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August 30, 2013 let_005_175661025

Ms. Shannon Bennett
Senior Project Manager
CCP Program Manager
Tennessee Valley Authority
1101 Market Street, LP 4T-C
Chattanooga, Tennessee 37402

Re: Additional Geotechnical Engineering Services
Exploratory Borings and Instrumentation Abandonment and Installation
Dry Fly Ash Stack Closure Project
John Sevier Fossil Plant
Rogersville, Tennessee

Dear Ms. Bennett:

Stantec Consulting Services Inc. (Stantec) has completed additional geotechnical exploratory work, piezometer abandonment, and installation of new instrumentation for the Dry Fly Ash Stack (DFAS) at the John Sevier Fossil Plant (JSF). This work was performed in accordance with two proposals (pro_006_175561025 and pro_007_Rev1_175661025) submitted February 20, 2013 and June 20, 2013.

The purpose of the additional geotechnical engineering services was to gather information in support of the closure design for the DFAS at JSF. The additional geotechnical information and instrumentation will supplement the subsurface information currently available and the previously installed instrumentation at the DFAS. This letter describes field investigation activities performed to install new instrumentation, abandon existing instrumentation, and obtain additional geotechnical information.

1. Scope of Work

1.1 Instrument Abandonment

This work consisted of abandoning four (4) standpipe piezometers. The procedure used to abandon the instruments was described in the Job Safety Analysis and Safe Work Plan submitted on March 14, 2013. All four instruments were successfully abandoned, and the bore holes were fully grouted with cement-bentonite grout. The affected surfaces were restored with new grass vegetation. Table 1 provides a summary of the abandoned instrument locations, depths, and elevations.

Table 1. List of Abandoned Instruments

Instrument	Northing	Easting	Surface Elevation (ft)	Depth (ft)
JS-12	736,796.96	289,2666.90	1114.8	55.3
JS-13	736,741.69	289,2570.62	1132.5	70.3
JS-17	737,004.19	289,2496.33	1114.5	52.8
JS-18	736,848.84	289,2429.18	1136.3	70.0

1.2 Subsurface Exploration

Fieldwork for the additional geotechnical exploration was performed by Stantec from March through July 2013. Table 2 provides a summary of the as-drilled boring locations, depths, elevations, and types of sampling performed in each boring. Appendix A provides a plan view of the recently completed boring locations at the Dry Fly Ash Stack along with the location of existing instrumentation. The following sampling techniques were performed for this project and are denoted in Table 2:

- Cone Penetrometer Test (CPT) - ASTM D5778: CPTu borings with pore pressure measurements were advanced at the locations indicated in Table 2, immediately adjacent to regular boring locations. As companion borings advanced near conventional SPT sample borings, the CPTu measurements supplemented estimates of subsurface pore pressures and material horizons for piezometer installations. Pore pressure dissipation testing was performed at different zones (vertical location) to help identify potential depths for piezometer installation. The results of the CPT sampling are presented in Appendix B. CPT work was performed at CPT-73, CPT-74, CPT-75, CPT-81, CPT-82, CPT-83, and CPT-84.

- Standard Penetration Test (SPT) - *ASTM D1586*: SPT sampling consists of dropping a 140-pound hammer to drive a split-spoon sampler 18 inches. The consistency or relative density of the soil is estimated by the number of blows it takes to drive the spoon the last 12 inches. Disturbed samples were generally collected at 5-feet intervals, logged, and transported in pint jars to Stantec's laboratory in Lexington, Kentucky. The results of SPT sampling are presented in boring logs attached in Appendix C. SPT sampling occurred in borings at JS-73, JS-74, and JS-75.

- Shelby Tube (ST) - *ASTM D1587*: Undisturbed soils samples were collected in three-inch diameter, thin-walled Shelby tubes. Shelby tubes were pushed in a smooth, continuous motion with the hydraulic ram utilizing a fixed piston-type sampler. Shelby tubes were then sealed, placed upright in a padded rack and transported to Stantec's laboratory in Lexington, Kentucky. The results of ST sampling are presented in boring logs attached in Appendix C. Two ST samples were taken at borings JS-74 and JS-75.

- Since borings JS-76, JS-77, JS-78, JS-79, and JS-80 were advanced with vacuum excavation, soil samples were not taken. No sampling was done at JS-81 either.

Table 2. Drilling and Sampling Summary

Hole No.	Northing	Easting	Surface Elevation (ft)	Sample Type
JS-73	734,639.83	2,890,303.16	1167.92	SPT
JS-74	734,855.82	2,890,660.56	1170.76	SPT, ST
JS-75	735,028.37	2,891,089.42	1194.73	SPT, ST
JS-76	735,085.46	2,891,876.50	1156.57	SPT, ST
JS-77	735,289.04	2,892,099.79	1158.65	None
JS-78	735,569.13	2,892,242.41	1152.71	None
JS-79	735,906.44	2,892,319.96	1154.56	None
JS-80	736,096.62	2,892,481.88	1154.45	None
JS-81	736,454.56	2,892,322.12	1156.94	None
CPT-73*	734,639.83	2,890,303.16	1167.92	None
CPT-74 *	734,855.82	2,890,660.56	1170.76	CPT
CPT-75 *	735,028.37	2,891,089.42	1194.73	CPT
CPT-81 *	736,454.56	2,892,322.12	1156.94	CPT
CPT-82 *	736,617.63	2,892,534.03	1154.60	CPT
CPT-83 *	735,954.65	2,891,620.88	1148.36	CPT
CPT-84 *	735,957.90	2,892,535.97	1126.43	CPT

*** CPT's were advanced immediately adjacent to the location of the sample borings.**

1.3 New Instrument Installations

This work included the installation of new instruments followed by the preparation and submittal of an updated instrumentation layout drawing (Appendix A) and instrumentation installation schematics (Appendix D). A summary of instrumentation installed during March through July, 2013 is presented in Table 3. The instruments were installed in select sample borings identified in Table 2. The following instruments are summarized in Table 3:

- Vibrating Wire Piezometers (VW): New vibrating wire piezometers were installed in the middle of the DFAS within borings JS-73, JS-74, JS-75 and JS-81. The installation consisted of installing nested vibrating wire transducers within each boring. Depths for the nested VW piezometers were determined based on the companion CPT boring results at each boring location, and confirmed with selected SPT results. Depths of these VW's were chosen to locate perched water tables that may exist in soil horizons or soft zones underneath the water table. All piezometers were installed fully grouted, as depicted in instrumentation details attached in Appendix D. Vibrating wire piezometer calibration records are included in Appendix E.

- Standpipe Piezometers: Leachate pipes located in lined areas of the DFAS were exposed by borings advanced using vacuum excavation techniques. Single open standpipe piezometers were installed in these borings with a two-foot slotted screen at the bottom of the boring with PVC riser pipe to the ground surface and backfilled

with a sand filter pack around the screen and bentonite pellets to seal off the boring. These piezometers were installed in borings JS-76, JS-77, JS-78, JS-79, and JS-80.

- Sondex Settlement Systems (SS): A sondex settlement system was installed in borings JS-73, JS-74, JS-75 and JS-81. Sensing rings were attached to the corrugated Sondex plastic pipe, sealed, and the borehole fully grouted outside of the Sondex pipe. Vibrating wire piezometers also were installed at these locations outside of the corrugated pipe. These installations are protected by a steel protective cover placed over the instruments at the ground surface, but backfilled with sand to allow for removal of the protective cover during future re-grading of the DFAS.

Table 3. Instrumentation Installation Summary

Instrument ID	Cross Section	Instrument Type	Surface Elevation (ft)	Location	
				Northing	Easting
JS-73	B-B'	VW & SS	1167.92	734639.83	2890303.16
JS-74	C-C'	VW & SS	1170.76	734855.82	2890660.56
JS-75	D-D'	VW & SS	1194.73	735028.37	2891089.42
JS-76	--	Piezometer	1156.57	735085.46	2891876.50
JS-77	--	Piezometer	1158.65	735289.04	2892099.79
JS-78	--	Piezometer	1152.71	735569.13	2892242.41
JS-79	--	Piezometer	1154.56	735906.44	2892319.96
JS-80	--	Piezometer	1154.45	736096.62	2892481.88
JS-81	H-H'	VW & SS	1156.94	736454.56	2892322.12

2. Subsurface Soil Conditions

JS-73

The subsurface conditions encountered at this location consist of 'dry' fly and bottom ash deposits underlain by a thin layer of clayey soil and weathered shale. The ash appeared mostly well compacted as determined by the SPT and CPT results. No water was encountered at the time of the drilling. No sluiced ash was encountered. The only soft condition was observed near elevation 1092 feet.

JS-74

Well compacted 'dry' fly ash was encountered to a depth of 70 feet where the ash is underlain by a 3-foot thick deposit of fat clay followed by about six feet of sluiced ash. The top of the sluiced ash was near elevation 1098 feet. The sluiced ash rests on alluvial deposits encountered at various previous boring locations drilled within the stack. Water was encountered near the top of the sluiced ash.

JS-75

Subsurface conditions at this location were similar to those encountered at JS-74 except that the top of the sluiced ash was near elevation 1103 feet and the sluiced ash thickness was about 12 feet. Water was recorded as being within the sluiced ash deposits at the time of the drilling.

JS-76, JS-77, JS-78, JS-79 and JS-80

These locations correspond to the approximate location of the inlet to the leachate collection system along the south side of the existing synthetic liner. The purpose of this particular effort was to determine if the leachate collection system was working after it was reported as not working properly. The inlet locations were exposed and, based on the dry conditions encountered at each location, the inlet system appears to be working. If the liner was placed as shown on the record drawings (design drawings were not available for our review), surface infiltration should be draining toward the leachate collection system inlets.

JS-81 and JS-81a

The subsurface conditions at these locations consist of well compacted fly and bottom ash extending down to the presumed top of bedrock. A five-foot thick layer of crushed stone encountered within the ash at a depth of 25 feet (elevation 1131 feet) prevented the penetration of the CPT tools. No water was encountered in Boring JS-81 at the time of the drilling.

JS-82

The CPT data shows the presence of medium to well compacted ash to a depth of 48 feet and ‘dry’ ash between elevations 1120 feet and 1080 feet. It is possible sluiced ash or other soft deposit is present between elevations 1080 feet and 1070.

JS-83 (and JS-31 Drilled in 2009)

Well compacted ash is present at this location down to approximate elevation 1100 feet where sluiced ash is present. The bottom of the sluiced ash is near elevation 1068 feet. The CPT probe refused at elevation 1065 feet.

JS-84

There is medium to well compacted ash at this location down to approximate elevation 1103 feet, followed by sluiced ash down to elevation 1076. The sluiced ash is probably underlain by alluvial deposits that extend down to the top of the bedrock.

Subsurface Water

Subsurface water was encountered in some of the borings advanced during this project. The water level reading was taken after the boring had been drilled and before the installation of instrumentation. The depths to water noted immediately after drilling are shown on the

boring logs enclosed (Appendix C). Additional water level readings were obtained from piezometers installed in the borings and will be reported as part of the Instrumentation Monitoring Program monthly reports.

Closure

The additional subsurface information appears to indicate that the phreatic surface under most of the stack is located near the top of the sluiced ash, confirming what was determined during previous exploratory efforts. Unlike the conditions encountered on other dry stacks, surface infiltration has not created a raised phreatic surface near the center of the stack. It is possible the alluvial deposits under the stack allow the surface infiltration to partially drain or seep out of the bottom of the stack toward Holston River while the perimeter clayey dikes create a bathtub effect that maintains the phreatic surface near the top of the dike system. However, the phreatic surface still has an impact on the stability of the North slope perimeter dike system.

The additional subsurface information will be used to review the subsurface conditions assumed for the design of the stack closure. The new instrumentation will be incorporated into the IMP (instrumentation monitoring plan) currently in use.

Subsurface profiles are generally based on straight line interpolation between borings and no warranties can be made regarding the continuity of subsurface conditions between the borings.

Stantec appreciates the opportunity to provide engineering services for this project. If you have any questions, or if we may be of further assistance, please contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Chrispin Gabriel, EIT
Project Engineer

Hugo Aparicio, PE
Principal

/rws

Appendices:
A. Boring and Instrumentation Layout
B. CPT Logs
C. Boring Logs
D. Instrument Details
E. Vibrating Wire Piezometer Calibration Sheets

Appendix A

Boring and Instrumentation Layout

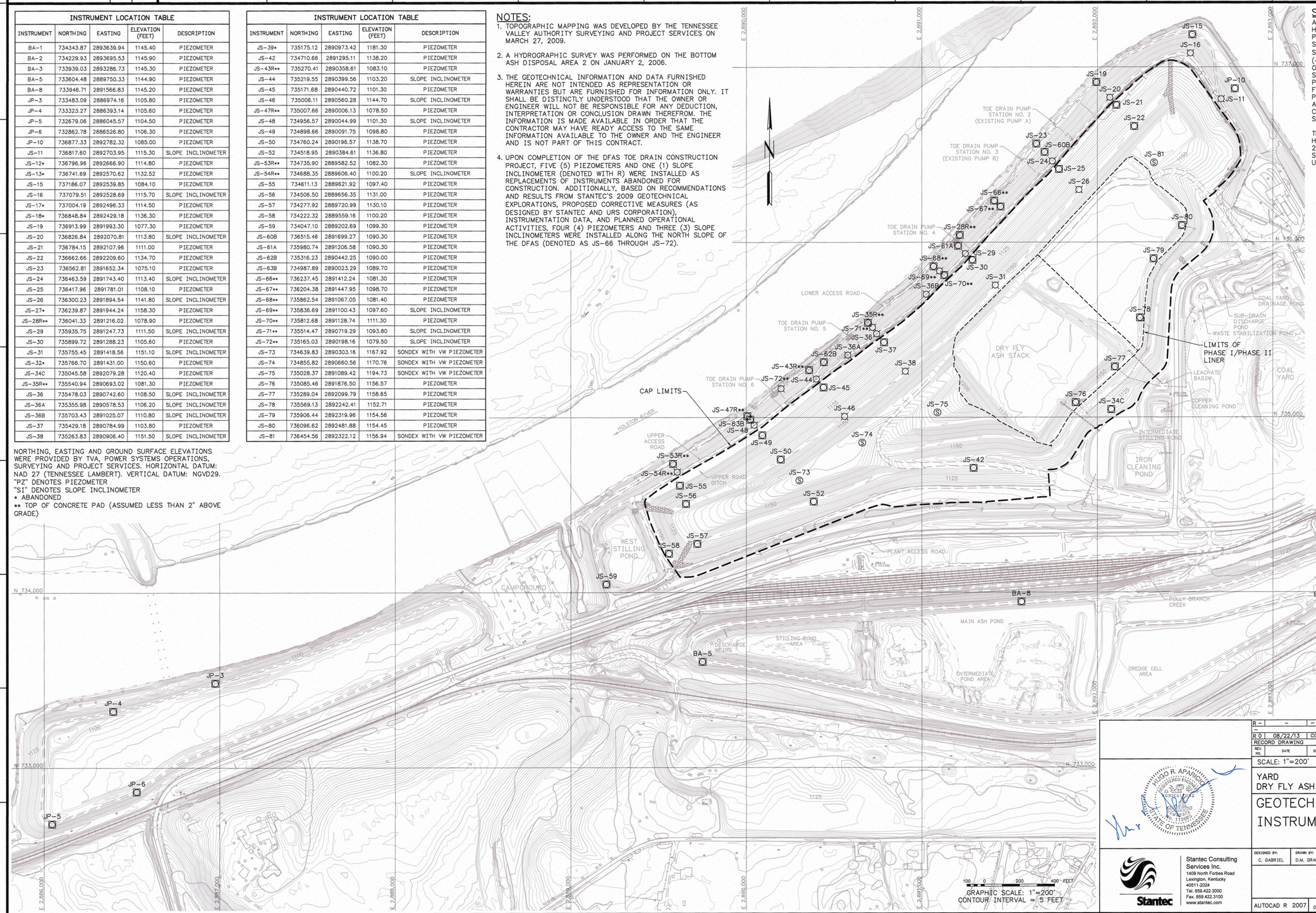
INSTRUMENT LOCATION TABLE				
INSTRUMENT	NORTHING	EASTING	ELEVATION (FEET)	DESCRIPTION
BA-1	734343.87	2893639.94	1145.40	PIEZOMETER
BA-2	734229.93	2893695.53	1145.90	PIEZOMETER
BA-3	733939.03	2893286.73	1145.30	PIEZOMETER
BA-5	733604.48	2889750.33	1144.90	PIEZOMETER
BA-8	733946.71	2891566.83	1145.20	PIEZOMETER
JP-3	733483.09	2886974.16	1105.80	PIEZOMETER
JP-4	733323.27	2886393.14	1105.60	PIEZOMETER
JP-5	732679.06	2886045.57	1104.50	PIEZOMETER
JP-6	732862.78	2886526.80	1106.30	PIEZOMETER
JP-10	736877.33	2892782.32	1085.00	PIEZOMETER
JP-11	736817.60	2892703.95	1115.30	SLOPE INCLINOMETER
JS-12*	736796.96	2892666.90	1114.80	PIEZOMETER
JS-13*	736741.69	2892570.62	1132.52	PIEZOMETER
JS-15	737186.07	2892539.85	1084.10	PIEZOMETER
JS-16	737079.51	2892528.69	1115.70	SLOPE INCLINOMETER
JS-17*	737004.19	2892496.33	1114.50	PIEZOMETER
JS-18*	736848.84	2892429.18	1136.30	PIEZOMETER
JS-19	736913.99	2891993.30	1077.30	PIEZOMETER
JS-20	736826.84	2892070.81	1113.80	SLOPE INCLINOMETER
JS-21	736784.15	2892107.96	1111.00	PIEZOMETER
JS-22	736662.66	2892209.60	1134.70	PIEZOMETER
JS-23	736562.81	2891652.34	1075.10	PIEZOMETER
JS-24	736463.59	2891743.40	1113.40	SLOPE INCLINOMETER
JS-25	736417.96	2891781.01	1108.10	PIEZOMETER
JS-26	736300.23	2891894.54	1141.80	SLOPE INCLINOMETER
JS-27*	736239.87	2891944.24	1158.30	PIEZOMETER
JS-28R**	736041.33	2891216.02	1078.90	PIEZOMETER
JS-29	735935.75	2891247.73	1111.50	SLOPE INCLINOMETER
JS-30	735899.72	2891288.23	1105.60	PIEZOMETER
JS-31	735755.45	2891418.56	1151.10	SLOPE INCLINOMETER
JS-32*	735766.70	2891431.00	1150.60	PIEZOMETER
JS-34C	735045.58	2892079.28	1120.40	PIEZOMETER
JS-35R**	735540.94	2890693.02	1081.30	SLOPE INCLINOMETER
JS-36	735478.03	2890742.60	1108.50	SLOPE INCLINOMETER
JS-36A	735355.98	2890578.53	1106.20	SLOPE INCLINOMETER
JS-36B	735703.43	2891025.07	1110.80	SLOPE INCLINOMETER
JS-37	735429.18	2890784.99	1103.80	PIEZOMETER
JS-38	735263.83	2890906.40	1151.50	SLOPE INCLINOMETER

INSTRUMENT LOCATION TABLE				
INSTRUMENT	NORTHING	EASTING	ELEVATION (FEET)	DESCRIPTION
JS-39*	735175.12	2890973.42	1181.30	PIEZOMETER
JS-42	734710.66	2891295.11	1138.20	PIEZOMETER
JS-43R**	735270.41	2890358.61	1083.10	PIEZOMETER
JS-44	735219.55	2890399.56	1103.20	SLOPE INCLINOMETER
JS-45	735171.68	2890440.72	1101.30	PIEZOMETER
JS-46	735006.11	2890560.28	1144.70	SLOPE INCLINOMETER
JS-47R**	735007.66	2890006.13	1078.50	PIEZOMETER
JS-48	734956.57	2890044.99	1101.30	SLOPE INCLINOMETER
JS-49	734898.66	2890091.75	1098.80	PIEZOMETER
JS-50	734760.24	2890196.57	1138.70	PIEZOMETER
JS-52	734518.95	2890384.61	1136.80	PIEZOMETER
JS-53R**	734735.90	2889582.52	1082.30	PIEZOMETER
JS-54R**	734688.35	2889606.40	1100.20	SLOPE INCLINOMETER
JS-55	734611.13	2889621.92	1097.40	PIEZOMETER
JS-56	734506.50	2889656.35	1131.00	PIEZOMETER
JS-57	734277.92	2889720.99	1130.10	PIEZOMETER
JS-58	734222.32	2889559.16	1100.20	PIEZOMETER
JS-59	734047.10	2889202.69	1099.30	PIEZOMETER
JS-60B	736515.46	2891699.27	1090.30	PIEZOMETER
JS-61A	735980.74	2891206.58	1090.30	PIEZOMETER
JS-62B	735316.23	2890442.25	1090.00	PIEZOMETER
JS-63B	734987.89	2890023.29	1089.70	PIEZOMETER
JS-66**	736237.45	2891412.24	1081.30	PIEZOMETER
JS-67**	736204.38	2891447.95	1098.70	PIEZOMETER
JS-68**	735862.54	2891067.05	1081.40	PIEZOMETER
JS-69**	735836.69	2891100.43	1097.60	SLOPE INCLINOMETER
JS-70**	735812.68	2891128.74	1111.30	PIEZOMETER
JS-71**	735514.47	2890719.29	1093.80	SLOPE INCLINOMETER
JS-72**	735165.03	2890198.16	1079.50	SLOPE INCLINOMETER
JS-73	734639.83	2890303.16	1167.92	SONDEX WITH VW PIEZOMETER
JS-74	734855.82	2890660.56	1170.76	SONDEX WITH VW PIEZOMETER
JS-75	735028.37	2891089.42	1194.73	SONDEX WITH VW PIEZOMETER
JS-76	735085.46	2891876.50	1156.57	PIEZOMETER
JS-77	735289.04	2892099.79	1158.65	PIEZOMETER
JS-78	735569.13	2892242.41	1152.71	PIEZOMETER
JS-79	735906.44	2892319.96	1154.56	PIEZOMETER
JS-80	736096.62	2892481.88	1154.45	PIEZOMETER
JS-81	736454.56	2892322.12	1156.94	SONDEX WITH VW PIEZOMETER

NORTHING, EASTING AND GROUND SURFACE ELEVATIONS WERE PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES. HORIZONTAL DATUM: NAD 27 (TENNESSEE LAMBERT). VERTICAL DATUM: NGVD29.
"PZ" DENOTES PIEZOMETER
"SI" DENOTES SLOPE INCLINOMETER
* ABANDONED
** TOP OF CONCRETE PAD (ASSUMED LESS THAN 2" ABOVE GRADE)

NOTES:

1. TOPOGRAPHIC MAPPING WAS DEVELOPED BY THE TENNESSEE VALLEY AUTHORITY SURVEYING AND PROJECT SERVICES ON MARCH 27, 2009.
2. A HYDROGRAPHIC SURVEY WAS PERFORMED ON THE BOTTOM ASH DISPOSAL AREA 2 ON JANUARY 2, 2006.
3. THE GEOTECHNICAL INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER OR ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION OR CONCLUSION DRAWN THEREFROM. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER AND THE ENGINEER AND IS NOT PART OF THIS CONTRACT.
4. UPON COMPLETION OF THE DFAS TOE DRAIN CONSTRUCTION PROJECT, FIVE (5) PIEZOMETERS AND ONE (1) SLOPE INCLINOMETER (DENOTED WITH R) WERE INSTALLED AS REPLACEMENTS OF INSTRUMENTS ABANDONED FOR CONSTRUCTION. ADDITIONALLY, BASED ON RECOMMENDATIONS AND RESULTS FROM STANTEC'S 2009 GEOTECHNICAL EXPLORATIONS, PROPOSED CORRECTIVE MEASURES (AS DESIGNED BY STANTEC AND URS CORPORATION), INSTRUMENTATION DATA, AND PLANNED OPERATIONAL ACTIVITIES, FOUR (4) PIEZOMETERS AND THREE (3) SLOPE INCLINOMETERS WERE INSTALLED ALONG THE NORTH SLOPE OF THE DFAS (DENOTED AS JS-66 THROUGH JS-72).



SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

THE HORIZONTAL COORDINATE SYSTEM REFERENCE HEREIN IS THE TENNESSEE STATE PLANE SYSTEM NAD 27 WITH UNITS OF FEET. THE VERICAL COORDINATE SYSTEM IS BASED ON THE NAVD 88 SYSTEM WITH UNITS OF FEET.

LEGEND

- REPEATER
- MONITORING WELL
- PIEZOMETER
- SLOPE INCLINOMETER
- SPOT ELEVATION
- CONTROL POINT
- LIGHT POLE
- UTILITY POLE
- POLE
- SIGN
- MANHOLE
- FIRE HYDRANT
- POST
- TREE
- BOLLARD
- SPRINKLER
- ROAD
- RAILROAD
- RIPRAP DITCH
- STORM PIPES
- AMMONIATED ASH LEACHATE SYSTEM
- ELECTRIC LINE
- 6" EQUALIZATION LINE
- 8" HDPE PIPE
- 12" PERFORATED HPDE PIPE
- 3" FORCE MAIN
- 4" FORCE MAIN
- TREE LINE
- EDGE OF WATER
- FENCE LINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- PIEZOMETER
- SLOPE INCLINOMETER
- SONDEX SETTLEMENT SYSTEM WITH VW PIEZOMETER

RECORD DRAWING

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV.	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV.
R 0	08/22/13 RECORD DRAWING	CG	DMG	WRM	HRA	SEB	MST	JCK	–	–	DISCIPLINE INTERFACE

SCALE: 1"=200' EXCEPT AS NOTED

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION INSTRUMENTATION PLAN

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
C. GABRIEL	D.M. GRAHAM	W.R. MATTINGLY	H.R. APARICIO	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

JOHN SEVIER FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

HUGO R. APARICIO — REGISTERED ENGINEER — 22 OCT 13 — PRINCIPAL — 110981 — STATE OF TENNESSEE

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AUTOCAD R 2007 | DATE 08/22/13 | 41 | C | 10W516-01 | R 0

PLOT FACTOR:1 W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

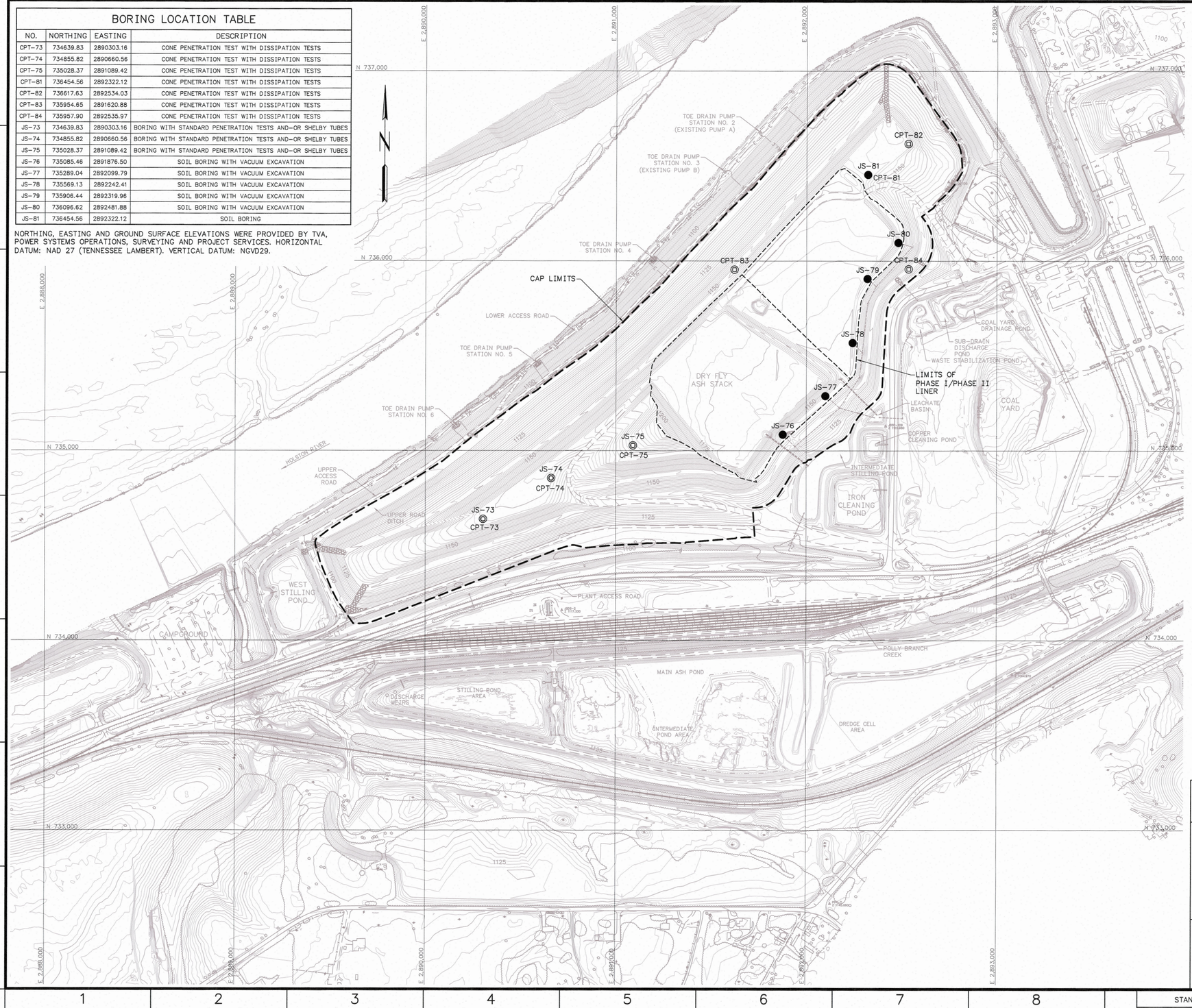
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT DATE: 09/27/2013 USER: JOHNSON, TRACY
N:\TVA\CAD\FOSSIL\DWG\10W516-01.MPW\DWG\SHEET_1\SHEET_1.DGN\DWG\10W516-01-RD.DWG

BORING LOCATION TABLE

NO.	NORTHING	EASTING	DESCRIPTION
CPT-73	734639.83	2890303.16	CONE PENETRATION TEST WITH DISSIPATION TESTS
CPT-74	734855.82	2890660.56	CONE PENETRATION TEST WITH DISSIPATION TESTS
CPT-75	735028.37	2891089.42	CONE PENETRATION TEST WITH DISSIPATION TESTS
CPT-81	736454.56	2892322.12	CONE PENETRATION TEST WITH DISSIPATION TESTS
CPT-82	736617.63	2892534.03	CONE PENETRATION TEST WITH DISSIPATION TESTS
CPT-83	735954.65	2891620.88	CONE PENETRATION TEST WITH DISSIPATION TESTS
CPT-84	735957.90	2892535.97	CONE PENETRATION TEST WITH DISSIPATION TESTS
JS-73	734639.83	2890303.16	BORING WITH STANDARD PENETRATION TESTS AND-OR SHELBY TUBES
JS-74	734855.82	2890660.56	BORING WITH STANDARD PENETRATION TESTS AND-OR SHELBY TUBES
JS-75	735028.37	2891089.42	BORING WITH STANDARD PENETRATION TESTS AND-OR SHELBY TUBES
JS-76	735085.46	2891876.50	SOIL BORING WITH VACUUM EXCAVATION
JS-77	735289.04	2892099.79	SOIL BORING WITH VACUUM EXCAVATION
JS-78	735569.13	2892242.41	SOIL BORING WITH VACUUM EXCAVATION
JS-79	735906.44	2892319.96	SOIL BORING WITH VACUUM EXCAVATION
JS-80	736096.62	2892481.88	SOIL BORING WITH VACUUM EXCAVATION
JS-81	736454.56	2892322.12	SOIL BORING

NORTHING, EASTING AND GROUND SURFACE ELEVATIONS WERE PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES. HORIZONTAL DATUM: NAD 27 (TENNESSEE LAMBERT). VERTICAL DATUM: NGVD29.



SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

THE HORIZONTAL COORDINATE SYSTEM REFERENCE HEREIN IS THE TENNESSEE STATE PLANE SYSTEM NAD 27 WITH UNITS OF FEET. THE VERICAL COORDINATE SYSTEM IS BASED ON THE NAVD 88 SYSTEM WITH UNITS OF FEET.

NOTES:

1. TOPOGRAPHIC MAPPING WAS DEVELOPED BY THE TENNESSEE VALLEY AUTHORITY SURVEYING AND PROJECT SERVICES ON MARCH 27, 2009.
2. A HYDROGRAPHIC SURVEY WAS PERFORMED ON THE BOTTOM ASH DISPOSAL AREA 2 ON JANUARY 2, 2006.
3. THE GEOTECHNICAL INFORMATION AND DATA FURNISHED HEREIN ARE NOT INTENDED AS REPRESENTATION OR WARRANTIES BUT ARE FURNISHED FOR INFORMATION ONLY. IT SHALL BE DISTINCTLY UNDERSTOOD THAT THE OWNER OR ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DEDUCTION, INTERPRETATION OR CONCLUSION DRAWN THEREFROM. THE INFORMATION IS MADE AVAILABLE IN ORDER THAT THE CONTRACTOR MAY HAVE READY ACCESS TO THE SAME INFORMATION AVAILABLE TO THE OWNER AND THE ENGINEER AND IS NOT PART OF THIS CONTRACT.
4. UPON COMPLETION OF THE DFAS TOE DRAIN CONSTRUCTION PROJECT, FIVE (5) PIEZOMETERS AND ONE (1) SLOPE INCLINOMETER (DENOTED WITH R) WERE INSTALLED AS REPLACEMENTS OF INSTRUMENTS ABANDONED FOR CONSTRUCTION. ADDITIONALLY, BASED ON RECOMMENDATIONS AND RESULTS FROM STANTEC'S 2009 GEOTECHNICAL EXPLORATIONS, PROPOSED CORRECTIVE MEASURES (AS DESIGNED BY STANTEC AND URS CORPORATION), INSTRUMENTATION DATA, AND PLANNED OPERATIONAL ACTIVITIES, FOUR (4) PIEZOMETERS AND THREE (3) SLOPE INCLINOMETERS WERE INSTALLED ALONG THE NORTH SLOPE OF THE DFAS (DENOTED AS JS-66 THROUGH JS-72).

LEGEND

- REPEATER
- MONITORING WELL
- PIEZOMETER
- SLOPE INCLINOMETER
- × 1313 SPOT ELEVATION
- CONTROL POINT
- LIGHT POLE
- UTILITY POLE
- POLE
- SIGN
- MANHOLE
- FIRE HYDRANT
- POST
- TREE
- BOLLARD
- SPRINKLER
- ROAD
- RAILROAD
- RIPRAP DITCH
- STORM PIPES
- AMMONIATED ASH LEACHATE SYSTEM
- ELECTRIC LINE
- 6"EQ 6" EQUALIZATION LINE
- 8" 8" HDPE PIPE
- 12" 12" PERFORATED HPDE PIPE
- 3"FM 3" FORCE MAIN
- 4"FM 4" FORCE MAIN
- TREE LINE
- EDGE OF WATER
- FENCE LINE
- 1100 INDEX CONTOUR
- INTERMEDIATE CONTOUR
- SOIL BORING
- CONE PENETRATION TEST (CPT) WITH DISSIPATION TESTS
- SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TEST (SPT)

100 0 200 400 FEET

GRAPHIC SCALE: 1"=200'
CONTOUR INTERVAL = 5 FEET

RECORD DRAWING

PLOT DATE: 08/22/2013 USER: JOHNSON, TROY C
V:\TVA\ACTIVE\TVA5100320\ENVIRONMENTAL\DRAWING\SHEET_FILES\JSFP\MXD\VRVS_RECORD\10W516-02-R0.DWG

REV NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV ID
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	08/22/13	CG	DMG	WRM	HRA	SEB	MST	JCK	–	–	–
RECORD DRAWING											DISCIPLINE INTERFACE

SCALE: 1"=200' EXCEPT AS NOTED

HUGO R. APARICIO — REGISTERED ENGINEER — AGRICULTURE — No. 113864 — STATE OF TENNESSEE

YARD
DRY FLY ASH STACK

GEOTECHNICAL EXPLORATION
BORING PLAN

Stantec Consulting Services Inc.
1409 North Forbes Road
Lexington, Kentucky
40511-2024
Tel. 859.422.3000
Fax. 859.422.3100
www.stantec.com

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
C. GABRIEL	D.M. GRAHAM	W.R. MATTINGLY	H.R. APARICIO	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

JOHN SEVIER FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2007	DATE 08/22/13	41	C	10W516-02	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

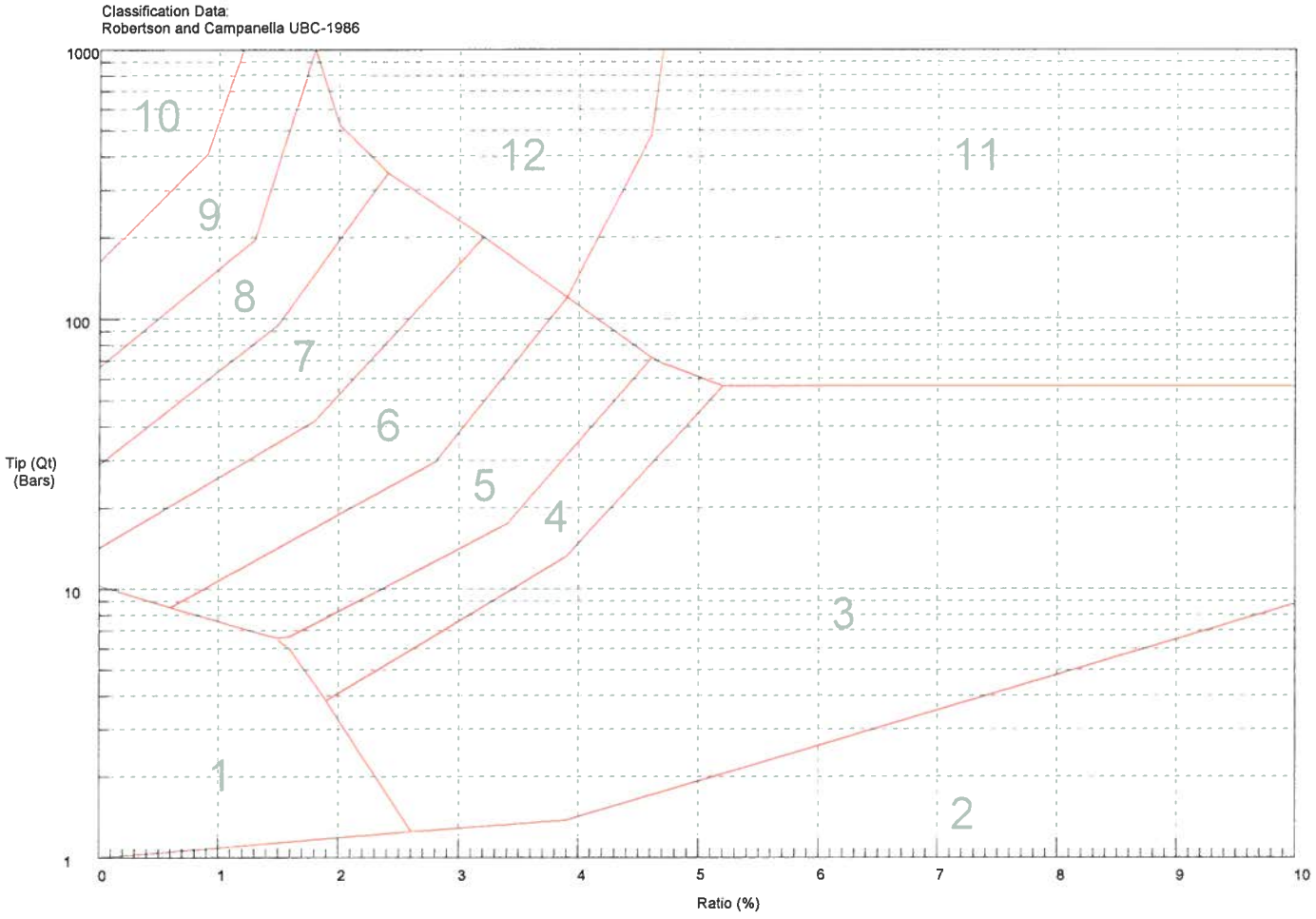
PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

Appendix B

CPT Logs

12 Zone Soil Behavior Chart



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

* Overconsolidated or cemented

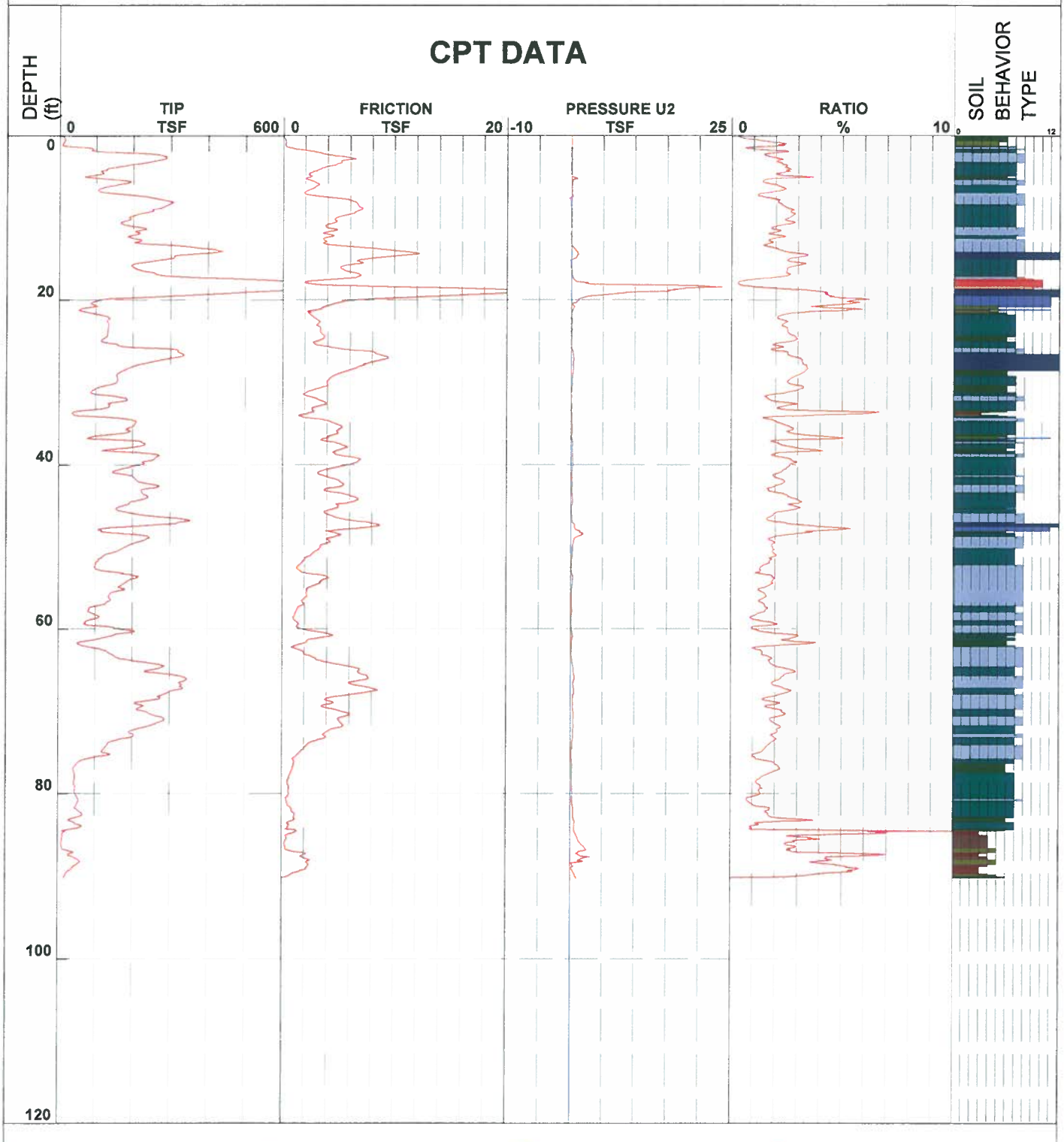
FUGRO

Job Number 04.1913-0019 CPT Number JS-73 Location Rogersville, Tennesee

Operator Albert Fonseca Date and Tir 28-Mar-2013 07:56:23 Cone Number F7.5CKE2HAW22477

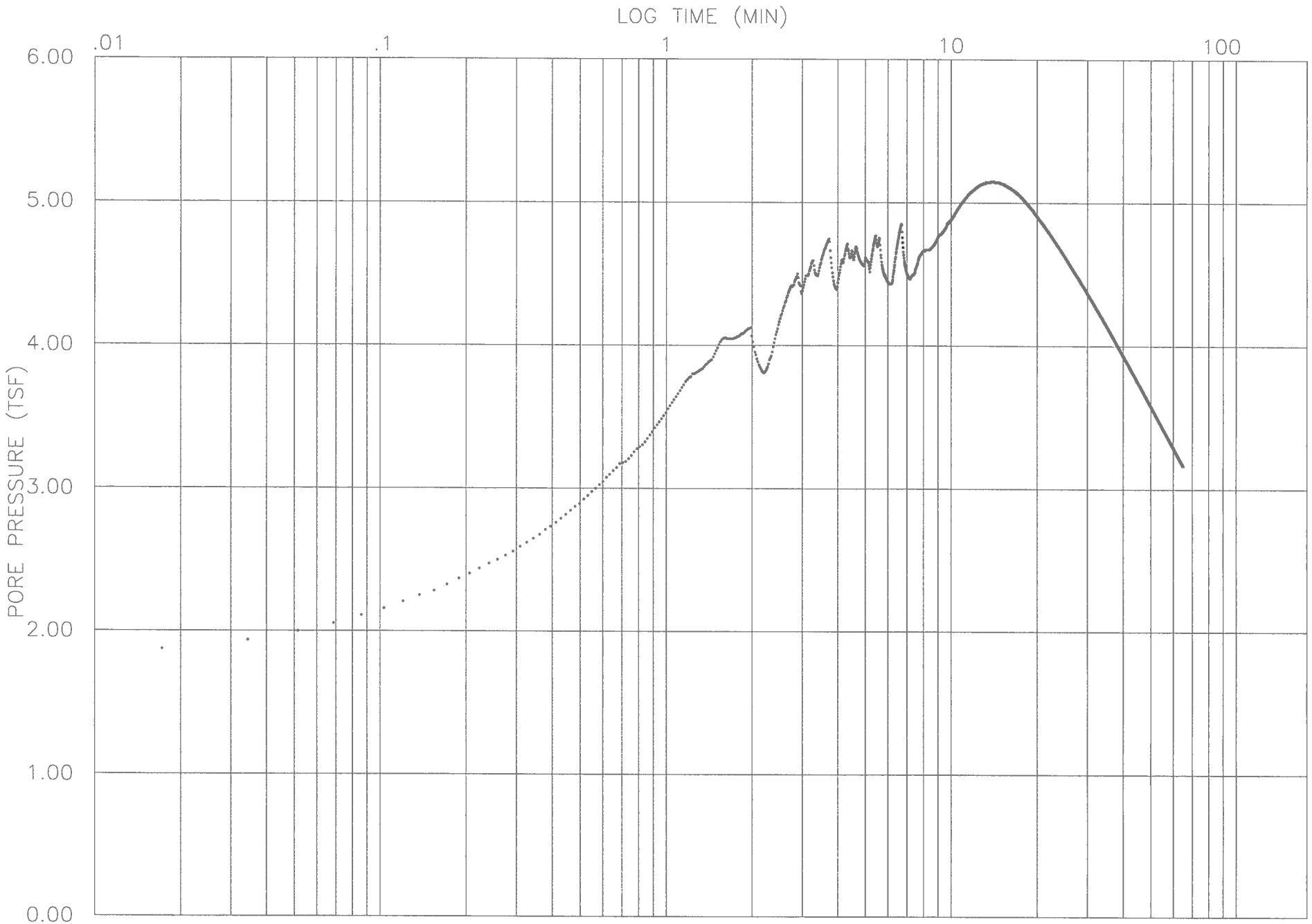
Client Stantec

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented



CPT NUMBER: JS-73
JOB NUMBER: 04.1913-0019

DISSIPATION TEST

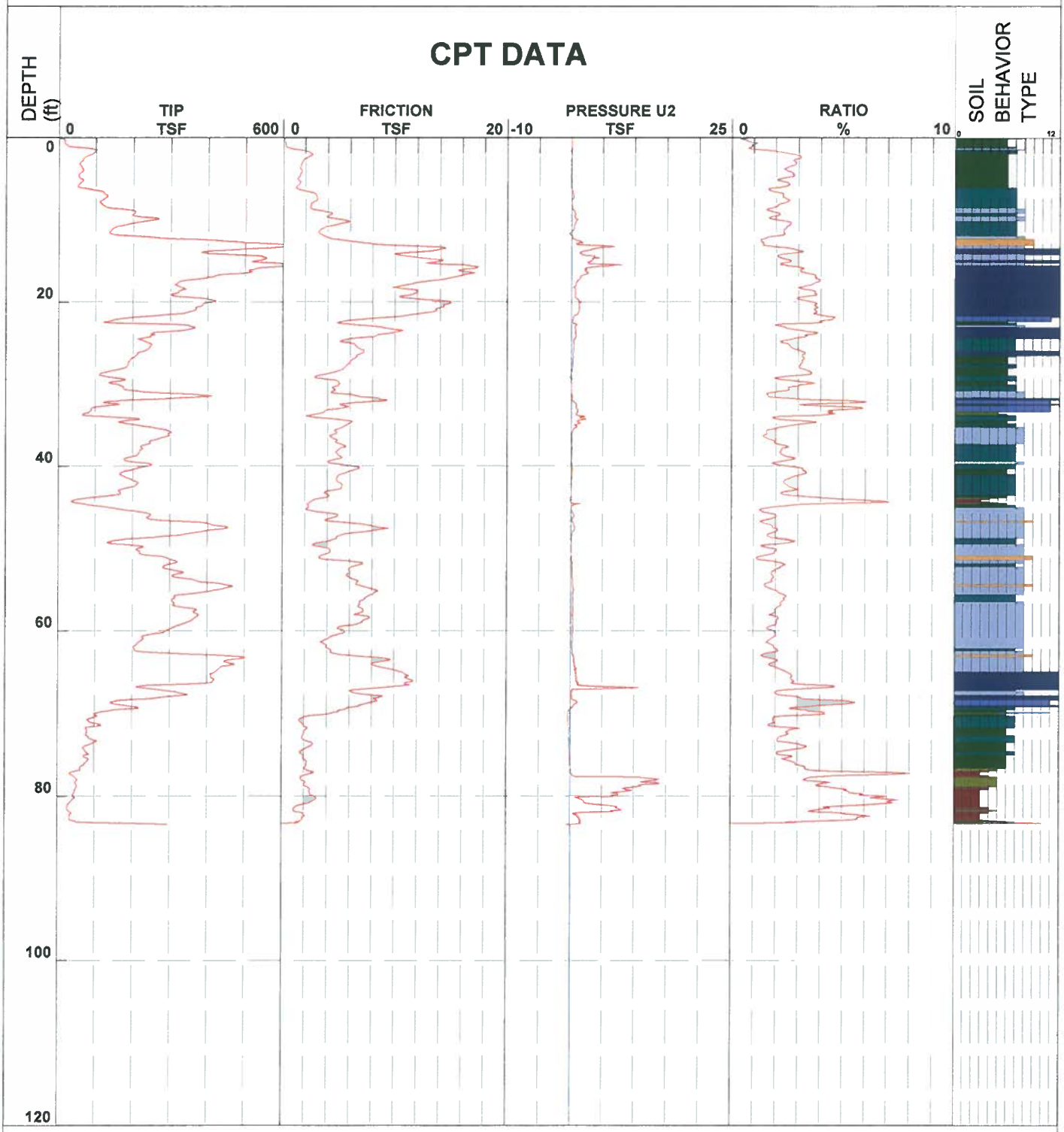
DEPTH: 87.63 Feet
DATE: 28-Mar-2013

FUGRO

Job Number 04.1913-0019 CPT Number JS-74 Location Rogersville, Tennesee

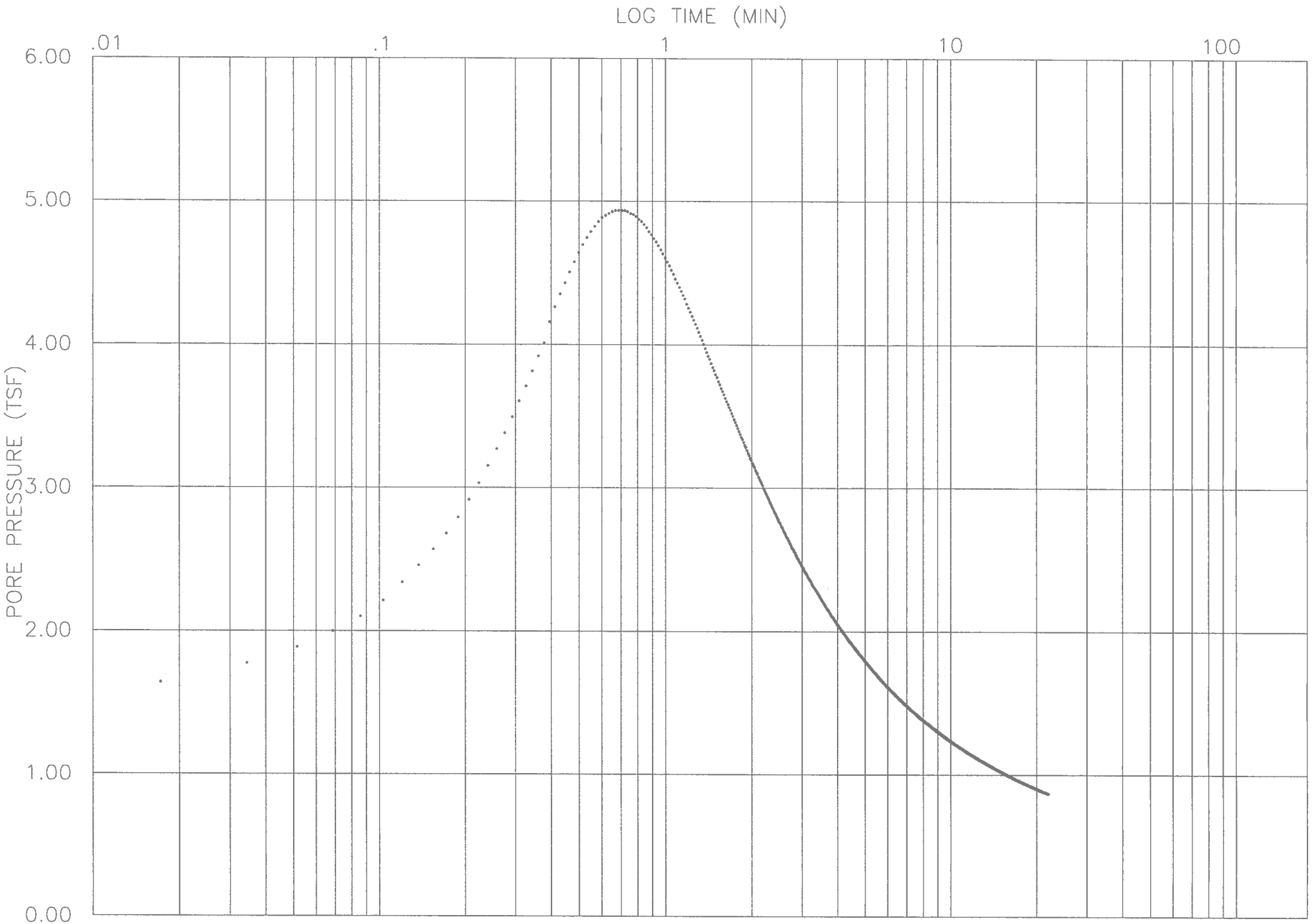
Operator Albert Fonseca Date and T 28-Mar-2013 10:41:17 Cone Number F7.5CKE2HAW22477

Client Stantec



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

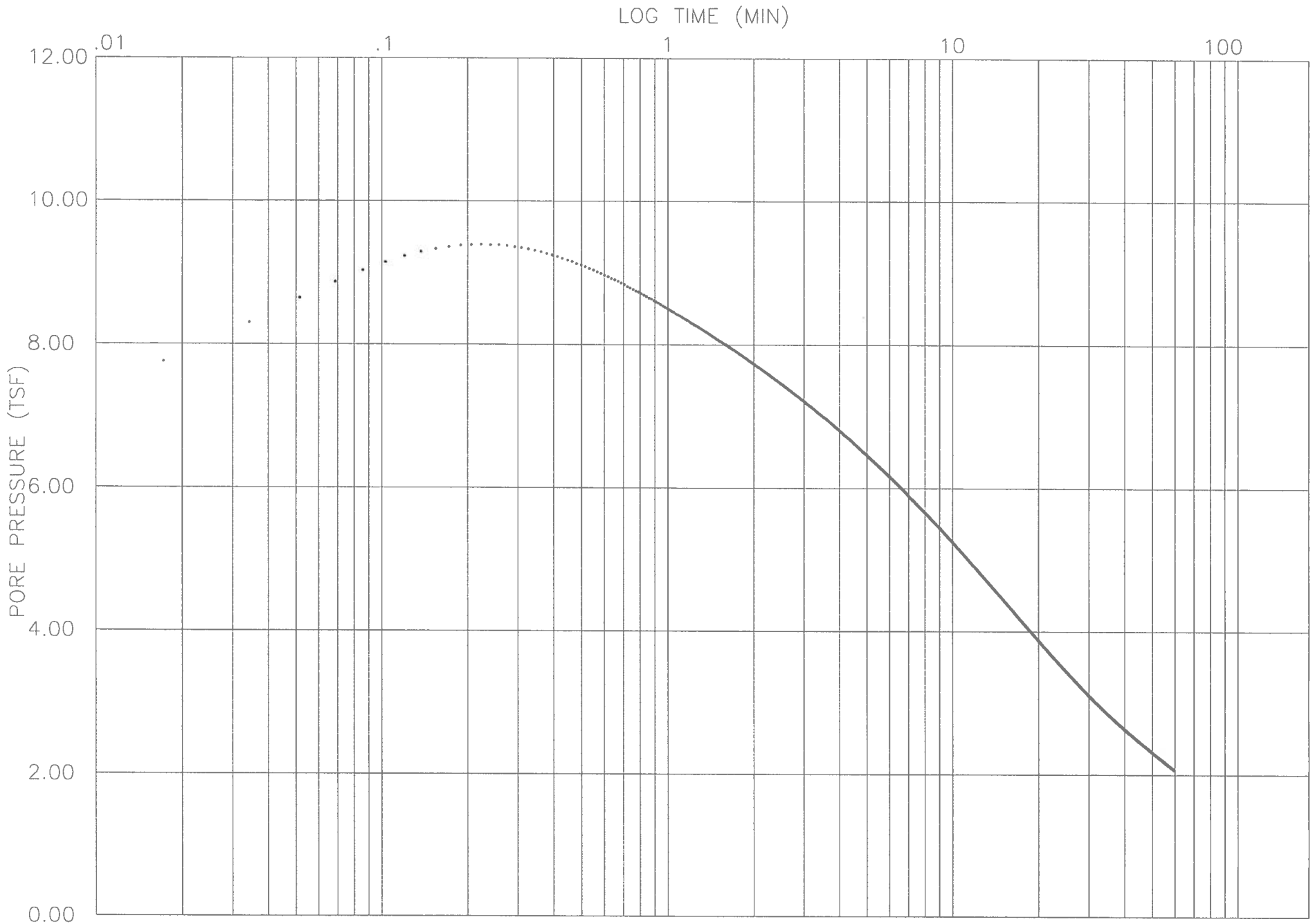
Robertson et al. 1986 * Overconsolidated or Cemented



CPT NUMBER: JS-74
JOB NUMBER: 04.1913-0019

DISSIPATION TEST

DEPTH: 68.73 Feet
DATE: 28-Mar-2013



CPT NUMBER: JS-74
JOB NUMBER: 04.1913-0019

DISSIPATION TEST

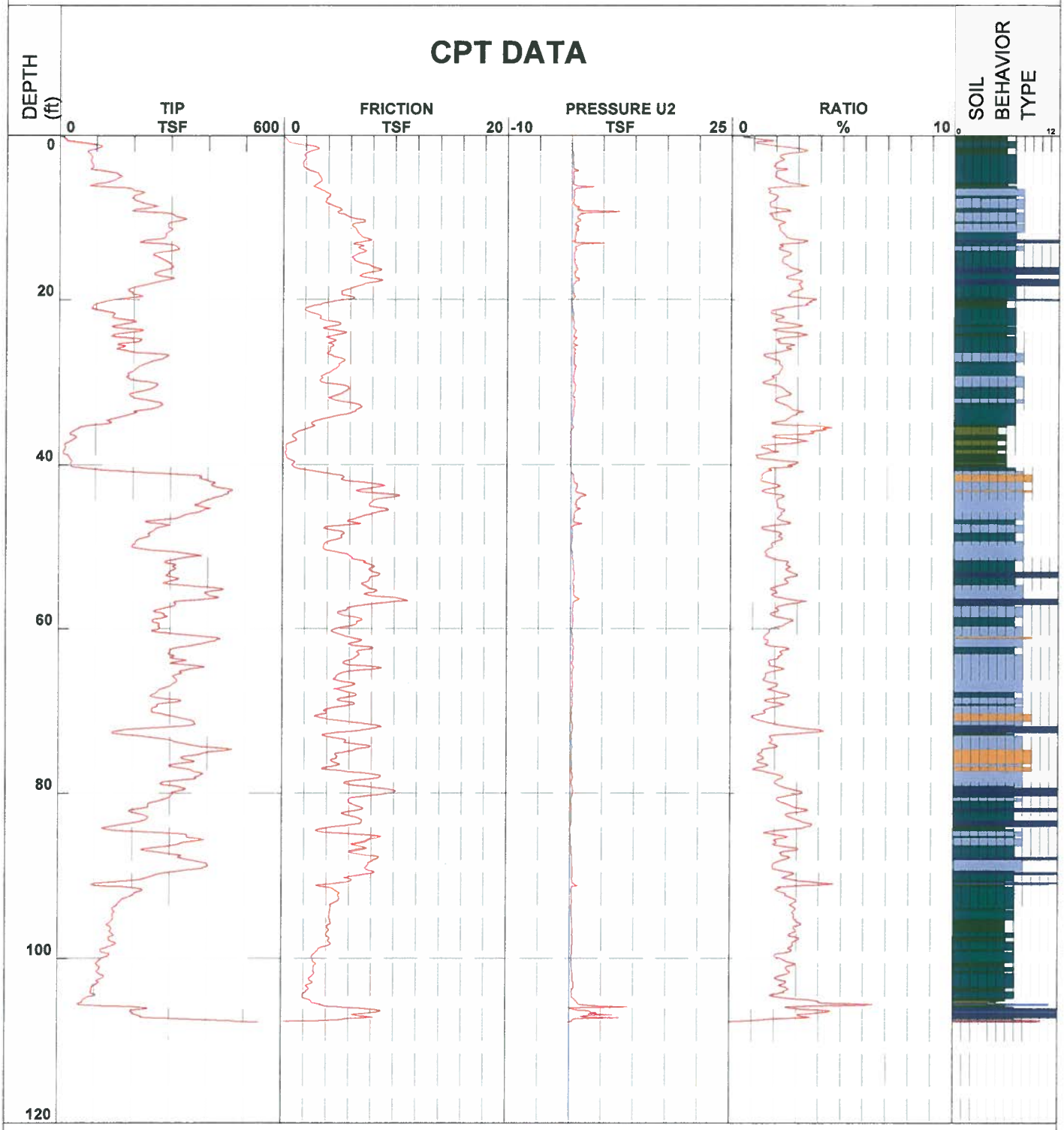
DEPTH: 80.09 Feet
DATE: 28-Mar-2013

Job Number 04.1913-0019 CPT Number JS-75 Location Rogersville, Tennesee

Operator Albert Fonseca Date and T 29-Mar-2013 07:38:42 Cone Number F7.5CKE2HAW22477

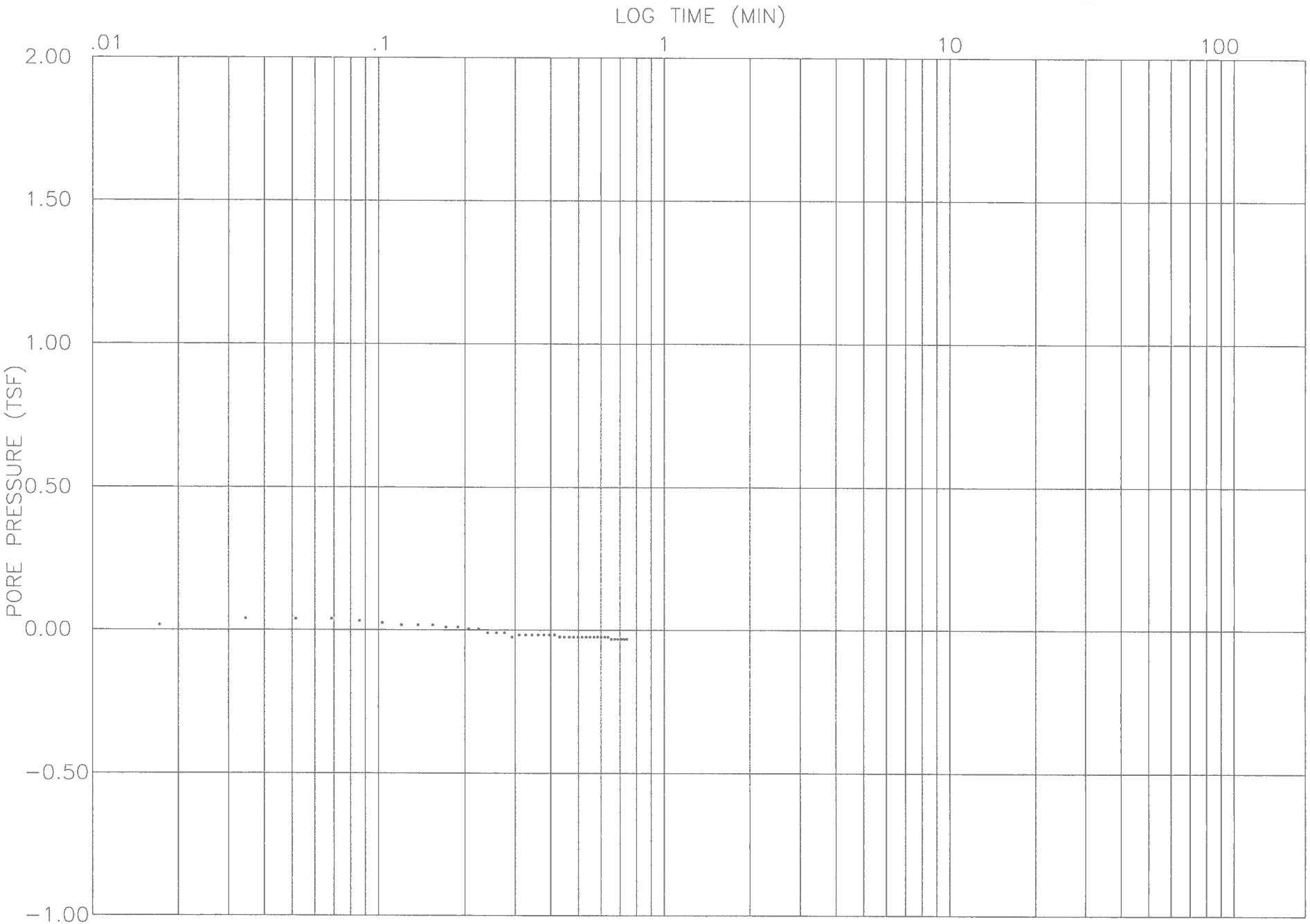
Client Stantec

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Robertson et al. 1986 * Overconsolidated or Cemented

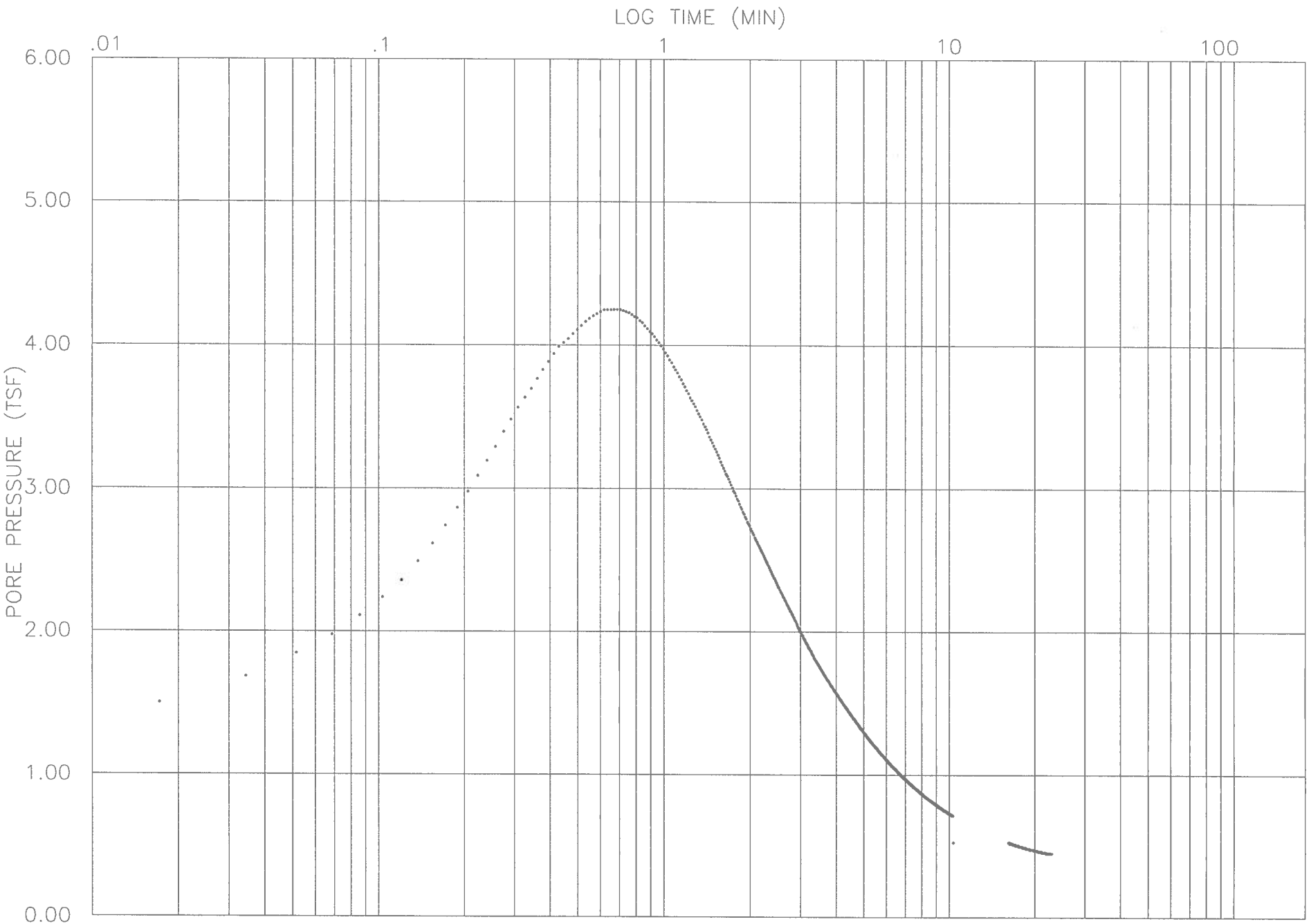


CPT NUMBER: JS−75
JOB NUMBER: 04.1913−0019

DISSIPATION TEST

DEPTH: 36.48 Feet
DATE: 29−Mar−2013

FUGRO CONSULTANTS, INC.



CPT NUMBER: JS-75
JOB NUMBER: 04.1913-0019

DISSIPATION TEST

DEPTH: 91.24 Feet
DATE: 29-Mar-2013

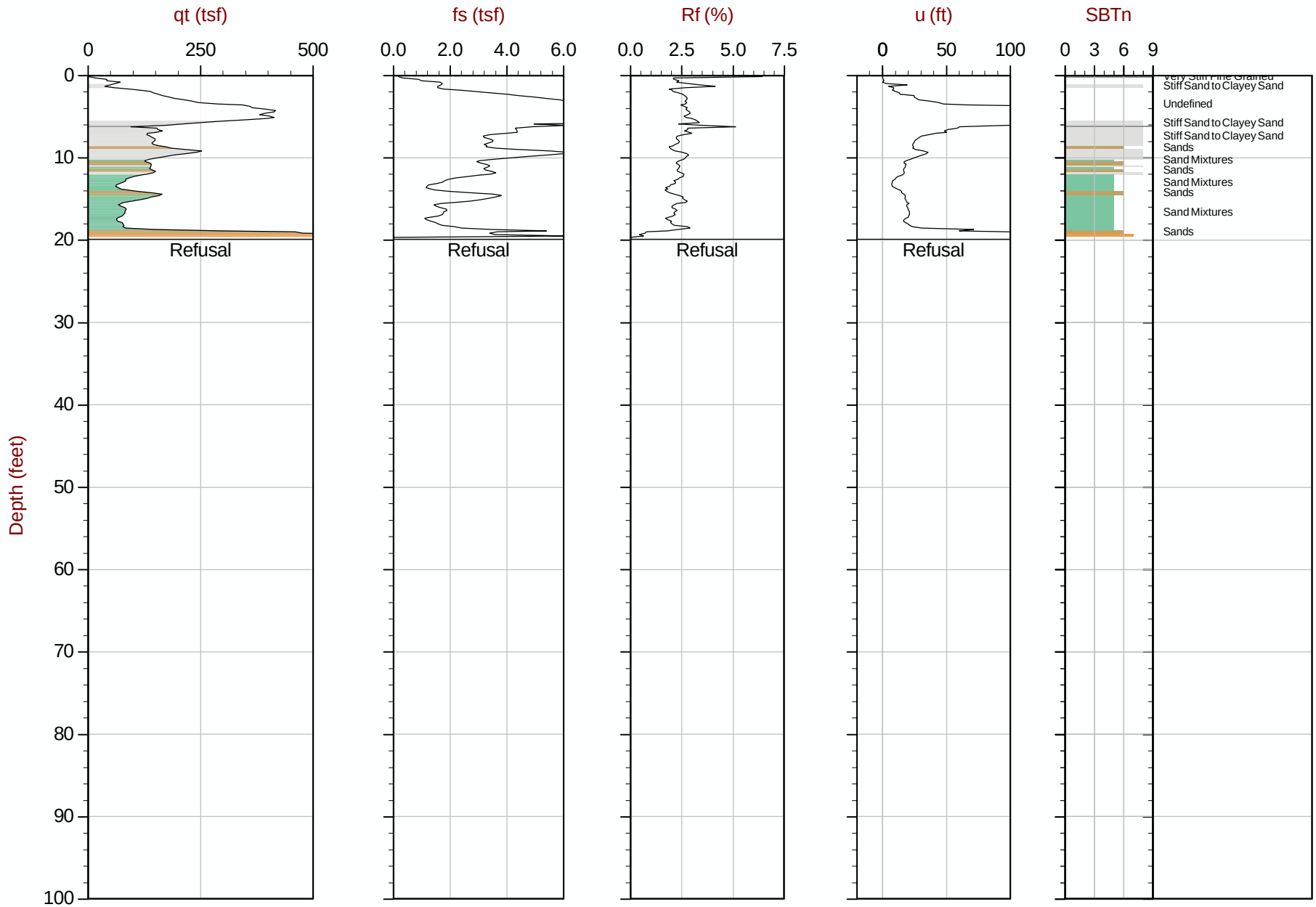
FUGRO CONSULTANTS, INC.

CONETEC

Stantec

Job No: 13-54044
Date: 07:09:13 08:36
Site: TVA JSF

Sounding: JS-81
Cone: 304:T1500F15U500



Max Depth: 6.050 m / 19.85 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 13-54044_CP01.cor
Unit Wt: SBT Chart Soil Zones

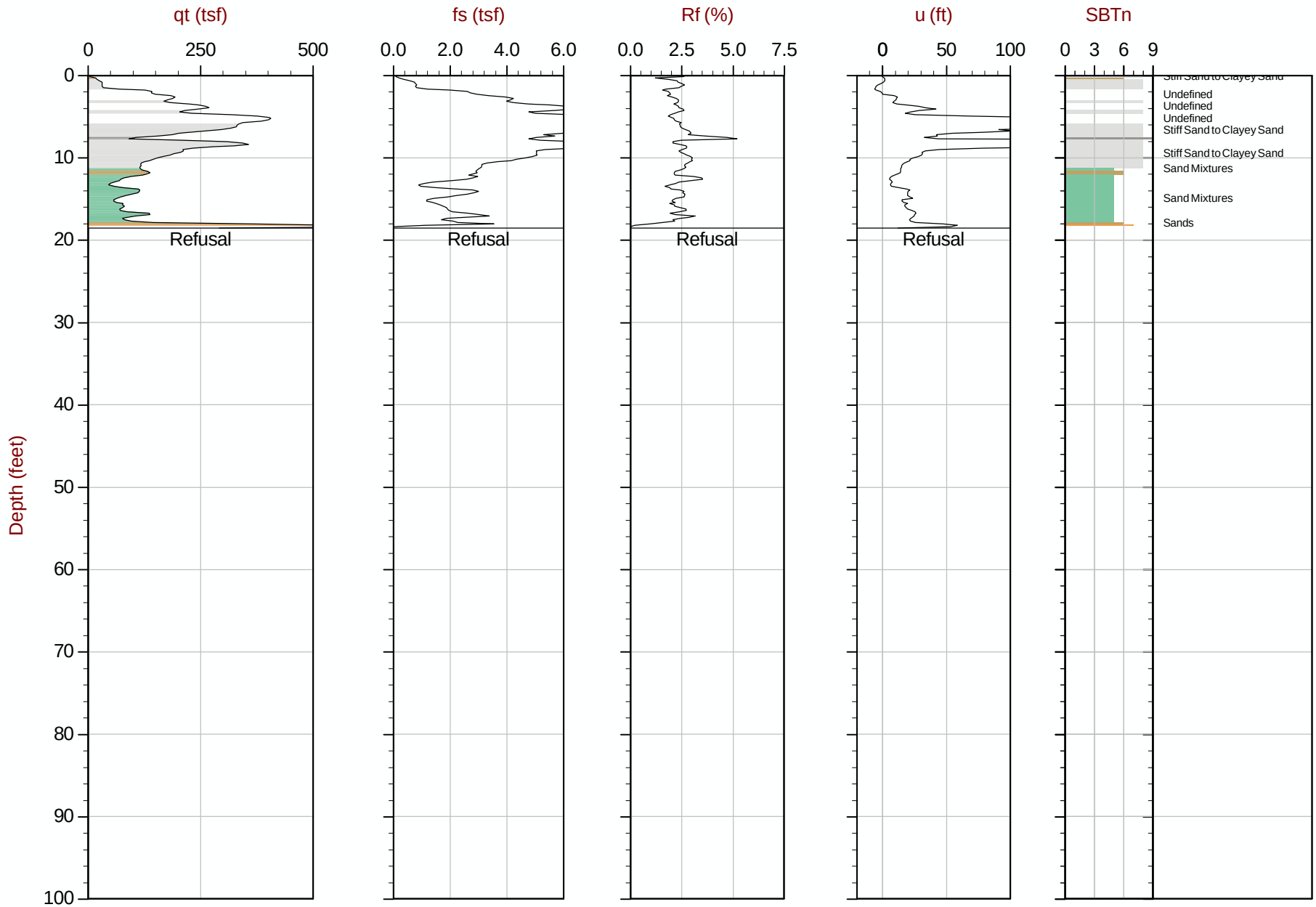
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 36.37717 Long: -82.96851

CONETEC

Stantec

Job No: 13-54044
Date: 07:09:13 09:46
Site: TVA JSF

Sounding: JS-81a
Cone: 304:T1500F15U500



Max Depth: 5.650 m / 18.54 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 13-54044_CP01A.cor
Unit Wt: SBT Chart Soil Zones

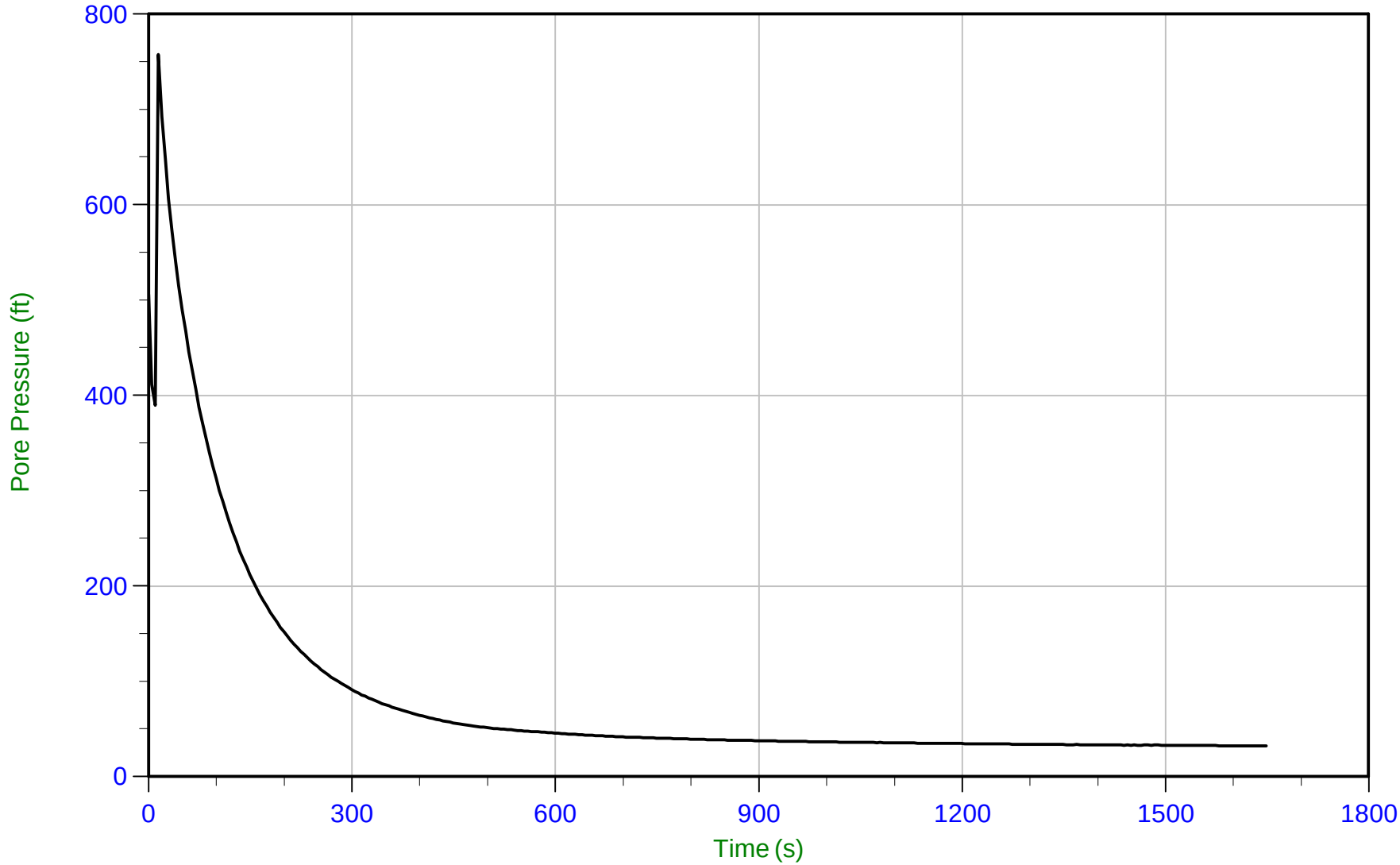
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 36.37717 Long: -82.96851

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 08:36:00
Site: TVA JSF

Sounding: JS-81
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-54044_CP01.PPD
Depth: 6.200 m / 20.341 ft
Duration: 1650.0 s

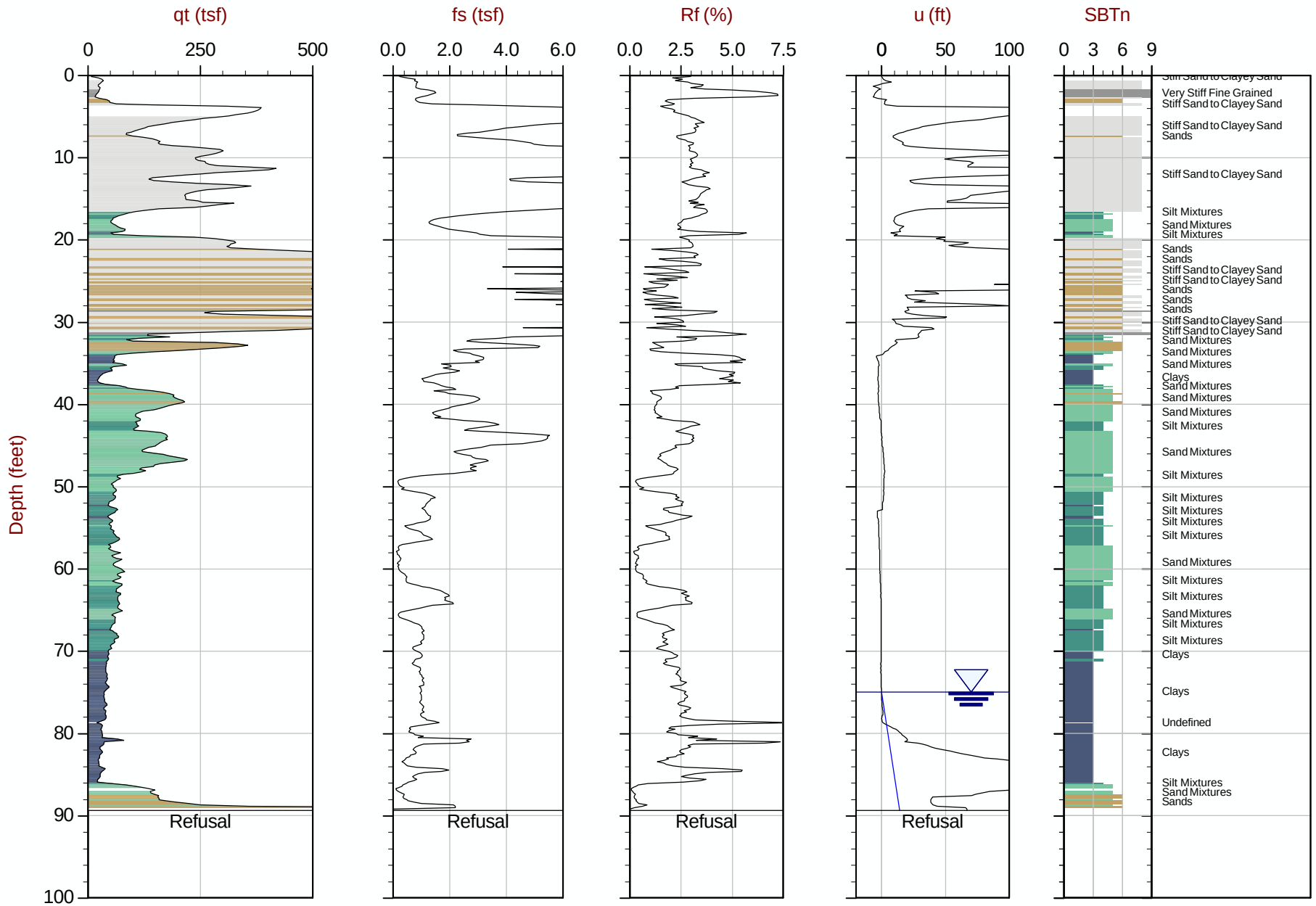
U Min: 32.3 ft
U Max: 757.6 ft

CONETEC

Stantec

Job No: 13-54044
Date: 07:09:13 10:31
Site: TVA JSF

Sounding: JS-82
Cone: 304:T1500F15U500



Max Depth: 27.250 m / 89.40 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 13-54044_CP02.cor
Unit Wt: SBT Chart Soil Zones

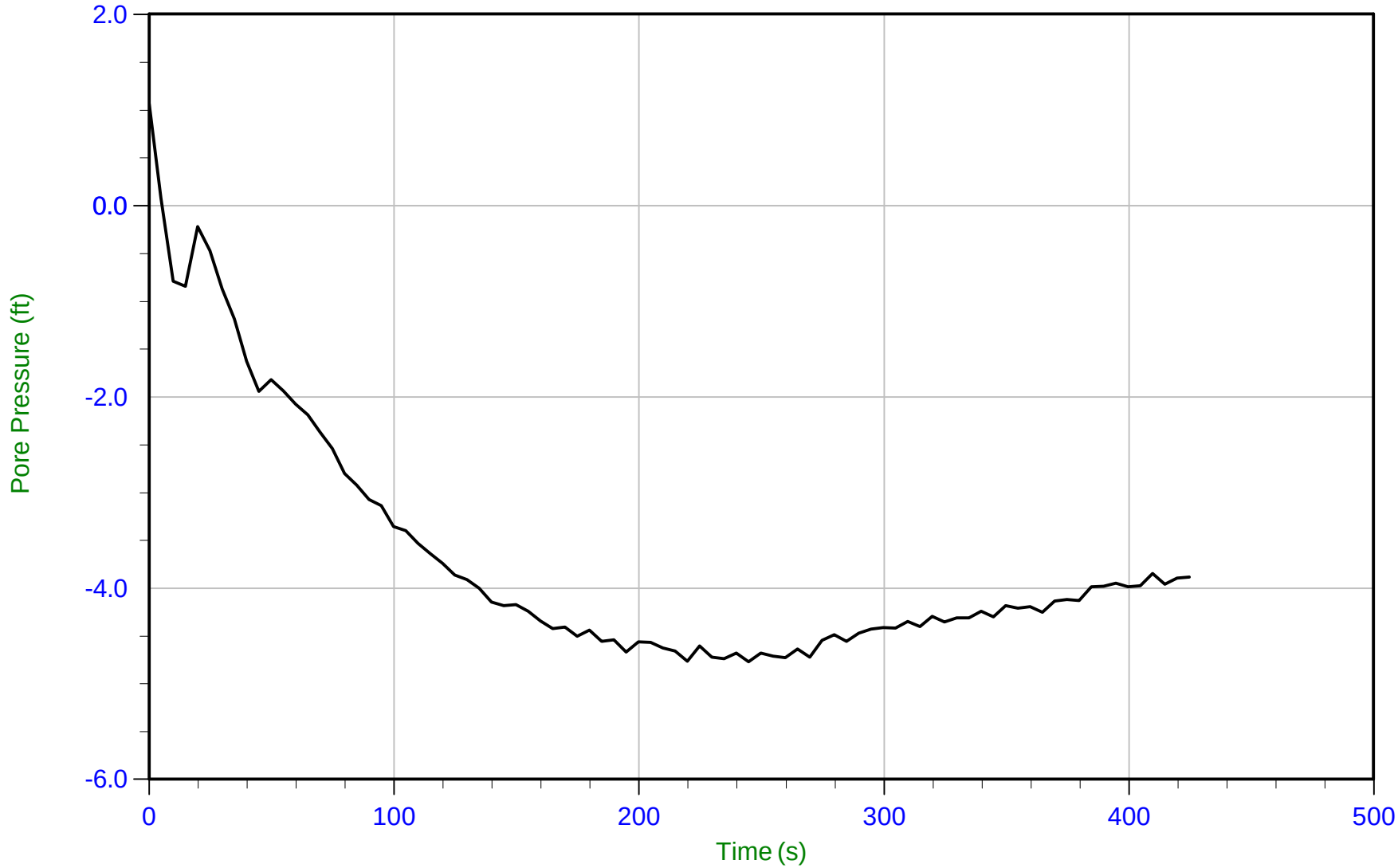
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 36.37782 Long: -82.96770
Page No: 1 of 1

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 10:31:12
Site: TVA JSF

Sounding: JS-82
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

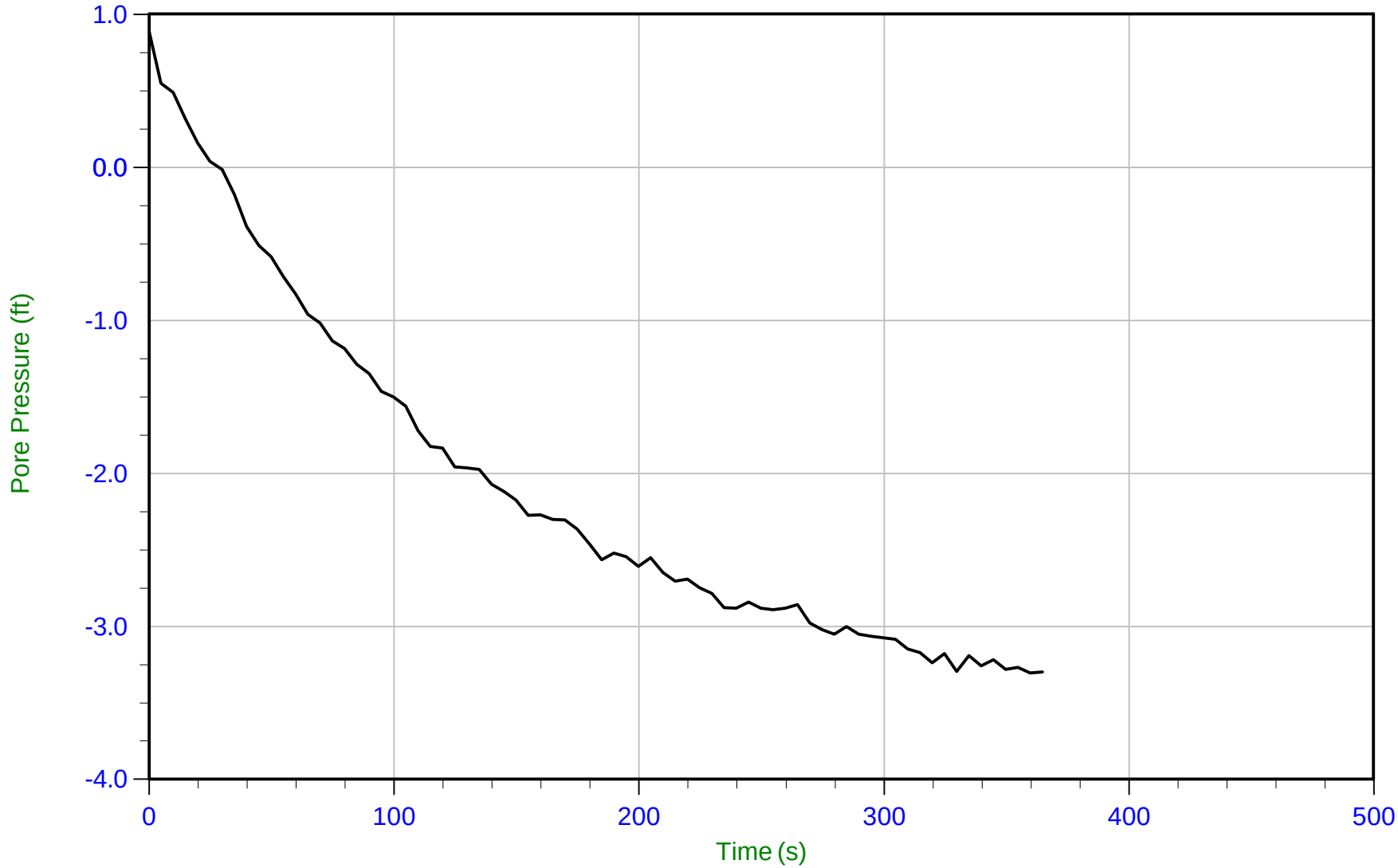
Filename: 13-54044_CP02.PPD U Min: -4.8 ft
Depth: 10.450 m / 34.284 ft U Max: 1.1 ft
Duration: 425.0 s

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 10:31:12
Site: TVA JSF

Sounding: JS-82
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-54044_CP02.PPD
Depth: 16.200 m / 53.149 ft
Duration: 365.0 s

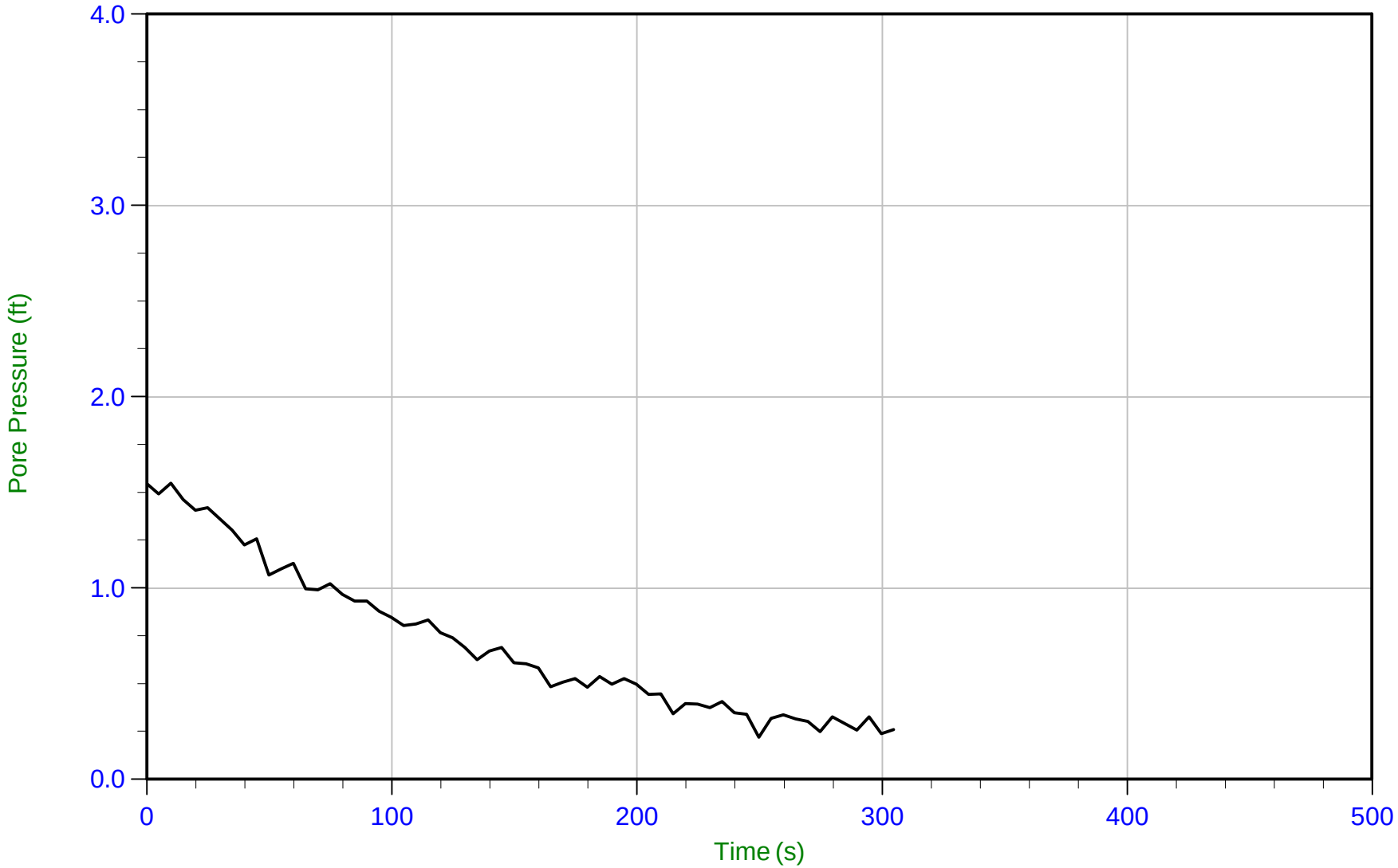
U Min: -3.3 ft
U Max: 0.9 ft

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 10:31:12
Site: TVA JSF

Sounding: JS-82
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

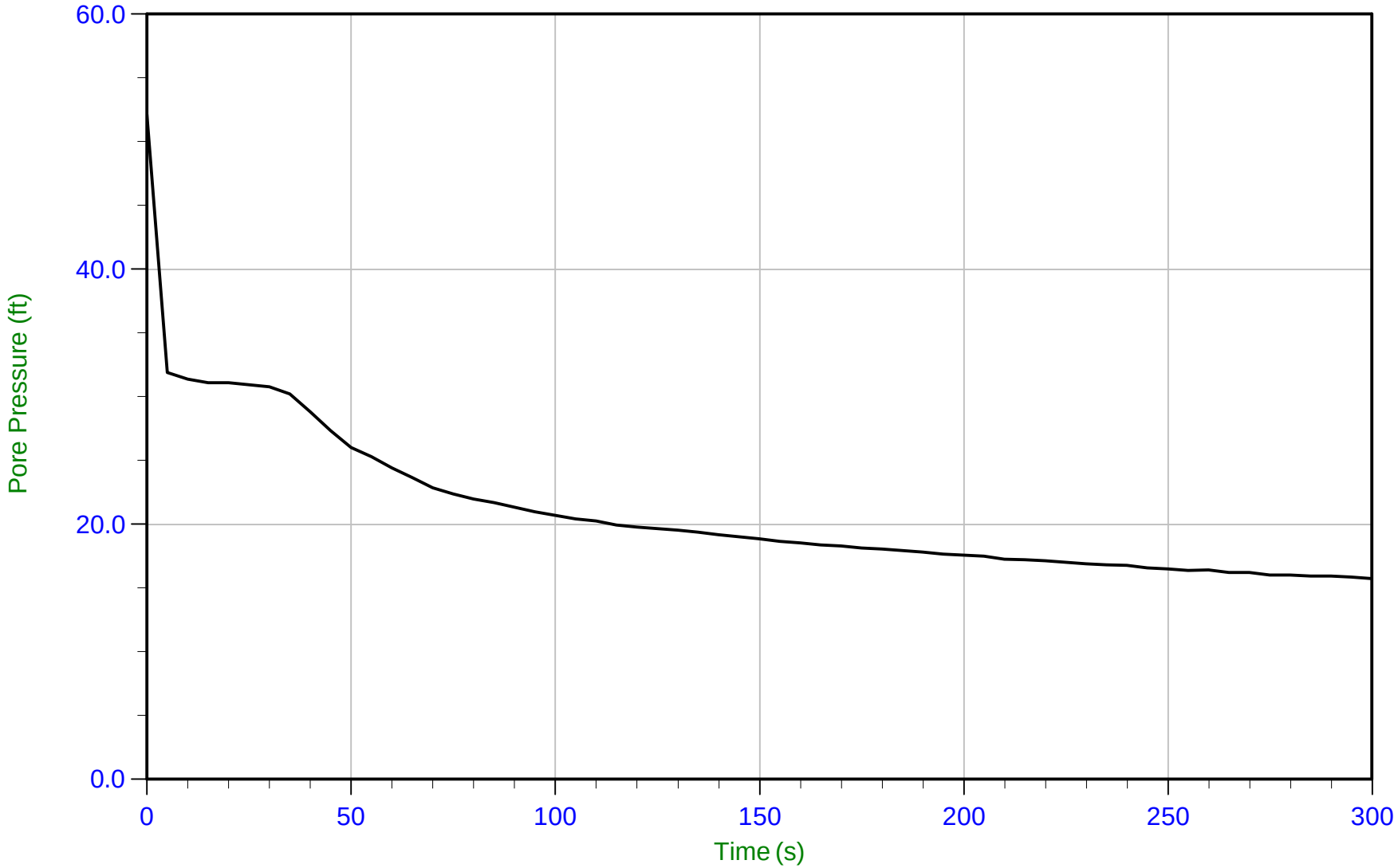
Filename: 13-54044_CP02.PPD U Min: 0.2 ft
Depth: 23.850 m / 78.247 ft U Max: 1.5 ft
Duration: 305.0 s

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 10:31:12
Site: TVA JSF

Sounding: JS-82
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

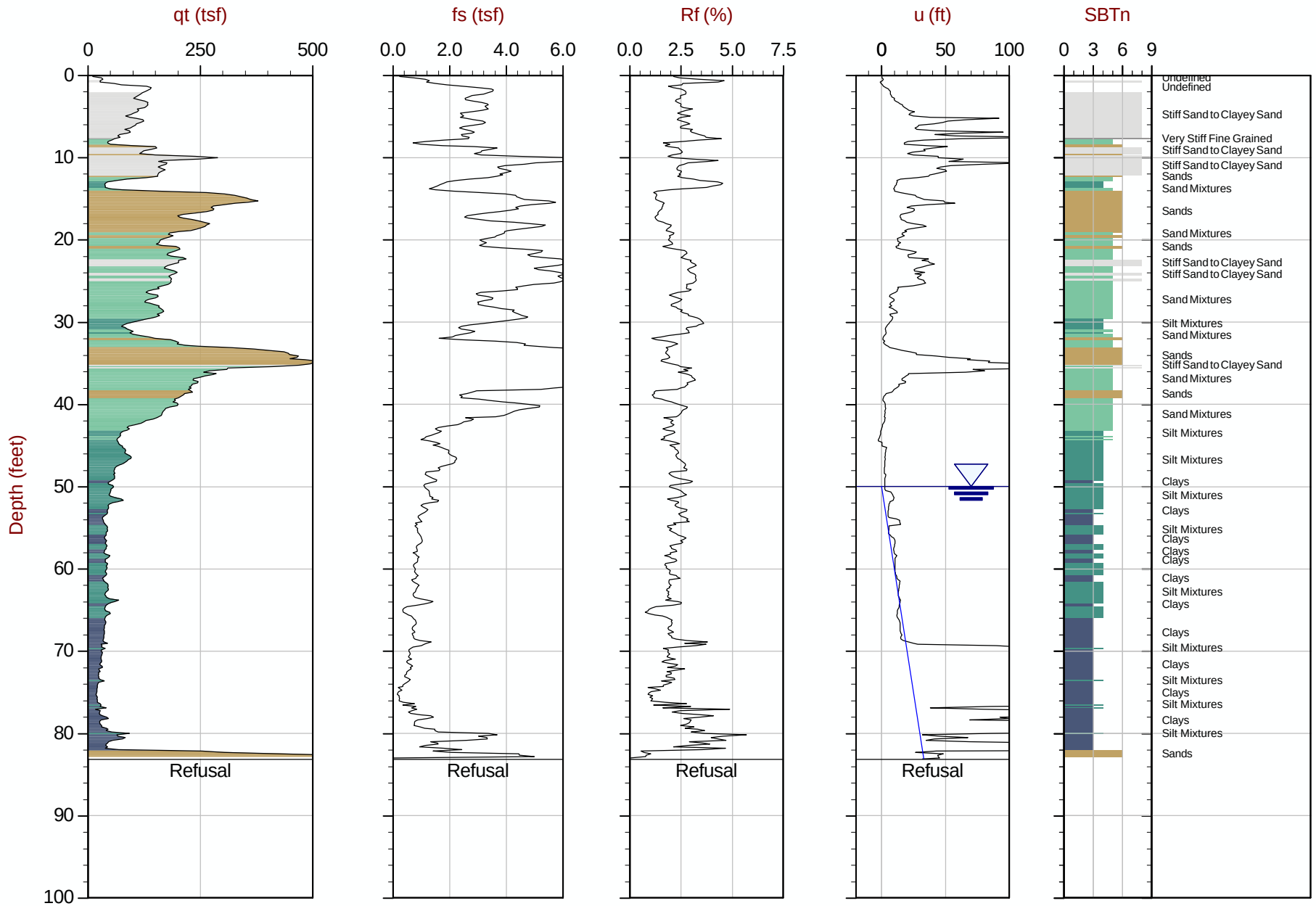
Filename: 13-54044_CP02.PPD U Min: 15.7 ft
Depth: 27.400 m / 89.894 ft U Max: 52.2 ft
Duration: 300.0 s

CONETEC

Stantec

Job No: 13-54044
Date: 07:09:13 12:25
Site: TVA JSF

Sounding: JS-83
Cone: 304:T1500F15U500



Max Depth: 25.350 m / 83.17 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 13-54044_CP03.cor
Unit Wt: SBT Chart Soil Zones

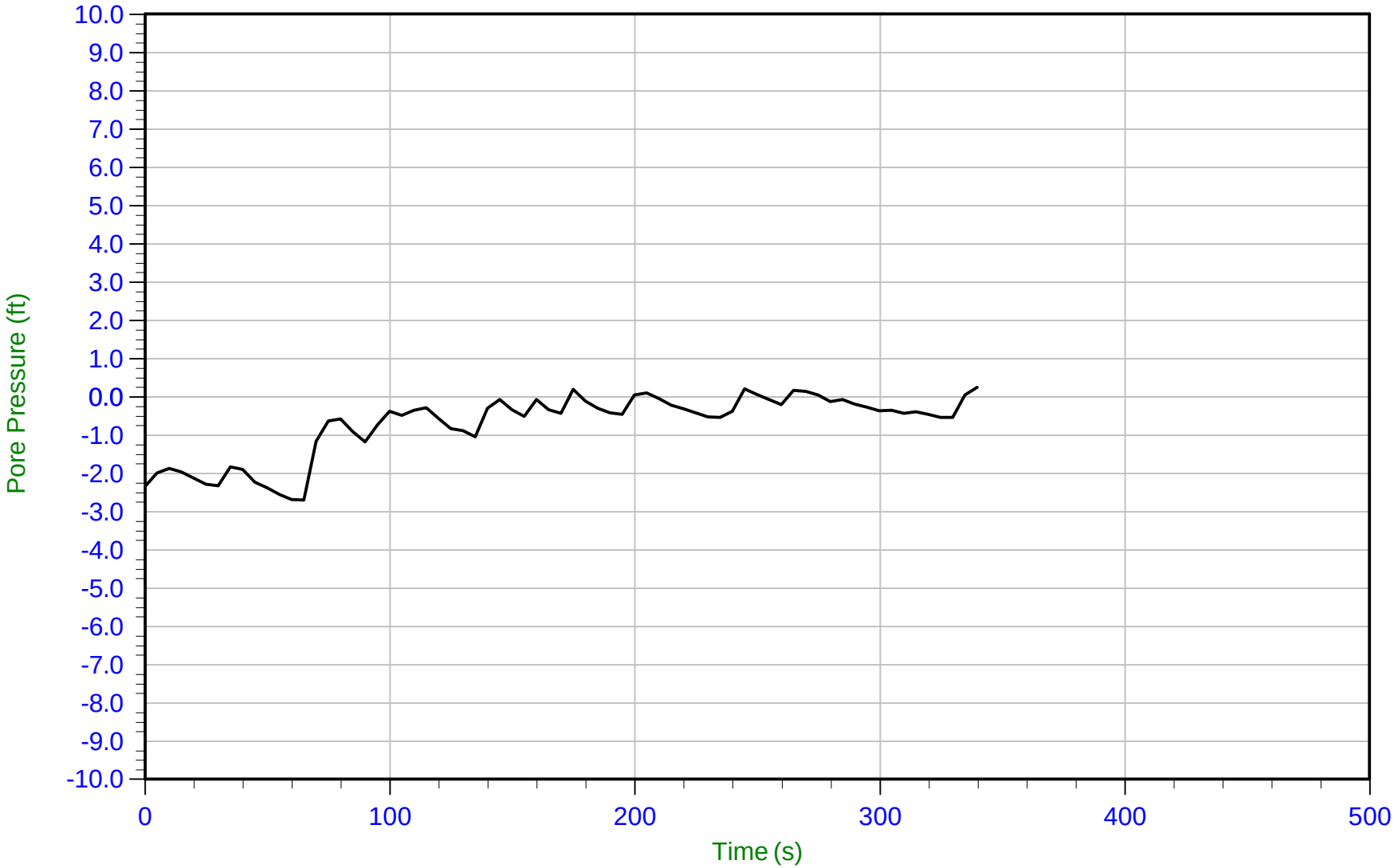
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 36.37593 Long: -82.97096
Page No: 1 of 1

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 12:25:52
Site: TVA JSF

Sounding: JS-83
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-54044_CP03.PPD
Depth: 13.600 m / 44.619 ft
Duration: 340.0 s

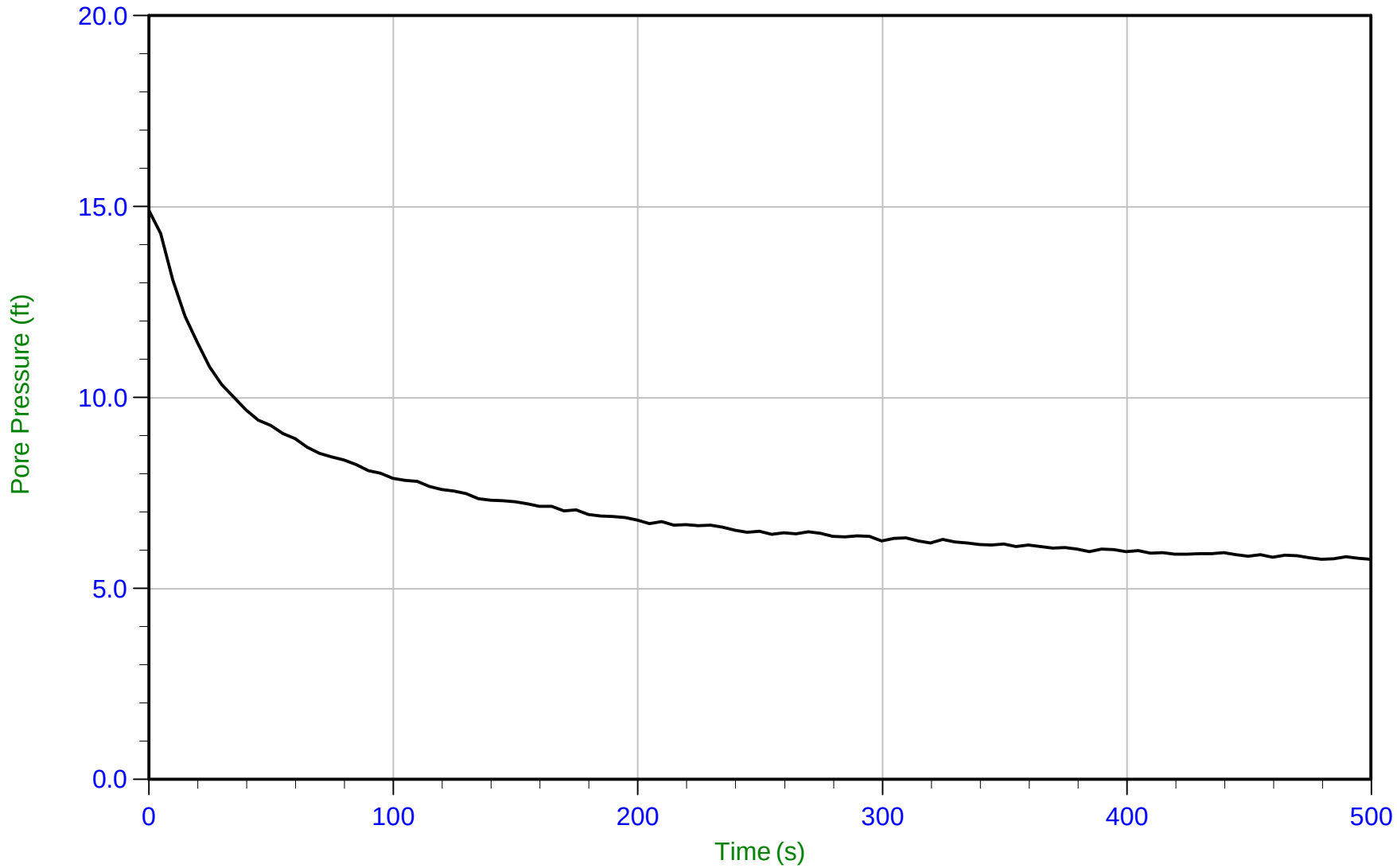
U Min: -2.7 ft
U Max: 0.3 ft

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 12:25:52
Site: TVA JSF

Sounding: JS-83
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

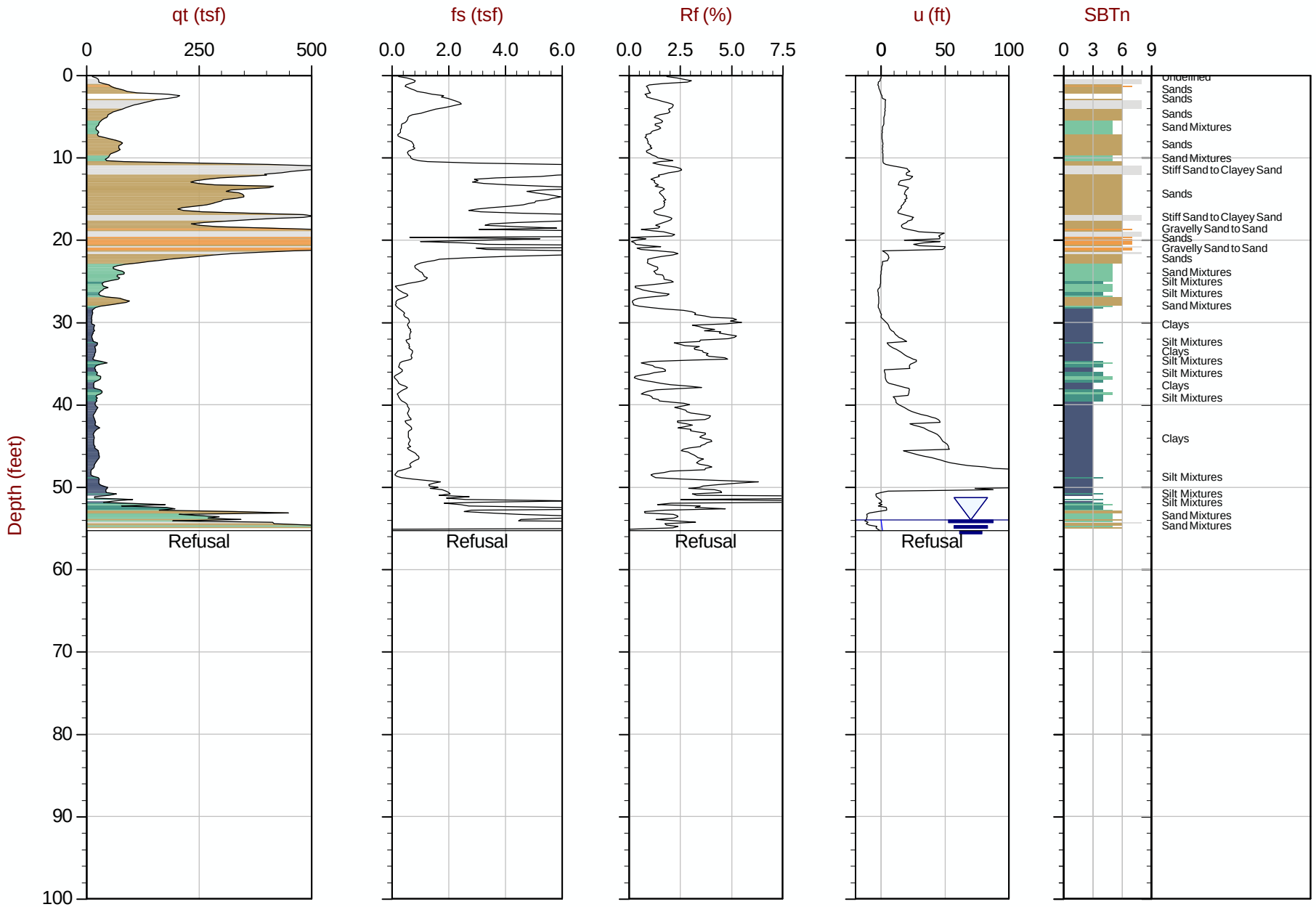
Filename: 13-54044_CP03.PPD U Min: 5.8 ft
Depth: 16.700 m / 54.789 ft U Max: 14.9 ft
Duration: 500.0 s

CONETEC

Stantec

Job No: 13-54044
Date: 07:09:13 15:04
Site: TVA JSF

Sounding: JS-84
Cone: 304:T1500F15U500



Max Depth: 16.850 m / 55.28 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 13-54044_CP04.cor
Unit Wt: SBT Chart Soil Zones

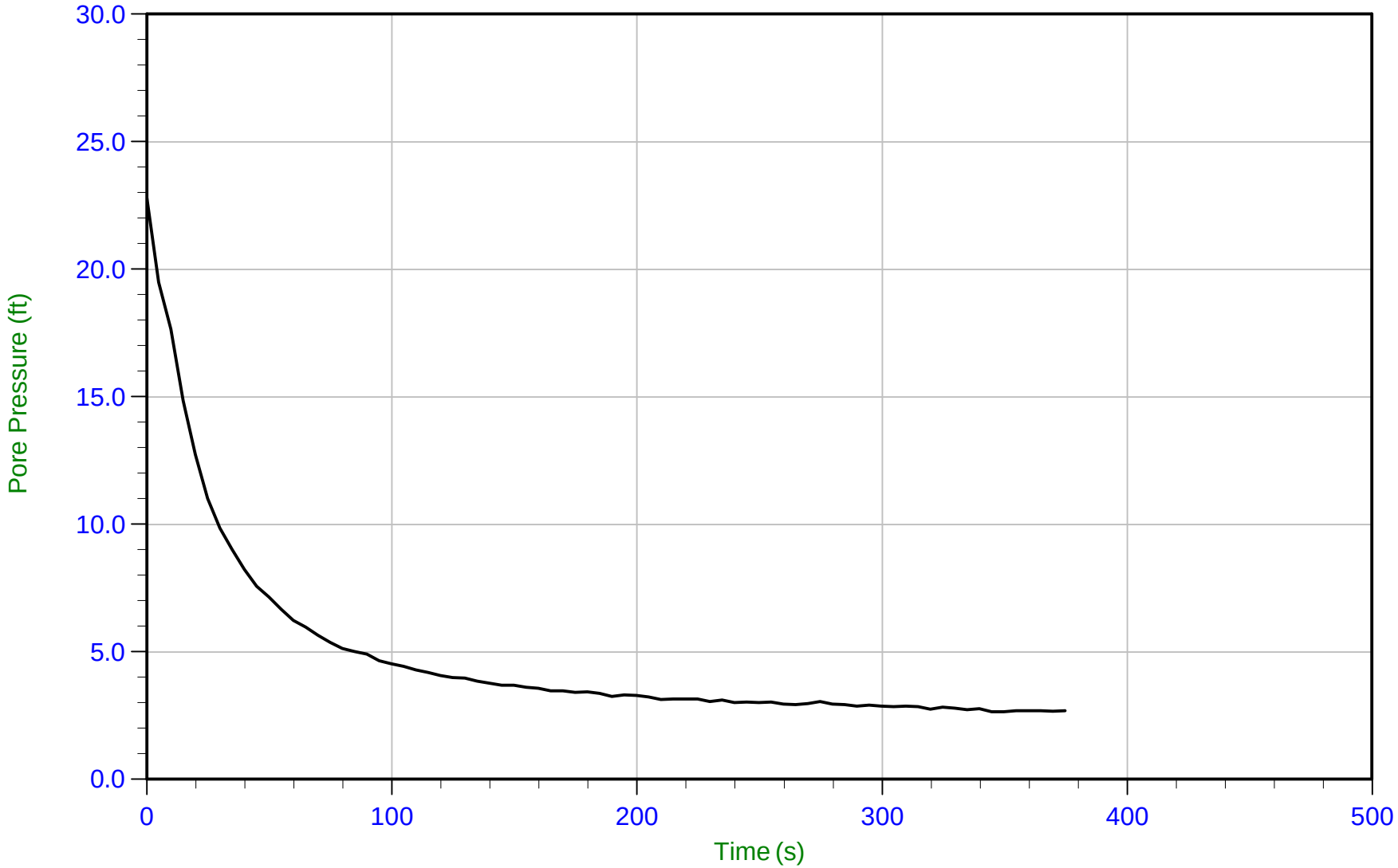
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 36.37597 Long: -82.96758
Page No: 1 of 1

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 15:04:05
Site: TVA JSF

Sounding: JS-84
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-54044_CP04.PPD
Depth: 10.850 m / 35.597 ft
Duration: 375.0 s

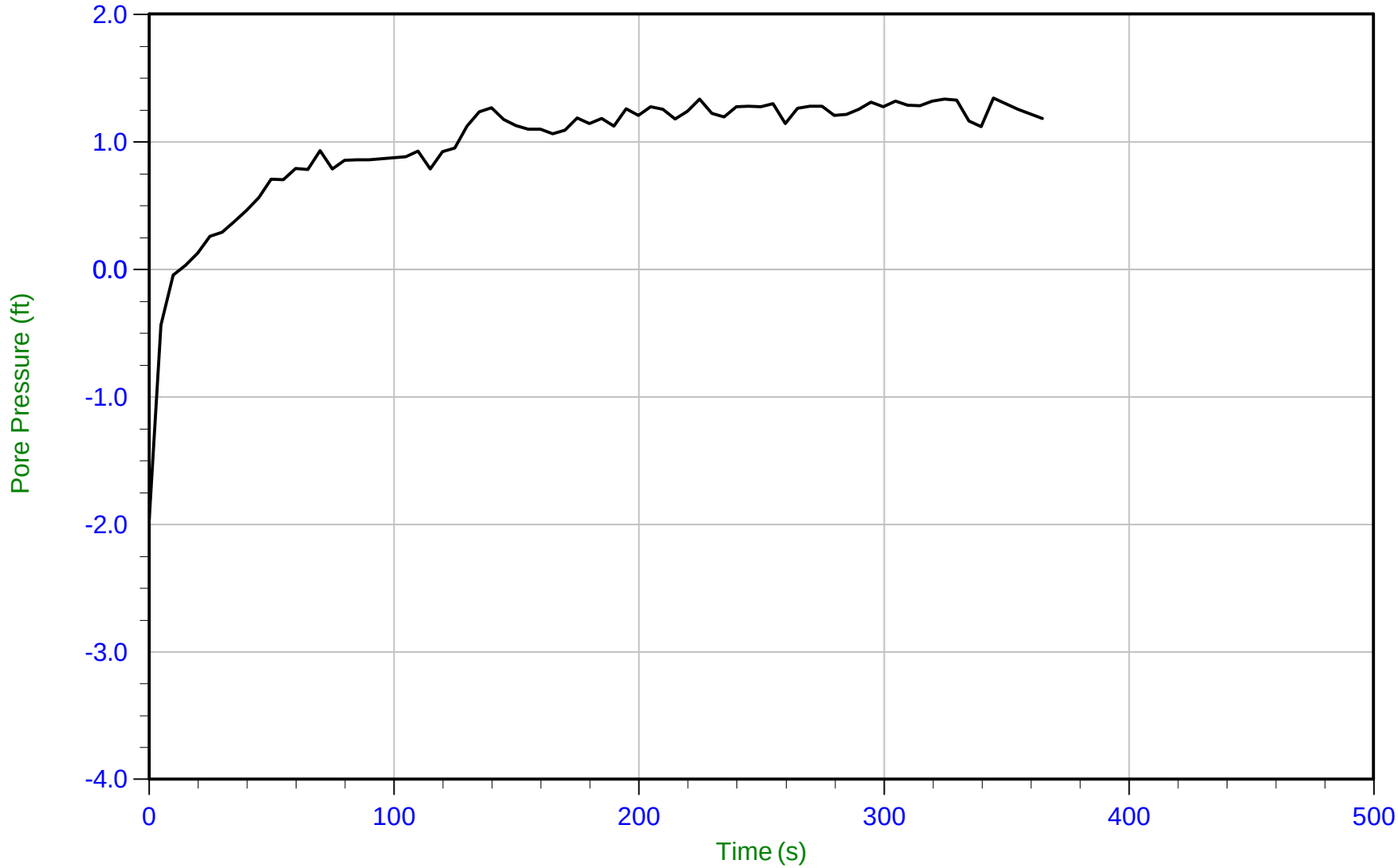
U Min: 2.6 ft
U Max: 22.8 ft

CONETEC

Stantec

Job No: 13-54044
Date: 09-Jul-2013 15:04:05
Site: TVA JSF

Sounding: JS-84
Cone: AD-304
Cone Area: 15 sq cm



Trace Summary:

Filename: 13-54044_CP04.PPD
Depth: 16.850 m / 55.281 ft
Duration: 365.0 s

U Min: -2.0 ft
U Max: 1.3 ft

TVA- John Sevier Fossil Plant (JSF)

Tuesday, July 09, 2013
13-54044

Table 2: Pore Pressure Dissipation Test Summary Table

Sounding	Depth (ft)	Duration (sec)	Comments
JS-81	21.3	1650	
JS-82	34.3	425	
	53.1	365	
	78.2	305	
	89.9	300	
JS-83	44.6	340	
	54.8	500	
JS-84	35.6	375	
	55.3	365	

Appendix C

Boring Logs

SUBSURFACE LOG

Project Number	175661025	Location	N: 736796.96 E: 2892666.90		
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-12**	Total Depth	55.3 ft
County	Hawkins, Tennessee	Surface Elevation	1114.8 ft		
Project Type	Drilling and Piezometer Installation	Date Started	3/26/13	Completed	3/26/13
Supervisor	Sam Lee Driller Master Drillers	Depth to Water	5.9 ft	Date/Time	3/26/13
Logged By	Robert Hatton	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1114.8	0.0	Top of Hole							
		Four bollards, one 3' x 3' x 6" concrete pad, one steel pro-cover, and riser pipe were removed with skid-steer loader. Boring was backfilled with cement-bentonite grout.							Encounterd H2O

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736796.96 E: 2892666.90
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-12** Total Depth 55.3 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Four bollards, one 3' x 3' x 6" concrete pad, one steel pro-cover, and riser pipe were removed with skid-steer loader. Boring was backfilled with cement-bentonite grout. *(Continued)*							
1059.5	55.3	No Refusal / Bottom of Hole							Bottom of hole.

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736741.69 E: 2892570.62
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-13** Total Depth 70.3 ft
County	Hawkins, Tennessee	Surface Elevation	1132.5 ft
Project Type	Drilling and Piezometer Installation	Date Started	3/26/13 Completed 3/26/13
Supervisor	Sam Lee Driller Master Drillers	Depth to Water	62.2 ft Date/Time 3/26/13
Logged By	Robert Hatton	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1132.5	0.0	Top of Hole							
		Four bollards, one 3' x 3' x 6" concrete pad, one steel pro-cover, and riser pipe were removed with skid-steer loader. Boring was backfilled with cement-bentonite grout.							

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736741.69 E: 2892570.62
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-13**
		Total Depth	70.3 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		Four bollards, one 3' x 3' x 6" concrete pad, one steel pro-cover, and riser pipe were removed with skid-steer loader. Boring was backfilled with cement-bentonite grout. *(Continued)*							
									Water observed in existing piezometer.
1062.3	70.3								Bottom of hole. No water observed in open borehole. All 73 ft of PVC was recovered.
1062.2	70.3	No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 737004.19 E: 2892496.33
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-17** Total Depth 52.8 ft
County	Hawkins, Tennessee	Surface Elevation	1114.5 ft
Project Type	Drilling and Piezometer Installation	Date Started	3/26/13 Completed 3/26/13
Supervisor	Sam Lee Driller Master Drillers	Depth to Water	47.0 ft Date/Time 3/26/13
Logged By	Robert Hatton	Depth to Water	N/A Date/Time N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1114.5	0.0	Top of Hole							
		Four bollards, one 3' x 3' x 6" concrete pad, one steel pro-cover, and riser pipe were removed with skid-steer loader. Boring was backfilled with cement-bentonite grout.							

STANTEC\FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number 175661025 | Location N: 737004.19 E: 2892496.33

Project Name JSF - Dry Stack Final Closure | Boring No. **JS-17** | Total Depth 52.8 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Four bollards, one 3' x 3' x 6" concrete pad, one steel pro-cover, and riser pipe were removed with skid-steer loader. Boring was backfilled with cement-bentonite grout. *(Continued)*							
									Bottom of hole. No H2O in boring.
1061.7	52.8	No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736848.84 E: 2892429.18		
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-18**	Total Depth	70.0 ft
County	Hawkins, Tennessee	Surface Elevation	1136.3 ft		
Project Type	Drilling and Piezometer Installation	Date Started	3/26/13	Completed	3/26/13
Supervisor	Sam Lee Driller Master Drillers	Depth to Water	64.3 ft	Date/Time	3/26/13
Logged By	Robert Hatton	Depth to Water	N/A	Date/Time	N/A

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1136.3	0.0	Top of Hole							
		Four bollards, concrete pad, one steel pro-cover were removed with a skid-steer loader. A CME 55 drilling rig was used to overdrill and remove riser pipe and old grout. Boring was backfilled with cement-bentonite grout.							Augered over existing PZ with 4-1/4" HSA.

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736848.84 E: 2892429.18
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-18** Total Depth 70.0 ft

Lithology		Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
Elevation	Depth								
		Four bollards, concrete pad, one steel pro-cover were removed with a skid-steer loader. A CME 55 drilling rig was used to overdrill and remove riser pipe and old grout. Boring was backfilled with cement-bentonite grout. *(Continued)*							
									Encountered H2O
1066.3	70.0								Bottom of hole. All 75 ft of PVC recovered.
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 734639.83 E: 2890303.16
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-73** Total Depth 86.5 ft
County	Hawkins, Tennessee	Surface Elevation	1167.9 ft
Project Type	Drilling and Piezometer Installation	Date Started	3/28/13 Completed 3/29/13
Supervisor	Sam Lee Driller Rob Tillery	Depth to Water	Dry Date/Time 3/29/13
Logged By	Sam Lee	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1167.9	0.0	Top of Hole							
		Compacted Fly Ash, gray to dark gray, loose to medium dense, damp to wet, with occasional bottom ash and gravel		SPT-1	0.0 - 1.5	1.5	2-3-5	--	
				SPT-2	4.0 - 5.5	1.0	4-15-15	--	Boring advanced with 4-1/4" I.D Hollow Stem Augers
				SPT-3	9.0 - 10.5	1.0	6-7-9	--	
				SPT-4	14.0 - 15.5	1.0	6-19-15	--	
1146.4	21.5			SPT-5	20.0 - 21.5	1.0	5-14-16	--	
		Bottom Ash, gray to dark gray and black, dense to very dense, medium to very coarse grained, gray to dark gray, poorly sorted, damp, angular		SPT-6	25.0 - 26.5	1.3	5-15-17	--	
				SPT-7	30.0 - 31.5	1.5	6-12-10	--	
1132.4	35.5			SPT-8	34.0 - 35.5	1.5	16-17-16	--	

STANTEC\FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number 175661025 | Location N: 734639.83 E: 2890303.16

Project Name JSF - Dry Stack Final Closure | Boring No. **JS-73** | Total Depth 86.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Compacted Fly Ash, gray to dark gray, loose to medium dense, damp to wet, with occasional bottom ash and gravel *(Continued)*		SPT-9	40.0 - 41.5	1.5	8-17-25	--	
				SPT-10	45.0 - 46.5	1.5	9-23-8	--	
				SPT-11	50.0 - 51.5	1.5	7-9-11	--	
				SPT-12	55.0 - 56.5	1.5	8-14-10	--	
				SPT-13	60.0 - 61.5	1.5	11-13-11	--	
				SPT-14	65.0 - 66.5	1.5		--	
				SPT-15	70.0 - 71.5	1.5	15-25-16	--	Compacted Fly Ash, gray to dark gray, loose to medium dense, damp to wet, with occasional bottom ash and gravel
				SPT-16	75.0 - 76.5	1.0	5-1-2	--	

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 734639.83 E: 2890303.16
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-73** Total Depth 86.5 ft

Lithology		Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
Elevation	Depth								
1086.4	81.5	Compacted Fly Ash, gray to dark gray, loose to medium dense, damp to wet, with occasional bottom ash and gravel *(Continued)*		SPT-17	80.0 - 81.5	1.5	3-6-9	--	
1082.9	85.0	Lean Clay with Sand and Gravel, brown, very stiff to hard, wet							
1081.4	86.5	Shale, Brown to Gray, moderately hard, very thin bedded, highly weathered (augered)		SPT-18	85.0 - 86.5	1.0	18-20-22	--	
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81\.GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 734855.82 E: 2890660.56
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-74** Total Depth 95.0 ft
County	Hawkins, Tennessee	Surface Elevation	1170.8 ft
Project Type	Drilling and Piezometer Installation	Date Started	5/16/13 Completed 5/17/13
Supervisor	C. Gabriel Driller Bertram G. JR.	Depth to Water	73.3 ft Date/Time 5/21/13
Logged By	C. Gabriel	Depth to Water	76.8 ft Date/Time 5/21/13

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1170.8	0.0	Top of Hole							
1169.3	1.5	Top Soil: Lean clay, light brown, dry to moist, medium stiff.							
		Fly Ash: Dark gray, dry to moist, medium dense to dense.		SPT-1	4.0 - 5.5	1.4	3-7-8	--	
				SPT-2	9.0 - 10.5	1.5	8-13-13	--	
				SPT-3	14.0 - 15.5	1.5	9-25-40	--	
				SPT-4	19.0 - 20.5	1.5	6-14-21	--	
				SPT-5	24.0 - 25.5	1.5	7-13-20	--	
				SPT-6	29.0 - 30.5	1.5	5-6-10	--	
				SPT-7	34.0 - 35.5	1.2	7-21-23	--	

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

Project Number 175661025 | Location N: 734855.82 E: 2890660.56

Project Name JSF - Dry Stack Final Closure | Boring No. **JS-74** | Total Depth 95.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fly Ash: Dark gray, dry to moist, medium dense to dense. *(Continued)*		SPT-8	39.0 - 40.5	1.4	7-11-13	--	
				SPT-9	44.0 - 45.5	1.5	3-6-9	--	
				SPT-10	49.0 - 50.5	1.2	10-10-10	--	
				SPT-11	54.0 - 55.5	1.5	7-22-26	--	
				SPT-12	59.0 - 60.5	1.5	7-16-15	--	
				SPT-13	64.0 - 65.5	1.5	10-22-25	--	
1101.1	69.7			SPT-14	69.0 - 70.5	1.5	7-10-22	--	
1097.8	73.0	Fat clay, dark brown, moist, stiff with traces of dark gray Bottom Ash		ST-1	70.5 - 72.5	2.0		--	Shelby tube was bent.
		Wet sluiced ash: Dark gray, wet, loose to medium dense.		SPT-15	74.0 - 75.5	1.4	1-2-2	--	

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 734855.82 E: 2890660.56
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-74** Total Depth 95.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1091.4	79.4								
		Sandy clay, yellowish brown, moist, stiff with coal fragments		SPT-16	79.0 - 80.5	1.5	3-6-8	--	
				ST-2	80.5 - 82.5	1.7		--	Shelby tube was bent as it encoutered an underlying alluvium sandy gravel layer.
1086.3	84.5								
1086.0	84.8	Alluvium sand with gravel, light brown, wet, loose		SPT-17	84.0 - 85.5	1.2	4-4-8	--	
		Lean clay, light brown, moist, stiff, with dark brown weathered shale fragments							
1081.8	89.0								
1080.8	90.0	Shale, dark brown, soft, brittle and fragmented, very thin bedded, highly weathered.		SPT-18	89.0 - 90.5	0.9	48-106--	--	Drilled with 6" water roller bit. Bottom of hole was cleaned using sand bailing.
		Limestone, dark brown to gray, hard, micro-grained.							
1075.8	95.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81\.GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 735028.37 E: 2891089.42
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-75** Total Depth 120.1 ft
County	Hawkins, Tennessee	Surface Elevation	1194.7 ft
Project Type	Drilling and Piezometer Installation	Date Started	5/29/13 Completed 5/30/13
Supervisor	C. Gabriel Driller Bertram G.	Depth to Water	96.3 ft Date/Time 5/29/13
Logged By	C. Gabriel	Depth to Water	N/A Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1194.7	0.0	Top of Hole							
1193.2	1.5	Top Soil: Lean clay, light brown, dry, medium stiff.							Topsoil with grass vegetation cover, 18" thick
		Fly Ash: gray to dark gray, dry to moist, loose to medium dense.		SPT-1	4.0 - 5.5	1.4	6-7-10	--	
				SPT-2	9.0 - 10.5	1.5	8-16-18	--	
				SPT-3	14.0 - 15.5	1.5	9-16-19	--	
				SPT-4	19.0 - 20.5	1.3	8-10-10	--	
				SPT-5	24.0 - 25.5	1.4	7-11-15	--	
1166.7	28.0								
		Bottom Ash: Gray to dark gray with fragments of coal. moist to wet, loose to medium dense, fine to medium coarse grained.		SPT-6	29.0 - 30.5	1.5	4-9-10	--	
				SPT-7	34.0 - 35.5	1.4	5-6-8	--	

STANTEC/FMSM_LEGACY BORINGS\JS-73_TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

Project Number	175661025	Location	N: 735028.37 E: 2891089.42
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-75** Total Depth 120.1 ft

Lithology		Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
Elevation	Depth								
		Bottom Ash: Gray to dark gray with fragments of coal. moist to wet, loose to medium dense, fine to medium coarse grained. *(Continued)*		ST-1	36.0 - 38.5	1.4		--	
				SPT-8	39.0 - 40.5	0.1	1-2-2	--	
1152.7	42.0								
		Fly Ash: gray to dark gray with small fragments of coal, dry to damp, loose.		SPT-9	44.0 - 45.5	1.4	6-12-15	--	
				SPT-10	49.0 - 50.5	1.3	4-9-13	--	
				SPT-11	54.0 - 55.5	1.2	7-16-32	--	
				SPT-12	59.0 - 60.5	1.4	7-14-19	--	
1131.7	63.0								
		Bottom Ash: Gray to dark gray with fragments of coal. Moist to wet, dense, fine to medium coarse grained.		SPT-13	64.0 - 65.5	1.4	9-18-20	--	
				SPT-14	69.0 - 70.5	1.5	7-13-19	--	
				SPT-15	74.0 - 75.5	1.5	9-15-20	--	

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81\.GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

Project Number	175661025	Location	N: 735028.37 E: 2891089.42
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-75** Total Depth 120.1 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Bottom Ash: Gray to dark gray with fragments of coal. Moist to wet, dense, fine to medium coarse grained. *(Continued)*		SPT-16	79.0 - 80.5	1.5	10-12-18	--	
				SPT-17	84.0 - 85.5	1.5	4-14-25	--	
1104.6	90.1			SPT-18	89.0 - 90.5	1.5	5-10-14	--	Bottom 0.4' of SPT-18 is stiff reddish brown clay
1102.7	92.0	Fat Clay: Dark brown, wet, stiff. Mixed with sluiced Ash.		ST-2	91.0 - 93.5	2.2		--	Bottom edge of tube was slightly kinked during the drive.
		Sluiced Ashed: Gray to dark gray, wet, loose to medium dense, very fine grained.		SPT-19	94.0 - 95.5	1.3	4-8-11	--	
				SPT-20	99.0 - 100.5	1.4	1-1-5	--	
1090.5	104.2								
1089.5	105.2	Fat Clay: Reddish brown, wet, stiff with a few veins of ash.		SPT-21	104.0 - 105.5	1.4	10-21-27	--	
		Sandy Gravel: reddish brown, well rounded, poorly		ST-3	109.0 - 111.5	1.6		--	Tube failed but sample is preserved for other purposes.
1080.5	114.2								
1080.1	114.6	Weathered Shale: reddish brown, moderately hard, thin bedded, moderately weathered.		SPT-22	114.0 - 115.5	0.6	106----	--	Weathered Shale was augered to 115.0' depth.

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81\.GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

Project Number	175661025	Location	N: 735028.37 E: 2891089.42
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-75** Total Depth 120.1 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1074.6	120.1	Limestone: Light to dark gray, micro grained, moderately hard. *(Continued)*							Advanced with 6" roller bit. No water return observed.
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81\.GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 735085.46 E: 2891876.50		
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-76**	Total Depth	19.2 ft
County	Hawkins, Tennessee	Surface Elevation	1156.6 ft		
Project Type	Drilling and Piezometer Installation	Date Started	4/9/13	Completed	4/10/13
Supervisor	C. Gabriel Driller Shane Haniford	Depth to Water	Dry	Date/Time	4/10/13
Logged By	C. Gabriel	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1156.6	0.0	Top of Hole							
1155.7	0.8	Top soil. Lean clay, reddish brown, moist, medium stiff, with isolated chert.							Topsoil with grass vegetation cover. Thickness varies from 0.5 to 0.8 feet.
		Fly Ash: Dark gray, dry to moist, medium dense to dense.							Hole was advanced using a vacuum excavation truck.
1138.6	18.0								
1137.4	19.2	Crushed stone, light to dark gray, 1.5 in to 2.0 in diameter, moist, densly compacted							Top of HDPE underdrain pipe was encountered at depth of 19.2'
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 735289.04 E: 2892099.79		
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-77**	Total Depth	21.2 ft
County	Hawkins, Tennessee	Surface Elevation	1163.3 ft		
Project Type	Drilling and Piezometer Installation	Date Started	4/2/13	Completed	4/3/13
Supervisor	C. Gabriel Driller Shane Haniford	Depth to Water	Dry	Date/Time	4/3/13
Logged By	C. Gabriel	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1163.3	0.0	Top of Hole							
1162.5	0.8	Fly Ash: Dark gray, dry to moist, medium dense to dense.							Topsoil with grass vegetation cover. Thickness varies from 0.5 to 0.8 feet. Hole was advanced using a vacuum excavation truck.
1142.7	20.6								Top of HDPE underdrain pipe was encountered at depth of 21.15'
1142.1	21.2	Crushed stone, light to dark gray, 1.5 in to 2.0 in diameter, moist, densely compacted							
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73_TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 735569.13 E: 2892242.41		
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-78**	Total Depth	9.6 ft
County	Hawkins, Tennessee	Surface Elevation	1152.7 ft		
Project Type	Drilling and Piezometer Installation	Date Started	3/28/13	Completed	4/3/13
Supervisor	C. Gabriel Driller Shane Haniford	Depth to Water	Dry	Date/Time	4/3/13
Logged By	C. Gabriel	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1152.7	0.0	Top of Hole							
1152.2	0.5	Top soil. Lean clay, reddish brown, moist, medium stiff, with isolated chert.							Topsoil with grass vegetation cover. Thickness varies from 0.5 to 0.8 feet.
		Fly Ash: Dark gray, dry to moist, medium dense to dense.							Hole was advanced using a vacuum excavation truck.
1143.7	9.0								
1143.1	9.6	Crushed stone, light to dark gray, 1.5 in to 2.0 in diameter, moist, densly compacted							Top of HDPE underdrain pipe was encountered at depth of 9.6'
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 735906.44 E: 2892319.96		
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-79**	Total Depth	7.6 ft
County	Hawkins, Tennessee	Surface Elevation	1154.6 ft		
Project Type	Drilling and Piezometer Installation	Date Started	3/27/13	Completed	3/28/13
Supervisor	C. Gabriel Driller Shane Haniford	Depth to Water	Dry	Date/Time	3/28/13
Logged By	C. Gabriel	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1154.6	0.0	Top of Hole							
1154.0	0.6	Top soil. Lean clay, reddish brown, moist, medium stiff, with isolated chert.							Topsoil with grass vegetation cover. Thickness varies from 0.5 to 0.8 feet.
		Fly Ash: Dark gray, dry to moist, medium dense to dense.							Hole was advanced using a vacuum excavation truck.
1147.6	7.0								
1147.0	7.6	Crushed stone, light to dark gray, 1.5 in to 2.0 in diameter, moist, densly compacted							Top of HDPE underdrain pipe was encountered at depth of 7.6'
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736096.602 E: 2892481.88		
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-80**	Total Depth	8.5 ft
County	Hawkins, Tennessee	Surface Elevation	1154.5 ft		
Project Type	Drilling and Piezometer Installation	Date Started	3/27/13	Completed	3/27/13
Supervisor	C. Gabriel Driller Shane Haniford	Depth to Water	Dry	Date/Time	3/27/13
Logged By	C. Gabriel	Depth to Water	N/A	Date/Time	N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1154.5	0.0	Top of Hole							
1153.9	0.6	Top soil. Lean clay, reddish brown, moist, medium stiff, with isolated chert.							Topsoil with grass vegetation cover. Thickness varies from 0.5 to 0.8 feet. Hole was advanced using a vacuum excavation truck.
1148.2	6.3	Fly Ash: Dark gray, dry to moist, medium dense to dense.							
1146.0	8.5	Gravel, 1.5 in to 2.0 in diameter. Gray crushed stone, moist, meduim to high density							Top of HDPE underdrain pipe was encountered at depth of 8.5'
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736454.56	E: 2892322.12	
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-81**	Total Depth	100.0 ft
County	Hawkins, Tennessee	Surface Elevation	1156.9 ft		
Project Type	Drilling and Piezometer Installation	Date Started	7/11/13	Completed	7/12/13
Supervisor	Sam Lee	Driller Bertram G	Depth to Water	Dry	Date/Time 7/12/13
Logged By	C. Gabriel		Depth to Water	N/A	Date/Time N/A

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
1156.9	0.0	Top of Hole							
1156.4	0.5	Top soil. Lean clay, reddish brown, moist, medium stiff, with isolated chert.							
		Fly Ash: light gray, moist, soft to very soft.							
1138.9	18.0								
		Fly Ash: light gray, moist to wet, stiff to very stiff							Perched Water table on top of bottom ash
1131.9	25.0								
		Crushed limestone with traces of lean brown clay mixed with fly ash							
1126.9	30.0								
		Bottom Ash: dark gray to black, dry to moist, stiff to very stiff							

STANTEC/FMSM_LEGACY BORINGS\JS-73_TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736454.56 E: 2892322.12
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-81** Total Depth 100.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1118.9	38.0								
		Fly Ash: light gray, moist to wet, stiff to very stiff.							

STANTEC/FMSM_LEGACY BORINGS\(JS-73 TO 81).GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175661025	Location	N: 736454.56 E: 2892322.12
Project Name	JSF - Dry Stack Final Closure	Boring No.	**JS-81** Total Depth 100.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fly Ash: light gray, moist to wet, stiff to very stiff. *(Continued)*							
1061.9	95.0								
		Limestone: Light to dark gray, micro grained, moderately hard.							
1056.9	100.0								
		No Refusal / Bottom of Hole							

STANTEC/FMSM_LEGACY BORINGS\JS-73 TO 81\.GPJ FMSM-GRAPHIC LOG.GDT 8/30/13

SUBSURFACE LOG

Project Number	175569038	Location	Rogersville, TN
Project Name	John Sevier Ash Disposal Areas	Boring No.	**JS-31** Total Depth 98.8 ft
County	Hawkins	Surface Elevation	1151.1 ft
Project Type	Geotechnical Exploration	Date Started	5/17/09 Completed 5/17/09
Supervisor	R. Mehnert Driller G. Thompson	Depth to Water	55.5 ft Date/Time 5/17/09
Logged By	R. Mehnert	Depth to Water	-- Date/Time --

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
1151.1	0.0	Top of Hole							
		SOIL 4: Compacted Fly Ash, gray to dark gray, very loose to very dense, damp to wet, with clay layers, and areas of bottom ash		SPT-1	0.0 - 1.5	1.5	2-3-3	20	Boring advanced with 4-1/4 I.D. Hollow Stem Augers
				SPT-2	1.5 - 3.0	0.8	3-3-4	20	
				SPT-3	3.0 - 4.5	1.5	1-3-2	20	
				SPT-4	4.5 - 6.0	0.9	2-1-2	20	Installed 98.5' of slope inclinometer casing. Casing protected with steel cover set in concrete pad. Boring grouted from 0 to 98.5'.
				SPT-5	6.0 - 7.5	1.1	1-1-2	18	
				SPT-6	7.5 - 9.0	1.2	2-2-2	19	
				SPT-7	9.0 - 10.5	1.5	3-4-4	18	
				SPT-8	10.5 - 12.0	1.5	2-5-6	26	
				SPT-9	12.0 - 13.5	1.5	3-4-6	29	
				SPT-10	13.5 - 15.0	1.4	5-13-17	16	
				SPT-11	15.0 - 16.5	1.5	12-12-16	20	
				BAG-1	13.5 - 18.0			--	
				SPT-12	16.5 - 18.0	1.1	5-17-16	15	
				SPT-13	18.0 - 19.5	0.1	4-5-5	13	
				SPT-14	19.5 - 21.0	1.5	2-1-2	14	
				SPT-15	21.0 - 22.5	1.5	4-8-13	26	
				SPT-16	22.5 - 24.0	1.5	4-14-17	19	
				SPT-17	24.0 - 25.5	1.5	5-10-12	20	
				SPT-18	25.5 - 27.0	1.4	3-9-10	19	
				SPT-19	27.0 - 28.5	1.5	8-8-13	18	
				SPT-20	28.5 - 30.0	1.5	5-7-9	10	
				SPT-21	30.0 - 31.5	1.5	4-5-17	19	
				SPT-22	31.5 - 33.0	1.5	9-27-29	20	
				SPT-23	33.0 - 34.5	1.4	10-33-50	16	
				SPT-24	34.5 - 36.0	1.2	10-30-50+	18	

STANTEC/FMSM_LEGACY_JOHN SEVIER ASH DISPOSAL AREAS.GPJ FMSM-GRAPHIC LOG.GDT 1/23/10

Project Number 175569038 Location Rogersville, TN

Project Name John Sevier Ash Disposal Areas Boring No. **JS-31** Total Depth 98.8 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		SOIL 4: Compacted Fly Ash, gray to dark gray, very loose to very dense, damp to wet, with clay layers, and areas of bottom ash *(Continued)*		SPT-25	36.0 - 37.5	0.7	33-50+	18	
				SPT-26	37.5 - 39.0	1.5	6-13-14	18	
				SPT-27	39.0 - 40.5	1.5	6-14-19	21	
				SPT-28	40.5 - 42.0	1.5	11-21-21	21	
				SPT-29	42.0 - 43.5	0.8	14-50+	16	
				SPT-30	43.5 - 45.0	1.5	12-14-16	19	
				SPT-31	45.0 - 46.5	1.4	9-10-14	26	
				SPT-32	46.5 - 48.0	1.5	10-13-14	28	
				SPT-33	48.0 - 49.5	1.5	5-6-8	28	
				BAG-2	48.0 - 51.0			--	
				SPT-34	49.5 - 51.0	1.4	6-10-8	24	
				SPT-35	51.0 - 52.5	1.5	7-7-8	24	
				SPT-36	52.5 - 54.0	1.4	5-5-7	26	
				SPT-37	54.0 - 55.5	1.5	4-3-4	36	
1094.1	57.0			SPT-38	55.5 - 57.0	1.5	5-2-2	41	
		SOIL 5: Sluiced Fly Ash, gray to dark gray, wet, very loose		SPT-39	57.0 - 58.5	1.5	WoR-WoR-1	35	
				SPT-40	58.5 - 60.0	1.3	WoR	39	
				SPT-41	60.0 - 61.5	1.1	1-1-1	50	
				SPT-42	61.5 - 63.0	1.5	WoR-2-1	46	
				SPT-43	63.0 - 64.5	1.1	WoH	44	
				SPT-44	64.5 - 66.0	1.0	WoR	40	
				SPT-45	66.0 - 67.5	1.5	WoR	38	
				SPT-46	67.5 - 69.0	1.4	WoR	40	
				SPT-47	69.0 - 70.5	1.5	WoR-1-2	39	
				SPT-48	70.5 - 72.0	1.2	WoR	49	
1078.3	72.8			SPT-49	72.0 - 73.5	1.5	WoR-6-8	33	
				SPT-50	73.5 - 75.0	1.4	5-10-12	22	
				SPT-51	75.0 - 76.5	1.5	5-7-10	21	
				SPT-52	76.5 - 78.0	1.1	8-8-10	21	

STANTEC/FMSM_LEGACY_JOHN SEVIER ASH DISPOSAL AREAS.GPJ FMSM-GRAPHIC LOG.GDT 1/23/10

SUBSURFACE LOG

Project Number 175569038 | Location Rogersville, TN

Project Name John Sevier Ash Disposal Areas | Boring No. **JS-31** | Total Depth 98.8 ft

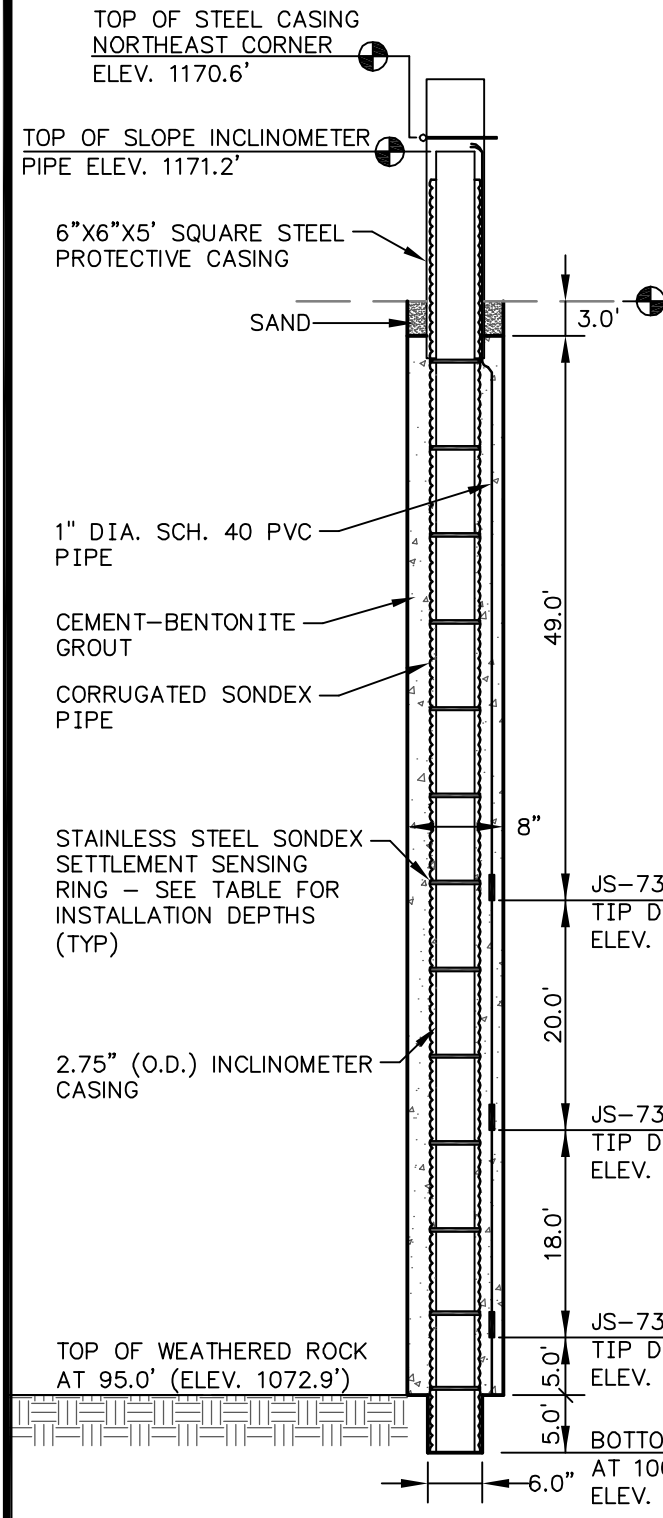
Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		SOIL 2: Lean Clay with Sand and Gravel, light brown to brown , medium stiff to very stiff, damp to moist, with occassional manganese concretions *(Continued)*		SPT-53	78.0 - 79.5	1.5	4-6-7	22	
				SPT-54	79.5 - 81.0	1.5	4-5-7	23	
1068.6	82.5			SPT-55	81.0 - 82.5	1.5	3-3-4	24	
				SPT-56	82.5 - 84.0	1.3	1-2-2	23	
		SOIL 7: Sand, light brown to brown, loose, medium to coarse grained, wet		SPT-57	84.0 - 85.5	0.9	2-3-3	26	
1064.1	87.0			SPT-58	85.5 - 87.0	0.9	3-4-4	24	
				SPT-59	87.0 - 88.5	1.1	5-13-22	13	
1062.2	88.9	SOIL 6: Gravel with Sand, gray to brown to tan, dense, poorly sorted, wet		SPT-60	88.5 - 90.0	0.4	12-13-26	13	
				SPT-61	90.0 - 90.5	0.4	50+	13	
		Shale, brown to gray, soft to moderately hard, very thin bedded, water stained, heavily weathered (augered)							
1052.3	98.8								
		No Refusal / Bottom of Hole Top of Rock = 88.9 Elevation (1062.2)							

STANTEC/FMSM_LEGACY JOHN SEVIER ASH DISPOSAL AREAS.GPJ FMSM-GRAPHIC LOG.GDT 1/23/10

Appendix D

Instrument Details

PROJECT: JSF – FINAL CLOSURE	
HOLE #: JS–73	DATE: 04/10/2013
NORTHING: 734,639.8	EASTING: 2,890,303.2
DRILLER: BERTRAM G.	SUPERVISORS: TONY S. CHRISPIN G.



SONDEX SENSING RING ID	DEPTH FROM TOP OF PIPE (FT)	ELEVATION (FT)
JS73–A	29.72	1141.48
JS73–B	39.03	1132.17
JS73–C	50.65	1120.55
JS73–D	60.80	1110.40
JS73–E	67.16	1104.04
JS73–F	74.30	1096.90
JS73–G	81.54	1089.66
JS73–H	89.39	1081.81
JS73–I	97.97	1073.23
JS73–J	102.80	1068.40
JS73–K	103.10	1068.10

NOTES:

1. INSTALLED ON 04/10/2013.
2. BORING ADVANCED WITH 4.25" (I.D.) AND 6.25" (I.D.) HOLLOW STEM AUGERS AND HQ WIRELINE ROCK CORING TOOLS.
3. REFER TO BORING LOG FOR OVERBURDEN AND BEDROCK STRATIGRAPHY.
4. LOCATIONS PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES. HORIZONTAL DATUM: NAD27, PROJECTION: GA MERCATOR WEST, VERTICAL DATUM: NGVD 29.

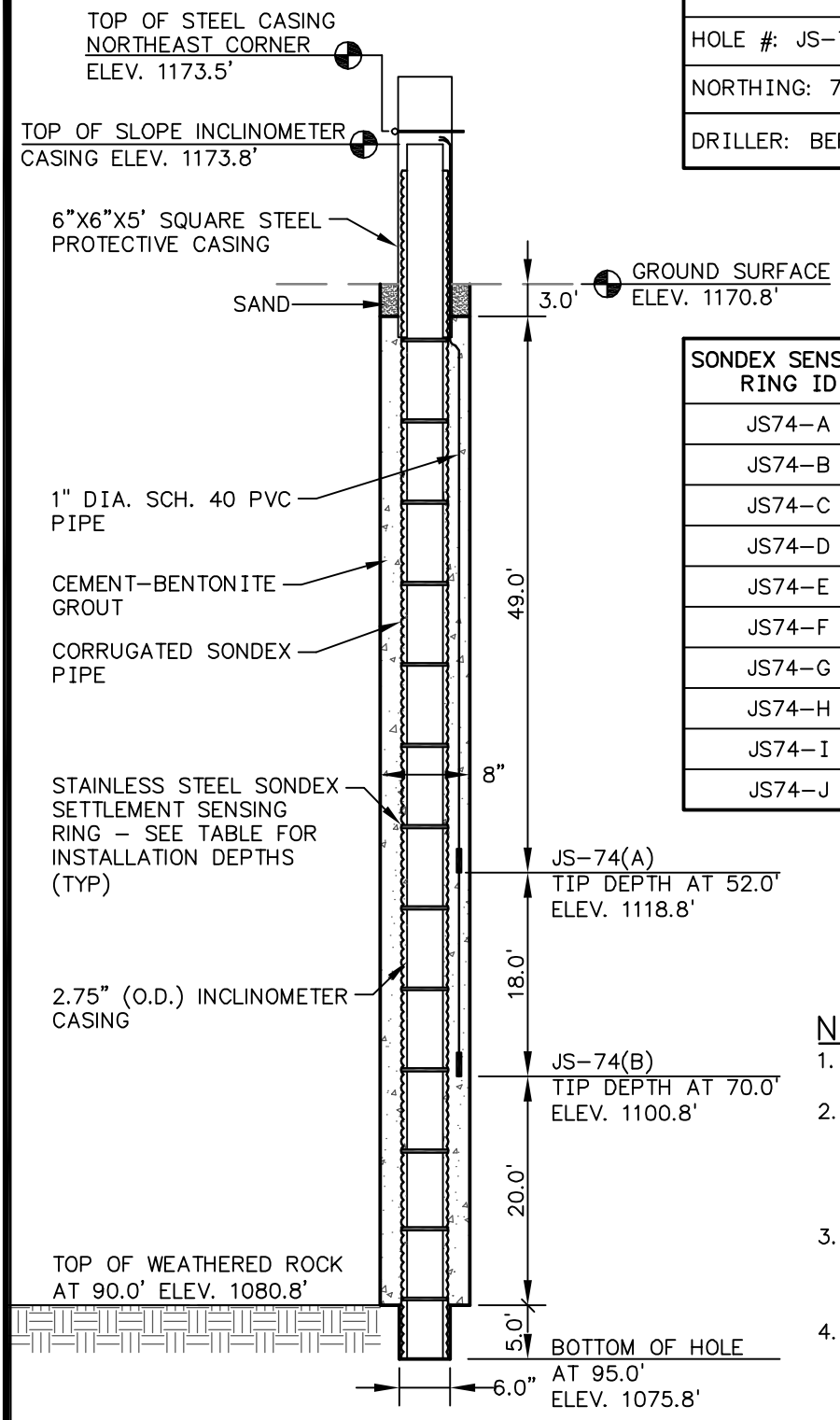
PLOT DATE: 08/14/2013 USER: JOHNSON, TRACY
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SLOPE INCLINOMETER INSTALLATION FORM
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HAWKINS COUNTY, TENNESSEE

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000
www.stantec.com

DRAWN BY	PJB	DATE	AUG., 2013	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	165661025	1.	3.	1 OF 1
CHECKED BY	–	SCALE	NTS	2.	4.	

PROJECT: JSF – FINAL CLOSURE	
HOLE #: JS–74	DATE: 05/23/2013
NORTHING: 734,855.8	EASTING: 2,890,660.6
DRILLER: BERTRAM G.	SUPERVISOR: CHRISPIN G.



SONDEX SENSING RING ID	DEPTH FROM TOP OF PIPE (FT)	ELEVATION (FT)
JS74–A	14.51	1159.29
JS74–B	24.40	1149.40
JS74–C	34.40	1139.40
JS74–D	45.39	1128.41
JS74–E	54.42	1119.38
JS74–F	66.43	1107.37
JS74–G	73.60	1100.20
JS74–H	82.65	1091.15
JS74–I	92.88	1080.92
JS74–J	97.64	1076.16

NOTES:

1. INSTALLED ON 05/23/2013.
2. BORING ADVANCED WITH 4.25" (I.D.) AND 6.25" (I.D.) HOLLOW STEM AUGERS AND HQ WIRELINE ROCK CORING TOOLS.
3. REFER TO BORING LOG FOR OVERBURDEN AND BEDROCK STRATIGRAPHY.
4. LOCATIONS PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES. HORIZONTAL DATUM: NAD27, PROJECTION: GA MERCATOR WEST, VERTICAL DATUM: NGVD 29.

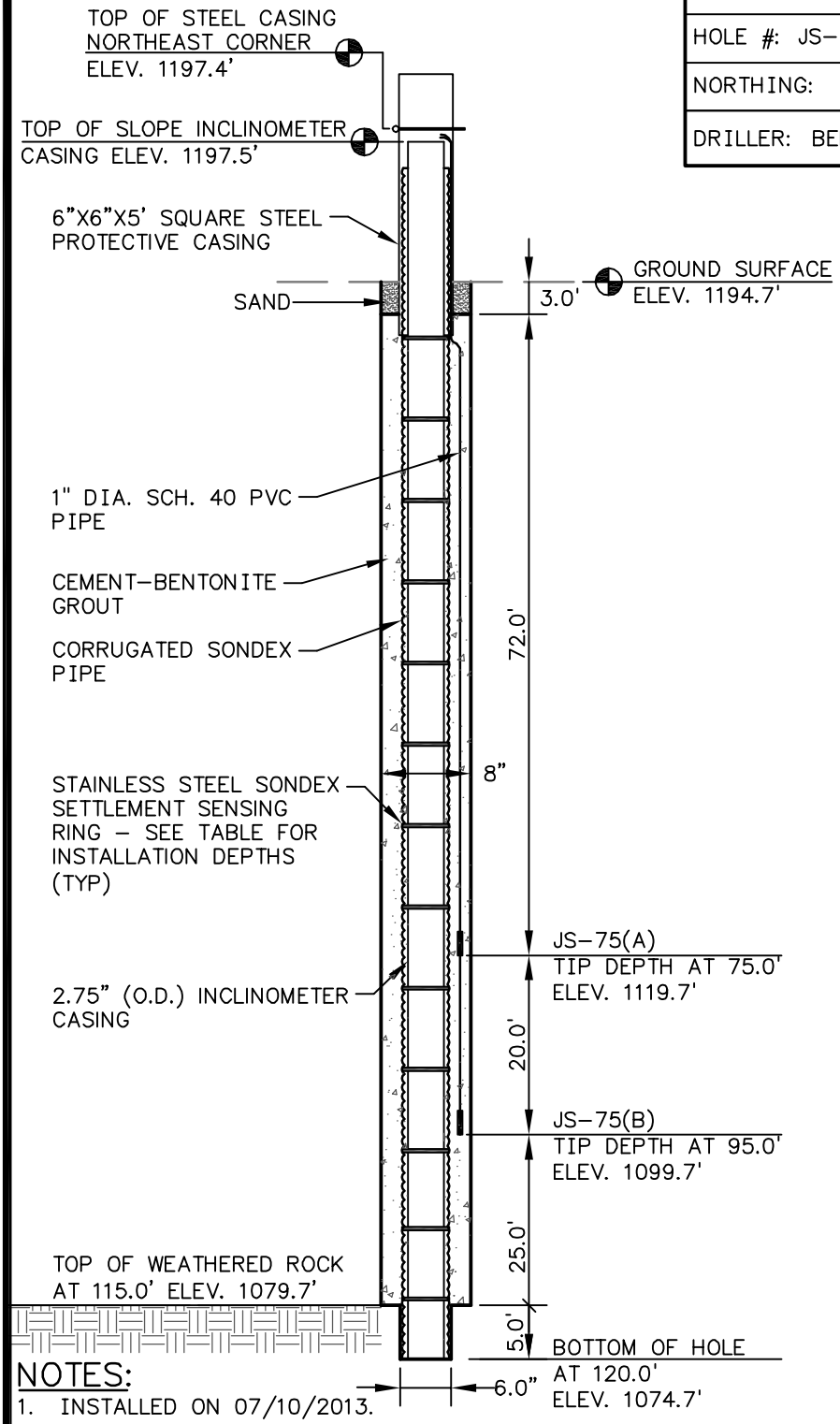
PLOT DATE: 08/14/2013 USER: JOHNSON, TRACY
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DRAWN BY PJB	DATE AUG., 2013	REVISED		SHEET
CHECKED BY CG	PROJ. NO. 165661025	1.	3.	1 OF 1
CHECKED BY –	SCALE NTS	2.	4.	

PROJECT: JSF – FINAL CLOSURE	
HOLE #: JS–75	DATE: 07/10/2013
NORTHING: 735,028.4	EASTING: 2,891,089.4
DRILLER: BERTRAM G.	SUPERVISOR: SAM LEE



SONDEX SENSING RING ID	INSTALLED DEPTH FROM TOP OF PIPE (FT)	ELEVATION (FT)
JS75–A	7.80	1189.70
JS75–B	12.80	1184.70
JS75–C	17.80	1179.70
JS75–D	22.80	1174.70
JS75–E	27.80	1169.70
JS75–F	32.80	1164.70
JS75–G	37.80	1159.70
JS75–H	42.80	1154.70
JS75–I	47.80	1149.70
JS75–J	52.80	1144.70
JS75–K	57.80	1139.70
JS75–L	62.80	1134.70
JS75–M	67.80	1129.70
JS75–N	72.80	1124.70
JS75–O	77.80	1119.70
JS75–P	82.80	1114.70
JS75–Q	87.80	1109.70
JS75–R	92.80	1104.70
JS75–S	97.80	1099.70
JS75–T	102.80	1094.70
JS75–U	107.80	1089.70
JS75–V	112.80	1084.70
JS75–W	117.80	1079.70
JS75–X	122.80	1074.70

NOTES:

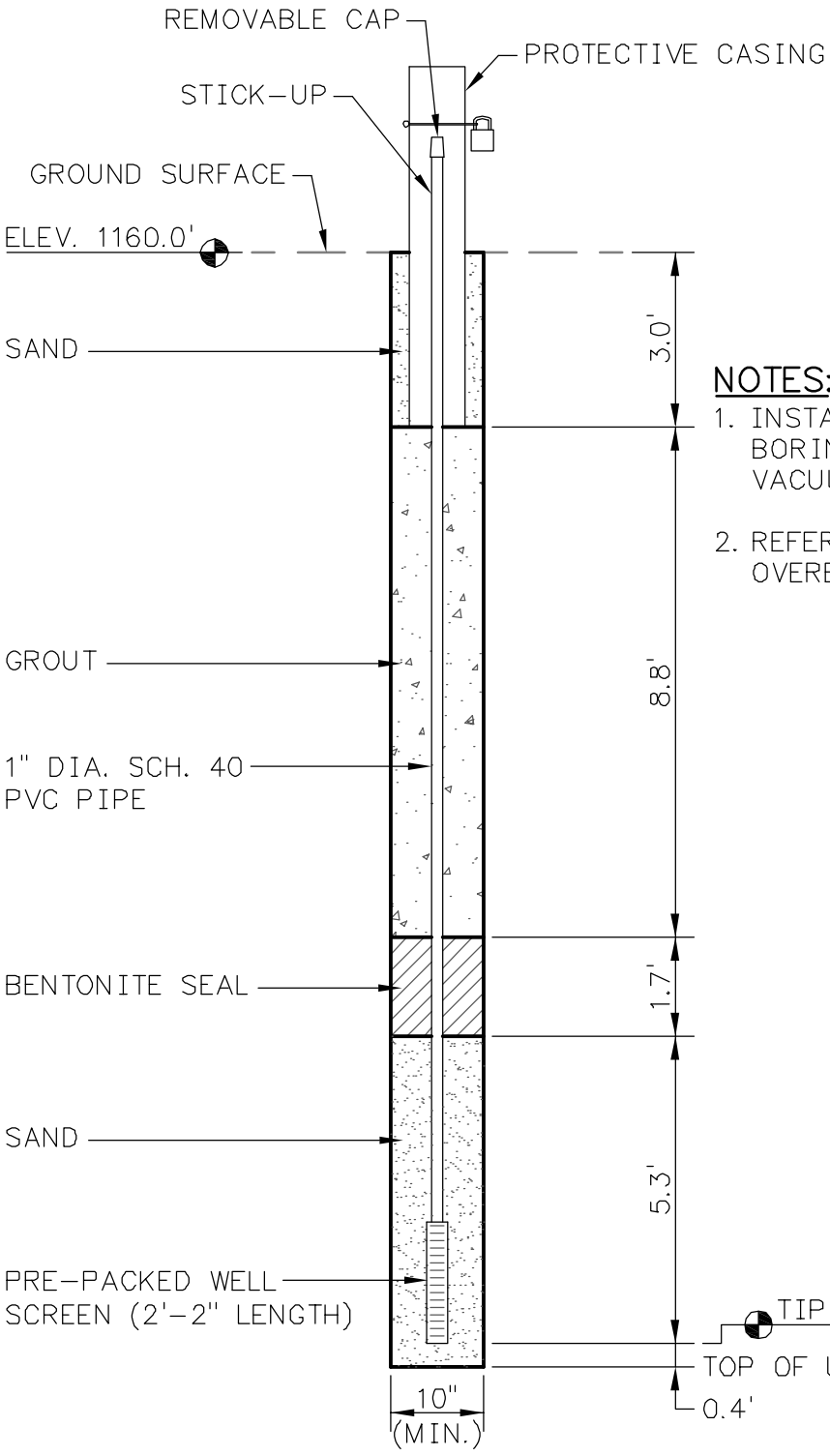
1. INSTALLED ON 07/10/2013.
2. BORING ADVANCED WITH 4.25" (I.D.) AND 6.25" (I.D.) HOLLOW STEM AUGERS AND HQ WIRELINE ROCK CORING TOOLS.
3. REFER TO BORING LOG FOR OVERBURDEN AND BEDROCK STRATIGRAPHY.
4. LOCATIONS PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES. HORIZONTAL DATUM: NAD27, PROJECTION: GA MERCATOR WEST, VERTICAL DATUM: NGVD 29.

PLOT DATE: 08/14/2013 USER: JOHNSON, TRACY
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DRAWN BY PJB	DATE AUG., 2013	REVISED		SHEET
CHECKED BY CG	PROJ. NO. 165661025	1.	3.	1 OF 1
CHECKED BY —	SCALE NTS	2.	4.	



NOTES:

1. INSTALLED ON 04/10/2013. BORING ADVANCED WITH VACUUM EXCAVATION TRUCK.
2. REFER TO BORING LOG FOR OVERBURDEN STRATIGRAPHY.

LOCATION:

NORTHING: 735,085.57
EASTING: 2,891,876.38
GROUND ELEVATION: 1160.0'

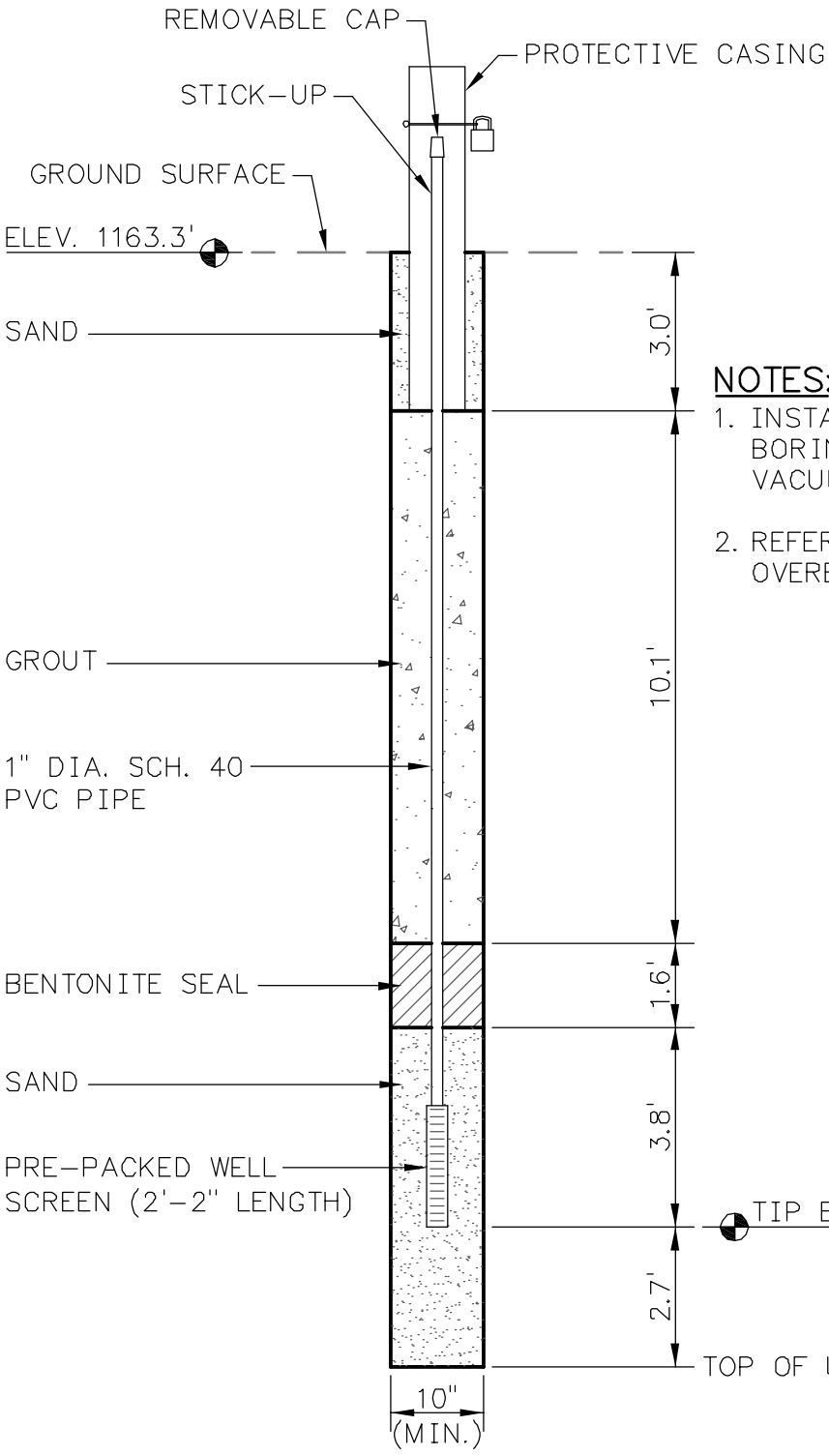
LOCATIONS TO BE PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES.
HORIZONTAL DATUM: NAD 27
VERTICAL DATUM: NGVD29

PIEZOMETER JS-76
DRY FLY ASH STACK
JOHN SEVIER FOSSIL PLANT

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000
www.stantec.com

DRAWN BY	ACC	DATE	APRIL, 2013	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	175661025	1.	3.	1 OF 1
CHECKED BY	RDF	SCALE	NTS	2.	4.	

PLOT DATE: 05/10/2013 USER: ELLISON, DOC
V:\1756\ACTIVE\175661025\ENVIRONMENTAL\DRAWING\SHEET_FILES\JSF12\INSTRUMENT\61025C_101_PZ76.DWG



NOTES:

1. INSTALLED ON 04/09/2013. BORING ADVANCED WITH VACUUM EXCAVATION TRUCK.
2. REFER TO BORING LOG FOR OVERBURDEN STRATIGRAPHY.

LOCATION:

NORTHING: 735,288.79
EASTING: 2,892,099.96
GROUND ELEVATION: 1163.3'

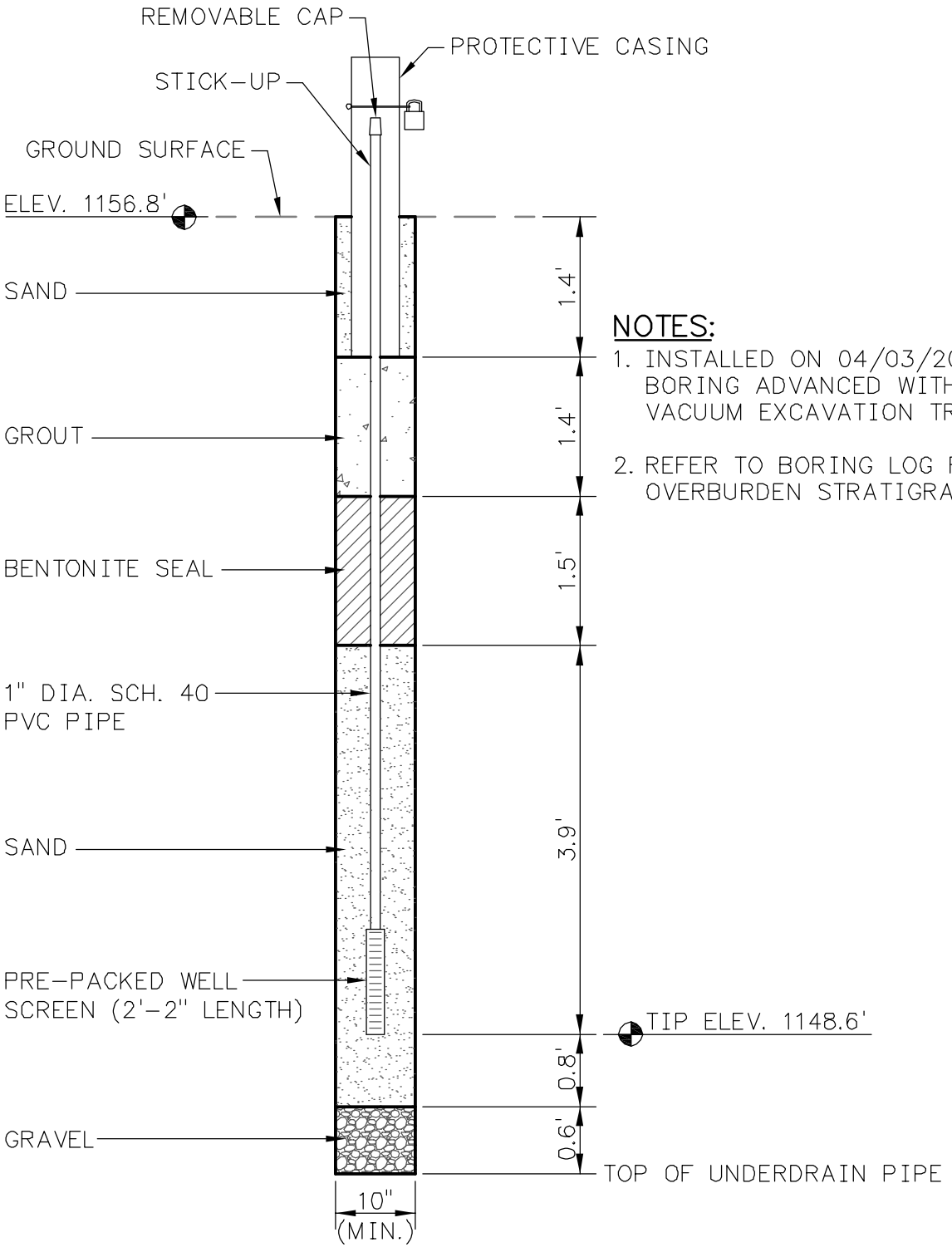
LOCATIONS TO BE PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES.
HORIZONTAL DATUM: NAD 27
VERTICAL DATUM: NGVD29

PIEZOMETER JS-77
DRY FLY ASH STACK
JOHN SEVIER FOSSIL PLANT

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DRAWN BY	ACC	DATE	APRIL, 2013	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	175661025	1.	3.	1 OF 1
CHECKED BY	RDF	SCALE	NTS	2.	4.	

PLOT DATE: 05/10/2013 USER: ELLISON, DOC
V:\1756\ACTIVE\175661025\ENVIRONMENTAL\DRAWING\SHEET_FILES\JSF12\INSTRUMENT\61025C_101_PZ77.DWG



NOTES:

1. INSTALLED ON 04/03/2013. BORING ADVANCED WITH VACUUM EXCAVATION TRUCK.
2. REFER TO BORING LOG FOR OVERBURDEN STRATIGRAPHY.

LOCATION:

NORTHING: 735,568.97
EASTING: 2,892,242.24
GROUND ELEVATION: 1156.8'

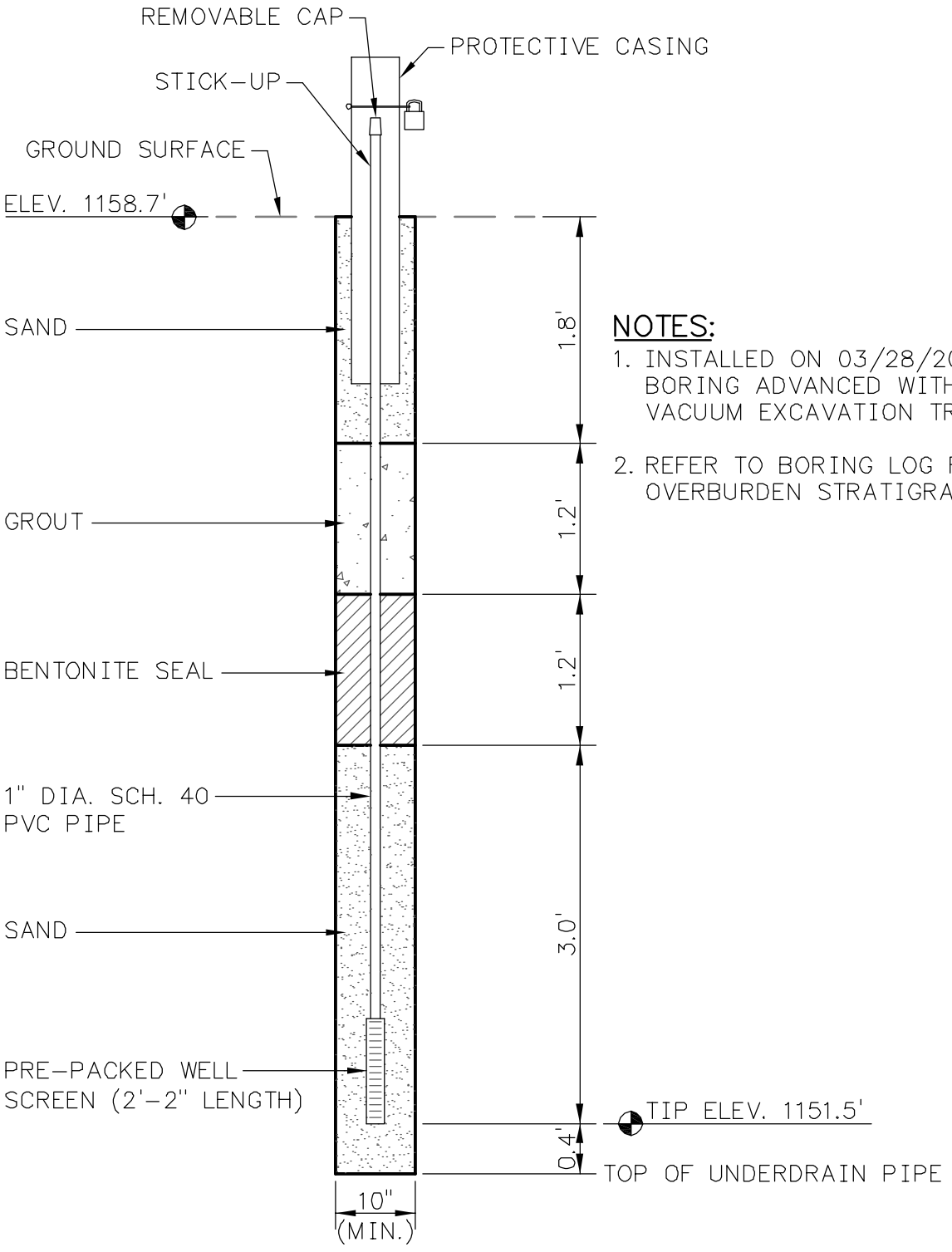
LOCATIONS TO BE PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES.
HORIZONTAL DATUM: NAD 27
VERTICAL DATUM: NGVD29

PIEZOMETER JS-78
DRY FLY ASH STACK
JOHN SEVIER FOSSIL PLANT

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DRAWN BY	ACC	DATE	APRIL, 2013	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	175661025	1.	3.	1 OF 1
CHECKED BY	RDF	SCALE	NTS	2.	4.	

PLOT DATE: 05/10/2013 USER: ELLISON, DOC
V:\1756\ACTIVE\175661025\ENVIRONMENTAL\DRAWING\SHEET_FILES\JSF12\INSTRUMENT\61025C_101_PZ78.DWG



NOTES:

1. INSTALLED ON 03/28/2013. BORING ADVANCED WITH VACUUM EXCAVATION TRUCK.
2. REFER TO BORING LOG FOR OVERBURDEN STRATIGRAPHY.

LOCATION:

NORTHING: 735,906.40
EASTING: 2,892,319.79
GROUND ELEVATION: 1158.7'

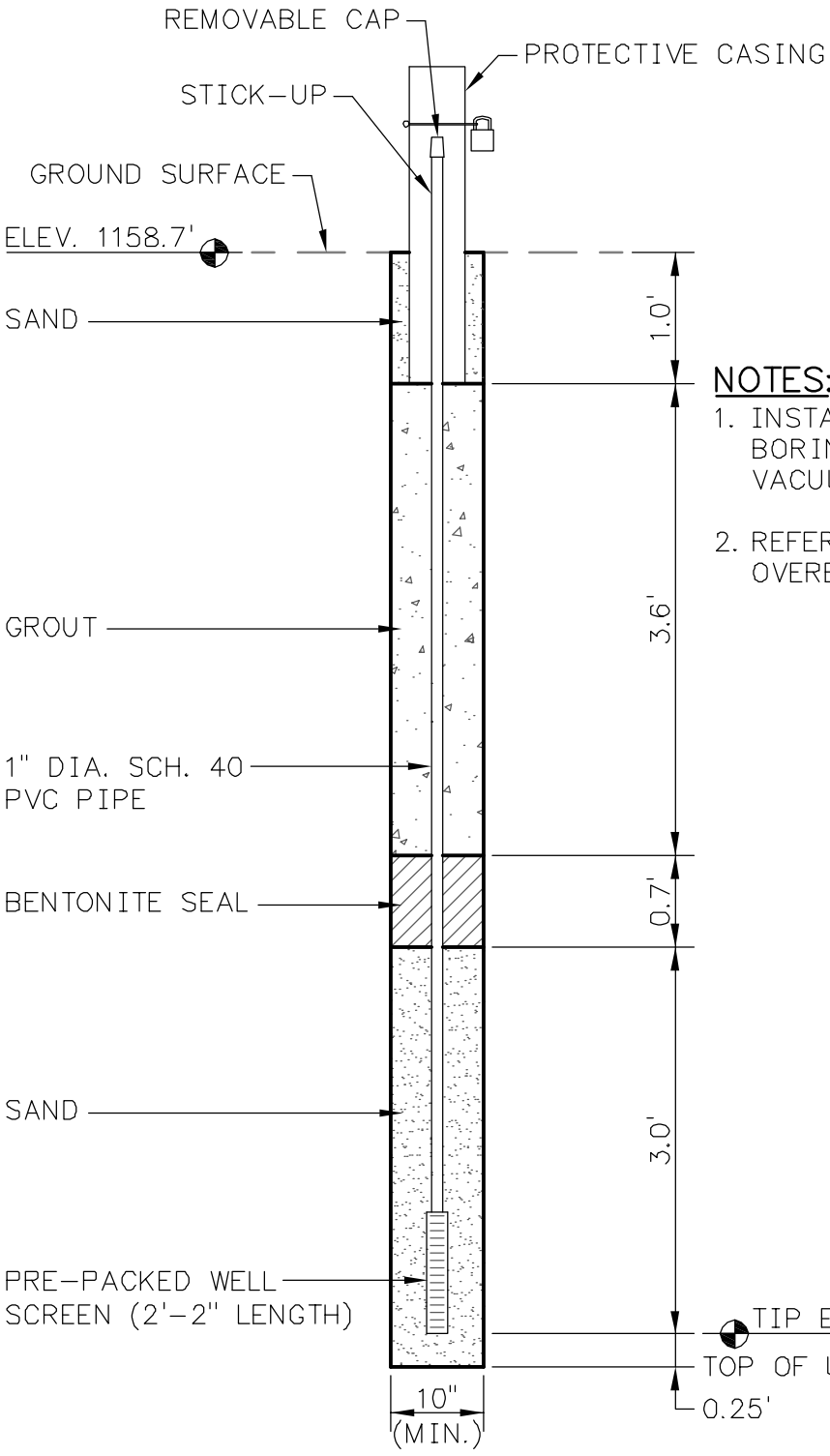
LOCATIONS TO BE PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES.
HORIZONTAL DATUM: NAD 27
VERTICAL DATUM: NGVD29

PIEZOMETER JS-79
DRY FLY ASH STACK
JOHN SEVIER FOSSIL PLANT

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DRAWN BY	ACC	DATE APRIL, 2013	REVISED		SHEET	
CHECKED BY	CG	PROJ. NO. 175661025	1.	3.	1 OF 1	
CHECKED BY	RDF	SCALE NTS	2.	4.		

PLOT DATE: 05/10/2013 USER: ELLISON, DOC
V:\1756\ACTIVE\175661025\ENVIRONMENTAL\DRAWING\SHEET_FILES\JSF12\INSTRUMENT\61025C_101_PZ79.DWG



NOTES:

1. INSTALLED ON 03/27/2013. BORING ADVANCED WITH VACUUM EXCAVATION TRUCK.
2. REFER TO BORING LOG FOR OVERBURDEN STRATIGRAPHY.

LOCATION:

NORTHING: 736,096.60
EASTING: 2,892,481.82
GROUND ELEVATION: 1158.7'

LOCATIONS TO BE PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES.
HORIZONTAL DATUM: NAD 27
VERTICAL DATUM: NGVD29

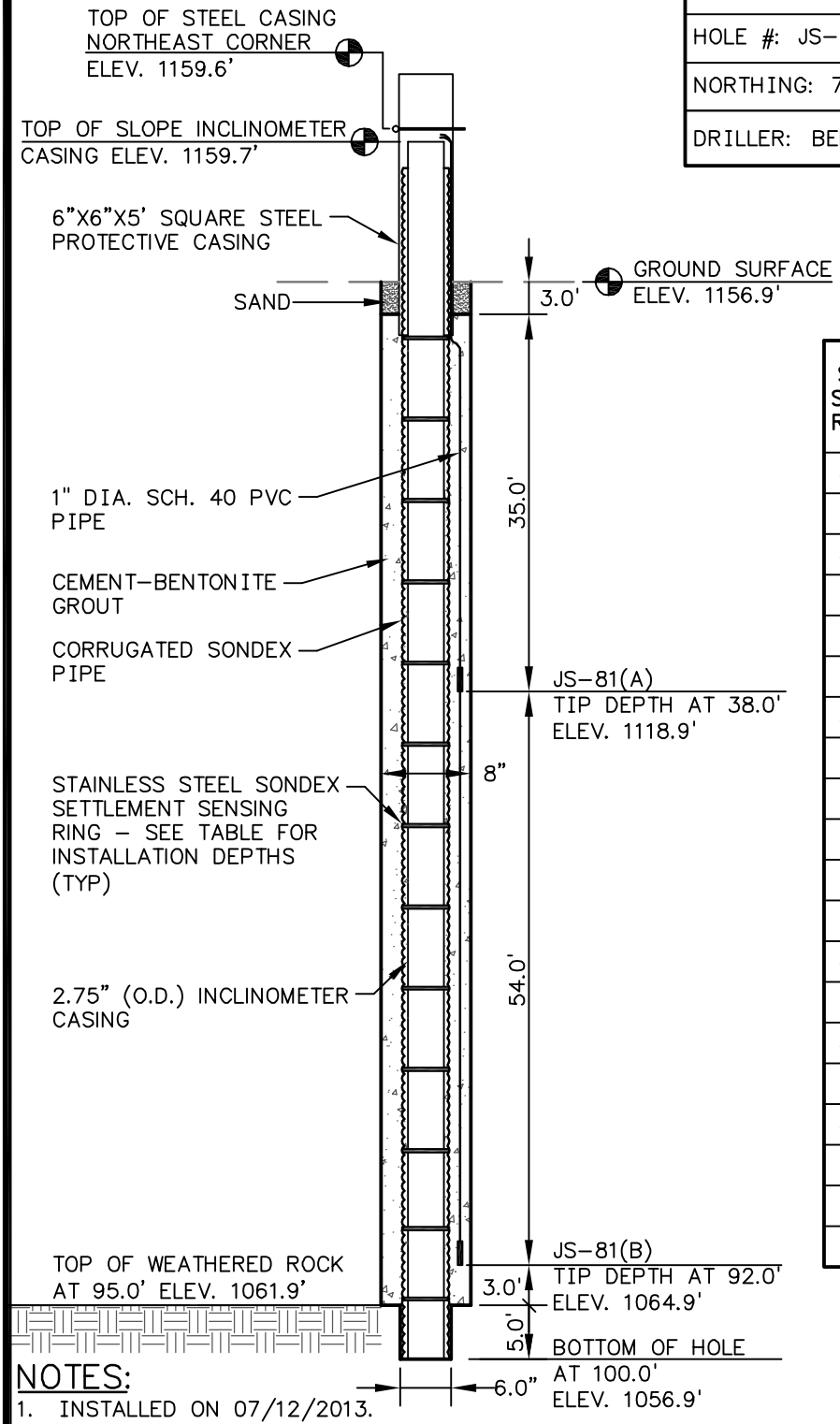
PIEZOMETER JS-80
DRY FLY ASH STACK
JOHN SEVIER FOSSIL PLANT

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DRAWN BY	ACC	DATE APRIL, 2013	REVISED		SHEET	
CHECKED BY	CG	PROJ. NO. 175661025	1.	3.	1 OF 1	
CHECKED BY	RDF	SCALE NTS	2.	4.		

PLOT DATE: 05/10/2013 USER: ELLISON, DOC
V:\1756\ACTIVE\175661025\ENVIRONMENTAL\DRAWING\SHEET_FILES\JSF12\INSTRUMENT\61025C_101_PZ80.DWG

PROJECT: JSF – FINAL CLOSURE	
HOLE #: JS–81	DATE: 07/12/2013
NORTHING: 736,454.6	EASTING: 2,892,322.1
DRILLER: BERTRAM G.	SUPERVISOR: SAM LEE



SONDEX SENSING RING ID	INSTALLED DEPTH FROM TOP OF PIPE (FT)	ELEVATION (FT)
JS81–A	7.80	1151.90
JS81–B	12.80	1146.90
JS81–C	17.80	1141.90
JS81–D	22.80	1136.90
JS81–E	27.80	1131.90
JS81–F	32.80	1126.90
JS81–G	37.80	1121.90
JS81–H	42.80	1116.90
JS81–I	47.80	1111.90
JS81–J	52.80	1106.90
JS81–K	57.80	1101.90
JS81–L	62.80	1096.90
JS81–M	67.80	1091.90
JS81–N	72.80	1086.90
JS81–O	77.80	1081.90
JS81–P	82.80	1076.90
JS81–Q	87.80	1071.90
JS81–R	92.80	1066.90
JS81–S	97.80	1061.90
JS81–T	102.80	1056.90

NOTES:

1. INSTALLED ON 07/12/2013.
2. BORING ADVANCED WITH 4.25" (I.D.) AND 6.25" (I.D.) HOLLOW STEM AUGERS AND HQ WIRELINE ROCK CORING TOOLS.
3. REFER TO BORING LOG FOR OVERBURDEN AND BEDROCK STRATIGRAPHY.
4. LOCATIONS PROVIDED BY TVA, POWER SYSTEMS OPERATIONS, SURVEYING AND PROJECT SERVICES. HORIZONTAL DATUM: NAD27, PROJECTION: GA MERCATOR WEST, VERTICAL DATUM: NGVD 29.

PLOT DATE: 08/14/2013 USER: JOHNSON, TRACY
V:\1756\ACTIVE\175661025\ENVIRONMENTAL\DRAWING\SHEET_FILES\JSF12\INSTRUMENT\JS–81.DWG

SLOPE INCLINOMETER INSTALLATION FORM
JOHN SEVIER FOSSIL PLANT
HAWKINS COUNTY, TENNESSEE

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000
www.stantec.com

DRAWN BY	PJB	DATE	AUG., 2013	REVISED		SHEET
CHECKED BY	CG	PROJ. NO.	165661025	1.	3.	1 OF 1
CHECKED BY	–	SCALE	NTS	2.	4.	

Appendix E

Vibrating Wire Piezometer Calibration Sheets

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: John Sevier Fossil - TVA
Stantec Project No: 175661025
Boring Number: JSF-73

VWP Make and Model: Geokon 4500S
Pressure Range: 145 PSI (1MPA)
Installation Type: Open Standpipe ____ Direct Burial ____ Fully Grouted X

Installation Crew: Sam Lee / Chrispin Gabriel
Supervisor: **T. Speer**
Date: 4/10/2013
Drill Rig Model / #:

Piezometer:
Manufacturer: Geokon
Casing Type: N/A
Inside Diameter: N/A
Tip Type: Porous Filter Stone

INSTALLATION CHECKLIST:

- x Office pressure check complete
- x Field zero complete (See page 2)
- x Borehole flushed with clean water
- x Confirm BOH depth 100 feet (inside casing)
- x Porous Filter Stone facing upward
- x Attached sacrificial Tape
- x Post-Installation pressure check complete
- x Final sacrificial tape measurement (feet BGS)
- x Grout proportions recorded

Checklist Performed By: Chrispin (printed) Date: 4/10/2013

Checklist Performed By:  (signature) Time: 9:22

Vibrating Wire Piezometer Calibration Data

VWP ID	Targeted Install Depth	Serial No.	Gage Factors from Factory Calibration Data Sheets T_0 (ºC)	S_0 (mbar)	R_0 (digits)	G (psi/digit)	A (psi/digit^2)	B (psi/digit)	C (psi)	K (psi/ºC)
JS-73(A)	52	1303045	22.6	989.7		-0.02486	-1.065E-07	-0.02339		-0.00265
JS-73(B)	72	1303042	22.6	989.7		-0.02461	-8.516E-08	-0.02346		-0.0038
JS-73(C)	90	1303041	22.6	989.7		-0.02532	-1.542E-08	-0.0251		-0.00467

NOTES:

Fully grouted vibrating wire piezometers installed within Inclinometer boring with Sondex pipe at TVA John Sevier Fossil. Three VWP transducers were installed.

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: John Sevier Fossil - TVA
Stantec Project No: 175661025
Boring Number: JSF-73

Pre-Installation Check of Vibrating Wire Piezometers

Pre-installation check to verify proper operation prior to installation by taking readings at water depths of 0 feet (atmospheric pressure) and one foot.

$P = AR^2+BR+C+K(T_1-T_0)-(S_1-S_0)$ in PSI Where: B, and C = Polynomial Gage Factors
R = Current digits reading
K = Thermal Factor
$(T_1 - T_0)$ = Temp. at time of reading minus temp. at time of calibration
$(S_1 - S_0)$ = Baro. pressure at time of reading minus Baro. pressure at time of calibration

Barometric Pressure at time of calibration, S_0: 29.03 inches Hg

VWP ID:	JS-73(A)	H_w:	0 feet	R_0:	8963.1	T_0:	20.9	
Serial No.:	1303045	Office C:	218.2028					
		H_w:	2 foot	R_2:	8925.5	T_2:	11.9	P_2 = 2.25 feet H_2O
VWP ID:	JS-73(B)	H_w:	0 feet	R_0:	8792.3	T_0:	13.5	
Serial No.:	1303042	Office C:	212.8506					
		H_w:	2 foot	R_2:	8753.3	T_2:	11.9	P_2 = 2.26 feet H_2O
VWP ID:	JS-73(C)	H_w:	0 feet	R_0:	8987.3	T_0:	21.8	
Serial No.:	1303041	Office C:	226.8267					
		H_w:	2 foot	R_2:	8951.1	T_2:	12.5	P_2 = 2.22 feet H_2O

Pre-Installation Check Performed By: Benjamin A. Halada (printed) Date: 3/19/2013
(signature) Time: 3:50 PM

Field Zero of Vibrating Wire Piezometers*

Barometric Pressure, S_0 = 30.1 inches Hg

VWP ID	Installed Depth	Serial No.	Reading R_0 (digits)	Temp T_0 (deg C)	New Field C psi
JS-73(A)	52.0	1303045	8964.2	19.7	218.23
JS-73(B)	72.0	1303042	8799.6	19.4	213.03
JS-73(C)	90.0	1303041	8990.2	20.1	226.90
0		0			0.0

Field Zero Performed By: Chrispin Gabriel (printed) Date: 5/21/2013
 (signature) Time: 8:30

*Field Zero measurements should be performed after allowing the VWP tip to be exposed to the air (barometric pressure only) for a minimum of 15 minutes to allow all of the instrument components to equalize temperature.

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: John Sevier Fossil - TVA
Stantec Project No: 175661025
Boring Number: JSF-73

Field Check of Installed Vibrating Wire Piezometers Prior to Backfilling the Boring

Stantec will attach a sacrificial tape to the tremie pipe to assist in setting the VWPs at the correct depth. However, the following check should be performed to verify that the VWP is set at the proper depth in the boring prior to backfilling.

Pressure Head = Pressure Measured by the VWP / Unit Weight of Water
(See calculation for Pressure Measured by the VWP in section for Pre-installation Check. Note that the Field Check measurements correspond to the Field Zero and installed pressure readings.)

Water Weight = 8.34 lbs. / gal = 62.39 lbs. / ft^3 (water)

Current Barometric Pressure = 30.1 in. Hg = 14.78 psi

VWP ID: JS-73(A) R: 8964.2 T : 20.1 VWP Tip Depth = 52 ft. bgs

Serial No.: 1303045 Calculated Pressure Head = 0.00 psi Measured Water Depth = 76.2 ft. bgs

Calculated Water Depth above VWP tip = 0.00 ft. Actual Water Depth above VWP tip = -24.20 ft.

error = 24.20 ft.

VWP ID: JS-73(B) R: 8798.5 T : 19.9 VWP Tip Depth = 72 ft. bgs

Serial No.: 1303042 Calculated Pressure Head = 0.03 psi Measured Water Depth = 76.2 ft. bgs

Calculated Water Depth above VWP tip = 0.06 ft. Actual Water Depth above VWP tip = -4.20 ft.

error = 4.26 ft.

VWP ID: JS-73(C) R: 8747.8 T : 17.2 VWP Tip Depth = 90 ft. bgs

Serial No.: 1303041 Calculated Pressure Head = 6.16 psi Measured Water Depth = 76.2 ft. bgs

Calculated Water Depth above VWP tip = 14.23 ft. Actual Water Depth above VWP tip = 13.80 ft.

error = 0.43 ft.

Pre-Backfill Check Performed By: Chrispin G. (printed) (signature) Date: 5/21/2013 Time: 9:10

GEOKON 48 Spencer St, Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa
Date of Calibration: February 27, 2013
Serial Number: 1303041
Temperature: 22.6 °C
Calibration Instruction: VW Pressure Transducers
Barometric Pressure: 989.7 mbar
Cable Length: 100 feet
Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8980	8981	8981	0.436	0.06	0.163	0.02
140.0	8182	8183	8183	139.7	-0.03	139.7	-0.03
280.0	7380	7380	7380	279.8	-0.03	279.9	-0.01
420.0	6577	6578	6578	419.9	-0.02	420.0	0.00
560.0	5772	5773	5773	560.4	0.05	560.4	0.05
700.0	4972	4972	4972	700.1	0.01	699.8	-0.03

(kPa) Linear Gage Factor (C): -0.1745 **(kPa/ digit)** **Regression Zero:** 8983

Polynomial Gage factors: **A:** -1.063E-07 **B:** -0.1731 **C:**

Thermal Factor (K): -0.03218 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02532 **(psi/ digit)**

Polynomial Gage Factors: **A:** -1.542E-08 **B:** -0.02510 **C:**

Thermal Factor (K): -0.004667 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)$*

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)$*

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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GEOKON 48 Spencer St, Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa
Date of Calibration: February 27, 2013
Serial Number: 1303042
Temperature: 22.6 °C
Calibration Instruction: VW Pressure Transducers
Barometric Pressure: 989.7 mbar
Cable Length: 100 feet
Technician: KBRyan

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8788	8789	8789	1.442	0.21	0.069	0.01
140.0	7973	7974	7974	139.7	-0.03	139.9	0.00
280.0	7154	7155	7155	278.7	-0.19	279.7	-0.04
420.0	6326	6327	6327	419.2	-0.11	420.2	0.03
560.0	5497	5498	5498	559.9	-0.02	560.1	0.01
700.0	4664	4664	4664	701.3	0.18	699.9	-0.01

(kPa) Linear Gage Factor (G): -0.1697 **(kPa/ digit)** **Regression Zero:** 8797

Polynomial Gage factors: **A:** -5.871E-07 **B:** -0.1618 **C:**

Thermal Factor (K): -0.02617 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02461 **(psi/ digit)**

Polynomial Gage Factors: **A:** -8.516E-08 **B:** -0.02346 **C:**

Thermal Factor (K): -0.003796 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)$*

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)$*

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges
The above listed instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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JS-73

GEOKON 48 Spencer St, Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa

Serial Number: 1303045

Calibration Instruction: VW Pressure Transducers

Cable Length: 100 feet

Date of Calibration: February 27, 2013

Temperature: 22.6 °C

Barometric Pressure: 989.7 mbar

Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8949	8950	8950	1.800	0.26	0.111	0.02
140.0	8145	8146	8146	139.6	-0.05	139.9	-0.01
280.0	7335	7336	7336	278.5	-0.22	279.7	-0.04
420.0	6516	6516	6516	419.0	-0.15	420.2	0.03
560.0	5694	5694	5694	559.9	-0.02	560.2	0.02
700.0	4867	4868	4868	701.6	0.22	699.9	-0.02

(kPa) Linear Gage Factor (G): -0.1714 **(kPa/ digit)** **Regression Zero:** 8960

Polynomial Gage factors: **A:** -7.34E-07 **B:** -0.1613 **C:**

Thermal Factor (K): -0.01829 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02486 **(psi/ digit)**

Polynomial Gage Factors: **A:** -1.065E-07 **B:** -0.02339 **C:**

Thermal Factor (K): -0.002652 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)$*

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)$*

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name:	John Sevier Fossil - TVA	Boring Number:	JSF-74
Stantec Project No:	175661025		
VWP Make and Model:	Geokon 4500S	Installation Type:	Open Standpipe
Pressure Range:	700kPa		Direct Burial
			Fully Grouted: X
Installation Crew:	Chrispin Gabriel	Piezometer:	
Supervisor:	**Chrispin Gabriel**	Manufacturer	Geokon
Date:	5/23/2013	Casing Type	N/A
Drill Rig Model / #:	CME95	Inside Diameter	N/A
		Tip Type	Porous Filter Stone

INSTALLATION CHECKLIST:

x	Office pressure check complete	x	Post-Installation pressure check complete
x	Field zero complete (See page 2)	x	Final sacrificial tape measurement (feet BGS)
x	Borehole flushed with clean water	x	Grout proportions recorded
x	Confirm BOH depth 95 feet (inside casing)		
x	Porous Filter Stone facing upward		
x	Attached sacrificial Tape		

Checklist Performed By: Chrispin Gabriel (printed) Date: 5/23/2013

Checklist Performed By: [signature] Time: 2:40 pm

Vibrating Wire Piezometer Calibration Data

VWP ID	Targeted Install Depth	Serial No.	Gage Factors from Factory Calibration Data Sheets							
			T_0 (ºC)	S_0 (mbar)	R_0 (digits)	G (psi/digit)	A (psi/digit^2)	B (psi/digit)	C (psi)	K (psi/ºC)
JS-74(A)	52	1302337	22	994.8		-0.02541	-1.055E-07	-0.02396		0.00051
JS-74(B)	70	1302343	22.6	989.7		-0.02566	-8.917E-08	-0.02441		0.0158

NOTES:

Fully grouted vibrating wire piezometers installed within Inclinometer boring with Sondex pipe at TVA John Sevier Fossil. Two VWP transducers were installed at different depths.

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: John Sevier Fossil - TVA
Stantec Project No: 175661025
Boring Number: JSF-74

Pre-Installation Check of Vibrating Wire Piezometers

Pre-installation check to verify proper operation prior to installation by taking readings at water depths of 0 feet (atmospheric pressure) and one foot.

$P = AR^2+BR+C+K(T_1-T_0)-(S_1-S_0)$ in PSI Where: B, and C = Polynomial Gage Factors
R = Current digits reading
K = Thermal Factor
$(T_1 - T_0)$ = Temp. at time of reading minus temp. at time of calibration
$(S_1 - S_0)$ = Baro. pressure at time of reading minus Baro. pressure at time of calibration

Barometric Pressure at time of calibration, S_0: 29.03 inches Hg

VWP ID:	JS-74(A)	H_w:	0 feet	R_0:	8893.6	T_0:	22	
Serial No.:	1302337	Office C:	221.4353					
		H_w:	2 foot	R_2:	8859.4	T_2:	11.6	P_2 = 2.03 feet H_2O
VWP ID:	JS-74(B)	H_w:	0 feet	R_0:	8981	T_0:	22.1	
Serial No.:	1302343	Office C:	226.4185					
		H_w:	2 foot	R_2:	8938.7	T_2:	11.9	P_2 = 2.17 feet H_2O
VWP ID:	0	H_w:	0 feet	R_0:		T_0:		
Serial No.:	0	Office C:	0					
		H_w:	2 foot	R_2:		T_2:		P_2 = 0.00 feet H_2O

Pre-Installation Check Performed By: Benjamin A. Halada (printed) Date: 3/19/2013
(signature) Time: 3:50 PM

Field Zero of Vibrating Wire Piezometers*

Barometric Pressure, S_0 = 29.96 inches Hg

VWP ID	Installed Depth	Serial No.	Reading R_0 (digits)	Temp T_0 (deg C)	New Field C psi
JS-74(A)	65.0	1302337	8900.7	24.1	221.6187
JS-74(B)	78.0	1302343	8990.3	24.8	226.6604
					0.00
					0.0

Field Zero Performed By: Chrispin Gabriel (printed) Date: 5/23/2013
(signature) Time: 1:50pm

*Field Zero measurements should be performed after allowing the VWP tip to be exposed to the air (barometric pressure only) for a minimum of 15 minutes to allow all of the instrument components to equalize temperature.

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: John Sevier Fossil - TVA
Stantec Project No: 175661025
Boring Number: JSF-74

Field Check of Installed Vibrating Wire Piezometers Prior to Backfilling the Boring

Stantec will attach a sacrificial tape to the tremie pipe to assist in setting the VWPs at the correct depth. However, the following check should be performed to verify that the VWP is set at the proper depth in the boring prior to backfilling.

Pressure Head = Pressure Measured by the VWP / Unit Weight of Water
(See calculation for Pressure Measured by the VWP in section for Pre-installation Check. Note that the Field Check measurements correspond to the Field Zero and installed pressure readings.)

Water Weight = 8.34 lbs. / gal = 62.39 lbs. / ft^3 (water)

Current Barometric Pressure = 30.18 in. Hg = 14.82 psi

VWP ID: JS-74(A) R: 8895.8 T : 17.3 VWP Tip Depth = 65 ft. bgs

Serial No.: 1302337 Calculated Pressure Head = 0.02 psi Measured Water Depth = 71.7 ft. bgs

Calculated Water Depth above VWP tip = 0.03 ft. Actual Water Depth above VWP tip = -6.70 ft.

error = 6.73 ft.

VWP ID: JS-74(B) R: 8866.6 T : 16.4 VWP Tip Depth = 78 ft. bgs

Serial No.: 1302343 Calculated Pressure Head = 2.98 psi Measured Water Depth = 71.7 ft. bgs

Calculated Water Depth above VWP tip = 6.87 ft. Actual Water Depth above VWP tip = 6.30 ft.

error = 0.57 ft.

VWP ID: 0 R: T : VWP Tip Depth = 0 ft. bgs

Serial No.: 0 Calculated Pressure Head = -0.11 psi Measured Water Depth = ft. bgs

Calculated Water Depth above VWP tip = -0.25 ft. Actual Water Depth above VWP tip = 0.00 ft.

error = -0.25 ft.

Pre-Backfill Check Performed By: Chrispin G. (printed) (signature) Date: 5/21/2013 Time: 2:30 pm

GEOKON 48 Spencer St, Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa
Date of Calibration: February 19, 2013
Serial Number: 1302337
Temperature: 22 °C
Calibration Instruction: VW Pressure Transducers
Barometric Pressure: 994.8 mbar
Cable Length: 100 feet
Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8869	8870	8870	1.489	0.21	-0.070	-0.01
140.0	8080	8080	8080	139.8	-0.02	140.1	0.02
280.0	7286	7287	7287	278.8	-0.18	280.0	0.00
420.1	6487	6488	6488	418.8	-0.18	420.0	-0.01
560.0	5683	5683	5683	559.7	-0.05	560.0	0.00
700.0	4873	4873	4873	701.6	0.23	700.0	0.00

(kPa) Linear Gage Factor (G): -0.1752 **(kPa/ digit)** **Regression Zero:** 8878

Polynomial Gage factors: **A:** -7.276E-07 **B:** -0.1652 **C:**

Thermal Factor (K): 0.003547 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02541 **(psi/ digit)**

Polynomial Gage Factors: **A:** -1.055E-07 **B:** -0.02396 **C:**

Thermal Factor (K): 0.0005145 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)^*$

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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GEOKON 48 Spencer St, Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa
Serial Number: 1303043
Calibration Instruction: VW Pressure Transducers
Cable Length: 100 feet

Date of Calibration: February 27, 2013
Temperature: 22.6 °C
Barometric Pressure: 989.7 mbar
Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8972	8973	8973	1.327	0.19	0.059	0.01
140.0	8191	8191	8191	139.6	-0.06	139.8	-0.02
280.0	7402	7403	7403	279.0	-0.14	280.1	0.01
420.0	6611	6612	6612	419.0	-0.15	420.0	0.00
560.0	5815	5816	5816	559.8	-0.04	560.0	0.00
700.0	5015	5016	5016	701.3	0.18	700.0	0.00

(kPa) Linear Gage Factor (G): -0.1769 (kPa/ digit) **Regression Zero:** 8980

Polynomial Gage factors: A: -6.148E-07 B: -0.1683 C:

Thermal Factor (K): 0.1089 (kPa/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02566 (psi/ digit)

Polynomial Gage Factors: A: -8.917E-08 B: -0.02441 C:

Thermal Factor (K): 0.01580 (psi/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)^*$

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: JSF - Dry Stack Closure
Stantec Project No: 175661025
Boring Number: JS-75

VWP Make and Model: Geokon 4500S
Pressure Range: 700 kPa
Installation Type: Open Standpipe ; Direct Bearing ; Fully Grouted X

Installation Crew: B. Graham J. Neuhof
Inspector: **Sam Lee**
Date: 7/10/2013
Drill Rig Model / #: CME95

Piezometer:
Manufacturer: Geokon
Casing Type: N/A
Inside Diameter: N/A
Tip Type: Porous Filter Stone

INSTALLATION CHECKLIST:

- X Office pressure check complete
- X Field zero complete (See page 2)
- X Borehole flushed with clean water
- X Confirm BOH depth = 120 feet BGS
- X Porous Filter Stone facing upward
- X Attached sacrificial Tape
- X Post-Installation pressure check complete
- X Final sacrificial tape measurement (feet BGS)
- X Grout proportions recorded

Checklist Performed By: Sam Lee (printed) Date: 7/10./2013
Checklist Performed By: (signature) Time: 21:00

Vibrating Wire Piezometer Calibration Data

VWP ID	Anticipated Install Depth	Serial No.	Gage Factors from Factory Calibration Data Sheets							
			T_0 (ºC)	S_0 (mbar)	R_0 (digits)	G (psi/digit)	A (psi/digit^2)	B (psi/digit)	C (psi)	K (psi / ºC)
JS-75(A)	75	1311000	24.9	991.6		-0.02658	-6.097E-08	-0.02575		0.01457
JS-75(B)	95	1311001	24.9	991.6		-0.02499	-6.94E-08	-0.02406		0.0139

NOTES:

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: JSF - Dry Stack Closure Boring Number: JS-75
Stantec Project No: 175661025

Pre-Installation Check of Vibrating Wire Piezometers

Pre-installation check to verify proper operation prior to installation by taking readings at water depths of 0 feet (atmospheric pressure) and 2 feet.

$P = AR^2+BR+C+K(T_1-T_0)-(S_1-S_0)$ in PSI Where: A,B, and C = Polynomial Gage Factors
R = Current digits reading
K = Thermal Factor
$(T_1 - T_0)$ = Temperature at time of reading minus temperature at time of calibration
$(S_1 - S_0)$ = Baro. pressure at time of reading minus Baro. pressure at time of calibration

Barometric Pressure at time of calibration, S_0: 29.73 inches Hg

VWP ID: JS-75(A) H_w: 0 feet R_0: 8722.5 T_0: 24.7
Serial No.: 1311000 Office C: 229.2431
H_w: 2 feet R_2: 8689.9 T_2: 24.8 P_2 = 2.02 feet H_2O

VWP ID: JS-75(B) H_w: 0 feet R_0: 8698.4 T 0: 24.6
Serial No.: 1311001 Office C: 214.5367
H_w: 2 feet R_2: 8663.2 T 2: 24.6 P_2 = 2.05 feet H_2O

Pre-Installation Check Performed By: Chrispin Gabriel (printed) (signature) Date: 6/28/2013 Time: 2:55 PM

Field Zero of Vibrating Wire Piezometers*

Barometric Pressure, S_0 = 30.02 inches Hg

VWP ID	Installed Depth	Serial No.	Reading R_0 (digits)	Temp T_0 (deg C)	New Field C psi
JS-75(A)	75	1311000	8695.3	26.3	228.5138
JS-75(B)	95	1311001	8720.8	26.2	215.1028
0		0			0.0
0		0			0.0

Field Zero Performed By: Sam Lee (printed) (signature) Date: 7/10/2013 Time: 9:30

*Field Zero measurements should be performed after allowing the VWP tip to be exposed to the air (barometric pressure only) for a minimum of 15 minutes to allow all of the instrument components to equalize temperature.

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: JSF - Dry Stack Closure Boring Number: JS-75
Stantec Project No: 175661025

Field Check of Installed Vibrating Wire Piezometers Prior to Backfilling the Boring

Stantec will attach a sacrificial tape to the tremie pipe to assist in setting the VWPs at the correct depth. However, the following check should be performed to verify that the VWP is set at the proper depth in the boring prior to backfilling.

Pressure Head = Pressure Measured by the VWP / Unit Weight of Water
(See calculation for Pressure Measured by the VWP in section for Pre-installation Check. Note that the Field Check measurements correspond to the Field Zero and installed pressure readings.)

Water Weight = 8.341 lbs / gal = 62.40 lbs / ft^3 (water)

Current Barometric Pressure = 29.91 inches Hg = 14.69 psi

VWP ID: JS-75(A) R: 8720 T : 25.4 VWP Tip Depth = 75 ft bgs

Serial No.: 1311000 Calculated Pressure Head = -0.62 psi Measured Water Depth = 91.8 ft bgs

Calculated Water Depth above VWP tip = -1.43 ft Actual Water Depth above VWP tip = -16.80 ft

error = 15.37 ft

VWP ID: JS-75(B) R: 8457.3 T : 24.7 VWP Tip Depth = 95 ft bgs

Serial No.: 1311001 Calculated Pressure Head = 6.69 psi Measured Water Depth = 79.3 ft bgs

Calculated Water Depth above VWP tip = 15.43 ft Actual Water Depth above VWP tip = 15.70 ft

error = -0.27 ft

Pre-Backfill Check Performed By: Sam Lee (printed) (signature) Date: 7/10/2013 Time: 17:00

GEOKON 48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa

Serial Number: 1311000

Calibration Instruction: VW Pressure Transducers

Cable Length: 100 feet

Date of Calibration: May 22, 2013

Temperature: 24.9 °C

Barometric Pressure: 991.6 mbar

Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8703	8703	8703	0.916	0.13	0.168	0.02
140.0	7947	7947	7947	139.4	-0.08	139.7	-0.05
280.0	7183	7184	7184	279.4	-0.09	280.1	0.01
419.9	6420	6420	6420	419.3	-0.09	420.0	0.01
559.9	5653	5653	5653	559.8	-0.02	560.0	0.01
700.1	4884	4884	4884	700.7	0.10	700.0	-0.01

(kPa) Linear Gage Factor (G): -0.1832 (kPa/ digit)

Regression Zero: 8708

Polynomial Gage factors: A: -4.204E-07 B: -0.1775 C:

Thermal Factor (K): 0.1005 (kPa/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02658 (psi/ digit)

Polynomial Gage Factors: A: -6.097E-08 B: -0.02575 C:

Thermal Factor (K): 0.01457 (psi/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)^*$

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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GEOKON 48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa
Date of Calibration: May 22, 2013
Serial Number: 1311001
Temperature: 24.9 °C
Calibration Instruction: VW Pressure Transducers
Barometric Pressure: 991.6 mbar
Cable Length: 100 feet
Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8682	8682	8682	1.034	0.15	0.037	0.01
140.0	7877	7877	7877	139.7	-0.04	140.0	0.00
280.0	7068	7069	7069	279.0	-0.14	279.9	-0.01
419.9	6255	6256	6256	419.1	-0.12	420.0	0.01
559.9	5439	5439	5439	559.7	-0.03	560.0	0.01
700.1	4619	4619	4619	701.0	0.14	700.0	0.00

(kPa) Linear Gage Factor (G): -0.1723 (kPa/ digit) **Regression Zero:** 8688

Polynomial Gage factors: A: -4.787E-07 B: -0.1659 C:

Thermal Factor (K): 0.09586 (kPa/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02499 (psi/ digit)

Polynomial Gage Factors: A: -6.943E-08 B: -0.02406 C:

Thermal Factor (K): 0.01390 (psi/ °C)

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_t - S_0)^*$

Polynomial, $P = AR_1^2 + BR_t + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: JSF - Dry Stack Closure
Stantec Project No: 175661025
Boring Number: JS-81

VWP Make and Model: Geokon 4500S
Pressure Range: 700 kPa
Installation Type: Open Standpipe ____ Direct Bearing ____ Fully Grouted X

Installation Crew: Sam Lee, Bertram Graham
Inspector: **Sam Lee**
Date: 7/12/2013
Drill Rig Model / #: CME95

Piezometer:
Manufacturer: Geokon
Casing Type: N/A
Inside Diameter: N/A
Tip Type: Porous Filter Stone

INSTALLATION CHECKLIST:

____ Office pressure check complete
____ Field zero complete (See page 2)
____ Borehole flushed with clean water
____ Confirm BOH depth = 100 feet BGS
____ Porous Filter Stone facing upward
____ Attached sacrificial Tape

____ Post-Installation pressure check complete
____ Final sacrificial tape measurement (feet BGS)
____ Grout proportions recorded

Checklist Performed By: _____ (printed) Date: _____

Checklist Performed By: _____ (signature) Time: _____

Vibrating Wire Piezometer Calibration Data

VWP ID	Anticipated Install Depth	Serial No.	Gage Factors from Factory Calibration Data Sheets							
			T_0 (ºC)	S_0 (mbar)	R_0 (digits)	G (psi/digit)	A (psi/digit^2)	B (psi/digit)	C (psi)	K (psi / ºC)
JS-81 (A)	38	1232536	22.8	985.4		-0.02663	-9.854E-08	-0.02523		0.002458
JS-81 (B)	92	1233396	24	978.5		-0.02609	-1.07E-07	-0.02458		0.01104

NOTES:

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: JSF - Dry Stack Closure Boring Number: JS-81
Stantec Project No: 175661025

Pre-Installation Check of Vibrating Wire Piezometers

Pre-installation check to verify proper operation prior to installation by taking readings at water depths of 0 feet (atmospheric pressure) and 2 feet.

$P = AR^2+BR+C+K(T_1-T_0)-(S_1-S_0)$ in PSI Where: A,B, and C = Polynomial Gage Factors
R = Current digits reading
K = Thermal Factor
$(T_1 - T_0)$ = Temperature at time of reading minus temperature at time of calibration
$(S_1 - S_0)$ = Baro. pressure at time of reading minus Baro. pressure at time of calibration

Barometric Pressure at time of calibration, S_0: 29.73 inches Hg

VWP ID: JS-81 (A) H_w: 0 feet R_0: 8996.2 T_0: 24.5
Serial No.: 1232536 Office C: 234.9491
H_w: 2 feet R_2: 8962.5 T_2: 24.5 P_2 = 2.10 feet H_2O

VWP ID: JS-81 (B) H_w: 0 feet R_0: 8977.3 T 0: 24.4
Serial No.: 1233396 Office C: 229.3176
H_w: 2 feet R_2: 8943.1 T 2: 24.6 P_2 = 2.10 feet H_2O

VWP ID: 0 H_w: 0 feet R_0: T_0:

Pre-Installation Check Performed By: Chrispin Gabriel (printed) (signature) Date: 6/28/2013 Time: 2:55 PM

Field Zero of Vibrating Wire Piezometers*

Barometric Pressure, S_0 = 29.92 inches Hg

VWP ID	Installed Depth	Serial No.	Reading R_0 (digits)	Temp T_0 (deg C)	New Field C psi
JS-81 (A)	38	1232536	8994.5	22.1	234.9032
JS-81 (B)	92	1233396	8975.0	21.7	229.2566
0		0			0.0
0		0			0.0

Field Zero Performed By: Sam Lee (printed) (signature) Date: 7/12/2013 Time: 8:25

*Field Zero measurements should be performed after allowing the VWP tip to be exposed to the air (barometric pressure only) for a minimum of 15 minutes to allow all of the instrument components to equalize temperature.

Vibrating Wire Piezometer (VWP) Installation Notes and Details

Project Name: JSF - Dry Stack Closure Boring Number: JS-81
Stantec Project No: 175661025

Field Check of Installed Vibrating Wire Piezometers Prior to Backfilling the Boring

Stantec will attach a sacrificial tape to the tremie pipe to assist in setting the VWPs at the correct depth. However, the following check should be performed to verify that the VWP is set at the proper depth in the boring prior to backfilling.

Pressure Head = Pressure Measured by the VWP / Unit Weight of Water
(See calculation for Pressure Measured by the VWP in section for Pre-installation Check. Note that the Field Check measurements correspond to the Field Zero and installed pressure readings.)

Water Weight = 8.341 lbs / gal = 62.40 lbs / ft^3 (water)

Current Barometric Pressure = 29.94 inches Hg = 14.70 psi

VWP ID: JS-81 (A) R: 8381.1 T : 23.9 VWP Tip Depth = 38 ft bgs

Serial No.: 1232536 Calculated Pressure Head = 16.52 psi Measured Water Depth = -0.5 ft bgs

Calculated Water Depth above VWP tip = 38.13 ft Actual Water Depth above VWP tip = 38.50 ft

error = -0.37 ft

VWP ID: JS-81 (B) R: 7458.8 T : 22.2 VWP Tip Depth = 92 ft bgs

Serial No.: 1233396 Calculated Pressure Head = 39.94 psi Measured Water Depth = -0.5 ft bgs

Calculated Water Depth above VWP tip = 92.18 ft Actual Water Depth above VWP tip = 92.50 ft

error = -0.32 ft

Pre-Backfill Check Performed By: Sam Lee (printed) (signature) Date: 7/12/2013 Time: 10:30

GEOKON 48 Spencer St. Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa

Date of Calibration: October 29, 2012

Serial Number: 1232536

Temperature: 22.8 °C

Calibration Instruction: VW Pressure Transducers

Barometric Pressure: 985.4 mbar

Cable Length: 100 feet

Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8978	8979	8979	1.377	0.20	0.022	0.00
140.0	8225	8225	8225	139.7	-0.04	139.9	-0.01
280.0	7466	7466	7466	279.0	-0.13	280.1	0.01
419.9	6704	6704	6704	418.9	-0.14	420.0	0.00
559.9	5937	5938	5938	559.6	-0.04	559.9	0.00
699.9	5166	5166	5166	701.3	0.20	699.9	0.00

(kPa) Linear Gage Factor (G): -0.1836 **(kPa/ digit)** **Regression Zero:** 8986

Polynomial Gage factors: **A:** -6.794E-07 **B:** -0.1740 **C:**

Thermal Factor (K): 0.01695 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02663 **(psi/ digit)**

Polynomial Gage Factors: **A:** -9.854E-08 **B:** -0.02523 **C:**

Thermal Factor (K): 0.002458 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)^*$

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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GEOKON 48 Spencer St, Lebanon, NH 03766 USA

Vibrating Wire Pressure Transducer Calibration Report

Model Number: 4500S-700 kPa

Date of Calibration: November 01, 2012

Serial Number: 1233396

Temperature: 24 °C

Calibration Instruction: VW Pressure Transducers

Barometric Pressure: 978.5 mbar

Cable Length: 100 feet

Technician:

Applied Pressure (kPa)	Gage Reading 1st Cycle	Gage Reading 2nd Cycle	Average Gage Reading	Calculated Pressure (Linear)	Error Linear (%FS)	Calculated Pressure (Polynomial)	Error Polynomial (%FS)
0.0	8965	8966	8966	1.529	0.22	0.055	0.01
140.0	8198	8198	8198	139.6	-0.06	139.9	-0.01
280.0	7424	7424	7424	278.8	-0.18	280.0	0.00
420.1	6645	6645	6645	418.9	-0.16	420.1	0.01
560.0	5862	5862	5862	559.7	-0.04	560.1	0.00
700.0	5074	5074	5074	701.5	0.21	700.0	-0.01

(kPa) Linear Gage Factor (G): -0.1799 **(kPa/ digit)** **Regression Zero:** 8974

Polynomial Gage factors: **A:** -7.407E-07 **B:** -0.1695 **C:**

Thermal Factor (K): 0.07612 **(kPa/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

(psi) Linear Gage Factor (G): -0.02609 **(psi/ digit)**

Polynomial Gage Factors: **A:** -1.074E-07 **B:** -0.02458 **C:**

Thermal Factor (K): 0.01104 **(psi/ °C)**

Calculate C by setting P=0 and R_1 = initial field zero reading into the polynomial equation

Calculated Pressures:

Linear, $P = G(R_1 - R_0) + K(T_1 - T_0) - (S_1 - S_0)^*$

Polynomial, $P = AR_1^2 + BR_1 + C + K(T_1 - T_0) - (S_1 - S_0)^*$

*Barometric pressures expressed in kPa or psi. Barometric compensation is not required with vented transducers.

The above instrument was found to be in tolerance in all operating ranges.
The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

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