Piney Run Dam Geologic and Geotechnical Investigation Report

Maryland Dam No. 139 (NID ID: MD 00139)

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Acronyms

ASCE	American Society of Civil Engineers
AMSL	Above Mean Sea Level
ANSS	Advanced National Seismic System
ASTM	ASTM International (Formerly the American Society for Testing & Materials)
ASW	Auxiliary spillway
c	Cohesion
CIU	Consolidated Isotropically Undrained
CID	Consolidated Isotropically Drained
cm/sec	Centimeters per second
deg	Degrees
ft	Feet
ft/day	Feet per day
ft/sec	Feet per second
k_h	Horizontal hydraulic conductivity
k_v	Vertical hydraulic conductivity
lb	Pounds
M	Magnitude
m/sec	Meters per second
MDE	Maryland Department of the Environment
NAVD	North American Vertical Datum (All elevations in this report are presented in NAVD 88)
NP	Non-plastic
NRCS	Natural Resources Conservation Service
PGA	Peak Ground Acceleration
pcf	Pounds per cubic foot
psf	Pounds per square foot
psi	Pounds per square inch
PSW	Principal spillway
RCP	Reinforced Concrete Pipe
SPT	Standard Penetration Test
SR	Seismic Refraction
TR	Technical Release
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USGS	United States Geological Survey

1. Introduction & Purpose

In 2016 a dam breach analysis was prepared by Charles P. Johnson and Associates, Inc. (CPJ) on behalf of the Maryland Department of the Environment (MDE) for existing conditions at Piney Run Dam in Carroll County, Maryland. The analysis included hydrologic and hydraulic modeling of the principal and auxiliary spillways. This analysis indicated that the capacity of the existing Auxiliary Spillway (ASW) may not be adequate to meet state criteria for a High Hazard dam (CPJ, 2016).

In 2017, MDE issued a letter to Carroll County including the results of the above-referenced analysis and identified concerns that the auxiliary spillway could erode causing an uncontrolled release. MDE noted in that letter that the spillway channel for the dam "was likely excavated through highly erodible residual soils and weathered rock" (MDE, personal communication, August 9, 2017). AECOM Technical Services, Inc. (AECOM) has been contracted by Carroll County, Maryland to prepare a supplemental Watershed Study which includes investigation of existing conditions at Piney Run Dam and development of alternatives to address identified deficiencies to meet current Natural Resources Conservation Service (NRCS) and MDE criteria for high hazard dams. These investigations include preparation of a geologic and geotechnical investigation of the dam and spillway.

1.1 Background

Piney Run Dam is an earthen dam constructed in 1974, located approximately 1.5 miles northwest of Sykesville, Maryland and approximately 1.75 miles southwest of Eldersburg, Maryland. The dam is approximately 73 feet in height (from principal spillway outlet invert) with a design crest at elevation (EL.) 540.5 feet, and 624 feet in length. It is classified as a High Hazard dam. The dam was designed for flood control, water supply, and recreation purposes but is currently only used for flood control and recreation. The dam's Principal Spillway (PSW) drains Piney Run Lake through a single-stage riser with a crest at EL. 523.0 feet leading to a 36-inch reinforced concrete pipe (RCP) which outlets at the toe of the dam into an impact basin. There are thirteen observation wells installed within the embankment, abutments, and ASW.

The ASW, also referred to as the emergency spillway is a 250-foot-wide vegetated channel and is located in the right abutment of the dam. The ASW crest activates when the reservoir reaches EL.531.2 feet which will generally occur during precipitation events greater than the one percent annual exceedance flood event (often referred to as a 100-year storm). The total drainage area to the facility is 10.6 square miles.

The water supply intake structure is topped with an intake house and has eight hand wheels to control the water intake through gated openings at varying depths, the deepest located at approximately 19 feet below the normal pool elevation. The structure leads to a 24-inch RCP which runs through the embankment approximately 352 feet downstream before terminating at a bulkhead. The system also has rate control piping with a monometer vault accessible at the downstream toe of the dam that allows water to be discharged to the PSW impact basin.

Figure 1 shows an aerial photograph of the dam taken from Google Earth. Unless otherwise noted, all elevations provided in this report are based on the North American Vertical Datum of 1988

(NAVD 88), which is approximately one foot higher than the datum used in the original design drawings.

1.2 Scope of Work

A subsurface investigation was performed through field exploration and laboratory testing to compile geotechnical data for existing conditions at Piney Run Dam. The data gathered as part of this investigation was used to develop design parameters for the geotechnical analyses presented in this report. This, in conjunction with other technical reports prepared by AECOM under separate covers, will be used to develop modification alternatives to address the deficiencies identified herein for Piney Run Dam.

Figure 1: Piney Run Dam aerial photograph

2. Site Geology

Piney Run Dam is located in central Maryland within the Piedmont physiographic province. In the western part of the province, lithology includes "phyllite, slate, marble, and moderately to slightly metamorphosed volcanic rocks" (Maryland Geological Survey, 2020). Local geology of Piney Run Dam shown on the Geologic Map of the Finksburg Quadrangle (Muller, 1994) indicates that the dam is located within the Morgan Run Formation [mr, a, um, and g] (**Figure 2**).

According to Muller's 1994 geologic map, the Morgan Run Formation primarily consists of fine- to medium-grained, lustrous, silver-gray to greenish-gray, garnetiferous mica schist and quartz-mica schist containing discontinuous layers and lenses of quartzite ranging from five centimeters to one meter thick.

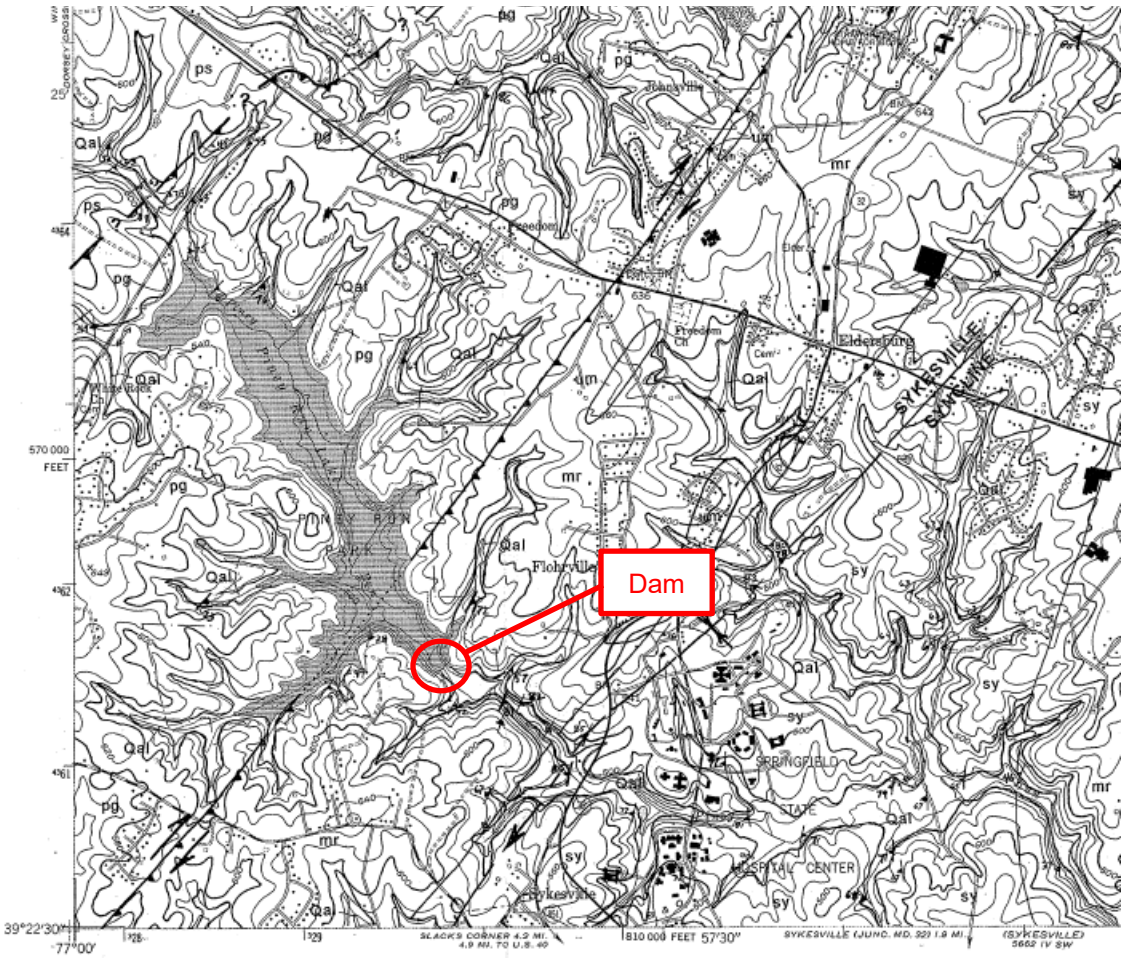


Figure 2: Lithology at Piney Run Dam (Muller, 1994)

Surficial soils surrounding Piney Run Dam, as classified by the NRCS Web Soil Survey, are shown in **Figure 3**. The surface soils of the dam and abutments are identified as "Dams, concrete" [DAM]. It should be noted that Piney Run Dam is an earthen embankment dam, but it does include concrete components such as the concrete riser, intake structure, and impact basin. The surface soils downstream of the dam outlet consist of Codorus silt loam [CdA] with 0 to 3 percent slopes. The surface soils of the ASW and west of the ASW outside slope consist of Glenelg loam [GdB] with

3 to 8 percent slopes. The surface soils directly surrounding the ASW to the west, south, and east consist of Manor loam [MaF] with 25 to 65 percent slopes. The surface soils of the northeast (left) abutment consist of Brinklow channery loam [BrC and BrD] with 8 to 15 and 15 to 25 percent slopes, respectively (Soil Survey Staff, 2019).

Figure 3: NRCS soil survey at Piney Run Dam (Soil Survey Staff, 2019).

3. Geotechnical Subsurface Exploration

The subsurface investigation of Piney Run Dam and its appurtenant structures was performed between November 25, 2019 and January 15, 2020 by Connelly and Associates, Inc., accompanied by an AECOM representative. Twenty-five total borings were drilled using a CME-55 track-mounted drill rig: twelve on the existing ASW, five beyond the outside slope of the existing ASW, three on the embankment, three on the left abutment, and two at the downstream toe (one of which is an offset boring). In addition, one hand-dug test pit was performed on the middle portion of the downstream slope approximately halfway between the crest and toe of the slope. Boring locations are provided in **Appendix A**.

Soil was drilled using 3 ¼-inch inside-diameter hollow stem augers. Representative soil samples were obtained using a 2-inch outer-diameter split spoon sampler in general accordance with ASTM International (ASTM) D1586 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. SPTs were performed by driving a split-barrel sampler with a 140-pound hammer dropped 30 inches. Soil samples were collected in jars and were obtained by split spoon sampling generally at 5-foot intervals. Where possible, samples were tested with a pocket penetrometer and pocket shear vane from the split spoon.

Shelby tube sampling was performed in select borings in general accordance with ASTM D1587, Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes. These samples were collected for laboratory testing requiring relatively undisturbed soil samples. Bulk samples were also obtained from select borings by sampling from the auger cuttings. One additional bulk sample was obtained from the hand-dug test pit located on the mid-downstream slope of the embankment because the drill rig was not able to safely access the location without significantly damaging the embankment.

Rock core sampling was performed generally at auger refusal using an NQ wireline coring barrel and 2 ½-inch outer diameter coring rods. Rock coring was performed at all boring locations except Borings 205 and 601A. The rock coring ranged between five linear feet (Borings 601 and 208) and 35 linear feet (Boring 805). In some instances, rock coring was performed with a split core barrel prior to auger refusal in order to sample the transitionary material at the soil-rock interface.

Upon drilling completion, 1-inch-diameter PVC pipes with slotted perforations in the bottom foot were temporarily installed in the majority of borings in order to take 24-hour groundwater readings and to preserve the hole to its termination for tremie grouting. After taking final groundwater readings, borings were backfilled by tremie grouting using cement-bentonite grout.

Boring logs for soil and rock core sampling are presented in **Appendix B**. A photographic log of the rock cores is presented in **Appendix C**.

In addition to the drilling exploration, a seismic refraction survey was performed and is described in **Section 6**.

4. Laboratory Testing

Laboratory testing on soil and rock samples obtained during the subsurface investigation of Piney Run Dam was performed by AECOM's geotechnical laboratory in Conshohocken, Pennsylvania. Laboratory testing was performed in general accordance with ASTM standards. The following laboratory tests were performed:

- Twenty-one (21) tests with ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- Thirty-three (33) tests with ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- Twenty-one (21) tests with ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- Ten (10) tests with ASTM D7263 Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens
- One (1) test with ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600kN-m/m3))
- Thirty-seven (37) tests with ASTM D7928 Standard Test Method for Particle Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
- Ninety-nine (99) tests with ASTM D6913 Standard Test Method for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- Four (4) tests with ASTM D7012 Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens under Varying States of Stress and Temperatures
- Three (3) tests with ASTM D4767 Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils
- One (1) test with ASTM D7181 Standard Test Method for Consolidated Drained Triaxial Compression Test for Soils
- One (1) test with ASTM D5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- Two (2) tests with ASTM D854 Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer
- Two (2) tests with ASTM C128 Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate

Tests with ASTM D4221, Standard Test Method for Dispersive Characteristics of Clay Soil By Double Hydrometer or ASTM D6572, Standard Test Methods for Determining Dispersive Characteristics of Clayey Soils by the Crumb Test, were planned for soil samples from the auxiliary spillway. However, within the spillway proper, the soils were found to be non-plastic and thus a test for dispersion was determined to not be applicable. A summary of the laboratory test results is presented in **Appendix D**. Results of the laboratory tests are provided in **Appendix E**.

5. Materials

Soil materials at Piney Run Dam were categorized into five general layers based on visual observation, soil index properties, classification, depth, and location. These layers are described below. Classifications are based on the Unified Soil Classification System (USCS).

5.1 Topsoil

The thickness of organic topsoil varied across the site with a maximum thickness of approximately 12 inches in Boring 805.

5.2 Embankment Fill

Piney Run Dam is an earth fill dam containing an earthen core. The material used to construct the dam is hereby referred to as Embankment Fill, consisting of Embankment Shell and Embankment Core material. The Embankment Fill material was sampled and tested from three borings located along the crest, two borings at the downstream toe of the dam, and a hand-dug test pit at the downstream mid-slope. A typical cross section of the dam is shown in **Figure 4**.

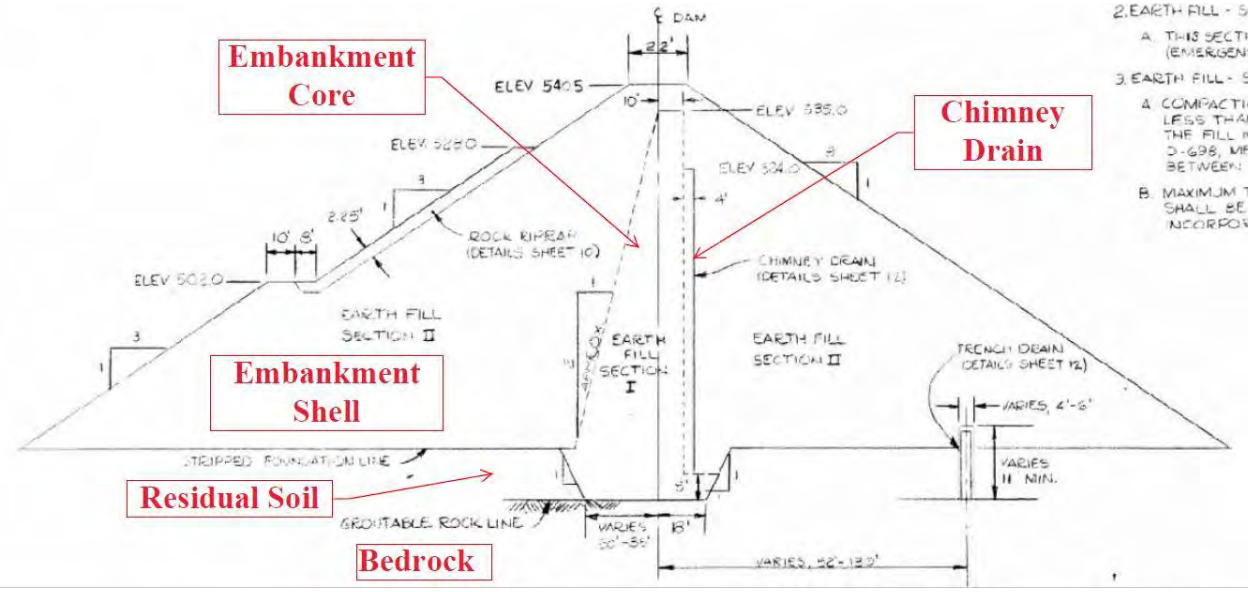


Figure 4: Typical embankment cross section.
(From Original Drawing Set: Sheet 11, 1972)

5.2.1 Embankment Shell

Embankment Shell samples were visually classified as Silty SAND with varying amounts of gravel (SM). One sample was laboratory classified as Silty SAND with gravel (SM). The average natural moisture content between two samples was 17.1 percent. One sample tested for plasticity was non-plastic (NP). Of five grain size analyses, the fines content ranged from 27.5 to 34.5 percent, averaging 31.6 percent. The gravel content ranged from 14.3 to 32.1 percent, averaging 23.6 percent. One compaction test was performed on the bulk sample taken from a hand dug test pit of the embankment shell at Boring 602 using Standard effort (ASTM D698). The maximum dry density for the test was 116.4 pounds per cubic foot (pcf), and the optimum moisture content was 13.8 percent.

One Consolidated Isotropically Undrained (CIU) Triaxial Test with porewater pressure measurements was performed on a remolded Embankment Shell sample compacted to 95 percent of its maximum dry density at within two percent of its optimum moisture content. The sample was tested using confining pressures representing a typical depth of Embankment Shell material and a wide range of confining pressures to provide a well-defined failure envelope. The confining pressures used were 10, 20, and 40 pounds per square inch (psi). The results of this test are shown in **Table 1** and **Appendix E**.

Table 1: Embankment Shell Soil Strength Parameters

Boring No.	Sample No.	Depth (ft)	USCS Classification	Total Strength		Effective Strength	
				φ (deg)	c (psf)	φ' (deg)	c' (psf)
602	BULK	1.0-2.0	SM	18.7	530	29.6	180

φ = angle of internal friction

5.2.2 Embankment Core

Embankment core samples were visually classified as Silty SAND with varying amounts of gravel (SM), Clayey SAND with varying amounts of gravel (SC), and Sandy Lean CLAY (CL). Three samples were laboratory classified as Silty SAND (SM) and Sandy Lean CLAY (CL). The average moisture content of the tested Embankment Core samples was 19.0%. Two of the three samples tested for plasticity were non-plastic (NP), and one plastic sample had a Liquid Limit of 34, a Plastic Limit of 22, and a Plasticity Index of 12. The fines content ranged from 16.3 to 66.1 percent, averaging 44.5 percent. The gravel content ranged from 2.2 to 32.0 percent, averaging 13.1 percent.

Unit weight testing was performed on Shelby tube samples taken from Borings 1, 2, and 3. The dry unit weights measured between 81.5 and 108.7 pcf, averaging 98.1 pcf. Specific gravity and permeability testing was performed on sample T-1 from Boring 2. The specific gravity of soils measured 2.80, and the specific gravity of fine aggregate measured 2.54. The permeability was tested using a falling head test in a flexible-wall permeameter and measured $9.3x10^{-6}$ cm/s, as shown in **Table 2** and **Appendix E**.

Table 2: Embankment Shell Hydraulic Conductivity

Boring No.	Sample No.	Initial Dry Density (pcf)	Depth (ft)	USCS	Hydraulic Conductivity	
					cm/sec	ft/day
2	T-1	101.9	25.0-26.2	SM	9.3E-06	2.6E-02

One Consolidated Isotropically Drained (CID) Triaxial Test and one CIU Triaxial Test with porewater pressure measurements were performed on Embankment Core samples, each from undisturbed Shelby tube samples obtained from Borings 2 and 3, respectively. The samples were tested using confining pressures representing the depth of the sample taken and a wide range of confining pressures to provide a well-defined failure envelope. The confining pressures used for both samples Boring 2, Sample T-2 (31.6 feet to 32.6 feet) and Boring 3, Sample T-1 (25.4 feet to 26.9 feet) were 15, 25, and 35 psi. The results of these tests are shown in **Table 3** and **Appendix E**.

Table 3: Embankment Core Soil Strength Parameters

Boring No.	Sample No.	Depth (ft)	Total Strength		Effective Strength	
			φ (deg)	c (psf)	φ' (deg)	c' (psf)
2	T-2	31.6-32.6	-	-	41.3	0
3	T-1	25.4-26.9	27.0	0	34.4	0

5.3 Residual Soil

Residual Soil was encountered within all borings at the project site except at Borings 1, 2, and 3. The variations in the residual soil layer are described in the following paragraphs organized by location:

5.3.1 Residual Soil Beneath the Embankment Fill

Residual soil was not identified in any of the Embankment Core borings, but based on the original design drawings, it is believed that a residual soil layer exists between the Embankment Fill and the underlying bedrock under the Embankment Shell zone, both upstream and downstream of the core trench as confirmed by Boring 601. Residual soil measured at Boring 601 is approximately seven feet thick. The soils were visually classified as Silty GRAVEL with sand (GM), and Silty SAND with a small amount of gravel (SM). A selected sample taken from the Silty SAND (SM) stratum was analyzed in the lab and found to have a natural water content of 11.4%. The fines and gravel contents of the sample tested were 44.3 and 0.8 percent, respectively.

5.3.2 Residual Soil located on the Left Abutment

Nearly all soil sampled in the left abutment was considered residual because it is in a cut area, with only a few feet of possible fill encountered in Boring 702. The Residual soil thickness at the center of the left abutment, measured at Boring 702, is approximately 38 feet.

Residual soil samples on the left abutment were visually classified as Silty GRAVEL with sand (GM), Silty SAND with varying amounts of gravel (SM), Clayey SAND with varying amounts of gravel (SC), and Sandy Lean CLAY (CL). Select samples were laboratory classified as Silty SAND (SM) and Silty GRAVEL with sand (GM) within the top ten feet. The average natural water content between two samples was 24.5 percent. Two samples within the top ten feet were tested for plasticity. Sample S-1A in Boring 701 was plastic with a Liquid Limit of 33, a Plastic Limit of 28, and a Plasticity Index of 5 while sample S-3 in Boring 703 was found to be non-plastic (NP). The fines content of six samples tested ranged from 22.1 to 47.6 percent, averaging of 35.1 percent. The gravel content ranged from 0.0 to 37.3 percent, averaging 15.9 percent.

Unit weight testing was performed on Shelby tube sample T-1 from Boring 702; its dry unit weight measured 81.4 pcf.

5.3.3 Residual Soil within the ASW

Nearly all soil sampled in the ASW was considered residual because it is in a cut area, with only a small amount of apparent fill encountered in Boring 211. The Residual soil thickness within the ASW measured between zero feet (Boring 204) and 39 feet (Boring 207), with an average thickness of 25 feet.

ASW soil was visually classified as Silty GRAVEL with sand (GM), Silty SAND with varying amounts of gravel (SM), Clayey SAND (SC), Silty Clayey SAND (SC-SM), Sandy SILT (ML), Sandy Lean CLAY (CL), and Sandy Silty CLAY (CL-ML). Select samples were laboratory classified as Silty GRAVEL with sand (GM), Silty SAND with varying amounts of gravel (SM), and SILT with varying amounts of sand (ML). The average moisture content of ASW residual soil was 21.4 percent. Ten out of eleven samples tested for plasticity were non-plastic (NP). Only sample S-2 collected in Boring 212 was plastic with a Liquid Limit of 37, a Plastic Limit of 25, and a Plasticity Index of 12. The fines content ranged from 12.3 to 70.9 percent, averaging 37.4 percent. The gravel content ranged from 0.0 to 67.2 percent, averaging 12.4 percent.

Unit weight testing was performed on four Shelby Tube samples. Dry unit weights ranged from 93.0 to 107.3 pcf and averaged 102.5 pcf. Specific gravity testing was performed on sample T-1 from Boring 202. The specific gravity of soils result was 2.74, and the specific gravity of fine aggregate result was 2.55.

During the investigation, cohesive materials were generally not encountered in the borings performed in the auxiliary spillway. There was one sample (S-2) collected in Boring 212 located downstream of the exit channel of the spillway which was classified as Silty GRAVEL with Sand and had a plasticity index greater than eight. However, since it occurred downstream of the auxiliary spillway and was isolated, it is not believed to be representative of the very silty and sandy stratum. As a result of this, no tests for dispersive soils per ASTM D4221/D6572 were prepared.

5.3.4 Residual Soil beyond the ASW Outside Slope

All soil sampled in the area beyond the ASW right (outside) slope was considered residual because the borings are located in a wooded, undisturbed area. Residual soil thickness beyond the ASW right slope measured between 8 feet (Boring 805) and 78 feet (Boring 803), with an average thickness of 37 feet.

Residual Soil samples beyond the ASW outside slope were visually classified as Silty SAND with varying amounts of gravel (SM), Clayey SAND (SC), Sandy Lean CLAY (CL), Sandy SILT (ML), and Sandy ELASTIC SILT (MH). Select samples were laboratory classified as Sandy ELASTIC SILT (MH), SILTY SAND (SM), and SILTY GRAVEL with sand (GM). The average moisture content of five tested samples was 17.6 percent. Two of the three samples tested for plasticity were non-plastic (NP), and the one plastic sample had a Liquid Limit of 57, a Plastic Limit of 46, and a Plasticity Index of 11. The fines content ranged from 18.1 to 68.3 percent, averaging 35.6 percent. The gravel content ranged from 0.0 to 44.5 percent, averaging 13.4 percent.

One CIU Triaxial Test with pore pressure measurements was performed on a boring taken beyond the outside slope of the ASW: sample T-2 (15.2 feet to 16.7 feet) obtained from Boring 803. The sample was tested using confining pressures representing the depth of the sample taken and a wide range of confining pressures to provide a well-defined failure envelope. The confining pressures used for the sample were 15, 25, and 35 psi. The result of this test is shown in **Table 4** and **Appendix E**. The sample's dry unit weight was also measured and the result was 95.1 pcf.

Table 4: Residual Soil Strength Parameters

Boring No.	Sample No.	Depth (ft)	USCS	Total Strength		Effective Strength	
				φ (deg)	c (psf)	φ' (deg)	c' (psf)
803	T-2	15.2-16.7	SM	26.3	0	33.1	0

5.4 Decomposed Rock

Decomposed Rock was encountered directly above bedrock in the majority of borings within the left abutment, ASW, and area beyond the ASW outside slope. It was defined per ASTM D1586 as the stratum for which blow counts driving the split spoon sampler were greater than 50 blows per six inches.

The decomposed rock layer ranged from approximately zero to 34 feet thick and averaged 9.5 feet thick. Twenty-seven samples taken from the subsurface investigation were determined to be Decomposed Rock. The material recovered in the split spoon was most often visually classified as slightly moist, brown to gray, non-plastic, fine to coarse Silty SAND with varying amounts of gravel (SM). Other visual classifications included Silty GRAVEL with sand (GM), Poorly-Graded SAND with silt (SP-SM), Silty Clayey SAND with gravel (SC-SM), and Sandy SILT (ML).

Two Decomposed Rock samples were laboratory classified as Sandy SILT (ML) and Silty GRAVEL with sand (GM). Two samples were laboratory tested for moisture content, averaging 13.6 percent. The fines content ranged from 15.2 to 60.5 percent, averaging 31.9 percent, and the gravel content ranged from 0.0 to 63.6 percent, averaging 19.8 percent. One sample was tested for plasticity and found to be non-plastic (NP).

5.5 Bedrock

The bedrock encountered in borings generally matched the Morgan Run Formation lithology described in Muller's 1994 geologic map. Rock core samples were predominantly weak to strong, slightly to highly weathered, slightly to intensely fractured, fine to medium grained, brownish gray to dark gray MICA SCHIST, with many samples containing quartz inclusions. Fractures were predominantly slightly rough to rough with spotty to partial iron and dark brown staining infill, with some fractures containing soil infill.

Unit weight and unconfined compressive strength testing were performed on select rock samples. Between four samples, the dry unit weight of the rock ranged from 170.1 to 178.9 pcf, averaging 174.2 pcf. and the unconfined compressive strength of the rock ranged from 6353 to 19296 psi, averaging 10412.5 psi. See **Appendix D** for a summary of the laboratory results.

5.6 Evaluation of Existing Borrow Sources for Future Use

In accordance with the scope of work, a brief review of available data was made to evaluate the feasibility of using the previously used borrow areas as sources of additional fill for implementation of future dam modifications. The as-built plans (SCS, 1975) identified two borrow areas used for construction of the embankment. Borrow I is located approximately 100 feet to the east (left) of the left downstream groin of the embankment. This area is approximately 3.5 acres in area and supplied the majority of the soils used to construct the Embankment Core (SCS, 1975). At the end of the project, approximately 22,500 cubic yards of excavated material from the ASW

was permanently stockpiled in this area. It is not clear if there is any remaining material in Borrow I suitable for use in the Embankment Core zone. Samples taken from borings performed on the embankment centerline (1, 2, and 3) indicate that the core material became progressively less plastic with fewer fines and greater amounts of coarser material toward the crest of the dam, indicating that the Embankment Core zone material in Borrow I may have been exhausted as the dam construction reached the crest elevation.

The ASW was the location of the second borrow source, Borrow II, and excavated material from the ASW was generally used to construct the Embankment Shell zones.

It is likely that most future modifications of the dam would involve primarily expanding the Embankment Shell zones either due to a crest raise or to broaden and / or buttress the slopes. Specifications for material to be used for Embankment Shell zones are typically less restrictive than those for Embankment Core zones. The materials may have higher contents of coarse materials and generally do not need to be cohesive. Since the material excavated from the ASW was used to construct the Embankment Shell zones, the same material, the latter portion of which is permanently stockpiled in Borrow I, could be acceptable for use as Embankment Shell zone material. In addition, the borings taken outside of the southwest (right) side slope of the ASW indicate similar materials to those found in the ASW itself. Therefore, any modification to the dam which involves additional excavation of the ASW into the right side slope could provide suitable material for placement in the Embankment Shell zones of the dam.

In summary, the material from both borrow areas (Borrow I and Borrow II) identified on the as-built drawings would be acceptable sources for borrow material for the Embankment Shell zones. However, it is not clear if Borrow I would have any available acceptable material remaining for use in the Embankment Core Zone. It should be noted that this type of material would not be required unless a future modification involves a raising of the pool, which would require a raising of the dam crest and the Embankment Core zone.

6. Seismic Refraction Survey

6.1 Seismic Refraction Methodology, Field Investigation and Data Processing

The seismic refraction (SR) method consists of transmitting seismic energy into the ground and recording the arrival of the direct and refracted compressional-waves (P-waves) at preset distances along the ground surface. Seismic energy travels through each subsurface layer with a characteristic P-wave velocity that is dependent on the density, compressibility, pore space, and fluid content of the geologic material. By evaluating seismic velocities, as inferred from the recorded first arrival travel times, and the seismic velocity contrasts, the investigator can interpret the configuration and depths of the subsurface geologic materials.

The SR survey was completed between January 14 and 15, 2020 by AECOM. Data were collected along four lines in the ASW. Lines 1 and 3 were collected in the southwest to northeast orientation and Lines 2 and 4 were collected in the northwest to southeast orientation, as shown in **Figure 5**. The array (spread) configuration, geophone coordinates, and file storage parameters were assigned using the Geometrics Seismodule Controller Software.

Figure 5: Seismic refraction survey lines

The seismic pulse was generated using a 16-pound sledgehammer and an aluminum strike plate. Twenty-four (24) spike or plate mounted geophones were coupled to the ground surface at 10-foot intervals, generating 230-foot-long spreads. Each spread consisted of approximately seven individual seismic source locations (i.e., shot locations- location of seismic source relative to the

geophone spread). A maximum of ten individual seismic source strikes were recorded at each shot location. The number of strikes at each shot location was determined in the field with more strikes generally improving the quality of the acquired data. Lines 1 and 3 consisted of a single 230-foot-long spread. Lines 2 and 4 were completed using two overlapping 230-foot-long spreads to reach the desired survey length.

Processing the seismic refraction data involved the construction of a time-distance plot for each seismic line segment. The first step in this process involved analyzing the seismic recordings to select the first arrival time for the direct or refracted P-wave at each geophone location for each shot record. This was done using the SeisImager Pickwin95 (version 5.2.1.3) software program by Geometrics, Inc. These arrival times were then plotted versus the geophone location (distance) in SeisImager Plotrefra (version 3.1.0.5). Velocities of each of the interpreted seismic layers were then calculated based on the slopes of the best-fit lines through the plotted p-wave time-distance data. The data were processed utilizing a gradational velocity model approach. In general, near surface conditions consist of a lower velocity overburden material overlying a higher velocity variably weathered bedrock. The conventional seismic refraction analysis method assumes relatively homogenous (i.e. lateral continuous constant velocity) subsurface conditions to calculate average velocities for each assigned vertical layer (generally two or three layers are assigned). A gradational velocity model is generally more appropriate for a residual weathering profile characterized by progressively less weathering with depth. It is also appropriate when laterally variable velocities may be encountered in complex geologic settings or to identify lateral variability. A significant limitation of the gradational method is that it generates a gradient irrespective of whether a gradient exists. Therefore, in the case of a distinct velocity change (e.g. soil over competent rock) the boundary must be interpreted from zones of maximum gradient. It has also been reported that velocity estimates at these boundaries may be low. For this reason, it is advisable to use caution if assessing rippability (ease of excavation) and utilize all available information.

Seismic P-wave velocity (Vp) data can be used to evaluate the excavate-ability of the subsurface materials. Caterpillar, Inc. publishes information documenting the relationship between seismic compressional wave velocity and rippability for various rock types. The rip-ability chart indicates that subsurface materials such as schist are generally rip-able at P-wave velocities up to approximately 7,200 feet per second (fps) and are marginally rip-able up to 9,000 fps using a D9 tractor with a single or multi-shank ripper. This information provides an evaluation of the relative strength of the encountered materials. Generally, slower velocities are more indicative of softer, weaker overburden material and faster velocities more indicative of variably-weathered rock to competent rock.

6.2 Seismic Refraction Results

The results of the SR survey for Lines 1 and 3 are presented on Figure F-2 and Lines 2 and 4 are presented on Figure F-3 in **Appendix F**. The SR profiles are displayed as color-enhanced two-dimensional profiles of the modeled compressional wave velocities. The velocity models generally correlate well with available boring logs regarding relative soil density or indication of bedrock. Soils having high relative density based on N values correspond to increased velocities in the SR profiles, similar to what would be expected from a soft soil to rock interface. The variation in geology shown in the boring logs is complex, with rapid changes in overburden material, variations in weathering, and abrupt changes in the depth to rock. All these variables impact the ability of any geophysical model to produce an accurate representation of the

subsurface. It appears prudent to use a combination of the SR and boring logs to characterize the site into three categories consisting of 1) soft overburden, 2) dense overburden/weathered rock and 3) relatively competent rock. Soft overburden material are shown above the thin dashed black lines (darker blue contours less than 4,000 fps), dense soils or weathered rock below the thin black line (primarily green contours greater than 4,000 fps and less than 9,000 fps) and more competent rock below the thick dashed black lines (orange to red contours greater than 9,000 fps). Interpretations may vary from the generalized velocities referenced above depending on a comparison with boring logs. Because the borings may be offset from the SR lines, they were used as a general guide, but characterization of the bedrock surface may be shown crossing through overburden layers of the displayed borings. Indications of a shallow water table shown in some of the borings may also be impacting the results. P-wave velocities in the range of 5,000 fps (approximate speed of sound through water) are likely indicative of saturated overburden material. However, the boring logs also indicate a coincidence between indicated groundwater levels and an increase in density where the 5,000 ft/s velocities are indicated on the refraction profiles. The results are presented in **Appendix F**.

7. Seismic Evaluation

The analysis performed on Piney Run Dam to determine seismic hazard potential is based on USACE ER 1110-2-1806 *Earthquake Design and Evaluation for Civil Works Projects* (2016) and the requirements of NRCS Technical Release TR-60 *Earth Dams and Reservoirs* (2019).

Based on the United States Geological Survey (USGS) Earthquake Hazards Program Quaternary Fault and Fold Database of the United States (https://earthquake.usgs.gov/hazards/qfaults/), the Central Virginia Seismic Zone (Class A) is the closest identified fault location to Piney Run Dam. Located between Richmond, Virginia and Charlottesville, Virginia, these faults are located approximately 128 miles from Piney Run Park. The proximity of the Central Virginia Seismic Zone to Piney Run Dam is presented in **Appendix G**.

Class A quaternary faults are defined as faults where, "Geologic evidence demonstrates the existence of a quaternary fault of tectonic origin, whether the fault is exposed for mapping or inferred from liquefaction or other deformational features" (https://earthquake.usgs.gov/hazards/qfaults/background.php#class).

According to Crone and Wheeler (2000), the Central Virginia Seismic Zone consists of one site with a few, small Holocene sand dikes and a second site with a few, small possible dikes of early Holocene or lesser age. The largest historical earthquake occurred in this zone in 1875 with a historical magnitude (M) of 4.8. Historical magnitude 4.0 or greater earthquakes of record and any historically active faults within a 100 km (62-mile) radius of the site are described below and presented in **Appendix G**.

According to the Advanced National Seismic System (ANSS), there has been one magnitude 4.0, or greater, earthquake within a 100 km (62-miles) radius of Piney Run Dam (https://earthquake.usgs.gov/earthquakes/map/). This occurred in Conestoga, Pennsylvania (approximately 49.5 miles from Piney Run Dam) on April 23, 1984 and registered at a magnitude of 4.2. There have been eighteen (18) earthquakes greater than 2.5 M within a 100 km radius of Piney Run Dam since 1900. The closest event (2.6 M) occurred approximately four miles Northeast of Eldersburg, Maryland. (approximately 5.75 miles from Piney Run Dam) on January 13, 1990.

Peak ground acceleration (PGA) was determined based on USACE ER 1110-2-1806 (2016). Piney Run Dam is a High Hazard dam, which is a determining factor in PGA return period selection. For this site, a return period of 10,000 years was selected as there is potential for loss of life from failure at normal pool levels, which means the dam would be categorized as a high consequence structure in the event of a seismic failure and thus subjected to an analysis return period of 10,000 years per TR-60 requirements. A shear wave velocity of 760 m/sec was selected as it is on the boundary of Class B "rock" and Class C "very dense soil and soft rock" site classifications from American Society of Civil Engineers (ASCE) Standard 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (2016). From the USGS Unified Hazard Tool, the PGA is projected to be 0.19g as shown in **Figure 6** (https://earthquake.usgs.gov/hazards/interactive/).

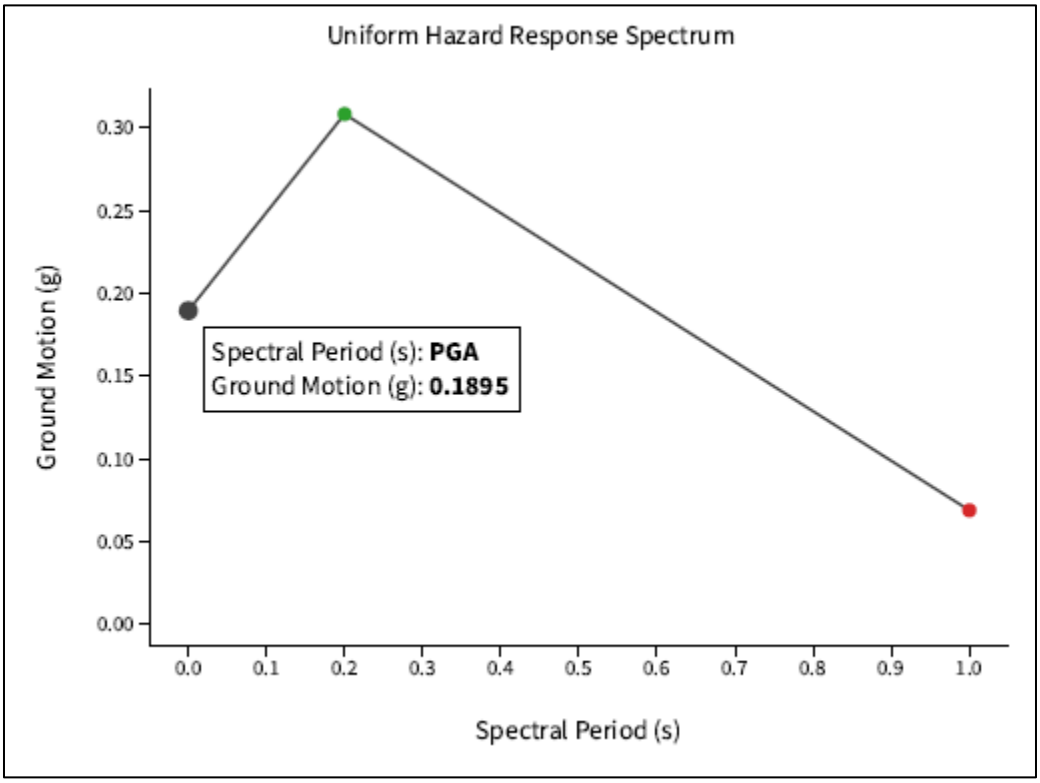


Figure 6: Peak ground acceleration.

Based on TR-60 requirements, dynamic stability analysis is required for all embankment dams. Piney Run dam is constructed on Mica Schist and a dense Residual soil foundation. Slope Stability analyses (**Section 9**) show Piney Run Dam exceeds minimum factors of safety for stability. Given the 10,000 year PGA is less than 0.20, special seismic analysis is not required.

8. Modeling Analysis

Computer modeling analyses were performed on Piney Run Dam to determine the slope stability under existing conditions. The computer modeling analysis was performed in general accordance with TR-60 requirements. Seepage and slope stability analyses were performed using GEOSLOPE Geostudio 2016 (Version 8.16.2.14053) software. Spencer's method, which satisfies all static equilibrium conditions, was used in these analyses.

The cross section analyzed at Piney Run Dam is perpendicular to the dam crest centerline approximately 20 feet northeast of the PSW conduit. This location was chosen based on subsurface investigation as it is located at the approximate maximum height of the dam. Additionally, this cross section is centrally located near existing piezometers. An example of the cross section analyzed is shown in **Figure 7**. The location of the soil and rock layers are based on subsurface investigation by AECOM described in this report and is supplemented with historical documentation. Embankment core, cutoff trench, chimney drain, and trench drain dimensions were based on Piney Run Dam design drawings, Sheet 11 (SCS, 1972).

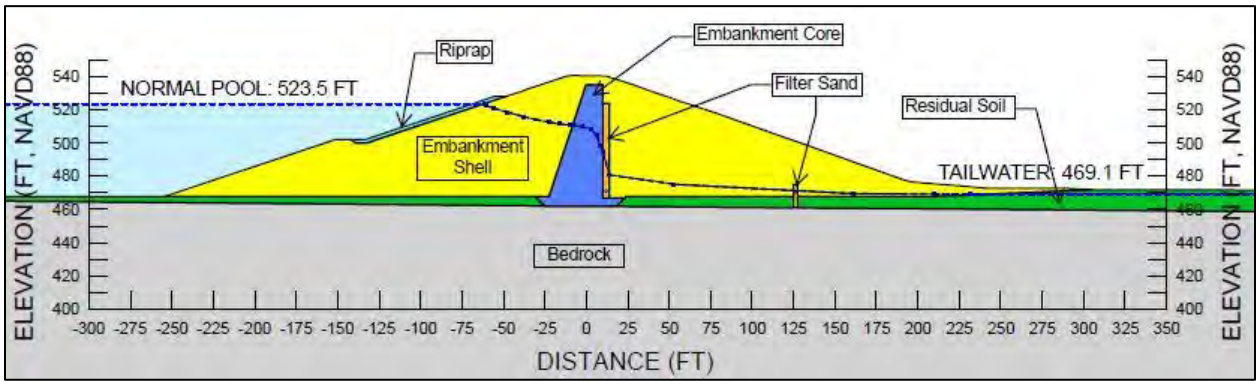


Figure 7: Analyzed embankment cross section

8.1 Material Properties

Material properties for seepage and slope stability analyses were based on laboratory investigation, historical documentation, and engineering judgement.

8.1.1 Seepage Analysis Material Properties

Hydraulic conductivity for embankment soils at Piney Run Dam is based on laboratory testing and empirical values. One hydraulic conductivity test was performed on sample T-1 (25.0 – 26.2 feet, depth) obtained from Boring 2 for the embankment core. The hydraulic conductivity of the embankment core undisturbed sample (47.5 percent fines) is 9.3E-06 cm/sec (2.6E-02 ft/day).

For the Embankment shell, residual soil, and drain material, hydraulic conductivity was estimated based on the Kozeny-Carman equation (Duncan, 2008). The Kozeny-Carman equation is a method used to correlate hydraulic conductivity with material grain size. One bulk sample from the embankment shell was compared with estimated values from eight embankment core values. Comparison showed there was no significant difference in hydraulic conductivity between the Embankment Shell (average 31.6 percent fines, 8.27E-01 ft/day) and the Embankment Core (average 44.5 percent fines, average 9.66E-01 ft/day).

Empirical values were obtained through the following literature sources to correlate the estimated values:

- Duncan, M. (2008). "Methods for Evaluating Permeability of Soils". Virginia Tech CGPR No. 51. Blacksburg, VA
- Natural Resources Conservation Service. 2012. National Engineering Handbook, Part 631 Geology, Chapter 3: Engineering Classification of Earth Materials. U.S. Department of Agriculture.
- Natural Resources Conservation Service. (2012). National Engineering Handbook, Part 631 Geology, Chapter 4: Engineering Classification of Rock Materials. U.S. Department of Agriculture.
- United States Bureau of Reclamation. (2014). Design Standards No. 13 Embankment Dams, Chapter 8: Seepage.

Anisotropy estimates of Embankment Core, Embankment Shell, and Residual soils were based on ranges of accepted values found in the United States Bureau of Reclamation (USBR) Design Standards No. 13 *Embankment Dams, Chapter 8: Seepage* (2014). Estimated values were selected from these ranges through calibration of the seepage model to observed levels in the observation wells of the dam. For the Embankment Core and Shell, the vertical hydraulic conductivities were selected to be 1/10 and 1/5 the horizontal hydraulic conductivity, respectively. For Residual Soil, vertical hydraulic conductivity was selected to be 1/2 of the horizontal hydraulic conductivity.

Bedrock hydraulic conductivity was estimated based on NRCS National Engineering Handbook Part 631, Chapter 4, *Engineering Classification of Rock* (2012) and USBR Design Standards No. 13 *Embankment Dams, Chapter 8: Seepage* (2014) for Mica Schist, which was identified as the predominant rock at Piney Run Dam during the geotechnical investigation and is a metamorphic rock.

Selected values for hydraulic conductivity are presented in **Table 5**.

Table 5: Hydraulic Conductivity Material Properties

Material Description	Hydraulic Conductivity				
	k_h (cm/s)	k_h (ft/day)	k_v (cm/s)	k_v (ft/day)	k_h/k_v
Embankment Core	9.31E-05	2.64E-01	1.03E-05	2.93E-02	10
Embankment Shell	3.53E-04	1.00E+00	7.06E-05	2.00E-01	5
Residual Soil	2.82E-04	8.00E-01	1.41E-04	4.00E-01	2
Bedrock	1.00E-04	2.83E-01	1.00E-04	2.83E-01	1
Filter Sand	1.23E-02	3.50E+01	1.23E-02	3.50E+01	1

8.1.2 Slope Stability Analysis Material Properties

The material properties (**Table 6**) used for slope stability analysis are based on laboratory testing and engineering judgement. One CID Triaxial Test and one CIU Triaxial Test with pore water measurements (ASTM D 4767) were performed on the Embankment Core. One CIU Triaxial Test was performed on a remolded specimen from a bulk sample of the Embankment Shell.

The Residual soil effective strength friction angle was estimated from a CIU Triaxial Test performed on a sample from the crest of the ASW outside slope (803, T-2). Boring 803, sample T-2 soil classified as Silty SAND (SM) with approximately 40% fines. The residual soil unit weight was based on the average of the laboratory-measured unit weights from the same area, the ASW outside slope, for consistency. Data from this area were used because there was insufficient recovery in the undisturbed sample from the toe boring (Boring 601).

Four compressive strength tests were performed with an average compressive strength of 10412.5 psi. The minimum compressive strength of these tests was 6353 psi. Cohesion equaling one-half compressive strength is based on assuming a zero-degree friction angle and cohesion equal to one-half the difference between major and minor principal stresses. Bedrock cohesion was assumed to be one-half of the unconfined ultimate compressive strength. As the compressive strength test is unconfined, the minor principal stress is zero psi. Therefore, the Mohr's circle radius is equal to one half of the major principal stress, which is the resultant compressive strength.

However, to account for potential variances and/or weathering within the Bedrock, only a percentile of the cohesion of Bedrock was assumed in the analyses. For these analyses, approximately 25 percent of the laboratory cohesion based on engineering judgment was assumed to create a conservative model. This correlates to a cohesion of 794 psi (114,336 pounds per square foot)

Saturated unit weight of the Embankment Core and Embankment Shell were estimated based on laboratory test results for dry unit weight, average moisture content, and specific gravity of the Embankment Core, as undisturbed samples of the Embankment Shell were unable to be obtained. Saturated unit weight of the Residual Soil beneath the embankment shell was estimated based on laboratory results from Residual Soil encountered beyond the ASW outside slope, because there was insufficient recovery in the undisturbed sample from the toe boring (Boring 601).

Bedrock dry unit weight was determined during laboratory testing of compressive strength. Saturated unit weight of rock was conservatively estimated based on dry unit weight.

Table 6: Slope Stability Material Properties

Material	Saturated Unit Weight*	Effective Strength		Total Strength	
	(pcf)	Effective Cohesion (psf)	Effective Friction Angle	Cohesion (psf)	Friction Angle
Embankment Fill - Shell	135	180	29.6	530	18.7
Embankment Fill - Core	135	0	34.4	0	27.0
Residual Soil	138	0	33.1	0	26.3
Filter Sand	130	0	35	0	35
Rip Rap	135	0	40	0	40
Bedrock	185	114,336	0	114,336	0

*estimated

8.2 Boundary Conditions for Software Modeling

The seepage analyses were performed using GEOSLOPE 2016 SEEP/W. At the reservoir, a boundary condition for the head elevation of the pool (normal pool or flood surcharge pool) being analyzed was used in each model. Boundary conditions were set within SEEP/W to simulate observed conditions at the dam for normal pool models. Normal Pool reservoir elevation was set at the reservoir elevation measured during inspection (EL. 523.5 feet). The normal pool tailwater elevation was assumed to be at EL. 469.1 feet based on 72-hr groundwater reading in Boring 601 (measured EL. 469.1 feet).

Flood surcharge pool, based on freeboard hydrograph level, was selected to be one foot below the crest of dam (EL. 539.5 feet). Tailwater at ASW crest reservoir pool elevation was assumed to be the elevation at 75 percent of the PSW conduit height at the outlet (EL. 469.41 feet). Tailwater elevation at flood surcharge pool was analyzed for two scenarios: (1) assumed one foot higher than tailwater at ASW crest pool, and (2) due to seepage through the dam, downstream existing ground surface elevation. Finally, PSW drain elevation, which refers to the base of the chimney drain, was utilized as a boundary condition.

The boundary conditions used for seepage analysis are summarized below:

- Normal Pool Elevation: 523.5 feet
- Flood Surcharge Pool (ASW crest) Elevation: 531.0 feet
- Flood Surcharge Pool Elevation: 539.5 feet
- Tailwater Elevation (Normal Pool): 469.1 feet
- Tailwater Elevation (ASW crest): 469.41 feet
- Tailwater Elevation (Flood Surcharge Pool): (1) 471.41 feet and (2) existing ground surface elevation
- PSW Drain Elevation: 470.0 feet

8.3 Phreatic surface

The phreatic surface within the embankment at Piney Run Dam for existing conditions was estimated based on open well readings and 24-hour minimum observations from 2019-2020 borings. Measured well data, laboratory test data and empirical values from literature for hydraulic conductivity and anisotropy (See **Section 7.1**) were used to conservatively estimate the phreatic surface at Piney Run Dam during flood surcharge conditions. Based on TR-60, flood surcharge elevation is the reservoir at freeboard hydrograph level. For this analysis, flood surcharge elevation was assumed to be one foot below top of dam elevation at EL. 539.5 feet.

9. Slope Stability Analyses

Slope Stability analyses were performed on the previously described cross section using the 2019 and 2005 versions of TR-60 guidelines for existing conditions. The analyses performed measured slope stability for rapid drawdown conditions for the upstream slope, steady-seepage slope conditions for full and normal pool conditions and seismic analysis at normal pool conditions for the downstream slope. Slope stability analyses were performed using GEOSLOPE 2016 SLOPE/W (Version 8.16.2.14053). Spencer's method of slices, which satisfies all conditions of static equilibrium, including horizontal and vertical force equilibrium, and moment equilibrium, was used for the analysis. Minimum depth for a failure was set at two feet. Failure was considered for circular failure planes through the crest of the dam and exiting at or near the toe as well as shallow failure within the embankment slope.

9.1 Rapid Drawdown

Rapid drawdown slope stability analysis for the upstream slope was performed using the Slope Stability for Rapid Drawdown Method developed by Duncan, Wright, and Wong (1990) and detailed in USACE EM 1110-2-1902 *Slope Stability* (2003). This method uses two phreatic surfaces. The initial phreatic surface is developed for steady-state conditions at the maximum storage pool elevation. The pool level is then assumed to rapidly drawdown to the lowest gated or ungated outlet.

Drawdown of the reservoir is modeled as instantaneous from the normal pool elevation to the reservoir bottom. The phreatic surface within the embankment is modeled as being unchanged. For this analysis, both total stress and effective stress parameters are utilized. This is a conservative approach as actual drawdown would not likely occur instantaneously.

9.2 Steady-State without Seismic Forces

Steady-State conditions were evaluated for the measured normal pool (EL. 523.5 feet) and flood surcharge pool elevations (EL. 539.5 feet) under existing conditions for the downstream slope of the embankment. Flood surcharge condition was conservatively assumed to be one foot below top of dam elevation. Effective stress drained properties were used for material properties.

9.3 Steady-State with Seismic Forces

For Steady-State with seismic forces, a horizontal acceleration constant is added to the seepage analysis model to simulate seismic conditions. While not required in the current 2019 version of TR-60, Seismic modeling analysis for Piney Run Dam was performed using USACE ER 1110-2-1806 *Earthquake Design and Evaluation for Civil Works Project*s criteria and the USGS Unified Hazard Tool to determine PGA. As detailed in **Section 6**, a 10,000 year return rate (0.5 percent exceedance in 50 years) was analyzed and the resultant PGA was 0.1895. A minimum required Factor of Safety of 1.1 was assumed based on TR-60 (2005) guidelines.

9.4 Slope Stability Analyses Results

Slope-stability of the embankment slopes was analyzed for loading conditions detailed in TR-60 (2019) for existing conditions. These results are presented in **Table 7** below. The minimum factors of safety for all analyses performed are provided in **Appendix H.**

The results of the analyses show that existing conditions at Piney Run Dam meet the requirements for slope stability for all conditions analyzed.

Table 7: Existing Slope Factors of Safety

Loading Condition (Embankment)	Factor of Safety	
	Minimum Required Factor of Safety	Existing Conditions
Rapid Drawdown (Instantaneous)	1.3	1.4
Normal Pool El. 523.5 ft (Steady Seepage without Seismic)	1.5	2.1
Flood Surcharge Pool El. 539.5 ft (Steady Seepage without Seismic)	1.4	1.4
Normal Pool El. 523.5 ft (Steady Seepage with Seismic)	1.1*	1.3

***Based on NRCS (2005) TR-60**

10. Filter Compatibility

Analysis was performed to determine if soil materials located at Piney Run Dam are compatible for filtration and/or drainage. Filtration inhibits the movement of fine material particles between soils. Particle movement between soils may initiate internal erosion and piping. Drainage is analyzed to determine if groundwater can easily pass between soils. Obstructed groundwater flow paths can cause increased pore pressures within the embankment, potentially causing heave and/or seepage on the downstream embankment slope.

Both the chimney filter and toe drains are two-stage filters using the same material specification for the coarse and fine-grained stages respectively. The fine-grained chimney filter material as specified in the as-built drawings (Soil Conservation Service, 1975) ranges in size from #200 sieve (0.075 mm) to 3/8-inches (9.5 mm) and is similar in gradation to the coarse limit of ASTM C-33 Fine Aggregate. The coarse-grained material as specified on the same as-built drawing ranges in size from #16 sieve (1.2 mm) to three inches and is a mix of 60 percent #2 gravel and 40 percent #5 gravel. A review of the specified materials against current NRCS filter gradation guidelines (NRCS, 2017) was completed and found that the fine-grained filter specification was compatible with the soils used in both the Embankment Shell and Embankment Core materials based on soil samples taken during the 2019-2020 subsurface geologic and geotechnical investigation. The analysis also showed that the coarse-grained filter specification as specified in the as-built drawings was generally compatible with the fine-grained filter specification. It should be noted that the coarse-grained filter specification lies partially outside the maximum allowable limits for larger grain sizes (greater than the 60th percentile diameter).

11. Limitations

Interpretation of general subsurface conditions presented herein is based on the soil, rock, and groundwater conditions encountered in the limited number of soil borings. Although representative portions of the samples taken were tested, subsurface conditions may vary outside of the exploration locations. This report does not reflect any variations that may occur across the site in areas not sampled. The nature and extent of such variations may not become evident until construction.

This report has been prepared for the specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices and standard of care. No warranty, express or implied, is provided. In the event that any changes in the nature of the project as outlined in this report are planned, the conclusions contained in this report will not be considered valid unless the changes are reviewed, and the conclusions of this report are modified or verified in writing by AECOM.

12. References

American Society of Engineers. (2016) Standard 7-16, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures.*

Charles P. Johnson and Associates, Inc. (2016). *Piney Run Dam, Dam Breach Analysis*.

Crone, A. J., and Wheeler, R. L. (2000). *Data for Quaternary faults, liquefaction features, and possible tectonic features in the central and eastern United States, east of the Rocky Mountain Front*, U.S. Geol. Surv. Open File Rep. 00-0260, 342 pp.

Duncan, Michael J. (2008). *Methods for Evaluating Permeability of Soils*. Virginia Polytechnic Institute and State University Center for Geotechnical Practice and Research. CGPR #51.

Maryland Department of Forests and Parks (1962), Piney Run Dam "As-Built" drawings. Prepared by James H Ludlow and associates Inc. Provided to AECOM by Maryland Department of the Environment.

Maryland Geological Survey. (2020). *Maryland Geology*. http://www.mgs.md.gov/geology/index.html.

Muller, Peter D. (1994). *Geologic Map of the Finksburg Quadrangle, Carroll and Baltimore Counties, Maryland*. State of Maryland Department of Natural Resources, Maryland Geological Survey. Black and white copy downloaded from http://www.mgs.md.gov/publications/data_pages/quadrangle_geo.html. Accessed March 2020.

Natural Resources Conservation Service, (2005). Technical Release TR-60, *Earth Dams and Reservoirs*. United States Department of Agriculture.

Natural Resources Conservation Service, (2019). Technical Release TR 210-60, *Earth Dams and Reservoirs*. United States Department of Agriculture.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture (2019). *Web Soil Survey*. https://websoilsurvey.sc.egov.usda.gov/. Accessed March 2020.

U.S. Army Corps of Engineers. (2016). ER 1110-2-1806*, Earthquake Design and Evaluation for Civil Works Projects*.

U.S. Army Corps of Engineers. (2003). EM 1110-2-1902, *Engineering and Design: Slope Stability*.

United States Geological Survey. (2019). *Earthquake Hazard Program*. https://earthquake.usgs.gov

Appendix A – Subsurface Investigation Plan

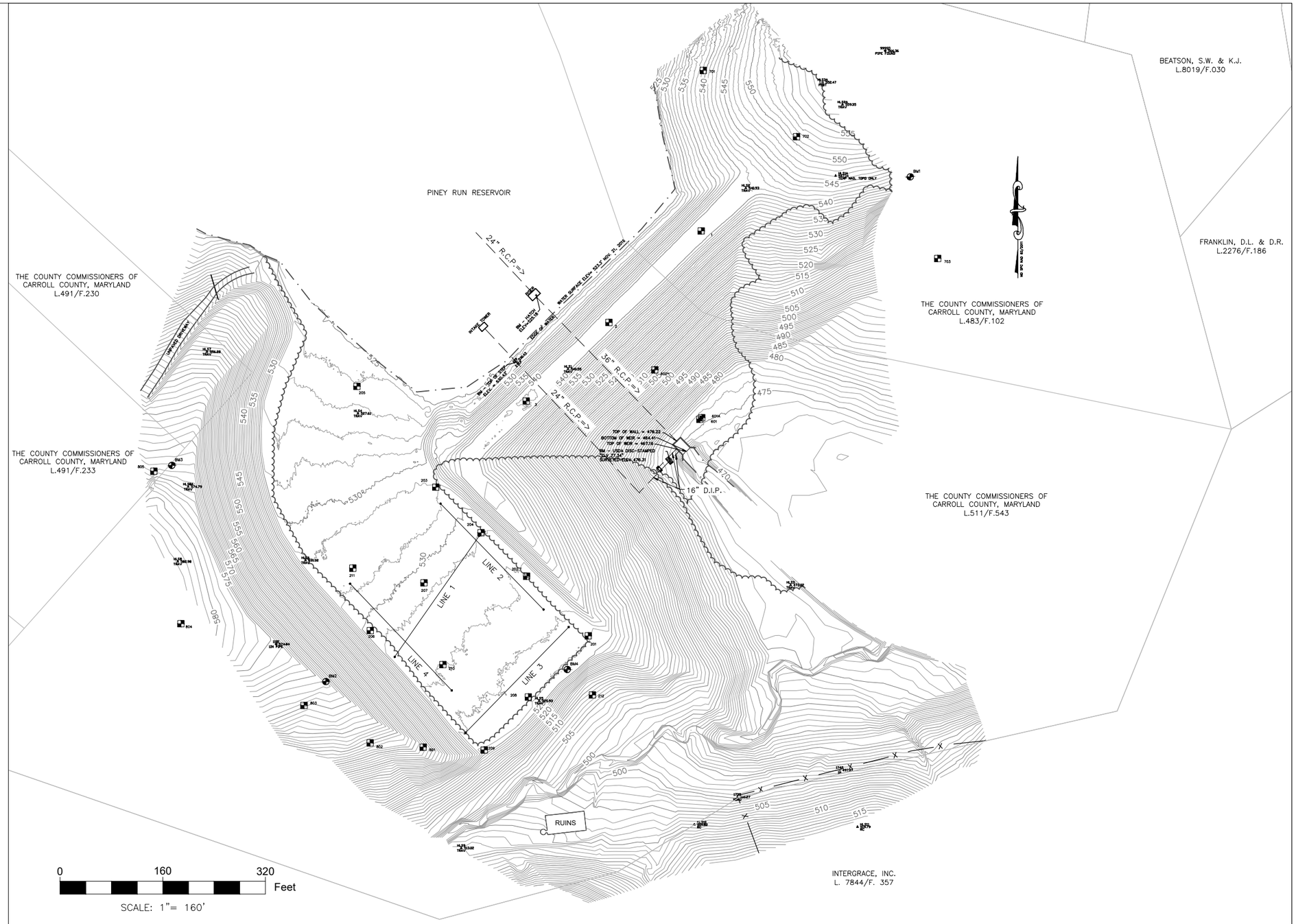
BORING LOCATION TABLE				
ID	NORTHING (FEET)	EASTING (FEET)	ELEVATION (FEET)	BENCHMARK REFERENCE
201	626380.91	1319128.54	526.29	HLS5
202	626473.88	1319032.59	527.85	HLS5
203	626612.65	1318891.02	531.16	HLS4
204	626541.58	1318961.58	529.11	HLS5
205	626769.77	1318768.06	526.05	HLS4
206	626389.15	1318788.98	530.06	HLS5
207	626463.72	1318872.71	529.40	HLS5
208	626285.70	1319035.21	526.36	HLS5
209	626203.14	1318966.47	526.40	HLS5
210	626336.24	1318902.06	528.06	HLS5
211	626486.44	1318761.73	531.16	HLS4
212	626288.93	1319135.04	507.65	BM4
1	627011.77	1319304.69	540.71	HLS2
2	626869.21	1319160.80	540.33	HLS1
3	626746.67	1319032.06	540.95	HLS1
601	626718.53	1319302.57	475.61	DISK "77.34"
601A	626720.92	1319305.49	475.69	DISK "77.34"
602*	626795.39	1319232.17	508.52	DISK "77.34"
701	627261.93	1319307.95	539.28	HLS2
702	627158.71	1319453.16	550.95	HLS2
703	626969.04	1319673.08	499.88	BM1
801	626207.46	1318871.42	547.99	BM2
802	626214.10	1318788.67	554.95	BM2
803	626272.55	1318685.70	567.49	BM2
804	626399.88	1318493.92	583.21	HLS3
805	626637.52	1318451.72	573.07	BM3

BENCH MARK TABLE				
ID	NORTHING (FEET)	EASTING (FEET)	ELEVATION (FEET)	DESCRIPTION
BM1	627096.12	1319630.31	541.32	REBAR
BM2	626309.71	1318719.72	568.46	REBAR
BM3	626646.60	1318479.67	572.60	REBAR
BM4	626328.55	1319095.85	525.91	REBAR
HLS1	626796.66	1319097.13	540.55	REBAR/CAP
HLS2	627078.65	1319374.13	540.93	REBAR/CAP
HLS3	626460.24	1319524.84	473.02	REBAR/CAP
HLS4	626727.49	1318769.78	527.61	REBAR/CAP
HLS5	626279.75	1319052.02	525.93	REBAR/CAP
DISK "77.34"	626654.53	1319255.58	476.31	BRASS USDA DISK ON RATE CONTROL VAULT

LEGEND

- BORING LOCATION* — <ID>*
- GEOPHYSICAL SURVEY LINE — LINE <#>
- REBAR BENCH MARK — BM<#>
- SURVEY CONTROL POINT — <POINT #> <ELEVATION> <DESCRIPTION>
- IRON PIPE BENCH MARK
- BRASS DISC BENCH MARK (DBM)
- CONCRETE BENCH MARK +
- PROPERTY LINE (GIS)
- 1-FOOT CONTOUR
- 5-FOOT CONTOUR — 550
- TREE LINE
- UN-PAVED ROAD
- SURFACE WATER LINE
- WALL
- STRUCTURE
- PIPE
- WATER VALVE (W)
- WATER VAULT MANHOLE (W)
- POST
- FENCE — .X — .X

*BORING WAS REPLACED WITH A HAND DUG TEST PIT DUE TO DRILL RIG SAFETY CONCERNS. TEST PIT LOCATION IS APPROXIMATE.



AECOM 12420 Milestone Center Drive Germantown, Maryland 20876 Tel. 301.820.3000	DATE: 07.22.2020	DRAWING No. B-01				PINEY RUN DAM
	SCALE: 1"=160'					Subsurface Investigation Plan
	CHECKED: AECOM					30 Martz Road Sykesville, Maryland 21784
	DRAWN BY: HLS/AECOM	SHEET 1 OF 1	NO.	DATE	REVISION	

C:\Users\jeffsloss\Desktop\Final Draft GIR\MD_2020_Piney Run Dam_Subsurface Investigation Plan\MD_2020_Piney Run Dam_Subsurface Investigation Plan.dwg User:jeffsloss Jul 22, 2020 - 1:34pm

Appendix B – Boring Logs

Log of Test Boring 1

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 627011.7689 E 1319304.6852**

DATE STARTED: **12/11/2019**
DATE COMPLETED: **12/12/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **54.0 FT**
SURFACE ELEVATION: **540.71 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-12-2019	N/A	40.0	N/A
24-hour	12-13-2020	N/A	30.6	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	540	0.3 - 8.0 ft: (FILL) Sampled as moist, medium dense, yellowish brown, nonplastic SILTY SAND WITH GRAVEL, 40.4% fine to coarse sand, 32.1% angular gravel, 27.5% fines	Topsoil / SM			S-1		3- 6- 12- 10 (N=18)	18" (75%)		10.3					
5	535															5.0ft: Rig chattering
		8.0 - 13.0 ft: (FILL) Sampled as moist, medium dense, brownish yellow, fine to coarse, nonplastic, SILTY SAND, estimated 65 - 75% fine to coarse sand, estimated 15 - 25% fines, estimated 10% gravel	SM			S-2		12- 10- 9- 10 (N=19)	18" (75%)							
10	530															
		13.0 - 15.0 ft: (FILL) Sampled as moist, loose, yellowish brown, fine to coarse, nonplastic, SILTY SAND WITH GRAVEL, estimated 45 - 55% fine to coarse sand, estimated 30 - 40% fines, estimated 15% gravel and gravel-sized pieces of mica	SM			S-3		4- 5- 5- 5 (N=10)	16" (67%)							
15	525					T-1			10" (71%)		18.2					15.0ft: Shelby tube advanced from 15-16.2 feet. Refusal at 16.2 feet
		15.0 - 18.0 ft: (FILL) Sampled as moist, reddish brown, nonplastic, SILTY SAND, 48.1% fine to coarse sand, 39.4% fines, 12.4% gravel, contains mica	SM													17.0ft: Stopped for day on 12/11/2019, continued 12/12/2019
		18.0 - 23.0 ft: (FILL) Sampled as moist, loose, strong brown, fine to coase, medium plasticity, SILTY SAND WITH GRAVEL, estimated 40 - 50% fine to coarse sand, estimated 30 - 40% fines, estimated 20% gravel, contains mica	SM			S-5		7- 5- 5- 5 (N=10)	3" (13%)							
20	520															
		23.0 - 28.0 ft: (FILL) Sampled as moist, medium dense, yellowish brown, fine to coarse, medium plasticity, CLAYEY SAND WITH GRAVEL, estimated 40 - 50% fine to coarse sand, estimated 30 - 40% fines, estimated 20% subangular gravel	SC			S-6		7- 10- 10- 10 (N=20)	20" (83%)							
25	515															
		28.0 - 38.0 ft: (FILL) Sampled as moist, stiff, strong brown, medium to high plasticity, SANDY LEAN CLAY, 66.1% fines, 30.8% fine to coarse sand, 3.1% gravel	CL			S-7		4- 6- 7- 10 (N=13)	22" (92%)			34	22	2.50	5.8	
30																

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B = Bulk Sample S = Split Spoon Sample P = Pitcher Sample
G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring 1

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
510	28.0 - 38.0 ft: (FILL) Sampled as moist, stiff, strong brown, medium to high plasticity, SANDY LEAN CLAY, 66.1% fines, 30.8% fine to coarse sand, 3.1% gravel*(continued)*														
	33.0 ft: changes to (FILL) Poor recovery	CL			S-8		11- 50/5" (N=50/5")	1" (9%)							33.0ft: Poor recovery
35 / 505															
	38.0 - 45.0 ft: Slightly moist, hard, olive yellow, nonplastic, DECOMPOSED BEDROCK friable to sandy silt, 59.4% fines, 39.9% fine to coarse sand, 0.7% gravel, contains mica				S-9		50/4" (N=50/4")	4" (100%)							
40 / 500		DR													
	43.0 ft: changes to Slightly moist, very dense, light gray, nonplastic, DECOMPOSED BEDROCK friable to silty sand with gravel, estimated 30-45% fine to coarse sand, estimated 30-45% subangular gravel, estimated 5-15 fines				S-10		50/2" (N=50/2")	2" (100%)							
45 / 495					S-11		50/0" (N=50/0")	0" (NR)							45.0ft: Auger refusal at 45 feet 45.1ft: Brown to gray effluent while coring RC-1
	45.0 - 54.0 ft: Strong, moderately weathered, highly fractured, dark gray to brownish gray, MICA SCHIST, fine to medium grained, slightly foliated, most fractures 10-70 degrees, partial iron and dark brown staining infill, some minor soil infill, slightly rough to smooth. 45.0 - 45.1 feet gravel section. 49.8 - 50.0 brown, fine to coase, medium plasticity, clayey sand				RC-1			57" (95%)	58						
50 / 490	50.0 ft: changes to Strong, slightly weathered, moderately fractured to highly fractured, dark gray, most fractures 5-40 degrees, spotty to partial iron staining infill, smooth. Gravel section 50.0 - 50.2 feet. Fracture at 53.2 feet thin layer of reddish orange clayey soil infill				RC-2			43" (90%)	71						49.8ft: Pocket of soil in rock core. Brown effluent
	Boring terminated at 54.0 FT on 12/12/2019.														
	1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring 2

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626869.2147 E 1319160.7989**

DATE STARTED: **12/16/2019**
DATE COMPLETED: **12/16/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **83.1 FT**
SURFACE ELEVATION: **540.33 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-16-2019	N/A	33.0	N/A
24-hour	12-17-2019	N/A	31.8	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	540	0.0 - 0.3 ft: Topsoil = 4 inches	Topsoil													
		0.3 - 3.0 ft: (FILL) Sampled as moist, loose, light brown, nonplastic, SILTY SAND WITH GRAVEL, 45.2% fine to coarse sand, 31.4% fines, 23.4% gravel, contains mica	SM			S-1		4- 4- 6- 8 (N=10)	18" (75%)							
		3.0 - 13.0 ft: (FILL) Sampled as moist, medium dense, reddish brown, low to medium plasticity, CLAYEY SAND, 49.7% fine to coarse sand, 45.4% fines, 4.9% gravel				S-2		6- 6- 6- 10 (N=12)	18" (75%)							
5	535															
		8.0 ft: changes to (FILL) Sampled as moist, medium dense, brown, low plasticity, CLAYEY SAND, 47.0% fine to coarse sand, 44.2% fines, 8.8% gravel	SC			S-3		7- 10- 10- 11 (N=20)	4" (17%)							8.0ft: Gravel obstructed split spoon recovery
10	530															
		13.0 - 18.0 ft: (FILL) Sampled as moist, medium dense, brown, low plasticity, SILTY SAND WITH GRAVEL, 50.8% fine to coarse sand, 32.9% fines, 16.3% gravel and gravel-sized pieces of mica	SM			S-4		4- 6- 6- 9 (N=12)	16" (67%)							
15	525															
		18.0 - 23.0 ft: (FILL) Sampled as moist, medium dense, light brown, low to medium plasticity, CLAYEY SAND, estimated 50 - 65% sand, estimated 25 - 40% fines, estimated 10% gravel and pieces of mica. Contained lens from 19-19.5 feet sampled as slightly moist, gray, nonplastic, SILTY SAND, 74.1% fine to coarse sand, 16.3% fines, 9.5% gravel, contains mica	SC			S-5		4- 11- 8- 7 (N=19)	18" (75%)							19.0ft: Possible cobble 19.0ft: 19-19.5 feet sampled from split spoon as S-5A
20	520															
		23.0 - 25.0 ft: (FILL) Sampled as moist, stiff, reddish brown and brown, low to medium plasticity, CLAYEY SAND, 52.5% fine to coarse sand, 39.4% fines, 8.1% gravel, contains mica	SC			S-6		5- 4- 5- 6 (N=9)	16" (67%)							
25	515															
		25.0 - 26.0 ft: (FILL) Sampled as moist, reddish brown, nonplastic, SILTY SAND, 47.5% fines, 39.2% fine to coarse sand, 13.4% gravel	SM			T-1			12" (86%)		22.5	NP	NP			25.0ft: Shelby tube advanced from 25.0-26.2 feet. Refusal at 26.2 feet
		26.0 - 27.0 ft: (FILL) Sampled as moist, medium dense, reddish brown, low plasticity, CLAYEY SAND, estimated 50 - 65% sand, estimated 35 - 50% fines, contains mica	SC			S-8		6- 7- 16- 15 (N=23)	24" (100%)							
			SM													
30			SC					3- 4- 5- 5								

AECOM SOIL ROCK PINEY RUN DAM LOGS REVISEDJULY2020.GPJ AECOM-GEOTECH_PROJECT-DESIGN.GDT 7/27/20 REV-0

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Log of Test Boring 2

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	510	27.0 - 29.0 ft: (FILL) Sampled as slightly moist, grayish brown, nonplastic, SILTY SAND, estimated 75 - 85% sand, estimated 15 - 25% fines	SC			S-9		(N=9)	24" (100%)							
		29.0 - 31.0 ft: (FILL) Sampled as moist, loose, reddish brown and orangish brown, low plasticity, CLAYEY SAND, estimated 50 - 65% sand, estimated 35 - 50% fines, contains mica *(continued)*	SC			T-2			21" (100%)							31.0ft: Shelby tube advanced from 31.0-32.7 feet. Refusal at 32.7 feet
35	505	31.0 - 33.0 ft: (FILL) Sampled as moist, reddish brown and orangish brown, low plasticity, CLAYEY SAND WITH GRAVEL, 42.8% fine to coarse sand, 32.0% gravel, 25.2% fines, contains mica	SM			S-11		5- 6- 7- 9 (N=13)	20" (83%)							
		33.0 - 38.0 ft: (FILL) Sampled as moist, stiff, reddish brown and orangish brown, low plasticity, SILTY SAND WITH GRAVEL, 43.6% fine to coarse sand, 33.0% fines, 23.3% gravel, contains mica				S-12		6- 7- 9- 10 (N=16)	20" (83%)							
40	500	38.0 - 43.0 ft: (FILL) Sampled as moist, medium dense, brown, medium platicity, CLAYEY SAND, 45.6% fine to coarse sand, 41.0% fines, 13.4% gravel, contains mica	SC													
		43.0 - 63.0 ft: (FILL) Sampled as moist, stiff, reddish brown, medium to high plasticity, SANDY LEAN CLAY, 55.3% fines, 33.2% fine to coarse sand, 11.5% gravel				S-13		6- 6- 7- 9 (N=13)	18" (75%)		16.6			1.50	3.5	
45	495															
		48.0 ft: changes to (FILL) Sampled as brown and dark brown, medium plasticity, 62.4% fines, 30.4% fine to coarse sand, 7.1% gravel				S-14		3- 5- 7- 8 (N=12)	20" (83%)					3.00	4.5	
50	490	50.0 ft: changes to (FILL) reddish brown				T-3			19" (79%)					3.75	6.0	50.0ft: Shelby tube advanced from 50-52 feet
		53.0 ft: changes to (FILL) Sampled as 56.3% fines, 33.0% fine to coarse sand, 10.7% gravel	CL			S-15		4- 5- 6- 7 (N=11)	16" (67%)					1.50	4.0	
55	485															
		58.0 ft: changes to (FILL) Sampled as hard, dark brown and brown, 61.0% fines, 30.0% fine to coarse sand, 9.0% gravel				S-16		6- 8- 10- 11 (N=18)	24" (100%)					3.75	2.8	
60	480															
		63.0 - 64.0 ft: (FILL) Sampled as moist, medium dense, orangish brown, low plasticity, SILTY SAND, estimated 50 - 65% fine to coarse sand, 35 - 50% fines. Contains approximate 2-inch lens of gray and white,	SM			S-17		4- 9- 11- 11 (N=20)	16" (67%)					2.00	1.5	
65	475		CL													

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Log of Test Boring 2

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		fine to coarse, nonplastic, silty sand, estimated 15 - 25% fines 64.0 - 73.0 ft: (FILL) Sampled as moist, hard, dark brown, medium plasticity, SANDY LEAN CLAY, 59.0% fines, 38.7% fine to coarse sand, 2.3% gravel, contains lignitic wood*(continued)* 68.0 ft: changes to (FILL) Sampled as stiff, medium plasticity, 63.2% fines, 34.6% fine to coarse sand, 2.2% gravel	CL			S-18		4- 6- 8- 11 (N=14)	22" (92%)					1.50	4.5	
70	470															
		73.0 - 78.0 ft: (FILL) Sampled as hard, orangish brown, medium plasticity, CLAYEY SAND WITH GRAVEL, 38.4% fines, 31.1% fine to coarse sand, 30.5% gravel. Contains approximate 1-inch lens of slightly moist, white, silty sand with gravel	SC			S-19		5- 8- 17- 12 (N=25)	16" (67%)							
75	465															
		78.0 - 78.3 ft: Moist, very dense, gray, nonplastic, DECOMPOSED BEDROCK friable to silty gravel with sand, 45.3% subangular gravel, 30.3% fine to coarse sand, 24.4% fines	DR			S-20		50/3" (N=50/3")	3" (100%)							78.0ft: Auger refusal at 78 feet
80	460					RC-1			61" (100%)	90						
		78.3 - 83.1 ft: Strong, fresh, slightly fractured to moderately fractured, dark gray, MICA SCHIST, fine to medium grained, strongly foliated, most fractures 35-70 degrees, spotty iron staining infill, some soil infill, rough to slightly rough														
		Boring terminated at 83.1 FT on 12/16/2019. Boring tremie grouted after final water level measurement.														

Log of Test Boring 3

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626746.6722 E 1319032.0582**

DATE STARTED: **12/17/2019**
DATE COMPLETED: **12/17/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **52.7 FT**
SURFACE ELEVATION: **540.95 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-17-2019	N/A	Dry	N/A
24-hour ▼	12-18-2019	N/A	28.0	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	540	0.0 - 0.3 ft: Topsoil 0.3 - 8.0 ft: (FILL) Sampled as moist, medium dense, orangish brown and reddish brown, nonplastic, SILTY SAND, 51.2% fine to coarse sand, 34.5% fines, 14.3% gravel	SM			S-1		4- 5- 7- 8 (N=12)	16" (67%)							
5	535	8.0 - 13.0 ft: (FILL) Sampled as moist, medium dense, orangish brown and reddish brown, low to medium plasticity, CLAYEY SAND, 44.6% fine to coarse sand, 41.2% fines, 14.2% gravel	SC			S-2		4- 6- 8- 10 (N=14)	18" (75%)							
10	530	13.0 - 18.0 ft: (FILL) Sampled as slightly moist, medium dense, light red, nonplastic, SILTY SAND WITH GRAVEL, 48.3% fine to coarse san, 29.0% angular gravel, 22.7% fines	SM			S-3		7- 10- 9- 9 (N=19)	12" (50%)							
15	525	18.0 - 23.0 ft: (FILL) Sampled as slightly moist, medium dense, grayish brown, nonplastic, SILTY SAND, 47.2% fine to coarse sand, 40.5% fines, 12.3% gravel	SM			S-4		4- 6- 10- 8 (N=16)	18" (75%)			NP	NP			
20	520	23.0 - 25.0 ft: (FILL) Sampled as slightly moist, loose, orangish brown, low to medium plasticity, CLAYEY SAND, 48.7% fine to coarse sand, 42.8% fines, 8.6% gravel and gravel-sized pieces of mica	SC			S-5		3- 4- 4- 5 (N=8)	16" (67%)							
25	515	25.0 - 28.0 ft: (FILL) Sampled as moist, low plasticity, CLAYEY SAND WITH GRAVEL, 44.2% fine to coarse sand, 36.8% fines, 19.1% gravel and gravel-sized pieces of mica	SC			T-1			25" (100%)							25.0ft: Shelby tube advanced from 25.0-27.1 feet
30		▼	SC			S-7		17- 10- 8- 8 (N=18)	20" (83%)		15.3					

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Log of Test Boring 3

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
510	28.0 - 33.0 ft: (FILL) Sampled as slightly moist, medium dense, CLAYEY SAND, 43.4% fines, 43.2% fine to coarse sand, 13.4% gravel. Lens of light gray silty sand with gravel (possible cobble) in upper end of spoon*(continued)*	SC													
35 / 505	33.0 - 38.0 ft: (FILL) Sampled as moist, stiff, reddish brown, medium to high platicity, SANDY LEAN CLAY, 58.9% fines, 26.2% fine to coarse sand, 14.9% gravel. Contains approximate 2-inch lens of grayish brown silty sand with gravel (possible cobble)	CL			S-8		2- 6- 7- 10 (N=13)	20" (83%)					3.00	5.0	
40 / 500	38.0 - 43.0 ft: (FILL) Sampled as moist, medium dense, reddish brown, low plasticity, CLAYEY SAND, 45.6% fine to coarse sand, 45.0% fines, 9.4% gravel. Contains approximate 1-inch lens of sily sand with gravel	SC			S-9		5- 8- 6- 7 (N=14)	6" (25%)							
45 / 495	43.0 - 44.4 ft: (FILL) Sampled as loose, orange, medium plasticity, CLAYEY SAND WITH GRAVEL, 44.7% fines, 40.3% fine to coarse sand, 15.0% gravel, contains mica. Large piece of quartz at top of spoon	SC			S-10		7- 4- 5- 50/5" (N=9)	18" (78%)							
	44.4 - 47.5 ft: Moist, dark grayish brown, nonplastic, DECOMPOSED BEDROCK friable to silty sand, estimated 50 - 75% fine to coarse sand, estimated 30 - 45% fines, estimated 5% gravel	DR			S-11		50/2" (N=50/2")	2" (100%)							47.5ft: Auger refusal at 47.5 feet 47.5ft: Grayish brown effluent while coring RC-1
50 / 490	47.5 - 52.7 ft: Strong to medium strong, moderately weathered, highly fractured to intensely fractured, dark gray white, MICA SCHIST, fine to medium grained, slightly foliated, most fractures 10-45 degrees, partial micaceous sandy soil infill, spotty iron and dark brown staining infill, slightly rough. 51.2-52.0 and 47.8-48.2 dark brownish gray, with more micaceous soil infill				RC-1			62" (100%)	48						
	Boring terminated at 52.7 FT on 12/17/2019. Boring tremie grouted after final water level measurement.														

Log of Test Boring 201

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626380.9096 E 1319128.5351**

DATE STARTED: **12/4/2019**
DATE COMPLETED: **12/5/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **70.2 FT**
SURFACE ELEVATION: **526.29 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-04-2019	N/A	39.0	N/A
24-hour	12-06-2019	N/A	31.5	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		Top soil														
	525	0.3 - 19.0 ft: Moist, loose, light orangish brown with speckles of black, nonplastic, SILTY SAND, 55.5% fine to medium sand, 44.5% fines, contains mica				S-1		5- 5- 4- 6 (N=9)	14" (58%)							
5	520															
10	515	8.0 ft: changes to Slightly moist, medium dense, light black with streaks of dark brown, 62.7% fine to coarse sand, 37.3% fines 9.0 ft: changes to estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines, light orangish brown with streaks of dark brown 10.0 ft: changes to 55.1% fine to medium sand, 44.9% fines	SM			S-2		4- 5- 8- 8 (N=13)	24" (100%)		10.6	NP	NP			
						T-1			20" (83%)		11.5					
15	510	13.0 ft: changes to light brown and light orange with streaks of black, 53.5% fine to coarse sand, 46.5% fines				S-4		9- 8- 9- 10 (N=17)	8" (33%)							
20	505	18.0 ft: changes to light orangish brown, estimated 75 - 85% fine to coarse sand, estimated 15 - 25% fines 19.0 - 23.0 ft: Slightly moist, very dense, light brown and dark brown, nonplastic, SILTY SAND WITH GRAVEL, 57.5% fine to coarse sand, 26.4% gravel and gravel-sized pieces of mica, 16.2% fines	SM			S-5		4- 12- 50/4" (N=12+50/4")	20" (125%)							
25	500	23.0 - 43.0 ft: Slightly moist, dense, light orangish brown with streaks of dark brown, low plasticity, SILTY SAND, 56.8% fine to medium sand, 43.2% fines, contains mica	SM			S-6		19- 16- 16- 15 (N=32)	16" (67%)							
30		28.0 ft: changes to medium dense, estimated 50 - 65% fine to coarse sand, estimated 30 - 45% fines				S-7		11- 10- 12- 12 (N=22)	2" (8%)							28.0ft: Coarse subangular quartz gravel obstructed split spoon recovery

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B = Bulk Sample S = Split Spoon Sample P = Pitcher Sample
G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring 201

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
495	23.0 - 43.0 ft: Slightly moist, dense, light orangish brown with streaks of dark brown, low plasticity, SILTY SAND, 56.8% fine to medium sand, 43.2% fines, contains mica *(continued)*														
35	33.0 ft: changes to Slightly moist, light brown and dark brown, nonplastic, 70.8% fine to coarse sand, 21.9% fines, 7.3% gravel				S-8		7- 7- 20- 34 (N=27)	24" (100%)							
490		SM													
40	38.0 ft: changes to Slightly moist, very dense, 69.7% fine to coarse sand, 17.6% fines, 12.7% gravel				S-9		28- 38- 50/5" (N=38+50/5")	17" (100%)							
485															
45	43.0 - 48.0 ft: Slightly moist, very dense, light orangish brown and dark brown, SILTY SAND WITH GRAVEL, low-no plasticity, 46.5% fine to coarse sand, 27.3% fines, 26.2% gravel and gravel-sized pieces of mica				S-10		44- 50/5" (N=50/5")	10" (91%)							
480		SM													
50	48.0 - 53.0 ft: Weak, highly weathered, highly fractured to intensely fractured, dark gray with speckles of orange, MICA SCHIST, fine to medium grained, strongly foliated, non-cylindrical core shape with worn and chipped edges. Fractures generally 45 degrees with one vertical fracture at 52.1 feet depth, partial iron and dark brown staining infill, slightly rough				S-11		50/2" (N=50/2")	2" (100%)							48.0ft: Began rock coring prior to auger refusal to sample transition material. Split core barrel used to sample 48-53 feet
475					RC-1			16" (27%)	13						
55	53.0 - 55.0 ft: Moist, very dense, dark gray and dark brown, nonplastic, SILTY SAND WITH GRAVEL, 43.5% fine to coarse sand, 31.3% gravel and gravel-sized pieces of mica, 25.2% fines	SM			S-12		3- 50/3" (N=50/3")	3" (100%)							53.0ft: Stopped for day on 12/04/2019, continued on 12/05/2019
					S-13		50/1" (N=50/1")	1" (100%)							53.0ft: Re-continued sampling with split spoon due to poor RC-1 quality and recovery
470	55.0 - 70.2 ft: Medium strong, slightly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, quartz inclusions, fractures generally 10 to 70 degrees, partial iron and dark brown staining infill				RC-2			62" (100%)	74						55.0ft: Auger refusal at 55 feet
60	58.0 ft: changes to Medium strong, moderately weathered, highly fractured to intensely fractured, dark brownish gray, quartz inclusions, fractures generally 10 to 70 degrees, partial iron and dark brown staining and some micaceous soil infill														
465	60.2 ft: changes to Medium strong, highly weathered to moderately weathered, gray orange, strongly foliated, fractures generally 10-60 degrees, partial iron and dark brown staining infill, smooth to rough. One very worn 70 degree fracture at 60.7 feet depth				RC-3			54" (90%)	42						55.5ft: Rock unconfined compressive strength of 6,353 psi, with 0.1% strain
65															

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Log of Test Boring 201

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
460	65.2 ft: changes to Same but dark gray. A 1/4-inch lens of clay was at the top of the core, brown lean clay with sand 55.0 - 70.2 ft: Medium strong, slightly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, quartz inclusions, fractures generally 10 to 70 degrees, partial iron and dark brown staining infill*(continued)*				RC-4			39" (65%)	35						
70	Boring terminated at 70.2 FT on 12/5/2019. 1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 202

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626473.8819 E 1319032.585**

DATE STARTED: **12/3/2019**
DATE COMPLETED: **12/4/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **38.0 FT**
SURFACE ELEVATION: **527.85 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-03-2019	N/A	Dry	N/A
24-hour ▼	12-05-2019	N/A	31.6	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.3 - 5.0 ft: Slightly moist, stiff, strong brown with streaks of black, nonplastic, SANDY SILT, 68.8% fines, 31.2% fine sand, contains mica	Topsoil / ML			S-1		3- 5- 7- 10 (N=12)	20" (83%)		24.3	NP	NP			
5	525	5.0 - 8.0 ft: Slightly moist, strong brown with speckles of black, nonplastic, SILTY GRAVEL WITH SAND, 52.0% gravel, 29.2% fine to coarse sand, 18.7% fines	GM			T-1			20" (100%)		15.7	NP	NP			5.0ft: Shelby tube advanced from 5-7 feet
10	520	8.0 - 13.0 ft: Slightly moist, medium dense, strong brown with speckles of black, low plasticity, SILTY SAND, 43.0% fines, 42.7% fine to coarse sand, 14.3% angular quartz gravel	SM			S-3		5- 9- 10- 12 (N=19)	18" (75%)							
15	515	13.0 - 18.1 ft: Slightly moist, very dense, gray, nonplastic, SILTY SAND WITH GRAVEL, 50.9% fine to coarse sand, 31.6% fines, 17.5% gravel	SM			S-4		36- 50/5" (N=50/5")	9" (82%)							
	510	18.0 ft: changes to 40.4% fine to coarse sand, 36.9% gravel, 22.7% fines				S-5		50/1" (N=50/1")	1" (100%)							17.0ft: Rig chattering 18.0ft: Auger refusal at 18 feet
20		18.1 - 38.0 ft: Medium strong, slightly weathered, moderately fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, contains quartz inclusions. Fractures generally 15-70 degrees, partial iron and dark brown staining infill, slightly rough to rough				RC-1			55" (92%)	75						
	505	21.0 ft: changes to dark brownish gray, moderately weathered, highly to intensely fractured														
25		23.0 ft: changes to dark gray, slightly weathered, moderately fractured				RC-2			60" (100%)	72						
	500	25.5 ft: changes to dark brownish gray, moderately weathered, highly to intensely fractured														
30		28.0 ft: changes to highly weathered, strongly foliated, no fractures were mechanical. Fractures generally 30-60 degrees, partial iron stain and dark brown spot infill, slightly														

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Log of Test Boring 202

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	rough. Dark gray, medium plasticity LEAN CLAY lens from approximately 30.1 to 30.4 feet				RC-3			50" (83%)	43				1.75	3.0	
495	18.1 - 38.0 ft: Medium strong, slightly weathered, moderately fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, contains quartz inclusions. Fractures generally 15-70 degrees, partial iron and dark brown staining infill, slightly rough to rough*(continued)*														33.0ft: Stopped for day on 12/03/2019, continued on 12/04/2019
35	33.0 ft: changes to Very strong to strong, slightly weathered, highly fractured, very dark gray, moderately foliated, contains quartz inclusions and a 6-inch layer of quartz at approimately 33.5-34.0 feet depth. Fractures generally 30-60 degrees with spotty iron staining and micaceous soil infill				RC-4			59" (98%)	57						
490	Boring terminated at 38.0 FT on 12/4/2019.														
	1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 203

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PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626612.6521 E 1318891.0237**

DATE STARTED: **11/25/2019**
DATE COMPLETED: **11/26/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **53.8 FT**
SURFACE ELEVATION: **531.16 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	11-25-2019	N/A	12.0	N/A
Completion	11-26-2019	N/A	8.4	32.2
24-hour	11-27-2019	N/A	9.0	25.6

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	530	0.3 - 4.0 ft: Moist, medium stiff, light brown, nonplastic, SANDY SILT, 70.8% fines, 29.2% fine sand	Topsoil / ML			S-1		2- 3- 5- 7 (N=8)	24" (100%)		32.5	NP	NP	1.50	3.8	
5	525	4.0 - 13.0 ft: Slightly moist, loose, orange and dark brown, nonplastic, SILTY SAND, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica														
10	520	8.0 ft: changes to Slightly moist, very dense, light grayish brown and orange, 60.2% fine to coarse sand, 27.0% fines, 12.8% gravel	SM			S-2		14- 32- 32- 18 (N=64)	18" (75%)							
15	515	13.0 - 18.0 ft: Slightly moist, very dense, gray and brown, nonplastic, SILTY SAND WITH GRAVEL, 55.7% fine to coarse sand, 25.4% gravel, 18.9% fines, contains mica	SM			S-3		38- 50/3" (N=50/3")	20" (222%)							
20	510	18.0 - 28.0 ft: Slightly moist, very stiff, gray and orange, low plasticity, SANDY SILT, 70.9% fines, 29.1% fine sand, contains mica				S-4		3- 9- 14- 17 (N=23)	24" (100%)					1.25	2.8	
25	505	23.0 ft: changes to light brownish gray, nonplastic, 51.9% fines, 47.5% fine to coarse sand, 0.6% gravel	ML			S-5		10- 13- 16- 20 (N=29)	18" (75%)							
30		28.0 - 33.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND, 56.7% fine to coarse sand, 32.9% fines, 10.4% gravel, contains mica	SM			S-6		39- 50/3" (N=50/3")	9" (100%)							

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Log of Test Boring 203

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
500	28.0 - 33.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND, 56.7% fine to coarse sand, 32.9% fines, 10.4% gravel, contains mica *(continued)*	SM													
35 / 495	33.0 - 37.5 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 50.8% fine to coarse sand, 30.9% gravel, 18.3% fines, contains mica	SM			S-7	⊠	38- 50/3" (N=50/3")	9" (100%)							
40 / 490	37.5 - 53.8 ft: Strong, fresh to slightly weathered, moderately fractured, dark gray, SCHIST, fine to medium grained, strongly foliated, most fractures 60 degrees, spotty iron staining infill, rough to slightly rough. One vertical fracture at 39.6 feet				RC-1			54" (90%)	67						37.5ft: Auger refusal at 37.5 feet 38.4ft: Rock unconfined compressive strength of 8,203 psi, with 0.1% strain
45 / 485	42.5 ft: changes to Very strong, fresh, very slightly fractured, contains quartz inclusions. All fractures appeared mechanical and were approximately 0-55 degrees				RC-2			76" (100%)	100						42.5ft: Stopped for day on 11/25/2019, continued 11/26/2019
50 / 480	48.8 ft: changes to all fractures appeared mechanical and were approximately 40-60 degrees				RC-3			60" (100%)	100						
	Boring terminated at 53.8 FT on 11/26/2019. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 204

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626541.581 E 1318961.575**

DATE STARTED: **12/18/2019**
DATE COMPLETED: **12/18/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **28.9 FT**
SURFACE ELEVATION: **529.11 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-18-2019	N/A	Dry	N/A
5-day ▼	12-23-2019	N/A	8.8	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.3 - 8.0 ft: Moist, very dense, gray and brown, nonplastic, SANDY SILT, 50.1% fines, 47.1% fine to coarse sand, 2.8% gravel	Topsoil / ML			S-1		30- 50/5" (N=50/5")	12" (109%)		11.3	NP	NP			
5	525															
		8.0 - 8.5 ft: Slightly moist, very dense, grayish brown, nonplastic, SILTY SAND WITH GRAVEL, 46.5% fines, 32.4% fine to coarse sand, 21.1% angular gravel	SM			S-2		9- 50/2" (N=50/2")	8" (100%)							
10	520 ▼	8.5 - 28.9 ft: Weak to very weak, severely weathered to highly weathered, intensely fractured to highly fractured, dark greenish gray and white, MICA SCHIST, fine to medium grained, strongly foliated, contains some quartz. Most fractures 10-20 degrees, partial iron and dark brown staining infill, rough to slightly rough. Gravel-sized rock fragments from 8.5 to 8.65 feet				RC-1			48" (80%)	42						8.5ft: Began rock coring prior to auger refusal to sample transition material. Split core barrel used to sample 8.5-13.5 feet
15	515	9.5 ft: changes to Medium strong to weak, moderately weathered, highly fractured to intensely fractured, dark gray, strongly foliated, most fractures 10-20 degrees, partial iron and dark brown staining infill, rough to slightly rough. Dark gray clayey soil layer from 9.3 to 9.5 feet				RC-2			60" (100%)	65						13.5ft: Began rock coring with solid core barrel due to high quality and recovery of RC-1
20	510	13.5 ft: changes to strong to medium strong, moderately weathered, moderately to intensely fractured. Most fractures 10-60 degrees, partial iron and dark brown spots staining infill. One approximate 80-degree fracture at 15.0 feet. One completely weathered section at approximately 22.3-22.4 feet				RC-3			62" (100%)	40						
25	505	18.5 ft: changes to highly fractured, dark brownish gray, poorly foliated. More quartz than previous run, with a quartz layer extending approximately 18.8-19.0 feet 23.7 ft: changes to very strong to strong, moderately to slightly weathered, highly fractured to intensely fractured, dark gray. Most fractures 10-50 degrees, partial and spotty iron and dark brown spots staining infill, some spotty soil infill. One quartz layer extended approximately 27.0-27.3 feet				RC-4			62" (100%)	55						23.7ft: Gray effluent

Boring terminated at 28.9 FT on 12/18/2019.
1-inch slotted temporary PVC standpipe installed for 5-day groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring 205

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626769.7739 E 1318768.062**

DATE STARTED: **11/25/2019**
DATE COMPLETED: **11/25/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **27.6 FT**
SURFACE ELEVATION: **526.05 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Completion ▼	11-25-2019	N/A	3.5	7.0
24-hour ▼	11-26-2019	N/A	3.2	7.6

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.5 ft: Topsoil = 6 inches	Topsoil													
	525	0.5 - 6.0 ft: Moist, loose, light olive brown, nonplastic, SILTY SAND, estimated 50 - 65% sand, estimated 35 - 50% fines				S-1		4- 4- 6- 5 (N=10)	24" (100%)							
		2.0 ft: changes to medium dense, 61.8% fine to coarse sand, 30.2% fines, 8.0% gravel, contains mica	SM			S-2		6- 8- 15- 13 (N=23)	16" (67%)			NP	NP			
5	520	4.0 ft: changes to loose, light brownish gray, estimated 75 - 85% sand, estimated 15 - 25% fines				S-3		4- 3- 2- 4 (N=5)	16" (67%)							
		6.0 - 8.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY GRAVEL WITH SAND, 56.1% gravel, 29.5% fine to coarse sand, 14.4% fines, contains mica	GM			S-4		14- 21- 50/4" (N=21+50/4")	13" (81%)							
10	515	8.0 - 27.6 ft: Slightly moist, very dense, grayish brown, nonplastic, SILTY SAND WITH GRAVEL, 44.5% fine to coarse sand, 38.3% fines, 17.2% gravel				S-5		38- 34- 22- 34 (N=56)	20" (83%)							
15	510	13.0 ft: changes to medium dense, light brownish gray, 46.5% fine to coarse sand, 30.5% fines, 23.0% gravel, contains mica				S-6		4- 7- 23- 50/3" (N=30)	18" (86%)		27.3					
20	505	18.0 ft: changes to very dense, low plasticity, 49.3% fine to coarse sand, 31.1% fines, 19.6% gravel, contains mica	SM			S-7		27- 34- 50/2" (N=34+50/2")	11" (79%)							
25	500	23.0 ft: changes to grayish brown, 49.6% fine to coarse sand, 35.0% fines, 15.4% gravel, contains mica				S-8		50/5" (N=50/5")	5" (100%)							26.0ft: Rig chattering
		27.5 ft: changes to nonplastic, 51.2% fine to coarse sand, 24.8% fines, 24.1% gravel				S-9		50/1" (N=50/1")	1" 100%							27.5ft: Auger refusal at 27.5 feet

Boring terminated at 27.6 FT on 11/25/2019.

Boring tremie grouted after final water level measurement.

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Log of Test Boring 206

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626389.1519 E 1318788.984**

DATE STARTED: **12/20/2019**
DATE COMPLETED: **12/23/2019**
LOGGED BY: **N. Schluter/K. Wachtel**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **63.0 FT**
SURFACE ELEVATION: **530.06 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	12-20-2019	N/A	16.0	N/A
72-hour ▼	12-23-2019	N/A	8.1	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.3 - 8.0 ft: Moist, medium dense, reddish brown and light brown, nonplastic, SILTY SAND, 50.1% fine to medium sand, 49.9% fines	Topsoil / SM			S-1		4- 5- 10- 16 (N=15)	24" (100%)							
5	525															
		8.0 - 13.0 ft: Slightly moist, stiff, orange and brown, medium plasticity, SANDY LEAN CLAY, 57.1% fines, 42.2% fine to coarse sand, 0.8% gravel	CL			S-2		5- 6- 6- 8 (N=12)	18" (75%)					1.25	2.3	
10	520															
		13.0 - 15.0 ft: Slightly moist, medium stiff, grayish brown with speckles of black, low plasticity, SANDY SILTY CLAY, 51.1% fines, 48.9% fine to medium sand	CL-ML			S-3		2- 3- 4- 7 (N=7)	24" (100%)					1.50	2.0	
15	515	15.0 - 18.0 ft: Moist, grayish brown, SANDY SILT, 56.8% fines, 43.2% fine to medium sand ▽	ML			T-1			17" (100%)		29.2	NP	NP	3.25	2.5	15.0ft: Shelby tube advanced from 15-16.4 feet. Refusal at 16.4 feet
		18.0 - 23.0 ft: Slightly moist, medium dense, grayish brown, low plasticity, SILTY CLAYEY SAND, 50.4% fine to coarse sand, 47.0% fines, 2.5% angular quartz gravel	SC-SM			S-5		6- 11- 18- 32 (N=29)	16" (67%)							
20	510															
		23.0 - 28.0 ft: Slightly moist, very stiff, grayish brown with streaks of black, medium plasticity, SANDY SILTY CLAY, 53.6% fines, 45.8% fine to coarse sand, 0.6% gravel	CL-ML			S-6		5- 10- 15- 17 (N=25)	18" (75%)					4.00	3.8	
25	505															
		28.0 - 33.0 ft: Slightly moist, hard, grayish brown with streaks of black, low plasticity, SANDY SILT, 60.5% fines, 39.5% fine to medium sand, contains mica	ML			S-7		50/6" (N=50/6")	6" (100%)					2.00	2.0	
30																

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Log of Test Boring 206

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		28.0 - 33.0 ft: Slightly moist, hard, grayish brown with streaks of black, low plasticity, SANDY SILT, 60.5% fines, 39.5% fine to medium sand, contains mica *(continued)*	ML													32.0ft: Rig chatter at 32 feet
35	495	33.0 - 38.2 ft: Very moist, very dense, brown and white, nonplastic, SILTY SAND WITH GRAVEL, 47.8% fine to coarse sand, 29.5% gravel angular to subangular gravel, 22.7% fines, contains mica	SM			S-8		14- 48- 50/4" (N=48+50/4")	12" (75%)							
		38.0 ft: changes to Slightly moist, grayish brown, 52.5% fine to coarse sand, 26.2% fines, 21.3% gravel, contains mica				S-9		50/2" (N=50/2")	2" (100%)							38.0ft: Began rock coring prior to auger refusal to sample transition material. Split core barrel used to sample 38-43 feet. Difficulty removing split core barrel from outer barrel jostled sample
40	490	38.2 - 63.0 ft: Weak to very weak, severely weathered, intensely fractured, dark grayish brown, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 30 degrees, silty and clayey soil infill, slightly rough. Interlayered rock and decomposed rock				RC-1			34" (57%)	10						
		43.0 ft: changes to Very weak, dark grayish brown with speckles of orange, strongly foliated, contains quartz inclusions														43.0ft: Began rock coring with solid core barrel due to high quality and recovery of RC-1
45	485	44.8 ft: changes to Weak, highly weathered, highly fractured, dark brownish gray white, moderately foliated, most fractures 30-45 degrees, spotty to partial iron staining, black spots, and micaceous soil infill, very rough to slightly rough				RC-2			48" (80%)	7						
		48.0 ft: changes to Medium strong, moderately weathered to slightly weathered, dark grayish brown, most fractures 15-60 degrees, spotty iron and dark brown staining, and micaceous soil infill, rough to slightly rough														
50	480					RC-3			63" (105%)	65						
		53.0 ft: changes to Weak, highly weathered to severely weathered, highly fractured to intensely fractured, dark brownish gray, strongly foliated, most fractures 45 degrees, partial iron staining and soil infill, slightly rough to smooth. No quartz inclusions														53.0ft: Stopped for day on 12/20/2019, continued 12/23/2019
55	475					RC-4			22" (37%)	7						
60	470	59.5 ft: changes to Strong to medium strong, slightly weathered, highly fractured, dark gray, slightly foliated, contains quartz inclusions, most fractures 5-45 degrees, spotty iron staining and soil infill, slightly rough to smooth				RC-5			49" (82%)	45						

Boring terminated at 63.0 FT on 12/23/2019.

1-inch slotted temporary PVC standpipe installed for 72-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring 207

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626463.7244 E 1318872.7146**

DATE STARTED: **12/6/2019**
DATE COMPLETED: **12/6/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **53.0 FT**
SURFACE ELEVATION: **529.40 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-06-2019	N/A	22.0	N/A
72-hour	12-09-2019	N/A	10.4	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		Top soil														
		0.3 - 8.0 ft: Slightly moist, very dense, light orangish brown with streaks of dark brown, low plasticity, SILTY SAND WITH GRAVEL, 54.9% fine to coarse sand, 23.6% fines, 21.5% angular quartz gravel (lens), contains mica	SM			S-1		11- 21- 35- 42 (N=56)	18" (75%)							
5	525															
		8.0 - 28.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND, 66.1% fine to coarse sand, 30.6% fines, 3.4% gravel, contains mica				S-2		7- 12- 13- 15 (N=25)	24" (100%)							
10	520	10.0 ft: changes to estimated 50 - 65% fine to coarse sand, estimated 35 - 50% fines, contains mica				T-1			15" (63%)		20.6	NP	NP			10.0ft: Shelby tube advanced from 10-12 feet
		13.0 ft: changes to dense, light gray and brown, 59.2% fine to coarse sand, 30.5% fines, 10.3% gravel, contains significant mica				S-4		9- 14- 23- 40 (N=37)	20" (83%)							
15	515															
		18.0 ft: changes to very dense, brownish gray with streaks of dark brown, 70.4% fine to coarse sand, 26.8% fines, 2.8% gravel, contains mica. Quartz lens at approximately 20 feet.	SM			S-5		13- 30- 50/4" (N=30+50/4")	20" (125%)							
20	510															
		23.0 ft: changes to brownish gray, low to no plasticity, 62.6% fine to coarse sand, 37.4% fines, contains mica				S-6		16- 25- 43- 50/1" (N=68)	16" (84%)							
25	505															
		28.0 - 37.5 ft: Slightly moist, very dense, brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 47.4% fine to coarse sand, 26.7% gravel, 26.0% fines, contains mica	SM			S-7		42- 50/2" (N=50/2")	8" (100%)							
30	500															

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Log of Test Boring 207

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	28.0 - 37.5 ft: Slightly moist, very dense, brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 47.4% fine to coarse sand, 26.7% gravel, 26.0% fines, contains mica *(continued)*														
35 / 495	33.0 ft: changes to grayish brown, 53.0% fine to coarse sand, 28.5% fines, 18.5% gravel, contains mica	SM			S-8		10- 50/5.5" (N=50/5.5")	11" (96%)							
	37.5 - 53.0 ft: Strong to medium strong, highly weathered to severely weathered, moderately fractured to highly fractured, dark gray and brownish gray, MICA SCHIST, fine to medium grained, moderately foliated, contains few quartz inclusions. Most fractures 10-60 degrees, partial iron staining and miaceous soil infill, slightly rough to smooth				S-9		50/3" (N=50/3")	3" (100%)							37.0ft: Rig chattering 37.5ft: Auger refusal at 37.5 feet
40 / 490					RC-1			55" (92%)	80						
	42.5 ft: changes to very strong, fresh, moderately fractured, dark gray. most fractures 45-55 degrees, no infill, slightly rough to smooth														42.5ft: Gray effluent
45 / 485					RC-2			62" (100%)	98						
	47.7 ft: changes to moderately to highly fractured, strongly foliated. Most fractures mechanical. Natural fractures generally 5-50 degrees, spotty iron stain infill, rough to smooth														
50 / 480					RC-3			63" (100%)	92						
	Boring terminated at 53.0 FT on 12/6/2019.														
	1-inch slotted temporary PVC standpipe installed for 72-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 208

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626285.7035 E 1319035.2072**

DATE STARTED: **12/5/2019**
DATE COMPLETED: **12/5/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **41.0 FT**
SURFACE ELEVATION: **526.36 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-05-2019	N/A	Dry	N/A
24-hour ▼	12-06-2019	N/A	22.0	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	525	Top soil 0.3 - 8.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND, 69.2% fine to coarse sand, 30.7% fines, 0.1% gravel, contains mica	SM		S-1		5- 10- 11- 12 (N=21)	24" (100%)							5.0ft: Bulk sample taken 5-15 feet. Slightly moist, light brown, nonplastic, SILTY SAND, 42.2% fine to coarse sand, 29.2% fines, 28.6% subangular gravel, contains mica
5	520	8.0 - 13.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND WITH GRAVEL, 51.3% fine to coarse sand, 28.5% fines, 20.2% subangular quartz gravel, contains mica	SM		S-2		7- 8- 8- 9 (N=16)	16" (67%)							
10	515	13.0 - 23.0 ft: Slightly moist, medium dense, light orangish brown with streaks of dark brown, nonplastic, SILTY SAND, 62.2% fine to coarse sand, 34.0% fines, 3.8% angular quartz gravel, contains mica	SM		S-3		4- 10- 14- 13 (N=24)	20" (83%)		16.3					
15	510	18.0 ft: changes to Slightly moist, very dense, light grayish brown with streaks of dark brown, 53.9% fine to coarse sand, 37.9% fines, 8.3% gravel	SM		S-4		29- 38- 36- 29 (N=74)	20" (83%)							
20 ▼	505	23.0 - 28.0 ft: Slightly moist, dense, light grayish brown with streaks of dark brown, nonplastic, SILTY SAND WITH GRAVEL, 60.2% fine to coarse sand, 25.7% angular quartz gravel and gravel-sized pieces of mica, 14.1% fines	SM		S-5		10- 15- 22- 33 (N=37)	20" (83%)							
25	500		SM		S-6		35- 38- 50/3" (N=38+50/3")	14" (93%)							27.0ft: Rig chattering/struggling at approximately 27.0 feet. Possible cobble or boulder.
30															

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Log of Test Boring 208

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
495	28.0 - 33.0 ft: Slightly moist, very dense, light grayish brown, nonplastic, SILTY SAND, 50.9% fine to coarse sand, 45.4% fines, 3.7% gravel, no mica. Large piece of gravel at top of spoon*(continued)*	SM													
					S-7		50/3" (N=50/3")	3" (100%)							
35	33.0 - 36.0 ft: Slightly moist, very dense, light grayish brown, nonplastic, SILTY SAND WITH GRAVEL, estimated 75 - 85% fine to coarse sand, estimated 15 - 25% fines, 50.5% fine to coarse sand, 34.4% fines, 15.1% angular quartz gravel	SM													
					S-8		50/0" (N=50/0")	0" (NR)							
490	36.0 - 41.0 ft: Medium strong, highly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, strongly foliated, contains quartz inclusions. Most fractures 30-60 degrees, partial iron and dark spots staining and micaceous soil infill, rough to slightly rough. Possible completely weathered section section														36.0ft: Auger refusal at 36 feet 36.0ft: The driller felt resistance during the entire RC-1 run despite the low recovery; a completely weathered section may have washed away
					RC-1			34" (57%)	27						
40															

Boring terminated at 41.0 FT on 12/5/2019.

1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring 209

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626203.1441 E 1318966.4746**

DATE STARTED: **1/9/2020**
DATE COMPLETED: **1/10/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **48.2 FT**
SURFACE ELEVATION: **526.40 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	01-09-2020	N/A	32.7	N/A
72-hour ▼	01-13-2020	N/A	19.4	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
0	526	Top soil														
	525	0.3 - 33.0 ft: Moist, medium dense, olive yellow with streaks of black, nonplastic, SILTY SAND, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica				S-1		8- 5- 6- 8 (N=11)	18" (75%)							
5	520	8.0 ft: changes to light yellowish brown, 55.4% fine to medium sand, 44.6% fines, contains mica				S-2		5- 12- 18- 23 (N=30)	16" (67%)							
10	515	13.0 ft: changes to dense, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines, contains mica	SM			S-3		9- 23- 27- 30 (N=50)	16" (67%)							
15	510	18.0 ft: changes to light yellowish brown, 58.9% fine to coarse sand, 37.2% fines, 3.9% subangular quartz gravel, contains mica				S-4		8- 13- 21- 27 (N=34)	22" (92%)							
20 ▽	505	23.0 ft: changes to very dense, light yellowish brown with streaks of dark brown, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica, no gravel				S-5		17- 21- 31- 41 (N=52)	24" (100%)							
25	500	28.0 ft: changes to Slightly moist, 61.8% fine to coarse sand, 38.2% fines, contains mica				S-6		50/5.5" (N=50/5.5")	5.5" (100%)							
30																

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Log of Test Boring 209

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
495	0.3 - 33.0 ft: Moist, medium dense, olive yellow with streaks of black, nonplastic, SILTY SAND, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines, contains mica *(continued)*	SM			S-7		50/1.5" (N=50/1.5")	1.5" (100%)							
35	33.0 - 48.2 ft: Strong to medium strong, moderately weathered, highly fractured to intensely fractured, brownish gray white, MICA SCHIST, fine to medium grained, strongly foliated, some quartz inclusions. Most fractures 20-50 degrees, partial iron stain and dark brown spots infill, slightly rough to smooth. 33.0-33.1 feet gravel-sized rock fragments				RC-1			55" (92%)	55						33.0ft: Stopped for day on 1/9/2020, continued 1/10/2020 33.0ft: Split core barrel used to sample 12.5-17.5 feet. Grayish brown effluent 33.8ft: Rock unconfined compressive strength of 7,798 psi, with 0.2% strain
490															
40	38.0 ft: changes to highly weathered, highly fractured, brownish gray, most fractures 45-90 degrees, partial iron stain and dark brown infill, few fractures with micaceous soil infill, slightly rough to smooth				RC-2			62" (100%)	65						
485															
45	43.2 ft: changes to no visible quartz. Most fractures 0-45 degrees, partial iron stain and dark brown spots infill, slightly rough to smooth. Layer from 43.5 to 43.7 feet of white, grainy material- likely highly weathered pegmatite 46.0 ft: changes to dark gray				RC-3			55" (92%)	48						
480															

Boring terminated at 48.2 FT on 1/10/2020.

1-inch slotted temporary PVC standpipe installed for 72-hr groundwater reading. Boring tremie grouted after final water level measurement.

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PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring 210

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626336.2409 E 1318902.0644**

DATE STARTED: **12/2/2019**
DATE COMPLETED: **12/3/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **42.2 FT**
SURFACE ELEVATION: **528.06 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-03-2019	N/A	15.1	N/A
24-hour	12-04-2019	N/A	17.6	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.3 ft: Topsoil = 4 inches 0.3 - 0.5 ft: Moist, medium stiff, brown, medium plasticity, SANDY LEAN CLAY, estimated 50 - 65% fines, est 35 - 50% fine to medium sand	Topsoil CL			S-1		2- 2- 5- 10 (N=7)	24" (100%)							
	525	0.5 - 13.0 ft: Slightly moist, loose, strong brown with streaks of black, nonplastic, SILTY SAND WITH GRAVEL, estimated 50 - 65% fine to medium sand, estimated 10 - 25% fines, estimated 10 - 25% gravel, contains mica 3.0 ft: changes to very dense, 62.7% fine to coarse sand, 19.4% gravel, 17.9% fines	SM			S-2		2- 21- 50/5" (N=21+50/5")	20" (118%)							
5																
	520	8.0 ft: changes to dense, light yellowish brown and white, 41.7% fine to coarse sand, 30.2% angular quartz gravel, 28.1 fines				S-3		4- 17- 28- 28 (N=45)	18" (75%)							
10																
	515	13.0 - 18.0 ft: very stiff, brownish yellow with speckles of black, nonplastic, SANDY SILT, 51.2% fines, 45.3% fine to coarse sand, 3.5% gravel	ML			S-4		7- 7- 11- 17 (N=18)	20" (83%)							
15																
	510	18.0 - 23.0 ft: medium dense, yellowish brown with speckles of black, nonplastic, SILTY SAND, 51.4% fine to coarse sand, 47.8% fines, 0.7% gravel	SM			S-5		3- 4- 7- 8 (N=11)	24" (100%)		21.4	NP	NP			
20																
	505	23.0 - 28.5 ft: dense, brown with streaks of black, low plasticity, SILTY SAND WITH GRAVEL, 50.8% fine to coarse sand, 25.0% fines, 24.2% gravel	SM			S-6		WOH- 8- 25- 19 (N=33)	20" (83%)							
25																27.0ft: Rig chattering
	500					S-7		50/3" (N=50/3")	2" (67%)							28.5ft: Auger refusal at 28.5 feet
30																

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Log of Test Boring 210

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
495	28.5 - 42.2 ft: Medium strong, moderately weathered to slightly weathered, moderately fractured to highly fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 30-70 degrees, partial to spotty iron staining infill, rough to slightly rough*(continued)*				RC-1			41" (68%)	63						28.5ft: Stopped for day on 12/02/2019, continued on 12/03/2019 28.5ft: Split core barrel used to sample 28.5-33.6 feet. Gray effluent
35	33.6 ft: changes to moderately weathered to highly weathered, highly fractured, dark gray to brownish gray, contains quartz inclusions. Most fractures 30-60 degrees, partial iron staining and spotty soil infill, rough to slightly rough				RC-2			41" (100%)	66						
490	37.0 ft: changes to slightly weathered, dark gray, strongly foliated, about half of fractures mechanical breaks. Most natural fractures 30-45 degrees, spotty iron staining infill, rough to smooth. One 75-degree fracture at approximately 40.3 feet														
40					RC-3			62" (100%)	83						

Boring terminated at 42.2 FT on 12/3/2019.

1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.

Log of Test Boring 211

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626486.4407 E 1318761.7274**

DATE STARTED: **11/26/2019**
DATE COMPLETED: **11/27/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **70.1 FT**
SURFACE ELEVATION: **531.16 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	11-26-2019	N/A	11.0	N/A
5-day ▼	12-02-2019	N/A	6.6	64.8

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	530	Top soil														
		0.3 - 3.5 ft: (FILL) sampled as moist, very dense, brown, medium plasticity, CLAYEY SAND, estimated 50 - 65% sand, estimated 35 - 50% fines, contains mica	SC													
		3.5 - 4.0 ft: (FILL) sampled as slightly moist, very dense, black and white, nonplastic, SILTY GRAVEL WITH SAND, estimated 35 - 45% gravel, estimated 35 - 45% sand, estimated 10 - 30% fines, contains mica	GM			S-1		7- 25- 35- 28 (N=60)	24" (100%)							3.0ft: Possible cobble or boulder
5	525	4.0 - 8.0 ft: Moist, very dense, light yellowish brown, nonplastic, SILTY SAND WITH GRAVEL, 48.8% fine to coarse sand, 26.3% gravel, 24.9% fines, contains mica	SM													
		8.0 - 13.0 ft: Slightly moist, very stiff, light yellowish brown with streaks of black, low plasticity, SANDY SILT, 64.4% fines, 35.6% fine sand	ML			S-2		6- 7- 10- 12 (N=17)	24" (100%)		21.9	NP	NP			
10	520					T-1			6" (100%)							10.0ft: Shelby tube advanced from 10.0-10.5 feet. Refusal at 10.5 feet
		13.0 - 18.0 ft: Slightly moist, dense, light yellowish brown, nonplastic, SILTY SAND WITH GRAVEL, 55.5% fine to coarse sand, 27.0% fines, 17.5% gravel	SM			S-4		5- 10- 35- 50/4" (N=45)	18" (82%)							
15	515															
		18.0 - 23.0 ft: Slightly moist, dense, light yellowish brown, nonplastic, SILTY SAND, 47.2% fine to coarse sand, 44.2% fines, 8.6% gravel	SM			S-5		50- 20- 22- 25 (N=42)	16" (67%)							
20	510															
		23.0 - 28.0 ft: Slightly moist, very dense, light yellowish brown, nonplastic, SILTY GRAVEL WITH SAND, 67.2% gravel, 20.5% fine to coarse sand, 12.3% fines	GM			S-6		50/3" (N=50/3")	3" (100%)							
25	505															
		28.0 - 48.0 ft: Slightly moist, dense, light yellowish brown, low plasticity, SILTY SAND, 52.6% fine to coarse sand, 42.6% fines, 4.8% gravel	SM			S-7		3- 7- 32- 50/3" (N=39)	18" (86%)							
30																

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Log of Test Boring 211

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
500	28.0 - 48.0 ft: Slightly moist, dense, light yellowish brown, low plasticity, SILTY SAND, 52.6% fine to coarse sand, 42.6% fines, 4.8% gravel*(continued)*														
35	33.0 ft: changes to 55.9% fine to coarse sand, 34.0% fines, 10.1% angular quartz gravel, contains mica				S-8		33- 26- 23- 22 (N=49)	18" (75%)							
495															
40	38.0 ft: changes to very dense, nonplastic, 68.6% fine to coarse sand, 24.8% fines, 6.5% gravel	SM			S-9		48- 50/5" (N=50/5")	9" (82%)							
490															
45	43.0 ft: changes to light brownish gray, low plasticity, 47.6% fine to coarse sand, 41.5% fines, 10.9% subangular gravel				S-10		50/5" (N=50/5")	5" (100%)							
485															
50	48.0 - 53.0 ft: Slightly moist, very dense, light brownish gray, nonplastic, SILTY SAND WITH GRAVEL, 35.5% fines, 33.7% fine to coarse sand, 30.9% gravel	SM			S-11		50/3" (N=50/3")	3" (100%)							50.0ft: Stopped for day on 11/26/2019, continued on 11/27/2019
480															
55	53.0 - 55.0 ft: Slightly moist, very dense, orangish brown and white, nonplastic, SILTY SAND, estimated 75 - 85% sand, estimated 15 - 25% fines, estimated 5% angular gravel	SM			S-12		50/5" (N=50/5")	5" (100%)							54.0ft: Rig chatter at 54 feet
					S-13		50/0" (N=50/0")	0" (NR)							55.0ft: Auger refusal at 55 feet
475	55.0 - 70.1 ft: Medium strong to weak, moderately weathered, highly fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 25-70 degrees, partial to spotty iron staining infill, rough to smooth				RC-1			51" (85%)	65						56.8ft: Rock unconfined compressive strength of 19,296 psi, with 0.3% strain
60															
470	60.0 ft: changes to Weak to very weak, highly weathered, intensely fractured, dark brownish gray, strongly foliated, most fractures partial iron staining and some mica and black areas infill, slightly rough to smooth 61.5 ft: changes to Medium strong to weak, moderately weathered to highly weathered, highly fractured to intensely fractured, dark gray white, moderately foliated, contains quartz inclusions. Most fractures partially infilled with light-colored sand, slightly rough				RC-2			49" (82%)	22						
65															

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Log of Test Boring 211

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
465	to smooth 65.0 ft: changes to Strong to medium strong, moderately weathered to slightly weathered, intensely fractured, dark gray, most fractures spotty iron staining and a few with light-colored sandy infill 55.0 - 70.1 ft: Medium strong to weak, moderately weathered, highly fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 25-70 degrees, partial to spotty iron staining infill, rough to smooth*(continued)* 66.0 ft: changes to moderately fractured				RC-3			61" (100%)	77						
70	Boring terminated at 70.1 FT on 11/27/2019. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 212

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626288.931 E 1319135.0379**

DATE STARTED: **1/8/2020**
DATE COMPLETED: **1/9/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **53.0 FT**
SURFACE ELEVATION: **507.65 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	01-08-2020	N/A	22.0	N/A
24-hour	01-10-2020	N/A	7.5	N/A
96-hour	01-13-2020	N/A	8.1	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.3 ft: Topsoil = 3 inches	Topsoil													
	505	0.3 - 3.0 ft: Moist, very loose, strong brown, low plasticity, CLAYEY SAND, estimated 50 - 75% fine to medium sand, estimated 20 - 45% fines, estimated 5% subrounded gravel	SC			S-1		1- 2- 2- 2 (N=4)	14" (58%)							
5		3.0 - 8.0 ft: Moist, medium dense, strong brown, medium plasticity, SILTY GRAVEL WITH SAND, 44.7% fines, 29.6% subangular gravel, 25.7% fine to coarse sand	GM			S-2		2- 2- 9- 6 (N=11)	20" (83%)		25.8	37	25			
	500															
10		8.0 - 13.0 ft: Moist, loose, light yellowish brown, nonplastic, SILTY SAND, estimated 50 - 75% fine to medium sand, estimated 15 - 25% fines, estimated 15 - 25% gravel	SM			S-3		3- 3- 5- 5 (N=8)	4" (17%)							
	495															
15		13.0 - 18.0 ft: Moist, medium dense, light olive brown, nonplastic, SILTY SAND WITH GRAVEL, 53.9% fine to coarse sand, 26.5% gravel, 19.7% fines	SM			S-4		4- 8- 19- 33 (N=27)	20" (83%)							
	490															
20		18.0 - 42.7 ft: Moist, medium dense, olive yellow with streaks of dark brown, low plasticity, SILTY SAND, estimated 50 - 65% medium to coarse sand, est 25 - 40% fines, estimated 10% gravel				S-5		2- 8- 11- 16 (N=19)	18" (75%)							
	485															
25		23.0 ft: changes to light olive brown with streaks of black, nonplastic	SM			S-6		14- 17- 10- 13 (N=27)	16" (67%)							25.0ft: Stopped for day on 01/08/2020, continued on 01/09/2020
	480															
30		28.0 ft: changes to Slightly moist, very dense, olive yellow with streaks of dark brown				S-7		22- 50/5.5" (N=50/5.5")	14" (122%)							

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Log of Test Boring 212

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
475 / 35	18.0 - 42.7 ft: Moist, medium dense, olive yellow with streaks of dark brown, low plasticity, SILTY SAND, estimated 50 - 65% medium to coarse sand, est 25 - 40% fines, estimated 10% gravel*(continued)* 33.0 ft: changes to light olive brown, low-no plasticity	SM			S-8		7- 19- 37- 50/5" (N=56)	16" (70%)							
470 / 40	38.0 ft: changes to light brown				S-9		50/3" (N=50/3")	3" (100%)							
465 / 45	42.7 - 52.8 ft: Strong to medium strong, slightly weathered, slightly fractured to highly fractured, dark gray, MICA SCHIST, fine to medium grained, slightly foliated, most fractures 5-35 degrees, spotty iron and dark brown staining and orangish silty sand soil infill, slightly rough to smooth. Gravel at section 46.6-46.7 feet				S-10		50/3" (N=50/3")	3" (100%)							41.0ft: Rig chattering at 41.0 feet. High effort to reach 42.5 feet 42.5ft: Auger refusal at 42.5 feet
					RC-1			63" (100%)	92						
460 / 50	47.8 ft: changes to mostly mechanical breaks; one natural fracture 30 degrees. Large quartz inclusion 49.0-49.4 feet				RC-2			58" (97%)	95						
455															

Boring terminated at 53.0 FT on 1/9/2020.

1-inch slotted temporary PVC standpipe installed for 24- and 96-hr groundwater reading.
Boring tremie grouted after final water level measurement.

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Log of Test Boring 601

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PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626718.5333 E 1319302.5687**

DATE STARTED: **1/10/2020**
DATE COMPLETED: **1/10/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **20.0 FT**
SURFACE ELEVATION: **475.61 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	01-10-2020	N/A	3.0	N/A
72-hour ▽	01-13-2020	N/A	6.5	N/A

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
475	0.0 - 0.3 ft: Topsoil = 4 inches	Topsoil													0.0ft: Approximately 0-1 inch standing water at ground surface prior to drilling
	0.3 - 3.0 ft: (FILL) Sampled as moist, medium dense, orangish brown, fine to coarse, medium plasticity, CLAYEY SAND WITH GRAVEL, estimated 35 - 45% fine to coarse sand, estimated 30 - 40% fines, estimated 15 - 25% subangular quartz gravel	SC			S-1		WOH- 5- 7- 6 (N=12)	14" (58%)							
	3.0 - 8.0 ft: (FILL) Sampled as moist, loose, light olive brown, nonplastic, SILTY SAND, 42.4% fine to coarse sand, 31.5% fines, 26.1% gravel	SM			S-2		2- 3- 5- 3 (N=8)	22" (92%)							
5 470															
	8.0 - 13.0 ft: Very moist, loose, yellowish brown, nonplastic, SILTY GRAVEL WITH SAND, estimated 30 - 45% gravel, estimated 30 - 45% fine to coarse sand, estimated 15 - 25% fines, gravel generally consists of subangular quartz	GM			S-3		6- 7- 1- 1 (N=8)	6" (25%)							
10 465					T-1			0" (NR)							
	13.0 - 15.0 ft: Slightly moist, very dense, yellowish brown, nonplastic, SILTY SAND, 54.9% fine to coarse sand, 44.3% fines, 0.8% gravel	SM			S-4		26- 50/4" (N=50/4")	6" (60%)		11.4					
15					S-5		50/3" (N=50/3")	3" (100%)							
460	15.0 - 20.0 ft: Medium strong to very weak, highly weathered to severely weathered, highly fractured to intensely fractured, brownish gray, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 15-60 degrees, few partial dark brown staining infill and soil infill, very rough to slightly rough. 15.0-15.3 subangular gravel and completely weathered rock fragments				RC-1			30" (50%)	7						15.0ft: Auger refusal at 15 feet 15.0ft: Brownish gray to gray effluent while rock coring RC-1
20															
	Boring terminated at 20.0 FT on 1/10/2020. Boring tremie grouted after final water level measurement.														

Log of Test Boring 601A

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626720.9179 E 1319305.4948**

DATE STARTED: **1/13/2020**
DATE COMPLETED: **1/13/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4"**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **10.0 FT**
SURFACE ELEVATION: **475.69 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
N/A	12-10-2019	N/A	N/A	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
0	475	0.3 - 10.0 ft: (FILL) Sampled as very moist, loose, light olive brown, nonplastic SILTY SAND WITH GRAVEL, estimated 30 - 45% fine to coarse sand, estimated 30 - 45% fines, estimated 25% gravel	Topsoil													0.0ft: No sampling, auger advanced and hole cleaned out 0-5'
5	470		SM			B-1										5.0ft: Bulk sample collected from auger cuttings 5-10'
10																

Boring terminated at 10.0 FT on 1/13/2020.

Boring tremie grouted upon completion.

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B = Bulk Sample S = Split Spoon Sample P = Pitcher Sample
G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Pit 602

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626795.39 E 1319232.17**

DATE STARTED: **1/29/2020**
DATE COMPLETED: **1/29/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **JB**
DRILLING CONTRACTOR: **AECOM**
DRILL RIG: **N/A**
DRILLER: **N. Schluter**

DRILL METHOD: **Shovel**
HAMMER TYPE/WEIGHT: **NA/NA**
CASING TYPE: **N/A**
CASING SIZE: **N/A**
BIT TYPE/SIZE: **NA**
BOREHOLE DEPTH: **2.0 FT**
SURFACE ELEVATION: **508 FT** **+/-**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	01-29-2020	N/A	Dry	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 1.0 ft: Topsoil = 12 inches	Topsoil												
		1.0 - 2.0 ft: (FILL) Sampled as very moist, light orangish brown, nonplastic SILTY SAND WITH GRAVEL, 44.6% fine to coarse sand, 33.2% fines, 22.2% gravel	SM			B-1				23.8	NP	NP			1.0ft: Test sample also referred to as Embankment Shell Bulk sample

Test pit terminated at 2.0 FT on 1/29/2020.

Test pit backfilled with site soils. Coordinates and elevation are approximate.

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Log of Test Boring 701

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 627261.9338 E 1319307.9469**

DATE STARTED: **12/10/2019**
DATE COMPLETED: **12/10/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4"**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **27.5 FT**
SURFACE ELEVATION: **539.28 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
24-hour ▼	12-11-2019	N/A	15.9	N/A
48-hour ▼	12-12-2019	N/A	16.5	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.3 - 12.5 ft: Moist, medium dense, dark reddish brown, medium plasticity, SILTY GRAVEL WITH SAND, 37.8% fines, 37.3% angular light gray gravel, 25.0% fine to coarse sand		Top soil												
5	535	4.0 ft: changes to Slightly moist, light gray, nonplastic, 63.6% gravel, 21.2% fine to coarse sand, 15.2% fines	GM			S-1		3- 8- 15- 50/5" (N=23)	20" (83%)			33	28			3.0ft: 3-4 feet sampled from split spoon as S-1A 4.0ft: 4-5 feet sampled from split spoon as S-1B
10	530	8.0 ft: changes to very dense, 35.4% angular gravel, 33.4% fine to coarse sand, 31.2% fines				S-2		50/3" (N=50/3")	2" (67%)							7.0ft: Rig difficulty/chattering (possible boulder)
		12.5 - 27.5 ft: Very strong to strong, slightly weathered, slightly fractured to moderately fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, some quartz inclusions. Most fractures 10-60 degrees, partial iron and dark brown staining infill, rough to slightly rough. Rock fragments from 12.5 to 12.7 feet				S-3		50/2" (N=50/2")	2" (100%)							12.5ft: Auger refusal at 12.5 feet 12.6ft: Split core barrel used to sample from 12.5-17.5 feet
15	525					RC-1			53" (88%)	77						
20	520	17.5 ft: changes to moderately fractured, larger quartz inclusions. Most fractures mechanical breaks. Most fractures 45-60 degrees, spotty iron staining. 1-2 inches of quartz at 20.5 feet				RC-2			57" (95%)	80						
25	515	22.5 ft: changes to slightly fractured, fewer quartz inclusions				RC-3			59" (98%)	95						

Boring terminated at 27.5 FT on 12/10/2019.

1-inch slotted temporary PVC standpipe installed for 24- and 48-hr groundwater reading. Boring tremie grouted after final water level measurement.

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Log of Test Boring 702

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 627158.7119 E 1319453.1596**

DATE STARTED: **12/10/2019**
DATE COMPLETED: **12/11/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **77.2 FT**
SURFACE ELEVATION: **550.95 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	12-10-2019	N/A	60.0	N/A
24-hour ▼	12-11-2019	N/A	43.5	48.5

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.3 ft: Topsoil = 4 inches	Topsoil													
	550	0.3 - 13.0 ft: Moist, medium dense, reddish brown, medium plasticity, CLAYEY SAND, estimated 50 - 65% fine to coarse sand, est 25 - 45% fines, estimated 5 - 10% gravel				S-1		4- 7- 7- 11 (N=14)	24" (100%)					0.75	2.0	1.0ft: Possible fill
		3.0 ft: changes to low plasticity				T-1			12" (100%)		26.6					3.0ft: Shelby tube advanced from 3-4 feet. Refusal at 4 feet
5	545		SC													
		8.0 ft: changes to No recovery				S-3		8- 6- 5- 6 (N=11)	0" (NR)							
10	540															
		13.0 - 23.0 ft: Slightly moist, dense, orangish brown with speckles of black, low plasticity, SILTY SAND, estimated 50 - 65% fine to coarse sand, estimated 25 - 40% fines, estimated 10% gravel. Large piece of quartz at top of spoon				S-4		20- 20- 22- 35 (N=42)	18" (75%)							
15	535															
		18.0 ft: changes to very dense, light orangish brown, nonplastic, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines	SM			S-5		24- 31- 50/5.5" (N=31+50/5.5")	14" (80%)							
20	530															
		23.0 - 28.0 ft: Slightly moist, very dense, orangish brown and white, medium plasticity, CLAYEY SAND WITH GRAVEL, estimated 30 - 45% fines, estimated 30 - 45% fine to coarse sand, estimated 25% subangular quartz gravel				S-6		18- 36- 25- 15 (N=61)	6" (25%)							
25	525		SC													
						S-7		32- 50/4" (N=50/4")	10" (100%)							
30			SM													

AECOM SOIL ROCK PINEY RUN DAM LOGS REVISEDJULY2020.GPJ AECOM-GEOTECH_PROJECT-DESIGN.GDT 7/22/20 REV-0

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Log of Test Boring 702

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
520	28.0 - 43.0 ft: Slightly moist, very dense, light orangish brown, nonplastic, SILTY SAND, estimated 50 - 65% fine to coarse sand, estimated 30 - 45% fines, estimated 5% angular quart gravel, contains mica*(continued)*														
	33.0 ft: changes to no gravel				S-8		16- 21- 32- 50/5" (N=53)	24" (104%)							
35 515		SM													
	38.0 ft: changes to gray, low plasticity				S-9		37- 50/3" (N=50/3")	6" (67%)							
40 510															
	43.0 - 48.0 ft: Slightly moist, very dense, light grayish brown, low plasticity, SILTY CLAYEY SAND WITH GRAVEL, estimated 30 - 55% fine to medium sand, estimated 30 - 55% fines, estimated 15% subangular quartz gravel				S-10		50/5.5" (N=50/5.5")	5.5" (100%)							
45 505		SC-SM													
	48.0 - 62.0 ft: very dense, light grayish brown, low plasticity, SILTY SAND, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines				S-11		50/3" (N=50/3")	3" (100%)							
50 500															
	53.0 ft: changes to grayish brown				S-12		27- 50/5" (N=50/5")	11" (100%)							
55 495		SM													
	58.0 ft: changes to nonplastic, estimated 40 - 55% fine to coarse sand, estimated 30 - 45% fines, estimated 15% gravel and gravel-sized pieces of mica				S-13		50/4" (N=50/4")	4" (100%)							
60 490					S-14		50/1" (N=50/1")	1" (100%)							62.0ft: Auger refusal at 62 feet 62.0ft: Stopped for day on 12/10/2019, continued 12/11/2019
65					RC-1			53" (88%)	55						

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Log of Test Boring 702

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	485	62.0 - 77.2 ft: Medium strong, slightly weathered, highly fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, moderately foliated, contains quartz inclusions. Most fractures 10-65 degrees, spotty iron staining infill, rough to slightly rough. Lens of Lean CLAY with sand from approximately 65.5-65.7 feet.*(continued)*														
70						RC-2			62" (100%)	55						
	480	67.0 ft: changes to Strong to medium strong, slightly weathered to highly weathered, dark brownish gray, most fractures 15-70 degrees, partial iron and dark brown staining infill, slightly rough to smooth 72.2 ft: changes to Strong, slightly weathered, moderately fractured to highly fractured, dark gray, strongly foliated, most fractures 30-60 degrees, partial iron and dark brown staining infill, slightly rough to smooth														
75						RC-3			59" (98%)	77						
	475															
		Boring terminated at 77.2 FT on 12/11/2019. 1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Upon reading, the pipe was partially clogged (clogged depth recorded as "cave" depth). Water level measured above the clog. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 703

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626969.0366 E 1319673.0804**

DATE STARTED: **1/13/2020**
DATE COMPLETED: **1/14/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **63.0 FT**
SURFACE ELEVATION: **499.88 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	01-13-2020	N/A	18.0	N/A
24-hour ▼	01-14-2020	N/A	16.7	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 0.2 ft: Topsoil = 2.5 inches	Topsoil													
		0.2 - 3.0 ft: Slightly moist, very loose, reddish yellow, nonplastic, SILTY SAND, estimated 50 - 65% fine to coarse sand, estimated 30 - 45% fines, contains mica	SM			S-1		1- 2- 2- 4 (N=4)	14" (58%)							
5	495	3.0 - 8.0 ft: Moist, loose, light reddish brown, low plasticity, SILTY SAND WITH GRAVEL, 49.6% fine to coarse sand, 30.6% fines, 19.8% angular quartz gravel (approximate 5-inch lens)	SM			S-2		2- 4- 5- 6 (N=9)	18" (75%)							
10	490	8.0 - 28.0 ft: Moist, loose, reddish yellow with streaks of black, nonplastic, SILTY SAND, 56.0% fine to coarse sand, 43.4% fines, 0.6% gravel, contains mica				S-3		2- 5- 5- 6 (N=10)	20" (83%)		22.3	NP	NP			
15	485	13.0 ft: changes to Slightly moist, olive yellow with streaks of black, estimated 50 - 85% fine to coarse sand, estimated 15 - 25% fines				S-4		3- 4- 4- 5 (N=8)	22" (92%)							
20	480	18.0 ft: changes to medium dense, light yellowish brown with streaks of dark brown, 52.4% fine to coarse sand, 47.6% fines, contains mica	SM			S-5		1- 6- 10- 8 (N=16)	24" (100%)							
25	475	23.0 ft: changes to olive yellow with speckles of black, low plasticity, estimated 50 - 65% fine to coarse sand, estimated 30 - 45% fines, contains mica				S-6		4- 6- 9- 10 (N=15)	13" (54%)							
30	470		SM			S-7		7- 10- 13- 10 (N=23)	8" (33%)							

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G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring 703

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		28.0 - 33.0 ft: Slightly moist, medium dense, light olive brown with streaks of dark brown, nonplastic, SILTY SAND WITH GRAVEL, 44.7% fine to coarse sand, 29.1% fines, 26.2% subangular gravel, contains mica*(continued)*	SM													
35	465	33.0 - 53.0 ft: dense, light olive brown with streaks of dark brown, low plasticity, SILTY SAND, 66.3% fine to coarse sand, 22.1% fines, 11.6% gravel and gravel-sized pieces of mica				S-8		7- 15- 19- 32 (N=34)	14" (58%)							
40	460	38.0 ft: changes to medium dense, estimated 50 - 65% fine to coarse sand, estimated 30 - 45% fines, estimated 5% gravel (lens)				S-9		7- 10- 19- 26 (N=29)	14" (58%)							
45	455	43.0 ft: changes to very dense, nonplastic, estimated 75 - 85% fine to medium sand, estimated 15 - 25% fines	SM			S-10		11- 21- 35- 49 (N=56)	9" (38%)							
50	450	48.0 ft: changes to medium dense				S-11		6- 8- 11- 17 (N=19)	8" (33%)							52.0ft: Rig chattering at 52 feet
		53.0 - 63.0 ft: Very weak, highly weathered to severely weathered, intensely fractured, dark gray and white, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 0-5 and 70-90 degrees, partial dark brown and spotty iron staining infill, smooth				S-12		50/1" (N=50/1")	1" (100%)							53.0ft: Auger refusal at 53 feet 53.0ft: Grayish brown to gray effluent while coring RC-1
55	445					RC-1			29" (48%)	7						55.0ft: Sand covering outside of inner core barrel
60	440	58.0 ft: changes to Strong to weak, grayish brown to dark gray, with white speckles, few white streaks. Most fractures 30-60 degrees, spotty dark brown and iron staining infill, slightly rough to smooth				RC-2			53" (88%)	0						59.0ft: Stopped for day on 1/13/2020, continued 1/14/2020
		Boring terminated at 63.0 FT on 1/14/2020. Boring tremie grouted after final water level measurement.														

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G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring 801

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626207.463 E 1318871.4183**

DATE STARTED: **12/30/2019**
DATE COMPLETED: **12/30/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **35.6 FT**
SURFACE ELEVATION: **547.99 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-30-2019	N/A	Dry	N/A
24-hour ▽	12-31-2019	N/A	30.0	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		Top soil														
	545	1.0 - 8.0 ft: Moist, medium stiff, strong brown with speckles of black, medium plasticity, SANDY ELASTIC SILT, 68.3% fines, 31.7% fine to medium sand														
5			MH			S-1		3- 4- 4- 5 (N=8)	18" (75%)		43.1	57	46	1.25	2.5	
	540	8.0 - 9.0 ft: Moist, very stiff, brown with speckles of black, medium plasticity, SANDY LEAN CLAY, estimated 50 - 65% fines, estimated 35 - 50% fine to medium sand	CL			S-2		3- 8- 11- 11 (N=19)	20" (83%)					1.50	2.8	
10		9.0 - 13.0 ft: Slightly moist, medium dense, dark yellowish brown with speckles of black, low plasticity, SILTY SAND, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines, contains mica	SM													
	535	13.0 - 18.0 ft: Slightly moist, dense, dark yellowish brown with streaks of black, nonplastic, SILTY SAND, 48.7% fine to coarse sand, 38.7% fines, 12.6% gravel				S-3		3- 13- 22- 50/3" (N=35)	20" (95%)							
15			SM													
	530	18.0 - 20.5 ft: Slightly moist, very dense, yellowish brown, low plasticity, SILTY SAND WITH GRAVEL, estimated 75 - 85% fine to coarse sand, estimated 15 - 25% fines, estimated 20% subangular gravel				S-4		50/5.5" (N=50/5.5")	3" (55%)							
20			SM			S-5		50/0" (N=50/0")	0" (NR)							20.0ft: Rig chattering at 20 feet 20.5ft: Auger refusal at 20.5 feet 20.5ft: Brown effluent while coring RC-1. Water stopped returning at approximately 23 feet
	525	20.5 - 35.6 ft: Strong to medium strong, moderately weathered to slightly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, strongly foliated, contains few quartz inclusions. Most fractures 35-50 degrees, partial iron staining and fine orange soil infill, slightly rough to smooth. Highly/completely weathered section at 20.5 feet				RC-1			58" (97%)	55						
25		25.5 ft: changes to Very strong to strong, fresh, moderately fractured to highly fractured, dark bluish gray, contains large quartz inclusion at 25.8-26.3 feet. Most fractures 15-70 degrees, no infill except for one fracture at 28.3 feet partial iron and dark brown staining infill				RC-2			58" (97%)	80						
	520															
30 ▽																

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Log of Test Boring 801

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
515	20.5 - 35.6 ft: Strong to medium strong, moderately weathered to slightly weathered, moderately fractured to intensely fractured, dark gray, MICA SCHIST, fine to medium grained, strongly foliated, contains few quartz inclusions. Most fractures 35-50 degrees, partial iron staining and fine orange soil infill, slightly rough to smooth. Highly/completely weathered section at 20.5 feet*(continued)*				RC-3			61" (100%)	100						
35	30.5 ft: changes to Very strong, slightly weathered, moderately fractured, contains quartz inclusions, all fractures mechanical, approximately 15-20 degrees														
	Boring terminated at 35.6 FT on 12/30/2019.														
	1-inch slotted temporary PVC standpipe installed for 24-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 802

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PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626214.1011 E 1318788.672**

DATE STARTED: **12/27/2019**
DATE COMPLETED: **12/27/2019**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **73.1 FT**
SURFACE ELEVATION: **554.95 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered ▽	12-27-2019	N/A	43.0	N/A
72-hour ▼	12-30-2019	N/A	35.6	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		Top soil														
		1.0 - 5.0 ft: Moist, medium dense, reddish brown, medium plasticity, CLAYEY SAND, estimated 50 - 65% fine to coarse sand, estimated 30 - 45% fines, estimated 5% gravel	SC			S-1		5- 7- 9- 8 (N=16)	18" (75%)							
5	550	5.0 - 8.0 ft: Moist, strong brown, medium plasticity, SANDY LEAN CLAY, estimated 50 - 65% fines, estimated 30 - 45% fines, estimated 5% gravel	CL			T-1			18" (78%)					4.00	7.0	5.0ft: Shelby tube advanced from 5.0-6.9 feet. Refusal at 6.9 feet
		8.0 - 23.0 ft: Moist, medium dense, strong brown with streaks of black, low plasticity, SILTY SAND, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines				S-3		6- 5- 6- 7 (N=11)	24" (100%)							
10	545															
		13.0 ft: changes to Slightly moist, brownish yellow, streaks of black and white, nonplastic, 56.2% fine to coarse sand, 33.4% fines, 10.4% gravel, contains mica				S-4		10- 12- 14- 16 (N=26)	18" (75%)							
15	540		SM													
		18.0 ft: changes to yellow, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines, contains mica, light brown and light orange with streaks of white				S-5		5- 12- 16- 16 (N=28)	16" (67%)							
20	535															
		23.0 - 28.0 ft: Slightly moist, medium dense, brownish yellow, SILTY SAND WITH GRAVEL, 55.6% fine to coarse sand, 22.2% fines, 22.2% gravel; contains more, larger pieces of mica				S-6		10- 13- 14- 20 (N=27)	20" (83%)		10.2					
25	530		SM													
			SM			S-7		6- 7- 10- 8 (N=17)	20" (83%)							
30	525															

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Log of Test Boring 802

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	28.0 - 38.0 ft: Slightly moist, medium dense, light yellowish brown with speckles of white, low plasticity, SILTY SAND, estimated 50 - 65% fine to coarse sand, estimated 25 - 40% fines, estimated 10% gravel*(continued)*														
	33.0 ft: changes to very dense, brownish yellow with streaks of black, nonplastic	SM			S-8		13- 26- 30- 31 (N=56)	18" (75%)							
35 520	▼														
	38.0 - 53.0 ft: Slightly moist, light yellowish brown, SILTY SAND WITH GRAVEL, 56.1% fine to coarse sand, 24.5% gravel and gravel-sized pieces of mica, 19.4% fines				S-9		24- 26- 35- 29 (N=61)	20" (83%)							
40 515															
	▽ 43.0 ft: changes to Slightly moist, very dense, light olive brown, nonplastic, estimated 50 - 60% fine to coarse sand, estimated 15 - 25% fines, estimated 15 - 25% gravel, almost entirely pieces of mica				S-10		8- 20- 25- 23 (N=45)	20" (83%)							
45 510		SM													
	48.0 ft: changes to 57.3% fine to coarse sand, 22.9% gravel, 19.8% fines				S-11		24- 42- 47- 44 (N=89)	20" (83%)							
50 505															
	53.0 - 58.0 ft: Slightly moist, very dense, light yellowish brown with streaks of dark brown, nonplastic, SILTY SAND, estimated 50 - 65% fine to medium sand, estimated 30 - 45% fines, estimated 5% subangular quartz gravel				S-12		24- 25- 50/3" (N=25+50/3")	12" (80%)							
55 500															57.0ft: Rig chattering at 57 feet
	58.0 - 73.1 ft: Strong, moderately weathered, highly fractured to intensely fractured, dark gray with streaks of brown, MICA SCHIST, fine to medium grained, strongly foliated, contains quartz inclusions and pyrite nodules. Most fractures 10-60 degrees, partial iron staining and micaceous soil infill, slightly rough. One highly to completely weathered section 61.6 to 61.9 feet				S-13		50/1" (N=50/1")	0" (NR)							58.0ft: Auger refusal at 58 feet
60 495					RC-1			53" (88%)	63						
	63.0 ft: changes to Very strong to strong, fresh to slightly weathered, moderately fractured to highly fractured, dark gray, no pyrite nodules. Most fractures 30-60 degrees, spotty iron staining infill, slightly rough														
65 490															

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Log of Test Boring 802

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		58.0 - 73.1 ft: Strong, moderately weathered, highly fractured to intensely fractured, dark gray with streaks of brown, MICA SCHIST, fine to medium grained, strongly foliated, contains quartz inclusions and pyrite nodules. Most fractures 10-60 degrees, partial iron staining and micaceous soil infill, slightly rough. One highly to completely weathered section 61.6 to 61.9 feet*(continued)*				RC-2			61" (100%)	89						
70	485	68.1 ft: changes to most fractures 30-60 degrees, no infill, rough. Few natural fractures 60 degrees, spotty to partial iron staining infill, slightly rough				RC-3			58" (97%)	83						
		Boring terminated at 73.1 FT on 12/27/2019.														
		1-inch slotted temporary PVC standpipe installed for 72-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 803

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626272.5515 E 1318685.6954**

DATE STARTED: **1/3/2020**
DATE COMPLETED: **1/7/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **93.0 FT**
SURFACE ELEVATION: **567.49 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	01-07-2020	N/A	63.0	N/A
24-hour	01-08-2020	N/A	44.2	N/A
72-hour	01-10-2020	N/A	45.3	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		Top soil														
	565	1.0 - 18.0 ft: Slightly moist, loose, yellowish brown and white, nonplastic, SILTY SAND, estimated 50 - 60% fine to coarse sand, estimated 30 - 40% fines, estimated 10% subangular quartz gravel, contains mica				S-1		3- 4- 4- 5 (N=8)	8" (33%)							
5																
	560	8.0 ft: changes to brownish yellow with streaks of black, low to no plasticity, estimated <5% gravel				S-2		2- 5- 5- 6 (N=10)	18" (75%)							
10		10.0 ft: changes to dark brownish yellow with streaks of black	SM			T-1			22" (92%)							10.0ft: Shelby tube advanced from 10-12 feet
	555	13.0 ft: changes to medium dense				S-4		4- 7- 7- 10 (N=14)	20" (83%)							
15		15.0 ft: changes to light brownish yellow with speckles of black, 55.4% fine to coarse sand, 40.4% fines, 4.2% gravel, contains mica				T-2			24" (100%)		14.4	NP	NP			15.0ft: Shelby tube advanced from 15-17 feet
	550	18.0 - 28.0 ft: Slightly moist, stiff, brownish yellow with speckles of black, nonplastic, SANDY SILT, estimated 50 - 65% fines, estimated 35 - 50% fine to coarse sand				S-6		3- 6- 8- 10 (N=14)	24" (100%)							
20																
	545	23.0 ft: changes to low to no plasticity, 56.8% fines, 43.2% fine to coarse sand	ML			S-7		7- 8- 7- 9 (N=15)	5" (21%)							
25																
	540		SM			S-8		6- 8- 12- 12 (N=20)	20" (83%)							28.0ft: 28-29.5 feet sampled from split spoon as S-8A
30																

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Log of Test Boring 803

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
	29.5 ft: changes to nonplastic 28.0 - 48.0 ft: Slightly moist, medium dense, yellowish brown with streaks of black, nonplastic, SILTY SAND, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines*(continued)*														29.5ft: 29.5-30.0 feet sampled from split spoon as S-8B
535															
	33.0 ft: changes to dense, brownish yellow with streaks of black, low to no plasticity, 56.6% fine to medium sand, 43.4% fines				S-9		7- 14- 23- 29 (N=37)	24" (100%)							
35															35.0ft: Stopped for day on 1/3/20, continued 1/7/20
530															
	38.0 ft: changes to Moist, medium dense, reddish brown with streaks of black, nonplastic, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines	SM			S-10		5- 8- 14- 15 (N=22)	22" (92%)							
40															
525															
	43.0 ft: changes to medium dense, nonplastic, 58.9% fine to coarse sand, 32.2% fines, 9.0% subangular quartz gravel, contains mica				S-11		7- 11- 16- 17 (N=27)	20" (83%)							
45															
520															
	48.0 - 53.0 ft: Moist, medium dense, light olive brown with streaks of black, low plasticity, SILTY SAND WITH GRAVEL, estimated 40 - 55% fine to coarse sand, estimated 30 - 45% fines, contains mica, contains approximate 1-inch quartz gravel lens at 49.5 feet, estimated 15% subangular quartz gravel	SM			S-12		10- 9- 15- 18 (N=24)	20" (83%)							
50															
515															
	53.0 - 58.0 ft: dense, yellowish brown, low plasticity, SILTY SAND, estimated 50 - 65% fine to coarse sand, estimated 35 - 50% fines, contains mica	SM			S-13		7- 13- 18- 50/5" (N=31)	3" (13%)							
55															
510															
	58.0 - 63.0 ft: very dense, light yellowish brown with streaks of dark brown, nonplastic, SILTY SAND WITH GRAVEL, estimated 40 - 55% fine to coarse sand, estimated 30 - 45% fines, estimated 15% quartz gravel, contains mica	SM			S-14		17- 25- 26- 27 (N=51)	14" (58%)							58.0ft: Approximate 1-inch piece of quartz at top of spoon
60															
505															
	63.0 - 73.0 ft: Slightly moist, very dense, light olive brown and dark brown, nonplastic, SILTY SAND, 54.4% fine to coarse sand, 42.0% fines, 3.6% subangular quartz gravel, contains mica	SM			S-15		27- 40- 50/5" (N=40+50/5")	14" (82%)							
65															

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Log of Test Boring 803

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
500 / 70	63.0 - 73.0 ft: Slightly moist, very dense, light olive brown and dark brown, nonplastic, SILTY SAND, 54.4% fine to coarse sand, 42.0% fines, 3.6% subangular quartz gravel, contains mica *(continued)* 68.0 ft: changes to low plasticity, estimated 50 - 65% fine to coarse sand, est 35 - 50% fines, contains mica	SM			S-16		6- 19- 50/4" (N=19+50/4")	12" (75%)							
495 / 75	73.0 - 83.0 ft: Slightly moist, very dense, light olive brown, nonplastic, SILTY SAND WITH GRAVEL, 50.4% fine to coarse sand, 30.8% angular quartz gravel and gravel-sized pieces of mica (lenses), 18.8% fines				S-17		39- 38- 50- 50/4" (N=88)	14" (64%)							
490 / 80	78.0 ft: changes to Moist, estimated 40 - 60% fine to coarse sand, estimated 15 - 35% fines, contains mica, estimated 25% subangular quartz gravel	SM			S-18		50/5" (N=50/5")	4" (80%)							78.0ft: Approximate 1-inch piece of subangular quartz at top of spoon 81.0ft: Rig chattering
485 / 85	83.0 - 93.0 ft: Weak to very weak, highly weathered to severely weathered, moderately fractured to intensely fractured, dark brown to grayish brown, MICA SCHIST, fine to medium grained, moderately foliated, most fractures 15-70 degrees, partial to filled dark brown staining and silty sand infill, rough to slightly rough. Approximate half-inch completely weathered section at 86.1 feet 88.0 ft: changes to Medium strong to very weak, grayish brown to brownish gray, contains quartz inclusions. Most fractures 25-70 degrees, spotty iron staining, partial dark brown staining, and some micaceous soil infill				S-19		50/1.5" (N=50/1.5")	1.5" (100%)							82.5ft: Harder rig chattering 83.0ft: Auger refusal at 83 feet 83.0ft: Brown effluent while coring RC-1
					RC-1			60" (100%)	58						
480 / 90					RC-2			60" (100%)	50						
475	Boring terminated at 93.0 FT on 1/7/2020. 1-inch slotted temporary PVC standpipe installed for 24- and 72-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 804

AECOM

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626399.884 E 1318493.9174**

DATE STARTED: **1/2/2020**
DATE COMPLETED: **1/3/2020**
LOGGED BY: **N. Schluter**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **82.0 FT**
SURFACE ELEVATION: **583.21 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	01-03-2020	N/A	57.0	N/A
96-hour	01-07-2020	N/A	50.7	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		Top soil														
		1.0 - 33.0 ft: Slightly moist, loose, strong brown with speckles of black, nonplastic, SILTY SAND, estimated 50 - 60% fine to medium sand, estimated 35 - 45% fines, estimated 5% gravel, contains mica				S-1		3- 4- 4- 4 (N=8)	14" (58%)							
5	580															
	575	8.0 ft: changes to brown with speckles of black, medium dense, low to no plasticity, 57.4% fine to coarse sand, 33.7% fines, 8.9% gravel				S-2		6- 12- 15- 18 (N=27)	16" (67%)							
10																
	570	13.0 ft: changes to brownish yellow with streaks of black, estimated 50 - 60% fine to medium sand, estimated 35 - 45% fines, estimated 5% gravel, very dense, nonplastic				S-3		10- 36- 32- 31 (N=68)	18" (75%)							
15			SM													
	565	18.0 ft: changes to dense, yellowish brown with streaks of black, 61.8% fine to coarse sand, 33.8% fines, 4.4% gravel				S-4		8- 15- 17- 20 (N=32)	20" (83%)							
20																
	560	23.0 ft: changes to yellowish brown, estimated 40 - 60% fine to medium sand, estimated 30 - 50% fines, estimated 10% gravel and gravel-sized pieces of mica				S-5		9- 15- 20- 23 (N=35)	24" (100%)							
25		25.0 ft: changes to yellowish brown with streaks of black, low plasticity				T-1			10" (100%)							25.0ft: Shelby tube advanced from 25.0-25.8 feet. Refusal at 25.8 feet
	555	28.0 ft: changes to very dense				S-7		47- 50/2" (N=50/2")	8" (100%)							
30																

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Log of Test Boring 804

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		1.0 - 33.0 ft: Slightly moist, loose, strong brown with speckles of black, nonplastic, SILTY SAND, estimated 50 - 60% fine to medium sand, estimated 35 - 45% fines, estimated 5% gravel, contains mica*(continued)*	SM													
35	550	33.0 - 38.0 ft: very dense, yellowish brown with streaks of black, nonplastic, SILTY SAND WITH GRAVEL, 57.3% fine to coarse sand, 23.8% angular gravel (lens) , 18.9% fines, contains mica	SM			S-8		38- 50/3" (N=50/3")	9" (100%)							
40	545	38.0 - 43.0 ft: Moist, very dense, yellowish brown with speckles of black, nonplastic, SILTY SAND, estimated 50 - 65% fine to coarse sand, estimated 35 - 50% fines, contains mica	SM			S-9		10- 33- 50/4" (N=33+50/4")	16" (100%)							
45	540	43.0 - 48.0 ft: Moist, very dense, dark yellowish brown, SILTY SAND WITH GRAVEL, orange and light brown with streaks of black, fine to medium, nonplastic, estimated 50 - 75% fine to medium sand, estimated 30 - 45% fines, estimated 15% gravel and pieces of mica	SM			S-10		19- 12- 12- 50/4" (N=24)	22" (100%)							
50	535	48.0 - 61.5 ft: Slightly moist, very dense, brownish yellow, nonplastic, SILTY SAND, estimated 50 - 65% fine to medium sand, estimated 35 - 50% fines, contains mica	SM			S-11		25- 49- 50/3" (N=49+50/3")	15" (100%)							
55	530	53.0 ft: changes to light yellowish brown with speckles of black, 50.4% fine to medium sand, 49.6% fines, contains mica	SM			S-12		24- 32- 50/5" (N=32+50/5")	17" (100%)		15.9					55.0ft: Stopped on 1/2/2020, continued 1/3/2020
60	525	58.0 ft: changes to light yellowish brown, estimated 75 - 85% fine to coarse sand, estimated 15 - 25% fines, no mica				S-13		50/5" (N=50/5")	4" (80%)							60.0ft: Rig chattering
65	520	61.5 - 62.0 ft: Slightly moist, very dense, gray, nonplastic, POORLY GRADED SAND WITH SILT, estimated 95% fine to coarse sand, estimated 5% fines	SP-SM			S-14		50/5.5" (N=50/5.5")	2" (36%)							61.5ft: Auger refusal at 62 feet
						RC-1			44" (73%)	32						

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G = Geoprobe T = Shelby Tube Sample RC = Rock Core
PS = Piston Sample H = Hand Auger Sample SC = Sonic Core

Log of Test Boring 804

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		62.0 - 82.0 ft: Weak to very weak, highly weathered to severely weathered, highly fractured to intensely fractured, dark brownish gray orange, MICA SCHIST, fine to medium grained, strongly foliated, most fractures 50 to 90 degrees, partial iron and dark brown spots staining infill, slightly rough to smooth*(continued)*														
	515															
70		67.0 ft: changes to Very weak, highly weathered, most fractures 50 to 90 degrees, partial iron and dark brown spots staining and some micaceous soil infill, rough to smooth				RC-2			60" (100%)	25						
		72.0 ft: changes to Strong to medium strong, moderately weathered, highly fractured, dark gray, 72.0 - 72.1 feet recovery consisted of gravel. Most fractures 30-80 degrees, partial iron and black staining infill, slightly rough. Multiple areas cracked but not broken														72.0ft: Grayish brown effluent while coring RC-3 and RC-4
	510															
75						RC-3			45" (75%)	55						
		77.0 ft: changes to Weak to medium strong, highly weathered to severely weathered, highly fractured to intensely fractured, grayish brown, completely weathered section 80.5 to 80.7 feet, approximately two inches of micaceous silty sand with gravel. Most fractures 10-30 degrees, partial dark brown staining infill, rough to smooth														
	505															
80						RC-4			58" (97%)	48						
		Boring terminated at 82.0 FT on 1/3/2020.														
		1-inch slotted temporary PVC standpipe installed for 96-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Log of Test Boring 805

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD** COORD. SYS./DATUM: **MD State Plane/USGS NAVD88**

PROJECT NUMBER: **60614688** COORDINATES: **N 626637.5184 E 1318451.7236**

DATE STARTED: **12/23/2019**
DATE COMPLETED: **12/23/2019**
LOGGED BY: **K. Wachtel**
CHECKED BY: **E. Wenz**
DRILLING CONTRACTOR: **Connelly&Assoc.**
DRILL RIG: **CME-55 (Track)**
DRILLER: **B. Mullendore**

DRILL METHOD: **3-1/4" I.D. HSA/Wireline Coring**
HAMMER TYPE/WEIGHT: **Auto Hammer/140lbs**
CASING TYPE: **HSA**
CASING SIZE: **3-1/4**
BIT TYPE/SIZE: **6" Cutter Head/NQ2 Solid Core Barrel**
BOREHOLE DEPTH: **48.5 FT**
SURFACE ELEVATION: **573.07 FT**

Groundwater Observations

Event	Date	Time	Depth (ft)	Cave in Depth (ft)
Encountered	12-26-2019	N/A	N/A	N/A
96-hour ▽	12-30-2019	N/A	37.7	N/A

DEPTH (FT)	ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
		0.0 - 1.0 ft: Topsoil = 12 inches	Topsoil													
		1.0 - 3.8 ft: Moist, very dense, brown, SILTY SAND WITH GRAVEL, 49.3% fines, 34.1% fine to coarse sand, 16.6% gravel	SM													
	570					S-1		9- 16- 41- 28 (N=57)	22" (92%)							
5		3.8 - 8.5 ft: very dense, nonplastic, SILTY GRAVEL WITH SAND, 44.5% angular gravel, 37.4% fine to coarse sand, 18.1% fines	GM													
	565	8.0 ft: changes to gray and brown, estimated 75 - 85% gravel, estimated 15 - 25% fine to coarse sand				S-2		50- 50/1" (N=50/1")	5.5" (79%)							8.5ft: Auger refusal at 8.5 feet
10		8.5 - 43.5 ft: Strong to medium strong, slightly weathered to moderately weathered, moderately fractured to intensely fractured, dark brownish gray to dark gray, MICA SCHIST, fine to medium grained, slightly foliated, most fractures 20-50 degrees partial iron staining and soil infill, slightly rough to smooth				RC-1			50" (83%)	45						
	560	13.5 ft: changes to dark gray, moderately foliated, contains quartz inclusions, most fractures 45-70 degrees, partial iron staining and soil infill, slightly rough to smooth				RC-2			59" (98%)	65						
15																
	555	18.5 ft: changes to highly fractured to intensely fractured, dark gray to dark brownish gray, strongly foliated, most fractures 45-60 degrees, partial iron and dark brown staining and micaceous soil infill, rough to slightly rough				RC-3			58" (97%)	42						18.5ft: Stopped for day on 12/23/219, continued on 12/26/2019
20																
	550	23.5 ft: changes to Strong, moderately weathered, highly fractured, dark brownish gray, strongly foliated, most fractures 45-60 degrees, partial iron and dark brown staining infill, slightly rough to smooth				RC-4			60" (100%)	58						
25																
	545	28.5 ft: changes to Medium strong, highly weathered, moderately fractured to highly fractured, light brownish gray, most fractures														
30																

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Log of Test Boring 805

PROJECT: **Piney Run Watershed Study**

PROJECT LOCATION: **Carroll County, MD**

PROJECT NUMBER: **60614688**

DEPTH (FT) / ELEV. (FT)	DESCRIPTION	USCS	GRAPHIC	STRATUM	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS	REC (IN) (%)	RQD (%)	Moisture Content (%)	Liquid Limit	Plastic Limit	Pocket Pen.(tsf)	Torvane (tsf)	REMARKS AND TESTS
540	30-90 degrees, partial iron and dark brown staining infill, slightly rough to smooth. Sandy soil infill in fracture at 32 feet. No quartz inclusions 8.5 - 43.5 ft: Strong to medium strong, slightly weathered to moderately weathered, moderately fractured to intensely fractured, dark brownish gray to dark gray, MICA SCHIST, fine to medium grained, slightly foliated, most fractures 20-50 degrees partial iron staining and soil infill, slightly rough to smooth*(continued)*				RC-5			51" (85%)	37						31.2ft: Thin clay seam
35															34.4ft: Orangish brown clayey soil with gravel encountered
535	35.1 ft: changes to Very strong to strong, slightly weathered, moderately fractured to intensely fractured, dark gray, moderately foliated, contains quartz inclusions, most fractures 30-60 degrees, partial iron staining infill, slightly rough to smooth				RC-6			58" (97%)	60						
40	38.5 ft: changes to intensely fractured, most fractures 30-45 degrees, spotty iron staining infill, rough to slightly rough 39.8 ft: changes to moderately fractured to highly fractured				RC-7			60" (100%)	77						
530															
45															
525	Boring terminated at 48.5 FT on 12/23/2019. 1-inch slotted temporary PVC standpipe installed for 96-hr groundwater reading. Boring tremie grouted after final water level measurement.														

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Appendix C – Rock Core Boxes Photographic Log

AECOM

ROCK CORE PHOTOGRAPHIC LOG

Client Name:	**Site Location:**	**Project No.**
Carroll County Bureau of Resource Management	Piney Run Dam, Carroll County, MD	60614688

Photo No. 1	**Date:** 2/6/2020

701 Box 1 of 1
Cored: 12/10/2019
Depth (feet): 12.5-27.5

Photo No. 2	**Date:** 2/6/2020

702 Box 1 of 1
Cored: 12/11/2019
Depth (feet): 62.0-77.2

AECOM	ROCK CORE PHOTOGRAPHIC LOG	
Client Name: Carroll County Bureau of Resource Management	**Site Location:** Piney Run Dam, Carroll County, MD	**Project No.** 60614688

Photo No. 3	**Date:** 2/6/2020

703 Box 1 of 1
Cored: 1/13/2020 - 1/14/2020
Depth (feet): 53.0-63.0

601 Box 1 of 1
Cored: 1/10/2020
Depth (feet): 15.0-20.0

Photo No. 4	**Date:** 2/6/2020

201 Box 1 of 1
Cored: 12/4/2019 – 12/5/2019
Depth (feet): 48.0-53.0 and
55.0-70.2

208 Box 1 of 1
Cored: 12/5/2019
Depth (feet): 36.0-41.0

AECOM	ROCK CORE PHOTOGRAPHIC LOG	
Client Name: Carroll County Bureau of Resource Management	**Site Location:** Piney Run Dam, Carroll County, MD	**Project No.** 60614688

Photo No. 5	**Date:** 2/6/2020

202 Box 1 of 1
Cored: 12/3/2019 - 12/4/2019
Depth (feet): 18.0-38.0

Photo No. 6	**Date:** 2/6/2020

203 Box 1 of 1
Cored: 11/25/2019 - 11/26/2019
Depth (feet): 37.5-53.8

AECOM	ROCK CORE PHOTOGRAPHIC LOG	
Client Name: Carroll County Bureau of Resource Management	**Site Location:** Piney Run Dam, Carroll County, MD	**Project No.** 60614688

Photo No. 7	**Date:** 2/6/2020

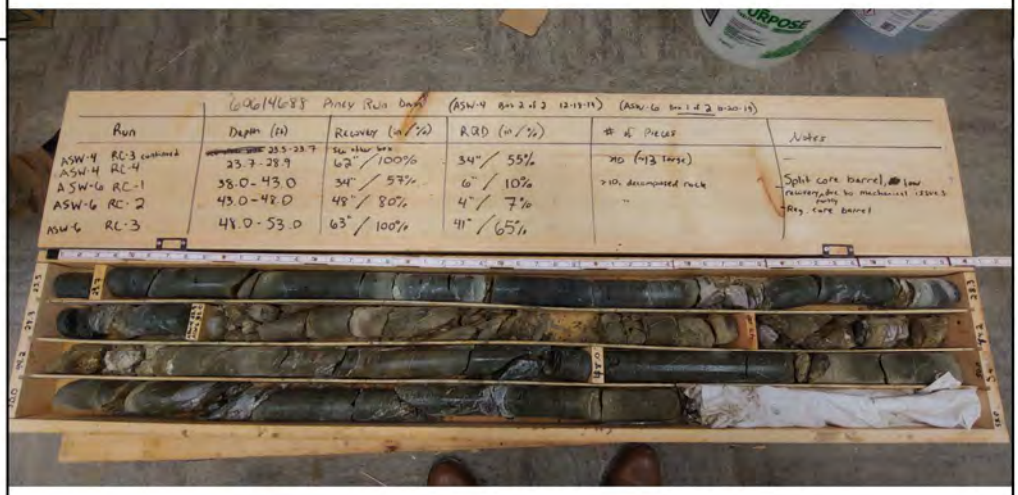
204 Box 1 of 2
Cored: 12/18/2019
Depth (feet): 8.5-23.7

3 Box 1 of 1
Cored: 12/17/2019
Depth (feet): 47.5-52.7

Photo No. 8	**Date:** 2/6/2020

204 Box 2 of 2
Cored: 12/18/2019
Depth (feet): 23.5-28.9

206 Box 1 of 2
Cored: 12/20/2019
Depth (feet): 38.0-53.0



AECOM

ROCK CORE PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Carroll County Bureau of Resource Management	Piney Run Dam, Carroll County, MD	60614688

Photo No. 9	Date: 2/6/2020

206 Box 2 of 2
Cored: 12/23/2019
Depth (feet): 53.0-63.0

805 Box 1 of 3
Cored: 12/23/2019
Depth (feet): 8.5-18.5

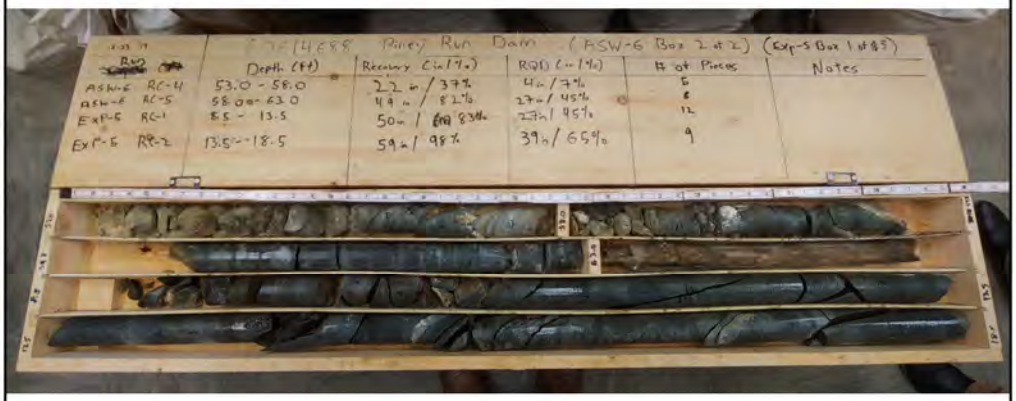


Photo No. 10	Date: 2/6/2020

805 Box 2 of 3
Cored: 12/26/2019
Depth (feet): 18.5-38.5

AECOM

ROCK CORE PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Carroll County Bureau of Resource Management	Piney Run Dam, Carroll County, MD	60614688

Photo No. 11	Date: 2/6/2020

805 Box 3 of 3
Cored: 12/26/2019
Depth (feet): 38.5-43.5 (box mislabeled)

802 Box 1 of 1
Cored: 12/27/2019
Depth (feet): 58.0-73.1

Photo No. 12	Date: 2/6/2020

207 Box 1 of 1
Cored: 12/6/2019
Depth (feet): 37.5-53.0

AECOM

ROCK CORE PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Carroll County Bureau of Resource Management	Piney Run Dam, Carroll County, MD	60614688

Photo No. 13	Date: 2/6/2020

212 Box 1 of 1
Cored: 1/9/2020
Depth (feet): 42.7-53.0

209 Box 1 of 2
Cored: 1/10/2020
Depth (feet): 33.0-42.2 (box mislabeled)

Photo No. 14	Date: 2/6/2020

209 Box 2 of 2
Cored: 1/10/2020
Depth (feet): 42.2-48.2

803 Box 1 of 1
Cored: 1/7/2020
Depth (feet): 83.0-93.0

AECOM

ROCK CORE PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Carroll County Bureau of Resource Management	Piney Run Dam, Carroll County, MD	60614688

Photo No. 15	Date: 2/6/2020

210 Box 1 of 1
Cored: 12/3/2019
Depth (feet): 28.5-42.2

Photo No. 16	Date: 2/6/2020

211 Box 1 of 1
Cored: 11/27/2019
Depth (feet): 55.0-70.1

AECOM

ROCK CORE PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Carroll County Bureau of Resource Management	Piney Run Dam, Carroll County, MD	60614688

Photo No. 17	Date: 2/6/2020

1 Box 1 of 1
Cored: 12/12/2019
Depth (feet): 45.0-54.0

2 Box 1 of 1
Cored: 12/16/2019
Depth (feet): 78.0-83.1

Photo No. 18	Date: 2/6/2020

801 Box 1 of 1
Cored: 12/20/2019
Depth (feet): 20.5-35.6

AECOM

ROCK CORE PHOTOGRAPHIC LOG

Client Name:	**Site Location:**	**Project No.**
Carroll County Bureau of Resource Management	Piney Run Dam, Carroll County, MD	60614688

Photo No. 19	**Date:** 2/6/2020

804 Box 1 of 1
Cored:1/3/2020
Depth (feet): 62.0-82.0

Appendix D – Summary of Laboratory Test Results

PINEY RUN: LABORATORY TESTING DATA SUMMARY

LOCATION	BORING NO.	SAMPLE NO.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS ASTM D4318			GRAVEL %	SAND %	FINES %	Cu	Cc	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (ASTM D698) (pcf)	OPTIMUM MOISTURE CONTENT (ASTM D698) (%)	SPECIFIC GRAVITY	COMPRESSIVE STRENGTH (psi)
						LL	PL	PI										
Abutment Soil	701	S-1A	3.0-4.0	GM		33	28	5	37.3	25	37.8	701.1	0.24					
	701	S-1B*	4.0-5.0						63.6	21.2	15.2							
	701	S-2*	8.0-10.0						35.4	33.4	31.2	232.04	0.13					
	702	T-1	3.0-5.0		26.6									81.4				
	703	S-2	3.0-5.0						19.8	49.6	30.6							
	703	S-3	8.0-10.0	SM	22.3	NP	NP	NP	0.6	56	43.4	10.78	1.57					
	703	S-5	18.0-20.0						0	52.4	47.6	10.28	1.43					
	703	S-7	28.0-30.0						26.2	44.7	29.1							
	703	S-8	33.0-35.0						11.6	66.3	22.1							
ASW Soil	201	S-1	3.0-5.0						0	55.5	44.5							
	201	S-2	8.0-10.0	SM	10.6	NP	NP	NP	0	62.7	37.3	3.83	1.02					
	201	T-1	10.0-12.0		11.5				0	55.1	44.9			102.7				
	201	S-4	13.0-15.0						0	53.5	46.5							
	201	S-5	18.0-20.0						26.4	57.5	16.2	29.23	0.29					
	201	S-6	23.0-25.0						0	56.8	43.2							
	201	S-8	33.0-35.0						7.3	70.8	21.9							
	201	S-9*	38.0-40.0						12.7	69.7	17.6							
	201	S-10*	43.0-45.0						26.2	46.5	27.3							
	201	S-12*	53.0-55.0						31.3	43.5	25.2							
	202	S-1	3.0-5.0	ML	24.3	NP	NP	NP	0	31.2	68.8	7.44	2.12					
	202	T-1	5.0-7.0	GM	15.7	NP	NP	NP	52	29.2	18.7			106.9		2.74 (D854) 2.55 (C128)		
	202	S-3	8.0-10.0						14.3	42.7	43							
	202	S-4*	13.0-15.0						17.5	50.9	31.6	12.43	0.71					
	202	S-5*	18.0-18.1						36.9	40.4	22.7							
	203	S-1	3.0-5.0	ML	32.5	NP	NP	NP	0	29.2	70.8	8.71	1.18					
	203	S-2	8.0-10.0						12.8	60.2	27							
	203	S-3	13.0-15.0						25.4	55.7	18.9							
	203	S-4	18.0-20.0						0	29.1	70.9	12.04	2.06					

PINEY RUN: LABORATORY TESTING DATA SUMMARY

LOCATION	BORING NO.	SAMPLE NO.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS ASTM D4318			GRAVEL %	SAND %	FINES %	Cu	Cc	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (ASTM D698) (pcf)	OPTIMUM MOISTURE CONTENT (ASTM D698) (%)	SPECIFIC GRAVITY	COMPRESSIVE STRENGTH (psi)
						LL	PL	PI										
ASW Soil	203	S-5	23.0-25.0						0.6	47.5	51.9							
	203	S-6*	28.0-30.0						10.4	56.7	32.9							
	203	S-7*	33.0-35.0						30.9	50.8	18.3							
	204	S-1*	3.0-5.0	ML	11.3	NP	NP	NP	2.8	47.1	50.1	4.77	0.82					
	204	S-2*	8.0-10.0						21.1	32.4	46.5							
	205	S-2	2.0-4.0	SM		NP	NP	NP	8	61.8	30.2	11.31	1.54					
	205	S-4	6.0-8.0						56.1	29.5	14.4							
	205	S-5	8.0-10.0						17.2	44.5	38.3							
	205	S-6	13.0-15.0		27.3				23	46.5	30.5	14.37	0.83					
	205	S-7*	18.0-20.0						19.6	49.3	31.1							
	205	S-8*	23.0-25.0						15.4	49.6	35							
	205	S-9*	27.0-27.1						24.1	51.2	24.8							
	206	S-1	3.0-5.0						0	50.1	49.9							
	206	S-2	8.0-10.0						0.8	42.2	57.1							
	206	S-3	13.0-15.0						0	48.9	51.1							
	206	T-1	15.0-16.5	SM or ML	29.2	NP	NP	NP	0	43.2	56.8			93				
	206	S-5	18.0-20.0						2.5	50.4	47							
	206	S-6	23.0-25.0						0.6	45.8	53.6							
	206	S-7*	28.0-30.0						0	39.5	60.5	7.63	1.91					
	206	S-8*	33.0-35.0						29.5	47.8	22.7							
	206	S-9*	38.0-40.0						21.3	52.5	26.2							
	206	RC-1	39.7-40.2															
	207	S-1	3.0-5.0						21.5	54.9	23.6							
	207	S-2	8.0-10.0						3.4	66.1	30.6							
	207	T-1	10.0-12.0	SM	20.6	NP	NP	NP						107.3				
	207	S-4	13.0-15.0						10.3	59.2	30.5							
	207	S-5	18.0-20.0						2.8	70.4	26.8							
	207	S-6	23.0-25.0						0	62.6	37.4							

PINEY RUN: LABORATORY TESTING DATA SUMMARY

LOCATION	BORING NO.	SAMPLE NO.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS ASTM D4318			GRAVEL %	SAND %	FINES %	Cu	Cc	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (ASTM D698) (pcf)	OPTIMUM MOISTURE CONTENT (ASTM D698) (%)	SPECIFIC GRAVITY	COMPRESSIVE STRENGTH (psi)
						LL	PL	PI										
ASW Soil	207	S-7*	28.0-30.0						26.7	47.4	26	120.86	0.19					
	207	S-8*	33.0-35.0						18.5	53	28.5							
	208	S-1	3.0-5.0						0.1	69.2	30.7							
	208	BULK	5.0-15.0	SM		NP	NP	NP	28.6	42.2	29.2	62.56	0.6					
	208	S-2	8.0-10.0						20.2	51.3	28.5							
	208	S-3	13.0-15.0		16.3				3.8	62.2	34							
	208	S-4	18.0-20.0						8.3	53.9	37.9	7.96	1.42					
	208	S-5	23.0-25.0						25.7	60.2	14.1							
	208	S-6*	28.0-30.0						3.7	50.9	45.4							
	208	S-7*	33.0-35.0						15.1	50.5	34.4							
	209	S-2	8.0-10.0						0	55.4	44.6	6.72	1.32					
	209	S-4	18.0-20.0						3.9	58.9	37.2							
	209	S-6*	28.0-30.0						0	61.8	38.2							
	210	S-2	3.0-5.0						19.4	62.7	17.9	58.03	0.59					
	210	S-3	8.0-10.0						30.2	41.7	28.1							
	210	S-4	13.0-15.0						3.5	45.3	51.2							
	210	S-5	18.0-20.0	SM	21.4	NP	NP	NP	0.7	51.4	47.8	12.25	0.68					
	210	S-6	23.0-25.0						24.2	50.8	25							
	211	S-1	3.0-5.0						26.3	48.8	24.9							
	211	S-2	8.0-10.0	ML	21.9	NP	NP	NP	0	35.6	64.4	11.46	1.15					
	211	S-4	13.0-15.0						17.5	55.5	27							
	211	S-5	18.0-20.0						8.6	47.2	44.2							
	211	S-6	23.0-25.0						67.2	20.5	12.3	266	13.83					
	211	S-7	28.0-30.0						4.8	52.6	42.6							
	211	S-8	33.0-35.0						10.1	55.9	34							
	211	S-9*	38.0-40.0						6.5	68.6	24.8	11.08	1.61					
	211	S-10*	43.0-45.0						10.9	47.6	41.5							
	211	S-11*	48.0-50.0						30.9	33.7	35.5							

PINEY RUN: LABORATORY TESTING DATA SUMMARY

LOCATION	BORING NO.	SAMPLE NO.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS ASTM D4318			GRAVEL %	SAND %	FINES %	Cu	Cc	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (ASTM D698) (pcf)	OPTIMUM MOISTURE CONTENT (ASTM D698) (%)	SPECIFIC GRAVITY	COMPRESSIVE STRENGTH (psi)
						LL	PL	PI										
ASW Soil	212	S-2	3.0-5.0	GM	25.8	37	25	12	29.6	25.7	44.7	234.4	0.65					
	212	S-4	13.0-15.0						26.5	53.9	19.7	42.51	0.33					
ASW Rock	201	RC-2	55.5-56.7		0.1									178.9				6353
	203	RC-1	38.4-39.2		0.1									177.6				8203
	209	RC-1	33.8-34.4		0.3									170.1				7798
	211	RC-1	56.8-57.7		0.1									170.1				19296
Embankment Shell	1	S-1	3.0-5.0		10.3				32.1	40.4	27.5	54.15	0.54					
	2	S-1	0.0-2.0						23.4	45.2	31.4							
	3	S-1	3.0-5.0						14.3	51.2	34.5							
	601	S-2	3.0-5.0						26.1	42.4	31.5							
	602	BULK	1.0-2.0	SM	23.8	NP	NP	NP	22.2	44.6	33.2	17.87	1.2		116.4	13.8		
Embankment Core	1	T-1	15.0-17.0		18.2				12.4	48.1	39.4			81.5				
	1	S-7	28.0-30.0	CL		34	22	12	3.1	30.8	66.1							
	2	S-2	3.0-5.0						4.9	49.7	45.4							
	2	S-3	8.0-10.0						8.8	47	44.2							
	2	S-4	13.0-15.0						16.3	50.8	32.9							
	2	S-5A	18.0-20.0						9.5	74.1	16.3							
	2	S-6	23.0-25.0						8.1	52.5	39.4							
	2	T-1	25.0-26.2	SM	22.5	NP	NP	NP	13.4	39.2	47.5	37.36	1.48	101.9		2.80 (D854) 2.54 (C128)		
	2	T-2	31.0-32.7		19.4				32	42.8	25.2			108.7				
	2	S-11	33.0-35.0						23.3	43.6	33							
	2	S-12	38.0-40.0						13.4	45.6	41							
	2	S-13	43.0-45.0		16.6				11.5	33.2	55.3							
	2	S-14	48.0-50.0						7.1	30.4	62.4							
	2	S-15	53.0-55.0						10.7	33	56.3							
	2	S-16	58.0-60.0						9	30	61							
	2	S-17	63.0-65.0						2.3	38.7	59							
	2	S-18	68.0-70.0						2.2	34.6	63.2							

PINEY RUN: LABORATORY TESTING DATA SUMMARY

LOCATION	BORING NO.	SAMPLE NO.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS ASTM D4318			GRAVEL %	SAND %	FINES %	Cu	Cc	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (ASTM D698) (pcf)	OPTIMUM MOISTURE CONTENT (ASTM D698) (%)	SPECIFIC GRAVITY	COMPRESSIVE STRENGTH (psi)
						LL	PL	PI										
Embankment Core	2	S-19	73.0-75.0						30.5	31.1	38.4							
	3	S-2	8.0-10.0						14.2	44.6	41.2							
	3	S-3	13.0-15.0						29	48.3	22.7							
	3	S-4	18.0-20.0	SM		NP	NP	NP	12.3	47.2	40.5	18.11	1.08					
	3	S-5	23.0-25.0						8.6	48.7	42.8							
	3	T-1	25.4-26.9		22.3				19.1	44.2	36.8			100.4				
	3	S-7	28.0-30.0		15.3				13.4	43.2	43.4							
	3	S-8	33.0-35.0						14.9	26.2	58.9							
	3	S-9	38.0-40.0						9.4	45.6	45	19.95	1.4					
Embankment Rock	1	S-9	38.0-40.0						0.7	39.9	59.4							
	2	S-20	78.0-78.3						45.3	30.3	24.4							
	3	S-10	43.0-45.0						15	40.3	44.7							
	601	S-4	13.0-15.0		11.4				0.8	54.9	44.3	5.43	1.29					
Expansion Soil	801	S-1	3.0-5.0	MH	43.1	57	46	11	0	31.7	68.3	10.31	0.58					
	801	S-3	13.0-15.0						12.6	48.7	38.7							
	802	S-4	13.0-15.0						10.4	56.2	33.4							
	802	S-6	23.0-25.0		10.2				22.2	55.6	22.2	26.38	1.07					
	802	S-9	38.0-40.0						24.5	56.1	19.4							
	802	S-11	48.0-50.0						22.9	57.3	19.8							
	803	T-2	15.0-17.0	SM	14.4	NP	NP	NP	4.2	55.4	40.4	13.04	0.94	95.1				
	803	S-7	23.0-25.0						0	43.2	56.8							
	803	S-9	33.0-35.0						0	56.6	43.4							
	803	S-11	43.0-45.0						9	58.9	32.2	15.8	1.38					
	803	S-15	63.0-65.0						3.6	54.4	42							
	803	S-17	73.0-75.0						30.8	50.4	18.8							
	804	S-2	8.0-10.0						8.9	57.4	33.7							
	804	S-4	18.0-20.0						4.4	61.8	33.8							
	804	S-8*	33.0-35.0						23.8	57.3	18.9							

PINEY RUN: LABORATORY TESTING DATA SUMMARY

LOCATION	BORING NO.	SAMPLE NO.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS ASTM D4318			GRAVEL %	SAND %	FINES %	Cu	Cc	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (ASTM D698) (pcf)	OPTIMUM MOISTURE CONTENT (ASTM D698) (%)	SPECIFIC GRAVITY	COMPRESSIVE STRENGTH (psi)
						LL	PL	PI										
Expansion Soil	804	S-12*	53.0-55.0		15.9				0	50.4	49.6	10.26	1.06					
	805	S-1A	3.0-4.0						16.6	34.1	49.3							
	805	S-1B	4.0-5.0	GM	2.8	NP	NP	NP	44.5	37.4	18.1	216.76	0.24					
	TOTAL			**21**	**33**	**21**	**21**	**21**	**136**	**136**	**136**	**37**	**37**	**14**	**1**	**1**	**2**	**4**

* Classified as Decomposed Rock due to consistent blow counts >50 over six inches

Shear Strength Parameters

BORING No.	Sample No.	Depth (ft)	USCS CLASSIFICATION ASTM D2487	Total Strength		Effective Strength	
				φ (deg)	c (psf)	φ' (deg)	c' (psf)
2	T-2	31.6-32.6	-	-	-	41.3	0
3	T-1	25.4-26.9	-	27.0	0	34.4	0
803	T-2	15.0-17.0	SM	26.3	0	33.1	0
602	BULK	1.0-2.0	SM	18.7	530	29.6	180

Hydraulic Conductivity

BORING No.	Sample No.	DEPTH (ft)	USCS	Hydraulic Conductvity	
				cm/sec	ft/day
2	T-1	25.0-26.2	SM	9.31E-06	2.64E-02

- Abutment Soil
- ASW Soil
- Embankment Shell
- Embankment Core
- Embankment Rock
- Expansion Soil
- Decomposed Rock
- Bedrock

	MATERIAL	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS			GRAVEL %	SAND %	FINES %	Cu	Cc	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	SPECIFIC GRAVITY	COMPRESSIVE STRENGTH (psi)
			LL	PL	PI										
AVERAGE	Abutment Soil	24.5	33.0	28.0	5.0	15.9	49.0	35.1	240.7	1.1	81.4	-	-	-	-
	ASW Soil	21.4	37.0	25.0	12.0	12.4	50.3	37.4	49.3	1.9	102.5	-	-	-	-
	Embankment Shell	17.1	NP	NP	NP	23.6	44.8	31.6	36.0	0.9	-	116.4	13.8	-	-
	Embankment Core	19.0	34.0	22.0	12.0	13.1	42.4	44.5	25.1	1.3	98.1	-	-	2.8	-
	Embankment Rock	11.4	-	-	-	15.5	41.4	43.2	5.4	1.3	-	-	-	-	-
	Expansion Soil	17.6	57.0	46.0	11.0	13.4	51.0	35.6	56.5	0.8	95.1	-	-	-	-
	Decomposed Rock	13.6	NP	NP	NP	19.8	48.3	31.9	57.0	0.9	-	-	-	-	-
	Bedrock	0.2	-	-	-	-	-	-	-	-	174.2	-	-	-	10413
MAXIMUM	Abutment Soil	26.6	33.0	28.0	5.0	37.3	66.3	47.6	701.1	1.6	81.4	-	-	-	-
	ASW Soil	32.5	37.0	25.0	12.0	67.2	70.8	70.9	266.0	13.8	107.3	-	-	-	-
	Embankment Shell	23.8	NP	NP	NP	32.1	51.2	34.5	54.2	1.2	-	116.4	13.8	-	-
	Embankment Core	22.5	34.0	22.0	12.0	32.0	74.1	66.1	37.4	1.5	108.7	-	-	2.8	-
	Embankment Rock	11.4	-	-	-	45.3	54.9	59.4	5.4	1.3	-	-	-	-	-
	Expansion Soil	43.1	57.0	46.0	11.0	44.5	61.8	68.3	216.8	1.4	95.1	-	-	-	-
	Decomposed Rock	15.9	NP	NP	NP	63.6	69.7	60.5	232.0	1.9	-	-	-	-	-
	Bedrock	0.3	-	-	-	-	-	-	-	-	178.9	-	-	-	19296
MINIMUM	Abutment Soil	22.3	33.0	28.0	5.0	0.0	25.0	22.1	10.3	0.2	81.4	-	-	-	-
	ASW Soil	10.6	37.0	25.0	12.0	0.0	20.5	12.3	3.8	0.3	93.0	-	-	-	-
	Embankment Shell	10.3	NP	NP	NP	14.3	40.4	27.5	17.9	0.5	-	116.4	13.8	-	-
	Embankment Core	15.3	34.0	22.0	12.0	2.2	26.2	16.3	18.1	1.1	81.5	-	-	2.8	-
	Embankment Rock	11.4	-	-	-	0.7	30.3	24.4	5.4	1.3	-	-	-	-	-
	Expansion Soil	2.8	57.0	46.0	11.0	0.0	31.7	18.1	10.3	0.2	95.1	-	-	-	-
	Decomposed Rock	11.3	NP	NP	NP	0.0	21.2	15.2	4.8	0.1	-	-	-	-	-
	Bedrock	0.1	-	-	-	-	-	-	-	-	170.1	-	-	-	6353

Unit Weight	Dry	Moist	Saturated
Embankment Core	98.1	116.80	134.4
Expansion Soil	95.1	111.86	137.6

Appendix E –Laboratory Test Results

Project: Piney Run Dam
Project No.: 60614688

AECOM

SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	CID	CIU		
701 S-1B	3.0-4.0									15									
701 S-1A	4.0-5.0	Brown SILTY GRAVEL with SAND	GM			33	28			38	8								
701 S-2	8.0-10.0									31	4								
702 T-1	3.0-5.0			26.6	81.4														
201 S-1	3.0-5.0									44									
201 S-2	8.0-10.0	Brown SILTY SAND	SM	10.6		NP	NP			37	0								
201 T-1	10.0-12.0			11.5	102.7					45									
201 S-4	13.0-15.0									46									
201 S-5	18.0-20.0									16	0								
201 S-6	23.0-25.0									43									
201 S-8	33.0-35.0									22									
201 S-9	38.0-40.0									18									
201 S-10	43.0-45.0									27									
201 S-12	53.0-53.5									25									
201 RC-2	55.5-56.7	Rock Core		0.1	178.9									6,353	0.1				
202 S-1	3.0-5.0	Brown SANDY SILT	ML	24.3		NP	NP			69	4								
202 T-1	5.0-7.0	Brown SILTY GRAVEL with SAND	GM	15.7	106.9	NP	NP	2.74	2.55	19									
202 S-3	8.0-10.0									43									
202 S-4	13.0-15.0									32	2								

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

AECOM

SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	CID	CIU		
202 S-5	18.0-18.1									23									
203 S-1	3.0-5.0	Brown SILT with SAND	ML	32.5		NP	NP			71	5								
203 S-2	8.0-10.0									27									
203 S-3	13.0-15.0									19									
203 S-4	18.0-20.0									71	5								
203 S-5	23.0-25.0									52									
203 S-6	28.0-30.0									33									
203 S-7	33.0-35.0									18									
203 RC-1	38.4-39.2	Rock Core		0.1	177.6									8,203	0.1				
204 S-1	3.0-5.0	Brown SANDY SILT	ML	11.3		NP	NP			50	1								
204 S-2	8.0-10.0									47									
205 S-2	2.0-4.0	Brown SILTY SAND	SM			NP	NP			30	2								
205 S-4	6.0-8.0									14									
205 S-5	8.0-10.0									38									
205 S-6	13.0-15.0			27.3						31	4								
205 S-7	18.0-20.0									31									
205 S-8	23.0-25.0									35									
205 S-9	27.0-27.1									25									
206 S-1	3.0-5.0									50									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

AECOM

SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	CID	CIU		
206 S-2	8.0-10.0									57									
206 S-3	13.0-15.0									51									
206 T-1	15.0-16.5	Brown SILTY SAND	SM	29.2	93.0	NP	NP			33	1								
206 S-5	18.0-20.0									47									
206 S-6	23.0-25.0									54									
206 S-7	28.0-30.0									60	2								
206 S-8	33.0-35.0									23									
206 S-9	38.0-40.0									26									
206 RC-1	39.7-40.2									57									
207 S-1	3.0-5.0									24									
207 S-2	8.0-10.0									31									
207 T-1	10.0-12.0	Brown SILTY SAND	SM	20.6	107.3	NP	NP			28	0								
207 S-4	13.0-15.0									30									
207 S-5	18.0-20.0									27									
207 S-6	23.0-25.0									37									
207 S-7	28.0-30.0									26	1								
207 S-8	33.0-35.0									28									
208 S-1	3.0-5.0									31									
208 BULK	5.0-15.0	Brown SILTY SAND with GRAVEL	SM			NP	NP			29	2								

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
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SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	CID	CIU		
208 S-2	8.0-10.0									28									
208 S-3	13.0-15.0			16.3						34									
208 S-4	18.0-20.0									38	2								
208 S-5	23.0-25.0									14									
208 S-6	28.0-30.0									45									
208 S-7	33.0-35.0									34									
210 S-2	3.0-5.0									18	1								
210 S-3	8.0-10.0									28									
210 S-4	13.0-15.0									51									
210 S-5	18.0-20.0	Brown SILTY SAND	SM	21.4		NP	NP			48	3								
210 S-6	23.0-25.0									25									
211 S-1	3.0-5.0									25									
211 S-2	8.0-10.0	Brown SANDY SILT	ML	21.9		NP	NP			64	3								
211 S-4	13.0-15.0									27									
211 S-5	18.0-20.0									44									
211 S-6	23.0-25.0									12									
211 S-7	28.0-30.0									43									
211 S-8	33.0-35.0									34									
211 S-9	38.0-40.0									25	1								

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

AECOM

SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	CID	CIU		
211 S-10	43.0-45.0									42									
211 S-11	48.0-50.0									35									
211 RC-1	56.8-57.7	Rock Core		0.1	170.1									19,296	0.3				
1 T-1	15.0-17.0			18.2	81.5					39									
2 S-1	0.0-2.0									31									
2 S-2	3.0-5.0									45									
2 S-3	8.0-10.0									44									
2 S-4	13.0-15.0									33									
2 S-5A	18.0-20.0									16									
2 S-6	23.0-25.0									39									
2 T-1	25.0-27.0	Brown SILTY SAND	SM	22.5		NP	NP	2.80	2.54	47	7							9.3E-06	
2 T-2	31.0-32.7									43	2					*			
2 S-11	33.0-35.0									33									
2 S-12	38.0-40.0									41									
2 S-13	43.0-45.0			16.6						55									
2 S-14	48.0-50.0									62	16								
2 S-15	53.0-55.0									56									
2 S-16	58.0-60.0									61									
2 S-17	63.0-65.0									59									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

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Project No.: 60614688

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SUMMARY OF LABORATORY TEST RESULTS

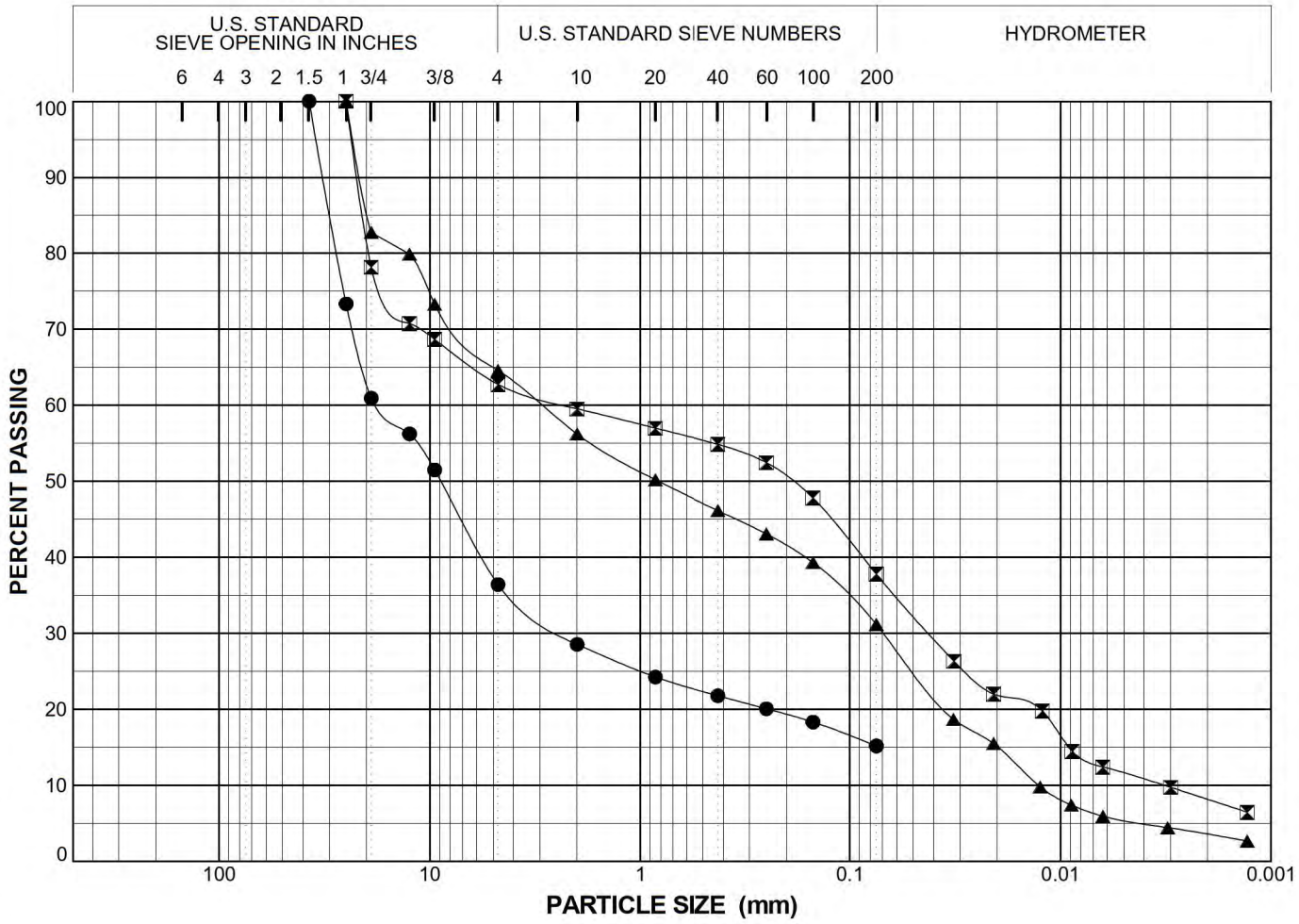
Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity D854	Specific Gravity C128	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	CID	CIU		
2 S-18	68.0-70.0									63									
2 S-19	73.0-75.0									38									
2 S-20	78.0-78.3									24									
3 S-1	3.0-5.0									34									
3 S-2	8.0-10.0									41									
3 S-3	13.0-15.0									23									
3 S-4	18.0-20.0	Brown SILTY SAND	SM			NP	NP			40	2								
3 S-5	23.0-25.0									43									
3 T-1	25.0-27.0									37							*		
3 S-7	28.0-30.0			15.3						43									
3 S-8	33.0-35.0									59									
3 S-9	38.0-40.0									45	3								
3 S-10	43.0-45.0									45									
805 S-1A	3.0-4.0									49									
805 S-1B	4.0-5.0	Gray SILTY GRAVEL with SAND	GM	2.8		NP	NP			18	0								

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	701	701	701
Sample	S-1A	S-1B	S-2
Spec			
Depth (ft)	3.0-4.0	4.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	63.6	37.3	35.4
% Sand	21.2	25.0	33.4
% Fines	15.2	37.8	31.2
% -2μ		8.1	3.5
Cc		0.24	0.13
Cu		701.10	232.04
LL		33	
PL		28	
PI		5	
USCS		GM	
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"	100.0		
1"	73.3	100.0	100.0
3/4"	60.9	78.2	82.7
1/2"	56.2	70.7	79.9
3/8"	51.5	68.7	73.3
4	36.4	62.7	64.6
10	28.5	59.5	56.2
20	24.2	57.0	50.2
40	21.8	54.9	46.1
60	20.1	52.5	43.1
100	18.3	47.8	39.3
200	15.2	37.8	31.2

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SILTY GRAVEL with SAND (GM)
▲	

PARTICLE SIZE DISTRIBUTION

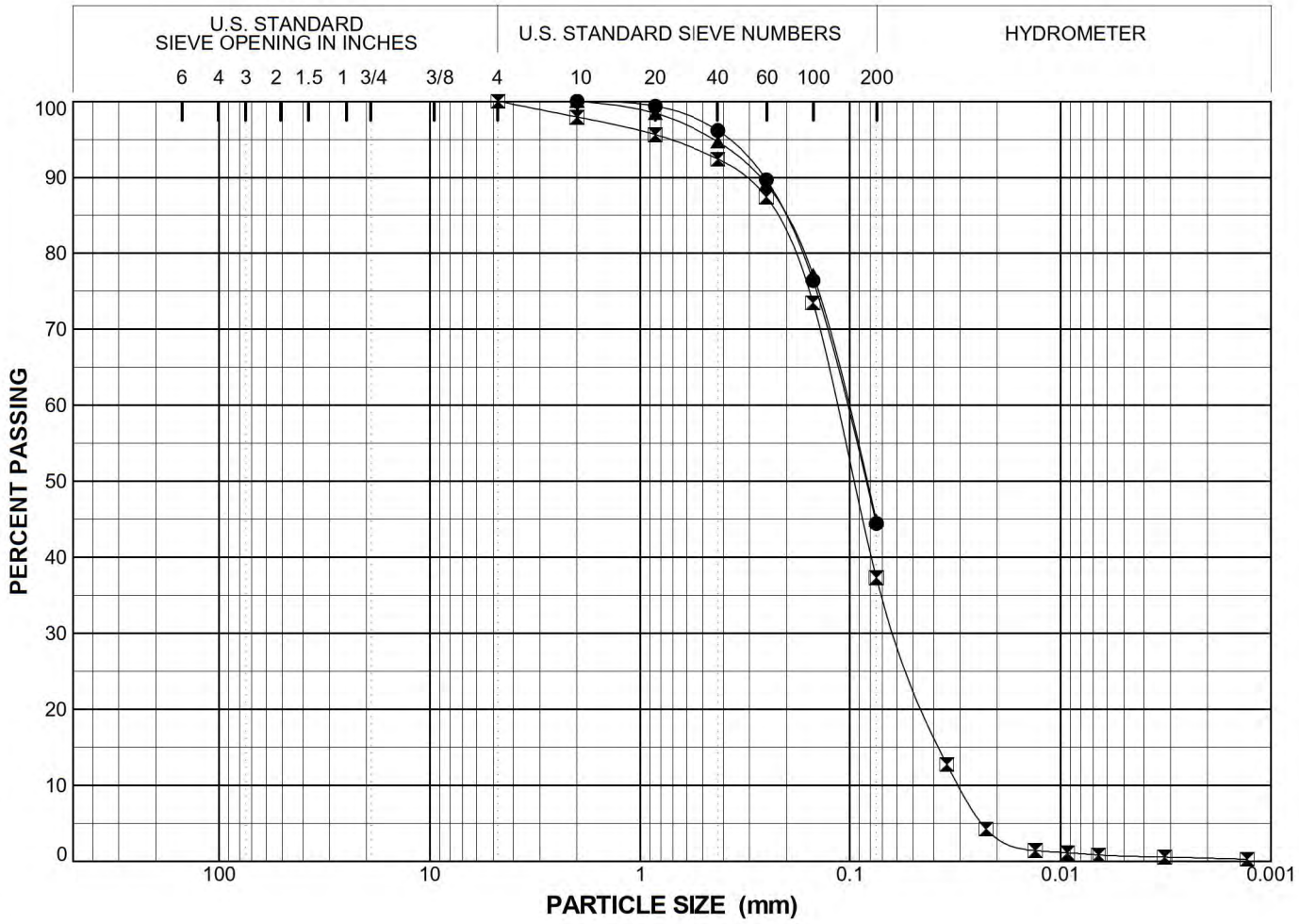
Piney Run Dam

Project Number 60614688	February 2020	Figure 1

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	201	201	201
Sample	S-1	S-2	T-1
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	10.0-12.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	0.0
% Sand	55.5	62.7	55.1
% Fines	44.5	37.3	44.9
% -2μ		0.4	
Cc		1.02	
Cu		3.83	
LL		NP	
PL		NP	
PI		NP	
USCS		SM	
w (%)		10.6	11.5

Particle Size (Sieve #)	PERCENT FINER		
	●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			
1/2"			
3/8"			
4		100.0	
10	100.0	97.9	100.0
20	99.4	95.6	98.4
40	96.2	92.4	94.7
60	89.7	87.4	89.1
100	76.4	73.5	77.2
200	44.5	37.3	44.9

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SILTY SAND (SM)
▲	

PARTICLE SIZE DISTRIBUTION

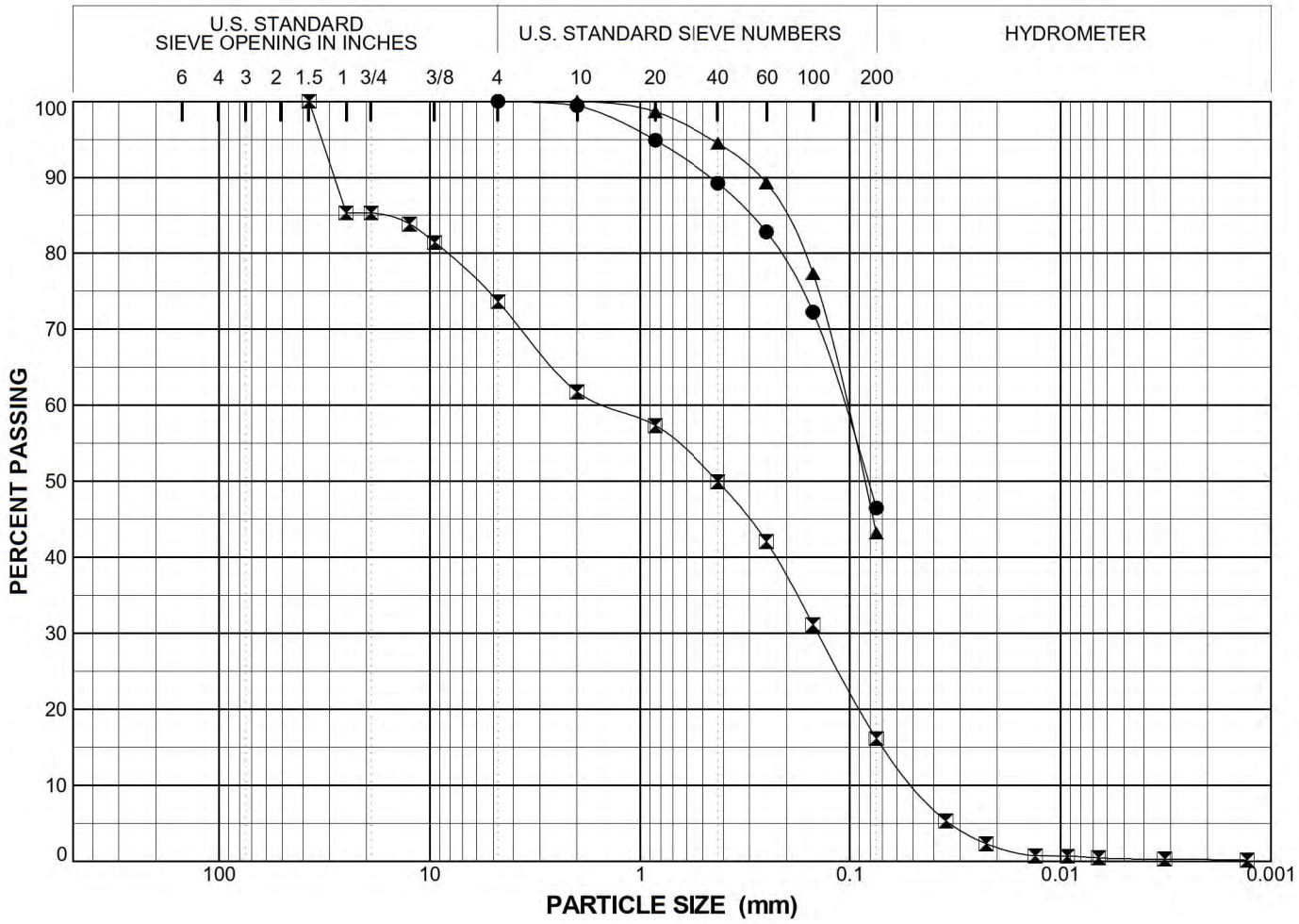
Piney Run Dam

Project Number 60614688	February 2020	Figure 2

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	201	201	201
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	26.4	0.0
% Sand	53.5	57.5	56.8
% Fines	46.5	16.2	43.2
% -2μ		0.2	
Cc		0.29	
Cu		29.23	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"		100.0	
1"		85.3	
3/4"		85.3	
1/2"		83.9	
3/8"		81.4	
4	100.0	73.6	
10	99.4	61.8	100.0
20	94.9	57.3	98.6
40	89.2	50.0	94.5
60	82.8	42.1	89.3
100	72.3	31.1	77.4
200	46.5	16.2	43.2

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

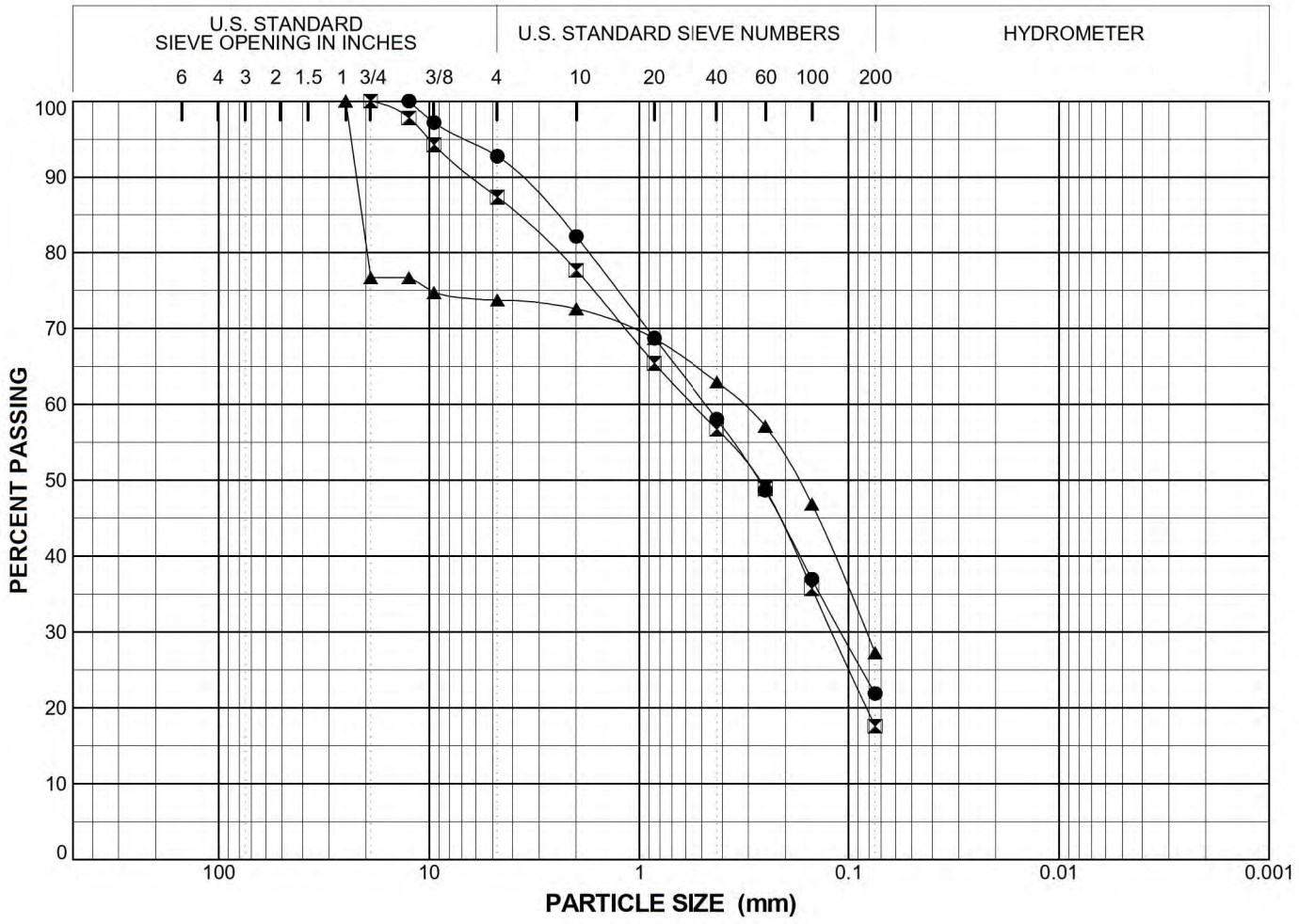
Piney Run Dam

Project Number 60614688	February 2020	Figure 3

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	201	201	201
Sample	S-8	S-9	S-10
Spec			
Depth (ft)	33.0-35.0	38.0-40.0	43.0-45.0
% +3"	0.0	0.0	0.0
% Gravel	7.3	12.7	26.2
% Sand	70.8	69.7	46.5
% Fines	21.9	17.6	27.3
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			100.0
3/4"		100.0	76.7
1/2"	100.0	97.8	76.7
3/8"	97.2	94.3	74.8
4	92.7	87.3	73.8
10	82.2	77.7	72.6
20	68.8	65.4	68.7
40	58.0	56.7	63.0
60	48.7	48.9	57.1
100	37.0	35.7	46.9
200	21.9	17.6	27.3

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

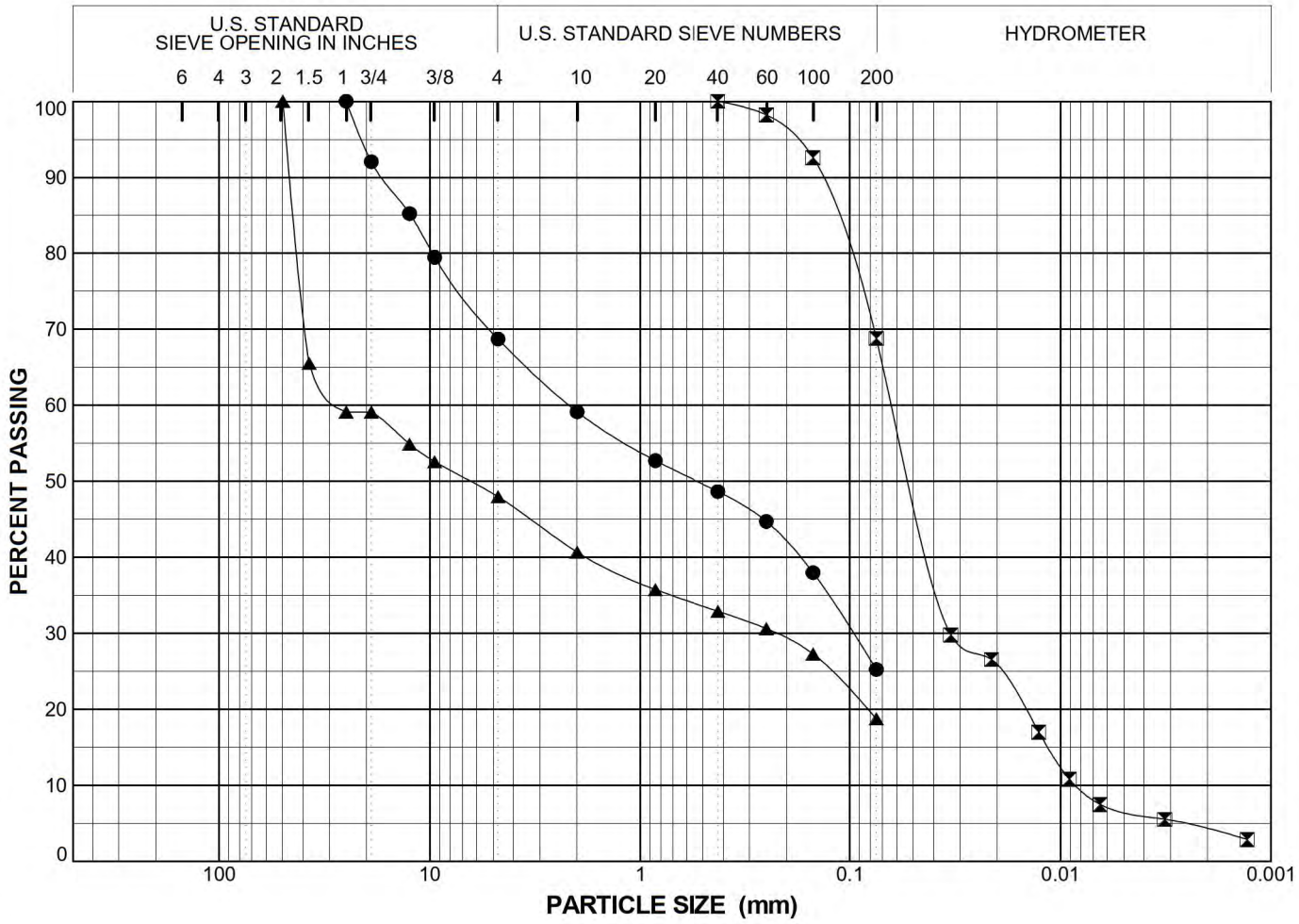
Piney Run Dam

Project Number 60614688	February 2020	Figure 4

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	201	202	202
Sample	S-12	S-1	T-1
Spec			
Depth (ft)	48.0-50.0	3.0-5.0	5.0-7.0
% +3"	0.0	0.0	0.0
% Gravel	31.3	0.0	52.0
% Sand	43.5	31.2	29.2
% Fines	25.2	68.8	18.7
% -2μ		4.1	
Cc		2.12	
Cu		7.44	
LL		NP	NP
PL		NP	NP
PI		NP	NP
USCS		ML	GM
w (%)		24.3	15.7

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			100.0
1 1/2"			65.5
1"	100.0		59.1
3/4"	92.0		59.1
1/2"	85.2		54.9
3/8"	79.5		52.6
4	68.7		48.0
10	59.1		40.7
20	52.7		35.7
40	48.6	100.0	32.9
60	44.7	98.2	30.6
100	38.0	92.6	27.3
200	25.2	68.8	18.7

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SANDY SILT (ML)
▲	Brown SILTY GRAVEL with SAND (GM)

PARTICLE SIZE DISTRIBUTION

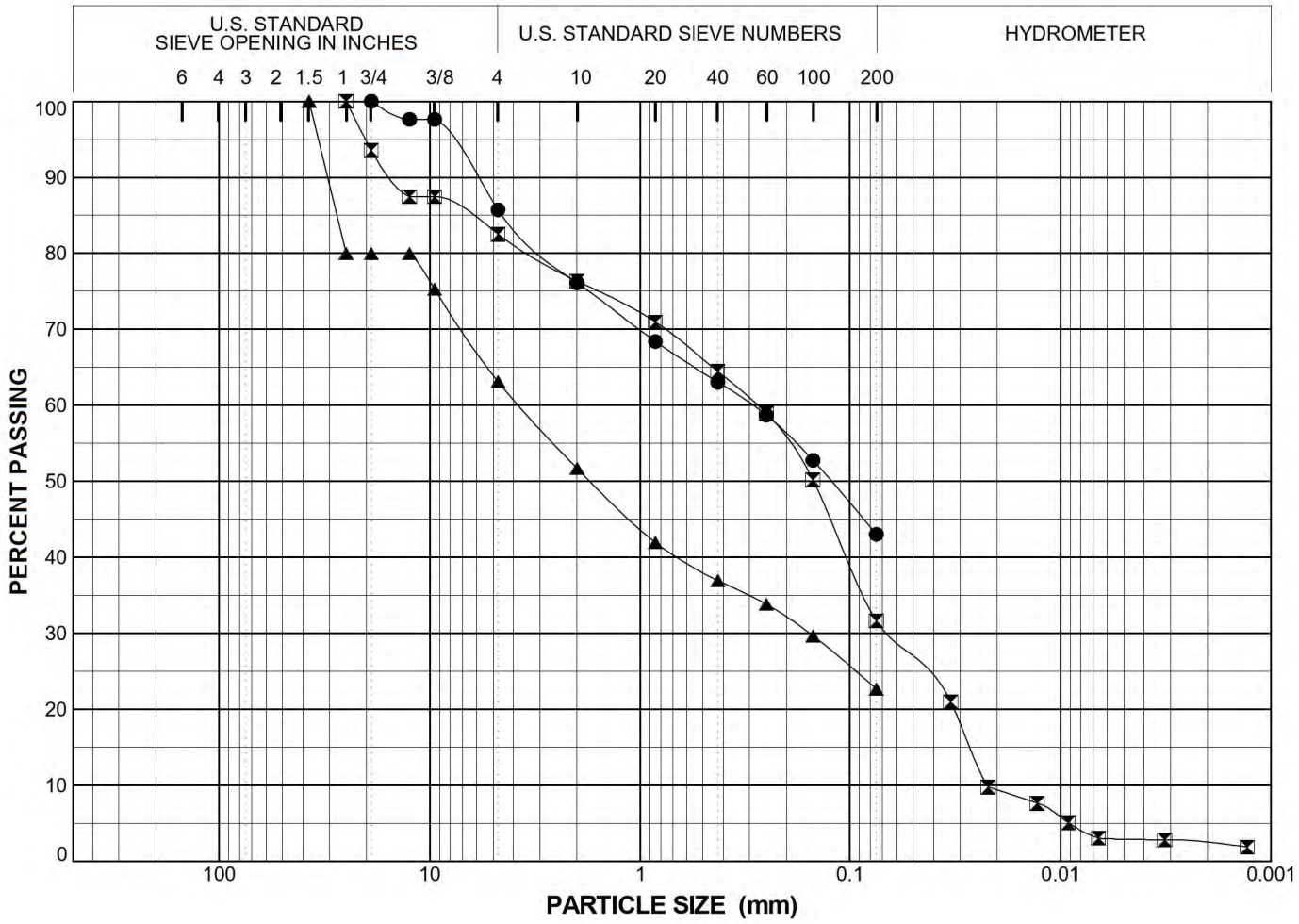
Piney Run Dam

Project Number 60614688	February 2020	Figure 5

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	202	202	202
Sample	S-3	S-4	S-5
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	14.3	17.5	36.9
% Sand	42.7	50.9	40.4
% Fines	43.0	31.6	22.7
% -2μ		2.3	
Cc		0.71	
Cu		12.43	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			100.0
1"		100.0	80.0
3/4"	100.0	93.6	80.0
1/2"	97.6	87.5	80.0
3/8"	97.6	87.5	75.3
4	85.7	82.5	63.1
10	76.1	76.3	51.7
20	68.4	71.0	41.9
40	63.1	64.5	36.9
60	58.7	58.9	33.8
100	52.8	50.2	29.7
200	43.0	31.6	22.7

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

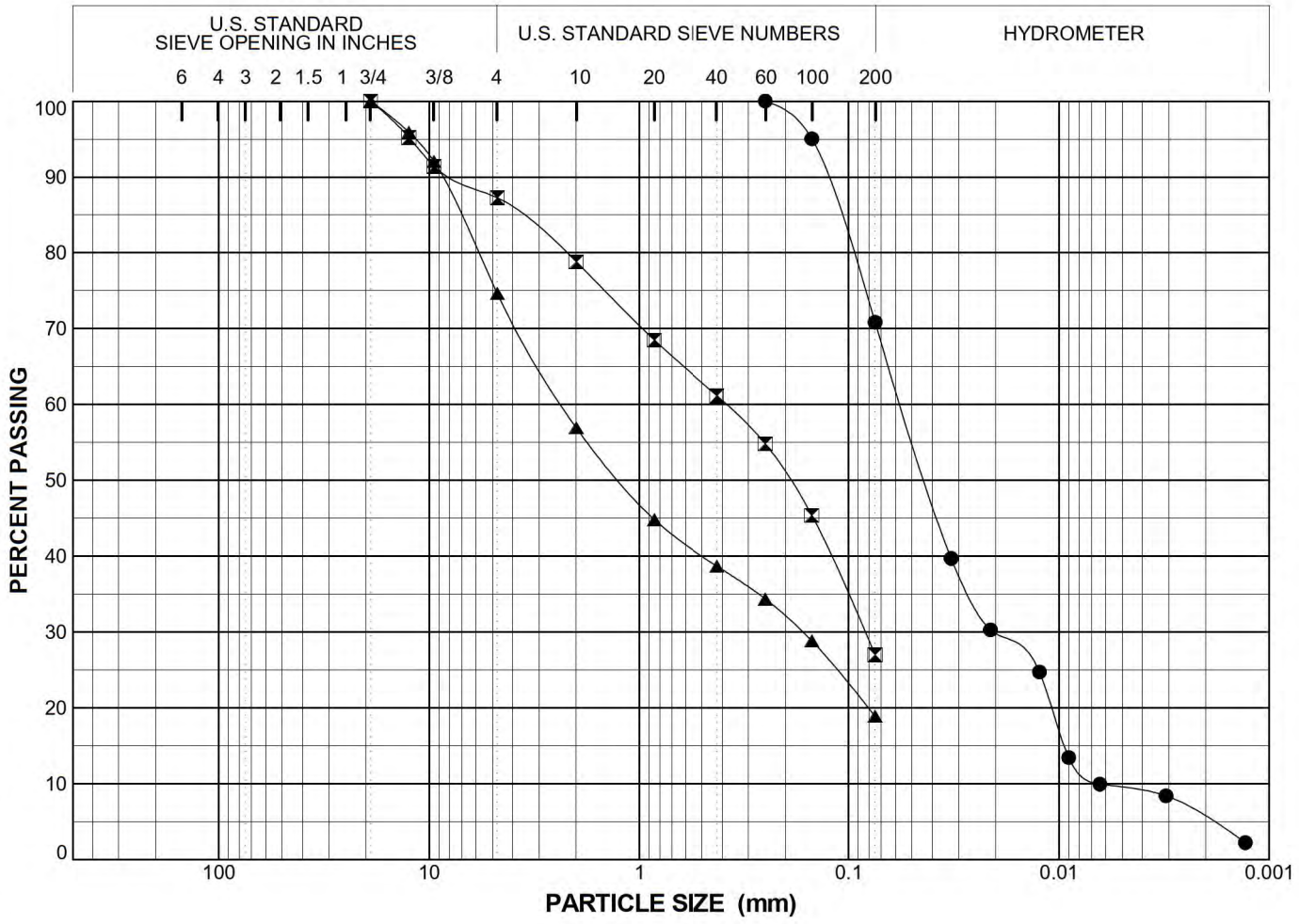
Piney Run Dam

Project Number 60614688	February 2020	Figure 6

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	203	203	203
Sample	S-1	S-2	S-3
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	12.8	25.4
% Sand	29.2	60.2	55.7
% Fines	70.8	27.0	18.9
% -2μ	5.3		
Cc	1.18		
Cu	8.71		
LL	NP		
PL	NP		
PI	NP		
USCS	ML		
w (%)	32.5		

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"		100.0	100.0
1/2"		95.2	95.9
3/8"		91.4	92.0
4		87.2	74.6
10		78.8	56.9
20		68.5	44.8
40		61.2	38.7
60	100.0	54.8	34.4
100	95.0	45.4	28.8
200	70.8	27.0	18.9

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILT with SAND (ML)
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

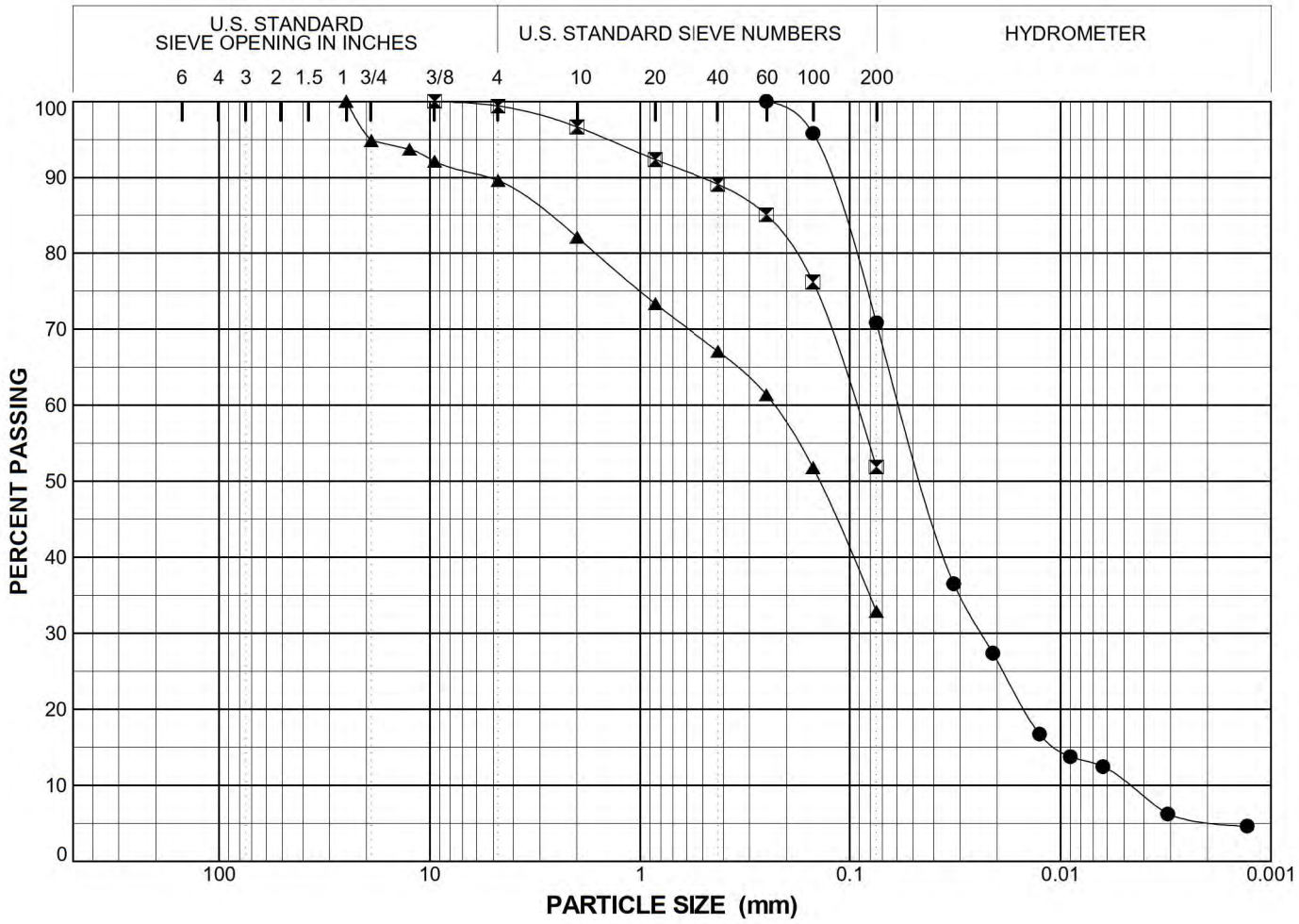
Piney Run Dam

Project Number 60614688	February 2020	Figure 7

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	203	203	203
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	18.0-20.0	23.0-25.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.6	10.4
% Sand	29.1	47.5	56.7
% Fines	70.9	51.9	32.9
% -2μ	5.4		
Cc	2.06		
Cu	12.04		
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			100.0
3/4"			94.8
1/2"			93.7
3/8"		100.0	92.1
4		99.4	89.6
10		96.6	82.1
20		92.3	73.4
40		89.1	67.1
60	100.0	85.1	61.4
100	95.8	76.2	51.8
200	70.9	51.9	32.9

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

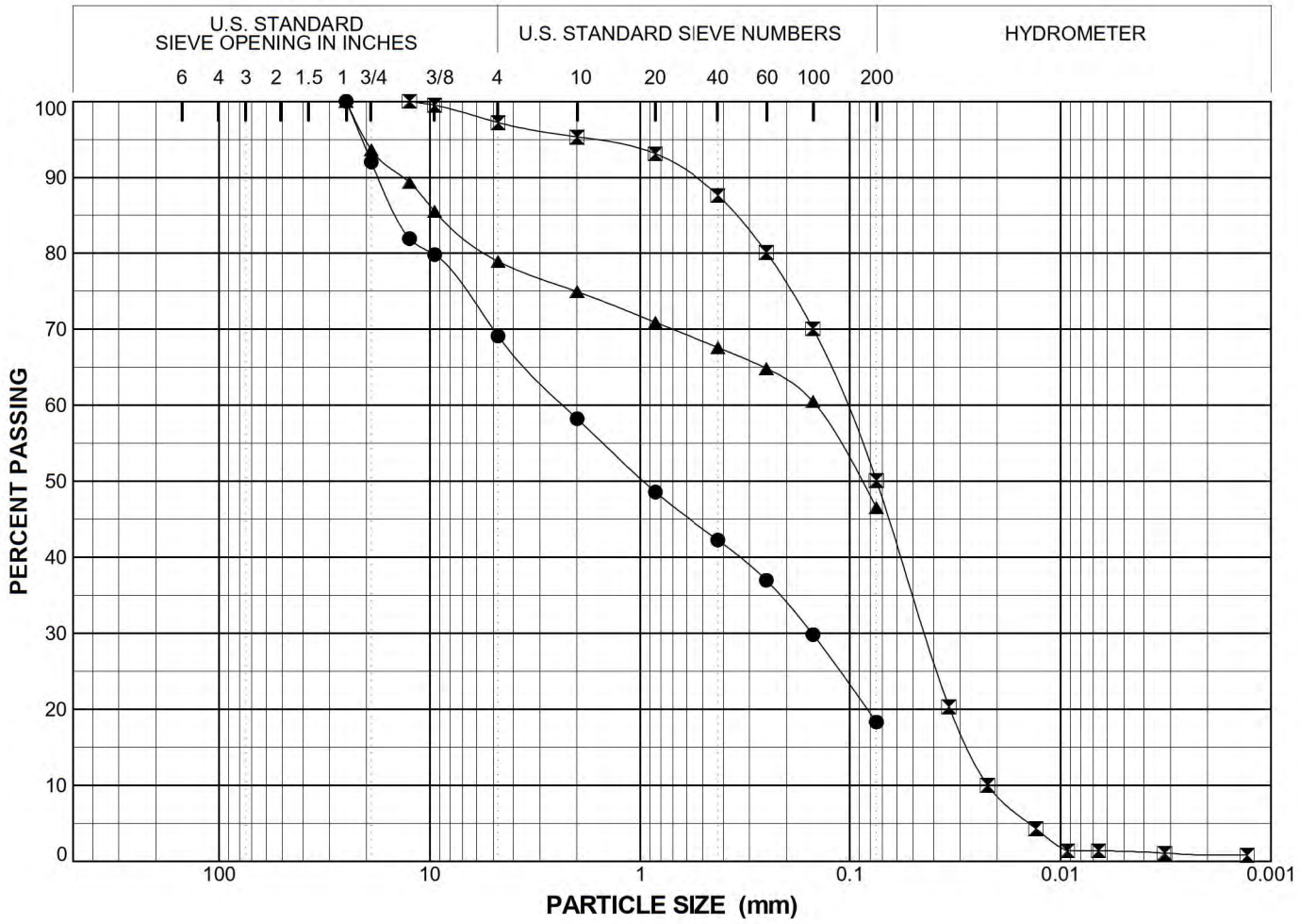
Piney Run Dam

Project Number 60614688	February 2020	Figure 8

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	203	204	204
Sample	S-7	S-1	S-2
Spec			
Depth (ft)	33.0-35.0	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	30.9	2.8	21.1
% Sand	50.8	47.1	32.4
% Fines	18.3	50.1	46.5
% -2μ		0.9	
Cc		0.82	
Cu		4.77	
LL		NP	
PL		NP	
PI		NP	
USCS		ML	
w (%)		11.3	

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"	100.0		100.0
3/4"	92.0		93.6
1/2"	81.9	100.0	89.3
3/8"	79.8	99.5	85.5
4	69.1	97.2	78.9
10	58.2	95.3	74.9
20	48.6	93.1	70.9
40	42.3	87.6	67.6
60	37.0	80.1	64.8
100	29.8	70.1	60.5
200	18.3	50.1	46.5

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SANDY SILT (ML)
▲	

PARTICLE SIZE DISTRIBUTION

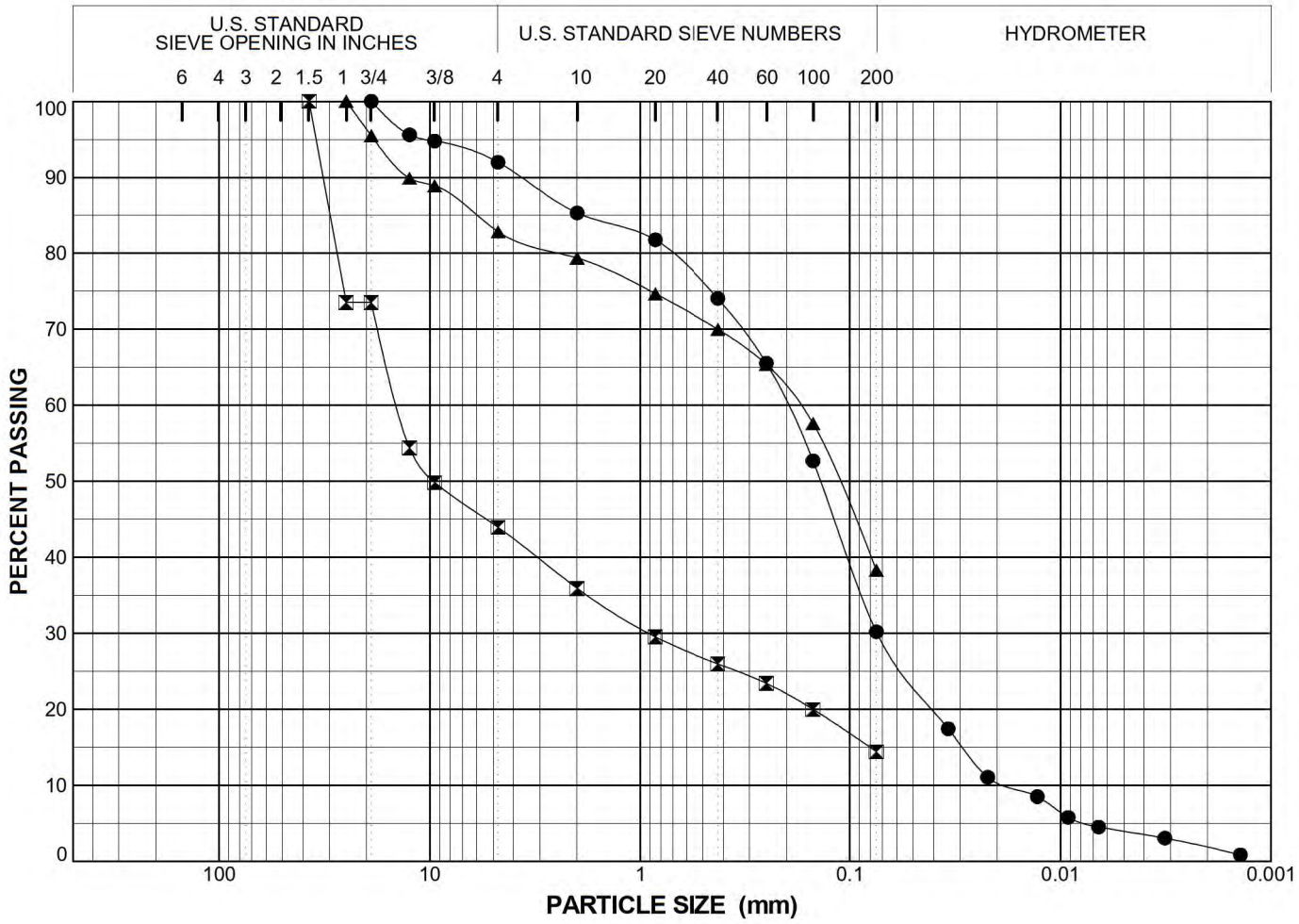
Piney Run Dam

Project Number 60614688	February 2020	Figure 9

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	205	205	205
Sample	S-2	S-4	S-5
Spec			
Depth (ft)	2.0-4.0	6.0-8.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	8.0	56.1	17.2
% Sand	61.8	29.5	44.5
% Fines	30.2	14.4	38.3
% -2μ	1.8		
Cc	1.54		
Cu	11.31		
LL	NP		
PL	NP		
PI	NP		
USCS	SM		
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"		100.0	
1"		73.5	100.0
3/4"	100.0	73.5	95.5
1/2"	95.6	54.4	89.9
3/8"	94.8	49.8	88.9
4	92.0	43.9	82.8
10	85.3	35.9	79.4
20	81.8	29.5	74.7
40	74.1	26.0	70.0
60	65.5	23.4	65.4
100	52.7	20.0	57.6
200	30.2	14.4	38.3

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND (SM)
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

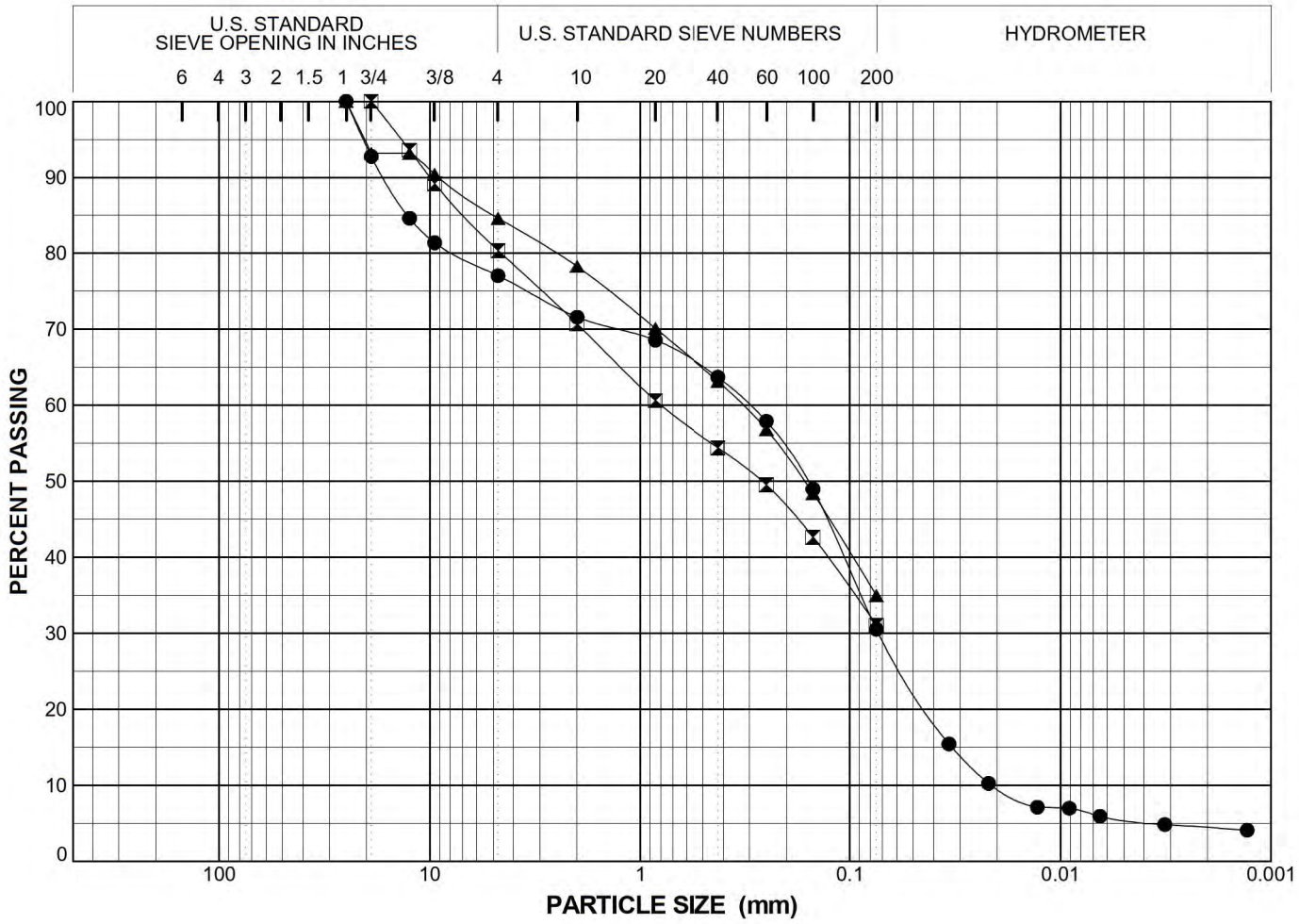
Piney Run Dam

Project Number 60614688	February 2020	Figure 10

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	205	205	205
Sample	S-6	S-7	S-8
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	23.0	19.6	15.4
% Sand	46.5	49.3	49.6
% Fines	30.5	31.1	35.0
% -2μ	4.4		
Cc	0.83		
Cu	14.37		
LL			
PL			
PI			
USCS			
w (%)	27.3		

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"	100.0		100.0
3/4"	92.7	100.0	93.2
1/2"	84.6	93.6	93.2
3/8"	81.4	89.2	90.4
4	77.0	80.4	84.6
10	71.6	70.7	78.3
20	68.6	60.6	70.1
40	63.7	54.4	63.1
60	57.9	49.5	56.8
100	49.0	42.7	48.4
200	30.5	31.1	35.0

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

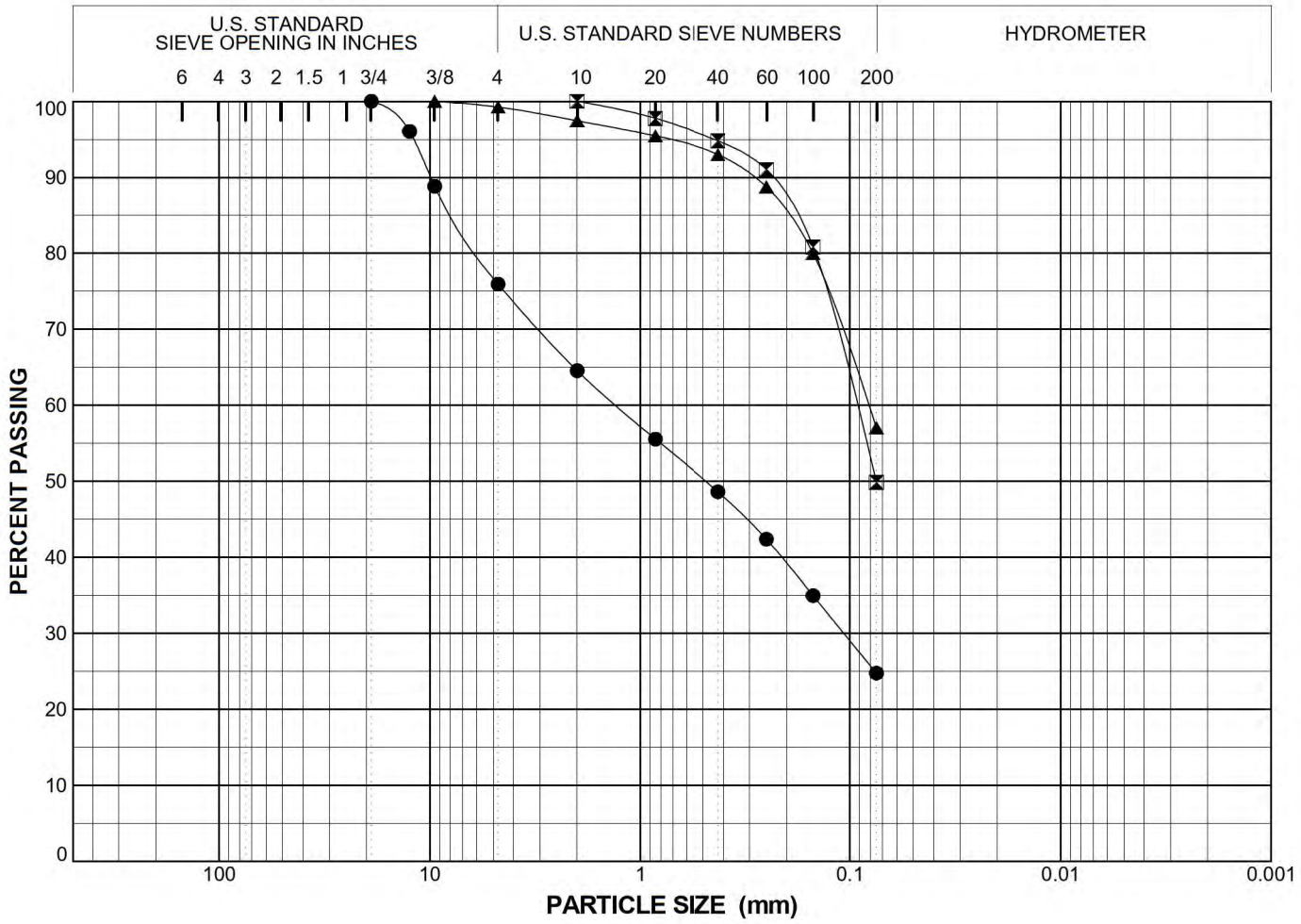
Piney Run Dam

Project Number 60614688	February 2020	Figure 11

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	205	206	206
Sample	S-9	S-1	S-2
Spec			
Depth (ft)	27.0-27.1	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	24.1	0.0	0.8
% Sand	51.2	50.1	42.2
% Fines	24.8	49.9	57.1
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0		
1/2"	96.0		
3/8"	88.8		100.0
4	75.9		99.2
10	64.6	100.0	97.4
20	55.5	97.8	95.5
40	48.6	94.8	93.0
60	42.4	91.0	88.7
100	35.0	80.8	80.0
200	24.8	49.9	57.1

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

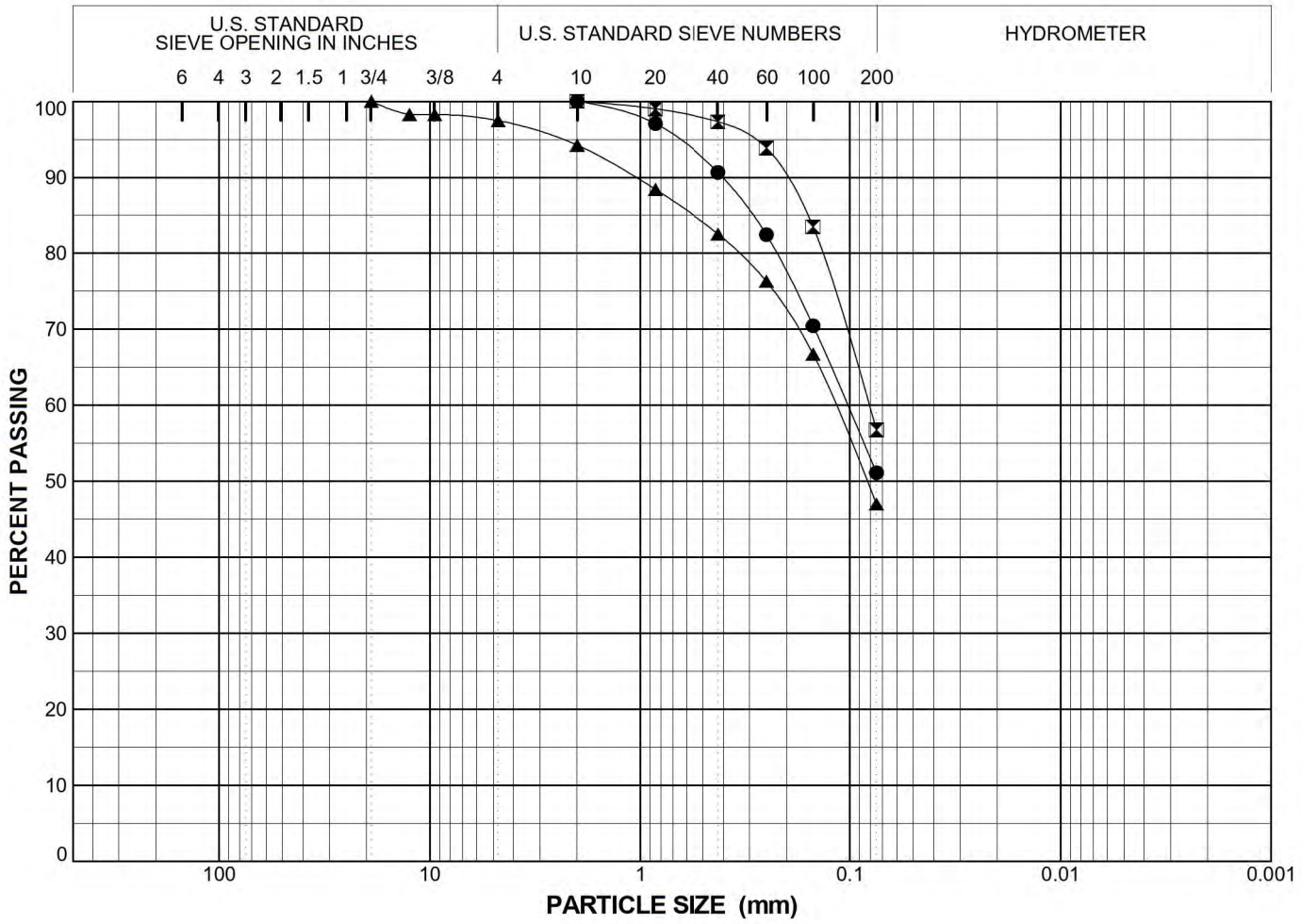
Piney Run Dam

Project Number 60614688	February 2020	Figure 12

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	206	206	206
Sample	S-3	T-1	S-5
Spec			
Depth (ft)	13.0-15.0	15.0-16.5	18.0-20.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	2.5
% Sand	48.9	43.2	50.4
% Fines	51.1	56.8	47.0
% -2μ			
Cc			
Cu			
LL		NP	
PL		NP	
PI		NP	
USCS		ML	
w (%)		29.2	

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"			98.3
3/8"			98.3
4			97.5
10	100.0	100.0	94.2
20	97.1	99.0	88.4
40	90.6	97.3	82.5
60	82.4	93.9	76.3
100	70.5	83.5	66.7
200	51.1	56.8	47.0

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SANDY SILT (ML)
▲	

PARTICLE SIZE DISTRIBUTION

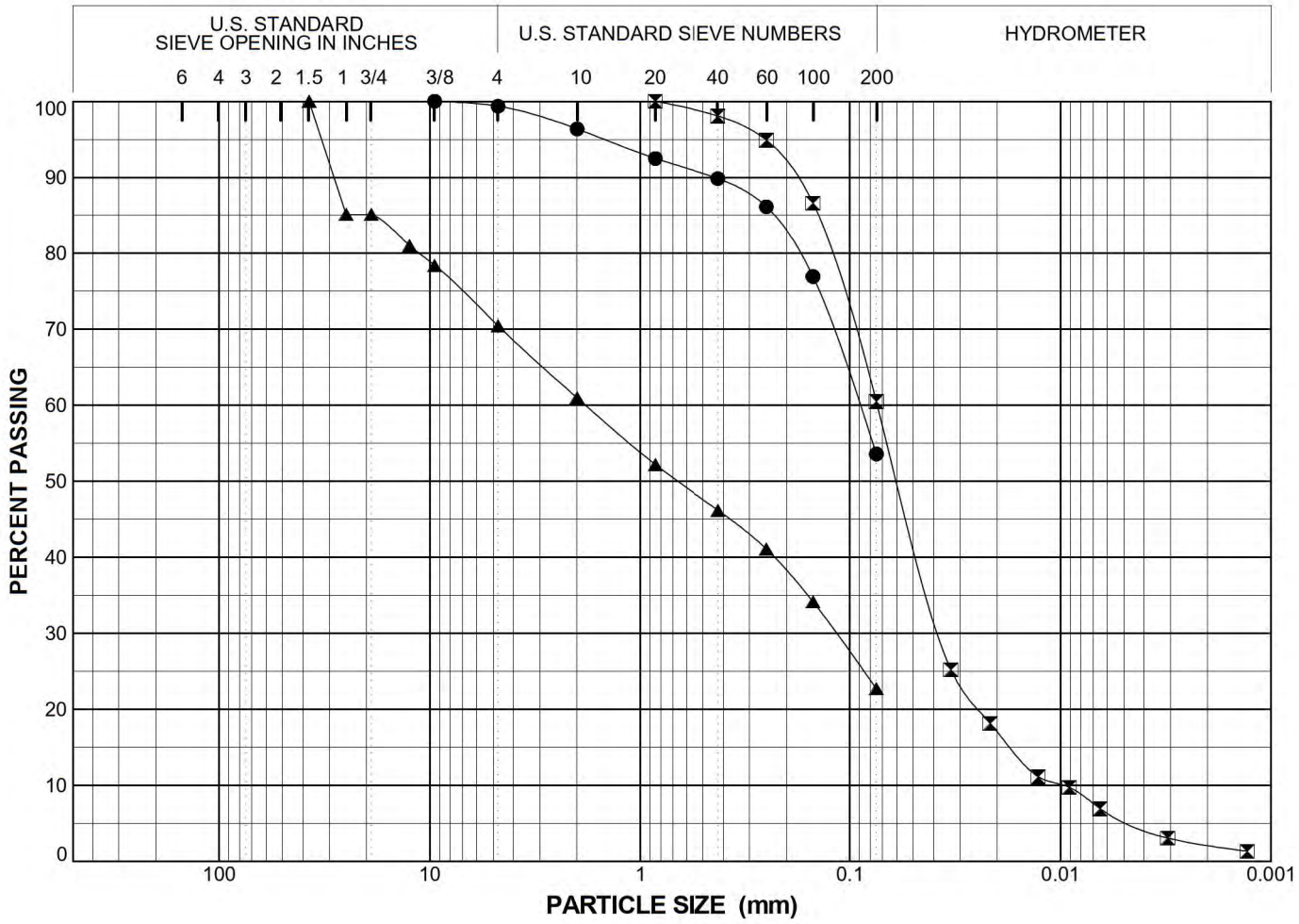
Piney Run Dam

Project Number 60614688	February 2020	Figure 13

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	206	206	206
Sample	S-6	S-7	S-8
Spec			
Depth (ft)	23.0-25.0	28.0-30.0	33.0-35.0
% +3"	0.0	0.0	0.0
% Gravel	0.6	0.0	29.5
% Sand	45.8	39.5	47.8
% Fines	53.6	60.5	22.7
% -2μ		2.2	
Cc		1.91	
Cu		7.63	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			100.0
1"			85.1
3/4"			85.1
1/2"			81.0
3/8"	100.0		78.4
4	99.4		70.5
10	96.4		61.0
20	92.5	100.0	52.2
40	89.8	98.1	46.2
60	86.1	94.9	41.1
100	76.9	86.6	34.1
200	53.6	60.5	22.7

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

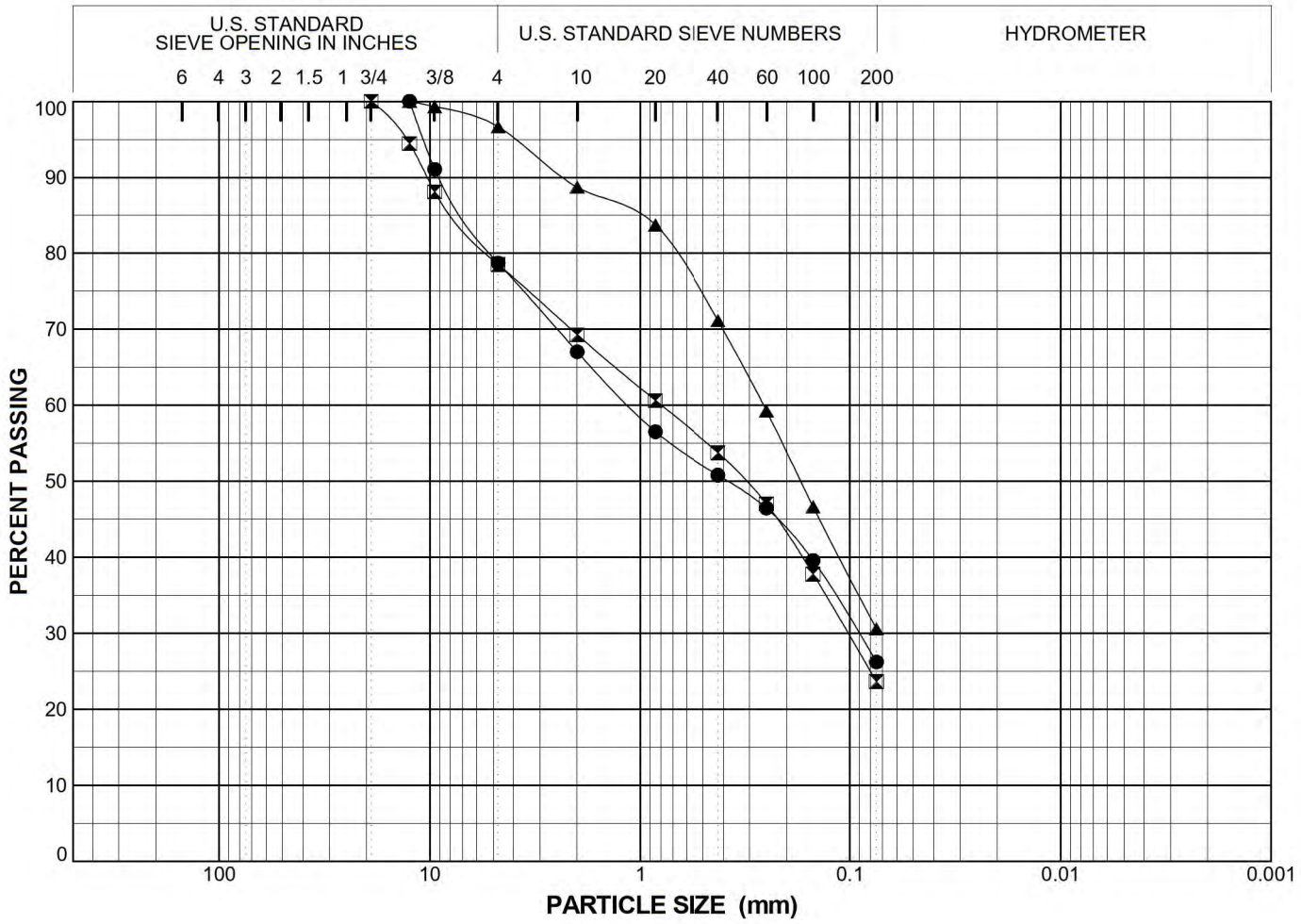
Piney Run Dam

Project Number 60614688	February 2020	Figure 14

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	206	207	207
Sample	S-9	S-1	S-2
Spec			
Depth (ft)	38.0-40.0	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	21.3	21.5	3.4
% Sand	52.5	54.9	66.1
% Fines	26.2	23.6	30.6
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"		100.0	
1/2"	100.0	94.5	100.0
3/8"	91.0	88.1	99.3
4	78.7	78.5	96.6
10	67.0	69.3	88.7
20	56.5	60.6	83.7
40	50.8	53.8	71.2
60	46.5	47.0	59.3
100	39.6	37.8	46.6
200	26.2	23.6	30.6

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

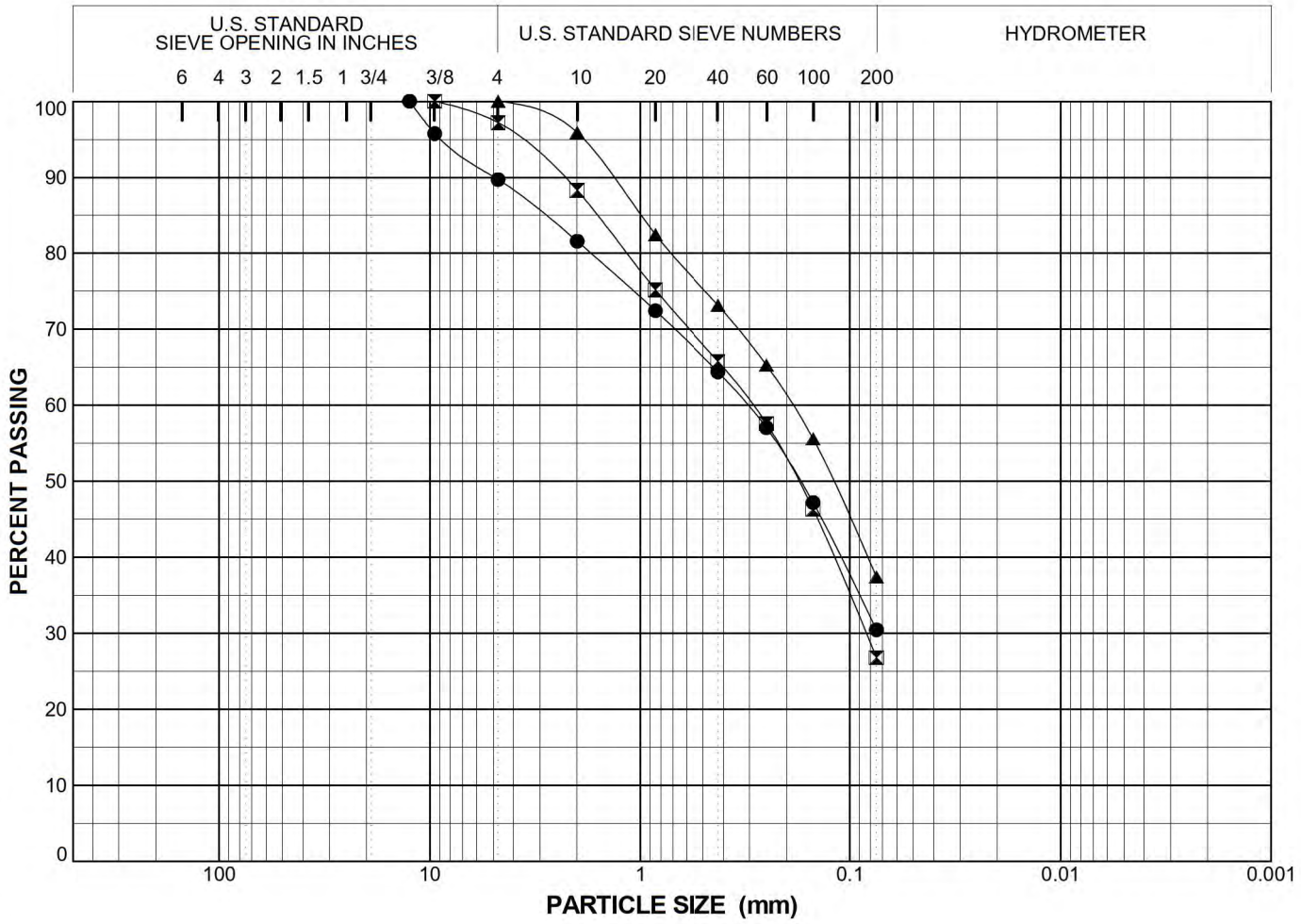
Piney Run Dam

Project Number 60614688	February 2020	Figure 15

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	207	207	207
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	10.3	2.8	0.0
% Sand	59.2	70.4	62.6
% Fines	30.5	26.8	37.4
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			
1/2"	100.0		
3/8"	95.8	100.0	
4	89.7	97.2	100.0
10	81.6	88.3	95.9
20	72.4	75.2	82.5
40	64.4	65.8	73.2
60	57.1	57.6	65.3
100	47.2	46.3	55.6
200	30.5	26.8	37.4

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

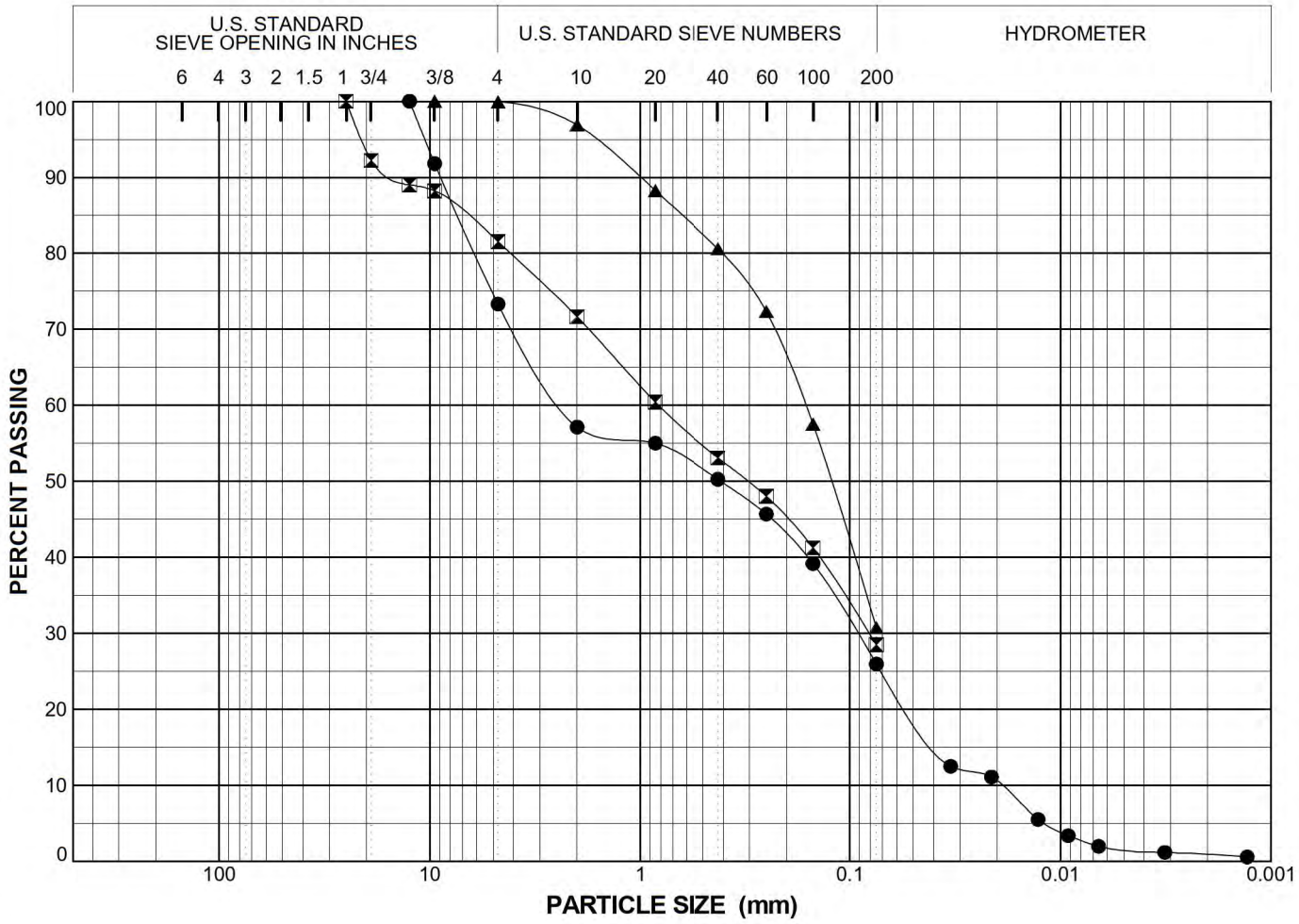
Piney Run Dam

Project Number 60614688	February 2020	Figure 16

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	207	207	208
Sample	S-7	S-8	S-1
Spec			
Depth (ft)	28.0-30.0	33.0-35.0	3.0-5.0
% +3"	0.0	0.0	0.0
% Gravel	26.7	18.5	0.1
% Sand	47.4	53.0	69.2
% Fines	26.0	28.5	30.7
% -2μ	0.8		
Cc	0.19		
Cu	120.86		
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"		100.0	
3/4"		92.2	
1/2"	100.0	89.0	
3/8"	91.8	88.2	100.0
4	73.3	81.5	99.9
10	57.1	71.7	96.9
20	55.0	60.4	88.3
40	50.3	53.1	80.6
60	45.7	48.0	72.3
100	39.2	41.2	57.5
200	26.0	28.5	30.7

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

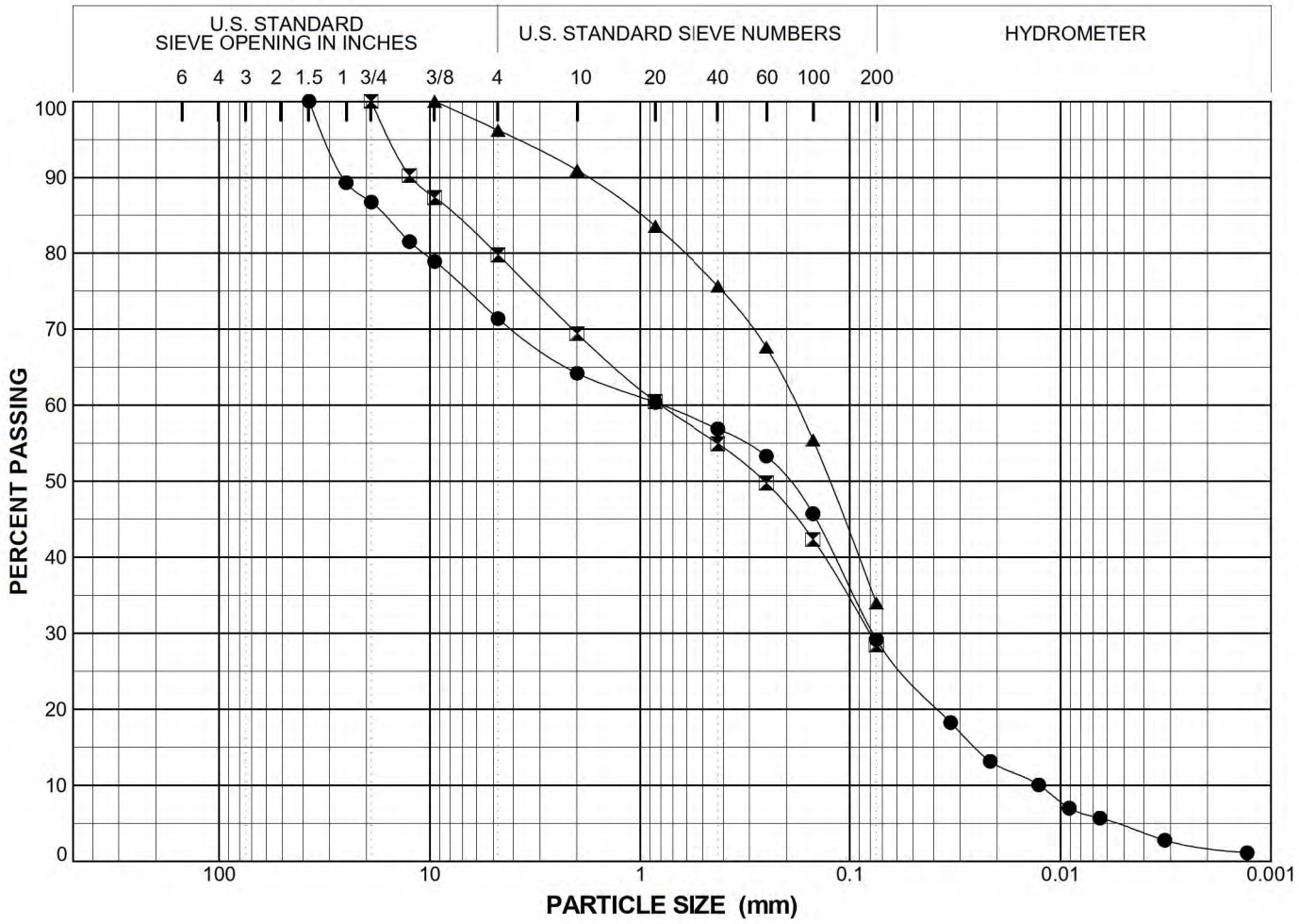
Piney Run Dam

Project Number 60614688	February 2020	Figure 17

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	208	208	208
Sample	BULK	S-2	S-3
Spec			
Depth (ft)	5.0-15.0	8.0-10.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	28.6	20.2	3.8
% Sand	42.2	51.3	62.2
% Fines	29.2	28.5	34.0
% -2μ	1.9		
Cc	0.60		
Cu	62.56		
LL	NP		
PL	NP		
PI	NP		
USCS	SM		
w (%)			16.3

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"	100.0		
1"	89.3		
3/4"	86.7	100.0	
1/2"	81.5	90.2	
3/8"	78.9	87.3	100.0
4	71.4	79.8	96.2
10	64.2	69.4	90.9
20	60.4	60.5	83.6
40	56.9	54.9	75.7
60	53.3	49.8	67.6
100	45.7	42.4	55.4
200	29.2	28.5	34.0

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND with GRAVEL (SM)
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

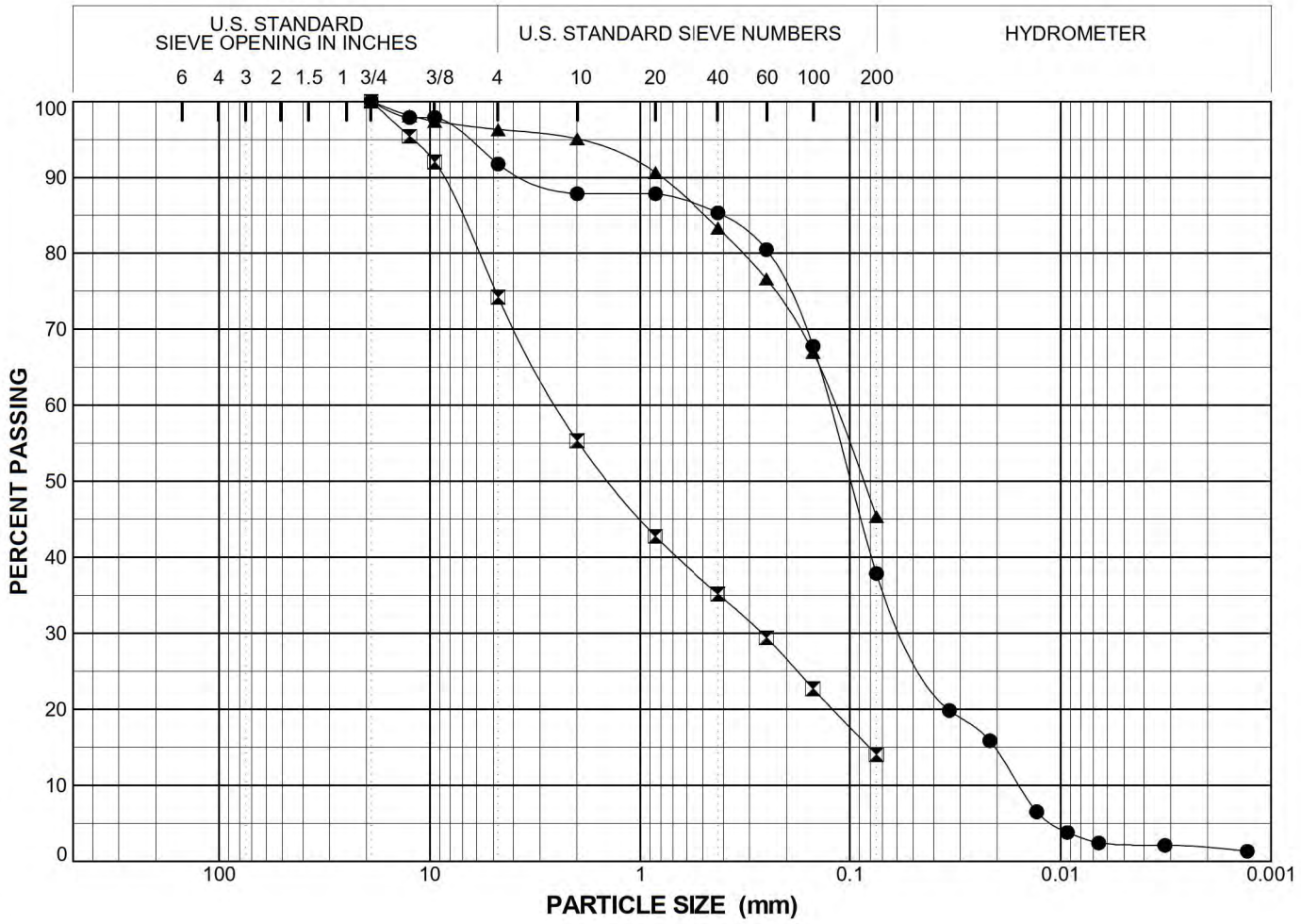
Piney Run Dam

Project Number 60614688	February 2020	Figure 18

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	208	208	208
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	18.0-20.0	23.0-25.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	8.3	25.7	3.7
% Sand	53.9	60.2	50.9
% Fines	37.9	14.1	45.4
% -2μ	1.7		
Cc	1.42		
Cu	7.96		
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER		
	●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0	100.0	100.0
1/2"	97.9	95.4	98.1
3/8"	97.9	92.0	97.4
4	91.7	74.3	96.3
10	87.8	55.3	95.1
20	87.8	42.8	90.6
40	85.3	35.2	83.3
60	80.5	29.4	76.6
100	67.8	22.7	67.0
200	37.9	14.1	45.4

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

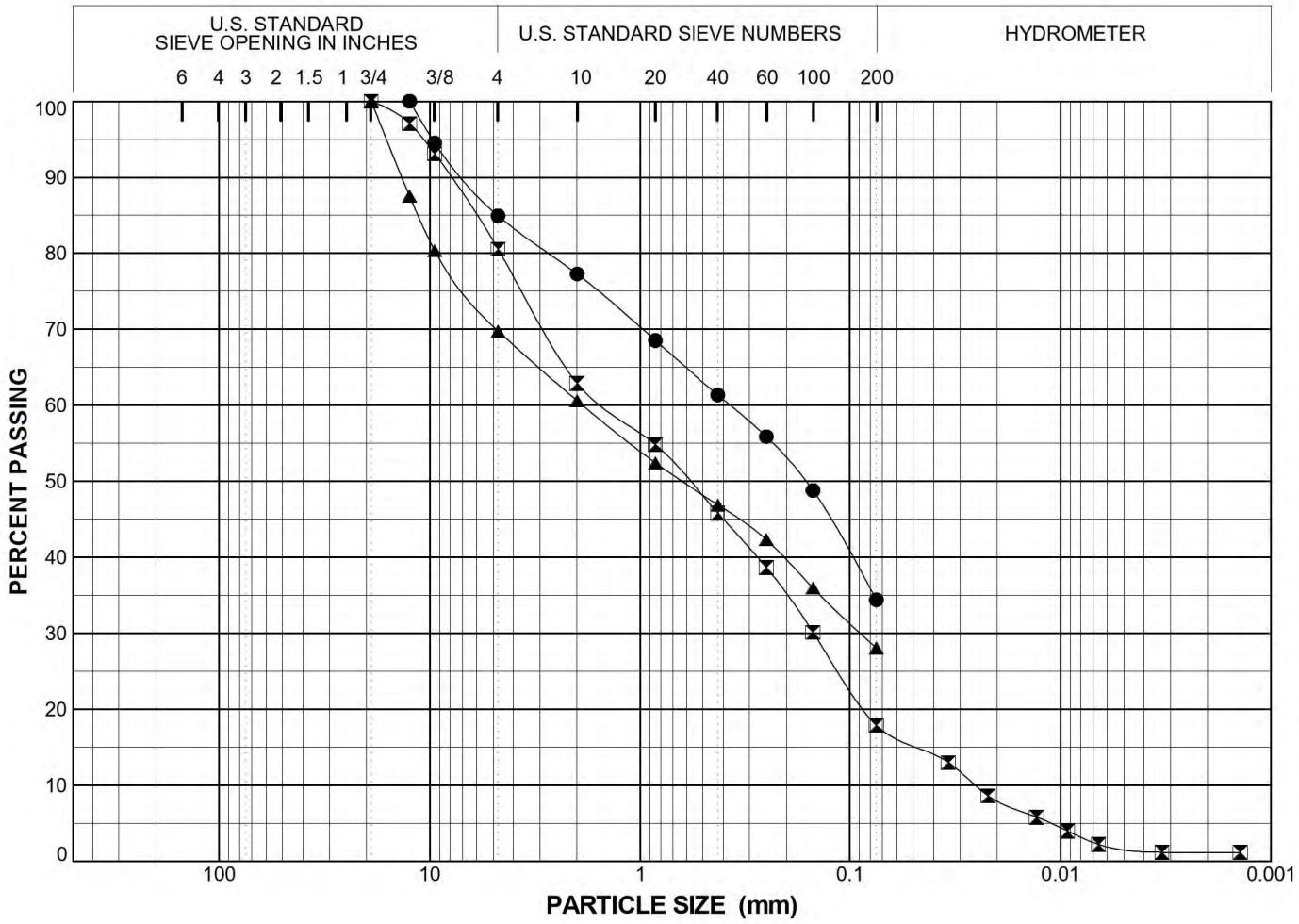
Piney Run Dam

Project Number 60614688	February 2020	Figure 19

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	208	210	210
Sample	S-7	S-2	S-3
Spec			
Depth (ft)	33.0-35.0	3.0-5.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	15.1	19.4	30.2
% Sand	50.5	62.7	41.7
% Fines	34.4	17.9	28.1
% -2μ		1.2	
Cc		0.59	
Cu		58.03	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"		100.0	100.0
1/2"	100.0	97.1	87.5
3/8"	94.5	93.1	80.3
4	84.9	80.6	69.8
10	77.3	62.9	60.6
20	68.5	54.8	52.4
40	61.4	45.8	46.9
60	55.9	38.7	42.3
100	48.8	30.1	36.0
200	34.4	17.9	28.1

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

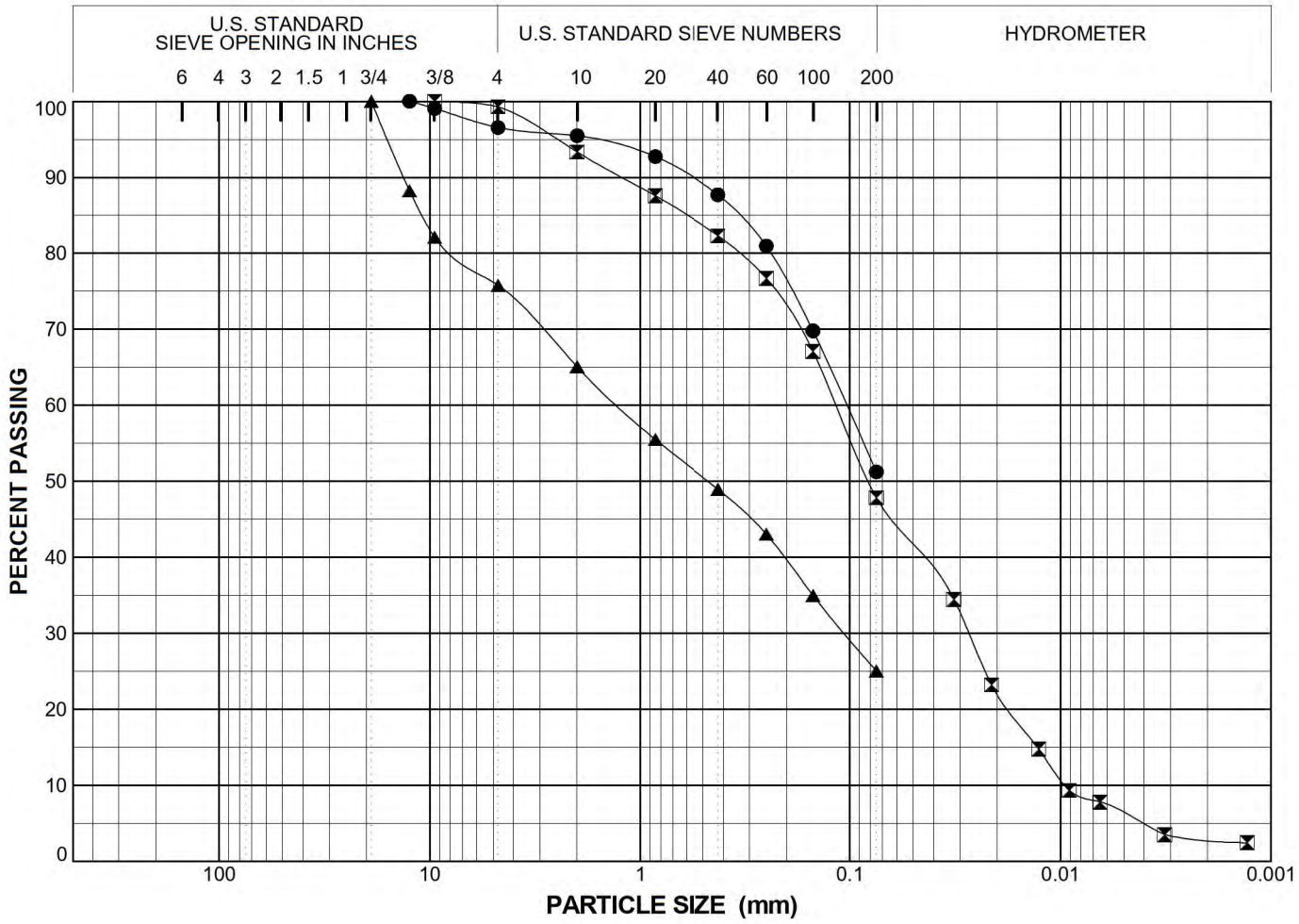
Piney Run Dam

Project Number 60614688	February 2020	Figure 20

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	210	210	210
Sample	S-4	S-5	S-6
Spec			
Depth (ft)	13.0-15.0	18.0-20.0	23.0-25.0
% +3"	0.0	0.0	0.0
% Gravel	3.5	0.7	24.2
% Sand	45.3	51.4	50.8
% Fines	51.2	47.8	25.0
% -2μ		2.9	
Cc		0.68	
Cu		12.25	
LL		NP	
PL		NP	
PI		NP	
USCS		SM	
w (%)		21.4	

Particle Size (Sieve #)	PERCENT FINER		
	●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"	100.0		88.2
3/8"	99.0	100.0	82.1
4	96.5	99.3	75.8
10	95.5	93.3	65.1
20	92.7	87.6	55.5
40	87.7	82.3	49.0
60	81.0	76.7	43.0
100	69.8	67.1	35.0
200	51.2	47.8	25.0

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SILTY SAND (SM)
▲	

PARTICLE SIZE DISTRIBUTION

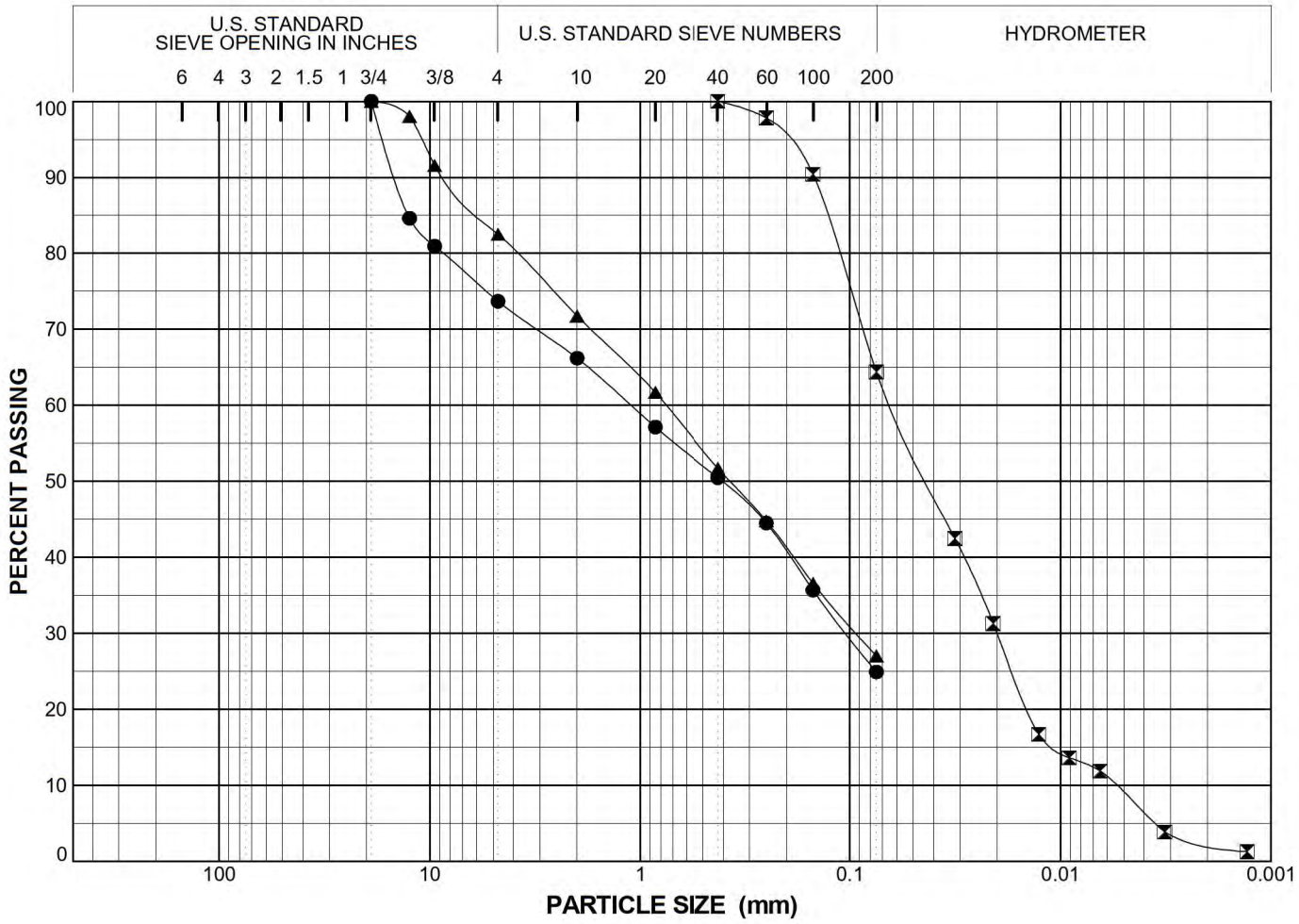
Piney Run Dam

Project Number 60614688	February 2020	Figure 21

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	211	211	211
Sample	S-1	S-2	S-4
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	26.3	0.0	17.5
% Sand	48.8	35.6	55.5
% Fines	24.9	64.4	27.0
% -2μ		2.5	
Cc		1.15	
Cu		11.46	
LL		NP	
PL		NP	
PI		NP	
USCS		ML	
w (%)		21.9	

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0		100.0
1/2"	84.6		98.0
3/8"	80.9		91.6
4	73.7		82.5
10	66.2		71.8
20	57.1		61.7
40	50.5	100.0	51.7
60	44.5	97.8	44.8
100	35.7	90.4	36.6
200	24.9	64.4	27.0

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SANDY SILT (ML)
▲	

PARTICLE SIZE DISTRIBUTION

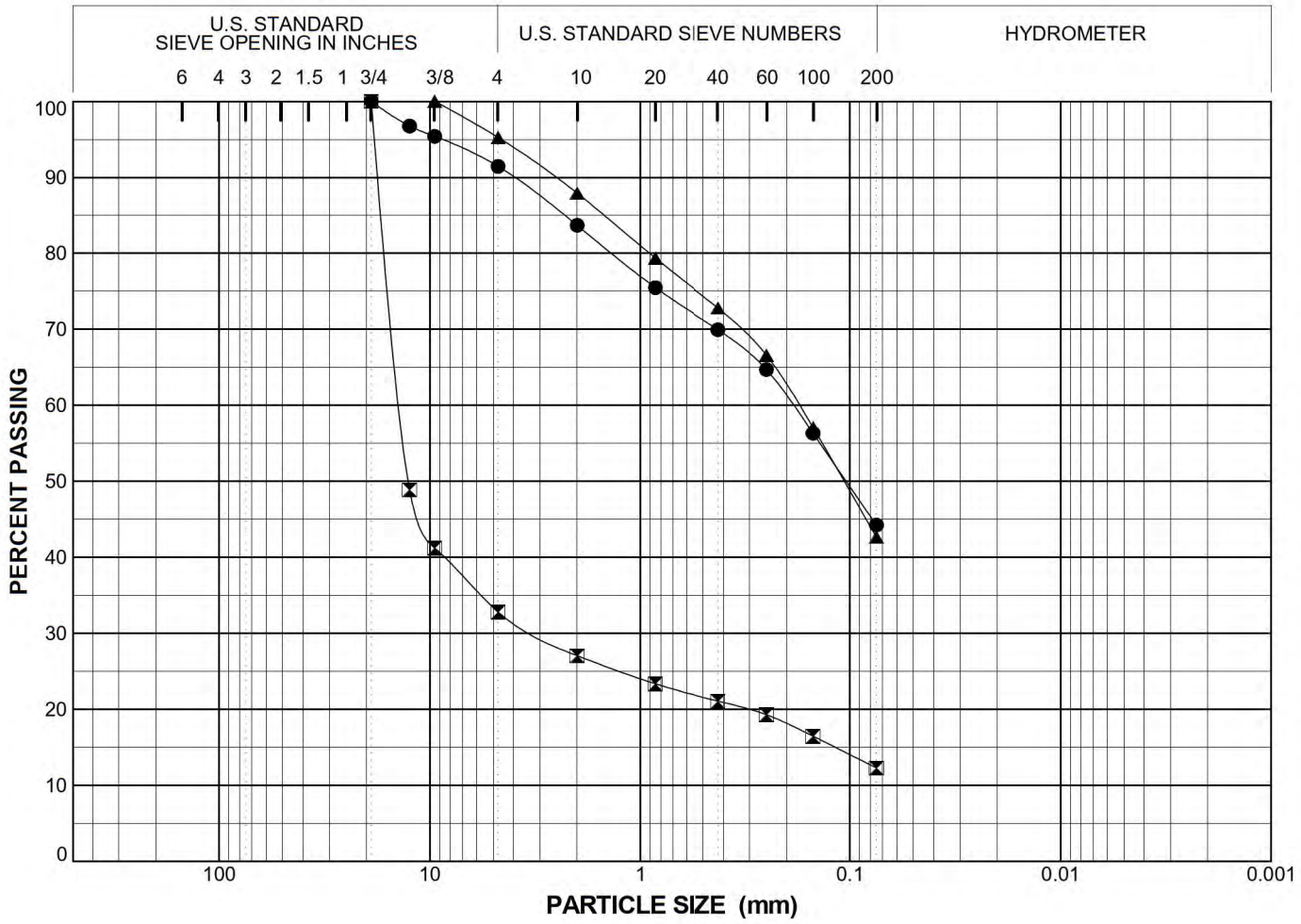
Piney Run Dam

Project Number 60614688	February 2020	Figure 22

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	211	211	211
Sample	S-5	S-6	S-7
Spec			
Depth (ft)	18.0-20.0	23.0-25.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	8.6	67.2	4.8
% Sand	47.2	20.5	52.6
% Fines	44.2	12.3	42.6
% -2μ			
Cc		13.83	
Cu		266.00	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0	100.0	
1/2"	96.7	48.9	
3/8"	95.4	41.2	100.0
4	91.4	32.8	95.2
10	83.7	27.0	87.9
20	75.5	23.3	79.4
40	69.9	21.1	72.8
60	64.7	19.3	66.6
100	56.3	16.4	57.1
200	44.2	12.3	42.6

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

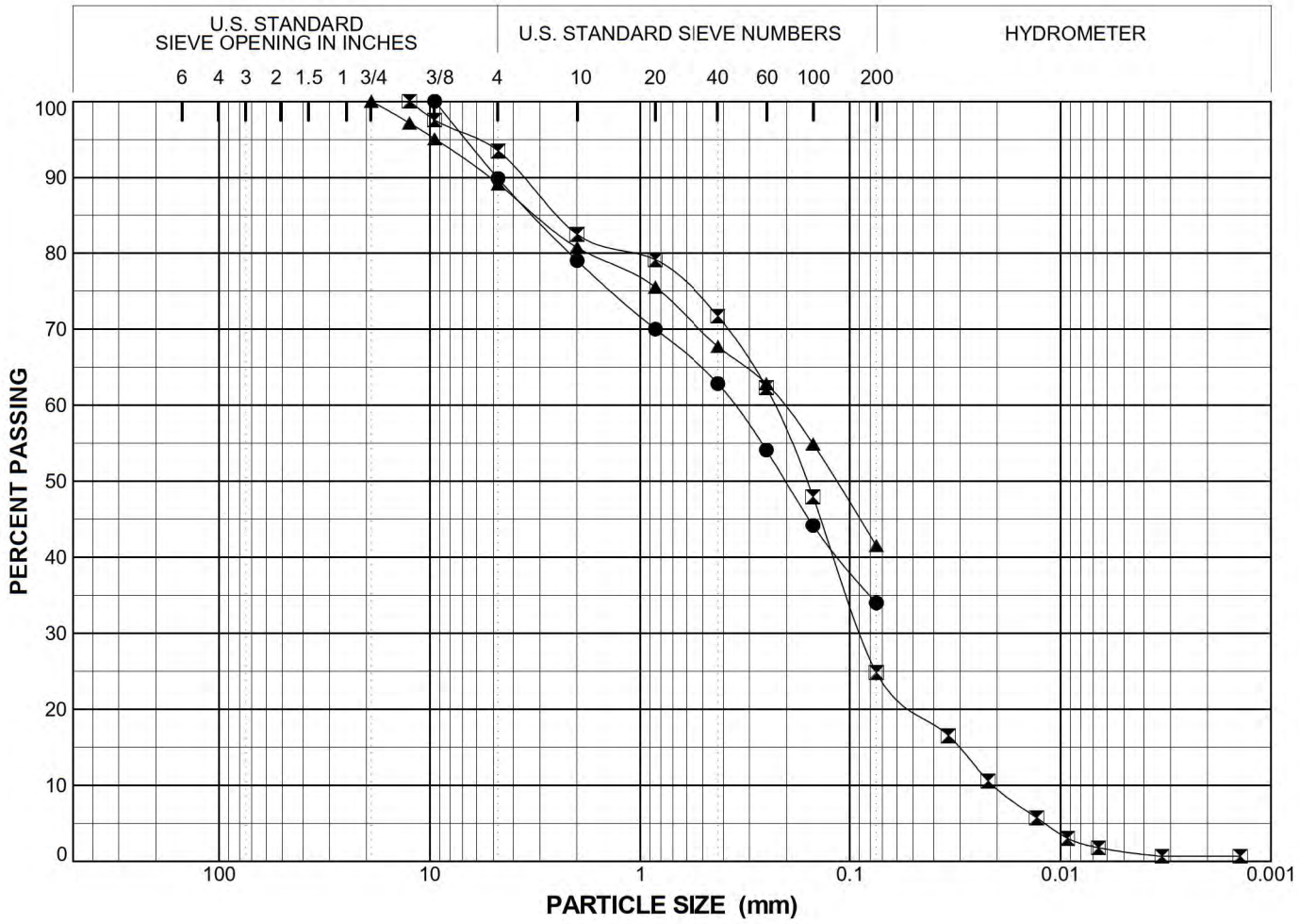
Piney Run Dam

Project Number 60614688	February 2020	Figure 23

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	211	211	211
Sample	S-8	S-9	S-10
Spec			
Depth (ft)	33.0-35.0	38.0-40.0	43.0-45.0
% +3"	0.0	0.0	0.0
% Gravel	10.1	6.5	10.9
% Sand	55.9	68.6	47.6
% Fines	34.0	24.8	41.5
% -2μ		0.7	
Cc		1.61	
Cu		11.08	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"		100.0	97.1
3/8"	100.0	97.5	95.1
4	89.9	93.5	89.1
10	79.0	82.5	80.7
20	70.0	79.1	75.5
40	62.9	71.7	67.7
60	54.1	62.4	62.8
100	44.2	48.0	54.9
200	34.0	24.8	41.5

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

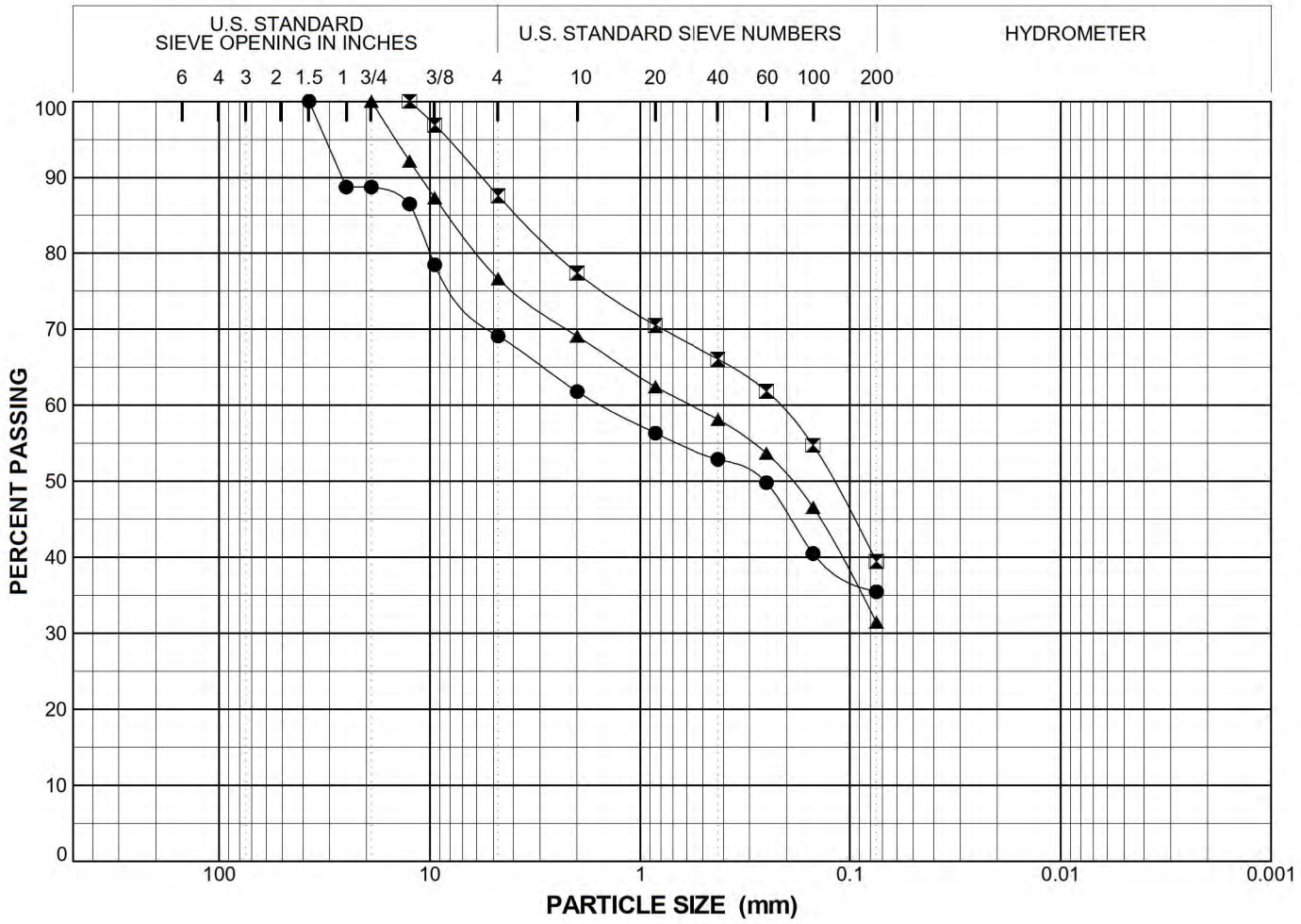
Piney Run Dam

Project Number 60614688	February 2020	Figure 24

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	211	1	2
Sample	S-11	T-1	S-1
Spec			
Depth (ft)	48.0-50.0	15.0-17.0	0.0-2.0
% +3"	0.0	0.0	0.0
% Gravel	30.9	12.4	23.4
% Sand	33.7	48.1	45.2
% Fines	35.5	39.4	31.4
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)		18.2	

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"	100.0		
1"	88.7		
3/4"	88.7		100.0
1/2"	86.5	100.0	92.1
3/8"	78.5	96.9	87.3
4	69.1	87.6	76.6
10	61.8	77.4	69.1
20	56.3	70.5	62.4
40	52.9	66.1	58.1
60	49.8	61.9	53.7
100	40.5	54.7	46.6
200	35.5	39.4	31.4

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

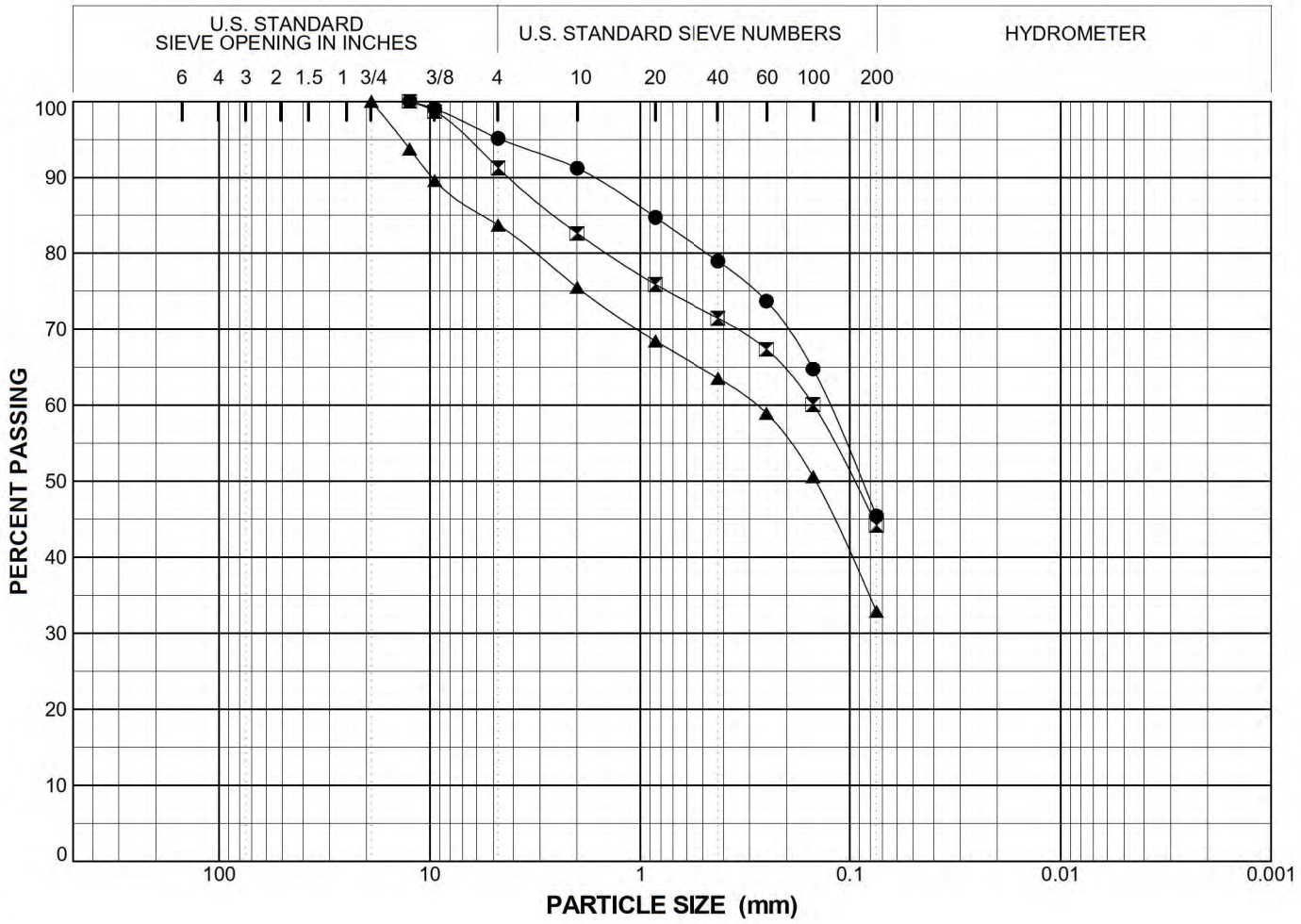
Piney Run Dam

Project Number 60614688	February 2020	Figure 25

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	2	2	2
Sample	S-2	S-3	S-4
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	4.9	8.8	16.3
% Sand	49.7	47.0	50.8
% Fines	45.4	44.2	32.9
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			100.0
1/2"	100.0	100.0	93.8
3/8"	99.0	98.7	89.6
4	95.1	91.2	83.7
10	91.2	82.6	75.5
20	84.7	75.9	68.5
40	79.0	71.4	63.6
60	73.7	67.4	59.0
100	64.8	60.1	50.6
200	45.4	44.2	32.9

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

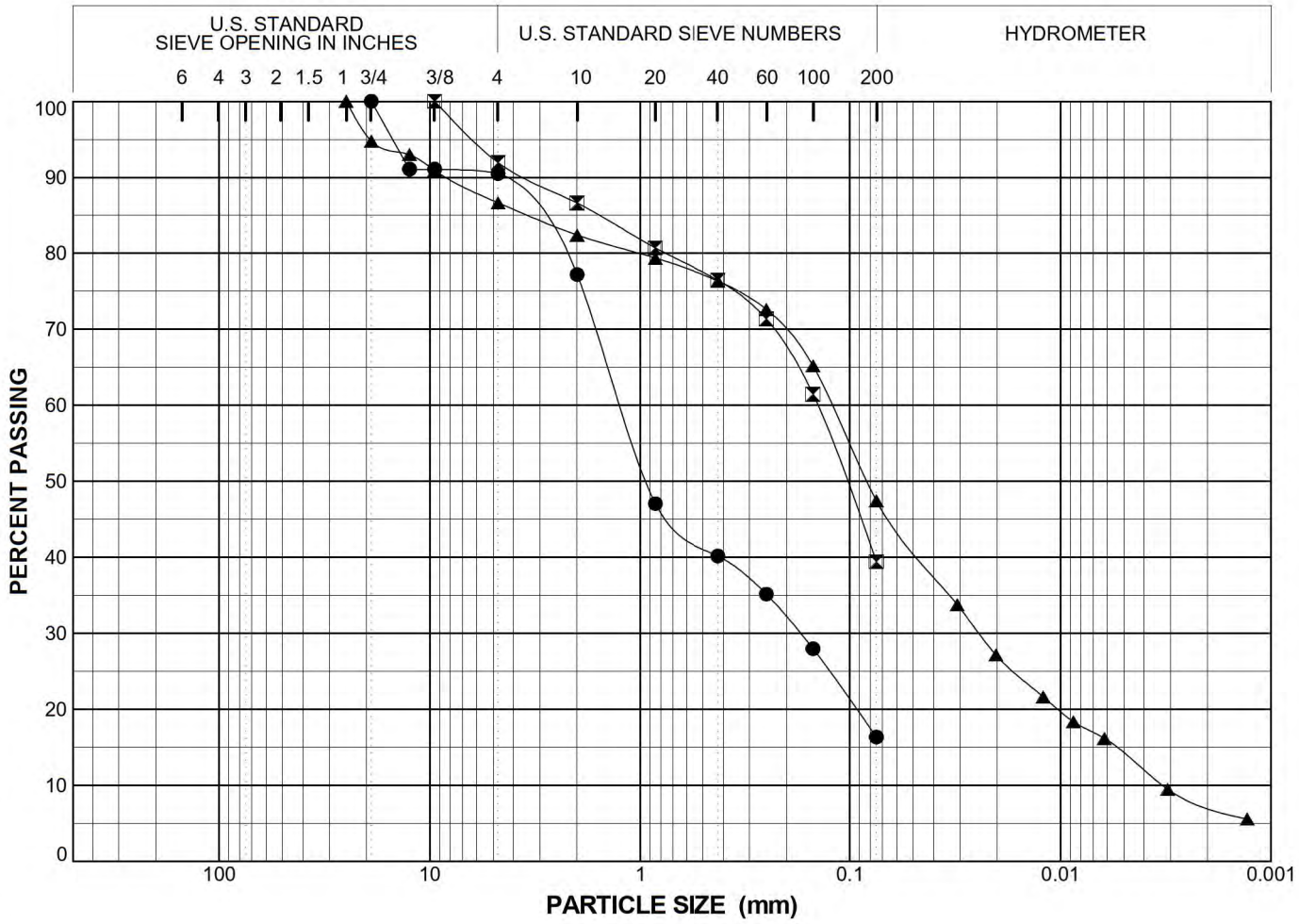
Piney Run Dam

Project Number 60614688	February 2020	Figure 26

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	2	2	2
Sample	S-5A	S-6	T-1
Spec			
Depth (ft)	18.0-20.0	23.0-25.0	25.0-27.0
% +3"	0.0	0.0	0.0
% Gravel	9.5	8.1	13.4
% Sand	74.1	52.5	39.2
% Fines	16.3	39.4	47.5
% -2μ			7.5
Cc			1.48
Cu			37.36
LL			NP
PL			NP
PI			NP
USCS			SM
w (%)			22.5

Particle Size (Sieve #)	PERCENT FINER		
	●	⧓	▲
2"			
1 1/2"			
1"			100.0
3/4"	100.0		94.8
1/2"	91.1		93.0
3/8"	91.1	100.0	90.9
4	90.5	91.9	86.6
10	77.2	86.6	82.4
20	47.1	80.7	79.4
40	40.2	76.4	76.3
60	35.1	71.4	72.6
100	28.0	61.5	65.2
200	16.3	39.4	47.5

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	Brown SILTY SAND (SM)

PARTICLE SIZE DISTRIBUTION

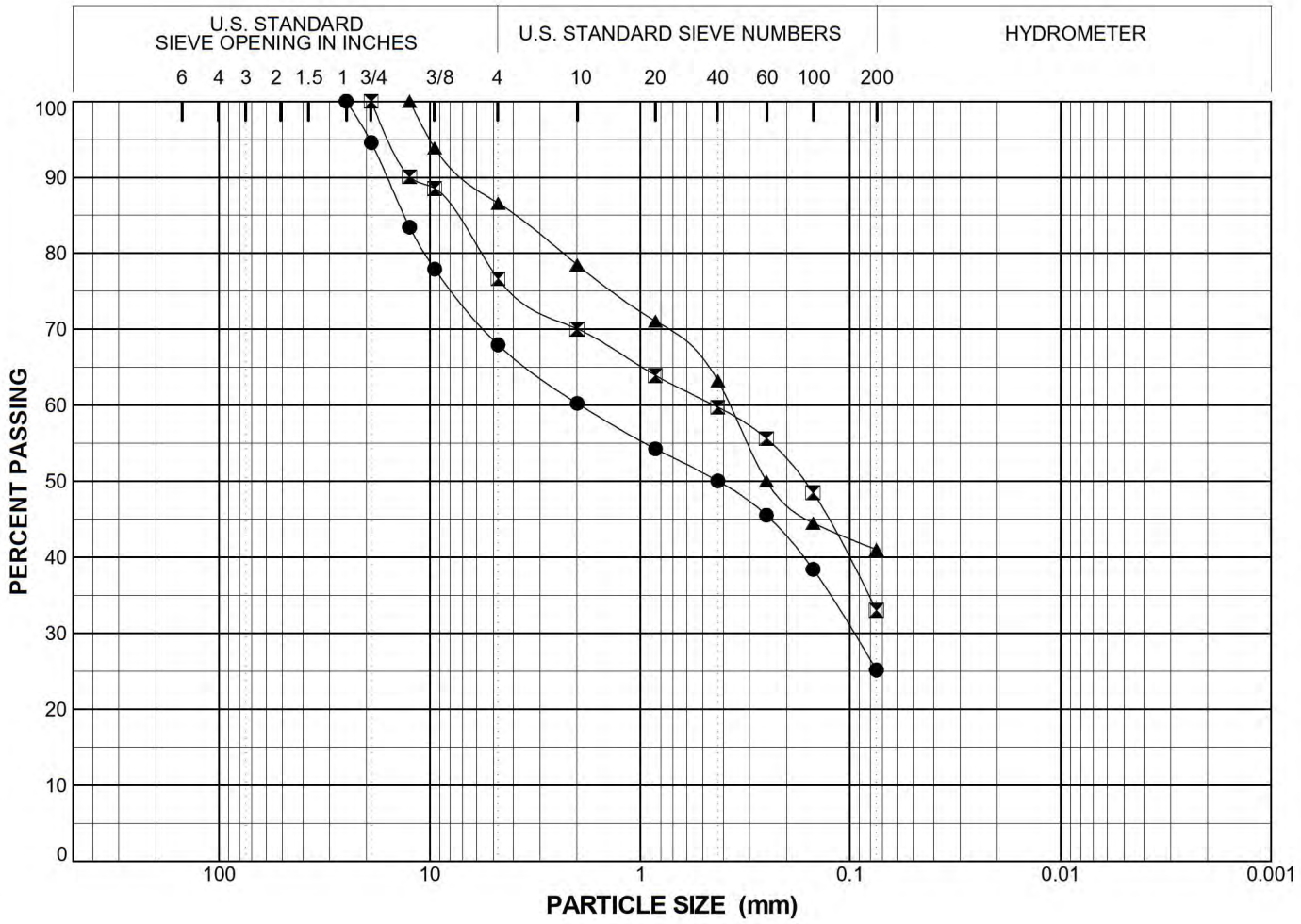
Piney Run Dam

Project Number 60614688	February 2020	Figure 27

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	2	2	2
Sample	T-2	S-11	S-12
Spec			
Depth (ft)	31.0-32.7	33.0-35.0	38.0-40.0
% +3"	0.0	0.0	0.0
% Gravel	32.0	23.3	13.4
% Sand	42.8	43.6	45.6
% Fines	25.2	33.0	41.0
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"	100.0		
3/4"	94.6	100.0	
1/2"	83.4	90.1	100.0
3/8"	77.9	88.5	93.8
4	68.0	76.7	86.6
10	60.2	70.0	78.5
20	54.3	63.9	71.1
40	50.0	59.7	63.3
60	45.5	55.6	50.0
100	38.4	48.5	44.5
200	25.2	33.0	41.0

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

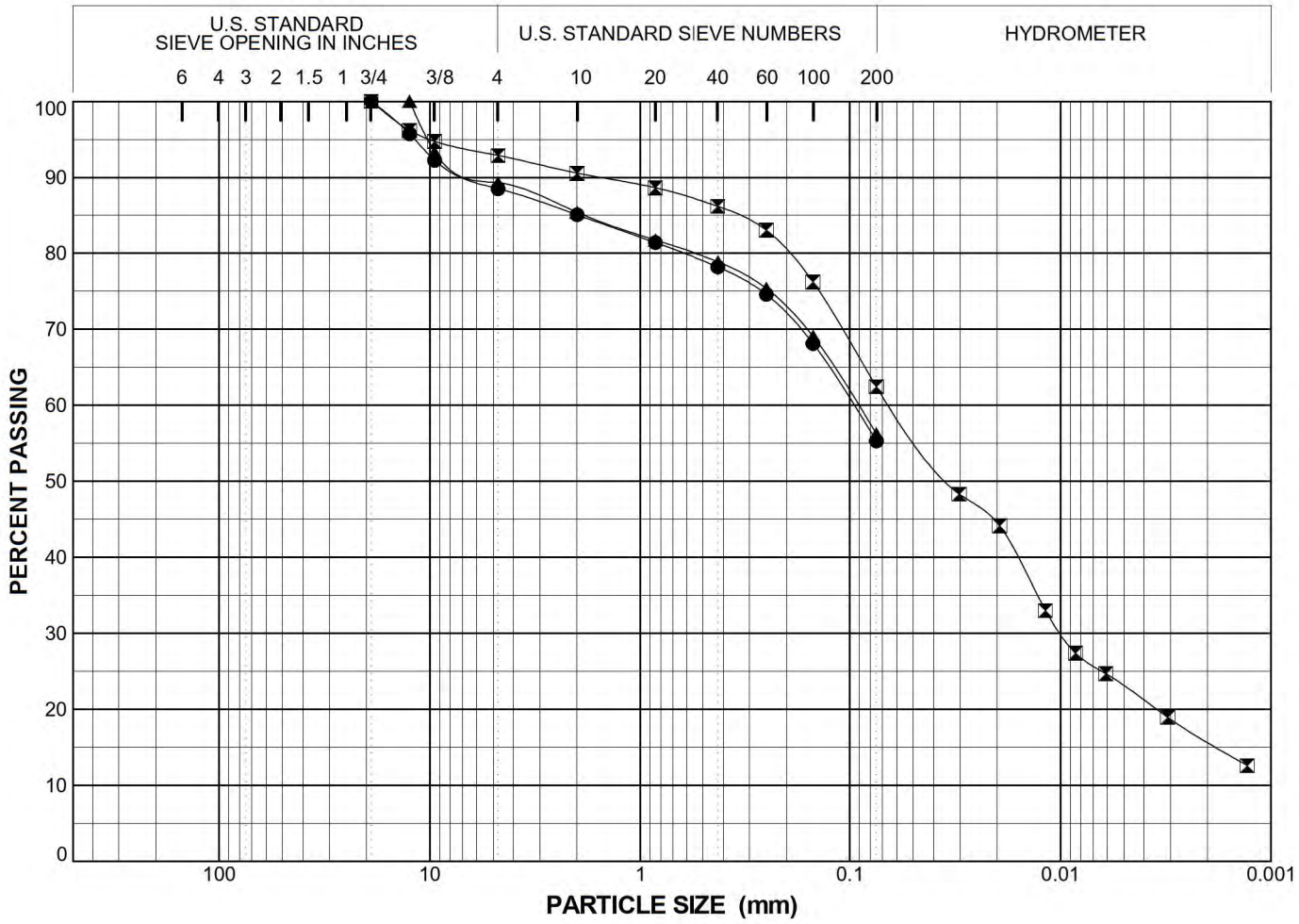
Piney Run Dam

Project Number 60614688	February 2020	Figure 28

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	2	2	2
Sample	S-13	S-14	S-15
Spec			
Depth (ft)	43.0-45.0	48.0-50.0	53.0-55.0
% +3"	0.0	0.0	0.0
% Gravel	11.5	7.1	10.7
% Sand	33.2	30.4	33.0
% Fines	55.3	62.4	56.3
% -2μ		15.7	
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)	16.6		

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0	100.0	
1/2"	95.7	96.2	100.0
3/8"	92.2	94.7	93.3
4	88.5	92.9	89.3
10	85.1	90.5	85.4
20	81.4	88.6	81.7
40	78.2	86.2	78.9
60	74.6	83.0	75.4
100	68.1	76.2	69.1
200	55.3	62.4	56.3

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

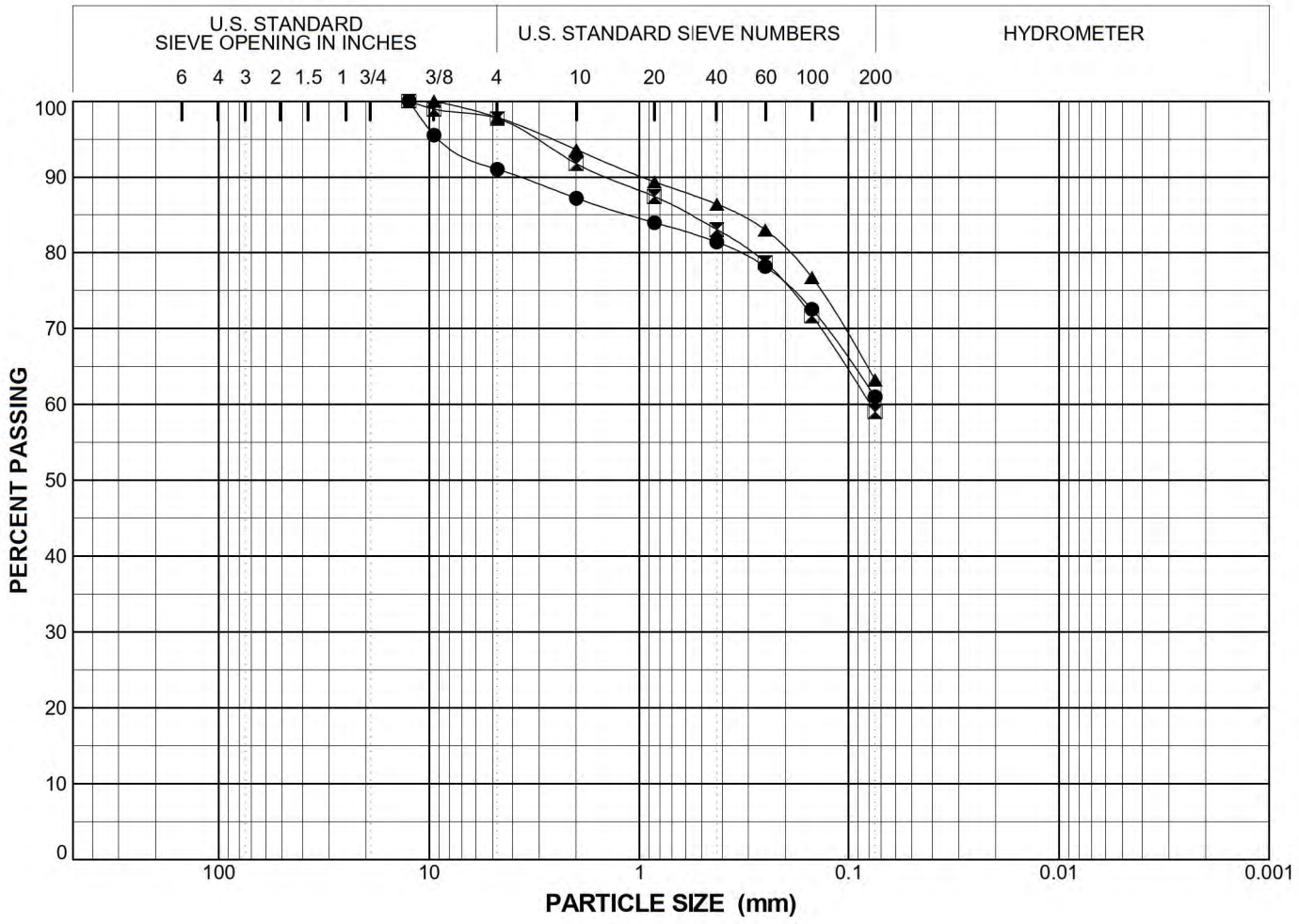
Piney Run Dam

Project Number 60614688	February 2020	Figure 29

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	2	2	2
Sample	S-16	S-17	S-18
Spec			
Depth (ft)	58.0-60.0	63.0-65.0	68.0-70.0
% +3"	0.0	0.0	0.0
% Gravel	9.0	2.3	2.2
% Sand	30.0	38.7	34.6
% Fines	61.0	59.0	63.2
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			
1/2"	100.0	100.0	
3/8"	95.5	98.9	100.0
4	91.0	97.7	97.8
10	87.2	91.7	93.6
20	84.0	87.4	89.3
40	81.4	83.1	86.4
60	78.2	78.7	83.0
100	72.6	71.7	76.8
200	61.0	59.0	63.2

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

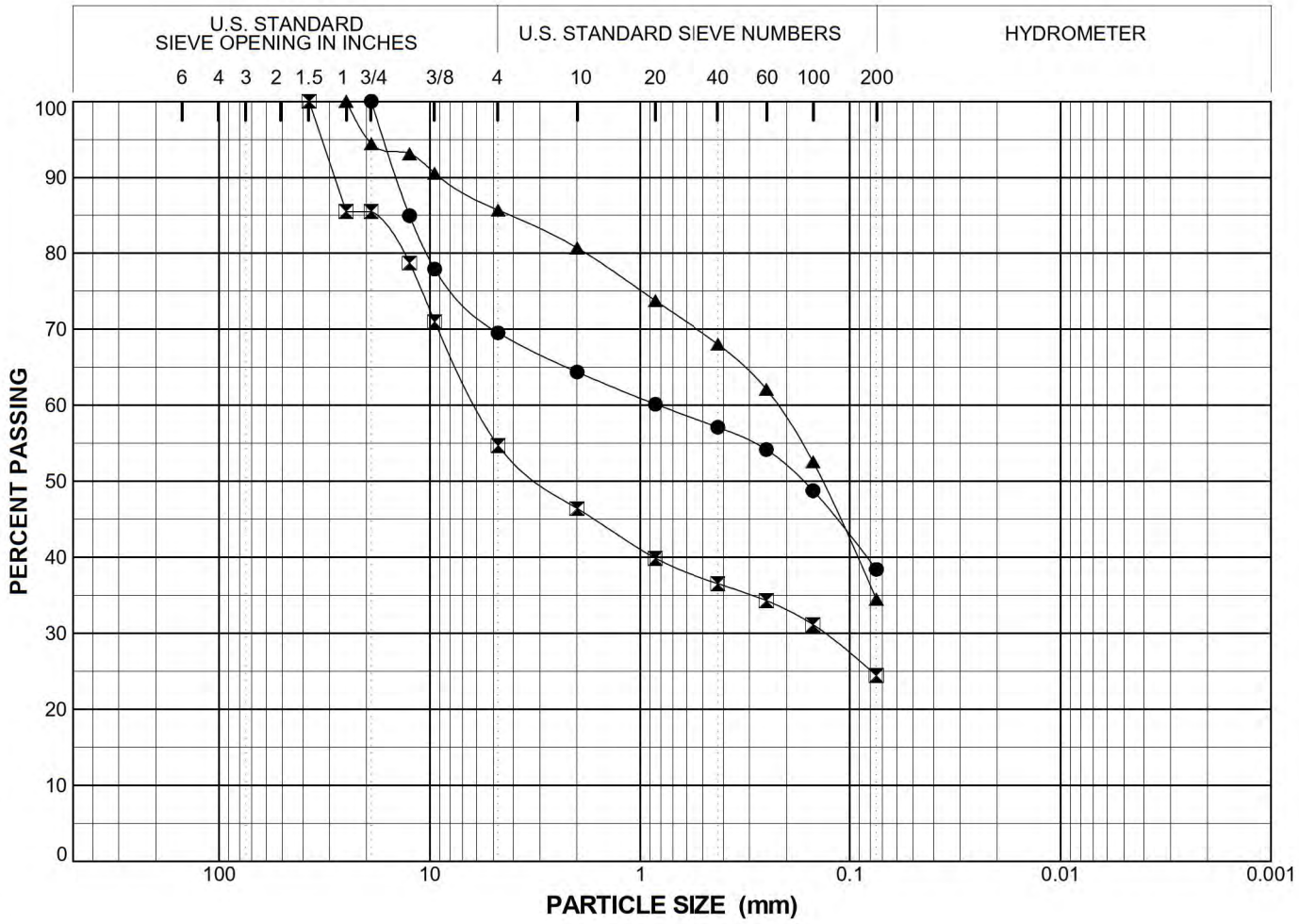
Piney Run Dam

Project Number 60614688	February 2020	Figure 30

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	2	2	3
Sample	S-19	S-20	S-1
Spec			
Depth (ft)	73.0-75.0	78.0-78.3	3.0-5.0
% +3"	0.0	0.0	0.0
% Gravel	30.5	45.3	14.3
% Sand	31.1	30.3	51.2
% Fines	38.4	24.4	34.5
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"		100.0	
1"		85.5	100.0
3/4"	100.0	85.5	94.4
1/2"	84.9	78.7	93.1
3/8"	77.9	71.0	90.5
4	69.5	54.7	85.7
10	64.4	46.4	80.7
20	60.1	39.9	73.8
40	57.1	36.5	68.0
60	54.2	34.3	62.1
100	48.8	31.1	52.6
200	38.4	24.4	34.5

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

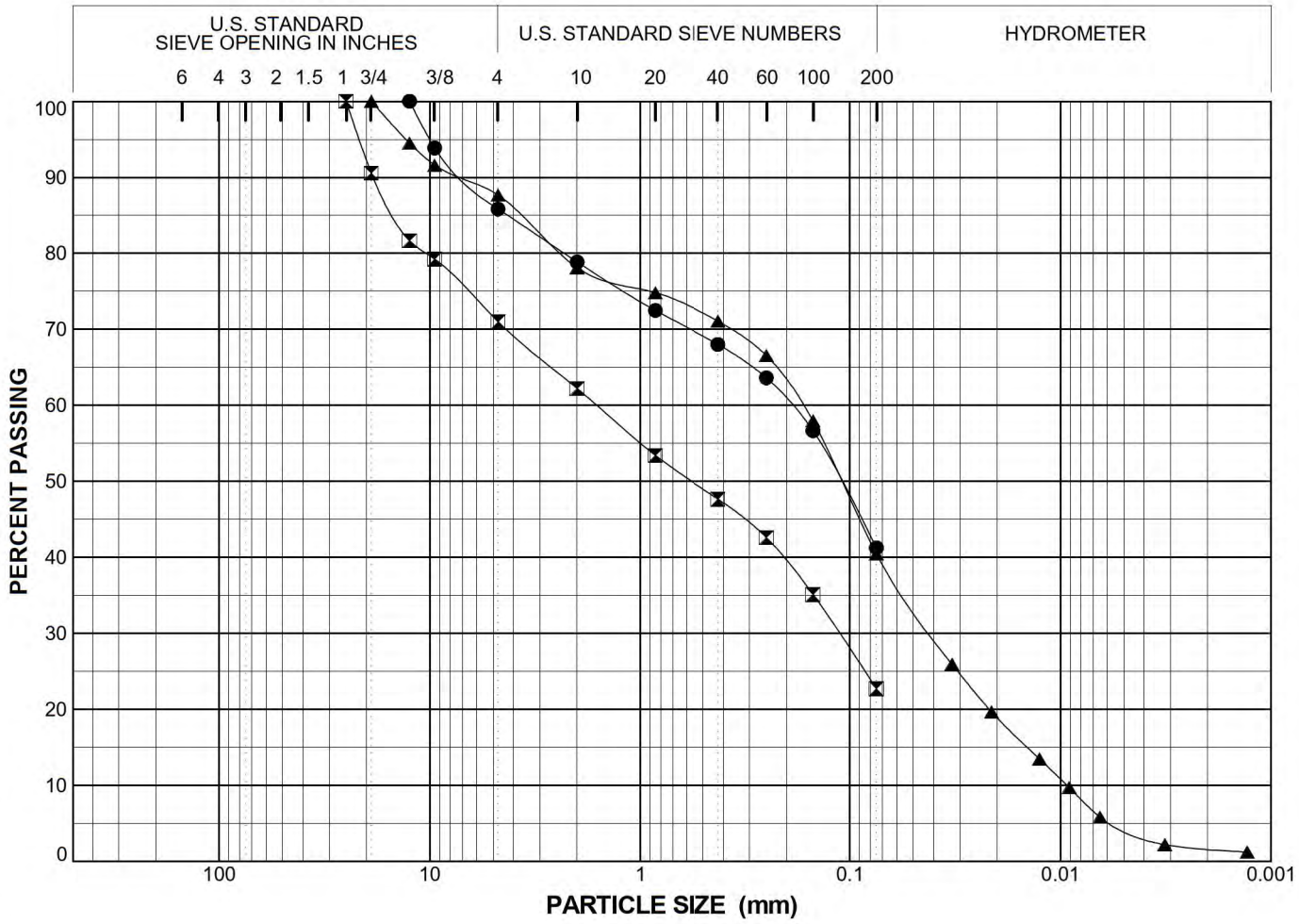
Piney Run Dam

Project Number 60614688	February 2020	Figure 31

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	3	3	3
Sample	S-2	S-3	S-4
Spec			
Depth (ft)	8.0-10.0	13.0-15.0	18.0-20.0
% +3"	0.0	0.0	0.0
% Gravel	14.2	29.0	12.3
% Sand	44.6	48.3	47.2
% Fines	41.2	22.7	40.5
% -2μ			1.7
Cc			1.08
Cu			18.11
LL			NP
PL			NP
PI			NP
USCS			SM
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"		100.0	
3/4"		90.6	100.0
1/2"	100.0	81.7	94.5
3/8"	93.9	79.2	91.6
4	85.8	71.0	87.7
10	78.8	62.2	78.1
20	72.5	53.4	74.8
40	68.0	47.7	71.1
60	63.6	42.6	66.5
100	56.6	35.1	57.9
200	41.2	22.7	40.5

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	Brown SILTY SAND (SM)

PARTICLE SIZE DISTRIBUTION

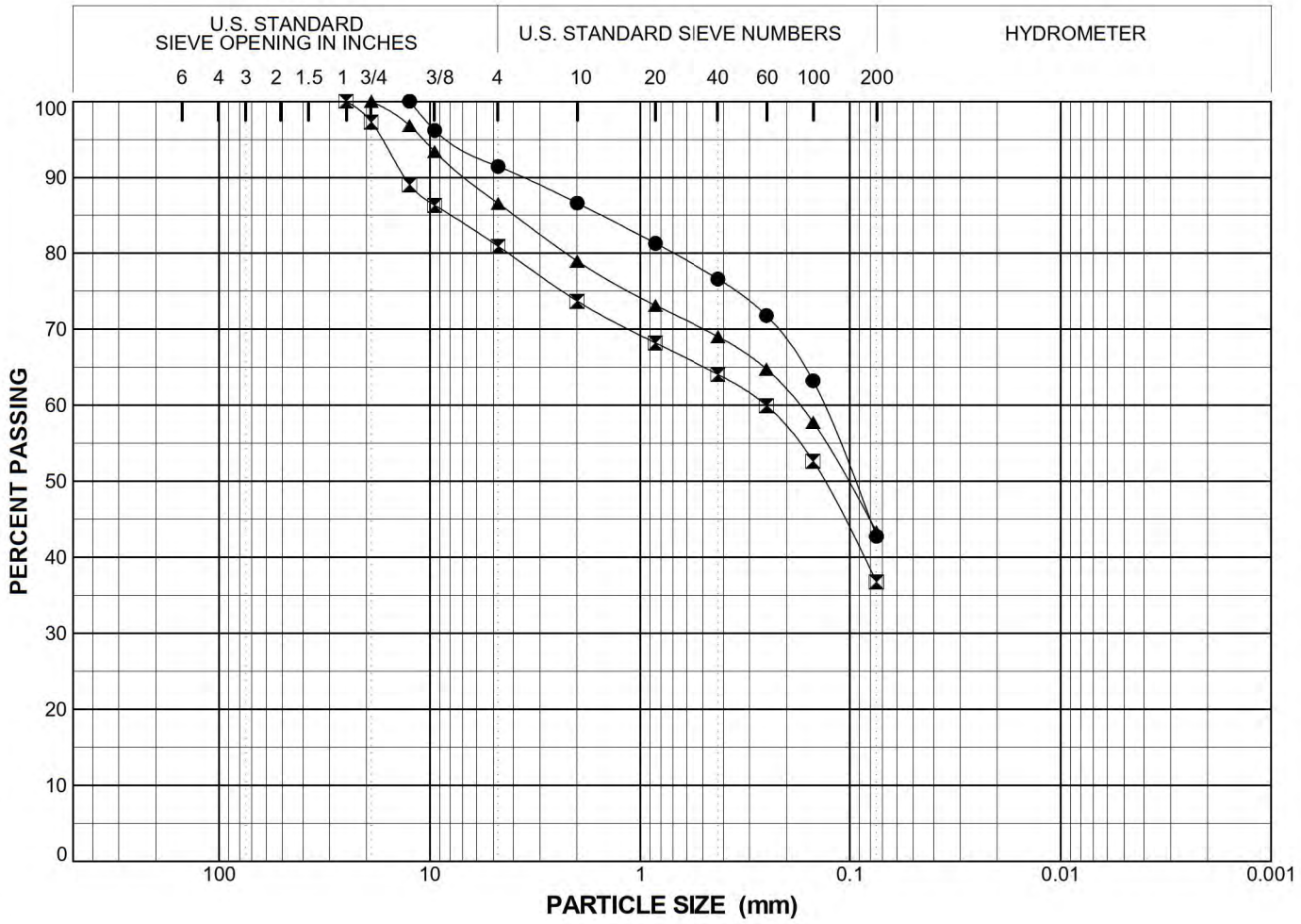
Piney Run Dam

Project Number 60614688	February 2020	Figure 32

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	3	3	3
Sample	S-5	T-1	S-7
Spec			
Depth (ft)	23.0-25.0	25.0-27.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	8.6	19.1	13.4
% Sand	48.7	44.2	43.2
% Fines	42.8	36.8	43.4
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			15.3

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"		100.0	
3/4"		97.3	100.0
1/2"	100.0	89.0	96.8
3/8"	96.2	86.3	93.4
4	91.4	80.9	86.6
10	86.6	73.7	79.0
20	81.3	68.2	73.1
40	76.6	64.1	69.0
60	71.8	60.0	64.8
100	63.2	52.7	57.8
200	42.8	36.8	43.4

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

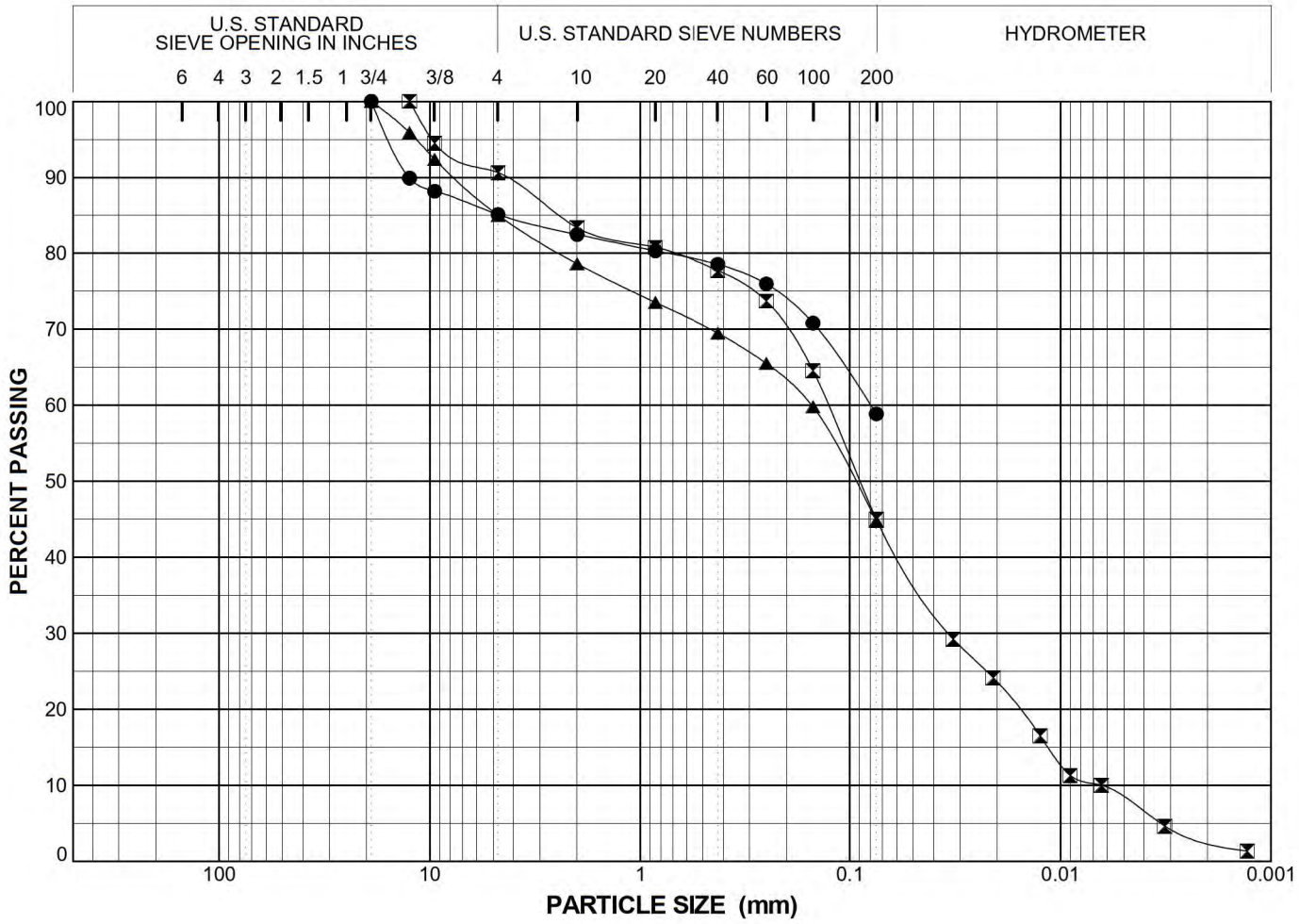
Piney Run Dam

Project Number 60614688	February 2020	Figure 33

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	3	3	3
Sample	S-8	S-9	S-10
Spec			
Depth (ft)	33.0-35.0	38.0-40.0	43.0-45.0
% +3"	0.0	0.0	0.0
% Gravel	14.9	9.4	15.0
% Sand	26.2	45.6	40.3
% Fines	58.9	45.0	44.7
% -2μ		2.9	
Cc		1.40	
Cu		19.95	
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0		100.0
1/2"	89.9	100.0	95.9
3/8"	88.2	94.5	92.4
4	85.1	90.6	85.0
10	82.5	83.4	78.6
20	80.3	80.8	73.5
40	78.5	77.7	69.5
60	76.0	73.7	65.5
100	70.8	64.6	59.8
200	58.9	45.0	44.7

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

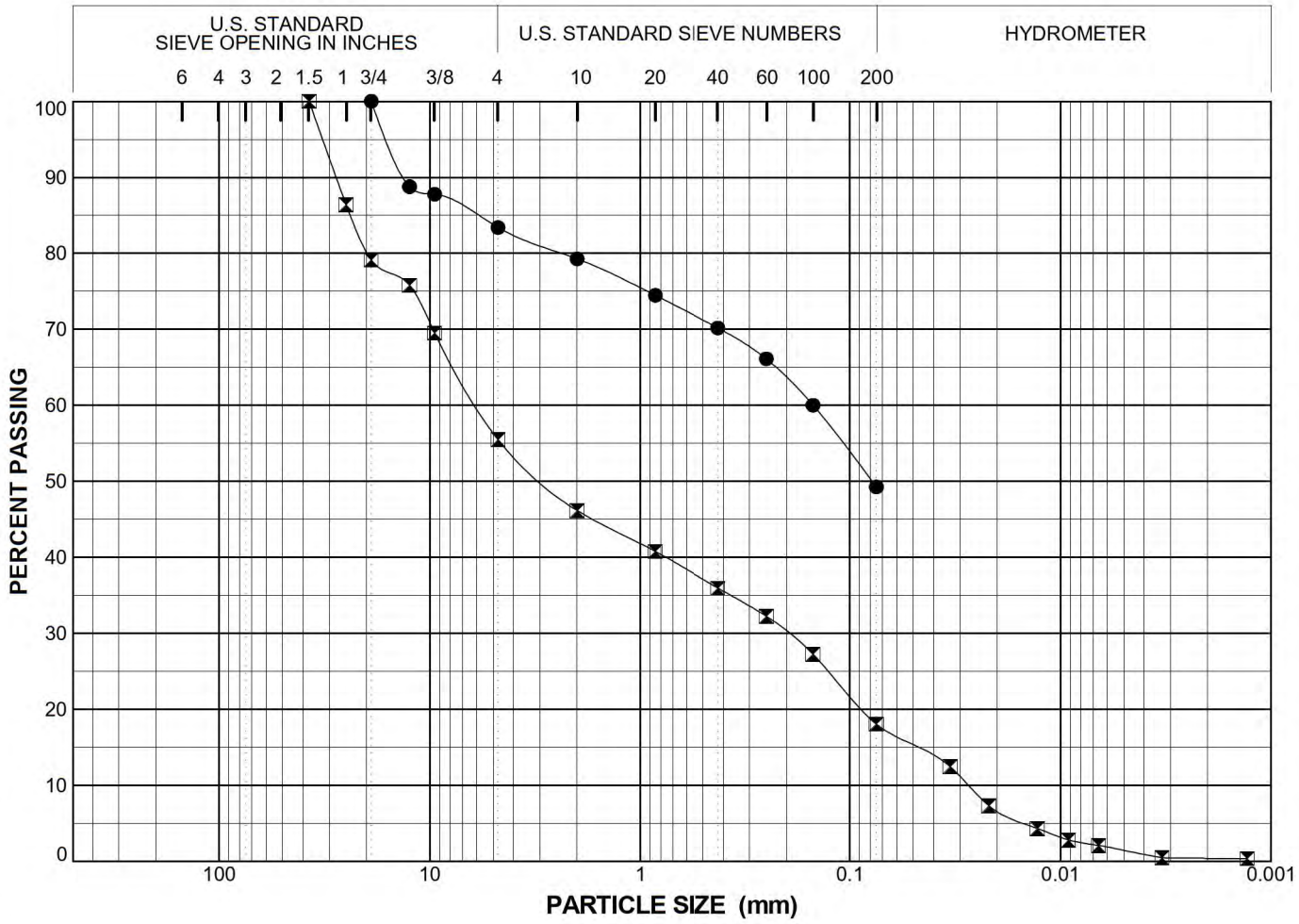
Piney Run Dam

Project Number 60614688	February 2020	Figure 34

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓
Boring	805	805
Sample	S-1A	S-1B
Spec		
Depth (ft)	3.0-4.0	4.0-5.0
% +3"	0.0	0.0
% Gravel	16.6	44.5
% Sand	34.1	37.4
% Fines	49.3	18.1
% -2μ		0.4
Cc		0.24
Cu		216.76
LL		NP
PL		NP
PI		NP
USCS		GM
w (%)		2.8

Particle Size (Sieve #)	PERCENT FINER ●	PERCENT FINER ⧓
2"		
1 1/2"		100.0
1"		86.4
3/4"	100.0	79.1
1/2"	88.8	75.8
3/8"	87.8	69.5
4	83.4	55.5
10	79.3	46.1
20	74.5	40.8
40	70.2	35.9
60	66.1	32.2
100	60.0	27.2
200	49.3	18.1

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Gray SILTY GRAVEL with SAND (GM)

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 35

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-01-03_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/3/20

AECOM

PERMEABILITY TEST
VARIABLE HEAD TEST WITH CONSTANT VOLUME U-TUBE
TEST METHOD: ASTM D 5084-F

Project Number: 60614688 | Project Name: Piney Run Dam
Sample Identification: 2 T-1 25.0-26.2 ft
Sample Classification: Brown SILTY SAND
Maximum Dry Density (pcf): | Optimum Moisture Content:
Apparatus Number: 9 | Cell Number: TW-1 | Date: 01/17/20

Test Sample Data

Specimen Height (in):	4.090	Specimen Diameter (in):	2.875
	4.090		2.875
	4.090		2.875
Average Height (in):	4.090	Average Diameter (in):	2.875
L, Average Height (cm):	10.389		
Change in Length, ΔH_c, (in.):	0.045	A_o, Sample Area(cm^2):	41.883
Initial Wet Sample wt (g):	865.9	A_c, Final Area(cm^2):	40.485
Final Specimen Height L_c (in):	4.045	Specific Gravity of Sample:	2.80

Water Content

	Initial	Final
Pan Number:		
Pan weight:	0	0
Wet Sample + Pan Weight:	865.9	884.3
Dry Sample + Pan Weight:	709.9	709.9
Water Content, %:	22.0	24.6
% Over Optimum:		

	Initial	Final
Dry Density (pcf):	101.9	105.3
Wet Density (pcf):	124.3	131.2
Degree of Saturation (%):	86.1	104.3
% Compaction:		

Test Sample Run Data

Run	Date	Start Time	Elapsed Time (min)	Temp. °C	Temp. °F		Gradient	Mercury Readings Right (h_{Ro})	Mercury Readings Left(h_{Lo})	Perm.@20°C (cm/sec)
1	1/17/2020		3	23.0	73.0	Initial	9.30	29.85	22.25	8.9E-06
						Final	3.12	26.70	24.15	
2	1/17/2020		3	23.0	73.0	Initial	5.81	28.15	23.40	9.3E-06
						Final	2.08	26.15	24.45	
3	1/17/2020		4	23.0	73.0	Initial	5.02	27.70	23.60	9.2E-06
						Final	1.22	25.70	24.70	
4	1/17/2020		4	23.0	73.0	Initial	5.51	28.00	23.50	9.7E-06
						Final	1.28	25.75	24.70	

AVERAGE PERMEABILITY @ 20°C = 9.3E-06

Maximum Cell Pressure: 105 psi
Confining Pressure: 5 psi
Maximum Back Pressure: 100 psi

Permeant Liquid Utilized: City tap water (deaired)

B Coefficient: 0.99

Remarks:

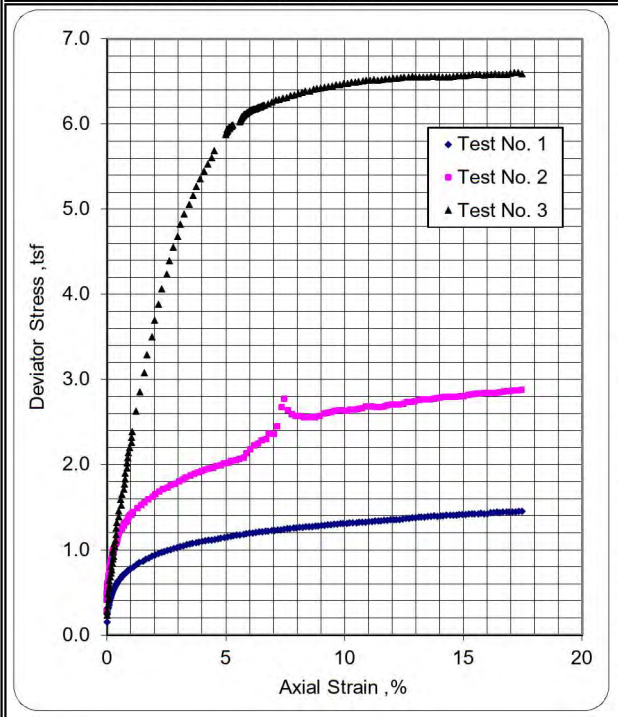
Performed by: TV | Checked By: YM | Date: 1/17/2020

AECOM

ASTM D4767 Isotropically Consolidated Undrained Triaxial Test Series (With Pore Pressure Measurements)

Project No.: 60614688 **File No.:** 2020-01-03

Project Name: Piney Run Dam **Date:** February 3, 2020



Test Sample Summary

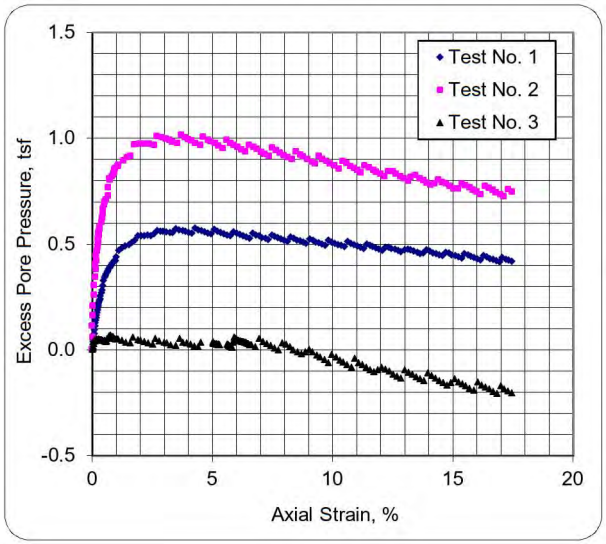
Test No.	Boring No.	Sample No./Depth	Water Content, % Initial	Water Content, % Final	Dry Density, pcf Initial	Dry Density, pcf Final	Degree of Saturation, % Initial	Degree of Saturation, % Final	B Factor,%	Void Ratio Initial	Void Ratio Final	$\bar{\sigma}_c$ tsf
1	3	T-1/25.4-25.9	24.3	26.9	95.3	100.0	85.3	105.9	98.0	0.770	0.685	1.08
2	3	T-1/25.9-26.4	23.5	24.2	99.7	104.8	92.0	107.6	99.0	0.691	0.607	1.80
3	3	T-1/26.4-26.9	19.2	21.0	106.2	109.6	88.4	105.9	98.0	0.588	0.537	2.52

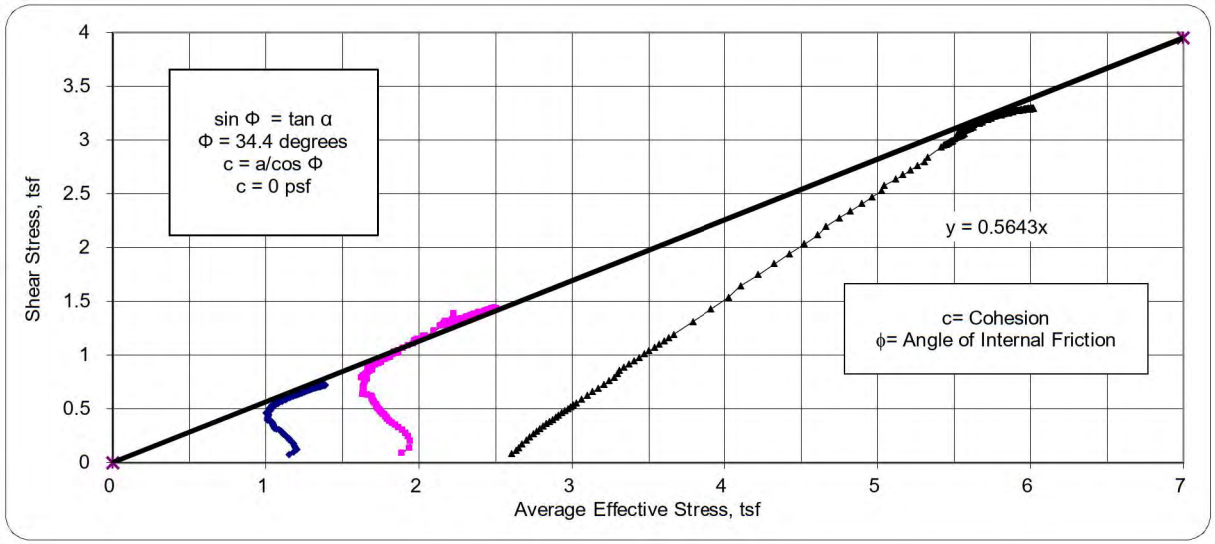
Specific Gravity=		2.70 Assumed					Liquid Limit, %		NA	NA	NA	
Stain Rate, %/hr.		1.9					Plastic Limit, %		NA	NA	NA	
Note: Atterberg Limits were conducted on Test No.1 only.							Liquidity Index		NA	NA	NA	

Test Series Summary

Test No.	Max. Deviator Stress, tsf	Value at Maximum Shear Stress: Axial Strain, %	Obliquity	A- Factor
1	1.42	15.0	3.229	0.314
2	2.79	15.0	3.692	0.273
3	6.56	15.0	3.468	-0.021
4				
5				
6				

Test #1 Test #2 Test #3



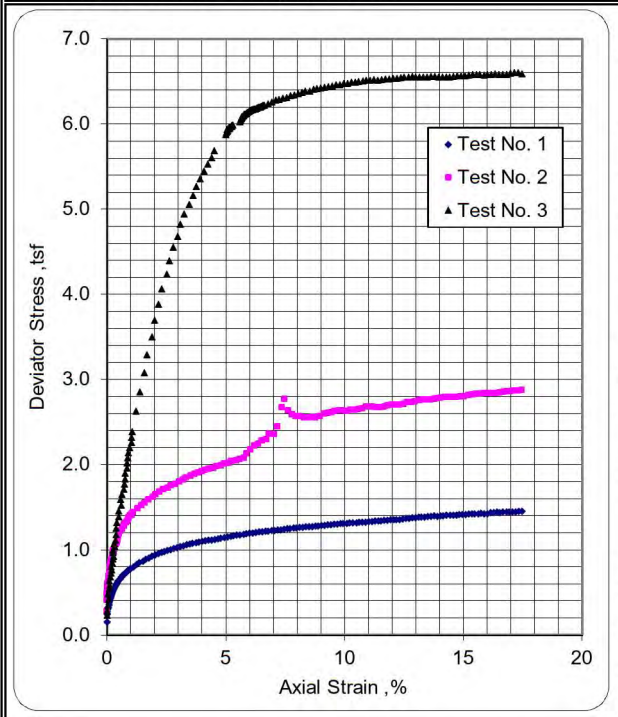


AECOM

ASTM D4767 Isotropically Consolidated Undrained Triaxial Test Series (Total Stress)

Project No.: 60614688 **File No.:** 2020-01-03

Project Name: Piney Run Dam **Date:** February 3, 2020



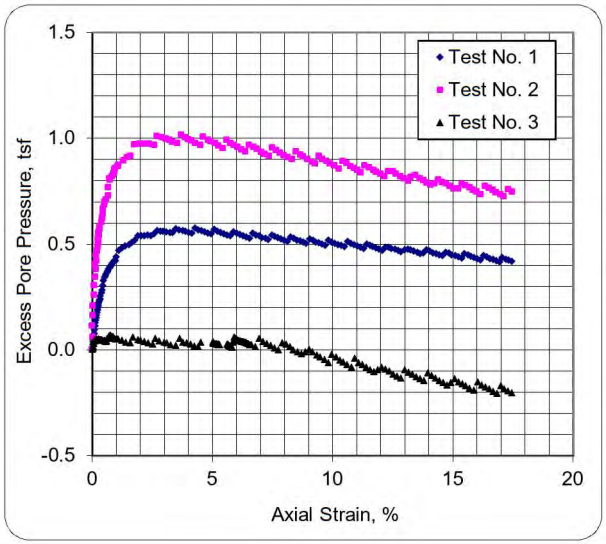
Test Sample Summary

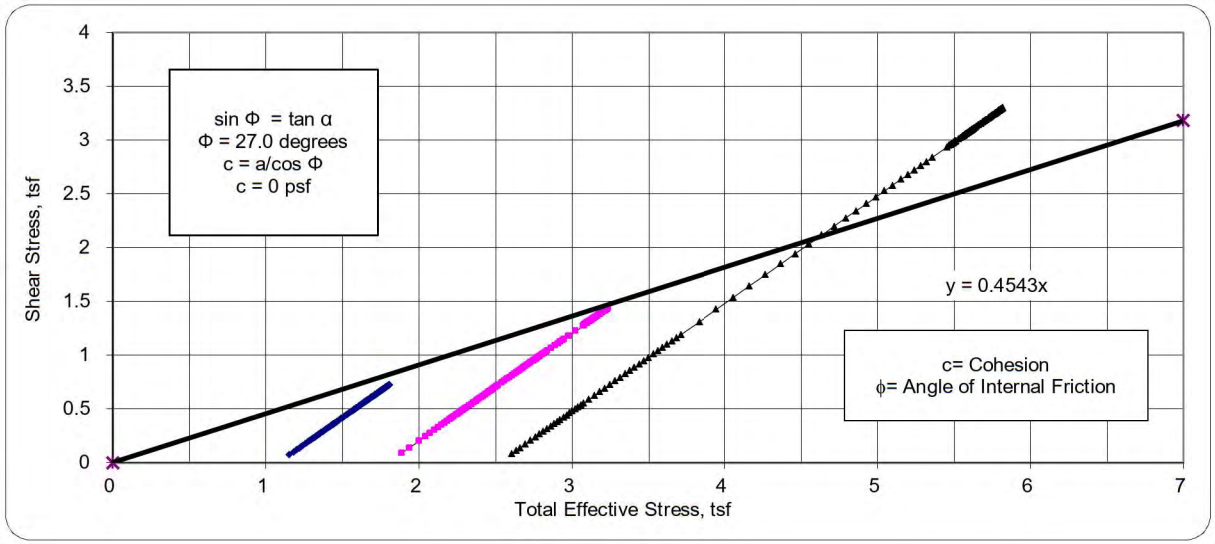
Test No.	Boring No.	Sample No./Depth	Water Content, % Initial	Water Content, % Final	Dry Density, pcf Initial	Dry Density, pcf Final	Degree of Saturation, % Initial	Degree of Saturation, % Final	B Factor,%	Void Ratio Initial	Void Ratio Final	$\overline{\sigma}_c$ tsf
1	3	T-1/25.4-25.9	24.3	26.9	95.3	100.0	85.3	105.9	98.0	0.770	0.685	1.08
2	3	T-1/25.9-26.4	23.5	24.2	99.7	104.8	92.0	107.6	99.0	0.691	0.607	1.80
3	3	T-1/26.4-26.9	19.2	21.0	106.2	109.6	88.4	105.9	98.0	0.588	0.537	2.52
Specific Gravity=			2.70 Assumed				Liquid Limit, %		NA	NA	NA	
Stain Rate, %/hr.			1.9				Plastic Limit, %		NA	NA	NA	
Note: Atterberg Limits were conducted on Test No.1 only.							Liquidity Index		NA	NA	NA	

Test Series Summary

Test No.	Max. Deviator Stress, tsf	Value at Maximum Shear Stress: Axial Strain, %	Obliquity	A- Factor
1	1.42	15.0	2.311	0.314
2	2.79	15.0	2.552	0.273
3	6.56	15.0	3.604	-0.021
4				
5				
6				

Test #1 Test #2 Test #3



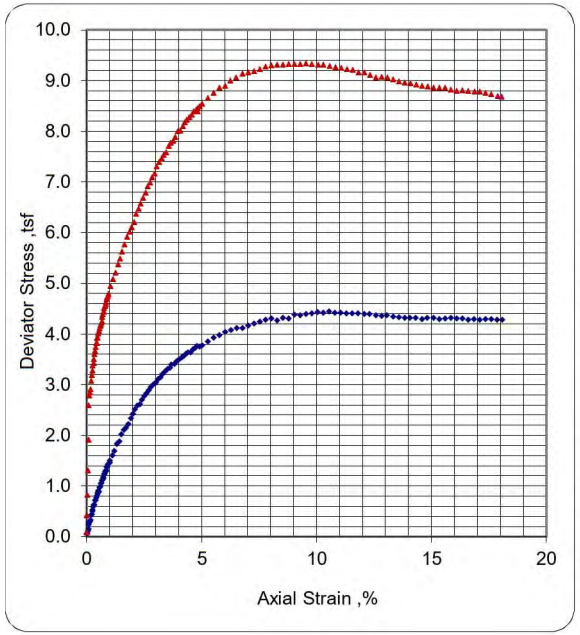


AECOM

ASTM D7181 Isotropically Consolidated Drained Triaxial Test Series

Project No.: 60614688 **File No.:** 2020-01-03

Project Name: Piney Run Dam **Date:** February 12, 2020



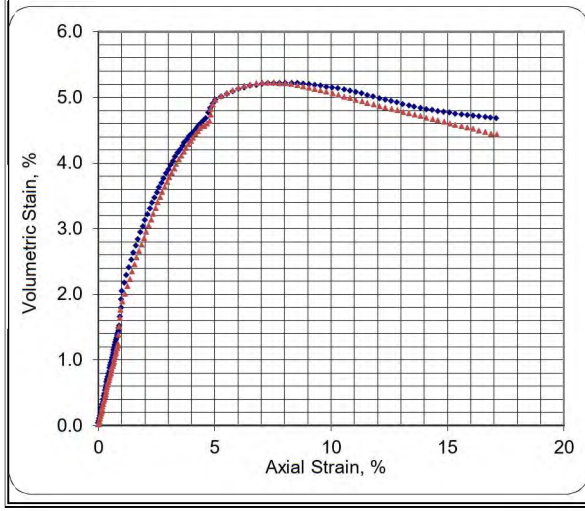
Test Sample Summary

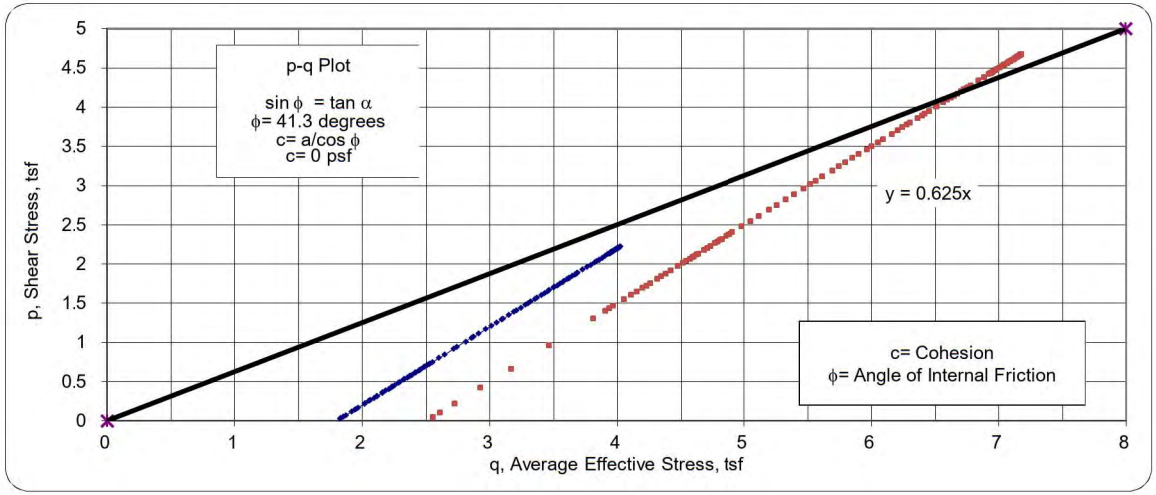
Test No.	Boring No.	Sample No./Depth	Water Content, % Initial	Water Content, % Final	Dry Density, pcf Initial	Dry Density, pcf Final	Degree of Saturation, % Initial	Degree of Saturation, % Final	B Factor,%	Void Ratio Initial	Void Ratio Final	$\bar{\sigma}_c$ tsf
1	2	T-2/31.6-32.1	21.8	21.4	105.0	107.9	97.4	102.8	99.0	0.605	0.562	1.80
2	2	T-2/32.1-32.6	16.9	17.5	112.3	115.3	90.8	102.4	99.0	0.501	0.461	2.52
3												
Specific Gravity=			2.70 Assumed				Liquid Limit, %		NA	NA		
Stain Rate, %/hr.			0.5				Plastic Limit, %		NA	NA		
Note: Atterberg Limits were conducted on Test No.1 only.							Liquidity Index		NA	NA		

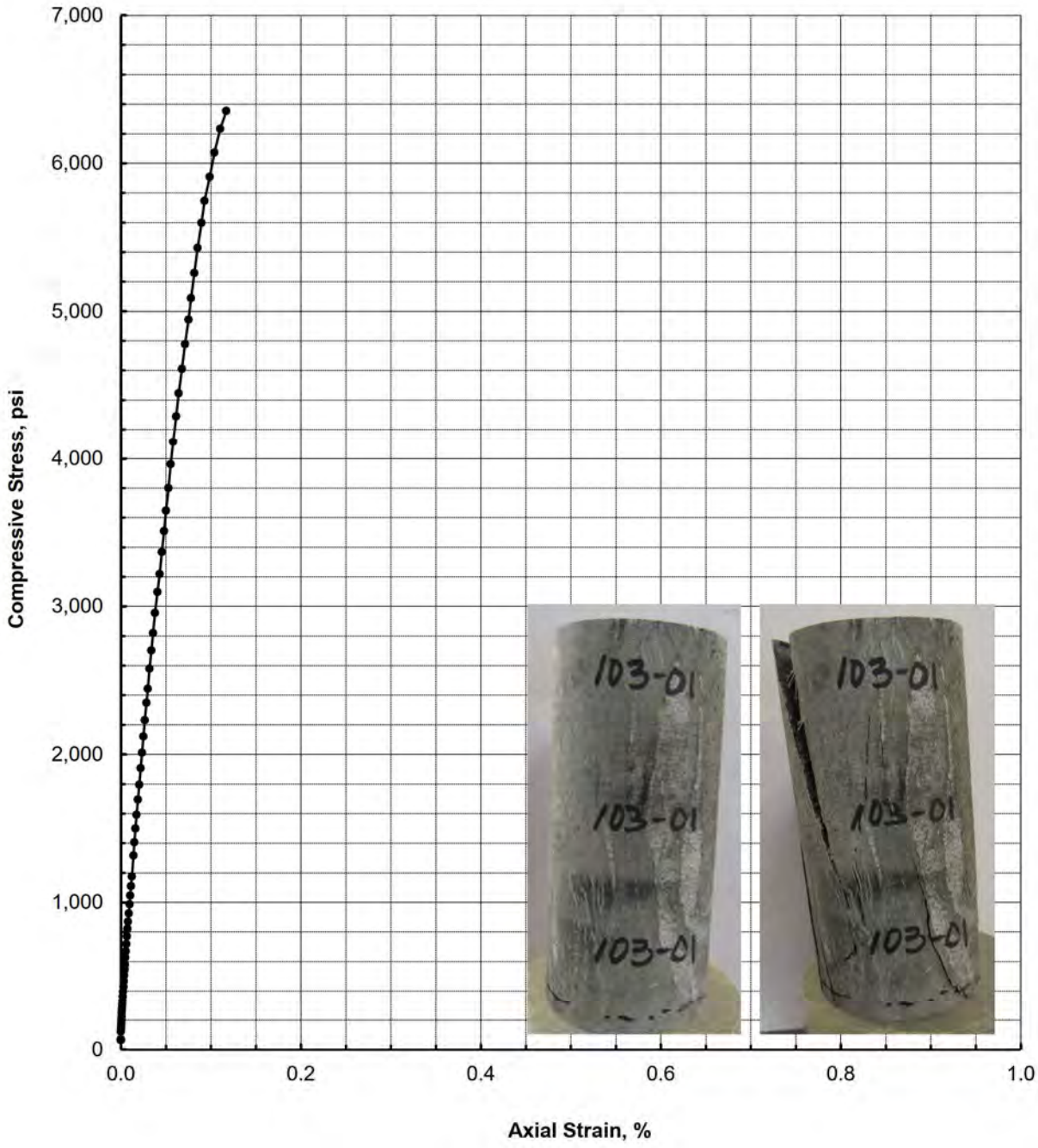
Test Series Summary

Test No.	Max. Deviator Stress, tsf	Value at Maximum Shear Stress: Axial Strain, %	Obliquity	Volumetric Strain, %
1	4.44	10.6	3.461	5.122
2	9.33	9.5	4.696	5.100
3				
4				
5				

Test #1 Test #2





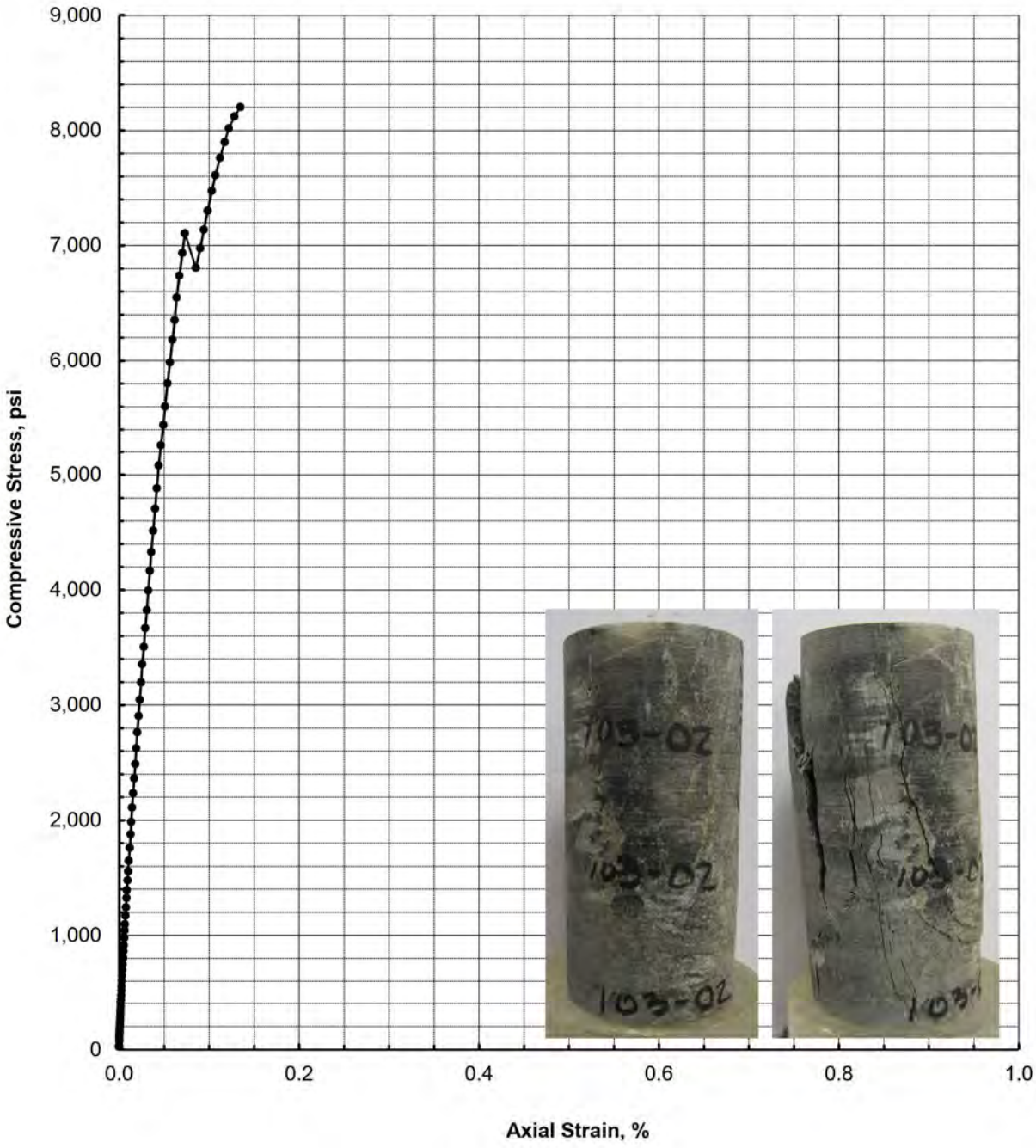


Specimen Information | **Test Summary**

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.1	179.0	178.9	4.23	1.97	6,353	0.12	0.28

Tested by: BS Test Date: 1/23/2020 Reviewed by: MHD

Project No. 60614688	**Piney Run Dam**	**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**	
AECOM		Boring: 201 Sample: RC-2 Depth:55.5-56.7	January 2020

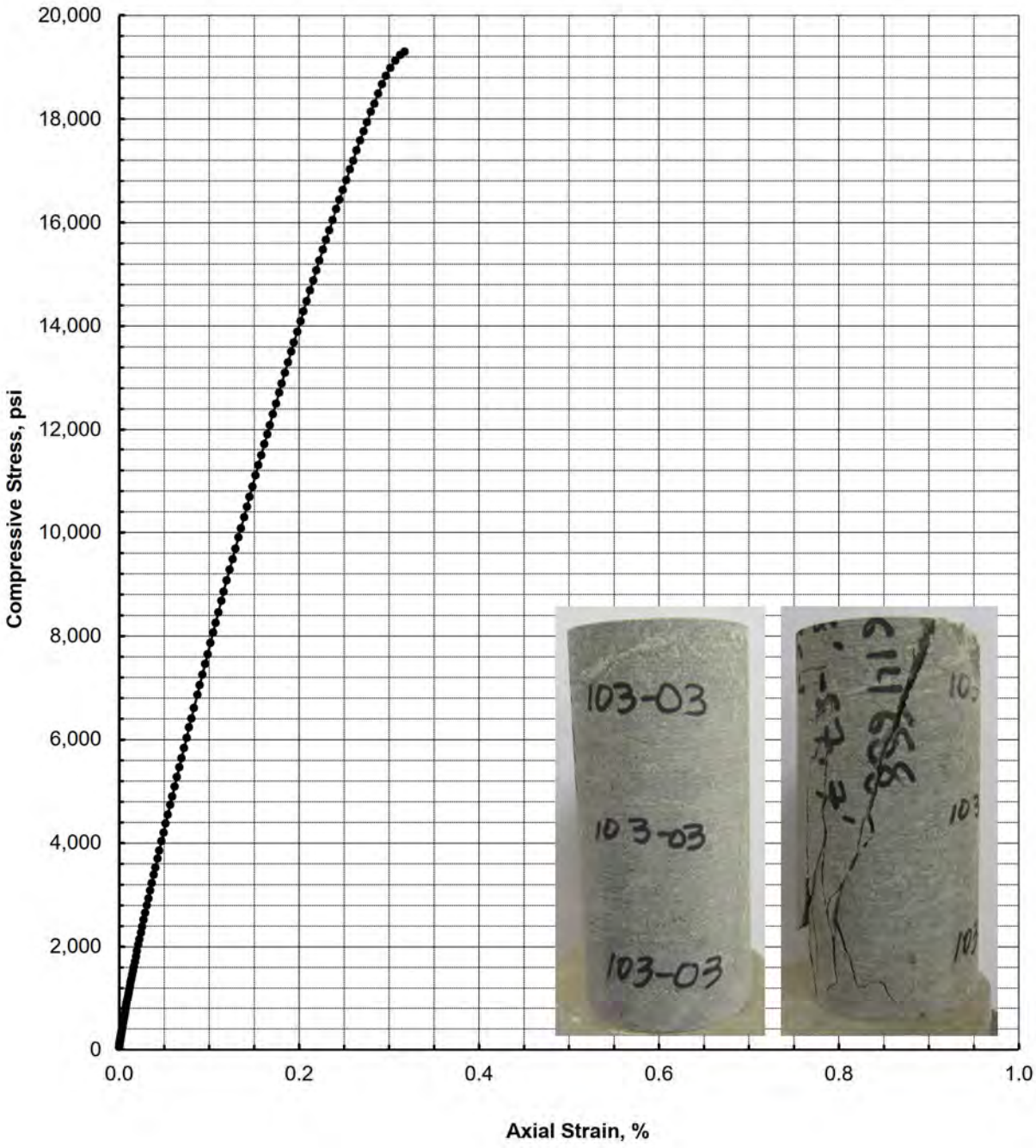


Specimen Information | **Test Summary**

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.1	177.7	177.6	4.20	1.96	8,203	0.13	0.28

Tested by: BS Test Date: 1/23/2020 Reviewed by: MHD

Project No. 60614688	**Piney Run Dam**	**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**	
AECOM		Boring: 203 Sample: RC-1 Depth:38.4-39.2	January 2020



Specimen Information | **Test Summary**

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.1	170.4	170.1	4.22	1.98	19,296	0.32	0.28

Tested by: BS Test Date: 1/23/2020 Reviewed by: MHD

Project No. 60614688	**Piney Run Dam**	**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**	
AECOM		Boring: 211 Sample: RC-1 Depth:56.8-57.7	January 2020

2020-01-03

Project Name:	Piney Run Dam
Project Number:	60616688
Task Number:	Task: 1.3
Tests Requested By:	G. Michael McIntyre
Laboratory Name:	AECOM

Samples Sent on:	12/23/2019
Samples Received on:	
Results Due by:	1/17/2019
Results Sent on:	
Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS D4318		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH SOIL ASTM D2166	COMPRESSIVE STRENGTH ROCK ASTM D2938	DIRECT SHEAR ASTM D3080	CBR ASTM D1883		UNIT WEIGHT (pcf)	PERMEABILITY ASTM D2434		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
						AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	#200	#4	#200	#4					UNDISTURBED	REMOLDED		UNDISTURBED	REMOLDED				
ASW-2	S-1	3.0-5.0	1	1		1				1	1															
ASW-2	S-3	13.0-15.0								1																
ASW-2	S-4	18.0-20.0								1	1															
ASW-2	S-5	23.0-25.0								1																
ASW-5	S-1	0.0-2.0								1																
ASW-5	S-2	2.0-4.0	1			1				1	1															
ASW-5	S-4	6.0-8.0								1																
ASW-5	S-5	8.0-10.0								1																
ASW-5	S-6	13.0-15.0		1						1	1															
ASW-5	S-7	18.0-20.0								1																
ASW-5	S-8	23.0-25.0								1																
ASW-5	S-9	27.0-27.1								1																
ASW-10	S-2	3.0-5.0								1	1															
ASW-10	S-3	8.0-10.0								1																
ASW-10	S-4	13.0-15.0								1																
ASW-10	S-5	18.0-20.0	1	1		1				1	1															
ASW-10	S-6	23.0-25.0								1																
ASW-11	S-1	3.0-5.0								1																
ASW-11	S-2	8.0-10.0	1	1		1				1	1															
ASW-11	S-4	13.0-15.0								1																
ASW-11	S-5	18.0-20.0								1																
ASW-11	S-6	23.0-25.0								2																
ASW-11	S-7	28.0-30.0								1																
ASW-11	S-8	33.0-35.0								1																
ASW-11	S-9	38.0-40.0								1	1															
ASW-11	S-10	43.0-45.0								1																
ASW-11	S-11	48.0-50.0								1																
TOTAL TESTS			4	4	0	4	0	0	0	27	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

AECOM

2020-01-03

[redacted] 2020-01-03

Project Name	Perry East Dam	Samples Received on	1/2/2020
Project Number	[redacted]	Samples Received by	[redacted]
Task Numbers	Task 15	Results Due by	1/23/2020
Tests Requested By	G. Michael McIntyre	Results Sent on	
Laboratory Name	AECOM	Results Reviewed by	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS (ASTM D4318)		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D7012	DIRECT SHEAR ASTM D3080	CIU ASTM D4767		CID ASTM D7181		PERMEABILITY ASTM D5084		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
					AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	SIEVE	HYDR.	SIEVE	HYDR.				UNCONSOLIDATED	CONSOLIDATED	UNCONSOLIDATED	CONSOLIDATED	UNCONSOLIDATED	CONSOLIDATED				
ASW-1	S-1	3.0-5.0							1																
ASW-1	S-2	8.0-10.0	1	1	1				1	1															
ASW-1	UD-1	10.0-12.0							1															1	Extrude Sample for visual classification, total unit weight, and log the tube.
ASW-1	S-4	13.0-15.0							1																
ASW-1	S-5	18.0-20.0							1	1															
ASW-1	S-6	23.0-25.0							1																
ASW-1	S-8	33.0-35.0							1																
ASW-1	S-9	38.0-40.0							1																
ASW-1	S-10	43.0-45.0							1																
ASW-1	S-12	48.0-50.0							1																
ASW-1	RC-2	55.5-56.7												1											
ASW-2	UD-1	5.0-7.0	1	1	1				1														1	1	1	Extrude Sample for visual classification, total unit weight, and log the tube.
ASW-3	S-1	3.0-5.0	1	1	1				1	1															
ASW-3	S-2	8.0-10.0							1																
ASW-3	S-3	13.0-15.0							1																
ASW-3	S-4	18.0-20.0							1	1															
ASW-3	S-5	23.0-25.0							1																
ASW-3	S-6	28.0-30.0							1																
ASW-3	S-7	33.0-35.0							1																
ASW-3	RC-1	38.4-39.2												1											
ASW-4	S-1	3.0-5.0	1	1	1				1	1															
ASW-4	S-2	8.0-10.0							1																
ASW-6	S-1	3.0-5.0							1																
ASW-6	S-2	8.0-10.0							1																
ASW-6	S-3	13.0-15.0							1																
ASW-6	UD-1	15.0-16.5	1	1	1				1	1														1	Extrude Sample for visual classification, total unit weight, and log the tube.
ASW-6	S-5	18.0-20.0							1																
ASW-6	S-6	23.0-25.0							1																
ASW-6	S-7	28.0-30.0							1	1															
ASW-6	S-8	33.0-35.0							1																
ASW-6	S-9	38.0-40.0							1																
ASW-6	RC-1	39.7-40.2												1											
TOTAL TESTS			5	5	5	0	0	0	29	7	0	0	0	3	0	0	0			0	0	1	1	3	

2020-01-03

2020-01-03

Project Name:	Piney Run Dam	Samples Sent on:	1/2/2020
Project Number:	60611688	Samples Received on:	
Task Number:	Task: 1.5	Results Due by:	1/23/2020
Tests Requested By:	G. Michael McIntyre	Results Sent on:	
Laboratory Name:	AECOM	Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS D4318		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D7012	DIRECT SHEAR ASTM D3080	CID ASTM D4767		PERMEABILITY ASTM D5084		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
						AIR DRIED	OVEN DRIED	ASTM D698	ASTM D4253	SIEVE	HYDR.	SIEVE	HYDR.				UNDISTURBED	REMOLDED	UNDISTURBED	REMOLDED				
ASW-7	S-1	3.0-5.0								1														
ASW-7	S-2	8.0-10.0								1														
ASW-7	U-1	10.0-12.0	1	1		1				1	1												1	Extrude Sample for visual classification, total unit weight, and log the tube.
ASW-7	S-4	13.0-15.0								1														
ASW-7	S-5	18.0-20.0								1														
ASW-7	S-6	23.0-25.0								1														
ASW-7	S-7	28.0-30.0								1	1													
ASW-7	S-8	33.0-35.0								1														
ASW-8	S-1	3.0-5.0								1														
ASW-8	BULK	5.0-15.0	1			1						1	1											
ASW-8	S-2	8.0-10.0								1														
ASW-8	S-3	13.0-15.0		1						1														
ASW-8	S-4	18.0-20.0								1	1													
ASW-8	S-5	23.0-25.0								1														
ASW-8	S-6	28.0-30.0								1														
ASW-8	S-7	33.0-35.0								1														
ASW-11	UD-1	10.0-10.5								1													1	Extrude Sample for visual classification, total unit weight, and log the tube.
TOTAL TESTS			2	2	0	2	0	0	0	16	3	1	1	0	0	0	0	0	0	0	0	0	2	

2020-01-03

AECOM

2020-01-03

Project Name:	Piney Run Dam	Samples Sent on:	1/2/2020
Project Number:	60616688	Samples Received on:	
Task Number:	1.5	Results Due by:	1/23/2020
Tests Requested By:		Results Sent on:	
Laboratory Name:	AECOM	Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS ASTM D4318		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D7012	DIRECT SHEAR ASTM D3080	UNIT WEIGHT ASTM D7263		PERMEABILITY ASTM D5084		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
						AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	SIEVE	HYDR.	SIEVE	HYDR.				UNDISTURBED	REMOLDED	UNDISTURBED	REMOLDED				
EXP-5	S-1A	30-40								1														
EXP-5	S-1B	40-50	1	1		1				1	1													
TOTAL TESTS			1	1	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	

2020-01-03

2020-01-03

Project Name	Piney Run Dam	Samples Sent on:	1/2/2020
Project Number	6061 6681	Samples Received on:	
Task Number	15	Results Due by:	1/23/2020
Tests Requested By:		Results Sent on:	
Laboratory Name:	AECOM	Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS D4318		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D7012	DIRECT SHEAR ASTM D3080	CIU ASTM D4767		CID ASTM D7181		PERMEABILITY ASTM D5084		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
					AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	SIEVE	HYDRO	SIEVE	HYDRO				UNDISTURBED	REMOLDED	UNDISTURBED	REMOLDED	UNDISTURBED	REMOLDED				
EMB-1	UD-1	15.0-17.0																						1	Extrude Sample for visual classification, total unit weight, and log the tube.
EMB-2	S-1	0.0-2.0							1																
EMB-2	S-2	3.0-5.0							1																
EMB-2	S-3	8.0-10.0							1																
EMB-2	S-4	13.0-15.0							1																
EMB-2	S-5A	18.0-20.0							1																
EMB-2	S-6	23.0-25.0							1																
EMB-2	UD-1	25.0-27.0	1	1	1				1	1											1		1	1	1	Use confining pressure of 22 psi for permeability test.
EMB-2	UD-2	31.0-32.7							1							1								1	Use confining pressures of 15 psi, 25 psi, and 35 psi for CIU W/ pore pressure test. Please provide both effective and total strength results.
EMB-2	S-11	33.0-35.0							1																
EMB-2	S-12	38.0-40.0							1																
EMB-2	S-13	43.0-45.0		1					1																
EMB-2	S-14	48.0-50.0							1	1															
EMB-2	UD-3	50.0-52.0																							HOLD AT THIS TIME
EMB-2	S-15	53.0-55.0							1																
EMB-2	S-16	58.0-60.0							1																
EMB-2	S-17	63.0-65.0							1																
EMB-2	S-18	68.0-70.0							1																
EMB-2	S-19	73.0-75.0							1																
EMB-2	S-20	78.0-78.3							1																
EMB-3	S-1	3.0-5.0							1																
EMB-3	S-2	8.0-10.0							1																
EMB-3	S-3	13.0-15.0							1																
EMB-3	S-4	18.0-20.0	1		1				1	1															
EMB-3	S-5	23.0-25.0							1																
EMB-3	UD-1	25.0-27.0																	1					1	Use confining pressures of 15 psi, 25 psi, and 35 psi for CID test.
EMB-3	S-7	28.0-30.0		1					1																
EMB-3	S-8	33.0-25.0							1																
EMB-3	S-9	38.0-40.0							1	1															
EMB-3	S-10	43.0-45.0							1																
TOTAL TESTS			2	3	2	0	0	0	27	4	0	0	0	0	0	1	0	1	0	1	0	1	1	4	

2020-01-03

AECOM

2020-01-03

Project Name:	Piney Run Dam
Project Number:	60611668
Task Number:	13
Tests Requested By:	
Laboratory Name:	AECOM

Samples Sent on:	1/2/2020
Samples Received on:	
Results Due by:	1/23/2020
Results Sent on:	
Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS (NOTE)		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK, ASTM D7012	DIRECT SHEAR ASTM D3080	CU ASTM D4767		PERMEABILITY ASTM D5084		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
						AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	SIEVE	HYDROM.	SIEVE	HYDROM.				UNDISTURBED	REMOLDED	UNDISTURBED	REMOLDED				
ABT-1	S-1A	3.0-4.0								1														
ABT-1	S-1B	4.0-5.0	1			1				1	1													
ABT-1	S-2	8.0-10.0								1	1													
ABT-2	UD-1	3.0-5.0																					1	Extrude Sample for visual classification, total unit weight,
TOTAL TESTS			1	0	0	1	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	1	

Notes:

2020-01-03

Project: Piney Run Dam
Project No.: 60614688

AECOM

SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity	Organic Content (%)	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	UU	CIU		
703 S-2	3.0-5.0									31									
703 S-3	8.0-10.0	Brown SILTY SAND	SM	22.3		NP	NP			43	2								
703 S-5	18.0-20.0									48	2								
703 S-7	28.0-30.0									29									
703 S-8	33.0-35.0									22									
209 S-2	8.0-10.0									45	1								
209 S-4	18.0-20.0									37									
209 S-6	28.0-30.0									38									
209 RC-1	33.8-34.4	Rock Core		0.3	170.1									7,798	0.2				
212 S-2	3.0-5.0	Brown SILTY GRAVEL with SAND	GM	25.8		37	25			45	11								
212 S-4	13.0-15.0									20	1								
1 S-1	3.0-5.0			10.3						27	2								
1 S-7	28.0-30.0	Brown SANDY LEAN CLAY	CL			34	22			66	20								
1 S-9	38.0-40.0									59									
601 S-2	3.0-5.0									31									
601 S-4	13.0-15.0			11.4						44	2								
801 S-1	3.0-5.0	Brown SANDY ELASTIC SILT	MH	43.1		57	46			68	4								
801 S-3	13.0-15.0									39									
802 S- 4	13.0-15.0									33									

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

Project: Piney Run Dam
Project No.: 60614688

AECOM

SUMMARY OF LABORATORY TEST RESULTS

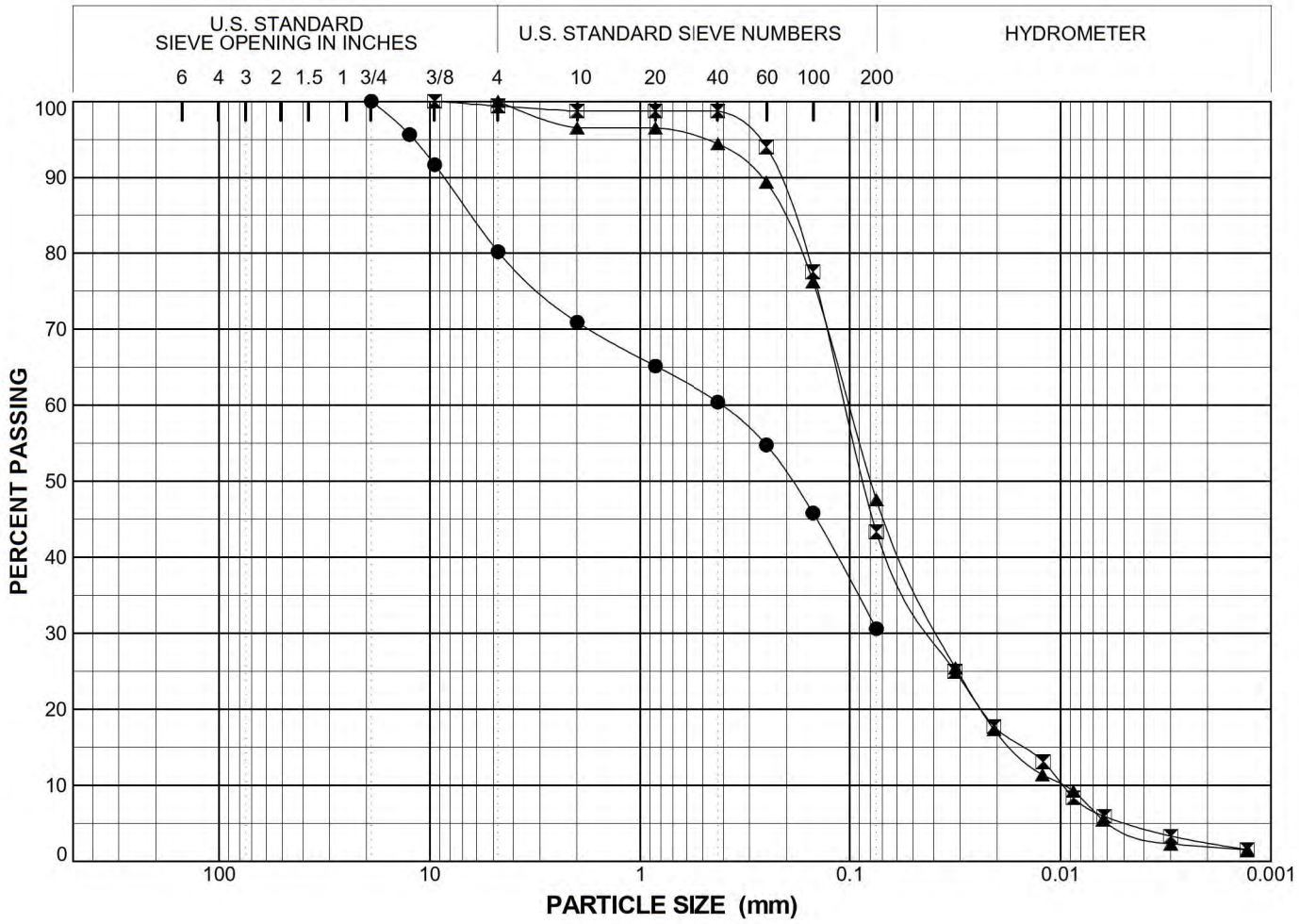
Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity	Organic Content (%)	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	UU	CIU		
802 S- 6	23.0-25.0			10.2						22	1								
802 S- 9	38.0-40.0									19									
802 S-11	48.0-50.0									20									
803 T-2	15.0-17.0	Brown SILTY SAND	SM	14.4		NP	NP			40	1						*		
803 S- 7	23.0-25.0									57									
803 S- 9	33.0-35.0									43									
803 S-11	43.0-48.0									32	1								
803 S-15	63.0-65.0									42									
803 S-17	73.0-75.0									19									
804 S- 2	8.0-10.0									34									
804 S- 4	18.0-20.0									34									
804 S- 8	33.0-35.0									19									
804 S-12	53.0-55.0			15.9						50	2								

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

Project File Path:

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	703	703	703
Sample	S-2	S-3	S-5
Spec			
Depth (ft)	3.0-5.0	8.0-10.0	18.0-20.0
% +3"	0.0	0.0	0.0
% Gravel	19.8	0.6	0.0
% Sand	49.6	56.0	52.4
% Fines	30.6	43.4	47.6
% -2μ		2.4	1.9
Cc		1.57	1.43
Cu		10.78	10.28
LL		NP	
PL		NP	
PI		NP	
USCS		SM	
w (%)		22.3	

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0		
1/2"	95.6		
3/8"	91.6	100.0	
4	80.2	99.4	100.0
10	70.9	98.7	96.5
20	65.2	98.7	96.5
40	60.4	98.7	94.4
60	54.8	94.0	89.3
100	45.8	77.6	76.3
200	30.6	43.4	47.6

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	Brown SILTY SAND (SM)
▲	

PARTICLE SIZE DISTRIBUTION

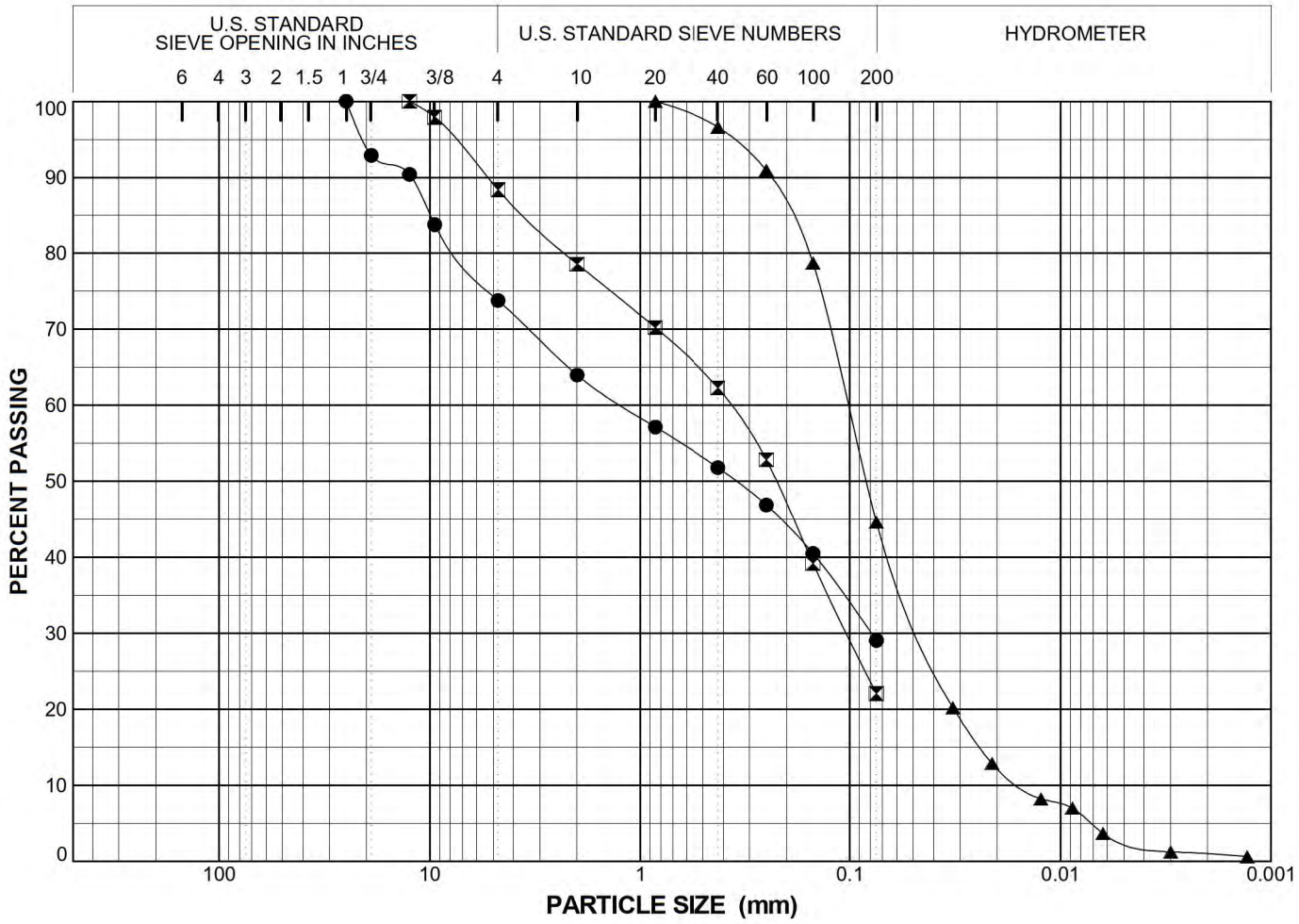
Piney Run Dam

Project Number 60614688	February 2020	Figure 1

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	703	703	209
Sample	S-7	S-8	S-2
Spec			
Depth (ft)	28.0-30.0	33.0-35.0	8.0-10.0
% +3"	0.0	0.0	0.0
% Gravel	26.2	11.6	0.0
% Sand	44.7	66.3	55.4
% Fines	29.1	22.1	44.6
% -2μ			0.9
Cc			1.32
Cu			6.72
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"	100.0		
3/4"	92.9		
1/2"	90.4	100.0	
3/8"	83.8	97.9	
4	73.8	88.4	
10	64.0	78.6	
20	57.1	70.2	100.0
40	51.8	62.3	96.6
60	46.9	52.8	90.9
100	40.5	39.2	78.7
200	29.1	22.1	44.6

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

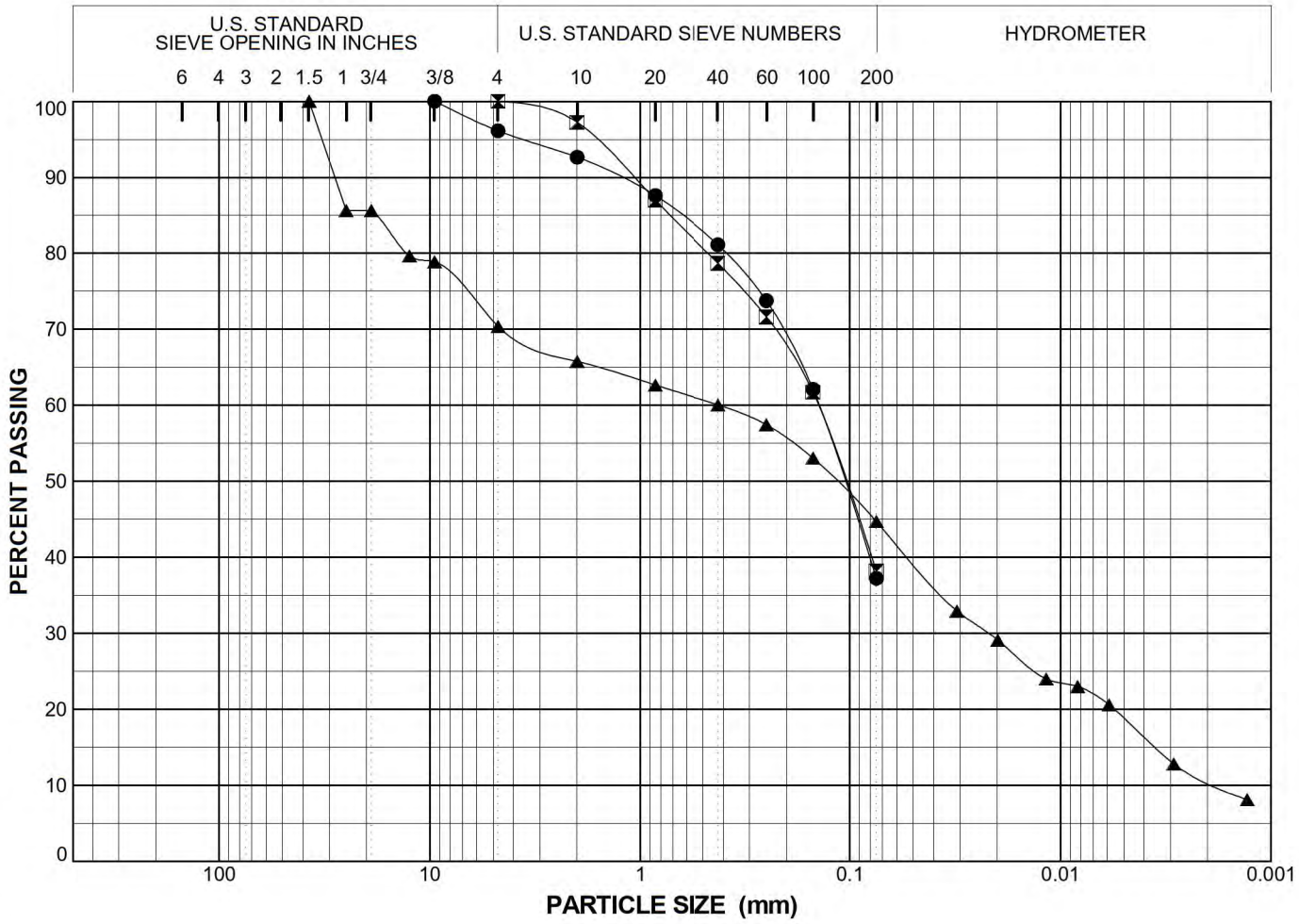
Piney Run Dam

Project Number 60614688	February 2020	Figure 2

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	209	209	212
Sample	S-4	S-6	S-2
Spec			
Depth (ft)	18.0-20.0	28.0-30.0	3.0-5.0
% +3"	0.0	0.0	0.0
% Gravel	3.9	0.0	29.6
% Sand	58.9	61.8	25.7
% Fines	37.2	38.2	44.7
% -2μ			10.6
Cc			0.65
Cu			234.40
LL			37
PL			25
PI			12
USCS			GM
w (%)			25.8

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			100.0
1"			85.6
3/4"			85.6
1/2"			79.7
3/8"	100.0		78.9
4	96.1	100.0	70.4
10	92.6	97.2	65.8
20	87.6	87.0	62.7
40	81.1	78.7	60.0
60	73.8	71.6	57.4
100	62.1	61.7	53.0
200	37.2	38.2	44.7

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	Brown SILTY GRAVEL with SAND (GM)

PARTICLE SIZE DISTRIBUTION

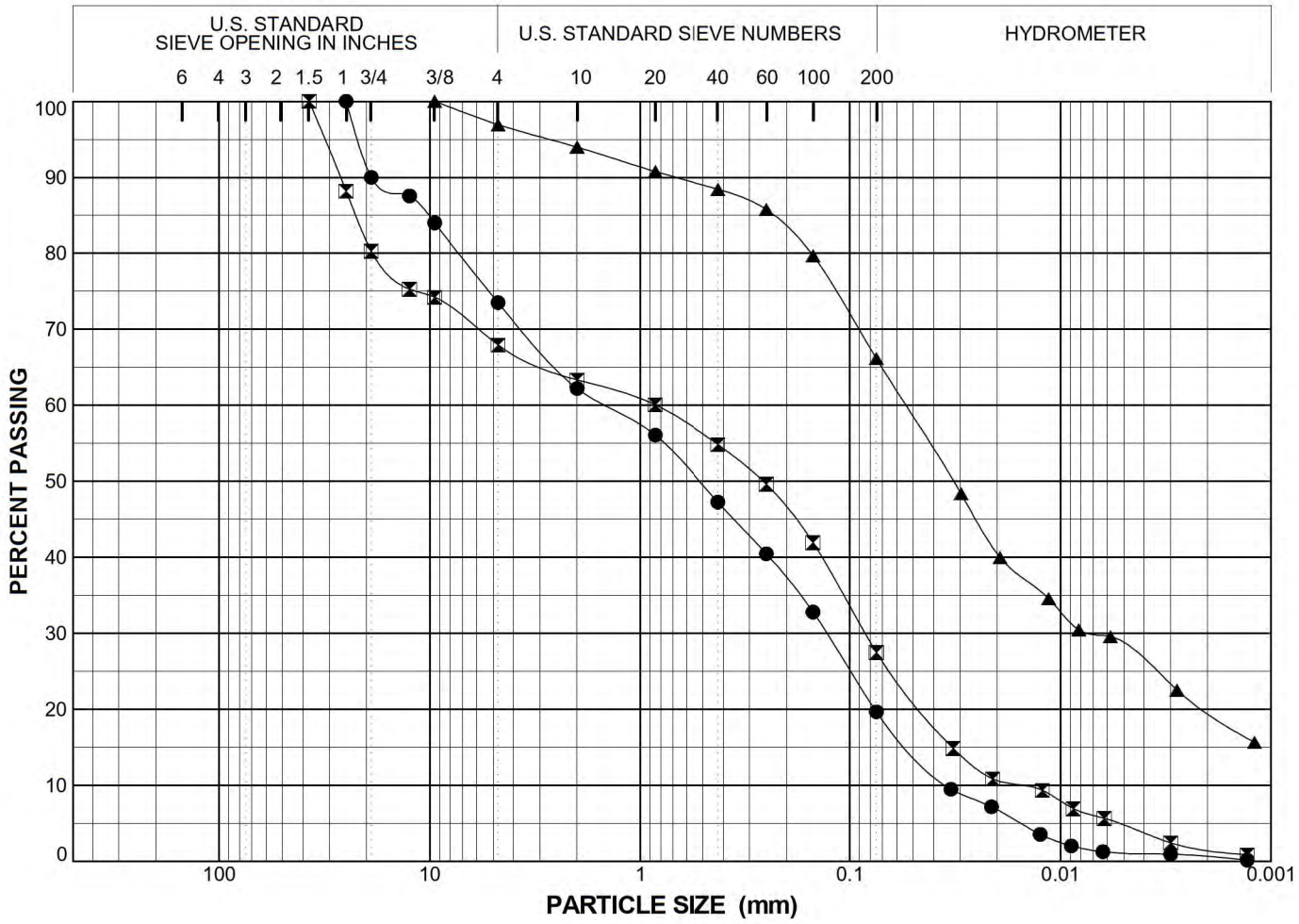
Piney Run Dam

Project Number 60614688	February 2020	Figure 3

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	212	1	1
Sample	S-4	S-1	S-7
Spec			
Depth (ft)	13.0-15.0	3.0-5.0	28.0-30.0
% +3"	0.0	0.0	0.0
% Gravel	26.5	32.1	3.1
% Sand	53.9	40.4	30.8
% Fines	19.7	27.5	66.1
% -2μ	0.5	1.6	19.8
Cc	0.33	0.54	
Cu	42.51	54.15	
LL			34
PL			22
PI			12
USCS			CL
w (%)		10.3	

Particle Size (Sieve #)	PERCENT FINER		
	●	⧓	▲
2"			
1 1/2"		100.0	
1"	100.0	88.2	
3/4"	90.0	80.3	
1/2"	87.5	75.3	
3/8"	84.0	74.2	100.0
4	73.5	67.9	96.9
10	62.2	63.3	94.0
20	56.1	60.1	90.7
40	47.3	54.8	88.4
60	40.5	49.6	85.8
100	32.8	41.9	79.7
200	19.7	27.5	66.1

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	Brown SANDY LEAN CLAY (CL)

PARTICLE SIZE DISTRIBUTION

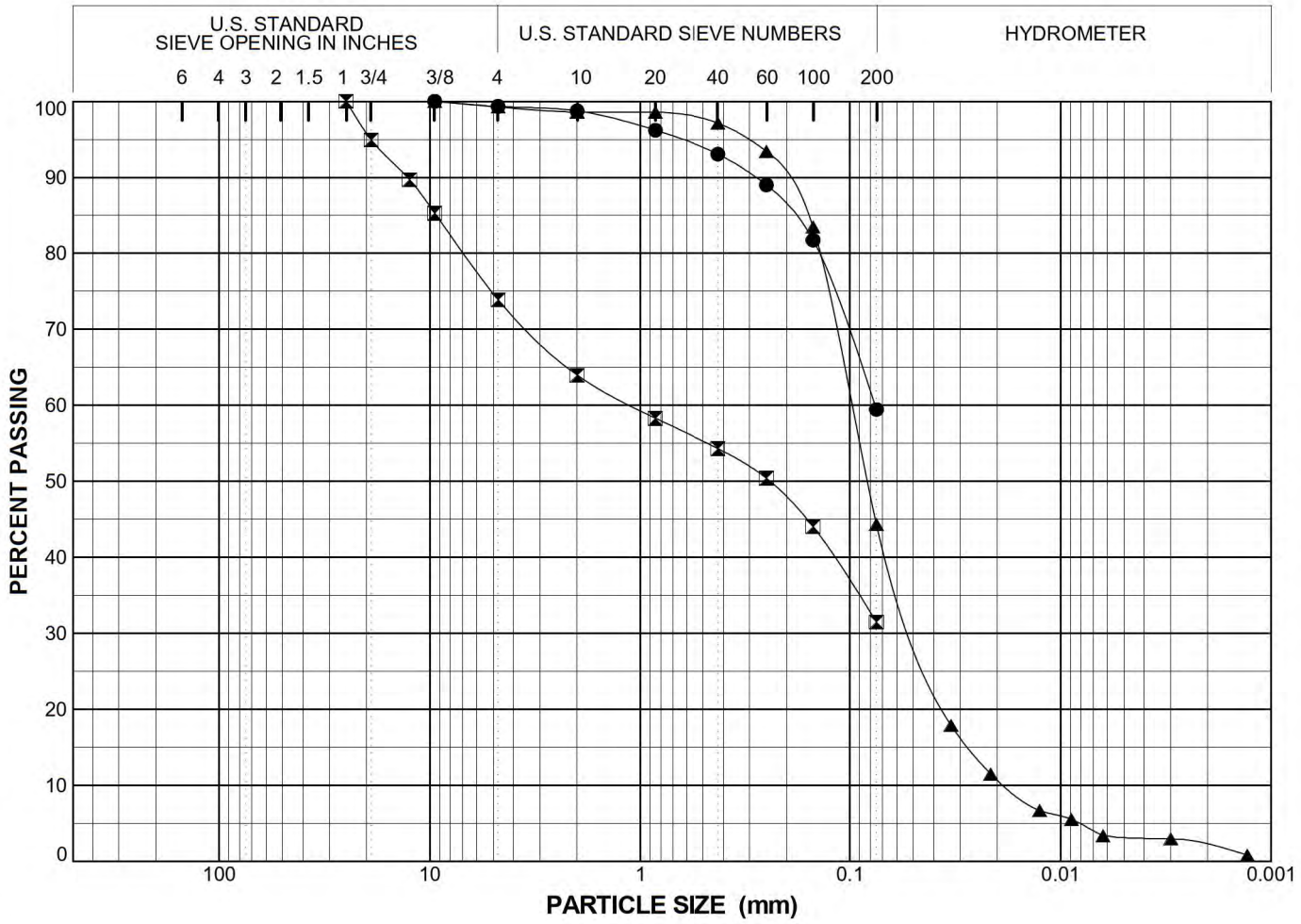
Piney Run Dam

Project Number 60614688	February 2020	Figure 4

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	1	601	601
Sample	S-9	S-2	S-4
Spec			
Depth (ft)	38.0-40.0	3.0-5.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	0.7	26.1	0.8
% Sand	39.9	42.4	54.9
% Fines	59.4	31.5	44.3
% -2μ			1.9
Cc			1.29
Cu			5.43
LL			
PL			
PI			
USCS			
w (%)			11.4

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"		100.0	
3/4"		94.9	
1/2"		89.7	
3/8"	100.0	85.3	100.0
4	99.3	73.9	99.2
10	98.7	64.0	98.6
20	96.2	58.3	98.6
40	93.0	54.3	97.1
60	89.0	50.4	93.4
100	81.7	44.0	83.4
200	59.4	31.5	44.3

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

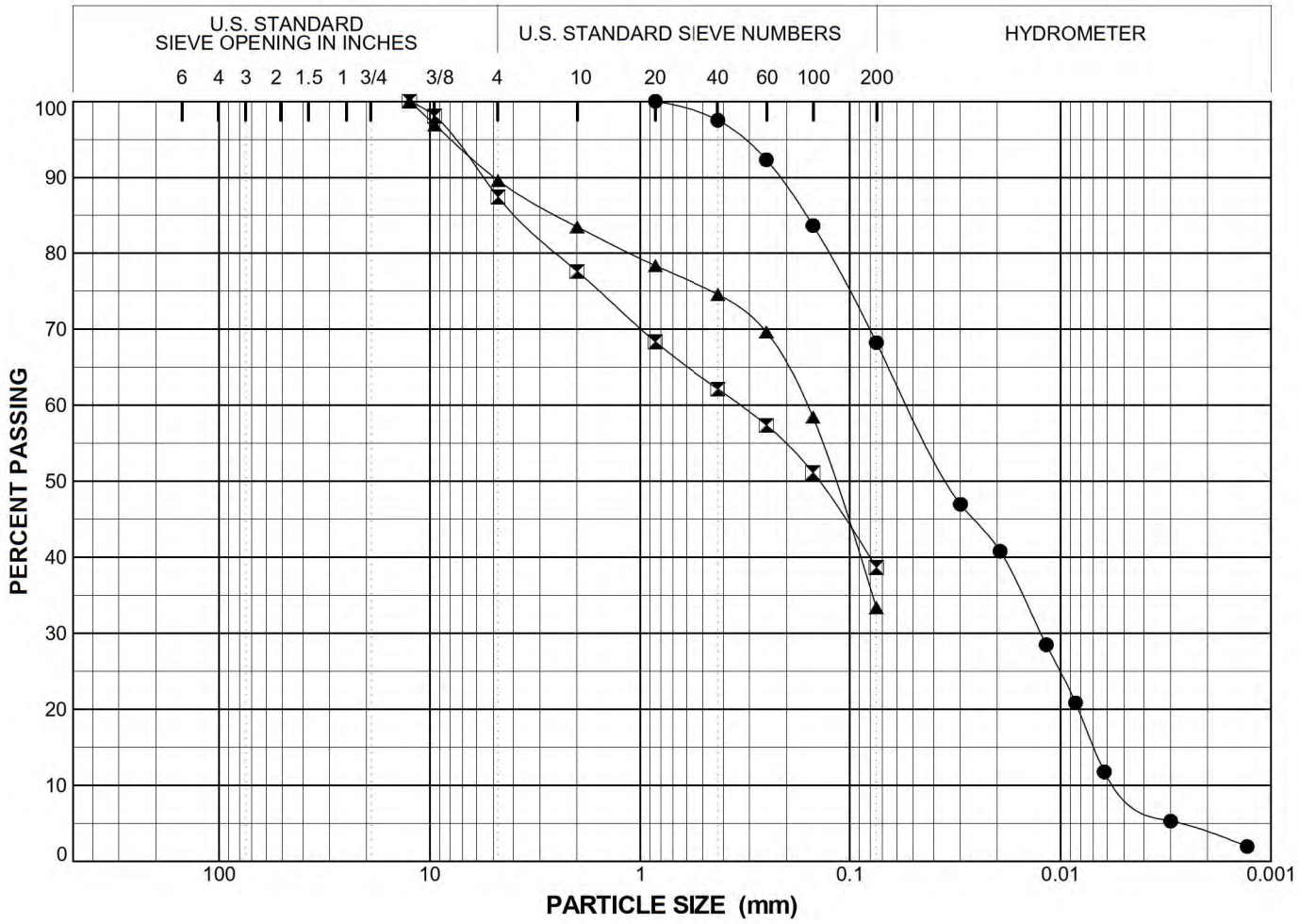
Piney Run Dam

Project Number 60614688	February 2020	Figure 5

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	801	801	802
Sample	S-1	S-3	S- 4
Spec			
Depth (ft)	3.0-5.0	13.0-15.0	13.0-15.0
% +3"	0.0	0.0	0.0
% Gravel	0.0	12.6	10.4
% Sand	31.7	48.7	56.2
% Fines	68.3	38.7	33.4
% -2μ	3.7		
Cc	0.58		
Cu	10.31		
LL	57		
PL	46		
PI	11		
USCS	MH		
w (%)	43.1		

Particle Size (Sieve #)	PERCENT FINER		
	●	⧓	▲
2"			
1 1/2"			
1"			
3/4"			
1/2"		100.0	100.0
3/8"		98.1	96.9
4		87.4	89.6
10		77.6	83.5
20	100.0	68.3	78.4
40	97.5	62.1	74.6
60	92.3	57.4	69.6
100	83.6	51.1	58.4
200	68.3	38.7	33.4

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SANDY ELASTIC SILT (MH)
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

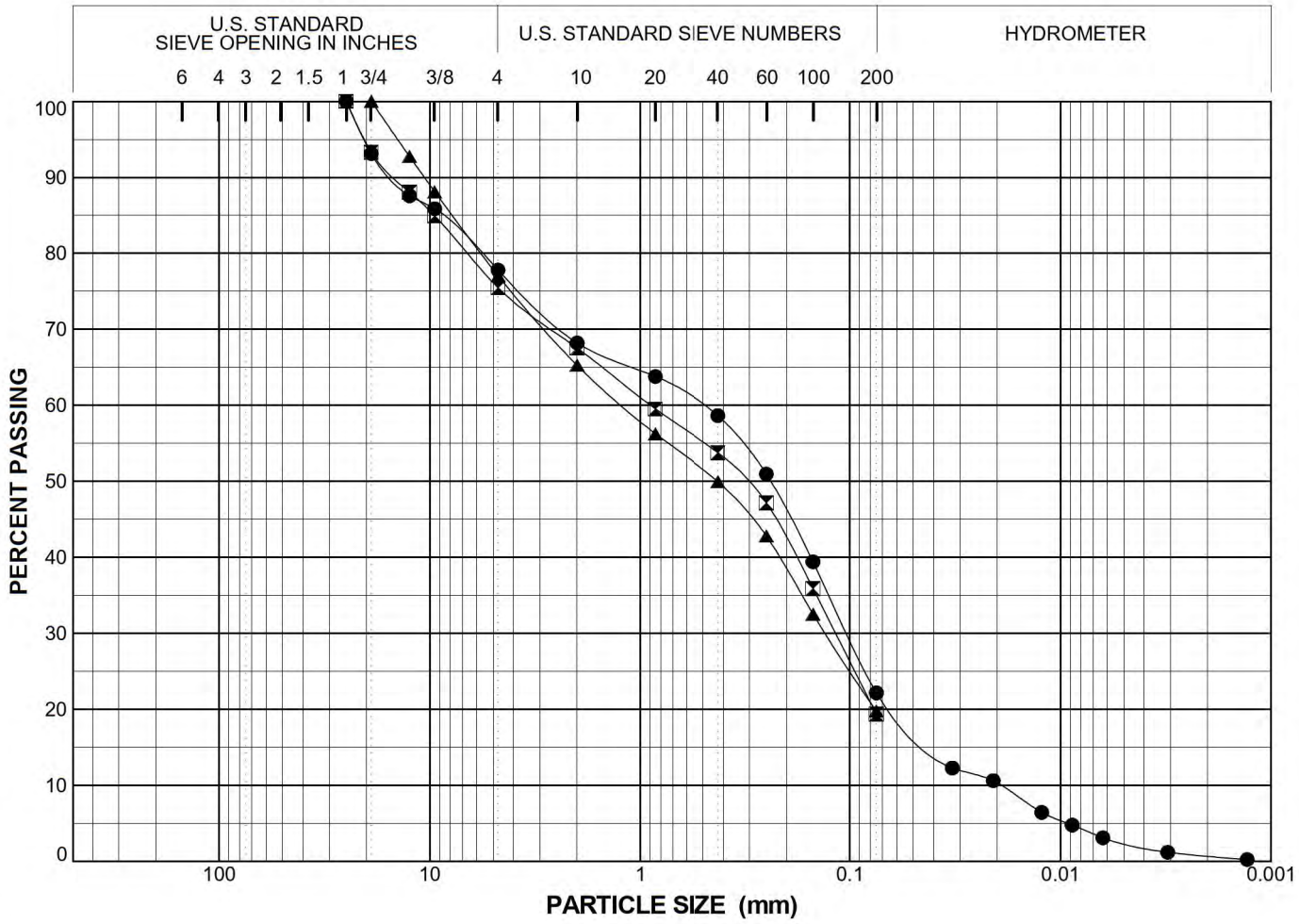
Piney Run Dam

Project Number 60614688	February 2020	Figure 6

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	802	802	802
Sample	S- 6	S- 9	S-11
Spec			
Depth (ft)	23.0-25.0	38.0-40.0	48.0-50.0
% +3"	0.0	0.0	0.0
% Gravel	22.2	24.5	22.9
% Sand	55.6	56.1	57.3
% Fines	22.2	19.4	19.8
% -2μ	0.7		
Cc	1.07		
Cu	26.38		
LL			
PL			
PI			
USCS			
w (%)	10.2		

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"	100.0	100.0	
3/4"	93.1	93.3	100.0
1/2"	87.6	88.0	92.7
3/8"	85.9	84.9	88.1
4	77.8	75.5	77.1
10	68.2	67.5	65.3
20	63.8	59.5	56.3
40	58.6	53.8	49.9
60	51.0	47.2	42.8
100	39.4	35.9	32.5
200	22.2	19.4	19.8

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

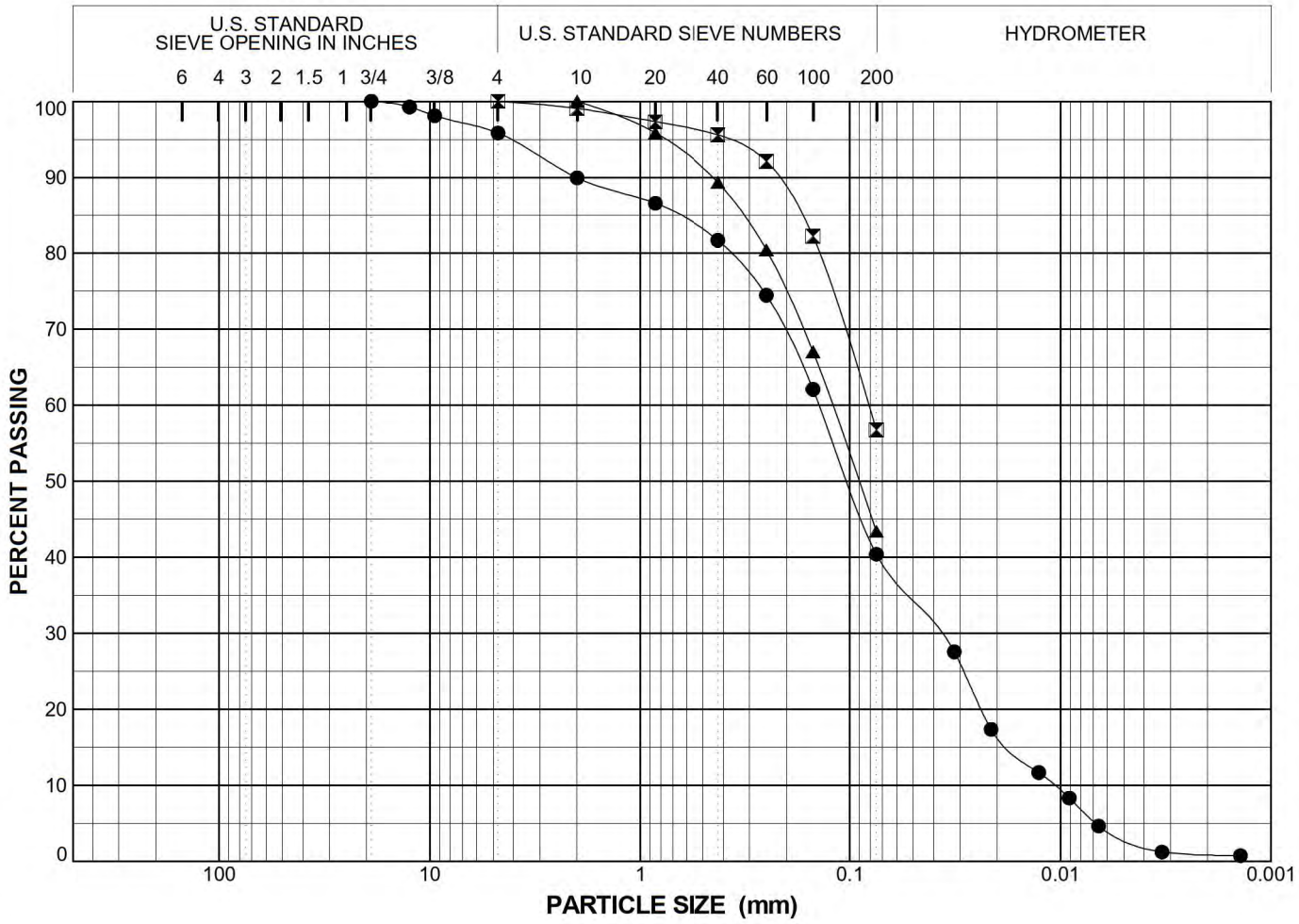
Piney Run Dam

Project Number 60614688	February 2020	Figure 7

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	803	803	803
Sample	T-2	S- 7	S- 9
Spec			
Depth (ft)	15.0-17.0	23.0-25.0	33.0-35.0
% +3"	0.0	0.0	0.0
% Gravel	4.2	0.0	0.0
% Sand	55.4	43.2	56.6
% Fines	40.4	56.8	43.4
% -2μ	0.9		
Cc	0.94		
Cu	13.04		
LL	NP		
PL	NP		
PI	NP		
USCS	SM		
w (%)	14.4		

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			
3/4"	100.0		
1/2"	99.2		
3/8"	98.1		
4	95.8	100.0	
10	89.9	99.0	100.0
20	86.6	97.3	95.8
40	81.7	95.6	89.3
60	74.5	92.1	80.5
100	62.1	82.2	67.1
200	40.4	56.8	43.4

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND (SM)
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

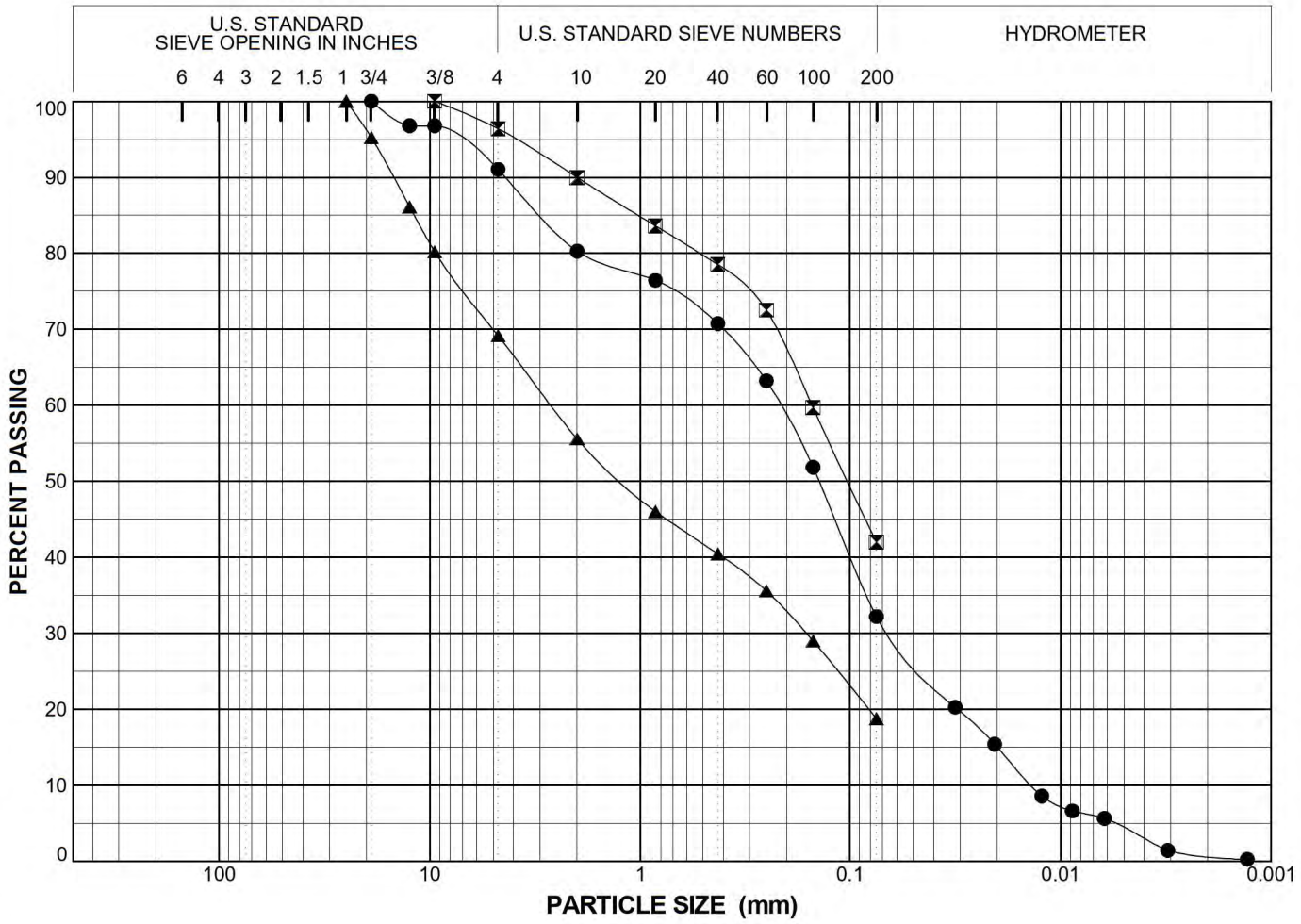
Piney Run Dam

Project Number 60614688	February 2020	Figure 8

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	803	803	803
Sample	S-11	S-15	S-17
Spec			
Depth (ft)	43.0-48.0	63.0-65.0	73.0-75.0
% +3"	0.0	0.0	0.0
% Gravel	9.0	3.6	30.8
% Sand	58.9	54.4	50.4
% Fines	32.2	42.0	18.8
% -2μ	0.8		
Cc	1.38		
Cu	15.80		
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"			100.0
3/4"	100.0		95.2
1/2"	96.8		86.1
3/8"	96.8	100.0	80.2
4	91.0	96.4	69.2
10	80.3	90.0	55.6
20	76.4	83.6	46.0
40	70.8	78.5	40.5
60	63.2	72.5	35.6
100	51.8	59.7	29.0
200	32.2	42.0	18.8

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

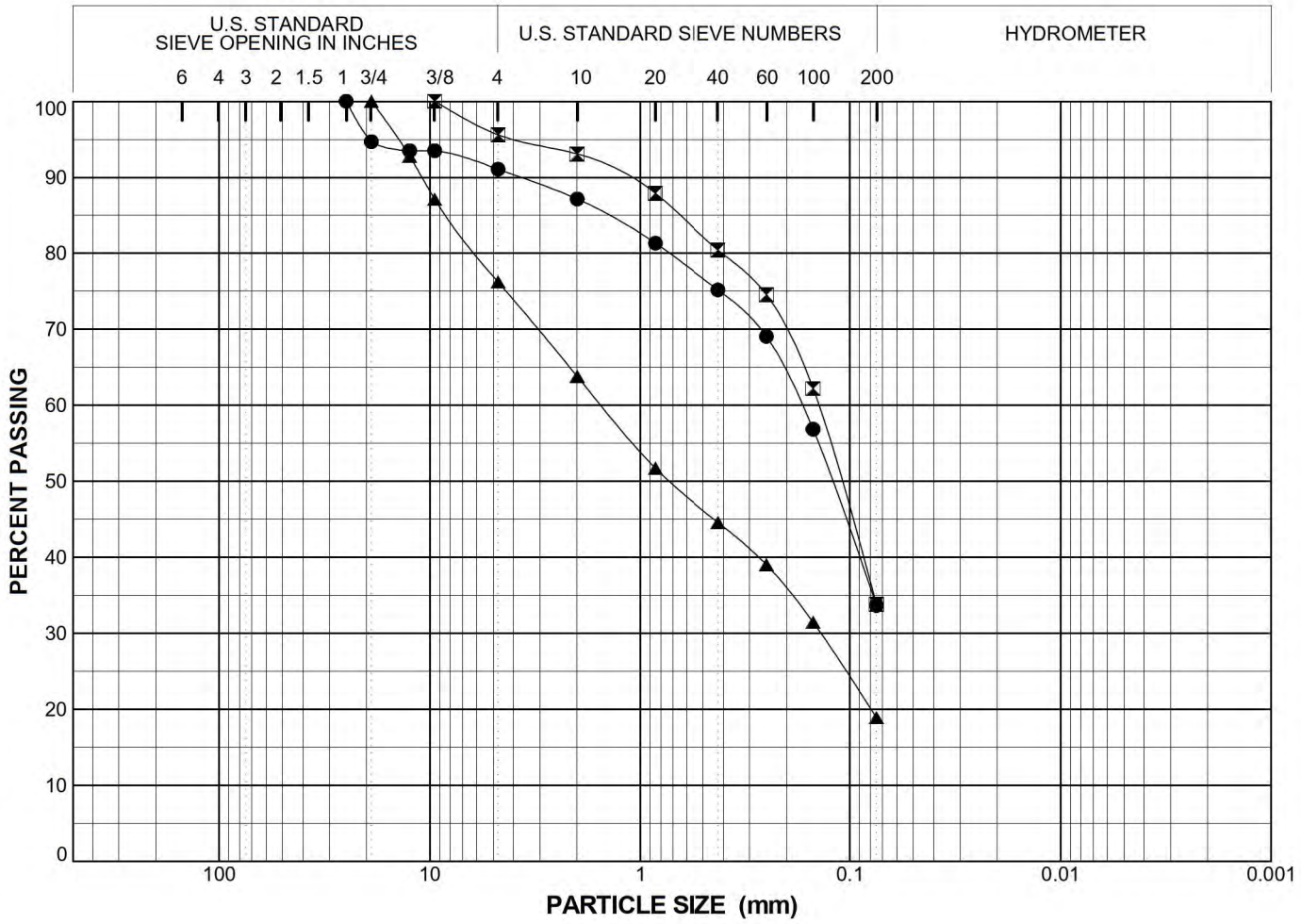
Piney Run Dam

Project Number 60614688	February 2020	Figure 9

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⧓	▲
Boring	804	804	804
Sample	S- 2	S- 4	S- 8
Spec			
Depth (ft)	8.0-10.0	18.0-20.0	33.0-35.0
% +3"	0.0	0.0	0.0
% Gravel	8.9	4.4	23.8
% Sand	57.4	61.8	57.3
% Fines	33.7	33.8	18.9
% -2μ			
Cc			
Cu			
LL			
PL			
PI			
USCS			
w (%)			

Particle Size (Sieve #)	PERCENT FINER ●	⧓	▲
2"			
1 1/2"			
1"	100.0		
3/4"	94.7		100.0
1/2"	93.5		92.8
3/8"	93.5	100.0	87.1
4	91.1	95.6	76.2
10	87.1	93.1	63.8
20	81.3	87.9	51.7
40	75.2	80.4	44.6
60	69.1	74.6	39.0
100	56.9	62.2	31.4
200	33.7	33.8	18.9

SYMBOL	DESCRIPTION AND REMARKS
●	
⧓	
▲	

PARTICLE SIZE DISTRIBUTION

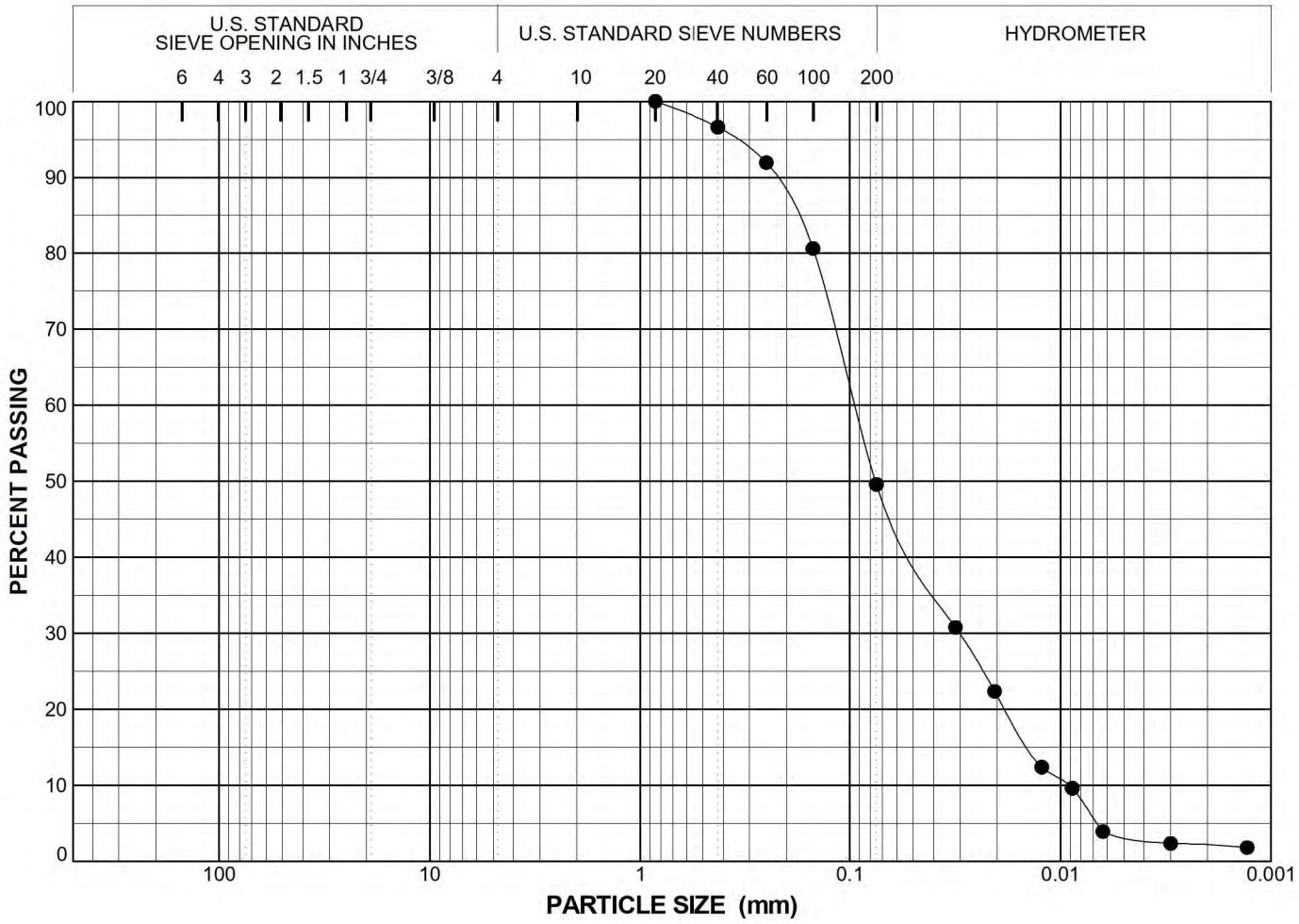
Piney Run Dam

Project Number 60614688	February 2020	Figure 10

AECOM

SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●		
Boring	804		
Sample	S-12		
Spec			
Depth (ft)	53.0-55.0		
% +3"	0.0		
% Gravel	0.0		
% Sand	50.4		
% Fines	49.6		
% -2μ	2.1		
Cc	1.06		
Cu	10.26		
LL			
PL			
PI			
USCS			
w (%)	15.9		

Particle Size (Sieve #)	PERCENT FINER ●
2"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0
40	96.6
60	91.9
100	80.6
200	49.6

SYMBOL	DESCRIPTION AND REMARKS
●	

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number 60614688	February 2020	Figure 11

AECOM

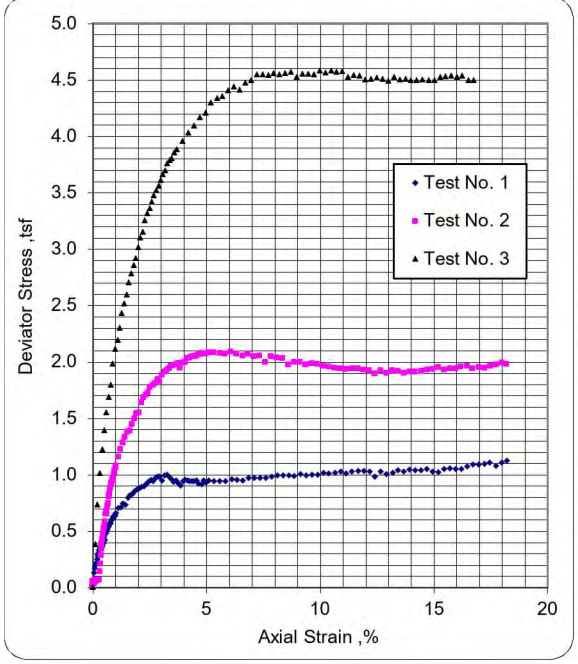
SIEVE_BLUEBELL_NEW 60614688_2020-02-01_PINEY RUN DAM.GPJ URS_BLUE.GDT 2/25/20

AECOM

ASTM D4767 Isotropically Consolidated Undrained Triaxial Test Series (With Pore Pressure Measurements)

Project No.: 60614688 **File No.:** 2020-02-01

Project Name: Piney Run Dam **Date:** February 18, 2020



Test Sample Summary

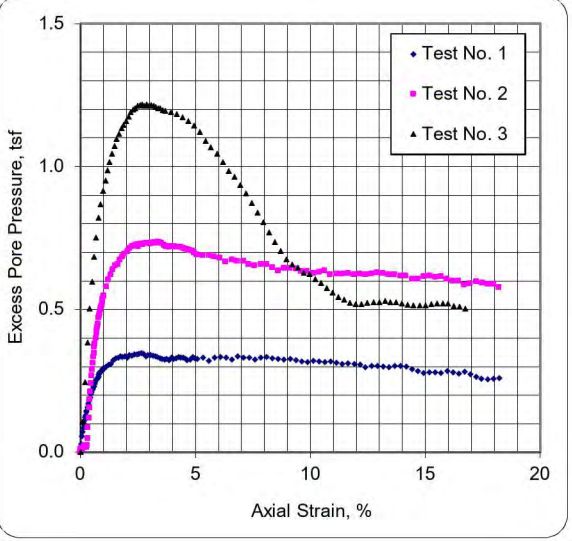
Test No.	Boring No.	Sample No./Depth	Water Content, % Initial	Water Content, % Final	Dry Density, pcf Initial	Dry Density, pcf Final	Degree of Saturation, % Initial	Degree of Saturation, % Final	B Factor,%	Void Ratio Initial	Void Ratio Final	$\overline{\sigma}_c$ tsf
1	803	T-2/15.2-15.7	19.2	32.8	85.5	89.1	53.4	99.4	99.0	0.970	0.891	0.72
2	803	T-2/15.7-16.2	17.9	28.4	93.3	97.3	60.1	104.9	98.0	0.807	0.731	1.44
3	803	T-2/16.2-16.7	14.1	22.3	106.5	109.1	65.3	110.8	100.0	0.583	0.544	2.88

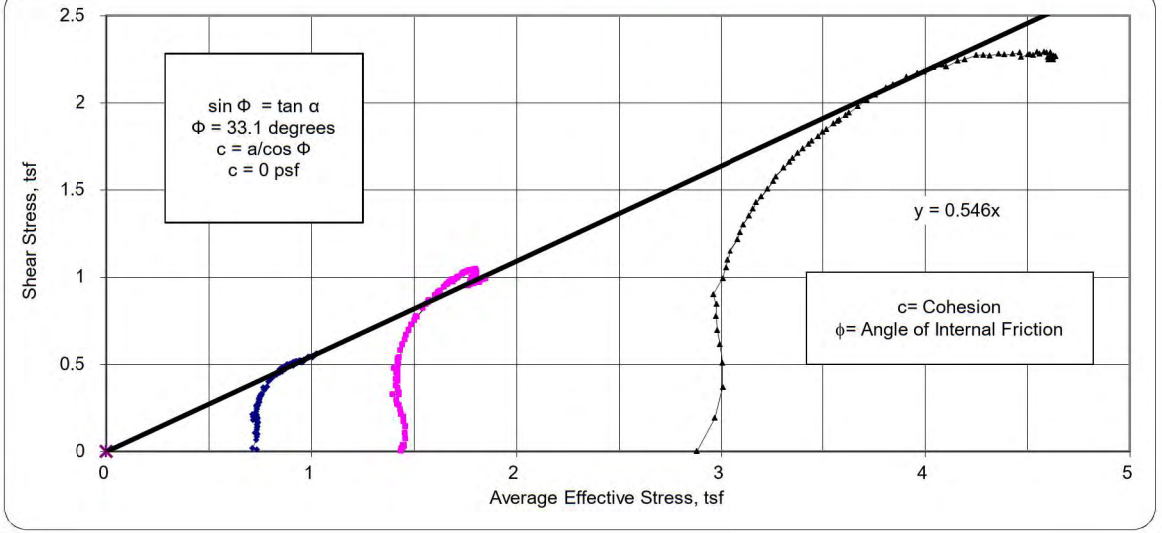
Specific Gravity=	2.70 Assumed	Liquid Limit, %	NP	NP	NP
Stain Rate, %/hr.	1.9	Plastic Limit, %	NP	NP	NP
Note: Atterberg Limits were conducted on Test No.1 only.		Liquidity Index	NP	NP	NP

Test Series Summary

Test No.	Max. Deviator Stress, tsf	Value at Maximum Shear Stress: Axial Strain, %	Obliquity	A- Factor
1	1.03	15.0	3.330	0.269
2	2.08	6.1	3.734	0.325
3	4.58	10.5	3.003	0.129
4				
5				
6				

Test #1 Test #2 Test #3



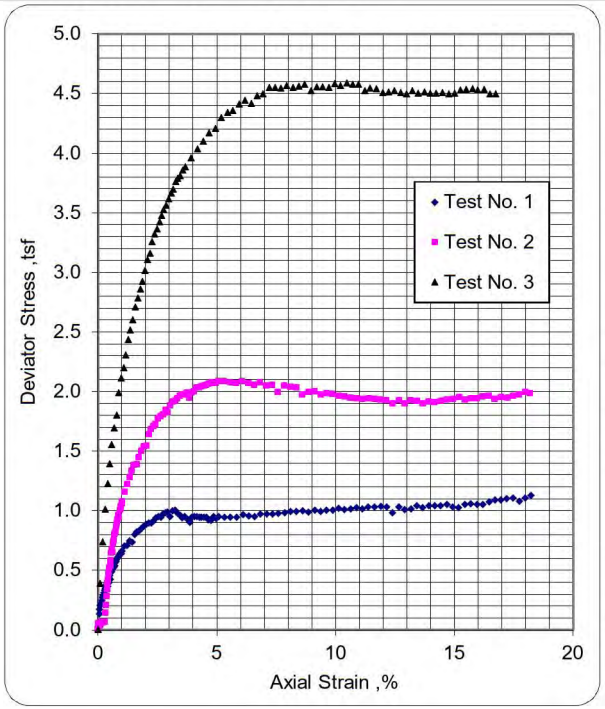


AECOM

ASTM D4767 Isotropically Consolidated Undrained Triaxial Test Series (Total Stress)

Project No.: 60614688 **File No.:** 2020-02-01

Project Name: Piney Run Dam **Date:** February 18, 2020



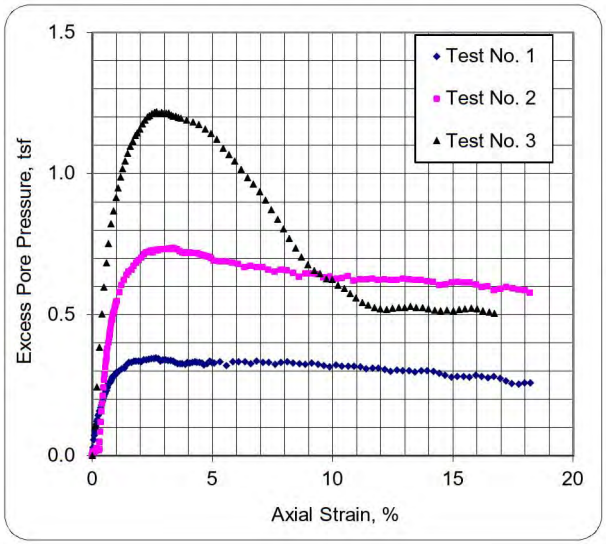
Test Sample Summary

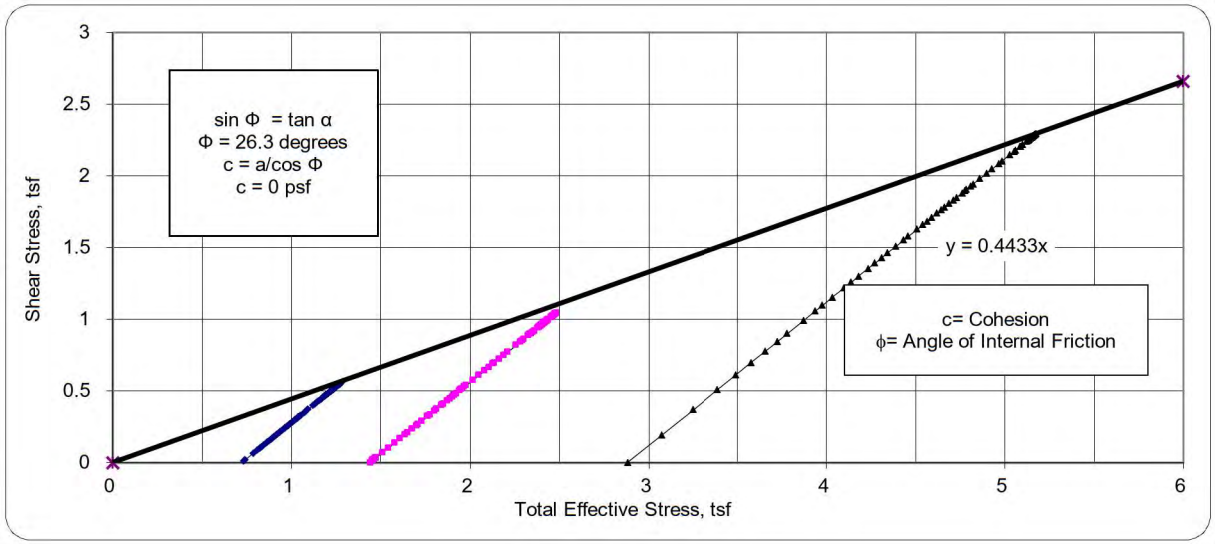
Test No.	Boring No.	Sample No./Depth	Water Content, % Initial	Water Content, % Final	Dry Density, pcf Initial	Dry Density, pcf Final	Degree of Saturation, % Initial	Degree of Saturation, % Final	B Factor,%	Void Ratio Initial	Void Ratio Final	$\overline{\sigma}_c$ tsf
1	803	T-2/15.2-15.7	19.2	32.8	85.5	89.1	53.4	99.4	99.0	0.970	0.891	0.72
2	803	T-2/15.7-16.2	17.9	28.4	93.3	97.3	60.1	104.9	98.0	0.807	0.731	1.44
3	803	T-2/16.2-16.7	14.1	22.3	106.5	109.1	65.3	110.8	100.0	0.583	0.544	2.88
Specific Gravity=			2.70 Assumed				Liquid Limit, %		NP	NP	NP	
Stain Rate, %/hr.			1.9				Plastic Limit, %		NP	NP	NP	
Note: Atterberg Limits were conducted on Test No.1 only.							Liquidity Index		NP	NP	NP	

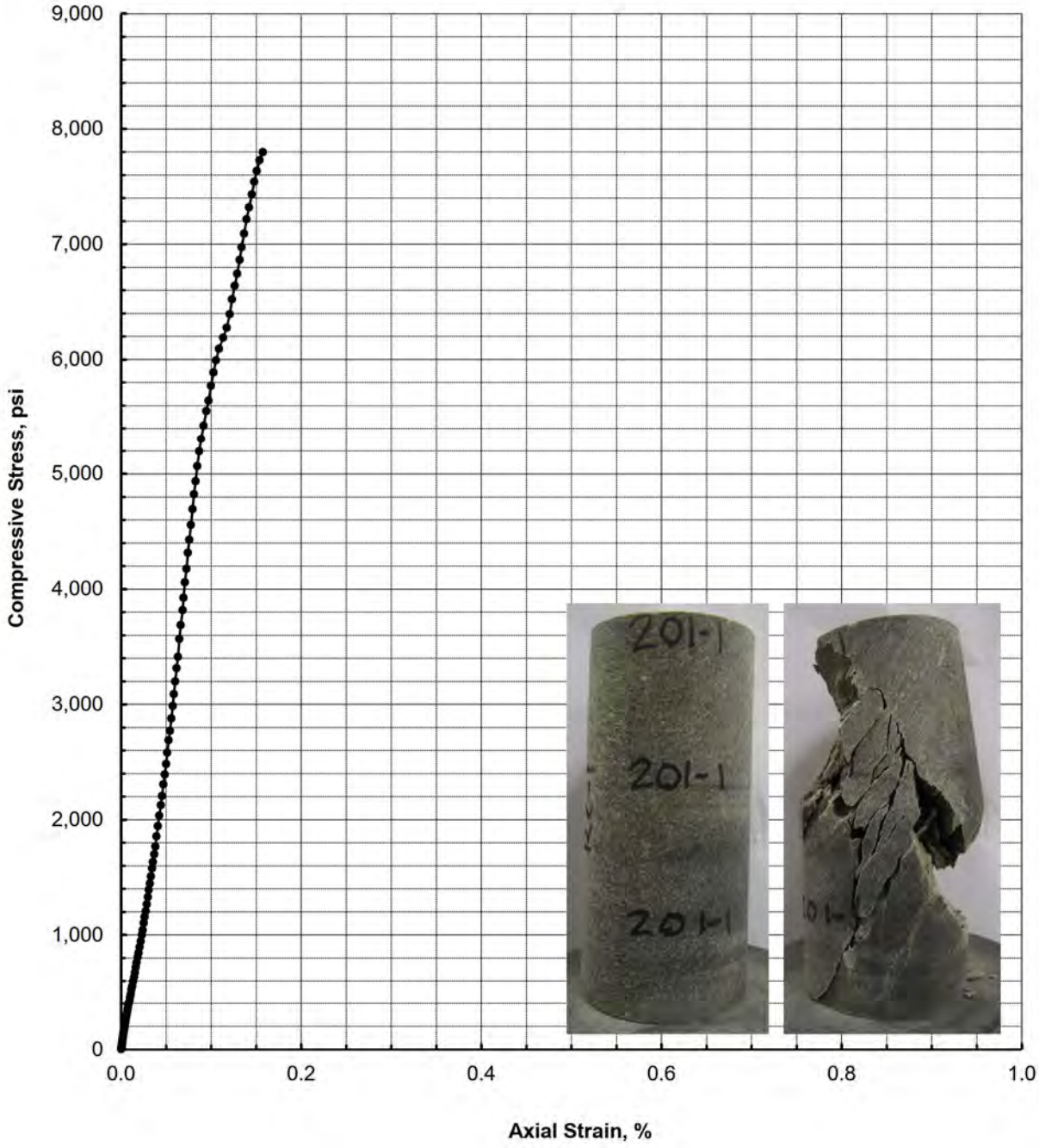
Test Series Summary

Test No.	Max. Deviator Stress, tsf	Value at Maximum Shear Stress: Axial Strain, %	Obliquity	A- Factor
1	1.03	15.0	2.433	0.269
2	2.08	6.1	2.447	0.325
3	4.58	10.5	2.592	0.129
4				
5				
6				

Test #1 Test #2 Test #3







Specimen Information | **Test Summary**

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (in)	Diameter (in)	q_u (psi)	Strain to Peak (%)	Strain Rate (%/min)
0.3	170.6	170.1	4.18	1.97	7,798	0.16	0.28

Tested by: BS Test Date: 2/7/2020 Reviewed by: MHD

Project No. 60614688	**Piney Run Dam**	**UNCONFINED COMPRESSION TEST ON ROCK CORE SPECIMEN**	
AECOM		Boring: 209 Sample: RC-1 Depth:33.8-34.4	February 2020

2020-02-01

Project Name:	Piney Run Dam	Samples Sent on:	1/15/2020
Project Number:	60611685	Samples Received on:	
Task Number:	Task: 1.5	Results Due by:	
Tests Requested By:	G. Michael McIntyre	Results Sent on:	
Laboratory Name:	AECOM	Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS D4318		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D7012	DIRECT SHEAR ASTM D3080	CIU ASTM D4767		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
						AIR DRIED	OVEN DRIED	ASTM D698	ASTM D4253	SIEVE	HYDR.	SIEVE	HYDR.				UNDISTURBED	REMOLDED				
ASW-7	RC-1	40.1-41.3																				HOLD AT THIS TIME
ASW-9	S-2	8.0-10.0								1	1											
ASW-9	S-4	18.0-20.0								1												
ASW-9	S-6	28.0-30.0								1												
ASW-9	RC-1	33.8-34.4													1							
ASW-12	S-2	3.0-5.0	1	1		1				1	1											
ASW-12	S-4	13.0-15.0								1	1											
TOTAL TESTS			1	1	0	1	0	0	0	5	3	0	0	0	1	0	0	0	0	0	0	

Notes:

2020-02-01

2020-02-01

Project Name	Piney Run Dam	Samples Sent on	1/15/2020
Project Number	60611688	Samples Received on:	
Task Number	1.5	Results Due by:	
Tests Requested By:		Results Sent on	
Laboratory Name	AECOM	Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS (ASTM D4318) AIR DRIED	ATTERBERG LIMITS (ASTM D4318) OVEN DRIED	COMPACTION TEST ASTM D698	COMPACTION TEST ASTM D1557	GRAIN SIZE LESS THAN #200 SIEVE	GRAIN SIZE LESS THAN #200 HYDR.	GRAIN SIZE GREATER THAN #200 SIEVE	GRAIN SIZE GREATER THAN #200 HYDR.	CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D7012	DIRECT SHEAR ASTM D3080	CIU ASTM D4767 UNDISTURBED	CIU ASTM D4767 REMOLDED	CID ASTM D7181 UNDISTURBED	CID ASTM D7181 REMOLDED	UNIT WGT. (pcf)	SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
EXP-1	S-1	3.0-5.0	1	1		1				1	1															
EXP-1	S-3	13.0-15.0								1																
EXP-2	UD-1	5.0-7.0																								HOLD AT THIS TIME
EXP-2	S-4	13.0-15.0								1																
EXP-2	S-6	23.0-25.0		1						1	1															
EXP-2	S-9	38.0-40.0								1																
EXP-2	S-11	48.0-50.0								1																
EXP-3	UD-1	10.0-12.0																								HOLD AT THIS TIME
EXP-3	UD-2	15.0-17.0	1	1		1				1	1							3							1	Use confining pressures of 10 psi, 20 psi, and 40 psi for CIU W/ pore pressure test. Please provide both effective and total strength results
EXP-3	S-7	23.0-25.0								1																
EXP-3	S-9	33.0-35.0								1																
EXP-3	S-11	43.0-45.0								1	1															
EXP-3	S-15	63.0-65.0								1																
EXP-3	S-17	73.0-75.0								1																
EXP-4	S-2	8.0-10.0								1																
EXP-4	S-4	18.0-20.0								1																
EXP-4	UD-1	25.0-27.0																								HOLD AT THIS TIME
EXP-4	S-8	33.0-35.0								1																
EXP-4	S-12	53.0-55.0		1						1	1															
TOTAL TESTS			2	4	0	2	0	0	0	16	5	0	0	0	0	0	3	0	0	0	0	0	0	0	1	

Notes:

2020-02-01

2020-02-01

Project Name:	Piney Run Dam	Samples Sent on:	1/15/2020
Project Number:	60611688	Samples Received on:	
Task Number:	1.5	Results Due by:	
Tests Requested By:		Results Sent on:	
Laboratory Name:	AECOM	Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ATTERBERG LIMITS D4318		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D2938	DIRECT SHEAR ASTM D3080	CIU ASTM D4767		CID ASTM D7181		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
					AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	SIEVE	HYDR.	SIEVE	HYDR.				UNDISTURBED	REMOLDED	UNDISTURBED	REMOLDED				
EMB-1	S-1	3.0-5.0		1					1	1													
EMB-1	S-7	28.0-30.0	1		1				1	1													
EMB-1	S-9	38.0-40.0							1														
EMB-5	S-2	3.0-5.0							1														
EMB-5	S-4	13.0-15.0		1					1	1													
			1	2	1				5	3													

Notes:

2020-02-01

2020-02-01

Project Name:	Piney Run Dam	Samples Sent on:	1/15/2020
Project Number:	60613688	Samples Received on:	
Task Number:	1.5	Results Due by:	
Tests Requested By:		Results Sent on:	
Laboratory Name:	AECOM	Results Reviewed by:	

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS D4318		COMPACTION TEST		GRAIN SIZE LESS THAN #200		GRAIN SIZE GREATER THAN #200		CONSOLIDATION TEST	COMPRESSIVE STRENGTH ROCK ASTM D7012	DIRECT SHEAR ASTM D3080	CIU ASTM D4767		SPECIFIC GRAVITY ASTM D854	SPECIFIC GRAVITY ASTM C127	EXTRUDE TUBE SAMPLE	COMMENTS
						AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	SIEVE	HYDR.	SIEVE	HYDR.				UNDISTURBED	REMOLDED				
ABT-3	S-2	3.0-5.0								1												
ABT-3	S-3	8.0-10.0	1	1		1				1	1											
ABT-3	S-5	18.0-20.0								1	1											
ABT-3	S-7	28.0-30.0								1												
ABT-3	S-8	33.0-35.0								1												
TOTAL TESTS			1	1	0	1	0	0	0	5	2	0	0	0	0	0	0	0	0	0	0	

Notes:

2020-02-01

Project: Piney Run Dam
Project No.: 60614688

AECOM

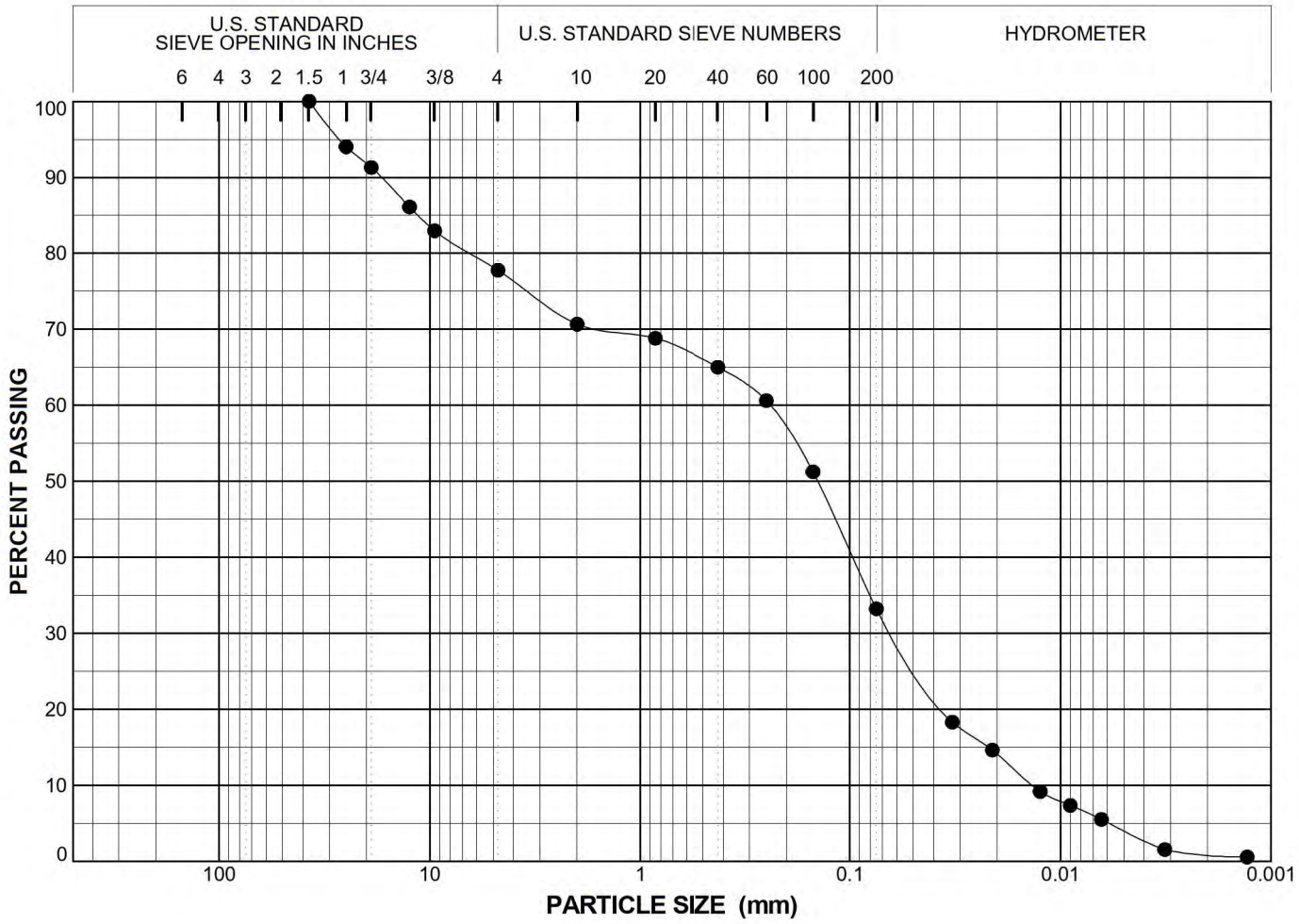
SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity	Organic Content (%)	Grain Size		Compaction	Consolidation	Unconfined Compression		Triaxial Compression		Permeability (cm/sec)	Special Tests
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Stress (psi)	Strain (%)	UU	CIU		
602/BULK	nt Shell 1.0-2.0	Brown SILTY SAND with GRAVEL	SM	23.8		NP	NP			33	1	*					*		

* Refer to Laboratory Test Curves

Project File Path:

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●
Boring	602
Sample	BULK
Spec	
Depth (ft)	1.0-2.0
% +3"	0.0
% Gravel	22.2
% Sand	44.6
% Fines	33.2
% -2μ	1.0
Cc	1.20
Cu	17.87
LL	NP
PL	NP
PI	NP
USCS	SM
w (%)	23.8

Particle Size (Sieve #)	PERCENT FINER ●
2"	
1 1/2"	100.0
1"	94.0
3/4"	91.3
1/2"	86.1
3/8"	83.0
4	77.8
10	70.7
20	68.8
40	65.0
60	60.6
100	51.2
200	33.2

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND with GRAVEL (SM)

PARTICLE SIZE DISTRIBUTION

Piney Run Dam

Project Number		
60614688	April 2020	Figure 1

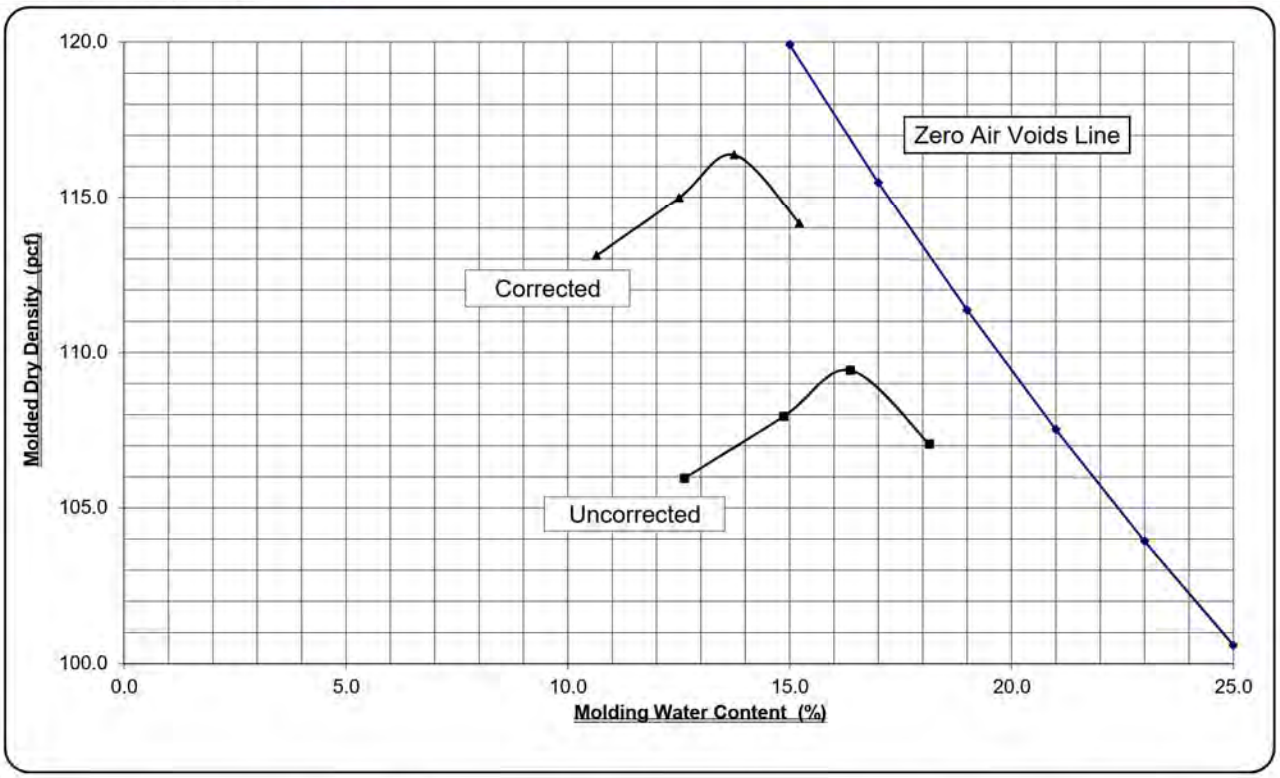
AECOM

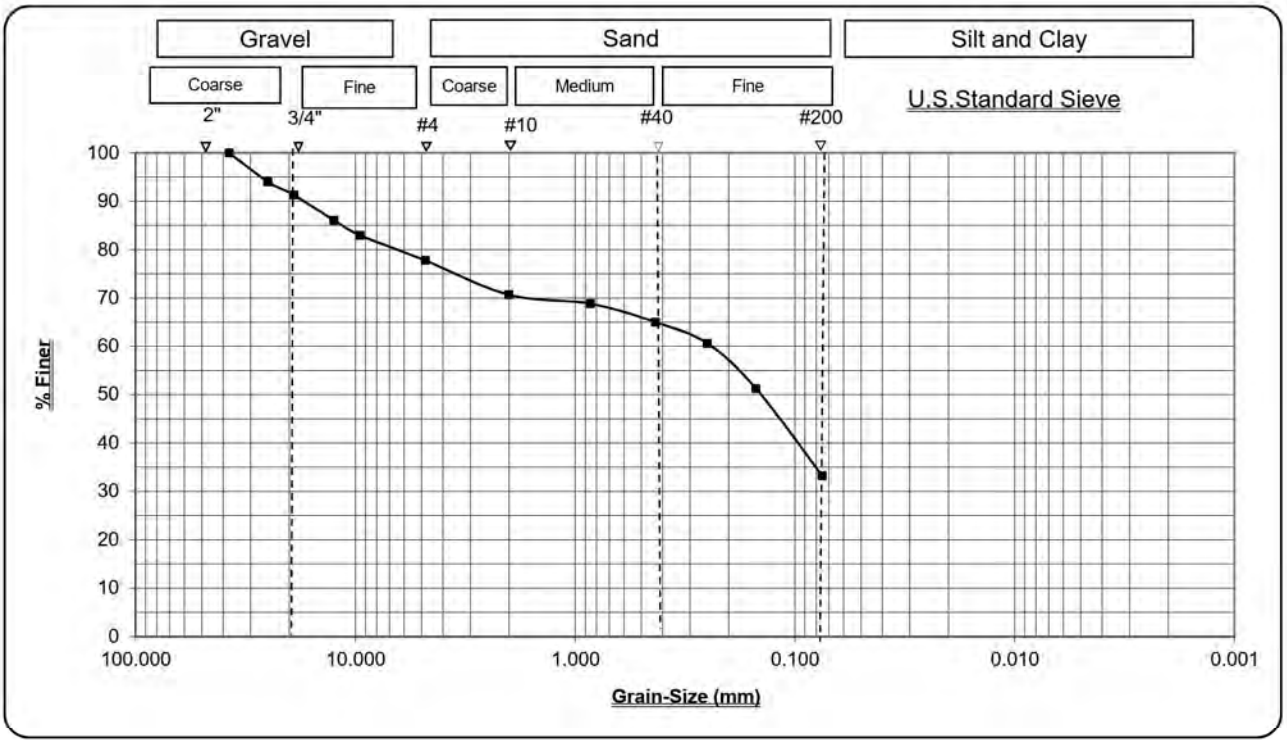
SIEVE_BLUEBELL_NEW 60614688_2020-03-11_PINEY RUN DAM.GPJ URS_BLUE.GDT 4/3/20

AECOM

Laboratory Compaction Characteristic of Soil Using Standard Effort (ASTM D 698) Method B

Job No.	60614688	Date	3-Apr-20
File No.	2020-03-11	Assumed Specific Gravity (-10 Sieve Mat.)	2.70
Job Name:	Piney Run Dam	Assumed Specific Gravity (+#4 Sieve Mat.)	2.70
Boring No.:	602 Sample: Bulk 1.0-2.0 ft	Average Specific Gravity	2.70
Description	Brown SILTY SAND with GRAVEL	Maximum Dry Density, pcf	109.4
Liquid Limit	NP	Optimum Water Content, %	16.4
Plastic Limit	NP	Corrected Max. Dry Density, pcf	116.4
Plastic Index	NP	Corrected Optimum Water Content, %	13.8
As-Received Water Content,%	23.8		



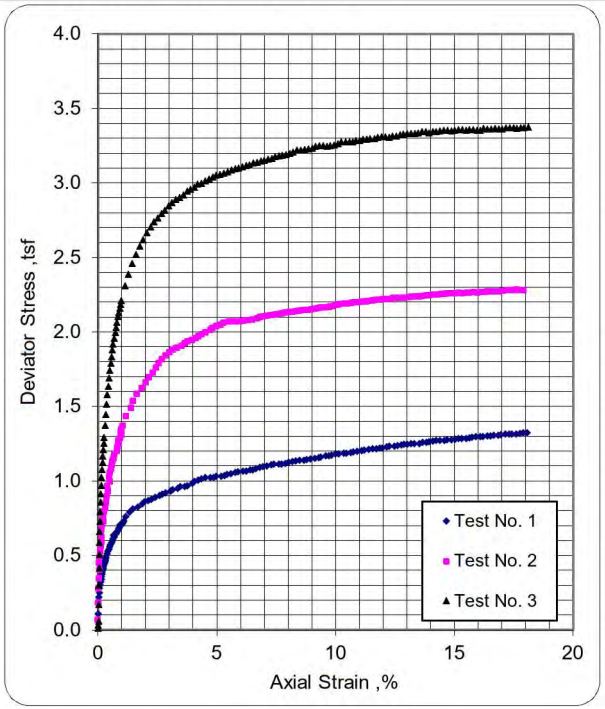


AECOM

ASTM D4767 Isotropically Consolidated Undrained Triaxial Test Series (With Pore Pressure Measurements)

Project No.: 60614688 **File No.:** 2020-03-11

Project Name: Piney Run Dam **Date:** April 14, 2020



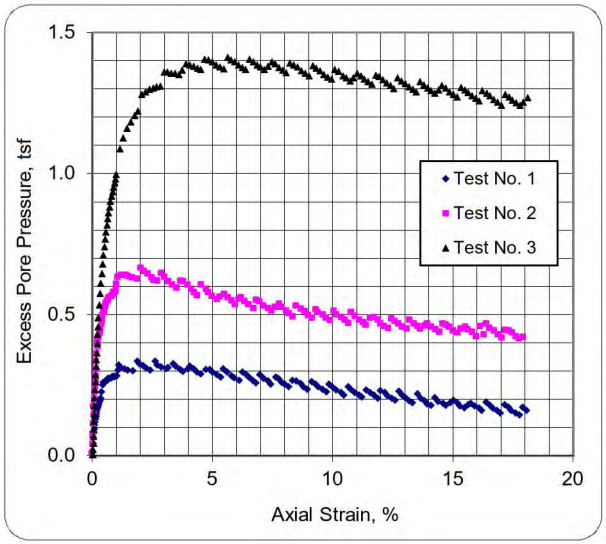
Test Sample Summary

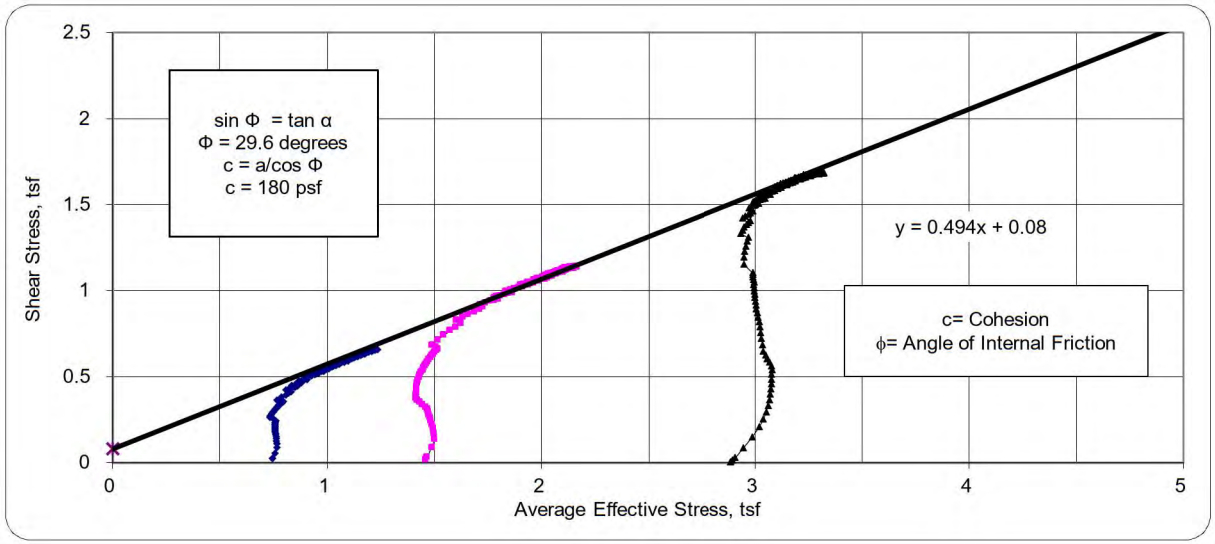
Test No.	Boring No.	Sample No./Depth	Water Content, % Initial	Water Content, % Final	Dry Density, pcf Initial	Dry Density, pcf Final	Degree of Saturation, % Initial	Degree of Saturation, % Final	B Factor,%	Void Ratio Initial	Void Ratio Final	$\bar{\sigma}_c$ tsf
1	602	Bulk/1.0-2.0	14.6	26.2	104.3	104.2	60.7	108.6	96.0	0.676	0.676	0.72
2	602	Bulk/1.0-2.0	14.5	24.0	104.5	105.3	60.2	102.0	98.0	0.673	0.659	1.44
3	602	Bulk/1.0-2.0	14.7	22.2	104.2	109.8	60.8	105.2	96.0	0.677	0.591	2.88
Specific Gravity=			2.80 Assumed				Liquid Limit, %		NP	NP	NP	
Stain Rate, %/hr.			1.9				Plastic Limit, %		NP	NP	NP	
Note: Atterberg Limits were conducted on Test No.1 only.							Liquidity Index		NP	NP	NP	

Test Series Summary

Test No.	Max. Deviator Stress, tsf	Value at Maximum Shear Stress: Axial Strain, %	Obliquity	A- Factor
1	1.28	15.0	3.443	0.153
2	2.25	15.0	3.260	0.196
3	3.35	15.0	3.093	0.382
4				
5				
6				

Test #1 Test #2 Test #3



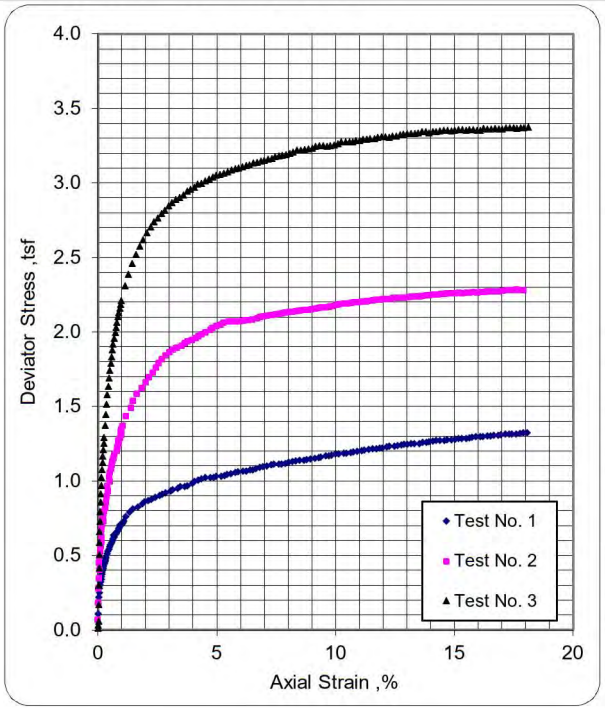


AECOM

ASTM D4767 Isotropically Consolidated Undrained Triaxial Test Series (Total Stress)

Project No.: 60614688 **File No.:** 2020-03-11

Project Name: Piney Run Dam **Date:** April 14, 2020



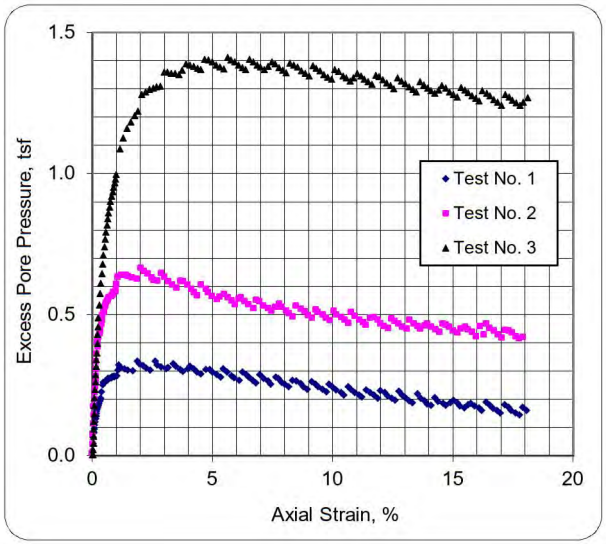
Test Sample Summary

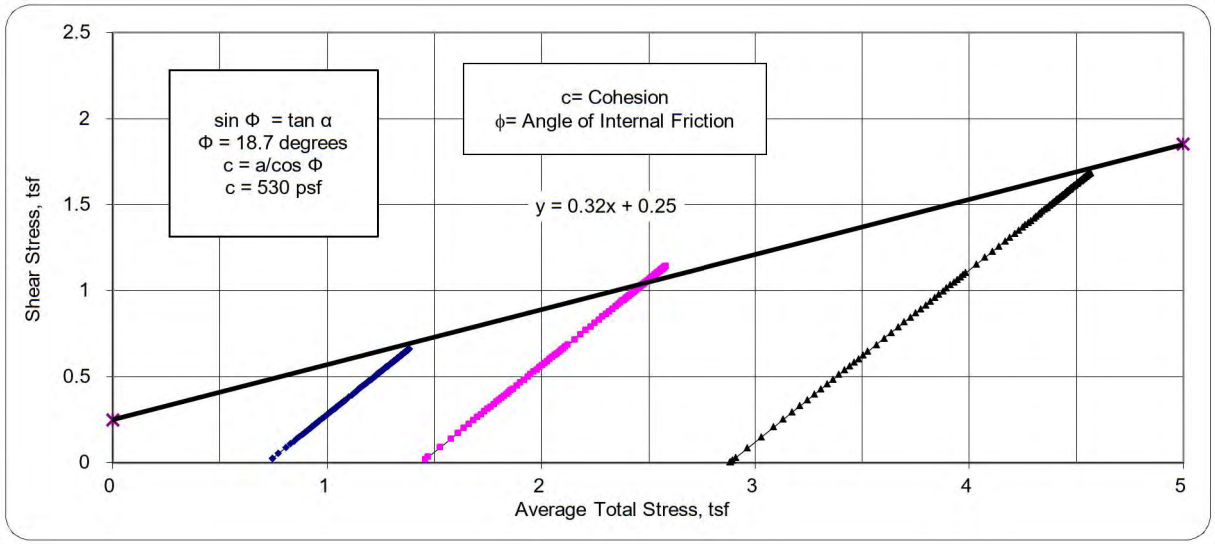
Test No.	Boring No.	Sample No./Depth	Water Content, % Initial	Water Content, % Final	Dry Density, pcf Initial	Dry Density, pcf Final	Degree of Saturation, % Initial	Degree of Saturation, % Final	B Factor,%	Void Ratio Initial	Void Ratio Final	$\overline{\sigma}_c$ tsf
1	602	Bulk/1.0-2.0	14.6	26.2	104.3	104.2	60.7	108.6	96.0	0.676	0.676	0.72
2	602	Bulk/1.0-2.0	14.5	24.0	104.5	105.3	60.2	102.0	98.0	0.673	0.659	1.44
3	602	Bulk/1.0-2.0	14.7	22.2	104.2	109.8	60.8	105.2	96.0	0.677	0.591	2.88
Specific Gravity=			2.80 Assumed				Liquid Limit, %		NP	NP	NP	
Stain Rate, %/hr.			1.9				Plastic Limit, %		NP	NP	NP	
Note: Atterberg Limits were conducted on Test No.1 only.							Liquidity Index		NP	NP	NP	

Test Series Summary

Test No.	Max. Deviator Stress, tsf	Value at Maximum Shear Stress: Axial Strain, %	Obliquity	A- Factor
1	1.28	15.0	2.778	0.153
2	2.25	15.0	2.566	0.196
3	3.35	15.0	2.163	0.382
4				
5				
6				

Test #1 Test #2 Test #3





2020-03-11

Project Name:	Piney Run Dam		3/2/2020
Project Number:	60614651		
Task Number:	1.5		3/20/2020
Tests Requested By:	Kris [redacted] Wechtel		
Laboratory Name:	AECOM		

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING No.	Sample No.	DEPTH (ft)	USCS CLASSIFICATION ASTM D2487	NATURAL WATER CONTENT (%) ASTM D2216	ORGANIC CONTENT ASTM D2974	ATTERBERG LIMITS D4318		COMPACTION TEST		GRAIN SIZE LESS THAN 5 LBS		GRAIN SIZE GREATER THAN 5 LBS		DIRECT SHEAR ASTM D3080	CIU ASTM D4767		EXTRUDE TUBE SAMPLE	COMMENTS
						AIR DRIED	OVEN DRIED	ASTM D698	ASTM D1557	SIEVE	HYDR.	SIEVE	HYDR.		UNDISTURBED	REMOLDED		
Embankment Shell	Bulk	1.0-2.0	1	1		1		1				1	1			3		For the CIU test, please use confining pressures of 10 psi, 20 psi, and 40 psi. Please use 95% compaction and a moisture content within + or -2% of optimum based on the results of the proctor test. Please provide both effective and total strength results.
TOTAL TESTS			1	1	0	1	0	1	0	0	0	1	1	0	0	3	0	

Notes:

2020-03-11

AECOM

Appendix F – Seismic Refraction Survey Results

NOTES:

1. Basemap provided by Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNE/Airbus DS, USDA, USGS, AeroGRID IGN, and the GIS User Community.

CLIENT	Carroll County Bureau of Resource Management		
PROJ	Piney Run Watershed Study		
REVISION NO	0	DES BY	MRG 04/15/2020
SCALE	1 inch = 100 feet	DR BY	MRG 04/15/2020
G:\Projects\ENG\Geophysics\PineyRunWatershed\G_Deliverables\Report_and_Figures		CHK BY	TJK 04/16/2020

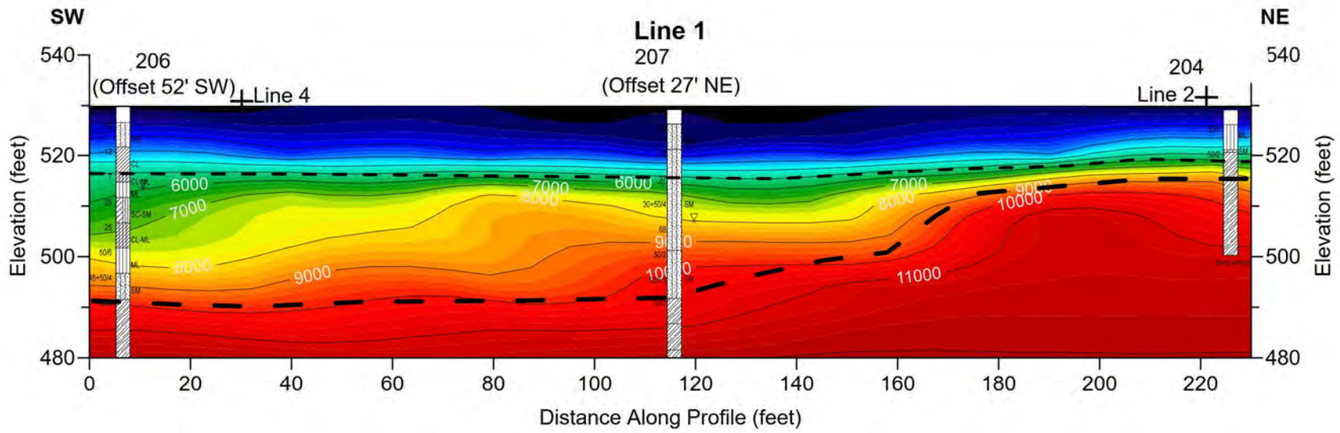
TITLE

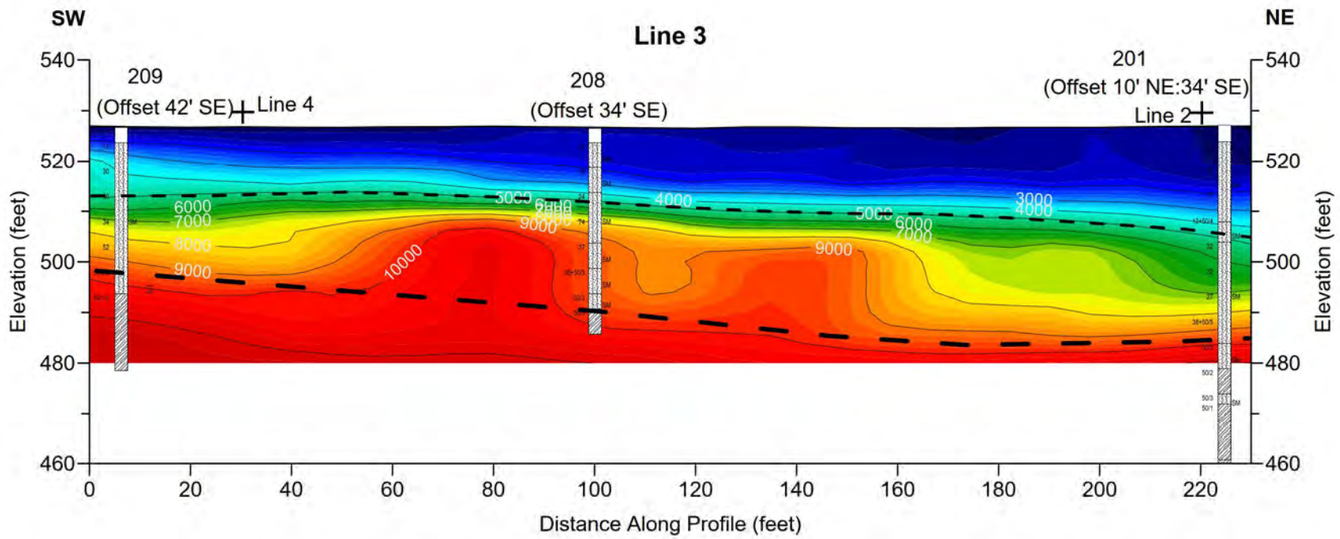
Seismic Refraction Survey Line Locations

AECOM Geophysical Services
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876

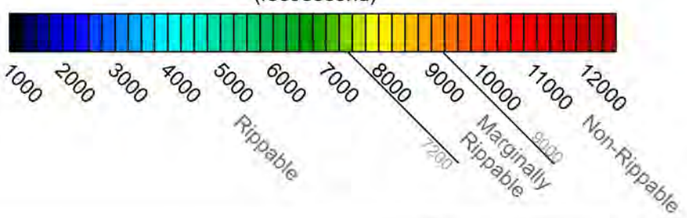
PROJ NO 60614688

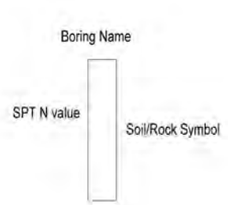
Figure F-1





Compressional Wave Velocity (feet/second)





- USCS Silty Sand
- USCS Silty Gravel
- FILL
- Water
- USCS Low Plasticity Clay
- Schist
- USCS Low Plasticity Silty Clay
- USCS Clayey Sand
- USCS Silt
- USCS Clayey Sand
- During Drilling
- At Drilling Completion
- 24 hour after Drilling
- Top of interpreted dense overburden/soft rock
- Top of interpreted competent rock

NOTES:

1. See Figure G-1 for line locations.
2. Elevations reference the North American Vertical Datum of 1988 (NAVD88) in units of feet.

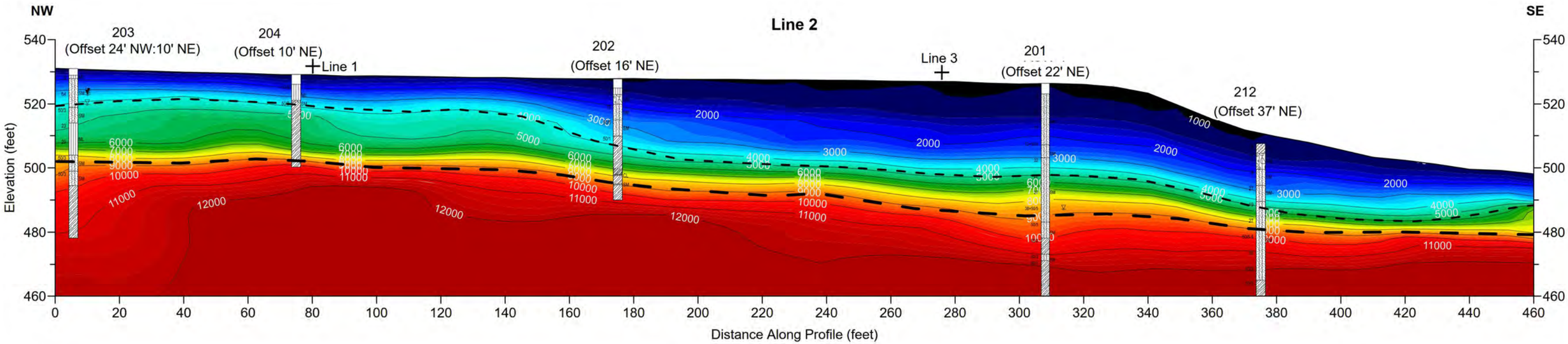
CLIENT	Carroll County Bureau of Resource Management			
PROJ	Piney Run Watershed Study			
REVISION NO	0	DES BY	MRG	04/15/2020
SCALE	1 inch = 30 feet	DR BY	MRG	04/15/2020
G:\Projects\ENG\Geophysics\PineyRun\Watershed\0_Deliverable\Report_and_Figures		CHK BY	TJK	04/16/2020

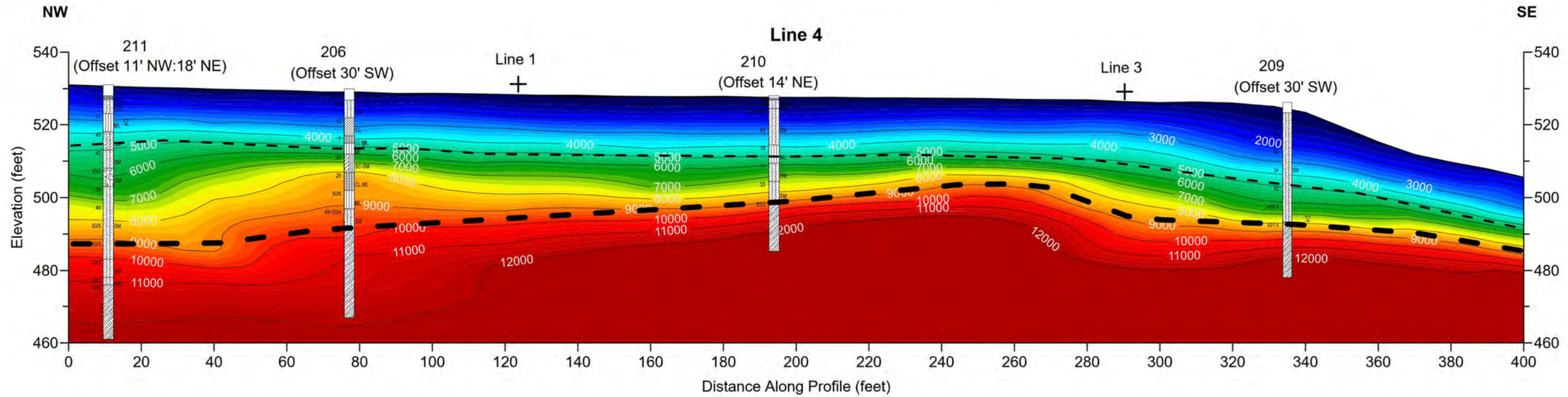
TITLE: Seismic Refraction Survey Results Lines 1 and 3

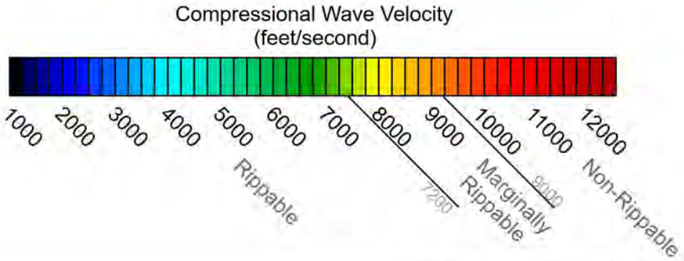
AECOM Geophysical Services
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876

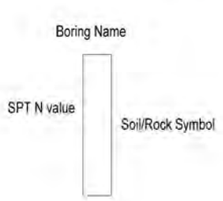
PROJ NO 60614688

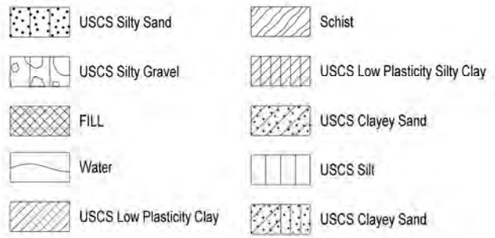
Figure F-2

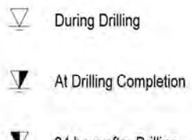


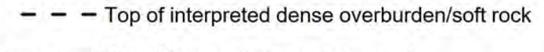












NOTES:

1. See Figure G-1 for line locations.
2. Elevations reference the North American Vertical Datum of 1988 (NAVD88) in units of feet.

CLIENT	Carroll County Bureau of Resource Management		
PROJ	Piney Run Watershed Study		
REVISION NO	0	DES BY	MRG 04/15/2020
SCALE	1 inch = 30 feet	DR BY	MRG 04/15/2020
G:\Projects\EN\GI\Geophysics\PineyRun\Watershed\G_Deliverables\Report_and_Figures		CHK BY	TJK 04/16/2020

TITLE: Seismic Refraction Survey Results Lines 2 and 4

AECOM Geophysical Services
12420 Milestone Center Drive, Suite 150
Germantown, MD 20876

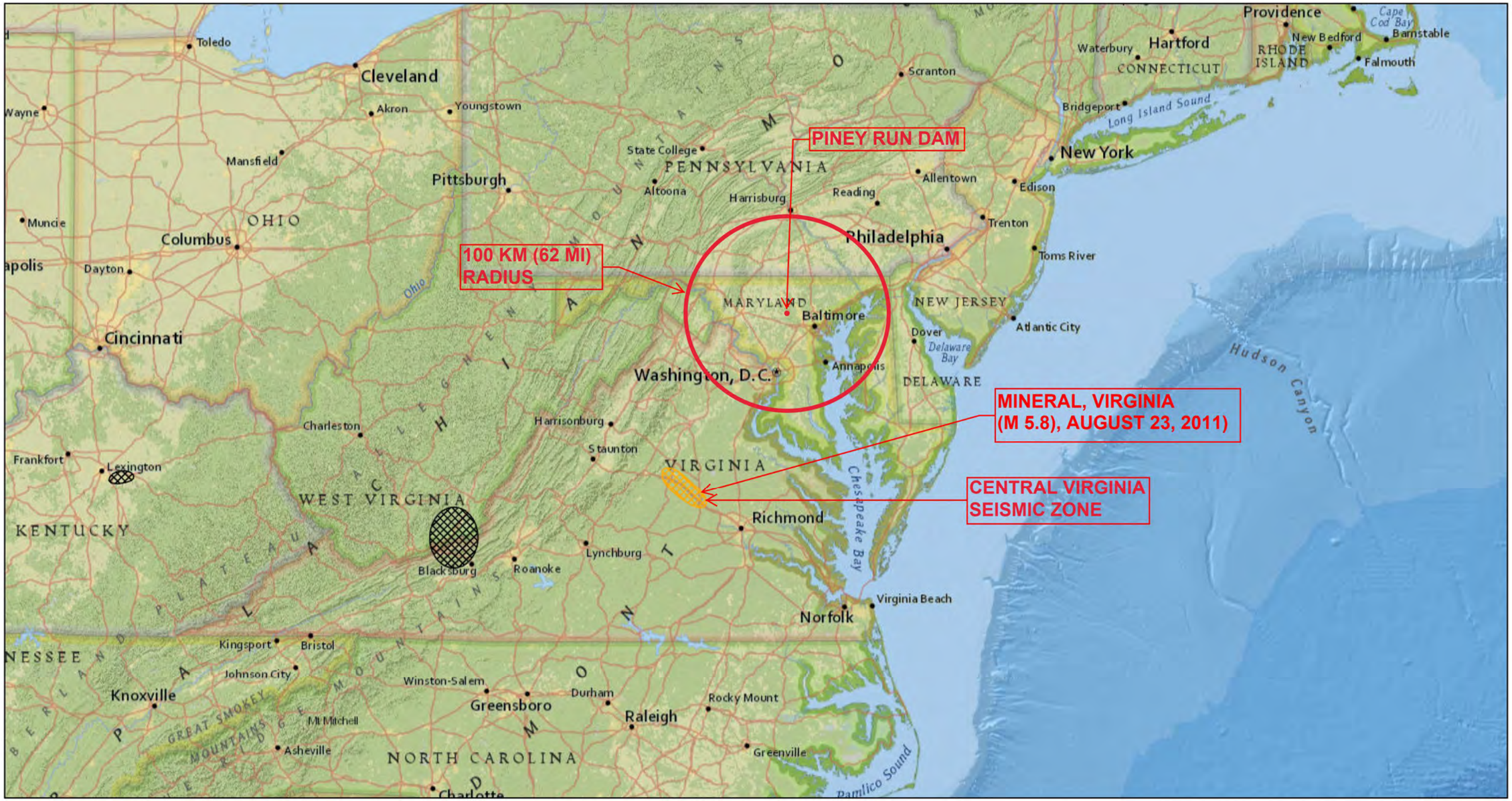
PROJ NO 60614688

Figure F-3

Appendix G – Seismic Evaluation

U.S. Geological Survey Quaternary Faults

REFERENCE : https://earthquake.usgs.gov



5/13/2020, 4:49:05 PM

1:4,622,324

0 45 90 180 mi

0 70 140 280 km

Fault Areas

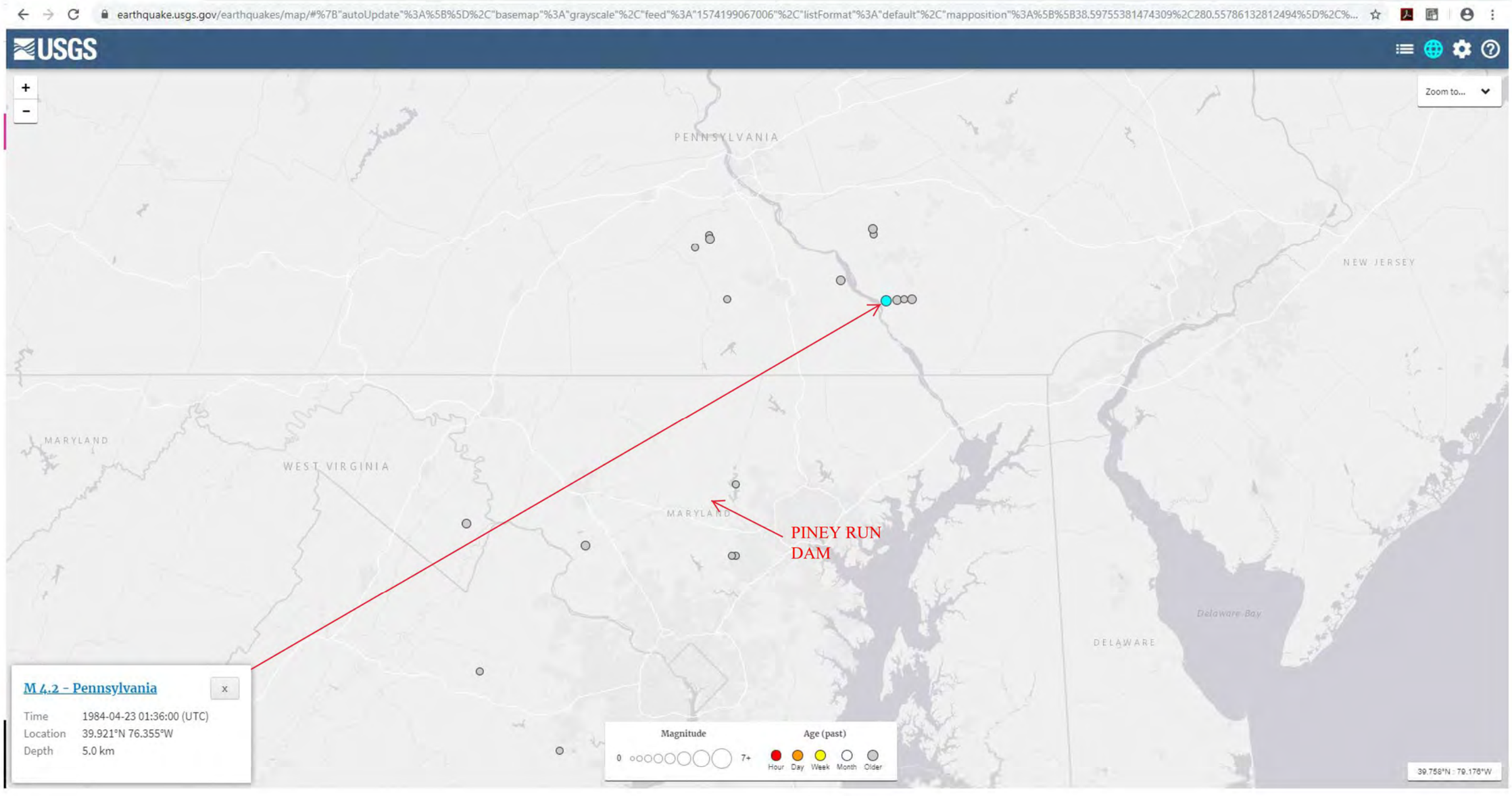
- Historic (< 150 years)
- Latest Quaternary (< 15,000 years)
- Late Quaternary (< 130,000 years)
- Middle and Late Quaternary (< 750,000 years)
- Undifferentiated Quaternary (< 1.6 million years)

Quaternary Faults Database

- Historic (< 150 years), well constrained location
- Historic (< 150 years), moderately constrained location
- Historic (< 150 years), inferred location
- Latest Quaternary (<15,000 years), well constrained location
- Latest Quaternary (<15,000 years), moderately constrained location
- Latest Quaternary (<15,000 years), inferred location
- Late Quaternary (< 130,000 years), well constrained location
- Late Quaternary (< 130,000 years), moderately contrained location
- Late Quaternary (< 130,000 years), inferred location
- Middle and late Quaternary (< 750,000 years), well constrained location
- Middle and late Quaternary (< 750,000 years), moderately constrained location
- Middle and late Quaternary (< 750,000 years), inferred location

USGS, National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

REFERENCE: https://earthquake.usgs.gov



U.S. Geological Survey - Earthquake Hazards Program

REFERENCE: https://earthquake.usgs.gov/hazards/interactive

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Conterminous U.S. 2014 (v4.0.x)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

39.388

Time Horizon

Return period in years

10000

Longitude

Decimal degrees, negative values for western longitudes

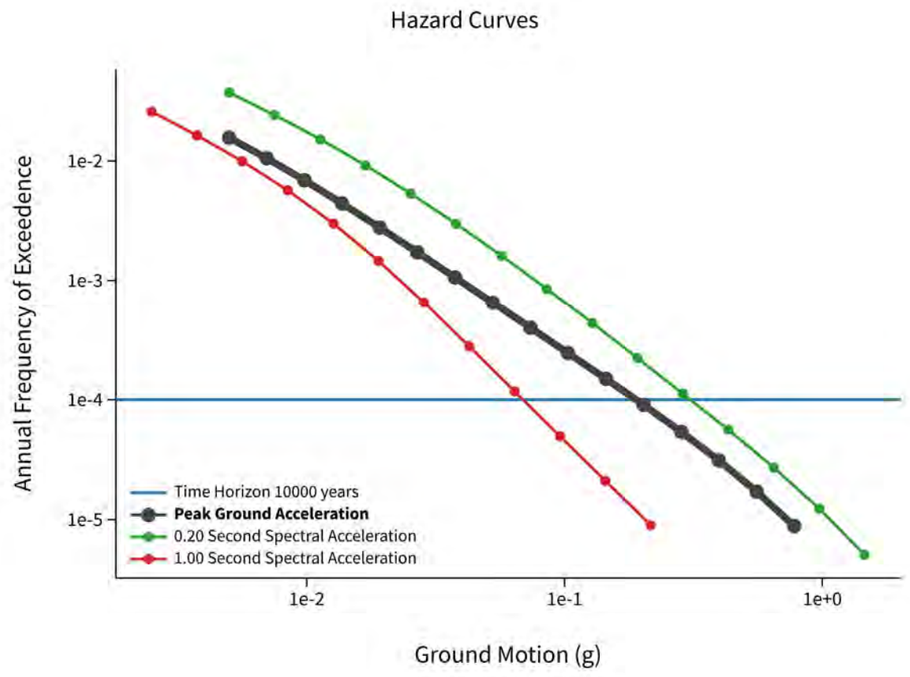
-76.976

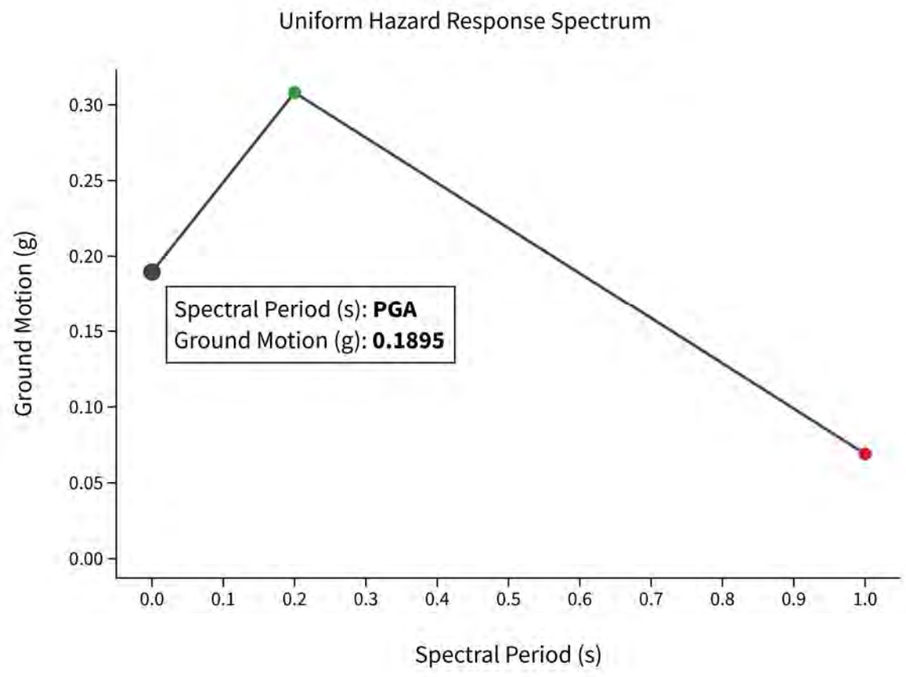
Site Class

760 m/s (B/C boundary)

REFERENCE: https://earthquake.usgs.gov/hazards/interactive

Hazard Curve





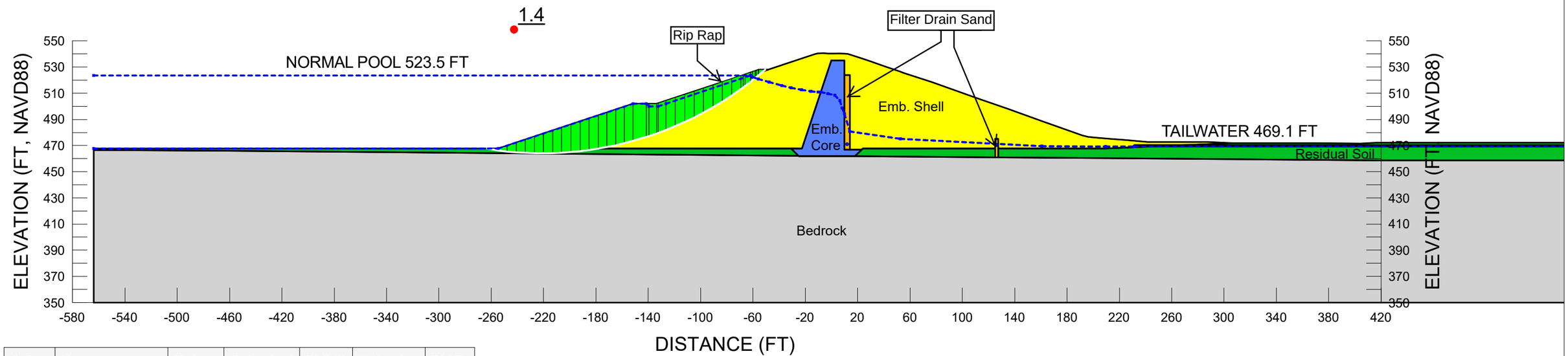
View Raw Data

Appendix H – Slope Stability Analysis Results

PINEY RUN DAM
NORMAL POOL: 523.5 FT
TAILWATER: 469.1FT
SLOPE STABILITY ANALYSIS
RAPID DRAWDOWN
UPSTREAM EMBANKMENT SLOPE

AECOM TECHNICAL SERVICES, INC.
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876
Tel: (301) 250-2934

Piney Run Dam Carroll County, Maryland		
Rapid Drawdown		
Date: May 2020	Project No.: 60614688	Checked By: NS



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Cohesion R (psf)	Phi R (°)
	Bedrock	185	114,336	0	114,336	0
	Fillter Drain Sand	130	0	35	0	35
	Residual Soil	138	0	33.1	0	26.3
	Rip Rap	135	0	40	0	40
	Zone 1 Embankment Core	135	0	34.4	0	27
	Zone 2 Embankment Shell	135	180	29.6	530	18.7

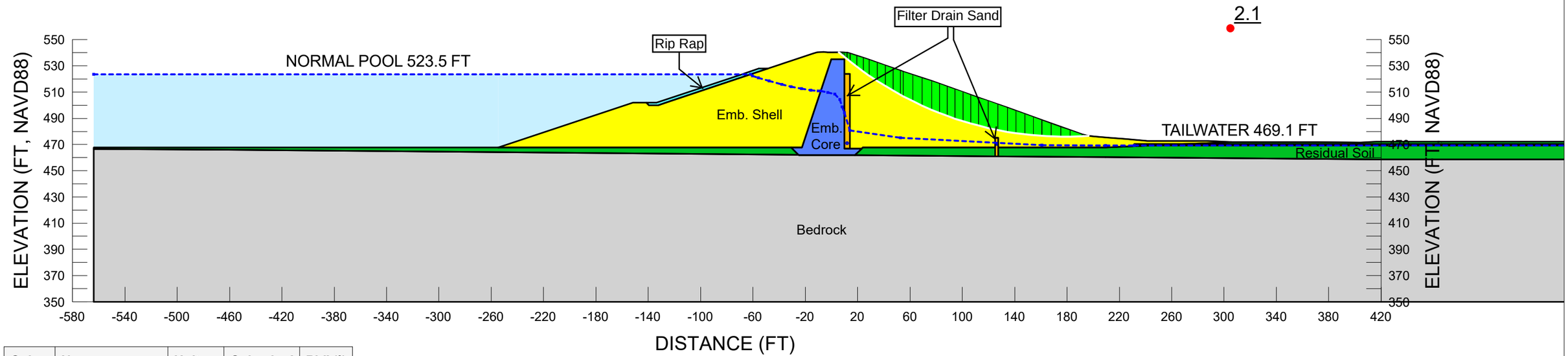
PINEY RUN DAM
NORMAL POOL: 523.5 FT
TAILWATER: 469.1 FT
SLOPE STABILITY ANALYSIS
STEADY-SEEPAGE: NORMAL POOL CONDITIONS
DOWNSTREAM EMBANKMENT SLOPE

AECOM TECHNICAL SERVICES, INC.
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876
Tel: (301) 250-2934

Piney Run Dam
Carroll County, Maryland

Steady Seepage
Steady Seepage: Normal Pool Conditions

Date: May 2020	Project No.: 60614688	Checked By: NS



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	185	114,336	0
	Fillter Drain Sand	130	0	35
	Residual Soil	138	0	33.1
	Rip Rap	135	0	40
	Zone 1 Embankment Core	135	0	34.4
	Zone 2 Embankment Shell	135	180	29.6

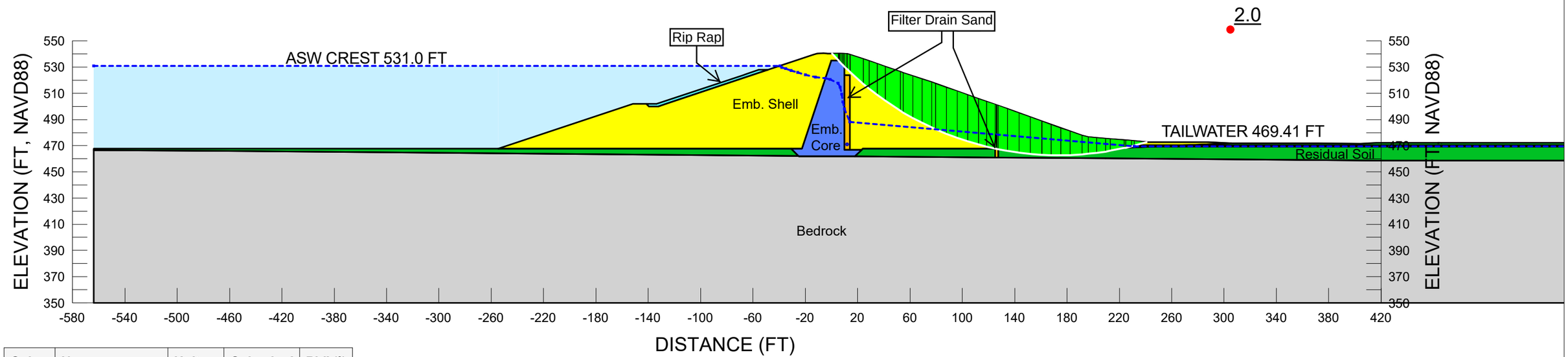
PINEY RUN DAM
ASW CREST ELEVATION: 531.0 FT
TAILWATER: 469.41 FT
SLOPE STABILITY ANALYSIS
STEADY-SEEPAGE: FLOOD SURCHARGE - ASW CREST ELEVATION
DOWNSTREAM EMBANKMENT SLOPE

AECOM TECHNICAL SERVICES, INC.
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876
Tel: (301) 250-2934

Piney Run Dam
Carroll County, Maryland

Steady Seepage
Flood Surcharge: ASW Crest Elevation

Date: May 2020	Project No.: 60614688	Checked By: NS



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	185	114,336	0
	Fillter Drain Sand	130	0	35
	Residual Soil	138	0	33.1
	Rip Rap	135	0	40
	Zone 1 Embankment Core	135	0	34.4
	Zone 2 Embankment Shell	135	180	29.6

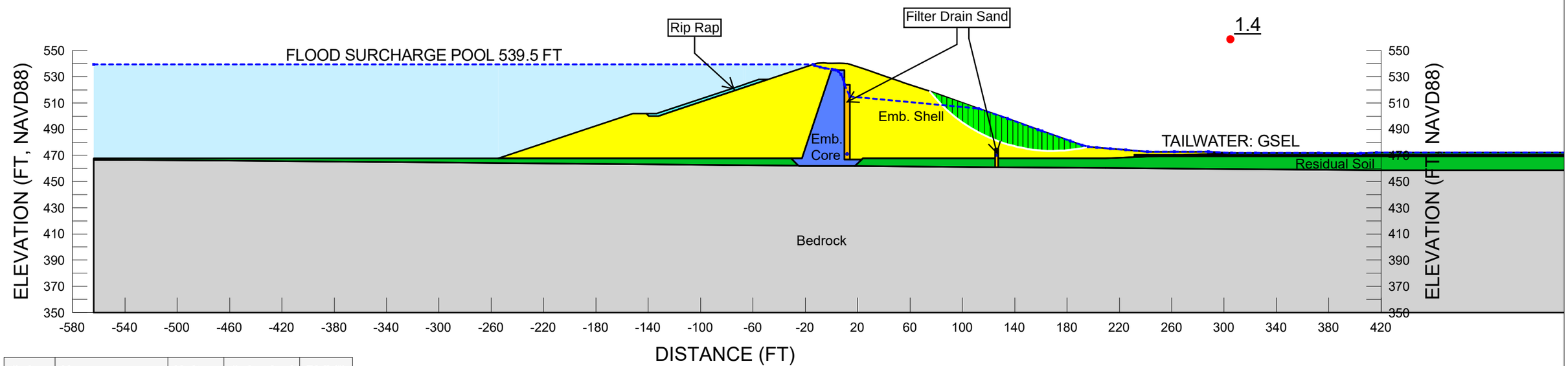
PINEY RUN DAM
FREEBOARD HYDROGRAPH ELEVATION: 539.5 FT
TAILWATER: GROUND SURFACE ELEVATION (GSEL)
SLOPE STABILITY ANALYSIS
STEADY-SEEPAGE: FLOOD SURCHARGE - FREEBOARD HYDROGRAPH ELEVATION
DOWNSTREAM EMBANKMENT SLOPE

AECOM TECHNICAL SERVICES, INC.
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876
Tel: (301) 250-2934

Piney Run Dam
Carroll County, Maryland

Steady Seepage
Flood Surcharge: Freeboard Hydrograph Elevation

Date: May 2020 | Project No.: 60614688 | Checked By: NS

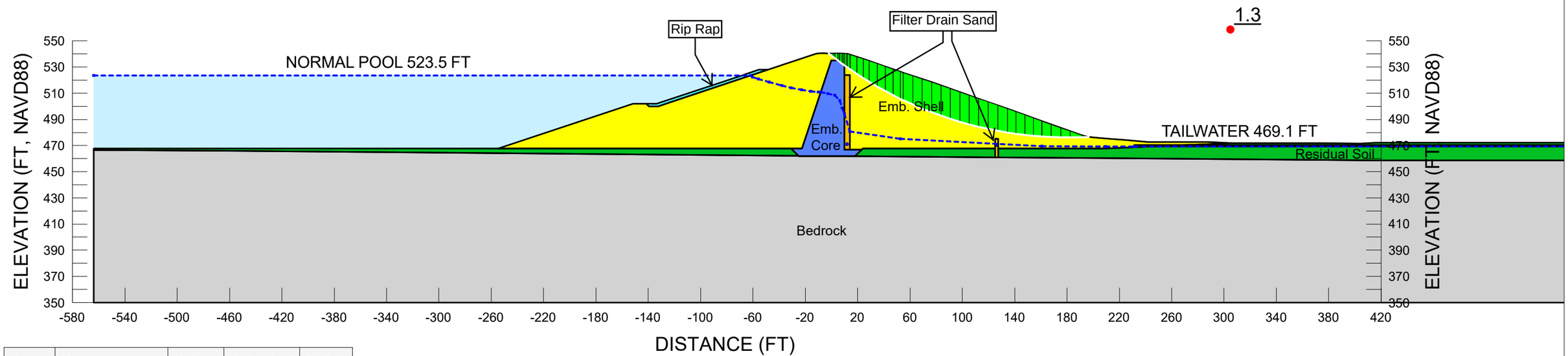


Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	185	114,336	0
	Fillter Drain Sand	130	0	35
	Residual Soil	138	0	33.1
	Rip Rap	135	0	40
	Zone 1 Embankment Core	135	0	34.4
	Zone 2 Embankment Shell	135	180	29.6

PINEY RUN DAM
NORMAL POOL: 523.5 FT
TAILWATER: 469.1 FT
SLOPE STABILITY ANALYSIS
SEISMIC ANALYSIS - NORMAL POOL CONDITIONS
HORIZONTAL COEFFICIENT: 0.1895
DOWNSTREAM EMBANKMENT SLOPE

AECOM TECHNICAL SERVICES, INC.
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876
Tel: (301) 250-2934

Piney Run Dam Carroll County, Maryland		
Steady Seepage Seismic Analysis		
Date: May 2020	Project No.: 60614688	Checked By: NS



Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Bedrock	185	114,336	0
	Fillter Drain Sand	130	0	35
	Residual Soil	138	0	33.1
	Rip Rap	135	0	40
	Zone 1 Embankment Core	135	0	34.4
	Zone 2 Embankment Shell	135	180	29.6

AECOM
12420 Milestone Center Drive
Germantown, MD 20876
aecom.com