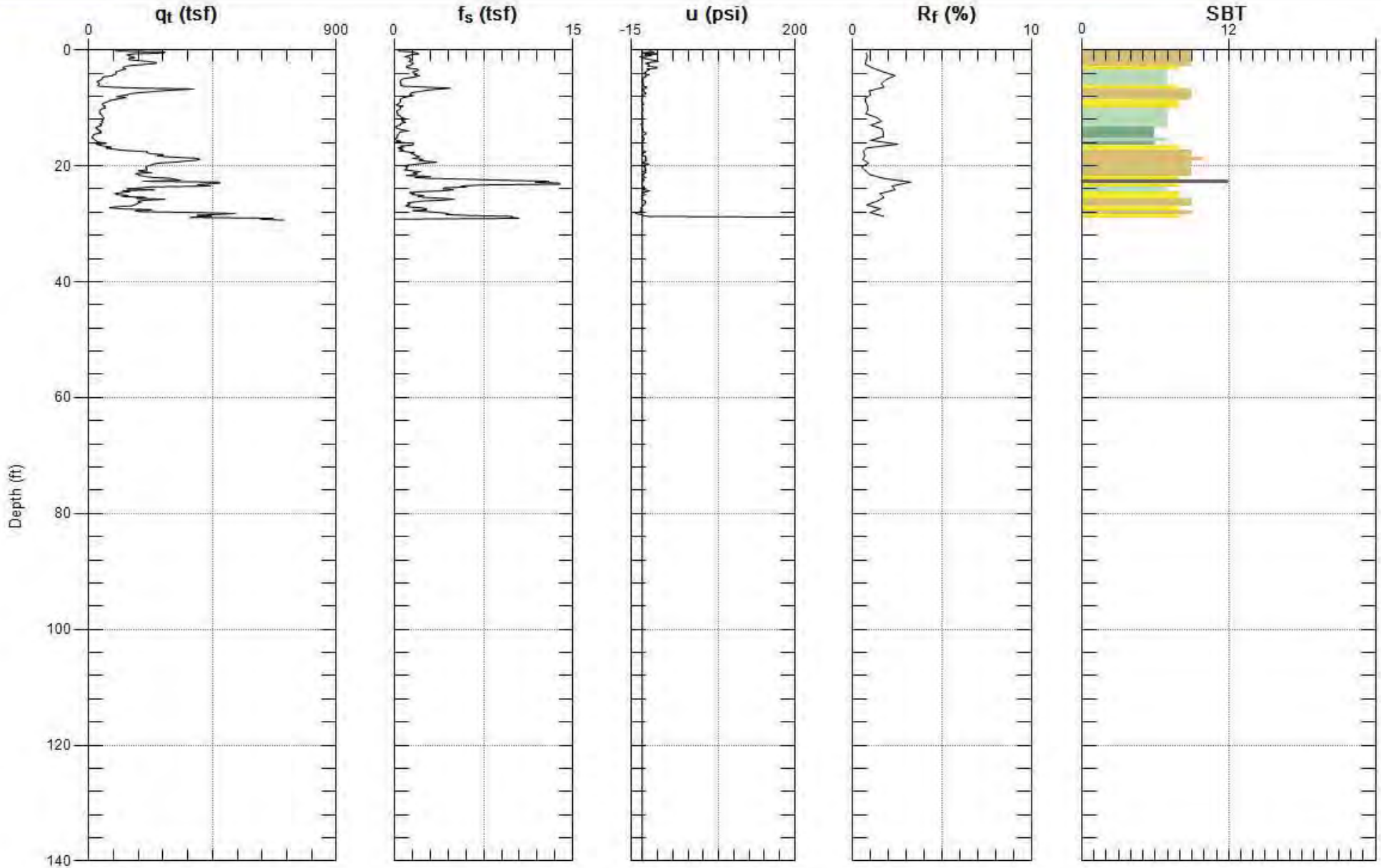
Max. Depth: 29.364 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK DAM Engineer: R.KIRBY

Sounding: SC-3-CPT Date: 1/24/2011 02:05



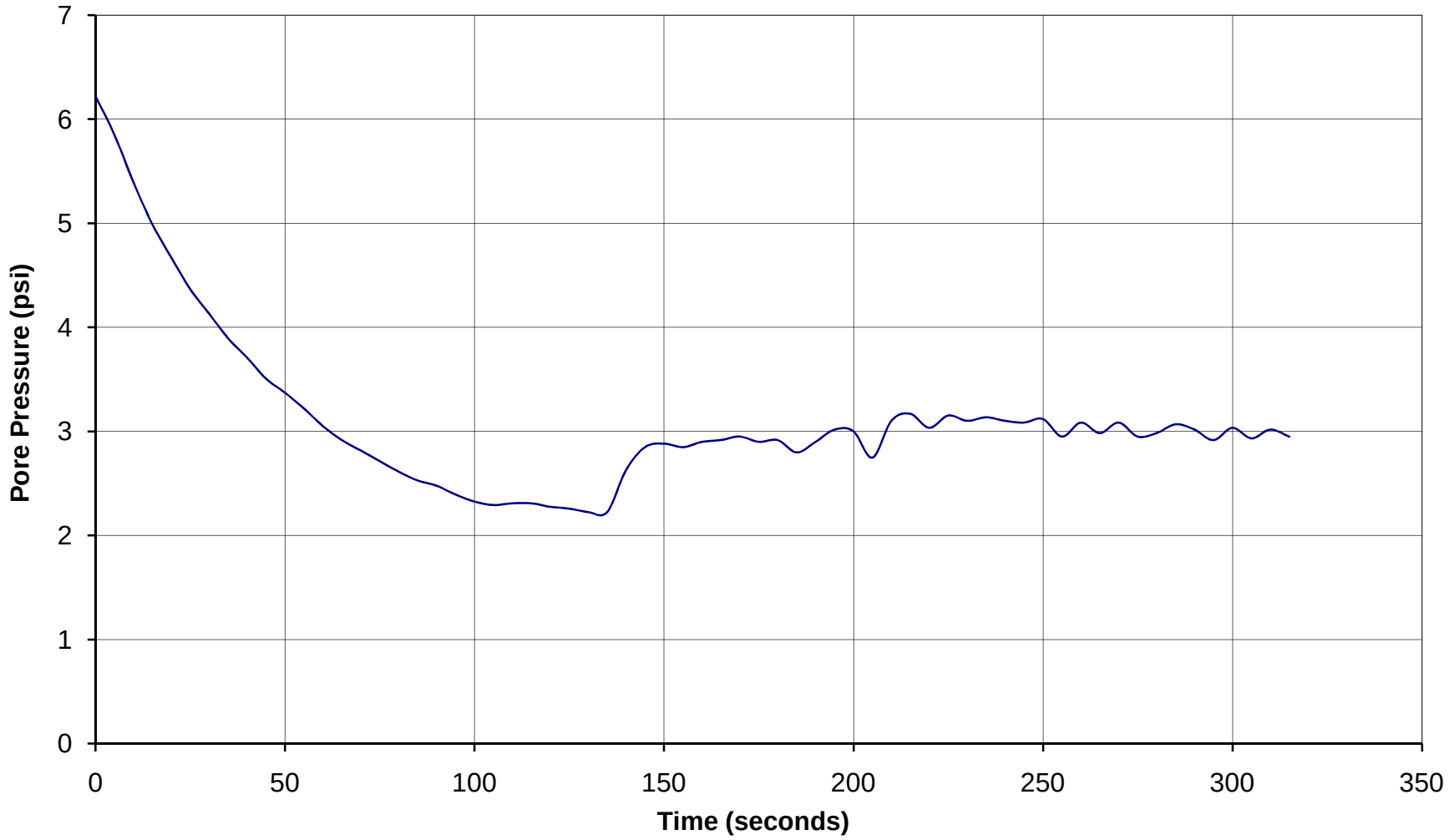
Max. Depth: 29.364 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

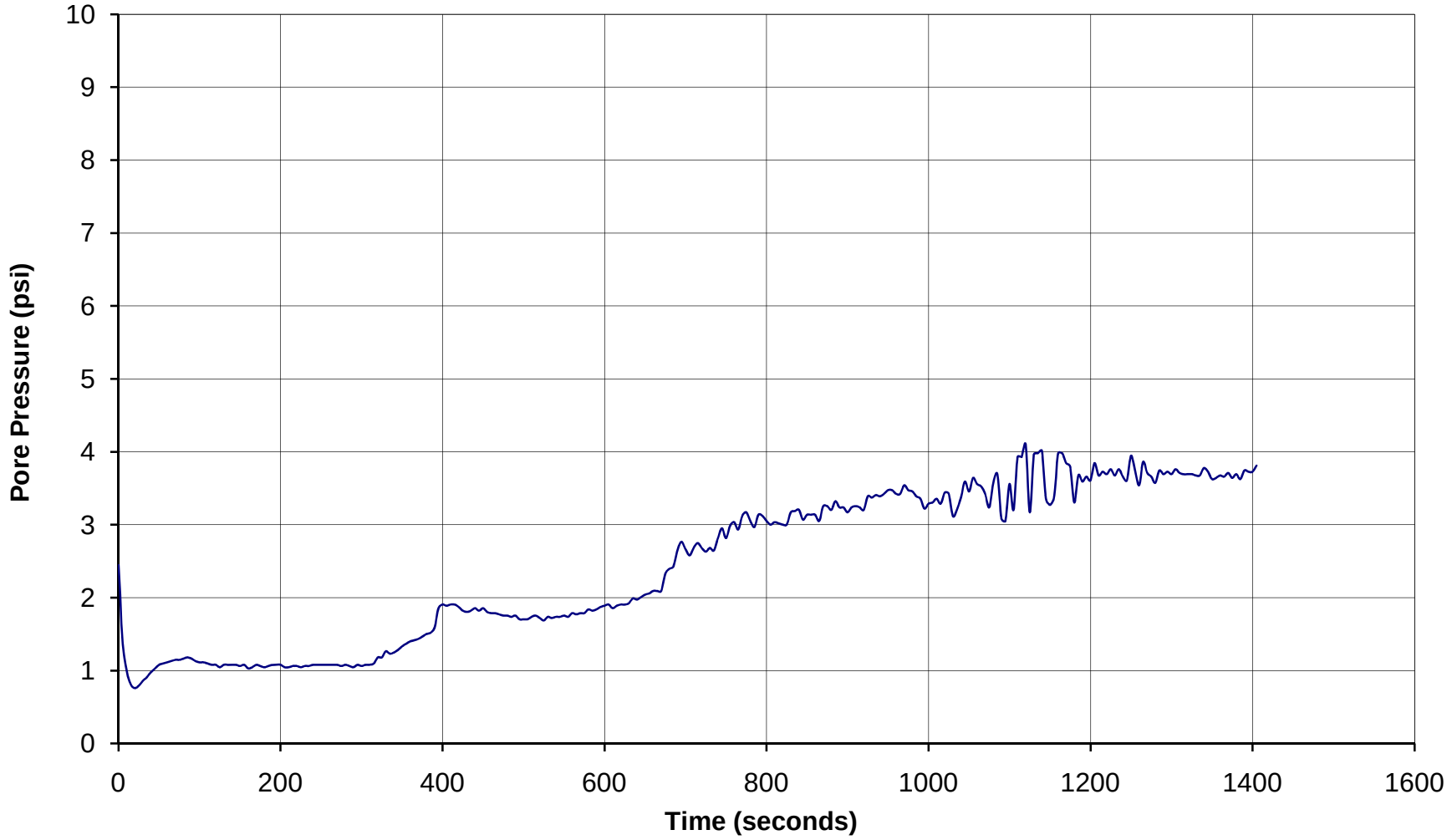
Sounding: SC-1-CPT
Depth: 136.9746525
Site: STEVENS CREEK DAM
Engineer: B.KIRBY



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

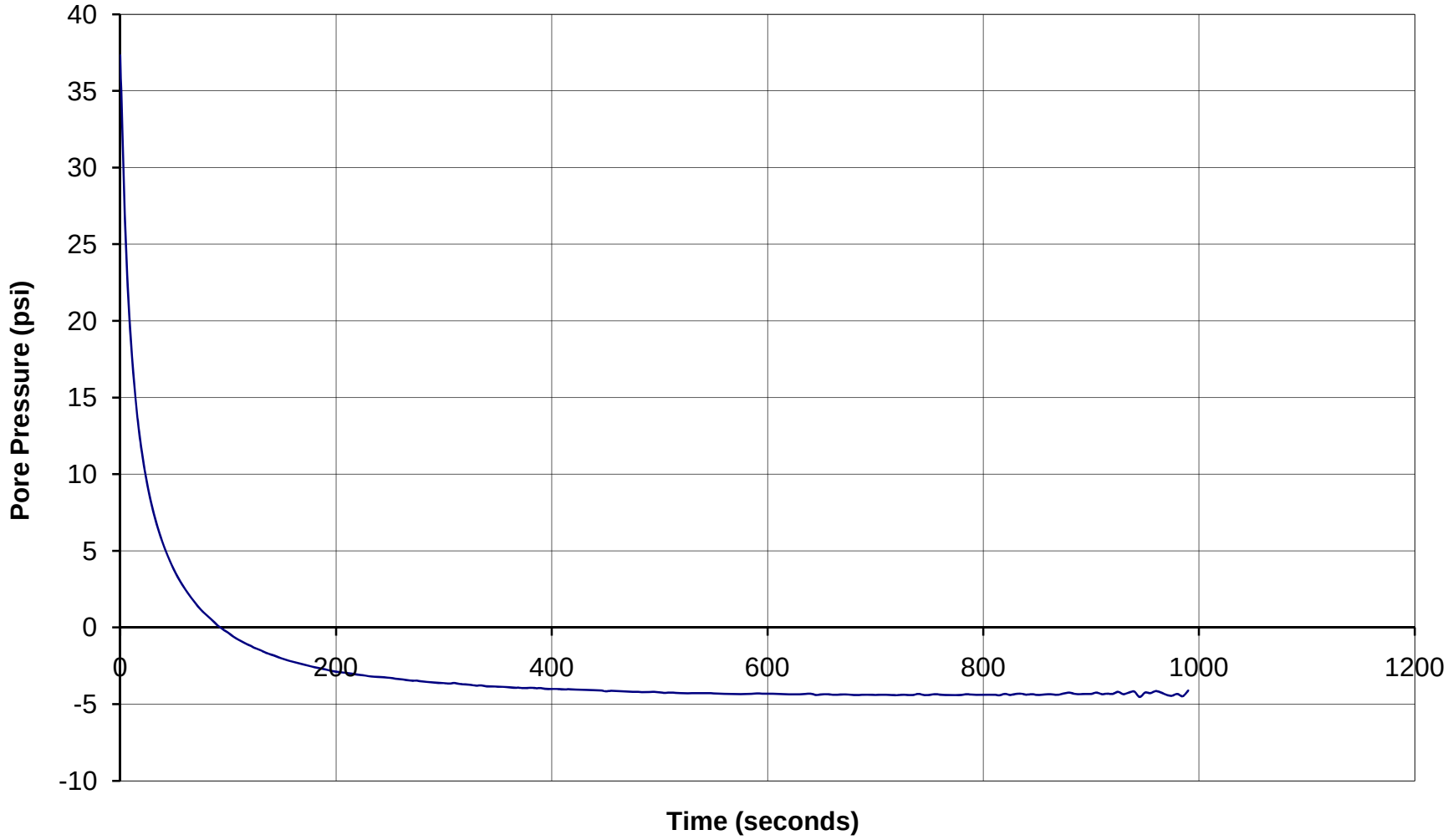
Sounding: SC-2-CPT
Depth: 57.086442
Site: STEVENS CREEK DAM
Engineer: B.KIRBY



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

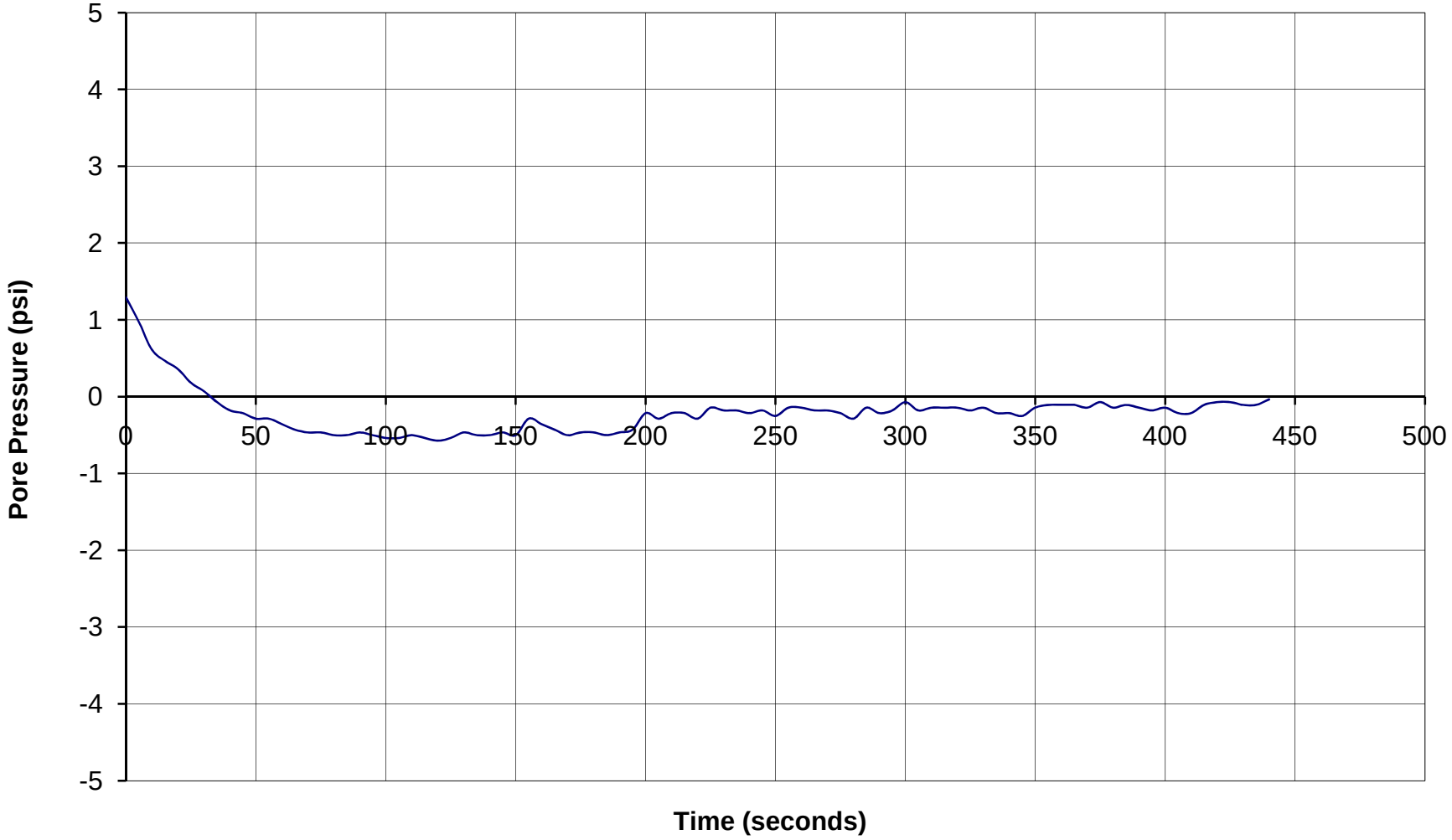
Sounding: SC-2-CPT
Depth: 63.320019
Site:
Engineer:



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

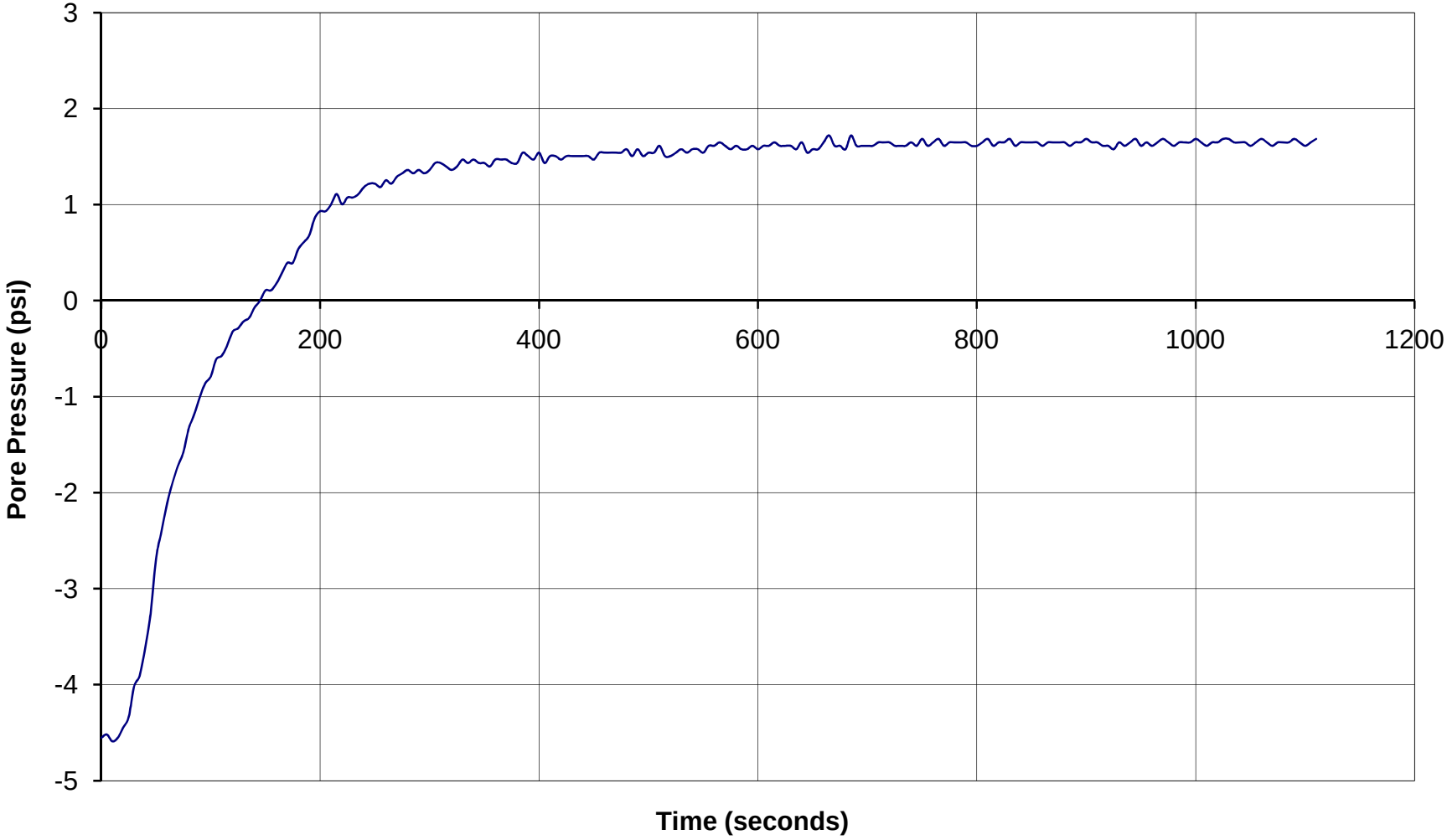
Sounding: SC-3-CPT
Depth: 20.013063
Site: STEVENS CREEK DAM
Engineer: B.KIRBY



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: SC-3-CPT
Depth: 27.887055
Site: STEVENS CREEK DAM
Engineer: B.KIRBY



Enclosure 2

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

November 9, 2011

Terra Engineers
Attn: Bob Kirby

Subject: CPT Site Investigation
Stevens Creek Reservoir
Cupertino, California
GREGG Project Number: 11-081MA – part 2

Dear Mr. Kirby:

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

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

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

Sincerely,
GREGG Drilling & Testing, Inc.

Mary Walden
Operations Manager

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (Feet)	Depth of Groundwater Samples (Feet)	Depth of Soil Samples (Feet)	Depth of Pore Pressure Dissipation Tests (Feet)
SC-CPT-4	10/27/11	27	-	-	24.6
SC-CPT-5	10/27/11	24	-	-	-
SC-CPT-5a	10/27/11	32	-	-	26.1
SC-CPT-7	10/27/11	138	-	-	-

Bibliography

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Robertson, P.K., T. Lunne and J.J.M. Powell, "Geo-Environmental Application of Penetration Testing", Geotechnical Site Characterization, Robertson & Mayne (editors), 1998 Balkema, Rotterdam, ISBN 90 5410 939 4 pp 35-47.

Campanella, R.G. and I. Weemees, "Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies", Canadian Geotechnical Journal, Vol. 27 No. 5, 1990 pp. 557-567.

DeGroot, D.J. and A.J. Lutenegger, "Reliability of Soil Gas Sampling and Characterization Techniques", International Site Characterization Conference - Atlanta, 1998.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, "Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT", 53rd Canadian Geotechnical Conference Montreal, QC October pp. 733-739, 2000.

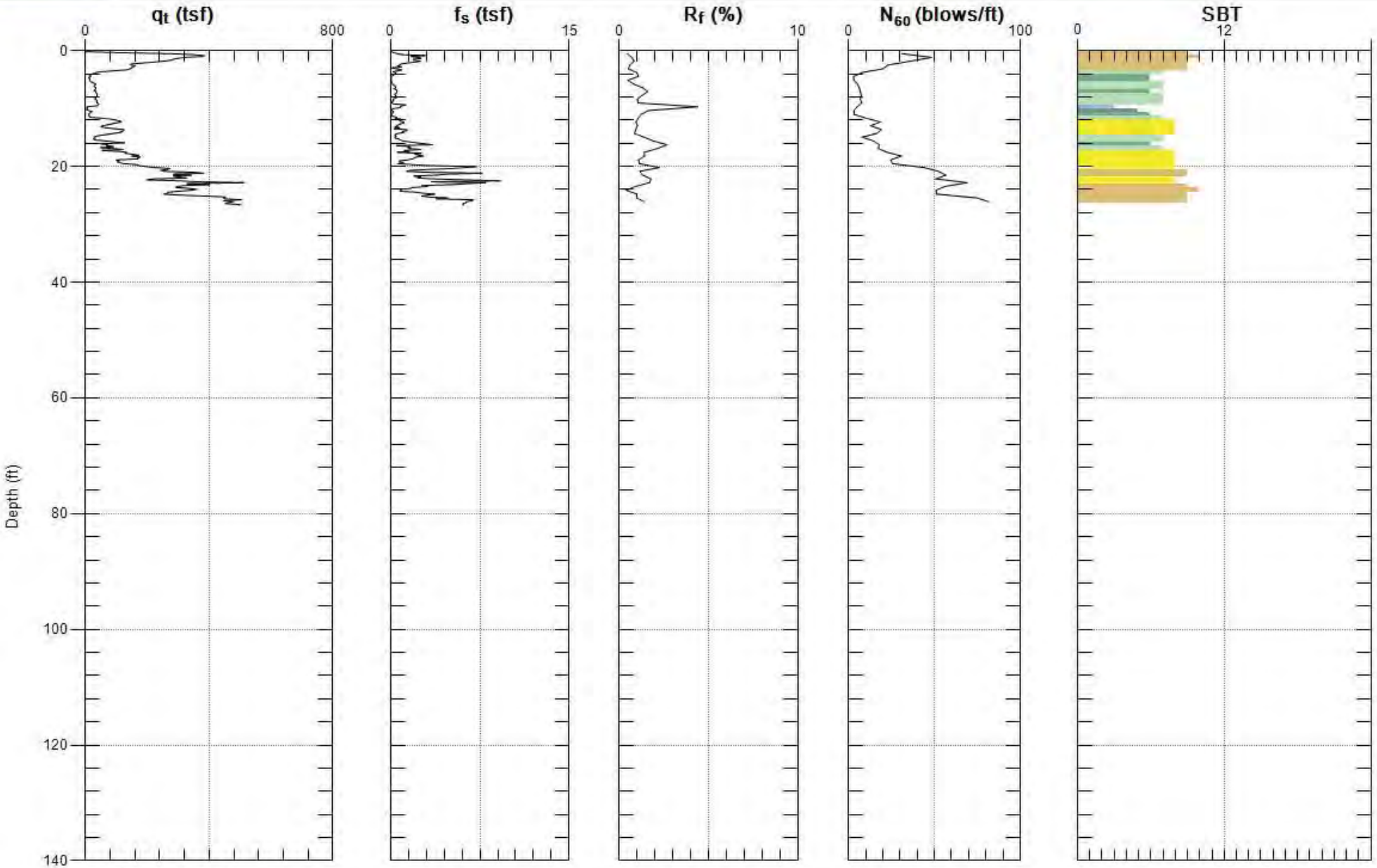
Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

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

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-4 Date: 10/27/2011 12:53



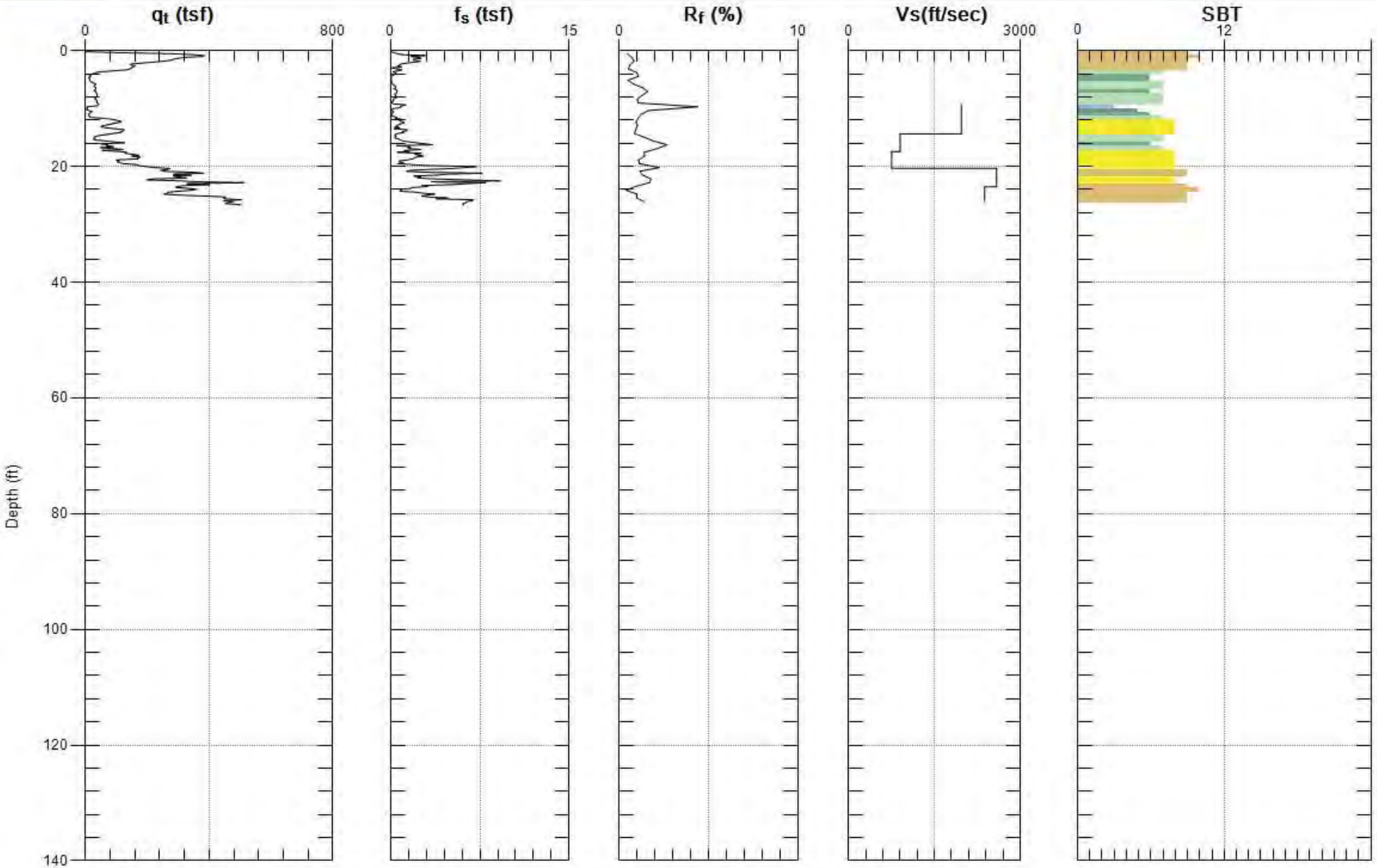
Max. Depth: 26.739 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-4 Date: 10/27/2011 12:53



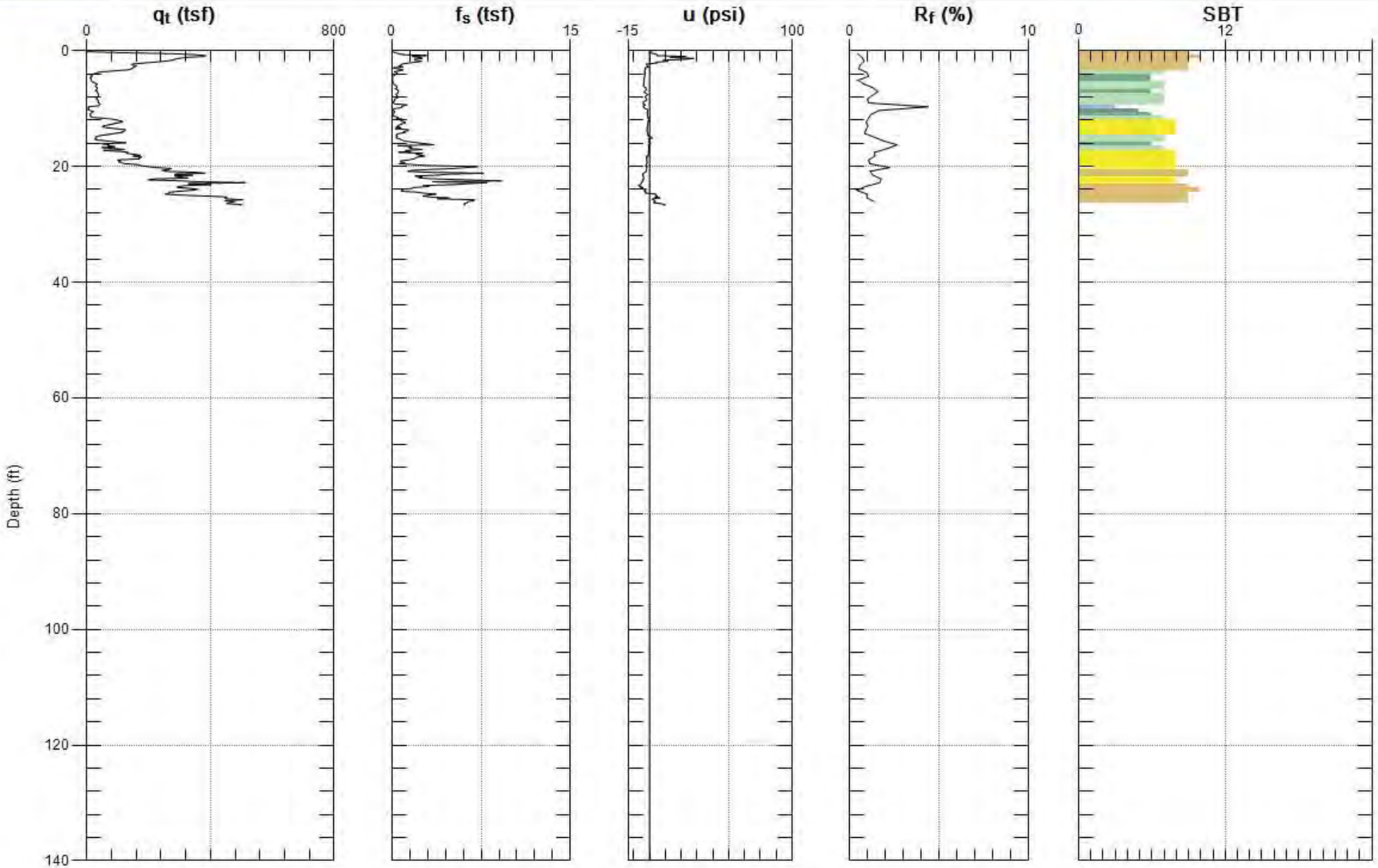
Max. Depth: 26.739 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-4 Date: 10/27/2011 12:53



Max. Depth: 26.739 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

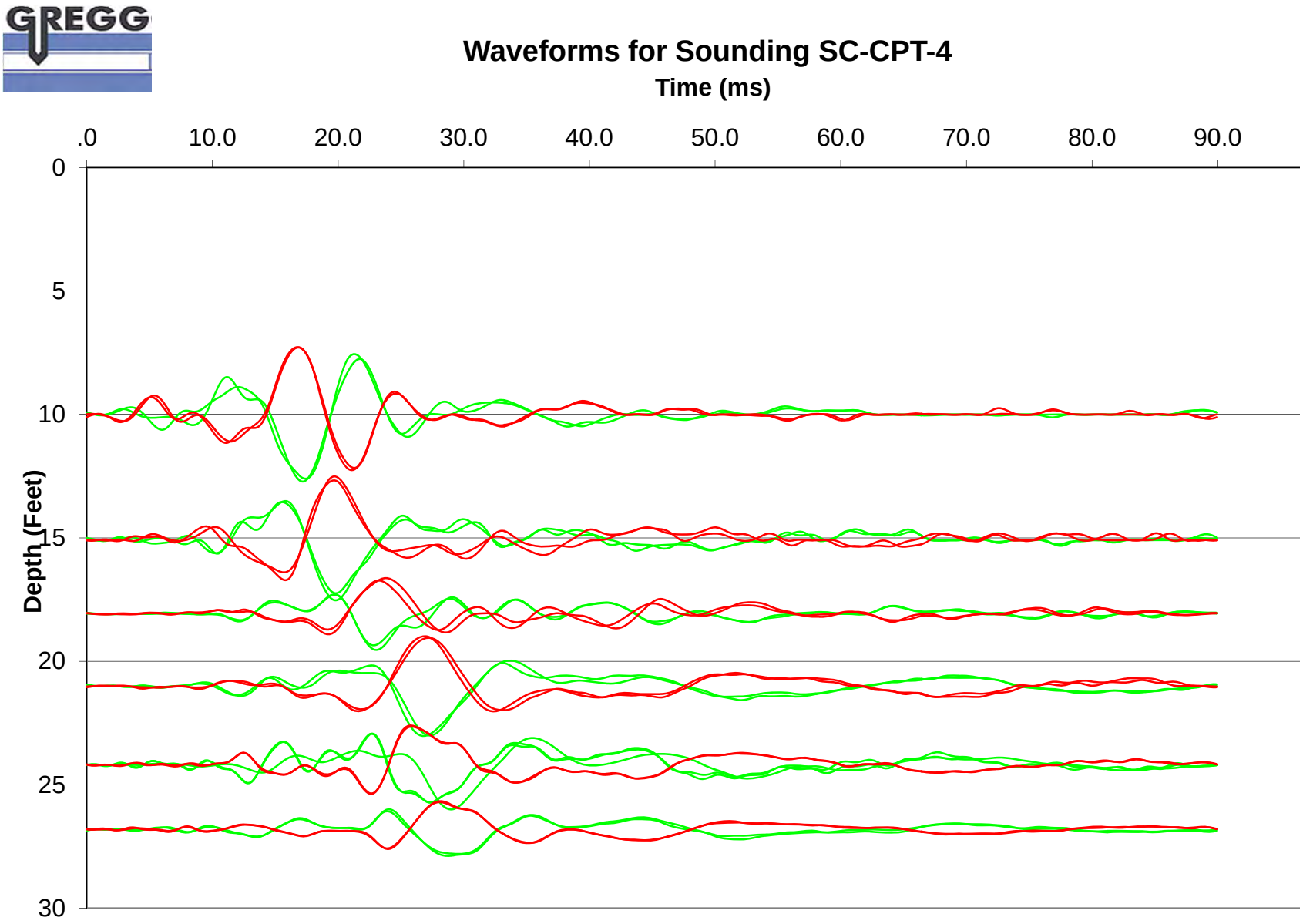
Shear Wave Velocity Calculations

STEVENS CREEK RESERVOIR
SC-CPT-4

Geophone Offset: 0.66 Feet
Source Offset: 1.67 Feet

10/27/11

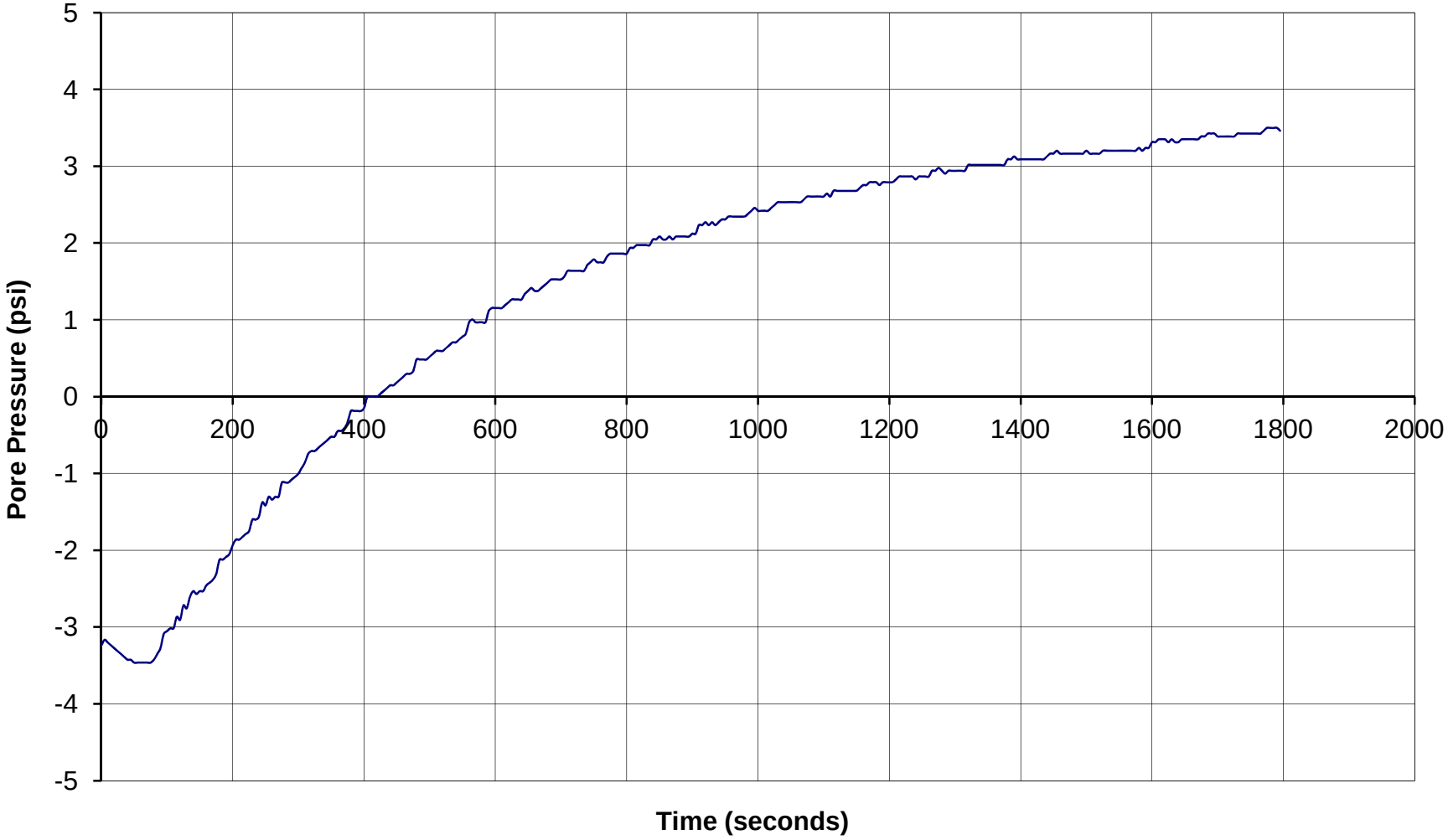
Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
10.01	9.35	9.49	9.49	17.2000			
15.09	14.43	14.53	5.03	19.7500	2.5500	1973.9	11.89
18.04	17.38	17.46	2.94	23.0000	3.2500	903.5	15.91
21.00	20.34	20.41	2.94	26.9000	3.9000	754.1	18.86
24.11	23.45	23.51	3.11	28.1000	1.2000	2589.8	21.90
26.74	26.08	26.13	2.62	29.2000	1.1000	2380.6	24.77


Waveforms for Sounding SC-CPT-4
Time (ms)
.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
0
5
10
15
20
25
30
Depth (Feet)

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

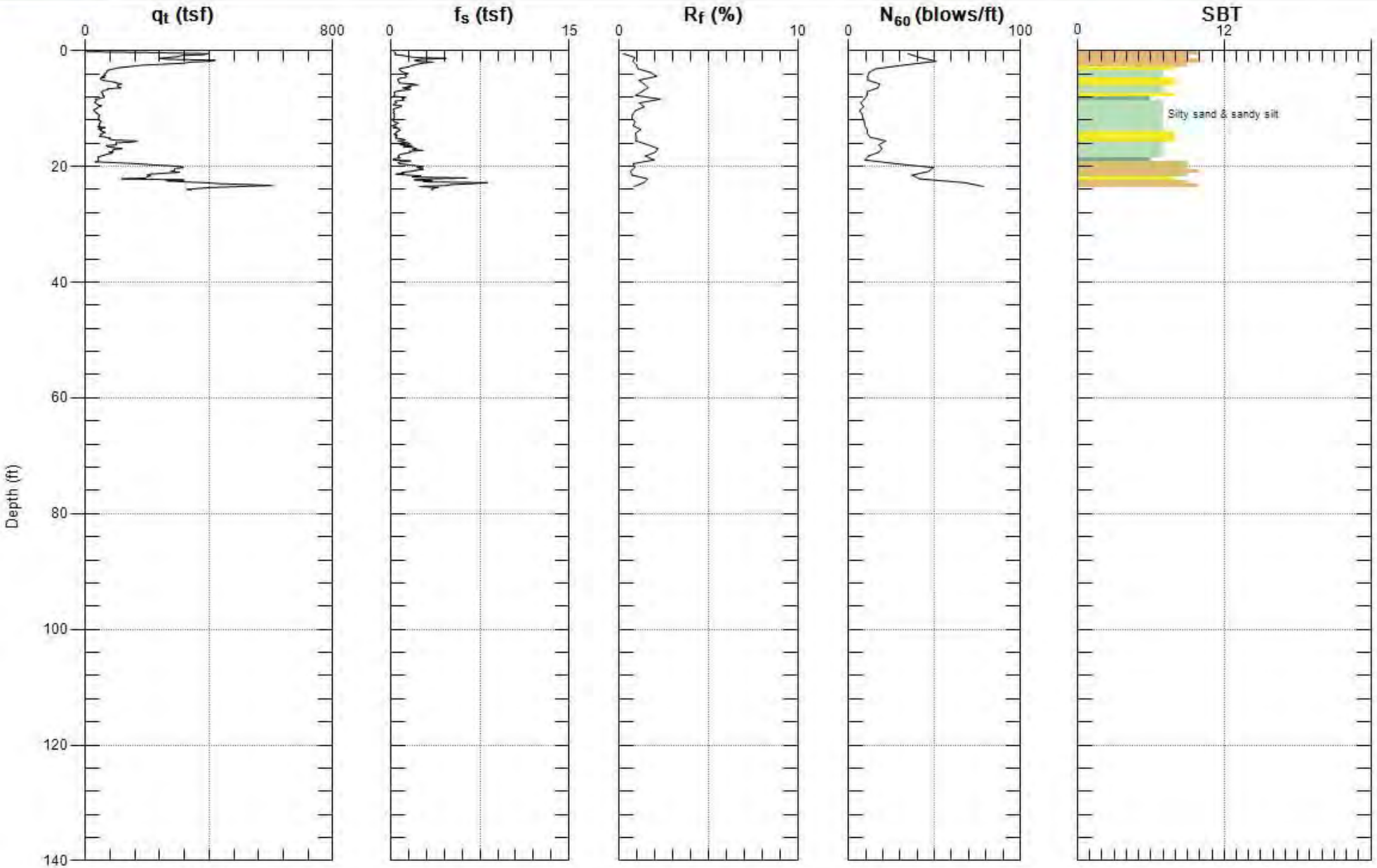
Sounding: SC-CPT-4
Depth: 24.606225
Site: STEVENS CREEK
Engineer: RICK



TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-5 Date: 10/27/2011 02:51



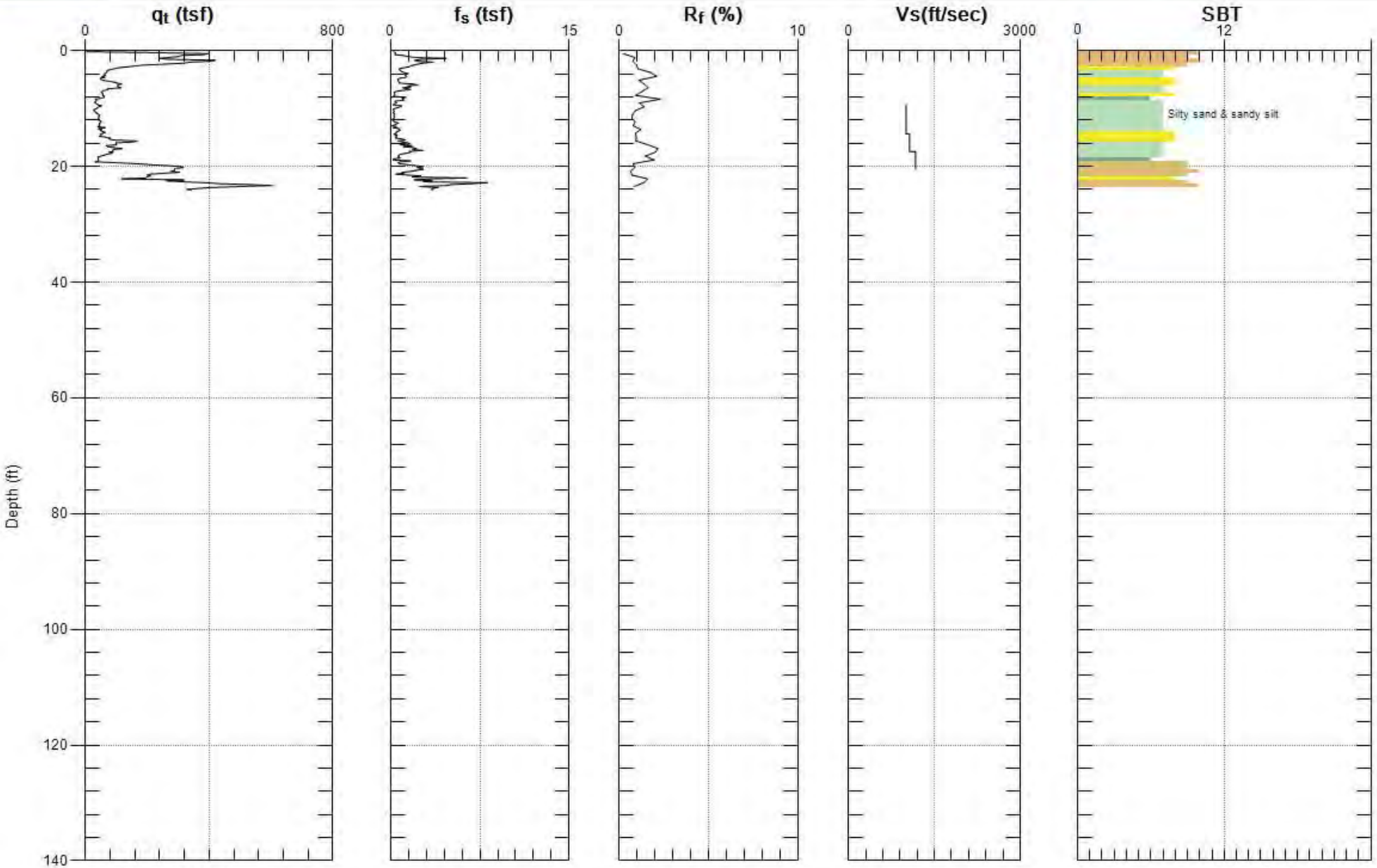
Max. Depth: 24.114 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-5 Date: 10/27/2011 02:51



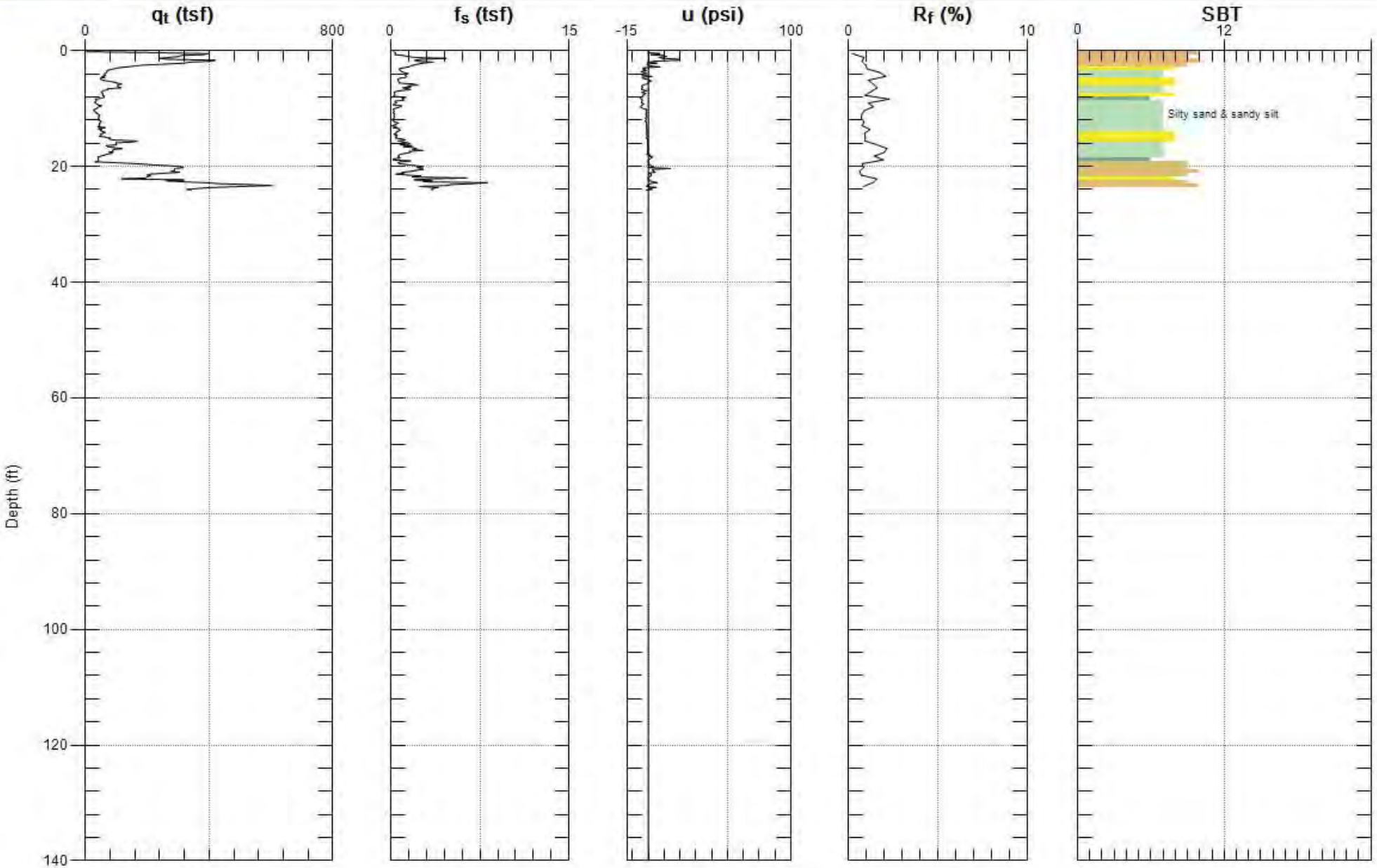
Max. Depth: 24.114 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-5 Date: 10/27/2011 02:51



Max. Depth: 24.114 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Shear Wave Velocity Calculations

STEVENS CREEK RESERVOIR

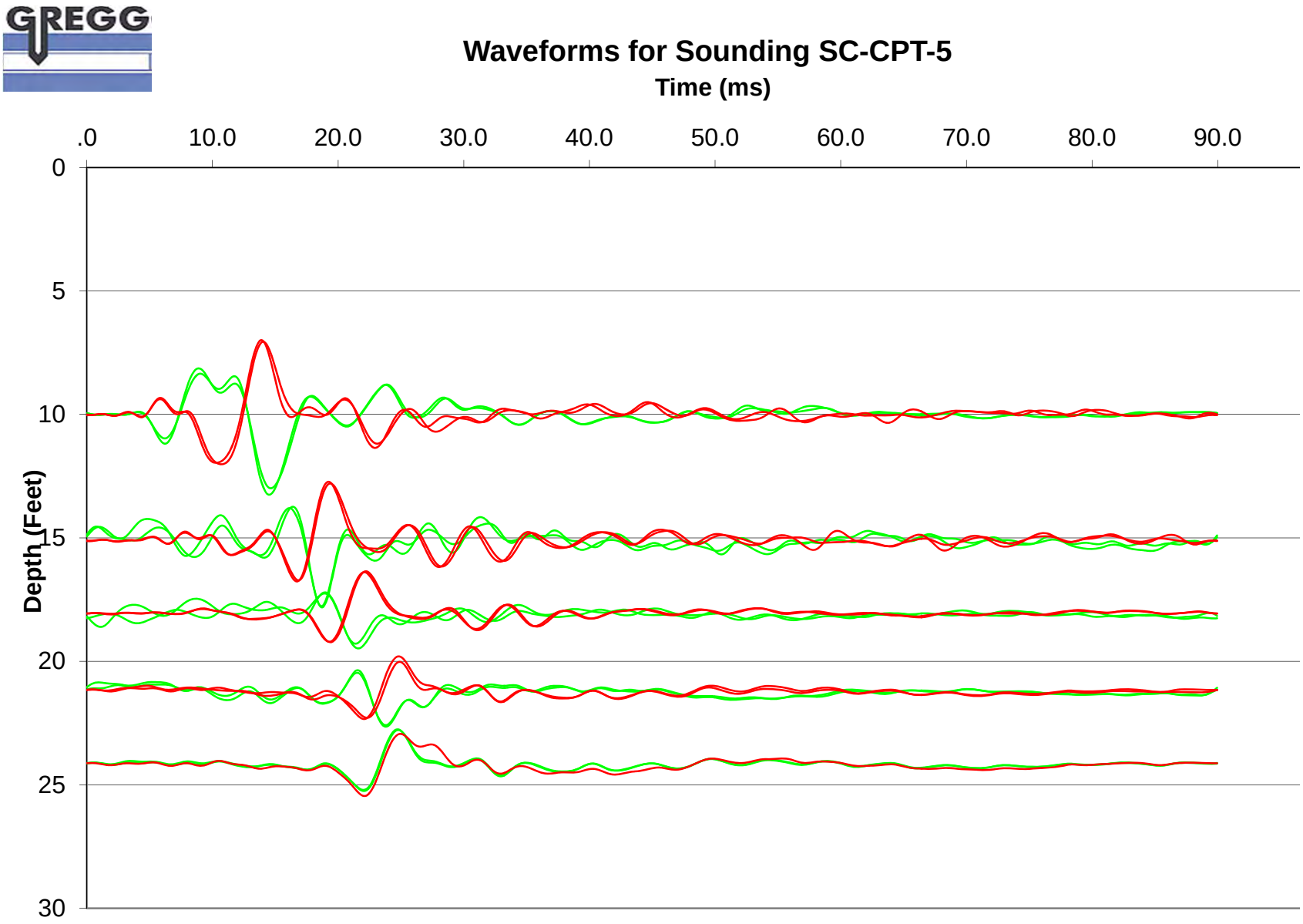
SC-CPT-5

Geophone Offset: 0.66 Feet

Source Offset: 1.67 Feet

10/27/11

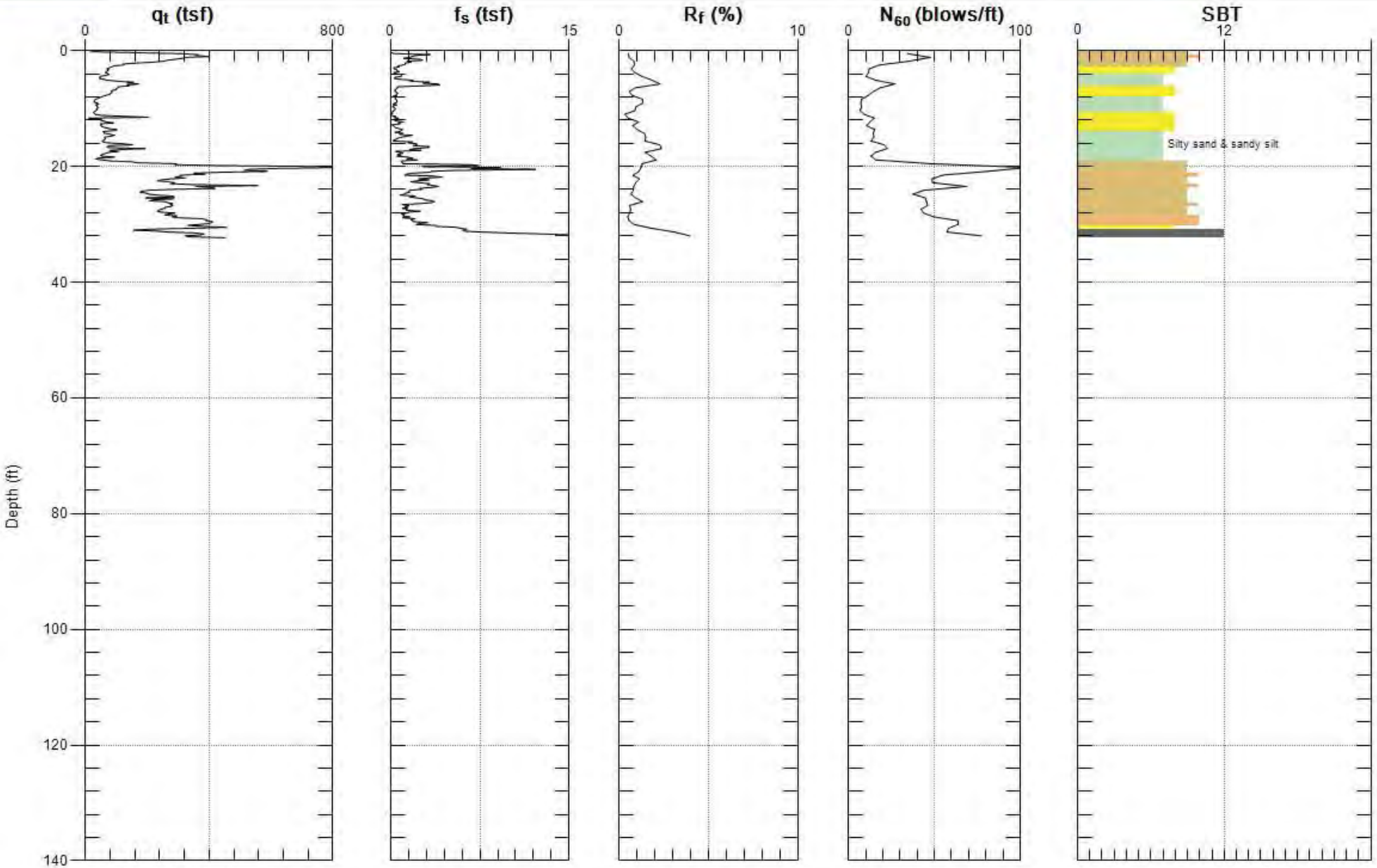
Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
10.01	9.35	9.49	9.49	12.5500			
15.09	14.43	14.53	5.03	17.5500	5.0000	1006.7	11.89
18.04	17.38	17.46	2.94	20.3000	2.7500	1067.8	15.91
21.16	20.50	20.57	3.10	22.9500	2.6500	1171.6	18.94


Waveforms for Sounding SC-CPT-5
Time (ms)
.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
0
5
10
15
20
25
30
Depth (Feet)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-5a Date: 10/27/2011 04:03



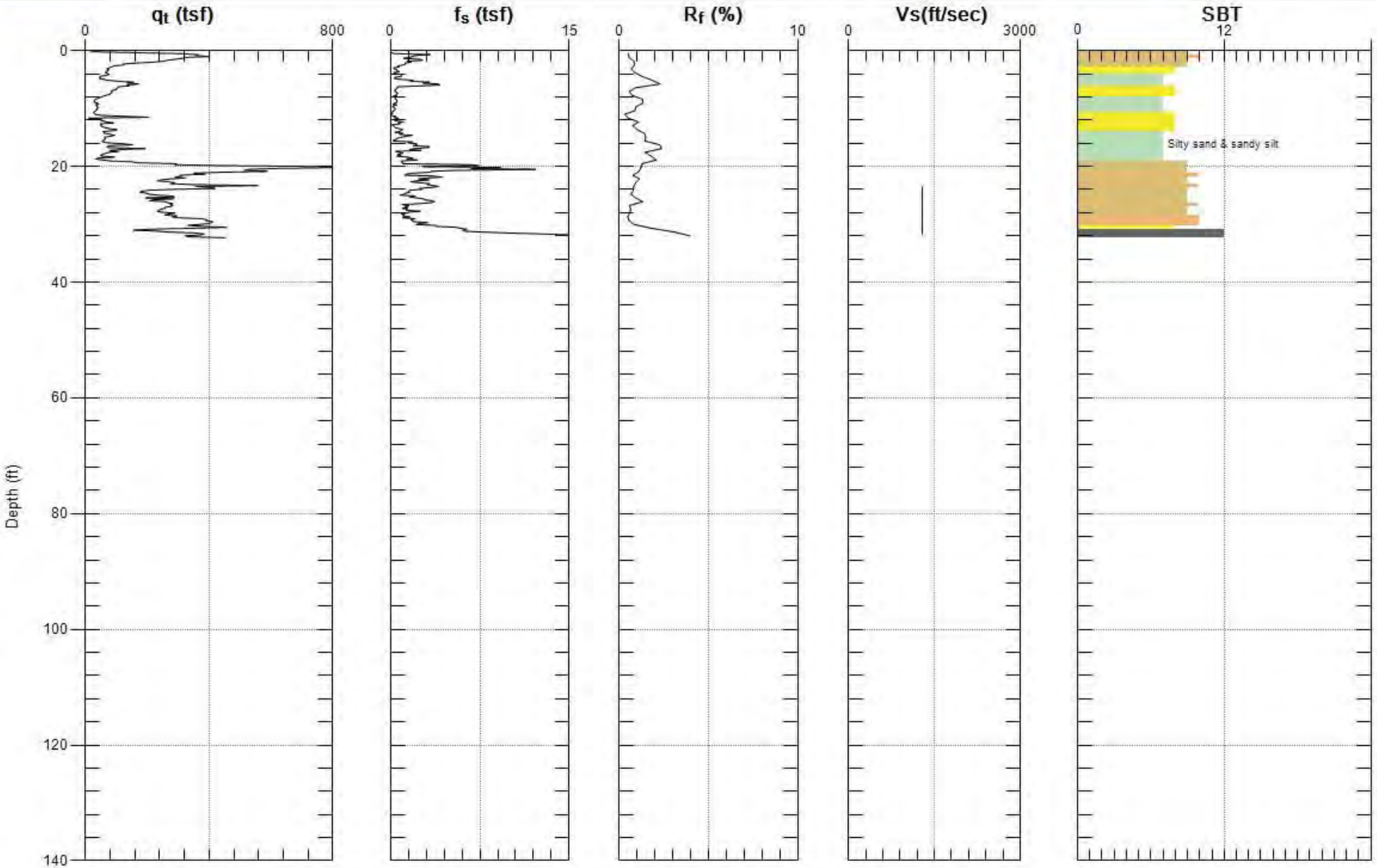
Max. Depth: 32.316 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-5a Date: 10/27/2011 04:03



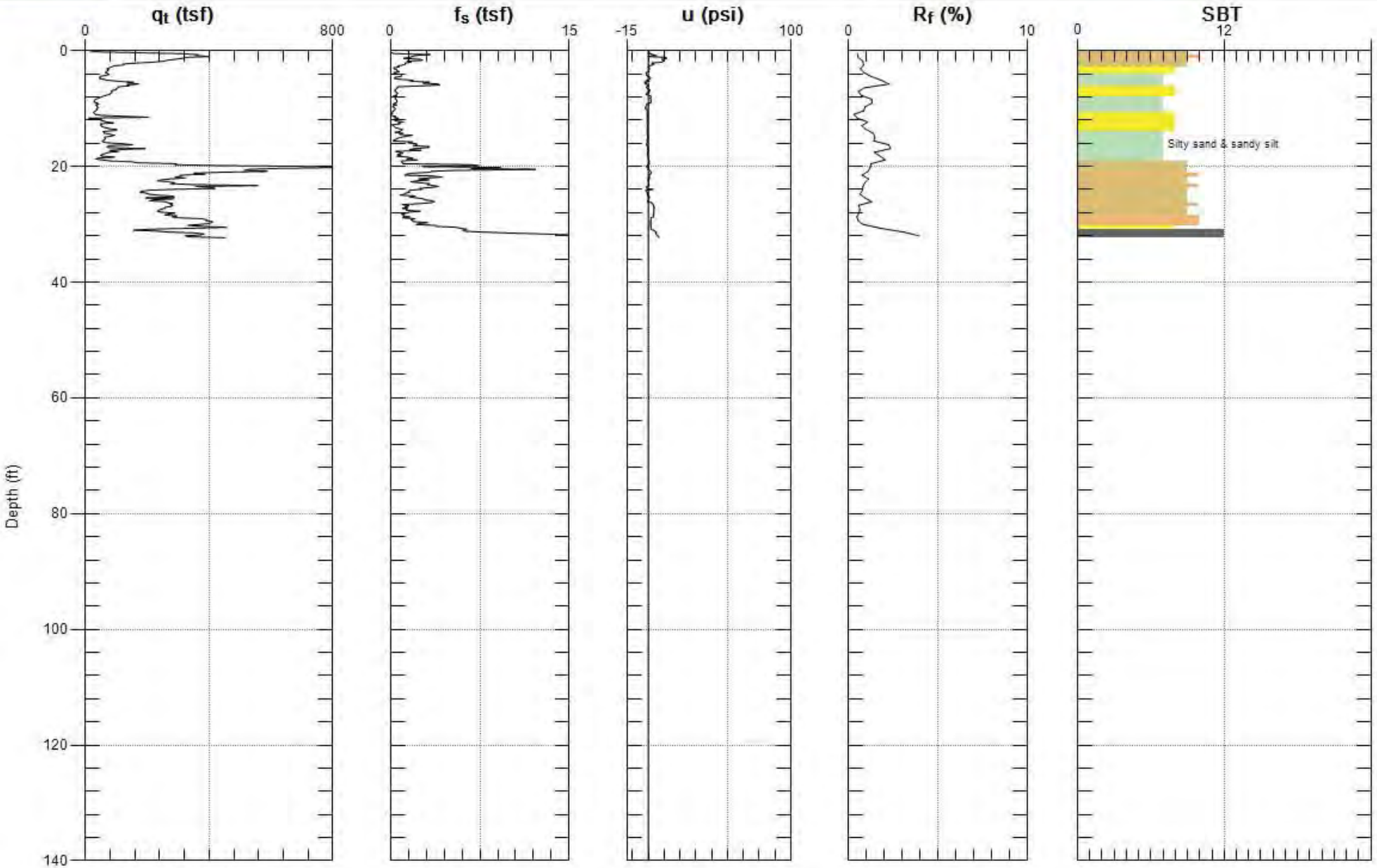
Max. Depth: 32.316 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-5a Date: 10/27/2011 04:03



Max. Depth: 32.316 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

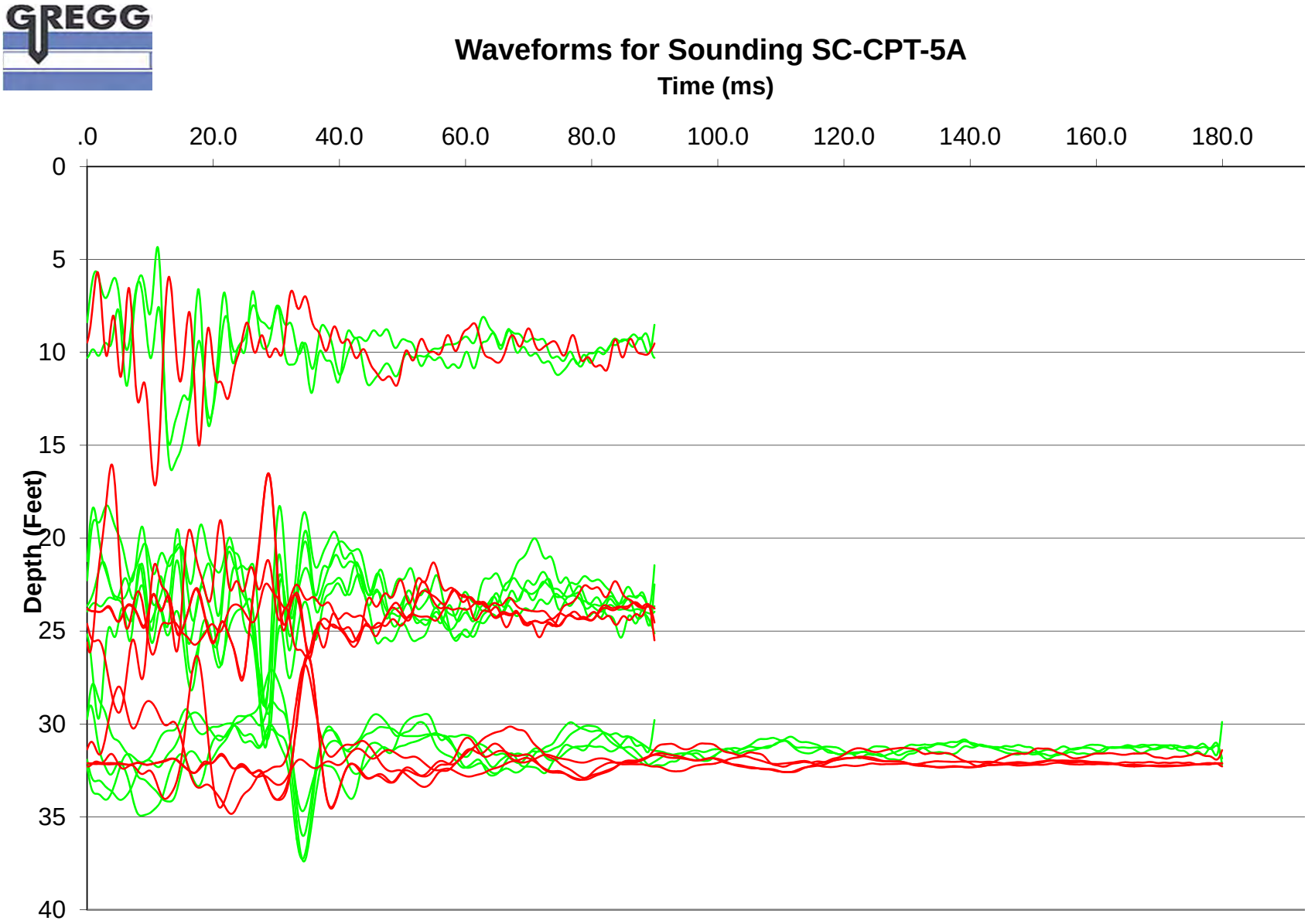
Shear Wave Velocity Calculations

STEVENS CREEK RESERVOIR
SC-CPT-5a

Geophone Offset: 0.66 Feet
Source Offset: 1.67 Feet

10/27/11

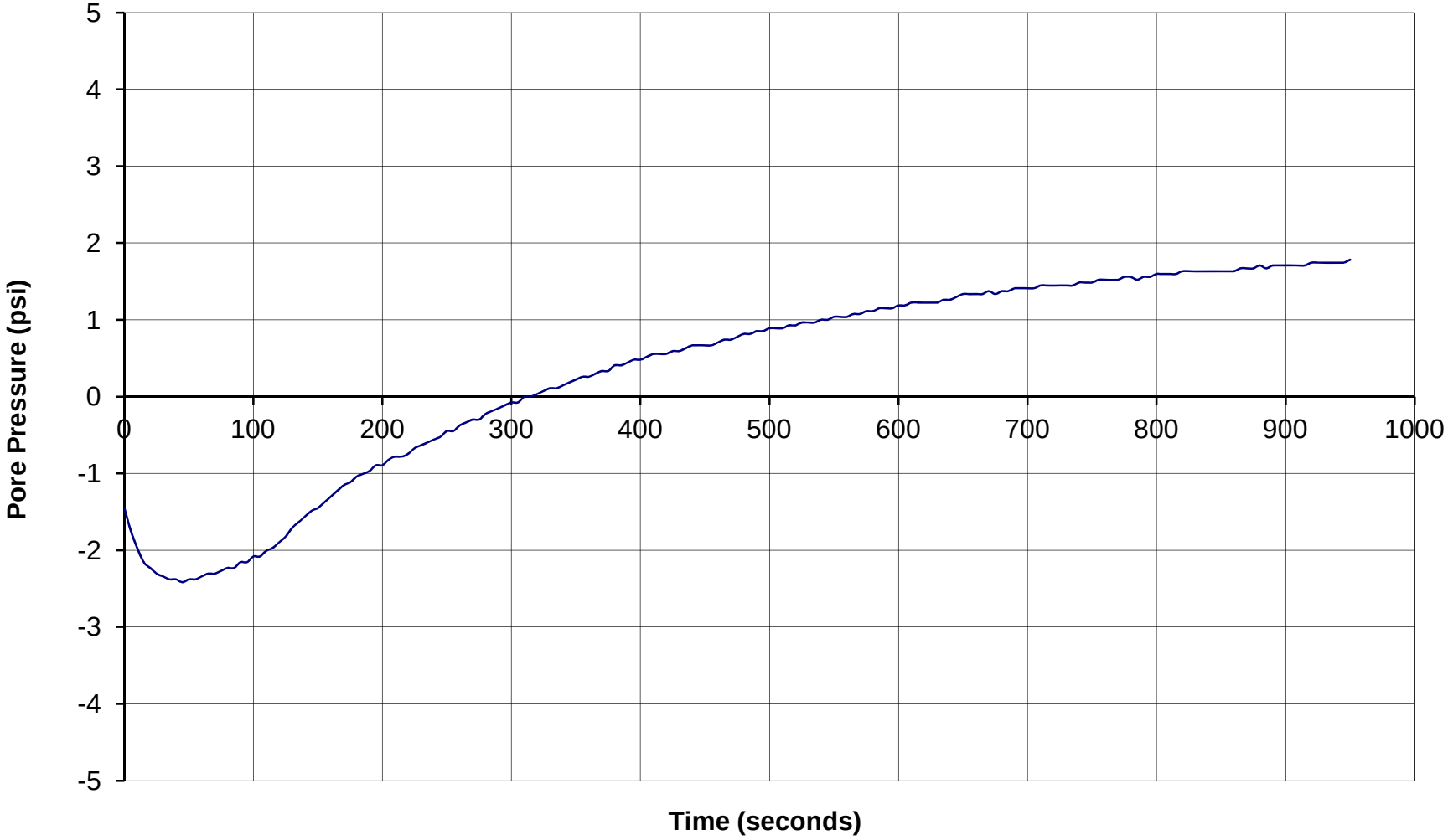
Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
24.11	23.45	23.51	23.51	28.5000			
32.32	31.66	31.70	8.19	34.8500	6.3500	1289.2	27.56


Waveforms for Sounding SC-CPT-5A
Time (ms)
.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
0
5
10
15
20
25
30
35
40
Depth (Feet)

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

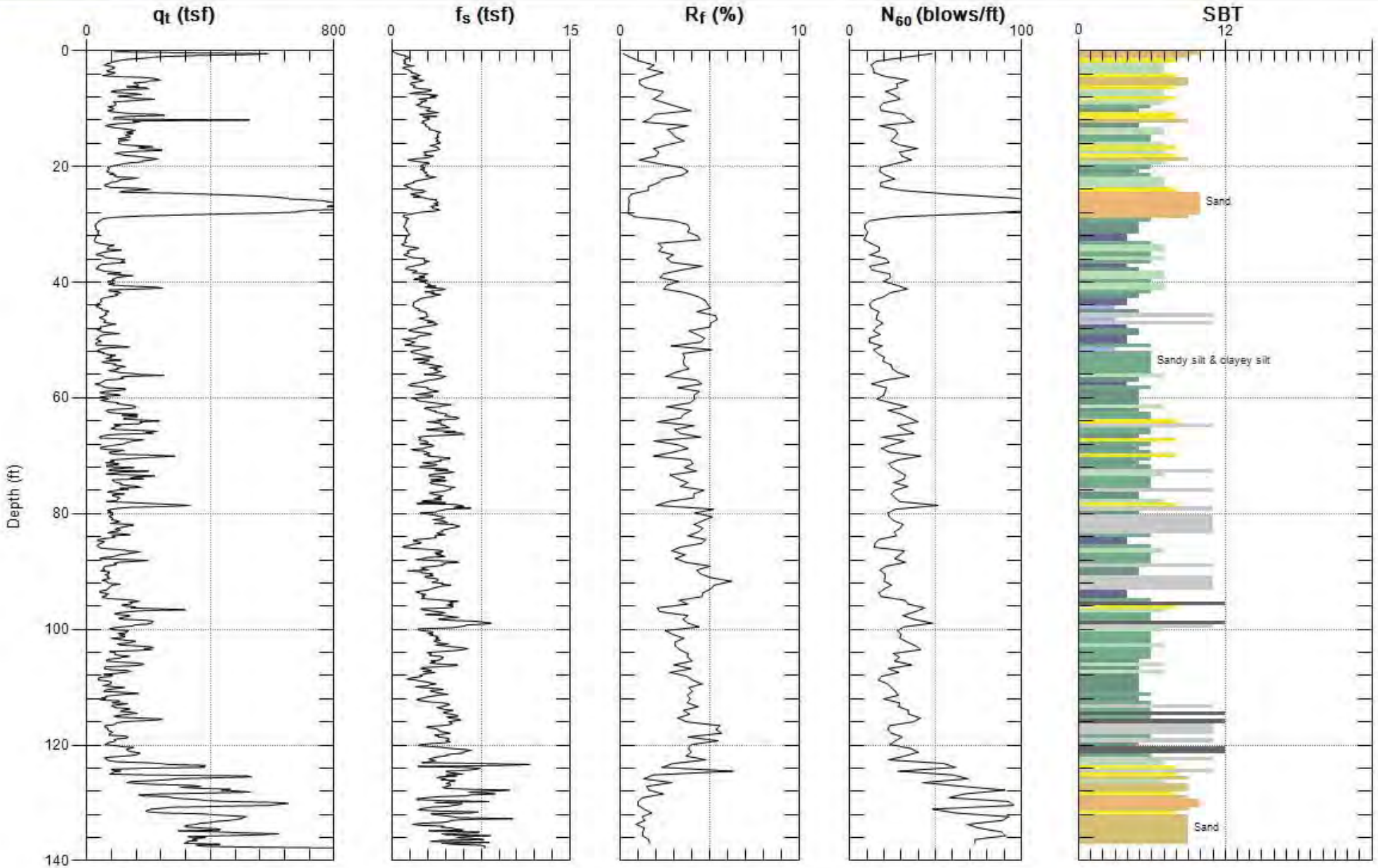
Sounding: SC-CPT-5A
Depth: 26.0825985
Site: STEVENS CREEK
Engineer: RICK



TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-7 Date: 10/27/2011 09:27



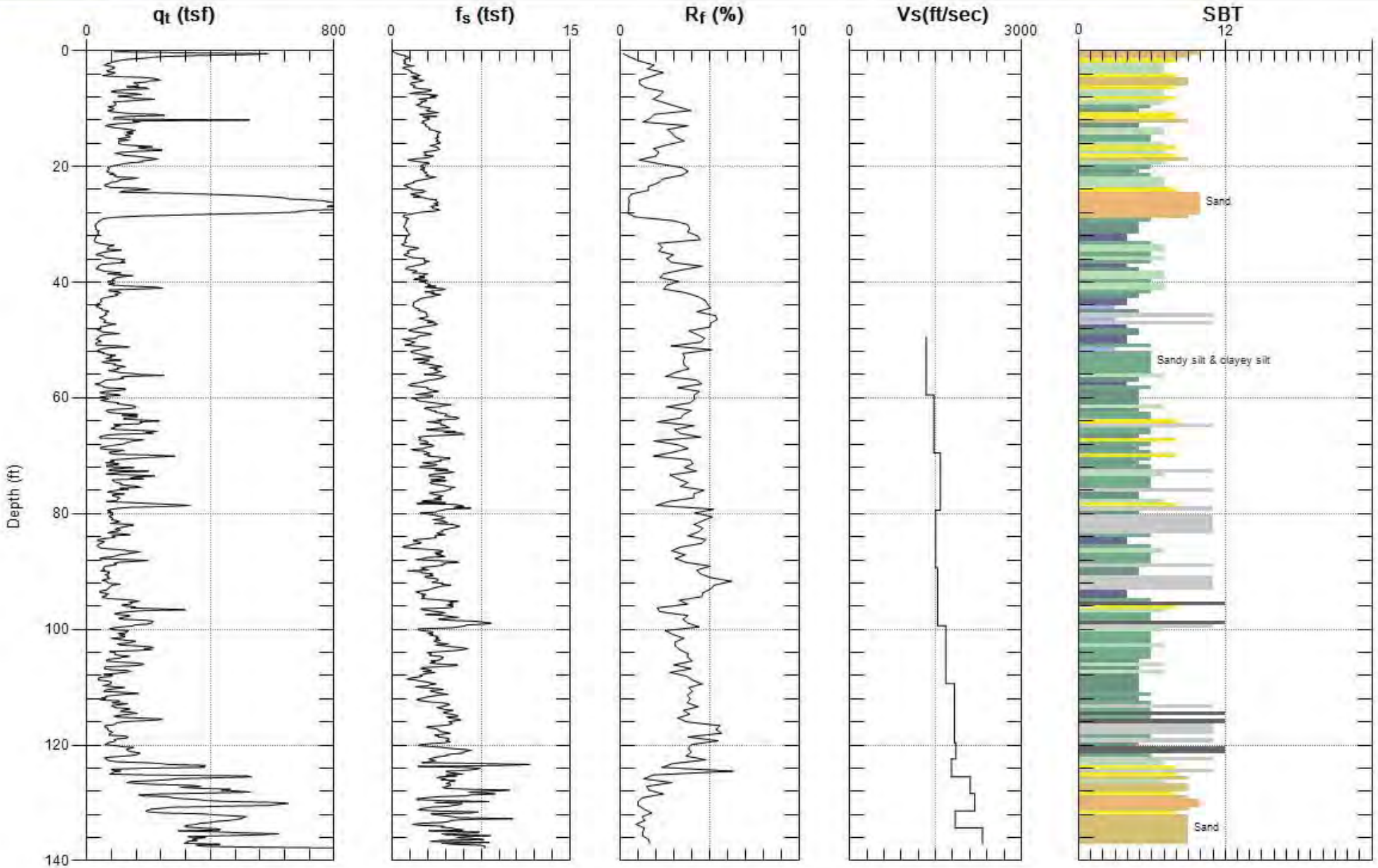
Max. Depth: 137.795 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-7 Date: 10/27/2011 09:27



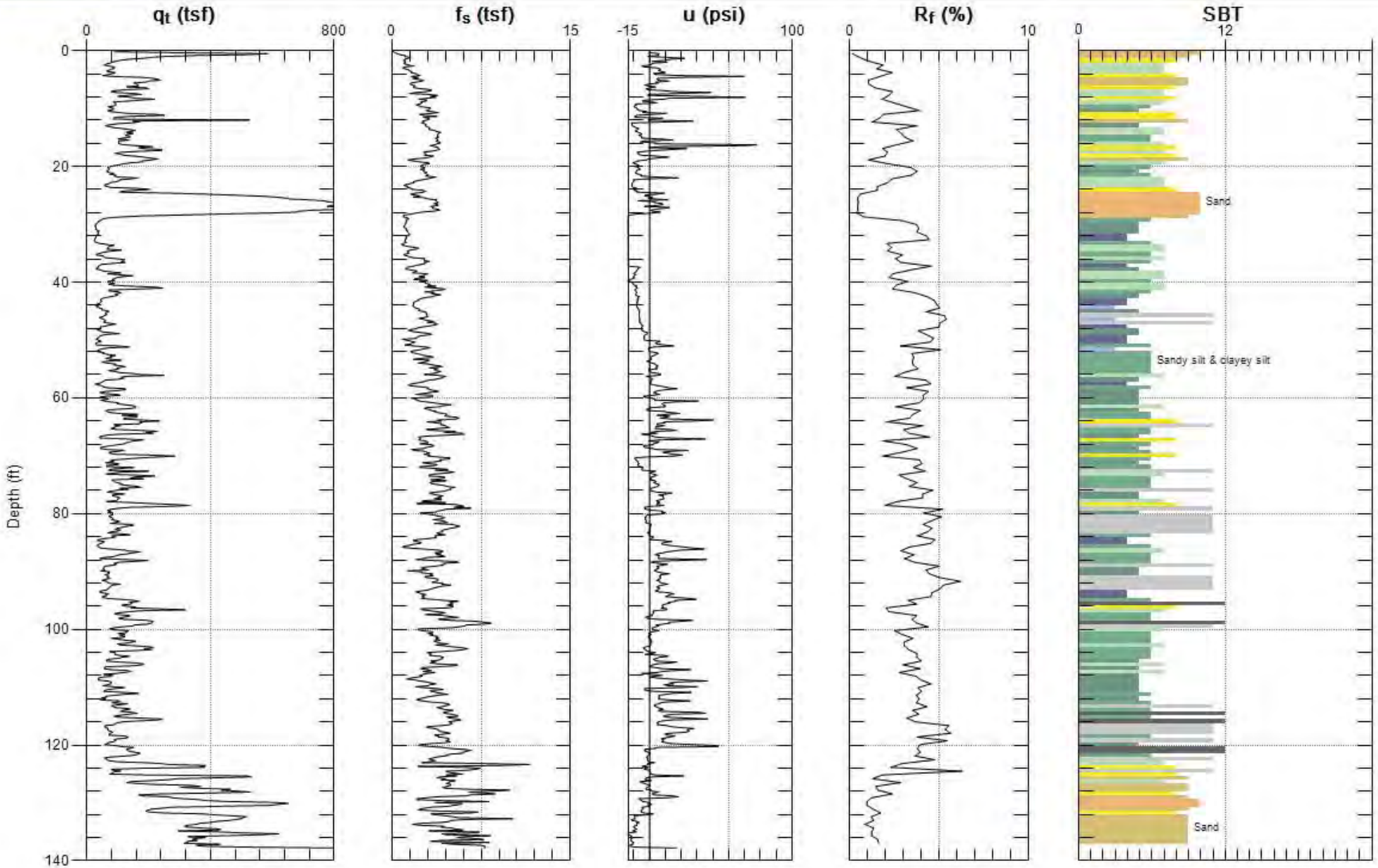
Max. Depth: 137.795 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

TERRA ENGINEERS

Site: STEVENS CREEK RES. Engineer: RICK

Sounding: SC-CPT-7 Date: 10/27/2011 09:27



Max. Depth: 137.795 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

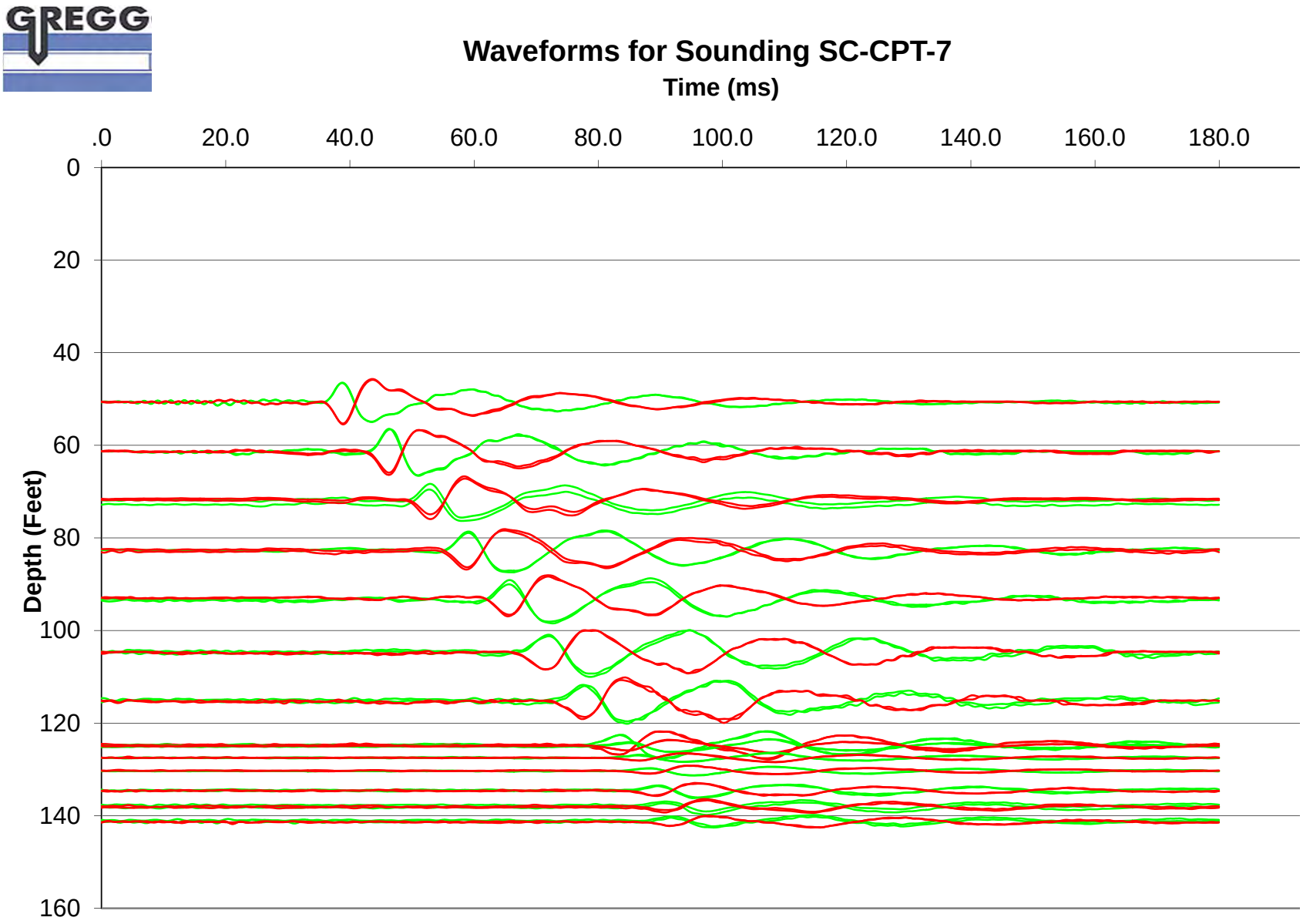
Shear Wave Velocity Calculations

STEVENS CREEK RESERVOIR
SC-CPT-7

Geophone Offset: 0.66 Feet
Source Offset: 1.67 Feet

10/27/11

Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
50.03	49.37	49.40	49.40	40.8000			
60.20	59.54	59.57	10.17	48.4000	7.6000	1337.6	54.46
70.21	69.55	69.57	10.00	55.2000	6.8000	1471.1	64.55
80.05	79.39	79.41	9.84	61.4000	6.2000	1587.1	74.47
90.06	89.40	89.41	10.00	68.0500	6.6500	1504.4	84.40
100.07	99.41	99.42	10.00	74.5500	6.5000	1539.2	94.40
110.07	109.41	109.42	10.01	80.5000	5.9500	1681.6	104.41
120.24	119.58	119.59	10.17	86.0500	5.5500	1832.3	114.50
123.03	122.37	122.38	2.79	87.5500	1.5000	1859.0	120.98
126.15	125.49	125.50	3.12	89.3000	1.7500	1780.9	123.93
129.10	128.44	128.45	2.95	90.7000	1.4000	2108.9	126.96
132.05	131.39	131.40	2.95	92.0500	1.3500	2187.0	129.92
135.01	134.35	134.36	2.95	93.6500	1.6000	1845.3	132.87
137.79	137.13	137.15	2.79	94.8500	1.2000	2323.7	135.74


Waveforms for Sounding SC-CPT-7
Time (ms)
.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Depth (Feet)
0
20
40
60
80
100
120
140
160

APPENDIX D

CONTENTS

Enclosure 1

GEOVision
geophysical services

STEVENS CREEK DAM
BORINGS SC-101 MR, SC-104 MR AND SC-105 MR
SUSPENSION PS VELOCITIES

Report 11038-01 Rev 0

March 7, 2011

STEVENS CREEK DAM
BORINGS SC-101 MR, SC-104 MR AND SC-105 MR
SUSPENSION PS VELOCITIES

Report 11038-01 Rev 0

March 7, 2011

Prepared for:

Terra Engineers, Inc.
350 Sansome Street, Suite 830
San Francisco, California 94104
888-888-4730

Prepared by

GEOVision Geophysical Services
1124 Olympic Drive
Corona, California 92881
(951) 549-1234

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APPENDICES

INTRODUCTION

Boring geophysical measurements were collected in three uncased borings located at Stevens Creek Dam. Geophysical data acquisition was performed between February 10 and 15, 2011 by Robert Steller of **GEO***Vision*. Data analysis and report preparation was performed by Robert Steller and reviewed by John Diehl of **GEO***Vision*. The work was performed for Terra Engineers, Inc. (Terra). Robert Kirby served as the point of contact for Terra.

This report describes the field measurements, data analysis, and results of this work.

SCOPE OF WORK

This report presents the results of boring geophysical measurements collected between February 10 and 15, 2011, in three uncased borings, as detailed below. The purpose of these studies was to supplement stratigraphic information obtained during Terra's soil and rock sampling program and to acquire shear wave velocities and compressional wave velocities as a function of depth.

BORING	DATES LOGGED	ELEVATION [1] (FEET)	COORDINATES (FEET) [1]	
			NORTHING	EASTING
SC-101 MR	2/10/2011	557.11	1935170	6102926
SC-104 MR	2/15/2011	441.83	1935505	6102939
SC-105 MR	2/14/2011	553.10	1935080	6103255

[1] Coordinates provided by Terra

Table 1. Boring locations and logging dates

The OYO Suspension PS Logging System (Suspension System) was used to obtain in-situ horizontal shear (S_H) and compressional (P) wave velocity measurements at 1.6 or 0.7 foot intervals. Measurements followed **GEO***Vision* Procedure for P-S Suspension Seismic Velocity Logging, revision 1.5. The acquired data was analyzed and a profile of velocity versus depth was produced for both compressional and horizontally polarized shear waves.

A detailed reference for the suspension PS velocity measurement techniques used in this study is:

> Guidelines for Determining Design Basis Ground Motions, Report TR-102293, Electric Power Research Institute, Palo Alto, California, November 1993, Sections 7 and 8.

INSTRUMENTATION

Suspension Instrumentation

Suspension soil velocity measurements were performed below the surface casing using the Suspension PS logging system, manufactured by OYO Corporation, and their subsidiary, Robertson Geologging. This system directly determines the average velocity of a 3.3-foot high segment of the soil column surrounding the boring of interest by measuring the elapsed time between arrivals of a wave propagating upward through the soil column. The receivers that detect the wave, and the source that generates the wave, are moved as a unit in the boring producing relatively constant amplitude signals at all depths.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave source (S_H) and compressional-wave source (P), joined to two biaxial receivers by a flexible isolation cylinder, as shown in Figure 1. The separation of the two receivers is 3.3 feet, allowing average wave velocity in the region between the receivers to be determined by inversion of the wave travel time between the two receivers. The total length of the probe as used in these surveys is 21 feet, with the center point of the receiver pair 12.5 feet above the bottom end of the probe.

The probe receives control signals from, and sends the digitized receiver signals to, instrumentation on the surface via an armored 4 conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder.

The entire probe is suspended in the boring by the cable, therefore, source motion is not coupled directly to the boring walls; rather, the source motion creates a horizontally propagating impulsive pressure wave in the fluid filling the boring and surrounding the source. This pressure wave is converted to P and S_H-waves in the surrounding soil and rock as it impinges upon the wall of the boring. These waves propagate through the soil and rock surrounding the boring, in

turn causing a pressure wave to be generated in the fluid surrounding the receivers as the soil waves pass their location. Separation of the P and S_H-waves at the receivers is performed using the following steps:

1. Orientation of the horizontal receivers is maintained parallel to the axis of the source, maximizing the amplitude of the recorded S_H -wave signals.
2. At each depth, S_H-wave signals are recorded with the source actuated in opposite directions, producing S_H-wave signals of opposite polarity, providing a characteristic S_H-wave signature distinct from the P-wave signal.
3. The 7.0-foot separation of source and receiver 1 permits the P-wave signal to pass and damp significantly before the slower S_H-wave signal arrives at the receiver. In faster soils or rock, the isolation cylinder is extended to allow greater separation of the P- and S_H-wave signals.
4. In saturated soils, the received P-wave signal is typically of much higher frequency than the received S_H-wave signal, permitting additional separation of the two signals by low pass filtering.
5. Direct arrival of the original pressure pulse in the fluid is not detected at the receivers because the wavelength of the pressure pulse in fluid is significantly greater than the dimension of the fluid annulus surrounding the probe (meter versus centimeter scale), preventing significant energy transmission through the fluid medium.

In operation, a distinct, repeatable pattern of impulses is generated at each depth as follows:

1. The source is fired in one direction producing dominantly horizontal shear with some vertical compression, and the signals from the horizontal receivers situated parallel to the axis of motion of the source are recorded.
2. The source is fired again in the opposite direction and the horizontal receiver signals are recorded.
3. The source is fired again and the vertical receiver signals are recorded. The repeated source pattern facilitates the picking of the P and S_H-wave arrivals; reversal of the source changes the polarity of the S_H-wave pattern but not the P-wave pattern.

The data from each receiver during each source activation is recorded as a different channel on the recording system. The Suspension PS system has six channels (two simultaneous recording channels), each with a 1024 sample record. The recorded data are displayed as six channels with a common time scale. Data are stored on disk for further processing. Up to 8 sampling sequences can be summed to improve the signal to noise ratio of the signals.

Review of the displayed data on the recorder or computer screen allows the operator to set the gains, filters, delay time, pulse length (energy), sample rate, and summing number to optimize the quality of the data before recording. Verification of the calibration of the Suspension PS digital recorder is performed every twelve months using a NIST traceable frequency source and counter, as outlined in Appendix B.

MEASUREMENT PROCEDURES

Suspension Measurement Procedures

The boring was logged in uncased lengths of the boring (below the casing), while filled with bentonite or polymer based drilling mud. Measurements followed the **GEO***Vision* Procedure for P-S Suspension Seismic Velocity Logging, revision 1.5. The probe was positioned with the mid-point of the receivers at ground level, and the depth value was set to zero, in order to reference all depths to ground level. The probe was lowered to the bottom of the boring, stopping at 1.6 or 0.7 foot intervals to collect data, as summarized in Table 2. Multiple logging runs were made below the casing depths shown in Table 2.

At each measurement depth the measurement sequence of two opposite horizontal records and one vertical record was performed, and the gains were adjusted as required. The data from each depth were viewed on the computer display, checked, and recorded on disk before moving to the next depth.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring.

BORING NUMBER	TOOL AND RUN NUMBER	DEPTH RANGE (FEET)	OPEN HOLE (FEET)	DEPTH TO BOTTOM OF CASING (FEET)	SAMPLE INTERVAL (FEET)	DATE LOGGED
SC-101 MR	SUSPENSION 1	124.6–164.0	176.5	137	1.6 / 0.7	2/10/2011
SC-101 MR	SUSPENSION 2	128.6 – 140.4	-	123	0.7	2/10/2011
SC-101 MR	SUSPENSION 3	31.2 – 124.6	-	34.3	1.6 / 0.7	2/10/2011
SC-101 MR	SUSPENSION 4	1.6 – 39.4	-	NONE	1.6	2/10/2011
SC-104 MR	SUSPENSION 1	23.0 – 54.8	67	25.3	0.7	2/15/2011
SC-105 MR	SUSPENSION 1	21.3 – 67.8	80	20	1.6 / 0.7	2/14/2011
SC-105 MR	SUSPENSION 2	1.6 – 24.6	-	NONE	1.6	2/14/2011

- PROBE DID NOT TOUCH BOTTOM OF BORING

Table 2. Logging dates and depth ranges

DATA ANALYSIS

Suspension Analysis

Using the proprietary OYO program PSLOG.EXE version 1.0, the recorded digital waveforms were analyzed to locate the most prominent first minima, first maxima, or first break on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between receiver 1 and receiver 2 (R1-R2) arrivals was used to calculate the P-wave velocity for that 3.3-foot segment of the soil column. When observable, P-wave arrivals on the horizontal axis records were used to verify the velocities determined from the vertical axis data. The time picks were then transferred into an EXCEL template (EXCEL version 2003 SP2) to complete the velocity calculations based upon the arrival time picks made in PSLOG.

The P-wave velocity over the 7.0-foot interval from source to receiver 1 (S-R1) was also picked using PSLOG, and calculated and plotted in EXCEL, for quality assurance of the velocity derived from the travel time between receivers. In this analysis, the depth values as recorded were increased by 5.2 feet to correspond to the mid-point of the 7.0-foot S-R1 interval. Travel times were obtained by picking the first break of the P-wave signal at receiver 1 and subtracting 4 milliseconds, the calculated and experimentally verified delay from source trigger pulse (beginning of record) to source impact. This delay corresponds to the duration of acceleration of the solenoid before impact.

As with the P-wave records, using PSLOG, the recorded digital waveforms were analyzed to locate the presence of clear S_H-wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the S_H-wave signals from the 'normal' and 'reverse' source pulses are very nearly inverted images of each other. Digital FFT - IFFT lowpass filtering was used to remove the higher frequency P-wave signal from the S_H-wave signal. Different filter cutoffs were used to separate P- and S_H-waves at different depths, ranging from 600 Hz in the slowest zones to 2000 Hz in the regions of highest velocity. At each

depth, the filter frequency was selected to be at least twice the fundamental frequency of the S_H-wave signal being filtered.

Generally, the first maxima were picked for the 'normal' signals and the first minima for the 'reverse' signals, although other points on the waveform were used if the first pulse was distorted. The absolute arrival time of the 'normal' and 'reverse' signals may vary by +/- 0.2 milliseconds, due to differences in the actuation time of the solenoid source caused by constant mechanical bias in the source or by boring inclination. This variation does not affect the R1-R2 velocity determinations, as the differential time is measured between arrivals of waves created by the same source actuation. The final velocity value is the average of the values obtained from the 'normal' and 'reverse' source actuations.

As with the P-wave data, S_H-wave velocity calculated from the travel time over the 7.0-foot interval from source to receiver 1 was calculated and plotted for verification of the velocity derived from the travel time between receivers. In this analysis, the depth values were increased by 5.2 feet to correspond to the mid-point of the 7.0-foot S-R1 interval. Travel times were obtained by picking the first break of the S_H-wave signal at the near receiver and subtracting 4 milliseconds, the calculated and experimentally verified delay from the beginning of the record at the source trigger pulse to source impact. These data and analysis were reviewed by John Diehl as a component of **GEO***Vision*'s in-house QA-QC program.

Figure 2 shows an example of R1 - R2 measurements on a sample filtered suspension record. In Figure 2, the time difference over the 3.3-foot interval of 1.88 milliseconds for the horizontal signals is equivalent to an S_H-wave velocity of 1745 feet/second. Whenever possible, time differences were determined from several phase points on the S_H-waveform records to verify the data obtained from the first arrival of the S_H-wave pulse. Figure 3 displays the same record before filtering of the S_H-waveform record with a 1400 Hz FFT - IFFT digital lowpass filter, illustrating the presence of higher frequency P-wave energy at the beginning of the record, and distortion of the lower frequency S_H-wave by residual P-wave signal.

RESULTS

Suspension Results

Suspension R1-R2 P- and S_H-wave velocities are plotted in Figures 4, 5 and 6. The suspension velocity data presented in these figures are presented in Tables 3, 4 and 5. These plots and data are included in the EXCEL analysis files accompanying this report.

P- and S_H-wave velocity data from R1-R2 analysis and quality assurance analysis of S-R1 data are plotted together in Figures A-1, A-2 and A-3 to aid in visual comparison. It should be noted that R1-R2 data are an average velocity over a 3.3-foot segment of the soil column; S-R1 data are an average over 7.0 feet, creating a significant smoothing relative to the R1-R2 plots. S-R1 data are presented in Tables A-1, A-2 and A-3 and included in the EXCEL analysis files.

Calibration procedures and records for the suspension PS measurement system are presented in Appendix B.

SUMMARY

Discussion of Suspension Results

Suspension PS velocity data are ideally collected in an uncased fluid filled boring, drilled with rotary mud (rotary wash) methods. This boring was ideal for collection of suspension PS velocity data.

Suspension PS velocity data quality is judged based upon 5 criteria:

1. Consistent data between receiver to receiver (R1 – R2) and source to receiver (S – R1) data.
2. Consistent relationship between P-wave and S_H -wave (excluding transition to saturated soils)
3. Consistency between data from adjacent depth intervals.
4. Clarity of P-wave and S_H-wave onset, as well as damping of later oscillations.
5. Consistency of profile between adjacent borings, if available.

These data show good correlation between R1 – R2 and S – R1 data, as well as good correlation between P-wave and S_H-wave velocities, though there is scatter in the P-wave data near the botttom of the dam embankment and in the alluvium, probably caused by variable water content. P-wave and S_H-wave onsets are generally clear, and later oscillations are well damped. Above 35 feet in boring SC-104 MR data quality declines significantly, probably due to borehole collapse. Data was not acquired in the upper portion of this boring due to collapse and risk of probe loss.

Quality Assurance

These boring geophysical measurements were performed using industry-standard or better methods for measurements and analyses. All work was performed under **GEO***Vision* quality assurance procedures, which include:

- Use of NIST-traceable calibrations, where applicable, for field and laboratory instrumentation
- Use of standard field data logs
- Use of independent verification of velocity data by comparison of receiver-to-receiver and source-to-receiver velocities
- Independent review of calculations and results by a registered professional engineer, geologist, or geophysicist.

Suspension Data Reliability

P- and S_H-wave velocity measurement using the Suspension Method gives average velocities over a 3.3-foot interval of depth. This high resolution results in the scatter of values shown in the graphs. Individual measurements are very reliable with estimated precision of +/- 5%. Standardized field procedures and quality assurance checks contribute to the reliability of these data.

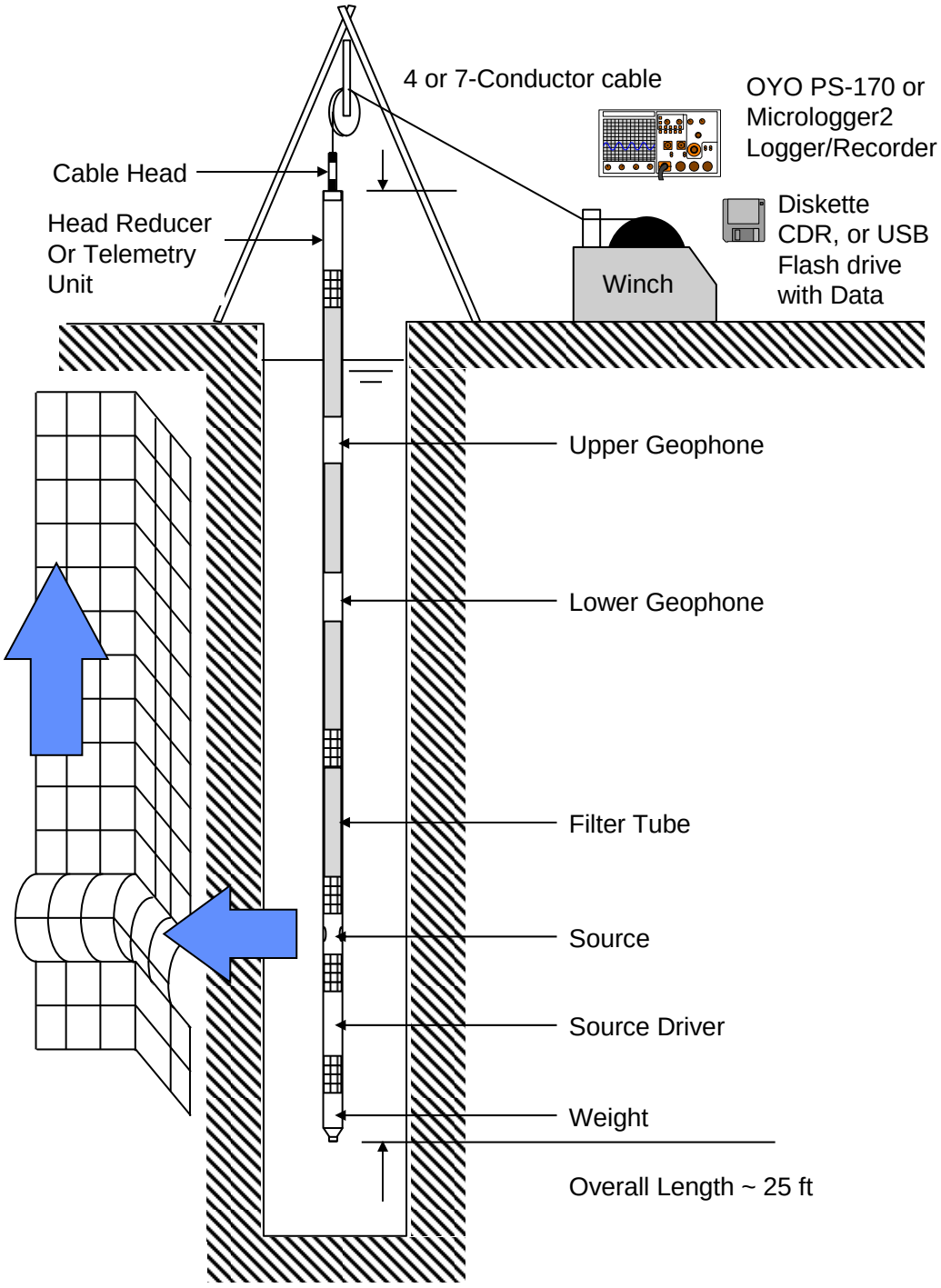

Figure 1: Concept illustration of P-S logging system

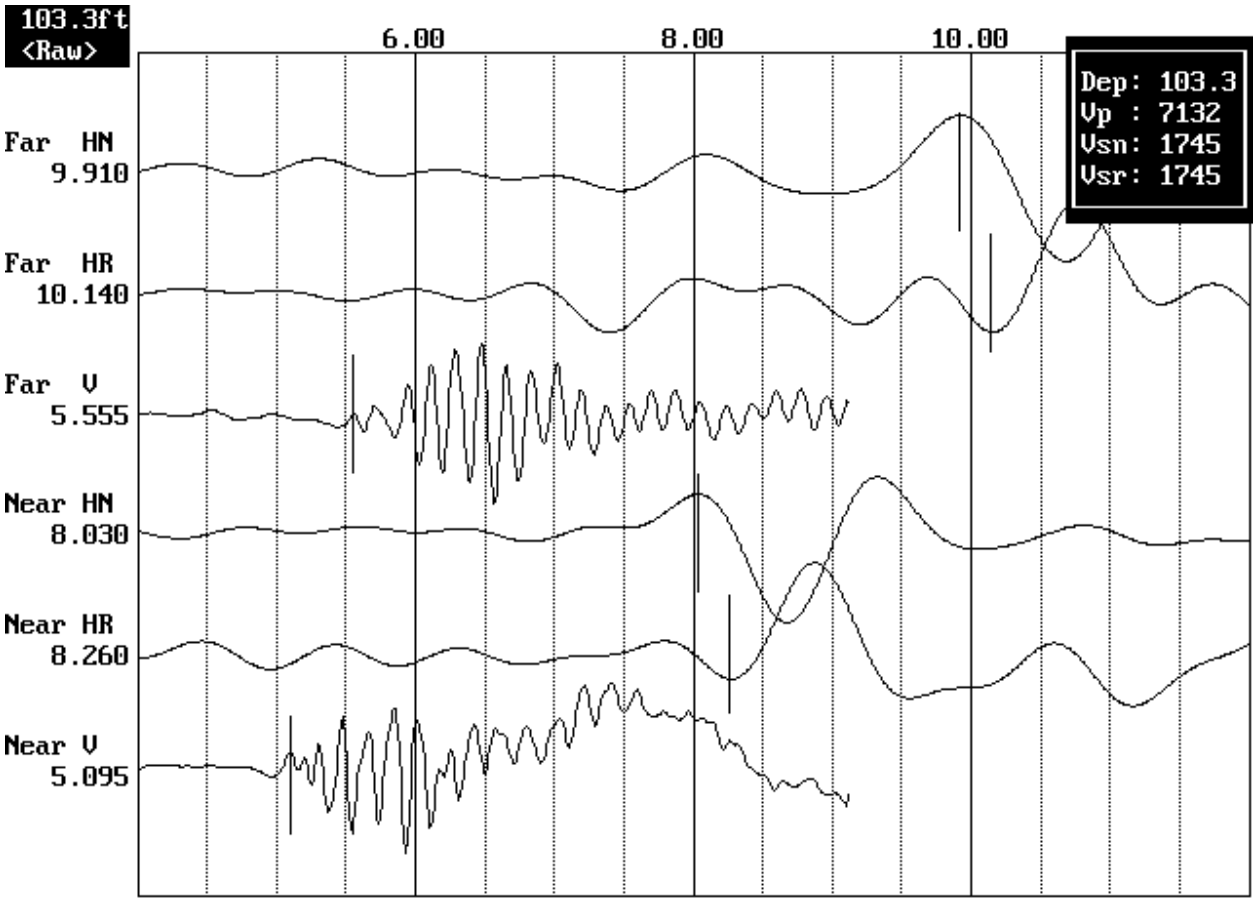

Figure 2: Example of filtered (1400 Hz lowpass) record

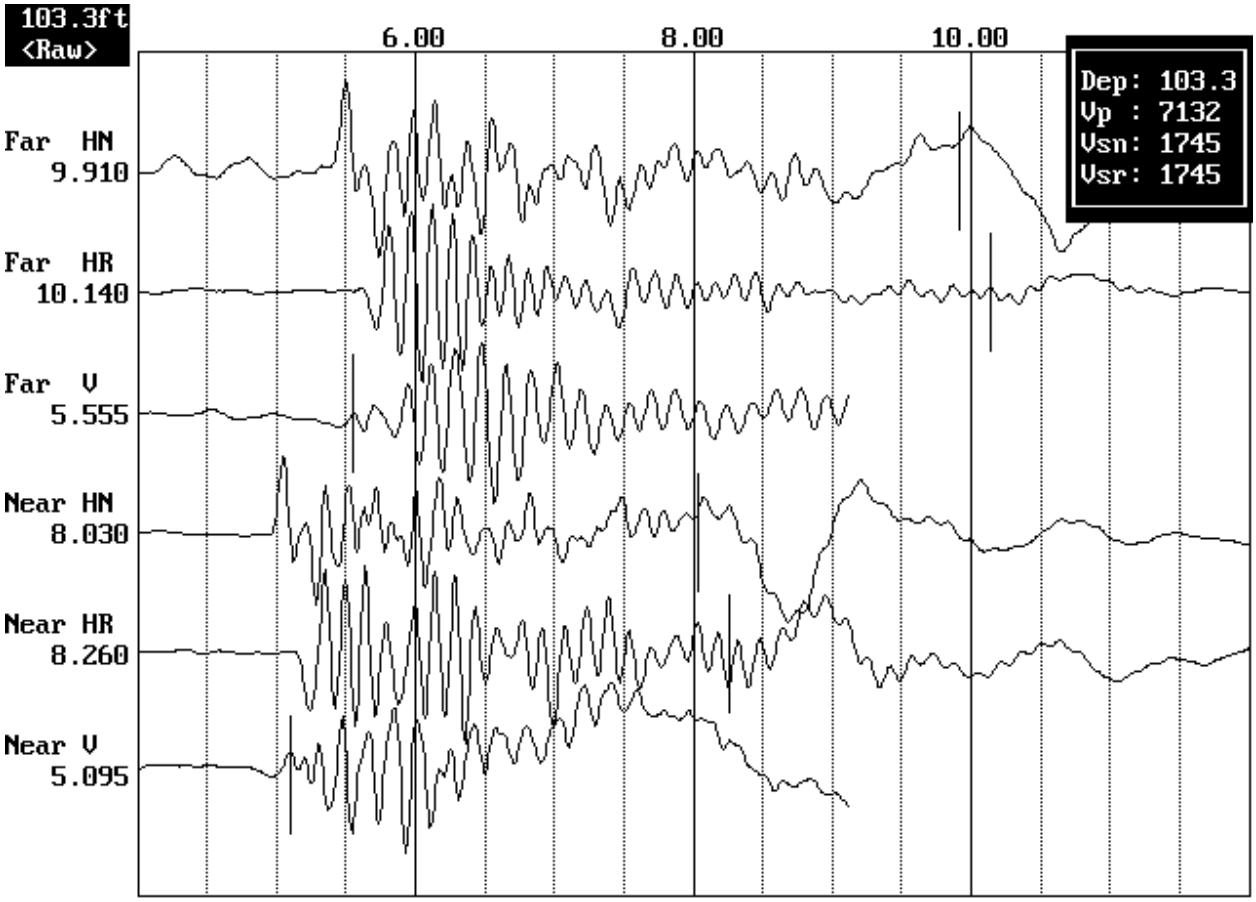

Figure 3. Example of unfiltered record

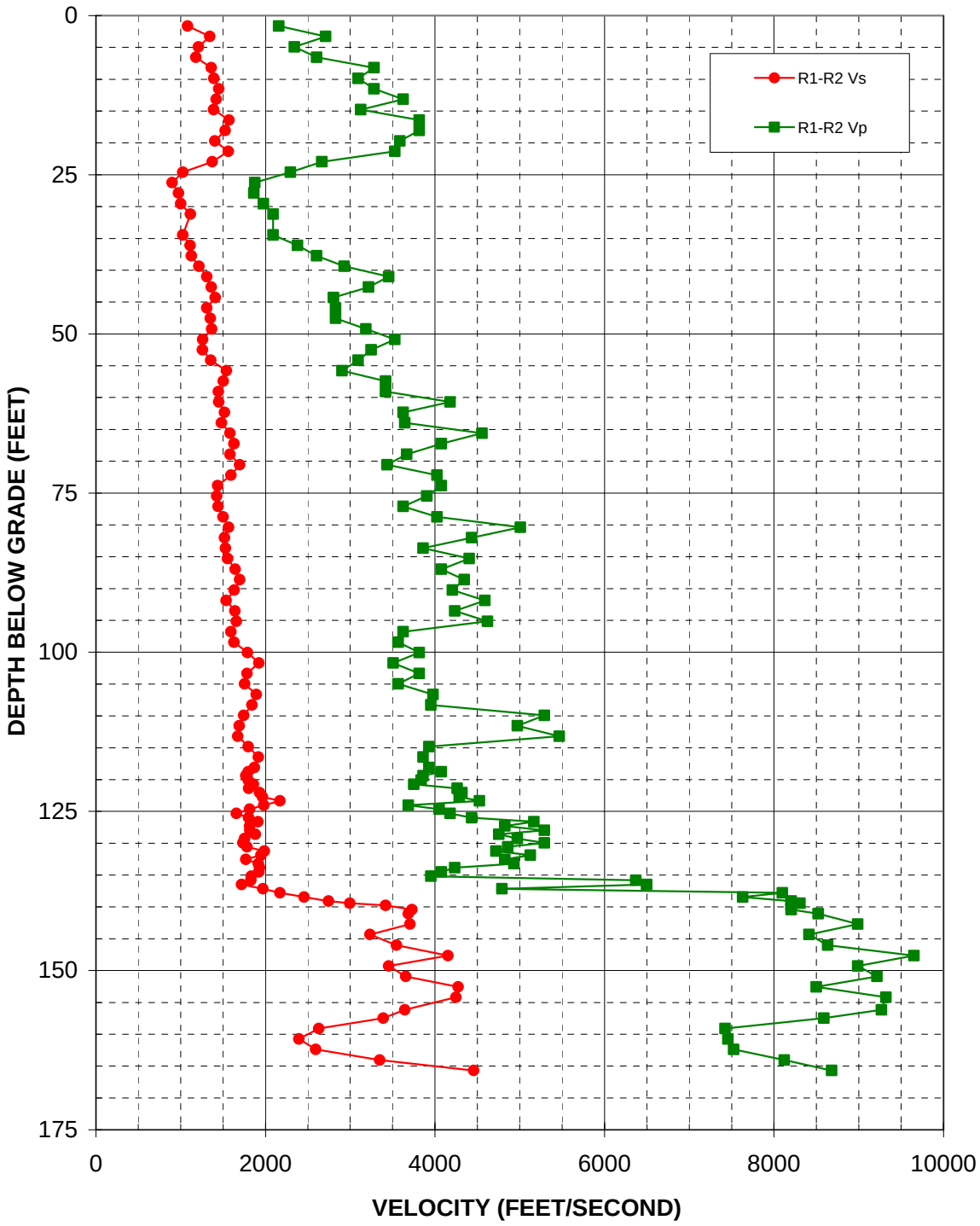

Figure 4: Boring SC-101 MR, Suspension R1-R2 P- and S_H-wave velocities

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
1.6	1083	2158
3.3	1345	2711
4.9	1211	2343
6.6	1180	2604
8.2	1361	3281
9.8	1393	3095
11.5	1452	3281
13.1	1420	3625
14.8	1390	3125
16.4	1570	3815
18.0	1526	3815
19.7	1402	3586
21.3	1562	3528
23.0	1373	2667
24.6	1025	2294
26.2	899	1875
27.9	976	1864
29.5	1000	1976
31.2	1116	2090
34.4	1025	2090
36.1	1112	2377
37.7	1127	2604
39.4	1215	2929
41.0	1307	3454
42.7	1361	3217
44.3	1408	2804
45.9	1307	2828
47.6	1350	2828
49.2	1367	3185
50.9	1262	3528
52.5	1257	3248
54.1	1356	3095
55.8	1540	2903
57.4	1505	3418
59.1	1445	3418
60.7	1452	4179
62.3	1519	3625
64.0	1481	3645
65.6	1581	4557
67.3	1628	4076
68.9	1581	3666
70.5	1696	3435
72.2	1593	4026
73.8	1436	4076
75.5	1426	3906
77.1	1442	3625
78.7	1502	4026
80.4	1566	5009
82.0	1519	4434
83.7	1530	3860
85.3	1555	4404
86.9	1645	4076
88.6	1696	4345
90.2	1632	4206
91.9	1537	4589
93.5	1640	4233
95.1	1657	4621
96.8	1593	3625
98.4	1628	3566
100.1	1788	3815
101.7	1924	3509
103.3	1783	3815
105.0	1754	3566
106.6	1891	3977
108.3	1843	3953
109.9	1745	5292
111.5	1691	4971
113.2	1674	5468
114.8	1798	3929
116.5	1919	3860
118.1	1869	3929
118.8	1798	4076
119.4	1769	3860
120.1	1798	3837
120.7	1859	3750
121.4	1803	4261
122.0	1930	4317
122.7	1965	4289
123.4	2173	4525
124.0	1982	3686
124.7	1813	4050
125.3	1657	4179
126.0	1803	4434
126.6	1913	5167
127.3	1813	4825
128.0	1818	5292
128.6	1880	4755
129.3	1754	4971
129.9	1736	5292
130.6	1783	4861
131.2	1988	4721
131.9	1947	5126
132.5	1769	4825
133.2	1919	4934
133.9	1930	4233
134.5	1924	4076
135.2	1833	3953
135.8	1828	6371
136.5	1718	6497
137.1	1970	4790
137.8	2173	8101
138.5	2458	7630
139.1	2745	8202
139.4	2996	8306
139.8	3418	8202
140.4	3728	8202
141.1	3686	8522
142.7	3707	8989
144.4	3232	8412
146.0	3547	8634
147.6	4153	9650
149.3	3454	8989
150.9	3656	9216
152.6	4275	8500
154.2	4247	9321
156.2	3645	9268
157.5	3391	8589
159.1	2630	7423
160.8	2395	7456
162.4	2594	7525
164.0	3348	8121
165.7	4458	8679

Table 3. Boring SC-101 MR, Suspension R1-R2 depths and P- and S_H-wave velocities

STEVENS CREEK DAM BORING SC-104 MR

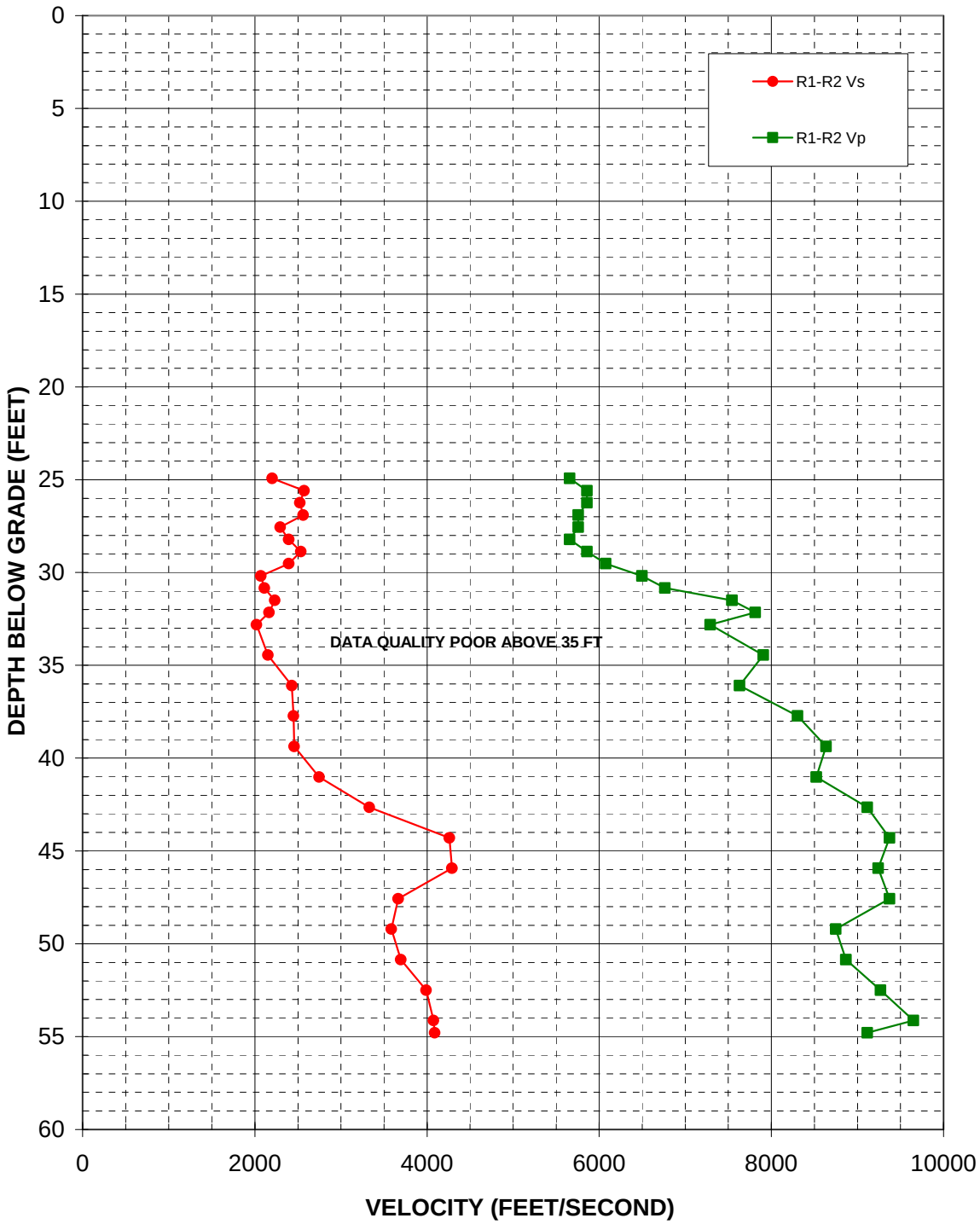

Figure 5: Boring SC-104 MR, Suspension R1-R2 P- and S_H-wave velocities

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
23.0		
23.6		
24.3		
24.9	2202	5657
25.6	2573	5859
26.2	2524	5859
26.9	2563	5756
27.6	2294	5756
28.2	2395	5657
28.9	2533	5859
29.5	2395	6076
30.2	2070	6497
30.8	2110	6765
31.5	2232	7542
32.2	2166	7812
32.8	2019	7291
34.4	2151	7906
36.1	2430	7630
37.7	2448	8306
39.4	2458	8634
41.0	2745	8522
42.7	3331	9113
44.3	4261	9374
45.9	4289	9242
47.6	3666	9374
49.2	3586	8749
50.9	3697	8867
52.5	3989	9268
54.1	4076	9650
54.8	4088	9113

Table 4. Boring SC-104 MR, Suspension R1-R2 depths and P- and S_H-wave velocities

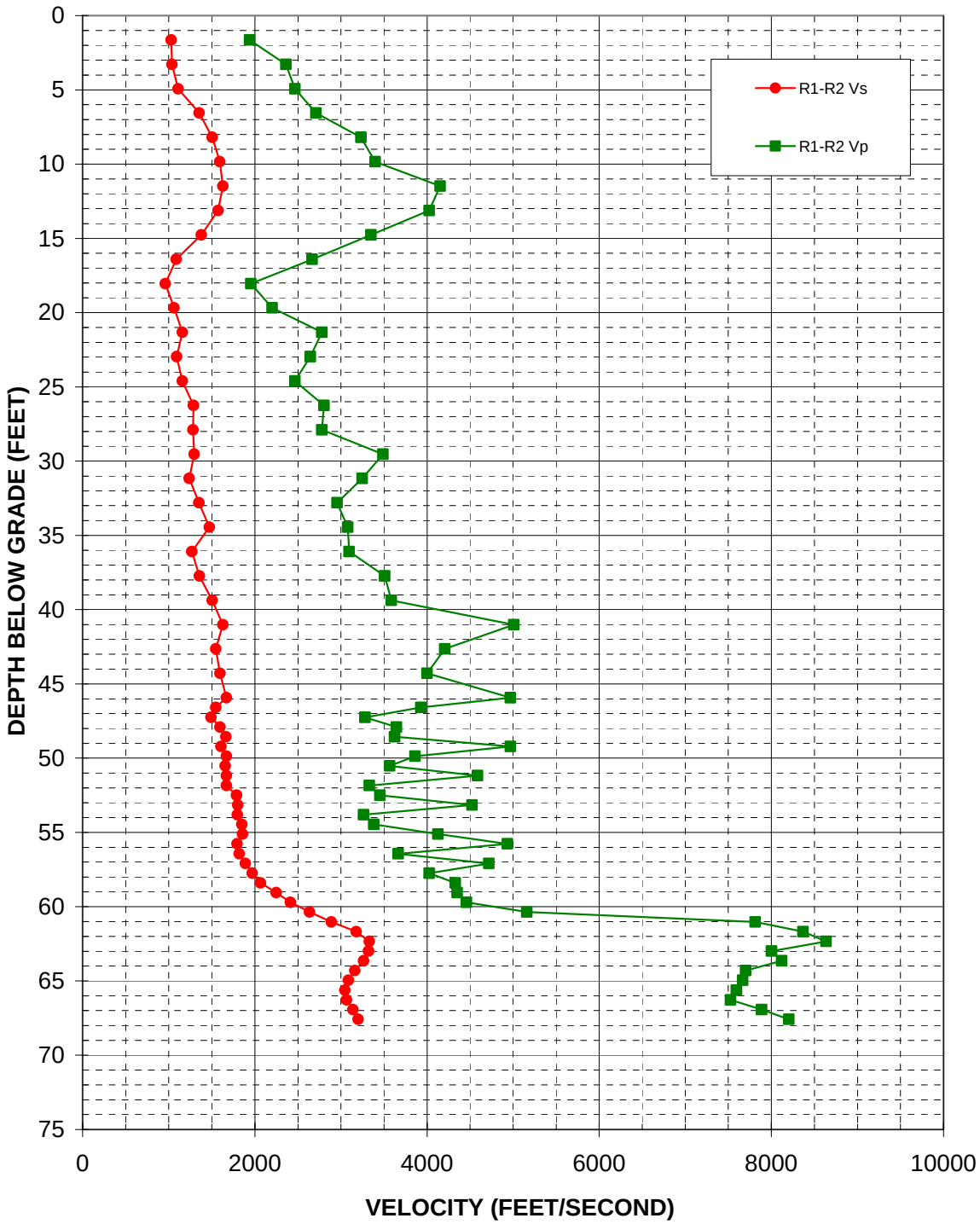

Figure 6: Boring SC-105 MR, Suspension R1-R2 P- and S_H-wave velocities

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
1.6	1028	1941
3.3	1038	2360
4.9	1108	2467
6.6	1353	2711
8.2	1505	3232
9.8	1593	3400
11.5	1628	4153
13.1	1574	4026
14.8	1379	3348
16.4	1086	2667
18.0	959	1953
19.7	1062	2202
21.3	1159	2780
23.0	1094	2646
24.6	1159	2467
26.2	1287	2804
27.9	1282	2780
29.5	1297	3490
31.2	1238	3248
32.8	1350	2956
34.4	1471	3081
36.1	1269	3095
37.7	1356	3509
39.4	1505	3586
41.0	1628	5009
42.7	1548	4206
44.3	1597	4001
45.9	1670	4971
46.6	1548	3929
47.2	1491	3281
47.9	1597	3645
48.6	1665	3625
49.2	1608	4971
49.9	1670	3860
50.5	1657	3566
51.2	1670	4589
51.8	1670	3331
52.5	1788	3454
53.1	1803	4525
53.8	1798	3265
54.5	1848	3382
55.1	1859	4127
55.8	1793	4934
56.4	1818	3666
57.1	1891	4721
57.7	1970	4026
58.4	2067	4328
59.1	2247	4351
59.7	2412	4458
60.4	2635	5159
61.0	2891	7812
61.7	3178	8369
62.3	3331	8634
63.0	3322	8002
63.6	3265	8121
64.3	3162	7701
65.0	3088	7666
65.6	3045	7595
66.3	3066	7525
66.9	3140	7887
67.6	3201	8202

Table 5. Boring SC-105 MR, Suspension R1-R2 depths and P- and S_H-wave velocities

APPENDIX A

SUSPENSION VELOCITY MEASUREMENT QUALITY ASSURANCE SUSPENSION SOURCE TO RECEIVER ANALYSIS RESULTS

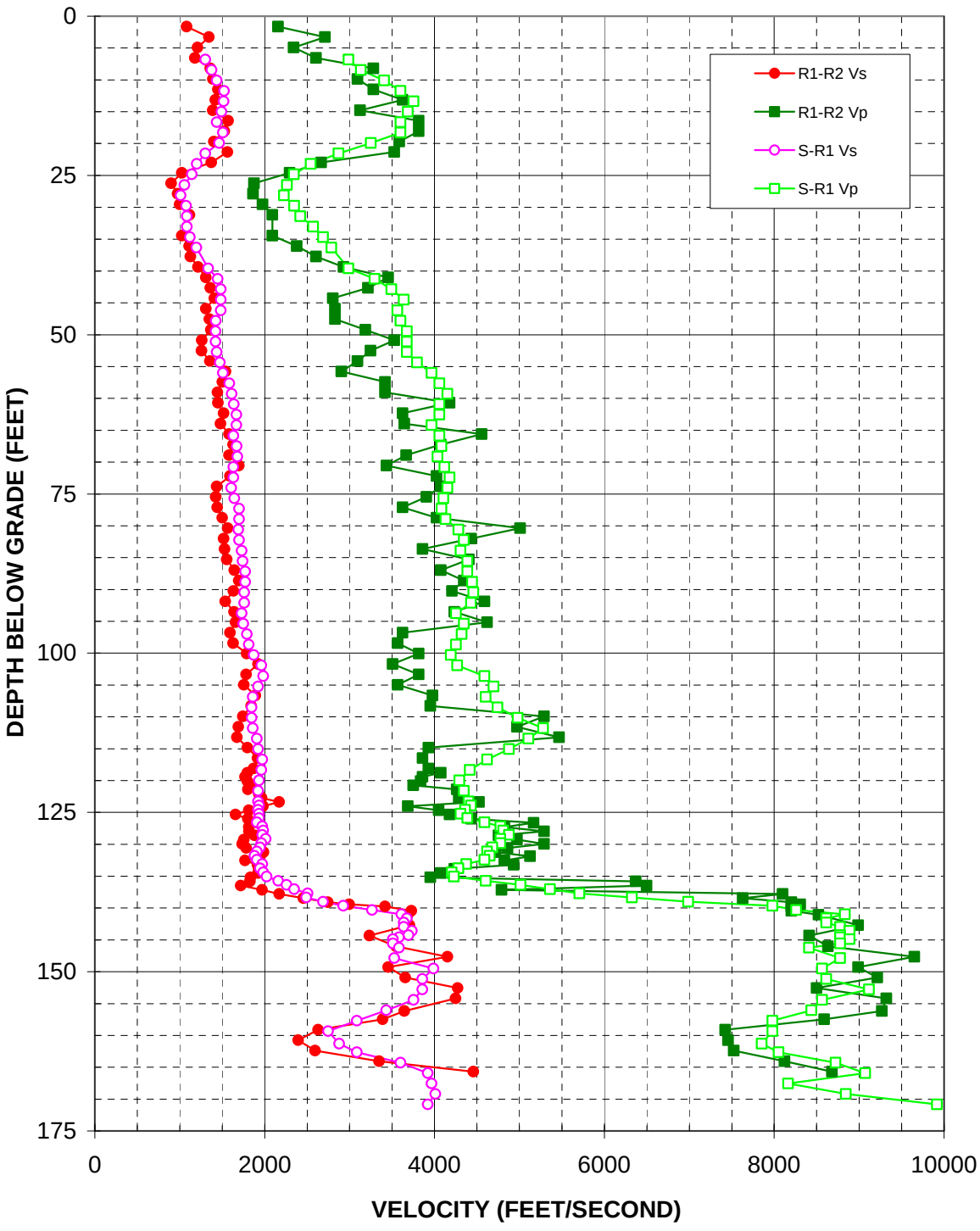

Figure A-1. Boring SC-101 MR, R1 - R2 high resolution analysis and S - R1 quality assurance analysis P- and S_H-wave data

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
6.8	1303	2988
8.4	1374	3134
10.1	1436	3408
11.7	1523	3601
13.4	1516	3755
15.0	1494	3686
16.6	1436	3601
18.3	1510	3601
19.9	1466	3250
21.6	1303	2872
23.2	1202	2544
24.8	1143	2344
26.5	1056	2265
28.1	1013	2229
29.8	1075	2348
31.4	1085	2421
33.0	1085	2572
34.7	1120	2690
36.3	1196	2786
39.6	1337	2988
41.2	1448	3296
42.9	1484	3493
44.5	1484	3638
46.2	1484	3564
47.8	1424	3601
49.4	1421	3676
51.1	1421	3676
52.7	1436	3676
54.4	1472	3795
56.0	1510	3967
57.6	1585	4058
59.3	1614	4154
60.9	1637	4058
62.6	1668	4058
64.2	1668	3967
65.8	1633	4058
67.5	1672	4082
69.1	1680	4035
70.8	1633	4118
72.4	1633	4179
74.0	1607	4154
75.7	1644	4106
77.3	1700	4082
79.0	1700	4130
80.6	1692	4281
82.3	1700	4347
83.9	1729	4307
85.5	1742	4388
87.2	1771	4388
88.8	1771	4444
90.5	1760	4458
92.1	1760	4430
93.7	1729	4255
95.4	1751	4347
97.0	1791	4321
98.7	1814	4255
100.3	1872	4192
101.9	1961	4268
103.6	1983	4589
105.2	1924	4696
106.9	1862	4604
108.5	1848	4744
110.1	1848	4979
111.8	1862	5279
113.4	1908	5106
115.1	1924	4876
116.7	1972	4619
118.3	1961	4416
120.0	1934	4294
121.6	1924	4347
123.3	1924	4402
123.9	1934	4430
124.6	1924	4361
125.2	1934	4307
125.9	1934	4388
126.5	1908	4589
127.2	1972	4776
127.9	1983	4809
128.5	1972	4876
129.2	2012	4776
129.8	1961	4776
130.5	1945	4681
131.1	1908	4619
131.8	1882	4650
132.4	1908	4589
133.1	1972	4374
133.8	1945	4281
134.4	1983	4204
135.1	2023	4230
135.7	2160	4604
136.4	2258	5015
137.0	2348	5360
137.7	2507	5708
138.4	2490	6325
139.0	2690	6986
139.7	2925	7978
140.3	3266	8260
141.0	3610	8831
141.6	3676	8615
142.3	3638	8615
142.9	3638	8776
143.6	3735	8887
144.3	3695	8776
144.6	3582	8776
144.9	3510	8887
145.6	3510	8776
146.2	3582	8408
147.9	3528	8776
149.5	3989	8562
151.1	3858	8615
152.8	3858	9118
154.4	3755	8562
156.1	3433	8439
157.7	3086	7978
159.4	2748	7978
161.3	2877	7853
162.6	3086	8052
164.3	3601	8722
165.9	3922	9071
167.6	3967	8164
169.2	4012	8843
170.8	3922	9917

Table A-1. Boring SC-101 MR, S - R1 quality assurance analysis P- and S_H-wave data

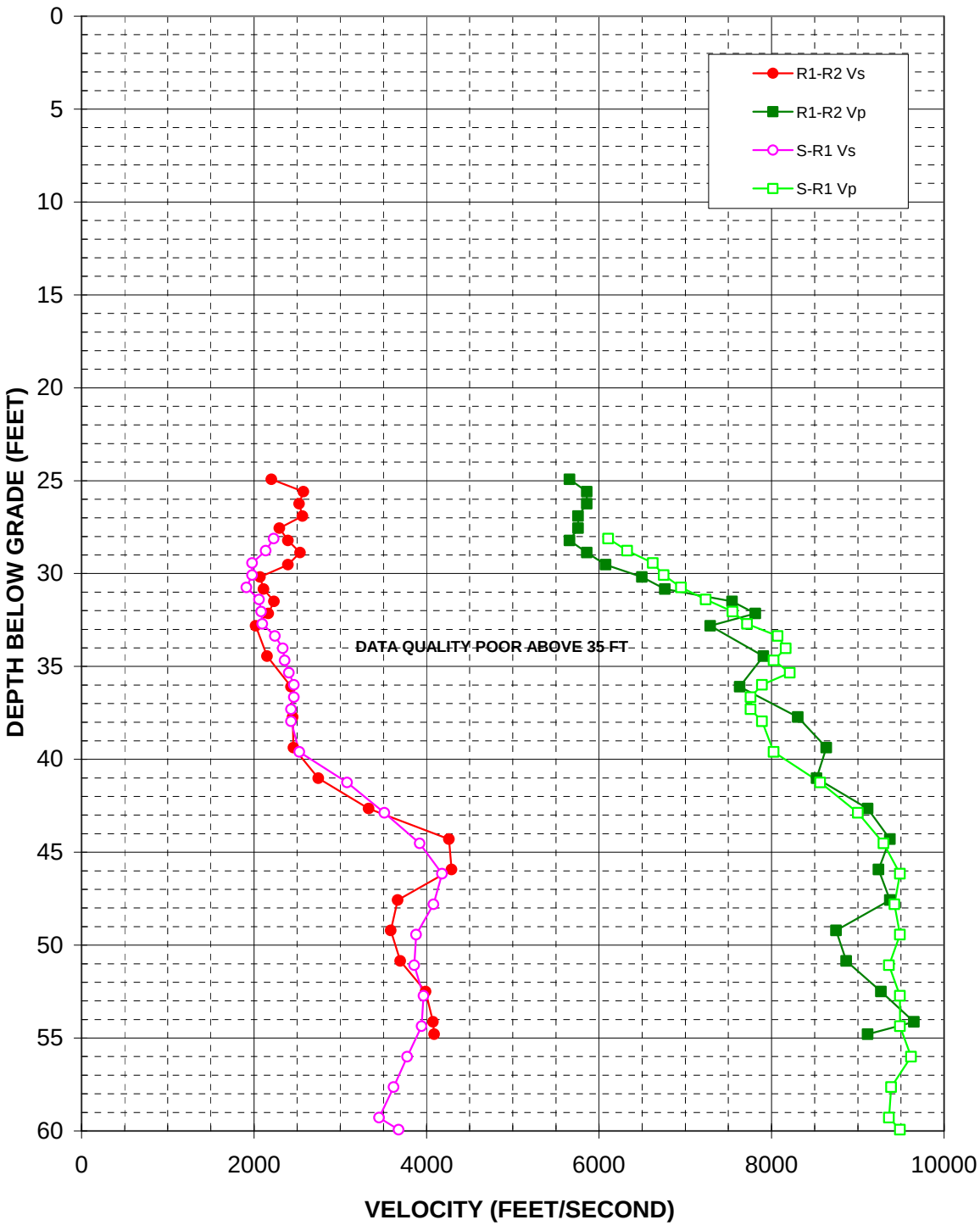

Figure A-2. Boring SC-104 MR, R1 - R2 high resolution analysis and S - R1 quality assurance analysis P- and S_H-wave data

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
28.1	2229	6105
28.8	2134	6325
29.4	1978	6624
30.1	1978	6751
30.7	1913	6951
31.4	2059	7238
32.1	2083	7549
32.7	2096	7715
33.4	2243	8070
34.0	2333	8164
34.7	2356	8024
35.3	2404	8212
36.0	2464	7889
36.6	2464	7758
37.3	2429	7758
38.0	2429	7889
39.6	2526	8024
41.2	3079	8562
42.9	3510	9001
44.5	3922	9299
46.2	4179	9488
47.8	4082	9424
49.4	3879	9488
51.1	3858	9361
52.7	3967	9488
54.4	3944	9488
56.0	3775	9618
57.6	3619	9386
59.3	3450	9361
59.9	3676	9488

Table A-2. Boring SC-104 MR, S - R1 quality assurance analysis P- and S_H-wave data

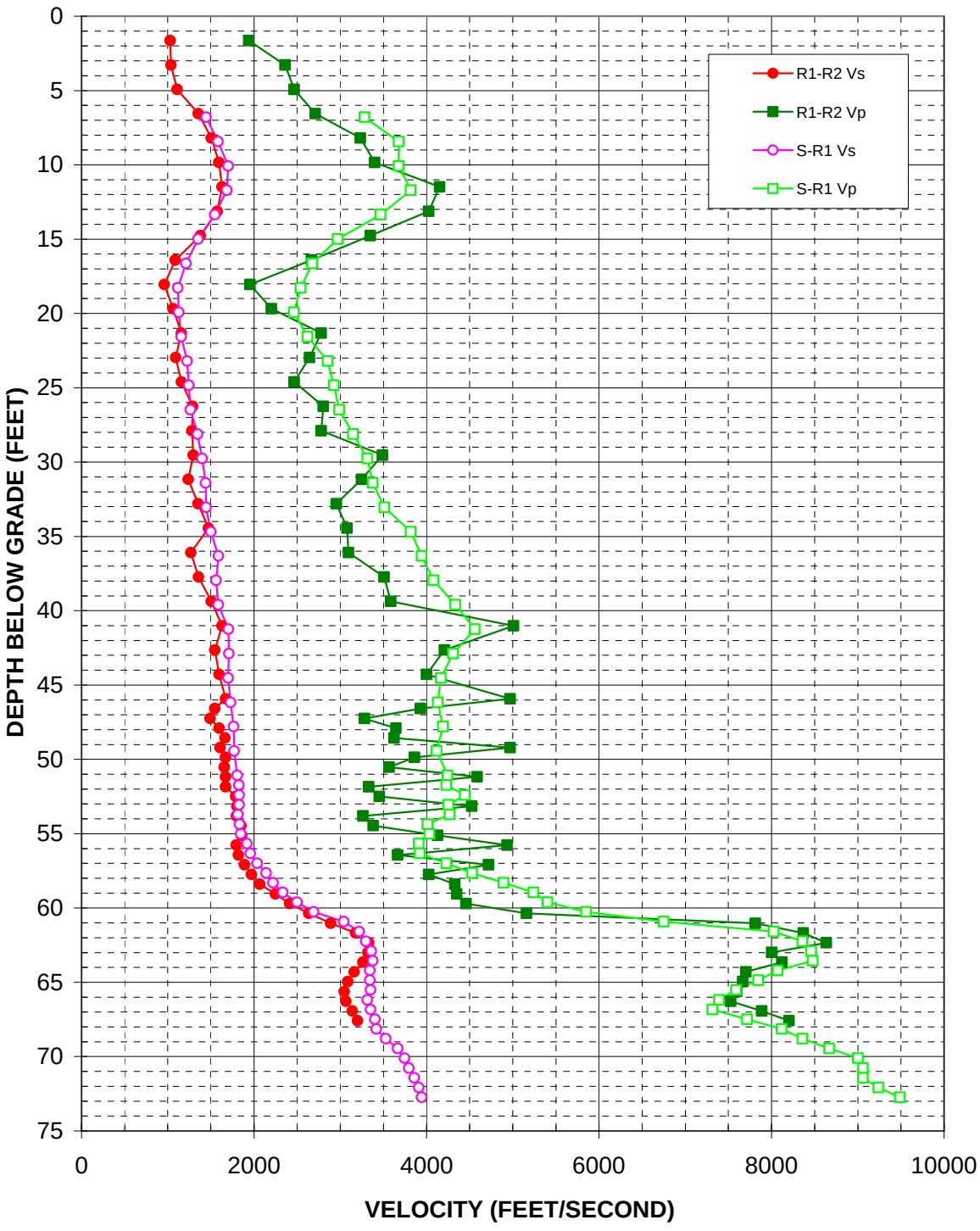

Figure A-3. Boring SC-105 MR, R1 - R2 high resolution analysis and S - R1 quality assurance analysis P- and S_H-wave data

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
6.8	1445	3281
8.4	1581	3676
10.1	1700	3676
11.7	1684	3816
13.4	1546	3467
15.0	1350	2969
16.6	1211	2675
18.3	1118	2539
19.9	1129	2464
21.6	1155	2620
23.2	1223	2854
24.8	1245	2925
26.5	1263	2988
28.1	1345	3148
29.8	1399	3312
31.4	1439	3375
33.0	1445	3510
34.7	1500	3816
36.3	1588	3944
38.0	1560	4082
39.6	1585	4334
41.2	1702	4559
42.9	1708	4307
44.5	1700	4167
46.2	1727	4130
47.8	1764	4192
49.4	1769	4118
51.1	1805	4242
51.7	1824	4230
52.4	1828	4444
53.1	1828	4255
53.7	1814	4268
54.4	1833	4012
55.0	1848	4035
55.7	1918	3911
56.3	1956	3922
57.0	2035	4230
57.6	2141	4530
58.3	2222	4893
59.0	2333	5240
59.6	2499	5401
60.3	2690	5851
60.9	3039	6751
61.6	3221	8024
62.2	3296	8358
62.9	3359	8459
63.5	3375	8479
64.2	3343	8070
64.9	3343	7845
65.5	3351	7590
66.2	3312	7391
66.8	3351	7314
67.5	3400	7715
68.1	3417	8117
68.8	3528	8358
69.5	3666	8668
70.1	3745	9001
70.8	3795	9059
71.4	3858	9059
72.1	3911	9238
72.7	3944	9488

Table A-3. Boring SC-105 MR, S - R1 quality assurance analysis P- and S_H-wave data

APPENDIX B

BORING GEOPHYSICAL LOGGING SYSTEMS - NIST TRACEABLE CALIBRATION PROCEDURES AND CALIBRATION RECORDS

MICRO PRECISION CALIBRATION, INC.
12686 HOOVER STREET
GARDEN GROVE, CA, 92841
(714) 901-5659

Certificate of Calibration

Date: 10/6/2010 **Lab #** 935.11 **Certificate #: 1114924**

Customer:
GEOVISION
1124 OLYMPIC DRIVE
CORONA, CA, 92881

Purchase Order:	OH-101004-01		
Work Order:	N/A		
MPC Control #:	BG9698	Serial Number:	15014
Asset ID:	15014	Department:	N/A
Gage Type:	LOGGER	Performed By:	STEVE BORING
Manufacturer:	OYO	Received Condition:	IN TOLERANCE
Model Number:	03331-0000	Returned Condition:	IN TOLERANCE
Size:	N/A	Cal Date:	October 4, 2010
Temp./RH:	70 °F / 35 %	Cal. Interval:	12 MONTHS
		Cal. Due Date:	October 4, 2011

Found conditions meet or exceed manufacturer specifications.

***Calibration Notes:**
The UUT (unit under test) was calibrated using the customers procedures in our Garden Grove lab.
The UUT was operated by the customers personnel and data collection was observed by MPC personnel.
The UUT was found to be in tolerance to customer supplied specifications. The reference standards used are in compliance with ISO/IEC 17025:2005, ISO9001:2000, ANSI/NCSL Z540-1-1994 and laboratory accreditation for lab code 935.11. Frequency is accredited. Measurement uncertainty is 0.2 x E12 Hz.
Please see attached data sheet.

Standards Used To Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AM4000	WAVEFORM GENERATOR	33250A	MY40000703	AGILENT	8/17/2011	1063979
T1100	COUNTER	53131A	3546A09912	HEWLETT PACKARD	1/20/2011	646688

Calibrating Technician: STEVE BORING

QC Approval: Tammy Webster

Unless Otherwise Noted, Uncertainty Estimated at >= 4 to 1. Uncertainties have been estimated at a 95 percent confidence level (k=2). Services rendered comply with ISO 17025:2005, ISO 9001:2008, ANSI/NCSL Z540-1, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to the National Institute of Standards and Technology (NIST). Services rendered include proper manufacture's service instructions and are warranted for no less than (30) days. This report may not be reproduced in part or in whole without the prior written approval of the issuing MPC lab.

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(CERT, Rev 1)

BG 9698

GEOVision
geophysical services

SUSPENSION PS SEISMIC LOGGER/RECORDER CALIBRATION DATA FORM

INSTRUMENT DATA

System mfg.:	OYO	Model no.:	3331
Serial no.:	15014	Calibration date:	10/4/2010
By:	Charles Carter	Due date:	10/4/2011
Counter mfg.:	Hewlett Packard	Model no.:	53131A
Serial no.:	3416A05377	Calibration date:	6/8/2010
By:	Micro Precision (LN)	Due date:	6/8/2011
Signal generator mfg.:	Agilent	Model no.:	33250A
Serial no.:	MY4000703	Calibration date:	8/17/2010
By:	Micro Precision (LN)	Due date:	8/17/2011

SYSTEM SETTINGS:

Gain:	20
Filter	LCF: 5Hz; HCF: 20kHz
Range:	See sample period in table below
Delay:	4 ms
Stack (1 std)	1
System date = correct date and time	10/4/2010 3:20pm

PROCEDURE:

Set sine wave frequency to target frequency with amplitude of approximately 0.25 volt peak
Note actual frequency on data form.
Set sample period and record data file to disk. Note file name on data form.
Pick duration of 9 cycles using PSLOG.EXE program, note duration on data form, and save as .sps file. Calculate average frequency for each channel pair and note on data form.

Average frequency must be within +/- 1% of actual frequency at all data points.

Maximum error ((AVG-ACT)/ACT*100)% As found 0.22% As left 0.22%

Target Frequency (Hz)	Actual Frequency (Hz)	Sample Period (microS)	File Name	Time for 9 cycles Hn (msec)	Average Frequency Hn (Hz)	Time for 9 cycles Hr (msec)	Average Frequency Hr (Hz)	Time for 9 cycles V (msec)	Average Frequency V (Hz)
50.00	50.00	200	1	180.2	49.94	179.8	50.06	180.0	50.00
100.0	100.0	100	2	90.10	99.89	90.00	100.0	90.10	99.89
200.0	200.0	50	3	45.00	200.0	45.05	199.8	45.05	199.8
500.0	500.0	20	4	18.00	500.0	18.02	499.5	17.96	501.1
1000	1000	10	5	9.010	998.9	8.990	1001	9.000	1000
2000	2000	5	6	4.510	1996	4.505	1998	4.500	2000

Calibrated by:	Charles Carter	10/4/2010	Charles Carter
	Name	Date	Signature
Witnessed by:	Steve Boring	10/4/2010	
	Name	Date	Signature

Suspension PS Seismic Recorder/Logger Calibration Data Form Rev 2.0 July 21, 2008

Enclosure 2

GEOVision
geophysical services

STEVENS CREEK DAM
BORING SC-103 MR
SUSPENSION PS VELOCITIES

Report 11038-03 Rev 0

November 7, 2011

STEVENS CREEK DAM
BORING SC-103 MR
SUSPENSION PS VELOCITIES

Report 11038-03 Rev 0

November 7, 2011

Prepared for:

Terra Engineers, Inc.
350 Sansome Street, Suite 830
San Francisco, California 94104
888-888-4730

Prepared by

GEOVision Geophysical Services
1124 Olympic Drive
Corona, California 92881
(951) 549-1234

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INTRODUCTION

Boring geophysical measurements were collected in one uncased boring located at Stevens Creek Dam. Geophysical data acquisition was performed on October 13, 2011 by Charles Carter of **GEO***Vision*. Data analysis and report preparation was performed by Robert Steller and reviewed by John Diehl of **GEO***Vision*. The work was performed for Terra Engineers, Inc. (Terra). Robert Kirby served as the point of contact for Terra.

This report describes the field measurements, data analysis, and results of this work.

SCOPE OF WORK

This report presents the results of boring geophysical measurements collected on October 14, 2011, in one uncased boring, as detailed below. The purpose of these studies was to supplement stratigraphic information obtained during Terra's soil and rock sampling program and to acquire shear wave velocities and compressional wave velocities as a function of depth.

BORING	DATES LOGGED	ELEVATION [1] (FEET)	COORDINATES (FEET) [1]	
			NORTHING	EASTING
SC-103 MR	10/14/2011	489.0	1935355.68	6102909.58

[1] Coordinates provided by Terra, coordinates in CA State Plane, elevation NAVD88

Table 1. Boring locations and logging dates

The OYO Suspension PS Logging System (Suspension System) was used to obtain in-situ horizontal shear (S_H) and compressional (P) wave velocity measurements at 1.6 foot intervals. Measurements followed **GEO***Vision* Procedure for P-S Suspension Seismic Velocity Logging, revision 1.5. The acquired data was analyzed and a profile of velocity versus depth was produced for both compressional and horizontally polarized shear waves.

A detailed reference for the suspension PS velocity measurement techniques used in this study is:

> Guidelines for Determining Design Basis Ground Motions, Report TR-102293, Electric Power Research Institute, Palo Alto, California, November 1993, Sections 7 and 8.

INSTRUMENTATION

Suspension Instrumentation

Suspension soil velocity measurements were performed below the surface casing using the Suspension PS logging system, manufactured by OYO Corporation, and their subsidiary, Robertson Geologging. This system directly determines the average velocity of a 3.3-foot high segment of the soil column surrounding the boring of interest by measuring the elapsed time between arrivals of a wave propagating upward through the soil column. The receivers that detect the wave, and the source that generates the wave, are moved as a unit in the boring producing relatively constant amplitude signals at all depths.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave source (S_H) and compressional-wave source (P), joined to two biaxial receivers by a flexible isolation cylinder, as shown in Figure 1. The separation of the two receivers is 3.3 feet, allowing average wave velocity in the region between the receivers to be determined by inversion of the wave travel time between the two receivers. The total length of the probe as used in these surveys is 21 feet, with the center point of the receiver pair 12.5 feet above the bottom end of the probe.

The probe receives control signals from, and sends the digitized receiver signals to, instrumentation on the surface via an armored 4 conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data, using a 3.28-foot circumference sheave fitted with a digital rotary encoder.

The entire probe is suspended in the boring by the cable, therefore, source motion is not coupled directly to the boring walls; rather, the source motion creates a horizontally propagating impulsive pressure wave in the fluid filling the boring and surrounding the source. This pressure wave is converted to P and S_H-waves in the surrounding soil and rock as it impinges upon the wall of the boring. These waves propagate through the soil and rock surrounding the boring, in

turn causing a pressure wave to be generated in the fluid surrounding the receivers as the soil waves pass their location. Separation of the P and S_H-waves at the receivers is performed using the following steps:

1. Orientation of the horizontal receivers is maintained parallel to the axis of the source, maximizing the amplitude of the recorded S_H -wave signals.
2. At each depth, S_H-wave signals are recorded with the source actuated in opposite directions, producing S_H-wave signals of opposite polarity, providing a characteristic S_H-wave signature distinct from the P-wave signal.
3. The 7.0-foot separation of source and receiver 1 permits the P-wave signal to pass and damp significantly before the slower S_H-wave signal arrives at the receiver. In faster soils or rock, the isolation cylinder is extended to allow greater separation of the P- and S_H-wave signals.
4. In saturated soils, the received P-wave signal is typically of much higher frequency than the received S_H-wave signal, permitting additional separation of the two signals by low pass filtering.
5. Direct arrival of the original pressure pulse in the fluid is not detected at the receivers because the wavelength of the pressure pulse in fluid is significantly greater than the dimension of the fluid annulus surrounding the probe (meter versus centimeter scale), preventing significant energy transmission through the fluid medium.

In operation, a distinct, repeatable pattern of impulses is generated at each depth as follows:

1. The source is fired in one direction producing dominantly horizontal shear with some vertical compression, and the signals from the horizontal receivers situated parallel to the axis of motion of the source are recorded.
2. The source is fired again in the opposite direction and the horizontal receiver signals are recorded.
3. The source is fired again and the vertical receiver signals are recorded. The repeated source pattern facilitates the picking of the P and S_H-wave arrivals; reversal of the source changes the polarity of the S_H-wave pattern but not the P-wave pattern.

The data from each receiver during each source activation is recorded as a different channel on the recording system. The Suspension PS system has six channels (two simultaneous recording channels), each with a 1024 sample record. The recorded data are displayed as six channels with a common time scale. Data are stored on disk for further processing. Up to 8 sampling sequences can be summed to improve the signal to noise ratio of the signals.

Review of the displayed data on the recorder or computer screen allows the operator to set the gains, filters, delay time, pulse length (energy), sample rate, and summing number to optimize the quality of the data before recording. Verification of the calibration of the Suspension PS digital recorder is performed every twelve months using a NIST traceable frequency source and counter, as outlined in Appendix B.

MEASUREMENT PROCEDURES

Suspension Measurement Procedures

The boring was logged below the surface casing, while filled with bentonite or polymer based drilling mud. Measurements followed the **GEO***Vision* Procedure for P-S Suspension Seismic Velocity Logging, revision 1.5. The probe was positioned with the mid-point of the receivers at ground level, and the depth value was set to zero, in order to reference all depths to ground level. The probe was lowered to the bottom of the boring, stopping at 1.6 foot intervals to collect data, as summarized in Table 2.

At each measurement depth the measurement sequence of two opposite horizontal records and one vertical record was performed, and the gains were adjusted as required. The data from each depth were viewed on the computer display, checked, and recorded on disk before moving to the next depth.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring.

BORING NUMBER	TOOL AND RUN NUMBER	DEPTH RANGE (FEET)	OPEN HOLE (FEET)	DEPTH TO BOTTOM OF CASING (FEET)	SAMPLE INTERVAL (FEET)	DATE LOGGED
SC-103 MR	SUSPENSION 1	4.9–139.4	152.1	4	1.6	10/14/2011

- PROBE DID NOT TOUCH BOTTOM OF BORING

Table 2. Logging dates and depth ranges

DATA ANALYSIS

Suspension Analysis

Using the proprietary OYO program PSLOG.EXE version 1.0, the recorded digital waveforms were analyzed to locate the most prominent first minima, first maxima, or first break on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between receiver 1 and receiver 2 (R1-R2) arrivals was used to calculate the P-wave velocity for that 3.3-foot segment of the soil column. When observable, P-wave arrivals on the horizontal axis records were used to verify the velocities determined from the vertical axis data. The time picks were then transferred into an EXCEL template (EXCEL version 2003 SP2) to complete the velocity calculations based upon the arrival time picks made in PSLOG.

The P-wave velocity over the 7.0-foot interval from source to receiver 1 (S-R1) was also picked using PSLOG, and calculated and plotted in EXCEL, for quality assurance of the velocity derived from the travel time between receivers. In this analysis, the depth values as recorded were increased by 5.2 feet to correspond to the mid-point of the 7.0-foot S-R1 interval. Travel times were obtained by picking the first break of the P-wave signal at receiver 1 and subtracting 4 milliseconds, the calculated and experimentally verified delay from source trigger pulse (beginning of record) to source impact. This delay corresponds to the duration of acceleration of the solenoid before impact.

As with the P-wave records, using PSLOG, the recorded digital waveforms were analyzed to locate the presence of clear S_H-wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the S_H-wave signals from the 'normal' and 'reverse' source pulses are very nearly inverted images of each other. Digital FFT - IFFT lowpass filtering was used to remove the higher frequency P-wave signal from the S_H-wave signal. Different filter cutoffs were used to separate P- and S_H-waves at different depths, ranging from 600 Hz in the slowest zones to 2000 Hz in the regions of highest velocity. At each

depth, the filter frequency was selected to be at least twice the fundamental frequency of the S_H-wave signal being filtered.

Generally, the first maxima were picked for the 'normal' signals and the first minima for the 'reverse' signals, although other points on the waveform were used if the first pulse was distorted. The absolute arrival time of the 'normal' and 'reverse' signals may vary by +/- 0.2 milliseconds, due to differences in the actuation time of the solenoid source caused by constant mechanical bias in the source or by boring inclination. This variation does not affect the R1-R2 velocity determinations, as the differential time is measured between arrivals of waves created by the same source actuation. The final velocity value is the average of the values obtained from the 'normal' and 'reverse' source actuations.

As with the P-wave data, S_H-wave velocity calculated from the travel time over the 7.0-foot interval from source to receiver 1 was calculated and plotted for verification of the velocity derived from the travel time between receivers. In this analysis, the depth values were increased by 5.2 feet to correspond to the mid-point of the 7.0-foot S-R1 interval. Travel times were obtained by picking the first break of the S_H-wave signal at the near receiver and subtracting 4 milliseconds, the calculated and experimentally verified delay from the beginning of the record at the source trigger pulse to source impact. These data and analysis were reviewed by John Diehl as a component of **GEO***Vision*'s in-house QA-QC program.

Figure 2 shows an example of R1 - R2 measurements on a sample filtered suspension record. In Figure 2, the time difference over the 3.3-foot interval of 1.88 milliseconds for the horizontal signals is equivalent to an S_H-wave velocity of 1745 feet/second. Whenever possible, time differences were determined from several phase points on the S_H-waveform records to verify the data obtained from the first arrival of the S_H-wave pulse. Figure 3 displays the same record before filtering of the S_H-waveform record with a 1400 Hz FFT - IFFT digital lowpass filter, illustrating the presence of higher frequency P-wave energy at the beginning of the record, and distortion of the lower frequency S_H-wave by residual P-wave signal.

RESULTS

Suspension Results

Suspension R1-R2 P- and S_H-wave velocities are plotted in Figure 4. The suspension velocity data presented in these figures are presented in Table 3. These plots and data are included in the EXCEL analysis file accompanying this report.

P- and S_H-wave velocity data from R1-R2 analysis and quality assurance analysis of S-R1 data are plotted together in Figure A-1 to aid in visual comparison. It should be noted that R1-R2 data are an average velocity over a 3.3-foot segment of the soil column; S-R1 data are an average over 7.0 feet, creating a significant smoothing relative to the R1-R2 plots. S-R1 data are presented in Table A-1 and included in the EXCEL analysis file.

Calibration procedures and records for the suspension PS measurement system are presented in Appendix B.

SUMMARY

Discussion of Suspension Results

Suspension PS velocity data are ideally collected in an uncased fluid filled boring, drilled with rotary mud (rotary wash) methods. This boring was ideal for collection of suspension PS velocity data.

Suspension PS velocity data quality is judged based upon 5 criteria:

1. Consistent data between receiver to receiver (R1 – R2) and source to receiver (S – R1) data.
2. Consistent relationship between P-wave and S_H -wave (excluding transition to saturated soils)
3. Consistency between data from adjacent depth intervals.
4. Clarity of P-wave and S_H-wave onset, as well as damping of later oscillations.
5. Consistency of profile between adjacent borings, if available.

These data show good correlation between R1 – R2 and S – R1 data, as well as good correlation between P-wave and S_H-wave velocities. Adjacent data points are consistent. P-wave and S_H-wave onsets are generally clear, and later oscillations are well damped. This velocity profile is similar to boring SC-101 MR, logged in February 2011.

Quality Assurance

These boring geophysical measurements were performed using industry-standard or better methods for measurements and analyses. All work was performed under **GEO***Vision* quality assurance procedures, which include:

- Use of NIST-traceable calibrations, where applicable, for field and laboratory instrumentation
- Use of standard field data logs
- Use of independent verification of velocity data by comparison of receiver-to-receiver and source-to-receiver velocities
- Independent review of calculations and results by a registered professional engineer, geologist, or geophysicist.

Suspension Data Reliability

P- and S_H-wave velocity measurement using the Suspension Method gives average velocities over a 3.3-foot interval of depth. This high resolution results in the scatter of values shown in the graphs. Individual measurements are very reliable with estimated precision of +/- 5%. Standardized field procedures and quality assurance checks contribute to the reliability of these data.

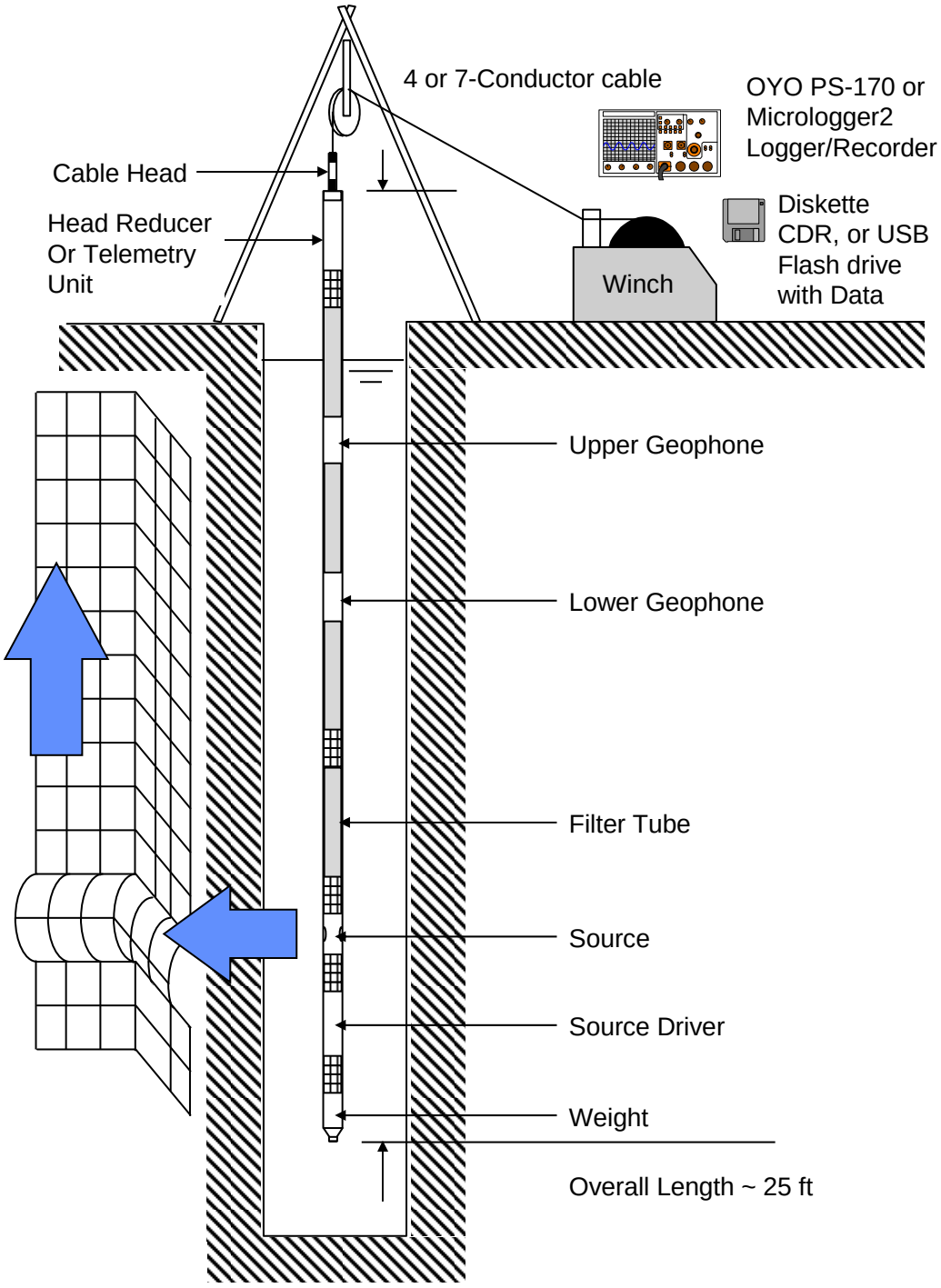


Figure 1: Concept illustration of P-S logging system

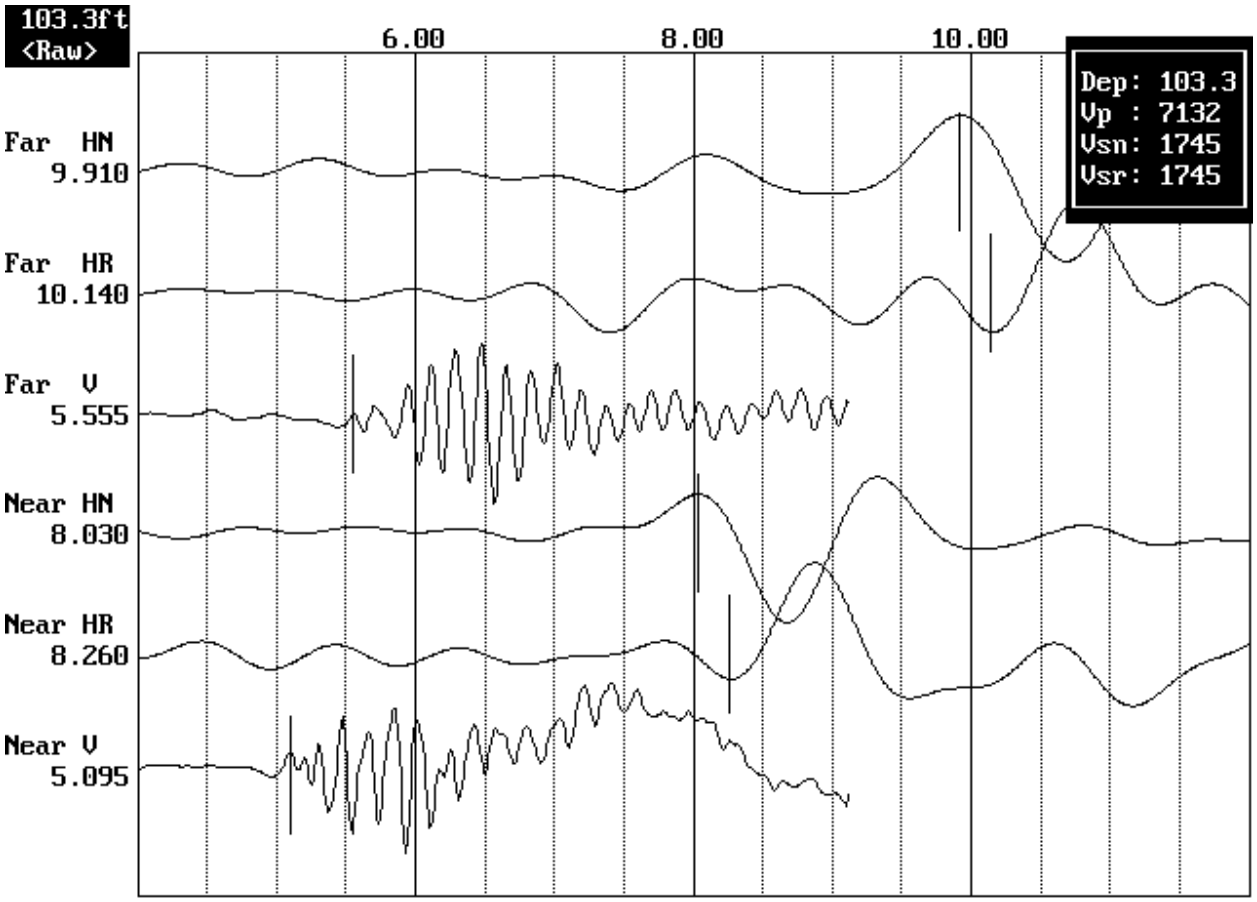


Figure 2: Example of filtered (1400 Hz lowpass) record

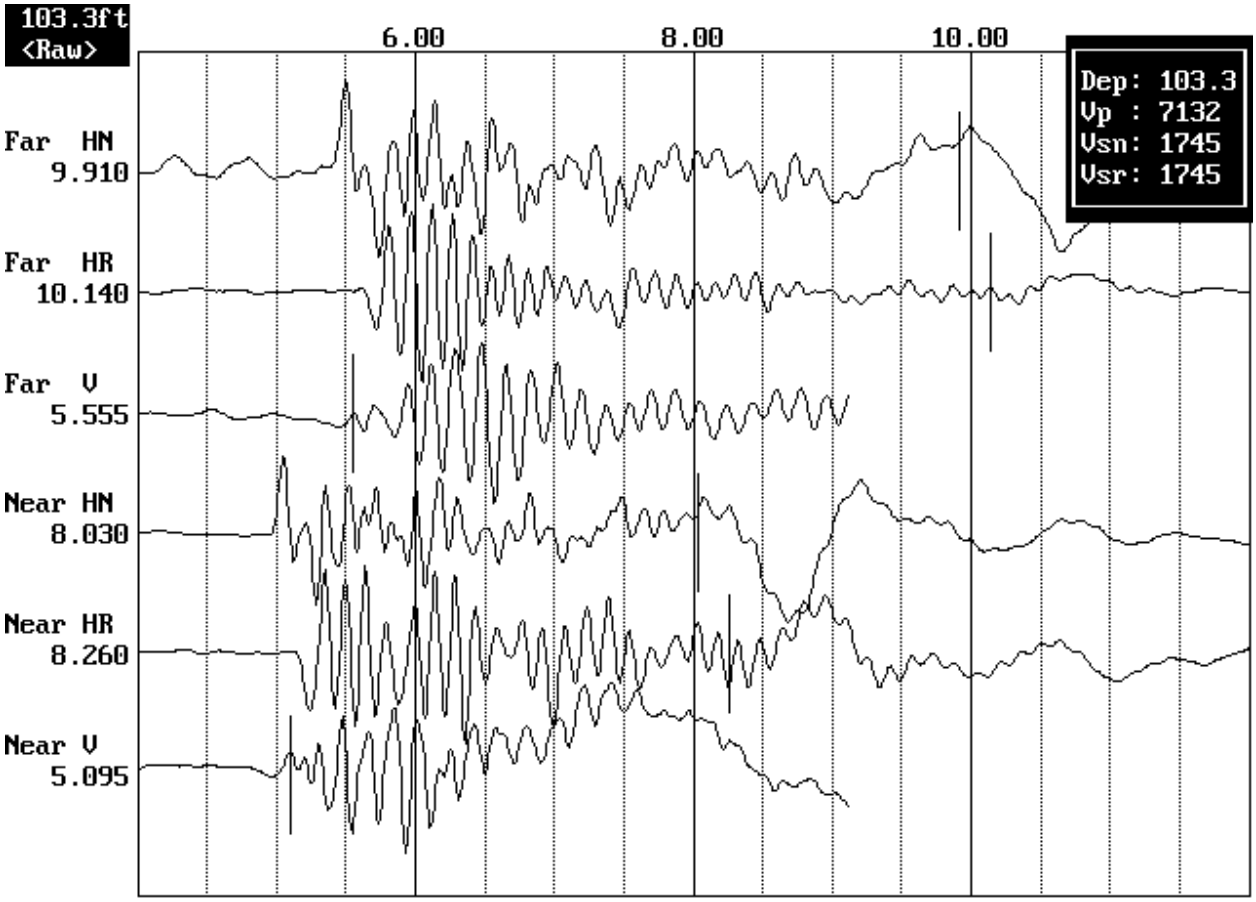


Figure 3. Example of unfiltered record

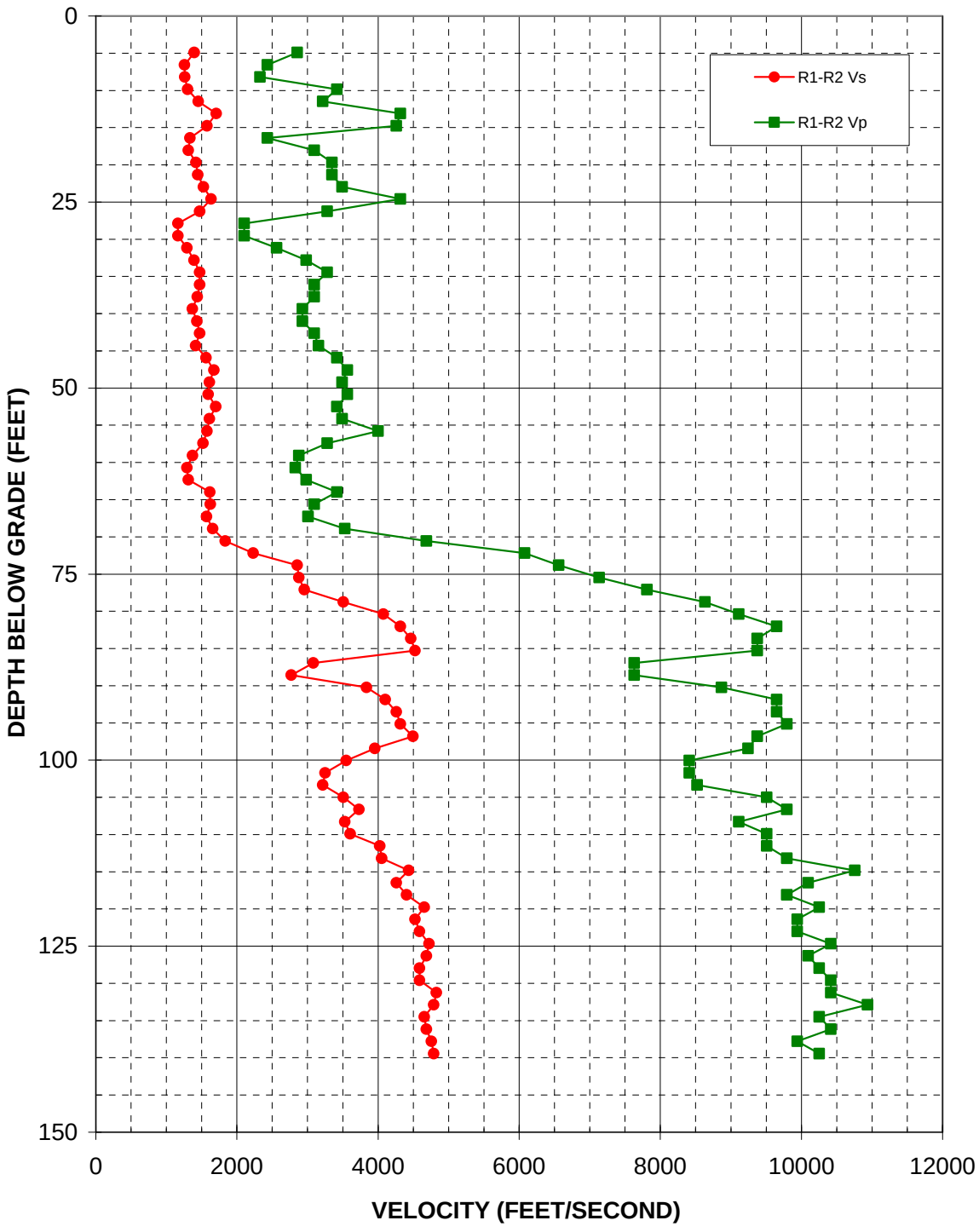


Figure 4: Boring SC-103 MR, Suspension R1-R2 P- and S_H-wave velocities

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
4.9	1396	2853
6.6	1257	2430
8.2	1262	2327
9.8	1302	3418
11.5	1452	3217
13.1	1709	4317
14.8	1577	4261
16.4	1334	2430
18.0	1312	3095
19.7	1420	3348
21.3	1445	3348
23.0	1526	3490
24.6	1632	4317
26.2	1471	3281
27.9	1163	2103
29.5	1163	2103
31.2	1292	2563
32.8	1390	2983
34.4	1471	3281
36.1	1471	3095
37.7	1439	3095
39.4	1367	2929
41.0	1433	2929
42.7	1471	3095
44.3	1414	3155
45.9	1562	3418
47.6	1674	3566
49.2	1608	3490
50.9	1593	3566
52.5	1700	3418
54.1	1608	3490
55.8	1577	4001
57.4	1519	3281
59.1	1373	2878
60.7	1292	2828
62.3	1312	2983
64.0	1616	3418
65.6	1624	3095
67.3	1570	3010
68.9	1657	3528
70.5	1833	4687
72.2	2232	6076
73.8	2853	6562
75.5	2878	7132
77.1	2956	7812
78.7	3509	8634
80.4	4076	9113
82.0	4317	9650
83.7	4464	9374
85.3	4525	9374
86.9	3081	7630
88.6	2769	7630
90.2	3837	8867
91.9	4103	9650
93.5	4261	9650
95.1	4317	9794
96.8	4494	9374
98.4	3953	9242
100.1	3547	8412
103.7	3248	8412
103.3	3217	8522
105.0	3509	9510
106.6	3728	9794
108.3	3528	9113
109.9	3605	9510
111.5	4026	9510
113.2	4050	9794
114.8	4434	10757
116.5	4261	10095
118.1	4404	9794
119.8	4654	10253
121.4	4525	9942
123.0	4589	9942
124.7	4721	10415
126.3	4687	10095
128.0	4589	10253
129.6	4589	10415
131.2	4825	10415
132.9	4790	10936
134.5	4654	10253
136.2	4687	10415
137.8	4755	9942
139.4	4790	10253

Table 3. Boring SC-103 MR, Suspension R1-R2 depths and P- and S_H-wave velocities

APPENDIX A

SUSPENSION VELOCITY MEASUREMENT QUALITY ASSURANCE SUSPENSION SOURCE TO RECEIVER ANALYSIS RESULTS

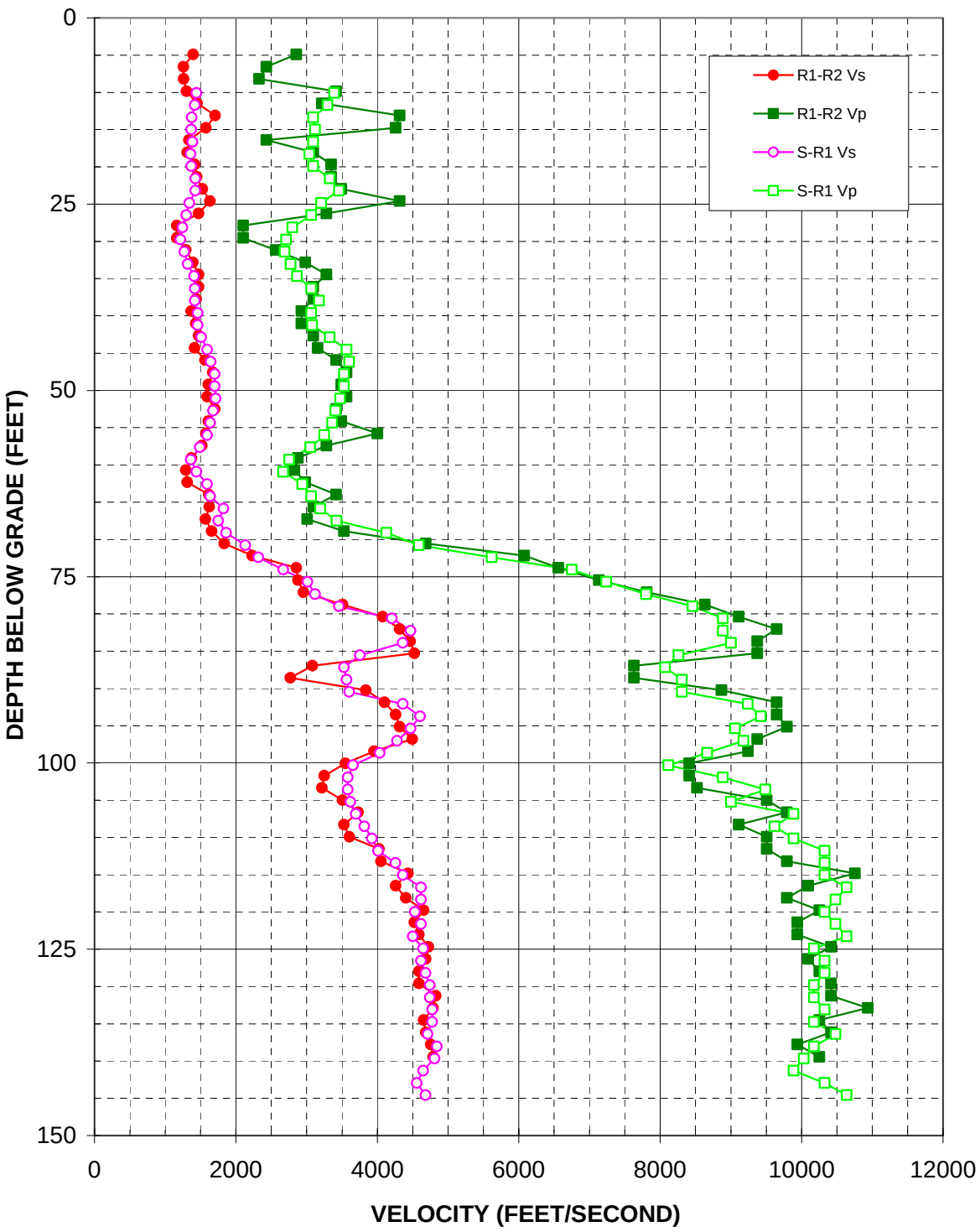


Figure A-1. Boring SC-103 MR, R1 - R2 high resolution analysis and S - R1 quality assurance analysis P- and S_H-wave data

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
10.1	1442	3392
11.7	1418	3296
13.4	1374	3093
15.0	1369	3120
16.6	1385	3093
18.3	1358	3039
19.9	1369	3093
21.6	1424	3327
23.2	1424	3459
24.8	1342	3206
26.5	1298	3066
28.1	1243	2797
29.8	1213	2711
31.4	1270	2690
33.0	1317	2775
34.7	1407	2866
36.3	1418	3066
38.0	1418	3177
39.6	1460	3066
41.2	1460	3079
42.9	1510	3327
44.5	1592	3564
46.2	1644	3601
47.8	1700	3528
49.4	1700	3528
51.1	1712	3476
52.7	1676	3408
54.4	1637	3359
56.0	1592	3250
57.6	1491	3053
59.3	1363	2753
60.9	1442	2670
62.6	1592	2938
64.2	1637	3066
65.8	1824	3191
67.5	1751	3425
69.1	1862	4130
70.8	2134	4589
72.4	2317	5617
74.0	2670	6751
75.7	3013	7238
77.3	3120	7801
79.0	3459	8459
80.6	4204	8887
82.3	4472	8887
83.9	4361	9001
85.5	3755	8260
87.2	3528	8070
88.8	3564	8309
90.5	3601	8309

Depth (feet)	V_s (feet/sec)	V_p (feet/sec)
92.1	4361	9238
93.7	4604	9424
95.4	4472	9059
97.0	4281	9178
98.7	4035	8668
100.3	3657	8117
101.9	3582	8887
103.6	3582	9488
105.2	3619	9001
106.9	3695	9889
108.5	3816	9618
110.1	3922	9889
111.8	4012	10325
113.4	4255	10325
115.1	4361	10325
116.7	4619	10638
118.3	4619	10479
120.0	4530	10325
121.6	4619	10479
123.3	4501	10638
124.9	4650	10175
126.5	4619	10325
128.2	4681	10325
129.8	4744	10175
131.5	4744	10175
133.1	4776	10325
134.7	4776	10175
136.4	4712	10479
138.0	4842	10175
139.7	4809	10030
141.3	4650	9889
142.9	4559	10325
144.6	4681	10638

Table A-1. Boring SC-103 MR, S - R1 quality assurance analysis P- and S_H-wave data

APPENDIX B

BORING GEOPHYSICAL LOGGING SYSTEMS - NIST TRACEABLE CALIBRATION PROCEDURES AND CALIBRATION RECORDS

MICRO PRECISION CALIBRATION, INC.
12686 HOOVER STREET
GARDEN GROVE, CA, 92841
(714) 901-5659

Certificate of Calibration

Date: 10/6/2010 **Lab #** 935.11 **Certificate #: 1114924**

Customer:
GEOVISION
1124 OLYMPIC DRIVE
CORONA, CA, 92881

Purchase Order:	OH-101004-01		
Work Order:	N/A		
MPC Control #:	BG9698	Serial Number:	15014
Asset ID:	15014	Department:	N/A
Gage Type:	LOGGER	Performed By:	STEVE BORING
Manufacturer:	OYO	Received Condition:	IN TOLERANCE
Model Number:	03331-0000	Returned Condition:	IN TOLERANCE
Size:	N/A	Cal Date:	October 4, 2010
Temp./RH:	70 °F / 35 %	Cal. Interval:	12 MONTHS
		Cal. Due Date:	October 4, 2011

Found conditions meet or exceed manufacturer specifications.

***Calibration Notes:**
The UUT (unit under test) was calibrated using the customers procedures in our Garden Grove lab.
The UUT was operated by the customers personnel and data collection was observed by MPC personnel.
The UUT was found to be in tolerance to customer supplied specifications. The reference standards used are in compliance with ISO/IEC 17025:2005, ISO9001:2000, ANSI/NCSL Z540-1-1994 and laboratory accreditation for lab code 935.11. Frequency is accredited. Measurement uncertainty is 0.2 x E12 Hz.
Please see attached data sheet.

Standards Used To Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AM4000	WAVEFORM GENERATOR	33250A	MY40000703	AGILENT	8/17/2011	1063979
T1100	COUNTER	53131A	3546A09912	HEWLETT PACKARD	1/20/2011	646688

Calibrating Technician: STEVE BORING

QC Approval: Tammy Webster

Unless Otherwise Noted, Uncertainty Estimated at >= 4 to 1. Uncertainties have been estimated at a 95 percent confidence level (k=2). Services rendered comply with ISO 17025:2005, ISO 9001:2008, ANSI/NCSL Z540-1, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to the National Institute of Standards and Technology (NIST). Services rendered include proper manufacture's service instructions and are warranted for no less than (30) days. This report may not be reproduced in part or in whole without the prior written approval of the issuing MPC lab.

BG 9698

GEOVision
geophysical services

SUSPENSION PS SEISMIC LOGGER/RECORDER CALIBRATION DATA FORM

INSTRUMENT DATA

System mfg.:	OYO	Model no.:	3331
Serial no.:	15014	Calibration date:	10/4/2010
By:	Charles Carter	Due date:	10/4/2011
Counter mfg.:	Hewlett Packard	Model no.:	53131A
Serial no.:	3416A05377	Calibration date:	6/8/2010
By:	Micro Precision (LN)	Due date:	6/8/2011
Signal generator mfg.:	Agilent	Model no.:	33250A
Serial no.:	MY4000703	Calibration date:	8/17/2010
By:	Micro Precision (LN)	Due date:	8/17/2011

SYSTEM SETTINGS:

Gain:	20
Filter	LCF: 5Hz; HCF: 20kHz
Range:	See sample period in table below
Delay:	4 ms
Stack (1 std)	1
System date = correct date and time	10/4/2010 3:20pm

PROCEDURE:

Set sine wave frequency to target frequency with amplitude of approximately 0.25 volt peak
Note actual frequency on data form.
Set sample period and record data file to disk. Note file name on data form.
Pick duration of 9 cycles using PSLOG.EXE program, note duration on data form, and save as .sps file. Calculate average frequency for each channel pair and note on data form.

Average frequency must be within +/- 1% of actual frequency at all data points.

Maximum error ((AVG-ACT)/ACT*100)% As found 0.22% As left 0.22%

Target Frequency (Hz)	Actual Frequency (Hz)	Sample Period (microS)	File Name	Time for 9 cycles Hn (msec)	Average Frequency Hn (Hz)	Time for 9 cycles Hr (msec)	Average Frequency Hr (Hz)	Time for 9 cycles V (msec)	Average Frequency V (Hz)
50.00	50.00	200	1	180.2	49.94	179.8	50.06	180.0	50.00
100.0	100.0	100	2	90.10	99.89	90.00	100.0	90.10	99.89
200.0	200.0	50	3	45.00	200.0	45.05	199.8	45.05	199.8
500.0	500.0	20	4	18.00	500.0	18.02	499.5	17.96	501.1
1000	1000	10	5	9.010	998.9	8.990	1001	9.000	1000
2000	2000	5	6	4.510	1996	4.505	1998	4.500	2000

Calibrated by: Charles Carter 10/4/2010 Charles Carter
Name Date Signature

Witnessed by: Steve Boring 10/4/2010
Name Date Signature

Suspension PS Seismic Recorder/Logger Calibration Data Form Rev 2.0 July 21, 2008

APPENDIX E

CONTENTS

Report by Gregg Drilling & Testing, Inc. , dated February 14, 2011

February 14, 2011

Bob Kirby
Terra Engineers
350 Sansome Street, Suite 830
San Francisco, CA 94104

Re: Standard Penetration Energy Measurements
Automatic Hammer on Mud Rotary Drill Rig, PD-61

Dear Mr. Kirby,

This report offers results of energy measurements and related calculations made on February 11, 2011 during Standard Penetration Testing (SPT) on Pitcher Drilling's mud rotary drill rig. Dynamic tests were performed on an instrumented section of NWJ drill rod attached to the sampler rod string. All dynamic measurements were obtained and recorded using a Pile Driving Analyzer®.

Equipment:

SPT energy measurements were made on SPT samplers driven by the hammer/anvil system on the Pitcher Drilling drill rig on February 11, 2011. The rig was tested on boring SC-105-MR. In total, 10 energy measurements were collected corresponding to 10 different samples at increasing depth.

Gregg used a Model PAK Pile Driving Analyzer (PDA) to acquire and process measurements of force and velocity with every impact of the automatic hammer on the sample rods. Gregg follows the procedure outlined in ASTM D4633. Two strain gauges mounted on a two foot section of NWJ rod measured force, while two piezoresistive accelerometers bolted on the same rod measured acceleration. The gauges were mounted approximately 6" from the top of the rod.
Analog signals from the gauges and accelerometers were collected, digitized, displayed in real-time, and stored by the PDA. Selected output from the PDA for each recorded impact of the hammer included:

- Maximum force in the rod (FMX)
- Maximum velocity in the rod (VMX)
- Maximum calculated transferred energy (EMX)
- Blows per minute (BPM)
- Energy transferred to the rods (ETR)

Data and Calculations:

The purpose of testing was to measure the energy transferred from the hammer to the drill rod and to calculate the energy efficiency of the hammer. The PDA measurements of force and velocity were reviewed after field testing and analyzed to calculate the transferred energy (EMX).

The maximum energy transferred past the gauge location, EMX, is computed by the PDA using force (F) and velocity (V) records as follows:

$$EMX = \int_a^b F(t)\, V(t)\, dt$$

The time "a" corresponds to the start of the record when the energy transfer begins and "b" is the time at which energy transferred to the rod reaches a maximum value. The energy transferred is defined as ETR, and is usually used to define the efficiency of the hammer/anvil system.

Results:

Table 1 summarizes the average calculated energies for each sample tested as well as the type of sample and depth. It is shown that the overall average (ETR) energy for this system is 88%. Appendix A provides plots and tables of PDA results for all hammer blows at each sampling depth. The plots and tables present selected measured and calculated results as a function of blow number. The results include:

- the blow number
- depth
- BLC (blow count in blows per foot)
- FMX (maximum rod force)
- VMX (maximum rod velocity)
- EMX (maximum transferred energy)
- BPM (blows per minute)
- ETR (energy transferred in percent of maximum)

At the end of each table is a statistical evaluation of the results for each variable including the average, standard deviation, maximum, and what blow number this maximum occurred.

If you have any questions or comments on this report, please do not hesitate to call our office at (562) 427-6899.

Sincerely,

Peter Robertson
Technical Advisor
Gregg Drilling & Testing

GREGG

Client: Terra Engineers
Boring: SC-105-MR
Date: 2/11/2010

Table 1 - SPT Sample Summary

Sample #	Sampler	Length of Sample Rod (ft)	Sampler Length (ft)	Total Rod Length* (ft)	Depth of Sample (below Mudline) (ft)	Total Blows Analyzed by PDA	Average Energy Transferred to Rods (% of Theoretical Max.)	Maximum Efficiency Recorded (%)	Standard Deviation
1	SPT	27	3.67	30.7	27	31	84.2	92.0	2
2	SPT	30	3.67	33.7	30	22	83.8	86.3	1
3	SPT	40	3.67	43.7	40	35	88.2	95.0	3
4	SPT	45	3.67	48.7	45	31	83.9	92.2	2
5	SPT	51	3.67	54.7	50	52	86.3	89.1	2
6	SPT	53	3.67	56.7	53	64	89.9	92.8	1
7	SPT	56	3.67	59.7	55.5	55	91.2	93.5	1
8	SPT	58	3.67	61.7	58	48	87.3	91.8	2
9	SPT	61	3.67	64.7	61	60	94.5	98.2	3
10	SPT	65	3.67	68.7	64	70	91.1	95.5	1
						Average	88.0		

* Total rod length includes, sampler, rod, adaptors, and instrumented section below gauges

Appendix A

Stevens Canyon Dam - SC-105-MR @ 27ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 33.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
3	0.00	0.3	30.1	0.3	15.5	92.0
4	0.00	0.3	0.0	0.3	14.4	82.3
5	0.00	0.3	19.8	0.3	14.7	82.8
6	0.00	0.3	19.7	0.3	14.6	82.4
7	0.00	0.3	19.6	0.3	14.9	82.7
8	0.00	0.3	19.6	0.3	14.7	83.0
9	0.00	0.3	25.2	0.3	14.6	83.0
11	0.00	0.3	0.0	0.3	14.6	85.3
12	0.00	0.3	29.0	0.3	14.2	84.1
13	0.00	0.3	28.3	0.3	13.6	84.2
14	0.00	0.3	28.3	0.3	13.4	83.5
15	0.00	0.3	28.3	0.3	13.4	83.9
16	0.00	0.3	28.3	0.3	13.5	83.1
17	0.00	0.3	28.3	0.3	13.8	83.1
18	0.00	0.3	28.3	0.3	13.9	83.9
19	0.00	0.3	28.4	0.3	14.0	84.3
20	0.00	0.3	28.3	0.3	14.2	84.4
21	0.00	0.3	28.3	0.3	14.6	84.3
22	0.00	0.3	28.3	0.3	14.5	83.7
23	0.00	0.3	28.3	0.3	14.3	84.4
24	0.00	0.3	28.2	0.3	14.1	84.2
25	0.00	0.3	28.2	0.3	13.9	83.8
26	0.00	0.3	28.2	0.3	12.9	83.6
27	0.00	0.3	28.2	0.3	13.1	84.9
28	0.00	0.3	28.1	0.3	13.1	84.6
29	0.00	0.3	28.1	0.3	12.3	84.5
30	0.00	0.3	28.1	0.3	12.7	84.9
31	0.00	0.3	28.0	0.3	12.6	83.8
32	0.00	0.3	28.0	0.3	13.0	84.5
33	0.00	0.3	28.0	0.3	13.2	84.6
34	0.00	0.3	27.9	0.3	13.6	85.3
	Average	0.3	27.0	0.3	13.9	84.2
	Std. Dev.	0.0	3.0	0.0	0.8	1.6
	Maximum	0.3	30.1	0.3	15.5	92.0
	@ Blow#	3	3	3	3	3

Total number of blows analyzed: 31

Time Summary

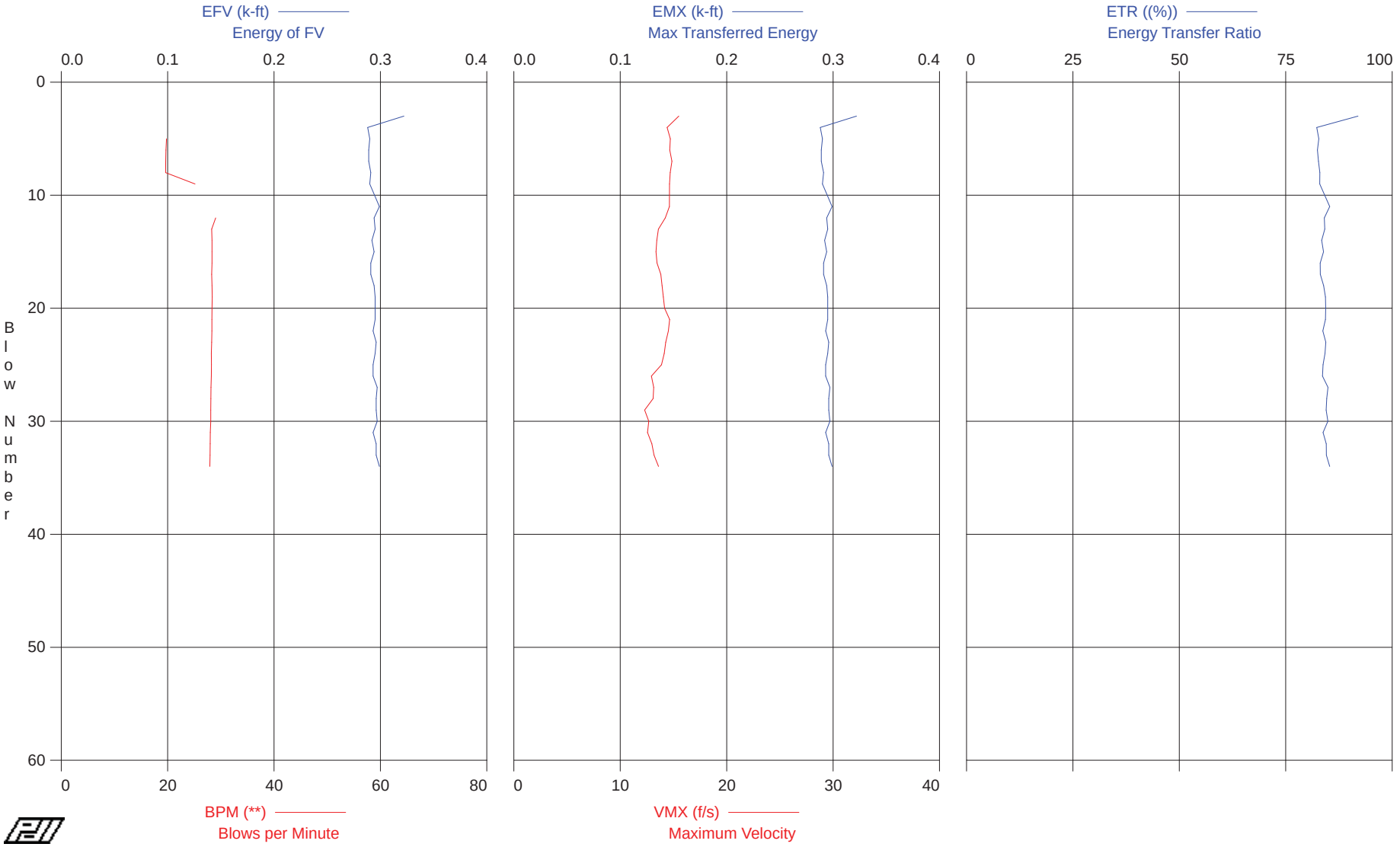
Drive 3 minutes 3 seconds 8:48:45 AM - 8:51:48 AM (2/11/2011) BN 3 - 34

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 27ft



Stevens Canyon Dam - SC-105-MR @ 30ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 33.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	0.0	0.3	14.0	83.0
2	0.00	0.3	0.0	0.3	13.5	82.6
3	0.00	0.3	0.0	0.3	13.5	83.0
4	0.00	0.3	0.0	0.3	13.8	83.1
5	0.00	0.3	0.0	0.3	13.6	82.9
6	0.00	0.3	0.0	0.3	13.8	83.3
7	0.00	0.3	0.0	0.3	13.5	83.1
8	0.00	0.3	0.0	0.3	13.4	82.6
9	0.00	0.3	0.0	0.3	13.3	82.8
10	0.00	0.3	0.0	0.3	13.8	82.9
11	0.00	0.3	0.0	0.3	13.8	83.4
12	0.00	0.3	0.0	0.3	13.8	83.0
13	0.00	0.3	0.0	0.3	13.9	83.2
14	0.00	0.3	21.0	0.3	13.8	84.0
15	0.00	0.3	20.4	0.3	13.8	84.0
16	0.00	0.3	20.4	0.3	13.7	83.7
17	0.00	0.3	20.4	0.3	13.8	84.3
18	0.00	0.3	20.3	0.3	13.7	84.4
19	0.00	0.3	20.2	0.3	14.1	85.7
20	0.00	0.3	20.1	0.3	14.3	86.3
21	0.00	0.3	20.1	0.3	14.3	85.8
22	0.00	0.3	20.1	0.3	14.1	86.1
	Average	0.3	20.3	0.3	13.8	83.8
	Std. Dev.	0.0	0.2	0.0	0.2	1.1
	Maximum	0.3	21.0	0.3	14.3	86.3
	@ Blow#	20	14	20	20	20

Total number of blows analyzed: 22

Time Summary

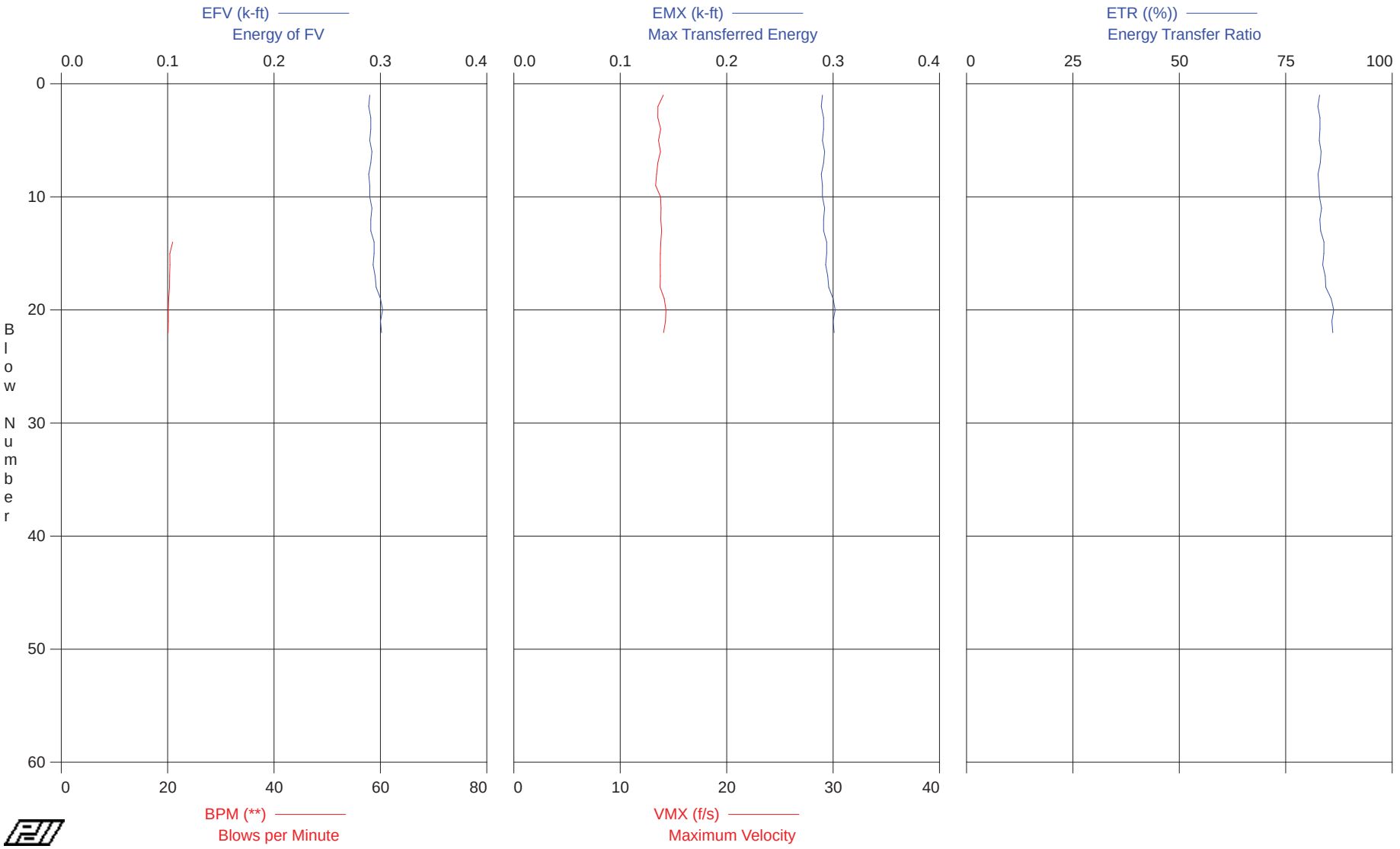
Drive 1 minute 8 seconds 9:18:44 AM - 9:19:52 AM (2/11/2011) BN 1 - 22

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 30ft



Stevens Canyon Dam - SC-105-MR @ 40ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 43.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	0.0	0.3	13.0	86.1
2	0.00	0.3	21.0	0.3	13.2	87.0
3	0.00	0.3	22.4	0.3	13.4	86.8
4	0.00	0.3	22.3	0.3	13.5	86.0
5	0.00	0.3	22.4	0.3	13.3	86.3
6	0.00	0.3	22.5	0.3	13.4	86.2
7	0.00	0.3	0.0	0.3	13.2	86.0
8	0.00	0.3	19.2	0.3	13.2	85.8
9	0.00	0.3	22.7	0.3	13.4	86.4
10	0.00	0.3	22.8	0.3	13.1	86.1
11	0.00	0.3	22.9	0.3	13.2	85.4
12	0.00	0.3	22.9	0.3	13.3	85.5
13	0.00	0.3	22.7	0.3	13.2	85.4
14	0.00	0.3	22.6	0.3	13.3	86.1
15	0.00	0.3	22.6	0.3	13.0	85.8
16	0.00	0.3	22.7	0.3	13.2	85.4
17	0.00	0.3	22.5	0.3	13.1	85.9
18	0.00	0.3	22.4	0.3	13.1	86.7
19	0.00	0.3	22.3	0.3	13.1	87.5
20	0.00	0.3	22.3	0.3	13.2	86.9
21	0.00	0.3	22.5	0.3	13.3	88.3
22	0.00	0.3	22.3	0.3	13.0	89.5
23	0.00	0.3	22.3	0.3	12.9	89.3
24	0.00	0.3	22.0	0.3	13.9	89.1
25	0.00	0.3	22.0	0.3	13.5	90.4
26	0.00	0.3	22.1	0.3	14.2	91.1
27	0.00	0.3	22.0	0.3	14.1	92.6
28	0.00	0.3	21.8	0.3	14.1	92.9
29	0.00	0.3	21.6	0.3	14.2	94.1
30	0.00	0.3	21.4	0.3	14.0	94.3
31	0.00	0.3	21.5	0.3	14.1	95.0
32	0.00	0.3	21.3	0.3	13.8	92.9
33	0.00	0.3	0.0	0.3	12.6	87.1
34	0.00	0.3	20.2	0.3	12.7	87.9
35	0.00	0.3	20.1	0.3	12.5	87.7
	Average	0.3	22.0	0.3	13.4	88.2
	Std. Dev.	0.0	0.9	0.0	0.4	2.9
	Maximum	0.3	22.9	0.3	14.2	95.0
	@ Blow#	31	11	31	26	31

Total number of blows analyzed: 35

Time Summary

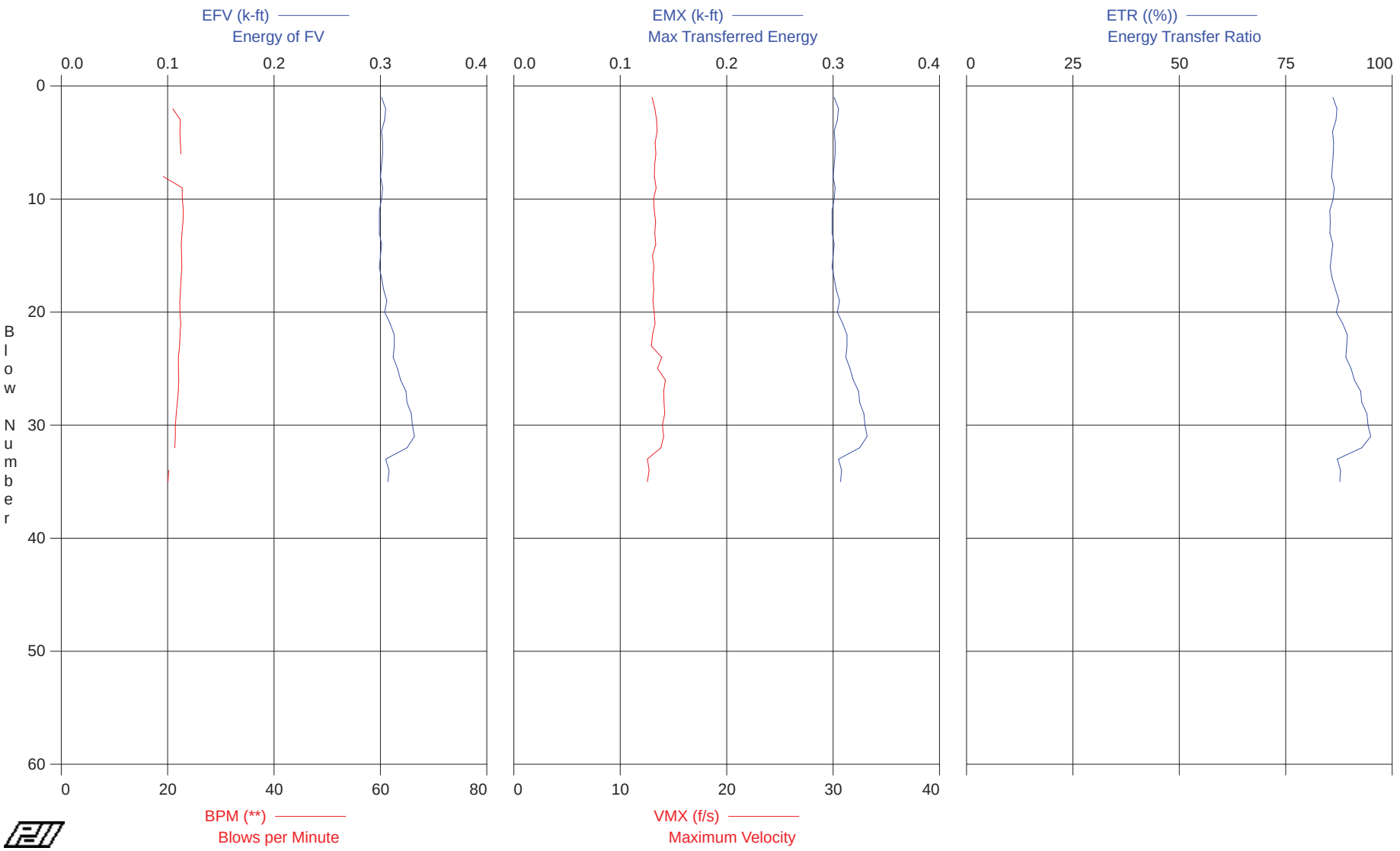
Drive 3 minutes 19 seconds 10:28:05 AM - 10:31:24 AM (2/11/2011) BN 1 - 35

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 40ft



Stevens Canyon Dam - SC-105-MR @ 45ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 48.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	0.0	0.3	12.2	92.2
2	0.00	0.3	0.0	0.3	12.2	82.9
3	0.00	0.3	0.0	0.3	12.2	84.2
4	0.00	0.3	0.0	0.3	12.1	82.8
5	0.00	0.3	0.0	0.3	12.3	82.8
6	0.00	0.3	0.0	0.3	12.1	82.3
7	0.00	0.3	0.0	0.3	12.2	82.6
8	0.00	0.3	0.0	0.3	12.4	82.7
9	0.00	0.3	0.0	0.3	12.1	82.5
10	0.00	0.3	0.0	0.3	12.2	83.7
11	0.00	0.3	21.2	0.3	12.0	83.3
12	0.00	0.3	20.9	0.3	11.8	82.8
13	0.00	0.3	20.9	0.3	11.9	83.3
14	0.00	0.3	20.9	0.3	11.9	82.3
15	0.00	0.3	20.8	0.3	11.7	83.4
16	0.00	0.3	20.8	0.3	11.9	83.1
17	0.00	0.3	20.8	0.3	11.9	83.1
18	0.00	0.3	20.8	0.3	12.1	83.4
19	0.00	0.3	20.7	0.3	12.4	83.5
20	0.00	0.3	20.8	0.3	12.7	83.9
21	0.00	0.3	20.8	0.3	12.7	84.2
22	0.00	0.3	20.8	0.3	12.7	84.1
23	0.00	0.3	20.9	0.3	12.8	84.3
24	0.00	0.3	20.9	0.3	12.7	85.4
25	0.00	0.3	20.9	0.3	13.0	84.8
26	0.00	0.3	20.8	0.3	13.0	84.4
27	0.00	0.3	20.9	0.3	13.0	84.4
28	0.00	0.3	20.8	0.3	13.0	84.8
29	0.00	0.3	20.7	0.3	12.9	84.2
30	0.00	0.3	20.7	0.3	12.7	83.9
31	0.00	0.3	20.8	0.3	12.9	84.5
	Average	0.3	20.8	0.3	12.4	83.9
	Std. Dev.	0.0	0.1	0.0	0.4	1.7
	Maximum	0.3	21.2	0.3	13.0	92.2
	@ Blow#	1	11	1	28	1

Total number of blows analyzed: 31

Time Summary

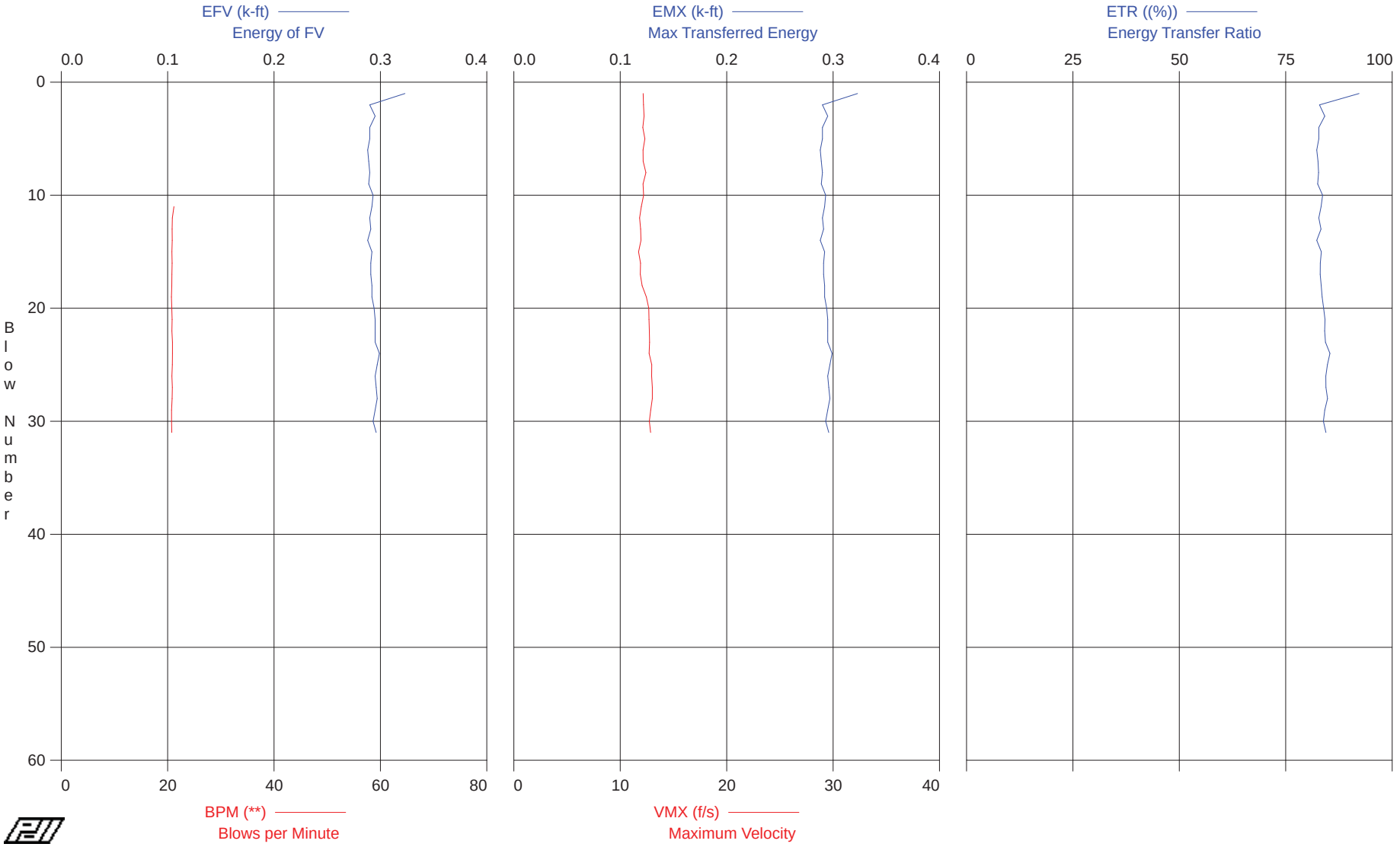
Drive 1 minute 32 seconds 11:02:30 AM - 11:04:02 AM (2/11/2011) BN 1 - 31

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 45ft



Stevens Canyon Dam - SC-105-MR @ 50ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 54.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	0.0	0.3	12.6	86.4
2	0.00	0.3	19.6	0.3	12.6	87.7
3	0.00	0.3	22.5	0.3	12.5	86.6
4	0.00	0.3	22.1	0.3	12.4	86.1
5	0.00	0.3	22.1	0.3	12.2	84.9
6	0.00	0.3	22.2	0.3	12.0	84.4
7	0.00	0.3	22.2	0.3	11.8	84.9
8	0.00	0.3	22.2	0.3	12.1	83.8
9	0.00	0.3	0.0	0.3	11.9	84.7
10	0.00	0.3	30.4	0.3	12.0	84.2
11	0.00	0.3	30.4	0.3	12.2	84.3
12	0.00	0.3	30.3	0.3	12.2	84.1
13	0.00	0.3	30.4	0.3	12.3	84.7
14	0.00	0.3	30.4	0.3	12.3	84.3
15	0.00	0.3	30.4	0.3	12.2	84.4
16	0.00	0.3	30.4	0.3	12.5	85.4
17	0.00	0.3	0.0	0.3	12.3	83.5
18	0.00	0.3	29.1	0.3	12.3	84.6
19	0.00	0.3	28.9	0.3	12.4	85.2
20	0.00	0.3	28.8	0.3	12.5	84.9
21	0.00	0.3	28.8	0.3	12.4	86.2
22	0.00	0.3	28.8	0.3	12.6	85.7
23	0.00	0.3	28.8	0.3	12.3	87.3
24	0.00	0.3	28.7	0.3	12.4	85.4
25	0.00	0.3	28.7	0.3	12.6	86.2
26	0.00	0.3	28.7	0.3	12.9	86.0
27	0.00	0.3	28.5	0.3	13.0	87.8
28	0.00	0.3	28.5	0.3	12.7	87.2
29	0.00	0.3	28.5	0.3	12.7	87.3
30	0.00	0.3	28.4	0.3	12.9	88.1
31	0.00	0.3	28.2	0.3	12.8	87.5
32	0.00	0.3	28.1	0.3	12.8	87.2
33	0.00	0.3	28.0	0.3	12.5	86.5
34	0.00	0.3	28.1	0.3	12.3	88.3
35	0.00	0.3	27.9	0.3	12.1	87.2
36	0.00	0.3	27.9	0.3	12.1	86.9
37	0.00	0.3	27.8	0.3	12.2	87.8
38	0.00	0.3	27.8	0.3	12.1	87.5
39	0.00	0.3	27.8	0.3	12.2	87.6
40	0.00	0.3	27.8	0.3	12.3	87.7
41	0.00	0.3	27.8	0.3	12.2	88.1
42	0.00	0.3	27.7	0.3	12.2	87.4
43	0.00	0.3	27.6	0.3	12.3	88.0
44	0.00	0.3	27.7	0.3	12.4	86.9
45	0.00	0.3	27.5	0.3	12.3	88.8
46	0.00	0.3	27.6	0.3	12.1	88.5
47	0.00	0.3	27.5	0.3	12.6	87.5
48	0.00	0.3	27.4	0.3	12.3	87.1
49	0.00	0.3	27.4	0.3	12.6	89.1
50	0.00	0.3	27.3	0.3	12.5	86.6
51	0.00	0.3	27.3	0.3	12.1	84.8
52	0.00	0.3	0.0	0.3	12.8	83.8
	Average	0.3	27.5	0.3	12.4	86.3
	Std. Dev.	0.0	2.5	0.0	0.3	1.5
	Maximum	0.3	30.4	0.3	13.0	89.1
	@ Blow#	49	13	49	27	49

Total number of blows analyzed: 52

Time Summary

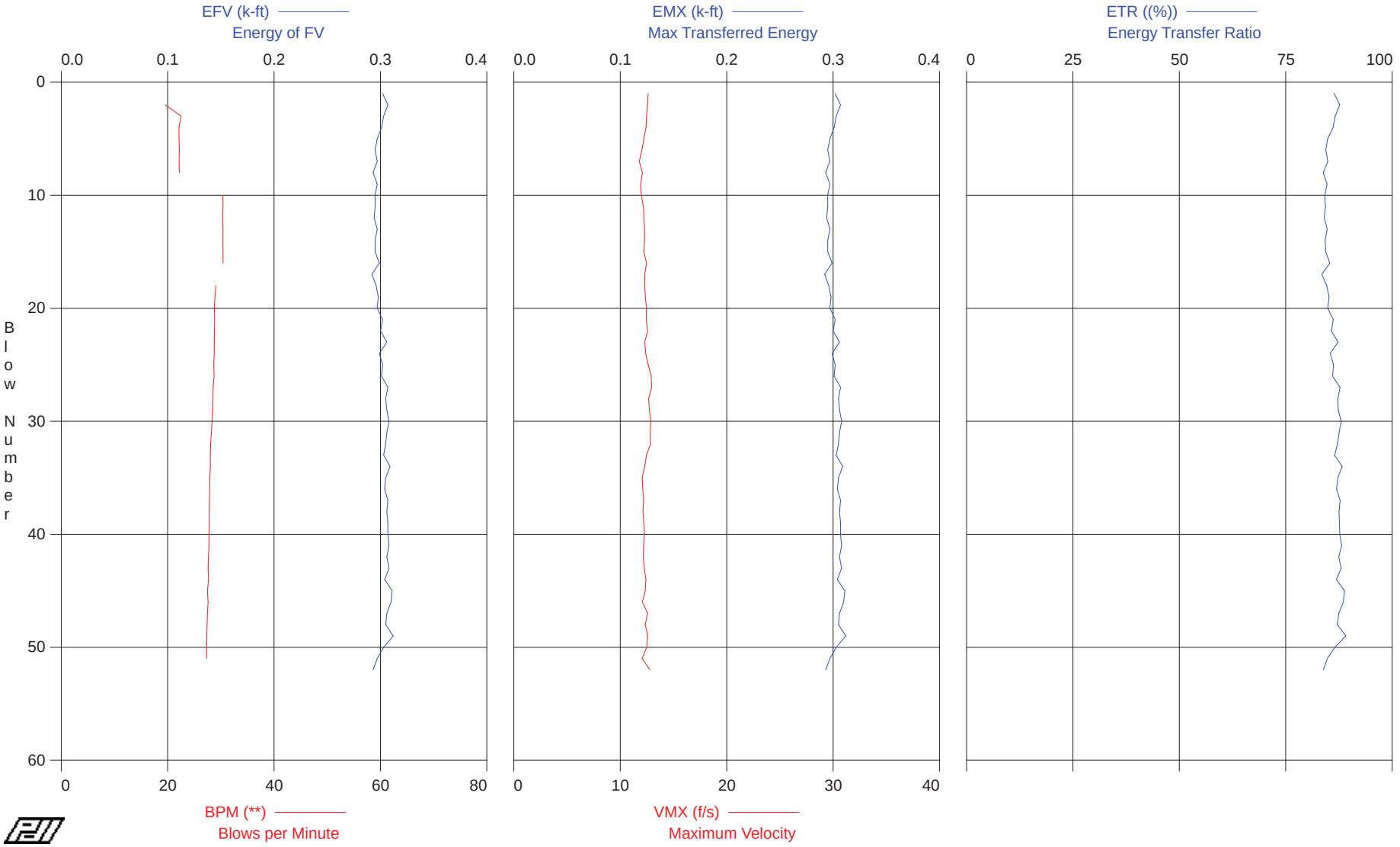
Drive 3 minutes 36 seconds 12:21:50 PM - 12:25:26 PM (2/11/2011) BN 1 - 52

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 50ft



Stevens Canyon Dam - SC-105-MR @ 53ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 56.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	24.3	0.3	14.5	88.0
2	0.00	0.3	23.8	0.3	14.7	88.9
3	0.00	0.3	23.9	0.3	14.7	88.8
4	0.00	0.3	23.8	0.3	14.7	88.5
5	0.00	0.3	23.8	0.3	14.6	88.3
6	0.00	0.3	23.7	0.3	14.6	88.6
7	0.00	0.3	23.6	0.3	14.6	88.2
8	0.00	0.3	23.5	0.3	14.6	89.2
9	0.00	0.3	23.5	0.3	14.6	89.1
10	0.00	0.3	23.5	0.3	14.6	89.1
11	0.00	0.3	23.4	0.3	14.7	89.3
12	0.00	0.3	23.3	0.3	14.6	88.3
13	0.00	0.3	23.3	0.3	14.7	88.8
14	0.00	0.3	23.3	0.3	14.6	88.9
15	0.00	0.3	23.3	0.3	14.8	89.7
16	0.00	0.3	23.2	0.3	14.6	89.1
17	0.00	0.3	23.1	0.3	14.6	89.2
18	0.00	0.3	23.1	0.3	14.7	88.8
19	0.00	0.3	23.1	0.3	14.6	89.4
20	0.00	0.3	23.0	0.3	14.8	89.7
21	0.00	0.3	23.0	0.3	14.7	89.6
22	0.00	0.3	23.0	0.3	14.5	89.1
23	0.00	0.3	22.9	0.3	14.7	89.1
24	0.00	0.3	22.9	0.3	14.6	88.4
25	0.00	0.3	22.9	0.3	14.5	88.1
26	0.00	0.3	22.7	0.3	14.4	87.4
27	0.00	0.3	22.7	0.3	14.4	87.5
28	0.00	0.3	22.7	0.3	14.6	89.4
29	0.00	0.3	22.6	0.3	14.5	89.6
30	0.00	0.3	22.6	0.3	14.7	89.0
31	0.00	0.3	22.6	0.3	14.7	89.4
32	0.00	0.3	22.5	0.3	14.6	89.9
33	0.00	0.3	22.5	0.3	14.7	89.8
34	0.00	0.3	22.4	0.3	14.6	89.5
35	0.00	0.3	22.4	0.3	14.6	89.0
36	0.00	0.3	22.4	0.3	14.6	90.3
37	0.00	0.3	22.4	0.3	14.7	89.8
38	0.00	0.3	22.4	0.3	14.6	89.6
39	0.00	0.3	22.3	0.3	14.8	91.0
40	0.00	0.3	22.3	0.3	14.8	90.2
41	0.00	0.3	22.3	0.3	14.8	89.9
42	0.00	0.3	22.2	0.3	14.6	90.4
43	0.00	0.3	22.2	0.3	14.6	91.1
44	0.00	0.3	22.2	0.3	14.9	92.1
45	0.00	0.3	22.3	0.3	15.3	92.8
46	0.00	0.3	22.3	0.3	14.9	91.9
47	0.00	0.3	22.2	0.3	14.9	92.0
48	0.00	0.3	22.2	0.3	14.7	91.4
49	0.00	0.3	22.2	0.3	14.7	91.9
50	0.00	0.3	22.2	0.3	14.6	91.3
51	0.00	0.3	22.2	0.3	14.6	91.3
52	0.00	0.3	22.2	0.3	14.5	91.4
53	0.00	0.3	22.1	0.3	14.6	91.2
54	0.00	0.3	22.2	0.3	14.8	91.7
55	0.00	0.3	22.1	0.3	14.5	90.6
56	0.00	0.3	22.1	0.3	14.5	90.8
57	0.00	0.3	22.1	0.3	14.7	91.4
58	0.00	0.3	22.1	0.3	14.6	89.9
59	0.00	0.3	22.0	0.3	14.5	90.3
60	0.00	0.3	22.0	0.3	14.7	91.0
61	0.00	0.3	22.0	0.3	14.5	90.8
62	0.00	0.3	22.0	0.3	14.6	90.8
63	0.00	0.3	22.0	0.3	14.5	90.2
64	0.00	0.3	22.1	0.3	14.5	90.3

Stevens Canyon Dam - SC-105-MR @ 53ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

	EFV	BPM	EMX	VMX	ETR
	k-ft	**	k-ft	f/s	(%)
Average	0.3	22.7	0.3	14.6	89.9
Std. Dev.	0.0	0.6	0.0	0.1	1.2
Maximum	0.3	24.3	0.3	15.3	92.8
@ Blow#	45	1	45	45	45

Total number of blows analyzed: 64

Time Summary

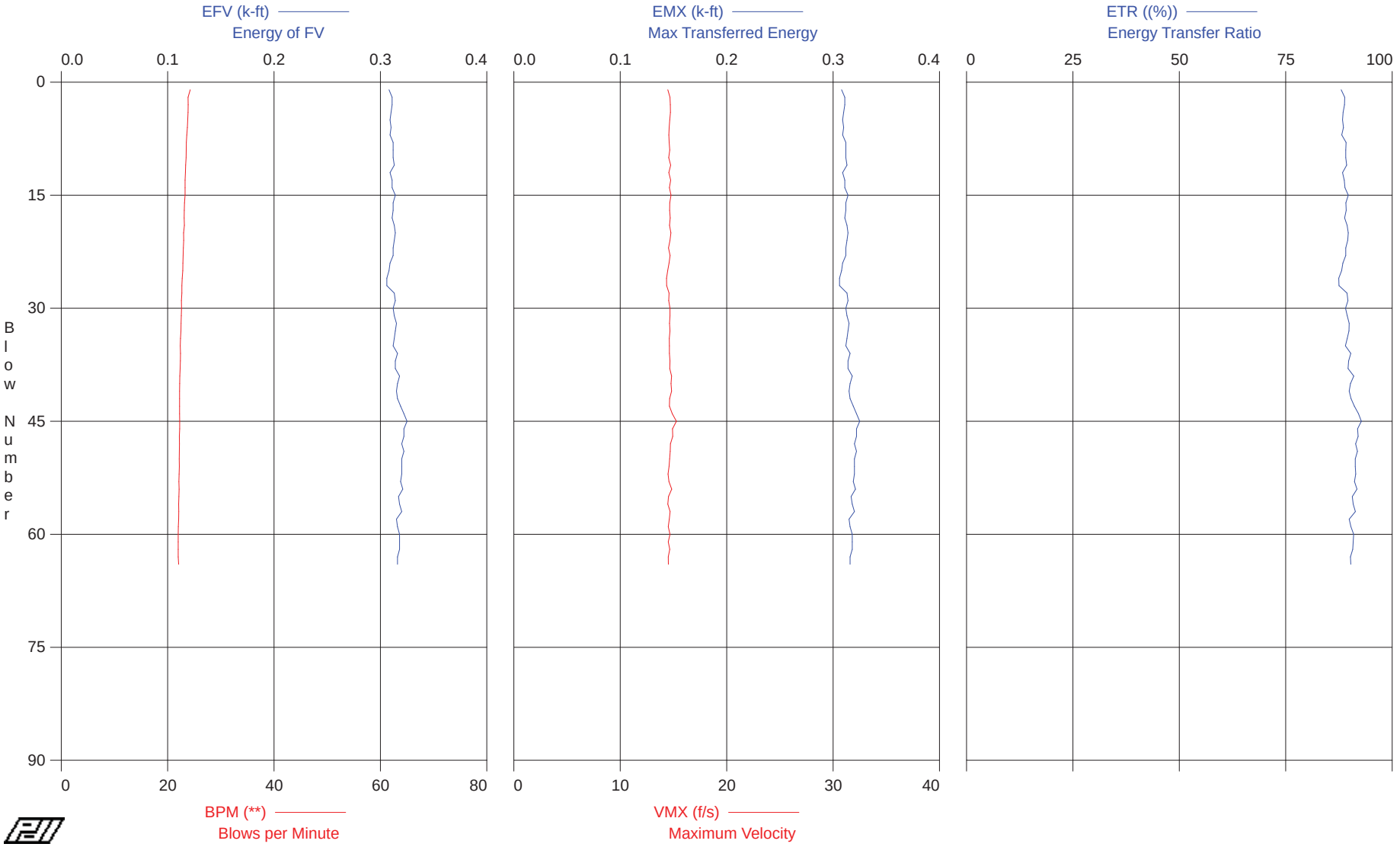
Drive	2 minutes 47 seconds	12:54:26 PM - 12:57:13 PM (2/11/2011) BN 1 - 64

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 53ft



Stevens Canyon Dam - SC-105-MR @ 55.5ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 59.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	37.8	0.3	12.5	93.5
2	0.00	0.3	29.2	0.3	12.5	92.2
3	0.00	0.3	29.2	0.3	12.5	91.3
4	0.00	0.3	29.3	0.3	12.7	90.5
5	0.00	0.3	29.2	0.3	12.5	89.8
6	0.00	0.3	29.2	0.3	12.6	89.7
7	0.00	0.3	29.2	0.3	12.9	90.5
8	0.00	0.3	29.3	0.3	12.7	90.6
9	0.00	0.3	29.2	0.3	12.6	91.2
10	0.00	0.3	29.0	0.3	12.6	89.9
11	0.00	0.3	29.0	0.3	12.5	91.3
12	0.00	0.3	29.0	0.3	12.9	90.8
13	0.00	0.3	28.9	0.3	13.1	91.3
14	0.00	0.3	28.9	0.3	12.9	90.8
15	0.00	0.3	28.8	0.3	13.2	91.3
16	0.00	0.3	28.8	0.3	12.9	90.7
17	0.00	0.3	28.8	0.3	13.0	90.5
18	0.00	0.3	28.7	0.3	12.9	90.9
19	0.00	0.3	28.6	0.3	13.0	91.2
20	0.00	0.3	28.6	0.3	13.2	91.8
21	0.00	0.3	28.6	0.3	12.9	90.7
22	0.00	0.3	28.4	0.3	13.0	91.4
23	0.00	0.3	28.4	0.3	13.2	92.3
24	0.00	0.3	28.4	0.3	13.4	91.7
25	0.00	0.3	28.3	0.3	13.4	91.7
26	0.00	0.3	28.3	0.3	13.2	92.1
27	0.00	0.3	28.3	0.3	13.6	93.2
28	0.00	0.3	28.4	0.3	13.4	92.9
29	0.00	0.3	28.3	0.3	13.4	92.7
30	0.00	0.3	28.3	0.3	13.5	92.8
31	0.00	0.3	28.2	0.3	13.1	92.8
32	0.00	0.3	28.3	0.3	13.0	92.0
33	0.00	0.3	28.3	0.3	13.1	92.1
34	0.00	0.3	0.0	0.3	11.6	89.4
35	0.00	0.3	23.8	0.3	11.6	89.7
36	0.00	0.3	23.8	0.3	11.6	90.2
37	0.00	0.3	23.8	0.3	11.6	89.7
38	0.00	0.3	23.7	0.3	11.9	90.1
39	0.00	0.3	23.7	0.3	12.2	90.6
40	0.00	0.3	23.6	0.3	11.8	90.0
41	0.00	0.3	23.5	0.3	11.7	90.7
42	0.00	0.3	23.5	0.3	12.1	90.4
43	0.00	0.3	23.4	0.3	12.8	90.4
44	0.00	0.3	23.4	0.3	13.0	90.7
45	0.00	0.3	23.3	0.3	13.0	91.1
46	0.00	0.3	23.4	0.3	12.7	90.8
47	0.00	0.3	23.3	0.3	13.1	90.6
48	0.00	0.3	23.4	0.3	13.7	91.1
49	0.00	0.3	23.4	0.3	13.4	90.2
50	0.00	0.3	23.4	0.3	13.9	91.3
51	0.00	0.3	23.4	0.3	13.6	91.3
52	0.00	0.3	23.4	0.3	14.2	92.1
53	0.00	0.3	23.3	0.3	13.9	92.2
54	0.00	0.3	23.1	0.3	13.8	91.3
55	0.00	0.3	23.2	0.3	14.1	92.5
	Average	0.3	26.9	0.3	12.9	91.2
	Std. Dev.	0.0	3.0	0.0	0.6	1.0
	Maximum	0.3	37.8	0.3	14.2	93.5
	@ Blow#	1	1	1	52	1

Total number of blows analyzed: 55

Time Summary

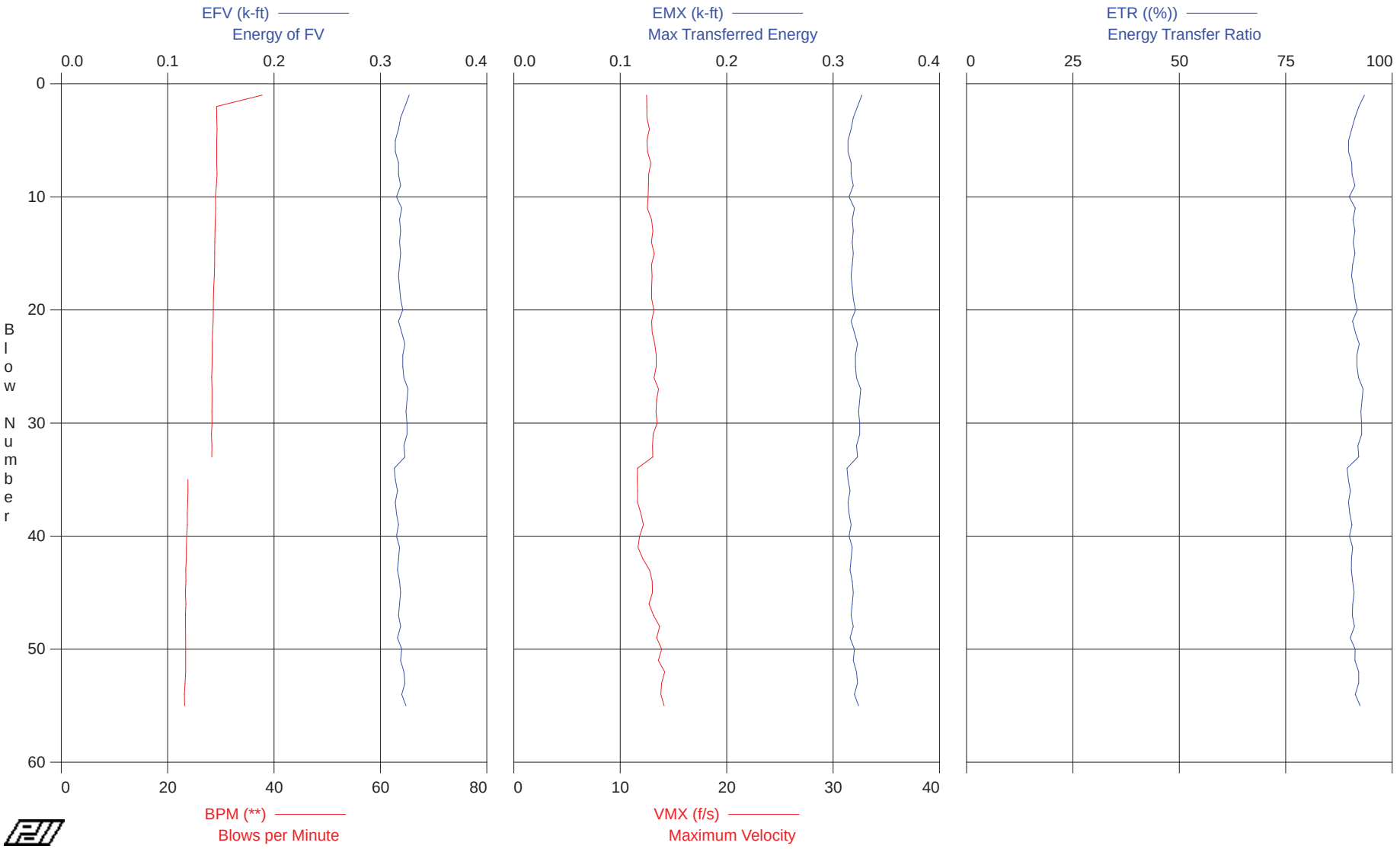
Drive 2 minutes 40 seconds 1:24:27 PM - 1:27:07 PM (2/11/2011) BN 1 - 55

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 55.5ft



Stevens Canyon Dam - SC-105-MR @ 58ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 61.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	23.0	0.3	13.4	91.0
2	0.00	0.3	23.0	0.3	13.5	91.2
3	0.00	0.3	23.0	0.3	13.2	91.0
4	0.00	0.3	23.0	0.3	13.1	91.1
5	0.00	0.3	23.1	0.3	13.4	91.7
6	0.00	0.3	23.1	0.3	13.4	91.1
7	0.00	0.3	23.1	0.3	13.3	91.1
8	0.00	0.3	23.1	0.3	13.1	91.4
9	0.00	0.3	23.1	0.3	13.3	91.8
12	0.00	0.3	19.4	0.3	12.3	85.5
13	0.00	0.3	20.2	0.3	12.4	86.1
14	0.00	0.3	20.2	0.3	12.4	85.9
15	0.00	0.3	20.2	0.3	12.5	86.0
16	0.00	0.3	20.2	0.3	12.4	86.4
17	0.00	0.3	20.1	0.3	12.5	86.3
18	0.00	0.3	20.0	0.3	12.5	86.2
19	0.00	0.3	20.1	0.3	12.5	86.3
20	0.00	0.3	20.0	0.3	12.6	86.2
21	0.00	0.3	19.9	0.3	12.6	86.5
22	0.00	0.3	20.0	0.3	12.6	86.9
23	0.00	0.3	19.9	0.3	12.7	86.3
24	0.00	0.3	19.9	0.3	12.6	86.6
25	0.00	0.3	19.9	0.3	12.7	87.0
26	0.00	0.3	19.8	0.3	12.7	86.9
27	0.00	0.3	19.8	0.3	12.7	86.8
28	0.00	0.3	19.8	0.3	12.7	87.0
29	0.00	0.3	19.6	0.3	12.6	87.3
30	0.00	0.3	19.7	0.3	12.6	86.3
31	0.00	0.3	19.7	0.3	12.6	86.1
32	0.00	0.3	19.6	0.3	12.6	86.2
33	0.00	0.3	19.6	0.3	12.5	85.8
34	0.00	0.3	21.9	0.3	12.5	86.3
35	0.00	0.3	21.2	0.3	12.5	87.1
36	0.00	0.3	21.3	0.3	12.5	87.0
37	0.00	0.3	19.7	0.3	12.3	86.0
38	0.00	0.3	19.2	0.3	12.3	87.1
39	0.00	0.3	19.0	0.3	12.3	86.2
40	0.00	0.3	0.0	0.3	12.3	85.7
41	0.00	0.3	0.0	0.3	12.2	85.1
42	0.00	0.3	19.0	0.3	12.4	86.2
43	0.00	0.3	0.0	0.3	12.3	85.2
44	0.00	0.3	0.0	0.3	12.2	86.0
45	0.00	0.3	0.0	0.3	12.3	85.7
46	0.00	0.3	0.0	0.3	12.4	85.6
47	0.00	0.3	0.0	0.3	12.2	85.2
48	0.00	0.3	0.0	0.3	12.3	85.7
49	0.00	0.3	0.0	0.3	13.4	88.8
50	0.00	0.3	0.0	0.3	13.4	89.6
	Average	0.3	20.7	0.3	12.7	87.3
	Std. Dev.	0.0	1.4	0.0	0.4	2.1
	Maximum	0.3	23.1	0.3	13.5	91.8
	@ Blow#	5	9	5	2	9

Total number of blows analyzed: 48

Time Summary

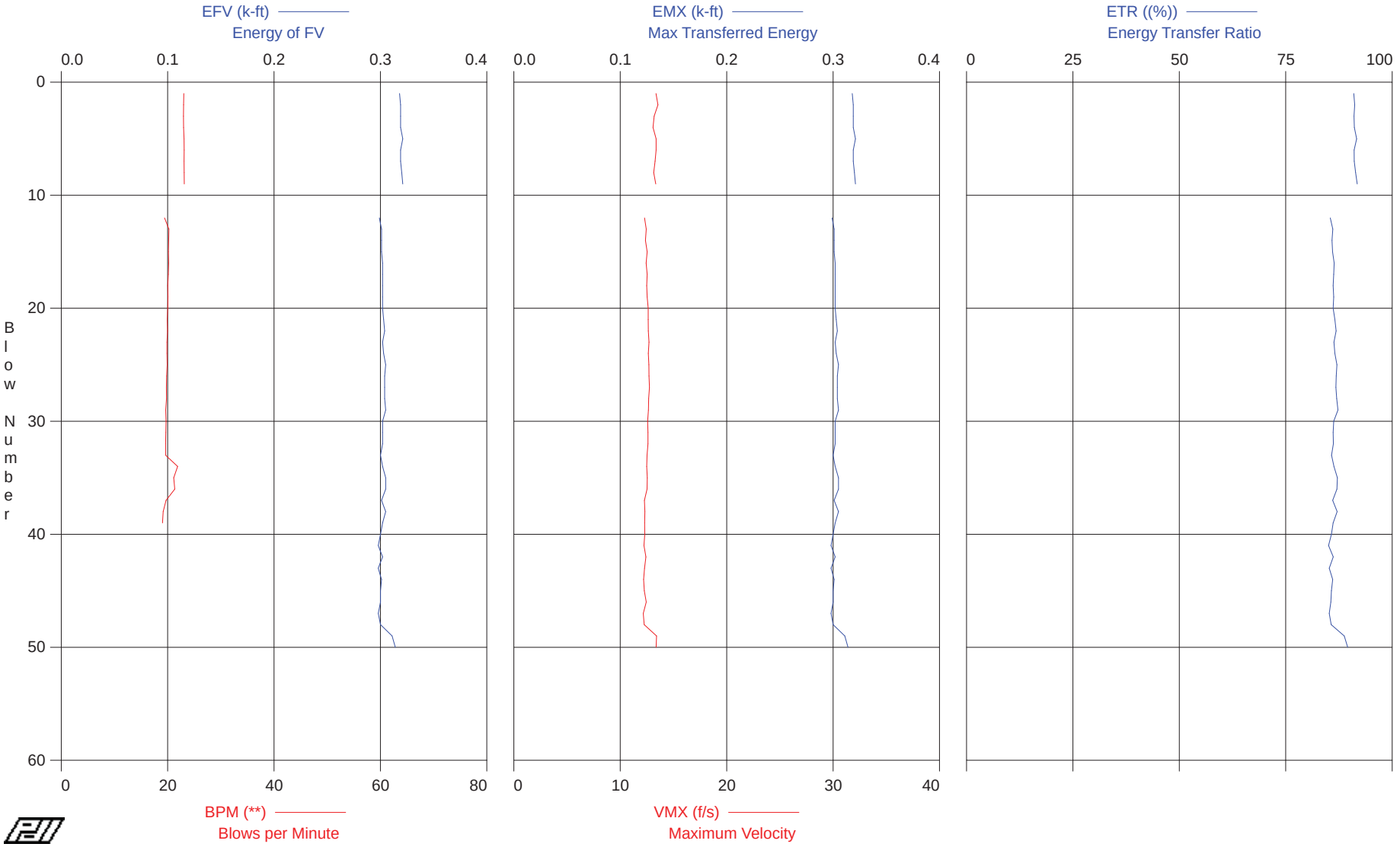
Drive 1 minute 56 seconds 2:00:42 PM - 2:02:38 PM (2/11/2011) BN 1 - 50

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 58ft



Stevens Canyon Dam - SC-105-MR @ 61ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 64.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	0.0	0.3	13.0	86.2
2	0.00	0.3	0.0	0.3	12.9	87.2
3	0.00	0.3	0.0	0.3	13.0	86.7
4	0.00	0.3	0.0	0.3	12.8	86.5
5	0.00	0.3	0.0	0.3	12.8	86.8
9	0.00	0.3	30.7	0.3	12.7	98.2
10	0.00	0.3	21.4	0.3	12.8	98.0
11	0.00	0.3	0.0	0.3	12.4	96.7
12	0.00	0.3	0.0	0.3	12.6	95.3
13	0.00	0.3	20.4	0.3	12.5	95.7
14	0.00	0.3	21.0	0.3	12.8	95.5
15	0.00	0.3	20.9	0.3	12.7	94.9
16	0.00	0.3	20.9	0.3	12.3	95.4
17	0.00	0.3	20.8	0.3	12.3	94.9
18	0.00	0.3	20.7	0.3	12.5	95.9
19	0.00	0.3	20.6	0.3	12.2	95.3
20	0.00	0.3	20.6	0.3	12.5	95.5
21	0.00	0.3	20.5	0.3	12.8	95.3
22	0.00	0.3	20.4	0.3	13.2	96.0
23	0.00	0.3	20.4	0.3	12.8	95.6
24	0.00	0.3	20.4	0.3	12.6	95.2
25	0.00	0.3	20.4	0.3	13.2	95.7
26	0.00	0.3	20.3	0.3	12.9	94.6
27	0.00	0.3	20.3	0.3	12.8	95.3
28	0.00	0.3	20.3	0.3	12.5	95.0
29	0.00	0.3	20.1	0.3	12.5	95.4
30	0.00	0.3	20.1	0.3	12.4	94.6
31	0.00	0.3	20.1	0.3	12.3	95.6
32	0.00	0.3	24.0	0.3	12.4	95.8
33	0.00	0.3	23.8	0.3	12.4	95.5
34	0.00	0.3	23.8	0.3	12.4	94.9
35	0.00	0.3	23.8	0.3	12.3	95.2
36	0.00	0.3	23.7	0.3	12.3	95.1
37	0.00	0.3	23.7	0.3	12.0	94.8
38	0.00	0.3	23.5	0.3	11.9	95.1
39	0.00	0.3	23.6	0.3	11.8	95.0
40	0.00	0.3	23.5	0.3	12.1	95.2
41	0.00	0.3	23.5	0.3	12.1	95.2
42	0.00	0.3	23.5	0.3	11.9	94.4
43	0.00	0.3	23.4	0.3	12.1	93.8
44	0.00	0.3	23.5	0.3	12.0	94.5
45	0.00	0.3	23.4	0.3	11.9	94.6
46	0.00	0.3	23.4	0.3	12.3	94.6
47	0.00	0.3	23.4	0.3	11.6	94.1
48	0.00	0.3	23.4	0.3	11.8	94.8
49	0.00	0.3	23.4	0.3	11.9	94.8
50	0.00	0.3	23.3	0.3	12.0	94.7
51	0.00	0.3	23.3	0.3	12.0	94.4
52	0.00	0.3	23.3	0.3	12.0	94.4
53	0.00	0.3	23.3	0.3	12.1	94.2
54	0.00	0.3	23.3	0.3	12.1	94.9
55	0.00	0.3	23.3	0.3	12.1	94.8
56	0.00	0.3	23.2	0.3	12.2	95.0
57	0.00	0.3	23.2	0.3	12.3	94.6
58	0.00	0.3	23.2	0.3	12.9	95.1
59	0.00	0.3	23.2	0.3	12.1	94.6
60	0.00	0.3	23.1	0.3	12.1	95.0
61	0.00	0.3	23.2	0.3	13.0	95.6
62	0.00	0.3	23.1	0.3	11.8	95.1
63	0.00	0.3	23.2	0.3	11.9	94.8
	Average	0.3	22.5	0.3	12.4	94.5
	Std. Dev.	0.0	1.8	0.0	0.4	2.5
	Maximum	0.3	30.7	0.3	13.2	98.2
	@ Blow#	9	9	9	22	9

Total number of blows analyzed: 60

Stevens Canyon Dam - SC-105-MR @ 61ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

Time Summary

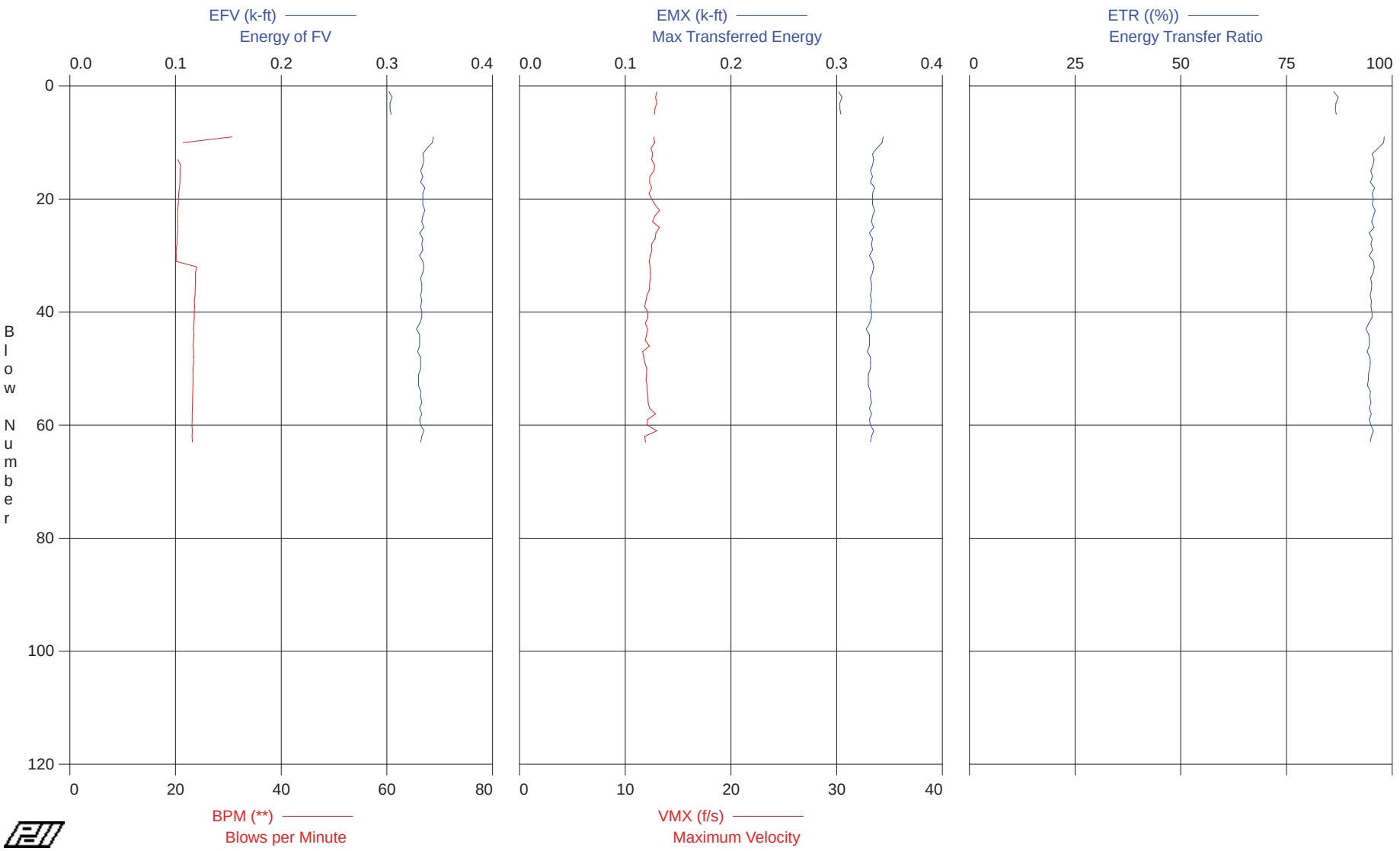
Drive	2 minutes 21 seconds	2:30:01 PM - 2:32:22 PM (2/11/2011)	BN 1 - 63

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 61ft



Stevens Canyon Dam - SC-105-MR @ 64ft
OP: C. Atwell

140lb Auto Hammer
Test date: 11-Feb-2011

AR: 1.40 in^2
LE: 68.67 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

EFV: Energy of FV
BPM: Blows per Minute
EMX: Max Transferred Energy

VMX: Maximum Velocity
ETR: Energy Transfer Ratio

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
1	0.00	0.3	0.0	0.3	13.8	90.0
2	0.00	0.3	25.5	0.3	14.4	95.5
3	0.00	0.3	0.0	0.3	14.2	92.8
4	0.00	0.3	22.2	0.3	14.4	92.5
5	0.00	0.3	23.7	0.3	14.6	95.2
6	0.00	0.3	27.1	0.3	14.5	91.8
7	0.00	0.3	20.5	0.3	14.4	91.8
8	0.00	0.3	20.5	0.3	14.6	91.4
9	0.00	0.3	20.6	0.3	14.7	91.5
10	0.00	0.3	20.5	0.3	14.8	91.9
11	0.00	0.3	20.4	0.3	14.8	91.7
12	0.00	0.3	20.4	0.3	14.7	91.9
13	0.00	0.3	20.4	0.3	14.8	92.2
14	0.00	0.3	20.4	0.3	14.7	91.5
15	0.00	0.3	20.5	0.3	14.7	91.6
16	0.00	0.3	20.3	0.3	14.6	90.6
17	0.00	0.3	20.4	0.3	14.7	91.8
18	0.00	0.3	20.2	0.3	14.7	91.5
19	0.00	0.3	20.0	0.3	14.3	91.9
20	0.00	0.3	19.9	0.3	14.6	91.9
21	0.00	0.3	19.8	0.3	14.3	91.5
22	0.00	0.3	19.7	0.3	14.3	91.0
23	0.00	0.3	21.4	0.3	14.2	91.8
24	0.00	0.3	28.0	0.3	14.4	91.9
25	0.00	0.3	26.7	0.3	14.6	93.2
26	0.00	0.3	25.2	0.3	14.6	92.1
27	0.00	0.3	23.2	0.3	14.5	91.9
28	0.00	0.3	23.4	0.3	14.7	92.2
29	0.00	0.3	23.3	0.3	14.7	91.9
30	0.00	0.3	23.4	0.3	14.7	90.8
31	0.00	0.3	23.2	0.3	15.1	93.0
32	0.00	0.3	22.9	0.3	14.8	91.7
33	0.00	0.3	23.1	0.3	14.9	91.1
34	0.00	0.3	23.3	0.3	15.0	91.1
35	0.00	0.3	23.4	0.3	15.1	91.3
36	0.00	0.3	23.1	0.3	15.2	92.1
37	0.00	0.3	22.7	0.3	14.8	90.8
38	0.00	0.3	22.8	0.3	14.9	91.7
39	0.00	0.3	23.1	0.3	14.9	91.5
40	0.00	0.3	23.1	0.3	14.8	90.3
41	0.00	0.3	22.6	0.3	15.2	91.2
42	0.00	0.3	22.6	0.3	15.0	91.7
43	0.00	0.3	22.5	0.3	14.8	90.5
44	0.00	0.3	22.8	0.3	14.5	89.9
45	0.00	0.3	23.0	0.3	14.8	90.5
46	0.00	0.3	22.9	0.3	15.0	90.8
47	0.00	0.3	22.8	0.3	14.8	90.4
48	0.00	0.3	23.0	0.3	14.9	91.8
49	0.00	0.3	22.7	0.3	14.7	90.7
50	0.00	0.3	22.7	0.3	15.0	91.2
51	0.00	0.3	22.7	0.3	14.7	89.7
52	0.00	0.3	23.1	0.3	15.2	91.1
53	0.00	0.3	22.9	0.3	14.6	89.5
54	0.00	0.3	22.6	0.3	15.2	92.2
55	0.00	0.3	22.4	0.3	15.0	90.1
56	0.00	0.3	22.3	0.3	14.8	89.7
57	0.00	0.3	23.0	0.3	14.5	90.4
58	0.00	0.3	22.9	0.3	14.7	89.5
59	0.00	0.3	22.3	0.3	14.9	89.2
60	0.00	0.3	22.4	0.3	15.0	90.3
61	0.00	0.3	22.4	0.3	14.5	89.8
62	0.00	0.3	22.5	0.3	14.4	90.2
63	0.00	0.3	22.7	0.3	14.4	89.0
64	0.00	0.3	22.6	0.3	15.1	90.4
65	0.00	0.3	22.6	0.3	14.8	89.2
66	0.00	0.3	22.9	0.3	14.7	90.1
67	0.00	0.3	22.7	0.3	14.4	88.5

Stevens Canyon Dam - SC-105-MR @ 64ft
OP: C. Atwell
140lb Auto Hammer
Test date: 11-Feb-2011

BL#	depth	EFV	BPM	EMX	VMX	ETR
	ft	k-ft	**	k-ft	f/s	(%)
68	0.00	0.3	22.3	0.3	14.8	90.4
69	0.00	0.3	22.6	0.3	14.3	89.4
70	0.00	0.3	22.6	0.3	14.2	88.2
	Average	0.3	22.5	0.3	14.7	91.1
	Std. Dev.	0.0	1.6	0.0	0.3	1.3
	Maximum	0.3	28.0	0.3	15.2	95.5
	@ Blow#	2	24	2	36	2

Total number of blows analyzed: 70

Time Summary

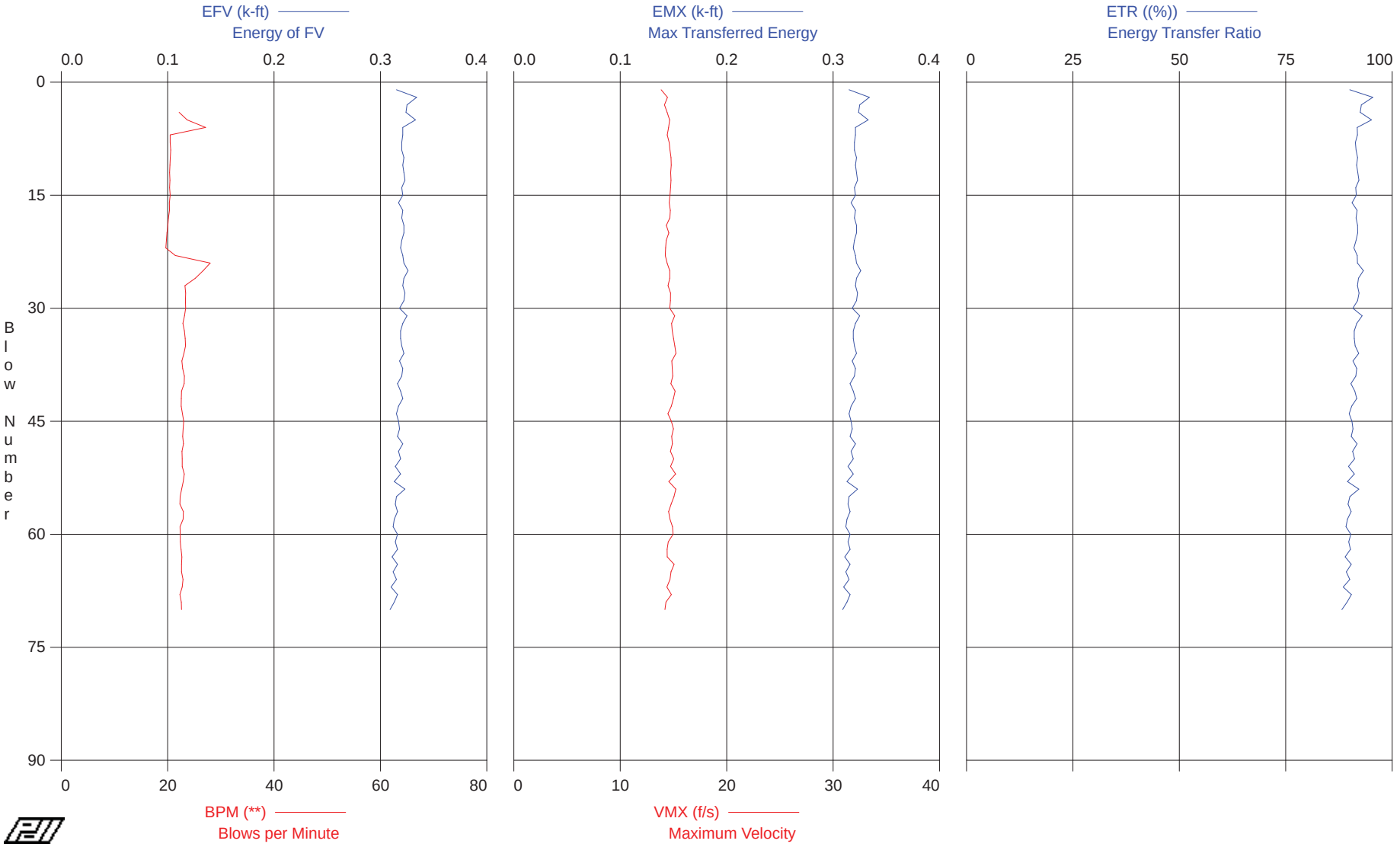
Drive	4 minutes 40 seconds	2:58:32 PM - 3:03:12 PM (2/11/2011) BN 1 - 70

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 14-Feb-2011

Test date: 11-Feb-2011

Stevens Canyon Dam - SC-105-MR @ 64ft



APPENDIX F

CONTENTS

Dynamic Pile Test Report by Abe Construction Services, Inc., dated March 1, 2011.

Supplemental CAPWAP Analysis by Abe Construction Services, Inc., dated March 27, 2011.

Abe Construction Services, Inc.

2230 Lariat Lane, Walnut Creek, CA 94596
PHONE: 925-944-6363 FAX: 925-476-1588
EMAIL: SA@AbeEngineering.com

Dynamic Pile Test Report

Company:	Great West Drilling, Inc.		March 1, 2011
Attn:	Jim Bensen	**From:**	Steve Abe
Re:	Becker Hammer Dynamic Monitoring Stevens Creek Dam Cupertino, CA		Job No. 11018

This report presents dynamic monitoring results for three Becker Hammer Penetration Test (BPT) borings for the project referenced above on February 17, 18, and 21, 2011. The primary objectives of the dynamic monitoring was to evaluate hammer performance and soil resistance. The dynamic testing was performed using a Model PAX Pile Driving Analyzer (PDA) according to the ASTM D4945 test standard.

Becker Hammer and Drill Details

The Becker Drill pipe consists of 10 ft long sections of 6.625-inch OD x 0.625 wall pipe and the penetration testing was performed using a closed ended bit. The drill pipe is driven with a Linkbelt LB180 closed ended diesel hammer which has a 1.73 kip ram weight and a maximum manufacturers rated energy of 8.10 kip-ft.

DYNAMIC TEST RESULTS

The following PDA calculated Case Method results are printed versus blow number and pile penetration depth in Appendix A for each BPT Boring.

EFV- maximum energy transferred to the drill pipe.
ETR- the energy transfer ratio or efficiency (EFV/ Rated Energy).
RTL- the total static and dynamic Case Method soil resistance with J=0.0. Includes both shaft friction and toe resistance with nor reduction for damping resistance.
SFT- the total static and dynamic estimated shaft resistance with no reduction for damping resistance. The ratio SFT/RTL can be used to estimate the approximate percentage of shaft resistance to total resistance.
RMX- the Case Method ultimate static capacity estimate using a Case Damping factor of 0.6. . Includes both shaft friction and toe resistance and is equal to RTL minus damping resistance.
FMX- maximum measutred force in the drill pipe.
VMX- maximum measured velocity of the drill pipe

The BPT borings were driven to depths ranging from 29 ft to 74 ft and the ETR values ranged from 27% to 34% at the end of driving.

I appreciate the opportunity to assist you with this project. Please contact me if you have any questions regarding these results, or if we may be of further service.

Very truly yours,
ABE Engineering
Steve Abe, P.E.

APPENDIX A

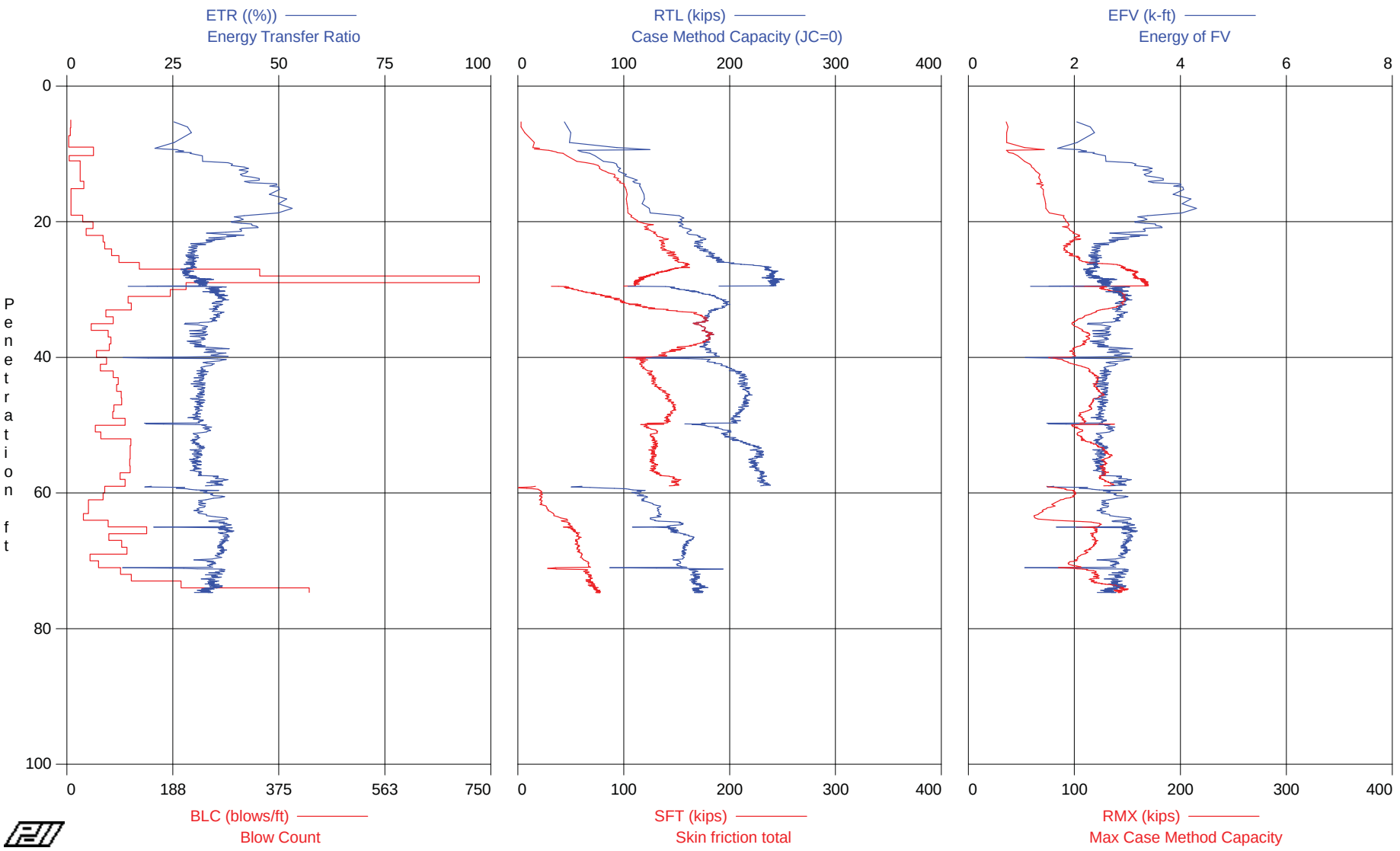
PDA Case Method Results

Abe Construction Services, Inc. - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 1-Mar-2011

Test date: 17-Feb-2011

STEVENS CREEK DAM - SC103BB



STEVENS CREEK DAM - SC103BB
OP: SA
RESTRIKE
Test date: 17-Feb-2011

ETR: Energy Transfer Ratio
EFV: Energy of FV
RTL: Case Method Capacity (JC=0)
SFT: Skin friction total
RMX: Max Case Method Capacity
BPM: Blows per Minute
FMX: Maximum Force
VMX: Maximum Velocity

BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
10	6.00	7	AV8	26.2	2.1	45	3	36	77.8	87	5.4
16	7.00	6	AV6	28.8	2.3	48	3	37	95.0	97	5.6
19	8.00	3	AV3	32.7	2.6	54	17	37	94.3	117	6.7
22	9.00	3	AV3	20.7	1.7	47	17	35	96.5	86	4.6
69	10.00	47	AV47	25.6	2.1	82	29	49	92.0	116	5.8
73	11.00	4	AV4	31.2	2.5	76	48	49	93.9	141	7.0
96	12.00	23	AV23	38.1	3.1	91	69	57	93.4	170	8.9
119	13.00	23	AV23	42.1	3.4	96	82	64	93.1	180	9.1
143	14.00	23	AV24	43.6	3.5	107	93	67	93.0	191	9.6
173	15.00	30	AV30	47.3	3.8	114	100	68	93.0	197	9.8
180	16.00	7	AV7	48.6	3.9	118	103	70	93.0	200	10.0
187	17.00	7	AV7	50.6	4.1	120	103	72	93.0	202	10.0
194	18.00	7	AV7	50.6	4.1	119	105	74	93.0	203	10.0
202	19.00	7	AV8	51.2	4.1	125	103	74	93.0	205	10.2
230	20.00	28	AV28	40.5	3.3	154	110	91	89.8	193	10.0
276	21.00	46	AV46	42.9	3.5	155	121	94	93.0	194	10.1
310	22.00	34	AV34	38.9	3.2	162	127	99	93.0	193	10.1
374	23.00	64	AV64	35.8	2.9	173	136	101	92.9	198	10.2
441	24.00	67	AV67	30.8	2.5	171	137	93	92.9	185	9.6
520	25.00	79	AV79	29.4	2.4	180	143	94	92.9	186	9.7
612	26.00	92	AV92	29.6	2.4	188	150	105	93.0	192	10.0
740	27.00	128	AV128	29.3	2.4	223	157	139	93.0	199	10.4
1081	28.00	341	AV341	28.2	2.3	240	134	156	93.0	195	10.2
1811	29.00	730	AV730	31.1	2.5	241	116	163	92.9	204	10.8
2022	30.00	211	AV206	32.5	2.6	192	79	146	92.4	193	10.3
2205	31.00	183	AV183	35.4	2.9	172	69	142	92.7	195	10.5
2313	32.00	108	AV108	36.3	2.9	192	94	147	92.7	199	10.9
2427	33.00	114	AV114	35.3	2.9	194	119	139	92.7	196	10.6
2496	34.00	69	AV69	35.5	2.9	181	163	117	92.7	197	10.6
2578	35.00	82	AV82	34.0	2.8	176	176	103	92.8	196	10.4
2621	36.00	43	AV43	31.7	2.6	174	174	102	92.9	194	10.0
2694	37.00	73	AV73	31.3	2.5	180	180	112	92.9	196	10.2
2772	38.00	78	AV78	30.9	2.5	179	178	111	92.9	195	10.3
2847	39.00	75	AV75	32.9	2.7	177	157	103	92.8	197	10.3
2899	40.00	52	AV52	34.6	2.8	184	139	99	93.0	201	10.3
2969	41.00	70	AV70	32.0	2.6	171	116	89	91.7	175	9.4
3028	42.00	59	AV59	32.5	2.6	198	119	109	92.9	198	10.4
3110	43.00	82	AV82	31.9	2.6	211	126	118	92.8	199	10.6
3201	44.00	91	AV91	31.4	2.5	213	128	121	92.8	198	10.6
3289	45.00	88	AV88	31.7	2.6	215	133	121	92.8	199	10.7
3385	46.00	96	AV96	31.5	2.5	217	141	125	92.9	201	10.7
3482	47.00	97	AV97	31.1	2.5	215	144	117	92.9	201	10.7
3565	48.00	83	AV83	31.1	2.5	212	147	114	93.0	202	10.7
3646	49.00	81	AV81	30.4	2.5	206	143	106	93.0	199	10.5
3749	50.00	103	AV97	30.1	2.4	196	137	110	92.1	187	9.9
3799	51.00	50	AV50	33.0	2.7	190	126	103	92.9	188	10.3
3859	52.00	60	AV60	30.9	2.5	198	128	105	92.9	197	10.5
3972	53.00	113	AV113	30.3	2.5	212	129	114	92.9	199	10.7
4084	54.00	112	AV112	31.1	2.5	226	128	126	92.9	202	11.0
4196	55.00	112	AV112	30.8	2.5	227	128	132	92.9	202	10.8
4307	56.00	111	AV111	30.4	2.5	223	128	128	93.0	201	10.6
4419	57.00	112	AV112	30.4	2.5	226	128	127	93.0	203	10.8
4513	58.00	94	AV94	33.6	2.7	230	140	126	92.9	211	11.4
4616	59.00	103	AV100	35.4	2.9	230	148	132	92.0	212	11.3
4683	60.00	67	AV67	28.9	2.3	97	16	91	93.1	121	7.4
4747	61.00	64	AV64	34.8	2.8	117	22	97	92.9	153	8.8
4785	62.00	38	AV38	31.8	2.6	126	23	82	93.1	150	8.6
4823	63.00	38	AV38	31.2	2.5	133	29	72	93.2	150	8.5
4852	64.00	29	AV29	35.1	2.8	131	39	65	93.3	148	8.4
4925	65.00	73	AV73	36.5	3.0	147	47	116	92.8	161	9.3
5066	66.00	141	AV141	36.2	2.9	145	53	119	92.1	163	9.4
5140	67.00	74	AV74	37.5	3.0	163	57	118	92.7	176	10.1
5237	68.00	97	AV97	36.6	3.0	159	56	119	92.7	173	9.9
5343	69.00	106	AV106	36.6	3.0	157	58	113	92.7	171	9.9
5384	70.00	41	AV41	34.6	2.8	155	61	104	92.9	168	9.7
5440	71.00	56	AV56	34.0	2.8	153	67	99	92.9	165	9.5
5535	72.00	95	AV95	33.6	2.7	162	57	113	92.1	162	9.2
5649	73.00	114	AV114	34.3	2.8	168	68	120	92.8	173	9.8
5851	74.00	202	AV202	34.6	2.8	170	70	131	92.7	176	9.9

STEVENS CREEK DAM - SC103BB
OP: SA
RESTRIKE
Test date: 17-Feb-2011

BL#	depth	BLC	TYPE	ETR	EFV	RTL	SFT	RMX	BPM	FMX	VMX
end	ft	bl/ft		(%)	k-ft	kips	kips	kips	**	kips	f/s
6151	74.70	429	AV300	32.8	2.7	169	75	144	92.7	171	9.6

STEVENS CREEK DAM - SC103BB
OP: SA

RESTRIKE
Test date: 17-Feb-2011

ETR: Energy Transfer Ratio
EFV: Energy of FV
RTL: Case Method Capacity (JC=0)
SFT: Skin friction total

RMX: Max Case Method Capacity
BPM: Blows per Minute
FMX: Maximum Force
VMX: Maximum Velocity

BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
27	9.11	47	AV25	25.9	2.1	57	9	40	85.7	94	5.5
52	9.64	47	AV25	24.6	2.0	92	24	54	93.5	113	5.7
77	11.17	23	AV25	29.6	2.4	70	44	43	94.2	133	6.5
102	12.24	23	AV25	40.1	3.2	94	73	59	93.3	176	9.2
127	13.31	23	AV25	41.6	3.4	98	86	65	93.1	181	9.1
152	14.30	30	AV25	43.9	3.6	109	95	68	93.0	192	9.6
177	15.55	7	AV25	49.4	4.0	116	101	69	93.0	200	10.0
202	19.00	7	AV25	50.5	4.1	121	103	73	93.0	203	10.0
227	19.89	28	AV25	40.9	3.3	154	110	91	89.4	193	10.0
252	20.48	46	AV25	41.2	3.3	154	119	94	93.0	193	10.0
277	21.03	34	AV25	44.0	3.6	155	122	93	93.1	194	10.2
302	21.76	34	AV25	38.7	3.1	162	126	97	93.0	192	10.0
327	22.27	64	AV25	38.8	3.1	169	132	103	93.0	200	10.3
352	22.66	64	AV25	35.4	2.9	176	139	103	92.9	201	10.3
377	23.04	67	AV25	33.7	2.7	171	136	98	92.9	192	9.9
402	23.42	67	AV25	31.7	2.6	170	137	95	92.9	187	9.7
427	23.79	67	AV25	30.0	2.4	170	137	92	92.9	183	9.5
452	24.14	79	AV25	29.9	2.4	173	138	91	92.9	184	9.6
477	24.46	79	AV25	29.5	2.4	176	141	92	92.9	184	9.5
502	24.77	79	AV25	29.4	2.4	182	144	95	92.9	187	9.7
527	25.08	92	AV25	29.4	2.4	183	146	97	92.9	189	9.8
552	25.35	92	AV25	29.5	2.4	185	149	103	92.9	190	9.9
577	25.62	92	AV25	29.7	2.4	188	150	104	93.0	192	10.0
602	25.89	92	AV25	29.8	2.4	191	150	106	93.0	193	10.0
627	26.12	128	AV25	29.0	2.3	196	155	113	93.0	196	10.1
652	26.31	128	AV25	29.3	2.4	206	160	130	93.0	199	10.3
677	26.51	128	AV25	29.7	2.4	222	160	142	93.0	199	10.4
702	26.70	128	AV25	29.7	2.4	233	157	145	93.0	200	10.5
727	26.90	128	AV25	29.3	2.4	236	154	147	93.0	200	10.5
752	27.04	341	AV25	27.8	2.3	236	146	149	92.9	196	10.2
777	27.11	341	AV25	27.6	2.2	236	144	151	92.9	196	10.2
802	27.18	341	AV25	27.8	2.3	238	142	152	92.9	196	10.2
827	27.26	341	AV25	28.3	2.3	239	141	152	92.9	197	10.3
852	27.33	341	AV25	28.8	2.3	242	140	156	93.0	198	10.4
877	27.40	341	AV25	28.0	2.3	242	136	158	93.0	195	10.2
902	27.48	341	AV25	28.0	2.3	242	134	158	93.1	195	10.2
927	27.55	341	AV25	28.3	2.3	242	132	158	93.0	196	10.3
952	27.62	341	AV25	28.3	2.3	241	131	157	93.0	195	10.2
977	27.70	341	AV25	27.8	2.2	240	131	156	93.0	193	10.1
1002	27.77	341	AV25	28.1	2.3	239	128	156	93.0	194	10.2
1027	27.84	341	AV25	28.4	2.3	240	128	156	92.9	195	10.2
1052	27.91	341	AV25	28.5	2.3	240	125	157	92.9	195	10.3
1077	27.99	341	AV25	28.8	2.3	239	124	157	92.9	196	10.3
1102	28.03	730	AV25	29.3	2.4	240	123	157	92.8	197	10.4
1127	28.06	730	AV25	29.7	2.4	240	123	157	92.8	198	10.5
1152	28.10	730	AV25	30.0	2.4	241	122	158	92.9	199	10.5
1177	28.13	730	AV25	30.1	2.4	241	120	158	92.9	200	10.6
1202	28.17	730	AV25	29.8	2.4	239	119	158	92.9	199	10.5
1227	28.20	730	AV25	29.4	2.4	238	118	158	93.0	198	10.5
1252	28.23	730	AV25	29.2	2.4	237	118	158	93.0	197	10.4
1277	28.27	730	AV25	29.0	2.3	234	116	157	93.0	196	10.3
1302	28.30	730	AV25	30.1	2.4	237	117	158	92.9	200	10.5
1327	28.34	730	AV25	30.7	2.5	239	117	159	92.9	203	10.7
1352	28.37	730	AV25	30.3	2.5	238	116	159	92.9	201	10.6
1377	28.41	730	AV25	31.4	2.5	241	117	161	92.9	205	10.8
1402	28.44	730	AV25	31.8	2.6	243	116	162	92.9	206	10.9
1427	28.47	730	AV25	33.1	2.7	247	117	165	92.9	211	11.2
1452	28.51	730	AV25	33.3	2.7	248	117	165	92.9	211	11.2
1477	28.54	730	AV25	33.5	2.7	247	117	165	92.9	211	11.2
1502	28.58	730	AV25	31.8	2.6	243	115	164	92.9	206	10.9
1527	28.61	730	AV25	31.5	2.6	242	115	164	92.9	205	10.9
1552	28.65	730	AV25	32.1	2.6	244	114	165	92.9	207	11.0
1577	28.68	730	AV25	31.2	2.5	240	112	164	92.9	204	10.8
1602	28.71	730	AV25	31.8	2.6	242	113	165	92.9	206	10.9
1627	28.75	730	AV25	31.3	2.5	241	113	165	92.9	204	10.8
1652	28.78	730	AV25	31.1	2.5	241	112	165	92.9	205	10.9
1677	28.82	730	AV25	31.5	2.6	242	113	166	92.9	206	10.9
1702	28.85	730	AV25	30.7	2.5	239	111	165	92.9	204	10.8
1727	28.88	730	AV25	30.9	2.5	240	113	166	92.9	204	10.8

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BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
1752	28.92	730	AV25	32.8	2.7	245	113	169	92.9	209	11.1
1777	28.95	730	AV25	32.4	2.6	243	112	168	92.9	208	11.1
1802	28.99	730	AV25	31.4	2.5	241	112	167	92.9	205	10.9
1827	29.08	211	AV25	32.4	2.6	243	111	168	92.8	209	11.1
1852	29.19	211	AV25	31.5	2.5	240	111	167	92.9	206	10.9
1877	29.31	211	AV25	31.9	2.6	242	111	168	92.9	207	11.0
1902	29.43	211	AV25	32.3	2.6	242	111	169	92.9	209	11.0
1927	29.55	211	AV20	24.0	1.9	182	79	137	88.6	166	8.6
1952	29.67	211	AV25	35.1	2.8	142	46	127	92.7	183	9.9
1977	29.79	211	AV25	35.0	2.8	146	46	126	92.7	185	10.0
2002	29.91	211	AV25	34.5	2.8	150	51	126	92.7	186	10.0
2027	30.03	183	AV25	34.5	2.8	153	53	128	92.7	188	10.0
2052	30.16	183	AV25	34.6	2.8	159	57	132	92.8	190	10.1
2077	30.30	183	AV25	35.6	2.9	165	61	137	92.7	194	10.4
2102	30.44	183	AV25	34.3	2.8	169	64	142	92.7	192	10.4
2127	30.57	183	AV25	34.9	2.8	173	71	145	92.7	194	10.5
2152	30.71	183	AV25	35.3	2.9	175	73	146	92.7	195	10.6
2177	30.85	183	AV25	36.2	2.9	181	78	148	92.7	198	10.7
2202	30.98	183	AV25	36.5	3.0	185	82	147	92.7	199	10.9
2227	31.20	108	AV25	36.3	2.9	187	86	147	92.7	198	10.9
2252	31.44	108	AV25	36.7	3.0	190	93	147	92.7	200	11.0
2277	31.67	108	AV25	37.0	3.0	194	95	148	92.7	200	11.0
2302	31.90	108	AV25	35.8	2.9	196	99	146	92.7	199	10.9
2327	32.12	114	AV25	34.6	2.8	197	102	145	92.7	195	10.6
2352	32.34	114	AV25	36.5	3.0	198	113	146	92.7	200	10.8
2377	32.56	114	AV25	35.4	2.9	195	116	141	92.7	196	10.6
2402	32.78	114	AV25	35.2	2.9	193	124	137	92.7	196	10.5
2427	33.00	114	AV25	34.7	2.8	187	135	129	92.7	195	10.4
2452	33.36	69	AV25	35.1	2.8	182	150	121	92.7	195	10.4
2477	33.72	69	AV25	35.9	2.9	181	167	116	92.7	199	10.6
2502	34.07	82	AV25	35.6	2.9	180	174	110	92.7	198	10.7
2527	34.38	82	AV25	34.6	2.8	177	177	106	92.8	197	10.5
2552	34.68	82	AV25	34.8	2.8	178	178	102	92.8	199	10.4
2577	34.99	82	AV25	32.1	2.6	172	172	99	92.9	192	10.1
2602	35.56	43	AV25	30.8	2.5	171	171	99	92.9	190	9.9
2627	36.08	73	AV25	32.0	2.6	177	177	106	92.9	197	10.2
2652	36.42	73	AV25	32.0	2.6	179	179	110	92.9	198	10.3
2677	36.77	73	AV25	31.3	2.5	181	181	114	92.9	196	10.2
2702	37.10	78	AV25	31.0	2.5	180	180	112	92.9	195	10.2
2727	37.42	78	AV25	32.1	2.6	180	180	113	92.9	198	10.4
2752	37.74	78	AV25	30.2	2.4	178	177	110	92.8	193	10.2
2777	38.07	75	AV25	30.3	2.5	177	172	109	92.9	193	10.2
2802	38.40	75	AV25	31.5	2.5	177	165	107	92.8	195	10.2
2827	38.73	75	AV25	34.0	2.7	176	153	100	92.9	197	10.3
2852	39.10	52	AV25	34.3	2.8	181	150	98	92.8	202	10.3
2877	39.58	52	AV25	34.6	2.8	183	140	99	92.9	202	10.3
2902	40.04	70	AV25	31.3	2.5	174	130	96	89.5	184	9.4
2927	40.40	70	AV25	31.1	2.5	158	118	84	93.1	165	8.9
2952	40.76	70	AV25	34.8	2.8	181	118	92	92.9	186	10.0
2977	41.14	59	AV25	33.6	2.7	189	117	98	92.9	192	10.2
3002	41.56	59	AV25	32.8	2.7	196	118	107	92.9	197	10.5
3027	41.98	59	AV25	31.9	2.6	203	120	114	92.9	200	10.5
3052	42.29	82	AV25	31.8	2.6	207	125	115	92.8	200	10.5
3077	42.60	82	AV25	31.8	2.6	211	124	118	92.8	198	10.6
3102	42.90	82	AV25	32.1	2.6	213	128	121	92.8	200	10.7
3127	43.19	91	AV25	31.5	2.6	212	128	122	92.8	198	10.6
3152	43.46	91	AV25	31.8	2.6	215	129	122	92.8	199	10.7
3177	43.74	91	AV25	30.9	2.5	212	128	121	92.8	196	10.5
3202	44.01	88	AV25	31.3	2.5	213	128	120	92.8	198	10.6
3227	44.30	88	AV25	31.3	2.5	213	130	119	92.8	199	10.7
3252	44.58	88	AV25	31.6	2.6	215	133	121	92.8	198	10.7
3277	44.86	88	AV25	31.6	2.6	215	134	122	92.8	198	10.7
3302	45.14	96	AV25	32.2	2.6	217	138	123	92.8	200	10.8
3327	45.40	96	AV25	31.3	2.5	218	139	126	92.8	201	10.7
3352	45.66	96	AV25	31.8	2.6	219	142	127	92.9	202	10.8
3377	45.92	96	AV25	31.2	2.5	215	142	124	92.9	200	10.6
3402	46.18	97	AV25	30.3	2.5	214	141	120	93.0	199	10.5
3427	46.43	97	AV25	31.8	2.6	216	144	118	92.9	202	10.7
3452	46.69	97	AV25	31.0	2.5	215	145	117	93.0	201	10.6
3477	46.95	97	AV25	31.1	2.5	215	146	116	92.9	202	10.7
3502	47.24	83	AV25	31.7	2.6	214	148	115	92.9	203	10.8
3527	47.54	83	AV25	30.9	2.5	212	148	116	93.0	201	10.6
3552	47.84	83	AV25	31.0	2.5	212	148	115	93.0	202	10.7
3577	48.15	81	AV25	30.8	2.5	210	145	110	93.0	200	10.6

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BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
3602	48.46	81	AV25	30.6	2.5	207	144	106	93.0	200	10.6
3627	48.77	81	AV25	30.6	2.5	206	143	105	93.0	200	10.5
3652	49.06	103	AV25	30.2	2.4	204	141	107	93.0	198	10.4
3677	49.30	103	AV25	31.0	2.5	203	142	108	93.0	199	10.6
3702	49.54	103	AV25	31.5	2.6	205	141	110	93.0	201	10.6
3727	49.79	103	AV19	29.4	2.4	200	138	109	88.3	192	10.1
3752	50.06	50	AV25	28.1	2.3	172	124	112	92.8	154	8.2
3777	50.56	50	AV25	33.1	2.7	185	123	101	92.9	182	10.1
3802	51.05	60	AV25	33.2	2.7	197	130	107	92.9	199	10.6
3827	51.47	60	AV25	30.6	2.5	196	128	103	92.9	196	10.4
3852	51.88	60	AV25	30.9	2.5	199	127	106	92.9	198	10.6
3877	52.16	113	AV25	30.5	2.5	204	129	108	92.9	198	10.5
3902	52.38	113	AV25	29.9	2.4	207	128	108	92.9	198	10.7
3927	52.60	113	AV25	30.0	2.4	213	129	114	92.9	199	10.7
3952	52.82	113	AV25	30.6	2.5	215	130	117	92.9	200	10.8
3977	53.04	112	AV25	31.0	2.5	221	130	121	92.9	201	10.9
4002	53.27	112	AV25	31.5	2.5	225	129	123	92.8	204	11.1
4027	53.49	112	AV25	32.0	2.6	229	130	127	92.9	204	11.1
4052	53.71	112	AV25	30.3	2.5	223	127	128	92.9	198	10.8
4077	53.94	112	AV25	30.9	2.5	228	127	129	92.9	202	11.0
4102	54.16	112	AV25	30.6	2.5	229	127	130	92.9	202	10.9
4127	54.38	112	AV25	31.1	2.5	228	129	132	92.9	203	10.9
4152	54.61	112	AV25	31.0	2.5	229	130	135	93.0	202	10.8
4177	54.83	112	AV25	31.0	2.5	227	128	133	92.9	202	10.8
4202	55.05	111	AV25	30.2	2.4	221	127	129	93.0	200	10.6
4227	55.28	111	AV25	30.2	2.4	222	127	127	93.0	201	10.7
4252	55.50	111	AV25	30.4	2.5	222	126	128	93.0	200	10.7
4277	55.73	111	AV25	30.1	2.4	224	128	130	93.0	201	10.6
4302	55.95	111	AV25	31.1	2.5	225	130	128	93.0	203	10.7
4327	56.18	112	AV25	30.1	2.4	223	128	126	93.0	202	10.6
4352	56.40	112	AV25	30.4	2.5	225	128	128	93.0	202	10.7
4377	56.62	112	AV25	30.5	2.5	226	128	127	93.0	203	10.9
4402	56.85	112	AV25	30.1	2.4	227	127	127	93.0	202	10.9
4427	57.09	94	AV25	31.4	2.5	231	131	128	92.9	206	11.2
4452	57.35	94	AV25	31.4	2.5	230	133	128	92.9	205	11.2
4477	57.62	94	AV25	33.3	2.7	231	139	126	92.9	210	11.4
4502	57.88	94	AV25	35.4	2.9	230	147	124	93.0	215	11.6
4527	58.14	103	AV25	37.2	3.0	230	151	127	93.0	219	11.8
4552	58.38	103	AV25	36.0	2.9	231	150	130	92.9	216	11.5
4577	58.62	103	AV25	34.5	2.8	232	148	133	92.9	211	11.2
4602	58.86	103	AV25	35.8	2.9	236	151	136	92.9	212	11.4
4627	59.16	67	AV22	26.8	2.2	137	74	102	89.3	140	7.7
4652	59.54	67	AV25	27.4	2.2	92	10	88	93.1	115	7.1
4677	59.91	67	AV25	32.9	2.7	115	22	99	92.8	138	8.5
4702	60.30	64	AV25	33.7	2.7	113	22	101	92.8	143	8.6
4727	60.69	64	AV25	35.9	2.9	119	22	98	92.9	157	9.0
4752	61.13	38	AV25	33.7	2.7	118	22	90	93.0	155	8.8
4777	61.79	38	AV25	31.6	2.6	125	22	82	93.1	149	8.6
4802	62.45	38	AV25	31.8	2.6	133	27	77	93.2	151	8.6
4827	63.14	29	AV25	31.1	2.5	133	31	69	93.2	150	8.5
4852	64.00	29	AV25	35.7	2.9	130	40	65	93.3	148	8.4
4877	64.34	73	AV25	34.9	2.8	140	44	102	92.9	156	9.0
4902	64.68	73	AV25	37.3	3.0	155	49	123	92.7	171	9.7
4927	65.01	141	AV25	35.8	2.9	141	49	121	93.0	152	8.9
4952	65.19	141	AV25	32.0	2.6	137	48	115	89.1	150	8.6
4977	65.37	141	AV25	36.9	3.0	144	51	120	92.8	164	9.4
5002	65.55	141	AV25	37.5	3.0	146	53	120	92.8	166	9.5
5027	65.72	141	AV25	38.6	3.1	149	54	121	92.7	169	9.7
5052	65.90	141	AV25	37.5	3.0	148	56	120	92.7	169	9.7
5077	66.15	74	AV25	36.6	3.0	155	56	117	92.8	171	9.9
5102	66.49	74	AV25	37.9	3.1	162	57	117	92.7	176	10.1
5127	66.82	74	AV25	37.5	3.0	165	58	119	92.7	178	10.2
5152	67.12	97	AV25	37.1	3.0	162	55	120	92.7	176	10.1
5177	67.38	97	AV25	36.8	3.0	160	56	120	92.7	174	10.0
5202	67.64	97	AV25	36.5	3.0	159	56	119	92.7	173	10.0
5227	67.90	97	AV25	36.0	2.9	158	57	118	92.8	172	9.8
5252	68.14	106	AV25	36.3	2.9	157	57	117	92.7	171	9.8
5277	68.38	106	AV25	36.9	3.0	157	57	115	92.7	172	9.9
5302	68.61	106	AV25	36.8	3.0	157	58	111	92.7	172	9.9
5327	68.85	106	AV25	36.9	3.0	157	58	112	92.7	171	9.9
5352	69.22	41	AV25	36.0	2.9	157	61	109	92.8	171	9.9
5377	69.83	41	AV25	34.9	2.8	155	60	103	92.8	169	9.7
5402	70.32	56	AV25	33.4	2.7	152	65	98	92.9	163	9.4
5427	70.77	56	AV25	34.1	2.8	152	67	96	92.9	163	9.5

STEVENS CREEK DAM - SC103BB
OP: SA
RESTRIKE
Test date: 17-Feb-2011

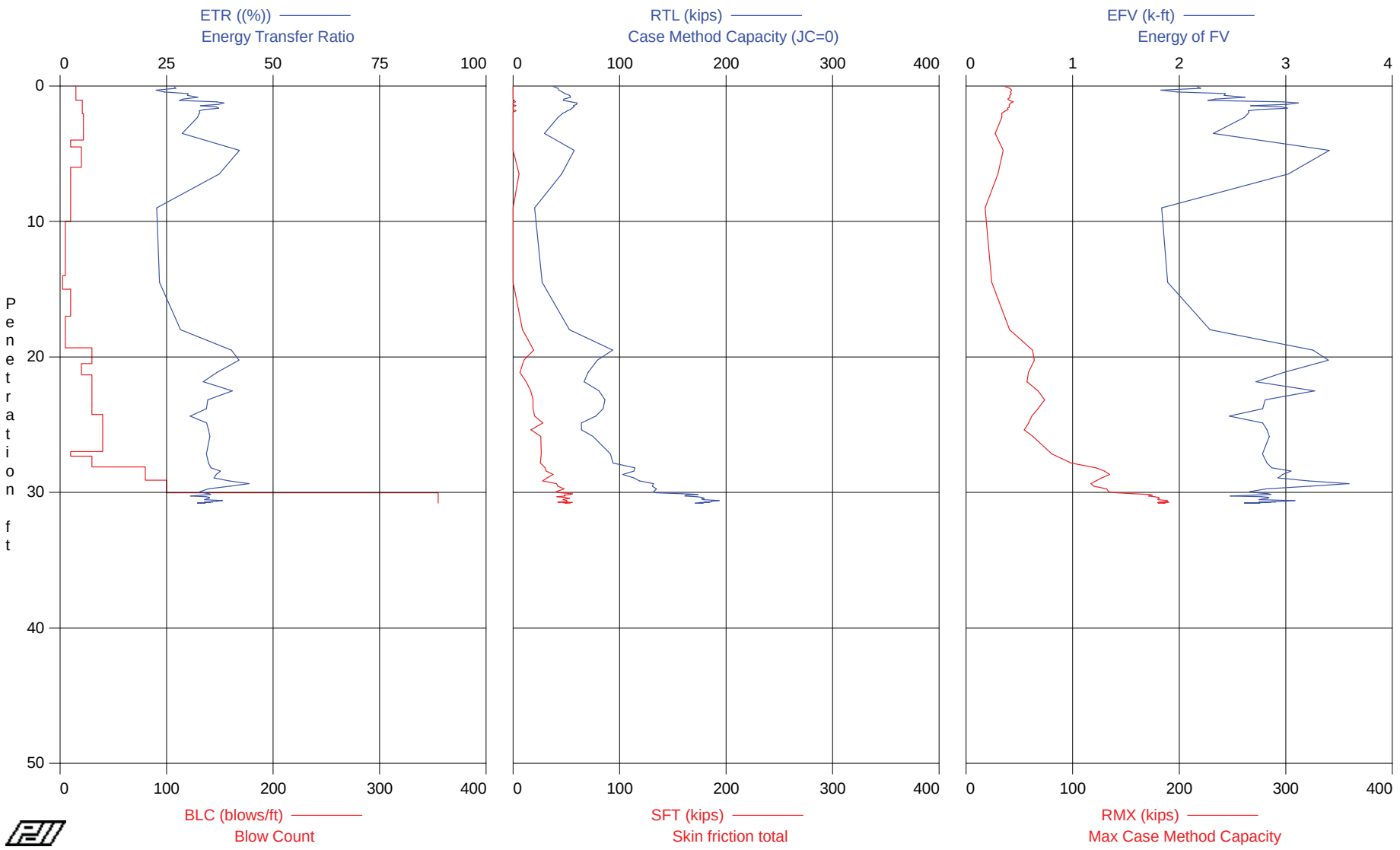
BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
5452	71.13	95	AV25	27.2	2.2	136	51	99	89.8	135	7.7
5477	71.39	95	AV25	34.4	2.8	171	49	108	93.0	163	9.3
5502	71.65	95	AV25	36.6	3.0	168	64	118	92.9	176	9.9
5527	71.92	95	AV25	35.4	2.9	166	65	119	92.9	173	9.8
5552	72.15	114	AV25	35.0	2.8	169	67	121	92.9	174	9.8
5577	72.37	114	AV25	34.8	2.8	168	68	122	92.8	173	9.8
5602	72.59	114	AV25	34.9	2.8	169	68	122	92.8	174	9.9
5627	72.81	114	AV25	33.4	2.7	167	68	116	92.8	172	9.7
5652	73.01	202	AV25	34.2	2.8	166	68	117	92.8	173	9.8
5677	73.14	202	AV25	34.5	2.8	167	68	117	92.8	175	9.9
5702	73.26	202	AV25	34.1	2.8	166	69	119	92.8	173	9.8
5727	73.39	202	AV25	34.1	2.8	168	70	124	92.8	174	9.8
5752	73.51	202	AV25	34.5	2.8	170	72	129	92.7	175	9.9
5777	73.63	202	AV25	34.3	2.8	171	69	136	92.7	175	9.9
5802	73.76	202	AV25	35.1	2.8	174	70	140	92.7	177	10.0
5827	73.88	202	AV25	34.8	2.8	174	73	142	92.6	179	10.1
5852	74.00	429	AV25	35.0	2.8	175	73	145	92.7	179	10.1
5877	74.06	429	AV25	33.8	2.7	169	73	145	92.7	173	9.7
5902	74.12	429	AV25	33.3	2.7	168	72	144	92.7	172	9.6
5927	74.18	429	AV25	32.8	2.7	167	73	146	92.7	170	9.5
5952	74.24	429	AV25	33.3	2.7	168	73	148	92.7	171	9.6
5977	74.29	429	AV25	32.6	2.6	168	73	148	92.8	171	9.6
6002	74.35	429	AV25	32.3	2.6	169	75	146	92.8	172	9.6
6027	74.41	429	AV25	31.8	2.6	167	76	139	92.9	170	9.5
6052	74.47	429	AV25	32.7	2.6	170	76	142	92.8	171	9.5
6077	74.53	429	AV25	32.7	2.6	171	76	142	92.7	170	9.6
6102	74.59	429	AV25	32.9	2.7	172	76	143	92.7	171	9.6
6127	74.64	429	AV25	32.7	2.6	172	76	143	92.7	170	9.6
6151	74.70	429	AV24	32.7	2.6	171	76	143	92.7	169	9.5

Abe Construction Services, Inc. - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 1-Mar-2011

Test date: 21-Feb-2011

STEVENS CREEK DAM - SC104BB



STEVENS CREEK DAM - SC104BB
OP: SA

RESTRIKE
Test date: 21-Feb-2011

ETR: Energy Transfer Ratio
EFV: Energy of FV
RTL: Case Method Capacity (JC=0)
SFT: Skin friction total

RMX: Max Case Method Capacity
BPM: Blows per Minute
FMX: Maximum Force
VMX: Maximum Velocity

BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
17	1.00	15	AV16	27.8	2.2	47	0	41	90.0	92	5.9
38	2.00	21	AV21	34.6	2.8	54	1	40	94.1	118	6.9
60	3.00	22	AV4	31.4	2.5	41	0	32	94.9	89	6.2
90	5.00	20	AV3	37.6	3.0	48	0	32	67.9	101	7.2
110	7.00	10	AV2	37.4	3.0	46	6	30	95.3	84	7.2
125	9.00	5	AV1	24.7	2.0	17	0	19	97.3	48	6.4
132	11.00	3	AV1	20.6	1.7	23	0	16	93.7	58	5.4
150	15.00	10	AV2	23.4	1.9	27	0	24	54.7	56	5.2
165	18.00	5	AV1	28.0	2.3	37	3	34	95.7	77	5.4
200	20.00	30	AV4	38.1	3.1	85	16	60	93.0	145	7.7
220	21.00	20	AV2	36.8	3.0	72	8	59	93.7	137	6.9
250	22.00	30	AV3	36.0	2.9	68	10	58	93.7	130	6.5
280	23.00	30	AV3	39.2	3.2	82	18	70	93.2	159	8.5
310	24.00	30	AV3	33.8	2.7	85	18	69	93.7	156	8.0
350	25.00	40	AV4	32.5	2.6	71	24	60	94.2	142	7.5
390	26.00	40	AV4	35.0	2.8	70	21	59	93.9	139	7.8
430	28.00	30	AV4	34.6	2.8	92	26	90	92.9	172	8.7
510	29.00	80	AV8	36.5	3.0	111	33	128	92.6	190	9.7
610	30.00	100	AV10	38.3	3.1	130	40	125	92.8	172	9.4
893	30.80	355	AV62	34.3	2.8	176	49	180	92.7	193	10.5

STEVENS CREEK DAM - SC104BB
OP: SA
RESTRIKE
Test date: 21-Feb-2011

ETR: Energy Transfer Ratio
EFV: Energy of FV
RTL: Case Method Capacity (JC=0)
SFT: Skin friction total
RMX: Max Case Method Capacity
BPM: Blows per Minute
FMX: Maximum Force
VMX: Maximum Velocity

BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
6	0.27	15	AV5	26.4	2.1	41	0	39	77.7	80	5.8
11	0.60	15	AV5	26.0	2.1	46	0	42	96.4	88	5.6
16	0.93	15	AV5	30.9	2.5	53	0	41	94.8	109	6.5
21	1.19	21	AV5	31.5	2.6	50	1	42	95.4	101	6.4
26	1.43	21	AV5	36.8	3.0	59	1	41	93.7	129	7.4
31	1.67	21	AV5	36.2	2.9	56	0	40	93.7	126	7.2
36	1.90	21	AV5	33.2	2.7	51	1	38	94.1	116	6.8
46	2.36	22	AV4	32.9	2.7	47	0	34	94.5	105	6.6
56	2.82	22	AV1	30.8	2.5	39	0	32	94.8	89	6.1
66	3.60	10	AV1	28.7	2.3	32	0	27	95.6	62	5.8
76	4.30	20	AV1	28.6	2.3	28	0	28	16.1	56	5.8
86	4.80	20	AV1	42.6	3.4	49	0	27	93.9	118	8.0
96	5.60	10	AV1	41.7	3.4	66	0	42	93.7	128	7.8
106	6.60	10	AV1	37.5	3.0	51	11	33	95.0	92	7.2
116	7.60	10	AV1	37.2	3.0	40	0	26	95.7	76	7.2
126	9.20	5	AV1	24.7	2.0	17	0	19	97.3	48	6.4
136	12.40	3	AV1	20.6	1.7	23	0	16	93.7	58	5.4
146	14.60	10	AV1	22.3	1.8	29	0	26	12.2	56	5.1
156	16.20	5	AV1	24.5	2.0	25	0	22	97.2	57	5.2
166	18.20	5	AV1	28.0	2.3	37	3	34	95.7	77	5.4
176	19.20	30	AV1	28.5	2.3	69	15	47	92.7	125	6.9
186	19.53	30	AV1	38.2	3.1	96	16	63	93.2	153	8.0
196	19.87	30	AV1	42.3	3.4	91	22	62	93.0	156	8.1
206	20.30	20	AV1	43.3	3.5	83	12	67	93.1	148	7.6
216	20.80	20	AV1	40.7	3.3	75	9	61	93.4	143	7.2
226	21.20	30	AV1	32.8	2.7	69	8	57	93.9	132	6.5
236	21.53	30	AV1	40.7	3.3	72	5	60	93.3	133	6.8
246	21.87	30	AV1	33.6	2.7	67	8	57	93.7	132	6.6
256	22.20	30	AV1	33.5	2.7	66	16	58	94.0	123	6.2
266	22.53	30	AV1	41.0	3.3	76	18	58	93.2	156	8.6
276	22.87	30	AV1	39.8	3.2	85	15	77	93.3	159	8.3
286	23.20	30	AV1	36.8	3.0	85	21	75	93.2	163	8.5
296	23.53	30	AV1	32.6	2.6	87	16	72	93.7	159	8.1
306	23.87	30	AV1	35.1	2.8	94	23	73	93.5	161	8.2
316	24.15	40	AV1	33.7	2.7	75	15	62	93.9	148	7.9
326	24.40	40	AV1	30.9	2.5	82	19	63	94.1	147	7.6
336	24.65	40	AV1	30.1	2.4	73	21	60	94.5	137	6.8
346	24.90	40	AV1	32.8	2.7	61	25	59	94.4	136	7.5
356	25.15	40	AV1	36.0	2.9	67	31	58	93.7	147	8.0
366	25.40	40	AV1	33.8	2.7	60	8	53	94.1	117	6.2
376	25.65	40	AV1	36.0	2.9	68	25	56	94.1	145	8.5
386	25.90	40	AV1	32.6	2.6	72	21	56	94.1	141	8.4
396	26.60	10	AV1	37.7	3.1	78	31	69	93.3	155	8.1
406	27.20	30	AV1	36.2	2.9	99	36	80	92.9	179	9.0
416	27.53	30	AV1	32.5	2.6	83	17	81	93.2	160	8.2
426	27.87	30	AV1	34.8	2.8	93	29	94	92.9	173	8.7
436	28.08	80	AV1	34.9	2.8	94	22	103	92.7	177	9.0
446	28.20	80	AV1	35.4	2.9	112	44	119	92.7	188	9.6
456	28.33	80	AV1	35.5	2.9	117	16	125	92.7	192	10.0
466	28.45	80	AV1	38.1	3.1	122	25	134	92.4	201	10.4
476	28.58	80	AV1	37.3	3.0	105	36	126	92.7	191	9.7
486	28.70	80	AV1	35.1	2.8	105	23	131	92.7	186	9.5
496	28.83	80	AV1	38.3	3.1	101	52	139	92.6	201	10.1
506	28.95	80	AV1	37.6	3.0	120	40	134	92.6	203	10.1
516	29.06	100	AV1	34.7	2.8	107	24	121	92.8	156	8.7
526	29.16	100	AV1	36.5	3.0	121	28	123	92.7	167	9.2
536	29.26	100	AV1	42.8	3.5	116	28	121	92.8	164	9.0
546	29.36	100	AV1	42.0	3.4	128	42	119	92.7	175	9.4
556	29.46	100	AV1	46.8	3.8	136	39	116	92.8	179	9.6
566	29.56	100	AV1	42.0	3.4	130	34	120	92.8	174	9.3
576	29.66	100	AV1	37.8	3.1	132	50	120	92.8	174	9.4
586	29.76	100	AV1	35.2	2.8	128	46	130	92.9	172	9.3
596	29.86	100	AV1	34.4	2.8	141	50	134	92.7	178	9.7
606	29.96	100	AV1	33.7	2.7	127	36	136	92.7	169	9.3
616	30.02	355	AV1	32.1	2.6	137	45	131	92.7	172	9.4
626	30.05	355	AV1	31.3	2.5	129	38	140	93.0	168	9.2
636	30.07	355	AV1	36.2	2.9	140	52	143	92.7	183	10.0
646	30.10	355	AV1	35.1	2.8	151	55	150	92.6	192	10.4
656	30.13	355	AV1	35.0	2.8	166	56	164	92.6	202	10.8

STEVENS CREEK DAM - SC104BB
OP: SA

RESTRIKE
Test date: 21-Feb-2011

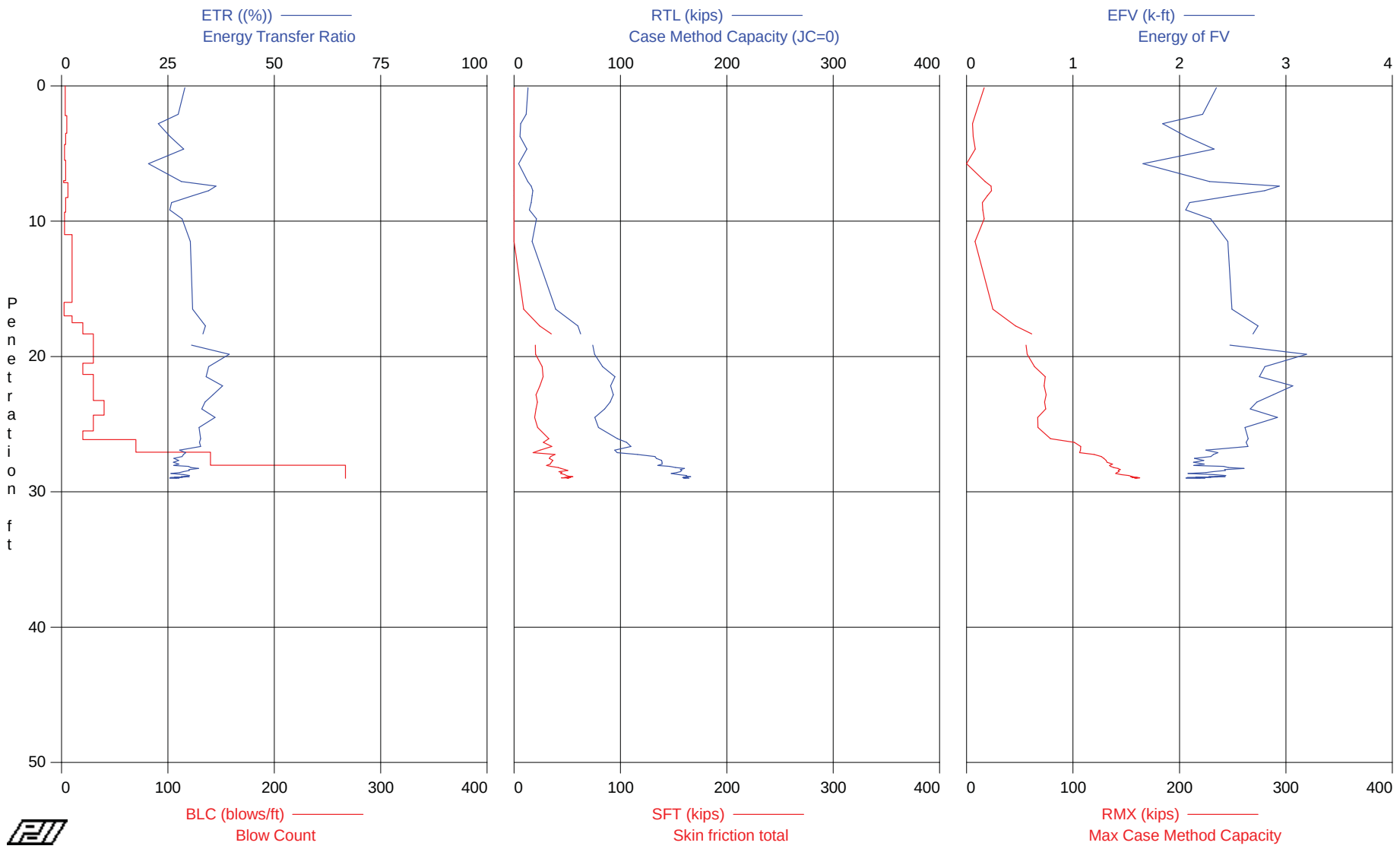
BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	RMX kips	BPM **	FMX kips	VMX f/s
666	30.16	355	AV1	33.7	2.7	175	53	170	92.6	204	10.9
676	30.19	355	AV1	36.9	3.0	173	55	173	92.7	204	11.1
686	30.21	355	AV1	34.7	2.8	164	49	176	92.7	190	10.4
696	30.24	355	AV1	32.1	2.6	160	47	174	92.7	183	10.0
706	30.27	355	AV1	29.5	2.4	158	46	170	92.8	175	9.7
716	30.30	355	AV1	31.7	2.6	165	51	173	92.7	184	10.0
726	30.33	355	AV1	33.4	2.7	168	43	176	92.6	188	10.3
736	30.35	355	AV1	35.1	2.8	177	39	177	92.6	197	10.8
746	30.38	355	AV1	35.1	2.8	178	39	179	92.7	197	10.9
756	30.41	355	AV1	35.1	2.8	177	57	182	92.7	195	10.5
766	30.44	355	AV1	35.6	2.9	181	55	184	92.7	199	10.9
776	30.47	355	AV1	34.2	2.8	179	52	179	92.7	193	10.6
786	30.50	355	AV1	33.6	2.7	178	51	179	92.7	192	10.5
796	30.52	355	AV1	35.1	2.8	176	48	181	92.7	196	10.6
806	30.55	355	AV1	34.9	2.8	178	43	181	92.7	196	10.7
816	30.58	355	AV1	33.0	2.7	180	51	180	92.7	193	10.4
826	30.61	355	AV1	37.3	3.0	190	47	186	92.7	207	11.2
836	30.64	355	AV1	39.0	3.2	197	53	191	92.7	211	11.4
846	30.66	355	AV1	36.7	3.0	189	52	188	92.6	205	11.0
856	30.69	355	AV1	36.9	3.0	183	48	190	92.7	198	10.8
861	30.71	355	AV6	35.1	2.8	185	47	185	92.8	200	10.7
866	30.72	355	AV5	34.8	2.8	181	44	184	92.7	195	10.6
871	30.74	355	AV5	34.6	2.8	180	45	186	92.8	195	10.5
876	30.75	355	AV5	34.7	2.8	182	52	185	92.7	196	10.6
881	30.76	355	AV5	34.0	2.8	175	48	182	92.8	190	10.3
886	30.78	355	AV5	33.2	2.7	177	51	181	92.7	191	10.3
891	30.79	355	AV5	33.0	2.7	175	50	183	92.9	187	10.1
893	30.80	355	AV2	32.3	2.6	176	51	184	92.9	187	10.1

Abe Construction Services, Inc. - Case Method Results

PDIPLOT Ver. 2010.2 - Printed: 1-Mar-2011

Test date: 21-Feb-2011

STEVENS CREEK DAM - SC108BB



STEVENS CREEK DAM - SC108BB
OP: SA

RESTRIKE
Test date: 21-Feb-2011

ETR: Energy Transfer Ratio
EFV: Energy of FV
RTL: Case Method Capacity (JC=0)
SFT: Skin friction total
FMX: Maximum Force

VMX: Maximum Velocity
BPM: Blows per Minute
RAU: Auto Capacity End Bearing Piles
RMX: Max Case Method Capacity

BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	FMX kips	VMX f/s	BPM **	RAU kips	RMX kips
5	1.00	4	AV2	29.0	2.3	13	0	48	8.3	4.9	15	16
14	3.00	5	AV4	25.1	2.0	9	0	47	9.8	2.3	6	7
18	4.00	4	AV2	25.5	2.1	6	0	57	10.9	3.0	6	6
21	5.00	3	AV2	28.7	2.3	12	0	71	10.4	2.9	6	8
25	6.00	4	AV2	20.5	1.7	4	0	49	10.9	3.1	4	0
33	8.00	6	AV7	33.1	2.7	15	0	71	7.4	71.1	19	21
37	9.00	4	AV4	24.7	2.0	17	0	43	6.4	99.1	14	15
40	10.00	3	AV3	29.6	2.4	18	0	62	6.9	33.5	12	17
60	12.00	10	AV2	30.3	2.5	17	0	68	7.8	50.2	7	8
80	17.00	10	AV2	30.8	2.5	39	9	83	6.7	96.3	20	25
100	18.00	20	AV2	33.8	2.7	60	24	114	6.3	94.9	40	46
130	19.00	30	AV2	27.5	2.2	68	25	118	6.0	95.0	49	58
160	20.00	30	AV3	39.4	3.2	76	21	150	8.5	93.8	40	57
180	21.00	20	AV2	34.6	2.8	83	27	149	8.0	94.1	46	64
210	22.00	30	AV3	34.3	2.8	92	26	156	8.0	93.5	54	72
240	23.00	30	AV3	37.3	3.0	94	22	157	8.3	93.5	51	76
280	24.00	40	AV4	33.3	2.7	88	21	151	7.8	93.7	50	74
310	25.00	30	AV3	34.4	2.8	75	20	147	7.8	93.7	56	66
330	26.00	20	AV2	33.7	2.7	88	27	159	8.1	93.4	54	71
400	27.00	70	AV7	31.0	2.5	103	30	167	8.5	93.4	82	102
540	28.00	140	AV14	27.7	2.2	128	33	176	8.9	93.2	115	126
807	29.00	267	AV58	28.2	2.3	159	48	193	9.8	92.9	138	152

STEVENS CREEK DAM - SC108BB
OP: SA
RESTRIKE
Test date: 21-Feb-2011

ETR: Energy Transfer Ratio
EFV: Energy of FV
RTL: Case Method Capacity (JC=0)
SFT: Skin friction total
FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows per Minute
RAU: Auto Capacity End Bearing Piles
RMX: Max Case Method Capacity

BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	FMX kips	VMX f/s	BPM **	RAU kips	RMX kips
6	1.14	4	AV2	29.0	2.3	13	0	48	8.3	4.9	15	16
11	2.40	5	AV2	27.4	2.2	11	0	50	9.5	2.0	6	8
16	3.50	4	AV3	23.3	1.9	6	0	45	10.4	2.7	5	5
21	5.00	3	AV3	28.0	2.3	10	0	70	10.5	3.0	6	8
26	6.50	2	AV2	20.5	1.7	4	0	49	10.9	3.1	4	0
31	7.67	6	AV5	32.6	2.6	15	0	71	7.4	60.6	19	21
36	8.75	4	AV5	29.7	2.4	17	0	57	7.0	97.9	16	18
46	10.60	10	AV4	26.9	2.2	18	0	54	6.5	50.4	12	16
56	11.60	10	AV1	26.8	2.2	22	0	63	6.0	98.4	9	10
66	14.40	3	AV1	33.8	2.7	12	0	73	9.5	1.9	5	6
76	16.60	10	AV1	24.4	2.0	18	0	53	6.2	97.2	10	10
86	17.30	20	AV1	37.2	3.0	61	18	114	7.1	95.5	31	40
96	17.80	20	AV1	35.3	2.9	57	27	111	6.6	95.2	37	42
106	18.20	30	AV1	32.4	2.6	63	21	116	6.0	94.6	44	50
126	18.87	30	AV1	33.2	2.7	63	35	117	5.8	94.3	57	61
136	19.20	30	AV1	21.7	1.8	73	16	119	6.1	95.7	42	55
146	19.53	30	AV1	39.4	3.2	75	24	151	8.5	93.8	41	56
156	19.87	30	AV1	38.4	3.1	75	24	149	8.4	93.8	40	59
166	20.30	20	AV1	40.5	3.3	76	16	149	8.7	93.9	40	55
176	20.80	20	AV1	38.7	3.1	79	26	149	8.4	94.1	46	61
186	21.20	30	AV1	30.5	2.5	88	27	149	7.5	94.1	46	66
196	21.53	30	AV1	34.4	2.8	103	33	161	8.3	93.3	52	78
206	21.87	30	AV1	33.6	2.7	86	21	149	7.7	93.7	56	70
216	22.20	30	AV1	34.8	2.8	85	23	158	8.1	93.5	54	68
226	22.53	30	AV1	40.8	3.3	96	25	165	8.8	93.3	50	78
236	22.87	30	AV1	35.8	2.9	98	25	154	8.0	93.5	46	75
246	23.15	40	AV1	35.4	2.9	88	16	152	8.0	93.6	56	74
256	23.40	40	AV1	33.2	2.7	89	19	156	8.2	93.7	49	71
266	23.65	40	AV1	34.2	2.8	92	25	150	7.8	93.7	47	75
276	23.90	40	AV1	31.5	2.5	83	19	149	7.6	93.8	53	75
286	24.20	30	AV1	34.4	2.8	87	22	150	7.7	93.7	50	74
296	24.53	30	AV1	37.1	3.0	78	17	153	8.4	93.5	54	68
306	24.87	30	AV1	35.0	2.8	74	21	149	8.1	93.7	59	66
316	25.30	20	AV1	31.1	2.5	75	21	140	7.0	94.0	55	65
326	25.80	20	AV1	33.5	2.7	84	23	152	7.6	93.6	52	69
336	26.09	70	AV1	33.8	2.7	93	32	167	8.5	93.2	55	73
346	26.23	70	AV1	31.6	2.6	101	33	162	8.2	93.5	69	84
356	26.37	70	AV1	33.0	2.7	102	24	171	8.9	93.4	70	102
366	26.51	70	AV1	31.9	2.6	110	31	170	8.6	93.4	73	100
376	26.66	70	AV1	30.9	2.5	112	34	171	8.6	93.2	75	104
386	26.80	70	AV1	34.5	2.8	107	37	178	9.0	93.1	87	111
396	26.94	70	AV1	26.5	2.1	94	29	154	7.8	93.7	95	103
406	27.04	140	AV1	29.0	2.3	96	20	163	8.2	93.3	103	110
416	27.11	140	AV1	28.8	2.3	94	17	161	8.3	93.5	71	105
426	27.19	140	AV1	29.6	2.4	100	19	165	8.3	93.5	104	108
436	27.26	140	AV1	28.3	2.3	111	35	169	8.4	93.3	97	112
446	27.33	140	AV1	29.0	2.3	122	42	177	8.8	93.2	103	128
456	27.40	140	AV1	28.6	2.3	130	38	175	8.8	93.2	108	124
466	27.47	140	AV1	28.2	2.3	135	31	176	9.0	93.2	123	129
476	27.54	140	AV1	25.3	2.0	133	31	172	8.7	93.3	121	127
486	27.61	140	AV1	27.6	2.2	135	35	179	9.0	93.2	123	131
496	27.69	140	AV1	25.7	2.1	132	34	176	8.8	93.2	119	127
506	27.76	140	AV1	29.3	2.4	145	39	188	9.4	92.9	124	135
516	27.83	140	AV1	26.2	2.1	138	35	181	9.1	93.1	123	130
526	27.90	140	AV1	26.5	2.1	140	35	182	9.1	93.1	126	134
536	27.97	140	AV1	27.9	2.3	140	35	185	9.4	93.1	130	136
546	28.02	267	AV1	27.3	2.2	138	33	182	9.1	93.2	135	138
556	28.06	267	AV1	26.5	2.1	134	30	177	8.8	93.2	134	135
566	28.10	267	AV1	26.2	2.1	137	31	178	8.8	93.2	132	134
576	28.13	267	AV1	24.0	1.9	128	31	168	8.2	93.5	128	129
586	28.17	267	AV1	35.6	2.9	165	39	209	10.7	92.7	131	142
596	28.21	267	AV1	31.6	2.6	156	41	199	10.1	92.7	124	141
606	28.25	267	AV1	29.2	2.4	147	42	191	9.6	92.8	129	136
616	28.28	267	AV1	31.5	2.5	159	40	201	10.3	92.7	130	140
626	28.32	267	AV1	32.9	2.7	161	49	209	10.5	92.8	138	145
636	28.36	267	AV1	29.6	2.4	155	48	197	9.9	93.0	133	145
646	28.40	267	AV1	30.3	2.5	157	48	200	10.1	92.8	132	144
656	28.43	267	AV1	29.4	2.4	155	50	197	9.8	92.9	135	142

STEVENS CREEK DAM - SC108BB
OP: SA

RESTRIKE
Test date: 21-Feb-2011

BL# end	depth ft	BLC bl/ft	TYPE	ETR (%)	EFV k-ft	RTL kips	SFT kips	FMX kips	VMX f/s	BPM **	RAU kips	RMX kips
666	28.47	267	AV1	30.6	2.5	160	51	203	10.2	92.9	136	143
676	28.51	267	AV1	29.6	2.4	159	42	196	10.0	92.8	127	143
686	28.55	267	AV1	27.6	2.2	154	42	190	9.7	93.0	127	143
696	28.58	267	AV1	29.3	2.4	155	46	194	9.9	92.8	137	142
706	28.62	267	AV1	26.3	2.1	150	44	185	9.4	93.0	135	141
716	28.66	267	AV1	25.4	2.1	146	46	182	9.2	93.1	131	139
726	28.70	267	AV1	26.0	2.1	149	42	181	9.3	93.1	132	141
736	28.73	267	AV1	25.5	2.1	148	42	182	9.3	93.0	133	140
746	28.77	267	AV1	31.9	2.6	161	53	207	10.6	92.7	135	150
756	28.81	267	AV1	29.6	2.4	160	45	198	10.1	92.7	140	150
766	28.85	267	AV1	30.5	2.5	164	53	201	10.2	92.7	140	155
771	28.87	267	AV1	29.5	2.4	164	55	201	10.2	92.7	144	155
776	28.88	267	AV4	28.5	2.3	162	53	197	9.9	92.9	141	155
781	28.90	267	AV5	29.3	2.4	165	53	199	10.1	92.8	141	156
786	28.92	267	AV5	28.4	2.3	163	51	197	10.0	92.9	141	157
791	28.94	267	AV5	27.7	2.2	161	49	193	9.8	92.8	142	158
796	28.96	267	AV5	26.2	2.1	160	49	188	9.6	93.0	141	158
801	28.98	267	AV5	27.2	2.2	162	49	192	9.8	92.8	145	162
806	29.00	267	AV5	26.7	2.2	161	51	190	9.7	93.0	142	158
807	29.00	267	AV1	27.0	2.2	166	49	193	9.9	92.9	143	162

Abe Construction Services, Inc.

2230 Lariat Lane, Walnut Creek, CA 94596
PHONE: 925-944-6363 FAX: 925-476-1588
EMAIL: SA@AbeEngineering.com

Company:	Great West Drilling, Inc.		March 27, 2011
Attn:	Jim Bensen	**From:**	Steve Abe
CC:	Robert Kirby- Terra Engineers		
Re:	Becker Hammer Dynamic Monitoring Stevens Creek Dam Cupertino, CA		Job No. 11018

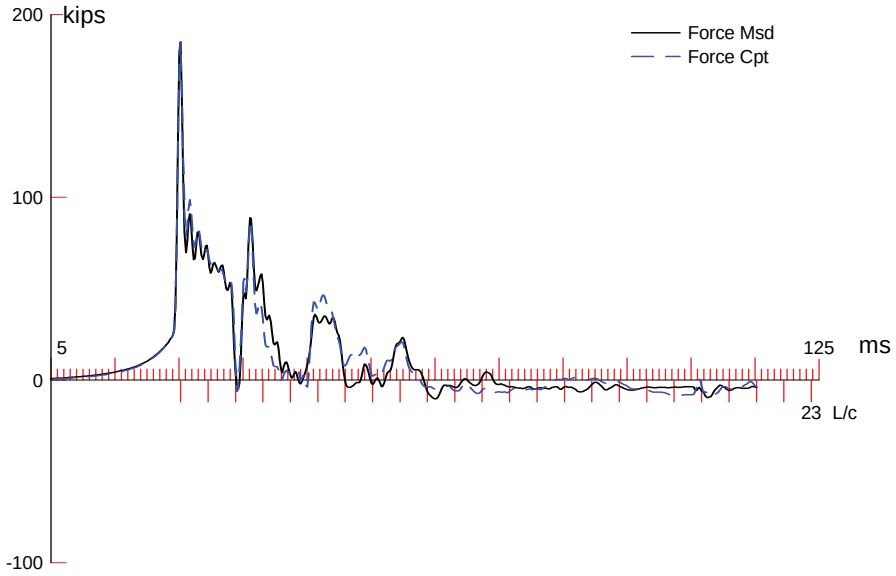
Attached please find supplemental CAPWAP analysis performed for dynamic test data obtained for Becker Hammer Boring data for the project referenced above on February 17, 18, and 21, 2011. The attached CAPWAP analysis results were performed for blow numbers 4877 and 5602 for Boring 103BB and Blow number 220 for Boring 104BB.

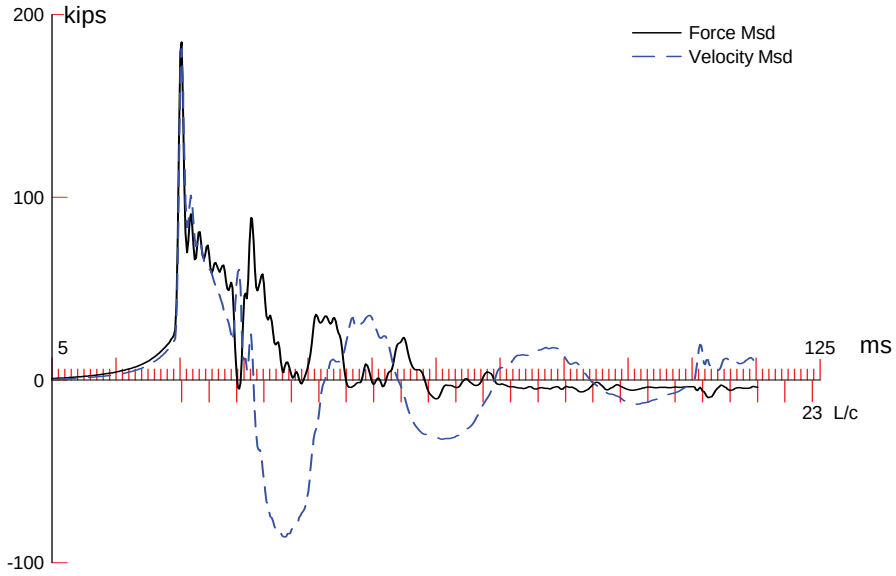
I appreciate the opportunity to assist you with this project. Please contact me if you have any questions regarding these results, or if we may be of further service.

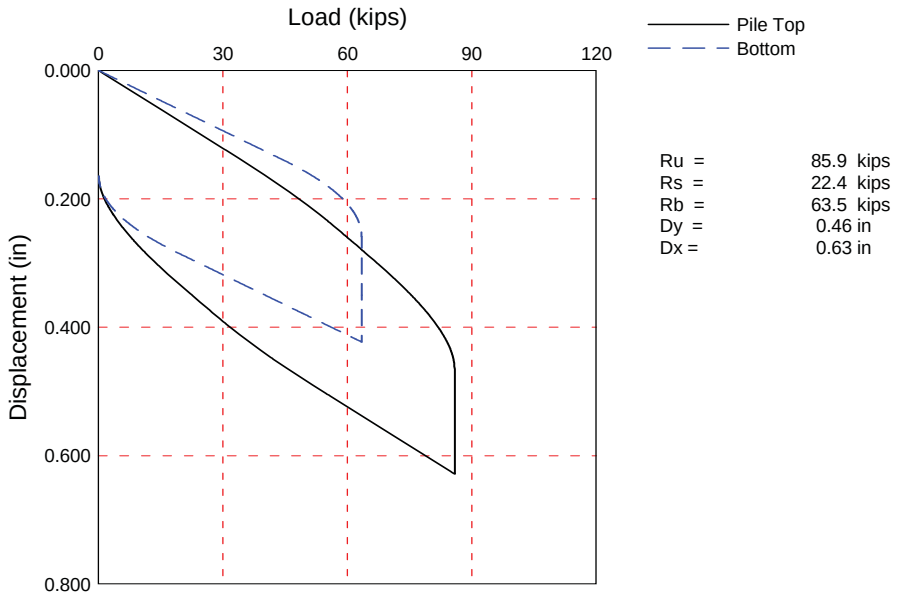
Very truly yours,
ABE Engineering
Steve Abe, P.E.

APPENDIX A

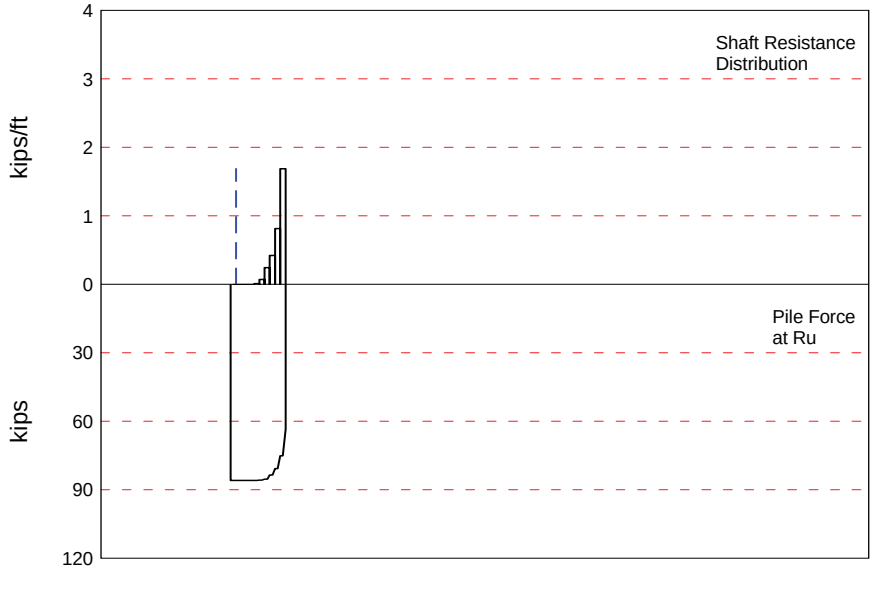
PDA Case Method Results







Ru =	85.9 kips
Rs =	22.4 kips
Rb =	63.5 kips
Dy =	0.46 in
Dx =	0.63 in



CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 85.9; along Shaft 22.4; at Toe 63.5 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf	Smith Damping Factor s/ft
				85.9				
1	10.3	2.3	0.0	85.9	0.0	0.00	0.00	0.000
2	17.1	9.1	0.0	85.9	0.0	0.00	0.00	0.000
3	24.0	16.0	0.0	85.9	0.0	0.00	0.00	0.000
4	30.9	22.9	0.0	85.9	0.0	0.00	0.00	0.000
5	37.7	29.7	0.1	85.8	0.1	0.01	0.01	0.183
6	44.6	36.6	0.5	85.3	0.6	0.07	0.04	0.183
7	51.4	43.4	1.7	83.6	2.3	0.25	0.14	0.183
8	58.3	50.3	2.9	80.7	5.2	0.42	0.24	0.183
9	65.1	57.1	5.6	75.1	10.8	0.82	0.47	0.183
10	72.0	64.0	11.6	63.5	22.4	1.69	0.98	0.183
Avg. Shaft			2.2			0.35	0.20	0.183
Toe			63.5				265.26	0.101

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.091	0.199
Case Damping Factor		0.195	0.305
Damping Type		Smith	
Unloading Quake	(% of loading quake)	75	66
Reloading Level	(% of Ru)	100	100
Soil Plug Weight	(kips)		0.11

CAPWAP match quality = 6.59 (Wave Up Match) ; RSA = 0
Observed: final set = 0.164 in; blow count = 73 b/ft
Computed: final set = 0.087 in; blow count = 138 b/ft
Replay Factor: F4:1.150; V3:1.000; V4:1.000;

max. Top Comp. Stress = 15.7 ksi (T= 25.7 ms, max= 1.015 x Top)
max. Comp. Stress = 16.0 ksi (Z= 51.4 ft, T= 28.6 ms)
max. Tens. Stress = -3.19 ksi (Z= 58.3 ft, T= 47.5 ms)
max. Energy (EMX) = 2.9 kip-ft; max. Measured Top Displ. (DMX)= 0.47 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.4	185.3	-9.5	15.7	-0.81	2.86	8.6	0.445
2	6.9	185.3	-13.5	15.7	-1.14	2.84	8.6	0.438
3	10.3	185.4	-15.4	15.7	-1.31	2.82	8.6	0.430
4	13.7	185.5	-14.8	15.7	-1.26	2.79	8.6	0.422
5	17.1	185.6	-16.1	15.7	-1.37	2.77	8.5	0.414
6	20.6	185.7	-17.5	15.8	-1.49	2.74	8.5	0.407
7	24.0	185.8	-18.6	15.8	-1.58	2.71	8.5	0.400
8	27.4	185.9	-19.8	15.8	-1.68	2.69	8.5	0.392
9	30.9	186.1	-20.8	15.8	-1.76	2.67	8.5	0.385
10	34.3	186.3	-21.5	15.8	-1.83	2.66	8.5	0.377
11	37.7	186.5	-22.1	15.8	-1.87	2.66	8.4	0.369
12	41.1	186.6	-26.0	15.8	-2.21	2.65	8.4	0.361
13	44.6	187.2	-29.4	15.9	-2.50	2.64	8.4	0.353
14	48.0	186.7	-32.0	15.8	-2.71	2.61	8.3	0.345
15	51.4	188.0	-36.0	16.0	-3.05	2.60	8.2	0.336
16	54.9	185.1	-36.6	15.7	-3.11	2.49	8.2	0.327
17	58.3	186.9	-37.6	15.9	-3.19	2.49	8.1	0.319
18	61.7	182.2	-33.3	15.5	-2.82	2.32	8.0	0.310
19	65.1	186.2	-34.8	15.8	-2.95	2.32	7.8	0.302
20	68.6	172.1	-28.3	14.6	-2.40	2.03	7.9	0.294
21	72.0	142.1	-27.5	12.1	-2.33	1.58	9.7	0.285
Absolute	51.4			16.0			(T =	28.6 ms)
	58.3				-3.19		(T =	47.5 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	165.9	144.0	122.1	100.3	78.4	56.6	34.7	12.8	0.0	0.0
RX	165.9	144.0	122.1	118.5	117.3	116.0	114.8	113.6	112.4	112.3
RU	165.9	144.0	122.1	100.3	78.4	56.6	34.7	12.8	0.0	0.0

RAU = 104.9 (kips); RA2 = 122.2 (kips)

Current CAPWAP Ru = 85.9 (kips); Corresponding J(RP)= 0.37;

RMX requires higher damping; see PDA-W

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips
8.98	25.50	188.9	195.6	195.6	0.466	0.147	0.164	2.9	110.9

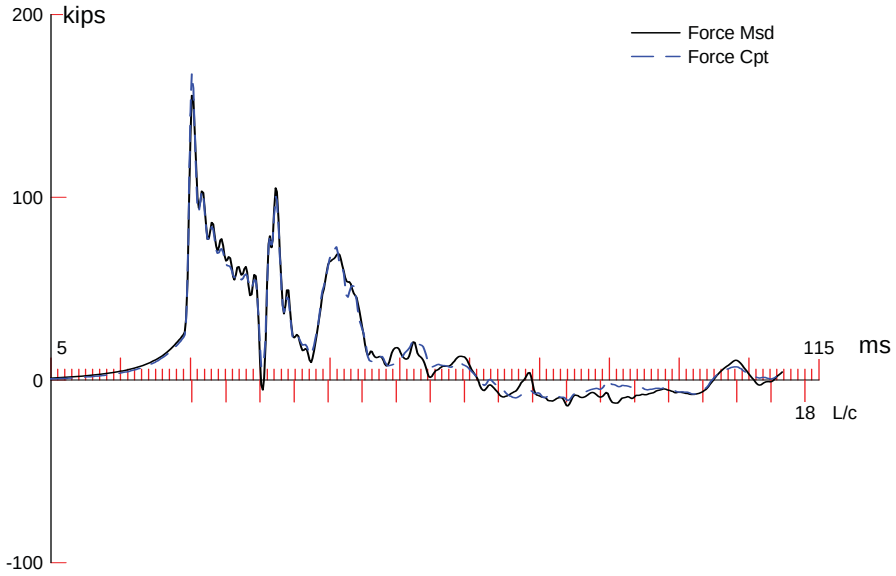
PILE PROFILE AND PILE MODEL

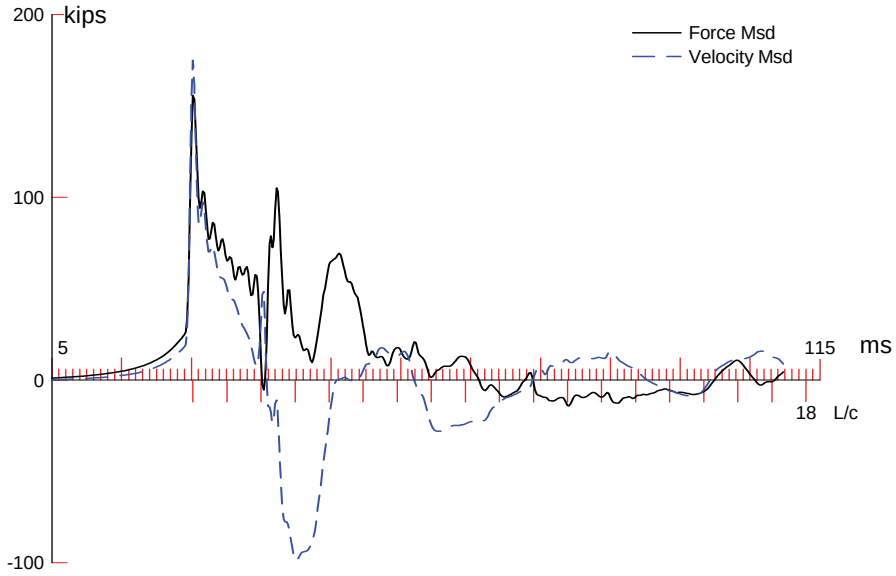
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.00	11.78	29992.2	492.000	1.734
72.00	11.78	29992.2	492.000	1.734

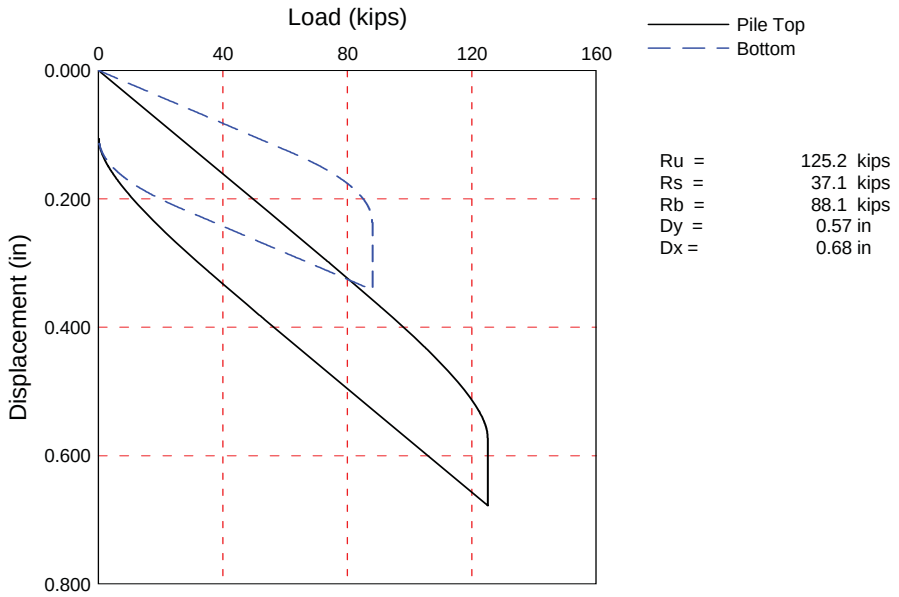
Toe Area 0.239 ft^2

Top Segment Length 3.43 ft, Top Impedance 21.03 kips/ft/s

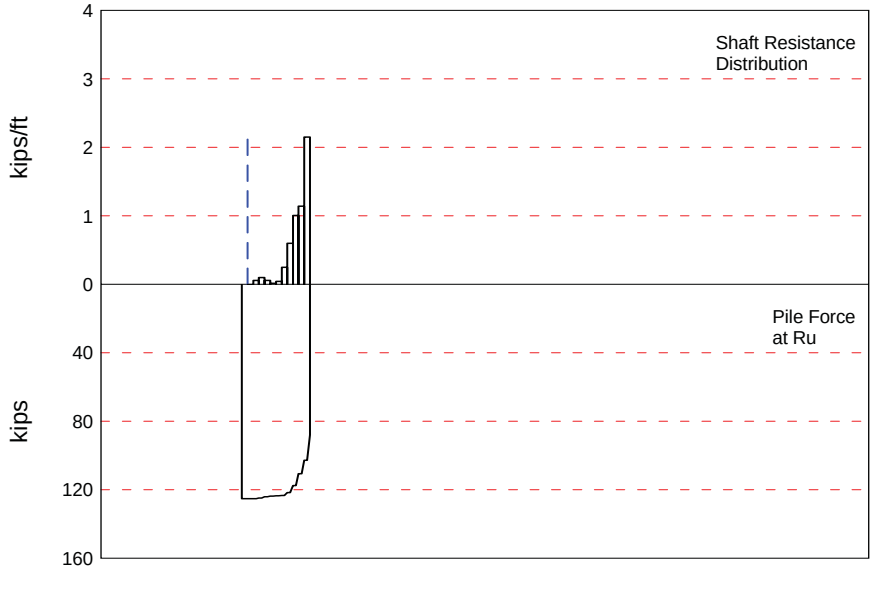
Pile Damping 1.0 %, Time Incr 0.204 ms, Wave Speed 16807.9 ft/s, 2L/c 8.6 ms







Ru	=	125.2 kips
Rs	=	37.1 kips
Rb	=	88.1 kips
Dy	=	0.57 in
Dx	=	0.68 in



CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 125.2; along Shaft 37.1; at Toe 88.1 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf	Smith Damping Factor s/ft	Quake in
				125.2					
1	13.7	4.3	0.0	125.2	0.0	0.00	0.00	0.000	0.200
2	20.5	11.1	0.4	124.8	0.4	0.06	0.03	0.195	0.200
3	27.3	17.9	0.7	124.1	1.1	0.10	0.06	0.195	0.200
4	34.2	24.8	0.4	123.7	1.5	0.06	0.03	0.195	0.200
5	41.0	31.6	0.1	123.6	1.6	0.01	0.01	0.195	0.200
6	47.8	38.4	0.3	123.3	1.9	0.04	0.03	0.195	0.200
7	54.7	45.3	1.7	121.6	3.6	0.25	0.14	0.195	0.200
8	61.5	52.1	4.1	117.5	7.7	0.60	0.35	0.195	0.200
9	68.3	58.9	6.9	110.6	14.6	1.01	0.58	0.195	0.200
10	75.2	65.8	7.8	102.8	22.4	1.14	0.66	0.195	0.200
11	82.0	72.6	14.7	88.1	37.1	2.15	1.24	0.195	0.169
Avg. Shaft			3.4			0.51	0.29	0.195	0.187
Toe			88.1				368.02	0.117	0.182

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		0.344	0.490
Damping Type			Smith
Unloading Quake	(% of loading quake)	65	69
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	90	
Soil Plug Weight	(kips)		0.12

CAPWAP match quality = 3.85 (Wave Up Match) ; RSA = 0
Observed: final set = 0.105 in; blow count = 114 b/ft
Computed: final set = 0.068 in; blow count = 177 b/ft
Replay Factor: F3:1.100; V3:1.000; V4:1.000;

max. Top Comp. Stress = 14.2 ksi (T= 25.6 ms, max= 1.001 x Top)
max. Comp. Stress = 14.2 ksi (Z= 20.5 ft, T= 26.6 ms)
max. Tens. Stress = -2.64 ksi (Z= 68.3 ft, T= 46.8 ms)
max. Energy (EMX) = 2.8 kip-ft; max. Measured Top Displ. (DMX)= 0.42 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.4	167.6	-11.0	14.2	-0.93	2.80	7.7	0.428
2	6.8	167.6	-11.4	14.2	-0.97	2.79	7.7	0.423
4	13.7	167.6	-12.9	14.2	-1.09	2.76	7.7	0.411
6	20.5	167.8	-14.1	14.2	-1.20	2.72	7.6	0.396
7	23.9	167.3	-14.3	14.2	-1.22	2.68	7.6	0.387
8	27.3	167.6	-14.9	14.2	-1.26	2.64	7.6	0.377
9	30.8	166.4	-14.8	14.1	-1.25	2.57	7.5	0.367
10	34.2	166.6	-15.1	14.1	-1.28	2.54	7.5	0.357
11	37.6	166.0	-15.3	14.1	-1.30	2.48	7.5	0.346
12	41.0	166.1	-16.9	14.1	-1.43	2.43	7.5	0.335
13	44.4	166.2	-19.0	14.1	-1.61	2.38	7.4	0.324
14	47.8	166.5	-18.4	14.1	-1.56	2.34	7.4	0.313
15	51.3	166.6	-18.0	14.1	-1.53	2.28	7.3	0.301
16	54.7	167.5	-19.4	14.2	-1.65	2.22	7.3	0.289
17	58.1	165.9	-22.4	14.1	-1.90	2.11	7.2	0.276
18	61.5	167.8	-24.3	14.2	-2.06	2.05	7.1	0.263
19	64.9	162.9	-24.8	13.8	-2.11	1.88	6.9	0.250
20	68.3	165.6	-31.1	14.1	-2.64	1.81	6.8	0.237
21	71.8	156.6	-28.6	13.3	-2.43	1.59	6.7	0.225
22	75.2	159.8	-29.3	13.6	-2.49	1.53	6.5	0.212
23	78.6	143.4	-25.4	12.2	-2.15	1.32	7.1	0.200
24	82.0	118.1	-26.0	10.0	-2.21	1.01	8.4	0.188
Absolute	20.5			14.2			(T =	26.6 ms)
	68.3				-2.64		(T =	46.8 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	152.5	133.6	114.7	95.8	76.9	58.0	39.0	20.1	1.2	0.0
RX	152.5	145.9	141.7	140.0	138.3	136.6	134.9	133.2	131.8	131.8
RU	152.5	133.6	114.7	95.8	76.9	58.0	39.0	20.1	1.2	0.0

RAU = 130.4 (kips); RA2 = 122.4 (kips)

Current CAPWAP Ru = 125.2 (kips); RMX requires J > 0.9;

Check with PDA-W; RA2 may be a better Case Method

VMX	TVP	VT1*Z	FT1	FMX	DMX	DFN	SET	EMX	QUS
ft/s	ms	kips	kips	kips	in	in	in	kip-ft	kips
8.55	25.41	179.8	161.8	161.8	0.421	0.094	0.105	2.8	127.7

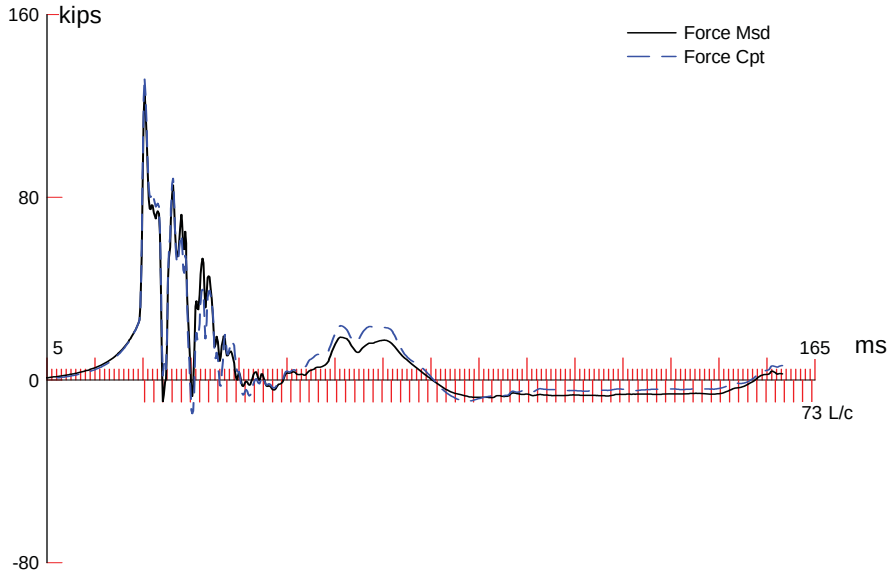
PILE PROFILE AND PILE MODEL

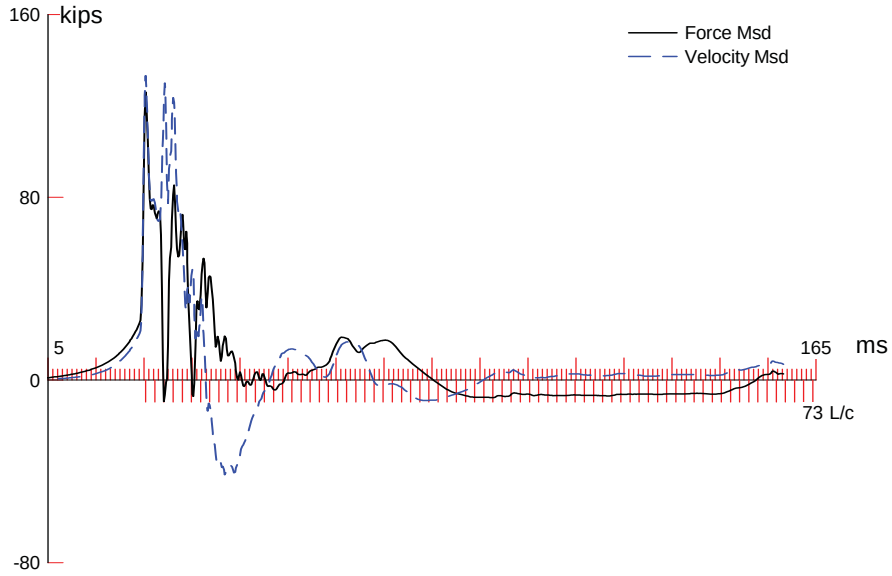
Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.00	11.78	29992.2	492.000	1.734
82.00	11.78	29992.2	492.000	1.734

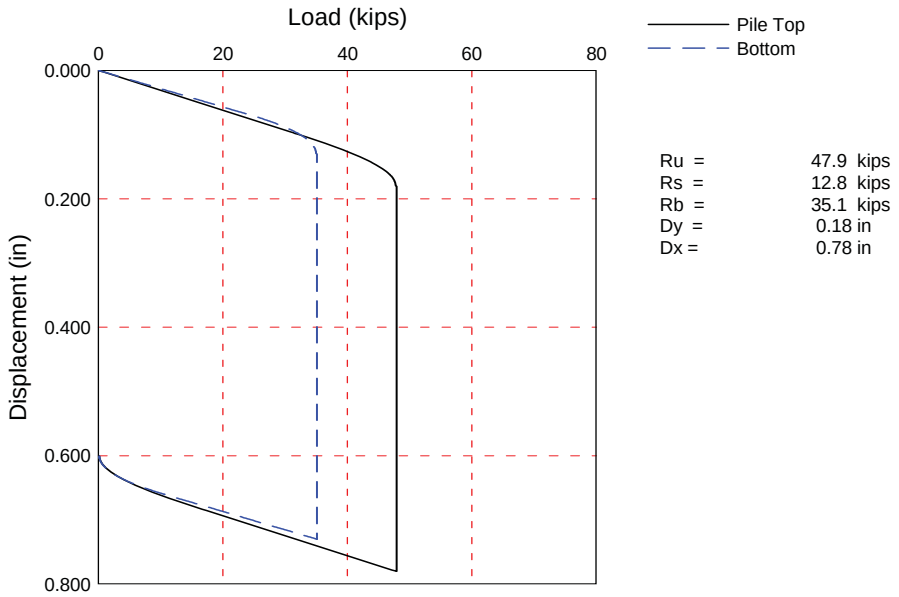
Toe Area 0.239 ft^2

Top Segment Length 3.42 ft, Top Impedance 21.03 kips/ft/s

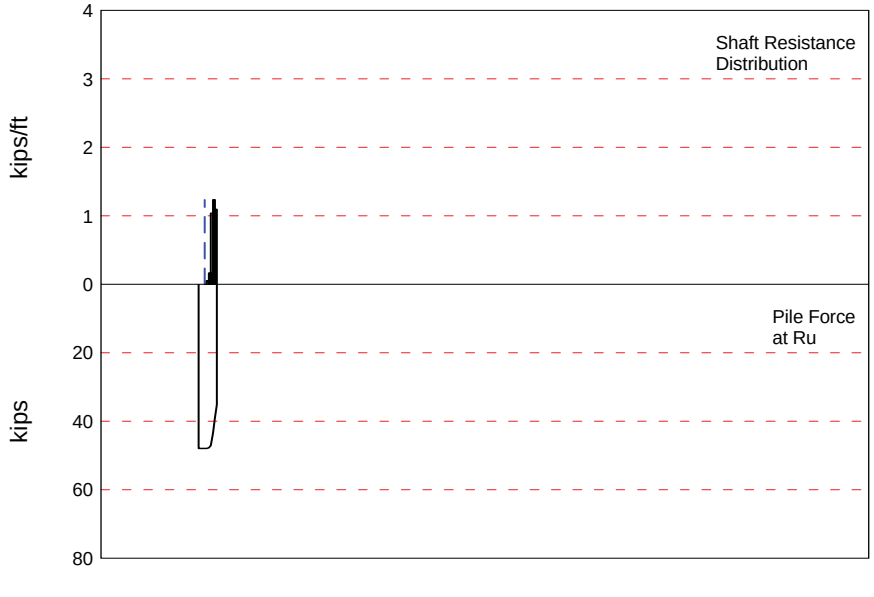
Pile Damping 1.0 %, Time Incr 0.203 ms, Wave Speed 16807.9 ft/s, 2L/c 9.8 ms







Ru	=	47.9 kips
Rs	=	12.8 kips
Rb	=	35.1 kips
Dy	=	0.18 in
Dx	=	0.78 in



CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 47.9; along Shaft 12.8; at Toe 35.1 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf	Smith Damping Factor s/ft
				47.9				
1	14.2	3.2	0.0	47.9	0.0	0.00	0.00	0.000
2	17.8	6.8	0.2	47.7	0.2	0.06	0.03	0.061
3	21.3	10.3	0.6	47.1	0.8	0.17	0.10	0.061
4	24.9	13.9	3.7	43.4	4.5	1.04	0.60	0.061
5	28.4	17.4	4.4	39.0	8.9	1.24	0.72	0.061
6	32.0	21.0	3.9	35.1	12.8	1.10	0.63	0.061
Avg. Shaft			2.1			0.61	0.35	0.061
Toe			35.1				147.74	0.060

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(in)	0.100	0.100
Case Damping Factor		0.037	0.099
Damping Type			Smith
Unloading Quake	(% of loading quake)	30	81
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	74	
Soil Plug Weight	(kips)		0.06

CAPWAP match quality = 9.43 (Wave Up Match) ; RSA = 0
Observed: final set = 0.600 in; blow count = 20 b/ft
Computed: final set = 0.464 in; blow count = 26 b/ft

max. Top Comp. Stress = 11.3 ksi (T= 25.8 ms, max= 1.010 x Top)
max. Comp. Stress = 11.4 ksi (Z= 21.3 ft, T= 26.9 ms)
max. Tens. Stress = -1.20 ksi (Z= 24.9 ft, T= 46.1 ms)
max. Energy (EMX) = 2.7 kip-ft; max. Measured Top Displ. (DMX)= 0.60 in

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages ft	max. Force kips	min. Force kips	max. Comp. Stress ksi	max. Tens. Stress ksi	max. Trnsfd. Energy kip-ft	max. Veloc. ft/s	max. Displ. in
1	3.6	132.8	-9.5	11.3	-0.81	2.69	6.0	0.604
2	7.1	132.9	-9.6	11.3	-0.81	2.68	6.0	0.599
3	10.7	133.1	-11.2	11.3	-0.95	2.67	6.0	0.594
4	14.2	133.3	-12.1	11.3	-1.03	2.65	6.1	0.587
5	17.8	133.6	-11.9	11.3	-1.01	2.64	6.3	0.581
6	21.3	134.0	-14.1	11.4	-1.19	2.62	6.3	0.576
7	24.9	132.5	-14.1	11.2	-1.20	2.58	6.5	0.572
8	28.4	108.8	-10.8	9.2	-0.92	2.38	7.8	0.570
9	32.0	63.4	-6.0	5.4	-0.51	1.91	8.8	0.566
Absolute	21.3			11.4			(T =	26.9 ms)
	24.9				-1.20		(T =	46.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	68.9	48.8	28.8	8.8	0.0	0.0	0.0	0.0	0.0	0.0
RX	88.3	82.1	75.9	69.7	63.5	59.0	56.7	56.4	56.1	55.8
RU	68.9	48.8	28.8	8.8	0.0	0.0	0.0	0.0	0.0	0.0

RAU = 53.1 (kips); RA2 = 65.6 (kips)

Current CAPWAP Ru = 47.9 (kips); Corresponding J(RP)= 0.10;

RMX requires higher damping; see PDA-W

VMX ft/s	TVP ms	VT1*Z kips	FT1 kips	FMX kips	DMX in	DFN in	SET in	EMX kip-ft	QUS kips
6.53	25.60	137.4	131.8	131.8	0.600	0.600	0.600	2.7	53.2

PILE PROFILE AND PILE MODEL

Depth ft	Area in^2	E-Modulus ksi	Spec. Weight lb/ft^3	Perim. ft
0.00	11.78	29992.2	492.000	1.728
32.00	11.78	29992.2	492.000	1.728

Toe Area 0.238 ft^2

Top Segment Length 3.56 ft, Top Impedance 21.03 kips/ft/s

Pile Damping 1.0 %, Time Incr 0.212 ms, Wave Speed 16807.9 ft/s, 2L/c 3.8 ms