3. Field Investigation Program

3.1 PREVIOUS EXPLORATIONS PERFORMED BY OTHERS

A subsurface exploration program was previously performed at the site by others. The approximate locations of the explorations performed by others are shown on **Figure 2**, "Subsurface Exploration Location Plan". A summary of the prior explorations is provided below and details are included in **Table I**[1]. Relevant logs are included in **Appendix E**.

- Two (2) test borings were drilled and three (3) test pits were excavated by Geotechnology, Inc. in 2009 during an investigation for a stability evaluation.

3.2 CURRENT SUBSURFACE EXPLORATIONS

A subsurface exploration program was conducted at the project site during the period 12 June 2017 to 21 June 2017 to obtain subsurface information for engineering evaluations. The program consisted of drilling four (4) test borings, performing seven (7) CPT soundings, and excavating four (4) test pits. Two (2) of the test borings were converted to observation wells upon completion. The test borings were drilled by Bulldog Drilling of Dupo, Illinois using an ATV-mounted CME 550 drill rig. The CPTs were performed by ConeTec, Inc. of West Berlin, New Jersey using a 25-ton, track-mounted CPT rig. Test pits were excavated by Dumey Contracting of Benton, Missouri using as a John Deere 350D LC track excavator. A Haley & Aldrich representative was present in the field to observe the subsurface explorations.

The locations of the subsurface explorations are shown on **Figure 2**. The as-drilled locations and elevations of the explorations were determined in the field by AECI by rover GPS unit. The locations and elevations of the explorations should be considered accurate only to the degree implied by the method used to make the determination. A summary of the subsurface explorations is presented in **Table II**.

3.2.1 Test Borings

The test borings were drilled to depths ranging from approximately 20 to 95 ft below ground surface. Test borings HA-B8OW, HA-B9, and HA-B10OW were advanced using 4.25-in. inside diameter (i.d.) hollow stem augers. Test boring HA-B9A was performed using a combination of 4.25-in. i.d. hollow stem augers and mud rotary methods. Split-spoon samples were typically obtained continuously for the upper 20 ft at each test boring and at 5 ft intervals thereafter. The standard penetration resistance was determined at each sample level by counting the number of blows required to drive a standard split-spoon sampler (1-3/8-in. inside diameter, 2-in. outside diameter) a distance of 24 in. into undisturbed soil and CCR under the impact of a 140-lb hammer free-falling 30 in. The number of blows required to advance the sampler was recorded for each 6-in. interval. The standard penetration resistance N-value is determined by summing the number of blows required to advance the sampler the middle 12 in. of the 24-in. sampling range.

Relatively undisturbed samples were obtained from test borings HA-B9 and HA-B10OW by pushing a 3-in. diameter thin-walled steel tube (Shelby tube) at planned sampling depths. Standard Shelby tube

[1] Note: A table that does not appear near its citation can be found at the end of the report.

direct push method using the hydraulics of the drill rill was used to advance tubes. The tubes were removed from the ground and sealed on site.

Samples recovered from the borings were taken to Shannon & Wilson in St. Louis, Missouri for laboratory testing. The boring logs are presented in **Appendix A**. The boring logs and related information depict subsurface conditions only at the specific locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at the exploration locations. Also, the passage of time may result in a change in the subsurface conditions at these exploration locations.

3.2.2 Groundwater Observation Wells

Groundwater observation wells were installed in boreholes HA-B8OW and HA-B10OW upon completion of drilling. The details of the well installations and the relationship to major soil strata are shown on the test boring logs and observation well reports in **Appendix A**. Details of the construction, materials, and backfill method are shown on the Observation Well Reports.

3.2.3 Test Pits

A total of four (4) test pits were excavated to depths ranging from approximately 10 to 11 feet below the existing ground surface. The test pits were located within the interior of the Lined Pond and were excavated to characterize ponded CCR and collect bulk samples. Upon completion of each test pit excavation, the contractor placed the excavated material back into the test pits and lightly compacted the material using the bucket of the excavator. Bulk samples were collected in select test pits and transported to Shannon & Wilson in St. Louis, Missouri for laboratory testing. The test pit logs are provided in **Appendix B**. The test pit logs and related information depict subsurface conditions only at the specific locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at the exploration locations. Also, the passage of time may result in a change in the subsurface conditions at these exploration locations.

3.2.4 Cone Penetrometer Soundings

A total of seven (7) CPT soundings were advanced to depths ranging from approximately 20.0 ft to 95.3 ft below ground surface. Several of the CPT soundings were performed immediately adjacent to SPT borings to facilitate correlating the readings from the CPT sounding with laboratory test results and SPT blowcounts. The CPT soundings were performed using a piezocone penetrometer that provides measurements of pore water pressure at one or more locations on the penetrometer surface in general conformance with ASTM D5778. CPT data, including pore pressure measurements, was collected at 1-cm depth intervals. The rod string and cone were advanced in natural soil and fill materials at the standard rate of 2 cm/sec. The rod string and cone were advanced in CCR at a rate of 0.2 cm/sec.

Seismic cone penetration testing was used to obtain in-situ measurements of shear wave velocity at CPT location HA-C15. Shear wave velocity measurements were taken at 2-meter (6.6-ft) intervals. Pore water dissipation testing was also performed at select depths in CPTs HA-C12, HA-C13, and HA-C15 to estimate hydraulic conductivity/pore pressure dissipation properties. The CPT data report is presented in **Appendix C**.

3.3 LABORATORY TESTING PROGRAM

A laboratory testing program was conducted on selected CCR and soil samples recovered from subsurface explorations to aid in classification and for determination of engineering properties required for design. The primary purpose of the testing program was to evaluate the index, strength, and compressibility properties of the native soil, ponded CCR material, and embankment fill materials. Testing included natural moisture contents, Atterberg limits, grain size distributions, unconsolidated-undrained (UU) triaxial strength, consolidated-undrained (CU) triaxial strength, standard proctor, and consolidation testing. The tests were performed in general conformance with applicable ASTM test procedures. Results of the laboratory testing program are summarized in **Table III** and the full results are included in **Appendix D**.

4. Subsurface Conditions

4.1 GEOLOGY

The site is located within the New Madrid Seismic Zone. The new Madrid Seismic Zone lies at the north end of the Mississippi Embayment, which is a deep, low-lying basin filled with Cretaceous to recent sediments. The stratigraphy at the site is presented on **Figure 3** and is based on the general profile develop by Van Arsdale and TenBrink (2000). The project site is immediately underlain by imported embankment fill and levee fill associated with embankment and levee construction as well as fly ash associated with coal burning operations.

The existing fill is underlain by Quaternary Mississippi River alluvium, which is characterized by silty clay and sand, Pleistocene Loess, which is characterized by silt and clayey silt, and Pliocene-Pleistocene Upland Complex Gravel consisting of fine to very coarse sand and gravel. These sediments are believed to be surficial deposits of fluvial or estuarine origin.

Underlying the Quaternary Deposits is the Jackson Formation, which is characterized by fluvial/deltaic medium to very fine grained silty sand, interbedded with clayey silt. The Jackson Formation overlies the Eocene Claiborne Group that consists of the Cockfield Formation over the Cook Mountain Formation over The Memphis Sand. The Cockfield formation is characterized by fluvial/deltaic silt and clay interbedded with medium to fine grained sand. The Cook Mountain Formation consists of silt and clay containing variable amounts of lignite and sand. The Memphis Sand is predominately described as consisting of fluvial/deltaic fine to very coarse grained quartzose sand containing rock fragments, pyrite and lignite.

Below the Eocene Claiborne Group is Paleocene consisting of the Wilcox Group and Midway Group. The Wilcox Group is comprised of the Flour Island Formation overlying the Fort Pillow Sand. The Flour Island formation is characterized by silty clay and clayey silt with lenses of fine grained sand. The Fort Pillow Sand is described as consisting of fine to very coarse grained quartzose sand. The Midway Group is comprised of Old Breastworks Formation, Porters Creek Clay and The Clayton Formation. Old Breastworks Formation is described as sandy, micaceous silty clay. The Porters Creek Clay is described as a micaceous clay. The Clayton Formation consists of glauconitic, fossiliferous clay.

Underlying the Wilcox and Midway groups is Upper Cretaceous soil consisting of McNairy Sand, Demopolis Formation and Coffee Formation. McNairy Sand is characterized by fine to coarse grained sand interbedded with silty clay. The Demopolis Formation is composed of calcareous clays, marls and some chalky materials. The Coffee Formation is made up of stratified and cross-bedded clays and fine-grained sand.

Below the Upper Cretaceous lies the Paleozoic strata. The Paleozoic strata is described as fine to coarse crystalline dolomite. At the AECI site, the depth to the Paleozoic strata is approximately 1,900 ft below ground surface.

The geologic descriptions discussed herein are credited to various references entitled "General Geology of the Mississippi Embayment" (Cushing, Boswell, Hosman 1964), "Deep Shear Wave Velocity Profiles of Mississippi Embayment Sediments Determined From Surface Wave Measurements" (Rosenblad, 2007) and "Late Cretaceous and Cenozoic Geology of the New Madrid Seismic Zone" (Van Arsdale and TenBrink, 2000).

4.2 SUBSURFACE CONDITIONS

Descriptions of the soil conditions encountered in the test borings and test pits during the subsurface exploration program conducted at the site are provided below in order of increasing depth below ground surface. Actual soil conditions between boring and test pit locations may differ from these typical descriptions. Refer to the test boring and test pit logs for specific descriptions of soil samples obtained from the borings.

The subsurface conditions identified by the CPT soundings do not represent material classifications based on grain-size distributions, index tests, or visual observation. Rather, the CPT soundings provide an indicator of relative behavior type based on the mechanical characteristics measured during the sounding. For this reason, the descriptions of subsurface conditions discussed below are only based on classifications of samples obtained from the test boring and the results of laboratory testing.

- *EMBANKMENT FILL* – Below the ground surface in test borings HA-B9 and HA-B10OW there is a stratum of fill material primarily described as lean CLAY (CL), fat CLAY (CH), SILT (ML), sandy SILT (ML), and silty SAND (SM). This stratum was fully penetrated where encountered and the thickness of this stratum ranged from approximately 7.5 ft to 20 ft. The density of coarse-grained soils encountered in this stratum was loose to dense. The consistency of fine-grained soils encountered in this stratum ranged from medium stiff to stiff but was generally stiff.

- *FLY ASH FILL* - Below the ground surface in test boring HA-B8OW and test pits TP3-1 through TP3-4, there is a stratum of CCR material primarily described as SILT (ML) and sandy SILT (ML). Where encountered, this stratum was not fully penetrated by any test borings or test pits. The density of CCR material encountered in this stratum ranged from very loose to medium dense but was generally medium dense.

- *ALLUVIAL DEPOSITS* – Below the EMBANKMENT FILL and FLY ASH FILL there is stratum of natural soil primarily described as sandy SILT (ML), SILT(ML), elastic SILT (MH), lean CLAY (CL), fat CLAY (CH), silty SAND (SM), poorly-graded SAND (SP), and poorly-graded SAND with silt (SP-SM). This stratum was encountered in borings HA-B9, B9A, and B10OW, but was only fully penetrated in boring HA-B9A. Where fully penetrated, the thickness was approximately 26 ft. The density of coarse-grained soils encountered in this stratum ranged from loose to medium dense. The consistency of fine-grained soils encountered in this stratum ranged from soft to very stiff.

- *FLUVIAL DEPOSITS* – Below the ALLUVIAL DEPOSITS there is stratum of natural soil primarily described as poorly-graded SAND (SP) and silty SAND (SM). This stratum was only encountered in boring HA-B9A but was not fully penetrated. The density of coarse-grained soils encountered in this stratum ranged from medium dense to dense but was generally medium dense.

4.3 GROUNDWATER CONDITIONS

Water levels were typically measured in the boreholes when water was encountered during drilling. Measured water levels are summarized in **Table II**. The water level measured within the interior of the Lined Pond was 8.0 ft below ground surface, which corresponds to a water level at El. 300.8. Outside of the lined pond, measured water levels during drilling ranged from a depth of approximately 30.0 to 32.0

ft below ground surface, which corresponds to a water level ranging between approximately El. 276.2 and 277.5. Water was not measured during drilling in test boring HA-B9A or at completion of drilling in the other test borings due to the use of drilling fluid.

Water levels were typically measured in the test pits at the conclusion of excavation. Measured water levels are summarized in **Table II**. Water levels measured during test pit excavation ranged from a depth of approximately 9.0 to 11.0 ft below ground surface, which corresponds to a water level within the interior of the Lined Pond ranging between approximately El. 297.1 and 300.8.

Water levels were also estimated during the CPT soundings. The water level estimated within the interior of the lined pond was 9.5 ft below ground surface, which corresponds to a water level at El. 299.3. Outside of the Lined Pond, estimated water levels during the soundings generally ranged from 20.3 to 30.7 ft below ground surface, which corresponds to a water level ranging between approximately El. 277.1 and El. 279.1. It should be noted that measurements estimated during the soundings did not involve physical observation of water levels, but rather an estimated water level based on pore pressure measurements. The estimates of water levels at each sounding should only be considered accurate to the degree implied by the determination method.

Water levels were measured in the two (2) new observation wells are summarized in **Table IV**. Water levels measured in observation well HAB-08OW generally ranged from 8.0 to 12.3 ft below ground surface, which corresponds to a water level ranging between approximately El. 296.5 and 300.8. Water was not observed in the two recorded reading events in observation well HAB-10OW.

Water level readings have been made in the subsurface explorations at times and under conditions discussed herein. However, it must be noted that fluctuations in the level of the water may occur due to variations in season, rainfall, temperature, plant activities, and other factors not evident at the time measurements were made and reported herein.

5. Discussion

5.1 PRELIMINARY MATERIAL PROPERTIES

Preliminary material properties to be used in analyses for slope stability have been evaluated using historic subsurface explorations, current explorations and laboratory testing. Preliminary material properties are summarized in **Table V**. Additional details are included in **Appendix F**.

TABLE V
PRELIMINARY MATERIAL PROPERTIES

Material	Material Strength	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degrees)	Vertical Stress Ratio	Minimum Shear Strength (psf)
Fly Ash Fill	Drained	105	0	34	--	--
	Undrained	105	--	0	0.30	500
Embankment Fill (Levee)	Drained	120	300	15	--	--
	Undrained	120	--	0	0.27	550
Embankment Fill (Non-Levee)	Drained	120	300	28	--	--
	Undrained	120	--	0	0.39	1,000
Alluvial Deposits (Cohesive)	Drained	120	0	30	--	--
	Undrained	120	--	0	0.50	1,000
Alluvial Deposits (Granular)	Drained	120	0	34	--	--
	Undrained	120				
Fluvial Deposits	Drained	125	0	38	--	--
	Undrained	125				

References

1. Cushing, E.M., Boswell, E.H., and Hosman, R.L, (1964), "General Geology of the Mississippi Embayment", Department of the Interior, Geological Survey Professional Paper 448-B.

2. Geotechnology, Inc. (June 2009). "Stability Evaluations Slag Pond 1 and Ash Pond 2 AECI New Madrid Power Generating Facility, New Madrid County, Missouri".

3. Rosenblad, B.L. (2007), "Deep Shear Wave Velocity Profiles of Mississippi Embayment Sediments Determined from Surface Wave Measurements," Research supported by the U.S.G.S., Department of Interior, under USGS award number 06HQGR0131.

4. Van Arsdale, R.B. and TenBrink, R.K. (2000), "Late Cretaceous and Cenozoic Geology of the New Madrid Seismic Zone," Bulletin of the Seismological Society of America, 90, 2, pp. 345-356, April 2000.

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TABLES

TABLE I
SUMMARY OF HISTORIC SUBSURFACE EXPLORATIONS
LINED POND
NEW MADRID POWER PLANT
MARSTON, MISSOURI

Exploration Designation[1]	Ground Surface Elevation[2] (ft)	Total Exploration Depth (ft)	Groundwater[3]	
			Depth Below Ground Surface (ft)	Elevation (ft)
TEST BORINGS PERFORMED BY GEOTECHNOLOGY, INC. IN 2009				
P-6	311	85.0	30.2	280.8
P-7	308	55.0	27.4	280.6
TEST PITS PERFORMED BY GEOTECHNOLOGY, INC. IN 2009				
TP-8	308	13.0	Not Encountered	--
TP-9	315	16.0	Not Encountered	--
TP-10	314	16.0	11.0	303.0

Notes:
1. Technical monitoring of explorations shown above was not performed by Haley & Aldrich, Inc.
2. Ground surface elevations are in feet and the datum is unknown.
3. Groundwater level readings represent the highest water level observed either during drilling, after completion of the exploration, or a subsequent piezometer level reading. Refer to the test boring logs for additional water level data.

TABLE II
SUMMARY OF CURRENT SUBSURFACE EXPLORATIONS
LINED POND
NEW MADRID POWER PLANT
MARSTON, MISSOURI

Exploration Designation[1]	Ground Surface EL.[2] (ft)	Northing[2] (ft)	Easting[2] (ft)	Depth (ft)	Water[3]	
					Depth Below Ground Surface (ft)	Elevation (ft)
TEST BORINGS						
HA-B8OW	308.8	244935.6	1096598.5	20.0	8.0	300.8
HA-B9	307.5	244393.7	1095065.9	31.0	30.0	277.5
HA-B9A	299.5	244415.0	1094991.2	95.0	Not Measured	Not Measured
HA-B10OW	308.2	245043.8	1097673.9	34.0	32.0	276.2
TEST PITS						
TP3-1	309.1	245081.1	1095786.0	10.0	9.0	300.1
TP3-2	308.1	245293.0	1096950.5	11.0	11.0	297.1
TP3-3	310.8	244272.9	1095470.8	10.0	10.0	300.8
TP3-4	308.2	244507.6	1096655.0	10.0	9.0	299.2
CONE PENETROMETER SOUNDINGS						
HA-C11	307.8	245478.9	1097019.4	50.9	N/A	N/A
HA-C12	308.6	245012.0	1097686.7	75.1	N/A	N/A
HA-C13	308.8	244939.9	1096612.2	20.0	N/A	N/A
HA-C14	299.3	244425.8	1094993.6	50.0	N/A	N/A
HA-C15	307.8	244389.9	1095064.6	95.3	N/A	N/A
HA-C16	307.9	244071.3	1097154.4	50.0	N/A	N/A
HA-C17	307.9	245097.9	1095393.7	50.0	N/A	N/A

Notes:

1) Technical monitoring of subsurface explorations completed during the period 12 June to 21 June 2017 was performed by Haley & Aldrich, Inc.

2) Ground surface elevations and coordinates of subsurface explorations were determined in the field by AECI by rover GPS unit. Ground surface elevations are in feet and reference North American Vertical Datum of 1988 (NAVD88). The horizontal control is the Missouri State Plane East, which is based on NAD83.

3) Water level readings represent the highest water level observed either during drilling or after completion of the exploration. Refer to the subsurface exploration logs for additional water level data. Water level readings have been made in the subsurface explorations at times and under conditions discussed herein. However, it must be noted that fluctuations in the level of the water may occur due to variations in season, rainfall, temperature, plant operations, and other factors not evident at the time measurements were made and reported.

TABLE III
SUMMARY OF LABORATORY TEST RESULTS
LINED POND
NEW MADRID POWER PLANT
MARSTON, MISSOURI

Exploration Designation	Sample Number	Sample Depth (ft)	USCS Symbol	Material Type[1]	Moisture Content (%)	LL	PL	PI[1]	% Gravel	% Sand	% Fines	Standard Proctor		UU Triaxial			CU Triaxial[2]				Consolidation				
												Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Moisture Content (%)	Dry Density (pcf)	Undrained Shear Strength (psf)	Average Moisture Content (%)	Average Dry Density (pcf)	c' (psf)	ϕ' (degrees)	Moisture Content (%)	Dry Density (pcf)	e_o[3]	C_C[3]	C_{CR}[3]
HA-B8OW	S3	4.0-6.0	ML	Fly Ash Fill	115.2				0	28	72														
HA-B8OW	S8	14.0-16.0	ML	Fly Ash Fill	95.4						84														
HA-B9	U1	6.8	CH	Embankment Fill	34.6	90	31	59			98						34.8	86.4	380	14.0					
HA-B9	S4	12.0-14.0	CL	Alluvial	21.4	45	22	23																	
HA-B9	U3	14.4	ML	Alluvial	19.6	35	25	10			97			24.7	94.4	2200					22.6	98.1	0.72	0.109	0.007
HA-B9	U3	15.0	ML	Alluvial										25.7	96.6	2600									
HA-B9	S6	24.0-26.0	SP-SM	Alluvial	4.7				0	90	10														
HA-B9A	S1	18.0-20.0	ML	Alluvial	30.9	26	22	4																	
HA-B9A	S3	28.0-30.0	SP	Fluvial	17.6						5														
HA-B9A	S11	68.0-70.0	SP	Fluvial	20.2				0	97	3														
HA-B10OW	S2	2.0-4.0	CL	Embankment Fill	18.0	31	19	12																	
HA-B10OW	S5	8.0-10.0	CL	Embankment Fill	20.4						87														
HA-B10OW	U1	10.0-12.0	CH	Embankment Fill	29.9	93	27	66			98														
HA-B10OW	U2	18.0-20.0	CH	Embankment Fill	19.0	54	17	37			96						20.4	106.5	750	25.0					
HA-B10OW	U3	30.0-32.0	ML	Alluvial	36.4	21	23	NP			100						31.4	91.9	0	36.5					
TP-3-2	Bulk (remolded)	0.0-11.0	ML	Fly Ash Fill	103.7	Non-Plastic			0	23	77	70.6	53.8				97.5	44.5	0	39	87.2	49.8	2.06	0.294	0.000
																	80.0	51.2	180	41					
TP-3-4	Bulk (remolded)	0.0-9.0	ML	Fly Ash Fill	113.4	Non-Plastic			0	58	52	64.9	54.4												

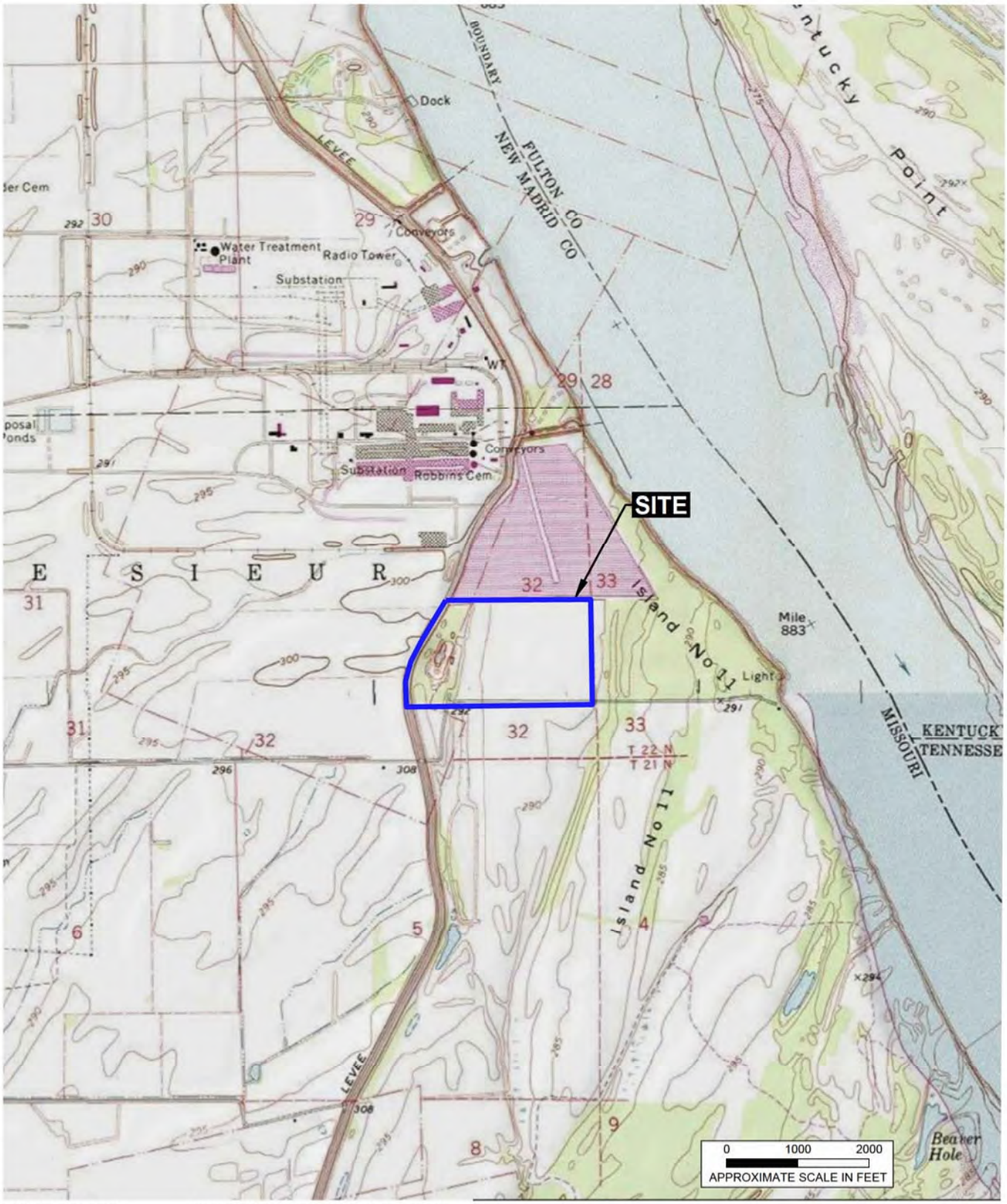
Notes:
1. NP = Non-Plastic
2. All CU Trixial tests were multi-stage tests using a single sample.
3. e_o = Initial Void Ratio, C_C = Compression Index, C_{CR} = Recompression Index

TABLE IV
SUMMARY OF SUBSURFACE WATER LEVEL MEASUREMENTS
LINED POND
NEW MADRID POWER PLANT
MARSTON, MISSOURI

Observation Well Designation	Top of Casing Elevation (ft)	Ground Surface Elevation (ft)	Well Depth (ft)	Measurement Date	Depth to Water[1] (ft)	Subsurface Water Elevation (ft)	Well Installation Notes
HAB-08OW	311.8	308.8	20.0	6/15/2017	8.0	300.8	Installed on 6/12/17 by Bulldog Drilling, Inc.
				11/2/2017	12.3	296.5	
HAB-10OW	311.0	308.2	26.0	6/15/2017	Dry	--	Installed on 6/13/17 by Bulldog Drilling, Inc.
				11/2/2017	Dry	--	

Notes:
1) Subsurface water level readings have been made in the wells at times and under conditions discussed herein. However it must be noted that fluctuations in the level of the subruface water may occur due to variations in season, rainfall, temperature, plant activities, and other factors not evident at the time measurements were made and reported.
2) Ground surface elevations of historic piezometers and were provided by AECI. Top of Casing Elevations were approximated using the surveyed ground surface elevations and a field measurement of top of casing to ground surface.

FIGURES



MAP SOURCE: ESRI

SITE COORDINATES: 36°30'14"N, 89°33'36"W

HALEY ALDRICH

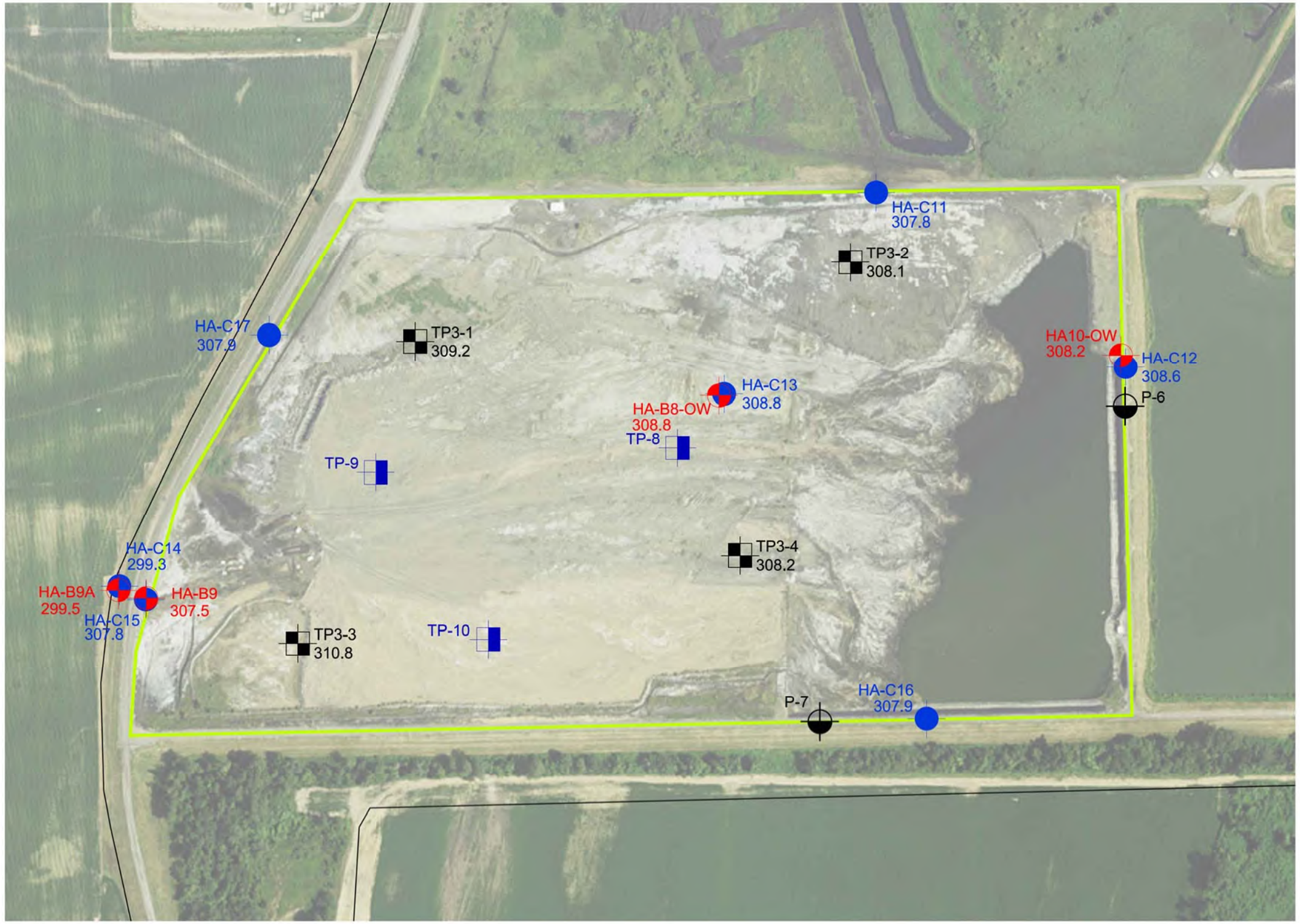
LINED POND
AECI, NEW MADRID POWER PLANT
MARSTON, MISSOURI

SITE LOCUS

SCALE: AS SHOWN
APRIL 2018

FIGURE 1

POSTOLOWSKI, KEVIN Printed: 4/9/2018 9:52 AM Layout: FIG 1 (2018-ARPIL)
Z:\CLE_COMMON\PROJECTS\129342_AECI-NMPP\CAD\LINED POND\FIGURES\129342_005_FIG-1_LOCUS.DWG



LEGEND

APPROXIMATE LIMIT OF CCR UNIT

HA-B10-OW 308.2 — DESIGNATION, LOCATION AND GROUND SURFACE ELEVATION OF TEST BORINGS PERFORMED BY BULLDOG DRILLING OF DUPO, ILLINOIS DURING THE PERIOD 12 JUNE 2017 TO 14 JUNE 2017. BORINGS WITH AN "OW" DESIGNATION INDICATES THE BORING WAS CONVERTED TO AN OBSERVATION WELL

HA-C12 308.6 — DESIGNATION, LOCATION AND GROUND SURFACE ELEVATION OF CONE PENETROMETER SOUNDINGS PERFORMED BY CONETEC, INC. OF WEST BERLIN, NEW JERSEY DURING THE PERIOD 12 JUNE 2017 TO 13 JUNE 2017.

P-7 — APPROXIMATE LOCATION OF EXISTING BORING PERFORMED BY GEOTECHNOLOGY IN 2009.

TP3-1 309.2 — DESIGNATION, LOCATION AND GROUND SURFACE ELEVATION OF TEST PITS PERFORMED BY DUMEY CONTRACTING OF BENTON, MISSOURI ON 21 JUNE 2017.

TP-8 — DESIGNATION AND APPROXIMATE LOCATION OF EXISTING TEST PITS PERFORMED BY GEOTECHNOLOGY IN 2009.

NOTES:

1. BACKGROUND IMAGE IS DATED 2 AUGUST 2014 FROM ESRI GIS.
2. ELEVATIONS INDICATED ON THIS DRAWING ARE IN FEET AND REFER TO NAVD88 DATUM. HORIZONTAL DATUM IS MISSOURI STATE PLANE NAD83, EAST ZONE US FOOT.
3. TECHNICAL MONITORING OF TEST BORINGS, CONE PENETROMETER SOUNDINGS, AND TEST PITS COMPLETED DURING THE PERIOD 12 JUNE 2017 TO 21 JUNE 2017 WAS PERFORMED BY HALEY & ALDRICH, INC.
4. AS DRILLED LOCATIONS AND GROUND SURFACE ELEVATIONS OF 2017 TEST BORINGS, CONE PENETROMETER SOUNDINGS, AND TEST PITS WERE DETERMINED IN THE FIELD BY AECI BY ROVER GPS UNIT.

N

0 300 601
SCALE IN FEET

HALEY ALDRICH

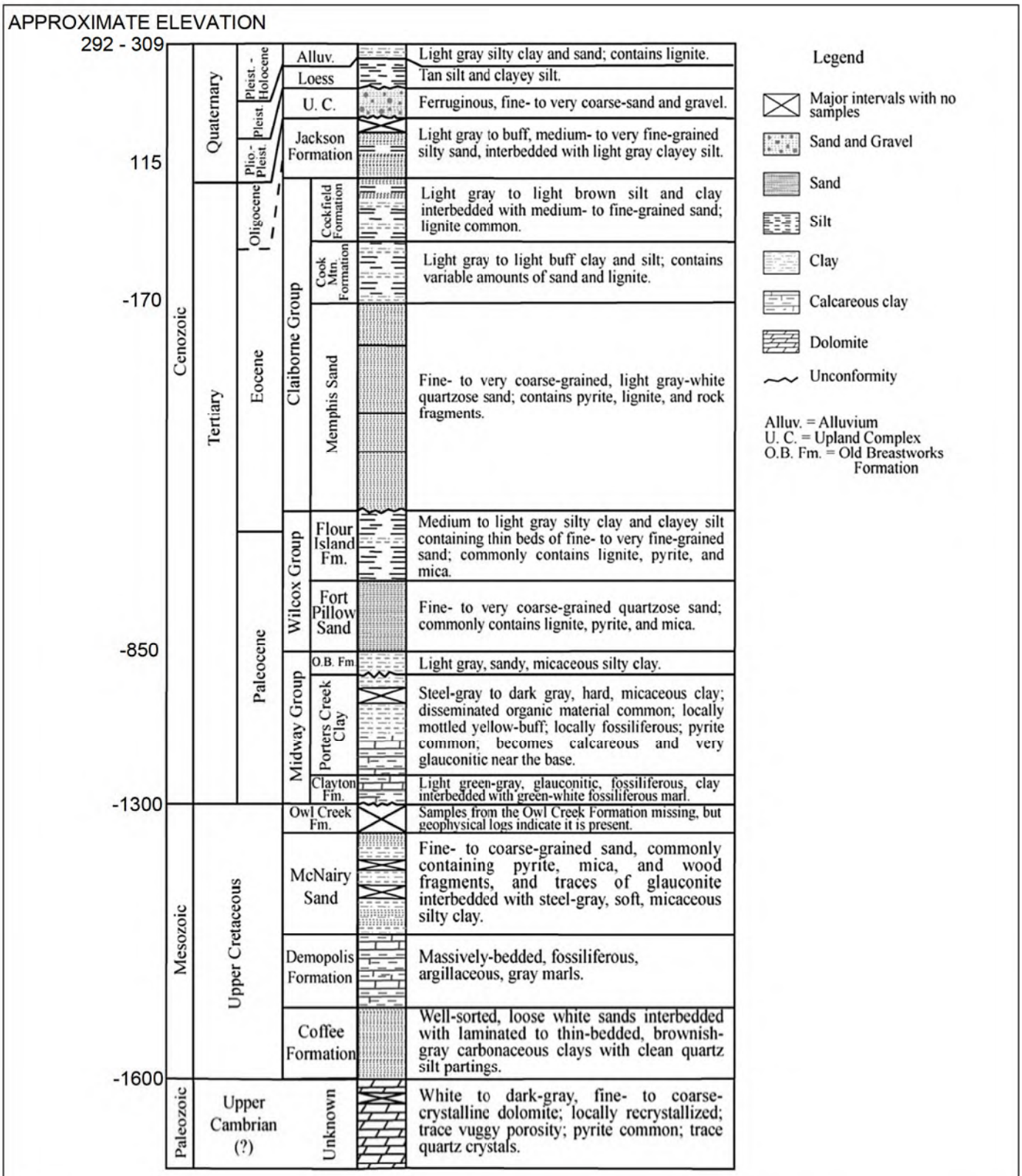
LINED POND
AECI, NEW MADRID POWER PLANT
MARSTON, MISSOURI

SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
NOVEMBER 2017

FIGURE 2

POSTOLOWSKI, KEVIN Printed: 10/12/2017 3:18 PM Layout: FIG 2 (OCT17)
Z:\CLE_COMMON\PROJECTS\129342 AECI-NMPP\CAD\LINED PONDFIGURES\129342 005 0003 FIG 2 SUBS EXPL.DWG



NOTES

1. IMAGE REFERENCE: VAN ARSDALE AND TENBRINK (2000).

2. ELEVATIONS SHOWN ARE SPECIFIC TO THE NEW MADRID POWER PLAN SITE AND WERE ESTIMATED USING FIGURES FROM VAN ARSDALE AND TENBRINK (2000) AND ROSENBLAD (2007).

3. ELEVATIONS INDICATED ON THIS DRAWING ARE IN FEET AND REFER TO NAVD 1988 DATUM.

HALEY ALDRICH

LINED POND
AECI, NEW MADRID POWER PLANT
MARSTON, MISSOURI

GEOLOGIC COLUMN FOR THE NEW MADRID SEISMIC ZONE

APPROXIMATE SCALE: AS SHOWN
APRIL 2018

FIGURE 3

129342-015 FIG_3.PDF

APPENDIX A

Current Test Boring Logs and Observation Well Installation Reports

TEST BORING REPORT

Boring No. HA-B8OW

Project	Lined Pond, New Madrid Power Plant Marston, MO
Client	Associated Electric Cooperative, Inc.
Contractor	Bulldog Drilling

File No.	129342-005
Sheet No.	1 of 2
Start	12 June 2017
Finish	12 June 2017
Driller	C. Dutton
H&A Rep.	C. Toscano
Elevation	308.8
Datum	NAVD88
Location	N 244,935.6 E 1,096,598.5

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	None	Rig Make & Model: CME 550
Inside Diameter (in.)	4.25	1.375	--	Bit Type: Cutting Head Drill Mud: None
Hammer Weight (lb)	--	140	-	Casing: HSA
Hammer Fall (in.)	--	30	-	Hoist/Hammer: Winch / Automatic Hammer PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	3 6 6 5	S1 24	0.0 2.0			ML	Medium dense dark brown to gray-brown SILT (ML), stratified, no odor, wet -FLY ASH-						100				
	1 1 3 8	S2 24	2.0 4.0			ML	Very loose dark brown to gray-brown SILT (ML), stratified, no odor, wet, contains trace fine sand						100				
5	10 6 3 6	S3 24	4.0 6.0			ML	Loose dark brown to gray-brown SILT with sand (ML), no odor, wet, contains intermixed seams and layers of cinders				12	16	72				
	3 9 9 13	S4 24	6.0 8.0			ML	Medium dense dark brown to gray-brown sandy SILT (ML), no odor, wet, contains intermixed seams and layers of cinders				20	10	70				
10	10 12 6 8	S5 24	9.0 11.0			ML	Medium dense dark brown to gray-brown sandy SILT (ML), no odor, wet, contains intermixed seams of cinders				10	20	70				
	6 4 8 4	S6 12	12.0 14.0			ML	Medium dense dark brown to gray-brown sandy SILT (ML), no odor, wet, contains intermixed seams of cinders				15	15	70				
15	6 10 5 5	S7 24	14.0 16.0			ML	Medium dense dark brown to gray-brown sandy SILT (ML), no odor, wet, contains intermixed seams of cinders				15	15	70				
	5 5 16 21	S8 20	16.0 18.0			ML	Medium dense gray-brown SILT with sand (ML), wet				5	11	84				
	10 5	S9 24	18.0 20.0			ML	Medium dense gray-brown SILT with sand (ML), wet				5	20	75				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/12/17		0	8.0	10.0	8.0
6/15/17		3 days	20.0	20.0	9.0
6/21/17		9 days	20.0	20.0	8.0

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20.0
Rock Cored (ft)	0.0
Samples	9S

Boring No. HA-B8OW

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

HALEY ALDRICH

Boring No. HA-B8OW

File No. 129342-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
	18 16						-FLY ASH-										
20					288.8 20.0		BOTTOM OF EXPLORATION 20.0 FT Note: Attempted to push undisturbed tube samples at 4, 6, 8, 11 and 14 ft, but could not due to hardness of material. Attempted five tubes, bent two tubes. Note: Set observation well at 20.0 ft. See Observation Well Report for details.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA-B8OW

TEST BORING REPORT

HALEY ALDRICH

Boring No. HA-B9

Project	Lined Pond, New Madrid Power Plant Marston, MO
Client	Associated Electric Cooperative, Inc.
Contractor	Bulldog Drilling

File No.	129342-005
Sheet No.	1 of 2
Start	13 June 2017
Finish	13 June 2017
Driller	C. Dutton
H&A Rep.	C. Toscano
Elevation	307.5
Datum	NAVD88
Location	N 244,393.7 E 1,095,065.9

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	None	Rig Make & Model: CME 550
Inside Diameter (in.)	4.25	1.375	--	Bit Type: Cutting Head Drill Mud: None
Hammer Weight (lb)	--	140	-	Casing: HSA
Hammer Fall (in.)	--	30	-	Hoist/Hammer: Winch / Automatic Hammer PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	5 15 18 13	S1 18	0.0 2.0		ML	Dense dark brown to olive-brown SILT with sand (ML), no odor, moist, contains intermixed cinders with layers of silty fine sand			5	10	10	75				
				305.5 2.0												
	5 5 5 4	S2 24	2.0 4.0		SM	Loose dark brown silty SAND (SM), no odor, moist, contains intermixed cinders -EMBANKMENT FILL-			15	30	30	25				
				303.5 4.0												
5	PUSH	U1A 12	4.0 6.0		ML	Yellow-brown sandy SILT (ML), contains trace cinder particles										
				301.5 6.0												
	PUSH	U1 21	6.0 8.0		CH	Gray and brown fat CLAY (CH)					2	98				
				300.0 7.5												
	3 3 4 3	S3 24	8.0 10.0		SM	Loose yellow-brown silty SAND (SM), no odor, dry -ALLUVIAL DEPOSITS-					60	40				
10	PUSH	U2 20	10.0 12.0		SM	Yellow-brown silty SAND (SM)										
				295.5 12.0												
	5 4 5 5	S4 20	12.0 14.0		CL	Stiff yellow-brown lean CLAY (CL), moist					10	90				
				293.5 14.0												
15	PUSH	U3 21	14.0 16.0		ML	Brown SILT (ML)					3	97				
				289.5 18.0												
	3 3 3 5	S5 24	18.0 20.0		MH	Medium stiff light brown elastic SILT (MH), moist, contains fine sand in frequent partings and layers						100				
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/13/17	15:10	0.25	29.0	31.0	30.0

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	31.0
Rock Cored (ft)	0.0
Samples	7S, 3U

Boring No. HA-B9

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

HALEY ALDRICH

Boring No. HA-B9

File No. 129342-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20				285.5 / 22.0												
	6 8 9 11	S6 20	24.0 26.0		SP-SM	Medium dense tan poorly graded SAND with silt (SP-SM), dry				3	87	10				
25						-ALLUVIAL DEPOSITS-										
	3 6 7 8	S7 15	29.0 31.0	278.5 / 29.0	SP	Medium dense tan poorly graded SAND (SP), wet				80	20					
30				276.5 / 31.0		BOTTOM OF EXPLORATION 31.0 FT Note: Borehole grouted to ground surface upon completion.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

Boring No. HA-B9A

Project	Lined Pond, New Madrid Power Plant Marston, MO
Client	Associated Electric Cooperative, Inc.
Contractor	Bulldog Drilling

File No.	129342-005
Sheet No.	1 of 4
Start	14 June 2017
Finish	14 June 2017
Driller	C. Dutton
H&A Rep.	C. Toscano
Elevation	299.5
Datum	NAVD88
Location	N 244,415.0 E 1,094,991.2

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	None	Rig Make & Model: CME 550
Inside Diameter (in.)	4.25	1.375	--	Bit Type: Roller Bit Drill Mud: Bentonite
Hammer Weight (lb)	--	140	-	Casing: Mud Rotary
Hammer Fall (in.)	--	30	-	Hoist/Hammer: Winch / Automatic Hammer PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						Note: HA-B9A was drilled at the toe of the levee embankment slope in line with HA-B9 on the levee embankment crest. Advanced borehole to 18 ft.										
5																
10																
15																
				281.5 18.0												
	3 3 3 6	S1 24	18.0 20.0		ML	Loose brown sandy SILT (ML), no odor, wet, contains fine sand in frequent seams and layers -ALLUVIAL DEPOSITS-					40	60				
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	95.0
Rock Cored (ft)	0.0
Samples	16S

Boring No. HA-B9A

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

HALEY ALDRICH

Boring No. HA-B9A
File No. 129342-005
Sheet No. 2 of 4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20																
				276.5 23.0												
	4 5 6 6	S2 24	23.0 25.0		SM	Medium dense brown silty SAND (SM), no odor, wet					60	40				
25						-ALLUVIAL DEPOSITS-										
				273.5 26.0												
	11 14 16 21	S3 24	28.0 30.0		SP	Medium dense brown poorly graded SAND (SP), wet				60	35	5				
30						-FLUVIAL DEPOSITS-										
	6 10 9 11	S4 24	33.0 35.0		SP	Medium dense brown poorly graded SAND (SP), wet, contains trace coarse to fine gravel			15	65	20					
35																
	10 13 14 15	S5 10	38.0 40.0		SP	Medium dense brown poorly graded SAND (SP), wet				80	20					
40																
	15 16 14 13	S6 20	43.0 45.0		SP	Medium dense brown poorly graded SAND (SP), wet			15	75	10					
45																
	10 14 16 18	S7 24	48.0 50.0		SP	Medium dense gray poorly graded SAND (SP), wet			5	80	5					

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

HALEY ALDRICH

Boring No. HA-B9A
File No. 129342-005
Sheet No. 3 of 4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50																
	6 8 12 16	S8 24	53.0 55.0	246.5 53.0	SM	Medium dense gray silty SAND (SM), no odor, wet				5	80	15				
55						-FLUVIAL DEPOSITS-										
	12 14 14 16	S9 20	58.0 60.0	241.5 58.0	SP	Medium dense gray poorly graded SAND (SP), wet				25	70	5				
60																
	15 15 18 21	S10 20	63.0 65.0		SP	Dense gray poorly graded SAND (SP), wet			5	80	15					
65																
	13 17 22 22	S11 24	68.0 70.0		SP	Dense gray poorly graded SAND (SP), wet			1	16	80	3				
70																
	11 13 15 15	S12 15	73.0 75.0		SP	Medium dense gray poorly graded SAND (SP), wet			5	85	10					
75																
	11 11 10	S13 18	78.0 80.0		SP	Medium dense gray poorly graded SAND (SP), wet			15	80	5					

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

HALEY ALDRICH

Boring No. HA-B9A
File No. 129342-005
Sheet No. 4 of 4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
	10															
80																
	11 13 16 17	S14 15	83.0 85.0		SP	Medium dense gray poorly graded SAND (SP), wet			25	70	5					
85						-FLUVIAL DEPOSITS-										
	10 14 15 15	S15 12	88.0 90.0		SP	Medium dense gray poorly graded SAND (SP), wet			5	90	5					
90																
	11 15 15 16	S16 16	93.0 95.0		SP	Medium dense gray poorly graded SAND (SP), wet			5	90	5					
95				204.5 95.0		BOTTOM OF EXPLORATION 95.0 FT Note: Due to the use of drilling fluid, groundwater was not measured. Borehole grouted to ground surface upon completion.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA-B9A

TEST BORING REPORT

Boring No. HA-B10OW

Project	Lined Pond, New Madrid Power Plant Marston, MO
Client	Associated Electric Cooperative, Inc.
Contractor	Bulldog Drilling

File No.	129342-005
Sheet No.	1 of 2
Start	13 June 2017
Finish	13 June 2017
Driller	C. Dutton
H&A Rep.	C. Toscano
Elevation	308.2
Datum	NAVD88
Location	N 245,043.8 E 1,097,673.9

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	None	Rig Make & Model: CME 550
Inside Diameter (in.)	4.25	1.375	--	Bit Type: Cutting Head Drill Mud: None
Hammer Weight (lb)	--	140	-	Casing: HSA
Hammer Fall (in.)	--	30	-	Hoist/Hammer: Winch / Automatic Hammer PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	6 5 4 6	S1 20	0.0 2.0			CL	Stiff brown lean CLAY (CL), no odor, dry						100	S	N	L	M
	3 4 4 8	S2 12	2.0 4.0			CL	Medium stiff brown lean CLAY (CL), no odor, moist -EMBANKMENT FILL-						100				
5	3 4 6 8	S3 18	4.0 6.0			CL	Stiff brown lean CLAY (CL), no odor, moist, contains trace fine gravel and coarse to fine sand						100				
	3 6 8 4	S4 15	6.0 8.0			CL	Stiff dark brown to gray-brown lean CLAY (CL), mottled, trace fine sand, no odor, moist						100	N	L	M	H
	3 5 5 7	S5 10	8.0 10.0			CL	Stiff dark brown to gray-brown lean CLAY (CL), mottled gray-brown to olive-brown, no odor, moist, fine sand in frequent seams					13	87		L	M	H
10	PUSH	U1 24	10.0 12.0		298.2 10.0	CH	Dark gray fat CLAY (CH)					2	98				
	3 3 6 7	S6 20	12.0 14.0			CH	Stiff gray-brown fat CLAY (CH), no odor, moist Note: Pond liner lodged in tip of spoon.						100			H	
15	2 5 7 9	S7 16	14.0 16.0		294.2 14.0	CL	Stiff dark brown to gray-brown lean CLAY (CL), mottled, no odor, moist, contains trace fine sand						100				
	3 5 5 7	S8 24	16.0 18.0			CL	Stiff dark brown to gray-brown lean CLAY (CL), mottled, no odor, moist, contains trace fine sand						100				
	PUSH	U2 18	18.0 20.0		290.2 18.0	CH	Gray and brown fat CLAY (CH)					4	96				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/13/17		0	32.0	34.0	32.0

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	34.0
Rock Cored (ft)	0.0
Samples	19S, 3U

Boring No. HA-B10OW

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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TEST BORING REPORT

HALEY ALDRICH

Boring No. HA-B10OW
File No. 129342-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	4 8 14 16	S9 24	20.0 22.0		288.2 20.0	ML	Very stiff light brown sandy SILT (ML), no odor, moist					40	60				
							-ALLUVIAL DEPOSITS-										
	5 8 12 12	S10 24	22.0 24.0			ML	Very stiff olive-brown SILT with sand (ML), no structure, no odor, moist					20	80				
	3 7 10 10	S11 24	24.0 26.0		284.2 24.0	MH	Very stiff brown to gray-brown elastic SILT (MH), moist, contains trace fine sand						100				
25	1 2 3 6	S12 24	26.0 28.0		282.2 26.0	CH	Medium stiff brown fat CLAY (CH), no odor, moist						100	N	H	H	H
	1 2 2 2	S13 24	28.0 30.0			CH	Soft brown fat CLAY (CH), no odor, moist						100				
30	PUSH	U3 24	30.0 32.0		278.2 30.0	ML	Brown SILT (ML)						100				
	1 2 2 3	S14 24	32.0 34.0			ML	Soft brown SILT (ML), wet, with fine sand in frequent seams and layers						100				
					274.2 34.0		-BOTTOM OF EXPLORATION 34.0 FT										
							Note: Set observation well at 26.0 ft. See Observation Well Report for details.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 129342-005_HA-LIB09-REV.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHARE\WAS_COMMON\PROJECTS\129342 - AECI\005\FIELDWORK\SUBSURFACE EXPLORATION LOGS\BORING LOGS\GINT\129342-005_TB8-10.GPJ 26 Sep 17

OBSERVATION WELL INSTALLATION REPORT

Privileged and Confidential

HALEY ALDRICH

Well No.	Boring No.
HA-B8OW	HA-B8OW

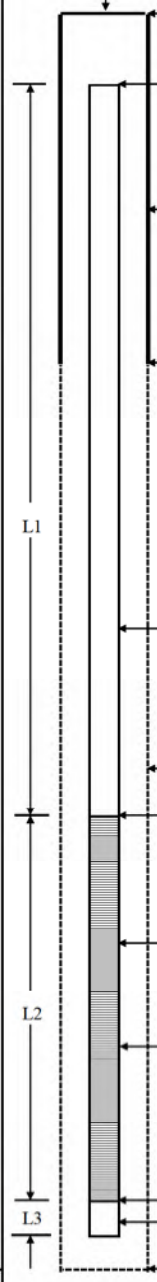
PROJECT	Lined Pond	H&A FILE NO.	129342-005
LOCATION	New Madrid Power Plant - Marston, MO	PROJECT MGR.	J. Pokorny
CLIENT	Associated Electric Cooperative, Inc.	FIELD REP.	C. Toscano
CONTRACTOR	Bulldog Drilling	DATE INSTALLED	6/12/2017
DRILLER	C. Dutton		

Ground El.	308.8 ft	Location	See Plan	☑ Guard Pipe
El. Datum	NAVD88		N 244,935.6/E 1,096,598.5	☐ Roadway Box

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
0.0	0.0
	Concrete
	1.0
	Bentonite
Fly Ash	
	8.0
	Filter Sand
20	20

(Bottom of Exploration)

(Numbers refer to depth from ground surface in feet)



(Not to Scale)

Type of protective cover/lock	Padlock	
Height of guard pipe above ground surface	3.3	ft
Height of riser pipe above ground surface	3.0	ft
Type of protective casing:	Steel Casing	
Length	5.0	ft
Inside Diameter	4.0	in
Depth of bottom of guard pipe	1.7	ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	1.0	7.0

Type of riser pipe:	Schedule 40 PVC	
Inside diameter of riser pipe	2.0	in
Type of backfill around riser	Bentonite, Cuttings	
Diameter of borehole	7-5/8	in
Depth to top of well screen	10.0	ft
Type of screen	Machine Slotted	
Screen gauge or size of openings	0.100	in
Diameter of screen	2.0	in
Type of backfill around screen	Filter Sand	
Depth of bottom of well screen	20.0	ft
Bottom of Silt trap	--	ft
Depth of bottom of borehole	20.0	ft

23 ft	+	10 ft	+	0 ft	=	33 ft
Riser Pay Length (L1)		Length of screen (L2)		Length of silt trap (L3)		Pay length

COMMENTS:

Form 2007

OBSERVATION WELL INSTALLATION REPORT

Privileged and Confidential

HALEY ALDRICH

Well No. HA-B10OW

Boring No. HA-B10OW

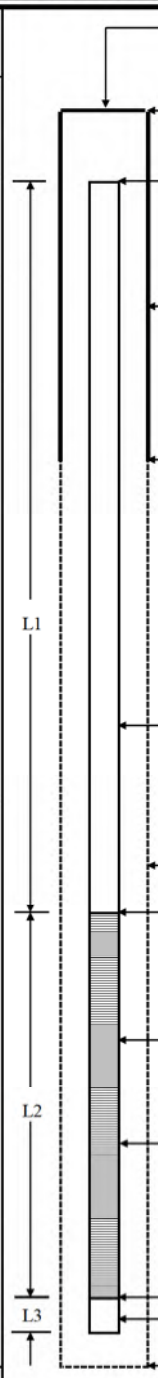
PROJECT	Lined Pond	**H&A FILE NO.**	129342-005
LOCATION	New Madrid Power Plant - Marston, MO	**PROJECT MGR.**	J. Pokorny
CLIENT	Associated Electric Cooperative, Inc.	**FIELD REP.**	C. Toscano
CONTRACTOR	Bulldog Drilling	**DATE INSTALLED**	6/13/2017
DRILLER	C. Dutton		

Ground El.	308.2 ft	**Location**	See Plan	☑ **Guard Pipe**
El. Datum	NAVD88		N 245,043.8/E 1,097,673.9	☐ **Roadway Box**

SOIL/ROCK CONDITIONS	BOREHOLE BACKFILL
0.0	0.0
	Concrete
	1.0
Embankment FILL	Bentonite
	15.0
	Filter Sand
Alluvial Deposits	
	27.0
	Bentonite
34	34

(Bottom of Exploration)

(Numbers refer to depth from ground surface in feet)



(Not to Scale)

Type of protective cover/lock	Padlock	
Height of guard pipe above ground surface	3.0	ft
Height of riser pipe above ground surface	2.8	ft
Type of protective casing:	Steel Casing	
Length	5.0	ft
Inside Diameter	4.0	in
Depth of bottom of guard pipe	2.0	ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	1.0
Bentonite	1.0	14.0

Type of riser pipe:	Schedule 40 PVC	
Inside diameter of riser pipe	2.0	in
Type of backfill around riser	Bentonite	
Diameter of borehole	7-5/8	in
Depth to top of well screen	16.0	ft
Type of screen	Machine Slotted	
Screen gauge or size of openings	0.100	in
Diameter of screen	2.0	in
Type of backfill around screen	Filter Sand	
Depth of bottom of well screen	26.0	ft
Bottom of Silt trap	--	ft
Depth of bottom of borehole	34.0	ft

18.8 ft	+	10 ft	+	0 ft	=	28.8 ft
Riser Pay Length (L1)		Length of screen (L2)		Length of silt trap (L3)		Pay length

COMMENTS:

Form 2007

APPENDIX B

Current Test Pit Logs

HALEY ALDRICH

TEST PIT LOG

Test Pit No. **TP3-1**

PROJECT	Lined Pond, New Madrid Power Plant	H&A FILE NO.	129342-005
LOCATION	Marston, Missouri	PROJECT MGR.	Jason Pokorny
CLIENT	Associated Electric Cooperative, Inc.	FIELD REP	C. Toscano
CONTRACTOR	Dumey Contracting	DATE	21 June 2017
EQUIPMENT	John Deere 350D LC Track Excavator	WEATHER	Sunny, 80 Degrees

Ground El.	309.1 ft.	Location	See Plan	Groundwater depths/entry rates (in./min.):
El. Datum	NAVD88		N 245,081.1/E 1,095,786.0	9.0 ft - Slow entry

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0			ML	Dark brown SILT (ML)										
				-FLY ASH-										
4														
				Note: Distinct increase in hardness at 6.0 ft										
8														
				-BOTTOM OF TEST PIT 10.0 FT-										
12														
16														
20														
24														
28														

Obstructions:

Remarks:

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:

at depth 9.0 ft.
measured after 0.25 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	0	=	-
over 24	0	=	-

Test Pit Dimensions (ft.):

Pit Depth	10.0
Pit Length X Width	10.0 X 5.0

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

Form 2006

HALEY ALDRICH

TEST PIT LOG

Test Pit No. **TP3-2**

PROJECT	Lined Pond, New Madrid Power Plant	H&A FILE NO.	129342-005
LOCATION	Marston, Missouri	PROJECT MGR.	Jason Pokorny
CLIENT	Associated Electric Cooperative, Inc.	FIELD REP	C. Toscano
CONTRACTOR	Dumey Contracting	DATE	21 June 2017
EQUIPMENT	John Deere 350D LC Track Excavator	WEATHER	Sunny, 80 Degrees

Ground El.	308.1 ft.	Location	See Plan	Groundwater depths/entry rates (in./min.):
El. Datum	NAVD88		N 245,293.0/E 1,096,950.5	11.0 ft - Slow entry

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0			ML	Dark brown SILT (ML)										
				-FLY ASH-										
4														
8														
				-BOTTOM OF TEST PIT 11.0 FT-										
12				Note: Bulk sample collected 0 to 11.0 ft										
16														
20														
24														
28														

Obstructions:

Remarks:

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:

at depth 11.0 ft.
measured after 0.25 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	0	=	-
over 24	0	=	-

Test Pit Dimensions (ft.):

Pit Depth	11.0
Pit Length X Width	10.0 X 5.0

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

Form 2006

HALEY ALDRICH

TEST PIT LOG

Test Pit No. **TP3-3**

PROJECT	Lined Pond, New Madrid Power Plant	H&A FILE NO.	129342-005
LOCATION	Marston, Missouri	PROJECT MGR.	Jason Pokorny
CLIENT	Associated Electric Cooperative, Inc.	FIELD REP	C. Toscano
CONTRACTOR	Dumey Contracting	DATE	21 June 2017
EQUIPMENT	John Deere 350D LC Track Excavator	WEATHER	Sunny, 80 Degrees

Ground El.	310.8 ft.	Location	See Plan	Groundwater depths/entry rates (in./min.):
El. Datum	NAVD88		N 244,272.9/E 1,095,470.8	10.0 ft - Slow entry

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0				Dark brown SILT (ML)										
				-FLY ASH-										
4				Note: Distinct increase in hardness at 5.0 ft										
8														
				-BOTTOM OF TEST PIT 10.0 FT-										
12														
16														
20														
24														
28														

Obstructions:

Remarks:

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:

at depth 10.0 ft.
measured after 0.25 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	0	=	-
over 24	0	=	-

Test Pit Dimensions (ft.):

Pit Depth	10.0
Pit Length X Width	10.0 X 5.0

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

Form 2006

HALEY ALDRICH

TEST PIT LOG

Test Pit No. **TP3-4**

PROJECT	Lined Pond, New Madrid Power Plant	H&A FILE NO.	129342-005
LOCATION	Marston, Missouri	PROJECT MGR.	Jason Pokorny
CLIENT	Associated Electric Cooperative, Inc.	FIELD REP	C. Toscano
CONTRACTOR	Dumey Contracting	DATE	21 June 2017
EQUIPMENT	John Deere 350D LC Track Excavator	WEATHER	Sunny, 80 Degrees

Ground El.	308.1 ft.	Location	See Plan	Groundwater depths/entry rates (in./min.):
El. Datum	NAVD88		N 244,507.6/E 1,096,655.0	9.0 ft - Slow entry

Depth (ft.)	Sample ID	Stratum Change Depth (ft.)	USCS Symbol	Visual Identification (Color, GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions, geologic interpretation)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0			ML	Dark brown SILT (ML)										
				-FLY ASH-										
				Note: Distinct increase in hardness at 3.0 ft										
4														
8														
				-BOTTOM OF TEST PIT 10.0 FT-										
				Note: Bulk sample collected 0 to 9.0 ft										
12														
16														
20														
24														
28														

Obstructions:

Remarks:

Field Tests

Dilatancy:	R - Rapid S - Slow N- None
Toughness:	L - Low M - Medium H - High
Plasticity:	N - Nonplastic L - Low M - Medium H - High
Dry Strength:	N - None L - Low M - Medium H - High V - Very High

Standing water in completed pit:

at depth 9.0 ft.
measured after 0.25 hrs. elapsed

Boulders:

Diameter (in.)	Number		Approx. vol. (cu. ft.)
12 to 24	0	=	-
over 24	0	=	-

Test Pit Dimensions (ft.):

Pit Depth	10.0
Pit Length X Width	10.0 X 5.0

NOTE: Soil identifications based on visual/manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

Form 2006

APPENDIX C

Current CPT Data

Job No:	17-53075
Client:	Haley & Aldrich
Project:	New Madrid Power Plant, Marston, MO
Sounding ID:	SCPT17-HA-C15
Date:	12-Jun-2017

Seismic Source:	Beam
Source Offset (ft):	1.00
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

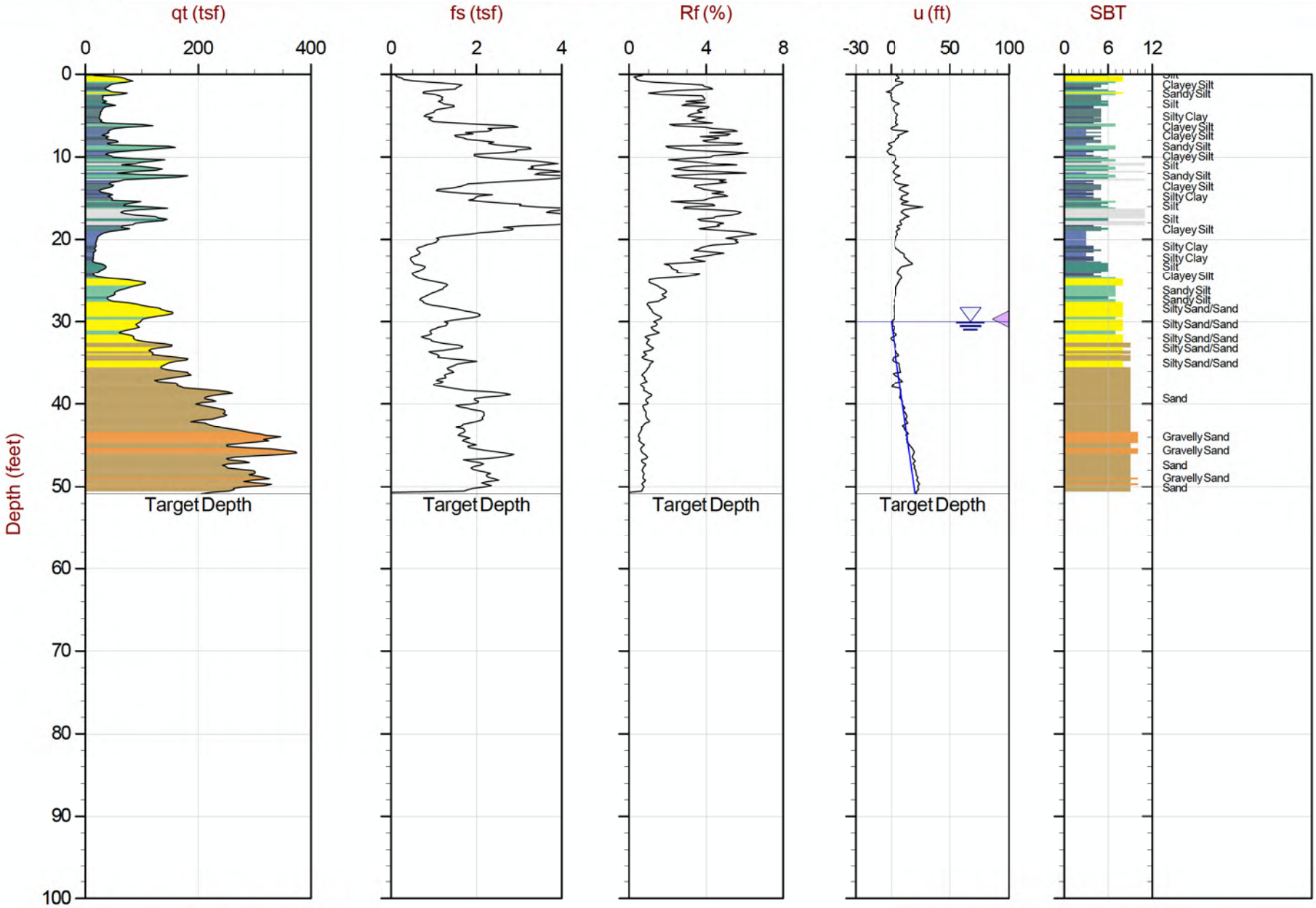
Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
6.56	5.91	5.99			
13.12	12.47	12.51	6.52	8.22	793
19.69	19.03	19.06	6.55	8.43	777
26.25	25.59	25.61	6.55	9.92	661
32.81	32.15	32.17	6.56	10.16	646
39.37	38.71	38.73	6.56	11.11	590
45.93	45.28	45.29	6.56	9.97	658
52.49	51.84	51.85	6.56	9.49	691
59.06	58.40	58.41	6.56	8.13	807
65.62	64.96	64.97	6.56	8.49	773
72.18	71.52	71.53	6.56	8.68	756
78.74	78.08	78.09	6.56	8.11	809
85.30	84.65	84.65	6.56	8.16	804
91.86	91.21	91.21	6.56	7.96	824
95.14	94.49	94.49	3.28	3.62	905

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 2017-06-12 11:40
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C11
Cone: 206:T1500F15U500



Max Depth: 15.500 m / 50.85 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-53075_CPHA-C11.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4042888m E: 270893m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

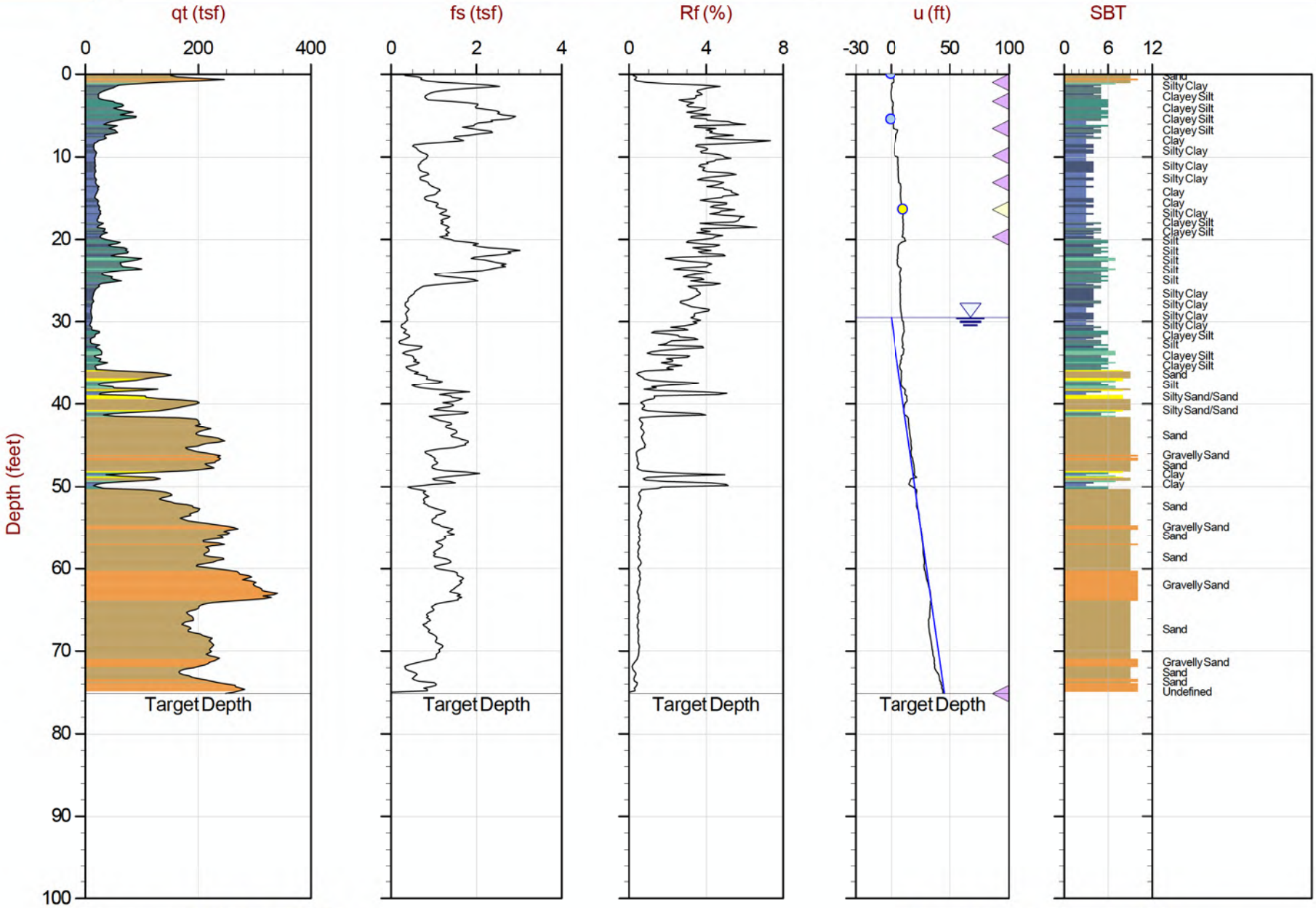
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 2017-06-12 12:55
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: 206:T1500F15U500



Max Depth: 22.900 m / 75.13 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-53075_CPHA-C12.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4042742m E: 271089m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

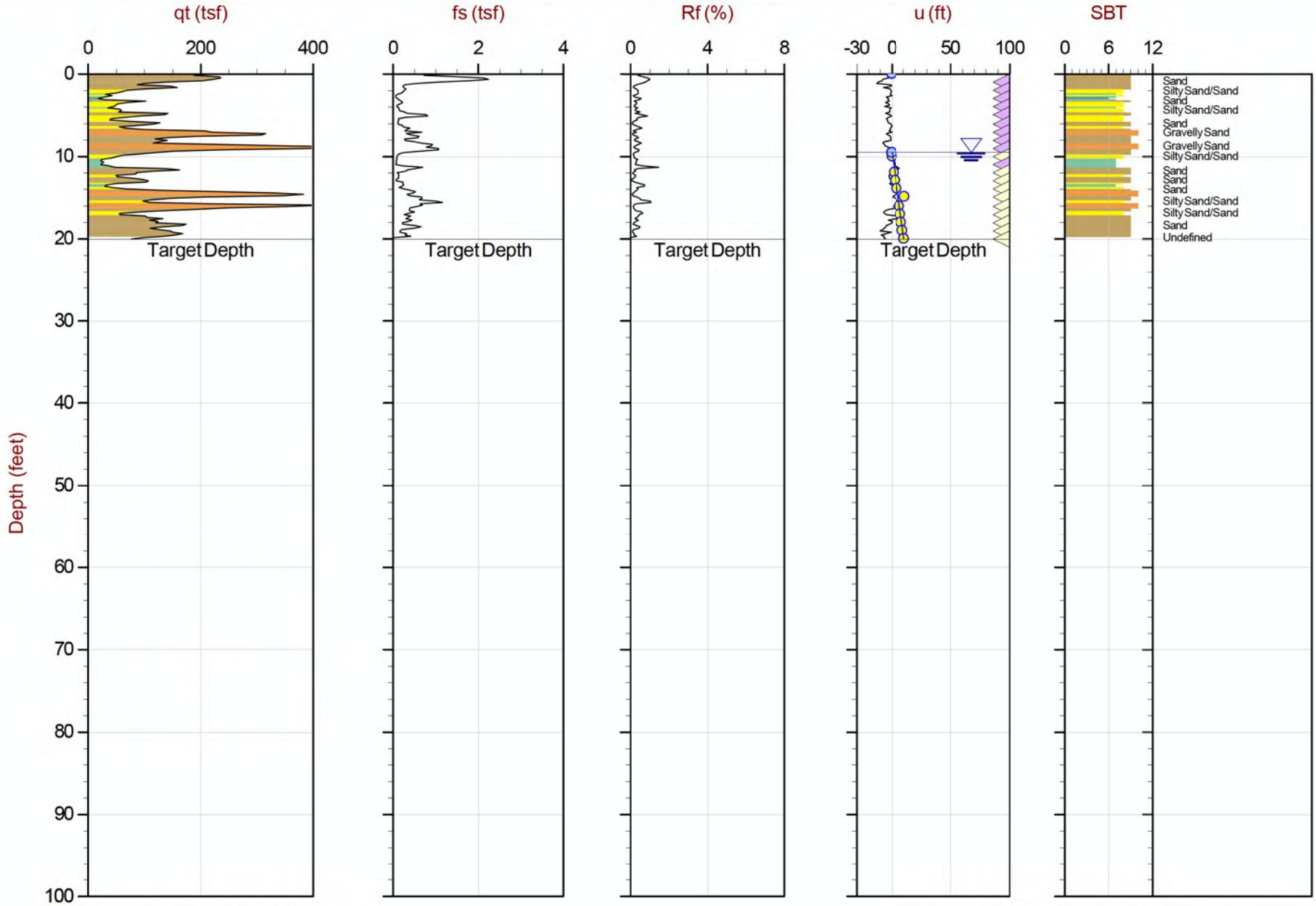
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 2017-06-13 08:41
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: 268:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-53075_CPHA-C13.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4042731m E: 270764m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

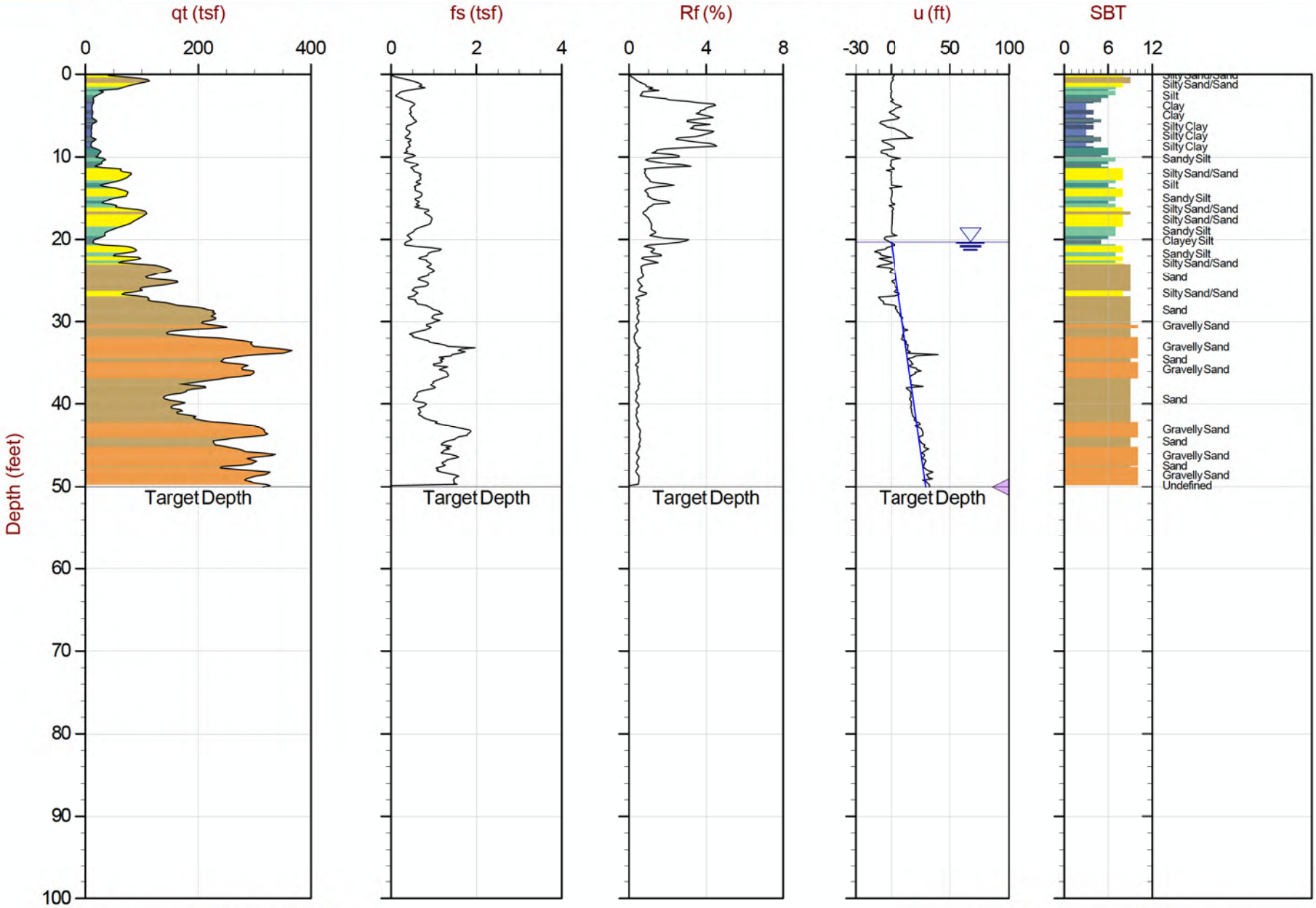
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 2017-06-13 12:30
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C14
Cone: 268:T1500F15U500



Max Depth: 15.250 m / 50.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-53075_CPHA-C14.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4042595m E: 270264m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

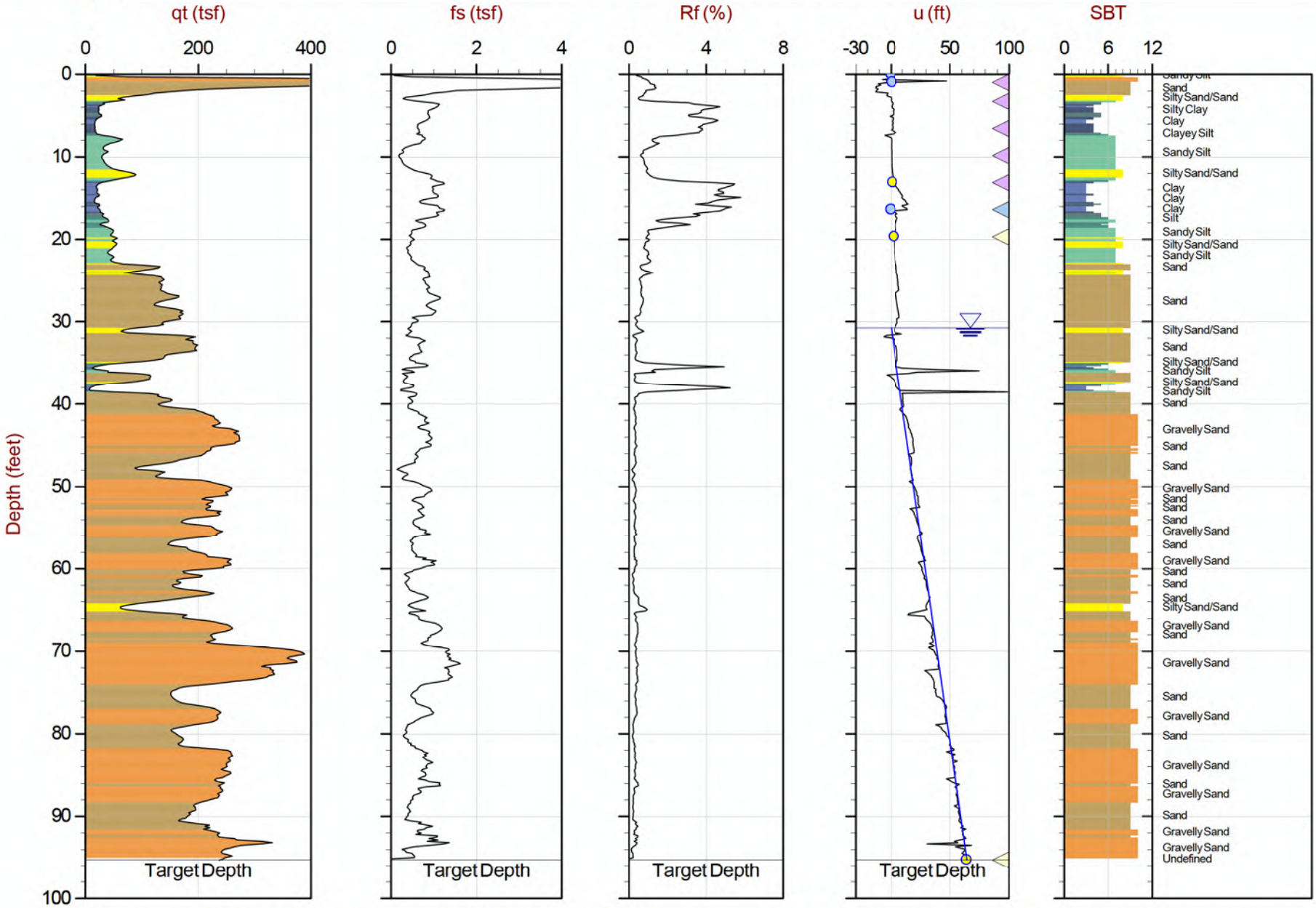
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 2017-06-12 16:20
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: 206:T1500F15U500



Max Depth: 29.050 m / 95.31 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-53075_SPHA-C15.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4042586m E: 270283m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

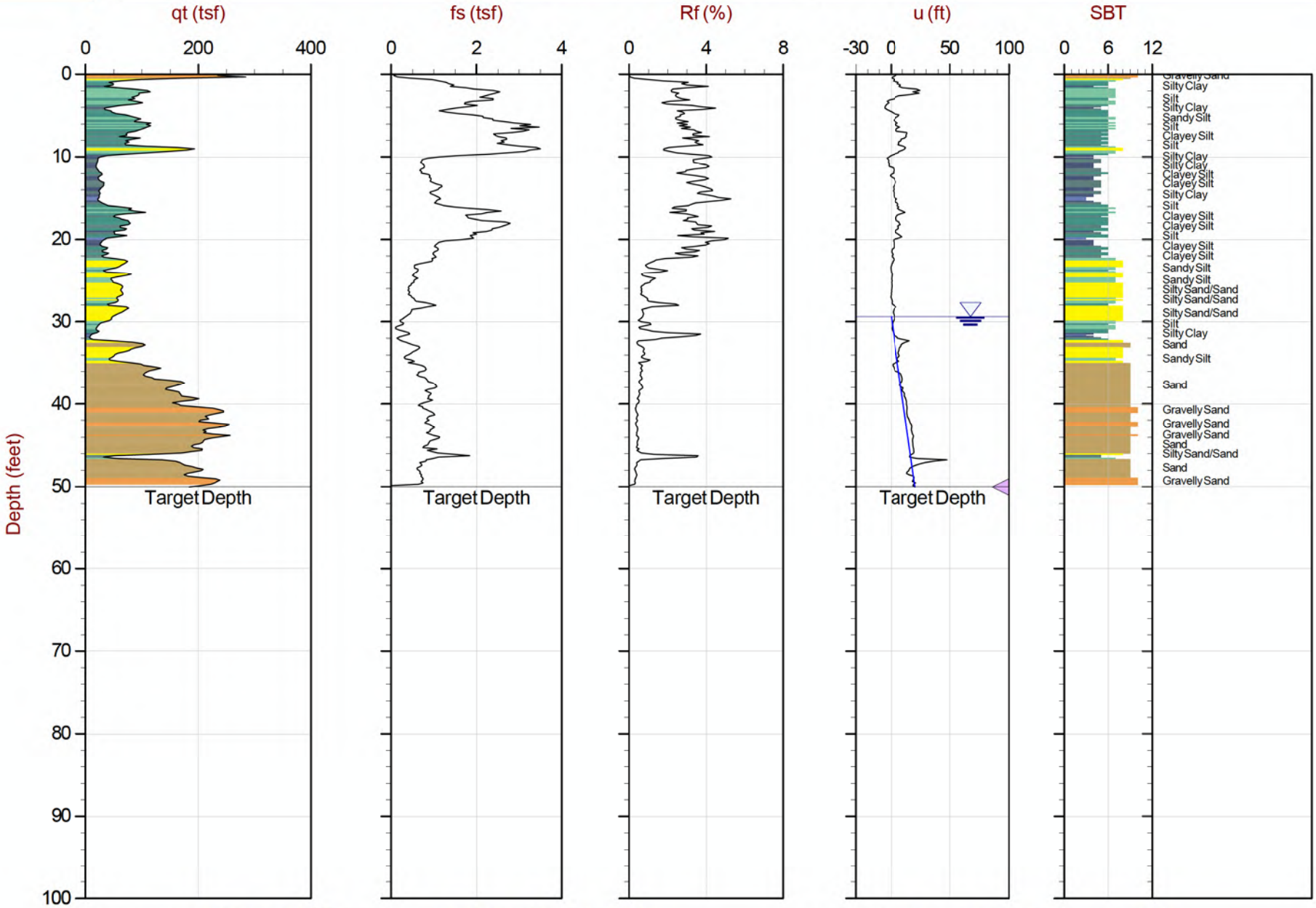
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 2017-06-12 15:12
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C16
Cone: 206:T1500F15U500



Max Depth: 15.250 m / 50.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-53075_CPHA-C16.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4042456m E: 270919m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

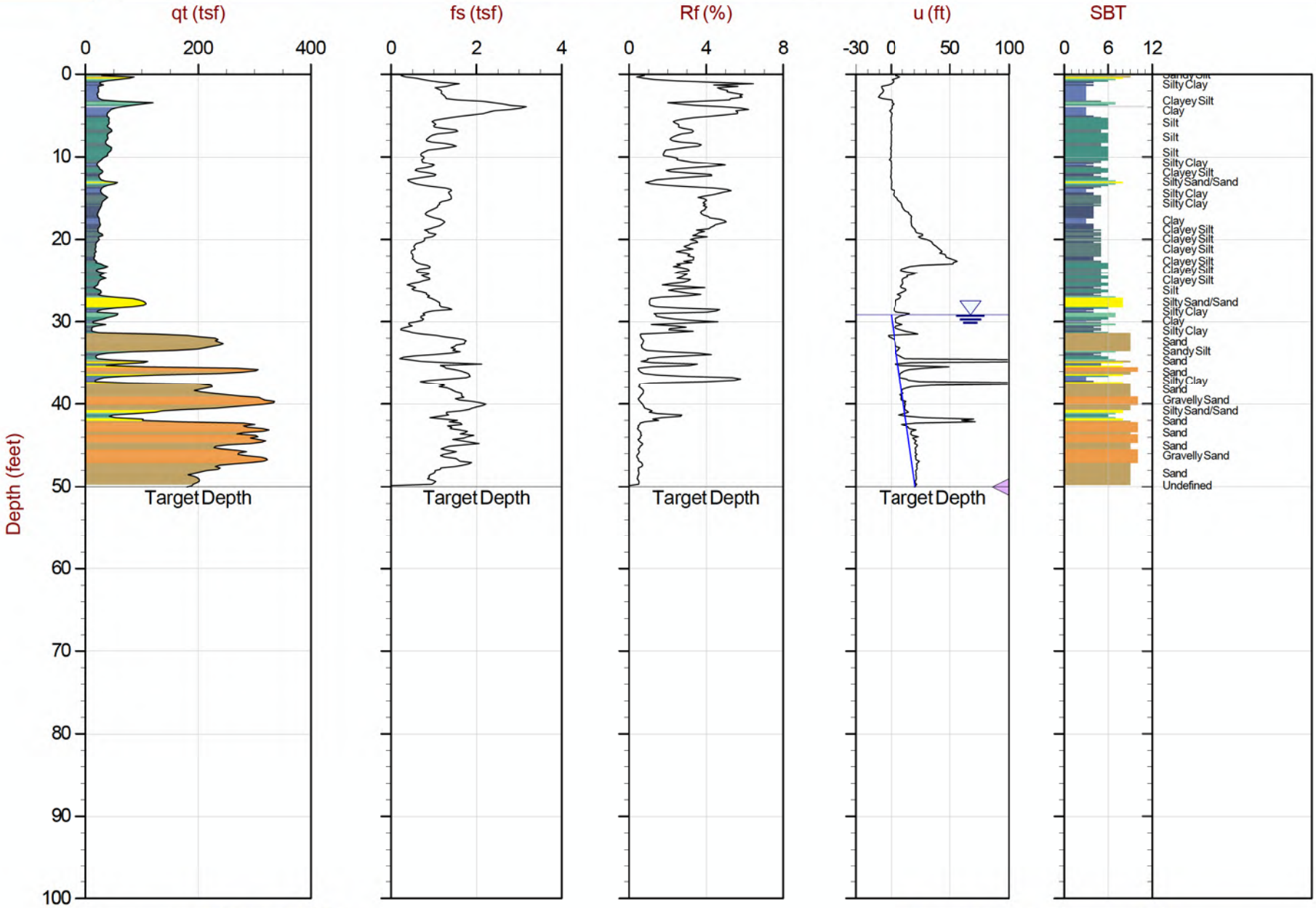
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 2017-06-13 11:34
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C17
Cone: 268:T1500F15U500



Max Depth: 15.250 m / 50.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 17-53075_CPHA-C17.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4042793m E: 270390m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

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

Job No:	17-53075
Client:	Haley & Aldrich
Project:	New Madrid Power Plant, Marston, MO
Start Date:	12-Jun-2017
End Date:	13-Jun-2017

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)	Estimated Phreatic Surface (ft)	t_{50} [a] (s)	Assumed Rigidity Index (I_r)	c_h [b] (cm^2/min)
CPT17-HA-C11	17-53075_CPHA-C11.PPD	15	210	29.69						
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	400	0.98						
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	295	3.28						
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	900	6.56						
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	900	9.84						
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	300	13.12						
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	300	16.40	10.91	5.50				
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	900	19.68						
CPT17-HA-C12	17-53075_CPHA-C12.PPD	15	355	75.13						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	0.98						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	250	1.97						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	2.95						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	3.94						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	4.92						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	6.07						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	400	7.05						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	8.04						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	9.02						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	10.01	0.44	9.57				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	10.99						
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	11.97	2.39	9.59				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	12.96	3.32	9.64				

Job No:	17-53075
Client:	Haley & Aldrich
Project:	New Madrid Power Plant, Marston, MO
Start Date:	12-Jun-2017
End Date:	13-Jun-2017

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)	Estimated Phreatic Surface (ft)	t_{50} [a] (s)	Assumed Rigidity Index (I_r)	c_h [b] (cm^2/min)
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	350	13.94	4.41	9.54				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	300	14.93	11.27	3.66				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	16.08	6.65	9.42				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	400	17.06	7.56	9.50				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	300	18.04	8.30	9.75				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	200	19.03	9.45	9.57				
CPT17-HA-C13	17-53075_CPHA-C13.PPD	15	1000	20.01	10.84	9.18				
CPT17-HA-C14	17-53075_CPHA-C14.PPD	15	610	50.03						
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	2100	0.98	0.98		0.00	12	100	56.84
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	200	3.28						
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	300	6.56						
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	250	9.84						
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	200	13.12	1.56	11.57				
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	2705	16.40	0.00		16.40	1040	100	0.68
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	300	19.68	2.85	16.83				
SCPT17-HA-C15	17-53075_SPHA-C15.PPD	15	300	95.31	64.58	30.73				
CPT17-HA-C16	17-53075_CPHA-C16.PPD	15	400	50.03						
CPT17-HA-C17	17-53075_CPHA-C17.PPD	15	350	50.03						
Totals	40 dissipations		297.9 min							

a. Time is relative to where umax occurred

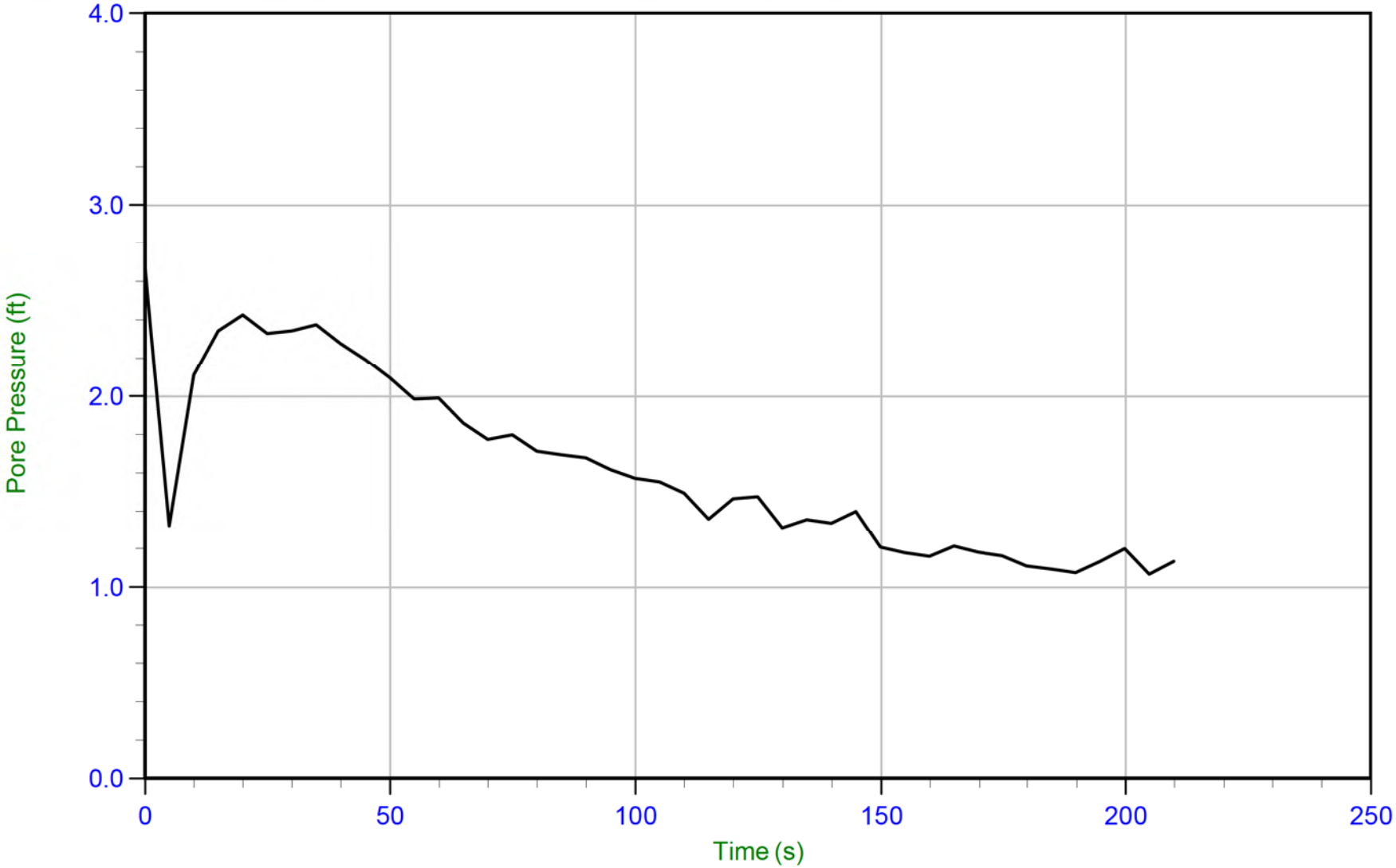
b. Houlsby and Teh, 1991

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 11:40:33
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C11
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C11.PPD
Depth: 9.050 m / 29.691 ft
Duration: 210.0 s

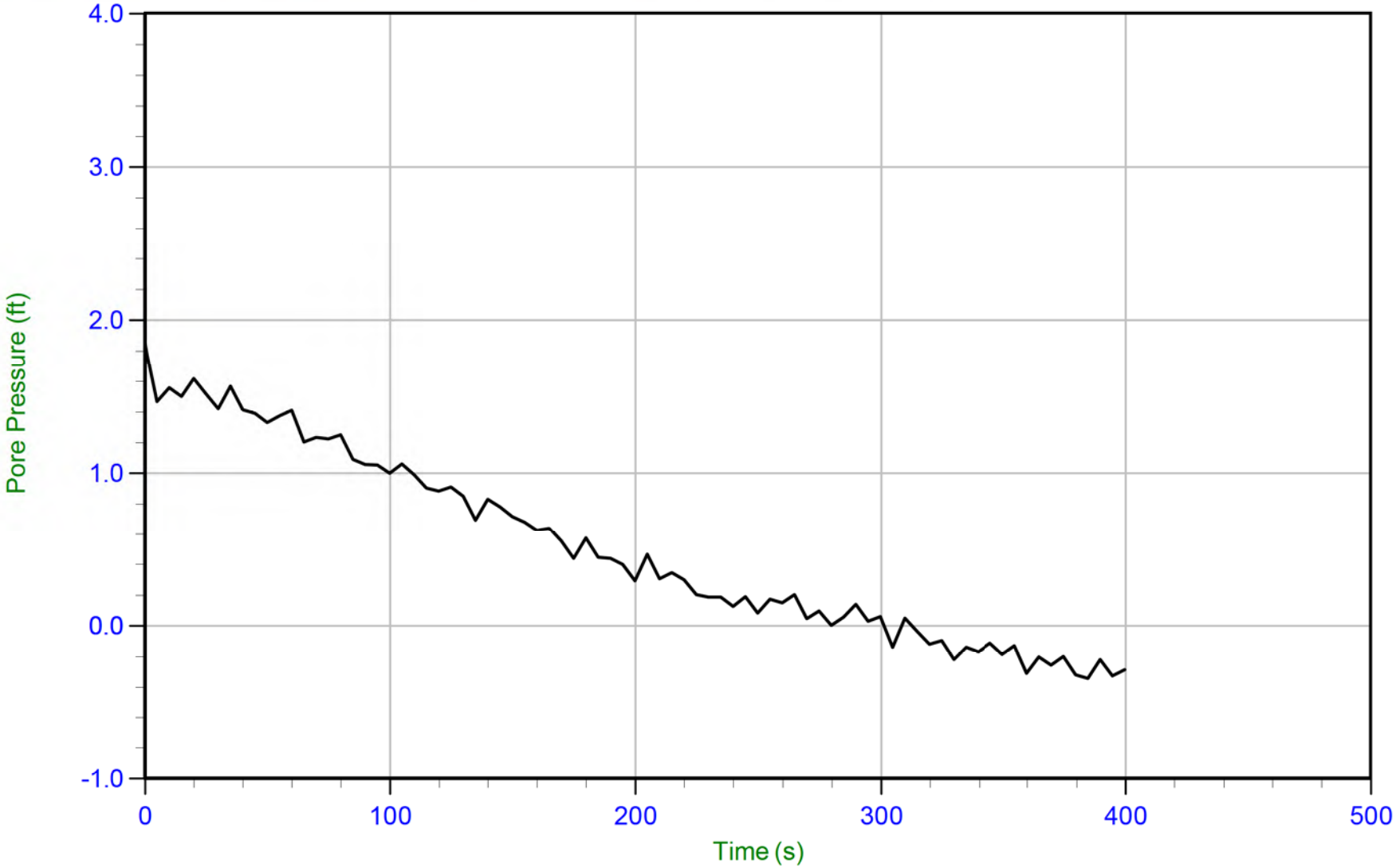
U Min: 1.1 ft
U Max: 2.7 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 0.300 m / 0.984 ft
Duration: 400.0 s

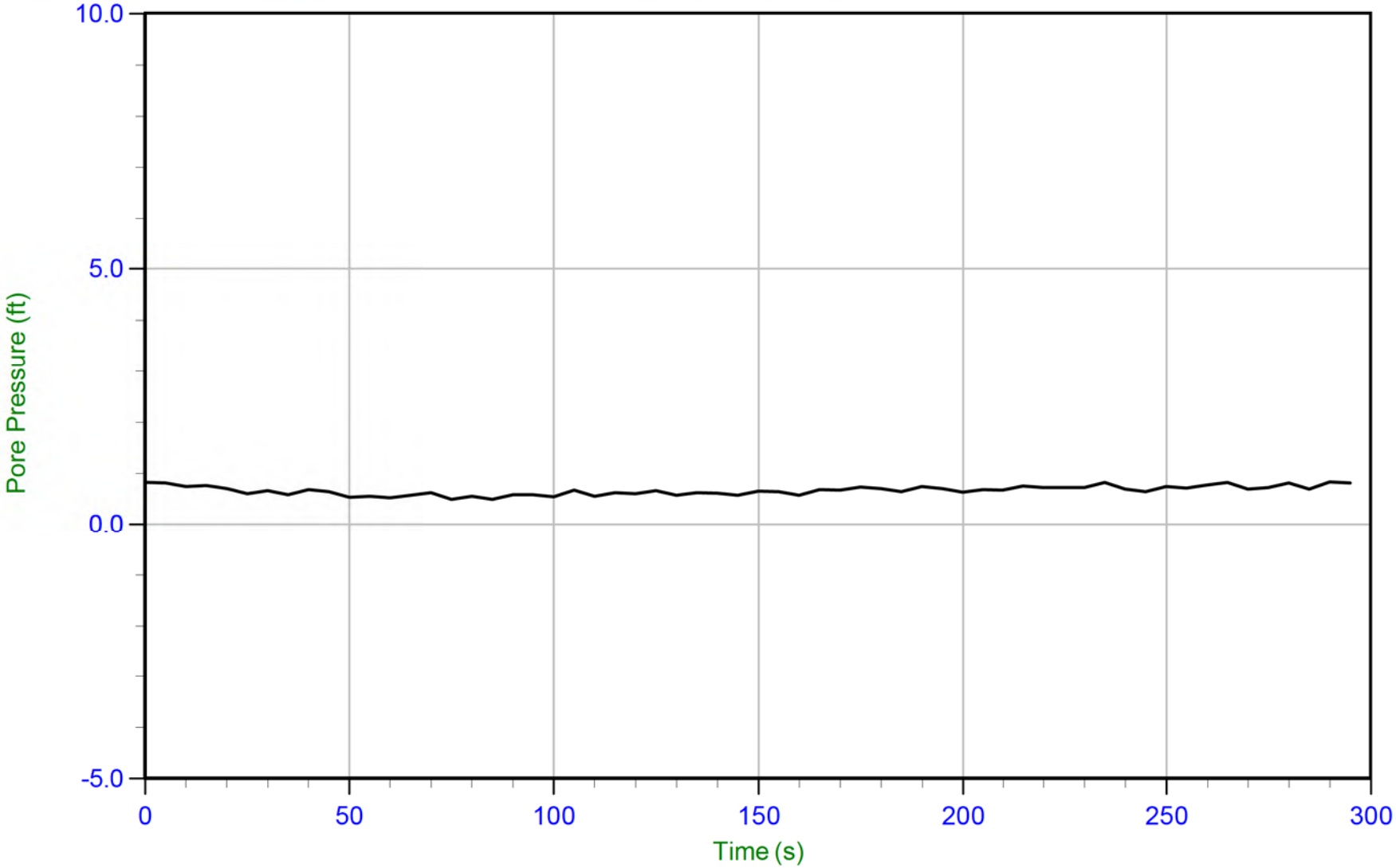
U Min: -0.3 ft
U Max: 1.8 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 1.000 m / 3.281 ft
Duration: 295.0 s

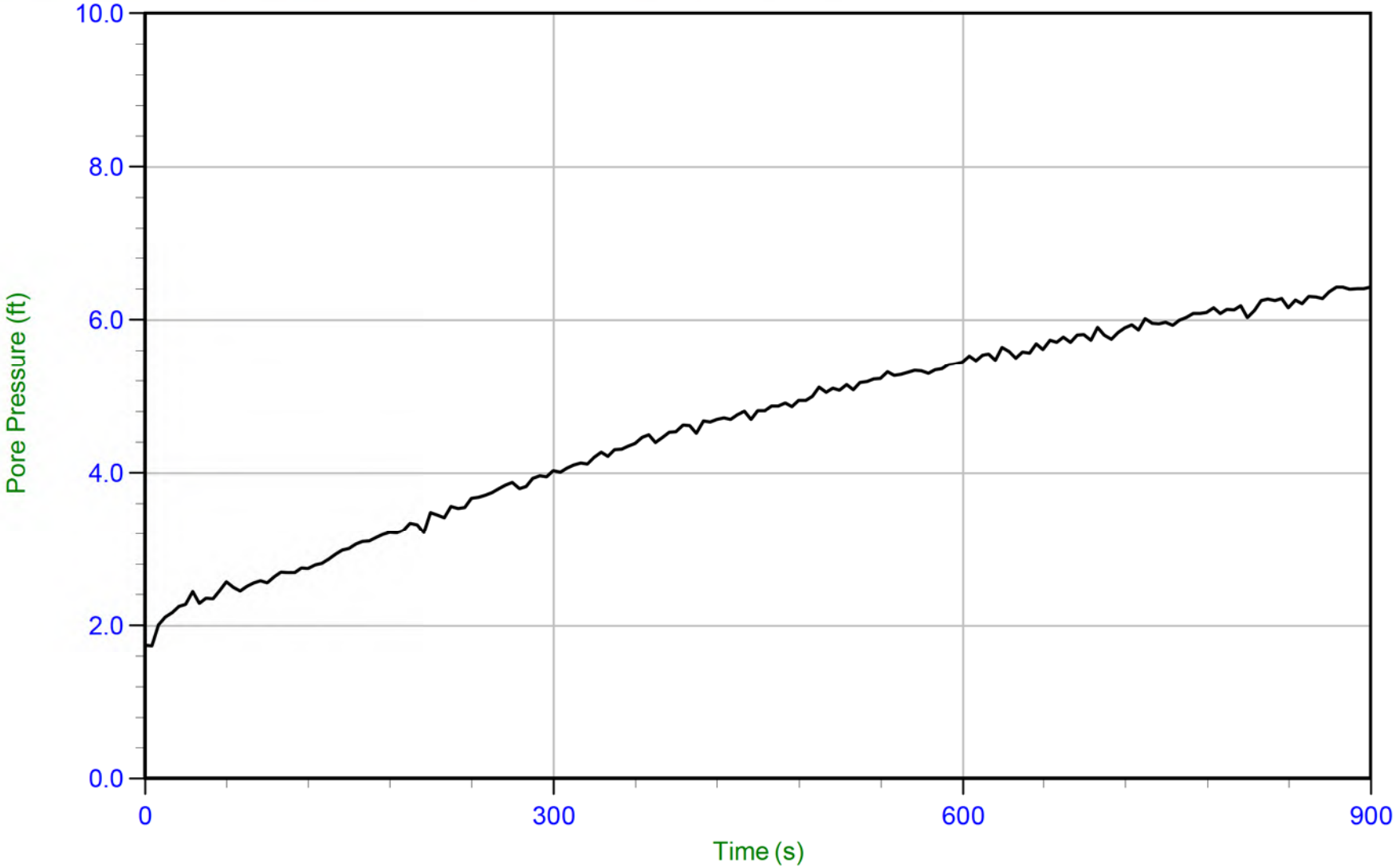
U Min: 0.5 ft
U Max: 0.8 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 2.000 m / 6.562 ft
Duration: 900.0 s

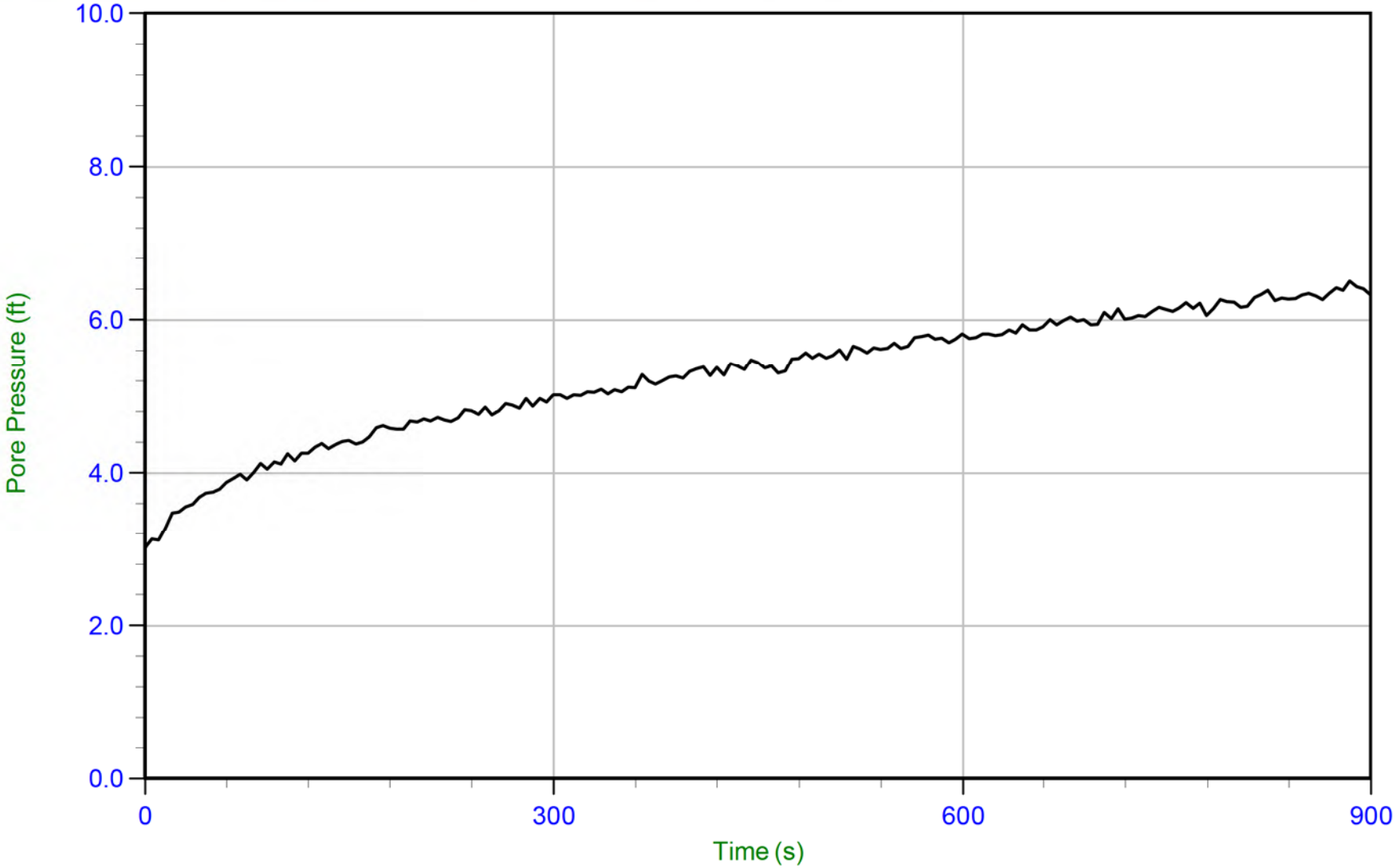
U Min: 1.7 ft
U Max: 6.4 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 3.000 m / 9.842 ft
Duration: 900.0 s

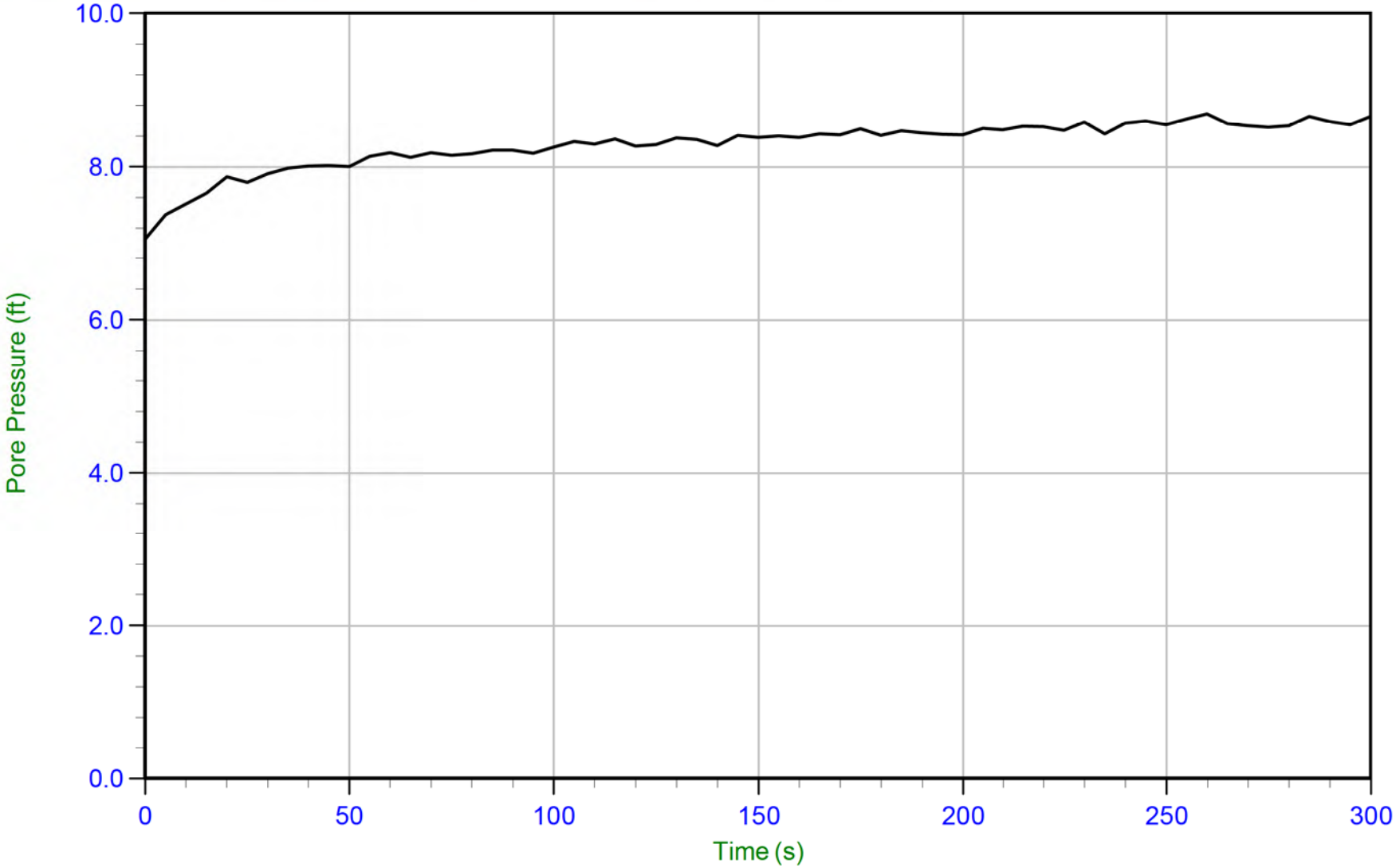
U Min: 3.0 ft
U Max: 6.5 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 4.000 m / 13.123 ft
Duration: 300.0 s

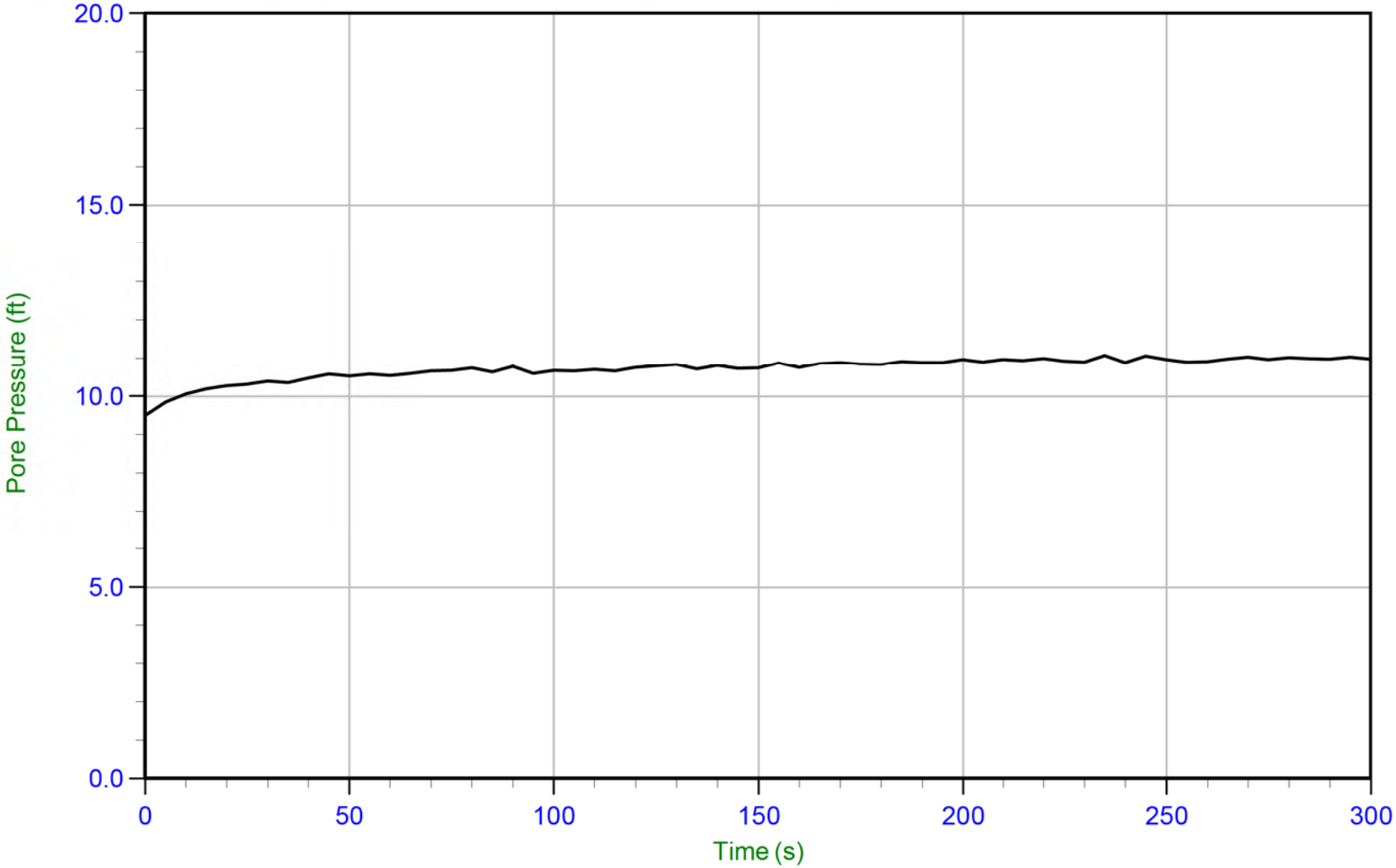
U Min: 7.1 ft
U Max: 8.7 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 5.000 m / 16.404 ft
Duration: 300.0 s

U Min: 9.5 ft
U Max: 11.1 ft

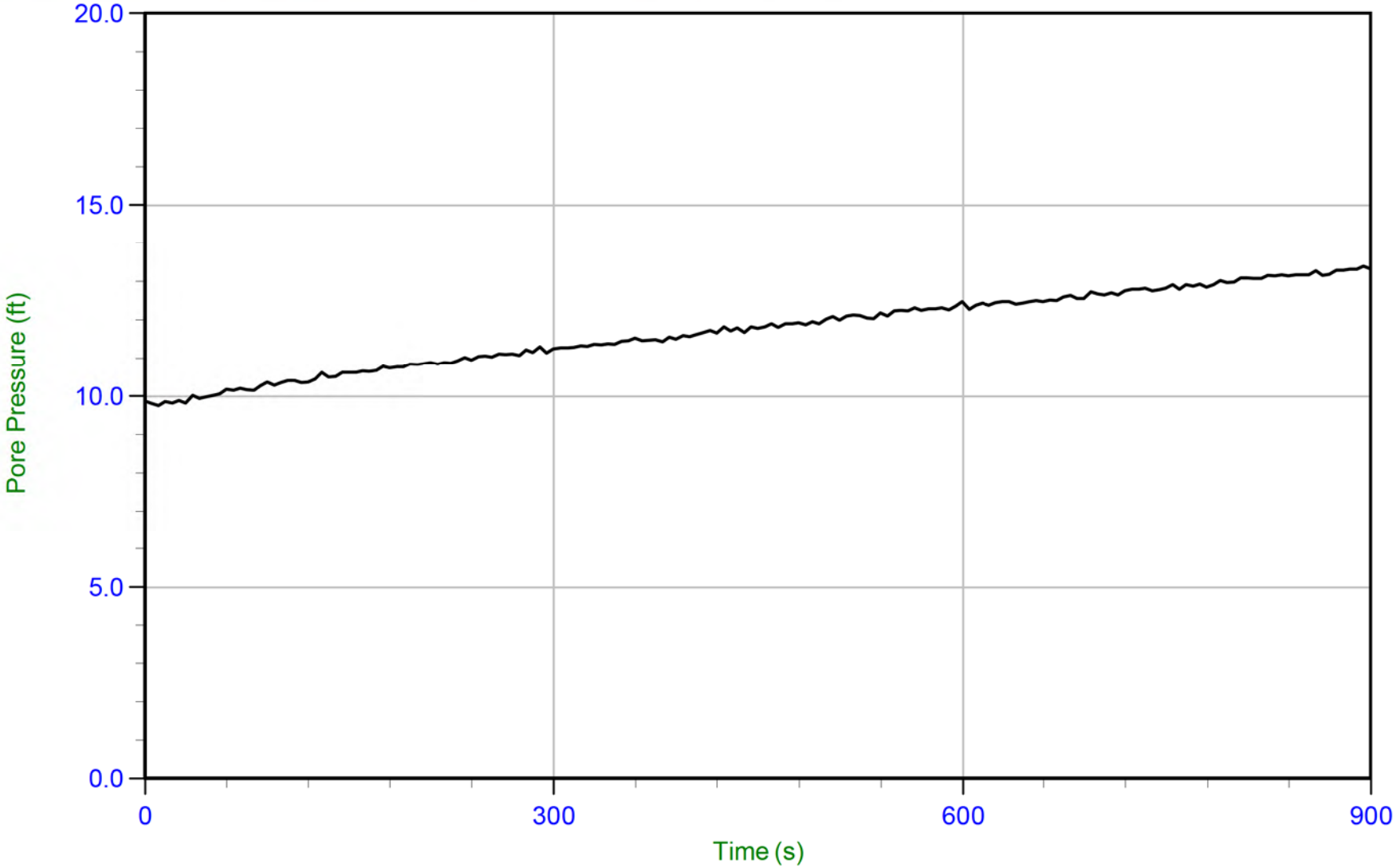
WT: 1.675 m / 5.495 ft
Ueq: 10.9 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 6.000 m / 19.685 ft
Duration: 900.0 s

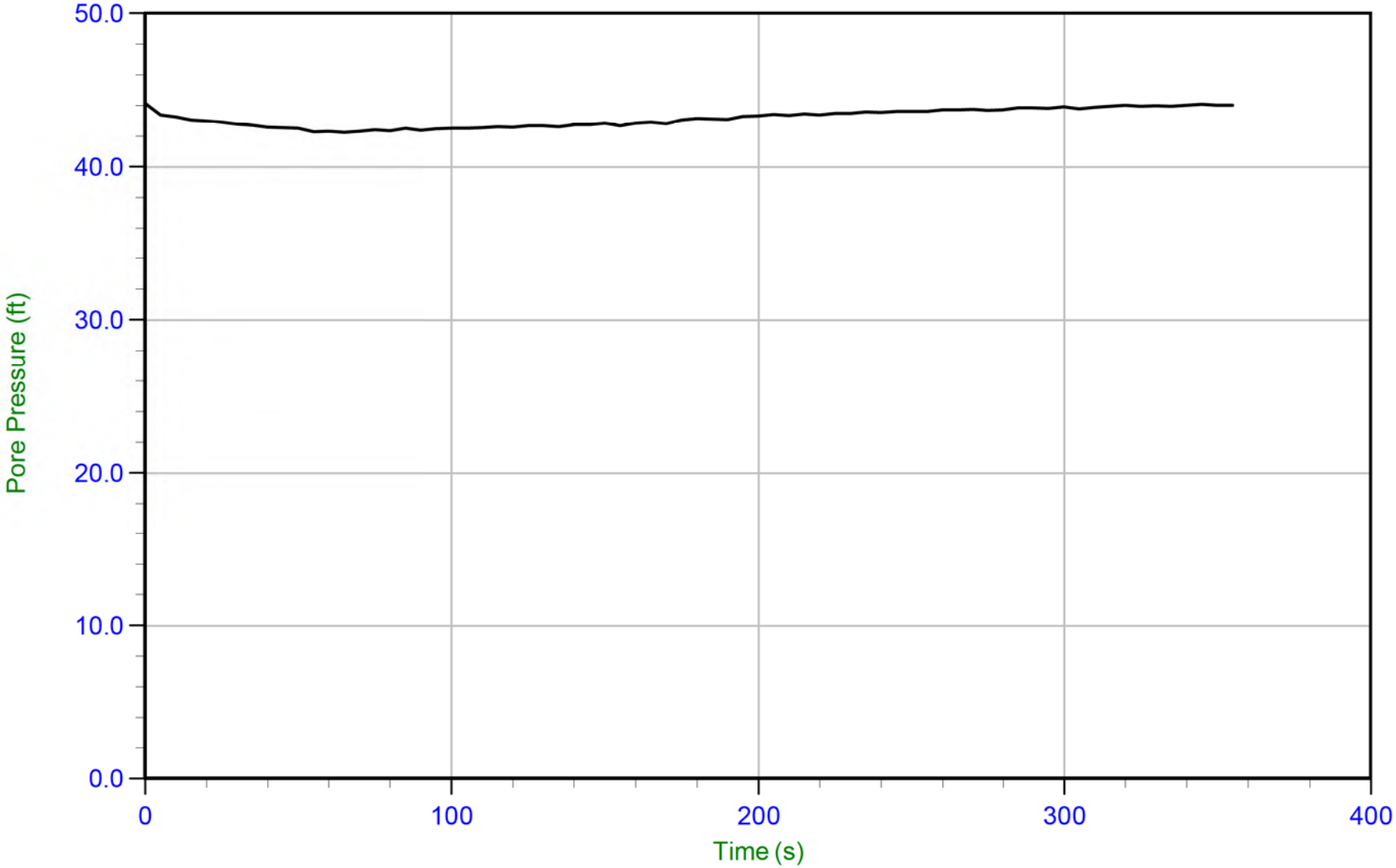
U Min: 9.8 ft
U Max: 13.4 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 12:55:13
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C12
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C12.PPD
Depth: 22.900 m / 75.130 ft
Duration: 355.0 s

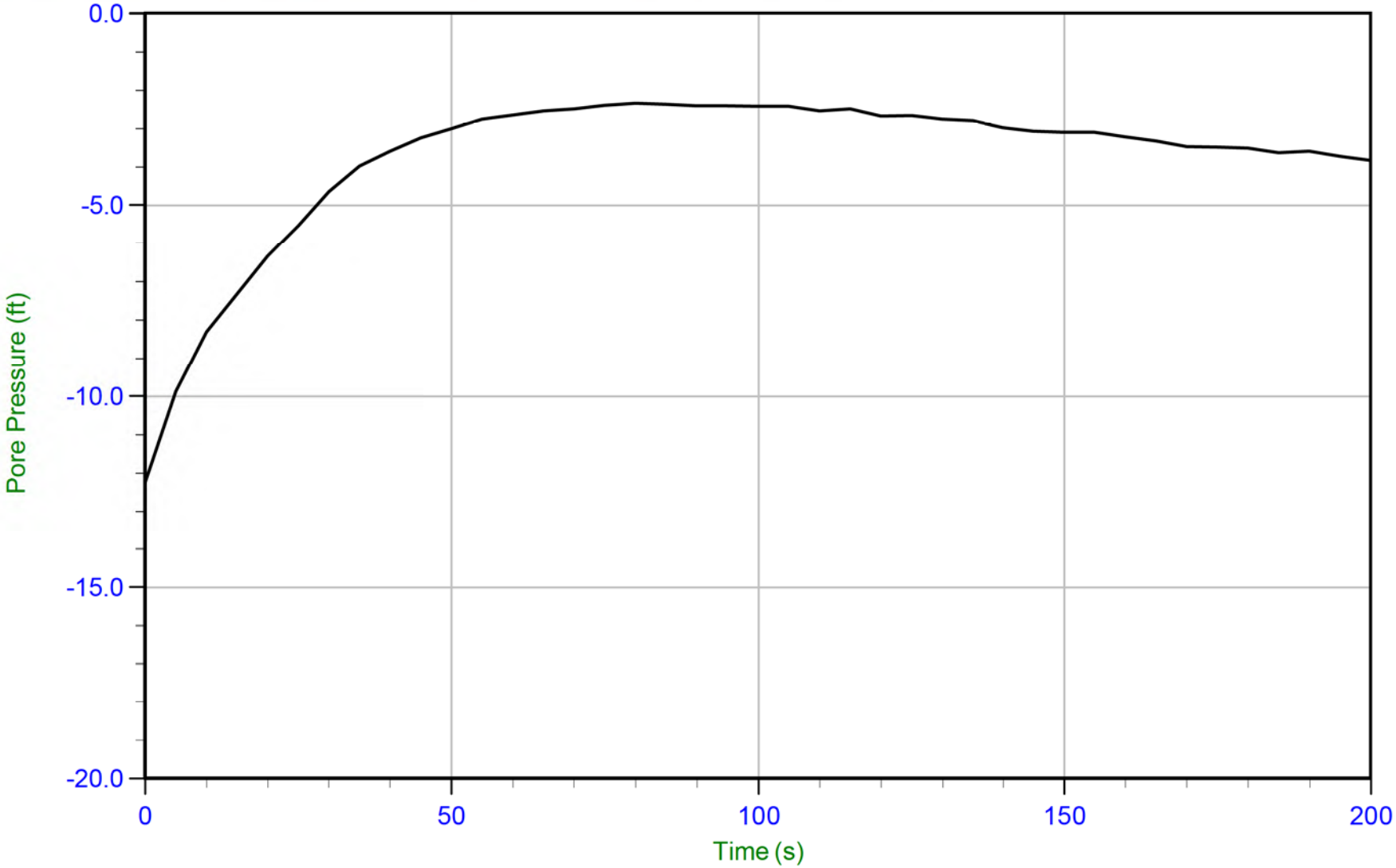
U Min: 42.3 ft
U Max: 44.1 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 0.300 m / 0.984 ft
Duration: 200.0 s

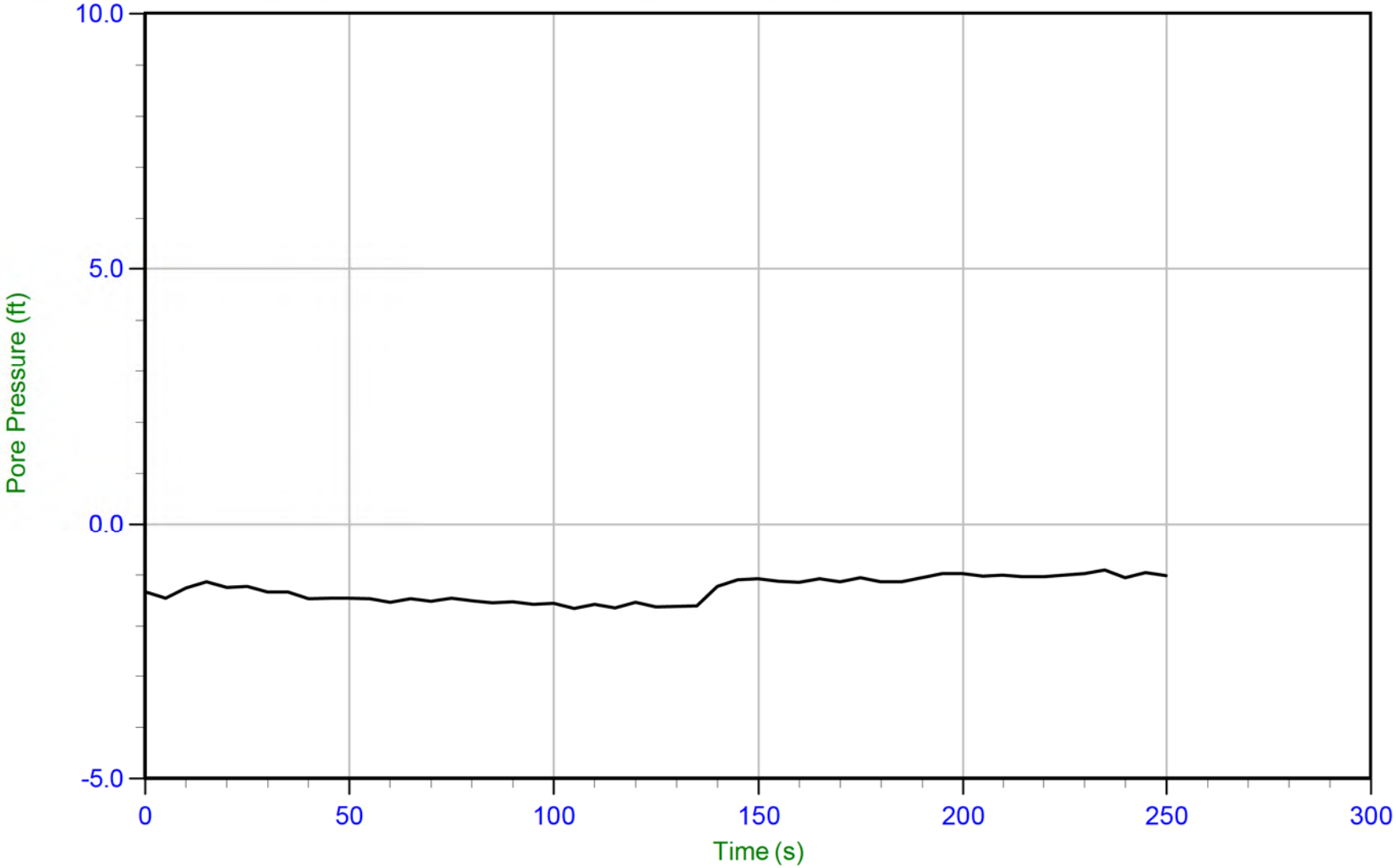
U Min: -12.2 ft
U Max: -2.3 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 0.600 m / 1.968 ft
Duration: 250.0 s

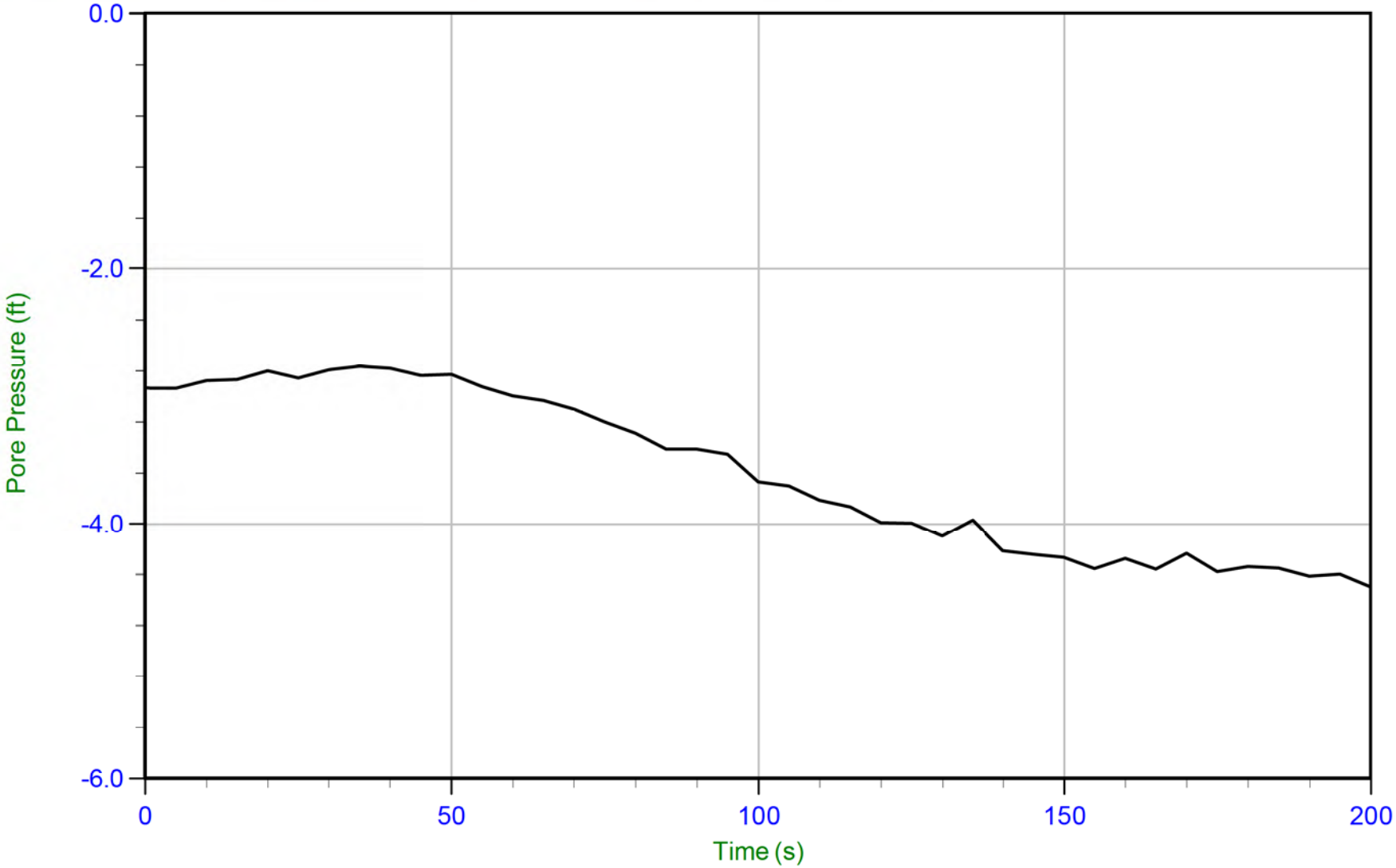
U Min: -1.7 ft
U Max: -0.9 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 0.900 m / 2.953 ft
Duration: 200.0 s

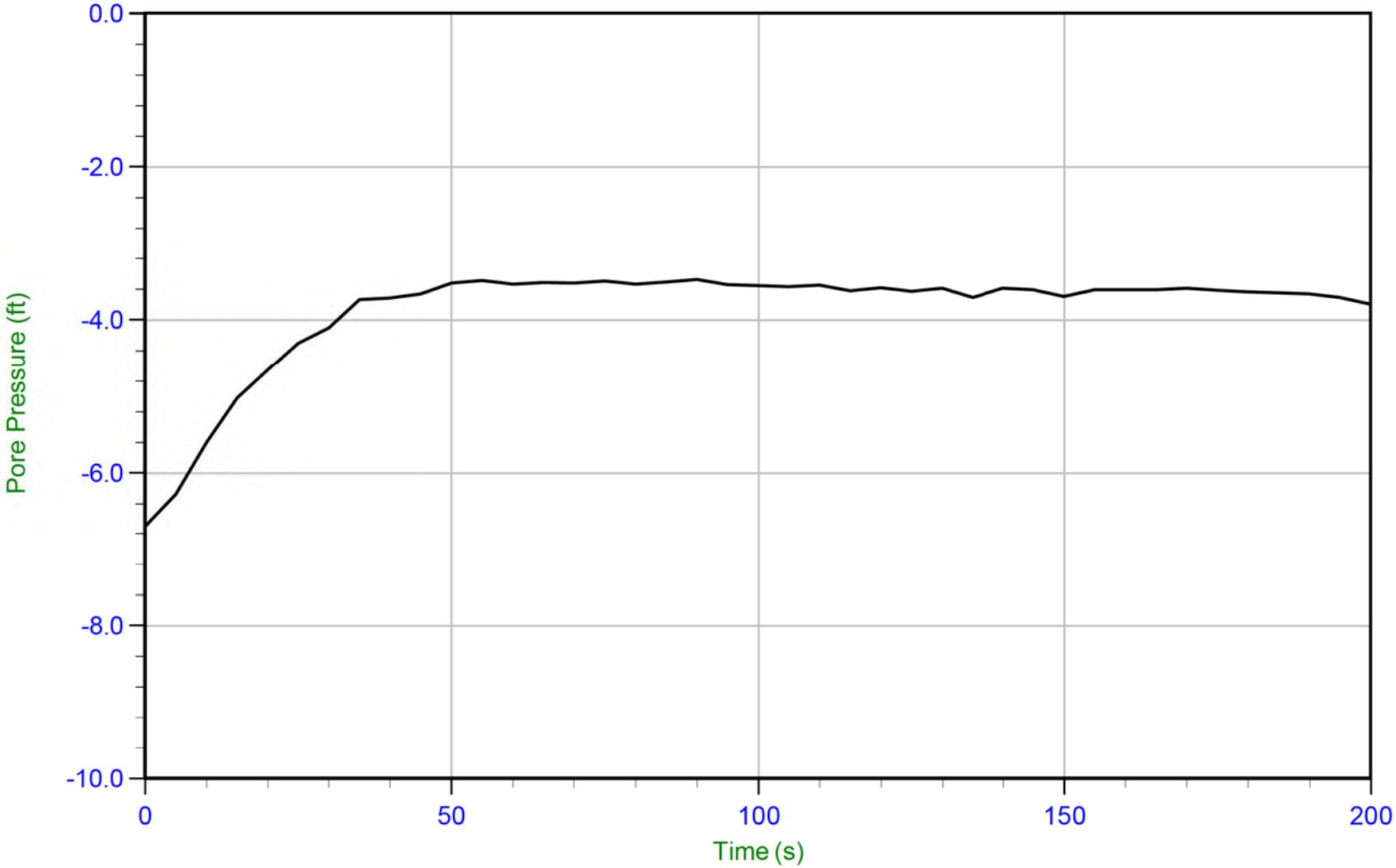
U Min: -4.5 ft
U Max: -2.8 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 1.200 m / 3.937 ft
Duration: 200.0 s

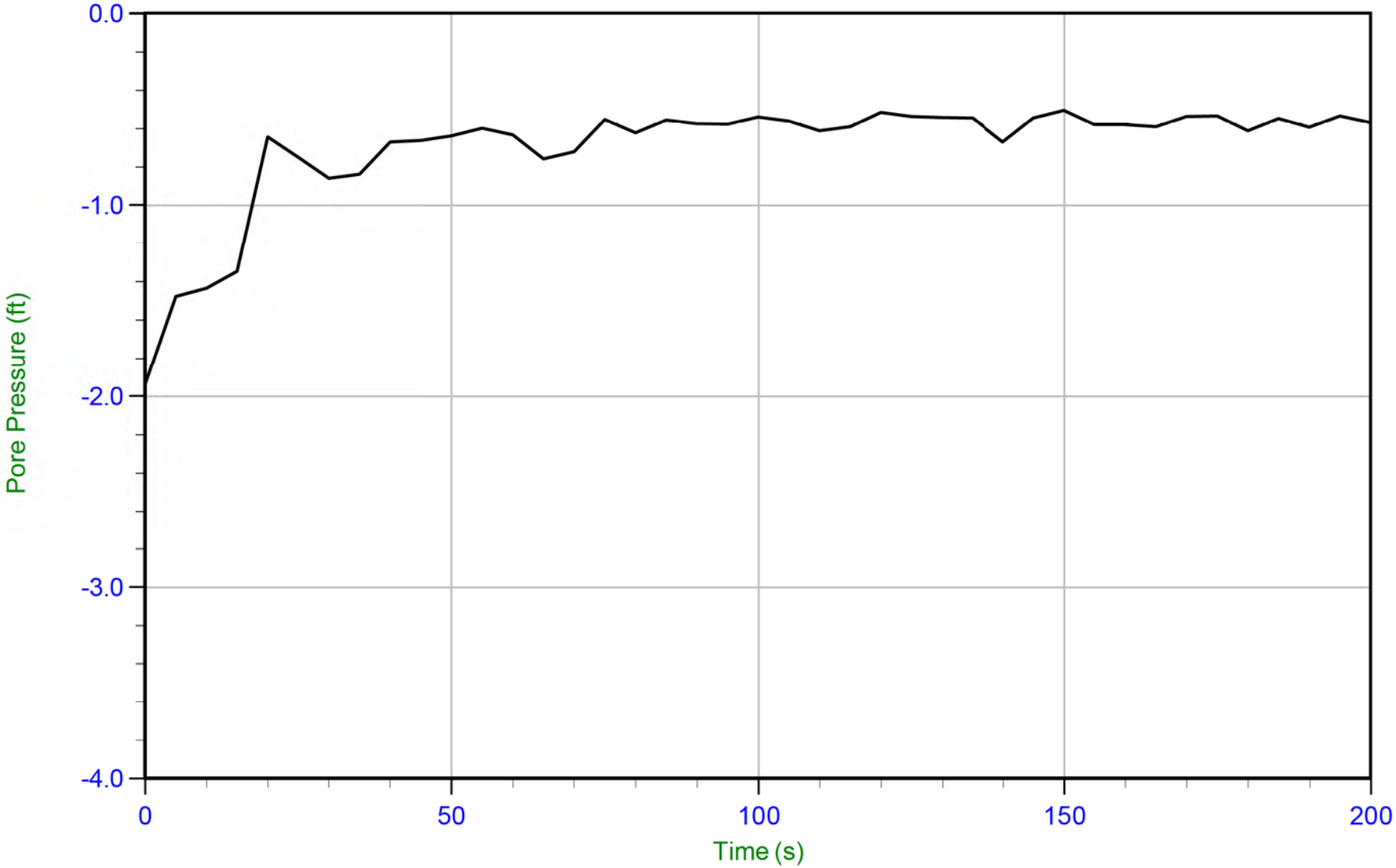
U Min: -6.7 ft
U Max: -3.5 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 1.500 m / 4.921 ft
Duration: 200.0 s

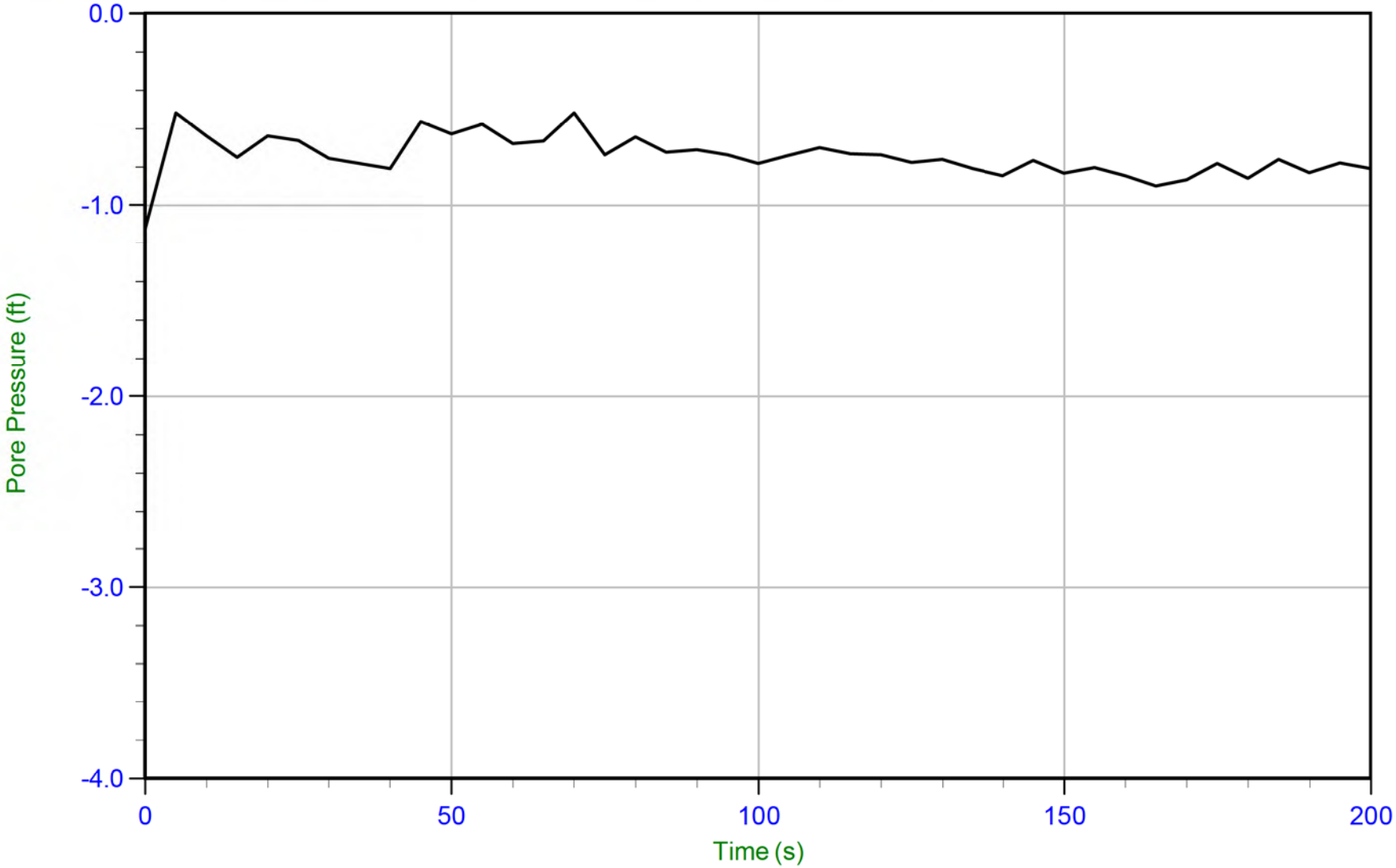
U Min: -1.9 ft
U Max: -0.5 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 1.850 m / 6.069 ft
Duration: 200.0 s

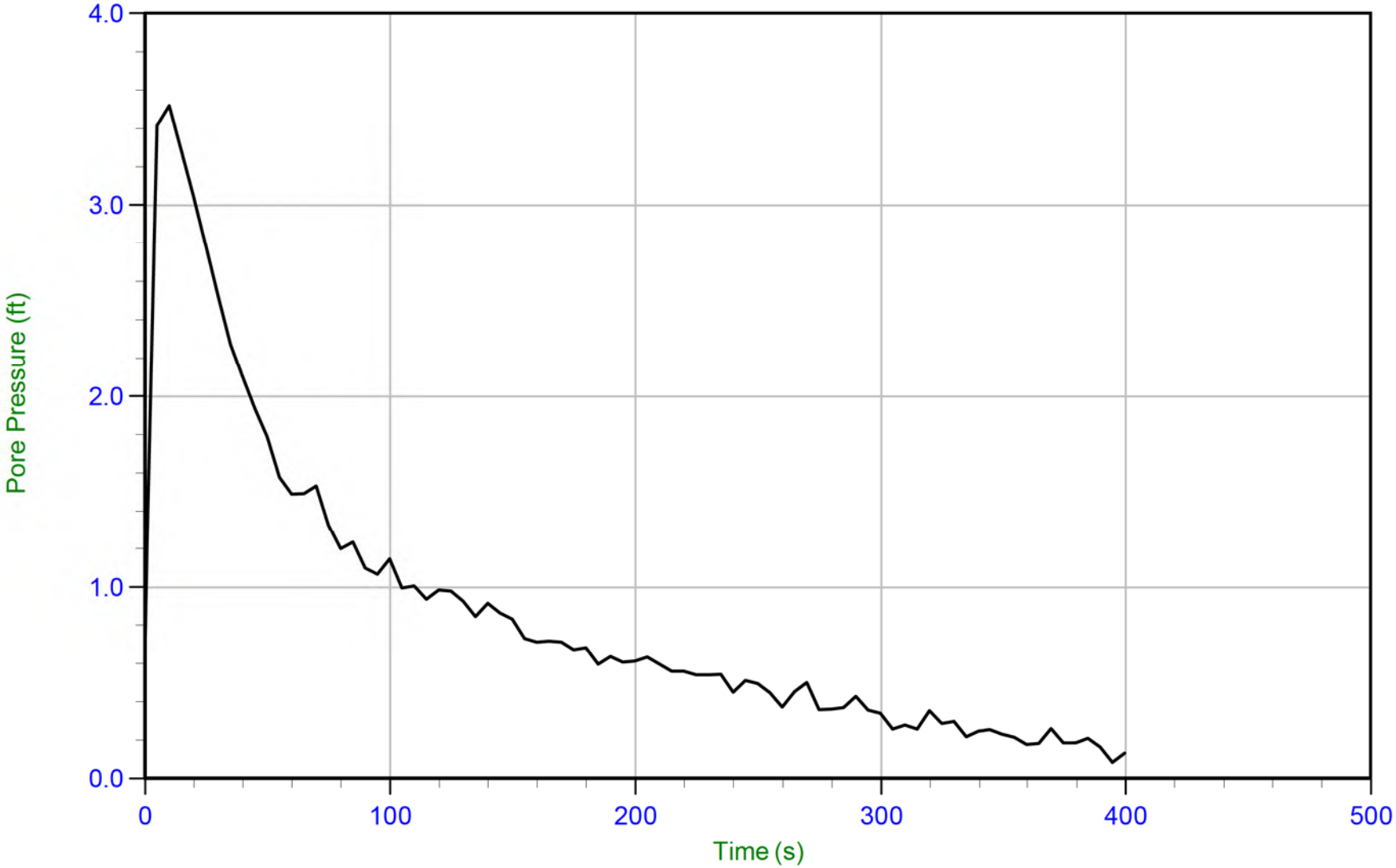
U Min: -1.1 ft
U Max: -0.5 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 2.150 m / 7.054 ft
Duration: 400.0 s

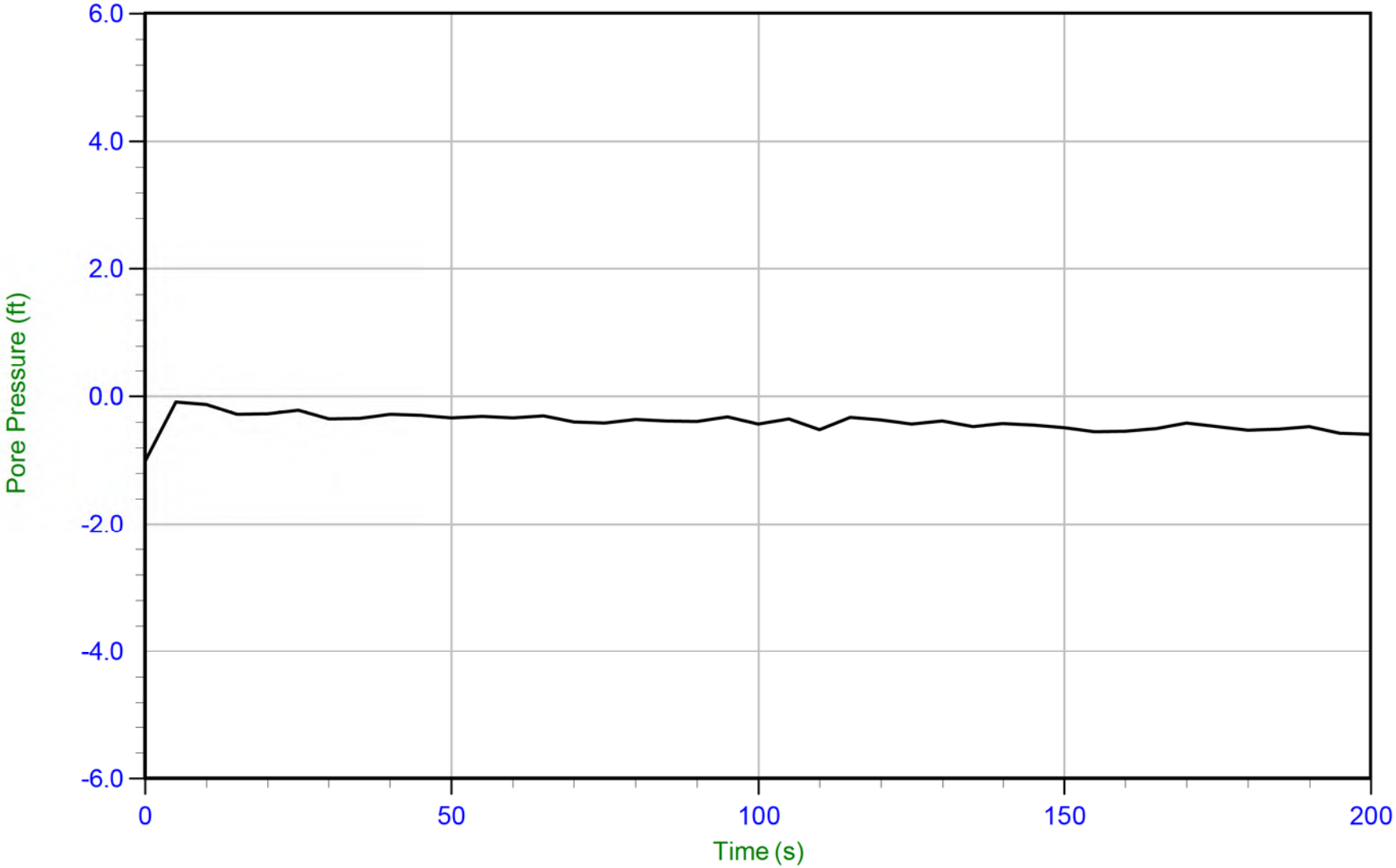
U Min: 0.1 ft
U Max: 3.5 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 2.450 m / 8.038 ft
Duration: 200.0 s

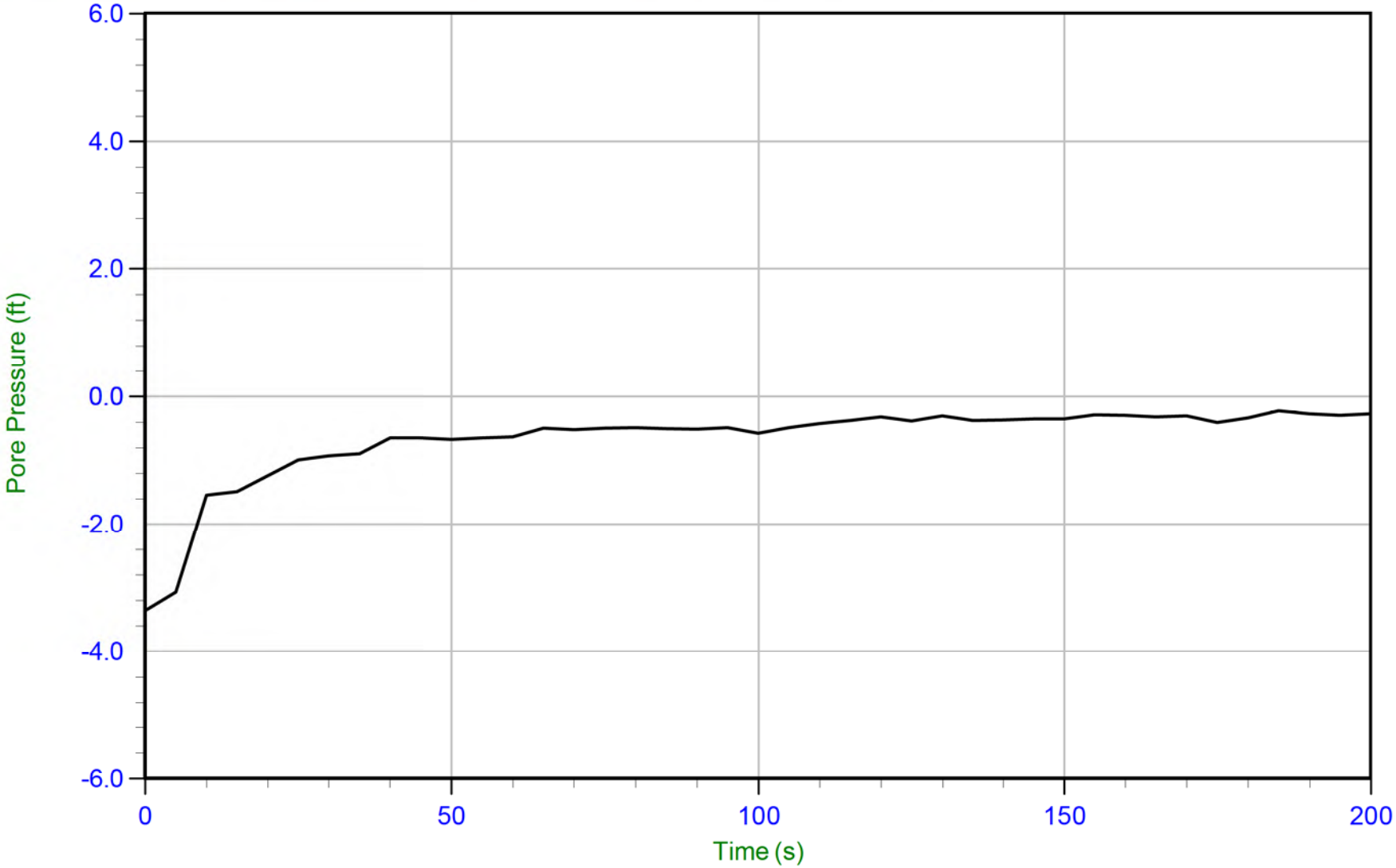
U Min: -1.0 ft
U Max: -0.1 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 2.750 m / 9.022 ft
Duration: 200.0 s

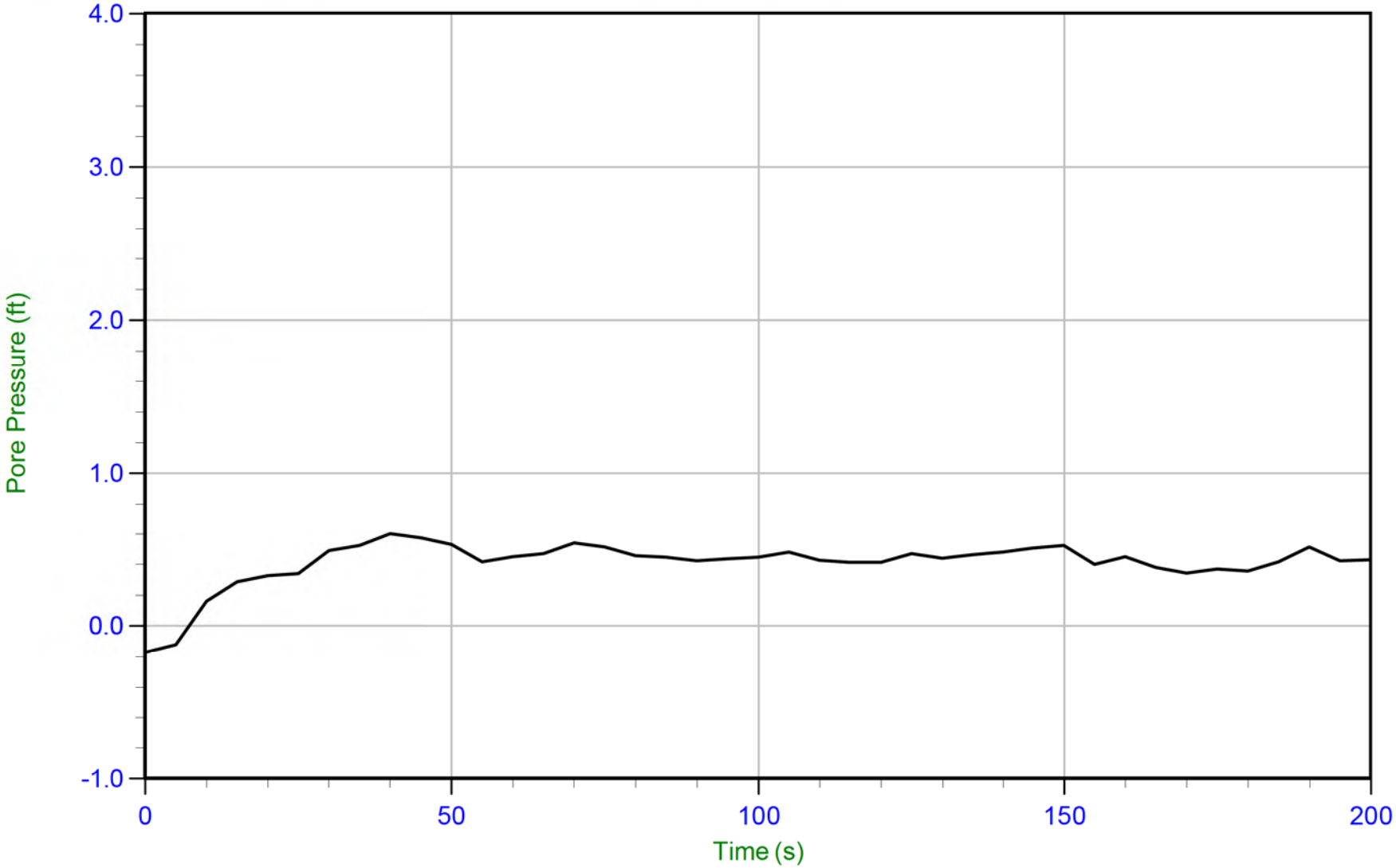
U Min: -3.4 ft
U Max: -0.2 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 3.050 m / 10.006 ft
Duration: 200.0 s

U Min: -0.2 ft
U Max: 0.6 ft

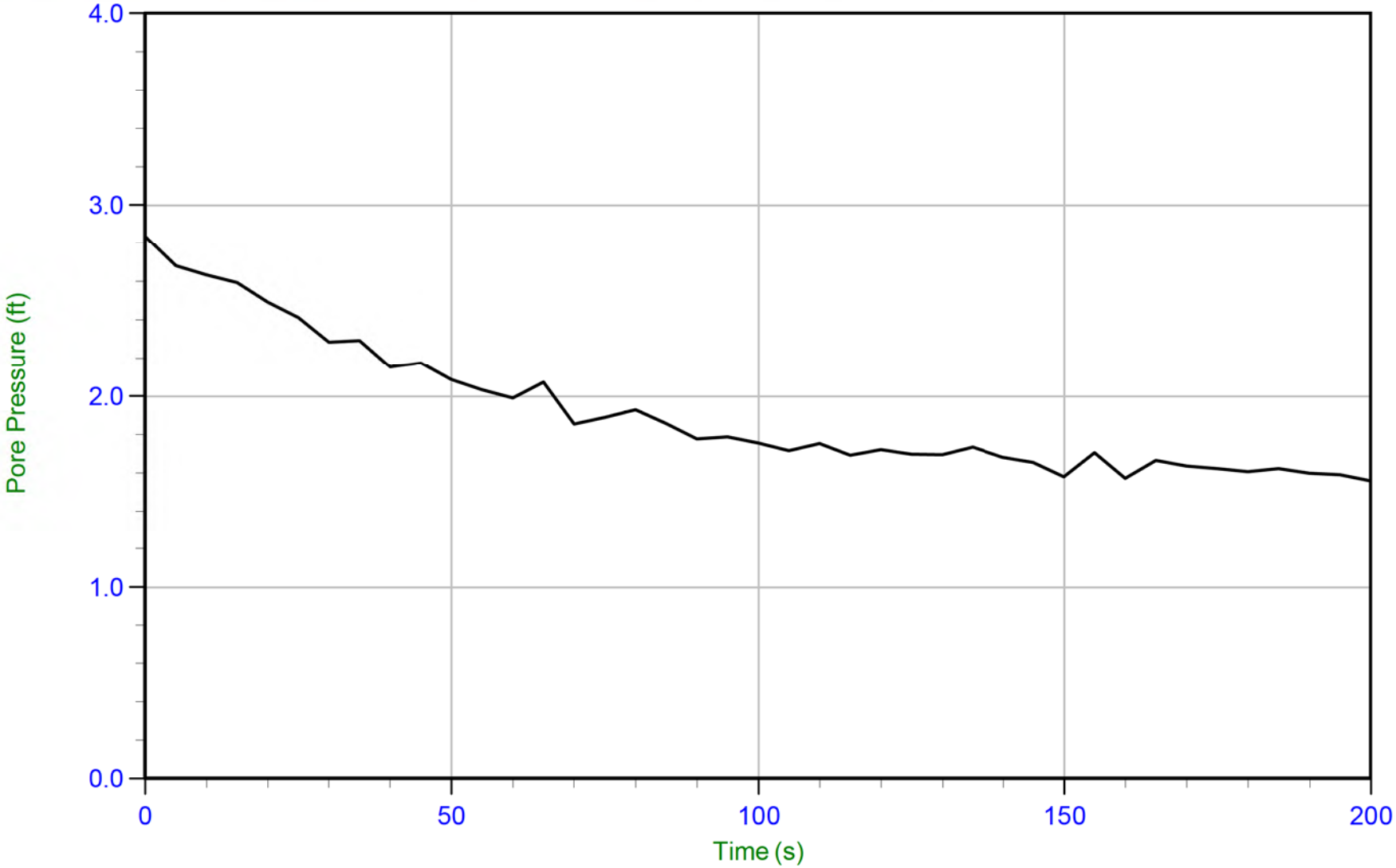
WT: 2.917 m / 9.570 ft
Ueq: 0.4 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 3.350 m / 10.991 ft
Duration: 200.0 s

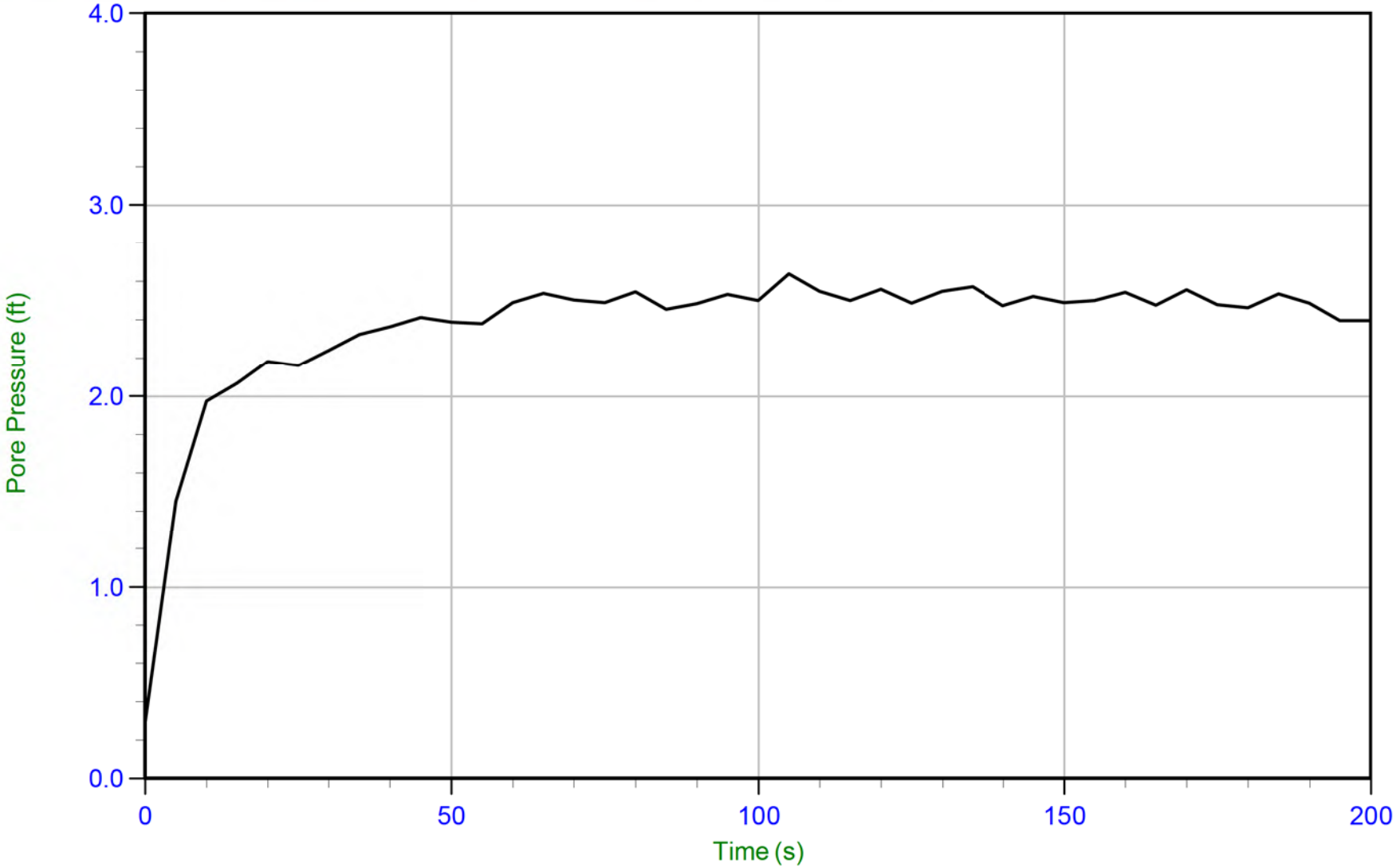
U Min: 1.6 ft
U Max: 2.8 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 3.650 m / 11.975 ft
Duration: 200.0 s

U Min: 0.3 ft
U Max: 2.6 ft

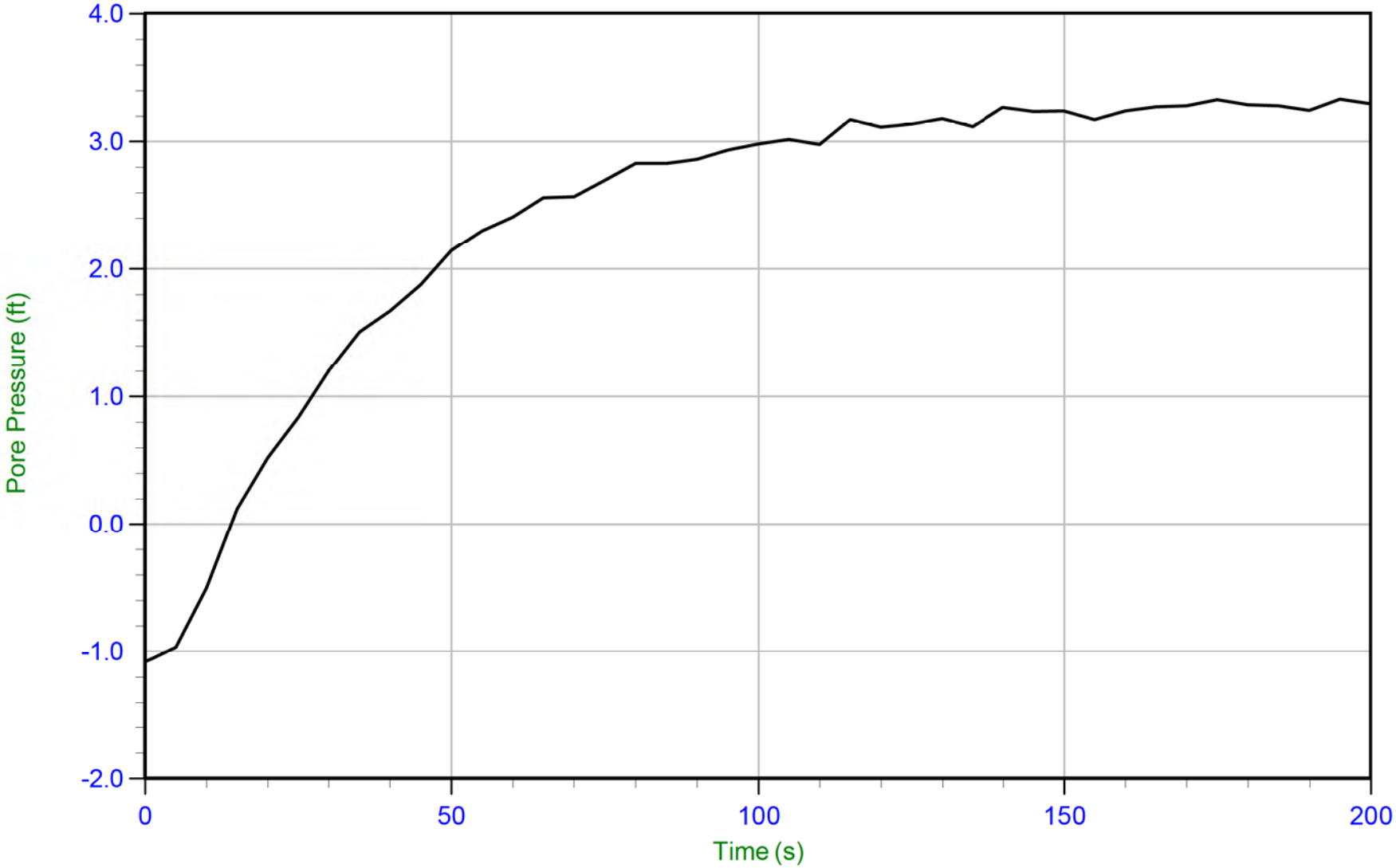
WT: 2.923 m / 9.589 ft
Ueq: 2.4 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 3.950 m / 12.959 ft
Duration: 200.0 s

U Min: -1.1 ft
U Max: 3.3 ft

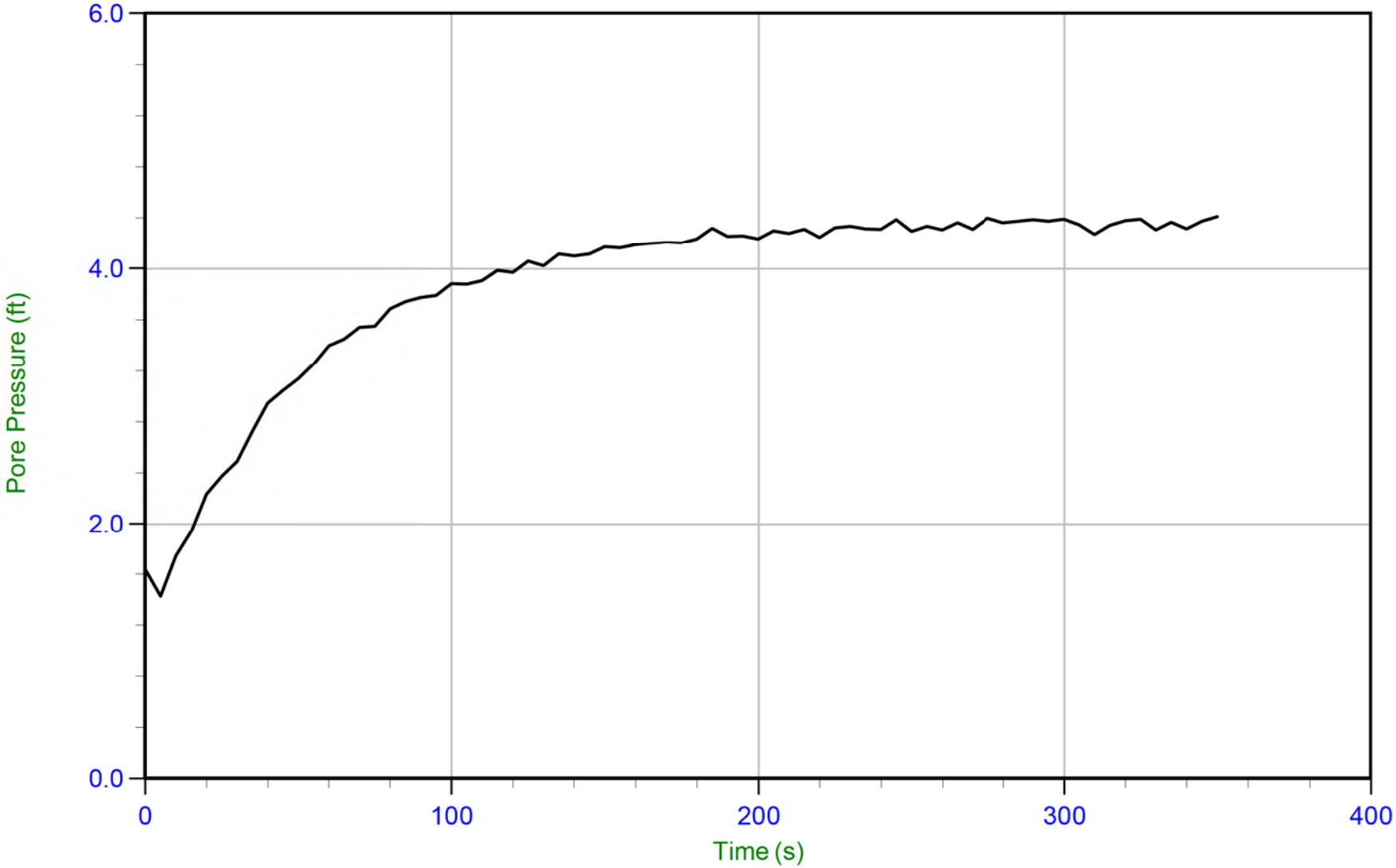
WT: 2.937 m / 9.636 ft
Ueq: 3.3 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 4.250 m / 13.943 ft
Duration: 350.0 s

U Min: 1.4 ft
U Max: 4.4 ft

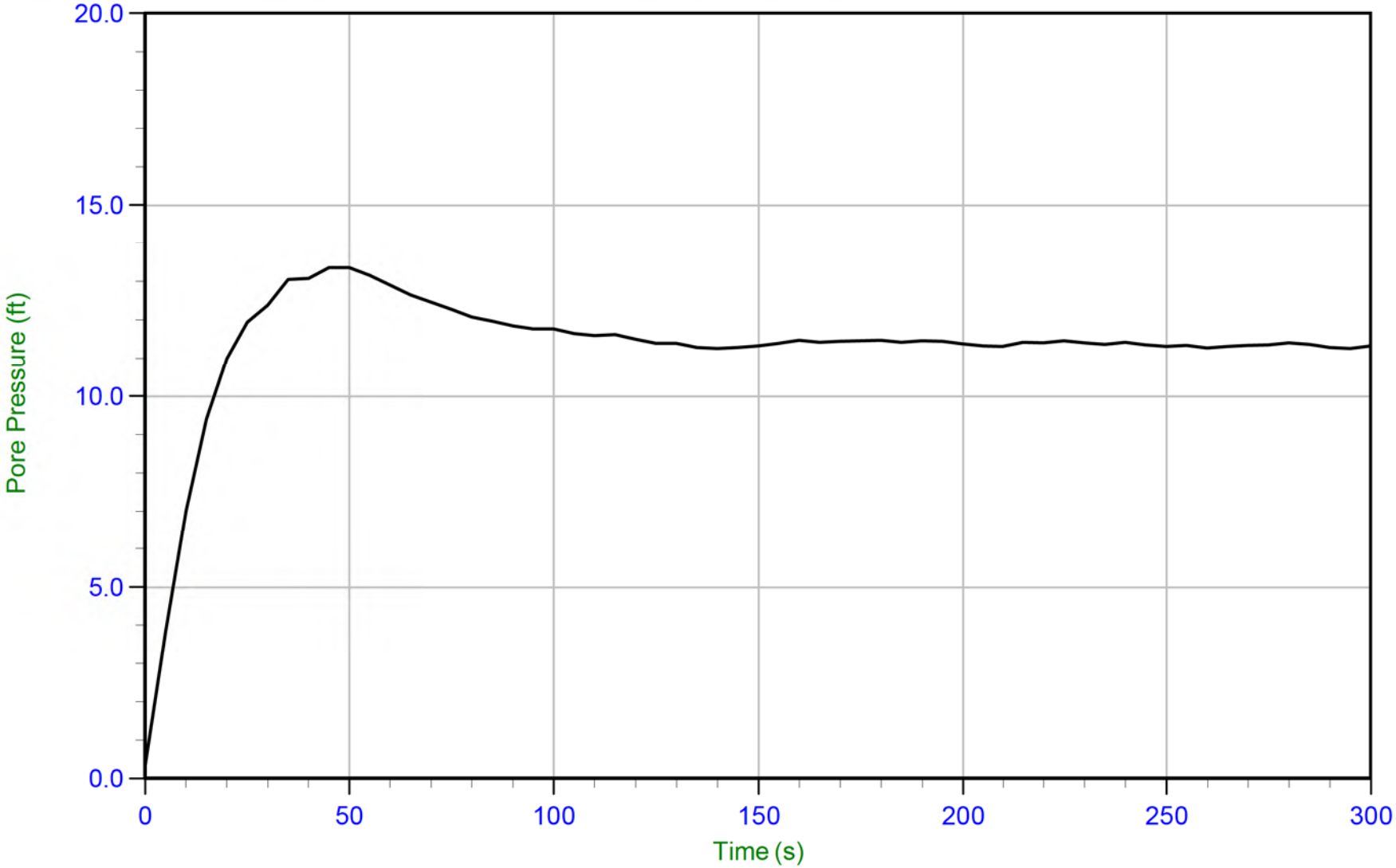
WT: 2.907 m / 9.536 ft
Ueq: 4.4 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 4.550 m / 14.928 ft
Duration: 300.0 s

U Min: 0.4 ft
U Max: 13.4 ft

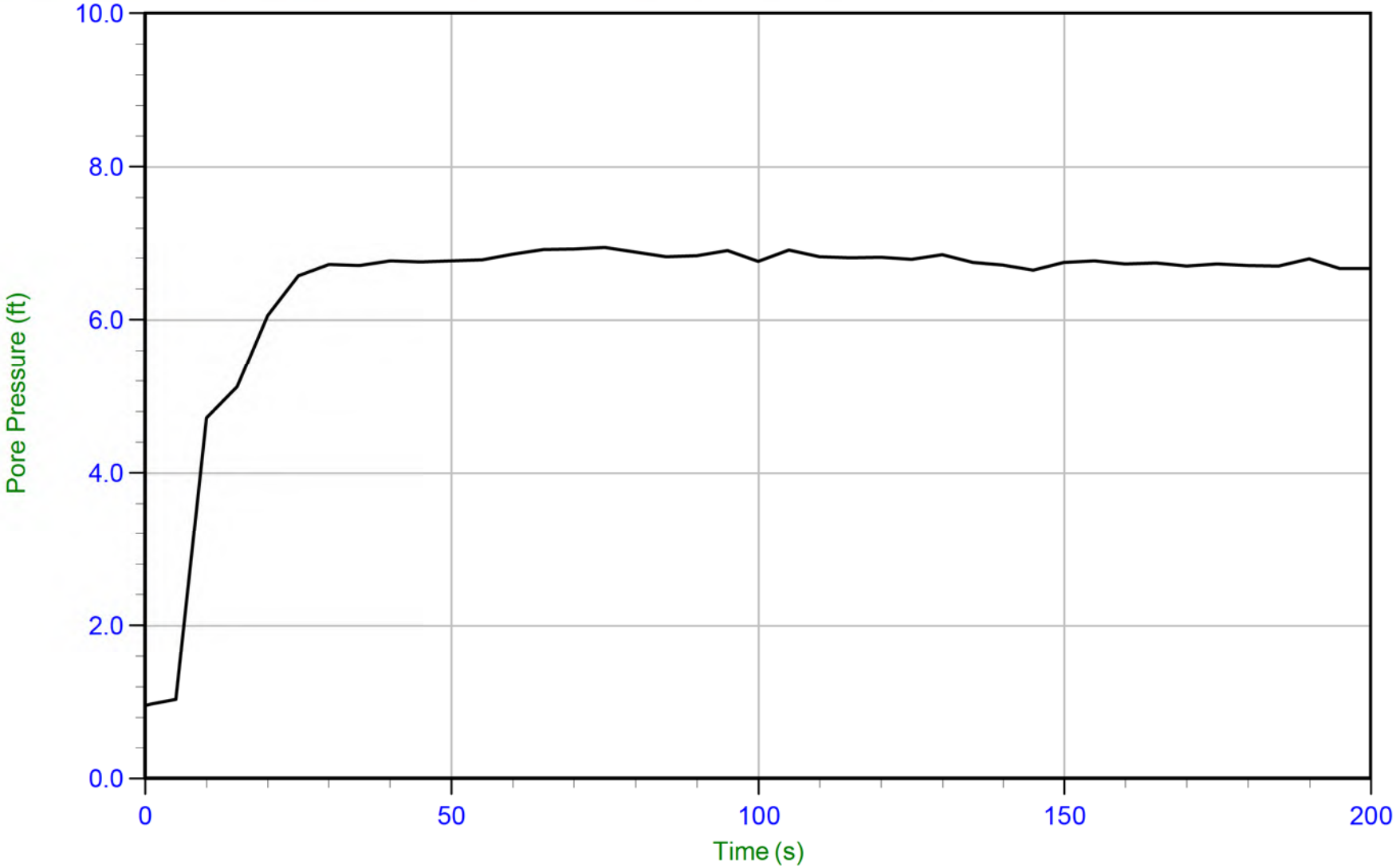
WT: 1.114 m / 3.655 ft
Ueq: 11.3 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 4.900 m / 16.076 ft
Duration: 200.0 s

U Min: 1.0 ft
U Max: 6.9 ft

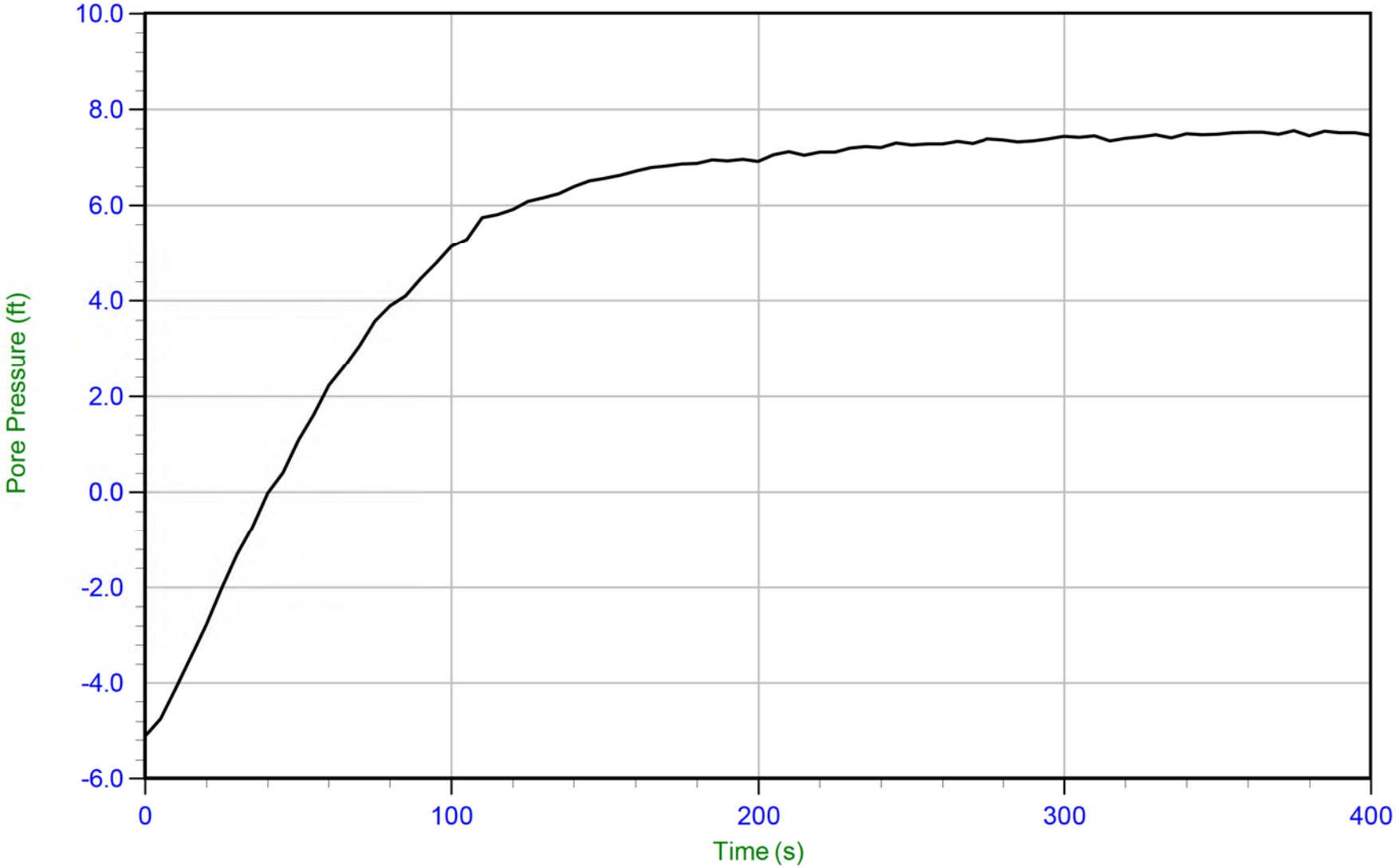
WT: 2.872 m / 9.421 ft
Ueq: 6.7 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 5.200 m / 17.060 ft
Duration: 400.0 s

U Min: -5.1 ft
U Max: 7.6 ft

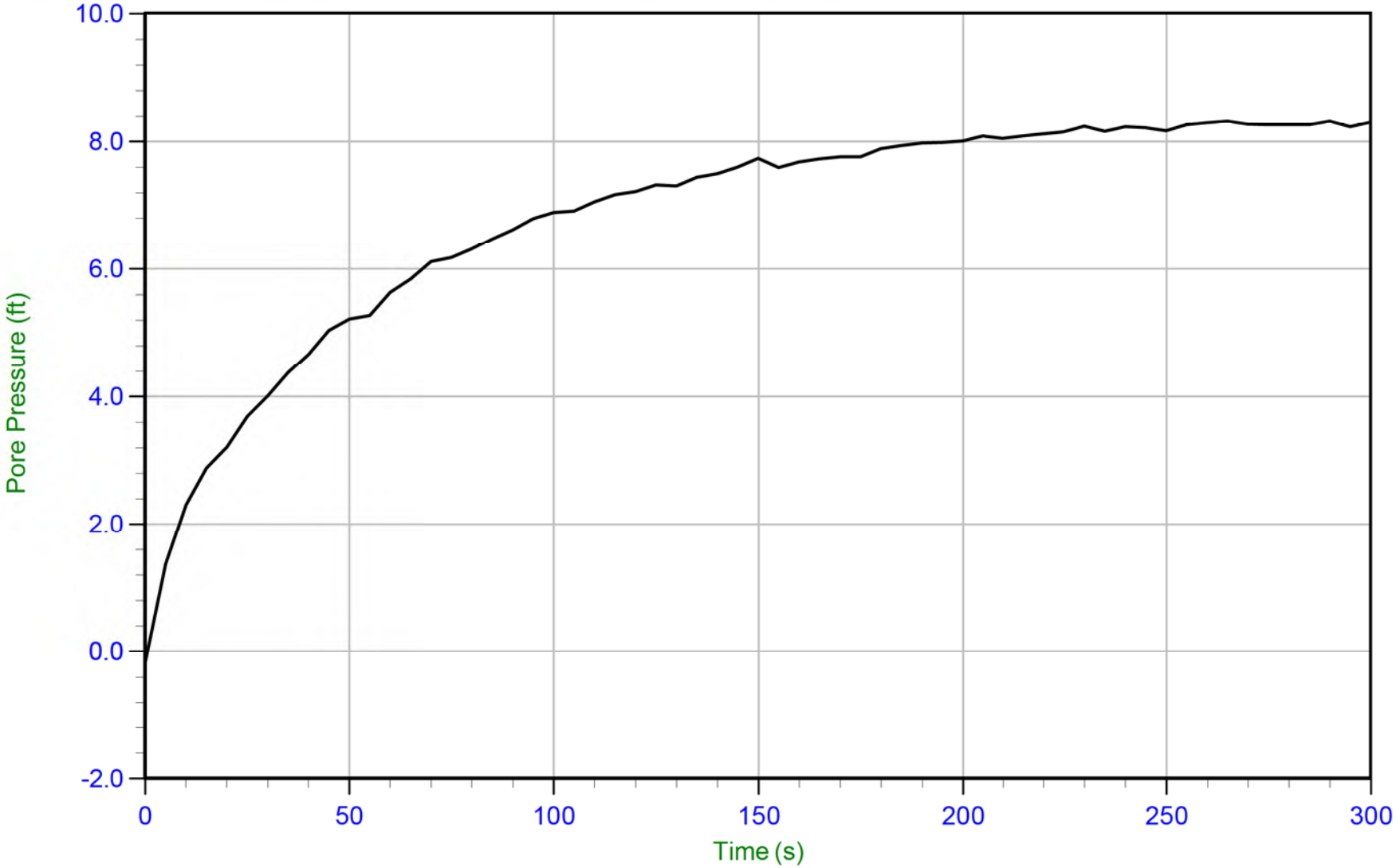
WT: 2.897 m / 9.504 ft
Ueq: 7.6 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 5.500 m / 18.044 ft
Duration: 300.0 s

U Min: -0.2 ft
U Max: 8.3 ft

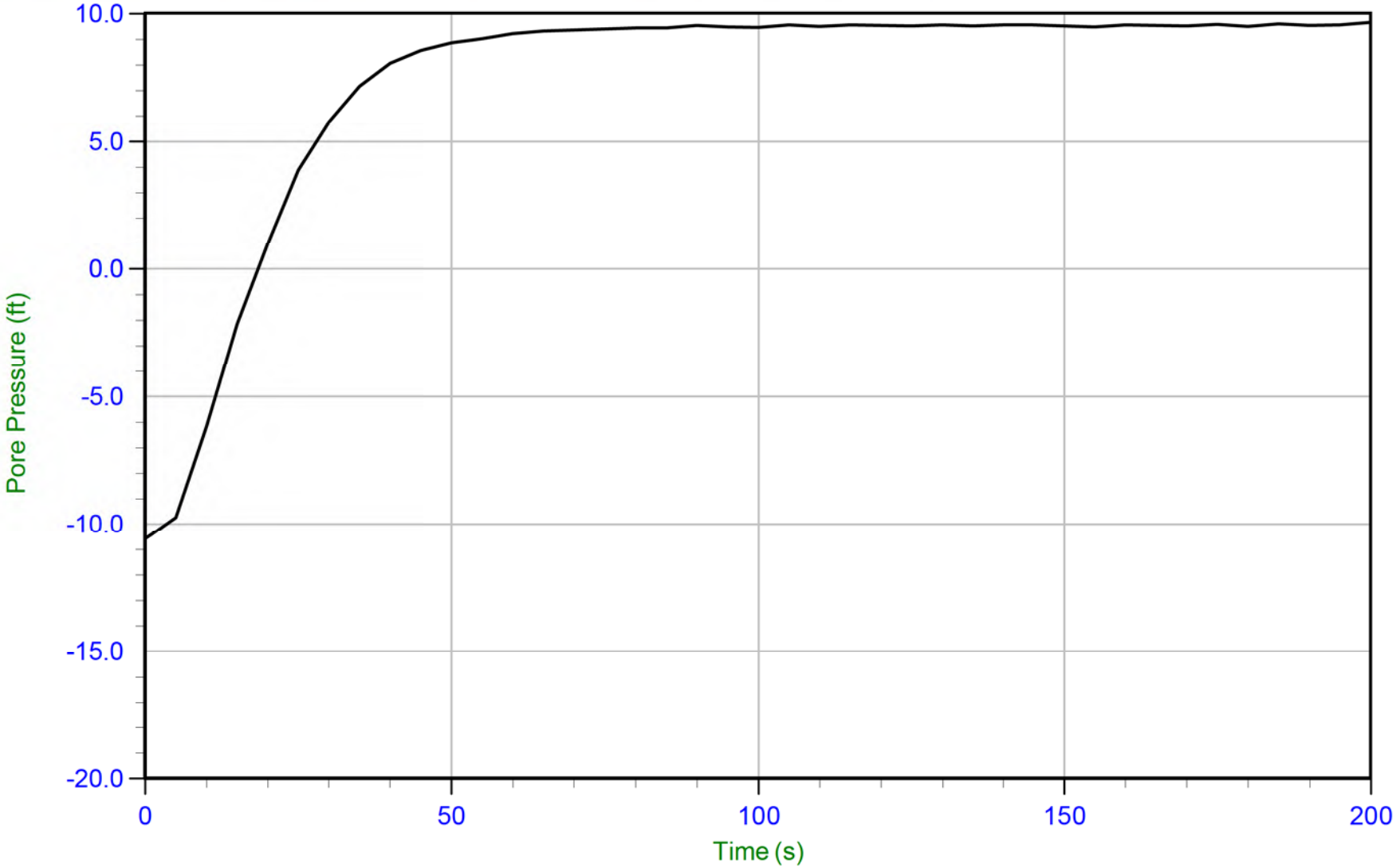
WT: 2.971 m / 9.746 ft
Ueq: 8.3 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 5.800 m / 19.029 ft
Duration: 200.0 s

U Min: -10.6 ft
U Max: 9.6 ft

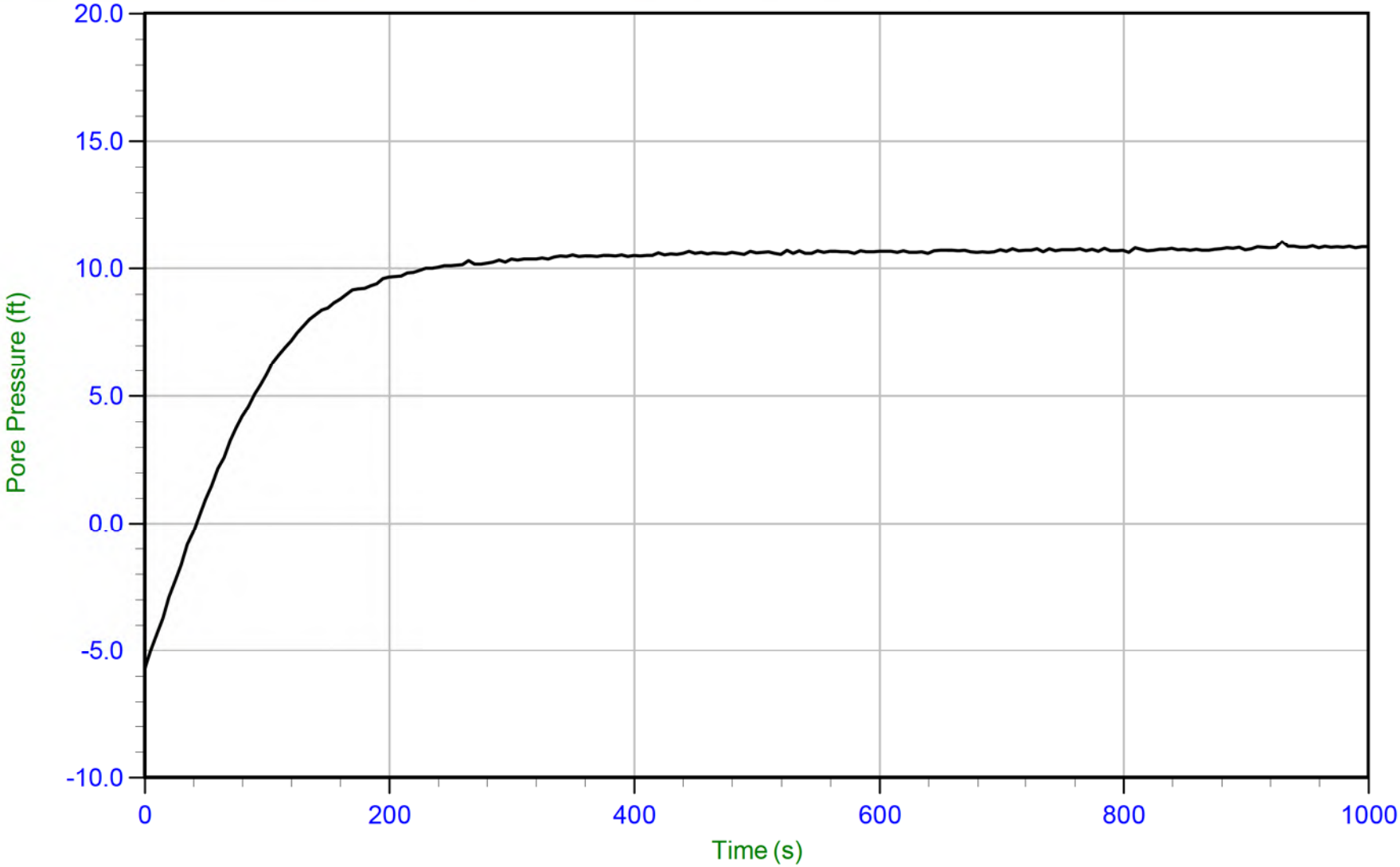
WT: 2.918 m / 9.574 ft
Ueq: 9.5 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 08:41:15
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C13
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C13.PPD
Depth: 6.100 m / 20.013 ft
Duration: 1000.0 s

U Min: -5.7 ft
U Max: 11.1 ft

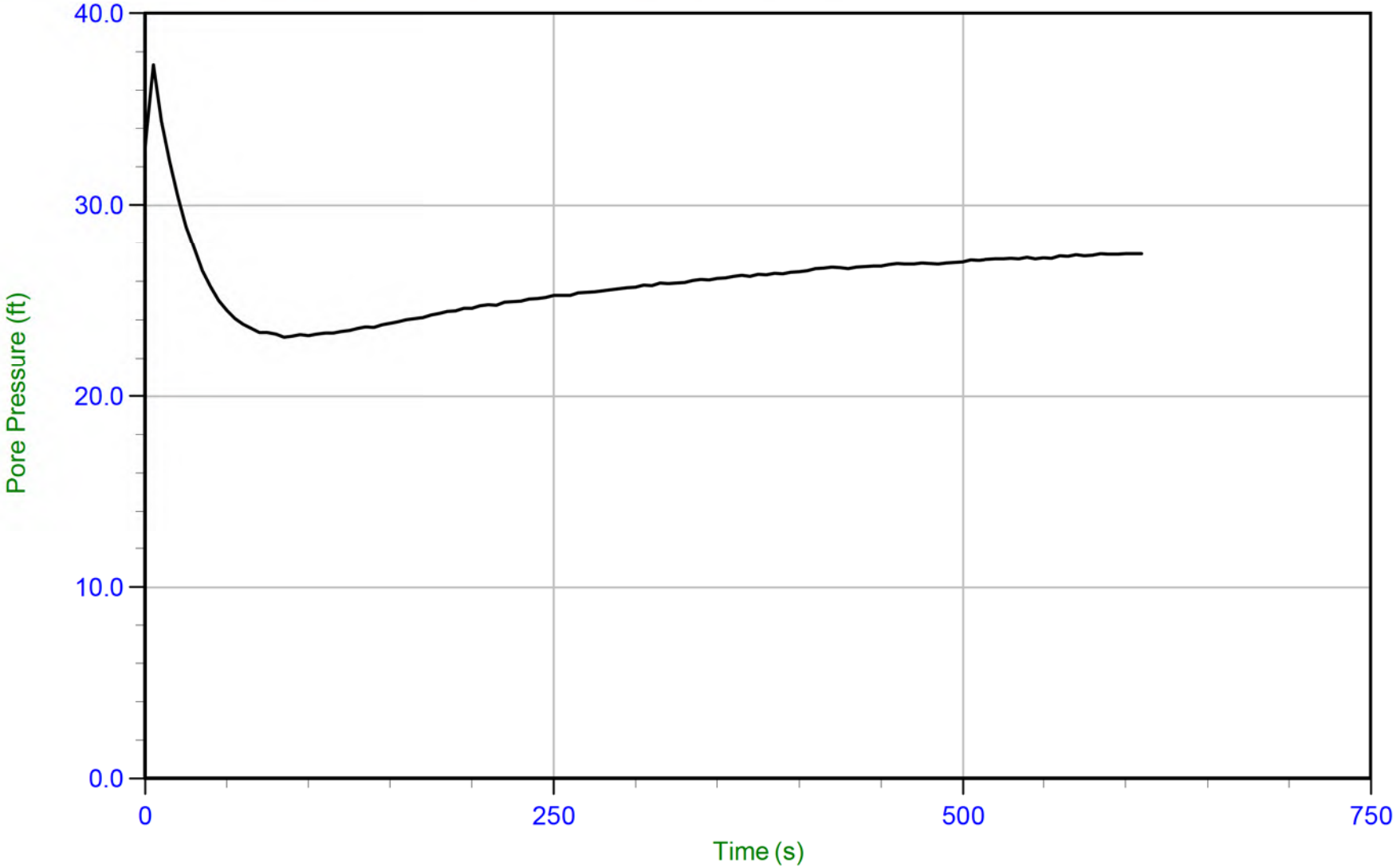
WT: 2.797 m / 9.177 ft
Ueq: 10.8 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 12:30:29
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C14
Cone: AD268 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C14.PPD
Depth: 15.250 m / 50.032 ft
Duration: 610.0 s

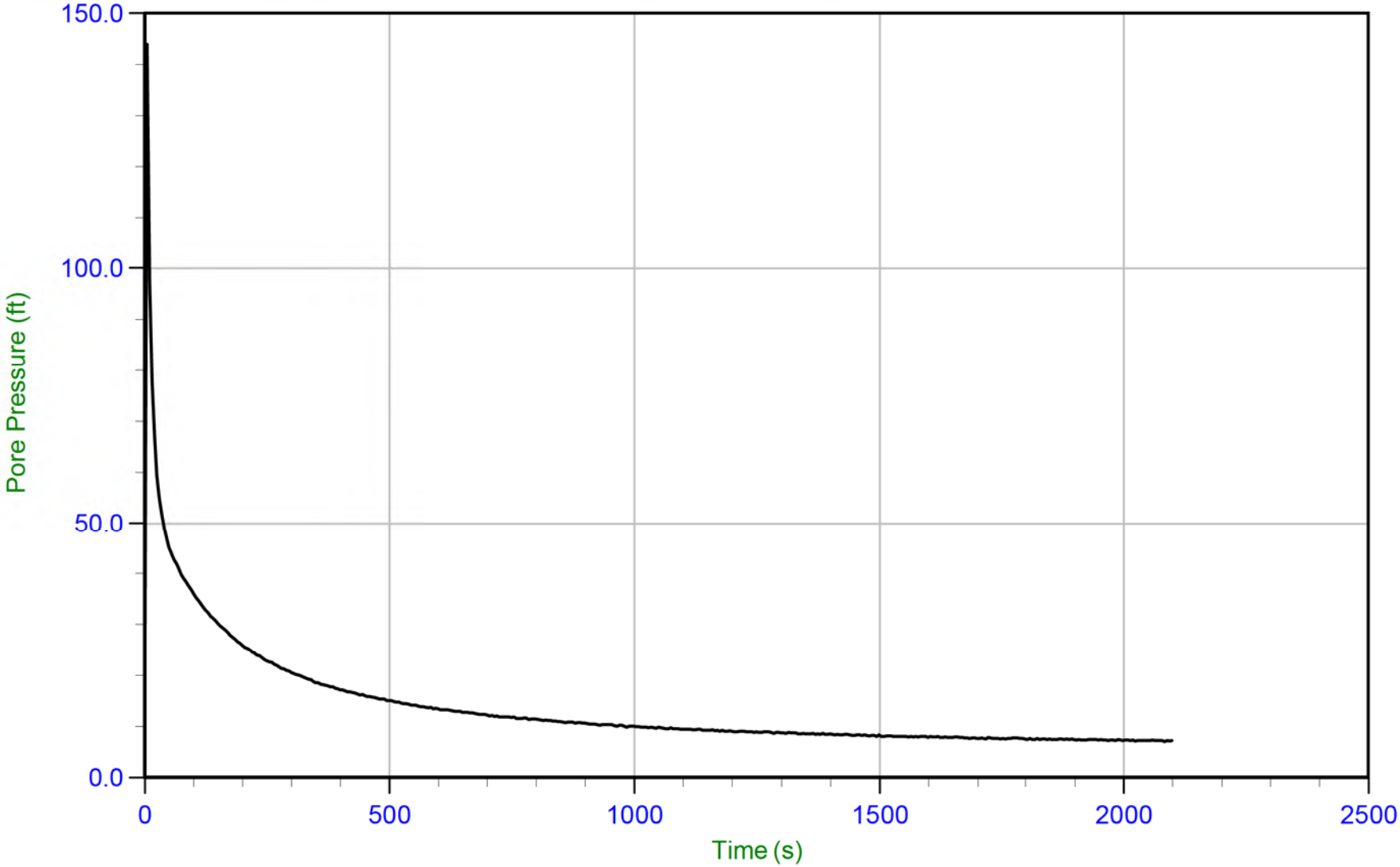
U Min: 23.1 ft
U Max: 37.3 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 0.300 m / 0.984 ft
Duration: 2100.0 s

U Min: 1.7 ft
U Max: 143.9 ft

WT: 0.000 m / 0.000 ft
Ueq: 1.0 ft
U(50): 72.45 ft

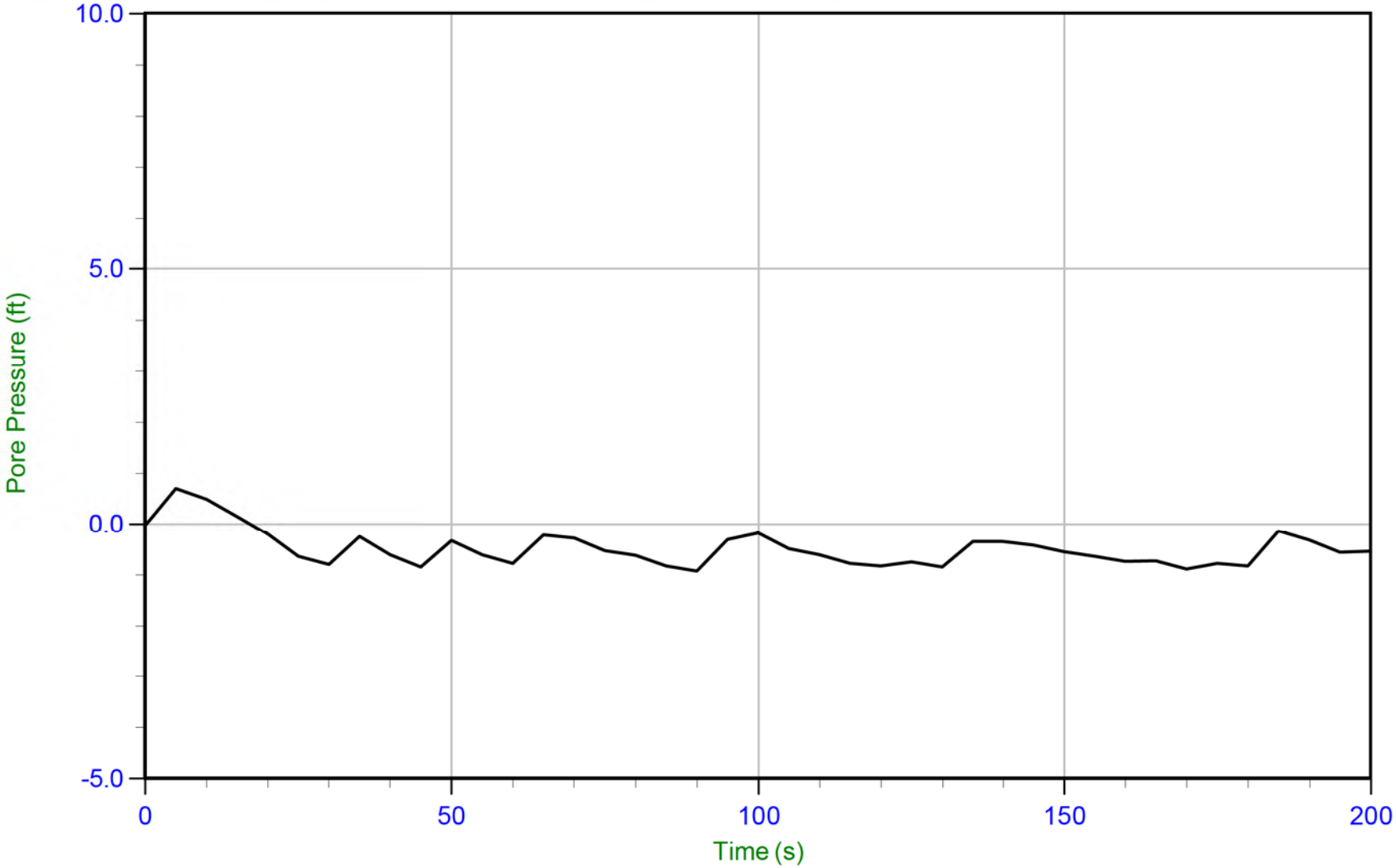
T(50): 12.3 s
Ir: 100
Ch: 56.8 sq cm/min

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 1.000 m / 3.281 ft
Duration: 200.0 s

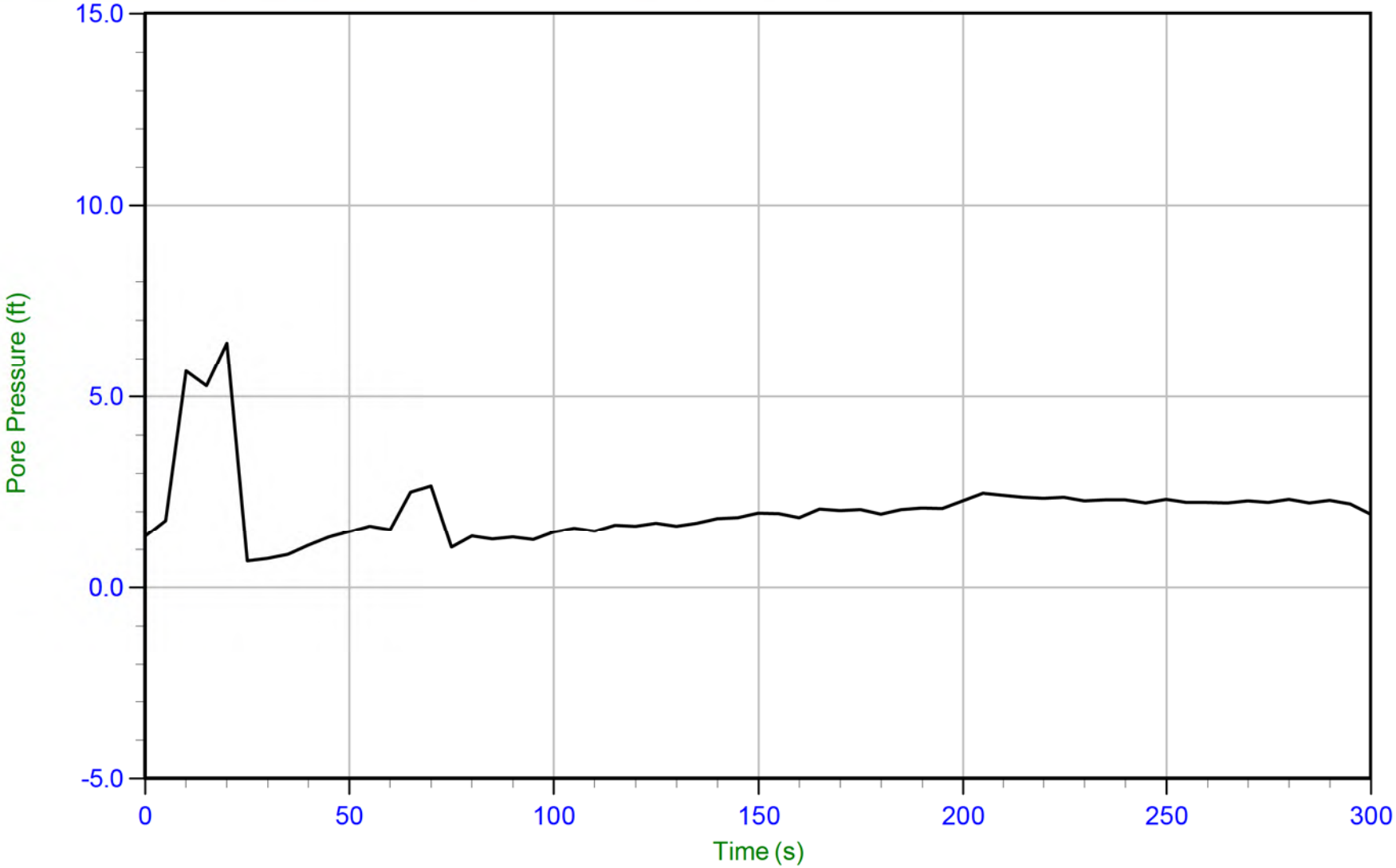
U Min: -0.9 ft
U Max: 0.7 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 2.000 m / 6.562 ft
Duration: 300.0 s

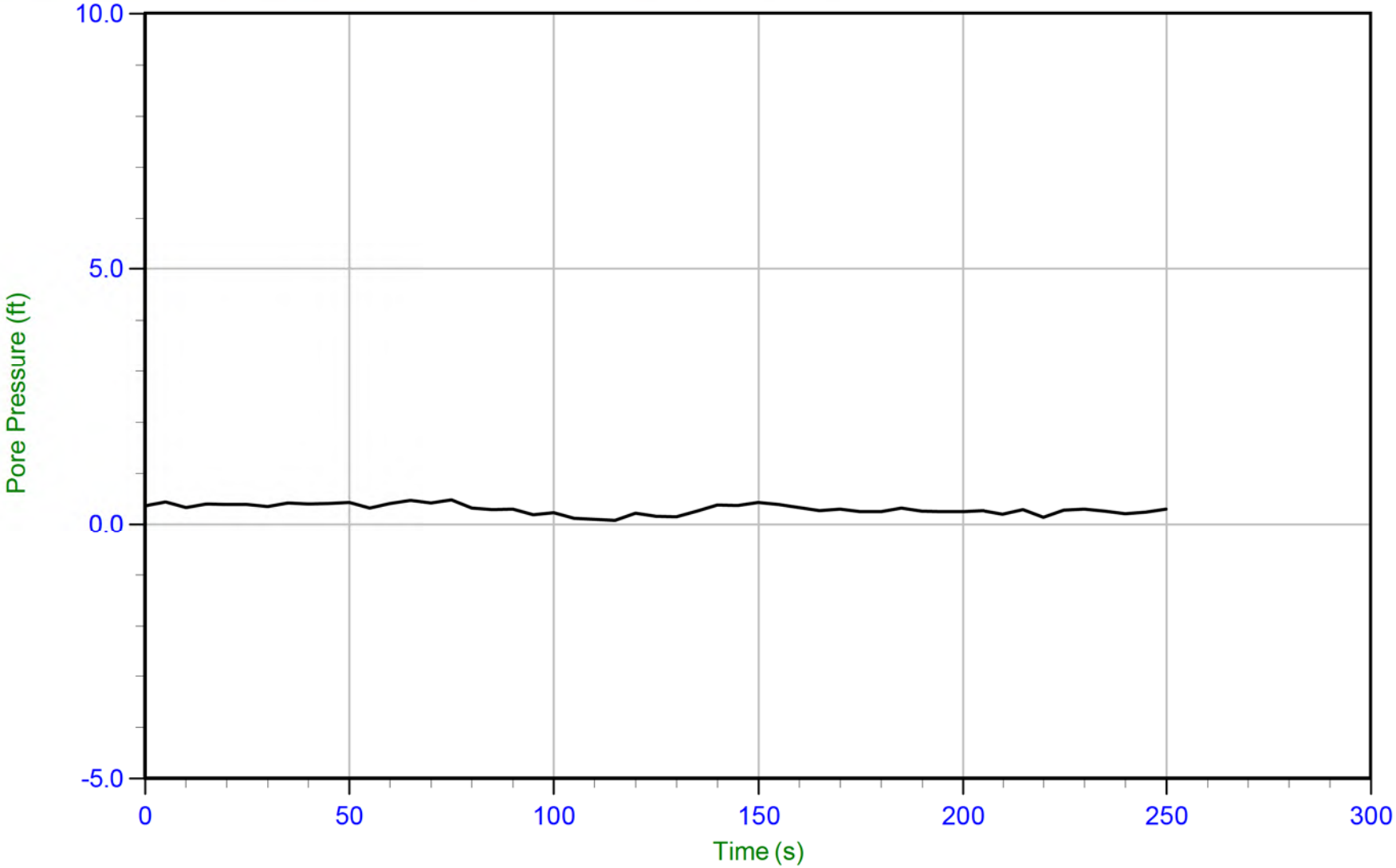
U Min: 0.7 ft
U Max: 6.4 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 3.000 m / 9.842 ft
Duration: 250.0 s

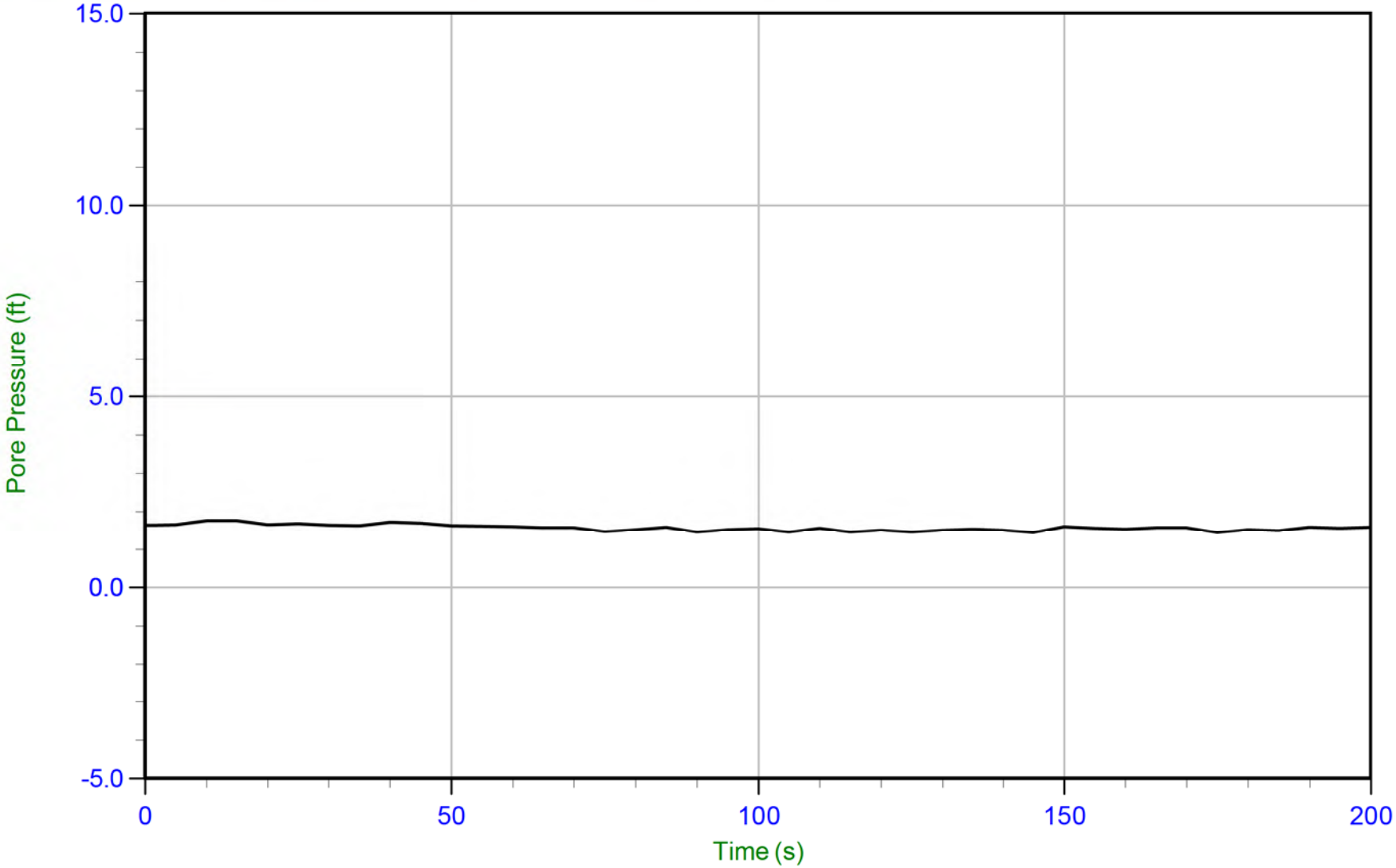
U Min: 0.1 ft
U Max: 0.5 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 4.000 m / 13.123 ft
Duration: 200.0 s

U Min: 1.4 ft
U Max: 1.8 ft

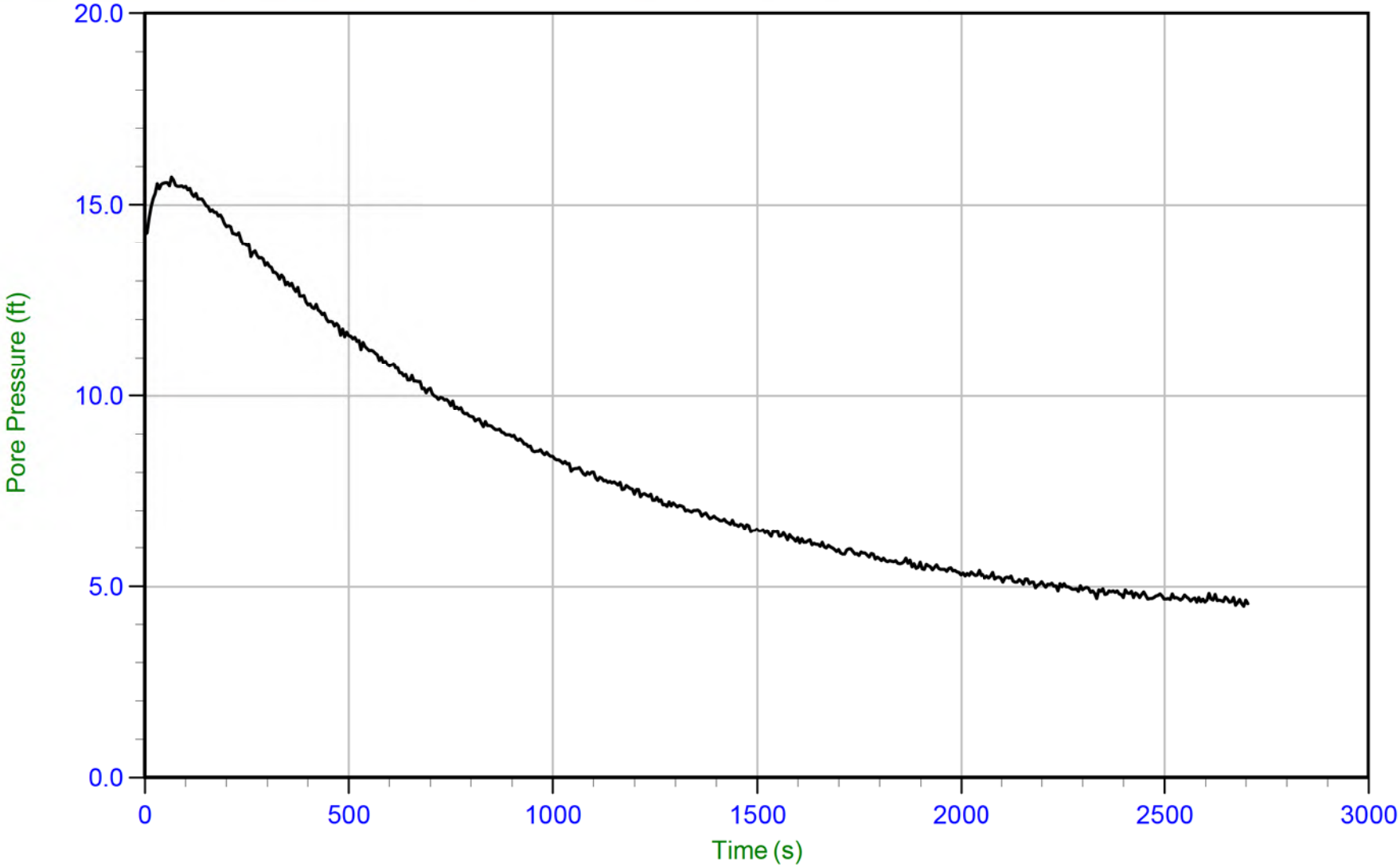
WT: 3.526 m / 11.567 ft
Ueq: 1.6 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 5.000 m / 16.404 ft
Duration: 2705.0 s

U Min: 4.5 ft
U Max: 15.7 ft

WT: 5.000 m / 16.404 ft
Ueq: 0.0 ft
U(50): 7.87 ft

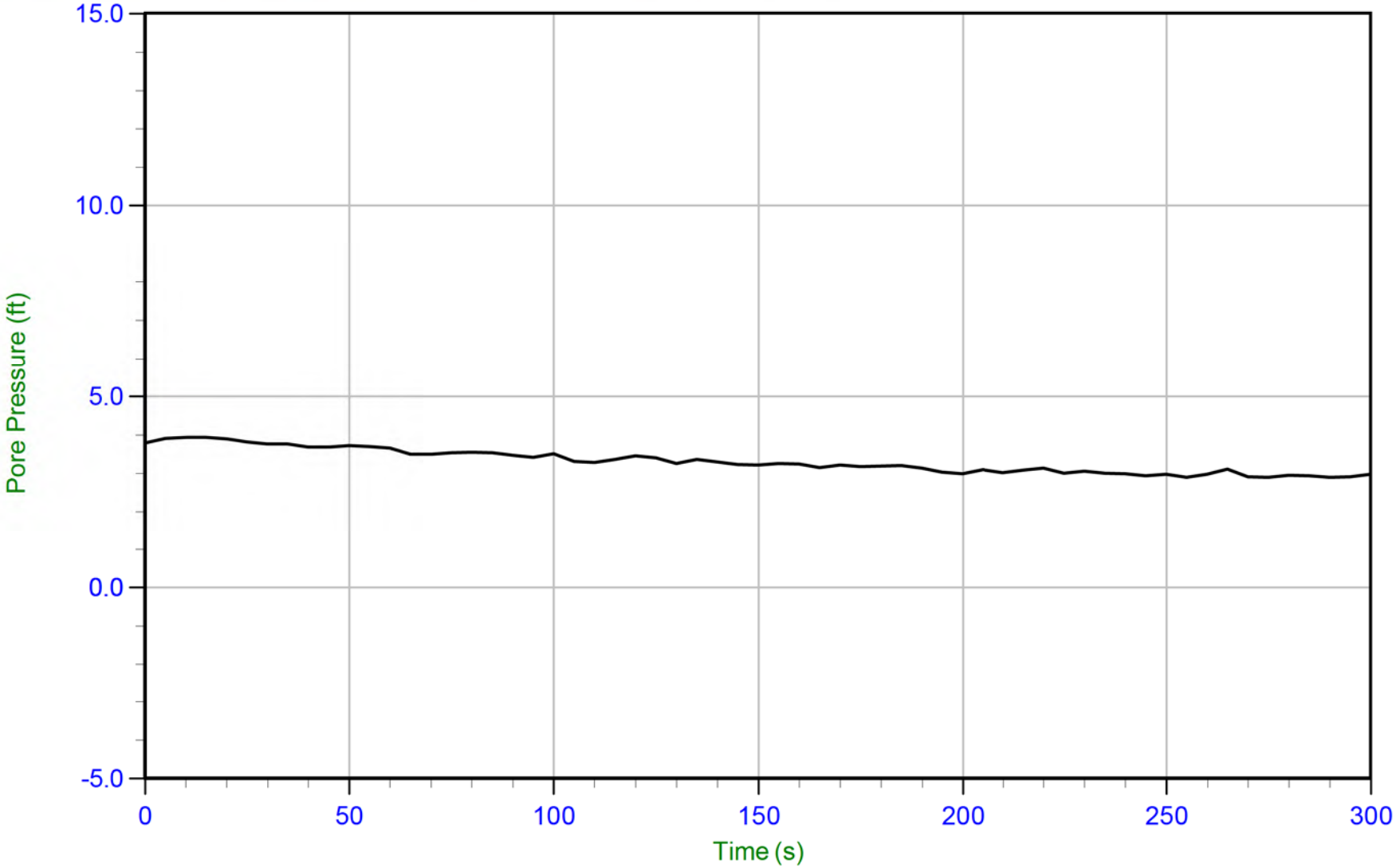
T(50): 1039.7 s
Ir: 100
Ch: 0.7 sq cm/min

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 6.000 m / 19.685 ft
Duration: 300.0 s

U Min: 2.9 ft
U Max: 3.9 ft

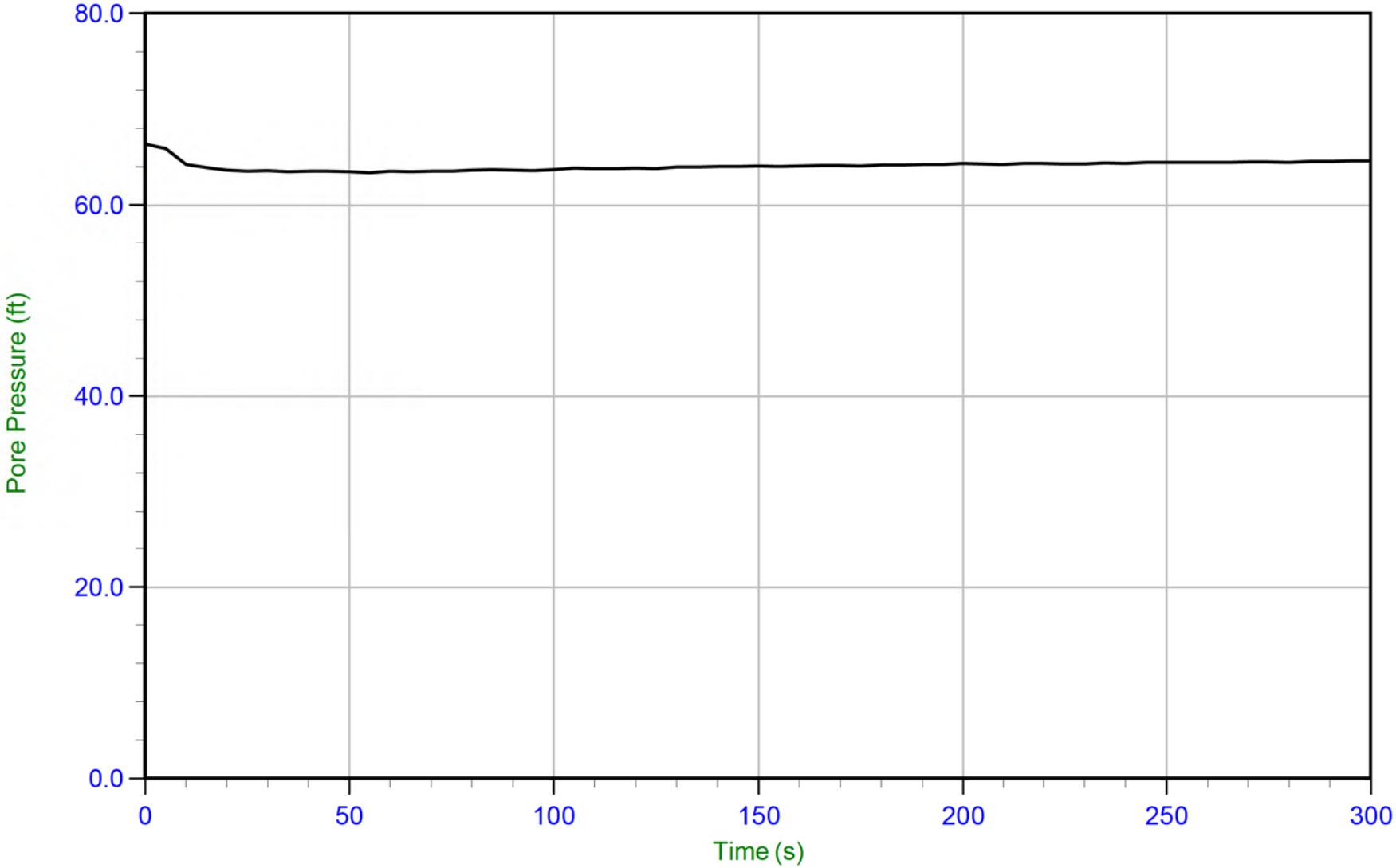
WT: 5.130 m / 16.830 ft
Ueq: 2.9 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 16:20:28
Site: New Madrid Power Plant, Marston, MO

Sounding: SCPT17-HA-C15
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_SPHA-C15.PPD
Depth: 29.050 m / 95.307 ft
Duration: 300.0 s

U Min: 63.4 ft
U Max: 66.4 ft

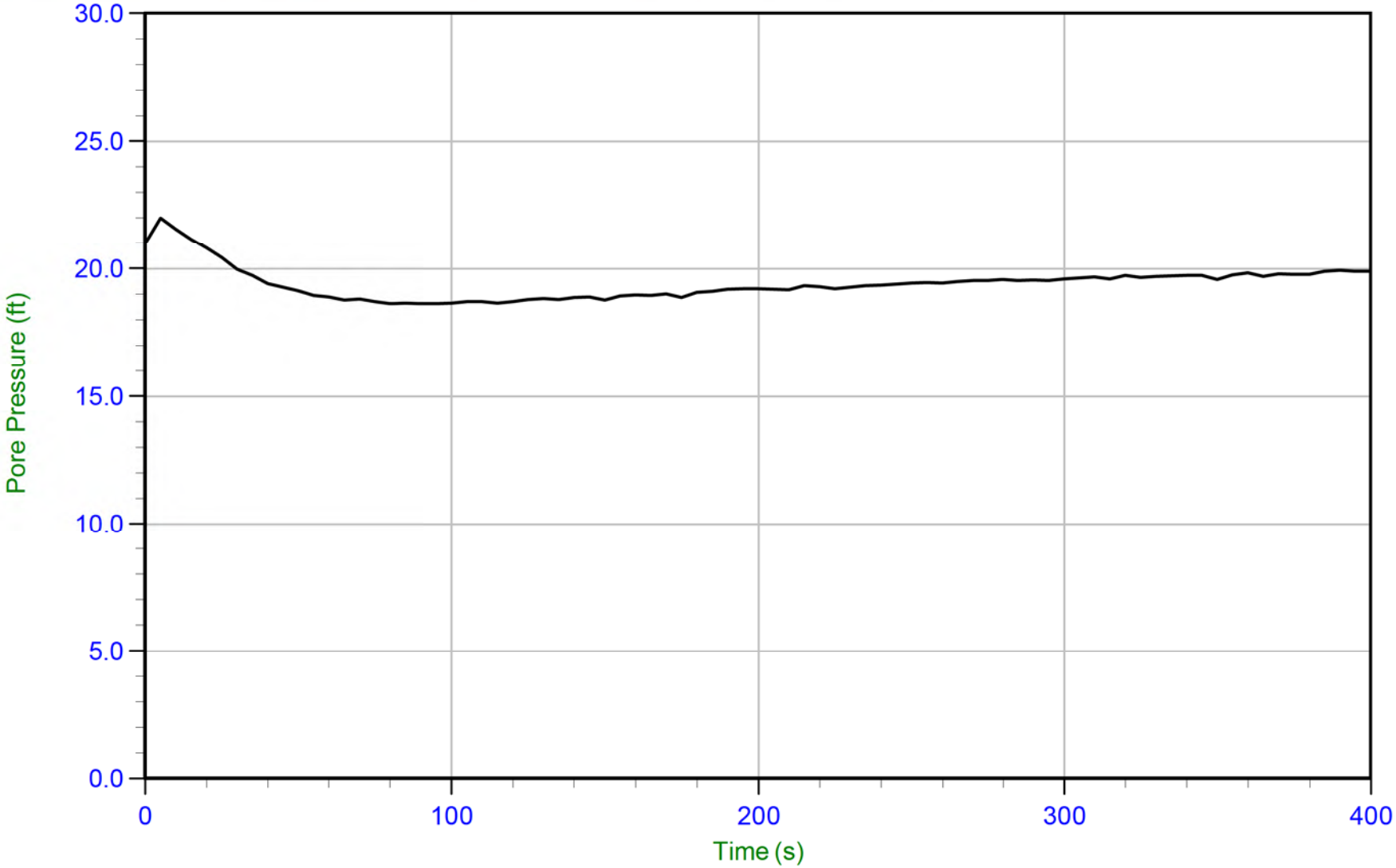
WT: 9.365 m / 30.726 ft
Ueq: 64.6 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 12-Jun-2017 15:12:37
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C16
Cone: AD206 Area=15 cm²



Trace Summary:

Filename: 17-53075_CPHA-C16.PPD
Depth: 15.250 m / 50.032 ft
Duration: 400.0 s

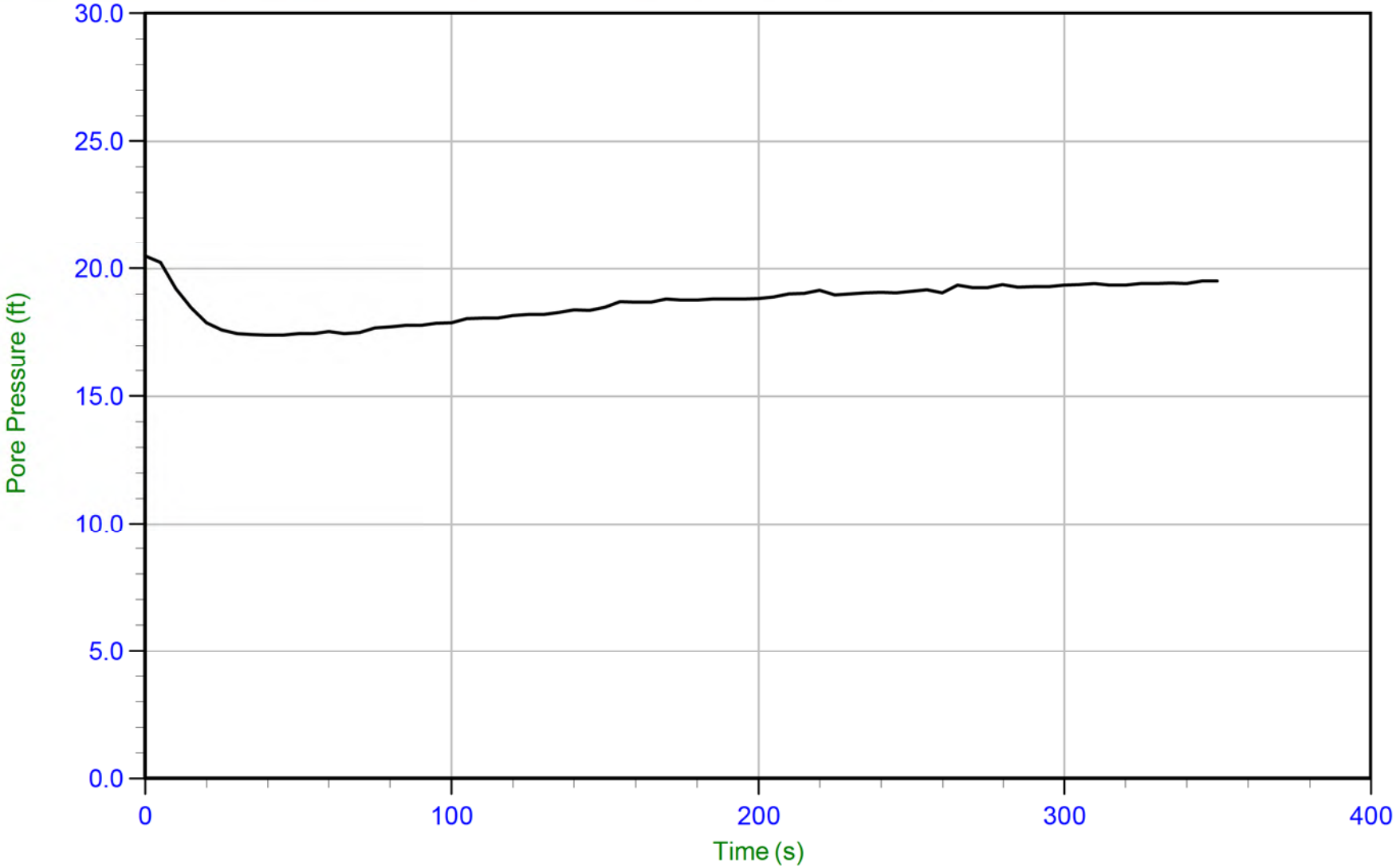
U Min: 18.6 ft
U Max: 22.0 ft

CONETEC

Haley & Aldrich

Job No: 17-53075
Date: 13-Jun-2017 11:34:12
Site: New Madrid Power Plant, Marston, MO

Sounding: CPT17-HA-C17
Cone: AD268 Area=15 cm²



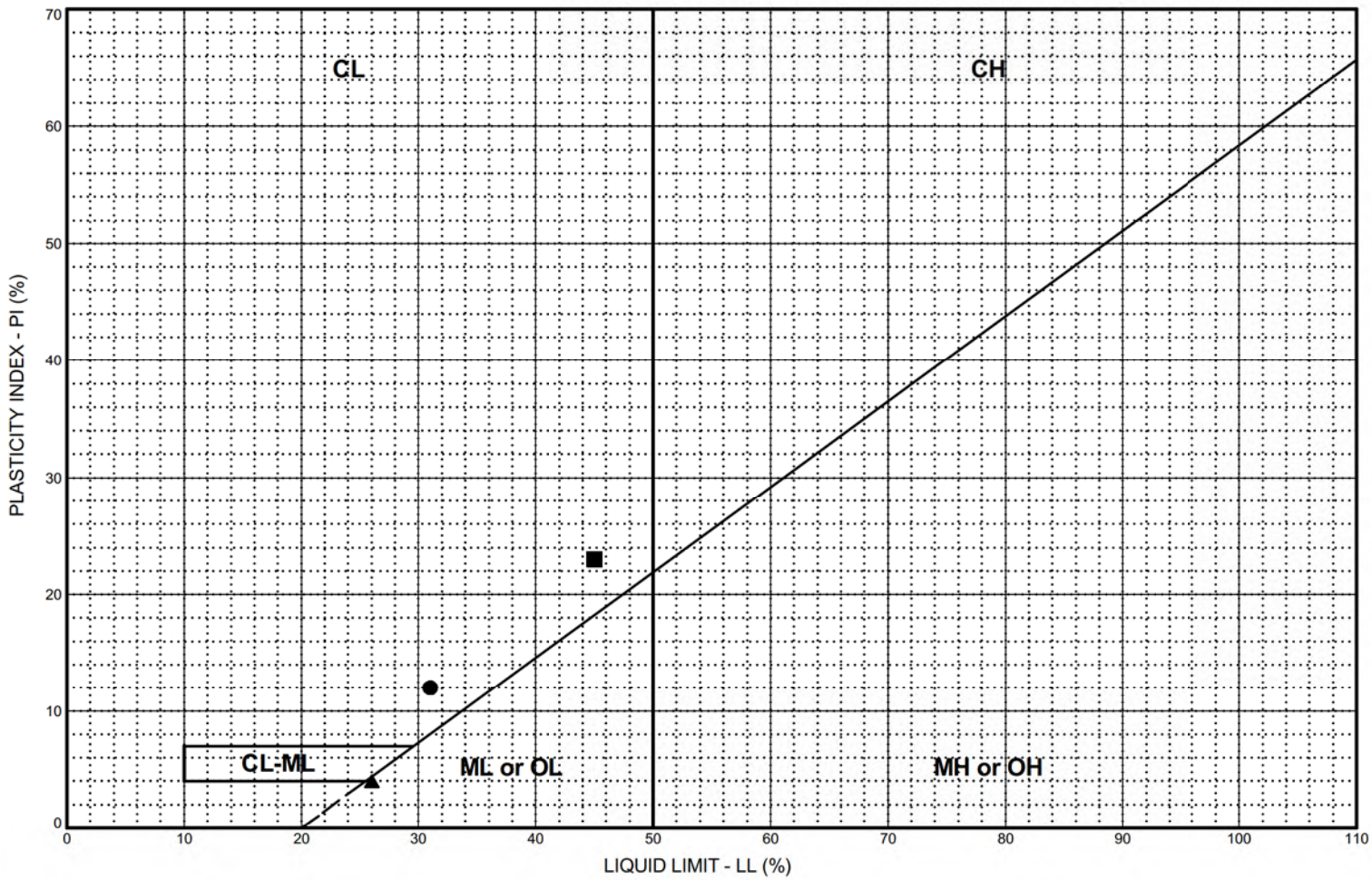
Trace Summary:

Filename: 17-53075_CPHA-C17.PPD
Depth: 15.250 m / 50.032 ft
Duration: 350.0 s

U Min: 17.4 ft
U Max: 20.5 ft

APPENDIX D

Current Laboratory Test Results



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● HA-B10OW, S2	2.0 - 4.0	CL	Gray and brown, Lean Clay.	31	19	12	18.0	
■ HA-B9, S4	12.0 - 14.0	CL	Brown, Lean Clay.	45	22	23	21.4	
▲ HA-B9A, S1	18.0 - 20.0	ML	Brown, Silt.	26	22	4	30.9	

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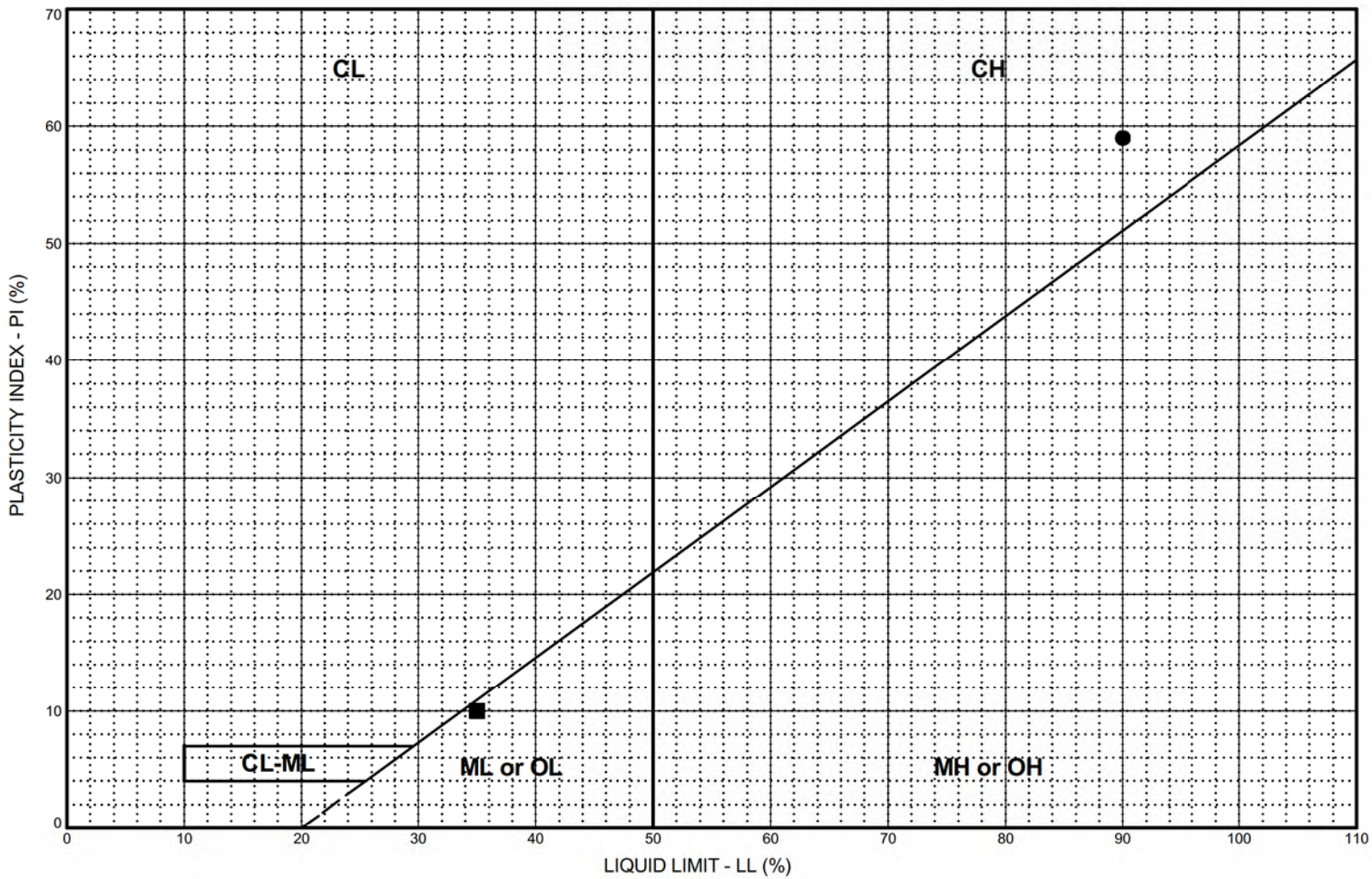
FIG.

FIG.

ATTERBERG - WITH SAMPLE INTERVALS 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/12/17



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● HA-B9, U1	6.8	CH	Mottled gray and brown, Fat Clay.	90	31	59	34.6	98.0
■ HA-B9, U3	14.4	ML	Brown, Silt.	35	25	10	19.6	97.1

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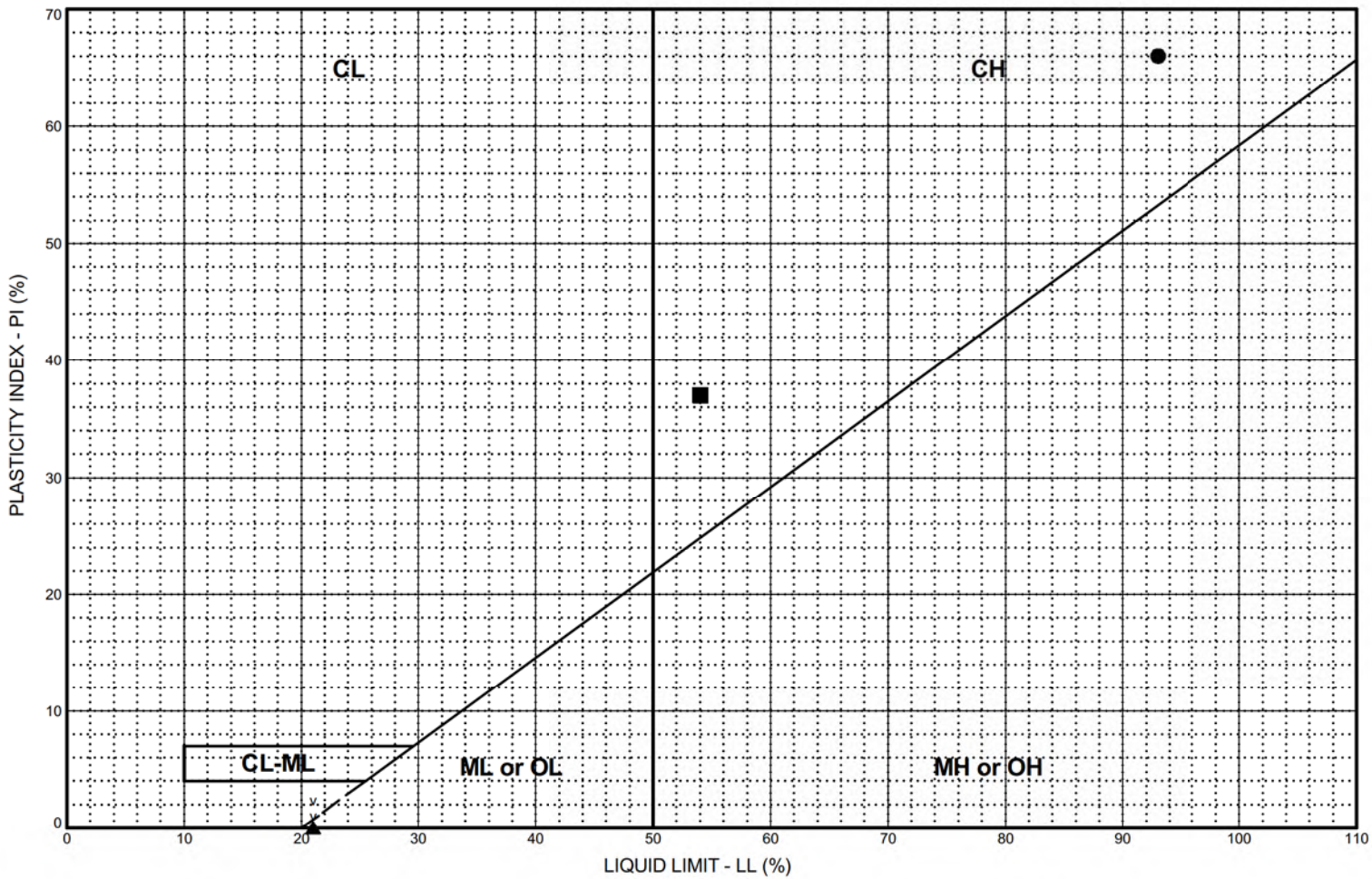
FIG.

ATTERBERG - NORMAL 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/26/17

FIG.



LEGEND

CL: Low plasticity inorganic clays; sandy and silty clays

CH: High plasticity inorganic clays

ML or OL: Inorganic and organic silts and clayey silts of low plasticity

MH or OH: Inorganic and organic silts and clayey silts of high plasticity

CL-ML: Silty clays and clayey silts

BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SOIL CLASSIFICATION	LL %	PL %	PI %	NAT. W.C. %	PASS. #200, %
● HA-B10OW, U1	10.0 - 12.0	CH	Mottled gray and brown, Fat Clay.	93	27	66	29.9	98.0
■ HA-B10OW, U2	18.0 - 20.0	CH	Mottled gray and brown, Fat Clay.	54	17	37	19.0	95.6
▲ HA-B10OW, U3	30.0 - 32.0	ML	Brown, Silt.	21	23	NP	36.4	99.6

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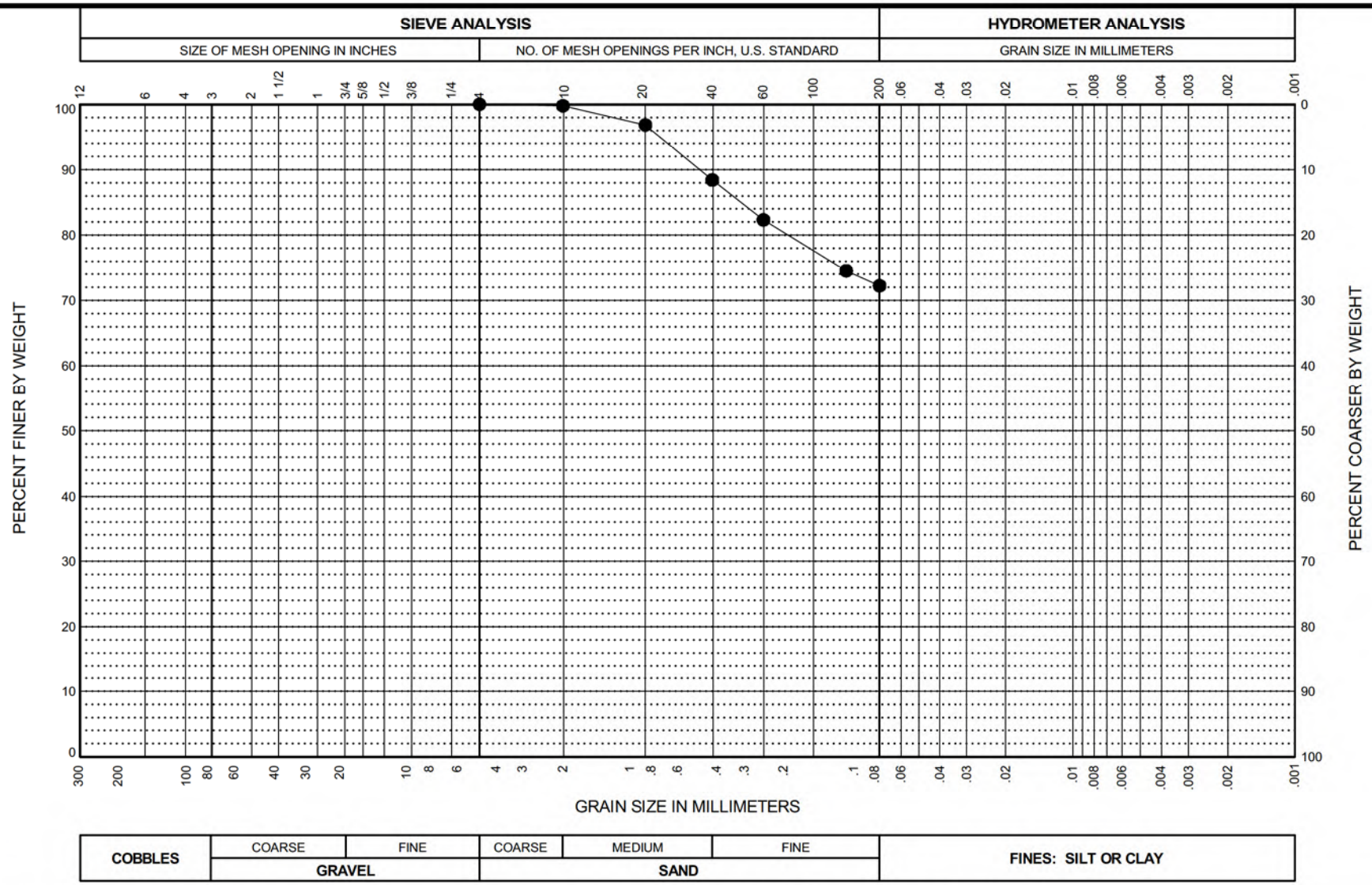
FIG.

FIG.

ATTERBERG - WITH SAMPLE INTERVALS 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/20/17



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● HA-B8OW, S3	4.0 - 6.0	ML	Gray, Silt with Sand.	72.2	115.2			

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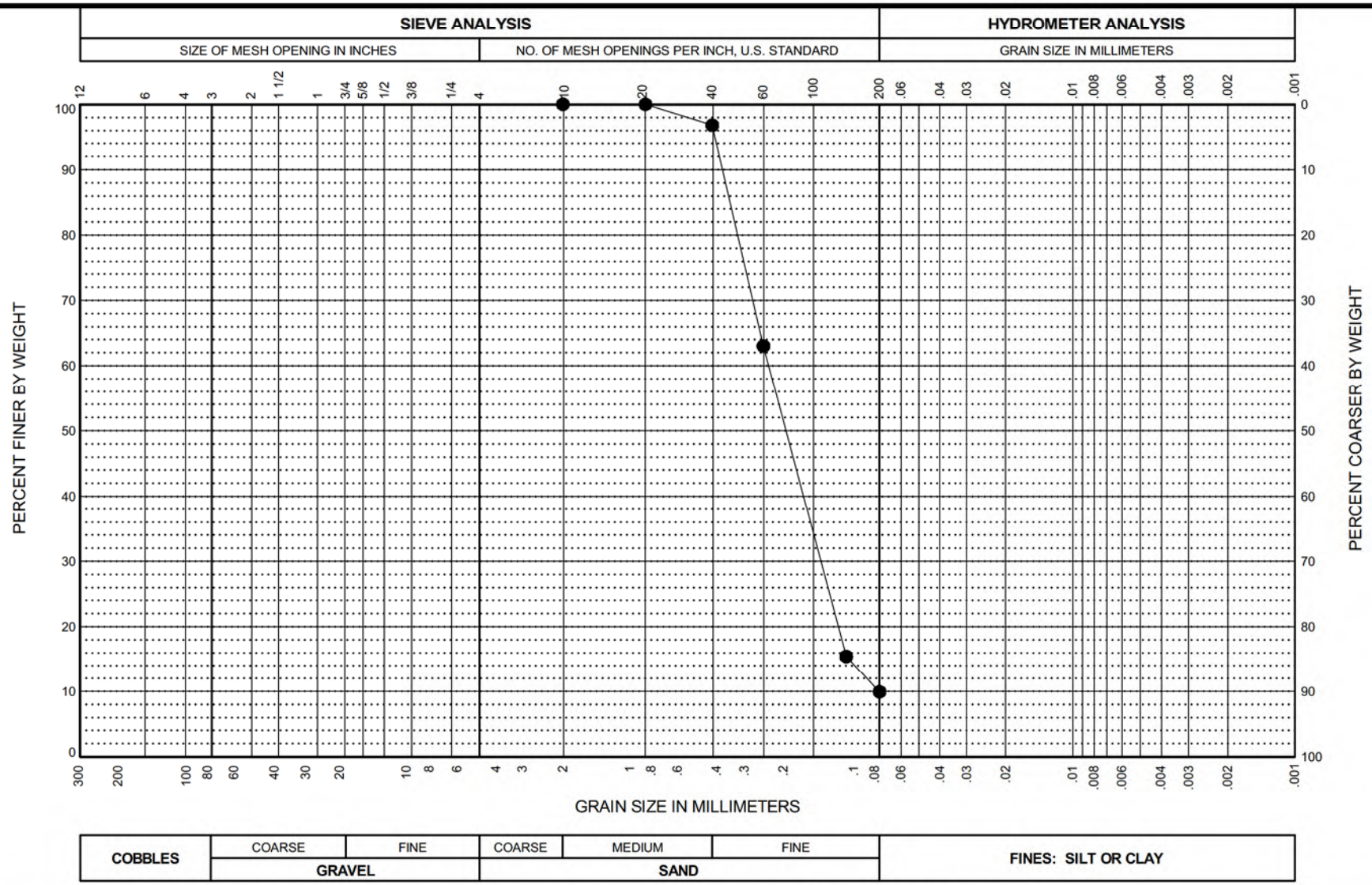
FIG.

GSA- WITH SAMPLE INTERVALS 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/12/17



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● HA-B9, S6	24.0 - 26.0	SP-SM	Brown, Poorly Graded Sand with Silt.	9.9	4.7			

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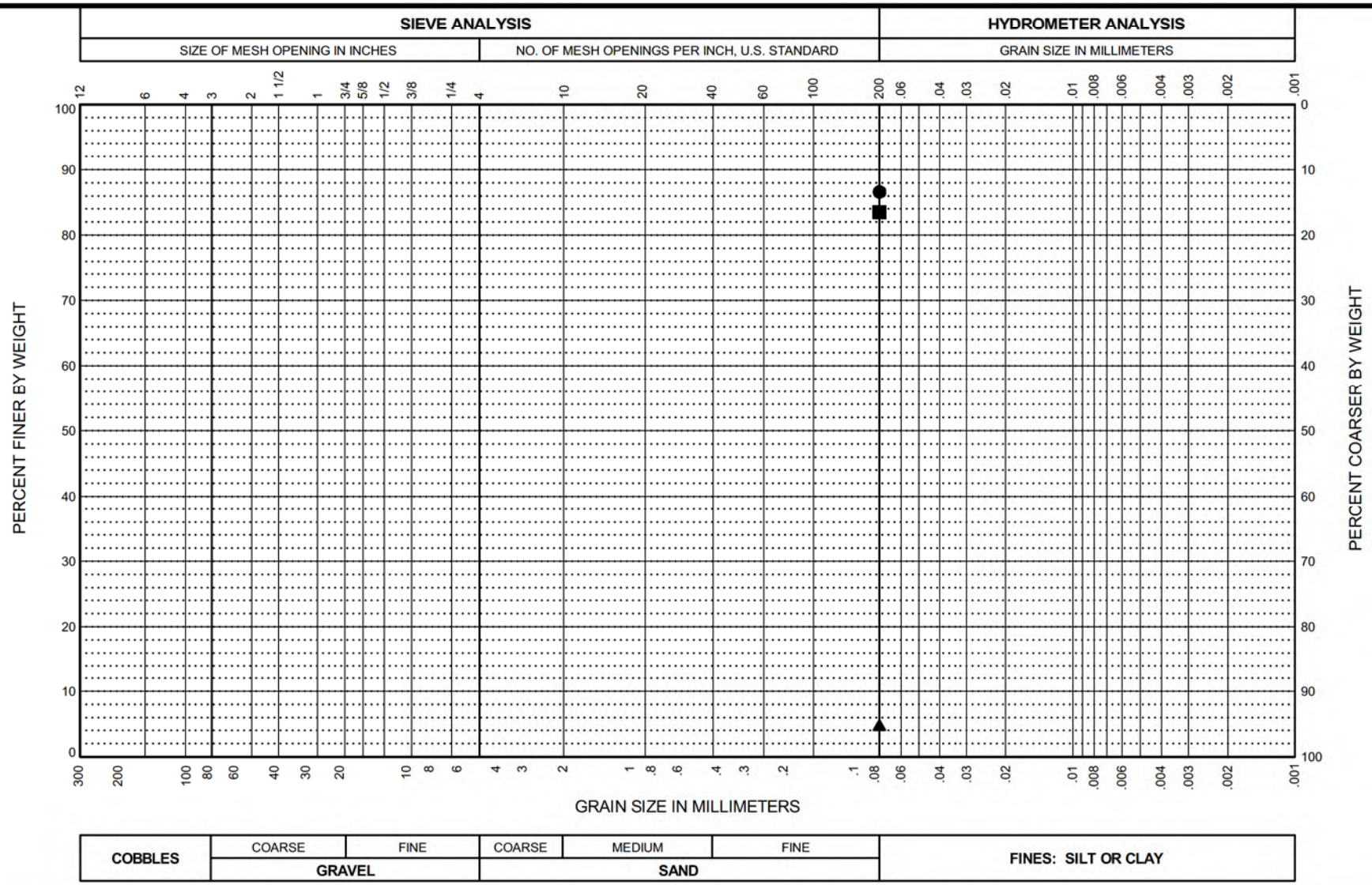
FIG.

GSA- WITH SAMPLE INTERVALS 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/12/17



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● HA-B10OW, S5	8.0 - 10.0	CL	Gray and brown, Lean Clay.	86.6	20.4			
■ HA-B8OW, S8	14.0 - 16.0	ML	Gray, Silt with Sand.	83.5	95.4			
▲ HA-B9A, S3	28.0 - 30.0	SP	Brown, Poorly Graded Sand.	4.9	17.6			

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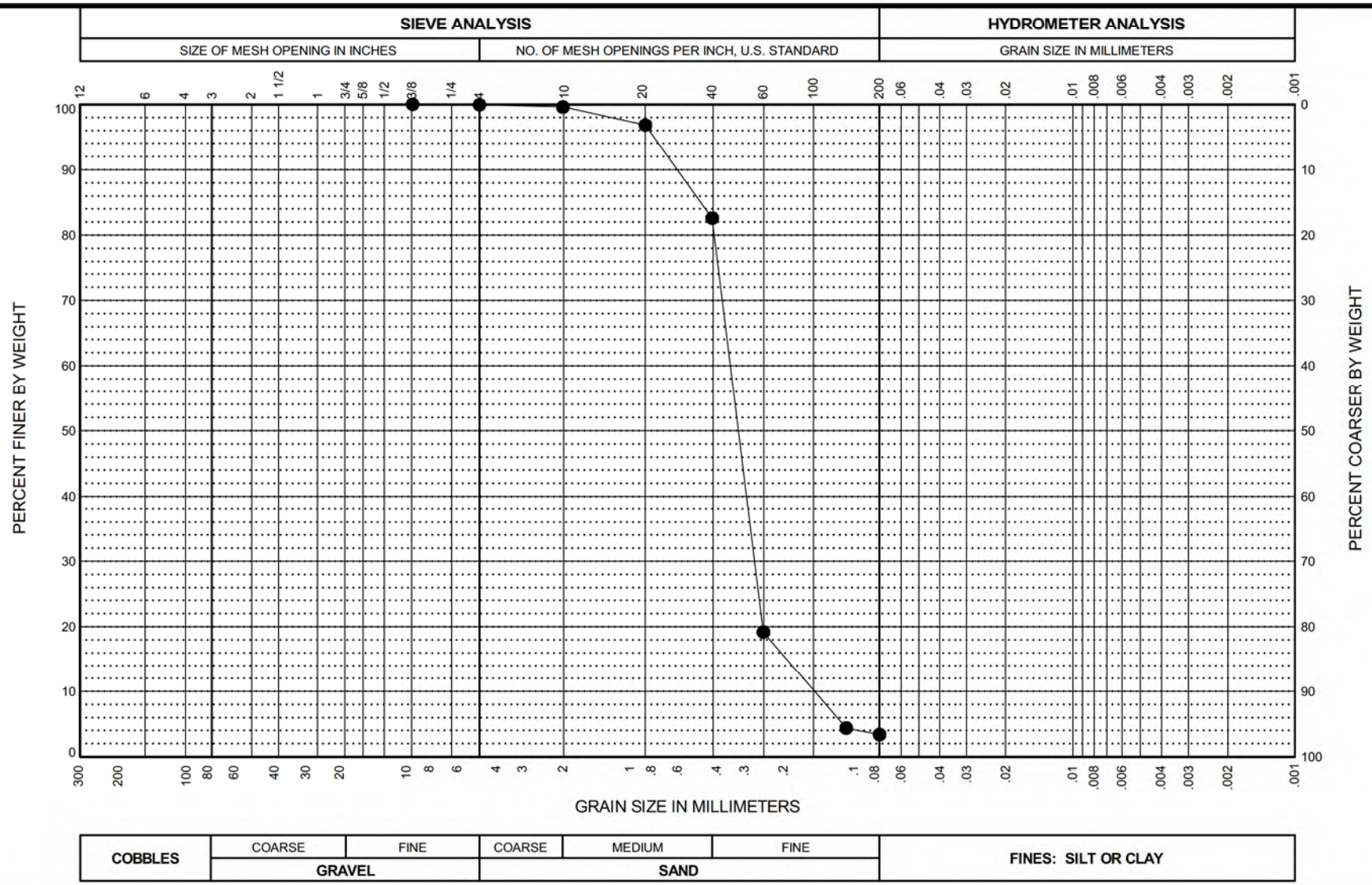
FIG.

GSA- WITH SAMPLE INTERVALS 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/12/17



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● HA-B9A, S11	68.0 - 70.0	SP	Gray, Poorly Graded Sand.	3.4	20.2			

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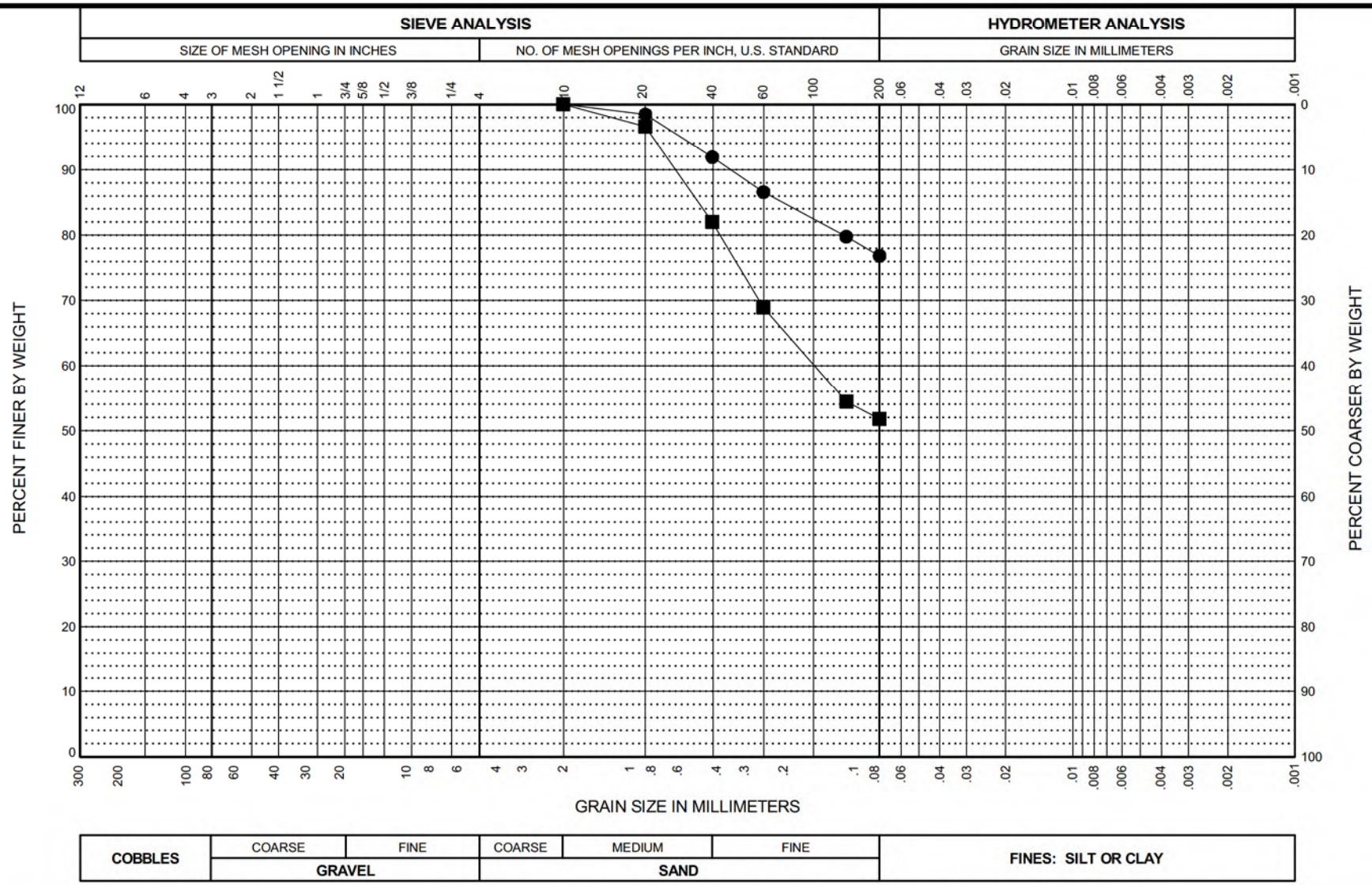
FIG.

GSA- WITH SAMPLE INTERVALS 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/12/17



BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● TP3-2, BULK	0.0 - 11.0	ML	Gray, Silt with Sand.	76.8	103.7	NP	NP	NP
■ TP3-4, BULK	0.0 - 9.0	ML	Tan, Sandy Silt.	51.8	113.4	NP	NP	NP

AECI NMPP - LINED POND
Marston, Missouri

GRAIN SIZE DISTRIBUTION

July 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG.

GSA- WITH SAMPLE INTERVALS 41-1-37431-008 LAB DATA.GPJ SHAN_WIL.GDT 7/3/17

PROJECT AECI NMPP - LINED POND | DATE 7/21/17 | BORING NO. HA-B9

JOB NO. 41-1-37431-008 | SHEET NO. 1 | TESTED BY CMB

CLIENT NAME Haley & Aldrich | CHECKED BY CMB

CLASSIFICATION OF UNDISTURBED SAMPLE

SAMPLE NO. U1 DEPTH (ft) 6-8

Sampling Method Push

Type of Sample Shelby Tube Inch 3"

Brass or Steel

DEPTH FT.	NAT. W.C. Strength info.	NAT. W.C. W.C.	TYPE OF TEST	CLASSIFICATION
6.0				17 INCH RECOVERY Sample: Good Fair Poor Disturbed
	PP = 3.25	HT-3	MC SAVED	Very stiff, mottled gray and brown, Fat Clay (CH); moist; <5% fine sand, 95% high dry strength and plasticity, no dilatancy. (Possible Fill)
6.5			CU	
7.0			SAVED	Hard, brown, Silt with Sand to Sandy Silt (ML); moist; 25-35% fine sand, 95% low dry strength and plasticity, rapid dilatancy. (Possible Fill)
	PP = 4.5+	HT-4	MC	
7.5				
8.0				

Can/Tare No.	HT-3	HT-4
WET + TARE	57.92	76.99
DRY + TARE	46.37	71.26
TARE	2.52	2.53
% WATER	26.3	8.3

Procedure: ASTM D 2488

NOTE: Soil description is based on visual-manual procedure. This description is not meant for engineering purposes requiring precise classification of soils.

All sample percentages for cobbles and boulders are by volume.

REMARKS: Tube would not extrude, had to cut into 6 inch pieces to extrude.

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

PROJECT AECI NMPP - LINED POND | DATE 7/20/17 | BORING NO. HA-B9

JOB NO. 41-1-37431-008 | SHEET NO. 1 | TESTED BY CMB

CLIENT NAME Haley & Aldrich | CHECKED BY CMB

CLASSIFICATION OF UNDISTURBED SAMPLE

SAMPLE NO. U3 | DEPTH (ft) 14-16

Sampling Method Push

Type of Sample Shelby Tube | Inch 3"

Brass or Steel

DEPTH FT.	NAT. W.C. Strength info.	NAT. W.C. W.C.	TYPE OF TEST	CLASSIFICATION
14.0				19 INCH RECOVERY Sample: Good Fair Poor Disturbed
	PP = 2.5	HT-1	MC	Stiff, brown, Silt (ML); moist; 5% fine sand, 95% low dry strength and plasticity, rapid dilatancy.
14.5			Atterberg #200 Wash UU-1	
15.0			UU-2	
15.5			Consolidation	
	PP = 2.0	HT-1	MC	
16.0				

Can/Tare No.	HT-1	HT-2
WET + TARE	95.66	69.31
DRY + TARE	79.51	57.90
TARE	2.52	2.53
% WATER	21.0	20.6

Procedure: ASTM D 2488

NOTE: Soil description is based on visual-manual procedure. This description is not meant for engineering purposes requiring precise classification of soils.

All sample percentages for cobbles and boulders are by volume.

REMARKS:

Shannon & Wilson, Inc.
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St. Louis, MO 63146

PROJECT AECI NMPP - LINED POND | DATE 7/11/17 | BORING NO. HA-B10OW

JOB NO. 41-1-37431-008 | SHEET NO. 1 | TESTED BY CMB

CLIENT NAME Haley & Aldrich | CHECKED BY CMB

CLASSIFICATION OF UNDISTURBED SAMPLE

SAMPLE NO. U1 | DEPTH (ft) 10-12

Sampling Method Push

Type of Sample Shelby Tube | Inch 3"

Brass or Steel

DEPTH FT.	NAT. W.C. Strength info.	NAT. W.C. W.C.	TYPE OF TEST	CLASSIFICATION
				24 INCH RECOVERY Sample: Good Fair Poor Disturbed
10.0	PP = 1.5	HT-1	MC	Stiff, mottled gray and brown, Fat Clay (CH); moist; <5% fine sand; >95% high dry strength and plasticity, no dilatancy. (Possible Fill.)
10.5				
11.0			SAVED	
11.5				
12.0	PP = 1.75	HT-2	Atterberg #200 Wash MC	

Can/Tare No.	HT-1	HT-2
WET + TARE	80.61	66.72
DRY + TARE	59.89	51.94
TARE	2.51	2.54
% WATER	36.1	29.9

Procedure: ASTM D 2488

NOTE: Soil description is based on visual-manual procedure. This description is not meant for engineering purposes requiring precise classification of soils.

All sample percentages for cobbles and boulders are by volume.

REMARKS: Sample disturbed and distorted, possibly hit obstruction .
See picture #7154.

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

PROJECT AECI NMPP - LINED POND | DATE 7/11/17 | BORING NO. HA-B10OW

JOB NO. 41-1-37431-008 | SHEET NO. 1 | TESTED BY CMB

CLIENT NAME Haley & Aldrich | CHECKED BY CMB

CLASSIFICATION OF UNDISTURBED SAMPLE

SAMPLE NO. U2 | DEPTH (ft) 18-20

Sampling Method Push

Type of Sample Shelby Tube | Inch 3"

Brass or Steel

DEPTH FT.	NAT. W.C. Strength info.	NAT. W.C. W.C.	TYPE OF TEST	CLASSIFICATION
18.0				16 INCH RECOVERY Sample: Good Fair Poor Disturbed
	PP = 3.25	HT-3	MC	Stiff, mottled gray and brown, Fat Clay (CH); moist; <5% fine sand; >95% high dry strength and plasticity, no dilatancy. Sample contains shredded plastic. (Possible Fill.)
			SAVED	
18.5			Atterberg #200 Wash CU	
19.0			SAVED	
	PP = 4.5+	HT-4	MC	
19.5				
20.0				

Can/Tare No.	HT-3	HT-4
WET + TARE	77.31	68.50
DRY + TARE	62.67	58.87
TARE	2.54	2.54
% WATER	24.3	17.1

Procedure: ASTM D 2488

NOTE: Soil description is based on visual-manual procedure. This description is not meant for engineering purposes requiring precise classification of soils.

All sample percentages for cobbles and boulders are by volume.

REMARKS: Sample contains pieces of plastic, possilbe geotextile.

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

PROJECT AECI NMPP - LINED POND | DATE 7/11/17 | BORING NO. HA-B10OW

JOB NO. 41-1-37431-008 | SHEET NO. 1 | TESTED BY CMB

CLIENT NAME Haley & Aldrich | CHECKED BY CMB

CLASSIFICATION OF UNDISTURBED SAMPLE

SAMPLE NO. U3 | DEPTH (ft) 30-32

Sampling Method Push

Type of Sample Shelby Tube | Inch 3"

Brass or Steel

DEPTH FT.	NAT. W.C. Strength info.	NAT. W.C. W.C.	TYPE OF TEST	CLASSIFICATION
30.0				23 INCH RECOVERY Sample: Good Fair Poor Disturbed
	PP = 0.5	HT-5	MC	Mottled gray and brown, Fat Clay (CH); moist; <5% fine sand, 95% high plastic.
30.5			Atterberg #200 Wash CU	Brown, Silt (ML); moist to wet; 5% fine sand, 95% low dry strength and plasticity, rapid dilatancy.
31.0				
			SAVED	Mottled gray and brown, Fat Clay (CH); moist; <5% fine sand, 95% high dry strength and plasticity, no dilatancy.
31.5				Mottled gray and brown, Lean Clay (CL) moist; <5% fine sand, 95% medium dry strength and plasticity, no dilatancy.
	PP = 0.75	HT-6	MC	
32.0				

Can/Tare No.	HT-5	HT-6
WET + TARE	46.98	53.62
DRY + TARE	34.88	40.23
TARE	2.54	2.54
% WATER	37.4	35.5

Procedure: ASTM D 2488

NOTE: Soil description is based on visual-manual procedure. This description is not meant for engineering purposes requiring precise classification of soils.

All sample percentages for cobbles and boulders are by volume.

REMARKS:

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

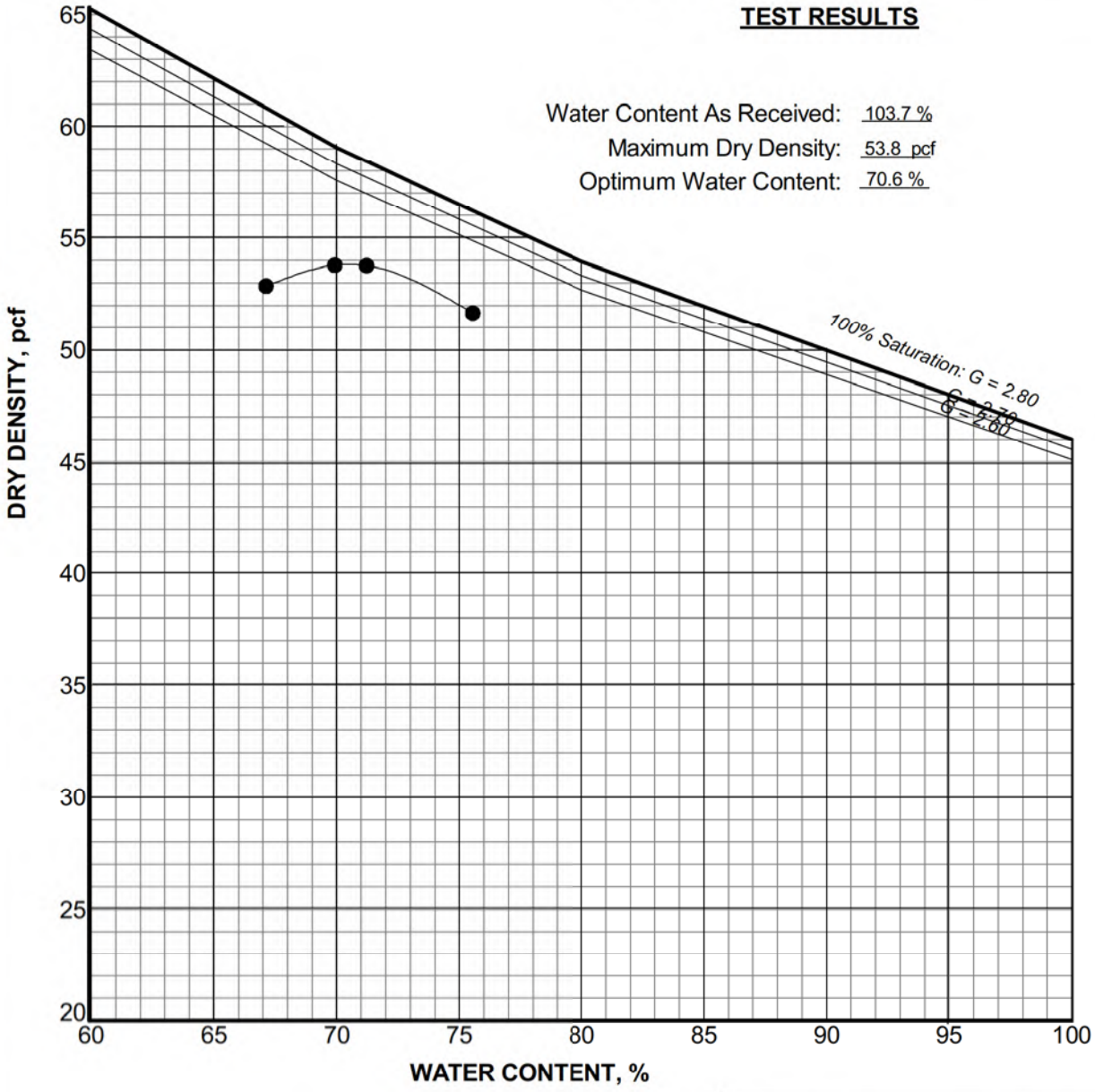
Sample Identification: TP3-2, Bulk, 0.0 - 11.0 feet.

Description of Material: Gray, Silt with Sand. (ML)

Compaction Test Method: ASTM D698 Method A
Rammer Type: Mechanical
Checked By:

TEST RESULTS

Water Content As Received: 103.7 %
Maximum Dry Density: 53.8 pcf
Optimum Water Content: 70.6 %



OTHER TEST RESULTS

GRAIN SIZE ANALYSES:	% Gravel:	0.0
	% Sand:	23.2
	% Fines:	76.8
ATTERBERG LIMITS:	Liquid Limit:	NP
	Plastic Limit:	NP
	Plasticity Index:	NP

AECI NMPP - LINED POND
Marston, Missouri

MOISTURE-DENSITY TEST

July 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG.

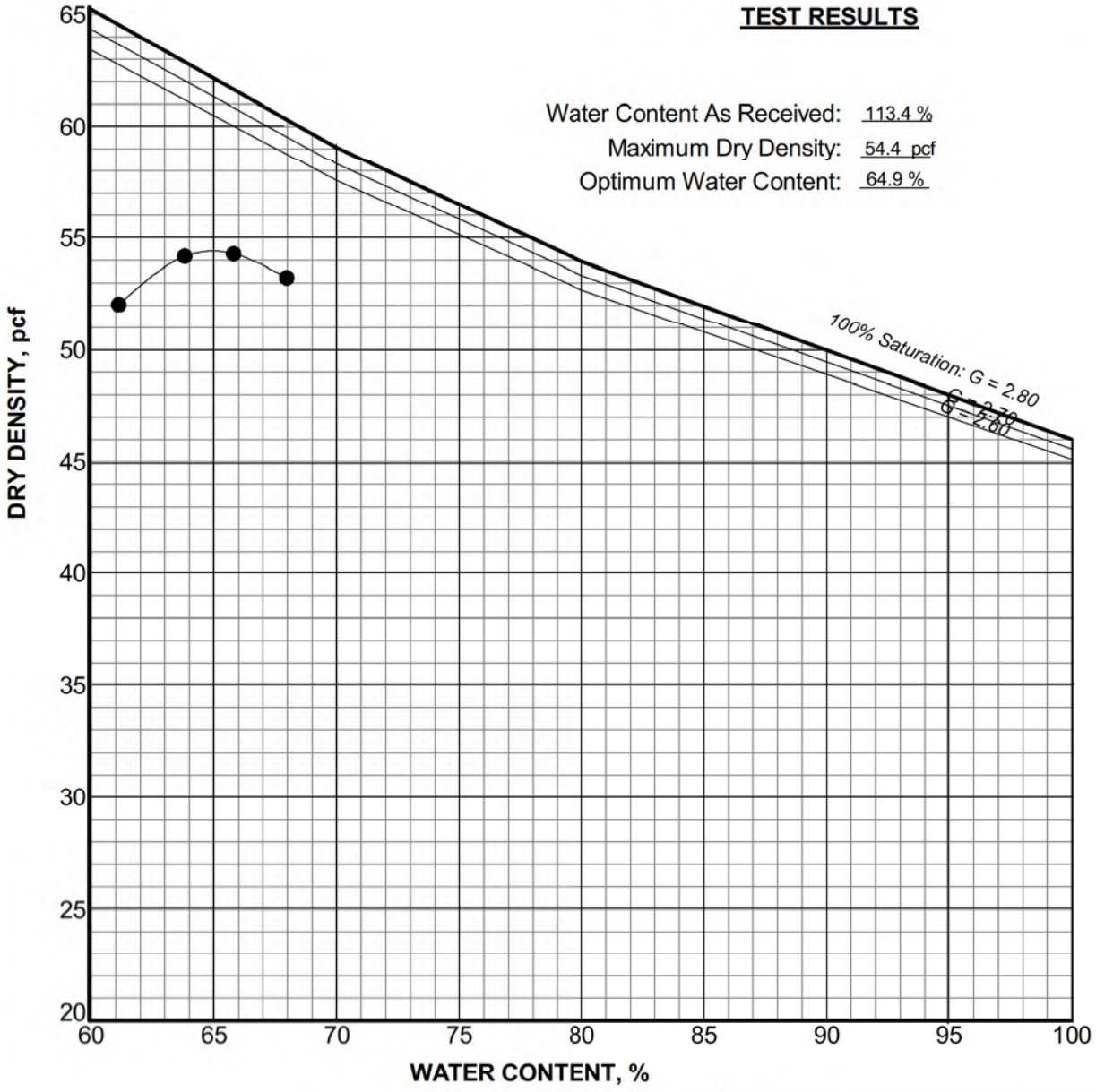
Sample Identification: TP3-4, Bulk, 0.0 - 9.0 feet.

Description of Material: Tan, Sandy Silt. (ML)

Compaction Test Method: ASTM D698 Method A
Rammer Type: Mechanical
Checked By:

TEST RESULTS

Water Content As Received: 113.4 %
Maximum Dry Density: 54.4 pcf
Optimum Water Content: 64.9 %



OTHER TEST RESULTS

GRAIN SIZE ANALYSES:	% Gravel:	0.0
	% Sand:	48.2
	% Fines:	51.8
ATTERBERG LIMITS:	Liquid Limit:	NP
	Plastic Limit:	NP
	Plasticity Index:	NP

AECI NMPP - LINED POND
Marston, Missouri

MOISTURE-DENSITY TEST

July 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG.

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION
SUMMARY OF TEST DATA

Boring	HA-B9	Tested by / Date	JAS	07/21/17
Sample	U3	Calculated by / Date	CMB	07/24/17
Depth (ft)	14.4	Checked by / Date	CMB	07/24/17
Description	Stiff, brown, Silt (ML).			

Specimen Data			Instrument Constants		
Height	5.985	inches	Deformation	0.001	inches/div
Diameter	2.854	inches	Load	1	lb/div.
H/D ratio	2.097		Confinment	10	psi
Volume	627.4	cc			
Wet wt.	1184.26	grams	Peak values		
Bulk Density	117.8	pcf	p	1.837	tsf
Dry Density	94.4	pcf	q	1.117	tsf
M.C.	24.7%	percent	strain	15.0%	%
Saturation	85.2%	percent	strain rate	0.040	in. per min.
Void ratio	0.784				
Gs	2.7	assumed			

Deformation div.	Load div.	Strain %	Load lb	Stress tsf	p tsf	q tsf
0.000	0.0	0.0%	0.0	0.000	0.720	0.000
0.005	3.6	0.1%	3.6	0.040	0.740	0.020
0.010	16.3	0.2%	16.3	0.183	0.812	0.092
0.015	23.3	0.3%	23.3	0.262	0.851	0.131
0.020	30.4	0.3%	30.4	0.341	0.891	0.171
0.030	44.5	0.5%	44.5	0.498	0.969	0.249
0.050	68.9	0.8%	68.9	0.769	1.105	0.385
0.075	95.6	1.3%	95.6	1.063	1.251	0.531
0.100	118.0	1.7%	118.0	1.306	1.373	0.653
0.125	133.1	2.1%	133.1	1.467	1.454	0.734
0.150	145.0	2.5%	145.0	1.592	1.516	0.796
0.175	153.8	2.9%	153.8	1.682	1.561	0.841
0.200	160.1	3.3%	160.1	1.744	1.592	0.872
0.225	167.1	3.8%	167.1	1.813	1.626	0.906
0.250	171.3	4.2%	171.3	1.851	1.645	0.925
0.300	179.7	5.0%	179.7	1.926	1.683	0.963
0.350	186.2	5.8%	186.2	1.980	1.710	0.990
0.400	192.8	6.7%	192.8	2.034	1.737	1.017
0.450	196.2	7.5%	196.2	2.054	1.747	1.027
0.500	200.5	8.4%	200.5	2.083	1.761	1.041
0.550	205.4	9.2%	205.4	2.117	1.779	1.059
0.600	209.2	10.0%	209.2	2.140	1.790	1.070
0.650	213.7	10.9%	213.7	2.170	1.805	1.085
0.700	215.9	11.7%	215.9	2.175	1.808	1.088
0.750	219.2	12.5%	219.2	2.192	1.816	1.096
0.800	223.1	13.4%	223.1	2.215	1.827	1.107
0.850	225.8	14.2%	225.8	2.225	1.833	1.113
0.900	228.4	15.0%	228.4	2.235	1.837	1.117

AECI NMPP - Lined Pond
Marston, Missouri

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION

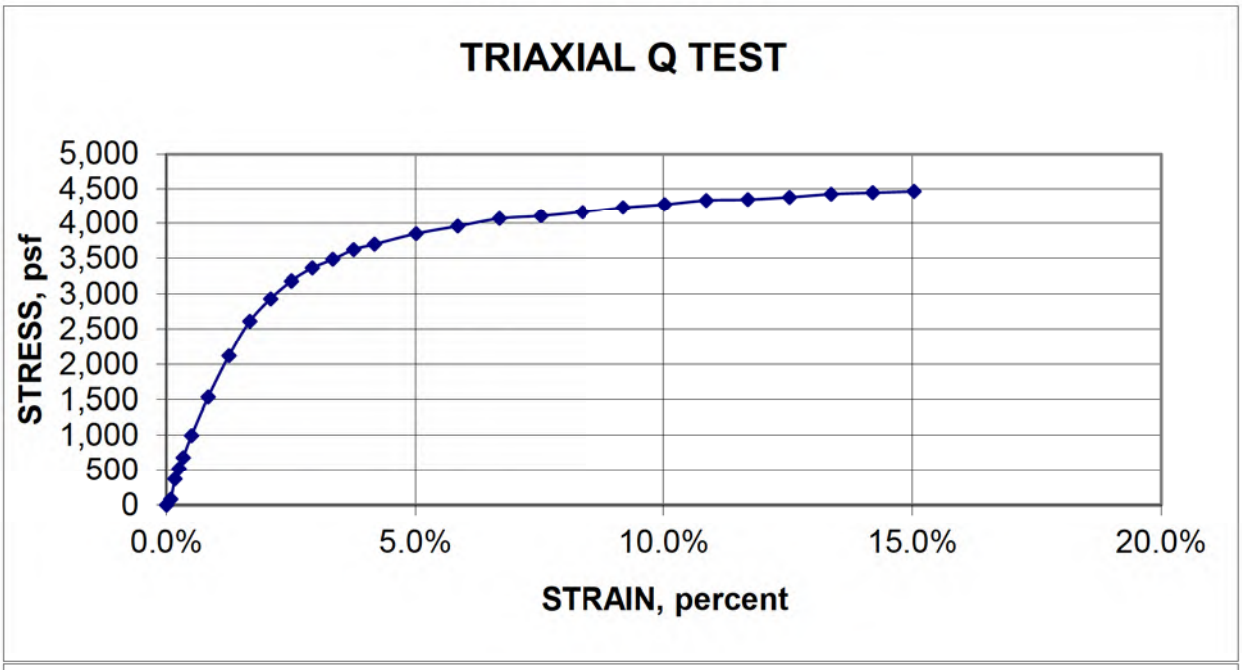
BORING - HA-B9 : SAMPLE - U3

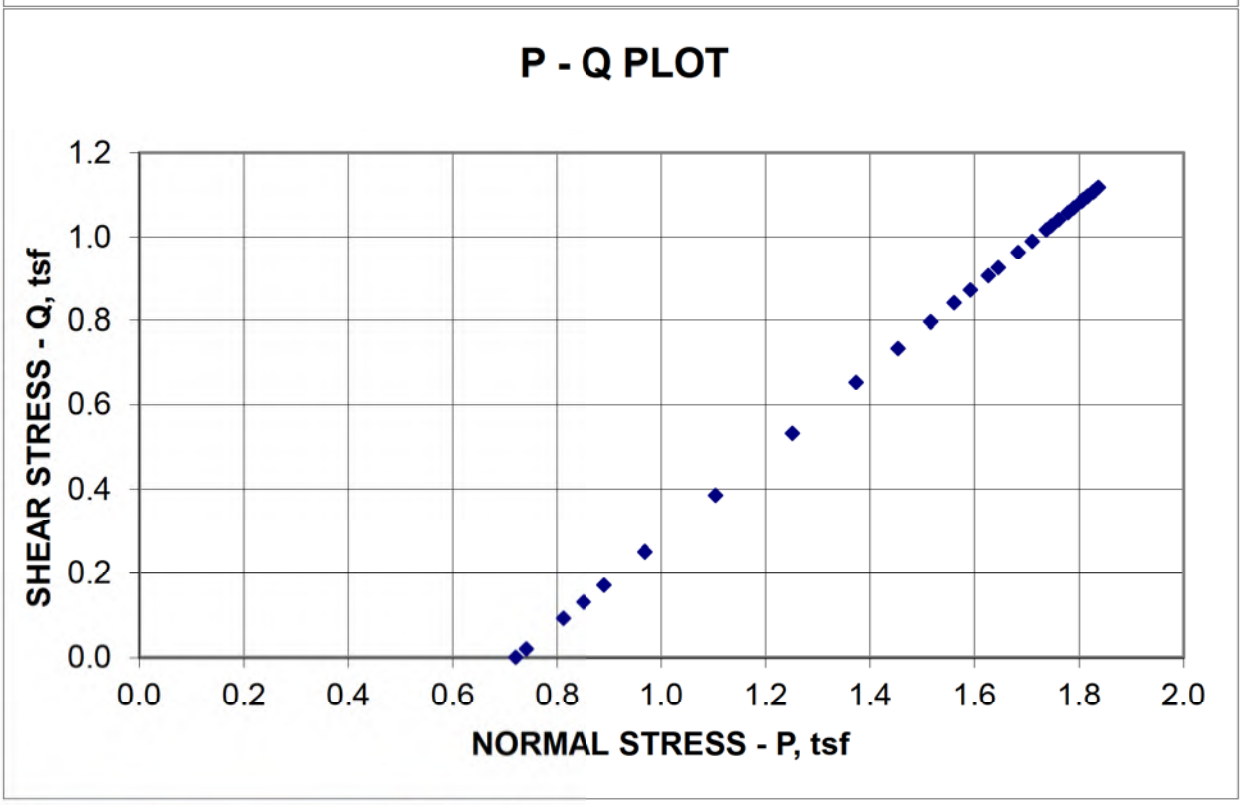
July 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG.

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION
PLOT OF TEST DATA





Photograph of Failure

AECI NMPP - Lined Pond
Marston, Missouri

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION

BORING - HA-B9 : SAMPLE - U3

July 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG.

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION
SUMMARY OF TEST DATA

Boring	HA-B9	Tested by / Date	JAS	07/21/17
Sample	U3	Calculated by / Date	CMB	07/24/17
Depth (ft)	15	Checked by / Date	CMB	07/24/17
Description	Stiff, brown, Silt (ML).			

Specimen Data			Instrument Constants		
Height	5.990	inches	Deformation	0.001	inches/div
Diameter	2.861	inches	Load	1	lb/div.
H/D ratio	2.094		Confinment	16.5	psi
Volume	631.0	cc			
Wet wt.	1227.54	grams	Peak values		
Bulk Density	121.4	pcf	p	2.481	tsf
Dry Density	96.6	pcf	q	1.293	tsf
M.C.	25.7%	percent	strain	15.0%	%
Saturation	93.2%	percent	strain rate	0.040	in. per min.
Void ratio	0.745				
Gs	2.7	assumed			

Deformation div.	Load div.	Strain %	Load lb	Stress tsf	p tsf	q tsf
0.000	0.0	0.0%	0.0	0.000	1.188	0.000
0.005	3.0	0.1%	3.0	0.034	1.205	0.017
0.010	7.3	0.2%	7.3	0.082	1.229	0.041
0.015	17.2	0.3%	17.2	0.192	1.284	0.096
0.020	27.1	0.3%	27.1	0.303	1.339	0.151
0.030	43.1	0.5%	43.1	0.480	1.428	0.240
0.050	66.7	0.8%	66.7	0.741	1.558	0.370
0.075	90.7	1.3%	90.7	1.003	1.690	0.502
0.100	110.4	1.7%	110.4	1.216	1.796	0.608
0.125	126.6	2.1%	126.6	1.389	1.882	0.694
0.150	139.5	2.5%	139.5	1.524	1.950	0.762
0.175	150.7	2.9%	150.7	1.640	2.008	0.820
0.200	159.2	3.3%	159.2	1.725	2.051	0.863
0.225	175.0	3.8%	175.0	1.889	2.132	0.944
0.250	180.5	4.2%	180.5	1.941	2.158	0.970
0.300	188.5	5.0%	188.5	2.010	2.193	1.005
0.350	198.6	5.8%	198.6	2.101	2.239	1.051
0.400	208.0	6.7%	208.0	2.184	2.280	1.092
0.450	217.3	7.5%	217.3	2.264	2.320	1.132
0.500	225.2	8.3%	225.2	2.328	2.352	1.164
0.550	233.1	9.2%	233.1	2.391	2.384	1.196
0.600	238.5	10.0%	238.5	2.428	2.402	1.214
0.650	244.8	10.9%	244.8	2.473	2.425	1.237
0.700	250.3	11.7%	250.3	2.510	2.443	1.255
0.750	254.1	12.5%	254.1	2.529	2.453	1.265
0.800	260.2	13.4%	260.2	2.571	2.473	1.285
0.850	263.0	14.2%	263.0	2.579	2.478	1.290
0.900	265.6	15.0%	265.6	2.586	2.481	1.293

AECI NMPP - Lined Pond
Marston, Missouri

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION

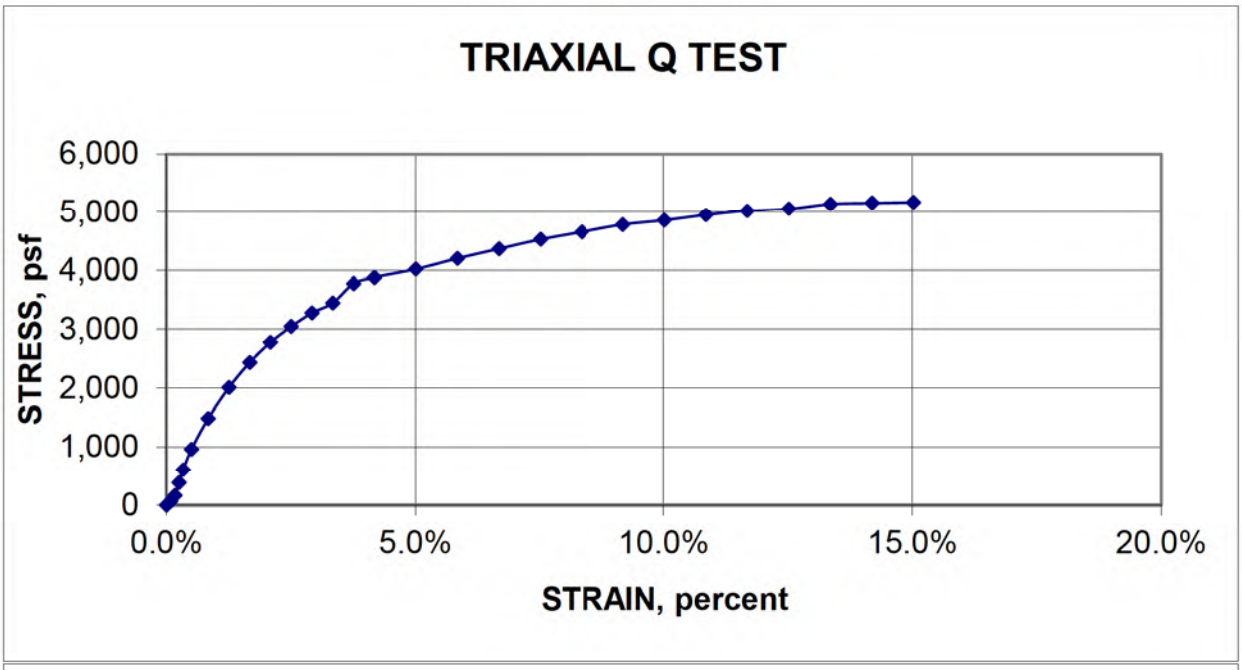
BORING - HA-B9 : SAMPLE - U3

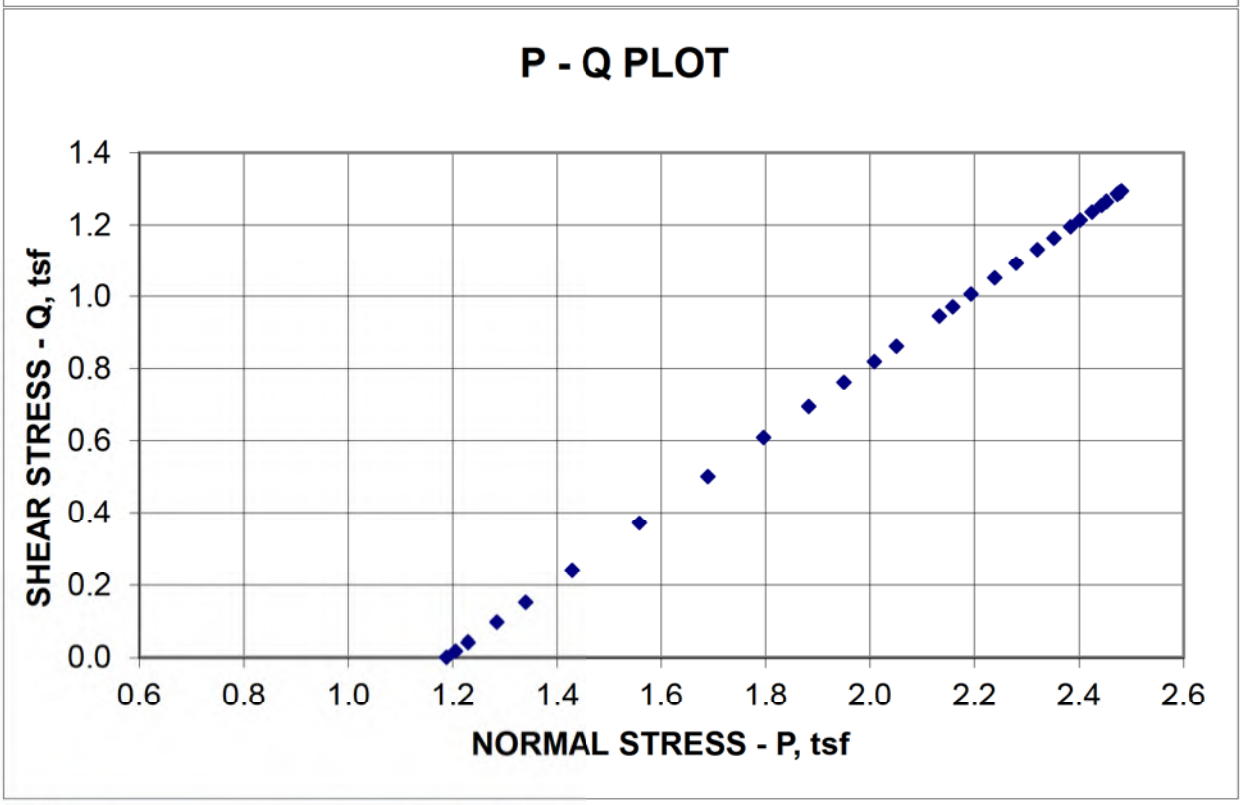
July 2017 41-1-37431-008

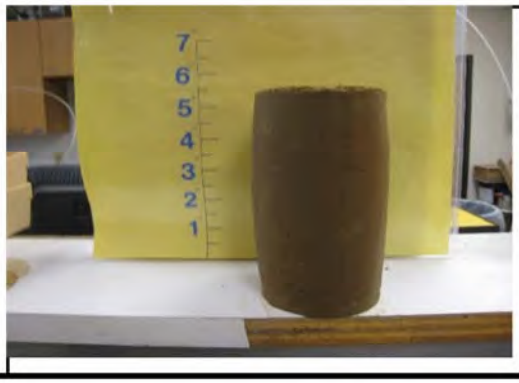
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG.

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION
PLOT OF TEST DATA







Photograph of Failure

AECI NMPP - Lined Pond
Marston, Missouri

UNCONSOLIDATED, UNDRAINED STRENGTH IN TRIAXIAL COMPRESSION

BORING - HA-B9 : SAMPLE - U3

July 2017 41-1-37431-008

SHANNON & WILSON, INC.
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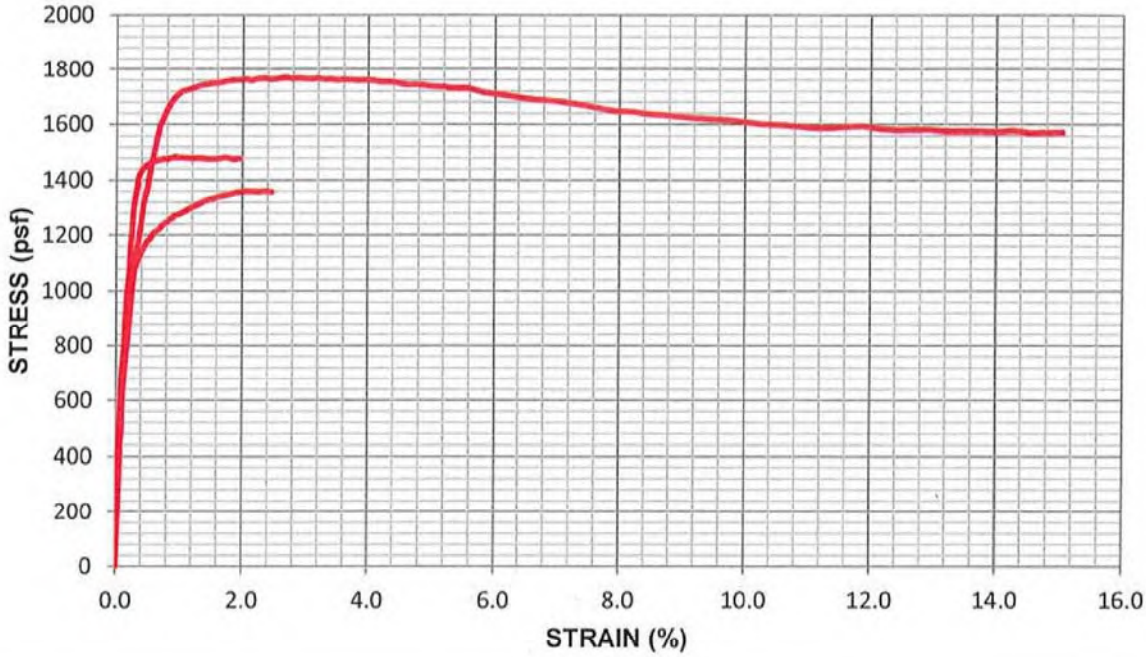
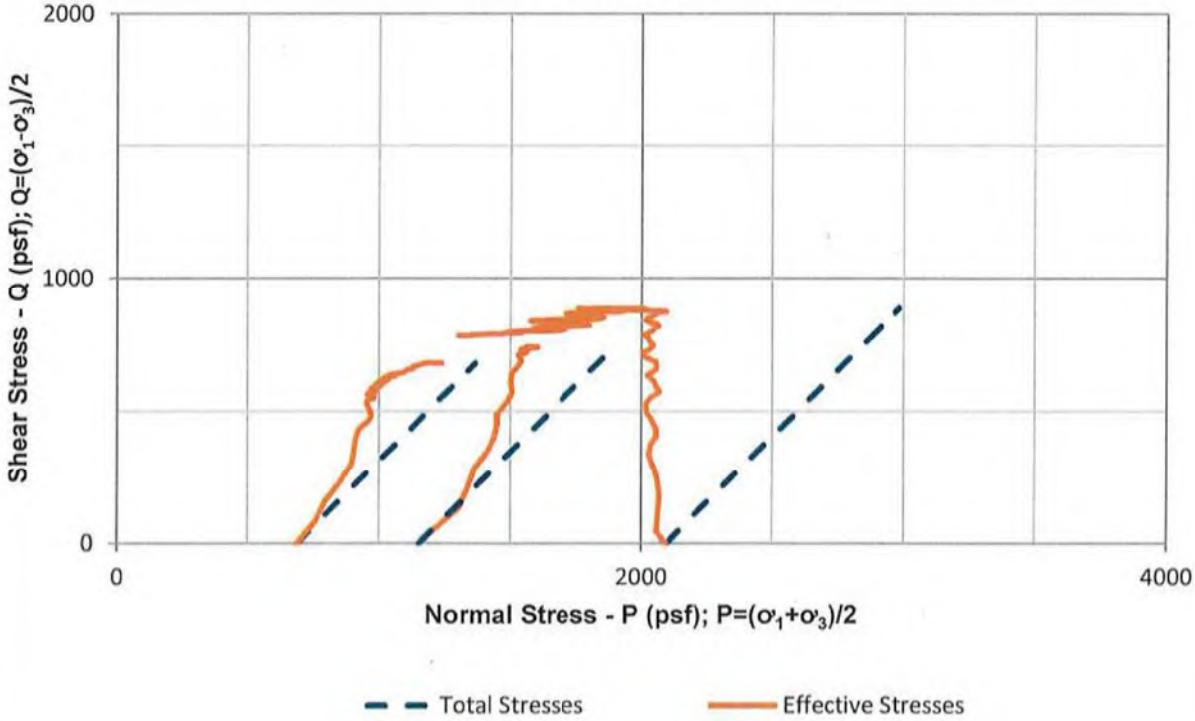
FIG.

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT

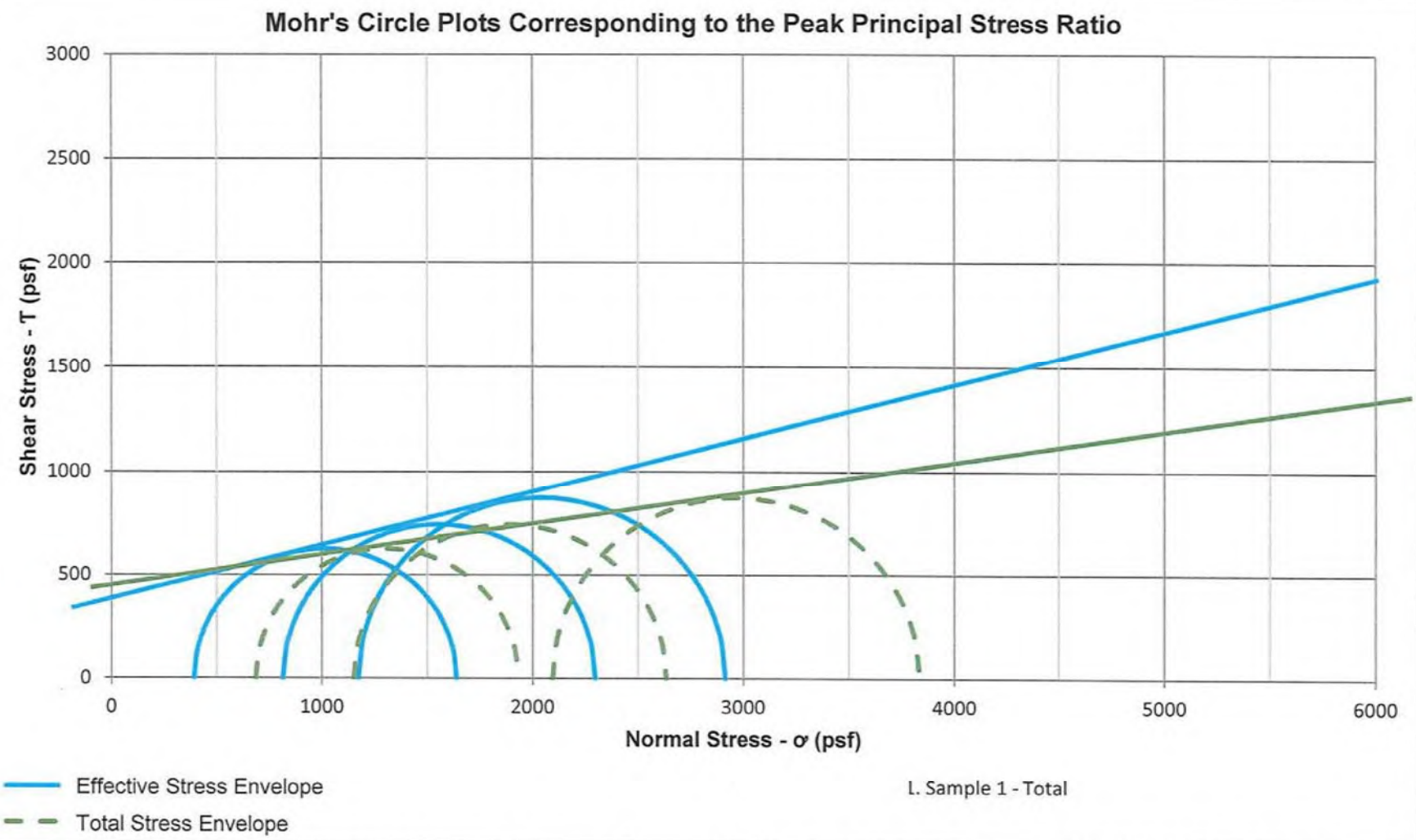
STRESS - STRAIN



P-Q PLOT



SHANNON & WILSON, INC. 2043 WESTPORT CENTER DR. SAINT LOUIS, MISSOURI 63146 41-1-37431-008	CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION AECI NMPP - Lined Pond Marston, Missouri HA-B9 / U1 / 6.8



Sample	Strain (%)
Stage 1	0.8
Stage 2	1.0
Stage 3	1.3

c =	450 psf
ϕ =	8 deg
c' =	380 psf
ϕ' =	14 deg

NOTES:
1. Mohr's circles in this plot are based upon the maximum principal stress difference observed during loading except Stage 3 in which similar strain was chosen.
2. Strength parameters determined by Shannon & Wilson. Engineer-of-Record should evaluate cohesion and friction commensurate with project conditions.

AECI NMPP - Lined Pond
Marston, Missouri

Mohr's Circle Plots
HA-B9 / U1

August 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Figure 1

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
SUMMARY OF TEST DATA

Project	AECI NMPP - Lined Pond					
Location	Marston, Missouri			Client	Haley & Aldrich	
Job No.	41-1-37431-008			Tested by	CMB	Jul-17
Boring	HA-B9			Calculated by	CMB	Aug-17
Sample	U1	Specimen Number	Stage 3	Checked by	DPM	8/16/17
Depth (ft)	6.8	Undisturbed/Remold	Undisturbed	File	41-1-37431-008 HA-B9 U1 ASTM D4767	
Description	Mottled gray and brown, Fat Clay (CH).			Procedure	ASTM D4767	
Remarks	On stage 3 strain, sample sheared far enough to touch cell walls.					

Specimen Data

	Initial	Post Consol.	Post Shear
Height (in)	5.546	5.521	4.690
Diameter (in)	2.868	2.848	
Volume (in^3)	35.830	35.171	
Height/Diameter ratio	1.934	1.939	
Weight (g)	1098.49	1087.69	1087.69
Water Content (%)	34.67	33.34	33.34
Bulk Unit Weight (pcf)	116.8	117.8	117.8
Dry Unit Weight (pcf)	86.7	88.4	88.4
Cross-Sectional Area* (in^2)	6.461	6.371	
% Saturation - Wet Method	100.09	100.10	100.10
Specific Gravity - Assumed	2.68	2.68	2.68
Void Ratio	0.928	0.893	0.893
			Entire Sample
Tare ID			31
Mass wet soil + tare (g)			1274.71
Mass dry soil + tare (g)			982.14
Mass tare (g)			164.95

*Cross-Sectional Area determined using ASTM D4767 Method A

Pressure Conditions

Cell Pressure (psi)	106.0
Pore Pressure (psi)	91.5
Effective Confining Pressure (psi)	14.6
B-value	0.97

Consolidation Phase

Change in Volume (in^3)	0.659
T_{50} (min)	351.2
Platen Travel Rate (in/min)	0.00007

Additional Testing

Liquid Limit (ASTM D4318)	
Plastic Limit (ASTM D4318)	
Particle-Size (ASTM D422)	
Specific Gravity (ASTM D854)	

Summary of Results

Peak P (psf)	2967.0
Peak P' (psf)	2045.4
Peak Q (psf)	870.7
Strain at Peak (%)	1.3
σ_3' (psf)	1174.7
σ_1' (psf)	2916.0
σ_3 (psf)	2096.3
σ_1 (psf)	3837.7

Picture of Failure

AECI NMPP - Lined Pond
Marston, Missouri

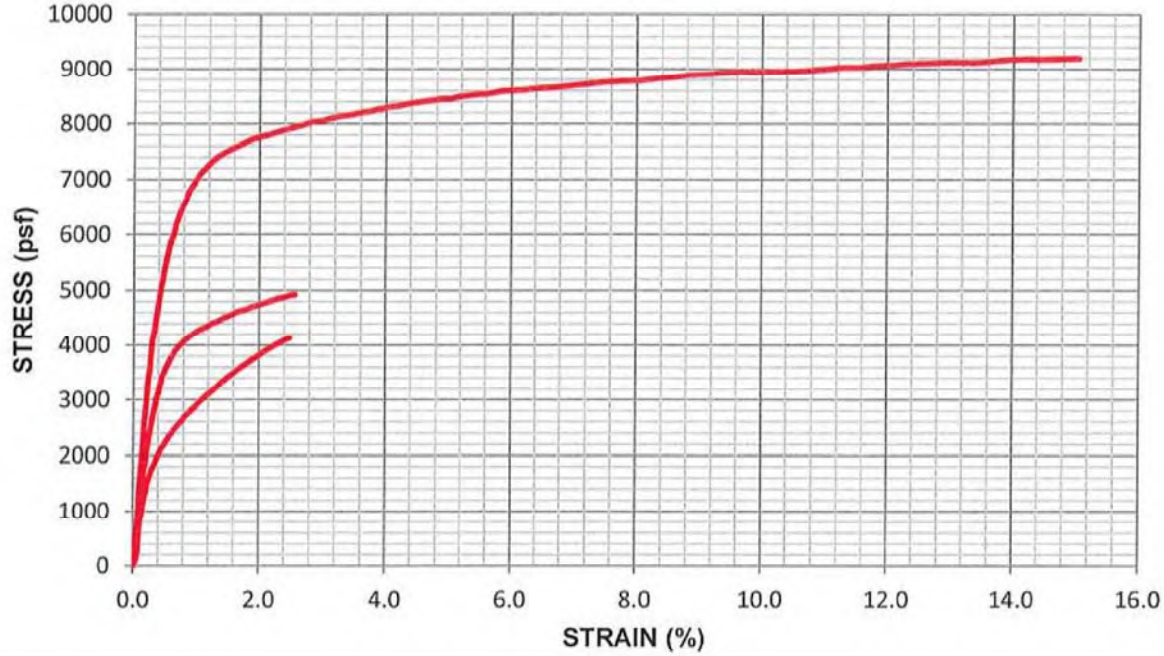
CU TRIAXIAL TEST RESULTS
HA-B9 / U1 / Stage 3

August 2017 | 41-1-37431-008

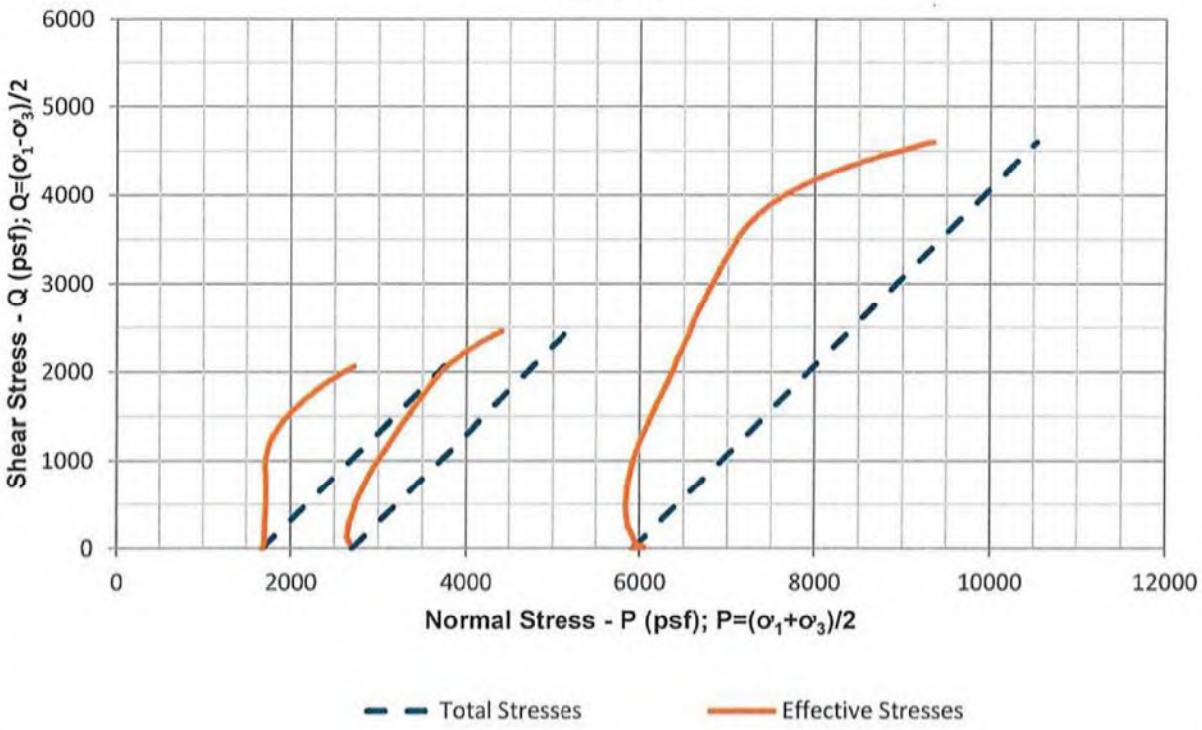
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT

STRESS - STRAIN

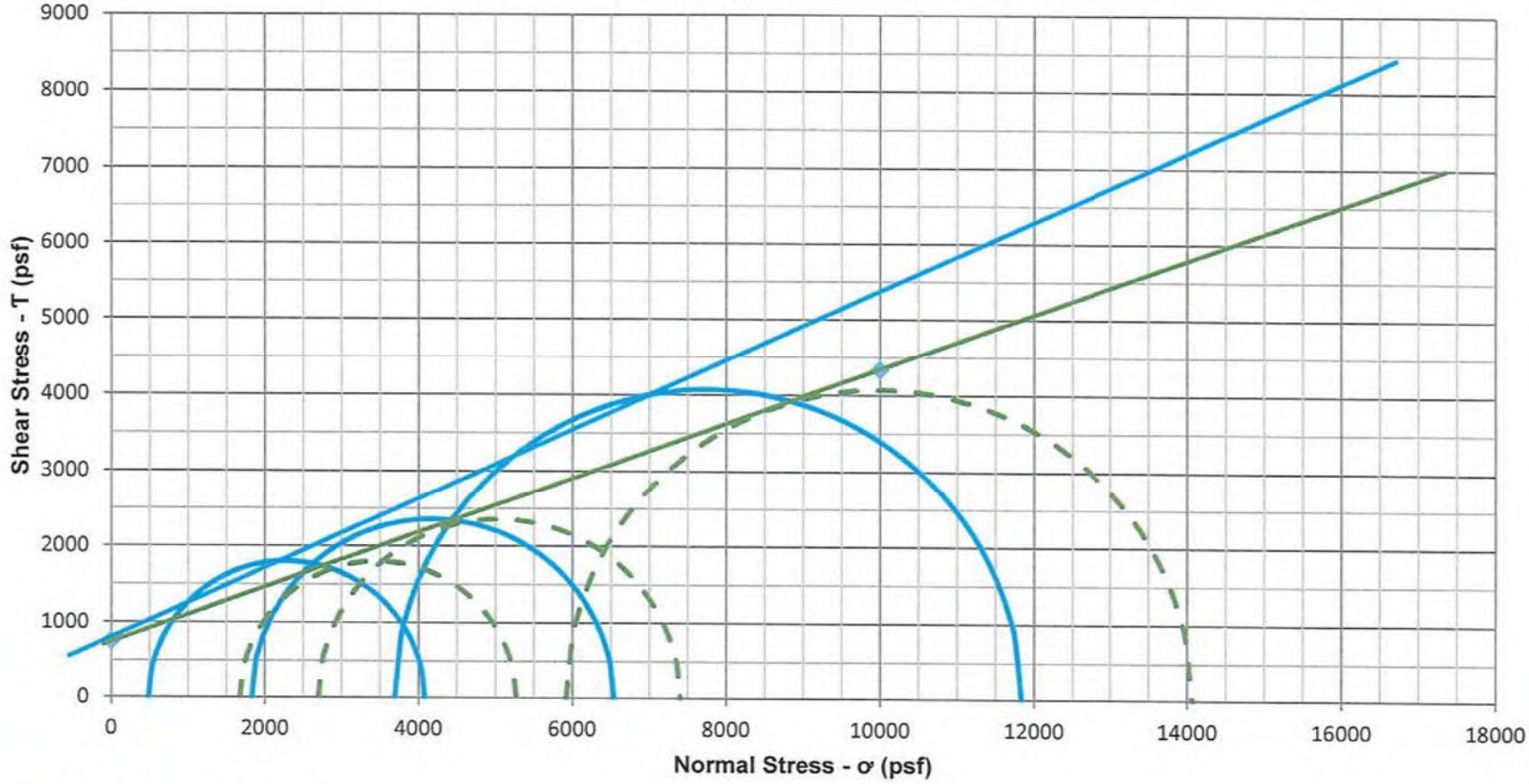


P-Q PLOT



SHANNON & WILSON, INC. 2043 WESTPORT CENTER DR. SAINT LOUIS, MISSOURI 63146 41-1-37431-008	CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION AECI NMPP - Lined Pond Marston, Missouri HA-B10OW / U2 / 18.6

Mohr's Circle Plots Corresponding to the Peak Principal Stress Ratio



Effective Stress Envelope

Total Stress Envelope

Sample	Strain (%)
Stage 1	1.7
Stage 2	1.9
Stage 3	3.3

c =	750 psf
ϕ =	20 deg
c' =	750 psf
ϕ' =	25 deg

NOTES:
1. Mohr's circles in this plot are based upon the maximum principal stress difference observed during loading.
2. Strength parameters determined by Shannon & Wilson. Engineer-of-Record should evaluate cohesion and friction commensurate with project conditions.

AECI NMPP - Lined Pond
Marston, Missouri

Mohr's Circle Plots
HA-B10OW / U2

August 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Figure 1

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
SUMMARY OF TEST DATA

Project	AECI NMPP - Lined Pond					
Location	Marston, Missouri			Client	Haley & Aldrich	
Job No.	41-1-37431-008			Tested by	CMB	Jul-17
Boring	HA-B10OW			Calculated by	CMB	Aug-17
Sample	U2	Specimen Number	Stage 3	Checked by	DCM	8/2/17
Depth (ft)	18.6	Undisturbed/Remold	Undisturbed	File	41-1-37431-008 HA-B10OW U2 ASTM D4	
Description	Mottled gray and brown, Fat Clay (CH).			Procedure	ASTM D4767	
Remarks						

Specimen Data	Initial	Post Consol.	Post Shear
Height (in)	5.630	5.594	5.475
Diameter (in)	2.934	2.922	
Volume (in^3)	38.071	37.522	
Height/Diameter ratio	1.919	1.914	
Weight (g)	1297.70	1288.70	1288.70
Water Content (%)	20.73	19.89	19.89
Bulk Unit Weight (pcf)	129.9	130.8	130.8
Dry Unit Weight (pcf)	107.6	109.1	109.1
Cross-Sectional Area* (in^2)	6.763	6.708	
% Saturation - Wet Method	100.13	100.13	100.13
Specific Gravity - Assumed	2.68	2.68	2.68
Void Ratio	0.555	0.532	0.532
			Entire Sample
Tare ID			25
Mass wet soil + tare (g)			1441.93
Mass dry soil + tare (g)			1210.08
Mass tare (g)			161.28

*Cross-Sectional Area determined using ASTM D4767 Method A

Pressure Conditions	
Cell Pressure (psi)	132.4
Pore Pressure (psi)	91.3
Effective Confining Pressure (psi)	41.1
B-value	0.96

Consolidation Phase	
Change in Volume (in^3)	0.549
T_{50} (min)	230.9

Platen Travel Rate (in/min)	0.00010

Additional Testing

Liquid Limit (ASTM D4318)	
Plastic Limit (ASTM D4318)	
Particle-Size (ASTM D422)	
Specific Gravity (ASTM D854)	

Summary of Results

Peak P (psf)	9996.3
Peak P' (psf)	7767.1
Peak Q (psf)	4072.3
Strain at Peak (%)	3.3
σ_3' (psf)	3694.8
σ_1' (psf)	11839.3
σ_3 (psf)	5924.0
σ_1 (psf)	14068.5

Picture of Failure

AECI NMPP - Lined Pond
Marston, Missouri

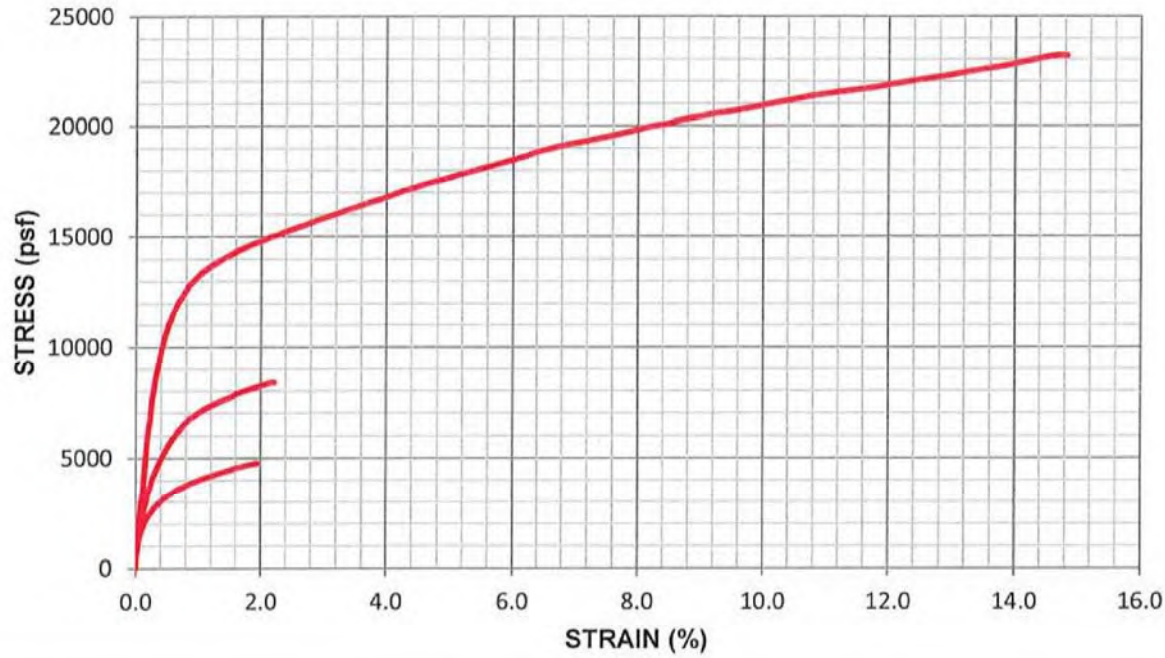
CU TRIAXIAL TEST RESULTS
HA-B10OW / U2 / Stage 3

August 2017 41-1-37431-008

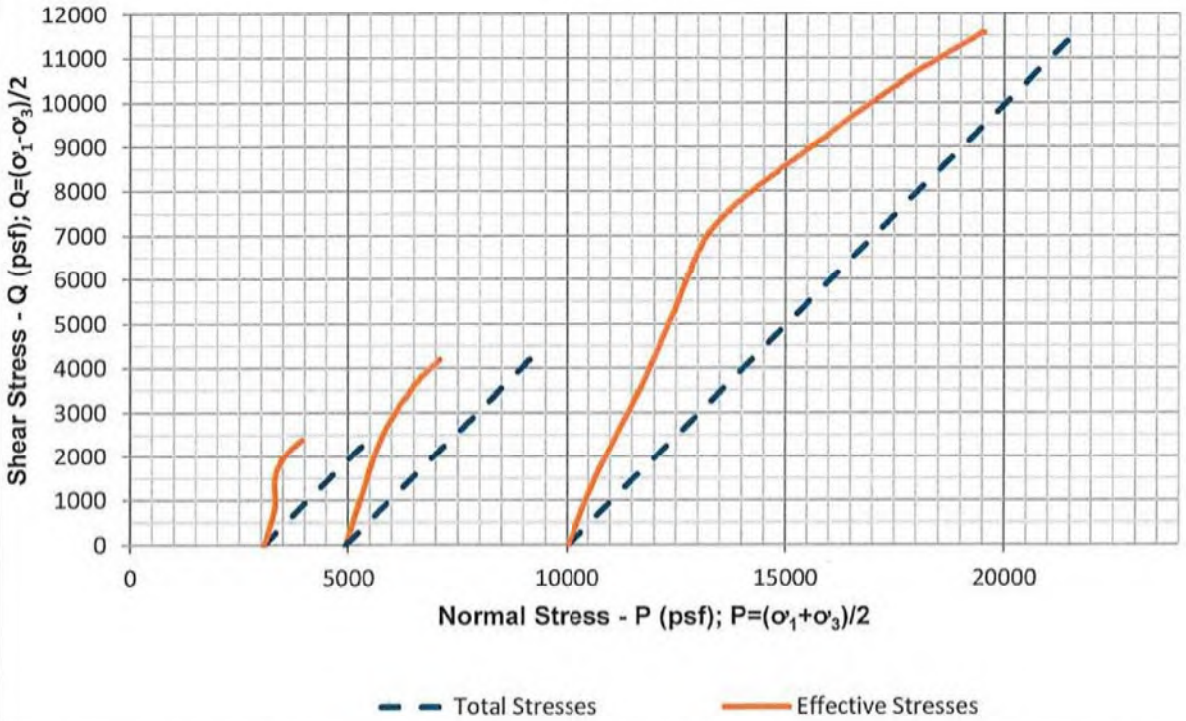
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT

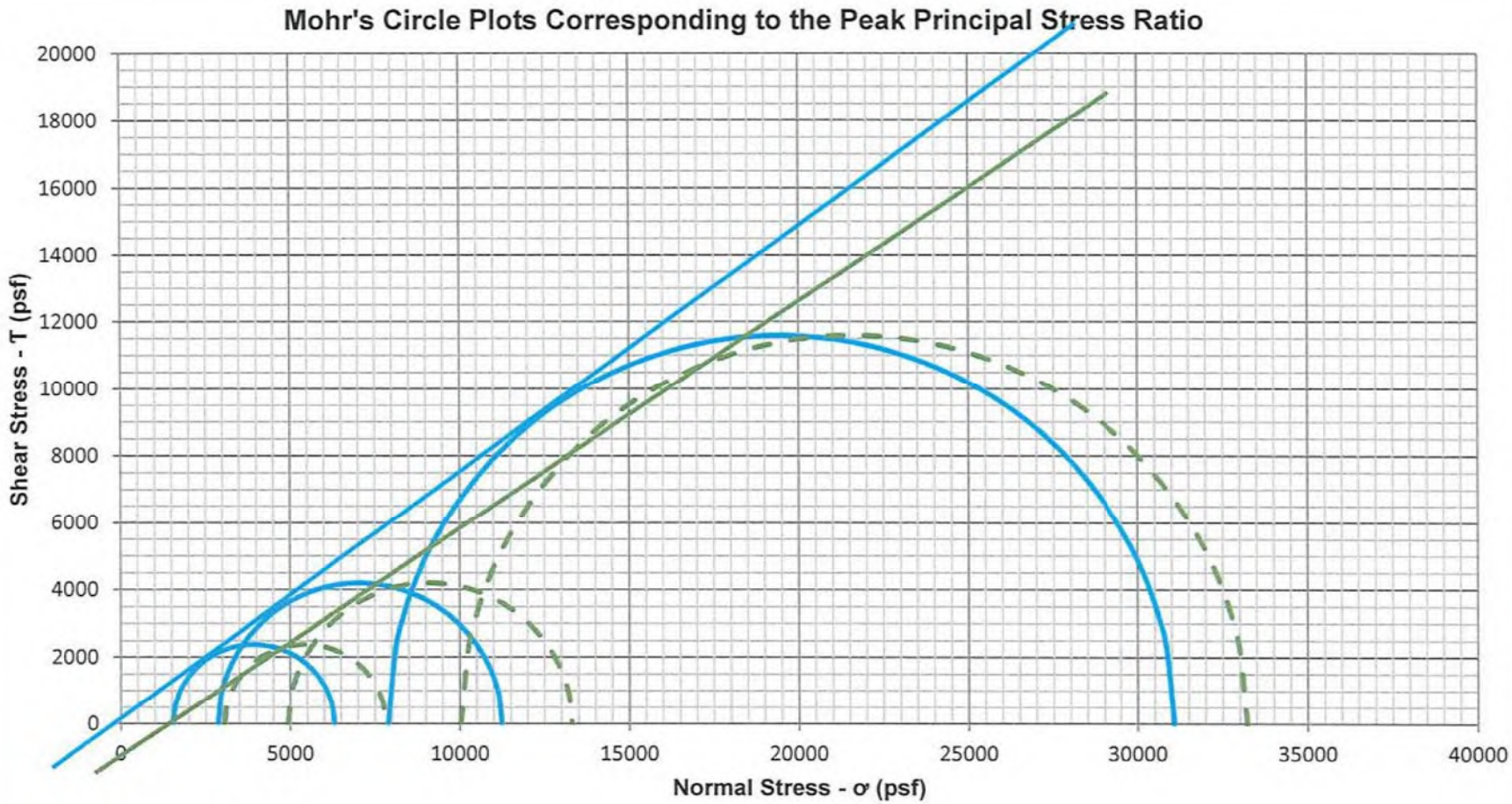
STRESS - STRAIN



P-Q PLOT



SHANNON & WILSON, INC. 2043 WESTPORT CENTER DR. SAINT LOUIS, MISSOURI 63146 41-1-37431-008	CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION AECI NMPP - Lined Pond Marston, Missouri HA-B10OW / U3 / 30.4



Sample	Strain (%)
Stage 1	1.9
Stage 2	2.1
Stage 3	14.7

c =	-1000 psf
ϕ =	34.2 deg
c' =	0 psf
ϕ' =	36.5 deg

NOTES:
1. Mohr's circles in this plot are based upon the maximum principal stress difference observed during loading.
2. Strength parameters determined by Shannon & Wilson. Engineer-of-Record should evaluate cohesion and friction commensurate with project conditions.

AECI NMPP - Lined Pond
Marston, Missouri

Mohr's Circle Plots
HA-B10OW / U3

July 2017 41-1-37431-008

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Figure 1

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
SUMMARY OF TEST DATA

Project	AECI NMPP - Lined Pond					
Location	Marston, Missouri			Client	Haley & Aldrich	
Job No.	41-1-37431-008			Tested by	CMB	Jul-17
Boring	HA-B10OW			Calculated by	CMB	Jul-17
Sample	U3	Specimen Number	Stage 3	Checked by	DPM	7/21/17
Depth (ft)	30.4	Undisturbed/Remold	Undisturbed	File	41-1-37431-008 HA-B10OW U3 ASTM D4	
Description	Brown, Silt (ML).			Procedure	ASTM D4767	
Remarks						

Specimen Data

	Initial	Post Consol.	Post Shear
Height (in)	5.669	5.646	4.808
Diameter (in)	2.752	2.726	
Volume (in^3)	33.728	32.953	
Height/Diameter ratio	2.060	2.071	
Weight (g)	1082.17	1069.47	1069.47
Water Content (%)	28.13	26.62	26.62
Bulk Unit Weight (pcf)	122.2	123.6	123.6
Dry Unit Weight (pcf)	95.4	97.6	97.6
Cross-Sectional Area* (in^2)	5.950	5.837	
% Saturation - Wet Method	100.10	100.11	100.11
Specific Gravity - Assumed	2.68	2.68	2.68
Void Ratio	0.753	0.713	0.713
			Entire Sample
Tare ID			8
Mass wet soil + tare (g)			1183.42
Mass dry soil + tare (g)			958.52
Mass tare (g)			100.00

*Cross-Sectional Area determined using ASTM D4767 Method A

Pressure Conditions

Cell Pressure (psi)	160.9
Pore Pressure (psi)	91.1
Effective Confining Pressure (psi)	69.7
B-value	0.96

Consolidation Phase

Change in Volume (in^3)	0.775
T_{50} (min)	0.9

Platen Travel Rate (in/min)	0.02538

Additional Testing

Liquid Limit (ASTM D4318)	
Plastic Limit (ASTM D4318)	
Particle-Size (ASTM D422)	
Specific Gravity (ASTM D854)	

Summary of Results

Peak P (psf)	21637.2
Peak P' (psf)	19493.6
Peak Q (psf)	11596.5
Strain at Peak (%)	14.7
σ_3' (psf)	7897.1
σ_1' (psf)	31090.1
σ_3 (psf)	10040.7
σ_1 (psf)	33233.7

Picture of Failure

AECI NMPP - Lined Pond
Marston, Missouri

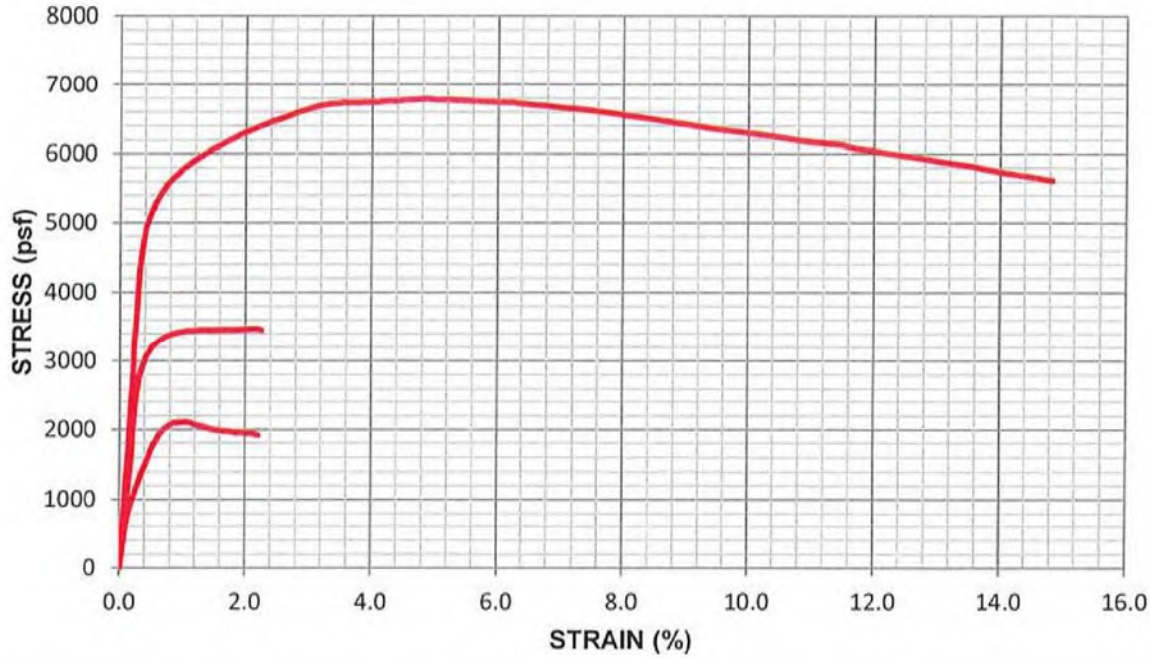
CU TRIAXIAL TEST RESULTS
HA-B10OW / U3 / Stage 3

July 2017 41-1-37431-008

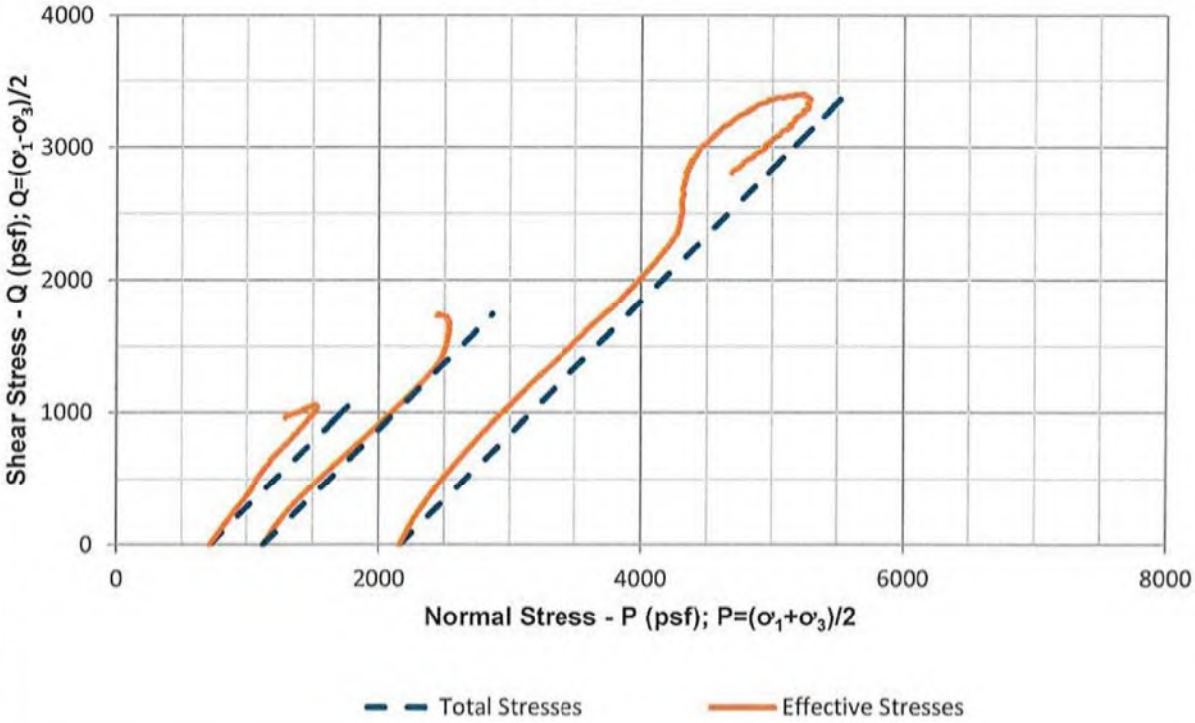
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT

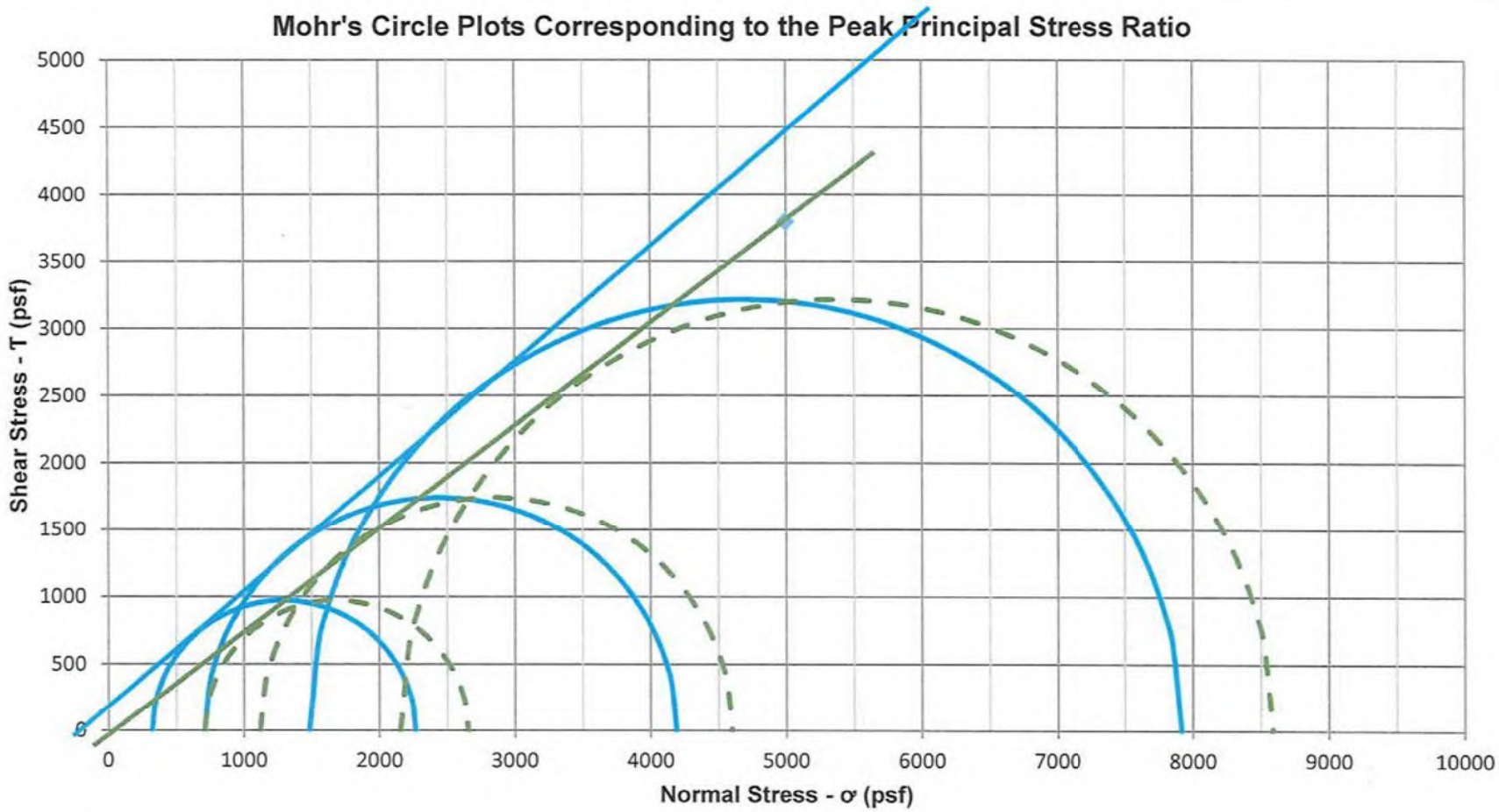
STRESS - STRAIN



P-Q PLOT



SHANNON & WILSON, INC. 2043 WESTPORT CENTER DR. SAINT LOUIS, MISSOURI 63146 41-1-37431-008	CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION AECI NMPP - Lined Pond Marston, Missouri TP3-2 #1 / Bulk / 0 - 11.0



Effective Stress Envelope

Total Stress Envelope

Sample	Strain (%)
Stage 1	2.1
Stage 2	2.2
Stage 3	2.3

c =	-50 psf
ϕ =	38 deg
c' =	180 psf
ϕ' =	41 deg

NOTES:
1. Mohr's circles in this plot are based upon the maximum principal stress difference observed during loading.
2. Strength parameters determined by Shannon & Wilson. Engineer-of-Record should evaluate cohesion and friction commensurate with project conditions.

AECI NMPP - Lined Pond
Marston, Missouri

Mohr's Circle Plots
TP3-2 #1 / Bulk

August 2017 41-1-37431-008

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Figure 1

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
SUMMARY OF TEST DATA

Project	AECI NMPP - Lined Pond					
Location	Marston, Missouri			Client	Haley & Aldrich	
Job No.	41-1-37431-008			Tested by	CMB	Aug-17
Boring	TP3-2 #1			Calculated by	CMB	Aug-17
Sample	Bulk	Specimen Number	Stage 3	Checked by	DPM	8/29/17
Depth (ft)	0 - 11.0	Undisturbed/Remold	Remold	File	41-1-37431-008 TP3-2 #1 Bulk ASTM D47	
Description	Gray, Silt with Sand (ML) (Ash).			Procedure	ASTM D4767	
Remarks						

Specimen Data

	Initial	Post Consol.	Post Shear
Height (in)	5.703	5.709	5.582
Diameter (in)	3.000	2.984	
Volume (in^3)	40.310	39.932	
Height/Diameter ratio	1.901	1.913	
Weight (g)	1001.52	995.32	995.32
Water Content (%)	84.14	83.00	83.00
Bulk Unit Weight (pcf)	94.7	95.0	95.0
Dry Unit Weight (pcf)	51.4	51.9	51.9
Cross-Sectional Area* (in^2)	7.068	6.994	
% Saturation - Wet Method	100.06	100.06	100.06
Specific Gravity - Assumed	2.68	2.68	2.68
Void Ratio	2.253	2.223	2.223
			Entire Sample
Tare ID			8
Mass wet soil + tare (g)			1077.42
Mass dry soil + tare (g)			636.69
Mass tare (g)			100.14

*Cross-Sectional Area determined using ASTM D4767 Method A

Pressure Conditions

Cell Pressure (psi)	107.6
Pore Pressure (psi)	92.6
Effective Confining Pressure (psi)	15.0
B-value	0.98

Consolidation Phase

Change in Volume (in^3)	0.378
T_{50} (min)	0.5

Platen Travel Rate (in/min)	0.01969

Additional Testing

Liquid Limit (ASTM D4318)	
Plastic Limit (ASTM D4318)	
Particle-Size (ASTM D422)	
Specific Gravity (ASTM D854)	

Summary of Results

Peak P (psf)	5374.2
Peak P' (psf)	4702.4
Peak Q (psf)	3216.7
Strain at Peak (%)	2.3
σ_3' (psf)	1485.8
σ_1' (psf)	7919.1
σ_3 (psf)	2157.6
σ_1 (psf)	8590.9

Picture of Failure

AECI NMPP - Lined Pond
Marston, Missouri

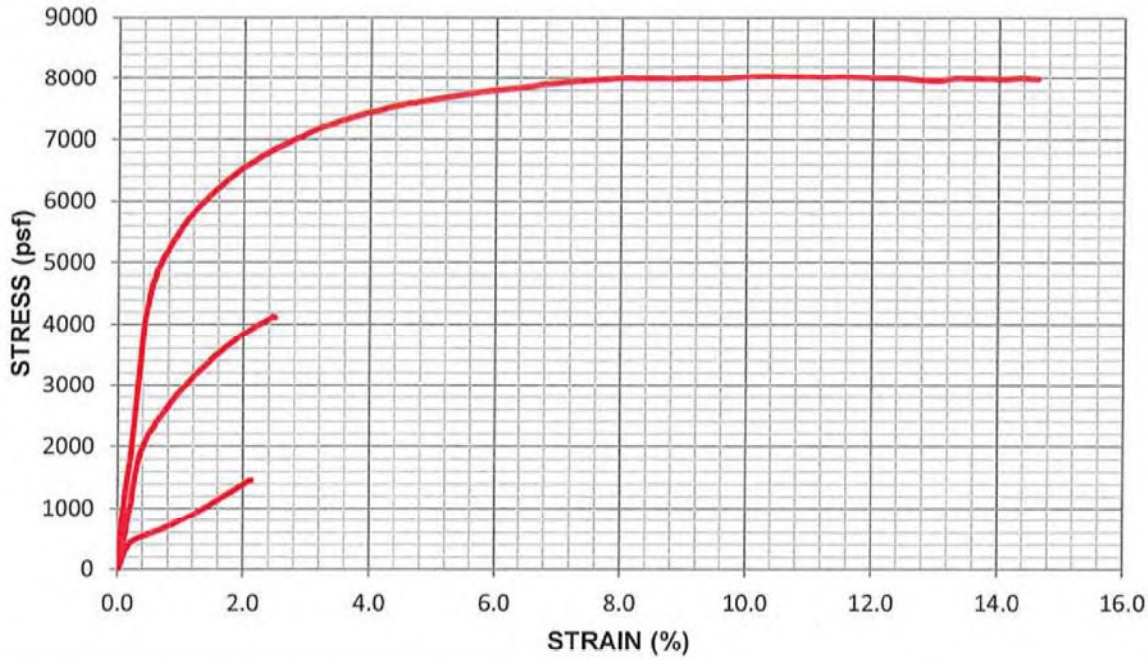
CU TRIAXIAL TEST RESULTS
TP3-2 #1 / Bulk / Stage 3

August 2017 41-1-37431-008

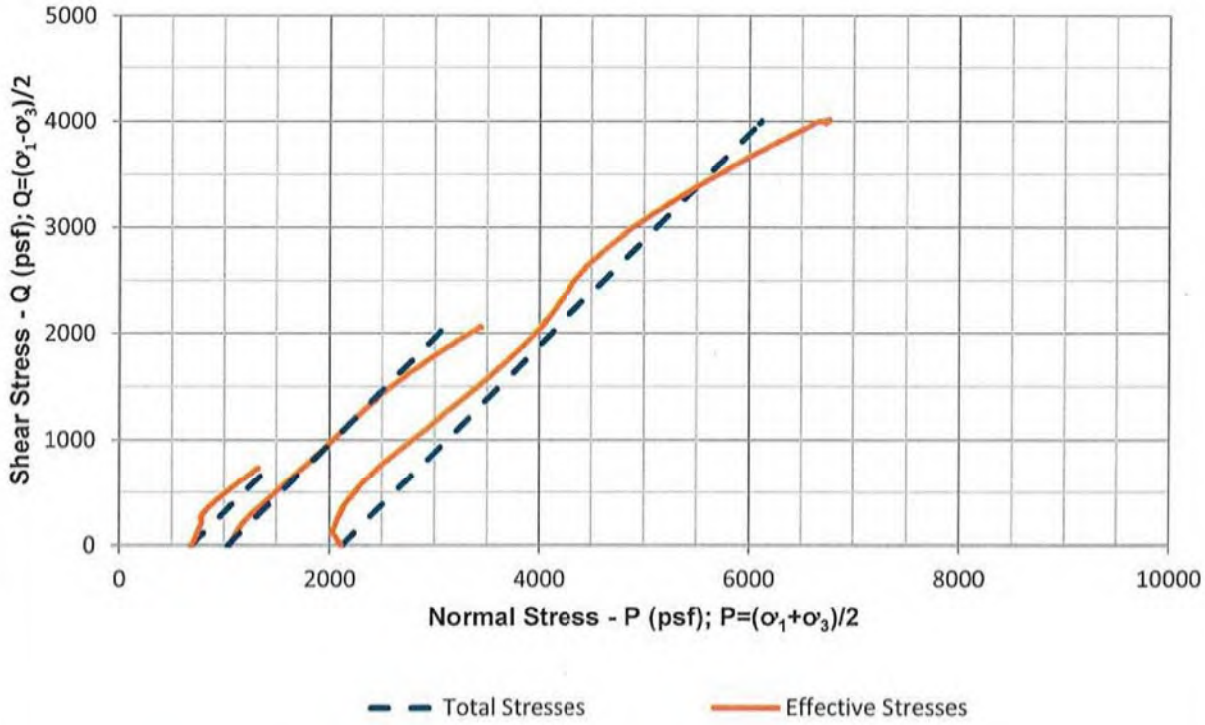
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST WITH PORE PRESSURE MEASUREMENT

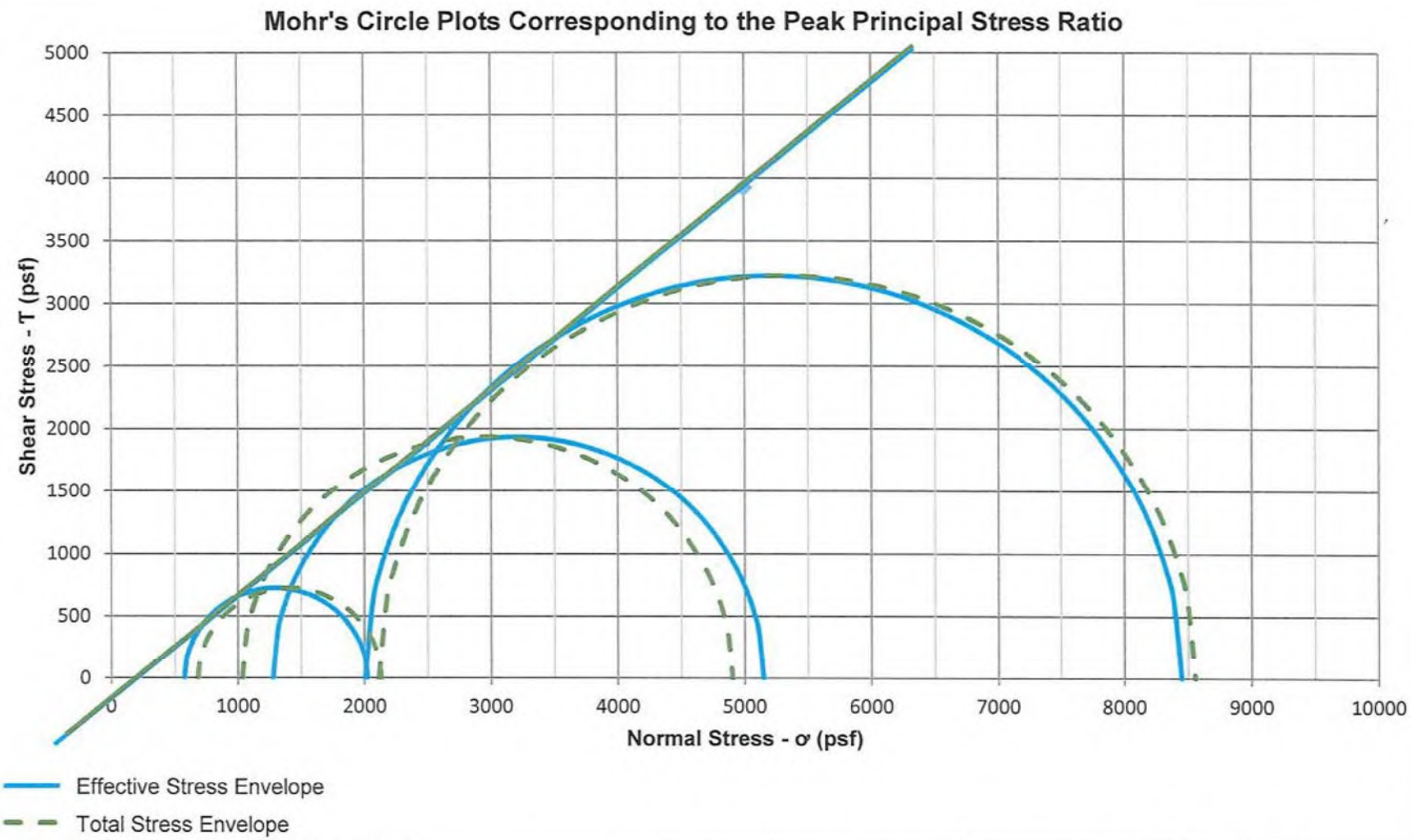
STRESS - STRAIN



P-Q PLOT



SHANNON & WILSON, INC. 2043 WESTPORT CENTER DR. SAINT LOUIS, MISSOURI 63146 41-1-37431-008	CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION AECI NMPP - Lined Pond Marston, Missouri TP3-2 #2 / Bulk / 0 - 11.0



Sample	Strain (%)
Stage 1	2.1
Stage 2	2.0
Stage 3	1.9

c =	-180 psf
ϕ =	39 deg
c' =	-180 psf
ϕ' =	39 deg

NOTES:
1. Mohr's circles in this plot are based upon the maximum principal stress difference observed during loading.
2. Strength parameters determined by Shannon & Wilson. Engineer-of-Record should evaluate cohesion and friction commensurate with project conditions.

AECI NMPP - Lined Pond
Marston, Missouri

Mohr's Circle Plots
TP3-2 #2 / Bulk

August 2017 41-1-37431-008

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Figure 1

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
SUMMARY OF TEST DATA

Project	AECI NMPP - Lined Pond					
Location	Marston, Missouri			Client	Haley & Aldrich	
Job No.	41-1-37431-008			Tested by	CMB	Aug-17
Boring	TP3-2 #2			Calculated by	CMB	Aug-17
Sample	Bulk	Specimen Number	Stage 3	Checked by	DPM	8/29/17
Depth (ft)	0 - 11.0	Undisturbed/Remold	Remold	File	41-1-37431-008 TP3-2 #2 Bulk ASTM D47	
Description	Gray, Silt with Sand (ML) (Ash).			Procedure	ASTM D4767	
Remarks						

Specimen Data	Initial	Post Consol.	Post Shear
Height (in)	5.742	5.759	5.640
Diameter (in)	3.007	2.966	
Volume (in^3)	40.770	39.794	
Height/Diameter ratio	1.910	1.942	
Weight (g)	967.97	951.97	951.97
Water Content (%)	102.35	99.01	99.01
Bulk Unit Weight (pcf)	90.4	91.1	91.1
Dry Unit Weight (pcf)	44.7	45.8	45.8
Cross-Sectional Area* (in^2)	7.100	6.909	
% Saturation - Wet Method	100.06	100.06	100.06
Specific Gravity - Assumed	2.68	2.68	2.68
Void Ratio	2.741	2.652	2.652
			Entire Sample
Tare ID			31
Mass wet soil + tare (g)			1040.63
Mass dry soil + tare (g)			658.42
Mass tare (g)			164.96

*Cross-Sectional Area determined using ASTM D4767 Method A

Pressure Conditions	
Cell Pressure (psi)	104.7
Pore Pressure (psi)	90.0
Effective Confining Pressure (psi)	14.7
B-value	0.98

Consolidation Phase	
Change in Volume (in^3)	0.976
T_{50} (min)	48.9
Platen Travel Rate (in/min)	0.00049

Additional Testing

Liquid Limit (ASTM D4318)	
Plastic Limit (ASTM D4318)	
Particle-Size (ASTM D422)	
Specific Gravity (ASTM D854)	

Summary of Results

Peak P (psf)	5337.7
Peak P' (psf)	5229.5
Peak Q (psf)	3222.4
Strain at Peak (%)	1.9
σ_3' (psf)	2007.1
σ_1' (psf)	8451.9
σ_3 (psf)	2115.3
σ_1 (psf)	8560.1

Picture of Failure

AECI NMPP - Lined Pond
Marston, Missouri

CU TRIAXIAL TEST RESULTS
TP3-2 #2 / Bulk / Stage 3

August 2017 | 41-1-37431-008

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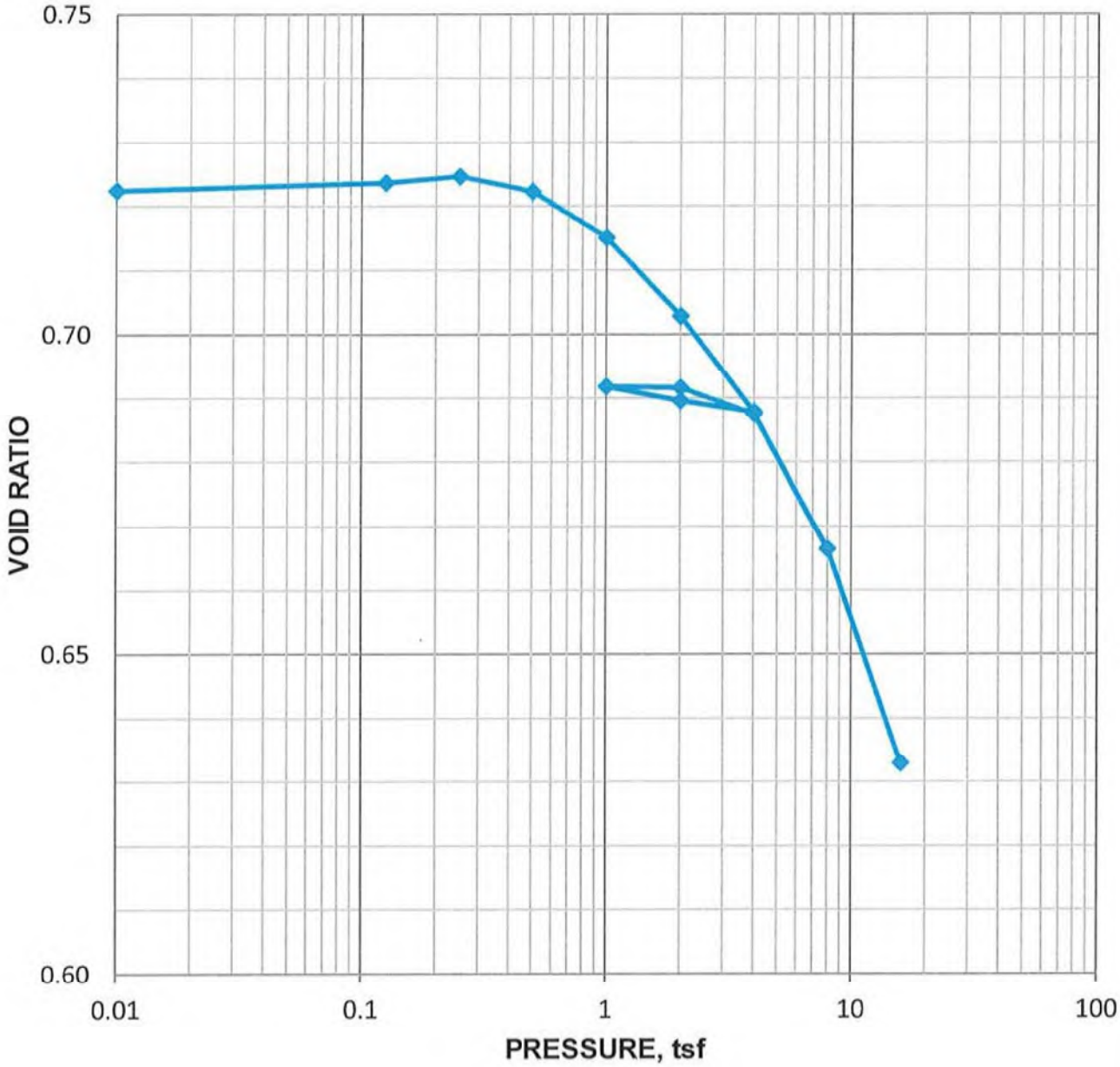
CONSOLIDATION TEST



Load, tsf	Coefficient of Consolidation, mm^2/second	Load, tsf	Coefficient of Consolidation, mm^2/second
0.125	5.3E+00	1.0	NA
0.25	3.3E+00	2.0	NA
0.5	3.3E+00	4.0	NA
1.0	2.6E+00	8.0	1.2E+00
2.0	2.0E+00	16.0	9.2E-01
4.0	9.1E-01		
2.0	NA		

AECI NMPP - Lined Pond
Marston, Missouri

VOID RATIO PLOT

HA-B9

U3

July 2017 41-1-37431-008

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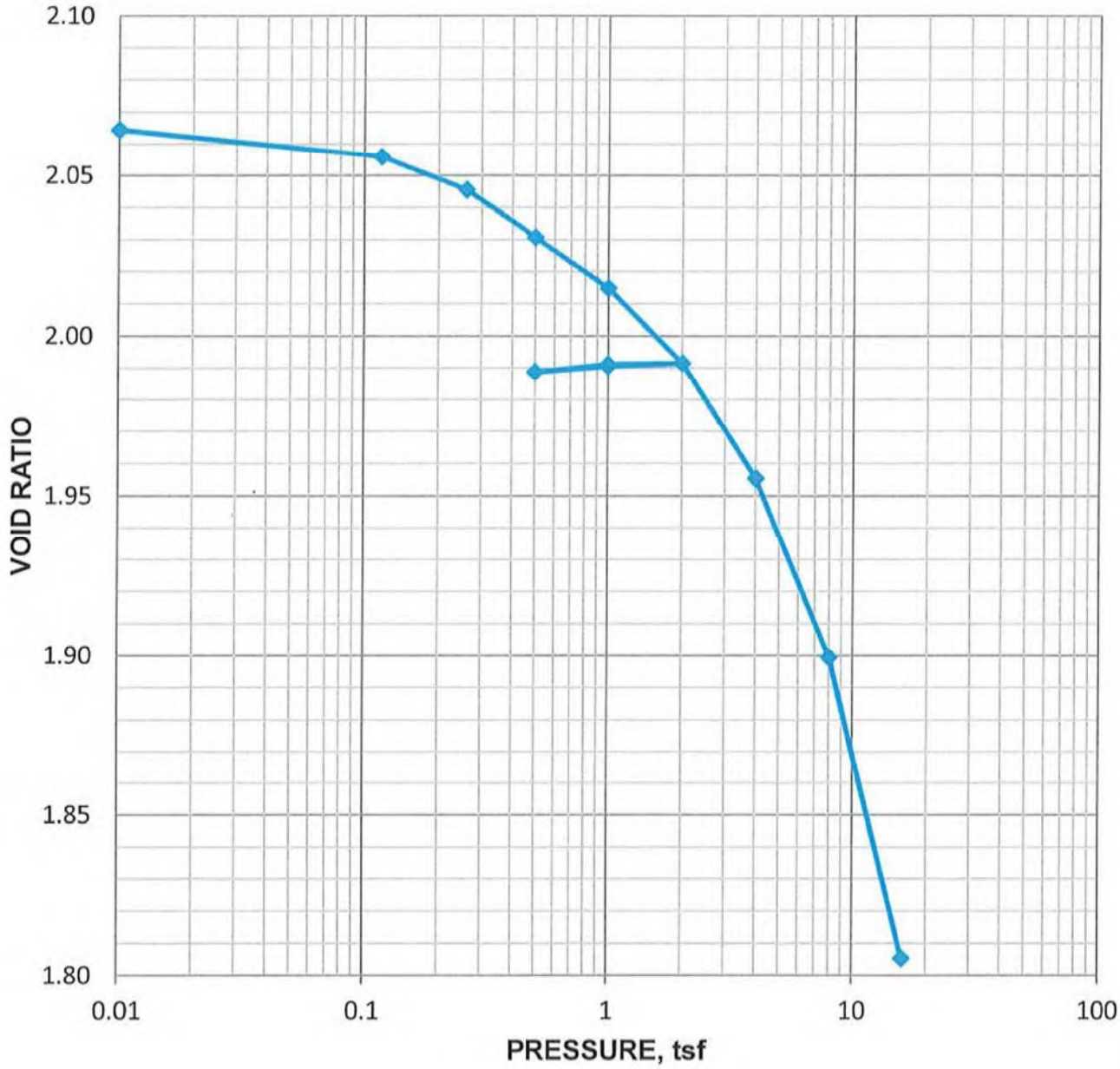
FIG.

CONSOLIDATION TEST



Load, tsf	Coefficient of Consolidation, mm^2/second	Load, tsf	Coefficient of Consolidation, mm^2/second
0.117	5.3E+00	1.0	NA
0.26	3.4E-03	2.0	NA
0.5	2.3E+00	4.0	2.9E-01
1.0	2.0E+00	8.0	1.4E-01
2.0	2.0E+00	16.0	1.6E-01
1.0	NA		
0.5	NA		

AECI NMPP - Lined Pond
Marston, Missouri

VOID RATIO PLOT

TP3-2

Bulk

August 2017 41-1-37431-008

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FIG.

APPENDIX E

Historic Subsurface Explorations

Surface Elevation 311 | Completion Date: 3/23/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
	Topsoil		
	FILL: brown, silty clay with gravel and sand		GB1
		5-8-8	SS2
5		106	ST3
	FILL: gray clay	2-3-5	SS4
10	FILL: brown and gray, silty clay	90	ST5
		4-5-6	SS6
15		100	ST7
		5-8-10	SS8
20	Very stiff to soft, brown and gray, silty CLAY - CL		
		6-8-8	SS9
25			
		3-3-3	SS10
30			
		2-2-2	SS11
35			
	Medium dense, occasionally dense, brown to gray SAND, trace silt - SP	5-6-8	SS12

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 31.8 FEET AFTER 74 DAYS ▼

AT 30.2 FEET AFTER 99 DAYS ▼

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER RFW LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: SJC	App'vd. by: MHM
Date: 3/29/09	Date: 6/12/09	Date: 6/15/09

GEOTECHNOLOGY, INC.
ENGINEERING AND ENVIRONMENTAL SERVICES
ST. LOUIS • COLLINSVILLE • KANSAS CITY

AECI New Madrid Embankment Stability Evaluation

LOG OF BORING: P-6

Project No. 1011304.91IG

Surface Elevation 311 | Completion Date: 3/23/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf (Δ - UU/2, O - QU/2, □ - SV; 0.5 1.0 1.5 2.0 2.5) / STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT) / WATER CONTENT, % (PL ● LL; 10 20 30 40 50)
	Medium dense, occasionally dense, brown to gray SAND, trace silt - SP *(continued)*				
			11-11-11	SS13	▲
45					
50					
			12-12-13	SS14	▲
55					
60					
	3 percent passing #200 sieve		12-14-17	SS15	▲
65					
70	Medium dense, gray, fine to coarse SAND - SP				
			8-9-16	SS16	▲
75					

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 31.8 FEET AFTER 74 DAYS ▼

AT 30.2 FEET AFTER 99 DAYS ▼

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER RFW LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: SL	App'vd. by: MHM
Date: 3/29/09	Date: 6/12/09	Date: 6/15/09

GEOTECHNOLOGY, INC.
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AECI New Madrid Embankment Stability Evaluation

CONTINUATION OF LOG OF BORING: P-6

Project No. 1011304.91IG

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

Surface Elevation 311 | Completion Date: 3/23/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Medium dense, gray, fine to coarse SAND - SP *(continued)*			
			9-10-11	SS17
85	Boring terminated at 85 feet.			
90				
95				
100				
105				
110				
115				

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL 1011304 - ASH POND.GPJ GTINC 0638301.GPJ 6/12/09

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 31.8 FEET AFTER 74 DAYS ▼

AT 30.2 FEET AFTER 99 DAYS ▼

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 20 FEET

MB DRILLER RFW LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: SG	App'vd. by: MHM
Date: 3/29/09	Date: 6/12/09	Date: 6/15/09

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AECI New Madrid Embankment Stability Evaluation

CONTINUATION OF LOG OF BORING: P-6

Project No. 1011304.91IG

Surface Elevation 308 | Completion Date: 3/24/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	DRY UNIT WEIGHT (pcf) / SPT BLOW COUNTS / CORE RECOVERY/RQD	SAMPLES
	Crushed rock road bed		
	FILL: brown, silty clay, trace sand and gravel	5-6-8	SS1
		4-5-9	SS2
5		*	ST3
		5-7-8	SS4
10		92	ST5
		3-4-5	SS6
15		97	ST7
	Very stiff, gray, silty CLAY - CL	6-11-11	SS8
20	Medium stiff, brown SILT - (ML)	86	ST9
	Stiff, brown, sandy SILT - ML	2-3-3	SS10
25			
		3-5-5	SS11
30			
	Loose, brown, silty SAND - SM	6-3-3	SS12
35			
	Very stiff, brown, sandy SILT - ML	6-9-10	SS13

GRAPHIC LOG

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 30.6 FEET AFTER 73 DAYS ▼

AT 27.4 FEET AFTER 98 DAYS ▼

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 30 FEET

MB DRILLER RFW LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: * Poor sample recovery.

Drawn by: KSA	Checked by: SA	App'vd. by: MHM
Date: 3/29/09	Date: 6/12/09	Date: 6/15/09

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AECI New Madrid Embankment Stability Evaluation

LOG OF BORING: P-7

Project No. 1011304.91IG

Surface Elevation 308 | Completion Date: 3/24/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Very stiff, brown, sandy SILT - ML *(continued)*			
	Medium dense to dense, brown and gray SAND - SP			
	6 percent passing #200 sieve		10-11-11	SS14
45				
			10-12-16	SS15
50				
			16-24-19	SS16
55	Boring terminated at 55 feet.			
60				
65				
70				
75				

SHEAR STRENGTH, tsf

Δ - UU/2 O - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

AT 30.6 FEET AFTER 73 DAYS ▼

AT 27.4 FEET AFTER 98 DAYS ▼

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM 30 FEET

MB DRILLER RFW LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS: * Poor sample recovery.

Drawn by: KSA	Checked by: SR	App'vd. by: MHM
Date: 3/29/09	Date: 6/12/09	Date: 6/15/09

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AECI New Madrid Embankment Stability Evaluation

CONTINUATION OF LOG OF BORING: P-7

Project No. 1011304.91IG

Surface Elevation 308 | Completion Date: 3/25/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Fly ash			GB1
5				
	Cemented fly ash			
10				
	Test pit terminated at 13 feet.			
15				
20				
25				
30				
35				

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

111

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

LOG OF BORING 2002 WL 1011304 - ASH POND.GPJ GTINC 0638301.GPJ 4/29/09

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

___ DRILLER RFW LOGGER

Cat 3242 BACKHOE

HAMMER TYPE ___

REMARKS:

Drawn by: LAH	Checked by: RC	App'vd. by: MHM
Date: 3/31/09	Date: 4/29/09	Date: 6/12/09

GEOTECHNOLOGY, INC.
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AECI New Madrid Embankment Stability Evaluation

LOG OF TEST PIT: TP-8

Project No. 1011304.91IG

Surface Elevation 315 | Completion Date: 3/25/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf (Δ - UU/2, O - QU/2, □ - SV; 0.5, 1.0, 1.5, 2.0, 2.5) / STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT) / WATER CONTENT, % (PL 10, 20, 30, 40, 50 LL)
	Fly ash				
5					
10				GB1	76
15					
	Test pit terminated at 16 feet.				
20					
25					
30					
35					

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY

LOG OF BORING 2002 WL 1011304 - ASH POND.GPJ GTINC 0638301.GPJ 4/29/09

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

___ DRILLER RFW LOGGER

Cat 3242 BACKHOE

HAMMER TYPE ___

REMARKS:

Drawn by: LAH	Checked by: [illegible]	App'vd. by: MHM
Date: 3/31/09	Date: 4/29/09	Date: 6/12/09

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AECI New Madrid Embankment Stability Evaluation

LOG OF TEST PIT: TP-9

Project No. 1011304.91IG

Surface Elevation 314 | Completion Date: 3/25/09

Datum msl

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	SHEAR STRENGTH, tsf (Δ - UU/2, O - QU/2, □ - SV; 0.5, 1.0, 1.5, 2.0, 2.5) / STANDARD PENETRATION RESISTANCE (ASTM D 1586) ▲ N-VALUE (BLOWS PER FOOT) / WATER CONTENT, % (PL 10, 20, 30, 40, 50 LL)
	Fly ash				
5					
10					
15				GB1	75
	Test pit terminated at 16 feet.				
20					
25					
30					
35					

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL 1011304 - ASH POND.GPJ GTINC 0638301.GPJ 4/29/09

GROUNDWATER DATA

ENCOUNTERED AT 11 FEET ⊽

DRILLING DATA

___ AUGER ___ HOLLOW STEM

WASHBORING FROM ___ FEET

___ DRILLER RFW LOGGER

Cat 3242 BACKHOE

HAMMER TYPE ___

REMARKS:

Drawn by: LAH	Checked by: SJC	App'vd. by: MHM
Date: 3/31/09	Date: 4/29/09	Date: 6/12/09

GEOTECHNOLOGY, INC.
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AECI New Madrid
Embankment Stability Evaluation

LOG OF TEST PIT: TP-10

Project No. 1011304.91IG

APPENDIX F

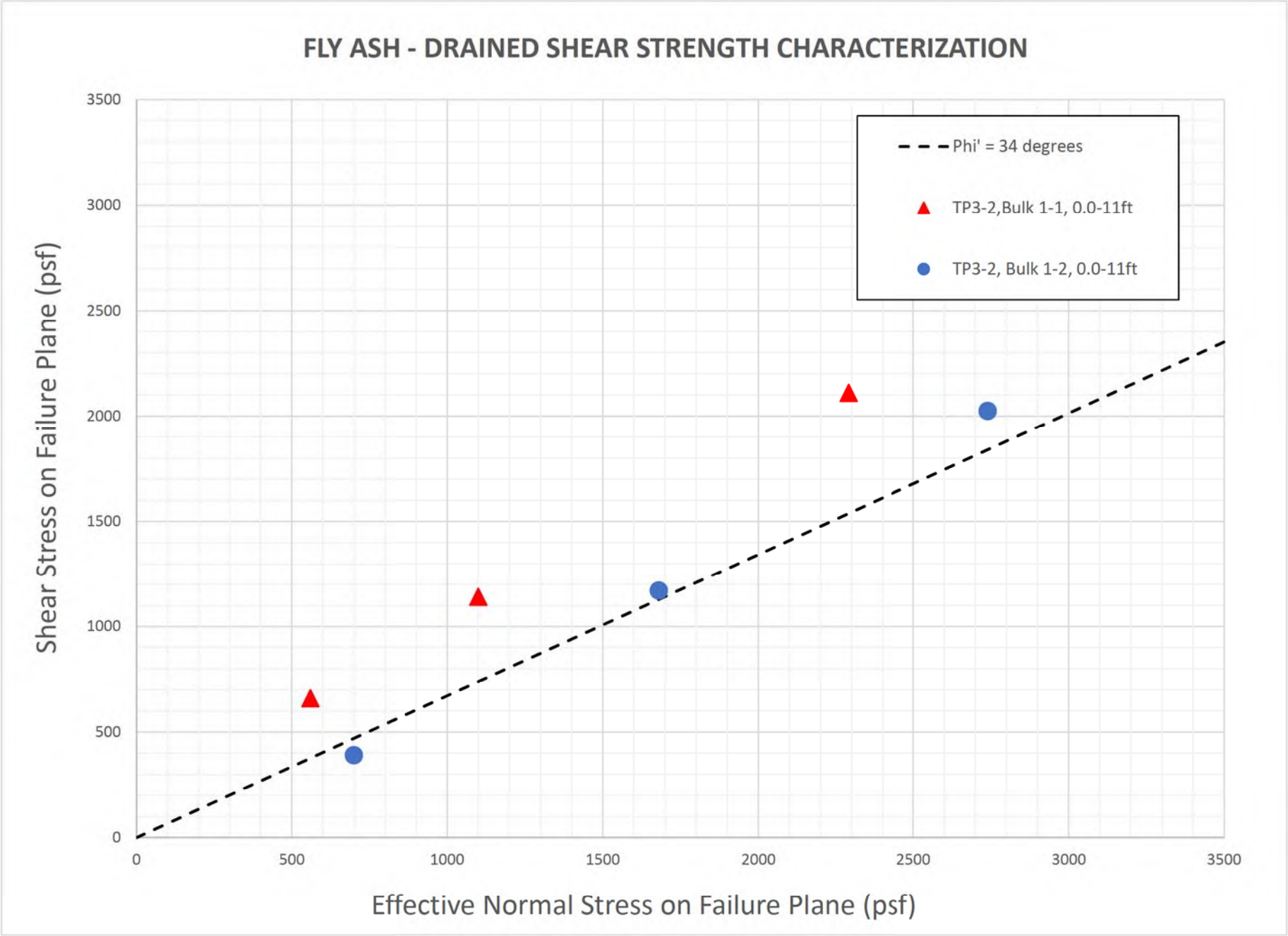
Preliminary Material Properties

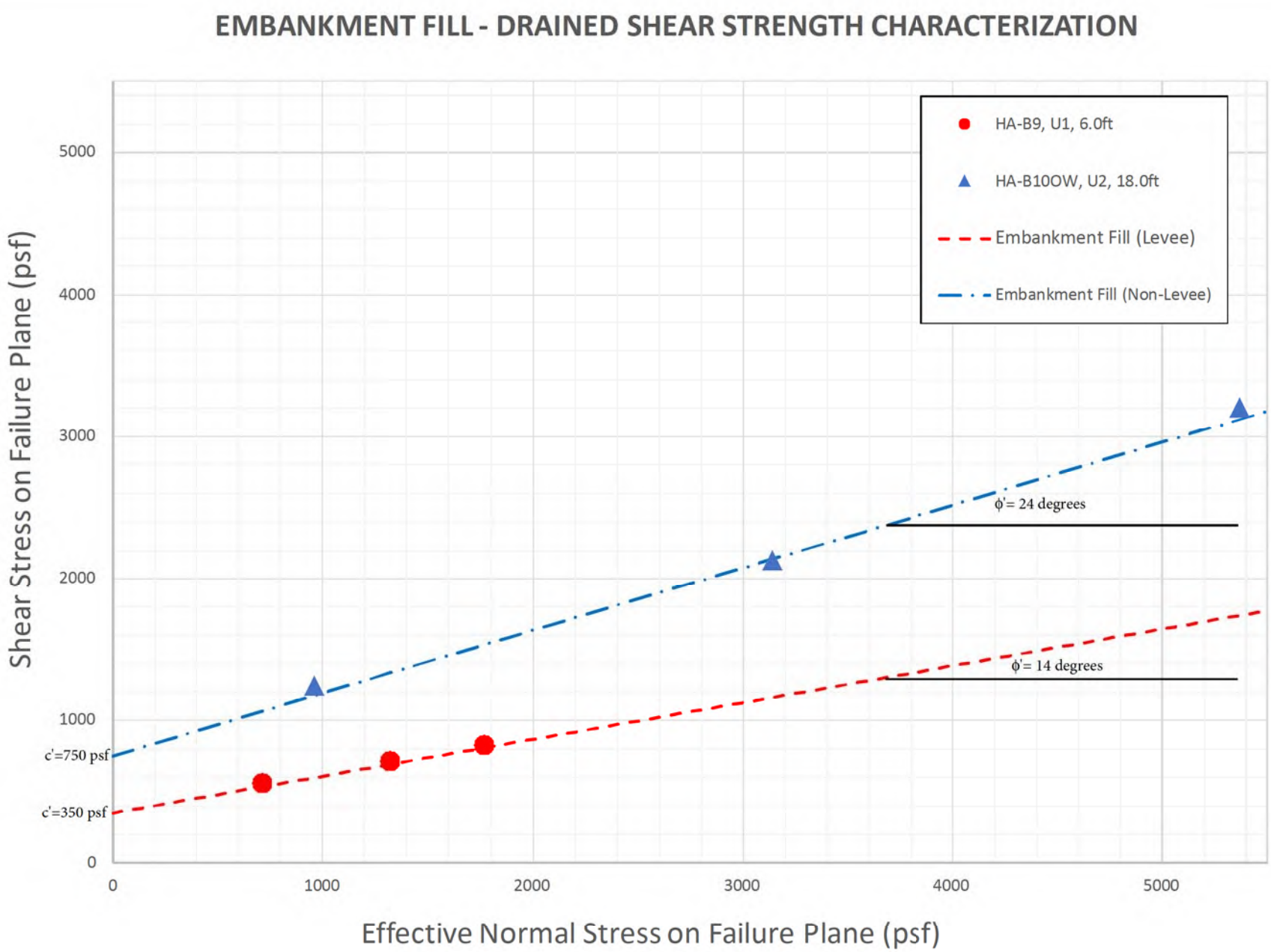
PRELIMINARY MATERIAL PROPERTY CHARACTERIZATION - AECI NMPP Lined Pond

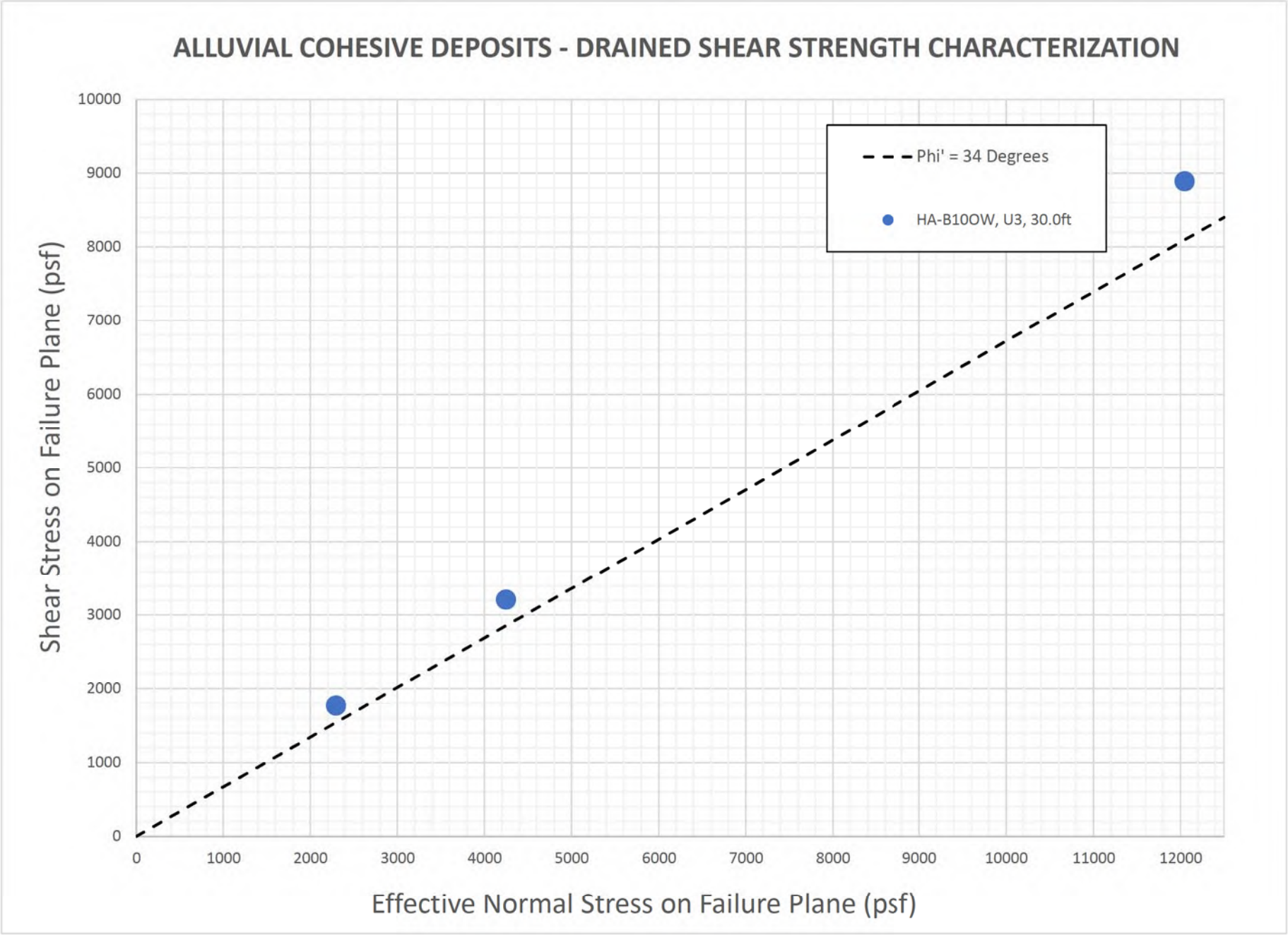
Material	Location	Total Unit Weight						Undrained Shear Strength								Drained Shear Strength											
		CPT	Laboratory[1]		Historic Stability Evaluations		Current Design	SPT		CPT[4]		UU Triaxial[1]	Historic Stability Evaluations		Current Design	SPT		CPT		Laboratory CU Triaxial[1]		Historic Stability Evaluations				Current Design	
		avg	Test Avg.	Tube Avg.	H&A 2016[2]	Geotechnology 2009[3]		avg	avg - 1σ	avg	avg - 1σ	avg	H&A 2016[2]	Geotechnology 2009[3]		avg	avg - 1σ	avg	avg - 1σ			H&A 2016[2]		Geotechnology 2009[3]			
		γ_T	γ_T	γ_T	γ_T	γ_T	γ_T	S_u	S_u	S_u	S_u	S_u	S_u	S_u	S_u	ϕ'	ϕ'	ϕ'	ϕ'	c'	ϕ'	c'	ϕ'	c'	ϕ'	c'	ϕ'
Fly Ash	Lined Pond Only	125 pcf	--	--	--	--	105 pcf	--	--	--	--	--	--	--	S_u/p' = 0.30 min = 500 psf	37°	35°	41°	38°	0 psf	34°	--	--	--	--	0 psf	34°
	Site Wide	112 pcf	106 pcf	102 pcf	90 pcf	--		--	--	--	--	600 psf	500 psf	--		32°	28°	38°	33°			0 psf	28°	--	--		
Embankment Fill (Levee)	Lined Pond Only	119 pcf	117 pcf	--	--	--	120 pcf	3,000 psf	3,000 psf	3,800 psf	2,000 psf	--	--	--	S_u/p' = 0.27 min = 550 psf	--	--	--	--	350 psf	14°	--	--	50 psf	30°	300 psf	15°
	Site Wide	117 pcf		--	115 pcf	--		1,327 psf	679 psf	2,840 psf	1,160 psf	--	800 psf	--		--	--	--	--			50 psf	30°	--	--		
Embankment Fill (Non-Levee)	Lined Pond Only	118 pcf	128 pcf	--	--	110 pcf	120 pcf	2,176 psf	1,660 psf	5,200 psf	2,200 psf	--	--	800 psf	S_u/p' = 0.39 min = 1,000 psf	--	--	--	--	750 psf	24°	--	--	50 psf	30°	300 psf	28°
	Site Wide	116 pcf		--	115 pcf	--		1,834 psf	1,338 psf	3,472 psf	673 psf	--	800 psf	--		--	--	--	--	375 psf	30°	50 psf	30°	--	--		
Alluvial Deposits (cohesive)	Lined Pond Only	115 pcf	120 pcf	--	--	110 pcf	120 pcf	1,441 psf	444 psf	4,000 psf	1,200 psf	2,400 psf	--	1,000 psf	S_u/p' = 0.50 min = 1,000 psf	--	--	--	--	0 psf	34°	--	--	50 psf	28°	0 psf	30°
	Site Wide	115 pcf	119 pcf	--	110 pcf	--		1,338 psf	448 psf	3,472 psf	880 psf	2,400 psf	1,300 psf	--		--	--	--	--	180 psf	36°	50 psf	28°	--	--		
Alluvial Deposits (granular)	Lined Pond Only	120 pcf	--	--	--	--	120 pcf	--	--	--	--	--	--	--	0 psf	34°	33°	36°	34°	--	--	--	--	--	--	0 psf	34°
	Site Wide	121 pcf	--	--	108 pcf	--		--	--	--	--	--	0 psf	--		34°	32°	37°	34°	--	--	0 psf	36°	--	--		
Fluvial Deposits	Lined Pond Only	123 pcf	--	--	--	120 pcf	125 pcf	--	--	--	--	--	--	0 psf	0 psf	37°	36°	41°	39°	--	--	--	--	0°	35°	0 psf	38°
	Site Wide	124 pcf	--	--	120 pcf	--		--	--	--	--	--	0 psf	--		36°	34°	41°	39°	--	--	0 psf	38°	--	--		

Notes:

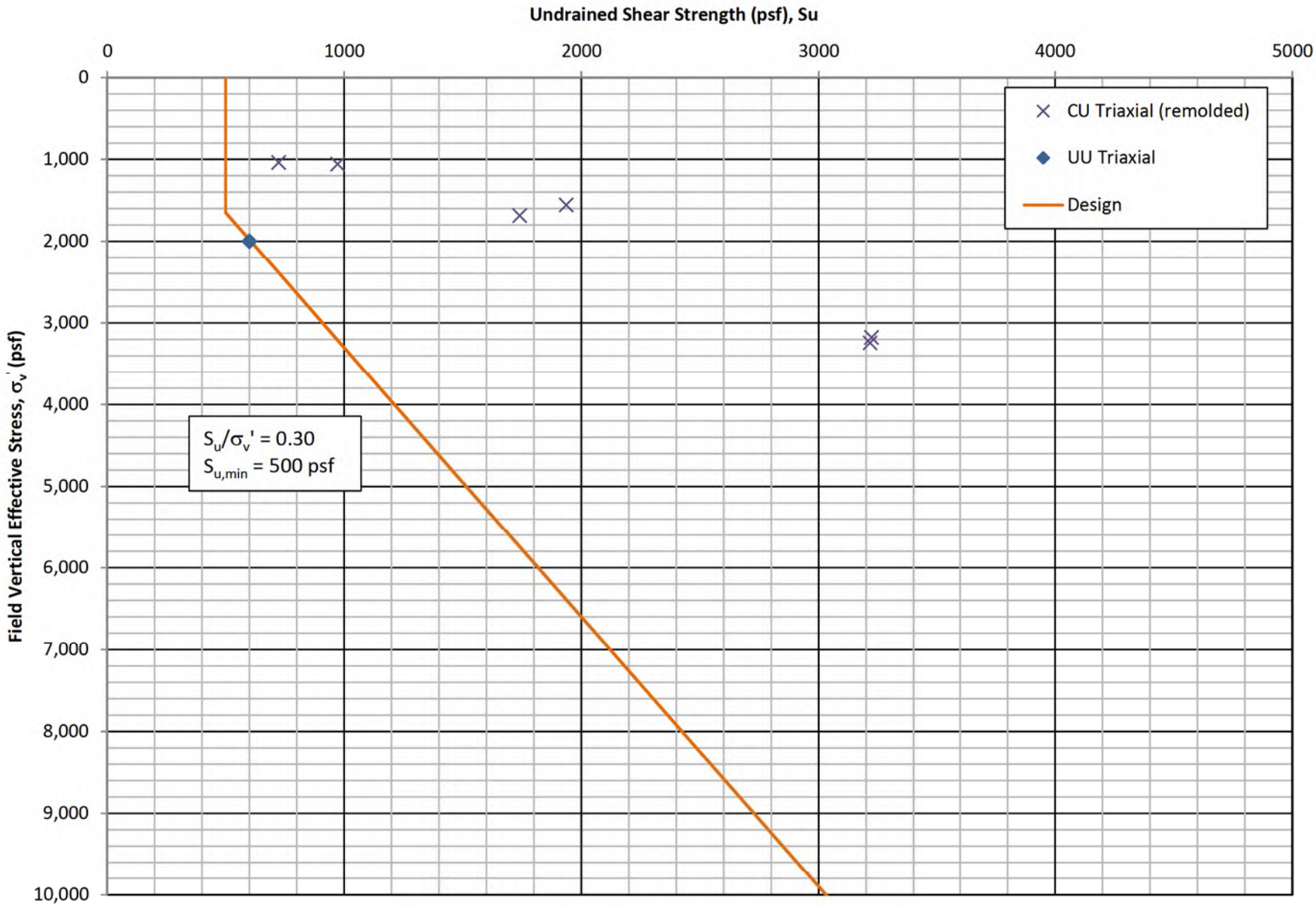
1. Laboratory values shown represent Haley & Aldrich's interpretation of the laboratory test results and may differ from the results reported by the laboratory.
2. Historic stability evaluation properties from Report on Safety Factor Assessment 003 Unlined Pond and 004 Slag Dewatering Pond prepared by Haley & Aldrich, Inc. dated October 2016.
3. Historic stability evaluation properties from Stability Evaluation Slag Pond 1 and Ash Pond 2 prepared by Geotechnology, Inc. dated June 2009.
4. Undrained shear strength correlations from CPT data are based on a N_{kt} factor of 15.


FLY ASH - DRAINED SHEAR STRENGTH CHARACTERIZATION
Phi' = 34 degrees
TP3-2,Bulk 1-1, 0.0-11ft
TP3-2, Bulk 1-2, 0.0-11ft
Shear Stress on Failure Plane (psf)
Effective Normal Stress on Failure Plane (psf)
0
500
1000
1500
2000
2500
3000
3500

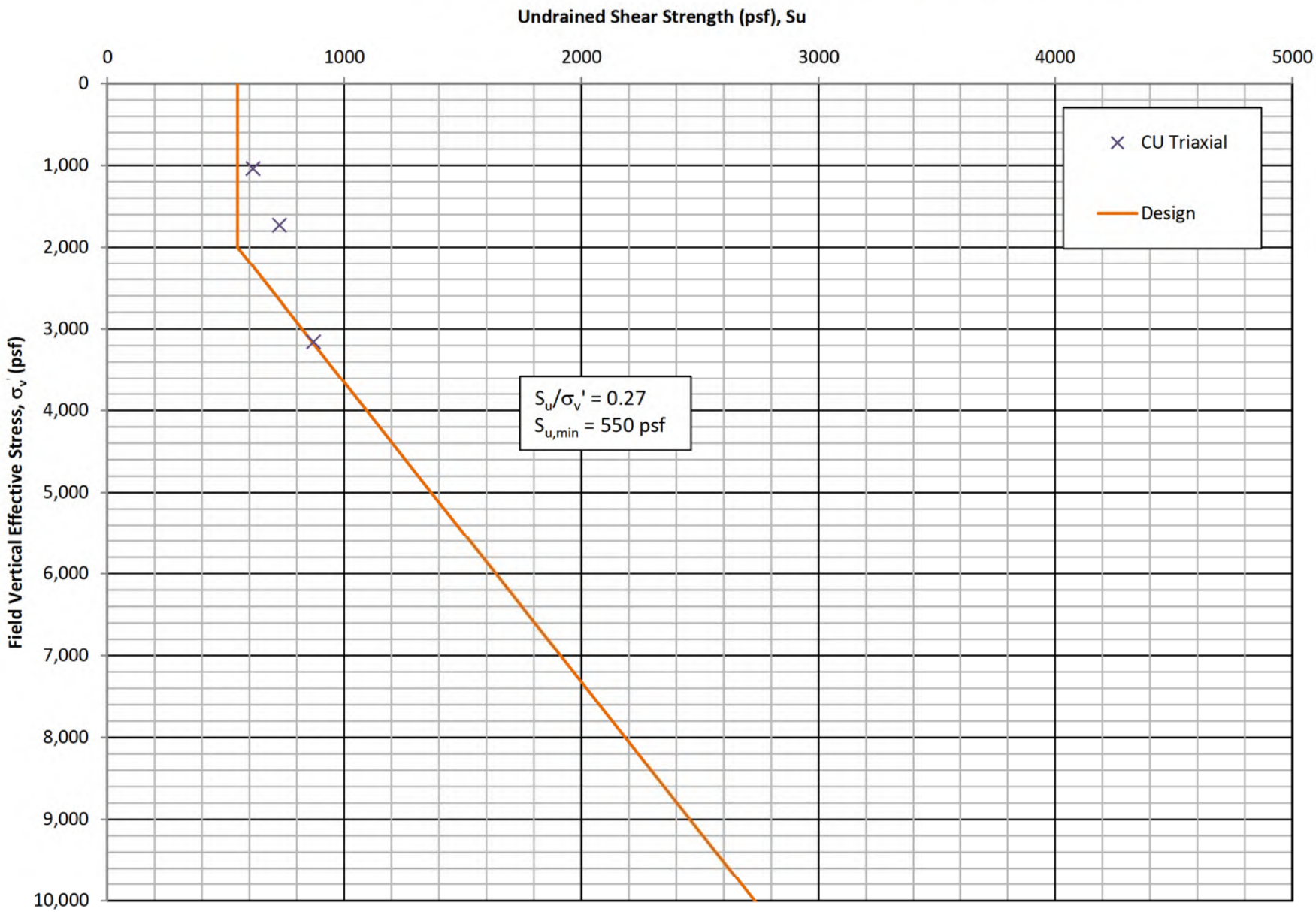

EMBANKMENT FILL - DRAINED SHEAR STRENGTH CHARACTERIZATION
HA-B9, U1, 6.0ft
HA-B10OW, U2, 18.0ft
Embankment Fill (Levee)
Embankment Fill (Non-Levee)
ϕ'= 24 degrees
ϕ'= 14 degrees
c'=750 psf
c'=350 psf
Shear Stress on Failure Plane (psf)
Effective Normal Stress on Failure Plane (psf)
0
1000
2000
3000
4000
5000

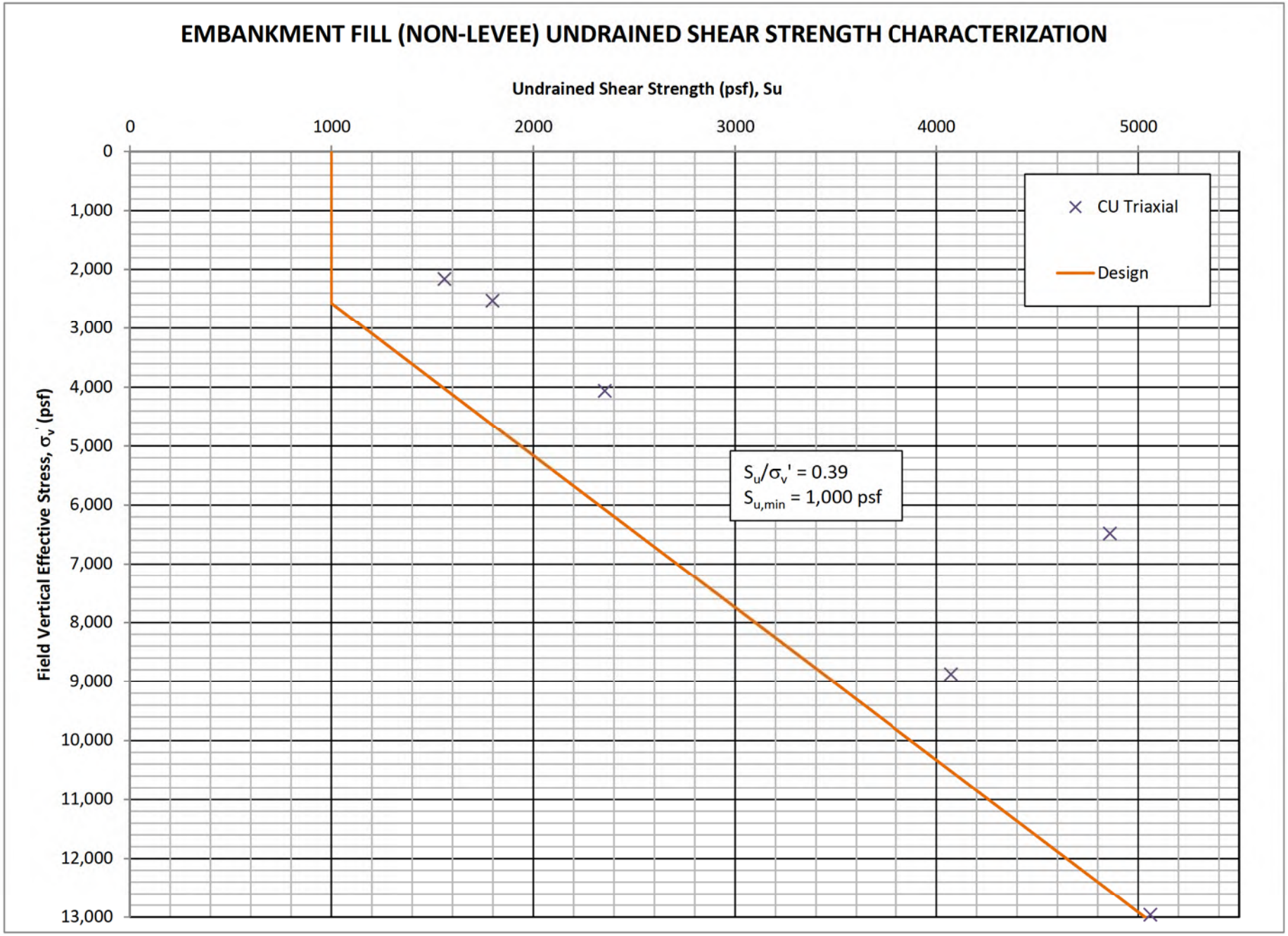

ALLUVIAL COHESIVE DEPOSITS - DRAINED SHEAR STRENGTH CHARACTERIZATION
Phi' = 34 Degrees
HA-B10OW, U3, 30.0ft
Shear Stress on Failure Plane (psf)
Effective Normal Stress on Failure Plane (psf)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000

FLY ASH UNDRAINED SHEAR STRENGTH CHARACTERIZATION

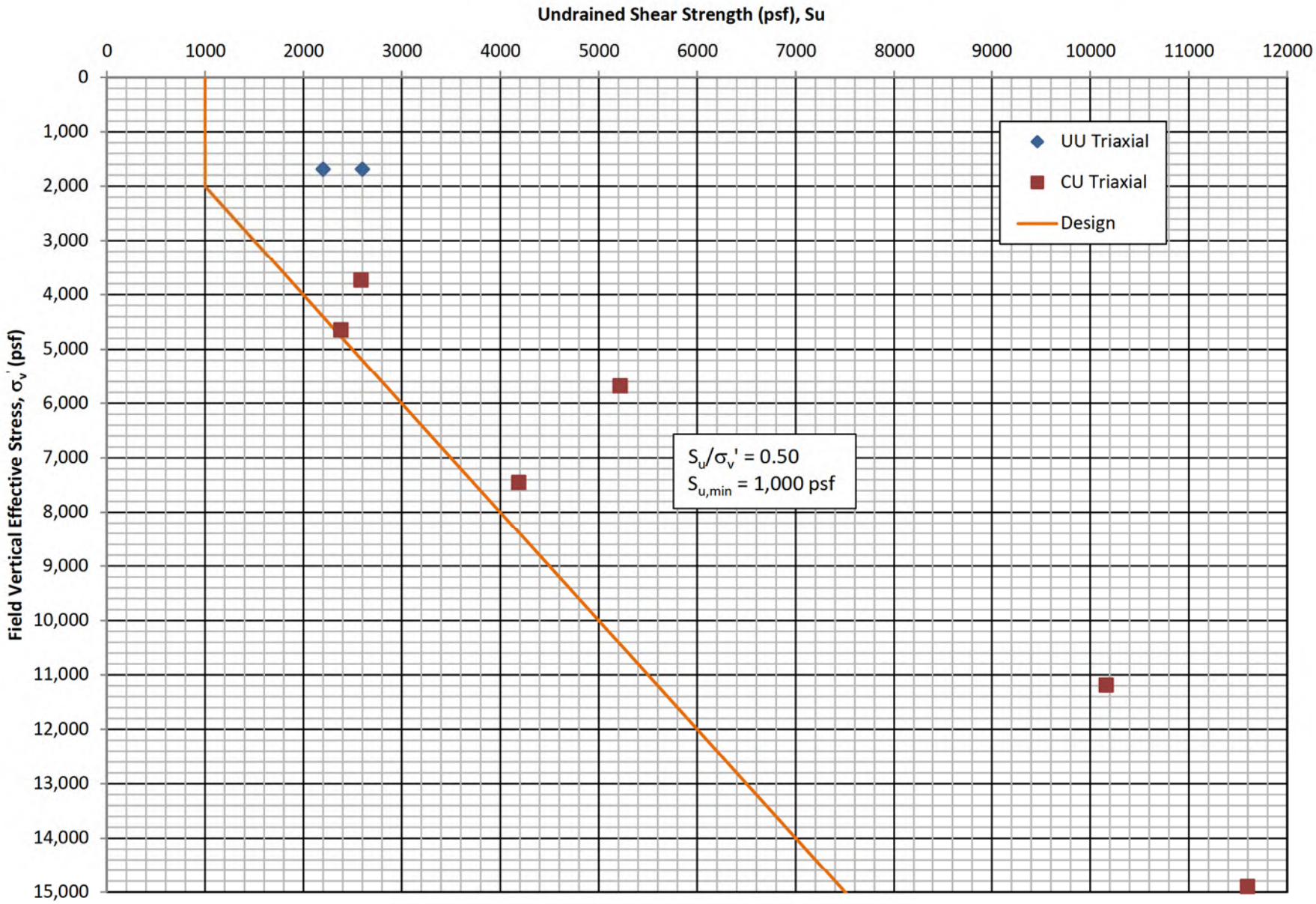


EMBANKMENT FILL (LEVEE) UNDRAINED SHEAR STRENGTH CHARACTERIZATION



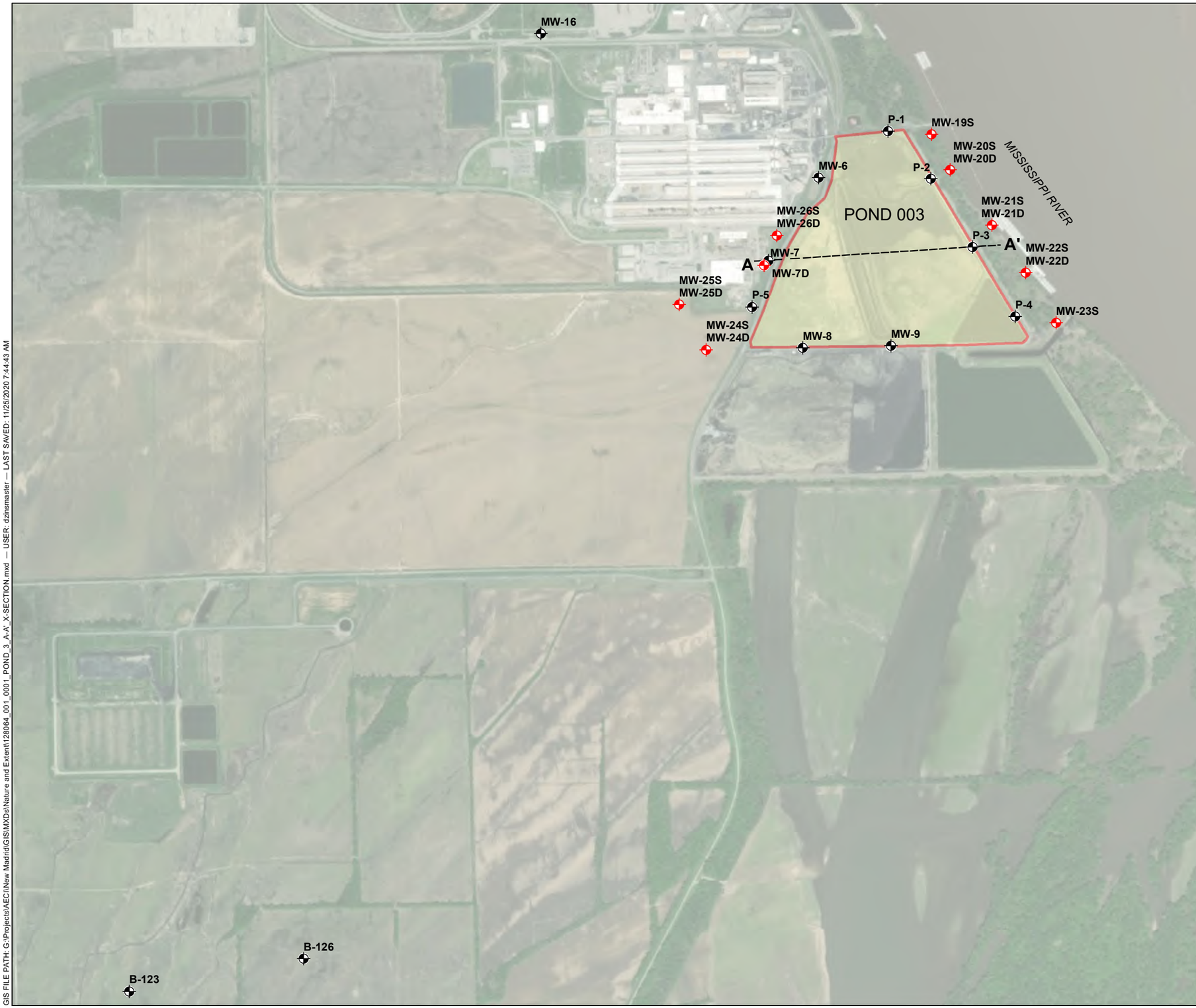

EMBANKMENT FILL (NON-LEVEE) UNDRAINED SHEAR STRENGTH CHARACTERIZATION
Undrained Shear Strength (psf), Su
0
1000
2000
3000
4000
5000
Field Vertical Effective Stress, σv' (psf)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
13,000
CU Triaxial
Design
Su/σv' = 0.39
Su,min = 1,000 psf

ALLUVIAL UNDRAINED SHEAR STRENGTH CHARACTERIZATION



ATTACHMENT 13

POND 003 NATURE AND EXTENT WELLS MAP AND CROSS SECTION



LEGEND

- NATURE & EXTENT MONITORING WELL
- COMPLIANCE MONITORING WELL
- CROSS SECTION PATH
- POND 003

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
3. AERIAL IMAGERY SOURCE: ESRI, APRIL 21, 2019.

N

0 1,100 2,200
SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COPPERATIVE, INC.
NEW MADRID POWER GENERATING FACILITY
NEW MADRID COUNTY, MISSOURI

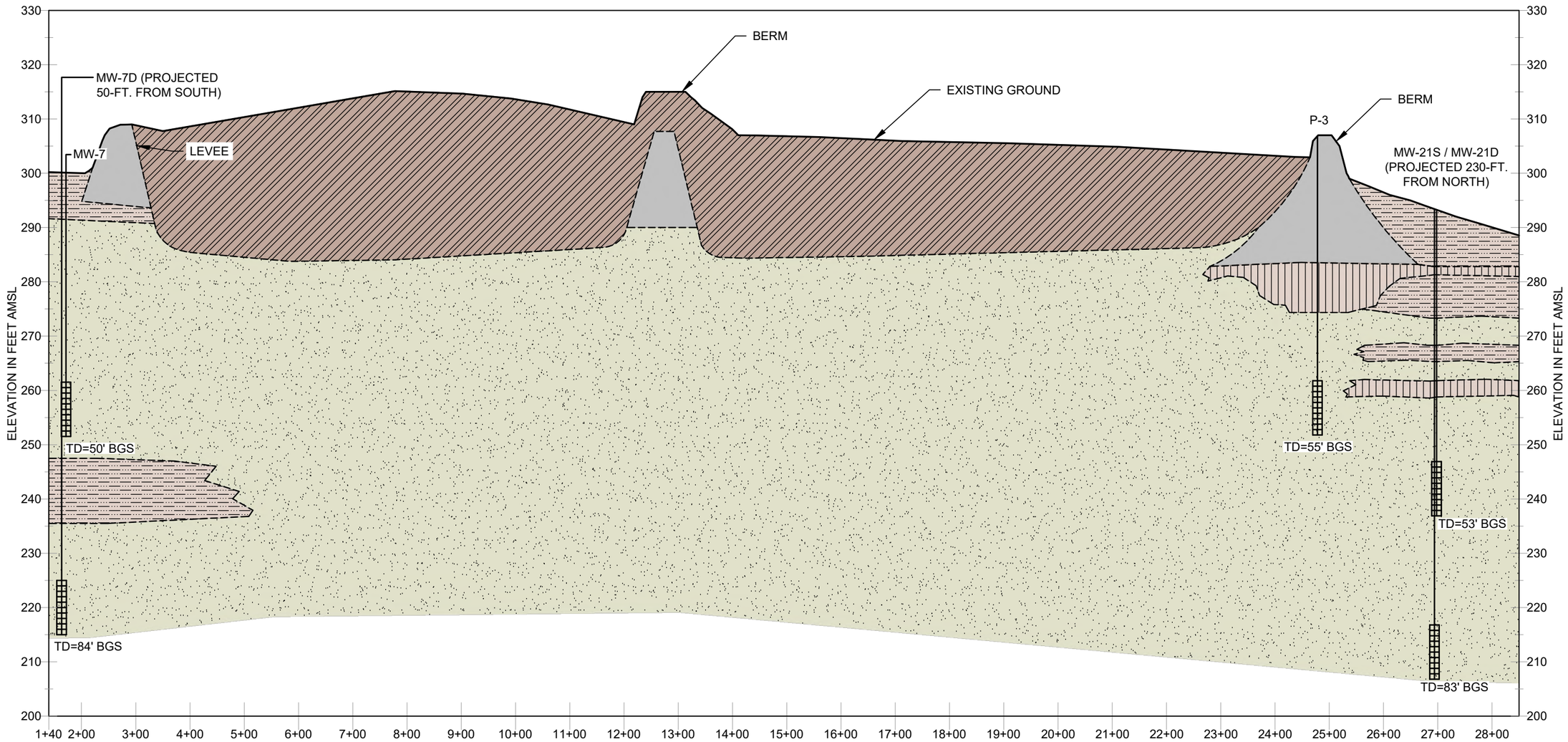
POND 003 NATURE AND EXTENT MONITORING WELL LOCATION MAP

aeci

NOVEMBER 2020
SCALE AS SHOWN

FIGURE 1

GIS FILE PATH: G:\Projects\AECI\New Madrid\GIS\MXDs\Nature and Extent\128064_001_0001_POND_3_A-A'_X-SECTION.mxd — USER: dzinsmaster — LAST SAVED: 11/25/2020 7:44:43 AM



LEGEND

- CCR
- SANDS
- SILT
- CLAYS
- BERM/LEVEE MATERIAL

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. VERTICAL SCALE IS EXAGGERATED 10 TIMES.
3. BGS - BELOW GROUND SURFACE
4. CCR - COAL COMBUSTION RESIDUALS

HORIZ. 0 200 400
VERT. 0 20 40
SCALE IN FEET

HALEY ALDRICH

ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
MARSTON, MISSOURI

POND 003 GENERALIZED CROSS SECTION A-A'

SCALE: AS SHOWN
NOVEMBER 2020

FIGURE 2

SAUNDERS, LEE Printed:11/25/2020 2:14 PM Layout: P0003_AA
\\HALEYALDRICH.COM\SHARE\PHX_COMMON\PROJECTS\AEC\NEW MADRID\CAD\X-SECTIONS\129342_016_00F1_CROSSSECTIONAA_P 003 REV2.DWG

ATTACHMENT 14

POND 003 NATURE AND EXTENT WELL CONSTRUCTION DIAGRAMS AND DRILLING LOGS

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-19S

Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 6 Sep 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 293.8
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	293.8
				0.5	293.3
SILT					
SILT with sand	4.5 / 5.0				
SILTY SAND					
SANDY SILT	8.0 / 9.5				
SAND with silt	12.0				
SANDY SILT					
SILTY SAND	16.5 / 19.0				
SAND					
SAND	30.0			30.5	263.3
SILTY CLAY	34.0 / 35.5			36.0	257.8
SILTY SAND	36.5			38.0	255.8
SAND					
SAND	43.5				
	48.0			48.0	245.8

WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.1 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	38.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	30.5
Bentonite	30.5	5.5
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	38.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	48 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	48.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-20D

Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 4 Sep 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 293.4
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	293.4
				0.5	292.9
SILT with sand	16.0				
SAND	30.0				
SAND with some gravel	51.0				
SAND				70.5	222.9
				75.8	217.6
				78.0	215.4
SILT	81.5				
SAND	85.0				
	88.0			88.0	205.4

WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.1 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	78.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	70.5
Bentonite	70.5	5.5
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	78.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	88 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	88.0 ft

COMMENTS:

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-20S

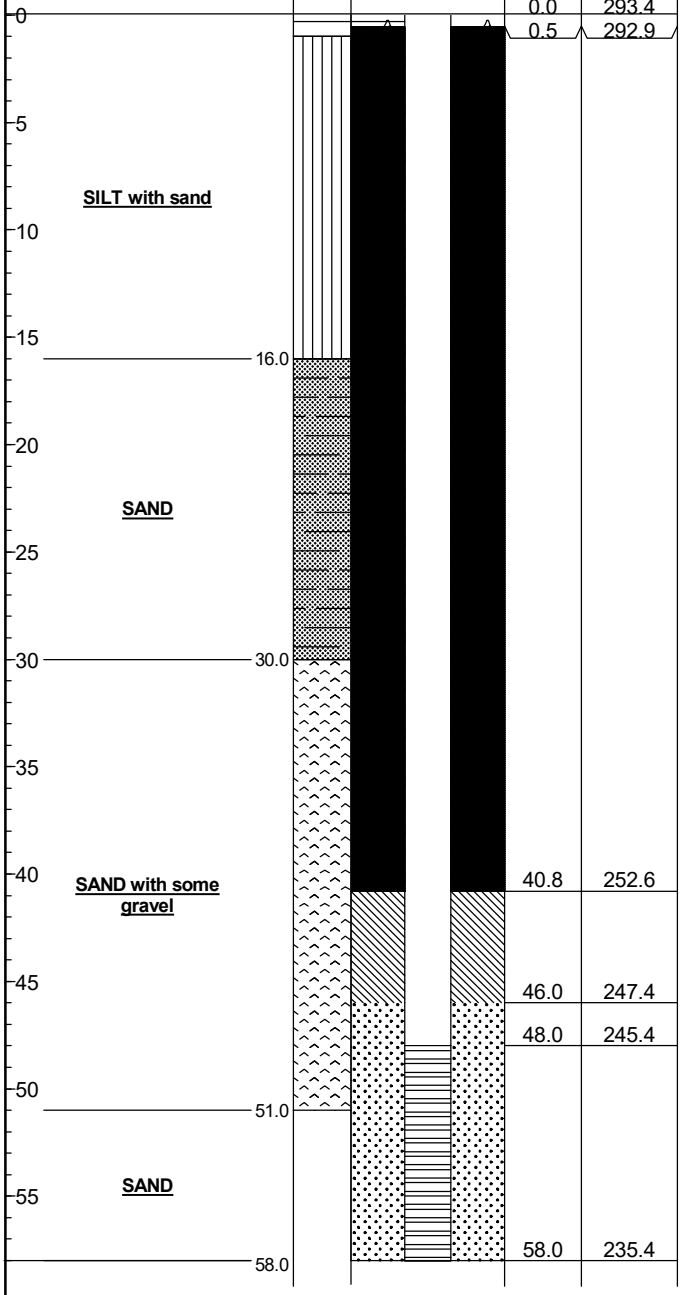
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 5 Sep 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 293.4
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	293.4
				0.5	292.9
SILT with sand	16.0				
SAND	30.0				
SAND with some gravel	51.0			40.8	252.6
				46.0	247.4
				48.0	245.4
SAND	58.0			58.0	235.4



WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.1 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	48.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	40.8
Bentonite	40.8	5.2
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	48.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	58 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	58.0 ft

COMMENTS:

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GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-21D

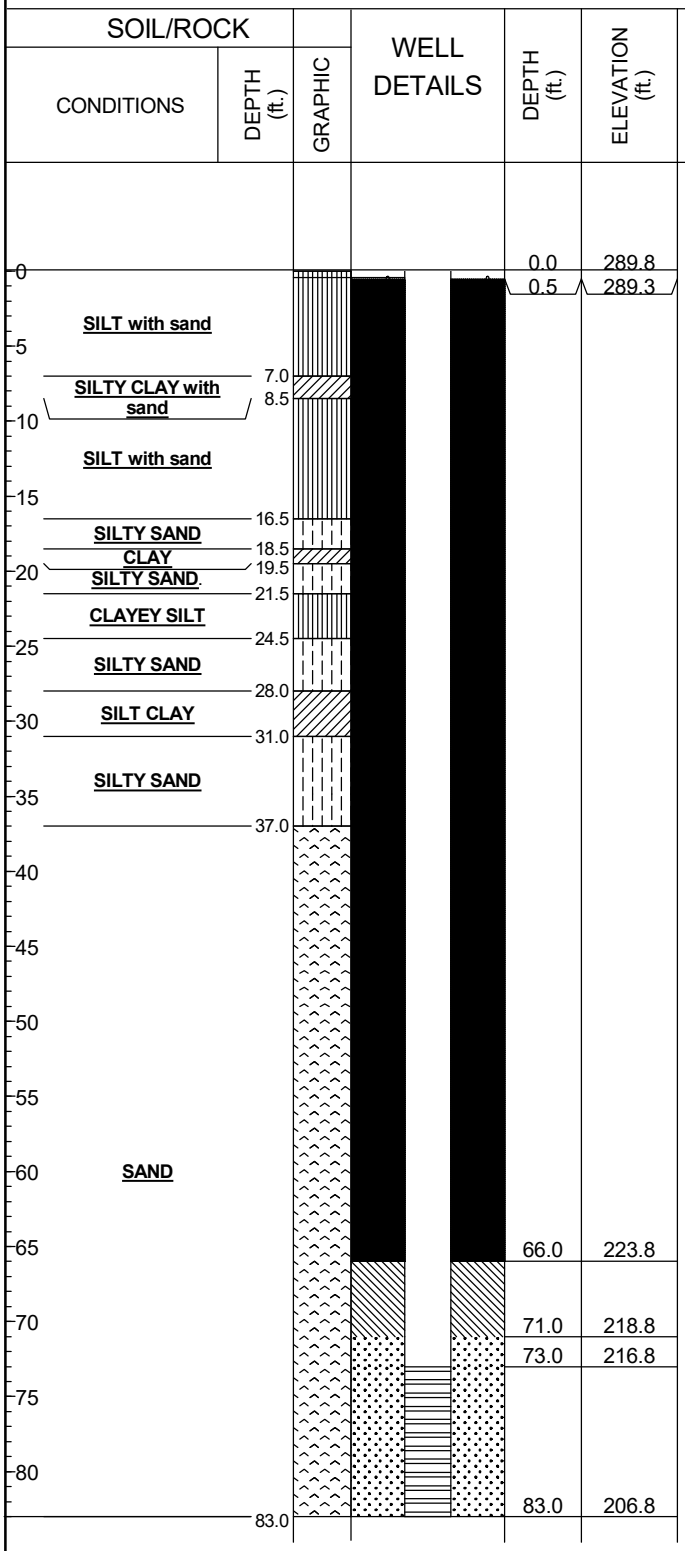
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 29 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 289.8
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)
SILT with sand	0 – 7.0
SILTY CLAY with sand	7.0 – 8.5
SILT with sand	8.5 – 16.5
SILTY SAND	16.5 – 18.5
CLAY	18.5 – 19.5
SILTY SAND	19.5 – 21.5
CLAYEY SILT	21.5 – 24.5
SILTY SAND	24.5 – 28.0
SILT CLAY	28.0 – 31.0
SILTY SAND	31.0 – 37.0
SAND	37.0 – 83.0



WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.2 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	73.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	66.0
Bentonite	66.0	5.0
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	73.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	83 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	83.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-21S

Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 30 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 289.9
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	289.9
				0.5	289.4
SILT with sand	7.0				
SILTY CLAY with sand	8.5				
SILT with sand	16.5				
SILTY SAND	18.5				
CLAY	19.5				
SILTY SAND	21.5				
CLAYEY SILT	24.5				
SILTY SAND	28.0				
SILT CLAY	31.0				
SILTY SAND	37.0			36.0	253.9
SAND	43.0			40.8	249.1
SAND with gravel	48.5			43.0	246.9
SAND	53.0			53.0	236.9

WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.0 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	53.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	36.0
Bentonite	36.0	4.8
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	43.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	53.0 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	53.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-22D

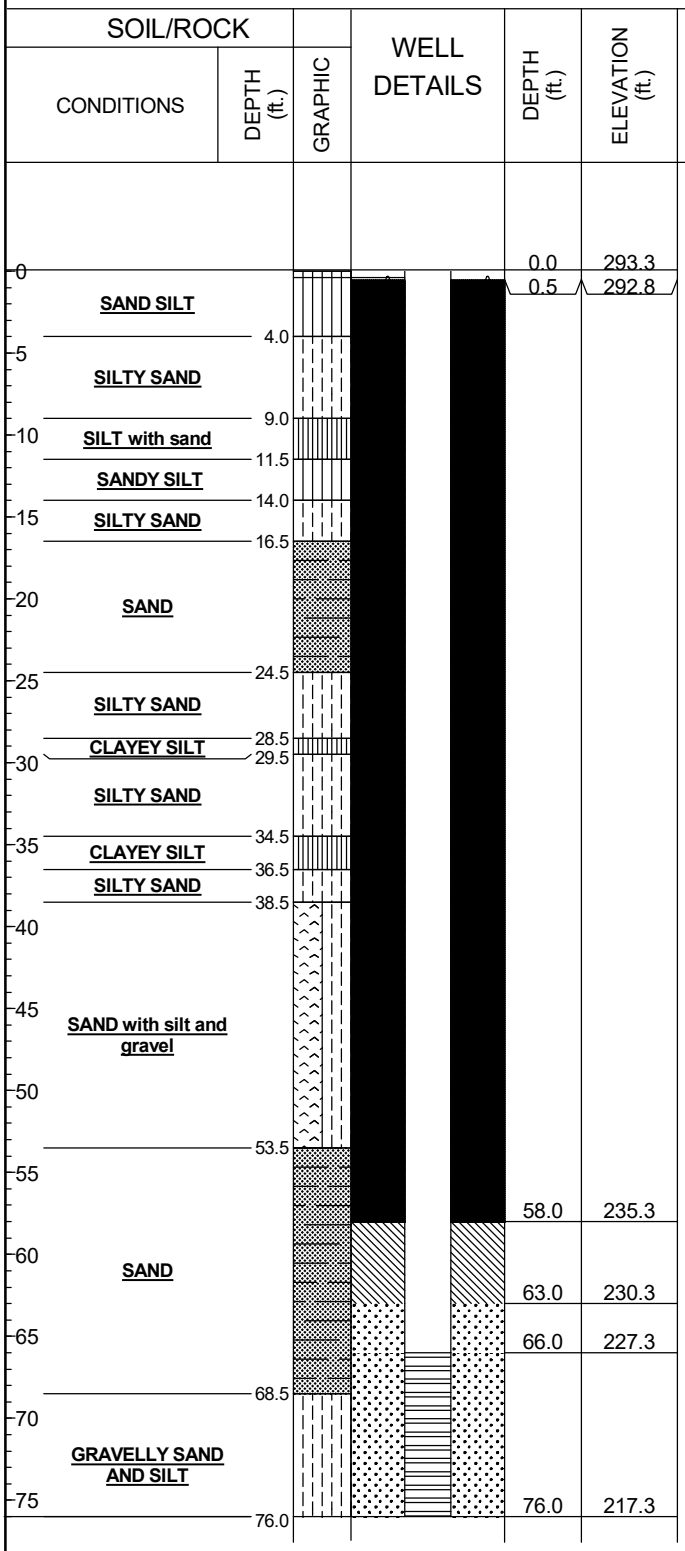
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 23 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 293.3
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)
SAND SILT	0 – 4.0
SILTY SAND	4.0 – 9.0
SILT with sand	9.0 – 11.5
SANDY SILT	11.5 – 14.0
SILTY SAND	14.0 – 16.5
SAND	16.5 – 24.5
SILTY SAND	24.5 – 28.5
CLAYEY SILT	28.5 – 29.5
SILTY SAND	29.5 – 34.5
CLAYEY SILT	34.5 – 36.5
SILTY SAND	36.5 – 38.5
SAND with silt and gravel	38.5 – 53.5
SAND	53.5 – 68.5
GRAVELLY SAND AND SILT	68.5 – 76.0



WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.3 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	66.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	58.0
Bentonite	58.0	5.0
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	66.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	76 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	76.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-22S

Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 26 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 293.4
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	293.4
				0.5	292.9
SANDY SILT	4.0				
SILTY SAND	9.0				
SILT with sand	11.5				
SANDY SILT	14.0				
SILTY SAND	16.5				
SAND	24.5				
SILTY SAND	28.5			29.0	264.4
CLAYEY SILT	29.5				
SILTY SAND	34.5			34.0	259.4
CLAYEY SILT	36.5			36.0	257.4
SILTY SAND	38.0				
SAND	41.0				
SILT with sand	41.5				
SAND	46.0			46.0	247.4

WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.2 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	36.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	29.0
Bentonite	29.0	5.0
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	36.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	46 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	46.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-23S

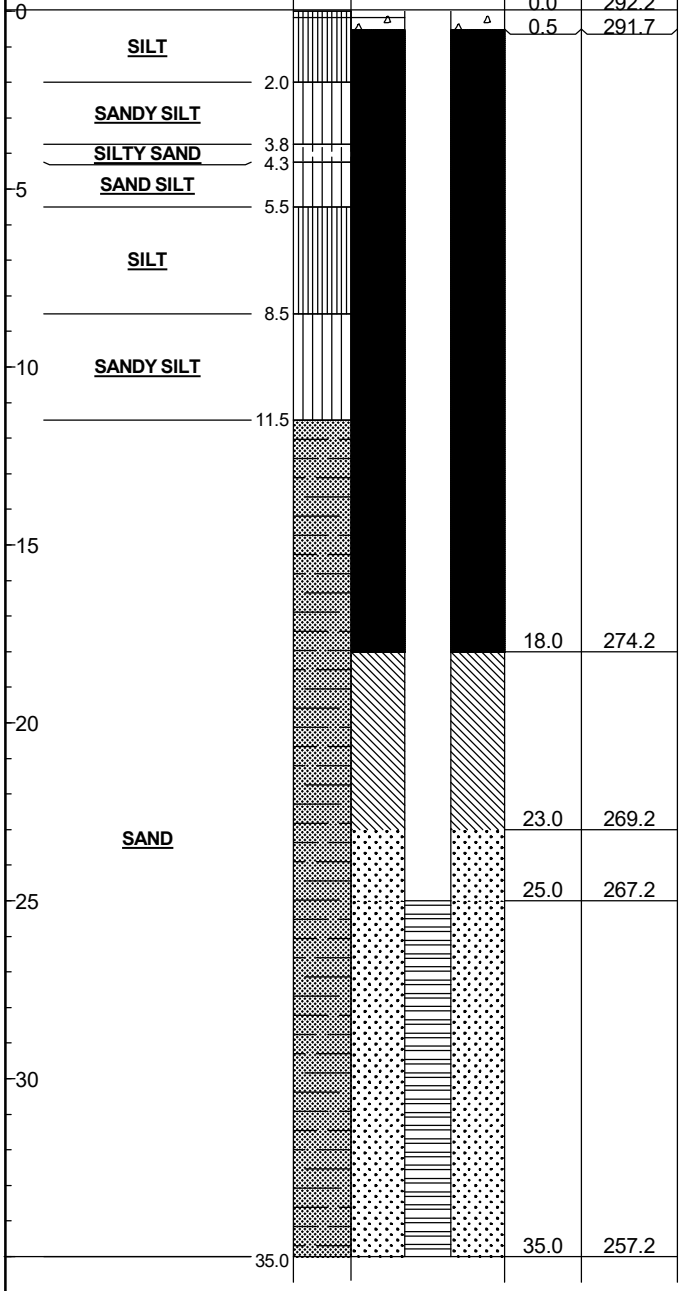
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 21 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 292.2
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)
SILT	0 – 2.0
SANDY SILT	2.0 – 3.8
SILTY SAND	3.8 – 4.3
SAND SILT	4.3 – 5.5
SILT	5.5 – 8.5
SANDY SILT	8.5 – 11.5
SAND	11.5 – 35.0



WELL CONSTRUCTION DETAILS

Type of protective cover	Flush Mount
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	0.2 ft
Type of protective casing	Flush Mount
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Flush Mount	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	25.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	18.0
Bentonite	18.0	5.0
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	25.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	35 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	35.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-24D

Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 13 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 298.3
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	298.3
				0.5	297.8
SANDY SILT	4.0				
SILTY SAND	6.8				
SAND	7.8				
SILTY SAND	14.0				
SAND	17.0				
SILTY SAND	19.0				
SANDY CLAY	19.8				
SAND.	22.0				
SANDY CLAY	23.1				
SANDY SILT	24.5				
SAND	39.0				
SILT with sand	44.0				
SAND	71.0				
SILTY SAND	73.5			68.0	230.3
				73.0	225.3
				75.0	223.3
GRAVELLY SAND with clay	82.0				
SAND with gravel	85.0			85.0	213.3

WELL CONSTRUCTION DETAILS

Type of protective cover	Padlock
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	2.4 ft
Type of protective casing	Guard Pipe
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Guard Pipe	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	75.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	68.0
Bentonite	68.0	5.0
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	75.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	85 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	85.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-24S

Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 14 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 298.2
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	298.2
				0.5	297.7
SANDY SILT	4.0				
SILTY SAND	6.8				
SAND	7.8				
SILTY SAND	14.0				
SAND	17.0				
SILTY SAND	19.0				
CLAYEY SILT	19.8				
SAND	22.0				
SANDY CLAY	23.1				
SANDY SILT	24.5				
SAND	39.0			37.0	261.2
SILT with sand	44.0			43.0	255.2
SAND	50.0			45.0	253.2
SILTY CLAY with sand	51.0				
SAND with silt	55.0			55.0	243.2

WELL CONSTRUCTION DETAILS

Type of protective cover	Padlock
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	2.5 ft
Type of protective casing	Guard Pipe
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Guard Pipe	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	45.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	37.0
Bentonite	37.0	6.0
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	45.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	55 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	55.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-25D

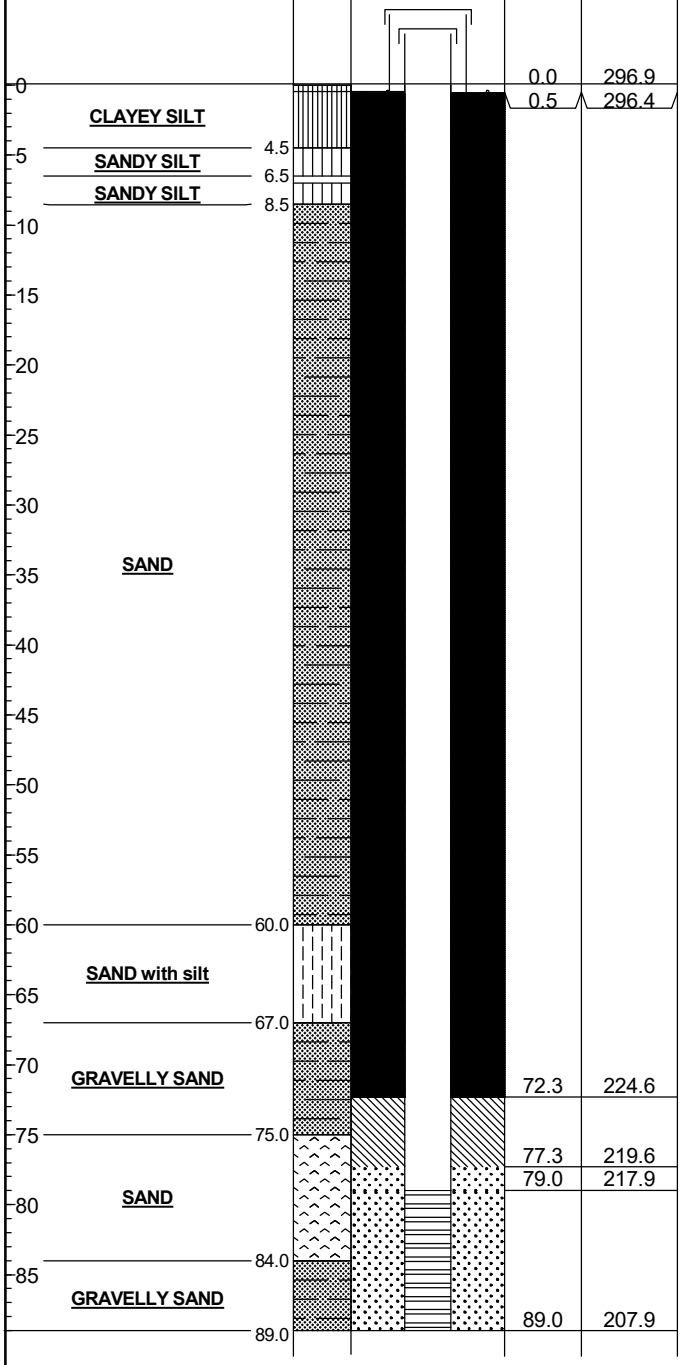
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 18 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 296.9
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	296.9
CLAYEY SILT				0.5	296.4
SANDY SILT	4.5				
SANDY SILT	6.5				
	8.5				
SAND					
	60.0				
SAND with silt					
	67.0				
GRAVELLY SAND				72.3	224.6
	75.0			77.3	219.6
				79.0	217.9
SAND					
	84.0				
GRAVELLY SAND				89.0	207.9
	89.0				



WELL CONSTRUCTION DETAILS

Type of protective cover	Padlock
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	2.3 ft
Type of protective casing	Guard Pipe
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Guard Pipe	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	79.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	72.3
Bentonite	72.3	5.0
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	79.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	89 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	89.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-25S

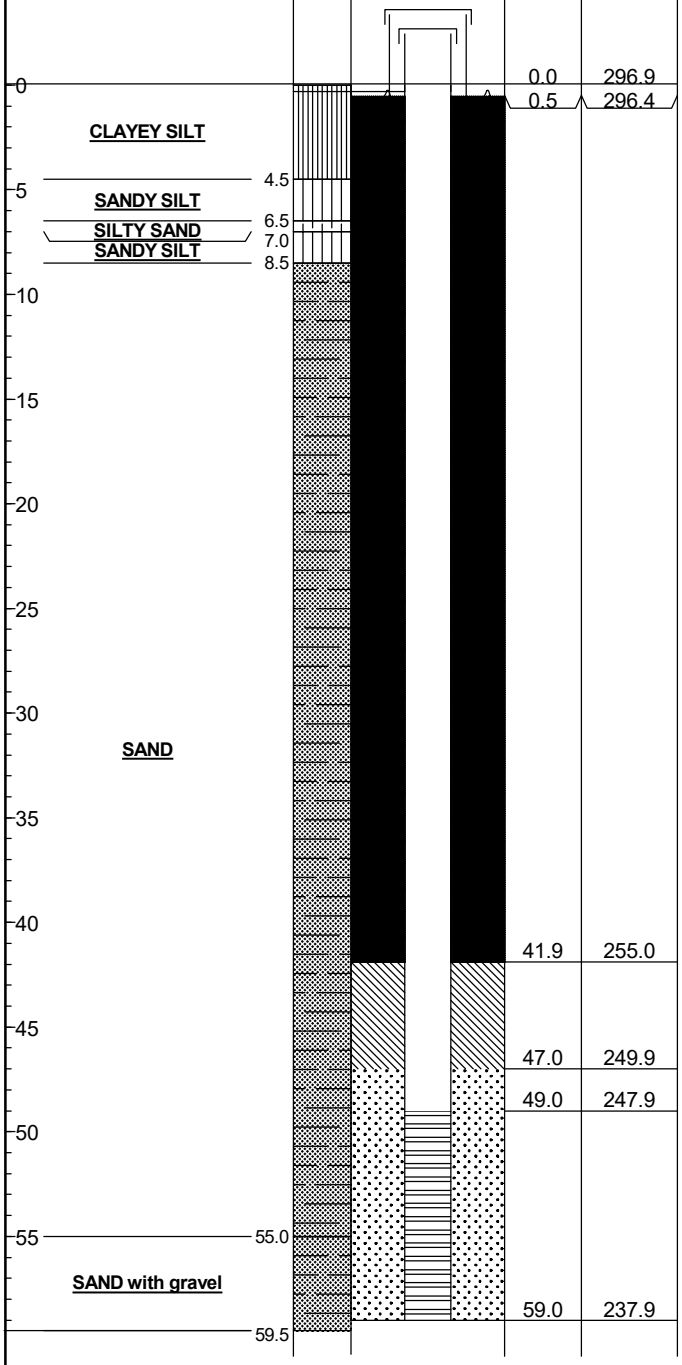
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 19 Aug 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 296.9
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	296.9
				0.5	296.4
CLAYEY SILT					
	4.5				
SANDY SILT					
	6.5				
SILTY SAND	7.0				
SANDY SILT	8.5				
SAND				41.9	255.0
				47.0	249.9
				49.0	247.9
	55.0				
SAND with gravel				59.0	237.9
	59.5				



WELL CONSTRUCTION DETAILS

Type of protective cover	Padlock
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	2.4 ft
Type of protective casing	Guard Pipe
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Guard Pipe	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	49.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	41.9
Bentonite	41.9	5.1
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	49.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	59 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	59.5 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-26D

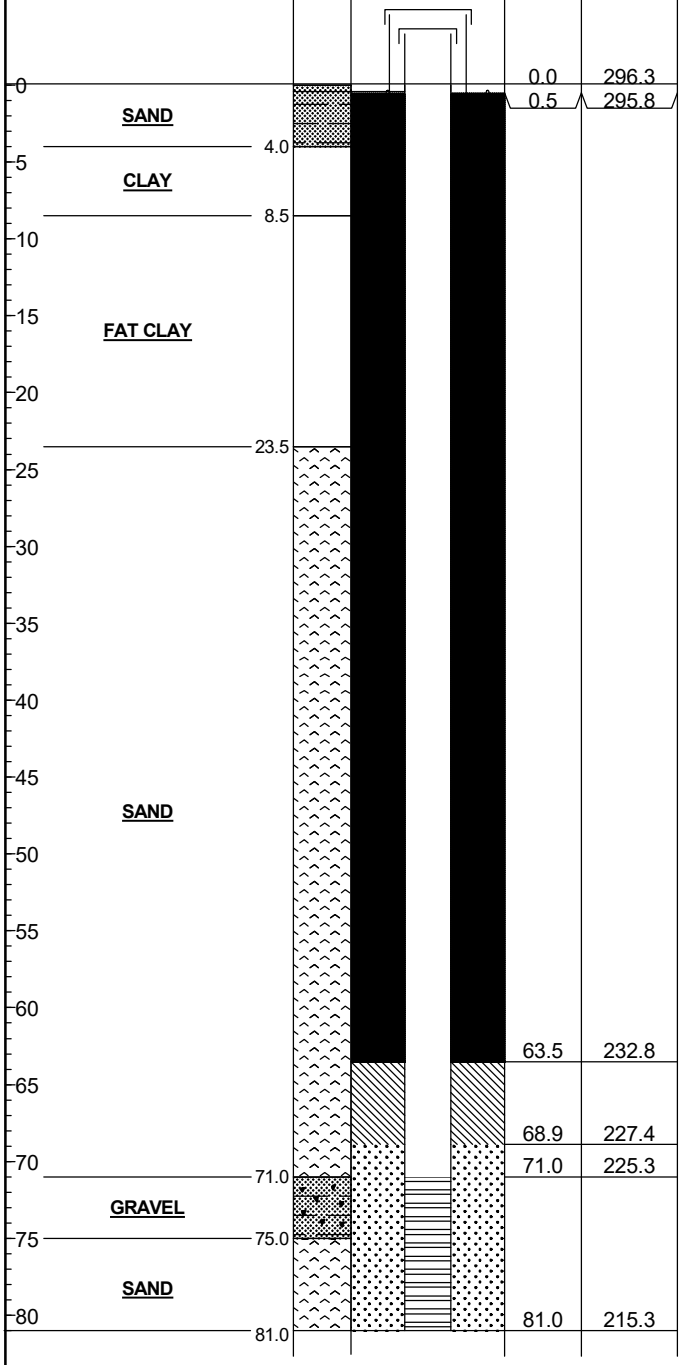
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 11 Sep 2019
H&A Rep. G. Foushee
Location See Plan

Ground El. 296.3
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	296.3
				0.5	295.8
SAND	4.0				
CLAY	8.5				
FAT CLAY	23.5				
SAND	71.0			63.5	232.8
				68.9	227.4
				71.0	225.3
GRAVEL	75.0				
SAND	81.0			81.0	215.3



WELL CONSTRUCTION DETAILS

Type of protective cover	Padlock
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	2.7 ft
Type of protective casing	Guard Pipe
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Guard Pipe	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	71.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	63.5
Bentonite	63.5	5.4
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	71.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	81 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	81.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-26S

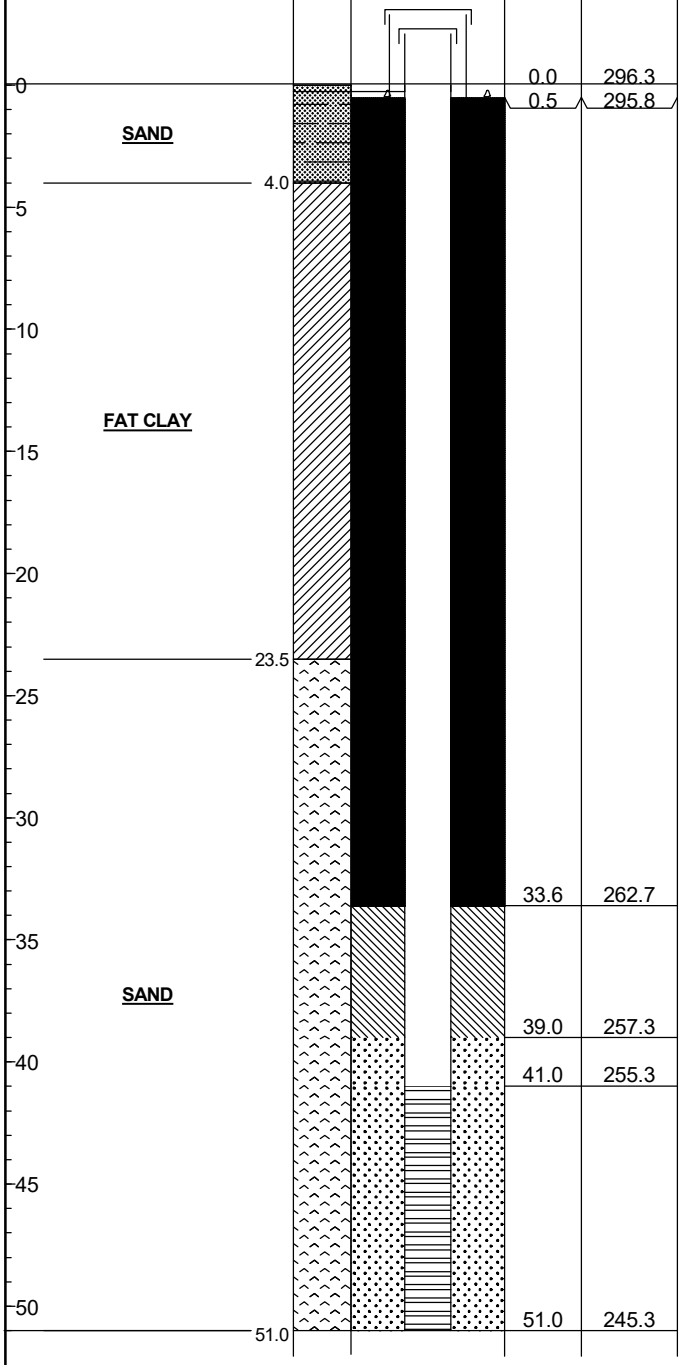
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 12 Sep 2019
H&A Rep. G. Foushee
Location See Plan

Ground El. 296.3
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	296.3
				0.5	295.8
SAND	4.0				
FAT CLAY	23.5				
				33.6	262.7
SAND				39.0	257.3
				41.0	255.3
	51.0			51.0	245.3



WELL CONSTRUCTION DETAILS

Type of protective cover	Padlock
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	2.6 ft
Type of protective casing	Guard Pipe
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Guard Pipe	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	41.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	33.6
Bentonite	33.6	5.4
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	41.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	51 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	51.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. MW-7D

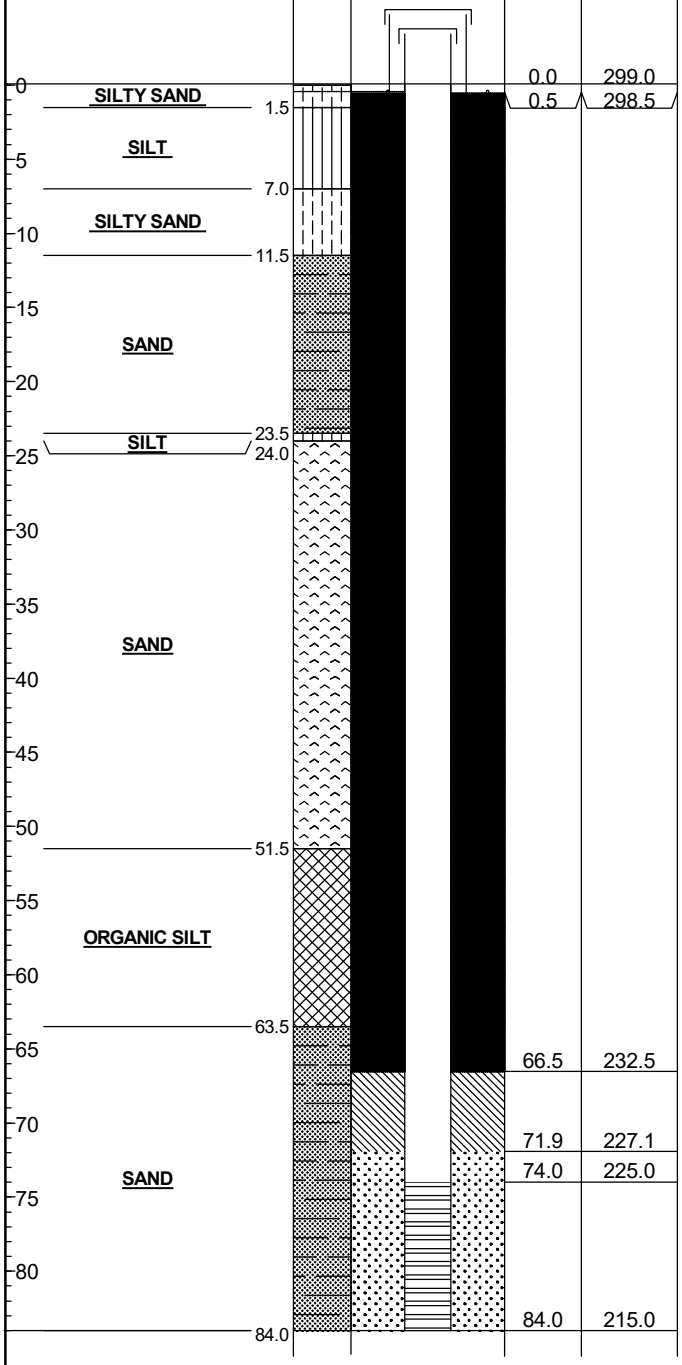
Project New Madrid - Nature & Extent
Location New Madrid, MO
Client AECI
Contractor Bulldog Drilling
Driller Bulldog

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

File No. 129342
Date Installed 10 Sep 2019
H&A Rep. N. Vaiana
Location See Plan

Ground El. 299.0
Datum NGVD 1988

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	299.0
SILTY SAND	1.5			0.5	298.5
SILT	7.0				
SILTY SAND	11.5				
SAND	23.5				
SILT	24.0				
SAND	51.5				
ORGANIC SILT	63.5				
				66.5	232.5
SAND				71.9	227.1
				74.0	225.0
	84.0			84.0	215.0



WELL CONSTRUCTION DETAILS

Type of protective cover	Padlock
Height of guard pipe above ground surface	NA
Height of top of riser above ground surface	3.1 ft
Type of protective casing	Guard Pipe
Length	1.5 ft
Inside diameter	30.0 in.
Depth of bottom of Guard Pipe	-
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	74.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Grout	0.0	66.5
Bentonite	66.5	5.4
-	-	-

Diameter of borehole	8.0 in.
Depth to top of well screen	74.0 ft
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Type of Backfill around Screen	8x12 Silica Sand
Depth to bottom of well screen	84 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	84.0 ft

COMMENTS:

HA-LIB09-BOS - SONIC.GLB GW INSTALLATION REPORT -07-1 AECI G:\PROJECTS\AECI\NEW MADRID\PROJECT DATA\GINT\NEWMADRID_NATURE-AND-EXTENT_102419.GPJ Nov 24, 20

ATTACHMENT 15

POND 003 NATURE AND EXTENT GROUNDWATER MONITORING CONSTITUENT CONCENTRATIONS TABLE

ATTACHMENT 15
SUMMARY OF ANALYTICAL RESULTS - NATURE & EXTENT POND 003
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
Marston, MO

Location	Date	Detection Monitoring - USEPA Appendix III Constituents (mg/L)							Assessment Monitoring - USEPA Appendix IV Constituents (mg/L)										
		Boron, Total	Calcium, Total	Chloride	Fluoride	Sulfate	pH (lab) (SU)	TDS	Arsenic, Total	Barium, Total	Cadmium, Total	Chromium, Total	Cobalt, Total	Lead, Total	Lithium, Total	Molybdenum, Total	Selenium, Total	Fluoride	Radium-226 & 228, Combined (pCi/L)
MW-7D	10/3/2019	7.8	110	24	0.712	250	7.58	560	0.0062	0.15	<0.0010	0.012	0.0027	0.0039	0.021	0.76	<0.001	0.712	1.83 +/- 1.17 (1.79)
	10/15/2019	9.9	130	16	0.791	220	7.25	580	0.0068	0.13	<0.0010	0.0081	0.0022	0.0036	0.023	1	<0.0010	0.791	1.12 +/- 1.96 (3.92)
	11/10/2019	7.8	120	17	0.946	230	7.46	620	0.0062	0.12	<0.00089	<0.0040	0.0016	0.0027	0.021	0.69	<0.0010	0.946	0.874 +/- 0.768 (1.44)
	3/4/2020	5.6	85	17	1.00	150	7.48	510	0.0050	0.061	<0.00089	<0.0040	<0.00086	<0.0010	0.022	0.84	<0.0010	1.00	1.35 +/- 0.806 (1.22)
	8/11/2020	12	120	15	0.780	250	7.28	720	0.0047	0.086	-	-	< 0.0010	-	0.022	0.94	<0.0010	0.780	1.47 +/- 0.764 (1.11
MW-19S	10/4/2019	0.83	170	19	0.312	230	7.41	630	0.0033	0.19	<0.0010	0.006	<0.0020	<0.0010	0.022	0.036	<0.001	0.312	0.749 +/- 0.979 (1.71)
	10/15/2019	0.92	200	16	0.529	250	7.26	760	0.0058	0.20	<0.0010	0.011	0.002	0.0019	0.024	0.047	<0.0010	0.529	1.17 +/- 2.25 (4.59)
	11/15/2019	0.90	170	17	0.377	250	7.19	760	<0.0010	0.14	<0.00089	0.0076	0.0014	<0.0010	0.025	0.016	0.0014	0.377	0.978 +/- 0.912 (1.81)
	3/6/2020	0.50	160	23	0.265	180	7.31	630	<0.0010	0.11	<0.00089	<0.0040	<0.00086	<0.0010	0.024	0.0095	0.0030	0.265	0.221 +/- 0.604 (1.41)
	8/13/2020	1.4	170	14	0.270	290	7.15	800	0.0011	0.12	-	-	< 0.0010	-	0.025	0.010	<0.0010	0.270	0.810 +/- 0.836 (1.58)
MW-20S	10/4/2019	2.1	170	21	0.463	330	7.30	710	0.0031	0.17	<0.0010	<0.0040	<0.0020	<0.001	0.028	0.20	<0.001	0.463	0.491 +/- 0.979 (2.01)
	10/15/2019	2.3	180	18	0.580	350	7.16	800	0.0049	0.20	<0.0010	0.011	<0.0020	0.0031	0.024	0.24	<0.0010	0.580	0.458 +/- 1.63 (3.70)
	11/15/2019	2.2	170	19	0.464	360	7.19	820	0.0030	0.16	<0.00089	<0.0040	<0.00086	<0.0010	0.025	0.19	<0.0010	0.464	0.854 +/- 0.855 (1.60)
	3/6/2020	2.1	180	17	0.380	250	7.20	720	0.0029	0.16	<0.00089	<0.0040	<0.00086	<0.0010	0.027	0.19	<0.0010	0.380	0.996 +/- 0.589 (0.887)
	8/17/2020	3.0	140	17	0.395	270	7.28	720	0.0030	0.14	-	-	<0.0020	-	0.022	0.29	<0.0010	0.395	0.551 +/- 1.01 (1.97)
	8/17/2020	3.0	140	17	0.463	270	7.32	730	0.0028	0.14	-	-	<0.0020	-	0.020	0.28	<0.0010	0.463	1.21 +/- 0.838 (1.40)
MW-20D	10/4/2019	2.1	140	30	0.673	190	7.70	570	0.0029	0.16	<0.0010	0.0076	0.0039	0.0052	0.026	0.20	<0.001	0.673	1.91 +/- 1.06 (1.60)
	10/15/2019	2.4	140	14	0.327	97	7.61	300	0.0022	0.10	<0.0010	0.0058	<0.0020	0.002	<0.020	0.24	<0.0010	0.327	4.12 +/- 3.62 (6.92)
	11/15/2019	2.5	140	19	0.649	170	7.44	660	0.0016	0.097	<0.00089	<0.0040	<0.00086	<0.0010	<0.020	0.24	<0.0010	0.649	0.679 +/- 0.774 (1.51)
	3/6/2020	2.3	140	20	0.663	220	7.52	610	0.0016	0.11	<0.00089	<0.0040	<0.00086	0.0011	0.020	0.23	<0.0010	0.663	1.11 +/- 0.744 (1.13)
	8/17/2020	2.5	150	15	0.581	270	7.50	710	0.0013	0.11	-	-	<0.0020	-	0.017	0.21	<0.0010	0.581	0.880 +/- 0.948 (1.78)
MW-21S	10/4/2019	1.3	150	26	0.614	74	7.48	480	0.0047	0.13	<0.0010	0.014	0.0051	0.0051	0.025	0.58	<0.001	0.614	1.11 +/- 0.973 (1.66)
	10/15/2019	1.1	160	21	0.609	66	7.29	540	0.0047	0.15	<0.0010	0.016	0.0056	0.0053	<0.020	0.64	0.0011	0.609	4.58 +/- 3.48 (6.59)
	11/10/2019	1.4	140	25	0.748	84	7.29	530	0.0013	0.10	<0.00089	<0.0040	0.0016	<0.0010	<0.020	0.62	<0.0010	0.748	1.01 +/- 0.797 (1.26)
	3/6/2020	0.87	140	25	0.562	80	7.20	470	0.0022	0.11	<0.00089	<0.0040	0.0048	0.0021	0.019	0.60	<0.0010	0.562	1.22 +/- 0.776 (1.17)
	8/17/2020	1.8	150	17	0.457	95	7.17	600	< 0.0010	0.10	-	-	0.0025	-	0.014	0.47	<0.0010	0.457	0.888 +/- 0.855 (1.54)
MW-21D	10/4/2019	2.3	96	29	0.513	130	8.03	420	0.0021	0.13	<0.0010	0.0075	<0.0020	0.0025	0.027	0.25	<0.001	0.513	2.00 +/- 1.37 (2.39)
	10/15/2019	2.6	120	17	0.634	150	7.54	480	0.0038	0.16	<0.0010	0.018	0.0022	0.0051	0.026	0.29	<0.0010	0.634	2.50 +/- 1.89 (3.42)
	11/10/2019	2.9	120	19	0.670	170	7.62	530	0.0021	0.13	<0.00089	<0.0040	<0.00086	<0.0010	0.024	0.32	<0.0010	0.670	1.47 +/- 0.838 (1.11)
	3/6/2020	2.8	120	19	0.450	170	7.37	500	0.0037	0.17	<0.00089	0.0069	0.0051	0.0064	0.021	0.26	<0.0010	0.450	0.541 +/- 0.588 (1.09)
	8/17/2020	3.9	150	17	0.346	200	7.52	630	0.0021	0.16	-	-	< 0.0020	-	0.025	0.37	<0.0010	0.346	1.77 +/- 0.948 (1.41)
MW-22S	10/4/2019	3.4	230	35	0.320	95	7.30	650	0.033	1.0	<0.0010	0.026	0.012	0.031	0.044	0.19	0.002	0.320	5.59 +/- 1.81 (2.12)
	10/15/2019	3.0	200	26	0.422	100	6.99	700	0.021	0.61	<0.0010	0.038	0.012	0.019	0.040	0.21	0.0017	0.422	10.6 +/- 4.31 (6.22)
	11/10/2019	4.0	160	26	0.452	96	7.12	720	0.0046	0.23	<0.00089	<0.0040	<0.00086	<0.0010	<0.020	0.20	<0.0010	0.452	1.70 +/- 0.849 (1.10)
	3/6/2020	3.2	180	27	<0.250	100	7.07	670	0.0015	0.20	<0.00089	<0.0040	0.0026	<0.0010	0.023	0.096	<0.0010	<0.250	1.01 +/- 0.729 (1.34)
	8/17/2020	2.9	170	23	<0.250	84	7.08	690	0.0030	0.20	-	-	< 0.0020	-	0.021	0.089	<0.0010	<0.250	0.671 +/- 0.886 (1.67)
MW-22D	10/4/2019	4.5	110	31	0.822	130	7.65	420	0.0087	0.20	<0.0010	0.019	0.013	0.030	0.029	0.95	0.0012	0.822	0.683 +/- 1.05 (2.02)
	10/15/2019	5.1	97	26	0.881	130	7.57	380	0.0093	0.19	<0.0010	0.027	0.012	0.027	0.028	0.95	0.0014	0.881	11.2 +/- 3.87 (4.91)
	11/10/2019	4.0	81	20	0.961	130	7.73	470	0.0044	0.065	<0.00089	<0.0040	<0.00086	0.0010	<0.020	0.87	<0.0010	0.961	1.18 +/- 0.803 (1.25)
	3/6/2020	3.8	96	20	0.831	140	7.11	440	0.0046	0.086	<0.00089	<0.0040	0.0015	0.0037	0.022	0.75	<0.0010	0.831	1.39 +/- 0.734 (1.12)
	8/17/2020	4.8	140	16	0.579	160	7.62	610	0.0044	0.110	-	-	< 0.0020	-	0.023	0.80	<0.0010	0.579	1.21 +/- 0.838 (1.40)

ATTACHMENT 15
SUMMARY OF ANALYTICAL RESULTS - NATURE & EXTENT POND 003
ASSOCIATED ELECTRIC COOPERATIVE, INC.
NEW MADRID POWER PLANT
Marston, MO

Location	Date	Detection Monitoring - USEPA Appendix III Constituents (mg/L)							Assessment Monitoring - USEPA Appendix IV Constituents (mg/L)										
		Boron, Total	Calcium, Total	Chloride	Fluoride	Sulfate	pH (lab) (SU)	TDS	Arsenic, Total	Barium, Total	Cadmium, Total	Chromium, Total	Cobalt, Total	Lead, Total	Lithium, Total	Molybdenum, Total	Selenium, Total	Fluoride	Radium-226 & 228, Combined (pCi/L)
MW-23S	10/3/2019	0.52	180	44	0.406	130	7.12	780	<0.001	0.17	<0.0010	<0.0040	<0.0020	0.0016	0.035	0.016	<0.0010	0.406	0.789 +/- 1.01 (2.01)
	10/15/2019	0.46	140	29	0.439	95	7.02	600	0.0035	0.17	<0.0010	0.018	0.0044	0.0062	0.032	0.020	<0.0010	0.439	1.01 +/- 1.58 (3.24)
	11/15/2019	0.54	140	26	0.352	110	7.06	580	<0.0010	0.13	<0.00089	<0.0040	<0.00086	<0.0010	0.029	0.014	<0.0010	0.352	0.866 +/- 0.845 (1.55)
	3/6/2020	0.54	140	25	0.306	100	6.99	500	<0.0010	0.12	<0.00089	<0.0040	<0.00086	<0.0010	0.034	0.013	<0.0010	0.306	0.276 +/- 0.726 (1.47)
	8/13/2020	0.57	180	29	< 0.250	140	6.88	670	<0.0010	0.15	-	-	< 0.0010	-	0.031	0.012	<0.0010	< 0.250	1.08 +/- 1.06 (1.75)
MW-24S	8/28/2019	0.18	110	11	<0.250	88	7.15	520	0.0075	0.30	<0.00089	<0.0040	<0.00086	<0.0010	0.023	0.0020	<0.0010	<0.250	2.25 +/- 1.16 (1.29)
	10/3/2019	0.12	130	27	0.298	53	7.21	480	0.012	0.30	<0.0010	0.0087	0.0035	0.0091	0.027	0.0020	<0.0010	0.298	1.45 +/- 0.825 (1.24)
	10/15/2019	0.11	120	13	0.360	54	7.30	470	0.0099	0.25	<0.0010	0.0058	<0.0020	0.0038	<0.020	0.0014	<0.0010	0.360	2.28 +/- 1.23 (2.01)
	11/13/2019	0.11	82	9.7	0.315	42	7.24	360	0.0034	0.14	<0.00089	<0.0040	<0.00086	<0.0010	<0.020	0.011	<0.0010	0.315	0.496 +/- 0.814 (1.73)
	3/3/2020	0.15	120	11	<0.250	48	7.17	410	0.0059	0.26	<0.00089	<0.0040	<0.00086	0.0010	0.022	0.0020	<0.0010	<0.250	0.724 +/- 0.724 (1.34)
	8/13/2020	0.14	120	11	< 0.250	55	7.13	460	0.0051	0.26	-	-	< 0.0010	-	0.019	< 0.0010	<0.0010	<0.250	1.28 +/- 1.03 (1.80)
MW-24D	8/28/2019	0.14	81	9.7	<0.250	41	7.17	330	0.0044	0.17	<0.00089	0.0050	<0.00086	<0.0010	0.016	0.012	<0.0010	<0.250	0.0597 +/- 1.34 (2.66)
	10/3/2019	0.099	98	62	<0.250	43	7.80	380	0.0052	0.20	<0.0010	0.0094	0.0026	0.0061	<0.020	0.0098	<0.0010	<0.250	1.82 +/- 0.873 (1.21)
	10/15/2019	0.11	100	9.9	0.346	39	7.19	360	0.0074	0.25	<0.0010	0.021	0.0062	0.011	0.020	0.013	<0.0010	0.346	2.18 +/- 1.43 (2.42)
	11/13/2019	0.11	120	12	0.309	52	7.44	490	0.00694	0.25	<0.00089	<0.0040	<0.00086	<0.0010	<0.020	0.0012	<0.0010	0.309	1.41 +/- 0.975 (1.66)
	3/3/2020	0.34	88	8.9	<0.250	56	7.18	340	0.0043	0.19	<0.00089	0.0041	0.00097	0.0018	0.020	0.029	<0.0010	<0.250	1.19 +/- 0.745 (0.936)
	8/13/2020	0.13	87	10	<0.250	42	7.09	430	0.0034	0.16	-	-	< 0.0010	-	0.013	0.0088	<0.0010	<0.250	1.29 +/- 0.926 (1.55)
MW-25S	8/28/2019	0.094	50	42	<0.250	110	6.79	380	0.0054	0.30	<0.00089	<0.0040	<0.00086	0.0010	0.015	0.0098	<0.0010	<0.250	1.57 +/- 1.22 (2.05)
	10/3/2019	0.34	33	45	0.339	91	6.86	380	<0.001	0.084	<0.0010	0.0044	<0.0020	<0.001	<0.020	0.015	<0.0010	0.339	7.37 +/- 1.89 (1.55)
	10/15/2019	0.52	39	30	<0.250	86	6.81	380	0.005	0.22	<0.0010	0.0085	0.003	0.0062	<0.020	0.021	<0.0010	<0.250	3.51 +/- 1.77 (2.69)
	11/13/2019	0.075	61	31	0.336	100	6.98	400	0.0056	0.35	<0.00089	<0.0040	<0.00086	0.0013	<0.020	0.049	<0.0010	0.336	0.723 +/- 1.17 (2.32)
	3/3/2020	0.086	61	22	<0.250	87	6.84	350	0.0065	0.36	<0.00089	<0.0040	0.0012	0.0024	0.017	0.037	<0.0010	<0.250	1.98 +/- 0.946 (1.25)
	8/13/2020	0.14	45	23	<0.250	84	6.72	390	0.0049	0.27	-	-	< 0.0010	-	0.011	0.020	<0.0010	<0.250	1.50 +/- 0.927 (1.38)
MW-25D	8/28/2019	1.6	87	11	0.315	100	7.06	460	0.0038	0.24	<0.00089	<0.0040	<0.00086	<0.0010	0.016	0.079	<0.0010	0.315	1.23 +/- 1.13 (1.98)
	10/3/2019	8	140	27	0.340	69	7.28	270	0.0027	0.14	<0.0010	<0.0040	0.0036	0.0018	0.035	1.2	<0.0010	0.340	2.03 +/- 0.942 (1.21)
	10/15/2019	0.55	52	14	<0.250	76	7.05	270	0.003	0.13	<0.0010	0.0082	<0.0020	0.0019	<0.020	0.031	<0.0010	<0.250	1.84 +/- 1.65 (3.07)
	11/13/2019	0.89	78	14	0.453	83	6.95	480	0.0038	0.18	<0.00089	<0.0040	<0.00086	<0.0010	<0.020	0.053	<0.0010	0.453	0.563 +/- 0.953 (2.01)
	3/3/2020	2.10	93	10	0.322	130	7.01	430	0.0039	0.20	<0.00089	<0.0040	<0.00086	<0.0010	0.016	0.076	<0.0010	0.322	1.19 +/- 0.707 (1.14)
	8/13/2020	2.1	90	9.6	< 0.250	150	6.92	550	0.0033	0.21	-	-	< 0.0010	-	0.012	0.058	<0.0010	<0.250	1.69 +/- 1.05 (1.57)
MW-26S	10/3/2019	5.7	120	33	0.690	230	7.36	600	0.0084	0.22	0.0012	0.014	0.0065	0.014	0.030	0.97	<0.0010	0.690	1.82 +/- 1.10 (1.74)
	10/15/2019	11	140	16	0.685	320	7.04	740	0.0037	0.079	<0.0010	<0.0040	<0.0020	0.0012	0.028	2	<0.0010	0.685	1.46 +/- 2.26 (4.68)
	11/10/2019	8.8	140	15	0.781	280	7.10	760	0.0037	0.14	<0.00089	<0.0040	0.0033	<0.0010	0.027	1.3	<0.0010	0.781	0.949 +/- 0.925 (1.64)
	3/4/2020	3.4	86	16	0.990	120	7.51	390	0.0045	0.061	<0.00089	<0.0040	<0.00086	<0.0010	0.020	0.65	<0.0010	0.990	1.40 +/- 0.814 (1.32)
	8/11/2020	8.3	170	14	0.666	340	7.00	790	0.0026	0.077	-	-	0.0029	-	0.025	1.2	<0.0010	0.666	0.886 +/- 1.02 (1.90)
MW-26D	10/3/2019	5.9	120	30	0.865	210	7.46	560	0.0094	0.220	0.0012	0.018	0.0071	0.015	0.025	0.97	0.0014	0.865	0.608 +/- 0.924 (1.77)
	10/15/2019	5.4	130	17	0.857	240	7.24	560	0.0083	0.18	<0.0010	0.012	0.0058	0.011	0.026	0.91	<0.0010	0.857	2.17 +/- 1.89 (3.48)
	11/10/2019	3.7	80	20	1.12	140	7.47	410	0.0049	0.071	<0.00089	<0.0040	<0.00086	<0.0010	<0.020	0.61	<0.0010	1.12	0.728 +/- 0.869 (1.58)
	3/4/2020	8.6	150	12	0.575	260	7.07	760	0.0026	0.079	<0.00089	<0.0040	0.0016	<0.0010	0.034	1.5	<0.0010	0.575	1.28 +/- 0.706 (0.917)
	8/11/2020	7.0	110	16	0.790	250	7.28	740	0.0053	0.077	-	-	< 0.0010	-	0.022	1.0	<0.0010	0.790	1.07 +/- 1.04 (1.95)

ABBREVIATIONS AND NOTES:

ND: "Non Detect," the report does not provide reporting limit and instead states "ND."

Bold Value: indicates a detection by the laboratory

mg/L : milligrams per liter

pCi/L : picocuries per liter

su : standard unit

USEPA : United States Environmental Protection Agency

USEPA. 2016. Final Rule: Disposal of Coal Combustion Residuals from Electric Utilities. July 26. 40 CFR Part 257. https://www.epa.gov/coalash/coal-ash-rule