INITIAL SAFETY FACTOR ASSESSMENT

40 CFR 257.73 (e)

Bottom Ash Pond Complex

Philo Site

Philo, Ohio

May, 2026

Prepared for: Ohio Franklin Realty

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

Philo Bottom Ash Pond Complex

Initial Safety Factor Assessment

PREPARED BY Blake Arthur, PE DATE

Digitally signed by Blake Arthur, PE
DN: cn=Blake Arthur, PE, c=US, email=barthur@aep.com
Date: 2026.05.06 11:15:00 -04'00'

Blake Arthur, P.E.

REVIEWED BY Dan Murphy DATE

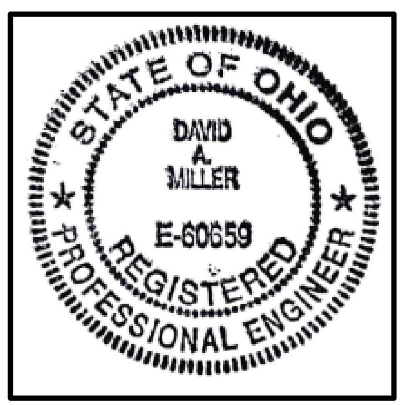
Digitally signed by Dan Murphy
DN: cn=Dan Murphy, c=US, email=dsmurphy1@aep.com
Date: 2026.05.04 14:59:23 -04'00'

Dan Murphy, P.E.

APPROVED BY David A. Miller DATE 05.04.2026

David A. Miller, P.E.

Director- Ash Management Services



I certify to the best of my knowledge, information, and belief that the information contained in this safety factor assessment meets the requirements of 40 CFR § 257.73(e)

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1.0 OBJECTIVE

The "Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Legacy CCR Surface Impoundments", 89 Fed. Reg. 38950 (May 8, 2024) (amending 40 C.F.R. §257) requires owners and operators of facilities with a legacy coal combustion residual (CCR) surface impoundment to prepare an initial safety factor assessment document for each legacy CCR surface impoundment at the facility.

The Bottom Ash Pond Complex at the Philo Site is subjected to this rule.

2.0 DESCRIPTION OF THE CCR UNIT

The Former Philo Site is located approximately 0.25 miles east of the Village of Philo, Ohio. The latitude/longitude of the facility is: 39°51'43.69"N/ 81°54'10.97"W. The Philo Plant was placed in service in October 1924 and subsequently retired in 1975.

The Bottom Ash Pond Complex is formed by a 27-foot-tall earthen embankment along the banks of the Muskingum River. The surrounding grades in the areas to the North, West and South of the Bottom Ash Pond Complex were filled in to elevate the site out of the floodplain with a variety of materials for fill.

The embankment is approximately 900 feet long. The downstream slope of the berm varies between 1.6 H:1V to 2H:1V. The interior slopes are approximately 2H:1V. The Bottom Ash Pond Complex encompasses approximately 5 acres.

3.0 SAFETY FACTOR ASSESSMENT 257.73(e)

The Initial Safety Factor Assessment was prepared by S&ME, Inc. and is included as Attachment A.

The most critical failure surfaces of the dike of the Bottom Ash Pond Complex meets the required FS values. Therefore, it is concluded that the Philo Bottom Ash Pond dikes are stable and meet the stability FS required by 40 CFR §257.73(e).

ATTACHMENT A

Initial Safety Factor Assessment Report

Philo Legacy CCR Impoundment
Periodic Safety Factor Assessment
Philo Power Plant
Philo, Ohio
S&ME Project No. 25170079

PREPARED FOR:

American Electric Power
1 Riverside Plaza
Columbus, OH 43215

PREPARED BY:

S&ME, Inc.
6190 Enterprise Court
Dublin, OH 43016

April 30, 2026

April 30, 2026

American Electric Power
1 Riverside Plaza
Columbus, OH 43215

Attention: Mr. Blake Arthur

Reference: **Periodic Safety Factor Assessment**
Philo Legacy CCR Impoundment
Philo Power Plant (former), Philo, Ohio
S&ME Project No. 25170079

Dear Mr. Arthur:

S&ME, Inc. (S&ME) has completed a Periodic Safety Factor Assessment of the Legacy CCR Impoundment at the former Philo Power Plant in Philo, Ohio. This assessment was carried out to fulfill the requirements of CFR §257.73 (e). Concurrent with the preparation of this assessment, S&ME prepared a Geotechnical Data Report and a Structural Stability Assessment for this CCR unit, which are referenced in this assessment report.

Sincerely,

S&ME, Inc.

STATE OF OHIO
DANIEL J.
TOBERGTE
E-87825
4/30/26
REGISTERED
PROFESSIONAL ENGINEER

Daniel J. Tobergte, PE
Project Engineer

Jason S. Reeves, PE (TN)
Technical Principal

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1.0 Introduction

1.1 Background

S&ME has completed a Periodic Safety Factor Assessment of the coal combustion residuals (CCR) impoundments at the former Philo Power Plant located in Philo, Ohio. This assessment was carried out to fulfill the requirements of U.S. Environmental Protection Agency Title 40 Code of Federal Regulations (CFR) § 257.73 (e), *Periodic Safety Factor Assessments*. Two CCR Units are present at this site – a bottom ash impoundment and a fly ash impoundment. Both impoundments were evaluated for this assessment.

1.2 Location, Description of CCR Units, and Geologic Conditions

The former Philo Power Plant site, as shown in Figure 1-1, is located between the east edge of Philo, Ohio and the south and west banks of the Muskingum River. The plant was constructed in 1924 and was retired in 1975. The south edge of the site is located along Duncan Falls, a tributary to the Muskingum River. Two CCR impoundments are present at the site – one dedicated primarily to bottom ash and the other dedicated primarily to fly ash. Each impoundment is described in the following paragraphs. In general, fill, presumably comprised of the nearby natural soils, was placed across the majority of the complex during construction of the plant to provide a roughly level working area. Topographic mapping developed by USGS dated 1910 (prior to construction of the plant) suggests that the ground surface elevation across the site was roughly El. 680 (20-foot contours, NAVD 29). Site topographic information used for this assessment was provided by AEP from a survey performed by Verdantas on December 21, 2026 referencing the Ohio State Plane South coordinates, NAD 83 and NAVD 88. The cross sections generated for this analysis were based on this survey.

The Bottom Ash Impound and the Fly Ash Impound have each been classified as a "Significant hazard potential CCR surface impoundment" in accordance with CFR §257.53.

The site is located in the Muskingum-Pittsburgh Plateau Region in the unglaciated portion of Ohio. This region is broadly characterized by a highly dissected plateau with moderate to high relief. The natural soils generally consist of outwash, lacustrine sediments, and colluvium derived from local bedrock. As the CCR impoundment is situated along the Muskingum River, the natural soils at the site consist of alluvium, confirmed by the recently completed geotechnical borings performed along the embankments. Bedrock in the region generally consists of shale, siltstone, sandstone, conglomerate, and lesser amounts of limestone, clay, flint, and coal from the Pennsylvanian-age.

Figure 1-1 – Former Philo Plant (2020 OGRIP Image)

1.2.1 *Bottom Ash Impoundment Embankments*

The bottom ash impoundment, currently dry, is contained by embankments along the east and west sides and the surrounding ground surface to the north. The east and west embankments converge at the south end of the site. The east embankment is situated along the banks of the Muskingum River, and the west embankment is located along the former coal storage area pit situated in the middle portion of the plant site. The east embankment is approximately 750 linear feet in length with a height difference of approximately 46 feet between the crest and the bed of the Muskingum River. The height difference is approximately 15 to 20 feet between the embankment crest and the bottom of the impoundment. The embankment side slopes are inclined at approximately 2H:1V for both the inboard and outboard slopes. The crest width of the east embankment is approximately 40 feet. The elevation of the crest of the east embankment is approximately El. 701 to El. 702 feet. The west embankment is approximately 500 feet long with a maximum height difference of approximately 20 feet between the crest and the bottom of the impoundment (inboard side) and the coal storage pit (outboard side). Side slopes along the west embankment are at inclinations of approximately 2H:1V and 5H:1V for the inboard and outboard slopes, respectively. The crest width of the west embankment is approximately 20 feet. The elevation of the crest of the west embankment is approximately El. 701 to El. 702 feet. The embankments were constructed primarily of bottom ash overlying fill soils which were placed over the natural alluvial soils. It is unknown whether these basins stored CCR material after their construction in approximately 1974 prior to the plant closure in 1975.

1.2.2 Fly Ash Impoundment Embankments

The impoundment is approximately 24 acres in size, of which approximately half was used for "dry" ash storage and half was used for fly ash storage. The "dry" ash storage area is bounded by a relatively short railroad embankment (less than about 5 feet in height) with a crest elevation of approximately El. 690 feet along the west side and the fly ash storage area to the east and south (ground surface elevation of approximately El. 700 feet); the ground surface gradually increases in elevation towards the east and south to meet the fly ash area.

The fly ash storage area is surrounded by an embankment with generally a consistent crest elevation of approximately El. 698 feet to El. 702 feet along the south and east sides and decreases to approximately El. 696 feet within the western portion between the "dry" ash and fly ash storage areas. The approximate elevation of the ground surface within the bottom of the impoundment is El. 685 feet, which is situated within the western portion of the "dry" ash storage area and within the southern portion of the fly ash storage area. Considering this assessment focuses on the stability of the impoundment, the portions of this report pertaining to the embankments will focus on the east and south embankments (referred to throughout this report as "embankment") as these appear to be the more critical aspects of the impoundment.

The embankment is approximately 2,000 linear feet in length with a height difference between the crest and the bed of the Muskingum River of approximately 47 feet. The embankments were constructed primarily of bottom ash with an outboard slope inclination of 2H:1V and an apparent inboard slope inclination of 2H:1V. The width of the crest is approximately 20 feet. According to historical documentation, the south outboard slope (situated along Duncan Run) includes a graded filter with rock protection along the face.

1.3 Previous Investigations and Assessments

Available information (refer to Section 3.0) includes a Data Gap Investigation report (AECOM, 2025) which generally consisted of defining the thickness of the CCR materials across the site using hydraulically pushed soil probes and groundwater level information from recently-installed groundwater monitoring wells by AECOM. These groundwater levels were used to develop the groundwater conditions for the stability analysis and are summarized in Appendix II. To our knowledge, a safety factor assessment has not been performed for these two CCR impoundments.

2.0 Scope

A Periodic Safety Factor Assessment for CCR Surface Impoundments, as defined by CFR §257.73 (e), is intended to assess whether the calculated factors of safety meet or exceed the minimum required safety factors per the regulation for the CCR unit. One cross section comprising the most susceptible of all cross sections to structural failure (based on appropriate engineering considerations and loading conditions) for each unit is to be evaluated. These minimum safety factors are summarized below:

i. Static, long-term conditions for the maximum storage pool shall meet or exceed a safety factor of 1.50. As the long out of service CCR impoundments do not retain a normal pool, the existing groundwater table was considered as the maximum storage pool.
ii. Static conditions for the maximum surcharge pool shall meet or exceed a safety factor of 1.40. For this condition, the existing groundwater table within the retained material / foundation soils will be used along with a surcharge of free water acting on the ground surface of the retained material based on the design storm (1,000-year storm event) as determined by others.
iii. Seismic conditions shall meet or exceed a safety factor of 1.00.
iv. Dikes (herein identified as "embankment(s)") with soils susceptible to liquefaction shall meet or exceed a safety factor of 1.20 for liquefaction conditions.

Additionally, S&ME performed a rapid drawdown analysis for the outboard slope of the embankments to model a 100-year storm event for the Muskingum River based on Federal Emergency Management Agency (FEMA) flood hazard maps for the area. An H&H analysis for a 1,000-year storm event for the Muskingum River was not performed and would require a large amount of effort as the Muskingum River serves as a major drainage pathway for mid- to eastern-portion of Ohio.

3.0 Information Review and Site Visit

S&ME has completed subsurface investigations and stability analyses of the embankments for these CCR impoundments. Additionally, S&ME has completed the Structural Stability Assessment, issued under separate cover. In preparation of this Safety Factor Assessment, S&ME conducted a cursory review of documents relating to the planning of the CCR impoundment embankments and conducted a site visit at the facility. S&ME has the following documents in our files:

- AEP Dr. No. 16-3925-1, "Bottom Ash Storage Area Existing Topography As Of Fall 1972", Rev. 1, date illegible
- AEP Dr. No. 16-3926-2, "Bottom Ash Storage Area Dikes", Rev. 2, date illegible
- AEP Dr. No. 16-5112-2, "Plant Layout Outfalls to River", Rev. 2, dated November 17, 1971
- AEP internal letter, "Ohio Power Company – Philo Plant – Repairs to Fly Ash Dike", dated January 31, 1972
- Data Gap Investigation report (draft version) prepared by AECOM dated March 2025, provided to S&ME by AEP on July 1, 2025.
- Water level measurements from the recently-installed AECOM water monitoring wells, provided to S&ME by AEP on February 5, 2026.

- Inflow Design Flood Control System Plans for the Bottom Ash Pond and the Fly Ash Pond have been prepared by AECOM (dated April 17, 2026) including an H&H analysis based on the 1,000-year storm event. These reports were provided to S&ME by AEP on April 20, 2026.

The information included in the referenced documents were used to generate stability models for both impoundments. A summary of the AEP drawings, the AEP internal letter, and the Data Gap Investigation report are provided in the Periodic Structural Stability Assessment report. The water level measurements from the AECOM water monitoring wells and the results of the H&H analysis performed by AECOM are included in this report and are summarized in Appendix II.

On July 7, 2025, Mr. Mike Rowland, Mr. Jason Reeves, and Mr. Dan Tobergte of S&ME met with Mr. Blake Arthur, Mr. Dan Murphy, and Mr. Dave Fry of AEP at the former Philo Plant and conducted a site visit at the CCR impoundments. The group walked the length of the embankments and inspected/assessed the features per the requirements of CFR §257.73 (d). At the time of the site visit, the majority of the entire site (including beyond the limits of the CCR impoundments) had been cleared of a significant amount of woody vegetation, and mulching was nearing completion. Dense vegetation including relatively closely-spaced mature trees were present along the entire outboard slopes of the embankments. Also at the time of our site visit, AECOM was installing groundwater monitoring wells at the site. The deepwell pumphouses along the crest of the embankment for the bottom ash impoundment had been located by AEP, and at the time of our site visit had been partially exposed. S&ME understands that AEP is currently planning on adequately closing/abandoning these deepwells and housing structures.

The surface of the embankments generally appeared to be in good condition with no obvious indication of sinkholes, differential settlements, sloughing, or erosion.

4.0 Slope Stability Analyses

4.1 Limit Equilibrium Analyses

4.1.1 Overview

Based on the configuration of the CCR impoundments (namely, the height of the embankment and the steepness of the outboard slope), the subsurface conditions encountered, and the loading conditions both currently and anticipated during the design storm event, one analysis cross-section was selected for each CCR impoundment to represent the most critical area of the embankments. Subsurface information was obtained by performing test borings through the crest of the embankments and seismic geophysical tests at select locations (both downhole and surface seismic tests were performed). Information from the geotechnical exploration including soil boring logs, seismic geophysical testing, and a summary of laboratory testing is included in the Geotechnical Data Report for the Philo Legacy CCR. Note that in order to obtain good-quality tests for liquefaction susceptibility analysis, the test borings were performed using the mud-rotary method of drilling for the full-depth of the borings; therefore, groundwater level information was not measured during drilling for these borings. Water levels for the stability analysis were obtained by the recent water level readings from the water quality monitoring wells installed by AECOM and are presented in Appendix II.

4.1.2 Discussion of Embankment and Subsurface Conditions

4.1.2.1 Embankment Geometry and Subsurface Profile

The embankment geometry and the subsurface profiles for the bottom ash impoundment and the fly ash impoundment are summarized in the following paragraphs. The subsurface profile used in the stability model for the impoundment embankments was generated based on the findings and results of the recently completed geotechnical investigation performed at the site. Although the subsurface conditions appear to be generally similar across both impoundment embankments, separate subsurface profiles were considered for each embankment analyzed due to varying depths between materials at the analyzed cross sections. The borings were drilled utilizing the mud-rotary method in an attempt to obtain more accurate Standard Penetration Test values for use in liquefaction screening analysis and strength parameter development. The Boring Logs and laboratory test results are included in Appendix III.

<u>Bottom Ash Impoundment</u>

As indicated in Section 1.0, the east embankment crest (El. ~701 feet to El. ~702 feet) is approximately 45 feet above the bottom of the Muskingum River (El. ~654 feet) and approximately 20 feet above the bottom of the impoundment (El. ~680 feet). The embankment side slopes are inclined at approximately 2H:1V for both the inboard and outboard slopes. The crest width of the east embankment is approximately 40 feet. The west embankment crest is similar in elevation to the east embankment; however, failure of the west embankment would discharge material into a nearby storage pit and keep the material on-site. As such, only the east embankment was analyzed for a safety factor assessment.

A total of five borings (designated as Borings B-09 through B-13) were performed between September 24, 2025 and October 1, 2025 at the locations depicted in the Plan of Borings included in Appendix I. Borings B-09 through B-11 were performed within the crest of the east embankment. The subsurface profile for the cross-section analyzed for this impoundment is summarized in the following paragraphs.

The embankment consisted of approximately 18 to 23 feet of bottom ash classified as poorly graded sand (SP), poorly graded sand with silt (SP-SM), and silty sand (SM) per the Unified Soil Classification System (USCS). This CCR material exhibited a very loose to very dense relative density rating.

Beneath the embankment, fine-grained fill soils were encountered to depths ranging from 28 to 41 feet below the existing ground surface with a range in thickness of approximately 6 to 12 feet. These soils generally consisted of soft to stiff lean clay (CL) within the northern and middle portions and silt (ML) and silty sand (SM) within the southern end of the embankments.

Beneath the fill soils, natural alluvial soils were encountered to refusal conditions in sandstone bedrock at depths of approximately 87 to 88 feet below existing grades for all borings except Boring B-11 (northern-most boring) which encountered refusal conditions at a depth of approximately 53 feet below existing grade. The alluvial soils generally consisted of alternating layers of poorly graded and well graded sand with varying amounts of silt size particles. These soils exhibited a loose to very dense relative density rating.

Fly Ash Impoundment

Similarly indicated in Section 1.0, the embankment crest along the east and south sides of the fly ash impoundment (El. ~694 feet to El. ~705 feet) is approximately 41 to 52 feet above the bottom of the Muskingum River (El. ~653 feet). The outboard side slope has an inclination of approximately 2H:1V and an apparent inboard slope inclination of 2H:1V. The width of the crest is approximately 20 feet. According to historical documentation, the south outboard slope (situated along Duncan Run) includes a graded filter with rock protection along the face.

A total of eight borings (designated as Borings B-01 through B-08) were performed between September 11, 2025 and September 23, 2025 at the locations depicted in the Plan of Borings included in Appendix I. The subsurface profile for the cross section analyzed for this impoundment is summarized in the following paragraphs.

The embankment consisted of approximately 18 to 26 feet of bottom ash classifying as poorly graded sand (SP), poorly graded sand with silt (SP-SM), and silty sand (SM) per the Unified Soil Classification System (USCS). This CCR material exhibited a very loose to very dense relative density rating. Fly ash was encountered within the embankment in Borings B-05 through B-08 (northern portion of the fly ash impoundment embankment), generally deeper within the embankment. The fly ash material consisted of silt and sandy silt (ML) per the USCS and exhibited a very soft to hard consistency rating.

Beneath the embankment, fine-grained fill soils were encountered to depths ranging from 30 to 47 feet below the existing ground surface with a range in thickness of approximately 7 to 25 feet. At the locations of Borings B-01 to B-03 and B-06, these soils consisted of lean clay (CL), silty clay (CL-ML), silt (ML), and sandy silt (ML) and exhibited a consistency ranging from very soft to very stiff. At the locations of Borings B-04, B-05, B-07, and B-08, these soils consisted of silty sand (SM) with a relative density ranging from very loose to dense.

Beneath the fill soils, natural alluvial soils were encountered to refusal conditions in sandstone bedrock at depths of approximately 44.5 to 86.0 feet below existing grades at all boring locations except Boring B-06 (situated about midway between the north and south ends of the east embankment). Based on record drawings provided by AEP, Boring B-06 appears to have been situated within an abandoned canal presumably filled in at the time of the plant construction. The alluvial soils generally consisted of alternating layers of poorly graded and well graded sand with varying amounts of silt size particles. These soils exhibited a loose to very dense relative density rating.

Note that the uppermost portion of the alluvial soils at the location of Boring B-04 consists of soft cohesive soil to a depth of approximately 47 feet below the existing grade. Although this cohesive zone appears to be naturally placed, this has been considered part of the fill soils in the stability model due to the similarity in anticipated soil behavior based on visual-manual classification procedures.

Refusal on sandstone bedrock was encountered at depths ranging from 44.5 to 86.0 feet below existing grades with the shallower bedrock at the locations of Borings B-05, B-06, and B-07. Bedrock was cored at the location of Boring B-04 for a depth of approximately 20 feet after reaching refusal conditions. The sandstone core samples generally exhibited poor rock quality designations (RQD ranged from 0 to 40 percent) with 92 to 96 percent core recovery.

4.1.2.2 Groundwater Table and Phreatic Surface

According to information provided by AEP, the groundwater elevations as measured in August and November of 2025 ranged from El. 661 feet to 666 feet at the locations of the groundwater monitoring wells installed by AECOM in 2025. Based on the OSIP I LiDAR survey data, the normal river elevation is roughly El. 665 feet. The top of the alluvial layer encountered at the boring locations performed by S&ME varied from approximately El. 650 feet to El. 675 feet with the cohesive soils not present at some boring locations above the alluvial layer. Based on this information, it appears that the groundwater table beneath the site is similar to the elevation of the Muskingum River. Although long-term measurements (over the course of a year or more) at the locations of the groundwater monitoring wells have not yet been recorded, both impoundments have not been observed to hold water throughout the course of a year. As such, a steady-state seepage analysis was not performed for the site, and the groundwater surface was modeled as a horizontal line at El. 664 feet.

4.1.2.3 Surcharge Pool Summary

As indicated in Section 3.0, AECOM performed a H&H study of the site for a 1,000-year storm event. Based on this analysis, pool elevations of El. ~688 feet and El. ~692 feet have been estimated for the Bottom Ash Impoundment and Fly Ash Impoundment, respectively. The stability analysis for the Bottom Ash Impoundment area includes a surcharge load within the basin representing this flood event. A seepage analysis was not considered for this storm event as the vegetated ground surface is expected to be less permeable than the underlying bottom ash material. The pool is expected to only be in place for a relatively short duration as it is believed that the water will either infiltrate downwards or evaporate at a faster rate than the impounded water establishing a phreatic surface within the embankment that would thereby decrease its stability. The stability analysis for the Fly Ash Impoundment does not include a surcharge load as the pool surcharge will be situated far enough away from the critical cross-section of the embankment so as not to impact its stability.

4.1.2.4 Seismicity

The seismic coefficient used for the stability analysis at this site was estimated using the procedure recommended in the U.S. Environmental Protection Agency (USEPA) RCRA Subtitle D (258) *Seismic Design Guidance for Municipal Solid Waste Landfill Facilities* (EPA/600/R-95/051) dated 1995 (termed "guidance document" in this section). The site was classified according to the table included in Chapter 4, Step 1 of the guidance document, based on the average shear wave velocities measured during the geophysical seismic tests performed at the site.

In addition, the average field N-values measured during the Standard Penetration Tests performed at the boring locations were correlated with shear wave velocities using Table 20.3-1 of ASCE 7-10 to confirm that the results of the geophysical tests were appropriate across the length of the embankments. The site classification was then used to estimate free field peak ground accelerations using Figure 4.5 (Kavazanjian and Matasović, 1994) by selecting the corresponding curve or interpolating between curves as appropriate.

The peak acceleration at the top of the embankment was estimated based on the free field peak ground acceleration and Figure 4.6 (Singh and Sun, 1995). The peak acceleration at the top of the embankment was then used to estimate the maximum acceleration at the base of the embankment using Figure 4.7 (Kavazanjian and Matasović, 1995) which was used as the seismic coefficient for the pseudo-static stability analysis.

The base rock peak ground acceleration (PGA) was estimated to be 0.050g per the USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/) for the 2 percent in 50-year earthquake event (2,475-year event). Based on the results of the seismic geophysical tests, a site classification of "Medium Stiff" as assigned to this site. Following the guidance document, the free field peak ground acceleration for a "Medium Stiff" site was taken as the average between the soft curve and the rock curve from Figure 4.5 and the maximum acceleration at the base of the embankment was estimated to be 0.108g. The seismic coefficient estimate calculation is provided in Appendix IV.

4.1.3 Soil and Rock Parameters

The shear strength parameters estimated for the CCR material, cohesive soils (comprising primarily of fill soils but includes cohesive alluvial soils as these soils were encountered generally within the same elevation range), and alluvium layers for the stability analyses were evaluated considering the results of the borings, laboratory testing results, and empirical correlations. A summary of the shear strengths estimated for the stability analysis are provided in Table 4-1. A summary of the development of the estimated shear strength parameters are included in Appendix IV.

Hydraulic conductivity parameters were developed in preparation of the stability analysis to assess the behavior of the soils during a rapid drawdown condition of the Muskingum River. As indicated in Section 4.1.2, a seepage analysis was not performed. These hydraulic parameters are presented in Appendix IV.

Table 4-1 - Shear Strength Parameters

Material Description	γ_T *(pcf)*	*Undrained*		*Effective*		*Reference*
		C (psf)	ϕ (deg)	c' (psf)	ϕ' (deg)	
CCR Material	110	50	32	50	32	SPT Correlations and Engineering experience
CCR Material (Seismic Loading)	110	200	20	50	32	Engineering experience
Cohesive Soils	120	250	17	100	32	Unit Weight, Undrained, Effective: CU Triaxial Tests.
Alluvium	125	0	36	0	36	SPT Correlations & Engineering experience
Rock	"Impenetrable"					Engineering experience

4.2 Liquefaction Potential of Embankment Soils

Materials located above the water table are considered not to be liquefiable, since saturation is required to initiate liquefaction. In addition, materials with clay-like behavior are resistant to liquefaction or cyclic softening. The Boulanger & Idriss (2008) along with the Bray & Sancio (2006) criteria were considered whether the materials exhibit clay-like behavior including a Plasticity Index (PI) greater than 7, a fines content (FC) greater than 50 percent, and a ratio of water content (w_c) to Liquid Limit (LL) less than 0.85. This screening was considered during the liquefaction susceptibility analysis.

Liquefaction screening analysis was performed for the embankment and foundation materials based on the Youd et al. (2001) N-value method, which considers the cyclic stress ratio (CSR) at the depth of the respective layer and the cyclic resistance ratio (CRR) of the layer. The analysis used a site modified peak ground acceleration of 0.108g and an embankment crest acceleration of 0.36g. For layers situated within the embankment, the acceleration of the respective layers were estimated using the Kavazanjian & Matasović, (1995) method indicated in Section 4.1.2.4 and were used to calculate the CSR with depth. The CRR of the individual analysis layers was estimated based on the corrected clean sand $(N_1)_{60}$ – values and estimated fines content for each material.

The analysis indicates that the factor of safety against liquefaction triggering for the analyzed soils have values of 1.0 or greater, or are otherwise too stiff/dense to liquefy per this method, and are not considered susceptible to liquefaction. In addition, the Liquefaction Probability Index (LPI) of the soil was estimated to be less than 1, indicating a low probability of liquefaction. Therefore, post-earthquake slope stability analysis using reduced shear strengths for liquefiable materials was not required for this site and was not performed.

4.3 Summary of Results

A summary of the computed safety factors for the critical cross-section is provided in Table 4-2 based on the loading conditions. Also referenced in the table are the minimum values defined in 40 CFR § 257.73(e)(1) subparts (i) through (iv). Graphical output corresponding to the analysis cases are presented in Appendix IV.

Table 4-2 – Safety Factor Summary

CCR Impoundment	Analysis Case	Min. Safety Factor	Computed Safety Factor
Bottom Ash Impoundment	Long-term, maximum storage pool	1.50	1.49
	Maximum surcharge pool	1.40	1.49
	Pseudo-static seismic loading	1.00	1.18
	Embankment Liquefaction	1.20	Non-liquefiable
Fly Ash Impoundment	Long-term, maximum storage pool	1.50	1.32
	Maximum surcharge pool	1.40	Not applicable
	Pseudo-static seismic loading	1.00	1.13
	Embankment Liquefaction	1.20	Non-liquefiable

The post-earthquake analysis considering embankment liquefaction was not evaluated, since liquefaction triggering analysis did not identify liquefiable zones within the embankment.

As indicated in Section 4.1.2.3, during the 1,000-year storm event, water collects within the normally dry Fly Ash Impoundment along the southern portion and not along the east embankment. To this end, the critical cross section will not be impacted by the maximum pool surcharge. As such, this case was not evaluated for this embankment section. Note, the maximum pool surcharge pool condition was evaluated for the cross-section through the Bottom Ash Impoundment.

Although not included with the required analysis case, a rapid drawdown condition of the Muskingum River was evaluated based on a 100-year storm event per FEMA mapping using the Duncan, Wright, and Wong (1990) method. The safety factor for this case was computed to be 1.43 for the Bottom Ash Impoundment and 1.28 for the Fly Ash Impoundment. According to industry-standard guidance (US Corps of Engineer's EM 1110-2-1902 *Slope Stability* and EM 1110-2-1913 *Design and Construction of Levees*), the minimum safety factor for rapid drawdown ranges from 1.1 to 1.3 for "New Earth and Rock-Fill Dams" depending on the pool elevation prior to the drawdown and 1.0 to 1.2 for levees depending on whether a pool exists along the slope of the levee. As such, the stability of the embankment during rapid drawdown conditions of the Muskingum River and Duncan Run are acceptable per these documents.

Based on the stability analysis performed, the computed factors of safety meet or exceed the regulatory factors of safety requirements for the surcharge, pseudo-static, and rapid drawdown loading cases analyzed. The long-term factor of safety for the Bottom Ash Impoundment is just below the minimum safety factor required per 40 CFR § 257.73(e); however, it is considered an acceptable safety factor (Safety Factor of 1.49 vs. 1.50).

The factor of safety for the Fly Ash Impoundment is below the minimum required safety factor (Safety Factor of 1.32 vs. 1.50). It should be noted that the failure surface estimated by the computer program for the long-term condition for the Fly Ash Impoundment embankment is situated within the CCR material embankment and represents a relatively shallow maintenance-type failure. Based on the model, the lowest factor of safety calculated was 1.65 for a deep seated failure that penetrates the foundation soils, which is above the minimum required safety factor of 1.50.

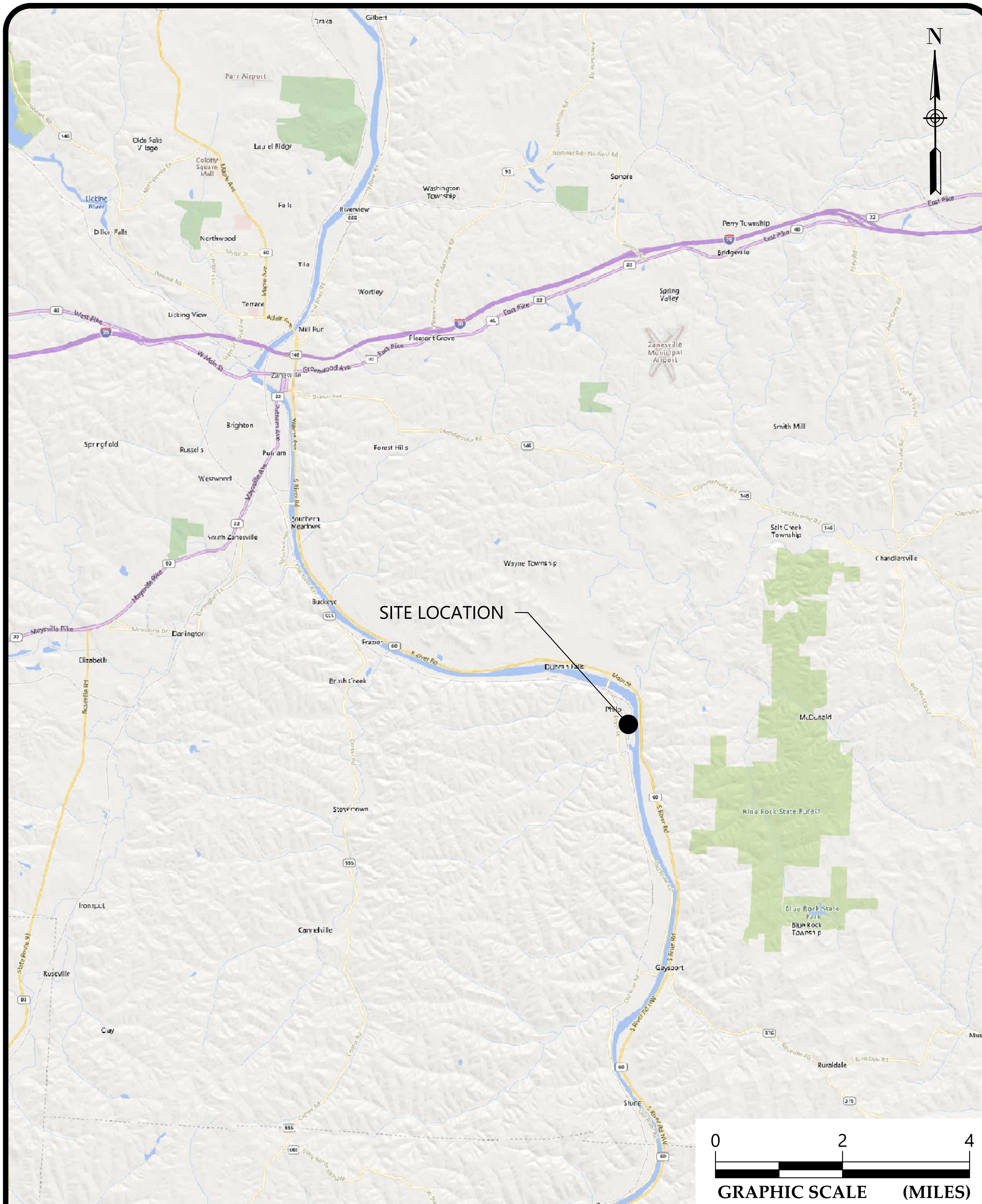
Given the subsurface conditions encountered at the time of drilling, the recently completed borings, and the duration of time since the plant ceased operations, long-term conditions are believed to have established along the embankments with no indications of slope failure (i.e. leaning trees, sloughs, sinkholes, scarps, etc.). S&ME understands that AEP intends to close the legacy CCR in accordance with 40 CFR § 257 in the relatively near future. As such, S&ME recommends that the stability of the embankments be improved at the time of closure activities. An increase in embankment stability at this site can be achieved by flattening the outboard slope of the embankments to a flatter grade, constructing a weighted filter overlay, or other means to meet the required minimum factor of safety. This conclusion assumes that the modeled embankment geometry, material properties, material strengths, and pore pressure conditions are representative of the actual embankment conditions.

5.0 Certification

Based on our current assessment of the CCR Impoundment facility, S&ME certifies that this assessment largely meets the requirements of paragraphs (e)(1) and (e)(2) of Part 257.73 for the critical cross-section identified at the two impoundments located at the former Philo Power Plant. As discussed, factors of safety less than that required by Part 257.73€(1)(i) were computed for relatively shallow failures within the CCR material. This scenario generally represents a more shallow maintenance-type failure. Deeper seated failure scenarios extending through the dam foundation indicated a factor of safety meeting the factor of safety requirements. Given that these impoundments have been out of service for about 50 years and do not contain water outside of significant rain events, it is believed that this factor of safety does not pose an undue risk of dam failure provided that regular inspections are performed, and shallow sloughs are repaired and maintained.

Appendices

Appendix I – Figures



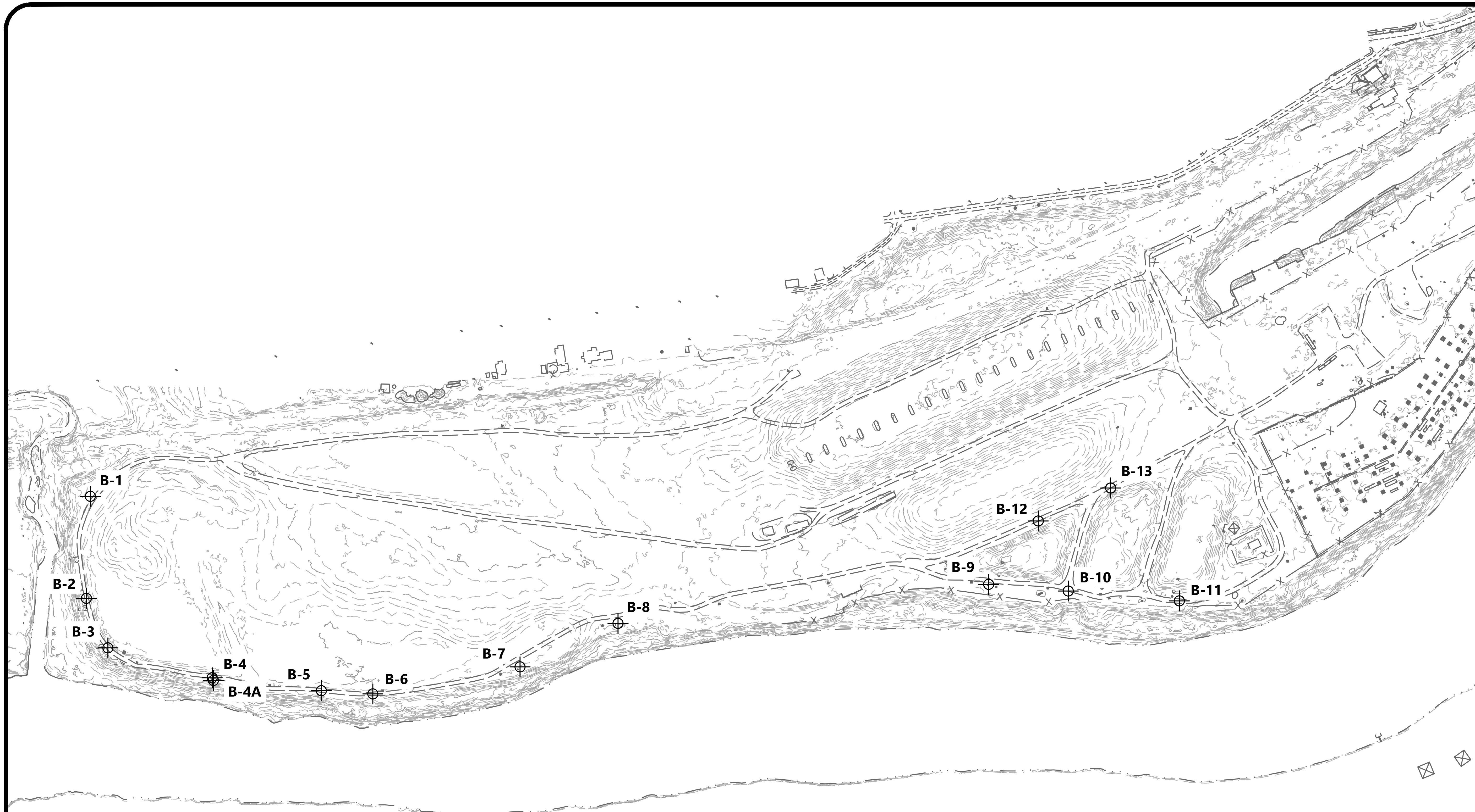
VICINITY MAP

AEP PHILO LEGACY CCR
AEP PHILO STATION
PHILO, OHIO

SCALE:	FIGURE NO.
1" = 2 Miles	1
DATE:	
03/16/2026	
PROJECT NUMBER	
25170079	

S&ME, Inc.

DRAWING PATH: T:\Columbus-1170\Projects\2025\25170079_AEP_Philo Legacy CCR Impoundments Eval\Civil\CAD\DWG\Exhibits\25170079-Location Plans.dwg TAB: VICINITY SAVE DATE: 2026-03-16 PAGE SIZE: ANSI full bleed A (11.00 x 8.50 Inches)



LEGEND

MAJOR CONTOUR (10 FT)
MINOR CONTOUR (2 FT)
EXISTING GRAVEL DRIVE
EXISTING WATER EDGE
EXISTING FENCE
EXISTING MISC. SITE FEATURE
B-1 APPROXIMATE BORING LOCATION AND IDENTIFICATION NUMBER

NOTES

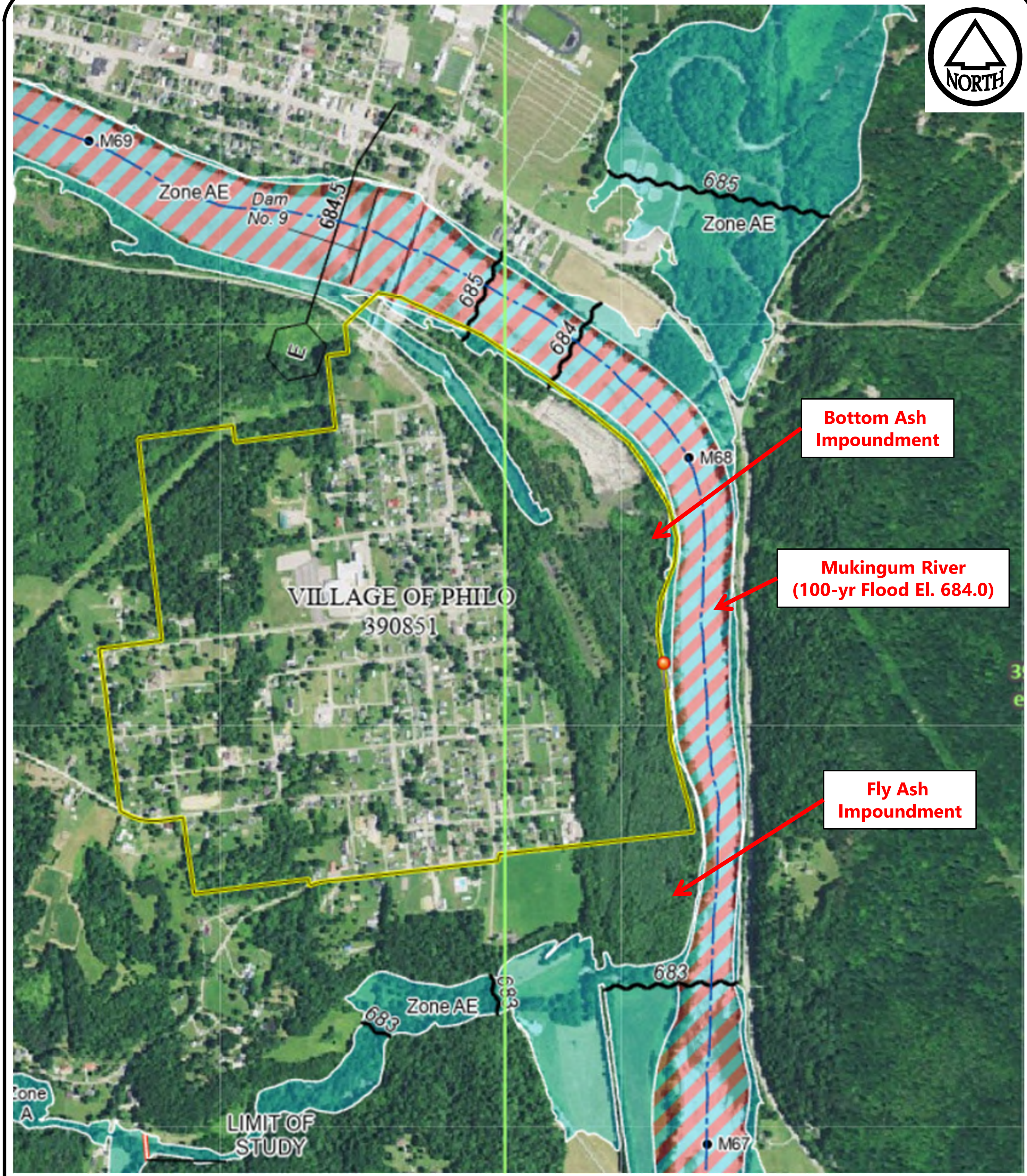
TOPOGRAPHIC SURVEY PROVIDED BY AEP
SURVEY DATE: 02/25/2026
COORDINATE SYSTEM: OHIO STATE PLANE SOUTH
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NAVD 88

S&ME, Inc.

PLAN OF BORINGS

AEP PHILO LEGACY CCR
AEP PHILO STATION
PHILO, OHIO

SCALE:	1" = 300'
DATE:	03/16/2026
PROJECT NUMBER	25170079
FIGURE NO.	2



REFERENCE:
FEMA's National Flood Hazard Layer (NFHL) Viewer
(https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd)

	FEMA National Flood Hazard Layer Viewer	SCALE: NTS	FIGURE NO. 3
		DATE: 2-11-2026	
	AEP Philo Legacy CCR Philo, Ohio	PROJECT NUMBER 25170079	

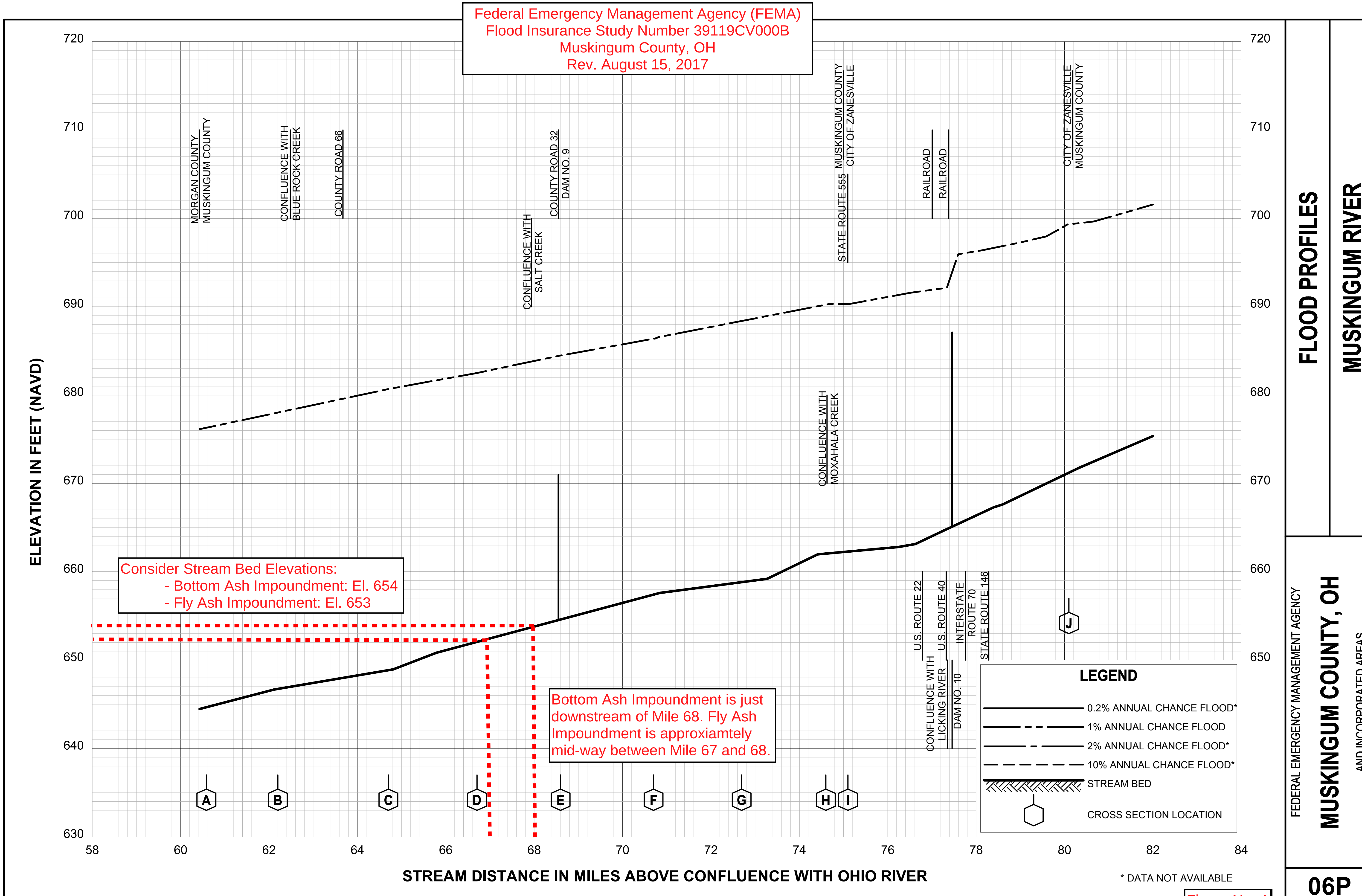
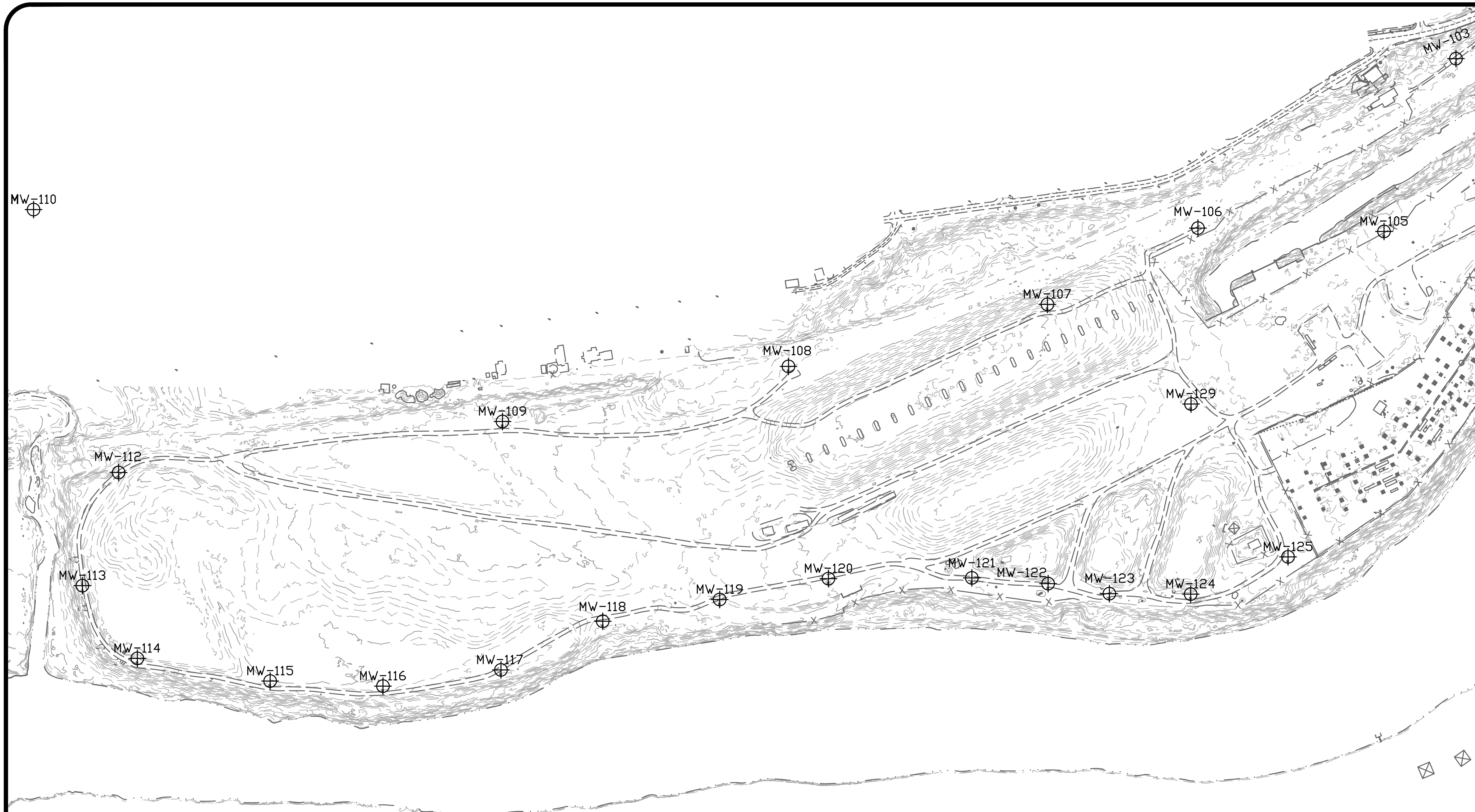

Federal Emergency Management Agency (FEMA)
Flood Insurance Study Number 39119CV000B
Muskingum County, OH
Rev. August 15, 2017
ELEVATION IN FEET (NAVD)
STREAM DISTANCE IN MILES ABOVE CONFLUENCE WITH OHIO RIVER
720
710
700
690
680
670
660
650
640
630
58
60
62
64
66
68
70
72
74
76
78
80
82
84
MORGAN COUNTY
MUSKINGUM COUNTY
CONFLUENCE WITH BLUE ROCK CREEK
COUNTY ROAD 66
CONFLUENCE WITH SALT CREEK
COUNTY ROAD 32
DAM NO. 9
STATE ROUTE 555
MUSKINGUM COUNTY
CITY OF ZANESVILLE
RAILROAD
RAILROAD
CITY OF ZANESVILLE
MUSKINGUM COUNTY
CONFLUENCE WITH MOXAHALA CREEK
U.S. ROUTE 22
U.S. ROUTE 40
INTERSTATE ROUTE 70
STATE ROUTE 146
CONFLUENCE WITH LICKING RIVER
DAM NO. 10
Consider Stream Bed Elevations:
- Bottom Ash Impoundment: El. 654
- Fly Ash Impoundment: El. 653
Bottom Ash Impoundment is just downstream of Mile 68. Fly Ash Impoundment is approxiamtely mid-way between Mile 67 and 68.
A
B
C
D
E
F
G
H
I
J
LEGEND
0.2% ANNUAL CHANCE FLOOD*
1% ANNUAL CHANCE FLOOD
2% ANNUAL CHANCE FLOOD*
10% ANNUAL CHANCE FLOOD*
STREAM BED
CROSS SECTION LOCATION
* DATA NOT AVAILABLE
FLOOD PROFILES
MUSKINGUM RIVER
FEDERAL EMERGENCY MANAGEMENT AGENCY
MUSKINGUM COUNTY, OH
AND INCORPORATED AREAS
06P

Figure No. 4

Appendix II – Groundwater Level and Storm Event Information

DRAWING PATH: T:\Columbus-1170\Projects\2025\25170079_AEP_Philo Legacy CCR Impoundments Eval\Civil\CAD\DWG\Exhibits\25170079-Location Plans.dwg TAB: MONITORING WELLS SAVE DATE: 2026-03-16 PAGE SIZE: ANSI full bleed B (11.00 x 17.00 Inches)



LEGEND

- MAJOR CONTOUR (10 FT)
- MINOR CONTOUR (2 FT)
- EXISTING GRAVEL DRIVE
- EXISTING WATER EDGE
- x EXISTING FENCE
- EXISTING MISC. SITE FEATURE
- MW-107 APPROXIMATE MONITORING WERLL LOCATION AND IDENTIFICATION NUMBER

NOTES

TOPOGRAPHIC SURVEY PROVIDED BY AEP
SURVEY DATE: 02/25/2026
COORDINATE SYSTEM: OHIO STATE PLANE SOUTH
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NAVD 88

WATER MONITORING WELLS INSTALLED BY AECOM IN 2025. LOCATION POINTS PROVIDED BY AEP ON FEBRUARY 6, 2026. NOTE THE LOCATIONS DEPICTED ON THIS DRAWING SHOULD BE CONSIDERED APPROXIMATE.

N

0 300 600

GRAPHIC SCALE (FEET)

S&ME, Inc.

WATER MONITORING WELL LOCATION PLAN

AEP PHILO LEGACY CCR
AEP PHILO STATION
PHILO, OHIO

SCALE: 1" = 300'

DATE: 03/16/2026

PROJECT NUMBER: 25170079

FIGURE NO. 1

Philo Legacy CCR Impoundment

Groundwater Monitoring Well Level Readings

Information provided to S&ME by AEP via email on February 6, 2026

Monitoring Well No.	Reading Date	
	8/11/2025	11/3/2025
MW-107	664.57	663.19
MW-108	673.41	674.25
MW-109	668.43	666.01
MW-110	662.24	661.56
MW-111	662.57	661.68
MW-112	663.78	662.06
MW-113	663.47	661.85
MW-114	663.78	661.89
MW-115	663.91	662
MW-116	663.44	662.2
MW-117	661.65	660.77
MW-118	662.77	661.83
MW-119	661.99	661.55
MW-120	662.24	661.64
MW-121	663	661.85
MW-122	665.59	665.05
MW-123	663.36	661.83
MW-124	663.28	661.83
MW-125	662.95	661.68
MW-126	662.69	661.7
MW-127	662.45	661.56
MW-128	662.32	661.56
MW-129	662.16	661.56
MW-101	661.84	661.47
MW-102	661.54	662.47
MW-103	661.34	661.43
MW-104	661.53	661.41
MW-105	662.57	662.01
MW-106	662.56	661.61
Zanesville Gauge	675.02	675.42
McConnelsville Gauge	651.48	650.99

Monitoring Wells situated along embankments

Philo Legacy CCR Impoundment

IDF Storm Evaluation

Storm Event: 1,000-year

Information developed by AECOM; AEP provided to S&ME via email on April 20, 2026.

Table 1. Bottom Ash Pond Complex Modeling Summary

Location	Design Storm	Drainage Area (ac)	Peak Inflow (cfs)	Peak Water Surface Elevation (ft)	Top of Perimeter Berm (ft)	Freeboard (ft)
Pond A	1000-year	5.2	35.5	687.5	701.0	13.5
Pond B	1000-year	2.2	18.4	687.4	701.0	13.6
Pond C	1000-year	1.7	20.0	685.8	701.0	15.2

Note that the Top of Perimeter Berm for the Bottom Ash Pond along the east embankment (bordering the Muskingum River) ranges in elevation from approximately El. 701 to El. 702 feet.

Table 1. Fly Ash Pond Modeling Summary

Location	Design Storm	Drainage Area (ac)	Peak Inflow (cfs)	Peak Water Surface Elevation (ft)	Top of Perimeter Berm (ft)	Freeboard (ft)
Northern Area	1000-year	12.3	81.2	689.4	689.5	0.1
Southern Area	1000-year	5.7	32.6	691.5	696.0	4.5

Note that the Top of Perimeter Berm for the Fly Ash Pond along the east and south embankments (bordering the Muskingum River and Duncan Run, respectively) ranges in elevation from approximately El. 698 to El. 702 feet.

Appendix III – Soil Parameter Justification

JOB NUMBER : 25-17-0079
PROJECT NAME : PHILO LEGACY CCR
PROJECT LOCATION : PHILO, OHIO
SUBJECT: STRENGTH AND PERMEABILITY PARAMETERS JUSTIFICATION
CALCULATED BY - DATE: WB - 02/11/2026
CHECKED BY - DATE: DJT - 02/17/2026

Introduction

The loading conditions expected at the site, along with the anticipated soil response are summarized in the following table.

Loading Condition	**Anticipated Soil Response**
Long-term with steady-state seepage	Drained
Pseudo-static seismic during steady-state seepage	Coarse-grained soils = Drained Fine-grained soils = Undrained
Surcharge loading due to storm event	Coarse-grained soils = Drained Fine-grained soils = Undrained
Rapid drawdown along the Muskingum River side	Coarse-grained soils = Drained Fine-grained soils = Undrained

A summary of the soil parameters assigned to each layer is provided in the following table. The development of these parameters are discussed in the following pages.

Material	Total Unit Weight (pcf)	Drained		Undrained	
		c' (psf)	f' (deg)	C (psf)	f' (deg)
CCR Material	110	50	32	50	32
CCR Material - Seismic	110	50	32	200	20
Cohesive Soils	120	100	32	250	17
Alluvium-Upper	125	0	34	0	34
Alluvium-Middle	125	0	36	0	36
Alluvium-Lower	125	0	38	0	38
Sandstone Bedrock	(modeled as "Impenetrable")				

Coarse-Grained Soils

Coarse-grained soils include Alluvium and a portion of the fill. Due to its soil classification and relative density, the fill was included with the Alluvium-Upper sublayer. Based on the SPT N-values with depth, the Alluvium can be subdivided into three layers titled "Alluvium-Upper", "Alluvium-Middle", and "Alluvium-Lower".

Based on the results of the liquefaction susceptibility analysis, these coarse-grained soils are not expected to become unstable during a seismic event at this site; as such, only drained strength values were determined for these soils.

Drained Strength - Alluvium layers

The drained strength of the Alluvium sublayers were based on correlations relating SPT N60 and (N1)60 values to effective friction angles. Several references were used:

1) ϕ' using $(N_1)_{60}$ correlation: Hatanaka, M. & Uchida, A. (1996)

2) ϕ' using $(N_1)_{60}$ correlation: Terzaghi, K., Peck, R., & Mesri, G. (1996)

3) ϕ' using N_{60} correlation: Schmertmann (1975)

Notes: - Soil appears to be normally consolidated, therefore cohesion intercept assumed to be null.
- SPT resulting sampler refusal conditions (N>50) were not included.

The N60 and (N1)60 values were calculated based on hammer efficiency, hole diameter, rod length, use of a liner, and overburden pressure (Skempton, 1986). These values for the Alluvium layers are summarized below.

Sublayer	Parameter	Min	Max	Mean	S.D.	Design Value
Alluvium-Upper	N_{60} (bpf)	11	79	33	17	N/A
	$(N_1)_{60}$ (bpf)	8	64	25	13	
	ϕ' (deg) [Ref. 1]	31	51	39	5	**34**
	ϕ' (deg) [Ref. 2]	30	43	36	3	
	ϕ' (deg) [Ref. 3]	30	51	40	5	
Alluvium-Middle	N_{60} (bpf)	21	66	36	12	N/A
	$(N_1)_{60}$ (bpf)	13	45	24	8	
	ϕ' (deg) [Ref. 1]	34	46	39	3	**36**
	ϕ' (deg) [Ref. 2]	32	41	36	2	
	ϕ' (deg) [Ref. 3]	34	47	40	3	
Alluvium-Lower	N_{60} (bpf)	31	79	47	11	N/A
	$(N_1)_{60}$ (bpf)	19	49	29	6	
	ϕ' (deg) [Ref. 1]	37	47	41	2	**38**
	ϕ' (deg) [Ref. 2]	34	42	37	2	
	ϕ' (deg) [Ref. 3]	38	47	41	2	

Based on our experience with these soils in this area and the subsurface conditions encountered at the site, a **total unit weight of 125 pcf** was assigned to all Alluvium sublayers.

Fine-Grained Soils

Fine-grained soils include the fill soils and cohesive alluvium (based on its soil classification and consistency, the cohesive alluvial soils are expected to behave similar to the cohesive fill soils). These soils were titled "Cohesive Soils" for the purposes of the stability analysis.

Both drained and undrained strength values were estimated for the fine-grained soils.

Drained and Undrained Strength - Cohesive Soils

The drained and undrained strengths of the Cohesive Soils were based on the results of three CU triaxial test results completed as part of the recent geotechnical study. A summary of the CU triaxial test results is included below.

Triaxial CU Test Summary																
Sample Information					Effective Strength			Undrained Strength			Limits			Initial Unit Weight		
Strata	Boring	Sample	Depth Top	Depth Bottom	c' (psf)	ϕ' (°)	tan(ϕ)	c (psf)	ϕ (°)	tan(ϕ)	LL	PL	PI	γ_{dry} (pcf)	w (%)	γ_{wet} (pcf)
Cohesive	B-02	S-06	26	28	260	31.4	0.61	380	17.3	0.31	29	18	11	100.7	22	122.9
Cohesive	B-04	S-12	38.5	39.5	80	32.3	0.63	290	17.3	0.31	38	22	16	93.2	29.2	120.4
Cohesive	B-11	S-09	35	37	100	33.2	0.65	230	17.1	0.31	29	19	10	103.4	22.9	127.1

	c' (psf)	ϕ' (°)	tan(ϕ)	c (psf)	ϕ (°)	tan(ϕ)	LL	PL	PI	γ_{dry} (pcf)	w (%)	γ_{wet} (pcf)
Max	260	33.2	0.7	380	17.3	0.31	38	22	16	103.40	29.2	127.1
Min	80	31.4	0.6	230	17.1	0.31	29	18	10	93.2	22.0	120.4
Median	100	32.3	0.6	290	17.3	0.31	29	19	11	100.7	22.9	122.9
Mean	147	32.3	0.6	300	17.2	0.31	32	20	12	99.10	24.7	123.4
Std. Dev.												

	c' (psf)	ϕ' (°)		c (psf)	ϕ (°)		γ_{wet} (pcf)
Use	**100**	**32**		**250**	**17**		**120**

Based on our experience with these soils in this area and the subsurface conditions encountered at the site, a **total unit weight of 120 pcf** was assigned to the Cohesive Soil layer.

Mixed-Grained Soil (CCR Material)

The CCR Material consisted primarily of bottom ash but included lesser amounts of fly ash and slag. Due to the varying nature of the material, both drained and undrained conditions were considered for the stability analysis. This material was titled "CCR Material".

Drained strengths were assigned to the CCR Material for the long-term with steady state seepage, rapid drawdown, and surcharge loading conditions, and undrained strength was assigned to the CCR Material for the pseudo-static seismic loading condition as the permeability of the material is estimated to be greater than 1e-04 cm/s (Duncan et al, 2014).

Drained Strength - CCR Material

The drained strength of the CCR Material was based on correlations relating SPT N60 and (N1)60 values to effective friction angles. Several references were used:

1) ϕ' using $(N_1)_{60}$ correlation: Hatanaka, M. & Uchida, A. (1996)

2) ϕ' using $(N_1)_{60}$ correlation: Terzaghi, K., Peck, R., & Mesri, G. (1996)

3) ϕ' using N_{60} correlation: Schmertmann (1975)

Notes: - SPT resulting sampler refusal conditions (N>50) were not included.

The N60 and (N1)60 values were calculated based on hammer efficiency, hole diameter, rod length, use of a liner, and overburden pressure (Skempton, 1986). These values for the Alluvium layers are summarized below. The CCR Material had a slightly greater variation in measured N-values, and was therefore assigned a lower strength.

Layer	Parameter	Min	Max	Mean	S.D.	Design Value
CCR Material	N_{60} (bpf)	0	53	21	15	N/A
	$(N_1)_{60}$ (bpf)	0	76	26	21	
	ϕ' (deg) [Ref. 1]	20	54	38	8	**32**
	ϕ' (deg) [Ref. 2]	28	46	38	6	
	ϕ' (deg) [Ref. 3]	27	44	35	5	

Based on our experience with CCR Materials, a **cohesion-intercept of 50 psf** was assigned.

Undrained Strength - CCR Material

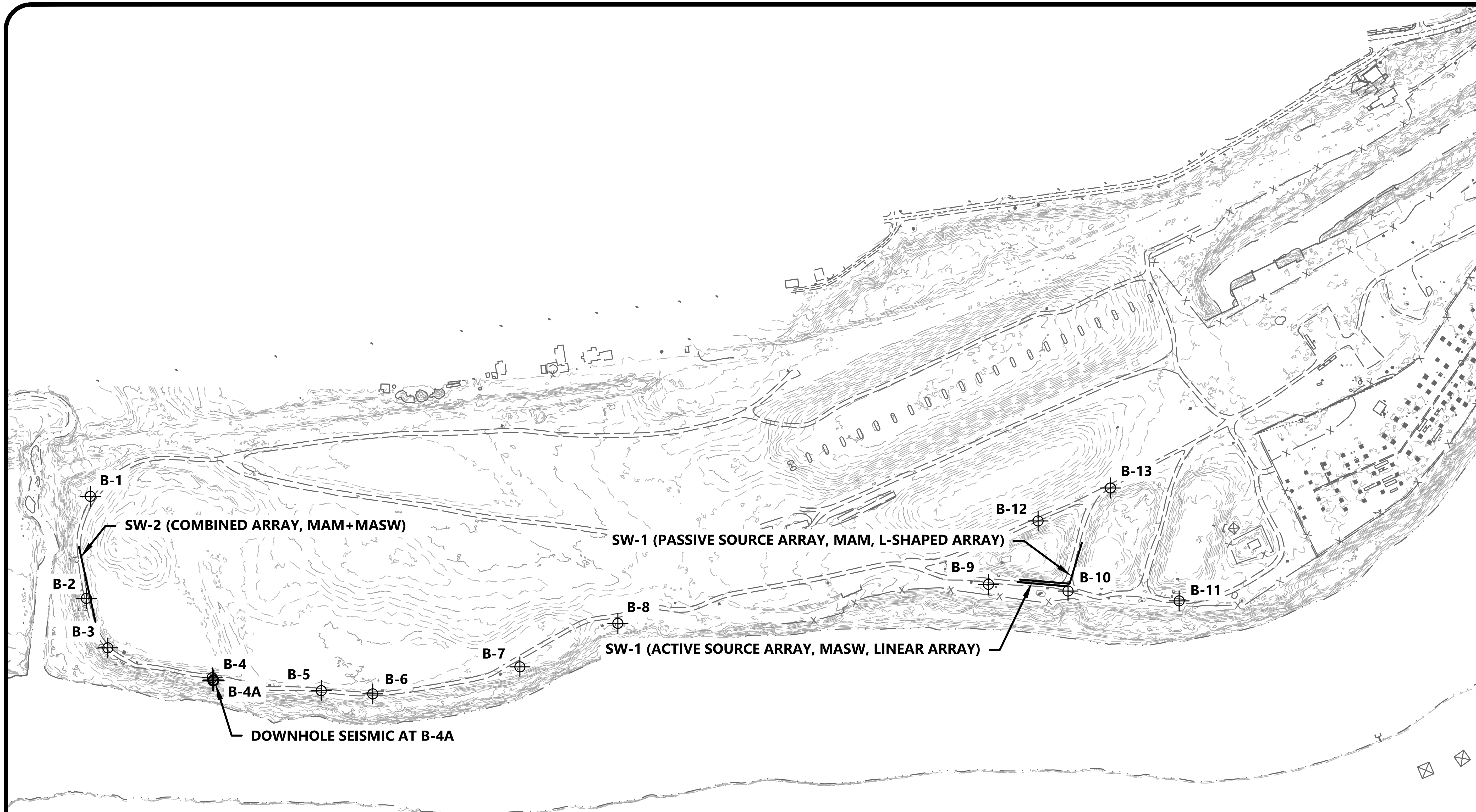
Based on our experience with CCR materials, the following undrained strengths were assigned:

ϕ = 20 deg

C = 200 psf

Based on our experience with these soils in this area and the subsurface conditions encountered at the site, a **total unit weight of 110 pcf** was assigned to all Alluvium sublayers.

DRAWING PATH: T:\Columbus-1170\Projects\2025\25170079_AEP_Philo Legacy CCR Impoundments Eval\Civil\CAD\DWG\Exhibits\25170079-Location Plans.dwg **TAB:** GEOPHYSICS **SAVE DATE:** 2026-03-16 **PAGE SIZE:** ANSI full bleed B (11.00 x 17.00 Inches)



LEGEND

- MAJOR CONTOUR (10 FT)
- MINOR CONTOUR (2 FT)
- EXISTING GRAVEL DRIVE
- EXISTING WATER EDGE
- EXISTING FENCE
- EXISTING MISC. SITE FEATURE
- B-1 APPROXIMATE BORING LOCATION AND IDENTIFICATION NUMBER

NOTES

TOPOGRAPHIC SURVEY PROVIDED BY AEP
SURVEY DATE: 02/25/2026
COORDINATE SYSTEM: OHIO STATE PLANE SOUTH
HORIZONTAL DATUM: NAD 83
VERTICAL DATUM: NAVD 88

N

0 300 600
GRAPHIC SCALE (FEET)

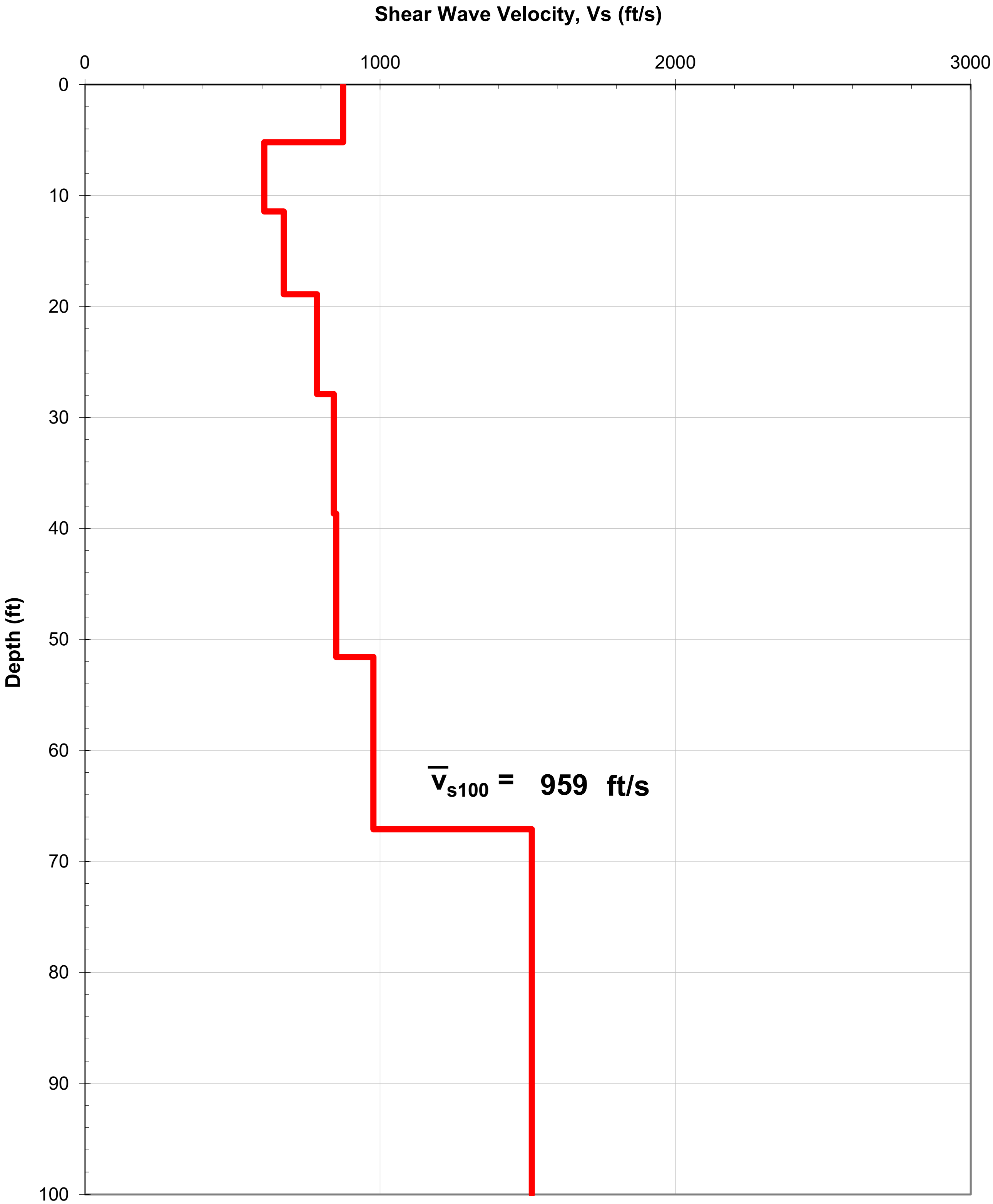
S&ME, Inc.

SEISMIC TEST LOCATION PLAN (PLAN OF BORINGS OVERLAY)

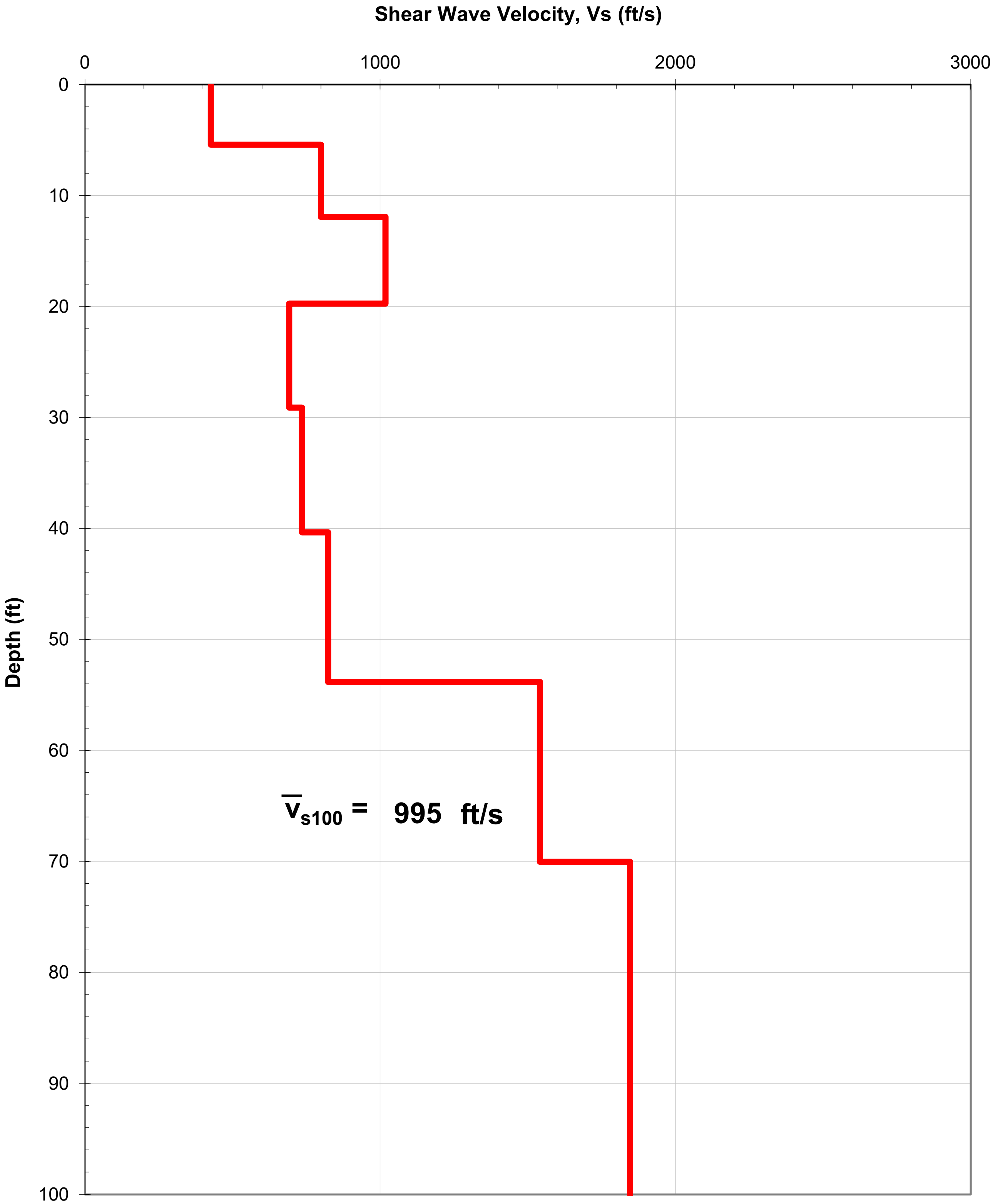
AEP PHILO LEGACY CCR
AEP PHILO STATION
PHILO, OHIO

SCALE:	1" = 300'
DATE:	03/16/2026
PROJECT NUMBER	25170079
FIGURE NO.	1

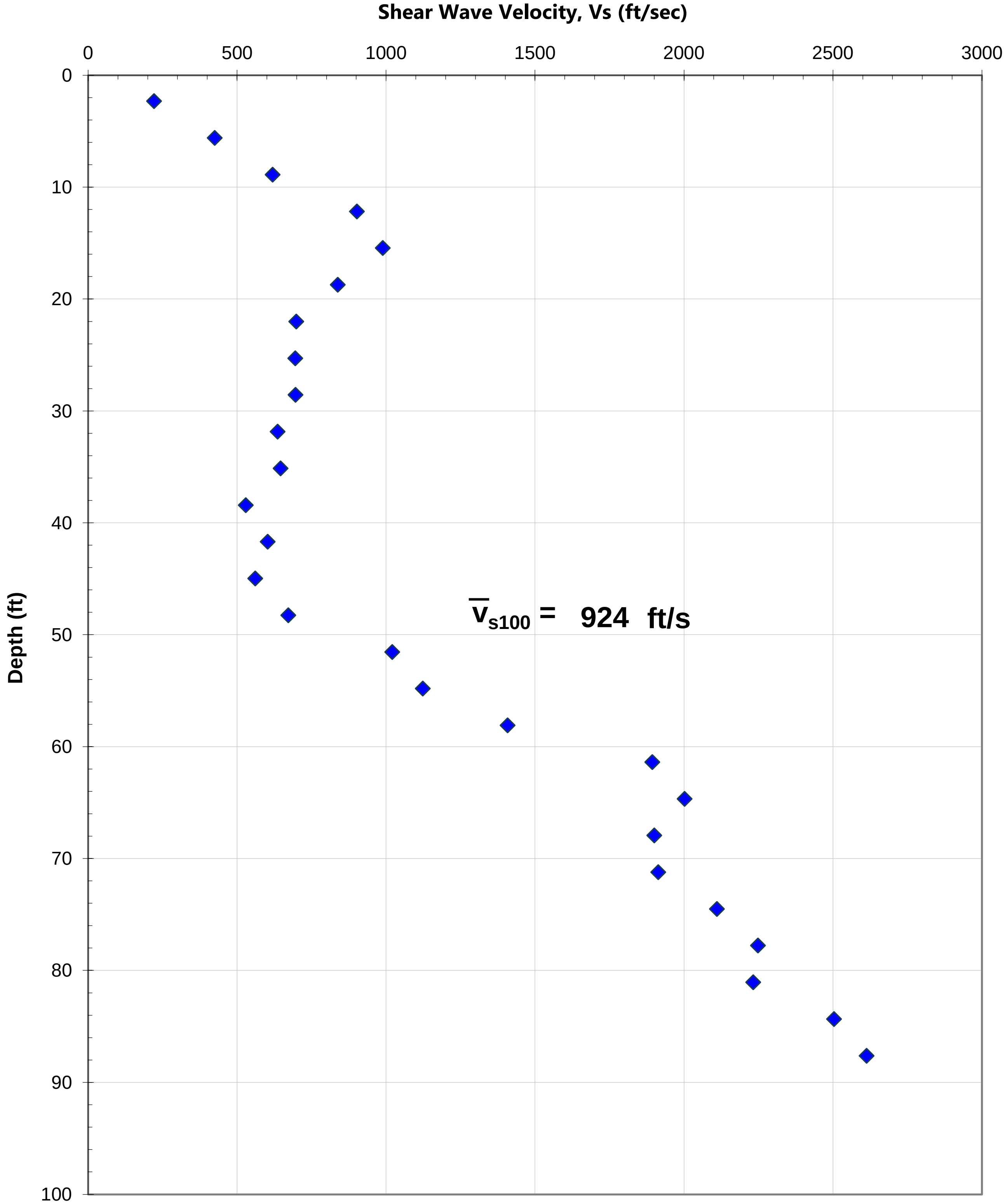
Shear Wave Velocity Profile SW-1
Philo Plant Legacy CCR Impoundments
Philo, Muskingum County, Ohio
S&ME Project: 25170079



Shear Wave Velocity Profile SW-2
Philo Plant Legacy CCR Impoundments
Philo, Muskingum County, Ohio
S&ME Project: 25170079



Shear Wave Velocity Profile B-04A
Philo Legacy CCR Impoundments
Philo, Ohio
S&ME Project 25170079



Seismic Site Classification (EPA 1995 and ASCE 7-10)

Project:	AEP Philo Legacy CCR	Proj. No.:	25170079
Location:	Philo, OH	Date:	2/11/2026

Seismic Site Classification Based on N-Value (ASCE 7-10 Eqn 20.4-2)

Note: Calculation of average field N value considers soils between bottom of embankment and top of bedrock.

B-01				B-02				B-03				B-04				B-05			
z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i
33.0	36.0	2	*1.500*	22.0	27.4	4	*1.350*	23.5	27.0	7	*0.500*	20.5	23.5	13	*0.231*	18.0	23.5	3	*1.833*
36.0	38.5	5	*0.500*	27.4	31.0	5	*0.720*	27.0	28.5	9	*0.167*	23.5	26.0	9	*0.278*	23.5	28.5	53	*0.094*
38.5	41.0	29	*0.086*	31.0	33.5	2	*1.250*	28.5	31.0	19	*0.132*	26.0	28.5	11	*0.227*	28.5	30.5	23	*0.087*
41.0	43.5	26	*0.096*	33.5	36.0	5	*0.500*	31.0	33.5	2	*1.250*	28.0	30.5	7	*0.357*	30.5	33.5	15	*0.200*
43.5	45.0	17	*0.088*	36.0	38.5	4	*0.625*	33.5	36.0	2	*1.250*	30.5	35.5	3	*1.667*	33.5	36.0	14	*0.179*
45.0	48.5	25	*0.140*	38.5	40.5	5	*0.400*	36.0	38.5	1	*2.500*	35.5	43.5	2	*4.000*	36.0	38.0	9	*0.222*
48.5	53.5	15	*0.333*	40.5	43.5	6	*0.500*	38.5	41.0	0	*2.500*	43.5	47.5	4	*1.000*	38.0	41.0	17	*0.176*
53.5	58.5	20	*0.250*	43.5	47.0	16	*0.219*	41.0	43.5	4	*0.625*	47.5	53.5	20	*0.300*	41.0	43.0	8	*0.250*
58.5	63.5	19	*0.263*	47.0	52.0	16	*0.313*	43.5	48.5	7	*0.714*	53.5	57.5	13	*0.308*	43.0	46.7	9	*0.411*
63.5	68.5	28	*0.179*	52.0	58.5	21	*0.310*	48.5	53.5	28	*0.179*	57.5	63.5	24	*0.250*	46.7	118.0	100	*0.713*
68.5	73.5	31	*0.161*	58.5	63.5	20	*0.250*	53.5	58.5	23	*0.217*	63.5	68.6	28	*0.182*				
73.5	78.5	29	*0.172*	63.5	67.0	33	*0.106*	58.5	63.5	24	*0.208*	68.6	120.5	100	*0.519*				
78.5	133.0	100	*0.545*	67.0	72.5	35	*0.157*	63.5	68.5	26	*0.192*								
				72.5	78.5	27	*0.222*	68.5	73.5	33	*0.152*								
				78.5	81.0	42	*0.060*	73.5	76.0	27	*0.093*								
				81.0	122.0	100	*0.410*	76.0	123.5	100	*0.475*								
Avg. N =			*23*	Avg. N =			*14*	Avg. N =			*9*	Avg. N =			*11*	Avg. N =			*24*

From ASCE 7-10, Chapter 20, use Table 20.3-1 to correlate the average N value to an average shear wave velocity.

$$\bar{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}} \qquad (20.4\text{-}2)$$

Table 20.3-1 Site Classification

$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$
>5,000 ft/s	NA
2,500 to 5,000 ft/s	NA
1,200 to 2,500 ft/s	>50
600 to 1,200 ft/s	15 to 50
<600 ft/s	<15

For these borings, consider average v_s ranging from **<600** to **1,200** ft/s.

From EPA (1995), Chapter 4, use the average shear wave velocity range to classify the soil.

CLASSIFICATION	AVERAGE SHEAR WAVE VELOCITY	
Special Study	Less than 100 m/s	(330ft/s)
Soft	100 to 200 m/s	(330 to 660 ft/s)
Medium Stiff	200 to 375 m/s	(600 to 1,230 ft/s)
Stiff	375 to 700 m/s	(1,230 to 2,300 ft/s)
Rock	Greater than 700 m/s	(2,300 ft/s)

For these borings, site classifies as "**Soft to Medium Stiff**".

Seismic Site Classification (EPA 1995 and ASCE 7-10)

Project:	AEP Philo Legacy CCR	Proj. No.:	25170079
Location:	Philo, OH	Date:	2/11/2026

Seismic Site Classification Based on N-Value (ASCE 7-10 Eqn 20.4-2)

Note: Calculation of average field N value considers soils between bottom of embankment and top of bedrock.

B-06				B-07				B-08				B-09				B-10			
z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i
33.5	38.5	7	0.714	36.0	43.0	5	1.400	17.0	20.0	6	0.500	18.0	22.0	6	0.667	17.5	23.5	7	0.857
38.5	43.5	39	0.128	43.0	46.0	37	0.081	20.0	28.0	0	8.000	22.0	26.0	5	0.800	23.5	26.0	5	0.500
43.5	44.5	16	0.063	46.0	48.0	26	0.077	28.0	31.0	18	0.167	26.0	28.0	5	0.400	26.0	28.0	39	0.051
44.5	133.5	100	0.890	48.0	51.0	18	0.167	31.0	33.5	14	0.179	28.0	30.5	15	0.167	28.0	31.0	23	0.130
				51.0	53.0	14	0.143	33.5	35.5	49	0.041	30.5	33.5	19	0.158	31.0	33.0	42	0.048
				53.0	56.0	19	0.158	35.5	38.0	24	0.104	33.5	36.0	42	0.060	33.0	37.5	11	0.409
				56.0	58.0	41	0.049	38.0	41.0	22	0.136	36.0	38.5	18	0.139	37.5	43.5	18	0.333
				58.0	136.0	100	0.780	41.0	43.5	30	0.083	38.5	40.0	7	0.214	43.5	47.5	20	0.200
								43.5	49.0	26	0.212	40.0	43.5	9	0.389	47.5	53.5	19	0.316
								49.0	53.5	25	0.180	43.5	47.5	16	0.250	53.5	58.5	41	0.122
								53.5	58.5	37	0.135	47.5	53.5	13	0.462	58.5	63.5	20	0.250
								58.5	63.5	23	0.217	53.5	58.5	28	0.179	63.5	67.5	22	0.182
								63.5	68.5	38	0.132	58.5	62.5	22	0.182	67.5	73.5	31	0.194
								68.5	73.5	28	0.179	62.5	68.5	24	0.250	73.5	78.5	49	0.102
								73.5	117.0	100	0.435	68.5	73.5	22	0.227	78.5	83.5	37	0.135
												73.5	78.5	38	0.132	83.5	88.5	33	0.152
												78.5	83.5	33	0.152	88.5	117.5	100	0.290
												83.5	88.5	30	0.167				
												88.5	118.0	100	0.295				
		Avg. N =	56			Avg. N =	35			Avg. N =	9			Avg. N =	19			Avg. N =	23

From ASCE 7-10, Chapter 20, use Table 20.3-1 to correlate the average N value to an average shear wave velocity.

$$\bar{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}} \qquad (20.4\text{-}2)$$

For these borings, consider average v_s ranging from **600** to **1,200** ft/s.

Table 20.3-1 Site Classification

$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$
>5,000 ft/s	NA
2,500 to 5,000 ft/s	NA
1,200 to 2,500 ft/s	>50
600 to 1,200 ft/s	15 to 50
<600 ft/s	<15

From EPA (1995), Chapter 4, use the average shear wave velocity range to classify the soil.

CLASSIFICATION	AVERAGE SHEAR WAVE VELOCITY	
Special Study	Less than 100 m/s	(330ft/s)
Soft	100 to 200 m/s	(330 to 660 ft/s)
Medium Stiff	200 to 375 m/s	(600 to 1,230 ft/s)
Stiff	375 to 700 m/s	(1,230 to 2,300 ft/s)
Rock	Greater than 700 m/s	(2,300 ft/s)

For these borings, site classifies as "**Medium Stiff**".

Seismic Site Classification (EPA 1995 and ASCE 7-10)

Project:	AEP Philo Legacy CCR	Proj. No.:	25170079
Location:	Philo, OH	Date:	2/11/2026

Seismic Site Classification Based on N-Value (ASCE 7-10 Eqn 20.4-2)

Note: Calculation of average field N value considers soils between bottom of embankment and top of bedrock.

B-11				B-12				B-13											
z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i	z_t (ft)	z_b (ft)	N	d_i/N_i
27.5	30.5	7	0.429	22.0	26.0	4	1.000	13.5	17.5	7	0.571								
30.5	36.0	4	1.375	26.0	28.0	10	0.200	17.5	21.0	7	0.500								
36.0	38.5	2	1.250	28.0	31.0	23	0.130	21.0	23.5	7	0.357								
38.5	40.5	8	0.250	31.0	33.0	49	0.041	23.5	26.0	6	0.417								
40.5	43.0	27	0.093	33.0	35.5	22	0.114	26.0	27.0	8	0.125								
43.0	45.5	15	0.167	35.5	38.5	18	0.167	27.0	30.5	19	0.184								
45.5	48.5	19	0.158	38.5	41.0	14	0.179	30.5	33.0	24	0.104								
48.5	53.5	22	0.227	41.0	43.5	18	0.139	33.0	36.0	23	0.130								
53.5	127.5	100	0.740	43.5	48.5	16	0.313	36.0	38.0	22	0.091								
				48.5	53.5	15	0.333	38.0	43.5	14	0.393								
				53.5	58.5	22	0.227	43.5	48.5	17	0.294								
				58.5	63.5	25	0.200	48.5	53.5	18	0.278								
				63.5	68.5	30	0.167	53.5	57.5	17	0.235								
				68.5	71.5	30	0.100	57.5	63.5	14	0.429								
				71.5	78.5	27	0.259	63.5	68.5	19	0.263								
				78.5	83.5	23	0.217	68.5	73.5	29	0.172								
				83.5	88.0	24	0.188	73.5	78.5	24	0.208								
				88.0	122.0	100	0.340	78.5	83.5	22	0.227								
								83.5	87.4	38	0.103								
								87.4	113.5	100	0.261								
	Avg. N =		21		Avg. N =		23		Avg. N =		19		Avg. N =		####		Avg. N =		####

From ASCE 7-10, Chapter 20, use Table 20.3-1 to correlate the average N value to an average shear wave velocity.

$$\bar{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}} \qquad (20.4\text{-}2)$$

For these borings, consider average v_s ranging from **600** to **1,200** ft/s.

Table 20.3-1 Site Classification

$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$
>5,000 ft/s	NA
2,500 to 5,000 ft/s	NA
1,200 to 2,500 ft/s	>50
600 to 1,200 ft/s	15 to 50
<600 ft/s	<15

From EPA (1995), Chapter 4, use the average shear wave velocity range to classify the soil.

CLASSIFICATION	AVERAGE SHEAR WAVE VELOCITY	
Special Study	Less than 100 m/s	(330ft/s)
Soft	100 to 200 m/s	(330 to 660 ft/s)
Medium Stiff	200 to 375 m/s	(600 to 1,230 ft/s)
Stiff	375 to 700 m/s	(1,230 to 2,300 ft/s)
Rock	Greater than 700 m/s	(2,300 ft/s)

For these borings, site classifies as "**Medium Stiff**".

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.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update) (unk…

Latitude

Decimal degrees

39.858655

Longitude

Decimal degrees, negative values for western longitudes

-81.902187

Site Class

760 m/s (B/C boundary)

Spectral Period

Peak Ground Acceleration

Time Horizon

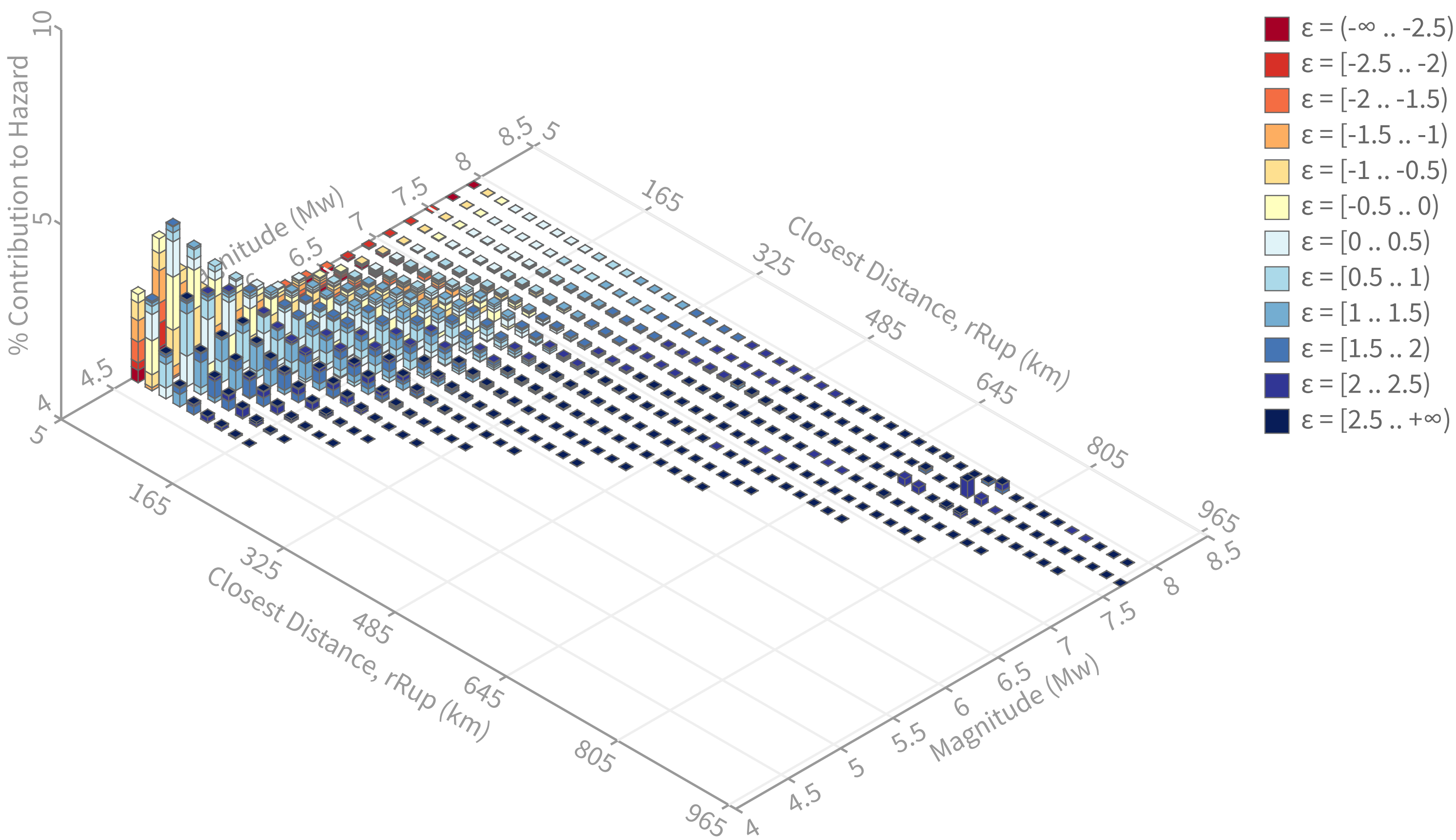
Return period in years

2475

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.049941782 g

Recovered targets

Return period: 2489.2162 yrs
Exceedance rate: 0.00040173289 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 2.36 %

Mean (over all sources)

m: 5.76
r: 112.18 km
ε_0: 0.15 σ

Mode (largest m-r bin)

m: 4.9
r: 30.75 km
ε_0: -0.2 σ
Contribution: 3.91 %

Mode (largest m-r-ε_0 bin)

m: 4.9
r: 31.56 km
ε_0: -0.25 σ
Contribution: 1.36 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

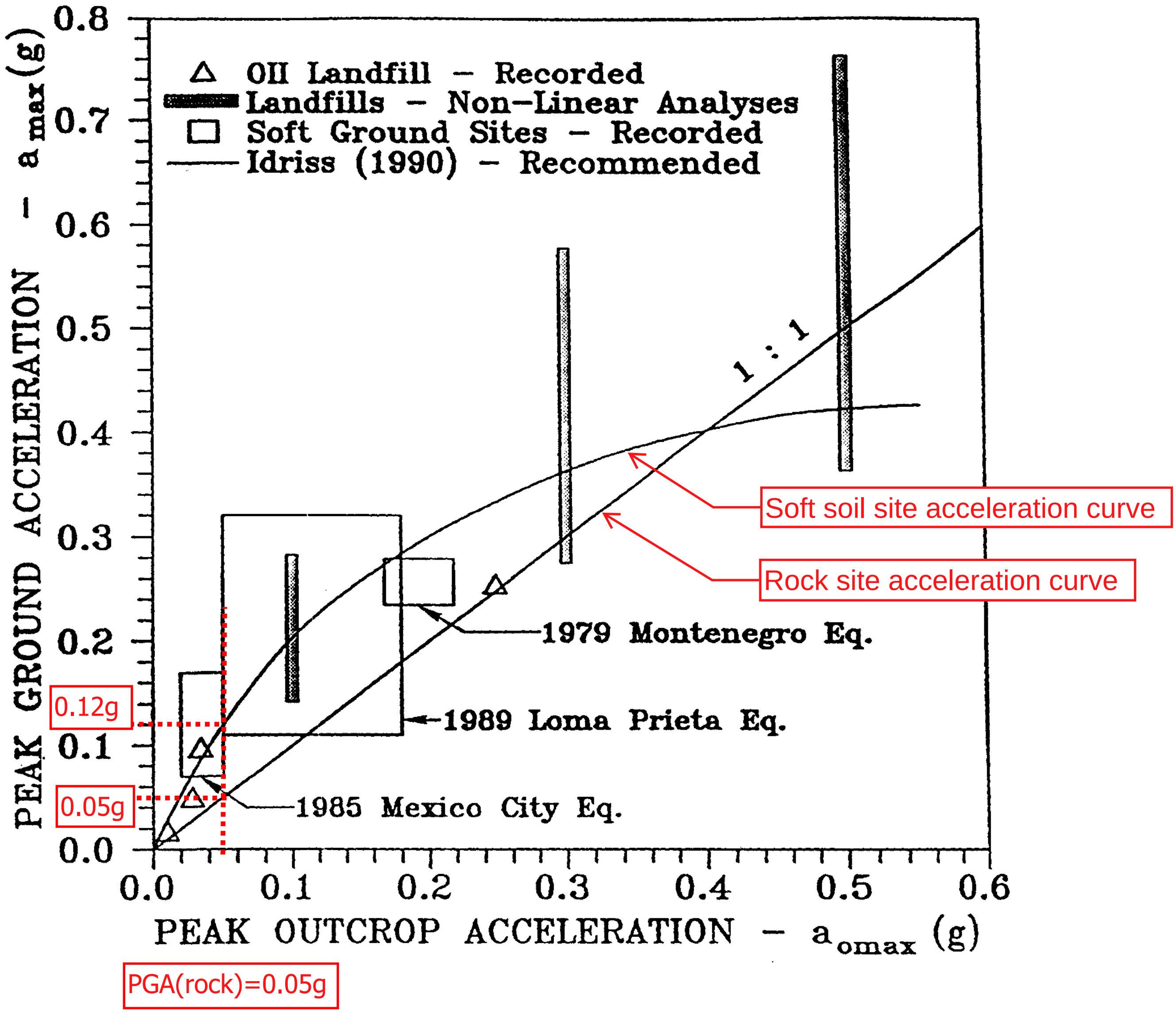
Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
SSCn Adaptive Smoothing Zone 1 (opt)	Grid							21.69
PointSourceFinite: -81.902, 40.016		18.01	5.15	-1.55	81.902°W	40.016°N	0.00	1.80
PointSourceFinite: -81.902, 40.106		27.67	5.22	-0.80	81.902°W	40.106°N	0.00	1.32
PointSourceFinite: -81.902, 40.151		32.54	5.25	-0.55	81.902°W	40.151°N	0.00	1.27
PointSourceFinite: -81.902, 40.331		52.06	5.42	0.09	81.902°W	40.331°N	0.00	1.08
PointSourceFinite: -81.902, 40.196		37.42	5.29	-0.35	81.902°W	40.196°N	0.00	1.05
USGS Adaptive Smoothing Zone 1 (opt)	Grid							21.21
PointSourceFinite: -81.902, 40.016		18.01	5.15	-1.55	81.902°W	40.016°N	0.00	1.80
PointSourceFinite: -81.902, 40.106		27.67	5.22	-0.80	81.902°W	40.106°N	0.00	1.32
PointSourceFinite: -81.902, 40.151		32.54	5.25	-0.55	81.902°W	40.151°N	0.00	1.27
PointSourceFinite: -81.902, 40.331		52.06	5.42	0.09	81.902°W	40.331°N	0.00	1.08
PointSourceFinite: -81.902, 40.196		37.42	5.29	-0.35	81.902°W	40.196°N	0.00	1.05
SSCn Fixed Smoothing Zone 1 (opt)	Grid							18.53
PointSourceFinite: -81.902, 40.016		18.01	5.15	-1.55	81.902°W	40.016°N	0.00	1.72
PointSourceFinite: -81.902, 40.151		32.54	5.25	-0.55	81.902°W	40.151°N	0.00	1.22
PointSourceFinite: -81.902, 40.106		27.67	5.22	-0.80	81.902°W	40.106°N	0.00	1.15
USGS Fixed Smoothing Zone 1 (opt)	Grid							17.97
PointSourceFinite: -81.902, 40.016		18.01	5.15	-1.55	81.902°W	40.016°N	0.00	1.72
PointSourceFinite: -81.902, 40.151		32.54	5.25	-0.55	81.902°W	40.151°N	0.00	1.22
PointSourceFinite: -81.902, 40.106		27.67	5.22	-0.80	81.902°W	40.106°N	0.00	1.15
USGS Fixed Smoothing Zone 2 (opt)	Grid							5.69
SSCn Fixed Smoothing Zone 7 (opt)	Grid							4.83
USGS Adaptive Smoothing Zone 2 (opt)	Grid							4.16
SSCn Adaptive Smoothing Zone 7 (opt)	Grid							3.48

U.S. Environmental Protection Agency. (1995). RCRA Subtitle D (258) seismic design guidance for municipal solid waste landfill facilities (EPA/600/R-95/051).



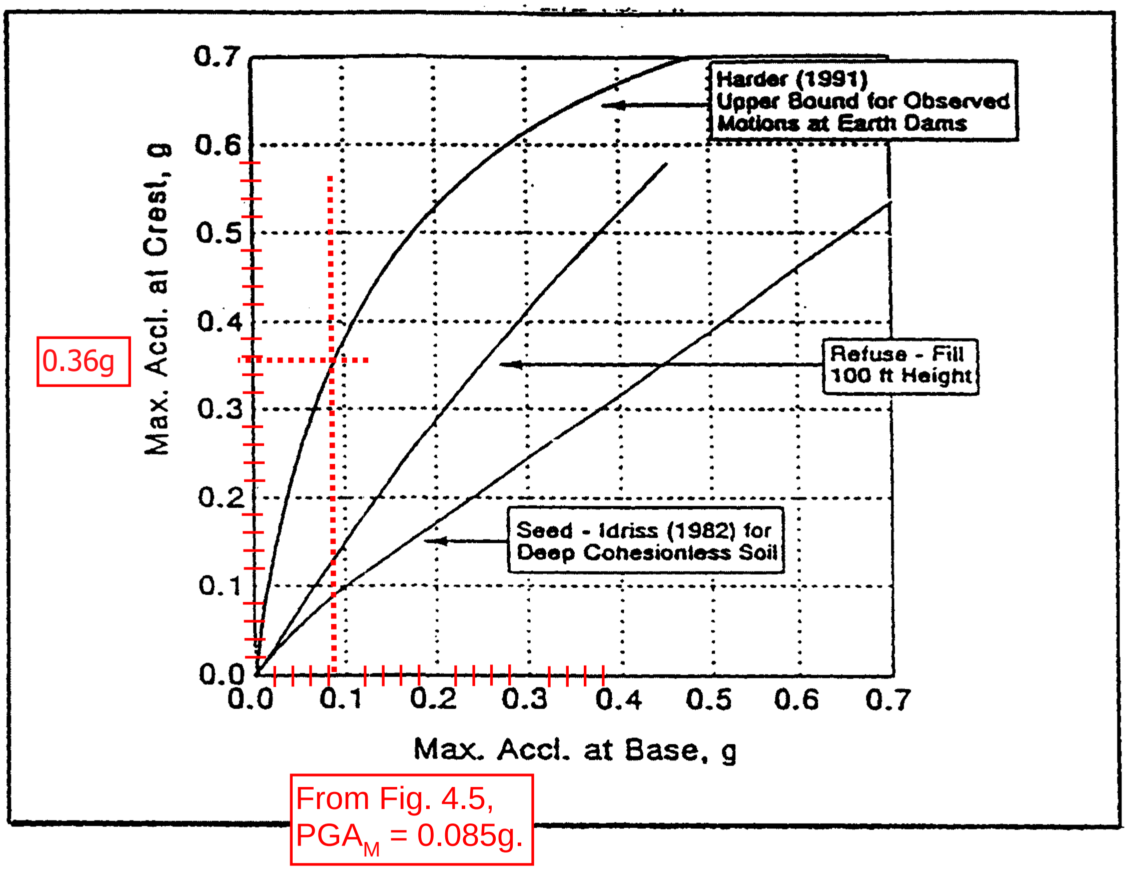
Based on the results of the geophysical seismic tests and the Standard Penetration Tests performed at the site, the site classifies as "Medium Stiff"; therefore, use the average of the rock site acceleration curve and the soft soil site acceleration curve per Step 2 of the EPA guidance document.

Avg. peak ground acceleration, $PGA_M = (0.05g + 0.12g)/2 = 0.085g$.

Figure 4.5 Observed Variations of Peak Horizontal Accelerations on Soft Soil and MSW Sites in Comparison to Rock Sites (Kavazanjian and Matasović, 1994).

64

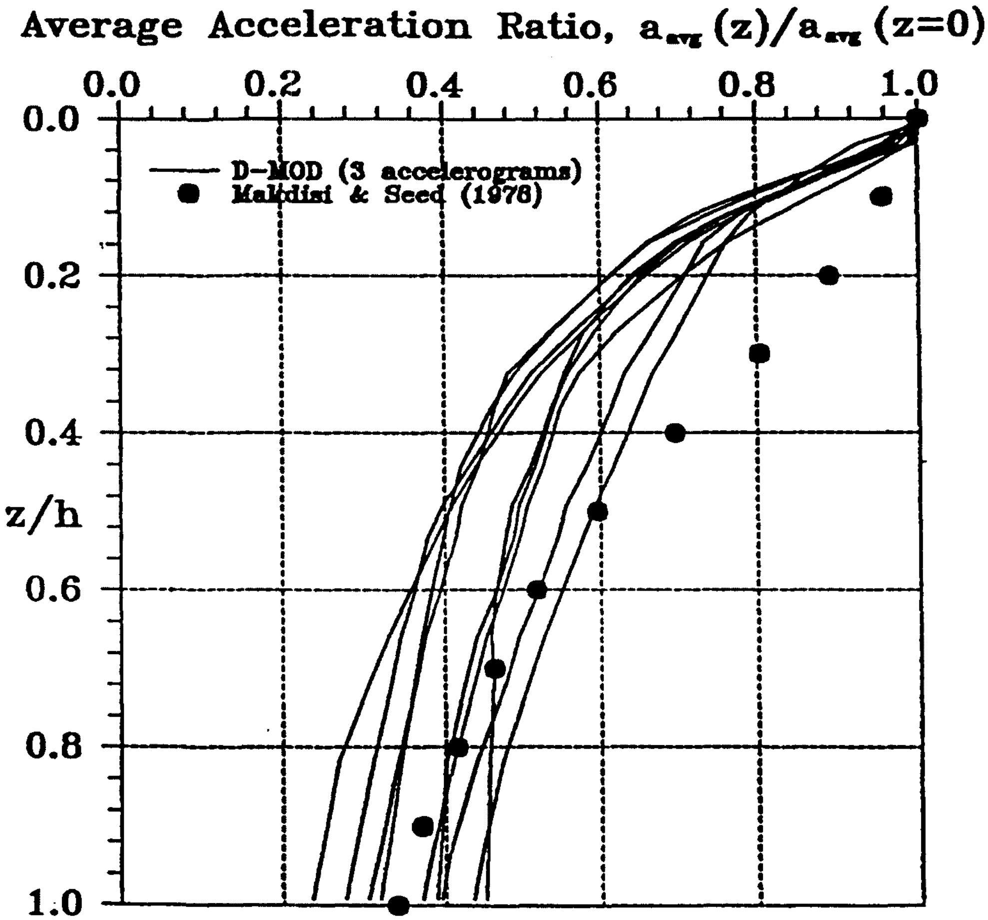
U.S. Environmental Protection Agency. (1995). RCRA Subtitle D (258) seismic design guidance for municipal solid waste landfill facilities (EPA/600/R-95/051).



Max acceleration at crest = 0.36g

Figure 4.6 Approximate Relationship Between Maximum Accelerations at the Base and Crest for Various Ground Conditions (Singh and Sun, 1995)

U.S. Environmental Protection Agency. (1995). RCRA Subtitle D (258) seismic design guidance for municipal solid waste landfill facilities (EPA/600/R-95/051).



Max acceleration at crest = 0.36 per Fig. 4.6

Considering a slip surface extending to the base of the embankment, use z/h = 1.0. From Fig. 4.7 with a z/h = 1.0, the average acceleration ratio is 0.3.

Peak acceleration at base of embankment is then
0.36 x 0.30 = **0.108g**.

Figure 4.7 Variation of Maximum Average Acceleration Ratio with Depth of Sliding Mass (Kavazanjian and Matasović, 1995)

Appendix IV – Limit Equilibrium & Seismic Analyses

LEGEND:

- DENOTES APPROXIMATE BORING LOCATION
- MAJOR CONTOUR
- MINOR CONTOUR

TOPOGRAPHIC SURVEY OBTAINED FROM OHIO STATEWIDE IMAGERY PROGRAM (OSIP) LIDAR DATA MANAGED BY THE OHIO GEOGRAPHICALLY REFERENCED INFORMATION PROGRAM (OGRIP). LIDAR SOURCE: OSIP I (2007) MUSKINGUM COUNTY LIDAR DATASET, OHIO STATE PLANE SOUTH, NAD 83 (2011) / NAVD 88.

N

0 300 600

GRAPHIC SCALE (FEET)

S&ME, Inc.

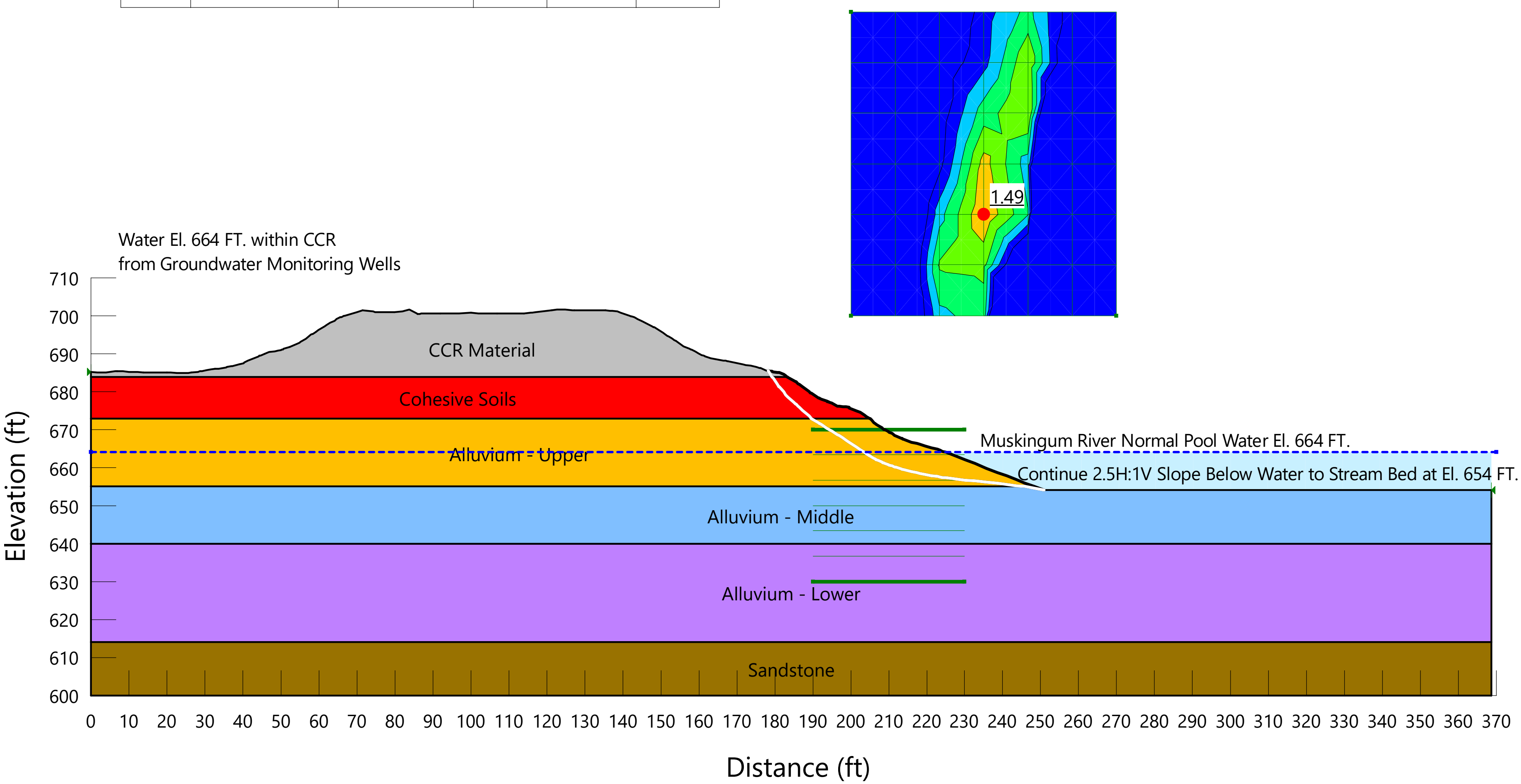
STABILITY CROSS SECTION LOCATIONS

AEP PHILO LEGACY CCR
AEP PHILO STATION
PHILO, OHIO

SCALE:	1" = 300'
DATE:	12-FEB-2026
PROJECT NUMBER	25170079
FIGURE NO.	1

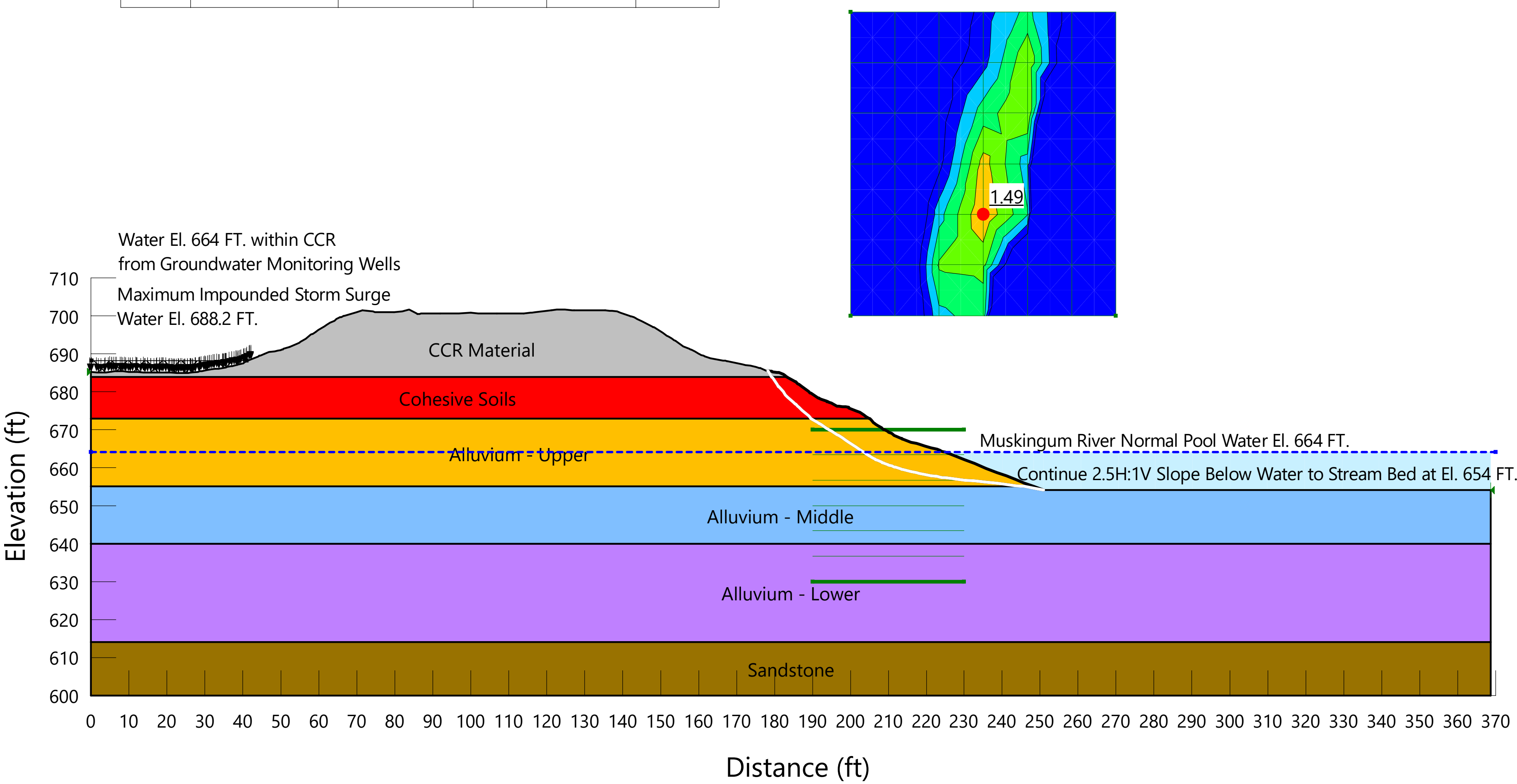
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Alluvium - Lower	Mohr-Coulomb	125	0	38
	Alluvium - Middle	Mohr-Coulomb	125	0	36
	Alluvium - Upper	Mohr-Coulomb	120	0	34
	CCR Material	Mohr-Coulomb	110	50	32
	Cohesive Soils	Mohr-Coulomb	120	100	32
	Sandstone	Bedrock (Impenetrable)			

Project: Philo Legacy CCR
Project #: 25170079
Title: Bottom Ash Embankment
Created By: Walter Babiy
Date: 03/19/2026
Name: Long Term Stability
Analysis Type: Spencer
Scale: 1:500



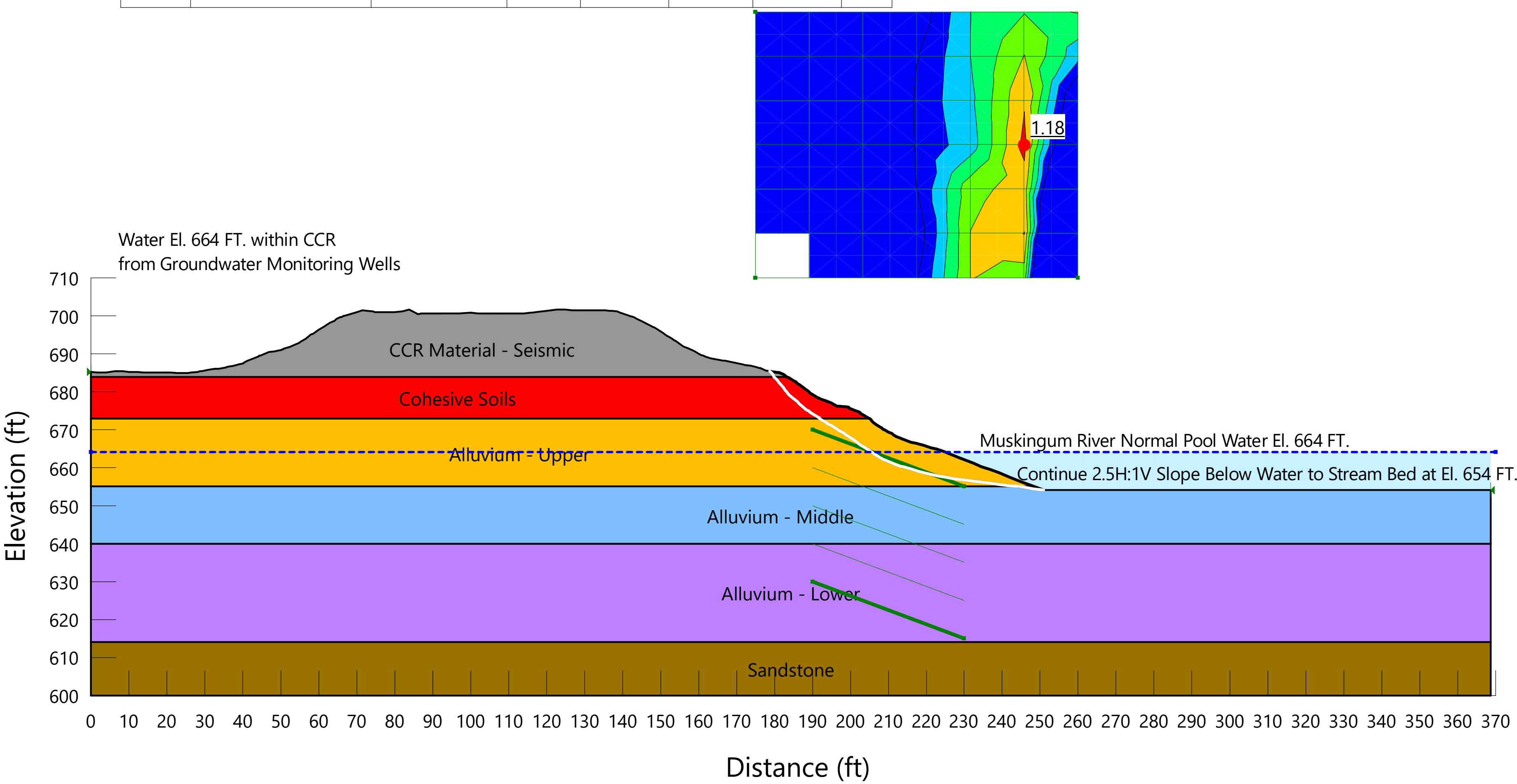
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Alluvium - Lower	Mohr-Coulomb	125	0	38
	Alluvium - Middle	Mohr-Coulomb	125	0	36
	Alluvium - Upper	Mohr-Coulomb	120	0	34
	CCR Material	Mohr-Coulomb	110	50	32
	Cohesive Soils	Mohr-Coulomb	120	100	32
	Sandstone	Bedrock (Impenetrable)			

Project: Philo Legacy CCR
Project #: 25170079
Title: Bottom Ash Embankment
Created By: Walter Babiy
Date: 03/19/2026
Name: Maximum Storm Surge Inundation
Analysis Type: Spencer
Scale: 1:500



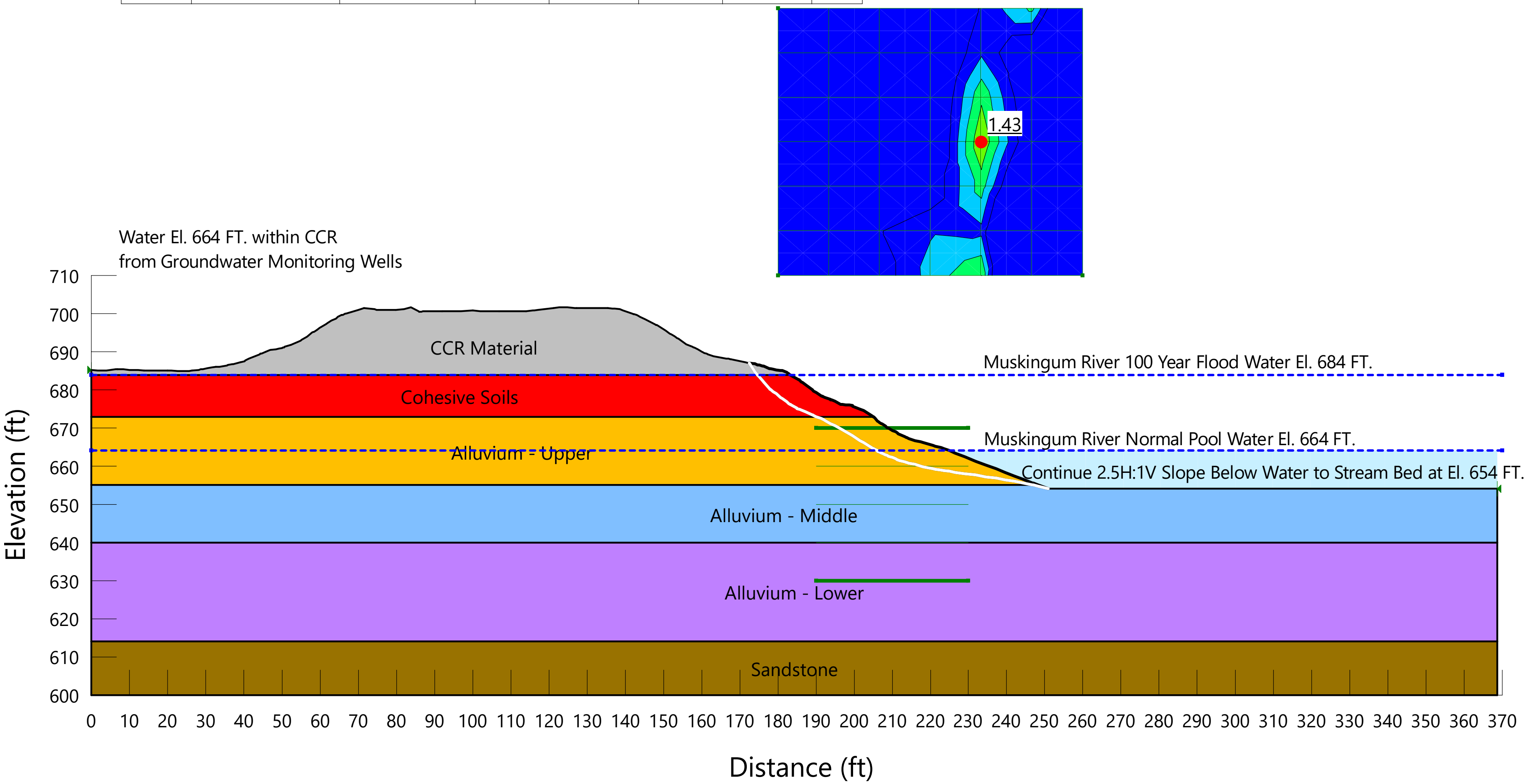
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Cohesion R (psf)	Phi R (°)
	Alluvium - Lower	Mohr-Coulomb	125	0	38	0	38
	Alluvium - Middle	Mohr-Coulomb	125	0	36	0	36
	Alluvium - Upper	Mohr-Coulomb	120	0	34	0	34
	CCR Material - Seismic	Mohr-Coulomb	110	50	32	200	20
	Cohesive Soils	Mohr-Coulomb	120	100	32	250	17
	Sandstone	Bedrock (Impenetrable)					

Project: Philo Legacy CCR
Project #: 25170079
Title: Bottom Ash Embankment
Created By: Walter Babiy
Date: 03/19/2026
Analysis Type: Spencer
Name: Pseudo-Static Stability
Staged Pseudo Static Analysis Option: Undrained Strengths (Duncan e
Horz Seismic Coef.: 0.108
Scale: 1:500



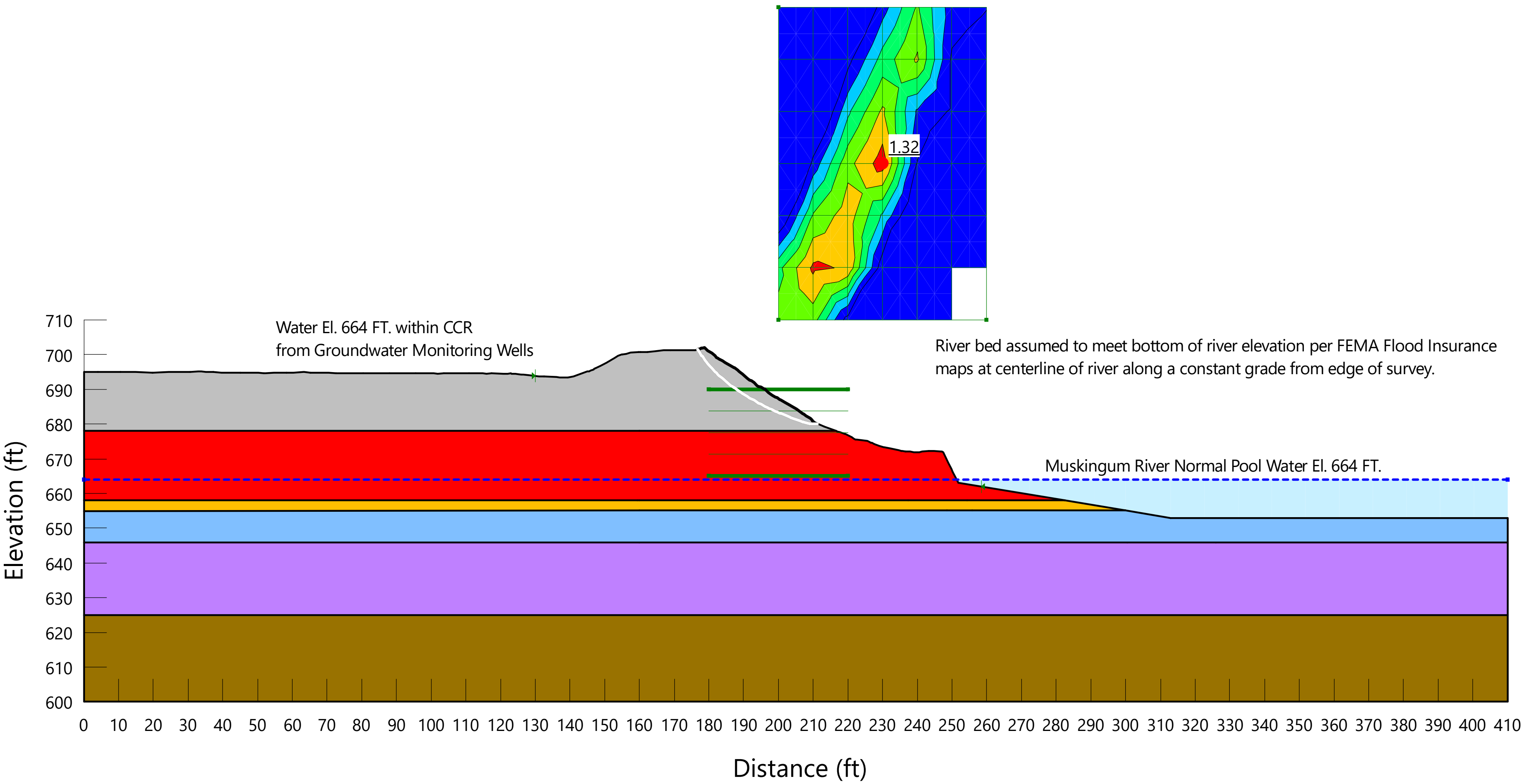
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Cohesion R (psf)	Phi R (°)
	Alluvium - Lower	Mohr-Coulomb	125	0	38	0	38
	Alluvium - Middle	Mohr-Coulomb	125	0	36	0	36
	Alluvium - Upper	Mohr-Coulomb	120	0	34	0	34
	CCR Material	Mohr-Coulomb	110	50	32	50	32
	Cohesive Soils	Mohr-Coulomb	120	100	32	250	17
	Sandstone	Bedrock (Impenetrable)					

Project: Philo Legacy CCR
Project #: 25170079
Title: Bottom Ash Embankment
Created By: Walter Babiy
Date: 03/19/2026
Name: Rapid Draw Down
Use Staged Rapid Drawdown: Yes
Analysis Type: Spencer
Scale: 1:500



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Alluvium-Lower	Mohr-Coulomb	125	0	38
	Alluvium-Middle	Mohr-Coulomb	125	0	36
	Alluvium-Upper	Mohr-Coulomb	125	0	34
	CCR Material	Mohr-Coulomb	110	50	32
	Cohesive Soils	Mohr-Coulomb	120	100	32
	Sandstone	Bedrock (Impenetrable)			

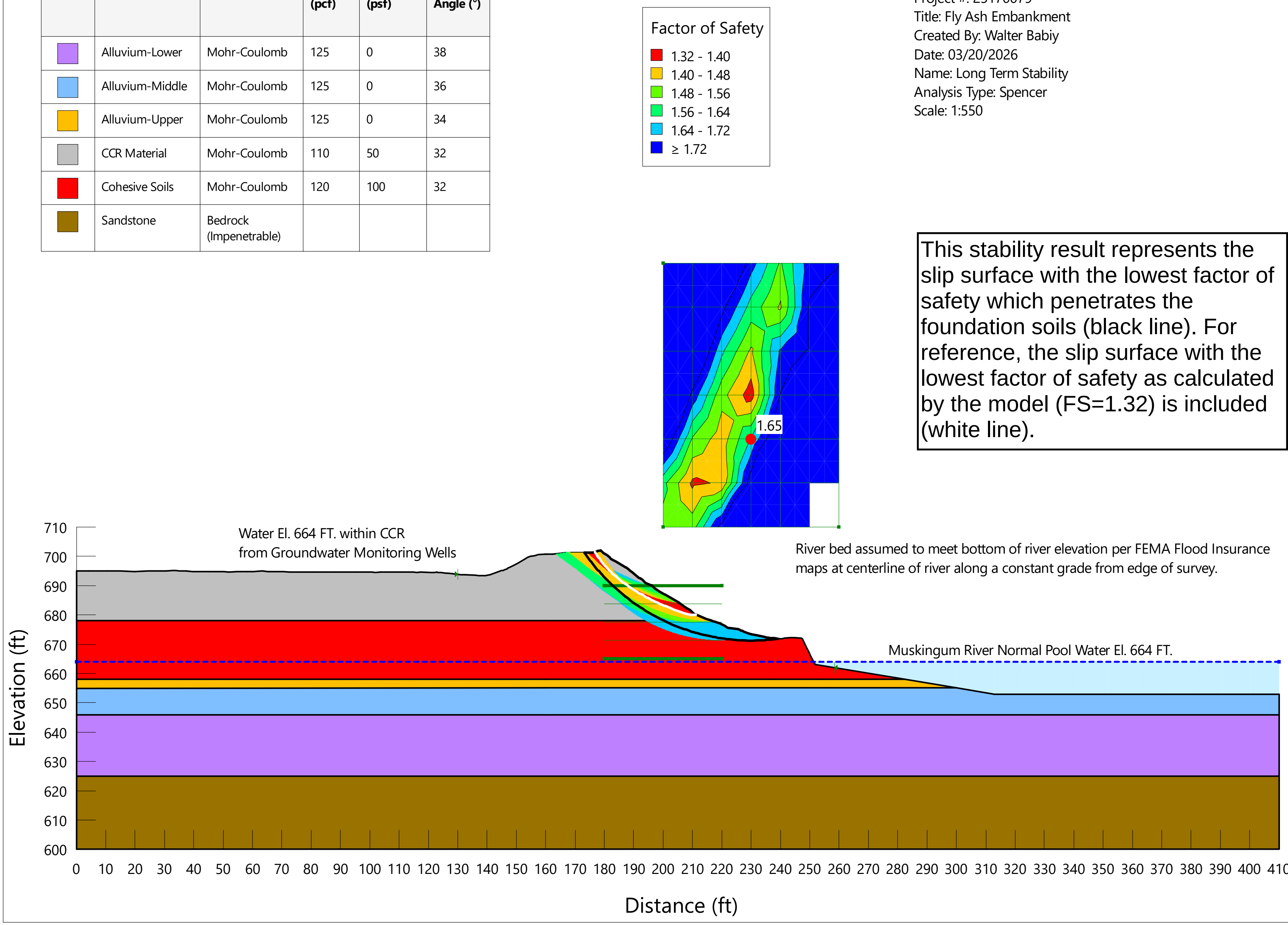
Project: Philo Legacy CCR
Project #: 25170079
Title: Fly Ash Embankment
Created By: Walter Babiy
Date: 03/20/2026
Name: Long Term Stability
Analysis Type: Spencer
Scale: 1:550



Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Alluvium-Lower	Mohr-Coulomb	125	0	38
	Alluvium-Middle	Mohr-Coulomb	125	0	36
	Alluvium-Upper	Mohr-Coulomb	125	0	34
	CCR Material	Mohr-Coulomb	110	50	32
	Cohesive Soils	Mohr-Coulomb	120	100	32
	Sandstone	Bedrock (Impenetrable)			

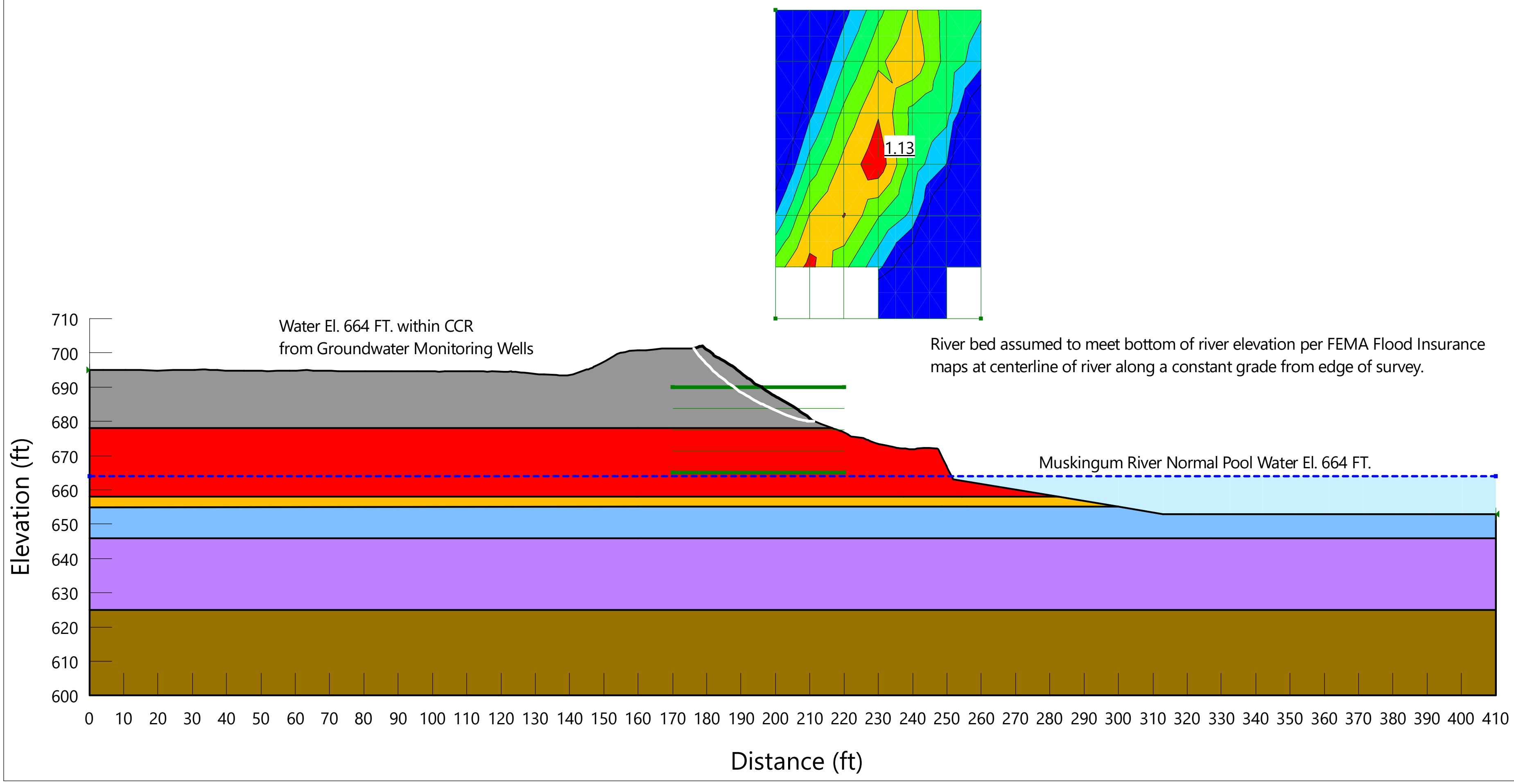
Project: Philo Legacy CCR
Project #: 25170079
Title: Fly Ash Embankment
Created By: Walter Babiy
Date: 03/20/2026
Name: Long Term Stability
Analysis Type: Spencer
Scale: 1:550

This stability result represents the slip surface with the lowest factor of safety which penetrates the foundation soils (black line). For reference, the slip surface with the lowest factor of safety as calculated by the model (FS=1.32) is included (white line).



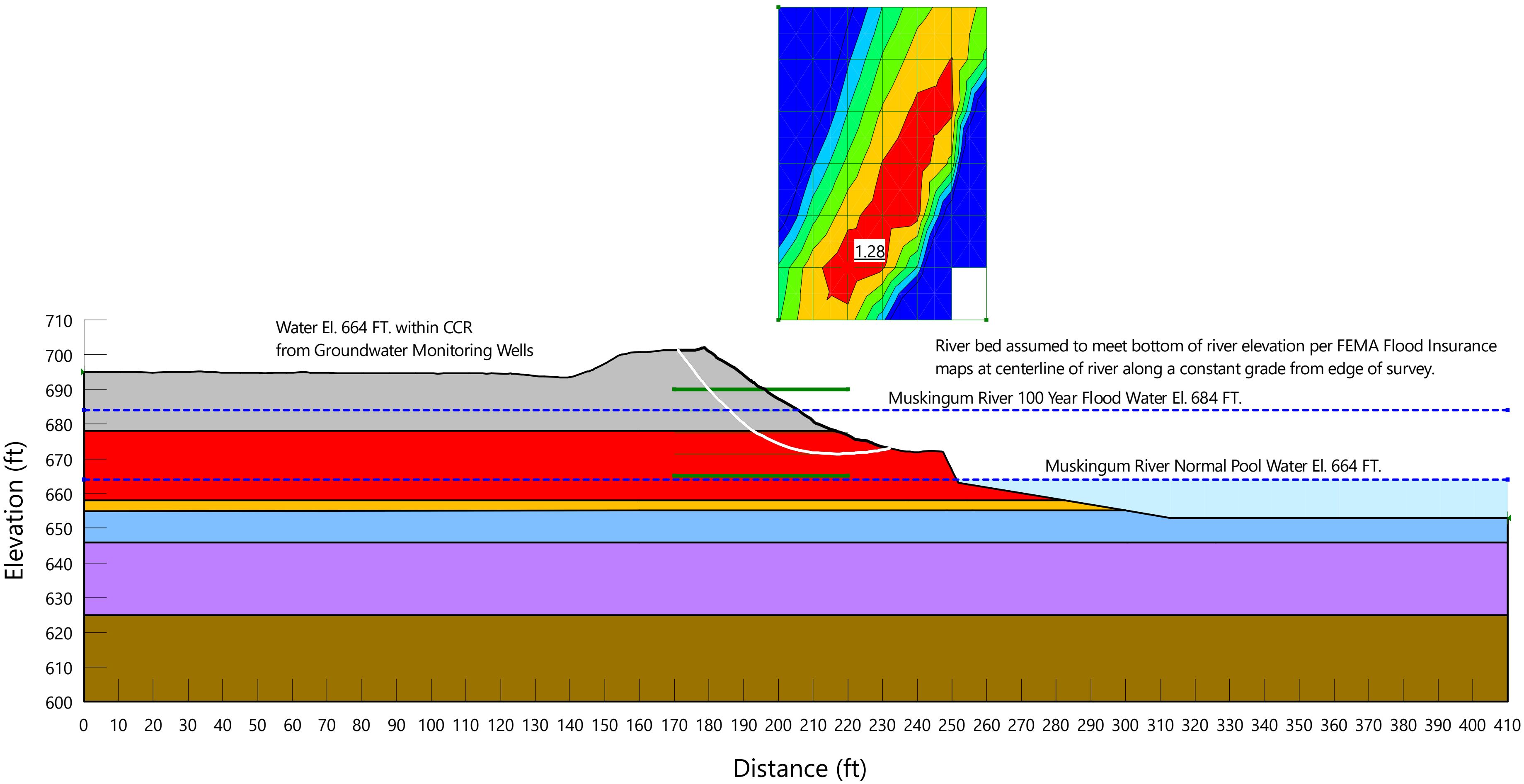
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Cohesion R (psf)	Phi R (°)
	Alluvium-Lower	Mohr-Coulomb	125	0	38	0	38
	Alluvium-Middle	Mohr-Coulomb	125	0	36	0	36
	Alluvium-Upper	Mohr-Coulomb	125	0	34	0	34
	CCR Material - Seismic	Mohr-Coulomb	110	50	32	200	20
	Cohesive Soils	Mohr-Coulomb	120	100	32	250	17
	Sandstone	Bedrock (Impenetrable)					

Project: Philo Legacy CCR
Project #: 25170079
Title: Fly Ash Embankment
Created By: Walter Babiy
Date: 03/20/2026
Name: Pseudo-Static Stability
Analysis Type: Spencer
Staged Pseudo Static Analysis Option: Undrained Strengths (Duncan et al., 1990)
Horz Seismic Coef.: 0.108
Scale: 1:550



Color	Name	Slope Stability Material Model	Piezometric Surface After Drawdown	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Cohesion R (psf)	Phi R (°)
	Alluvium-Lower	Mohr-Coulomb	2	125	0	38	0	38
	Alluvium-Middle	Mohr-Coulomb	2	125	0	36	0	36
	Alluvium-Upper	Mohr-Coulomb	2	125	0	34	0	34
	CCR Material	Mohr-Coulomb	2	110	50	32	50	32
	Cohesive Soils	Mohr-Coulomb	2	120	100	32	250	17
	Sandstone	Bedrock (Impenetrable)	2					

Project: Philo Legacy CCR
Project #: 25170079
Title: Fly Ash Embankment
Created By: Walter Babiy
Date: 03/20/2026
Name: Rapid Draw Down
Analysis Type: Spencer
Use Staged Rapid Drawdown: Yes
Scale: 1:550



620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information

Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-01
GS Elevation: 700.00 ft MSL (NAVD88)
GW Depth: 38.0 ft
GW Depth: 11.6 m

Quake Parameters

M_w: 5.76
MSF[1]: 1.96 (lower bound)
MSF[2]: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 30 ft
Crest Elevation: 700.00 ft MSL (NAVD88)

Hammer Parameters

ER: 90.1 %
C_E: 1.50
C_B: 1.00
C_S: 1.2

General Parameters

γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification

Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	-	5.0	4.3	1.30	8	5	4.3	0.14	0.91	0.33	NL	22.4	22.4	0.99	0.21	1.54	0.75	17	17	0.178	65	1.0	0.67	1.00	0.35	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	10.0	9.3	2.82	19	5	9.3	0.31	0.75	0.27	NL	48.8	48.8	0.98	0.17	1.30	0.75	33	n/a	n/a	83	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	13.5	-	15.0	14.3	4.34	35	5	14.3	0.48	0.54	0.20	NL	75.1	75.1	0.97	0.12	1.13	0.85	60	n/a	n/a	101	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	18.5	-	20.0	19.3	5.87	7	5	19.3	0.64	0.41	0.15	NL	101.5	101.5	0.96	0.09	0.99	0.85	11	11	0.119	42	1.0	0.79	1.00	0.23	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	23.5	-	25.0	24.3	7.39	8	5	24.3	0.81	0.34	0.12	NL	127.8	127.8	0.94	0.08	0.89	0.95	12	12	0.133	42	1.0	0.79	0.95	0.25	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	28.5	-	30.0	29.3	8.92	0	80	29.3	0.98	0.30	0.11	NL	154.2	154.2	0.92	0.07	0.80	0.95	0	5	0.072	0	1.0	0.80	0.92	0.13	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	33.0	-	34.5	33.8	10.29	2	80	33.8	1.13	0.30	0.11	NL	177.9	177.9	0.90	0.06	0.74	1.00	3	8	0.098	19	1.0	0.80	0.89	0.17	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	36.0	-	37.5	36.8	11.20	5	80	36.8	1.23	0.30	0.11	NL	193.7	193.7	0.88	0.06	0.70	1.00	6	13	0.137	30	1.0	0.80	0.88	0.24	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GP-GM	38.5	-	40.0	39.3	11.96	29	10	39.3	1.31	0.30	0.11		206.9	203.1	0.86	0.06	0.68	1.00	36	n/a	n/a	72	1.0	0.64	0.78	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GP-GM	41.0	-	42.5	41.8	12.73	26	10	41.8	1.39	0.30	0.11		220.0	208.8	0.84	0.06	0.67	1.00	31	n/a	n/a	67	1.0	0.66	0.78	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GP-GM	43.5	-	45.0	44.3	13.49	17	10	44.3	1.48	0.30	0.11		233.2	214.5	0.81	0.06	0.66	1.00	20	21	0.234	54	1.0	0.73	0.82	0.38	6.07	no	0.00	none	0.00	0.00		1.5	0.0
SP-SM	46.0	-	47.5	46.8	14.25	25	10	46.8	1.56	0.30	0.11		246.4	220.2	0.79	0.06	0.65	1.00	29	31	0.519	65	1.0	0.67	0.78	0.79	12.83	no	0.00	none	0.00	0.00		1.5	0.0
SP-SM	48.5	-	50.0	49.3	15.01	15	10	49.3	1.64	0.30	0.11		259.6	225.9	0.76	0.06	0.64	1.00	17	18	0.197	50	1.0	0.75	0.82	0.32	5.15	no	0.00	none	0.00	0.00		1.5	0.0
GP	53.5	-	55.0	54.3	16.54	20	5	54.3	1.81	0.30	0.11		285.9	237.3	0.71	0.06	0.62	1.00	22	22	0.245	57	1.0	0.71	0.78	0.38	6.27	no	0.00	none	0.00	0.00		1.5	0.0
GP	58.5	-	60.0	59.3	18.06	19	5	59.3	1.98	0.30	0.11		312.3	248.7	0.67	0.06	0.60	1.00	20	20	0.221	55	1.0	0.72	0.78	0.34	5.78	no	0.00	none	0.00	0.00		1.5	0.0
GP	63.5	-	65.0	64.3	19.58	28	5	64.3	2.14	0.30	0.11		338.6	260.2	0.63	0.06	0.58	1.00	29	29	0.420	66	1.0	0.67	0.73	0.60	10.54	no	0.00	none	0.00	0.00		1.5	0.0
GP	68.5	-	70.0	69.3	21.11	31	5	69.3	2.31	0.30	0.11		365.0	271.6	0.60	0.06	0.56	1.00	31	n/a	n/a	69	1.0	0.66	0.71	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GP	73.5	-	75.0	74.3	22.63	29	5	74.3	2.48	0.30	0.11		391.3	283.0	0.57	0.06	0.55	1.00	29	29	0.390	66	1.0	0.67	0.71	0.55	9.85	no	0.00	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information

Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-02
GS Elevation: 698.00 ft MSL (NAVD88)
GW Depth: 40.0 ft
GW Depth: 12.2 m

Quake Parameters

M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest} 0.36 %g

Embankment Height: 22 ft
Crest Elevation: 698.00 ft MSL (NAVD88)

Hammer Parameters

ER 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters

γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification

Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer			z		N_m	%	y	y/h	$k_{max}/$	k_{max}	Manual Screening	σ_{vo}	σ'_{vo}	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR	fos	Liq? (by	Liq	Liq	LPI (FS)	LPI (P_L)	ε_v	t	ΔH
	top		bottom	(ft)	(m)		Fines	(ft)		u_{max}	(%g)		(kPa)	(kPa)												(corect.)		FOS def'n)	Prob[10]	Likelihood	0.0	0.0	(%)	(ft)	(in.)
SP	3.5	-	5.0	4.3	1.30	16	5	4.3	0.19	0.87	0.31	NL	22.4	22.4	0.99	0.20	1.54	0.75	30	30	0.455	87	1.0	0.60	1.00	0.89	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	10.0	9.3	2.82	39	5	9.3	0.42	0.61	0.22	NL	48.8	48.8	0.98	0.14	1.30	0.75	61	n/a	n/a	112	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	13.5	-	15.0	14.3	4.34	38	5	14.3	0.65	0.40	0.14	NL	75.1	75.1	0.97	0.09	1.13	0.85	59	n/a	n/a	99	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	18.5	-	20.0	19.3	5.87	27	5	19.3	0.88	0.33	0.12	NL	101.5	101.5	0.96	0.07	0.99	0.85	37	n/a	n/a	78	1.0	0.61	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	23.5	-	25.0	24.3	7.39	4	75	24.3	1.10	0.30	0.11	NL	127.8	127.8	0.94	0.07	0.89	0.95	5	12	0.127	28	1.0	0.80	0.95	0.24	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	28.5	-	30.0	29.3	8.92	5	75	29.3	1.33	0.30	0.11	NL	154.2	154.2	0.92	0.06	0.80	0.95	6	12	0.134	30	1.0	0.80	0.92	0.24	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	31.0	-	32.5	31.8	9.68	2	75	31.8	1.44	0.30	0.11	NL	167.3	167.3	0.91	0.06	0.77	0.95	2	8	0.094	19	1.0	0.80	0.90	0.17	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	33.5	-	35.0	34.3	10.44	5	75	34.3	1.56	0.30	0.11	NL	180.5	180.5	0.90	0.06	0.73	1.00	6	12	0.132	29	1.0	0.80	0.89	0.23	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	36.0	-	37.5	36.8	11.20	4	75	36.8	1.67	0.30	0.11	NL	193.7	193.7	0.88	0.06	0.70	1.00	5	10	0.117	25	1.0	0.80	0.88	0.20	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	38.5	-	40.0	39.3	11.96	5	75	39.3	1.78	0.30	0.11	NL	206.9	206.9	0.86	0.06	0.67	1.00	5	11	0.127	28	1.0	0.80	0.87	0.22	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	41.0	-	42.5	41.8	12.73	6	5	41.8	1.90	0.30	0.11		220.0	214.8	0.84	0.06	0.66	1.00	6	6	0.082	30	1.0	0.80	0.86	0.14	2.32	no	0.00	none	0.00	0.00		1.5	0.0
SP	43.5	-	45.0	44.3	13.49	16	5	44.3	2.01	0.30	0.11		233.2	220.5	0.81	0.06	0.65	1.00	17	17	0.177	49	1.0	0.75	0.83	0.29	4.76	no	0.00	none	0.00	0.00		1.5	0.0
CL-ML	48.5	-	50.0	49.3	15.01	16	75	49.3	2.24	0.30	0.11	NL	259.6	231.9	0.76	0.06	0.63	1.00	16	24	0.279	49	1.0	0.76	0.82	0.45	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP-SM	53.5	-	55.0	54.3	16.54	21	10	54.3	2.47	0.30	0.11	NL	285.9	243.3	0.71	0.06	0.61	1.00	20	22	0.239	55	1.0	0.72	0.79	0.37	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP-SM	58.5	-	60.0	59.3	18.06	20	10	59.3	2.69	0.30	0.11	NL	312.3	254.7	0.67	0.06	0.59	1.00	19	20	0.217	53	1.0	0.73	0.78	0.33	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP-SM	63.5	-	65.0	64.3	19.58	33	10	64.3	2.92	0.30	0.11	NL	338.6	266.1	0.63	0.06	0.57	1.00	30	n/a	n/a	67	1.0	0.66	0.72	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	68.5	-	70.0	69.3	21.11	35	0	69.3	3.15	0.30	0.11	NL	365.0	277.5	0.60	0.06	0.55	1.00	31	n/a	n/a	69	1.0	0.66	0.71	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	73.5	-	75.0	74.3	22.63	27	0	74.3	3.38	0.30	0.11	NL	391.3	288.9	0.57	0.05	0.54	1.00	23	23	0.263	60	1.0	0.70	0.73	0.38	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	78.5	-	80.0	79.3	24.16	42	0	79.3	3.60	0.30	0.11	NL	417.7	300.3	0.55	0.05	0.52	1.00	35	n/a	n/a	74	1.0	0.63	0.67	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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		-																																	
		-																																	
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P_G = 0.01 Σ= 0.0

Risk = very low to none

1

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information

Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-03
GS Elevation: 701.00 ft MSL (NAVD88)
GW Depth: 40.0 ft
GW Depth: 12.2 m

Quake Parameters

M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest} 0.36 %g

Embankment Height: 23.5 ft
Crest Elevation: 701.00 ft MSL (NAVD88)

Hammer Parameters

ER 90.1 %
C_E: 1.50
C_B: 1.00
C_S: 1.2

General Parameters

γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification

Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d [3]	CSR [4]	C_N [5]	C_R [6]	$(N_1)_{60}$	$(N_1)_{60cs}$ [7]	$CRR_{7.5}$ [8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob [10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	-	5.0	4.3	1.30	33	5	4.3	0.18	0.88	0.32	NL	22.4	22.4	0.99	0.21	1.54	0.75	69	n/a	n/a	133	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	10.0	9.3	2.82	8	5	9.3	0.39	0.64	0.23	NL	48.8	48.8	0.98	0.15	1.30	0.75	14	14	0.151	54	1.0	0.73	1.00	0.30	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	13.5	-	15.0	14.3	4.34	7	5	14.3	0.61	0.43	0.15	NL	75.1	75.1	0.97	0.10	1.13	0.85	12	12	0.132	45	1.0	0.77	1.00	0.26	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	18.5	-	20.0	19.3	5.87	4	5	19.3	0.82	0.34	0.12	NL	101.5	101.5	0.96	0.08	0.99	0.85	6	6	0.080	32	1.0	0.80	1.00	0.16	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	23.5	-	25.0	24.3	7.39	7	75	24.3	1.03	0.30	0.11	NL	127.8	127.8	0.94	0.07	0.89	0.95	11	18	0.189	39	1.0	0.80	0.95	0.35	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	27.0	-	28.5	27.8	8.46	9	75	27.8	1.18	0.30	0.11	NL	146.3	146.3	0.93	0.07	0.83	0.95	13	20	0.219	43	1.0	0.78	0.92	0.40	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	28.5	-	30.0	29.3	8.92	19	75	29.3	1.24	0.30	0.11	NL	154.2	154.2	0.92	0.06	0.80	0.95	26	36	-0.167	62	1.0	0.69	0.88	-0.29	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	31.0	-	32.5	31.8	9.68	2	75	31.8	1.35	0.30	0.11	NL	167.3	167.3	0.91	0.06	0.77	0.95	3	8	0.097	20	1.0	0.80	0.90	0.17	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	33.5	-	35.0	34.3	10.44	2	85	34.3	1.46	0.30	0.11	NL	180.5	180.5	0.90	0.06	0.73	1.00	3	8	0.097	19	1.0	0.80	0.89	0.17	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	36.0	-	37.5	36.8	11.20	1	85	36.8	1.56	0.30	0.11	NL	193.7	193.7	0.88	0.06	0.70	1.00	1	7	0.084	13	1.0	0.80	0.88	0.14	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	38.5	-	40.0	39.3	11.96	0	85	39.3	1.67	0.30	0.11	NL	206.9	206.9	0.86	0.06	0.67	1.00	0	5	0.072	0	1.0	0.80	0.87	0.12	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	41.0	-	42.5	41.8	12.73	4	60	41.8	1.78	0.30	0.11		220.0	214.8	0.84	0.06	0.66	1.00	5	11	0.119	26	1.0	0.80	0.86	0.20	3.36	no	0.00	none	0.00	0.00		1.5	0.0
SM	43.5	-	45.0	44.3	13.49	7	25	44.3	1.88	0.30	0.11		233.2	220.5	0.81	0.06	0.65	1.00	8	13	0.144	34	1.0	0.80	0.86	0.24	4.03	no	0.00	none	0.00	0.00		1.5	0.0
SM	48.5	-	50.0	49.3	15.01	28	25	49.3	2.10	0.30	0.11		259.6	231.9	0.76	0.06	0.63	1.00	32	n/a	n/a	68	1.0	0.66	0.75	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	53.5	-	55.0	54.3	16.54	23	25	54.3	2.31	0.30	0.11	NL	285.9	243.3	0.71	0.06	0.61	1.00	25	32	0.813	61	1.0	0.70	0.77	1.22	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	58.5	-	60.0	59.3	18.06	24	5	59.3	2.52	0.30	0.11	NL	312.3	254.7	0.67	0.06	0.59	1.00	25	25	0.300	62	1.0	0.69	0.75	0.44	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	63.5	-	65.0	64.3	19.58	26	5	64.3	2.73	0.30	0.11	NL	338.6	266.1	0.63	0.06	0.57	1.00	27	27	0.330	63	1.0	0.68	0.74	0.48	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	68.5	-	70.0	69.3	21.11	33	5	69.3	2.95	0.30	0.11	NL	365.0	277.5	0.60	0.06	0.55	1.00	33	n/a	n/a	71	1.0	0.65	0.70	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	73.5	-	75.0	74.3	22.63	27	5	74.3	3.16	0.30	0.11	NL	391.3	288.9	0.57	0.05	0.54	1.00	26	26	0.317	63	1.0	0.68	0.72	0.45	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD
WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information
Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-04
GS Elevation: 703.00 ft MSL (NAVD88)
GW Depth: 38.0 ft
GW Depth: 11.6 m

Quake Parameters
M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest} 0.36 %g

Embankment Height: 20.5 ft
Crest Elevation: 703.00 ft MSL (NAVD88)

Hammer Parameters
ER 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters
γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification
Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	-	5.0	4.3	1.30	29	5	4.3	0.21	0.86	0.31	NL	22.4	22.4	0.99	0.20	1.54	0.75	54	n/a	n/a	117	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	10.0	9.3	2.82	29	5	9.3	0.45	0.57	0.21	NL	48.8	48.8	0.98	0.13	1.30	0.75	46	n/a	n/a	97	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	13.5	-	15.0	14.3	4.34	14	5	14.3	0.70	0.38	0.14	NL	75.1	75.1	0.97	0.09	1.13	0.85	22	22	0.236	60	1.0	0.70	1.00	0.46	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	18.5	-	20.0	19.3	5.87	24	5	19.3	0.94	0.31	0.11	NL	101.5	101.5	0.96	0.07	0.99	0.85	33	n/a	n/a	73	1.0	0.63	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	21.0	-	22.5	21.8	6.63	13	40	21.8	1.06	0.30	0.11	NL	114.6	114.6	0.95	0.07	0.94	0.95	19	27	0.348	52	1.0	0.74	0.97	0.66	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	23.5	-	25.0	24.3	7.39	9	40	24.3	1.18	0.30	0.11	NL	127.8	127.8	0.94	0.07	0.89	0.95	12	20	0.211	42	1.0	0.79	0.95	0.39	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	26.0	-	27.5	26.8	8.15	11	40	26.8	1.30	0.30	0.11	NL	141.0	141.0	0.94	0.07	0.84	0.95	14	22	0.242	46	1.0	0.77	0.93	0.44	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	28.5	-	30.0	29.3	8.92	7	40	29.3	1.43	0.30	0.11	NL	154.2	154.2	0.92	0.06	0.80	0.95	9	15	0.163	36	1.0	0.80	0.92	0.29	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL-ML	31.0	-	32.5	31.8	9.68	3	75	31.8	1.55	0.30	0.11	NL	167.3	167.3	0.91	0.06	0.77	0.95	4	9	0.106	23	1.0	0.80	0.90	0.19	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	36.0	-	37.5	36.8	11.20	2	75	36.8	1.79	0.30	0.11	NL	193.7	193.7	0.88	0.06	0.70	1.00	2	8	0.093	18	1.0	0.80	0.88	0.16	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	43.5	-	45.0	44.3	13.49	4	75	44.3	2.16	0.30	0.11		233.2	214.5	0.81	0.06	0.66	1.00	4	10	0.114	25	1.0	0.80	0.86	0.19	3.11	no	0.00	none	0.00	0.00		1.5	0.0
SM	48.5	-	50.0	49.3	15.01	20	10	49.3	2.40	0.30	0.11		259.6	225.9	0.76	0.06	0.64	1.00	20	22	0.239	55	1.0	0.73	0.80	0.38	6.14	no	0.00	none	0.00	0.00		1.5	0.0
SM	53.5	-	55.0	54.3	16.54	13	10	54.3	2.65	0.30	0.11	NL	285.9	237.3	0.71	0.06	0.62	1.00	13	14	0.150	44	1.0	0.78	0.83	0.25	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GW	58.5	-	60.0	59.3	18.06	24	5	59.3	2.89	0.30	0.11	NL	312.3	248.7	0.67	0.06	0.60	1.00	23	23	0.257	58	1.0	0.71	0.77	0.39	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GW	63.5	-	68.6	66.1	20.13	28	5	66.1	3.22	0.30	0.11	NL	348.1	264.3	0.62	0.06	0.57	1.00	26	26	0.308	62	1.0	0.69	0.74	0.45	n/a	no	n/a	none	0.00	0.00		5.1	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information
Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-05
GS Elevation: 705.00 ft MSL (NAVD88)
GW Depth: 38.0 ft
GW Depth: 11.6 m

Quake Parameters
M_w: 5.76
MSF[1]: 1.96 (lower bound)
MSF[2]: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 18 ft
Crest Elevation: 705.00 ft MSL (NAVD88)

Hammer Parameters
ER: 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters
γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Liklihood Classification
Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	-	5.0	4.3	1.30	32	5	4.3	0.24	0.83	0.30	NL	22.4	22.4	0.99	0.19	1.54	0.75	60	n/a	n/a	123	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
MH	8.5	-	10.0	9.3	2.82	22	75	9.3	0.51	0.50	0.18	NL	48.8	48.8	0.98	0.12	1.30	0.75	35	n/a	n/a	84	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	13.5	-	15.0	14.3	4.34	4	5	14.3	0.79	0.35	0.13	NL	75.1	75.1	0.97	0.08	1.13	0.85	6	6	0.081	32	1.0	0.80	1.00	0.16	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	18.5	-	20.0	19.3	5.87	3	35	19.3	1.07	0.30	0.11	NL	101.5	101.5	0.96	0.07	0.99	0.85	4	10	0.112	26	1.0	0.80	1.00	0.22	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	23.5	-	25.0	24.3	7.39	53	35	24.3	1.35	0.30	0.11	NL	127.8	127.8	0.94	0.07	0.89	0.95	72	n/a	n/a	103	1.0	0.60	0.91	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	28.5	-	30.0	29.3	8.92	23	35	29.3	1.63	0.30	0.11	NL	154.2	154.2	0.92	0.06	0.80	0.95	28	39	0.071	65	1.0	0.68	0.87	0.12	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	31.0	-	32.5	31.8	9.68	15	35	31.8	1.76	0.30	0.11	NL	167.3	167.3	0.91	0.06	0.77	0.95	18	26	0.313	51	1.0	0.74	0.88	0.54	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	33.5	-	35.0	34.3	10.44	14	35	34.3	1.90	0.30	0.11	NL	180.5	180.5	0.90	0.06	0.73	1.00	16	25	0.286	48	1.0	0.76	0.87	0.49	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	35.0	-	35.5	35.3	10.74	16	35	35.3	1.96	0.30	0.11	NL	185.8	185.8	0.89	0.06	0.72	1.00	19	27	0.342	51	1.0	0.74	0.86	0.58	n/a	no	n/a	none	0.00	0.00		0.5	0.0
SM	36.0	-	37.5	36.8	11.20	9	35	36.8	2.04	0.30	0.11	NL	193.7	193.7	0.88	0.06	0.70	1.00	10	17	0.182	38	1.0	0.80	0.88	0.31	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	38.5	-	40.0	39.3	11.96	17	5	39.3	2.18	0.30	0.11		206.9	203.1	0.86	0.06	0.68	1.00	19	19	0.199	52	1.0	0.74	0.84	0.33	5.32	no	0.00	none	0.00	0.00		1.5	0.0
SP	41.0	-	42.5	41.8	12.73	8	5	41.8	2.32	0.30	0.11		220.0	208.8	0.84	0.06	0.67	1.00	9	9	0.101	35	1.0	0.80	0.87	0.17	2.78	no	0.00	none	0.00	0.00		1.5	0.0
GW-GM	43.5	-	45.0	44.3	13.49	9	15	44.3	2.46	0.30	0.11		233.2	214.5	0.81	0.06	0.66	1.00	10	12	0.136	37	1.0	0.80	0.86	0.23	3.70	no	0.00	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

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Mt. Pleasant, SC 29464

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information

Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-06
GS Elevation: 694.00 ft MSL (NAVD88)
GW Depth: 38.0 ft
GW Depth: 11.6 m

Quake Parameters

M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 33.5 ft
Crest Elevation: 694.00 ft MSL (NAVD88)

Hammer Parameters

ER: 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters

γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification

Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	-	5.0	4.3	1.30	22	5	4.3	0.13	0.92	0.33	NL	22.4	22.4	0.99	0.21	1.54	0.75	41	n/a	n/a	102	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	10.0	9.3	2.82	26	5	9.3	0.28	0.79	0.28	NL	48.8	48.8	0.98	0.18	1.30	0.75	41	n/a	n/a	91	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SC-SM	13.5	-	15.0	14.3	4.34	15	20	14.3	0.43	0.60	0.22	NL	75.1	75.1	0.97	0.14	1.13	0.85	23	29	0.391	62	1.0	0.69	1.00	0.77	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SC-SM	18.5	-	20.0	19.3	5.87	35	20	19.3	0.57	0.45	0.16	NL	101.5	101.5	0.96	0.10	0.99	0.85	48	n/a	n/a	88	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SC-SM	23.5	-	25.0	24.3	7.39	21	20	24.3	0.72	0.37	0.13	NL	127.8	127.8	0.94	0.08	0.89	0.95	28	34	-2.556	65	1.0	0.68	0.93	-4.66	n/a	no	n/a	none	0.00	0.00		1.5	0.0
MH	28.5	-	30.0	29.3	8.92	58	75	29.3	0.87	0.33	0.12	NL	154.2	154.2	0.92	0.07	0.80	0.95	71	n/a	n/a	102	1.0	0.60	0.85	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	33.5	-	35.0	34.3	10.44	7	50	34.3	1.02	0.30	0.11	NL	180.5	180.5	0.90	0.06	0.73	1.00	8	15	0.159	34	1.0	0.80	0.89	0.28	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	38.5	-	40.0	39.3	11.96	39	50	39.3	1.17	0.30	0.11	NL	206.9	203.1	0.86	0.06	0.68	1.00	43	n/a	n/a	78	1.0	0.61	0.76	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	43.5	-	45.0	44.3	13.49	16	50	44.3	1.32	0.30	0.11	NL	233.2	214.5	0.81	0.06	0.66	1.00	17	25	0.298	50	1.0	0.75	0.83	0.49	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information
Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-07
GS Elevation: 699.00 ft MSL (NAVD88)
GW Depth: 40.0 ft
GW Depth: 12.2 m

Quake Parameters
M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 36 ft
Crest Elevation: 699.00 ft MSL (NAVD88)

Hammer Parameters
ER 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters
γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification
Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SM	3.5	-	5.0	4.3	1.30	30	15	4.3	0.12	0.93	0.33	NL	22.4	22.4	0.99	0.22	1.54	0.75	56	n/a	n/a	119	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	8.5	-	10.0	9.3	2.82	17	15	9.3	0.26	0.81	0.29	NL	48.8	48.8	0.98	0.19	1.30	0.75	27	31	0.508	74	1.0	0.63	1.00	1.00	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	13.5	-	15.0	14.3	4.34	27	15	14.3	0.40	0.64	0.23	NL	75.1	75.1	0.97	0.15	1.13	0.85	42	n/a	n/a	84	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	18.5	-	20.0	19.3	5.87	29	15	19.3	0.53	0.48	0.17	NL	101.5	101.5	0.96	0.11	0.99	0.85	39	n/a	n/a	80	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	23.5	-	25.0	24.3	7.39	77	80	24.3	0.67	0.39	0.14	NL	127.8	127.8	0.94	0.09	0.89	0.95	104	n/a	n/a	124	1.0	0.60	0.91	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	28.5	-	30.0	29.3	8.92	20	80	29.3	0.81	0.34	0.12	NL	154.2	154.2	0.92	0.07	0.80	0.95	25	34	-2.135	60	1.0	0.70	0.88	-3.70	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	33.5	-	35.0	34.3	10.44	12	80	34.3	0.95	0.31	0.11	NL	180.5	180.5	0.90	0.06	0.73	1.00	14	22	0.241	45	1.0	0.78	0.88	0.42	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	38.5	-	40.0	39.3	11.96	5	75	39.3	1.09	0.30	0.11	NL	206.9	206.9	0.86	0.06	0.67	1.00	5	11	0.127	28	1.0	0.80	0.87	0.22	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	43.5	-	45.0	44.3	13.49	37	10	44.3	1.23	0.30	0.11		233.2	220.5	0.81	0.06	0.65	1.00	38	n/a	n/a	75	1.0	0.63	0.75	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	46.0	-	47.5	46.8	14.25	26	10	46.8	1.30	0.30	0.11		246.4	226.2	0.79	0.06	0.64	1.00	27	28	0.370	62	1.0	0.69	0.78	0.57	9.42	no	0.00	none	0.00	0.00		1.5	0.0
SM	48.5	-	50.0	49.3	15.01	18	10	49.3	1.37	0.30	0.11		259.6	231.9	0.76	0.06	0.63	1.00	18	19	0.208	52	1.0	0.74	0.81	0.33	5.51	no	0.00	none	0.00	0.00		1.5	0.0
SM	51.0	-	52.5	51.8	15.77	14	10	51.8	1.44	0.30	0.11	NL	272.8	237.6	0.74	0.06	0.62	1.00	14	15	0.160	45	1.0	0.77	0.82	0.26	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	53.5	-	55.0	54.3	16.54	19	5	54.3	1.51	0.30	0.11	NL	285.9	243.3	0.71	0.06	0.61	1.00	18	18	0.197	52	1.0	0.74	0.80	0.31	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	56.0	-	57.5	56.8	17.30	41	5	56.8	1.58	0.30	0.11	NL	299.1	249.0	0.69	0.06	0.60	1.00	39	n/a	n/a	76	1.0	0.62	0.71	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information

Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-08
GS Elevation: 690.00 ft MSL (NAVD88)
GW Depth: 32.0 ft
GW Depth: 9.8 m

Quake Parameters

M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 17 ft
Crest Elevation: 690.00 ft MSL (NAVD88)

Hammer Parameters

ER 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters

γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification

Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	-	5.0	4.3	1.30	5	5	4.3	0.25	0.82	0.29	NL	22.4	22.4	0.99	0.19	1.54	0.75	9	9	0.107	49	1.0	0.76	1.00	0.21	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	10.0	9.3	2.82	3	5	9.3	0.54	0.48	0.17	NL	48.8	48.8	0.98	0.11	1.30	0.75	5	5	0.070	31	1.0	0.80	1.00	0.14	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	13.5	-	15.0	14.3	4.34	0	50	14.3	0.84	0.34	0.12	NL	75.1	75.1	0.97	0.08	1.13	0.85	0	5	0.072	0	1.0	0.80	1.00	0.14	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	18.5	-	20.0	19.3	5.87	6	0	19.3	1.13	0.30	0.11	NL	101.5	101.5	0.96	0.07	0.99	0.85	8	8	0.097	37	1.0	0.80	1.00	0.19	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	23.5	-	25.0	24.3	7.39	0	80	24.3	1.43	0.30	0.11	NL	127.8	127.8	0.94	0.07	0.89	0.95	0	5	0.072	0	1.0	0.80	0.95	0.14	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	28.5	-	30.0	29.3	8.92	18	20	29.3	1.72	0.30	0.11	NL	154.2	154.2	0.92	0.06	0.80	0.95	22	27	0.351	57	1.0	0.71	0.89	0.61	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP-SM	31.0	-	32.5	31.8	9.68	14	10	31.8	1.87	0.30	0.11	NL	167.3	167.3	0.91	0.06	0.77	0.95	16	18	0.187	49	1.0	0.75	0.88	0.33	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP-SM	33.5	-	35.0	34.3	10.44	49	10	34.3	2.01	0.30	0.11		180.5	173.8	0.90	0.07	0.75	1.00	59	n/a	n/a	91	1.0	0.60	0.81	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GW	36.0	-	37.5	36.8	11.20	24	0	36.8	2.16	0.30	0.11		193.7	179.5	0.88	0.07	0.73	1.00	28	28	0.382	63	1.0	0.68	0.83	0.63	9.42	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	38.5	-	40.0	39.3	11.96	22	10	39.3	2.31	0.30	0.11		206.9	185.2	0.86	0.07	0.72	1.00	26	27	0.336	60	1.0	0.70	0.83	0.55	8.19	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	41.0	-	42.5	41.8	12.73	30	10	41.8	2.46	0.30	0.11		220.0	190.9	0.84	0.07	0.71	1.00	34	n/a	n/a	70	1.0	0.65	0.80	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW-SM	43.5	-	45.0	44.3	13.49	26	10	44.3	2.60	0.30	0.11		233.2	196.6	0.81	0.07	0.69	1.00	29	31	0.512	65	1.0	0.68	0.81	0.81	12.01	no	0.00	none	0.00	0.00		1.5	0.0
SW	48.5	-	50.0	49.3	15.01	25	5	49.3	2.90	0.30	0.11		259.6	208.0	0.76	0.07	0.67	1.00	27	27	0.337	62	1.0	0.69	0.80	0.53	7.95	no	0.00	none	0.00	0.00		1.5	0.0
SW	53.5	-	55.0	54.3	16.54	37	5	54.3	3.19	0.30	0.11	NL	285.9	219.4	0.71	0.06	0.65	1.00	39	n/a	n/a	75	1.0	0.63	0.75	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	58.5	-	60.0	59.3	18.06	23	5	59.3	3.49	0.30	0.11	NL	312.3	230.8	0.67	0.06	0.63	1.00	23	23	0.260	58	1.0	0.71	0.79	0.40	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	63.5	-	65.0	64.3	19.58	38	5	64.3	3.78	0.30	0.11	NL	338.6	242.2	0.63	0.06	0.61	1.00	37	n/a	n/a	74	1.0	0.63	0.72	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	68.5	-	70.0	69.3	21.11	28	5	69.3	4.07	0.30	0.11	NL	365.0	253.6	0.60	0.06	0.59	1.00	27	27	0.325	63	1.0	0.69	0.75	0.48	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information
Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-09
GS Elevation: 702.00 ft MSL (NAVD88)
GW Depth: 22.0 ft
GW Depth: 6.7 m

Quake Parameters
M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest} 0.36 %g

Embankment Height: 18 ft
Crest Elevation: 702.00 ft MSL (NAVD88)

Hammer Parameters
ER 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters
γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification
Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d [3]	CSR [4]	C_N [5]	C_R [6]	$(N_1)_{60}$	$(N_1)_{60cs}$ [7]	$CRR_{7.5}$ [8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob [10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP-SM	3.5	-	5.0	4.3	1.30	13	15	4.3	0.24	0.83	0.30	NL	22.4	22.4	0.99	0.19	1.54	0.75	24	28	0.366	79	1.0	0.61	1.00	0.72	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP-SM	8.5	-	10.0	9.3	2.82	18	15	9.3	0.51	0.50	0.18	NL	48.8	48.8	0.98	0.12	1.30	0.75	28	32	0.777	76	1.0	0.62	1.00	1.53	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP-SM	13.5	-	15.0	14.3	4.34	6	15	14.3	0.79	0.35	0.13	NL	75.1	75.1	0.97	0.08	1.13	0.85	9	12	0.133	39	1.0	0.80	1.00	0.26	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	18.5	-	20.0	19.3	5.87	6	20	19.3	1.07	0.30	0.11	NL	101.5	101.5	0.96	0.07	0.99	0.85	8	12	0.135	37	1.0	0.80	1.00	0.27	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	23.5	-	25.0	24.3	7.39	5	60	24.3	1.35	0.30	0.11		127.8	121.1	0.94	0.07	0.91	0.95	7	13	0.144	32	1.0	0.80	0.97	0.27	3.90	no	0.00	none	0.00	0.00		1.5	0.0
ML	26.0	-	27.5	26.8	8.15	5	60	26.8	1.49	0.30	0.11		141.0	126.8	0.94	0.07	0.89	0.95	7	13	0.142	32	1.0	0.80	0.96	0.27	3.66	no	0.00	none	0.00	0.00		1.5	0.0
SP	28.5	-	30.0	29.3	8.92	15	0	29.3	1.63	0.30	0.11		154.2	132.5	0.92	0.08	0.87	0.95	20	20	0.215	54	1.0	0.73	0.93	0.39	5.20	no	0.00	none	0.00	0.00		1.5	0.0
SP	31.0	-	32.5	31.8	9.68	19	0	31.8	1.76	0.30	0.11		167.3	138.2	0.91	0.08	0.85	0.95	25	25	0.287	60	1.0	0.70	0.91	0.51	6.62	no	0.00	none	0.00	0.00		1.5	0.0
SP	33.5	-	35.0	34.3	10.44	42	0	34.3	1.90	0.30	0.11		180.5	143.9	0.90	0.08	0.83	1.00	56	n/a	n/a	89	1.0	0.60	0.87	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	36.0	-	37.5	36.8	11.20	18	0	36.8	2.04	0.30	0.11		193.7	149.6	0.88	0.08	0.82	1.00	24	24	0.267	58	1.0	0.71	0.89	0.47	5.88	no	0.00	none	0.00	0.00		1.5	0.0
SP	38.5	-	40.0	39.3	11.96	7	0	39.3	2.18	0.30	0.11		206.9	155.3	0.86	0.08	0.80	1.00	9	9	0.104	36	1.0	0.80	0.92	0.19	2.35	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	40.0	-	40.5	40.3	12.27	5	15	40.3	2.24	0.30	0.11		212.1	157.6	0.85	0.08	0.79	1.00	6	9	0.106	30	1.0	0.80	0.92	0.19	2.38	no	0.00	none	0.00	0.00		0.5	0.0
SW-SM	41.0	-	42.5	41.8	12.73	9	15	41.8	2.32	0.30	0.11		220.0	161.0	0.84	0.08	0.78	1.00	11	14	0.154	40	1.0	0.80	0.91	0.28	3.44	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	43.5	-	45.0	44.3	13.49	16	15	44.3	2.46	0.30	0.11		233.2	166.7	0.81	0.08	0.77	1.00	20	23	0.260	53	1.0	0.74	0.88	0.45	5.62	no	0.00	none	0.00	0.00		1.5	0.0
SP	48.5	-	50.0	49.3	15.01	13	0	49.3	2.74	0.30	0.11		259.6	178.1	0.76	0.08	0.74	1.00	15	15	0.164	47	1.0	0.77	0.88	0.28	3.64	no	0.00	none	0.00	0.00		1.5	0.0
SP	53.5	-	55.0	54.3	16.54	28	0	54.3	3.01	0.30	0.11	NL	285.9	189.5	0.71	0.08	0.71	1.00	32	n/a	n/a	68	1.0	0.66	0.81	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	58.5	-	60.0	59.3	18.06	22	0	59.3	3.29	0.30	0.11	NL	312.3	200.9	0.67	0.07	0.69	1.00	24	24	0.278	59	1.0	0.70	0.82	0.45	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	63.5	-	65.0	64.3	19.58	24	0	64.3	3.57	0.30	0.11	NL	338.6	212.3	0.63	0.07	0.66	1.00	26	26	0.303	61	1.0	0.70	0.80	0.48	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	68.5	-	70.0	69.3	21.11	22	0	69.3	3.85	0.30	0.11	NL	365.0	223.7	0.60	0.07	0.64	1.00	23	23	0.251	58	1.0	0.71	0.80	0.39	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	73.5	-	75.0	74.3	22.63	38	0	74.3	4.13	0.30	0.11	NL	391.3	235.1	0.57	0.07	0.62	1.00	38	n/a	n/a	75	1.0	0.63	0.73	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	78.5	-	80.0	79.3	24.16	33	0	79.3	4.40	0.30	0.11	NL	417.7	246.5	0.55	0.07	0.60	1.00	32	n/a	n/a	69	1.0	0.66	0.74	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	83.5	-	85.0	84.3	25.68	30	0	84.3	4.68	0.30	0.11	NL	444.0	257.9	0.53	0.06	0.58	1.00	28	28	0.372	65	1.0	0.68	0.74	0.54	n/a	no	n/a	none	0.00	0.00		1.5	0.0
		-																																	

P_G = 0.01 Σ= 0.0
Risk = very low to none

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information
Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-10
GS Elevation: 702.00 ft MSL (NAVD88)
GW Depth: 22.0 ft
GW Depth: 6.7 m

Quake Parameters
M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 17.5 ft
Crest Elevation: 702.00 ft MSL (NAVD88)

Hammer Parameters
ER: 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters
γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Liklihood Classification
Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	1.0	-	2.5	1.8	0.53	21	5	1.8	0.10	0.94	0.34	NL	9.2	9.2	1.00	0.22	1.70	0.75	43	n/a	n/a	125	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	9.4	9.0	2.73	100	5	9.0	0.51	0.51	0.18	NL	47.2	47.2	0.98	0.12	1.32	0.75	159	n/a	n/a	181	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		0.9	0.0
SP	13.5	-	15.0	14.3	4.34	3	5	14.3	0.81	0.34	0.12	NL	75.1	75.1	0.97	0.08	1.13	0.85	5	5	0.069	28	1.0	0.80	1.00	0.14	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	18.5	-	20.0	19.3	5.87	7	75	19.3	1.10	0.30	0.11	NL	101.5	101.5	0.96	0.07	0.99	0.85	10	16	0.175	40	1.0	0.80	1.00	0.34	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	23.5	-	25.0	24.3	7.39	5	75	24.3	1.39	0.30	0.11	NL	127.8	121.1	0.94	0.07	0.91	0.95	7	13	0.144	32	1.0	0.80	0.97	0.27	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	26.0	-	27.5	26.8	8.15	39	75	26.8	1.53	0.30	0.11	NL	141.0	126.8	0.94	0.07	0.89	0.95	53	n/a	n/a	88	1.0	0.60	0.91	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	28.5	-	30.0	29.3	8.92	23	5	29.3	1.67	0.30	0.11		154.2	132.5	0.92	0.08	0.87	0.95	31	n/a	n/a	67	1.0	0.66	0.91	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	30.5	-	31.0	30.8	9.37	9	5	30.8	1.76	0.30	0.11		162.1	135.9	0.92	0.08	0.86	0.95	12	12	0.130	42	1.0	0.79	0.94	0.24	3.12	no	0.00	none	0.00	0.00		0.5	0.0
SP	31.0	-	32.5	31.8	9.68	42	5	31.8	1.81	0.30	0.11		167.3	138.2	0.91	0.08	0.85	0.95	55	n/a	n/a	90	1.0	0.60	0.88	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW-SM	33.5	-	35.0	34.3	10.44	11	15	34.3	1.96	0.30	0.11		180.5	143.9	0.90	0.08	0.83	1.00	15	18	0.191	45	1.0	0.77	0.92	0.35	4.40	no	0.00	none	0.00	0.00		1.5	0.0
SP	38.5	-	40.0	39.3	11.96	18	0	39.3	2.24	0.30	0.11		206.9	155.3	0.86	0.08	0.80	1.00	23	23	0.259	57	1.0	0.72	0.89	0.45	5.62	no	0.00	none	0.00	0.00		1.5	0.0
SP	43.5	-	45.0	44.3	13.49	20	0	44.3	2.53	0.30	0.11		233.2	166.7	0.81	0.08	0.77	1.00	25	25	0.286	59	1.0	0.70	0.86	0.48	6.08	no	0.00	none	0.00	0.00		1.5	0.0
SW	48.5	-	50.0	49.3	15.01	19	0	49.3	2.81	0.30	0.11		259.6	178.1	0.76	0.08	0.74	1.00	23	23	0.250	57	1.0	0.72	0.85	0.42	5.38	no	0.00	none	0.00	0.00		1.5	0.0
SW	53.5	-	55.0	54.3	16.54	41	0	54.3	3.10	0.30	0.11	NL	285.9	189.5	0.71	0.08	0.71	1.00	47	n/a	n/a	82	1.0	0.60	0.78	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	58.5	-	60.0	59.3	18.06	20	0	59.3	3.39	0.30	0.11	NL	312.3	200.9	0.67	0.07	0.69	1.00	22	22	0.243	56	1.0	0.72	0.82	0.39	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	63.5	-	65.0	64.3	19.58	22	0	64.3	3.67	0.30	0.11	NL	338.6	212.3	0.63	0.07	0.66	1.00	23	23	0.264	58	1.0	0.71	0.81	0.42	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	68.5	-	70.0	69.3	21.11	31	0	69.3	3.96	0.30	0.11	NL	365.0	223.7	0.60	0.07	0.64	1.00	32	n/a	n/a	68	1.0	0.66	0.76	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	73.5	-	75.0	74.3	22.63	49	0	74.3	4.24	0.30	0.11	NL	391.3	235.1	0.57	0.07	0.62	1.00	49	n/a	n/a	85	1.0	0.60	0.71	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	78.5	-	80.0	79.3	24.16	37	0	79.3	4.53	0.30	0.11	NL	417.7	246.5	0.55	0.07	0.60	1.00	36	n/a	n/a	73	1.0	0.64	0.72	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	83.5	-	85.0	84.3	25.68	33	0	84.3	4.81	0.30	0.11	NL	444.0	257.9	0.53	0.06	0.58	1.00	31	n/a	n/a	68	1.0	0.66	0.73	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information
Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-11
GS Elevation: 701.00 ft MSL (NAVD88)
GW Depth: 22.0 ft
GW Depth: 6.7 m

Quake Parameters
M_w: 5.76
MSF[1]: 1.96 (lower bound)
MSF[2]: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 27.5 ft
Crest Elevation: 701.00 ft MSL (NAVD88)

Hammer Parameters
ER 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters
γ_{soil}: 110 lb/ft³
γ_{soil}: 17.3 kN/m²
γ_{water}: 62.4 lb/ft³
γ_{water}: 9.8 kN/m²
Pa: 101.33 kPa

Liquefaction Likliehood Classification
Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SM	3.5	-	5.0	4.3	1.30	11	30	4.3	0.15	0.91	0.33	NL	22.4	22.4	0.99	0.21	1.54	0.75	20	28	0.383	72	1.0	0.64	1.00	0.75	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	8.5	-	10.0	9.3	2.82	9	30	9.3	0.34	0.72	0.26	NL	48.8	48.8	0.98	0.16	1.30	0.75	14	21	0.229	54	1.0	0.73	1.00	0.45	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	13.5	-	15.0	14.3	4.34	6	30	14.3	0.52	0.50	0.18	NL	75.1	75.1	0.97	0.11	1.13	0.85	9	15	0.164	39	1.0	0.80	1.00	0.32	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	18.5	-	20.0	19.3	5.87	4	30	19.3	0.70	0.38	0.14	NL	101.5	101.5	0.96	0.08	0.99	0.85	5	11	0.122	30	1.0	0.80	1.00	0.24	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SM	23.5	-	25.0	24.3	7.39	4	30	24.3	0.88	0.33	0.12		127.8	121.1	0.94	0.08	0.91	0.95	6	11	0.123	29	1.0	0.80	0.97	0.23	3.08	no	0.00	none	0.00	0.00		1.5	0.0
SP	28.5	-	30.0	29.3	8.92	7	5	29.3	1.06	0.30	0.11		154.2	132.5	0.92	0.08	0.87	0.95	9	9	0.107	37	1.0	0.80	0.95	0.20	2.64	no	0.00	none	0.00	0.00		1.5	0.0
ML	31.0	-	32.5	31.8	9.68	4	60	31.8	1.15	0.30	0.11		167.3	138.2	0.91	0.08	0.85	0.95	5	11	0.124	28	1.0	0.80	0.94	0.23	2.96	no	0.00	none	0.00	0.00		1.5	0.0
ML	33.5	-	35.0	34.3	10.44	2	60	34.3	1.25	0.30	0.11		180.5	143.9	0.90	0.08	0.83	1.00	3	8	0.098	19	1.0	0.80	0.93	0.18	2.27	no	0.00	none	0.00	0.00		1.5	0.0
ML	38.5	-	40.0	39.3	11.96	8	60	39.3	1.43	0.30	0.11		206.9	155.3	0.86	0.08	0.80	1.00	10	17	0.184	38	1.0	0.80	0.92	0.33	4.15	no	0.00	none	0.00	0.00		1.5	0.0
SW	41.0	-	42.5	41.8	12.73	27	5	41.8	1.52	0.30	0.11		220.0	161.0	0.84	0.08	0.78	1.00	34	n/a	n/a	69	1.0	0.65	0.85	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	43.5	-	45.0	44.3	13.49	15	0	44.3	1.61	0.30	0.11		233.2	166.7	0.81	0.08	0.77	1.00	19	19	0.198	51	1.0	0.74	0.88	0.34	4.29	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	46.0	-	47.5	46.8	14.25	19	10	46.8	1.70	0.30	0.11		246.4	172.4	0.79	0.08	0.75	1.00	23	24	0.280	57	1.0	0.71	0.86	0.47	5.99	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	48.5	-	50.0	49.3	15.01	22	10	49.3	1.79	0.30	0.11		259.6	178.1	0.76	0.08	0.74	1.00	26	28	0.354	61	1.0	0.70	0.84	0.59	7.54	no	0.00	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information

Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-12
GS Elevation: 703.00 ft MSL (NAVD88)
GW Depth: 22.0 ft
GW Depth: 6.7 m

Quake Parameters

M_w: 5.76
MSF[1]: 1.96 (lower bound)
MSF[2]: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 22 ft
Crest Elevation: 703.00 ft MSL (NAVD88)

Hammer Parameters

ER: 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters

γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification

Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top		Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	-	5.0	4.3	1.30	29	5	4.3	0.19	0.87	0.31	NL	22.4	22.4	0.99	0.20	1.54	0.75	54	n/a	n/a	117	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	-	10.0	9.3	2.82	3	5	9.3	0.42	0.61	0.22	NL	48.8	48.8	0.98	0.14	1.30	0.75	5	5	0.070	31	1.0	0.80	1.00	0.14	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	13.5	-	15.0	14.3	4.34	12	5	14.3	0.65	0.40	0.14	NL	75.1	75.1	0.97	0.09	1.13	0.85	18	18	0.197	56	1.0	0.72	1.00	0.39	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	18.5	-	20.0	19.3	5.87	9	5	19.3	0.88	0.33	0.12	NL	101.5	101.5	0.96	0.07	0.99	0.85	12	12	0.133	45	1.0	0.78	1.00	0.26	n/a	no	n/a	none	0.00	0.00		1.5	0.0
ML	23.5	-	25.0	24.3	7.39	4	50	24.3	1.10	0.30	0.11		127.8	121.1	0.94	0.07	0.91	0.95	6	12	0.128	29	1.0	0.80	0.97	0.24	3.48	no	0.00	none	0.00	0.00		1.5	0.0
ML	26.0	-	27.5	26.8	8.15	10	50	26.8	1.22	0.30	0.11		141.0	126.8	0.94	0.07	0.89	0.95	14	21	0.233	45	1.0	0.78	0.95	0.44	5.96	no	0.00	none	0.00	0.00		1.5	0.0
SW	28.5	-	30.0	29.3	8.92	23	5	29.3	1.33	0.30	0.11		154.2	132.5	0.92	0.08	0.87	0.95	31	n/a	n/a	67	1.0	0.66	0.91	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	31.0	-	32.5	31.8	9.68	49	5	31.8	1.44	0.30	0.11		167.3	138.2	0.91	0.08	0.85	0.95	64	n/a	n/a	97	1.0	0.60	0.88	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	33.5	-	35.0	34.3	10.44	22	0	34.3	1.56	0.30	0.11		180.5	143.9	0.90	0.08	0.83	1.00	29	29	0.436	64	1.0	0.68	0.89	0.76	9.70	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	36.0	-	37.5	36.8	11.20	18	10	36.8	1.67	0.30	0.11		193.7	149.6	0.88	0.08	0.82	1.00	24	25	0.292	58	1.0	0.71	0.89	0.51	6.43	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	38.5	-	40.0	39.3	11.96	14	10	39.3	1.78	0.30	0.11		206.9	155.3	0.86	0.08	0.80	1.00	18	19	0.206	50	1.0	0.75	0.90	0.36	4.54	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	41.0	-	42.5	41.8	12.73	18	10	41.8	1.90	0.30	0.11		220.0	161.0	0.84	0.08	0.78	1.00	23	24	0.274	56	1.0	0.72	0.88	0.47	5.89	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	43.5	-	45.0	44.3	13.49	16	10	44.3	2.01	0.30	0.11		233.2	166.7	0.81	0.08	0.77	1.00	20	21	0.229	53	1.0	0.74	0.88	0.39	4.95	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	48.5	-	50.0	49.3	15.01	15	10	49.3	2.24	0.30	0.11		259.6	178.1	0.76	0.08	0.74	1.00	18	19	0.204	50	1.0	0.75	0.87	0.35	4.47	no	0.00	none	0.00	0.00		1.5	0.0
SW-SM	53.5	-	55.0	54.3	16.54	22	10	54.3	2.47	0.30	0.11	NL	285.9	189.5	0.71	0.08	0.71	1.00	25	27	0.327	60	1.0	0.70	0.83	0.53	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW-SM	58.5	-	60.0	59.3	18.06	25	10	59.3	2.69	0.30	0.11	NL	312.3	200.9	0.67	0.07	0.69	1.00	28	29	0.411	63	1.0	0.69	0.81	0.65	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW-SM	63.5	-	65.0	64.3	19.58	30	10	64.3	2.92	0.30	0.11	NL	338.6	212.3	0.63	0.07	0.66	1.00	32	n/a	n/a	68	1.0	0.66	0.78	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW-SM	68.5	-	70.0	69.3	21.11	30	10	69.3	3.15	0.30	0.11	NL	365.0	223.7	0.60	0.07	0.64	1.00	31	n/a	n/a	67	1.0	0.66	0.77	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	73.5	-	75.0	74.3	22.63	27	0	74.3	3.38	0.30	0.11	NL	391.3	235.1	0.57	0.07	0.62	1.00	27	27	0.336	63	1.0	0.69	0.77	0.51	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	78.5	-	80.0	79.3	24.16	23	0	79.3	3.60	0.30	0.11	NL	417.7	246.5	0.55	0.07	0.60	1.00	22	22	0.245	57	1.0	0.71	0.77	0.37	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	83.5	-	85.0	84.3	25.68	24	0	84.3	3.83	0.30	0.11	NL	444.0	257.9	0.53	0.06	0.58	1.00	22	22	0.249	58	1.0	0.71	0.76	0.37	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0

Risk = very low to none

SPT LIQUEFACTION POTENTIAL CALCULATION SHEET BASED ON YOUD ET AL. (2001) METHOD WITH KAVAZANJIAN & MATASOVIC (1995) ACCELERATION ESTIMATES

620 Wando Park Blvd.
Mt. Pleasant, SC 29464

* Areas of user input are shaded in green
* Data needed for user calculation are in red

Project Information
Date: 2/11/2026
Site: AEP Philo Legacy CCR
Location: Philo, OH
Project No.: 25170079

Boring: B-13
GS Elevation: 702.00 ft MSL (NAVD88)
GW Depth: 22.0 ft
GW Depth: 6.7 m

Quake Parameters
M_w: 5.76
MSF^1: 1.96 (lower bound)
MSF^2: 2.39 (upper bound)
PGA_M: 0.085 %g
PGA_{Crest}: 0.36 %g

Embankment Height: 13.5 ft
Crest Elevation: 702.00 ft MSL (NAVD88)

Hammer Parameters
ER: 80.4 %
C_E: 1.34
C_B: 1.00
C_S: 1.2

General Parameters
γ_{soil}: 110 lb/ft^3
γ_{soil}: 17.3 kN/m^2
γ_{water}: 62.4 lb/ft^3
γ_{water}: 9.8 kN/m^2
Pa: 101.33 kPa

Liquefaction Likliehood Classification
Almost Certain to liquefy ("certain")
Very likely to liquefy ("very likely")
Liquefaction and no liquefaction are equally likely ("fifty-fifty")
Unlikely to liquefy ("unlikely")

Almost Certain that it will not liquefy ("none")

USCS	Layer top	Layer bottom	z (ft)	z (m)	N_m	% Fines	y (ft)	y/h	k_{max}/u_{max}	k_{max} (%g)	Manual Screening	σ_{vo} (kPa)	σ'_{vo} (kPa)	r_d[3]	CSR[4]	C_N[5]	C_R[6]	$(N_1)_{60}$	$(N_1)_{60cs}$[7]	$CRR_{7.5}$[8]	D_r	Kdr	f	K_σ	CRR (corect.)	fos	Liq? (by FOS def'n)	Liq Prob[10]	Liq Likelihood	LPI (FS) 0.0	LPI (P_L) 0.0	ε_v (%)	t (ft)	ΔH (in.)
SP	3.5	5.0	4.3	1.30	24	5	4.3	0.31	0.74	0.27	NL	22.4	22.4	0.99	0.17	1.54	0.75	45	n/a	n/a	107	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	8.5	10.0	9.3	2.82	26	5	9.3	0.69	0.38	0.14	NL	48.8	48.8	0.98	0.09	1.30	0.75	41	n/a	n/a	91	1.0	0.60	1.00	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	13.5	15.0	14.3	4.34	7	75	14.3	1.06	0.30	0.11	NL	75.1	75.1	0.97	0.07	1.13	0.85	11	18	0.191	43	1.0	0.79	1.00	0.38	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	18.5	20.0	19.3	5.87	7	75	19.3	1.43	0.30	0.11	NL	101.5	101.5	0.96	0.07	0.99	0.85	10	16	0.175	40	1.0	0.80	1.00	0.34	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	21.0	22.5	21.8	6.63	7	75	21.8	1.61	0.30	0.11	NL	114.6	114.6	0.95	0.07	0.94	0.95	10	17	0.181	38	1.0	0.80	0.98	0.35	n/a	no	n/a	none	0.00	0.00		1.5	0.0
CL	23.5	25.0	24.3	7.39	6	75	24.3	1.80	0.30	0.11	NL	127.8	121.1	0.94	0.07	0.91	0.95	8	15	0.160	35	1.0	0.80	0.97	0.30	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SP	26.0	27.5	26.8	8.15	8	10	26.8	1.98	0.30	0.11		141.0	126.8	0.94	0.07	0.89	0.95	11	12	0.131	40	1.0	0.80	0.96	0.25	3.38	no	0.00	none	0.00	0.00		1.5	0.0
SC-SM	28.5	30.0	29.3	8.92	19	25	29.3	2.17	0.30	0.11		154.2	132.5	0.92	0.08	0.87	0.95	25	32	0.897	61	1.0	0.70	0.92	1.62	21.51	no	0.00	none	0.00	0.00		1.5	0.0
SW	31.0	32.5	31.8	9.68	24	0	31.8	2.35	0.30	0.11		167.3	138.2	0.91	0.08	0.85	0.95	31	n/a	n/a	68	1.0	0.66	0.90	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GW	33.5	35.0	34.3	10.44	23	5	34.3	2.54	0.30	0.11		180.5	143.9	0.90	0.08	0.83	1.00	31	n/a	n/a	66	1.0	0.67	0.89	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
GW	36.0	37.5	36.8	11.20	22	5	36.8	2.72	0.30	0.11		193.7	149.6	0.88	0.08	0.82	1.00	29	29	0.404	64	1.0	0.68	0.88	0.70	8.79	no	0.00	none	0.00	0.00		1.5	0.0
SP	38.5	40.0	39.3	11.96	14	0	39.3	2.91	0.30	0.11		206.9	155.3	0.86	0.08	0.80	1.00	18	18	0.192	50	1.0	0.75	0.90	0.34	4.22	no	0.00	none	0.00	0.00		1.5	0.0
SP	43.5	45.0	44.3	13.49	17	0	44.3	3.28	0.30	0.11		233.2	166.7	0.81	0.08	0.77	1.00	21	21	0.228	54	1.0	0.73	0.87	0.39	4.91	no	0.00	none	0.00	0.00		1.5	0.0
SP	48.5	50.0	49.3	15.01	18	0	49.3	3.65	0.30	0.11		259.6	178.1	0.76	0.08	0.74	1.00	21	21	0.233	55	1.0	0.72	0.86	0.39	5.04	no	0.00	none	0.00	0.00		1.5	0.0
SP	53.5	55.0	54.3	16.54	17	0	54.3	4.02	0.30	0.11	NL	285.9	189.5	0.71	0.08	0.71	1.00	19	19	0.208	53	1.0	0.74	0.85	0.35	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	58.5	60.0	59.3	18.06	14	0	59.3	4.39	0.30	0.11	NL	312.3	200.9	0.67	0.07	0.69	1.00	15	15	0.164	47	1.0	0.76	0.85	0.27	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	63.5	65.0	64.3	19.58	19	0	64.3	4.76	0.30	0.11	NL	338.6	212.3	0.63	0.07	0.66	1.00	20	20	0.218	54	1.0	0.73	0.82	0.35	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	68.5	70.0	69.3	21.11	29	0	69.3	5.13	0.30	0.11	NL	365.0	223.7	0.60	0.07	0.64	1.00	30	30	0.457	66	1.0	0.67	0.77	0.69	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	73.5	75.0	74.3	22.63	24	0	74.3	5.50	0.30	0.11	NL	391.3	235.1	0.57	0.07	0.62	1.00	24	24	0.272	59	1.0	0.70	0.78	0.42	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	78.5	80.0	79.3	24.16	22	0	79.3	5.87	0.30	0.11	NL	417.7	246.5	0.55	0.07	0.60	1.00	21	21	0.231	56	1.0	0.72	0.78	0.35	n/a	no	n/a	none	0.00	0.00		1.5	0.0
SW	83.5	85.0	84.3	25.68	38	0	84.3	6.24	0.30	0.11	NL	444.0	257.9	0.53	0.06	0.58	1.00	36	n/a	n/a	73	1.0	0.64	0.71	n/a	n/a	no	n/a	none	0.00	0.00		1.5	0.0
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P_G = 0.01 Σ= 0.0
Risk = very low to none